

Hydrologic Analysis:
Proposed Site Redevelopment
31 Frederick Street
Framingham, MA

Prepared for: ***VTT Frederick Street, LLC***
100 Concord Street
Framingham, MA 01702

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March, 2016

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**Hydrologic Assessment
Proposed Site Redevelopment
31 Frederick Street, Framingham MA**

Introduction

The project site is located on the southerly side of Frederick Street in the Town of Framingham, Massachusetts. The site is located in the downtown area of town approximately 400-feet east of the intersection of Concord Street and Frederick Street. The project site is shown in Figure One, entitled *Locus Map: 31 Frederick Street, Framingham MA*. The locus has frontage and access on Frederick Street and is surrounded by commercial and multi-family residential properties.

The subject parcel, Assessor's Map 4, Block 8, Lot 5, has a record area of 7,985 square feet (0.18-acres) and is presently improved with a three-story multi-family house, bituminous driveway and supporting utilities. The existing house is located approximately 10-feet off the sideline of Frederick Street and surrounded by turf lawn on the north, east and south and gravel parking area to the west. The property slopes gently downhill from the rear property line to Frederick Street (in a northerly direction) with approximately four-feet of vertical relief across the site.

According to the NRCS Soil Survey, soils on and around the site belong to the Urban Land Complex (602) and are not classified within any hydrologic soil group. Abutting soil groups are listed within the Merrimac Soil Series and further classified within hydrologic soil group A. Group A soil runoff curve numbers were used in this analysis due to on site soil testing and abutting soil groups.

On February 1, 2016 Metro West Engineering Inc. performed an on-site evaluation of existing soil conditions. Two test holes were excavated at site, D.T.H.-1 and D.T.H.-2. D.T.H.-1 was excavated in the northern portion of the property approximate 15-feet south of the sideline of Frederick Street. Fill was encountered in this test pit down to a depth of four-feet. The C-horizon consisted of a medium sand down to a depth of approximately nine-feet. D.T.H.-2 was excavated in the southern portion of the property. Fill was encountered in this test pit down to a depth of six-feet. The C-horizon consisted of a medium sand down to a depth of approximately ten-feet. Possible mottling was observed approximately six to seven-feet below existing grade. No refusal was encountered in either of the test pits.

The site development includes the demolition of the existing building followed by the construction of a new building, paved driveways, subsurface infiltration system for roof runoff, and supporting utilities. The existing impervious footprint on the site is 3,547 square feet and the proposed redevelopment will introduce an additional 1,290 square feet of impervious surface area, for a total impervious footprint of 4,837 square feet.

Figure One: Locus Map, 31 Frederick Street, Framingham MA



Drainage Approach

At present, the site has no stormwater management system in place to manage runoff from the roof of the existing house or existing paved surfaces. A subsurface infiltration system is proposed on the site to store and recharge runoff from the roof surface of the proposed building.

In general, the majority of the site drains in a northerly direction to the municipal street drainage system in Frederick Street. For a more detailed view of the existing drainage patterns, please see Figure Two: Pre-Development Watershed Delineation Plan included in this report.

The goal of the proposed stormwater management system is to maintain or reduce runoff rates and volumes to all design points compared to existing conditions despite the increase in impervious surface area. In order to achieve this, a subsurface infiltration system is proposed to collect stormwater runoff from the surface of the new building roof for storage and recharge. The proposed subsurface infiltration system consists of multiple pre-cast, concrete leaching chambers surrounded by double-washed, crushed stone. Details for this system can be found in the Hydrologic Analysis section of this report.

Hydrologic Analysis

A hydrologic analysis of the project has been performed to establish pre-development conditions, assess post-development impacts and evaluate the effectiveness of the proposed drainage infiltration system. The analysis employs an SCS TR-55 hydrologic computer model and analyzes design storms with return periods of 2, 10, 25 and 100-years. An SCS Type 3 24-hour rainfall distribution pattern is used for the theoretical design storm. Times of concentration values were computed by the LAG short method or manually entered at five minutes for watersheds containing small areas or hydraulic length to allow for the use of a three-minute time interval for all hydrograph computations. Longest flow path segment properties for both pre and post-development models are shown on Figures Two and Three respectively.

Existing Conditions

The existing conditions model analyzes the site as one basin; Existing Conditions Basin 1. Existing Conditions Basin 1 (E.C.B.-1) contains 7,991 square feet of surface area and flows in a northwesterly direction to design point A, located at the northeast corner of the property on Frederick Street.

The Existing Conditions Basins are shown on Figure Two, The Pre-Development Watershed Delineation Plan and information for all Existing Conditions Basins is listed below.

NOTES:

1. SUBJECT PARCEL IS SHOWN AS ASSESSORS SHEET 4, BLOCK 8, LOTS 5, 5A, 6, 7, 8 AND 9. RECORD TITLE FROM BOOK 56002, PAGE 322.
2. THIS PLAN IS THE RESULT OF AN ON-GROUND SURVEY PERFORMED BY METROWEST ENGINEERING, INC. UTILITY LOCATIONS ARE BASED ON FIELD OBSERVATIONS, AVAILABLE RECORDS AND INFORMATION. METROWEST ENGINEERING, INC. DOES NOT WARRANT LOCATION, CHARACTER NOR ELEVATIONS OF ALL UNDERGROUND UTILITIES NOR THE LOCATION NOR CHARACTER OF SURFACE IMPROVEMENTS THE OBSERVATION OF WHICH WAS OBSERVED AT THE TIME OF THE SURVEY.
3. THE PROPERTY DESCRIBED ON THIS SURVEY DOES NOT LIE WITHIN A SPECIAL FLOOD HAZARD AREA AS DEFINED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY; THE PROPERTY LIES WITHIN ZONE "X" OF THE FLOOD INSURANCE RATE MAP IDENTIFIED AS MAP NUMBER 25017C0518E, BEARING AN EFFECTIVE DATE OF JULY 7, 2014.

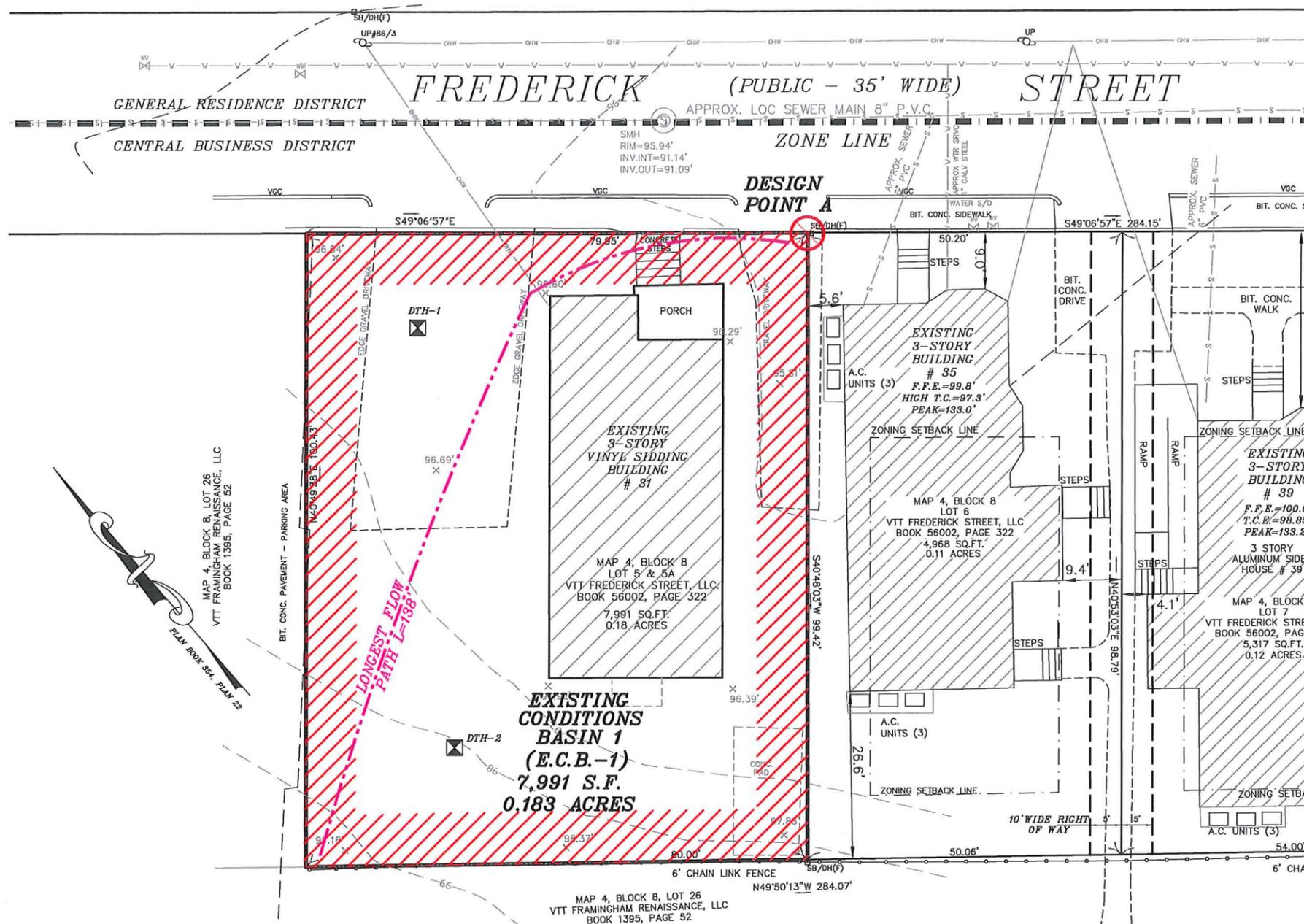
USDA SOIL CLASSIFICATION

SOIL NUMBER	SOIL SERIES	HYDROLOGIC SOIL GROUP
602	URBAN LAND COMPLEX	N/A

HYDROLOGIC SOIL GROUP A USED FOR ANALYSIS BASED ON ABUTTING SOIL GROUPS

LEGEND

- B BOLLARD
- S.B. STONE BOUND
- VGC- VERTICAL GRANITE CURB
- (F) FOUND
- D.H. DRILL HOLE
- BIT. CONC. BITUMINOUS CONCRETE PAVEMENT
- EDGE OF PAVEMENT
- UTILITY POLE
- OHW OVERHEAD WRES



FOR METROWEST ENGINEERING, INC. DATE
 ROBERT A. GEMMA, P.L.S. # 37046
 P.E. # 31967 (CIVIL)

FIGURE TWO

**PRE-DEVELOPMENT WATERSHED
 DELINEATION PLAN
 #31 FREDERICK STREET
 IN
 FRAMINGHAM, MASS**

PREPARED FOR:
VTT FREDERICK STREET, LLC
 100 CONCORD STREET, THIRD FLOOR
 FRAMINGHAM, MA 01702

PROPERTY OF:
VTT FREDERICK STREET, LLC
 100 CONCORD STREET, THIRD FLOOR
 FRAMINGHAM, MA 01702

ENGINEERS & SURVEYORS:
MWE METROWEST ENGINEERING, INC.
 75 FRANKLIN STREET
 FRAMINGHAM, MA 01702
 TEL: (508)828-0083
 FAX: (508)875-6440

SHEET 1 OF 1 DATE: JANUARY 26, 2016

CALC'D BY: PHA/RAG FIELD BK: 563 CAD FILE: 31_FREDERICK_EC_HYDRO.dwg
 DRAFTER: PHA/BTN PROJECT: FRM_FRED DWG FILE: SK012616.dwg

EXISTING CONDITIONS BASIN PROPERTIES:

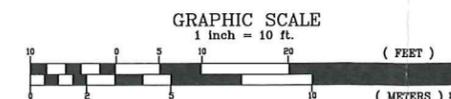
EXISTING CONDITIONS BASIN 1 (E.C.B.-1)

TOTAL BASIN AREA = 7,991 S.F. (0.183 ACRES)
 HYDRAULIC LENGTH = 138 FEET
 CHANGE IN ELEVATION = 3.5 FEET
 BASIN SLOPE = 0.025 (2.5%)

GROUND COVER	Cn	AREA (ACRES)	PRODUCT
IMPERVIOUS AREA = 3,547 S.F. (0.081 ACRES)	98	0.081	7.938
LAWN AREA (GOOD COND.) = 4,444 S.F. (0.102 ACRES)	39	0.102	3.978
		SUM 0.183	SUM 11.916

WEIGHTED CURVE NUMBER (C_N) = (11.916/0.183) = 65.1

SOIL TEST RESULTS	
DTH-1 (ELEV=96.1')	DTH-2 (ELEV=98.2')
0"-68" FILL 32"-112" C1 MED. SAND 2.5Y 5/3	0"-48" FILL 48"-60" B SANDY LOAM 10YR 5/6 60"-80" C1 MED. SAND 2.5Y 6/4 80"-118" C2 MED. SAND 2.5Y 5/3
MOTTLING @76" 7.5YR 5/8 (10%) WATER WEeping @92" NO REFUSAL ESTIMATED HIGH WATER=89.8'	MOTTLING @82" 7.5YR 5/8 (10%) WATER WEeping @112" NO REFUSAL ESTIMATED HIGH WATER=91.4'
DATE: FEBRUARY 1, 2016	
BY: BRIAN NELSON, SOIL EVALUATOR F.B. 630, PAGE 63	
INSPECTOR: NO INSPECTOR	



Hydrologic Assessment for Site Redevelopment at 31 Frederick Street, Framingham Massachusetts

Existing Conditions Basin 1 (E.C.B.-1)

Area = 7,991 square feet
Impervious area = 3,547 square feet; curve number = 98.0
Lawn area (good condition) = 4,444 square feet; curve number = 39.0
Hydrologic soil group A
Weighted Curve Number = 65.1
Basin slope = 2.5%
Hydraulic length = 138 feet
Time of concentration = 6.3 minutes (LAG Method)

Proposed Conditions

The proposed condition model analyzes the site as two drainage basins, Post-Development Basins 1 and 2. Post-Development Basin 1 (P.D.B.-1) contains 5,144 square feet of surface area and flows in a northeasterly direction to design point A, located at the northeast corner of the property on Frederick Street.

Post-Development Basin 2 (P.D.B.-2) contains 2,847 square feet of roof area of the proposed building and flows into proposed subsurface infiltration system 1, located north of the proposed house.

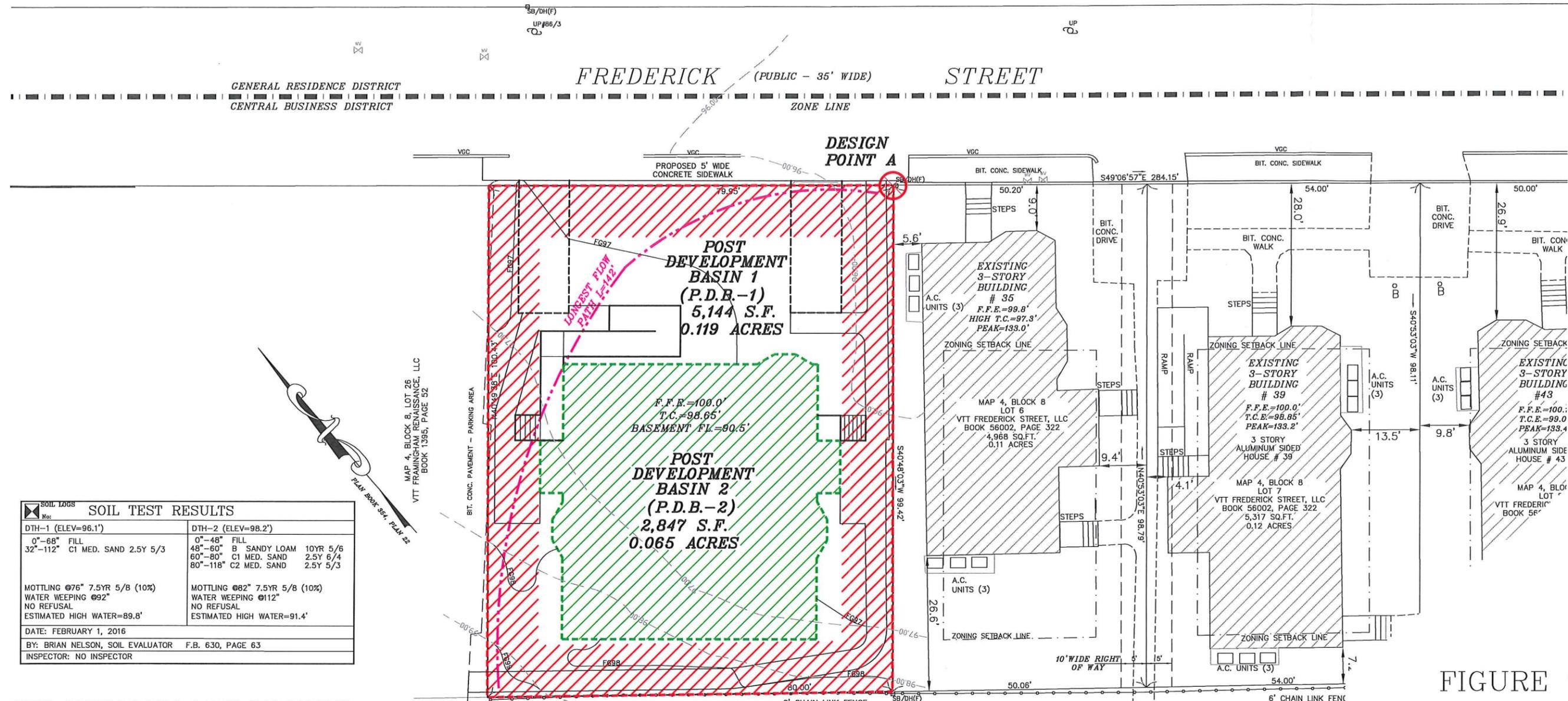
The Proposed Conditions Basins are shown on Figure Three, *The Post Development Watershed Delineation Plan* and information for all Post-Development Basins is listed hereafter.

Post-Development Basin 1 (P.D.B.-1)

Area = 5,144 square feet
Impervious area = 1,990 square feet; curve number = 98.0
Lawn area (good condition) = 2,554 square feet; curve number = 39.0
Wooded/Landscaped area (good condition) = 600 square feet; curve number = 36.0
Hydrologic soil group A
Weighted Curve Number = 61.5
Basin slope = 2.5%
Hydraulic length = 141 feet
Time of concentration = 7.0 minutes (LAG Method)

Post-Development Basin 2 (P.D.B.-2)

Area = 2,847 square feet
Impervious area = 2,847 square feet; curve number = 98.0
Hydrologic soil group A
Weighted Curve Number = 98.0
Basin slope = n.a.
Hydraulic length = n.a.



SOIL TEST RESULTS	
DTH-1 (ELEV=96.1')	DTH-2 (ELEV=98.2')
0"-68" FILL	0"-48" FILL
32"-112" C1 MED. SAND 2.5Y 5/3	48"-60" B SANDY LOAM 10YR 5/6
	60"-80" C1 MED. SAND 2.5Y 6/4
	80"-118" C2 MED. SAND 2.5Y 5/3
MOTTLING @76" 7.5YR 5/8 (10%)	MOTTLING @82" 7.5YR 5/8 (10%)
WATER WEeping @92"	WATER WEeping @112"
NO REFUSAL	NO REFUSAL
ESTIMATED HIGH WATER=89.8'	ESTIMATED HIGH WATER=91.4'
DATE: FEBRUARY 1, 2016	
BY: BRIAN NELSON, SOIL EVALUATOR F.B. 630, PAGE 63	
INSPECTOR: NO INSPECTOR	

POST-DEVELOPMENT BASIN PROPERTIES:

POST-DEVELOPMENT BASIN 1 (P.D.B.-1)

TOTAL BASIN AREA = 5,144 S.F. (0.119 ACRES)
HYDRAULIC LENGTH = 141 FEET
CHANGE IN ELEVATION = 3.5 FEET
BASIN SLOPE = 0.025 (2.5%)

GROUND COVER	Cn	AREA (ACRES)	PRODUCT
IMPERVIOUS AREA = 1,990 S.F. (0.046 ACRES)	98	0.046	4.508
LAWN AREA (GOOD COND.) = 2,554 S.F. (0.059 ACRES)	39	0.059	2.301
LANDSCAPED AREA = 600 S.F. (0.014 ACRES)	36	0.014	0.504
	SUM	0.119	7.313

WEIGHTED CURVE NUMBER (C_N) = (7.313/0.119) = 61.5

POST-DEVELOPMENT BASIN 2 (P.D.B.-2)

TOTAL BASIN AREA = 2,847 S.F. (0.065 ACRES)
HYDRAULIC LENGTH = N.A.
CHANGE IN ELEVATION = N.A.
BASIN SLOPE = N.A.

GROUND COVER	Cn	AREA (ACRES)	PRODUCT
IMPERVIOUS AREA = 2,847 S.F. (0.065 ACRES)	98	0.065	6.370
	SUM	0.065	6.370

WEIGHTED CURVE NUMBER (C_N) = (6.370/0.065) = 98.0

USDA SOIL CLASSIFICATION

SOIL NUMBER	SOIL SERIES	HYDROLOGIC SOIL GROUP
602	URBAN LAND COMPLEX	N/A

HYDROLOGIC SOIL GROUP A USED FOR ANALYSIS
BASED ON ABUTTING SOIL GROUPS

FIGURE THREE

**POST-DEVELOPMENT WATERSHED
DELINEATION PLAN
#31 FREDERICK STREET
IN
FRAMINGHAM, MASS**

PREPARED FOR:
V.T.T. MANAGEMENT, INC.
100 CONCORD STREET, THIRD FLOOR
FRAMINGHAM, MA 01702

PROPERTY OF:
FRAMINGHAM ACQUISITION LLC
C/O VTT FREDERICK STREET, LLC
100 CONCORD STREET
FRAMINGHAM, MA 01702

ENGINEERS & SURVEYORS:
MWE METROWEST ENGINEERING, INC.
75 FRANKLIN STREET
FRAMINGHAM, MA 01702
TEL: (508)828-0063
FAX: (508)875-6440

SHEET 1 OF 1
DATE: MARCH 7, 2016
CALC'D BY: PHA/RAG FIELD BK: 583 CAD FILE:31_FREDERICK_PD_HYDRO.dwg
DRAFTER: PHA/BTN PROJECT: FRM_FRED DWG FILE: SK030716.dwg

Time of concentration = 5.0 minutes (Manually Set)

Drain Infiltration System

Proposed Infiltration System 1

Basic geometry: 16.0-foot wide by 13.0-foot long bed
System type: Rotondo G444 leaching galleys; 360 gallons each
Use 6 Galleys; 4-feet long by 4.5 feet wide by 4-feet high
Infiltration rate: 8.27 inches per hour over 208 square foot bed

The proposed condition model analyzes the infiltration systems using a reservoir-analysis method. Consistent with DEP stormwater management standards, a value of 8.27-inches per hour (sandy soils) was used as the design infiltration rate for the proposed infiltration system.

Model Results

The model results for the design points A and B are shown in Tables One through Six below:

Table One: Comparison of Pre and Post-Development Peak Runoff Rates at Design Point A

Drainage Basin	2-year storm	10-year storm	25-year storm	100-year storm
E.C.B.-1	0.09 CFS	0.25 CFS	0.36 CFS	0.51 CFS
P.D.B.-1	0.04 CFS	0.13 CFS	0.20 CFS	0.28 CFS
Difference	-0.05 CFS	-0.12 CFS	-0.26 CFS	-0.23 CFS

Table Two: Comparison of Pre and Post-Development Runoff Volumes at Design Point A

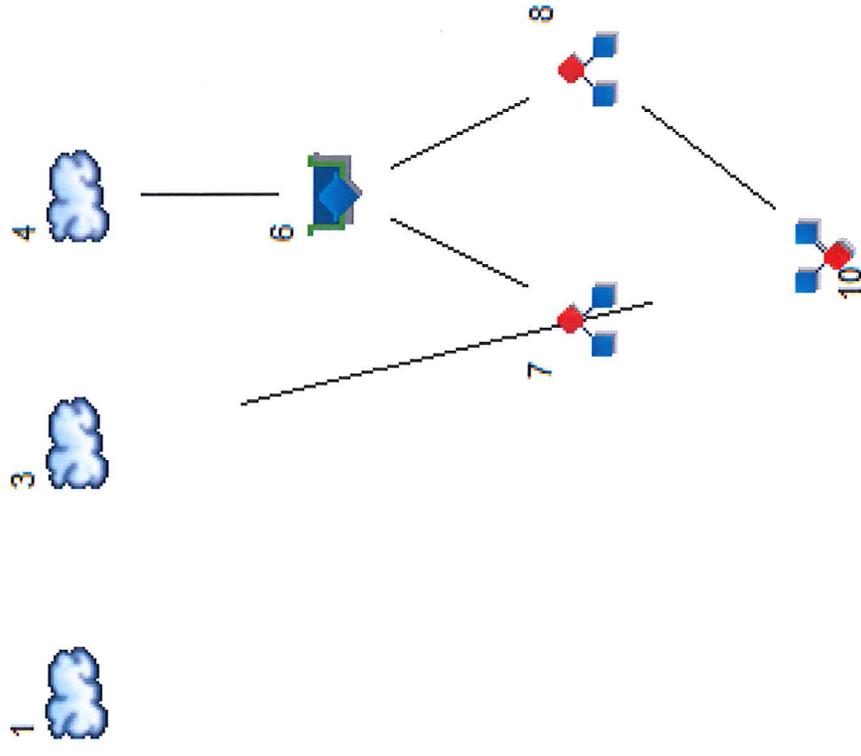
Drainage Basin	2-year storm	10-year storm	25-year storm	100-year storm
E.C.B.-1	376 CF	872 CF	1,247 CF	1,701 CF
P.D.B.-1	187 CF	472 CF	695 CF	969 CF
Difference	-189 CF	-400 CF	-552 CF	-732 CF

Conclusion

The results provided in Tables One and Two demonstrate that the project, with the stormwater controls in place, will result in a decrease both in peak runoff rates and total runoff volume discharged from the project site. The project will impact neither the municipal stormwater drainage system nor abutting properties.

Additionally, the runoff from the proposed roof surfaces will be collected and recharged. The stormwater management system as designed is consistent with MADEP Stormwater Management Policy and accepted design practice.

**Appendix A:
Hydrologic Assessment**



Legend

Hvd.	Origin	Description
1	SCS Runoff	E.C.B.-1
3	SCS Runoff	P.D.B.-1
4	SCS Runoff	P.D.B.-2
6	Reservoir	Infiltration
7	Diversion1	Infiltration
8	Diversion2	Overflow
10	Combine	Post-Development Flow to D.P.-A

2-Year Storm, Pre and Post-Development

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description	
1	SCS Runoff	0.09	3	726	376	----	-----	-----	E.C.B.-1	
3	SCS Runoff	0.04	3	729	187	----	-----	-----	P.D.B.-1	
4	SCS Runoff	0.17	3	726	656	----	-----	-----	P.D.B.-2	
6	Reservoir	0.05	3	744	656	4	151.30	138	Infiltration	
7	Diversion1	0.05	3	744	636	6	-----	-----	Infiltration	
8	Diversion2	0.00	3	648	0	6	-----	-----	Overflow	
10	Combine	0.04	3	729	187	3, 8,	-----	-----	Post-Development Flow to D.P.-A	
31 Frederick Street, Framingham.gpw							Return Period: 2 Year		Wednesday, Mar 9 2016, 7:23 AM	

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

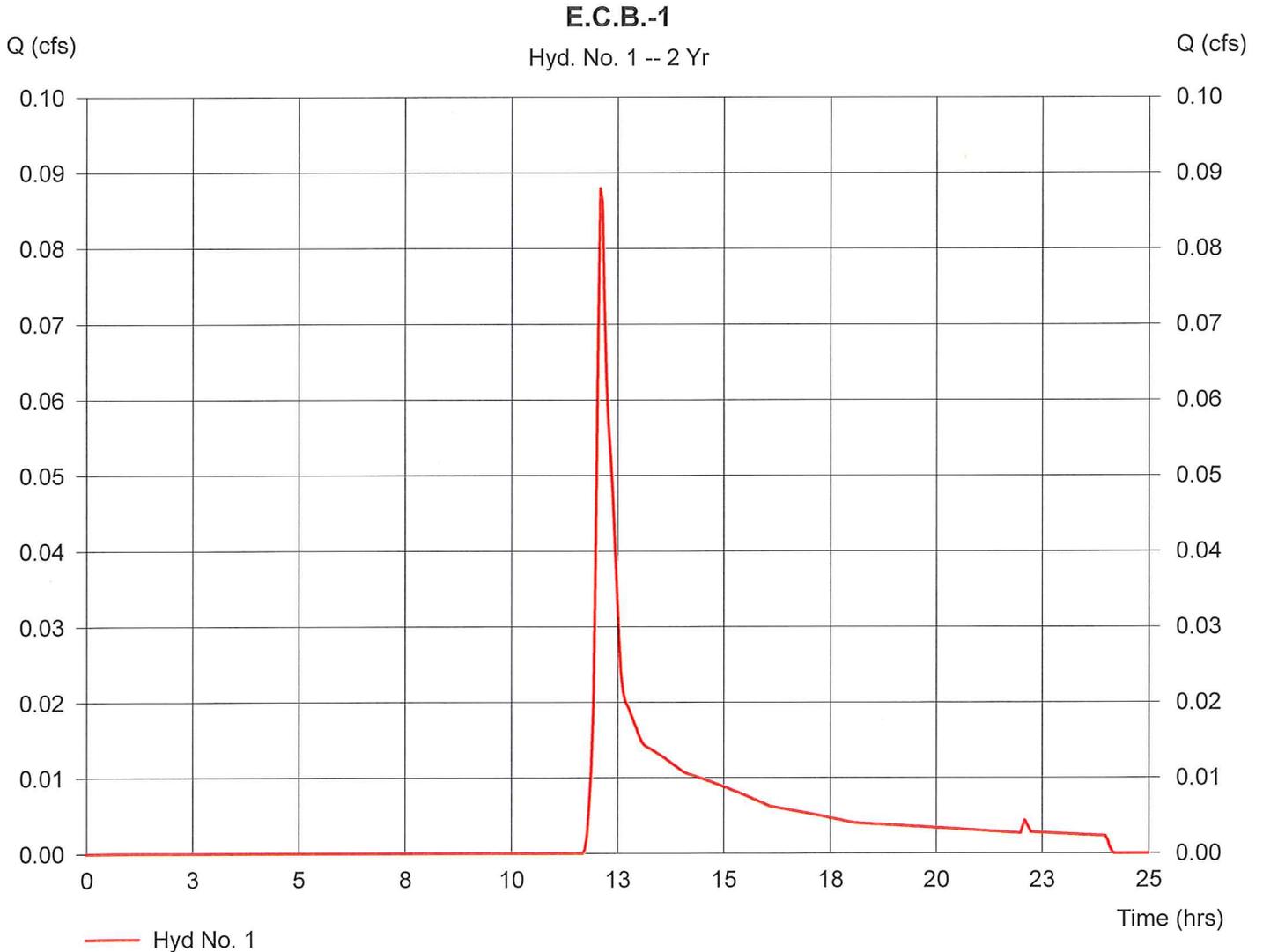
Hyd. No. 1

E.C.B.-1

Hydrograph type = SCS Runoff
 Storm frequency = 2 yrs
 Drainage area = 0.18 ac
 Basin Slope = 2.5 %
 Tc method = LAG
 Total precip. = 3.20 in
 Storm duration = 24 hrs

Peak discharge = 0.09 cfs
 Time interval = 3 min
 Curve number = 65.1
 Hydraulic length = 138 ft
 Time of conc. (Tc) = 6.273564 min
 Distribution = Type III
 Shape factor = 484

Hydrograph Volume = 376 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

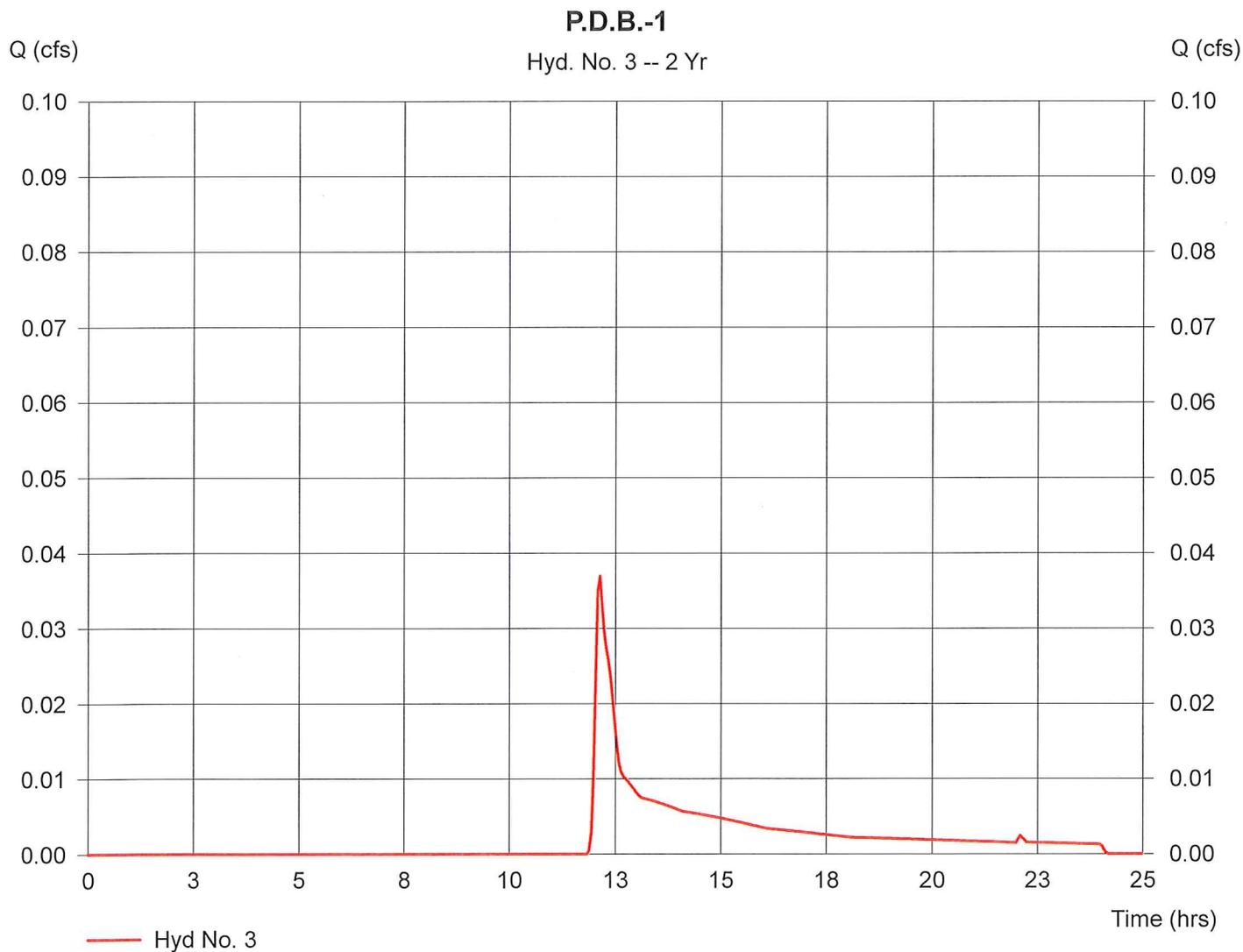
Hyd. No. 3

P.D.B.-1

Hydrograph type = SCS Runoff
 Storm frequency = 2 yrs
 Drainage area = 0.12 ac
 Basin Slope = 2.5 %
 Tc method = LAG
 Total precip. = 3.20 in
 Storm duration = 24 hrs

Peak discharge = 0.04 cfs
 Time interval = 3 min
 Curve number = 61.5
 Hydraulic length = 141 ft
 Time of conc. (Tc) = 7.001351 min
 Distribution = Type III
 Shape factor = 484

Hydrograph Volume = 187 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

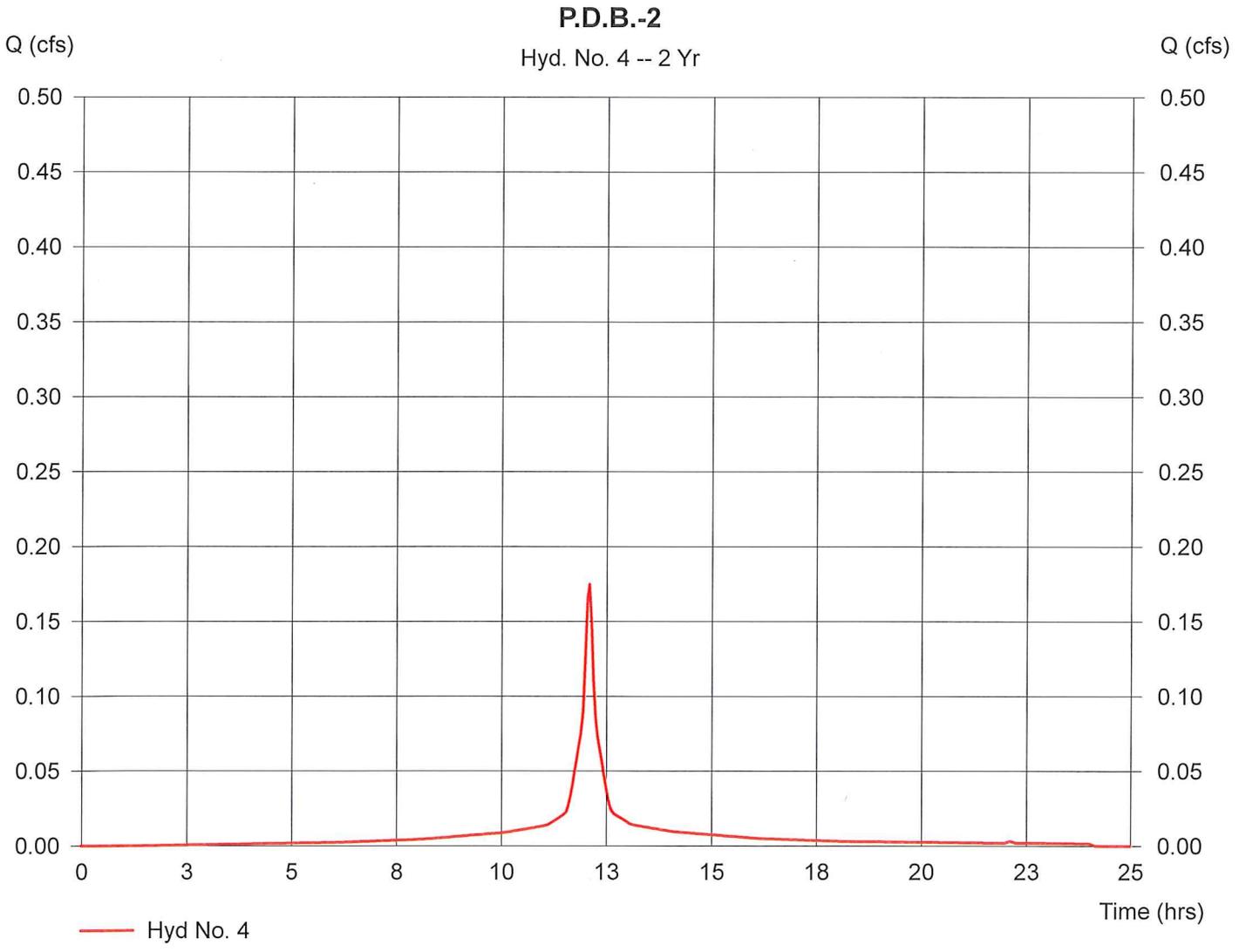
Hyd. No. 4

P.D.B.-2

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Drainage area = 0.07 ac
Basin Slope = 2.0 %
Tc method = USER
Total precip. = 3.20 in
Storm duration = 24 hrs

Peak discharge = 0.17 cfs
Time interval = 3 min
Curve number = 98
Hydraulic length = 50 ft
Time of conc. (Tc) = 5 min
Distribution = Type III
Shape factor = 484

Hydrograph Volume = 656 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

Hyd. No. 6

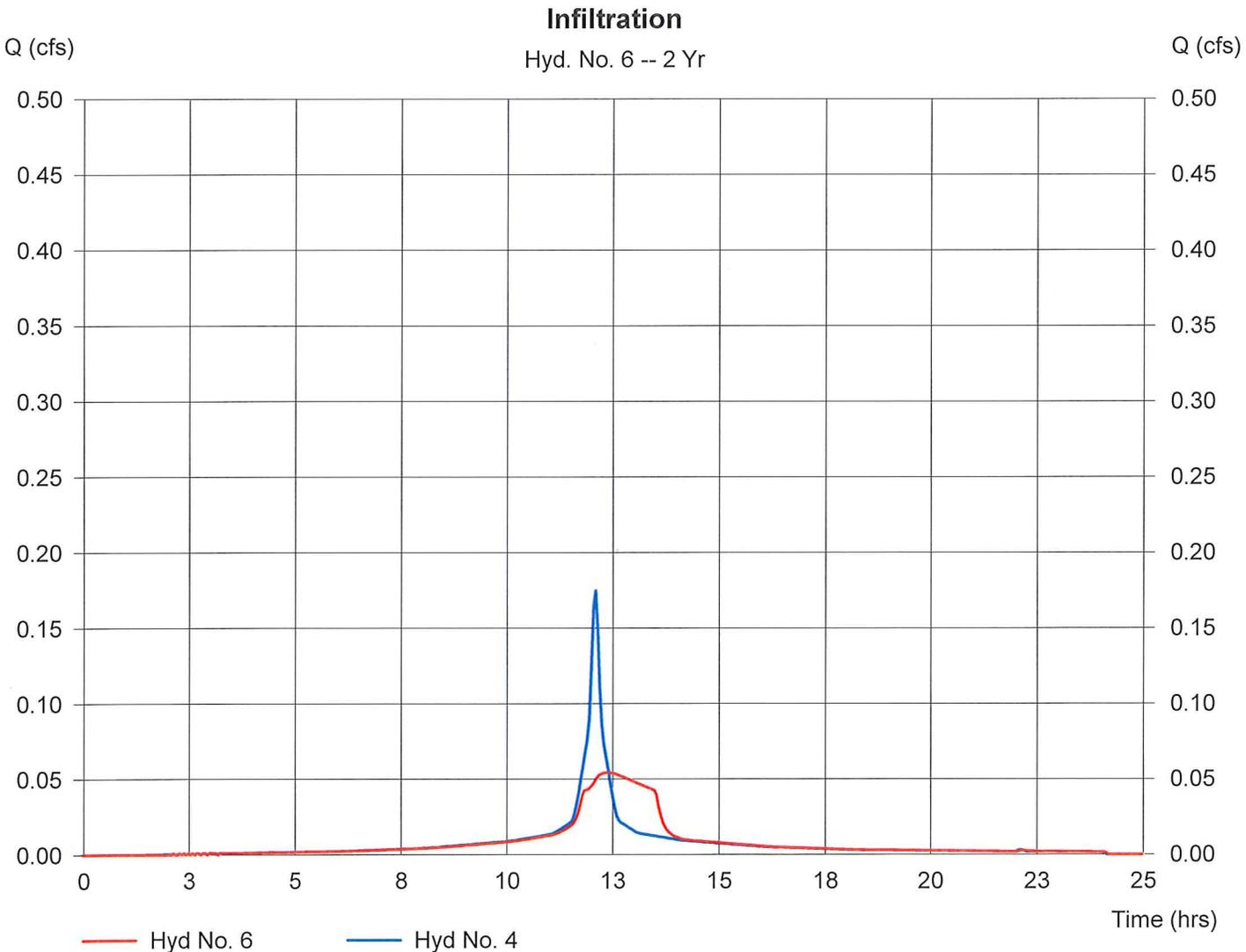
Infiltration

Hydrograph type = Reservoir
 Storm frequency = 2 yrs
 Inflow hyd. No. = 4
 Reservoir name = Infiltration System

Peak discharge = 0.05 cfs
 Time interval = 3 min
 Max. Elevation = 151.30 ft
 Max. Storage = 138 cuft

Storage Indication method used.

Hydrograph Volume = 656 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

Pond No. 1 - Infiltration System

Pond Data

Bottom LxW = 16.0 x 13.0 ft Side slope = 0.0:1 Bottom elev. = 150.00 ft Depth = 4.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*	(*51.00% voids applied)
0.00	150.00	208	0	0	
0.20	150.20	208	21	21	
0.40	150.40	208	21	42	
0.60	150.60	208	21	64	
0.80	150.80	208	21	85	
1.00	151.00	208	21	106	
1.20	151.20	208	21	127	
1.40	151.40	208	21	149	
1.60	151.60	208	21	170	
1.80	151.80	208	21	191	
2.00	152.00	208	21	212	
2.20	152.20	208	21	233	
2.40	152.40	208	21	255	
2.60	152.60	208	21	276	
2.80	152.80	208	21	297	
3.00	153.00	208	21	318	
3.20	153.20	208	21	339	
3.40	153.40	208	21	361	
3.60	153.60	208	21	382	
3.80	153.80	208	21	403	
4.00	154.00	208	21	424	

Culvert / Orifice Structures

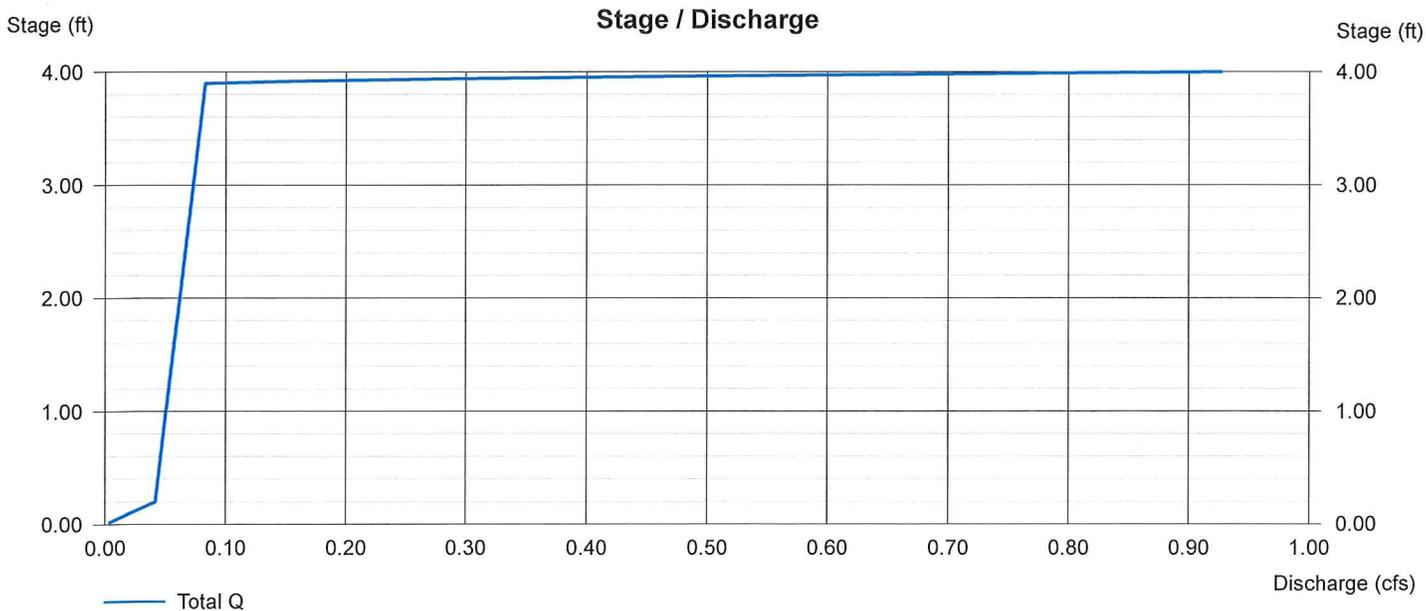
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 153.90	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 8.270 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, Mar 9 2016, 7:23 AM

Hyd. No. 7

Infiltration

Hydrograph type = Diversion1

Storm frequency = 2 yrs

Inflow hydrograph = 6

Diversion method = Pond - Infiltration System

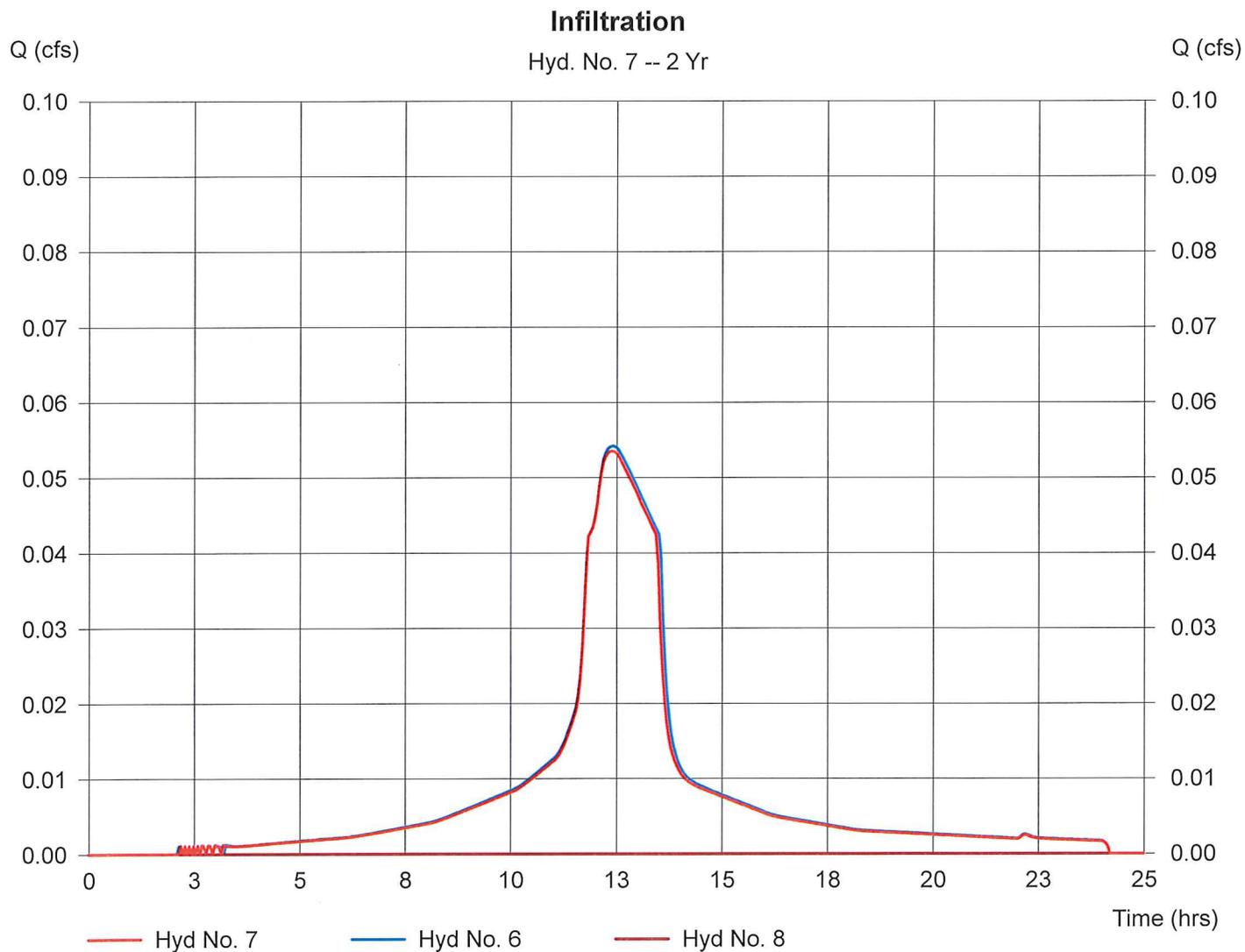
Peak discharge = 0.05 cfs

Time interval = 3 min

2nd diverted hyd. = 8

Pond structure = Exfiltration

Hydrograph Volume = 636 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

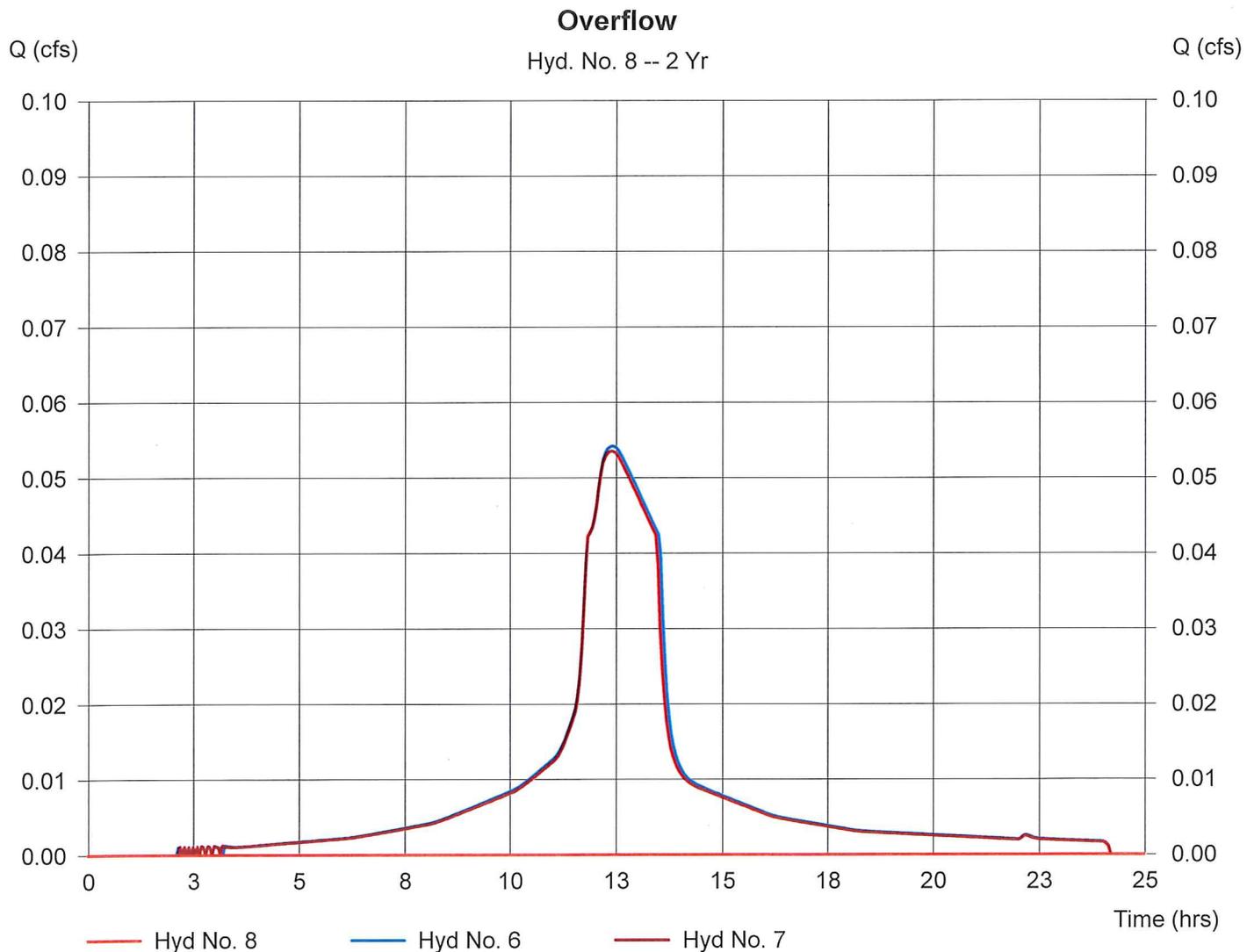
Hyd. No. 8

Overflow

Hydrograph type = Diversion2
 Storm frequency = 2 yrs
 Inflow hydrograph = 6
 Diversion method = Pond - Infiltration System

Peak discharge = 0.00 cfs
 Time interval = 3 min
 2nd diverted hyd. = 7
 Pond structure = Exfiltration

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

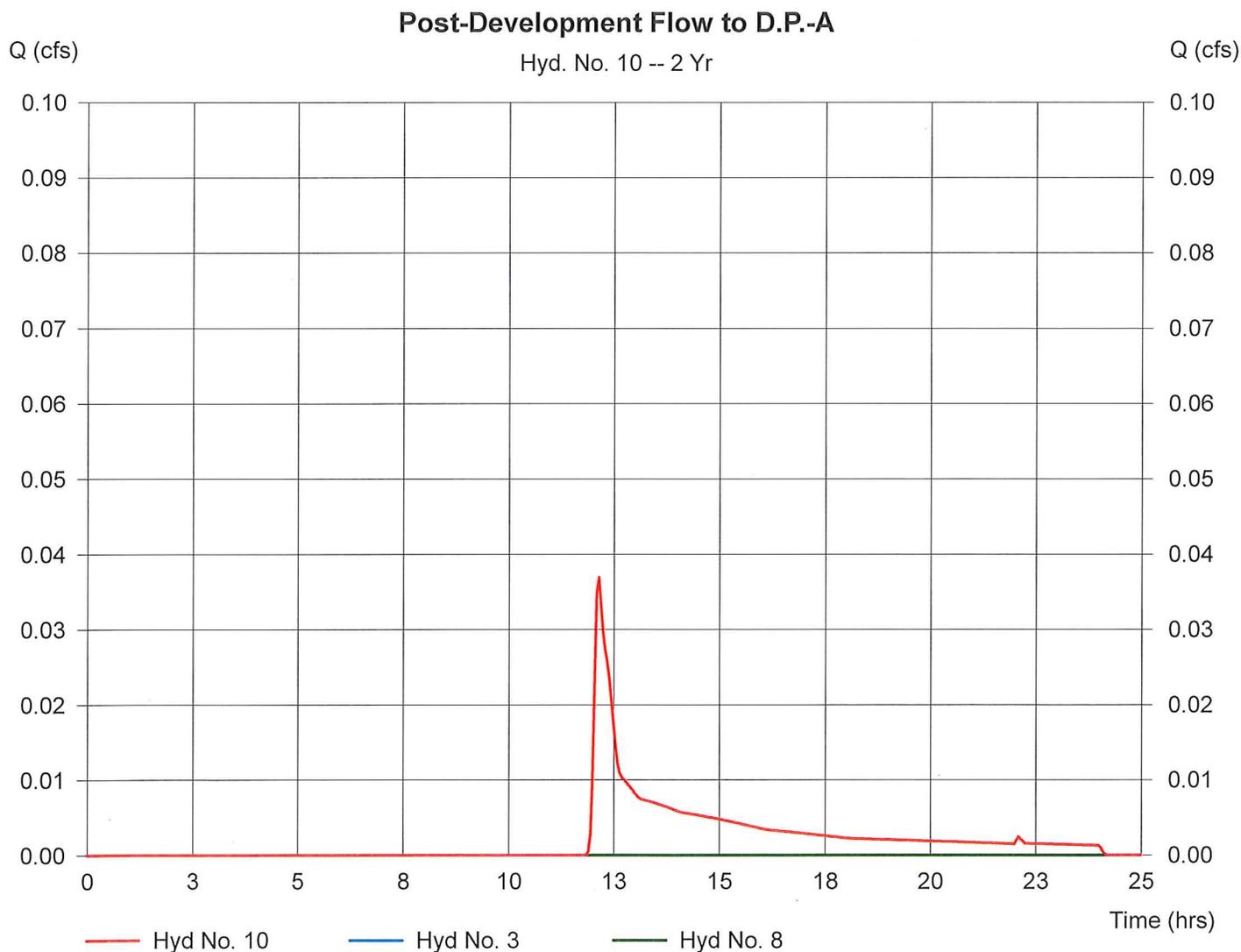
Hyd. No. 10

Post-Development Flow to D.P.-A

Hydrograph type = Combine
Storm frequency = 2 yrs
Inflow hyds. = 3, 8

Peak discharge = 0.04 cfs
Time interval = 3 min

Hydrograph Volume = 187 cuft



10-Year Storm, Pre and Post-Development

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	0.25	3	726	872	----	-----	-----	E.C.B.-1
3	SCS Runoff	0.13	3	726	472	----	-----	-----	P.D.B.-1
4	SCS Runoff	0.25	3	726	965	----	-----	-----	P.D.B.-2
6	Reservoir	0.06	3	747	965	4	152.24	237	Infiltration
7	Diversion1	0.06	3	747	935	6	-----	-----	Infiltration
8	Diversion2	0.00	3	579	0	6	-----	-----	Overflow
10	Combine	0.13	3	726	472	3, 8,	-----	-----	Post-Development Flow to D.P.-A
31 Frederick Street, Framingham.gpw Return Period: 10 Year							Wednesday, Mar 9 2016, 7:23 AM		

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

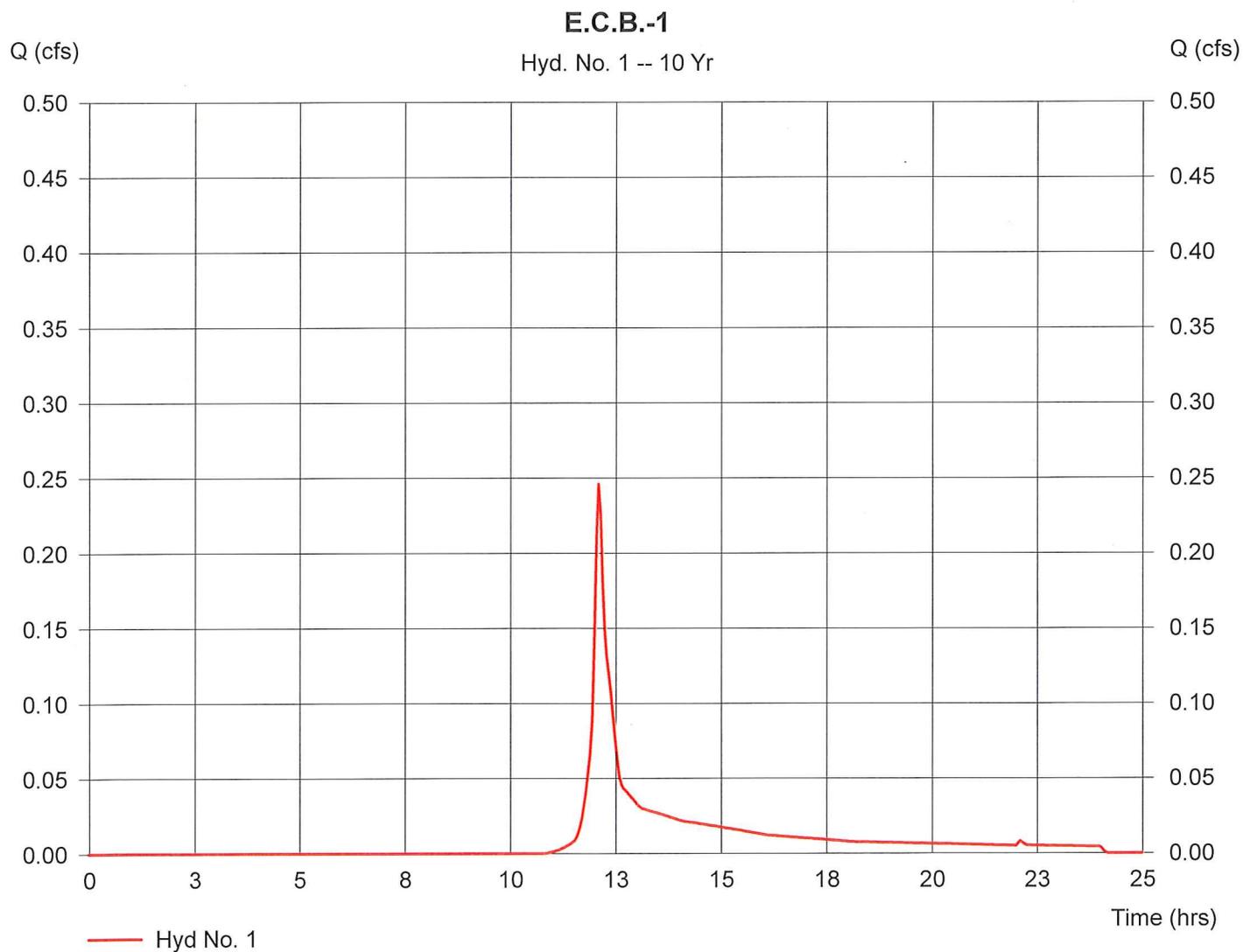
Hyd. No. 1

E.C.B.-1

Hydrograph type = SCS Runoff
 Storm frequency = 10 yrs
 Drainage area = 0.18 ac
 Basin Slope = 2.5 %
 Tc method = LAG
 Total precip. = 4.60 in
 Storm duration = 24 hrs

Peak discharge = 0.25 cfs
 Time interval = 3 min
 Curve number = 65.1
 Hydraulic length = 138 ft
 Time of conc. (Tc) = 6.273564 min
 Distribution = Type III
 Shape factor = 484

Hydrograph Volume = 872 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

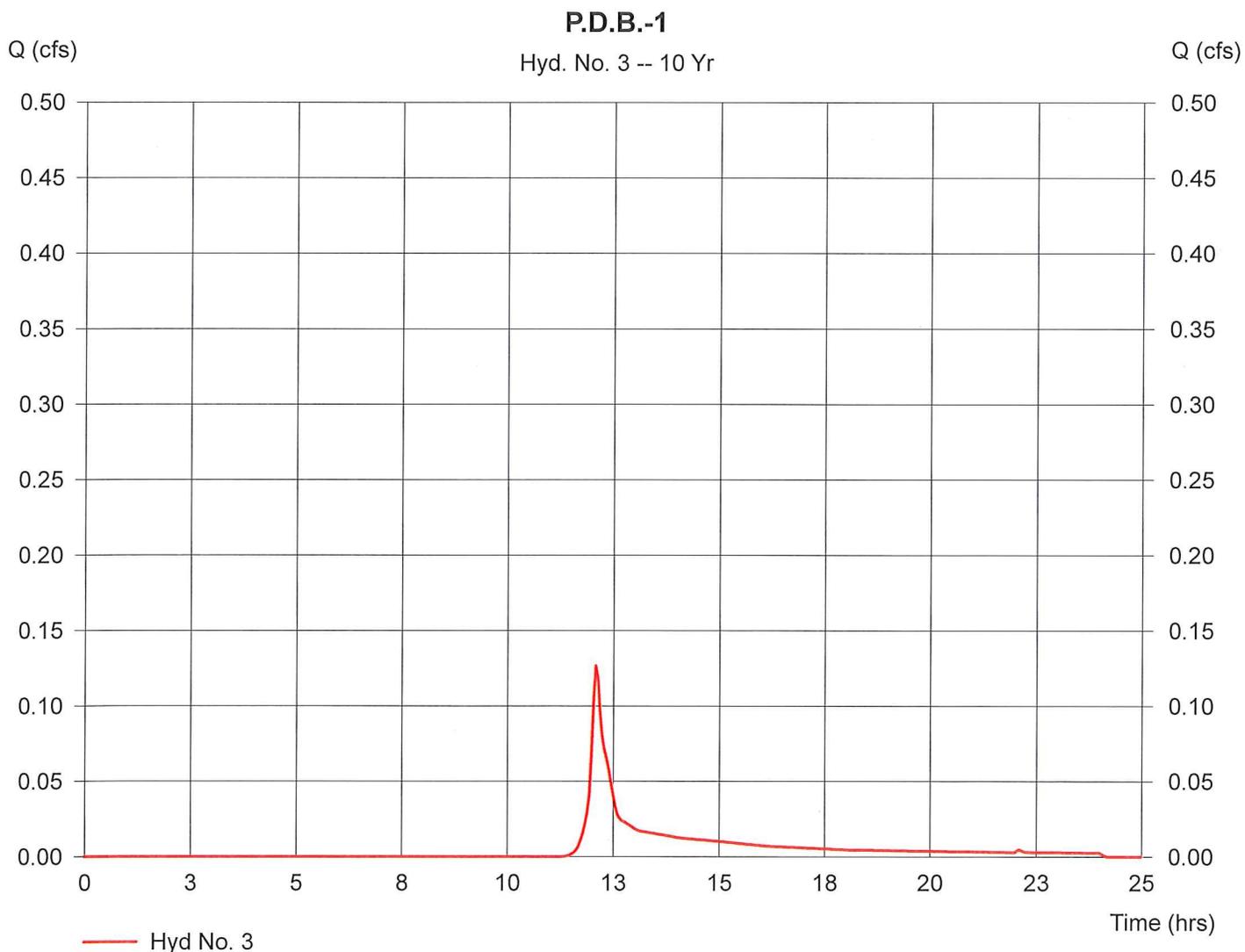
Hyd. No. 3

P.D.B.-1

Hydrograph type = SCS Runoff
 Storm frequency = 10 yrs
 Drainage area = 0.12 ac
 Basin Slope = 2.5 %
 Tc method = LAG
 Total precip. = 4.60 in
 Storm duration = 24 hrs

Peak discharge = 0.13 cfs
 Time interval = 3 min
 Curve number = 61.5
 Hydraulic length = 141 ft
 Time of conc. (Tc) = 7.001351 min
 Distribution = Type III
 Shape factor = 484

Hydrograph Volume = 472 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

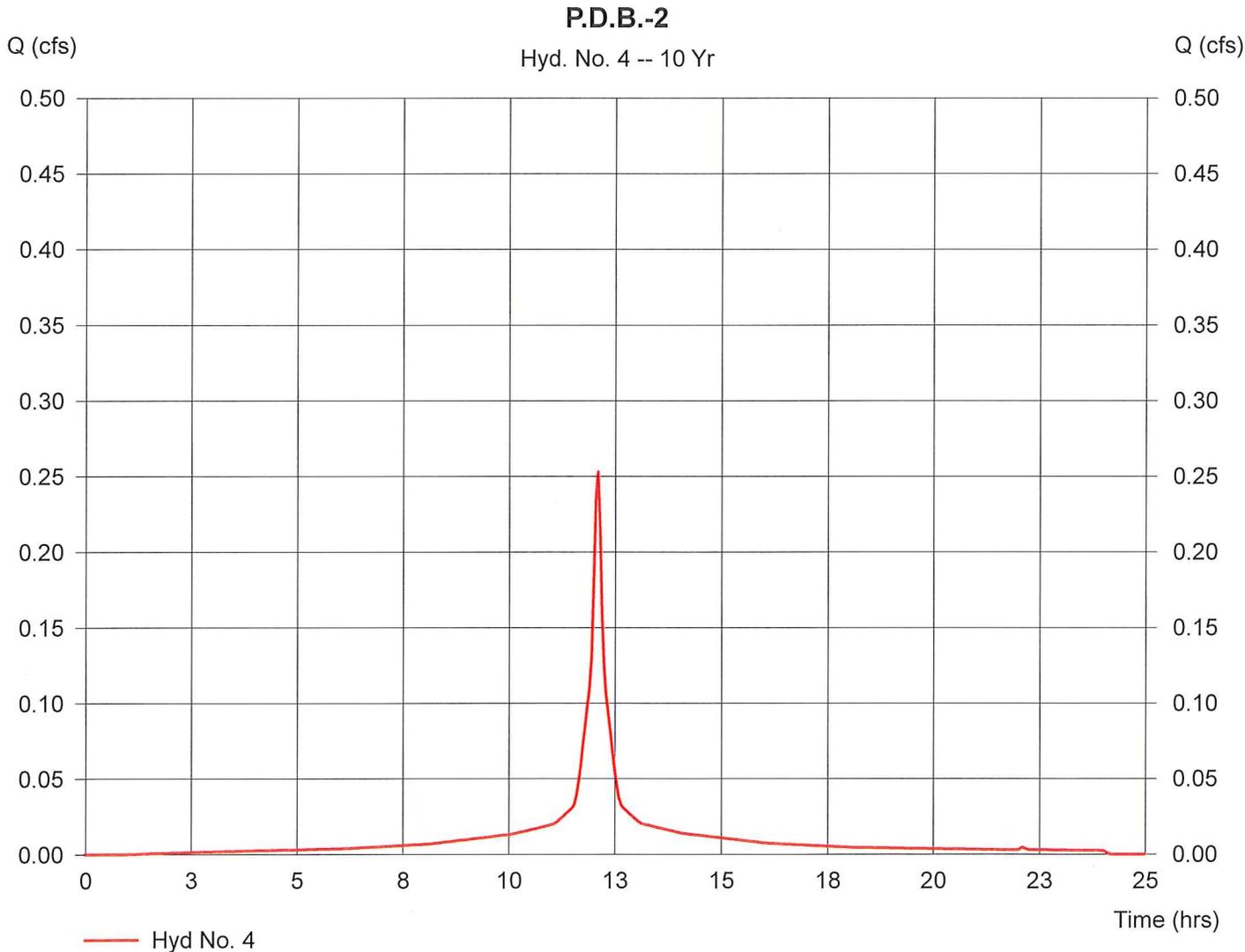
Hyd. No. 4

P.D.B.-2

Hydrograph type = SCS Runoff
 Storm frequency = 10 yrs
 Drainage area = 0.07 ac
 Basin Slope = 2.0 %
 Tc method = USER
 Total precip. = 4.60 in
 Storm duration = 24 hrs

Peak discharge = 0.25 cfs
 Time interval = 3 min
 Curve number = 98
 Hydraulic length = 50 ft
 Time of conc. (Tc) = 5 min
 Distribution = Type III
 Shape factor = 484

Hydrograph Volume = 965 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

Hyd. No. 6

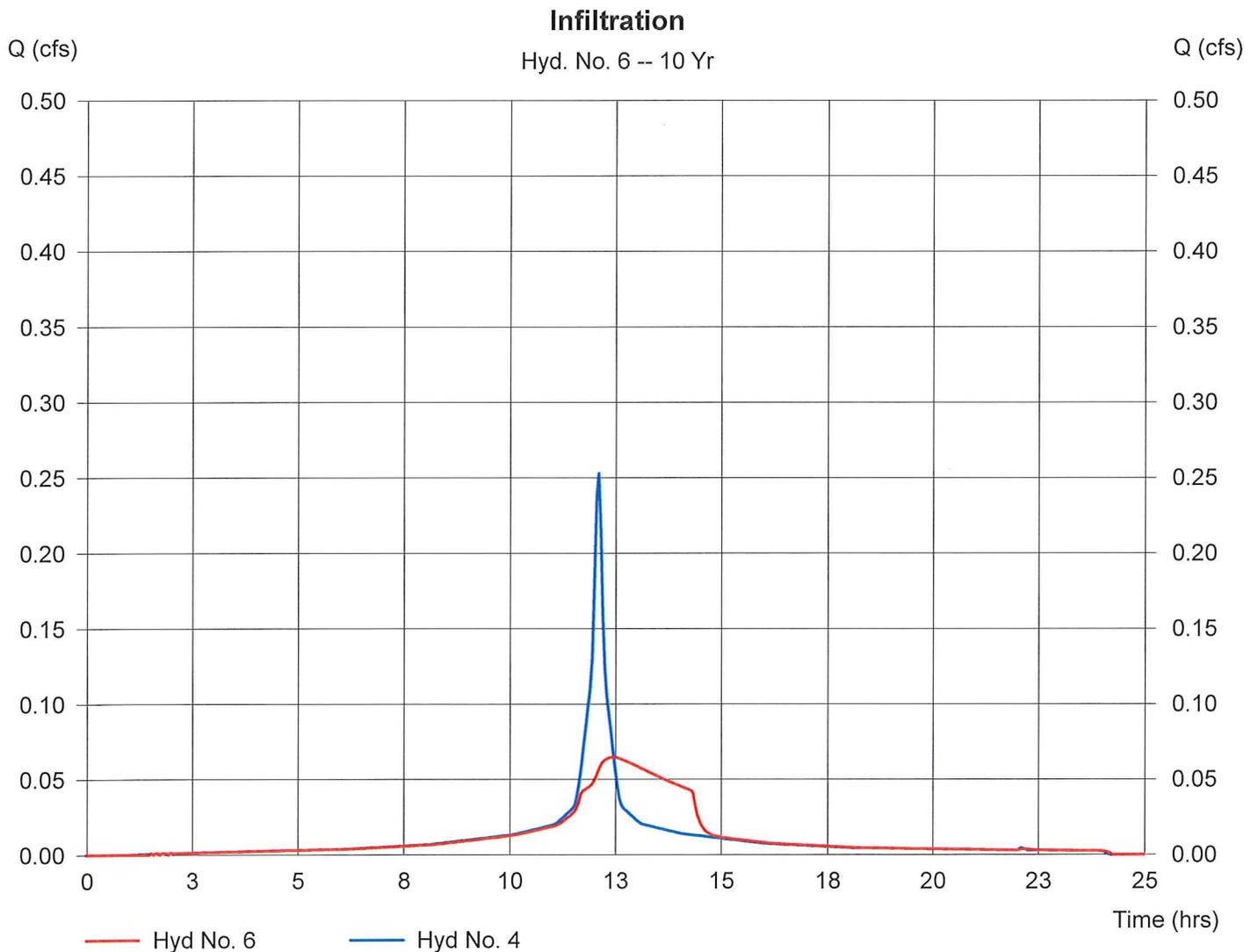
Infiltration

Hydrograph type = Reservoir
 Storm frequency = 10 yrs
 Inflow hyd. No. = 4
 Reservoir name = Infiltration System

Peak discharge = 0.06 cfs
 Time interval = 3 min
 Max. Elevation = 152.24 ft
 Max. Storage = 237 cuft

Storage Indication method used.

Hydrograph Volume = 965 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

Pond No. 1 - Infiltration System

Pond Data

Bottom LxW = 16.0 x 13.0 ft Side slope = 0.0:1 Bottom elev. = 150.00 ft Depth = 4.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*	(*51.00% voids applied)
0.00	150.00	208	0	0	
0.20	150.20	208	21	21	
0.40	150.40	208	21	42	
0.60	150.60	208	21	64	
0.80	150.80	208	21	85	
1.00	151.00	208	21	106	
1.20	151.20	208	21	127	
1.40	151.40	208	21	149	
1.60	151.60	208	21	170	
1.80	151.80	208	21	191	
2.00	152.00	208	21	212	
2.20	152.20	208	21	233	
2.40	152.40	208	21	255	
2.60	152.60	208	21	276	
2.80	152.80	208	21	297	
3.00	153.00	208	21	318	
3.20	153.20	208	21	339	
3.40	153.40	208	21	361	
3.60	153.60	208	21	382	
3.80	153.80	208	21	403	
4.00	154.00	208	21	424	

Culvert / Orifice Structures

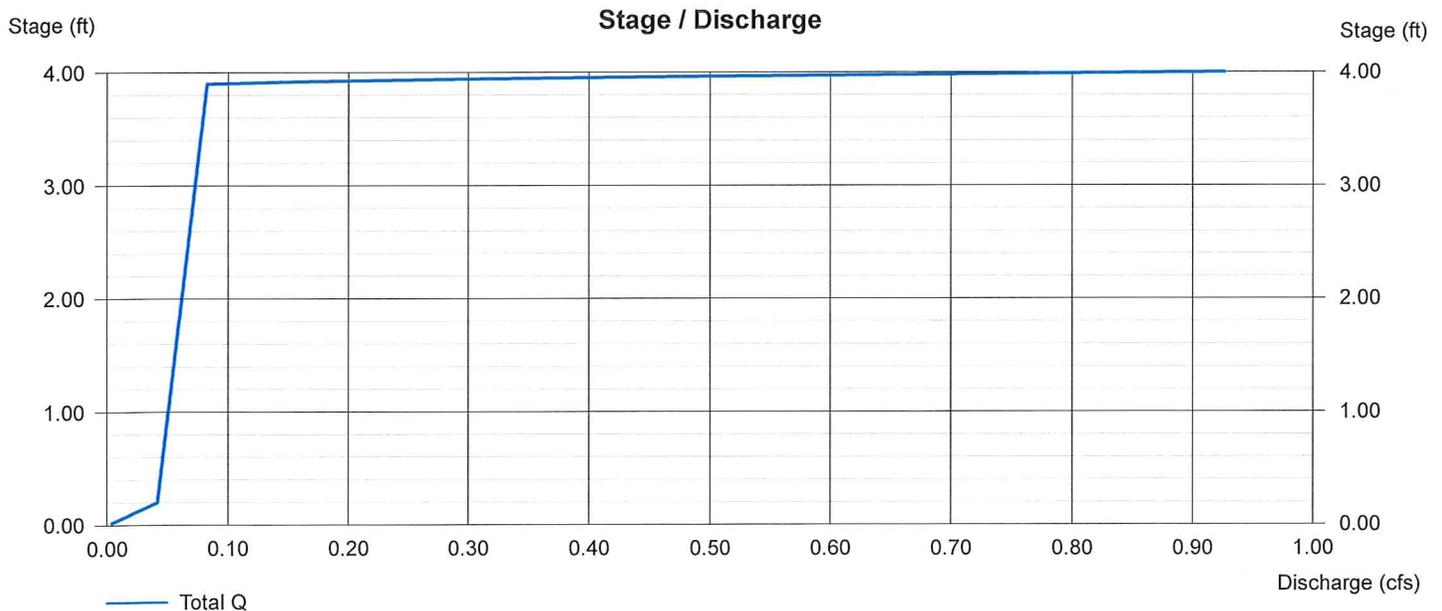
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 153.90	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 8.270 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, Mar 9 2016, 7:23 AM

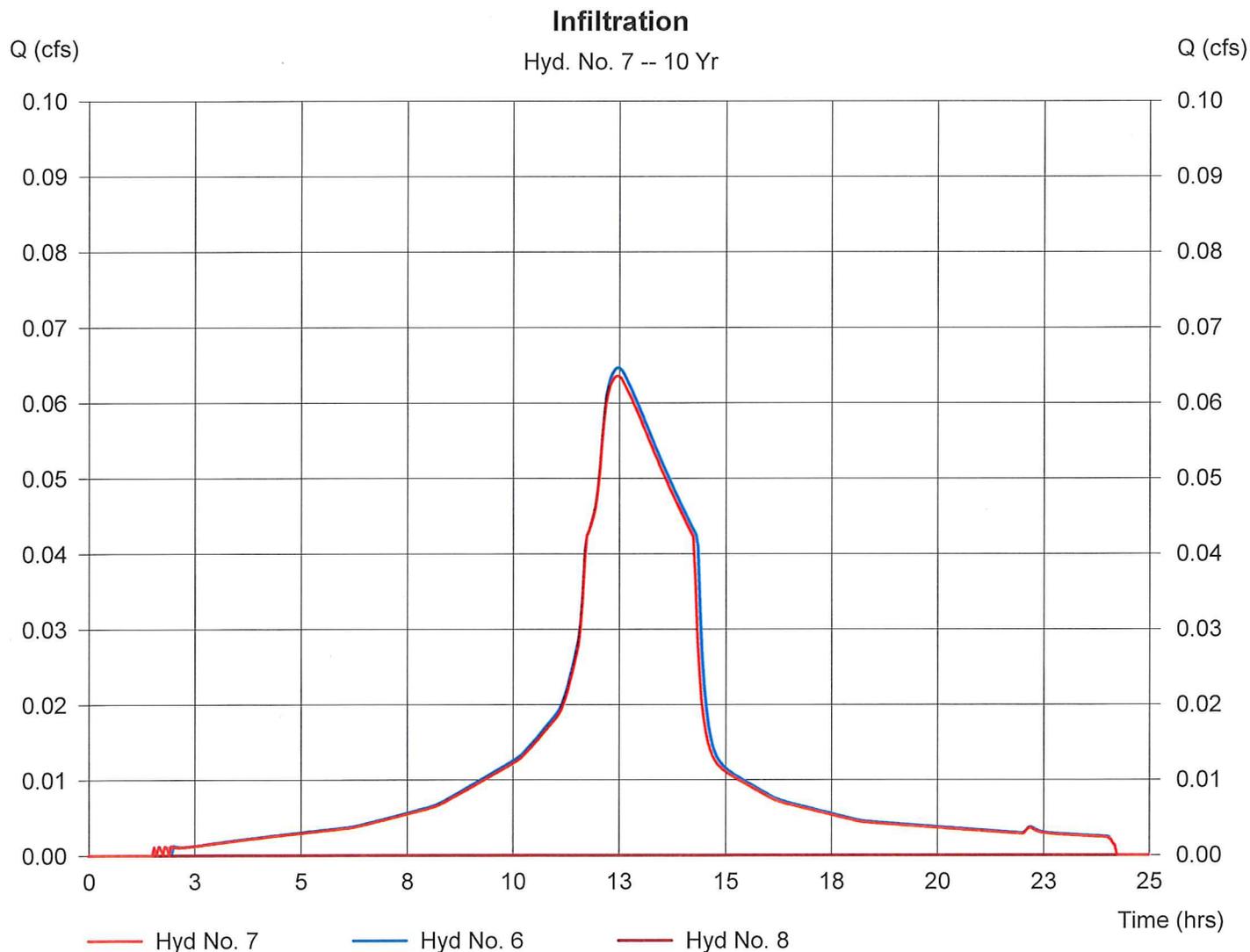
Hyd. No. 7

Infiltration

Hydrograph type = Diversion1
 Storm frequency = 10 yrs
 Inflow hydrograph = 6
 Diversion method = Pond - Infiltration System

Peak discharge = 0.06 cfs
 Time interval = 3 min
 2nd diverted hyd. = 8
 Pond structure = Exfiltration

Hydrograph Volume = 935 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

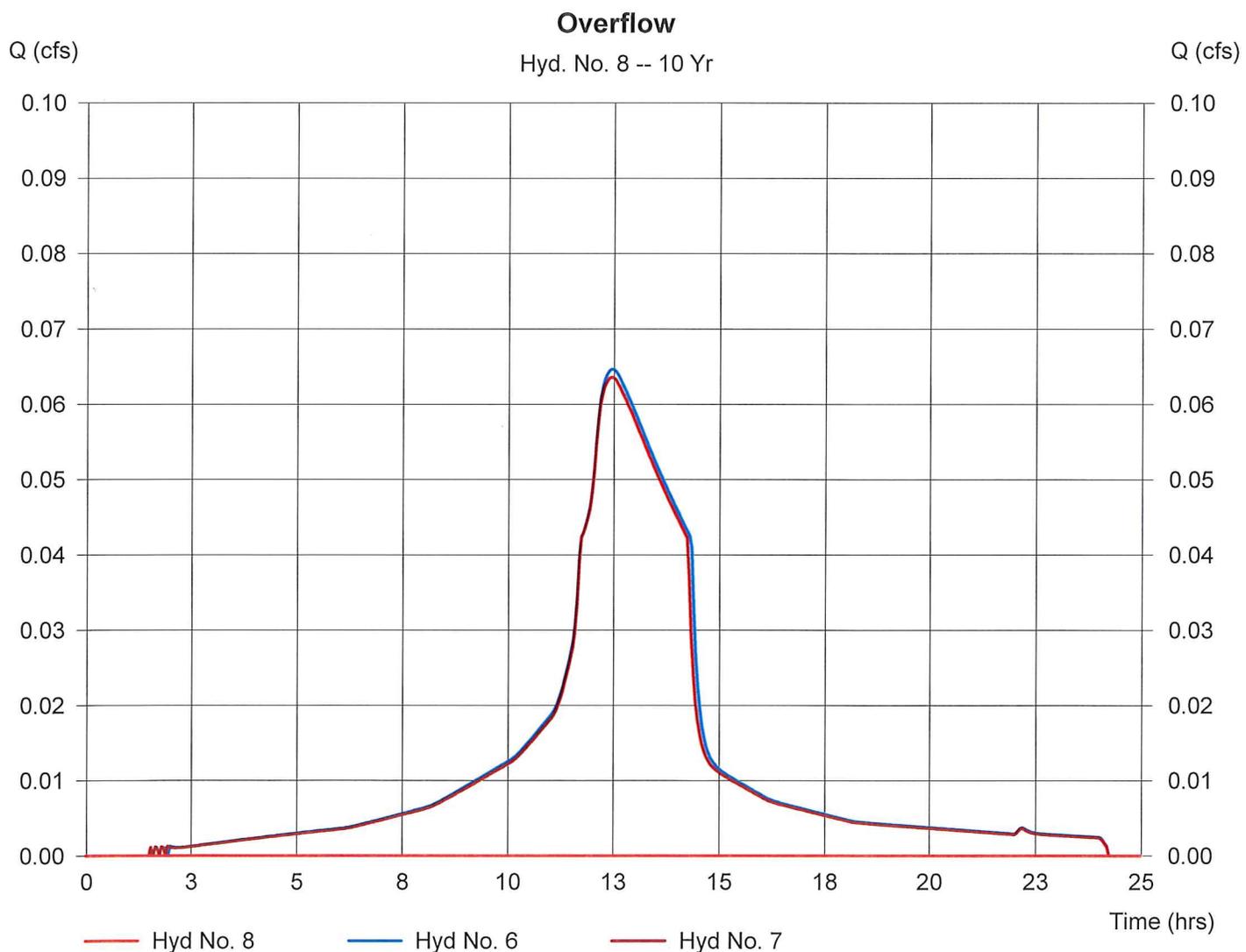
Hyd. No. 8

Overflow

Hydrograph type = Diversion2
 Storm frequency = 10 yrs
 Inflow hydrograph = 6
 Diversion method = Pond - Infiltration System

Peak discharge = 0.00 cfs
 Time interval = 3 min
 2nd diverted hyd. = 7
 Pond structure = Exfiltration

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

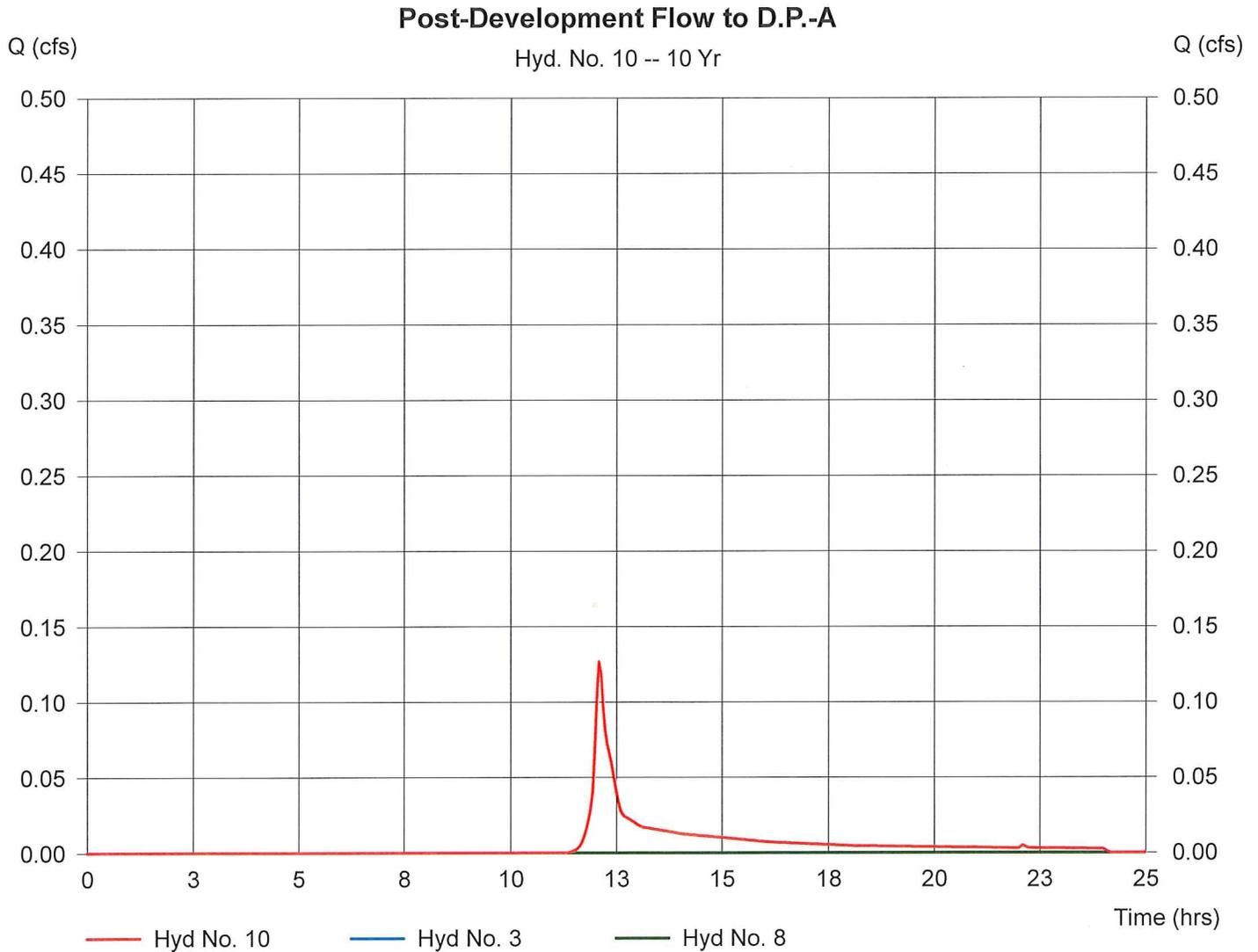
Hyd. No. 10

Post-Development Flow to D.P.-A

Hydrograph type = Combine
Storm frequency = 10 yrs
Inflow hyds. = 3, 8

Peak discharge = 0.13 cfs
Time interval = 3 min

Hydrograph Volume = 472 cuft



25-Year Storm, Pre and Post-Development

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	0.36	3	726	1,247	----	-----	-----	E.C.B.-1
3	SCS Runoff	0.20	3	726	695	----	-----	-----	P.D.B.-1
4	SCS Runoff	0.30	3	726	1,164	----	-----	-----	P.D.B.-2
6	Reservoir	0.07	3	750	1,164	4	152.86	304	Infiltration
7	Diversion1	0.07	3	750	1,128	6	-----	-----	Infiltration
8	Diversion2	0.00	3	654	0	6	-----	-----	Overflow
10	Combine	0.20	3	726	695	3, 8,	-----	-----	Post-Development Flow to D.P.-A
31 Frederick Street, Framingham.gpw							Return Period: 25 Year		Wednesday, Mar 9 2016, 7:23 AM

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

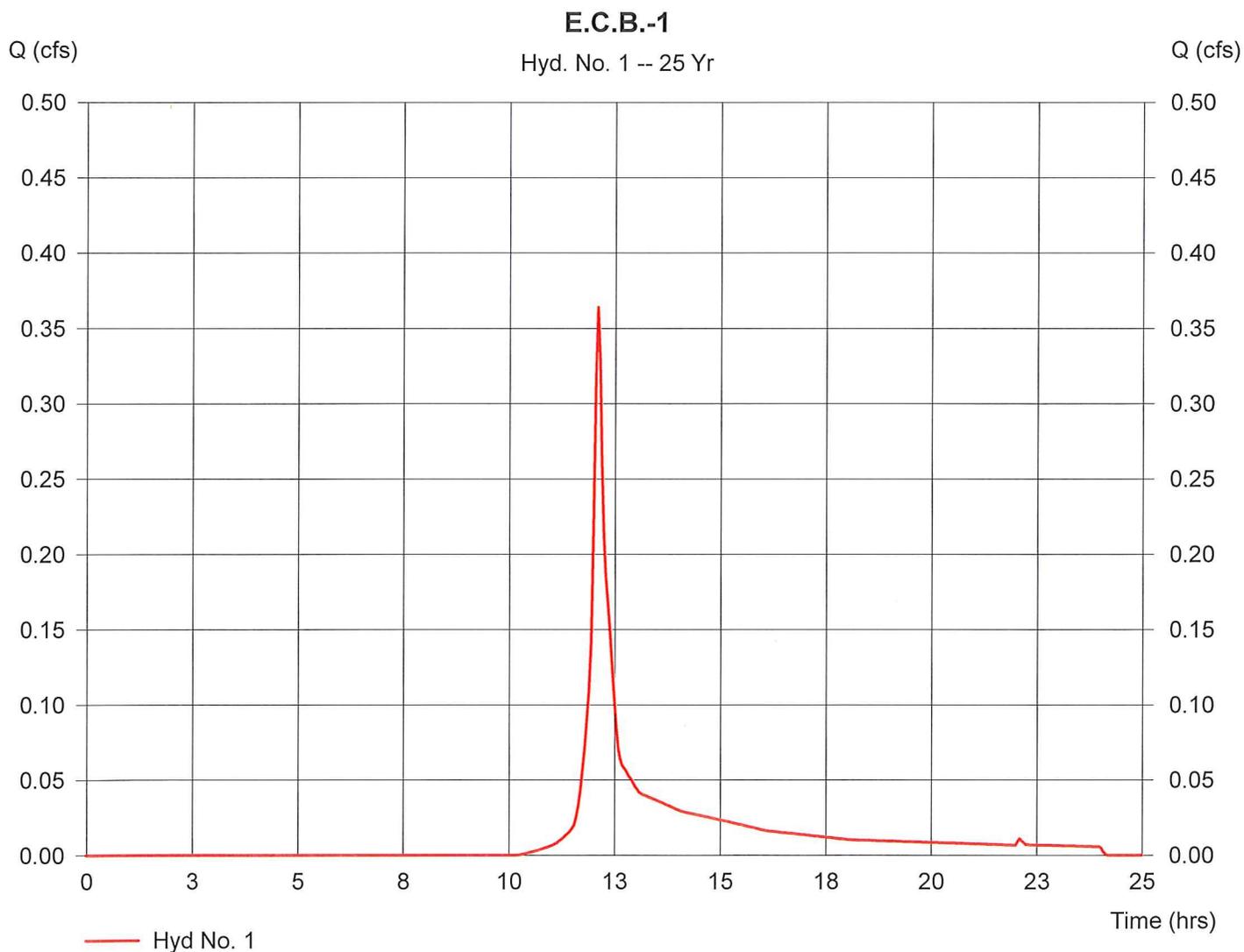
Hyd. No. 1

E.C.B.-1

Hydrograph type = SCS Runoff
 Storm frequency = 25 yrs
 Drainage area = 0.18 ac
 Basin Slope = 2.5 %
 Tc method = LAG
 Total precip. = 5.50 in
 Storm duration = 24 hrs

Peak discharge = 0.36 cfs
 Time interval = 3 min
 Curve number = 65.1
 Hydraulic length = 138 ft
 Time of conc. (Tc) = 6.273564 min
 Distribution = Type III
 Shape factor = 484

Hydrograph Volume = 1,247 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

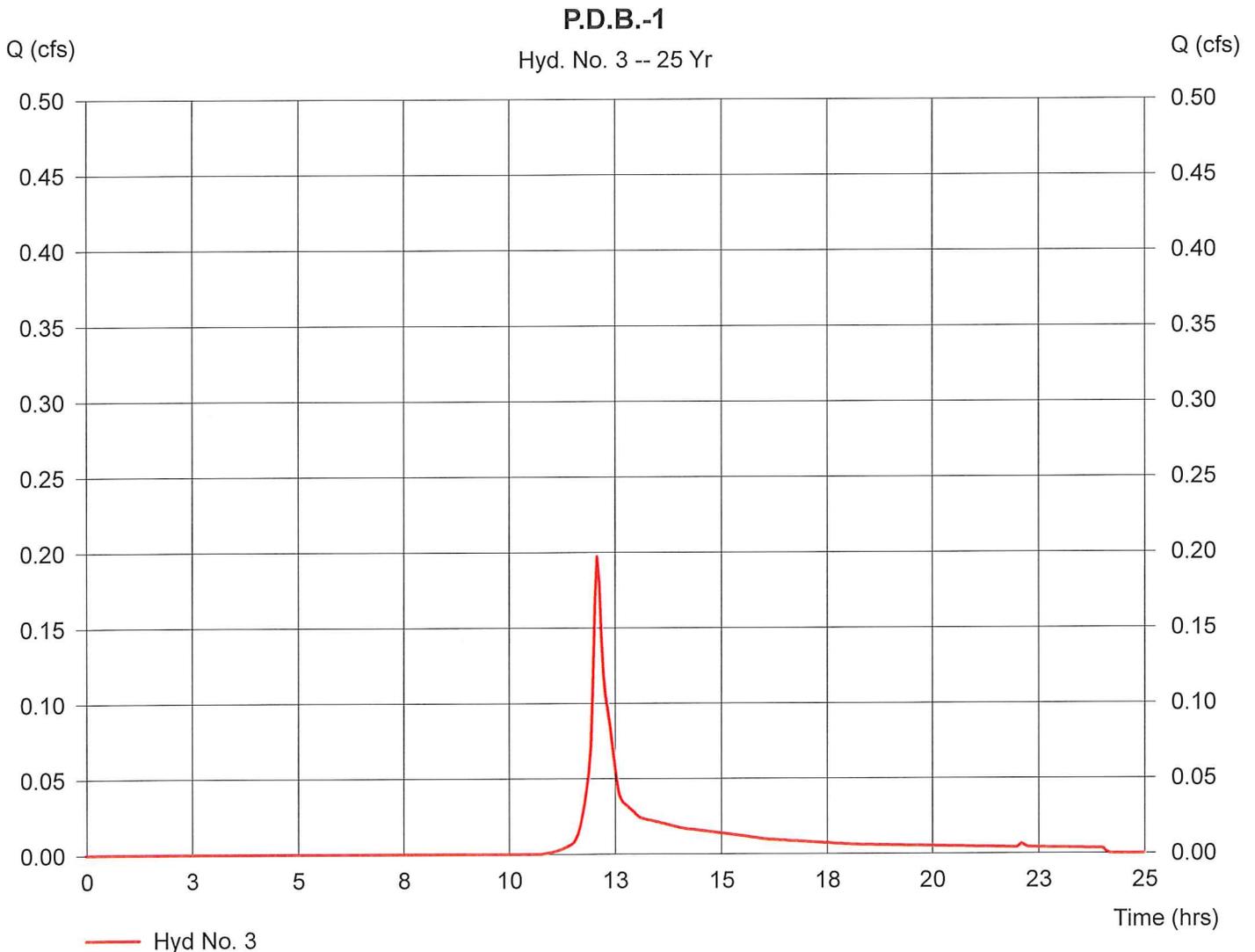
Hyd. No. 3

P.D.B.-1

Hydrograph type = SCS Runoff
 Storm frequency = 25 yrs
 Drainage area = 0.12 ac
 Basin Slope = 2.5 %
 Tc method = LAG
 Total precip. = 5.50 in
 Storm duration = 24 hrs

Peak discharge = 0.20 cfs
 Time interval = 3 min
 Curve number = 61.5
 Hydraulic length = 141 ft
 Time of conc. (Tc) = 7.001351 min
 Distribution = Type III
 Shape factor = 484

Hydrograph Volume = 695 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

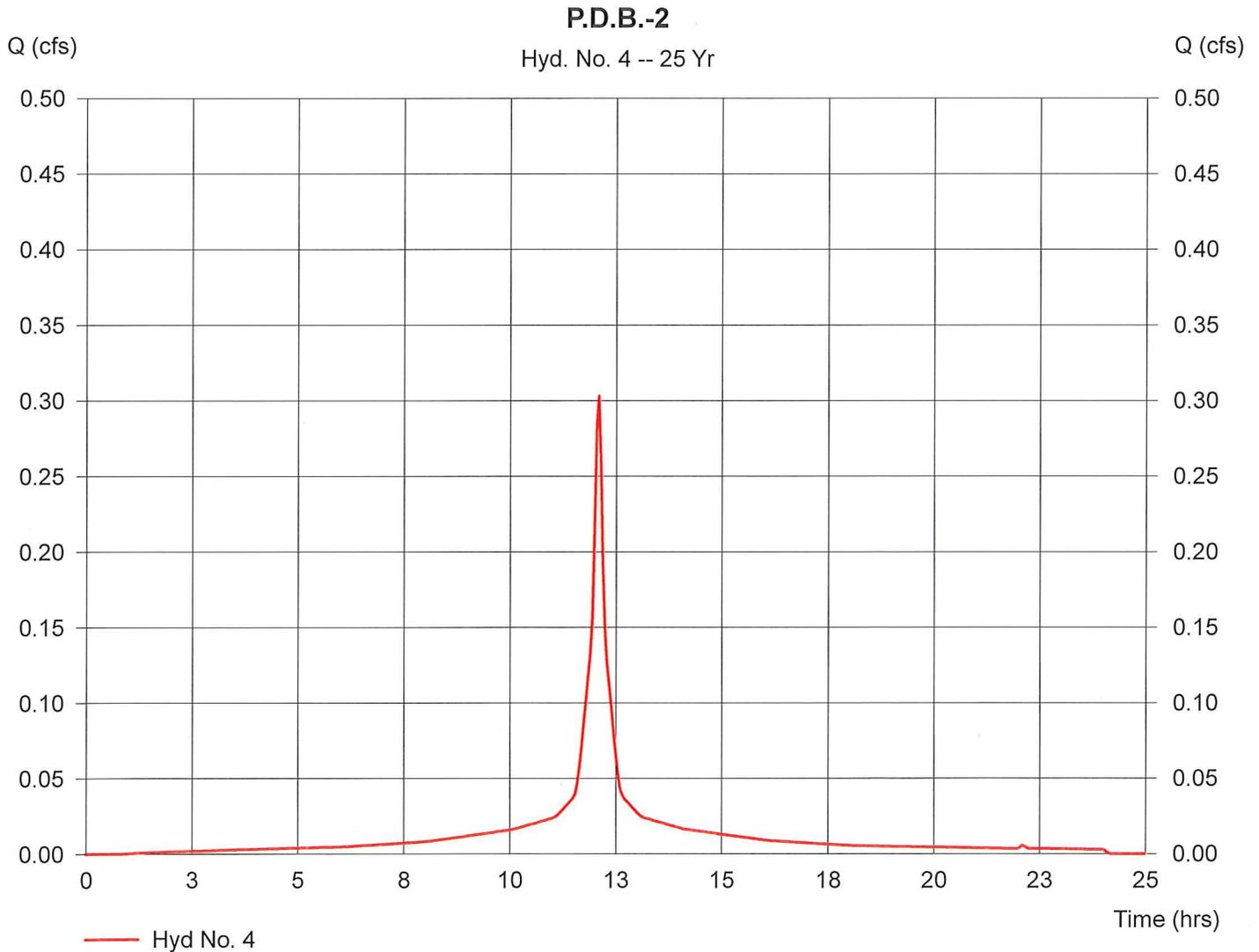
Hyd. No. 4

P.D.B.-2

Hydrograph type = SCS Runoff
 Storm frequency = 25 yrs
 Drainage area = 0.07 ac
 Basin Slope = 2.0 %
 Tc method = USER
 Total precip. = 5.50 in
 Storm duration = 24 hrs

Peak discharge = 0.30 cfs
 Time interval = 3 min
 Curve number = 98
 Hydraulic length = 50 ft
 Time of conc. (Tc) = 5 min
 Distribution = Type III
 Shape factor = 484

Hydrograph Volume = 1,164 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

Hyd. No. 6

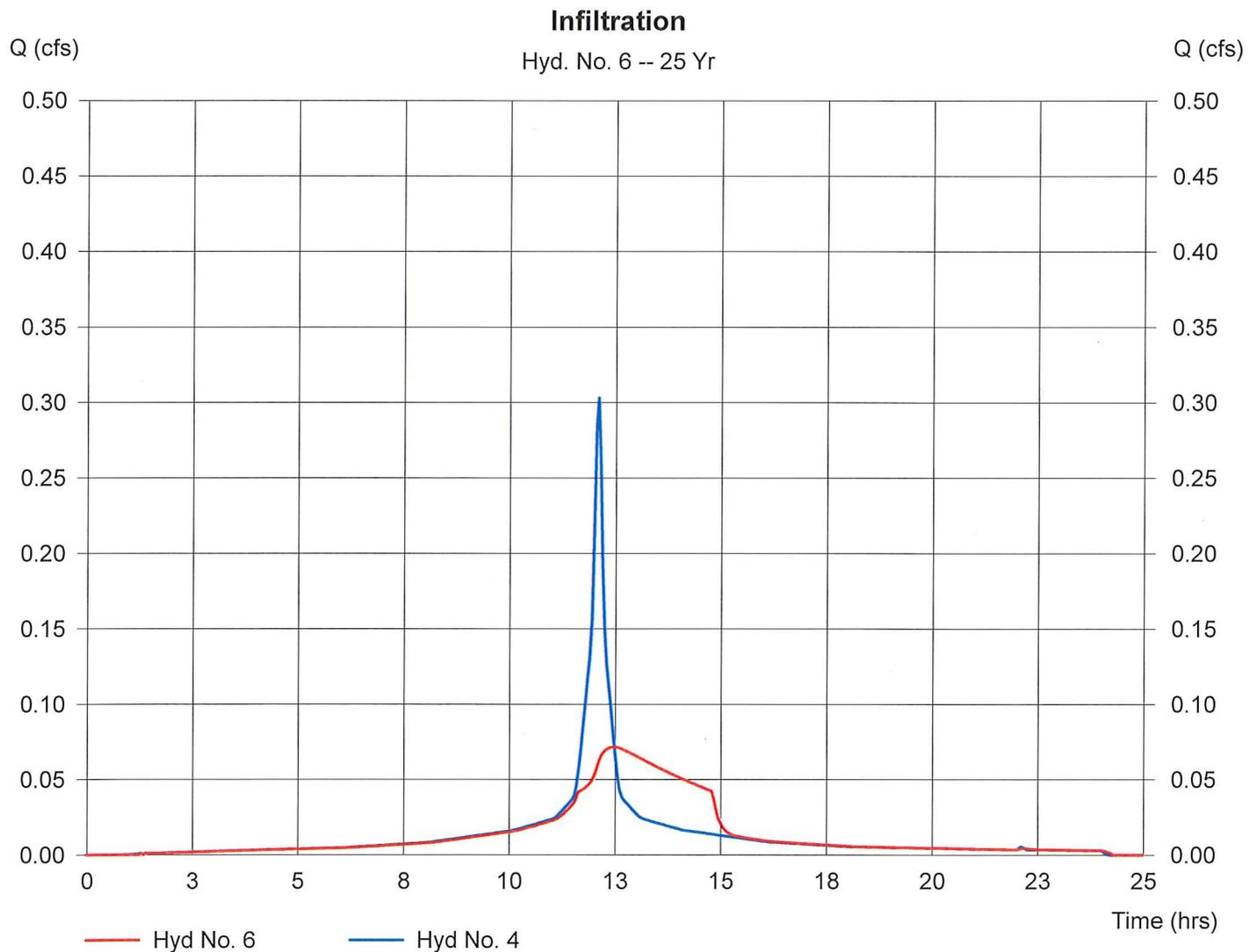
Infiltration

Hydrograph type = Reservoir
 Storm frequency = 25 yrs
 Inflow hyd. No. = 4
 Reservoir name = Infiltration System

Peak discharge = 0.07 cfs
 Time interval = 3 min
 Max. Elevation = 152.86 ft
 Max. Storage = 304 cuft

Storage Indication method used.

Hydrograph Volume = 1,164 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

Pond No. 1 - Infiltration System

Pond Data

Bottom LxW = 16.0 x 13.0 ft Side slope = 0.0:1 Bottom elev. = 150.00 ft Depth = 4.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*	(*51.00% voids applied)
0.00	150.00	208	0	0	
0.20	150.20	208	21	21	
0.40	150.40	208	21	42	
0.60	150.60	208	21	64	
0.80	150.80	208	21	85	
1.00	151.00	208	21	106	
1.20	151.20	208	21	127	
1.40	151.40	208	21	149	
1.60	151.60	208	21	170	
1.80	151.80	208	21	191	
2.00	152.00	208	21	212	
2.20	152.20	208	21	233	
2.40	152.40	208	21	255	
2.60	152.60	208	21	276	
2.80	152.80	208	21	297	
3.00	153.00	208	21	318	
3.20	153.20	208	21	339	
3.40	153.40	208	21	361	
3.60	153.60	208	21	382	
3.80	153.80	208	21	403	
4.00	154.00	208	21	424	

Culvert / Orifice Structures

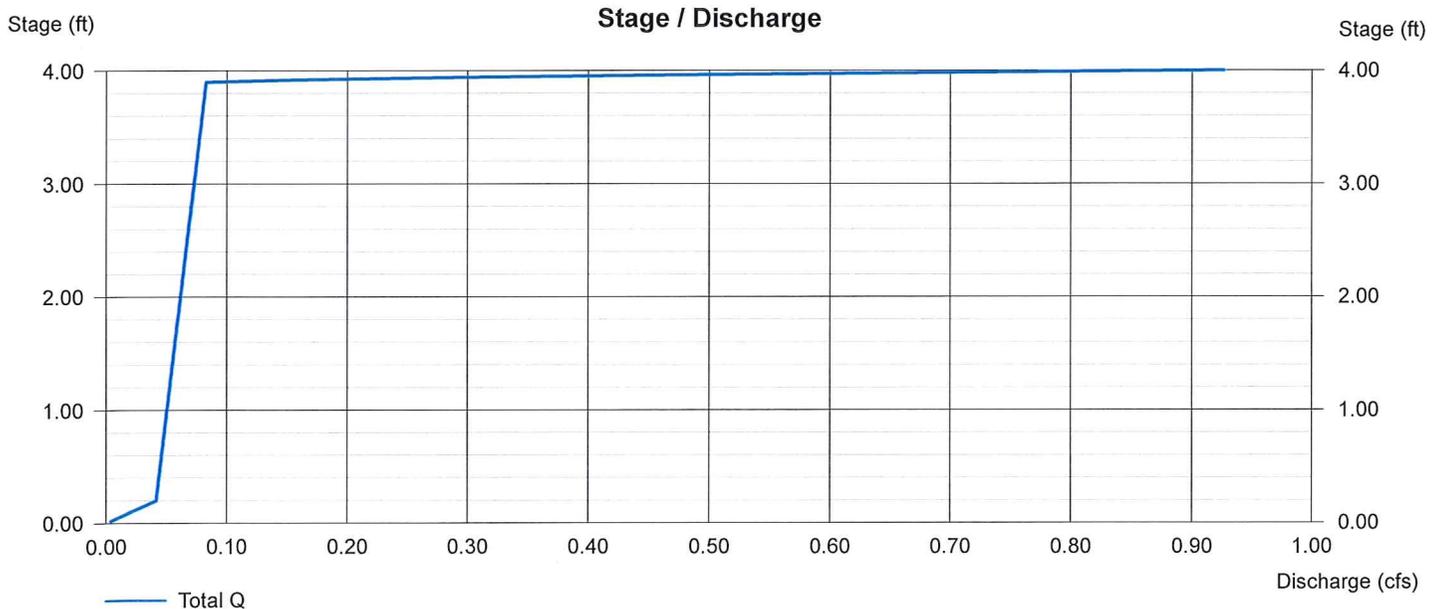
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 153.90	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 8.270 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, Mar 9 2016, 7:23 AM

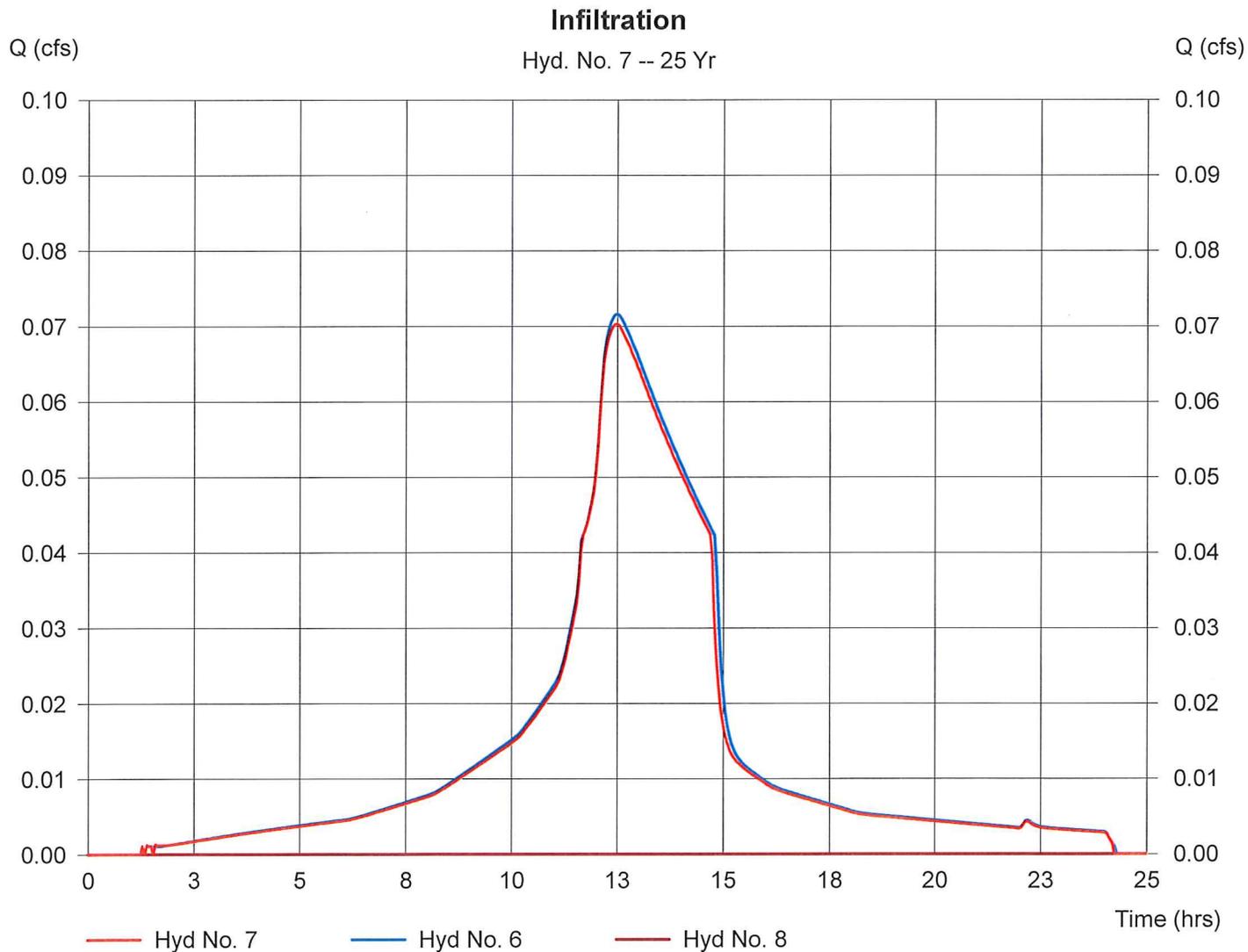
Hyd. No. 7

Infiltration

Hydrograph type = Diversion1
 Storm frequency = 25 yrs
 Inflow hydrograph = 6
 Diversion method = Pond - Infiltration System

Peak discharge = 0.07 cfs
 Time interval = 3 min
 2nd diverted hyd. = 8
 Pond structure = Exfiltration

Hydrograph Volume = 1,128 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

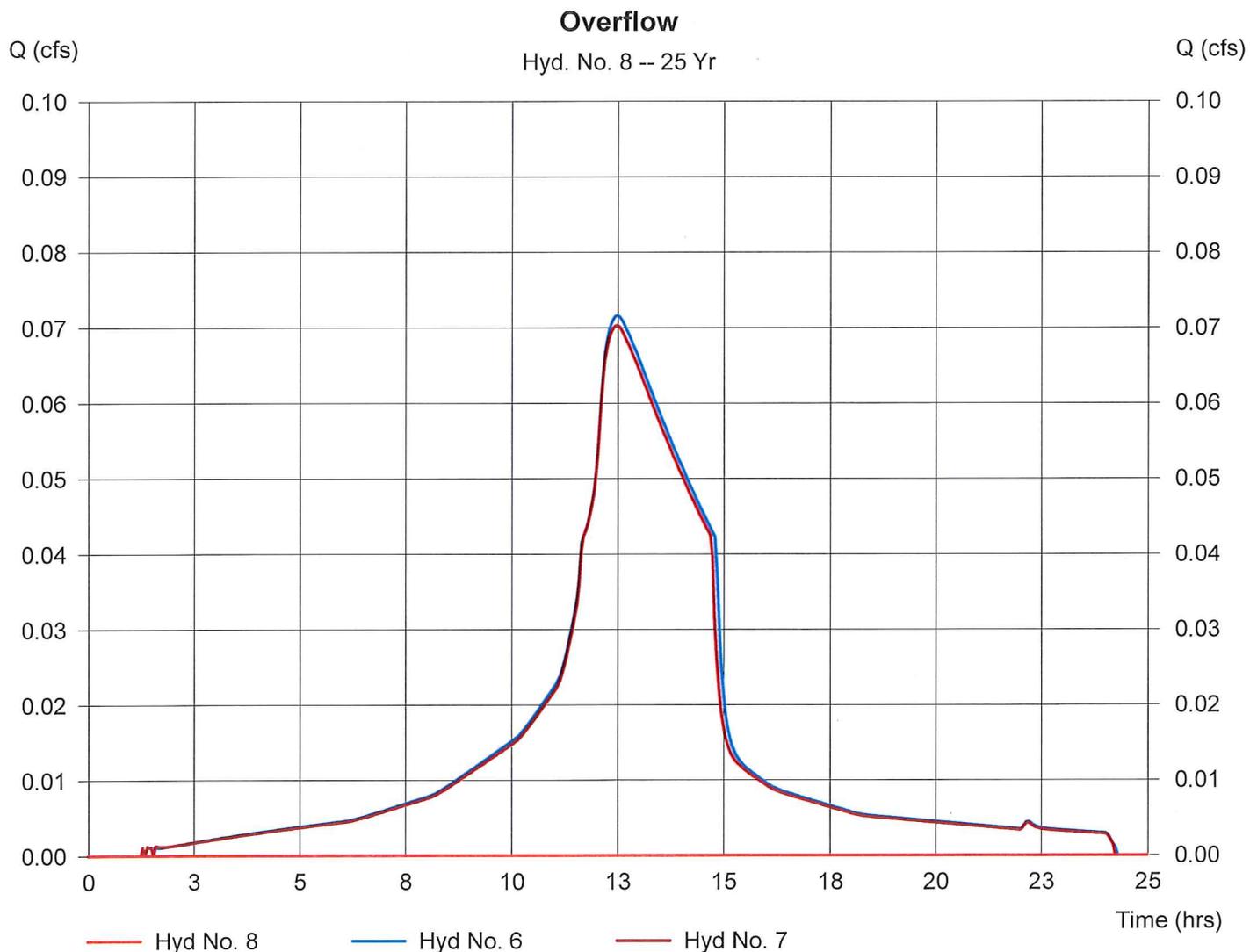
Hyd. No. 8

Overflow

Hydrograph type = Diversion2
 Storm frequency = 25 yrs
 Inflow hydrograph = 6
 Diversion method = Pond - Infiltration System

Peak discharge = 0.00 cfs
 Time interval = 3 min
 2nd diverted hyd. = 7
 Pond structure = Exfiltration

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

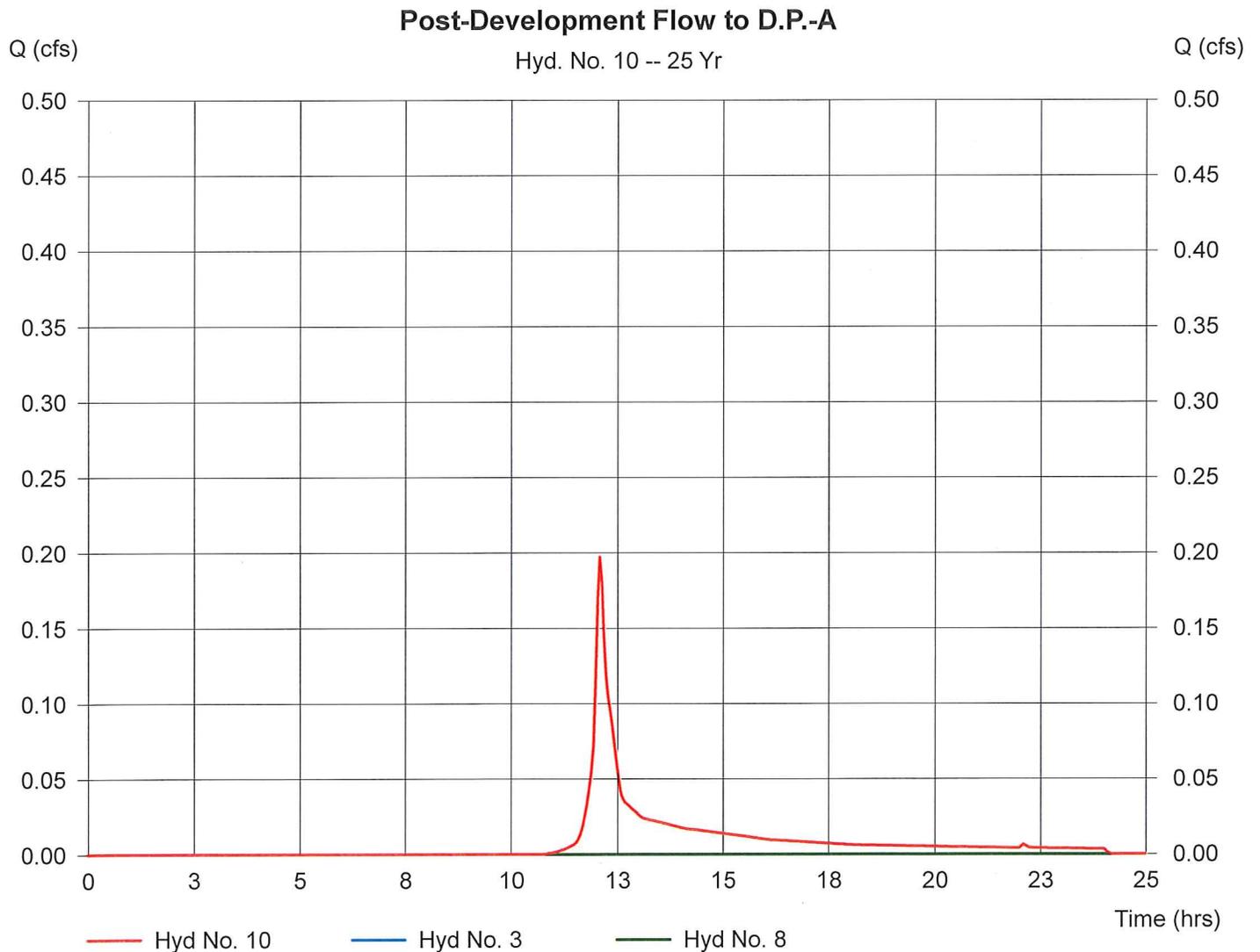
Hyd. No. 10

Post-Development Flow to D.P.-A

Hydrograph type = Combine
 Storm frequency = 25 yrs
 Inflow hyds. = 3, 8

Peak discharge = 0.20 cfs
 Time interval = 3 min

Hydrograph Volume = 695 cuft



100-Year Storm, Pre and Post-Development

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	0.51	3	726	1,701	----	-----	-----	E.C.B.-1
3	SCS Runoff	0.28	3	726	969	----	-----	-----	P.D.B.-1
4	SCS Runoff	0.36	3	726	1,385	----	-----	-----	P.D.B.-2
6	Reservoir	0.08	3	750	1,385	4	153.58	379	Infiltration
7	Diversion1	0.08	3	750	1,342	6	-----	-----	Infiltration
8	Diversion2	0.00	3	504	0	6	-----	-----	Overflow
10	Combine	0.28	3	726	969	3, 8,	-----	-----	Post-Development Flow to D.P.-A
31 Frederick Street, Framingham.gpw							Return Period: 100 Year		Wednesday, Mar 9 2016, 7:23 AM

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

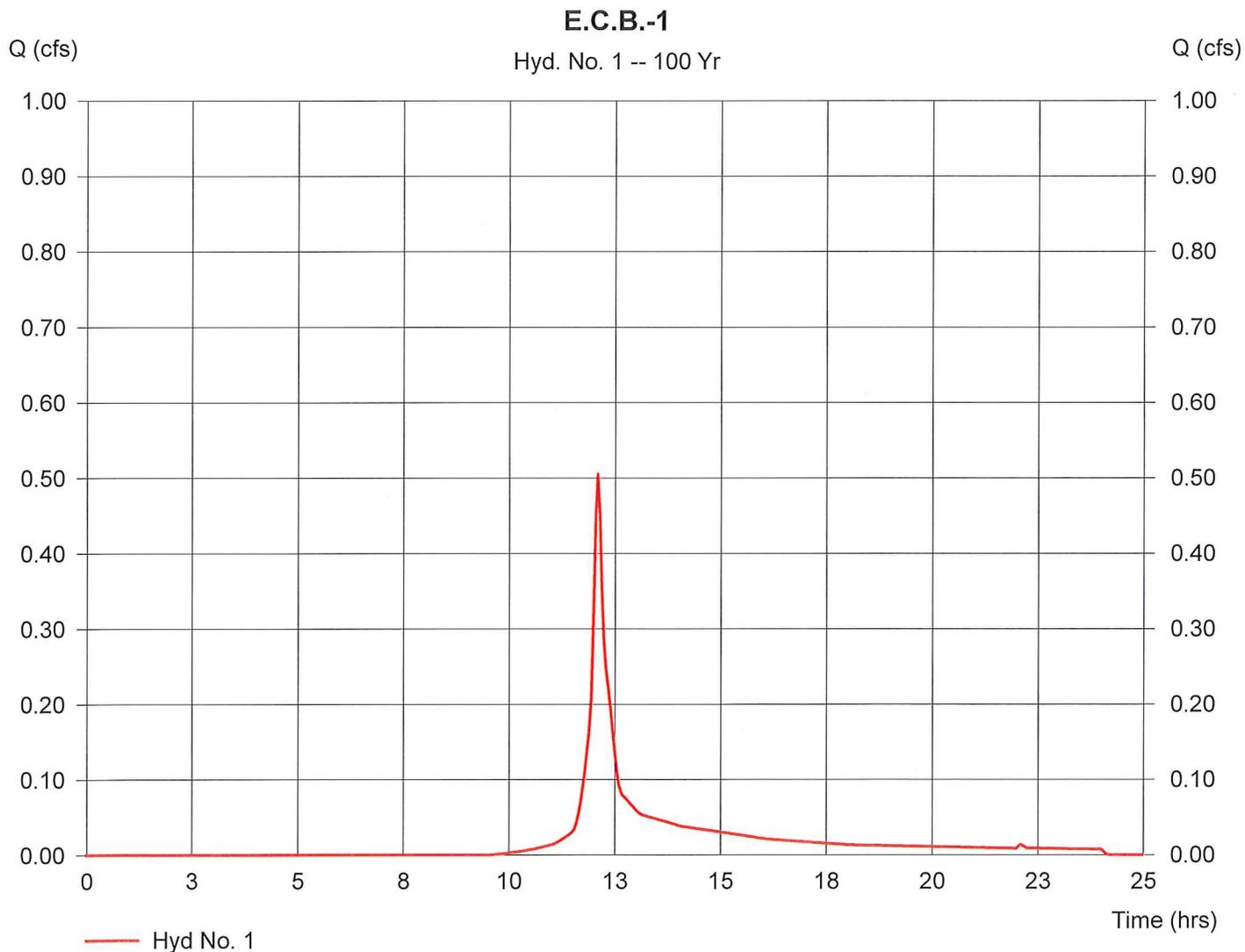
Hyd. No. 1

E.C.B.-1

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Drainage area = 0.18 ac
 Basin Slope = 2.5 %
 Tc method = LAG
 Total precip. = 6.50 in
 Storm duration = 24 hrs

Peak discharge = 0.51 cfs
 Time interval = 3 min
 Curve number = 65.1
 Hydraulic length = 138 ft
 Time of conc. (Tc) = 6.273564 min
 Distribution = Type III
 Shape factor = 484

Hydrograph Volume = 1,701 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

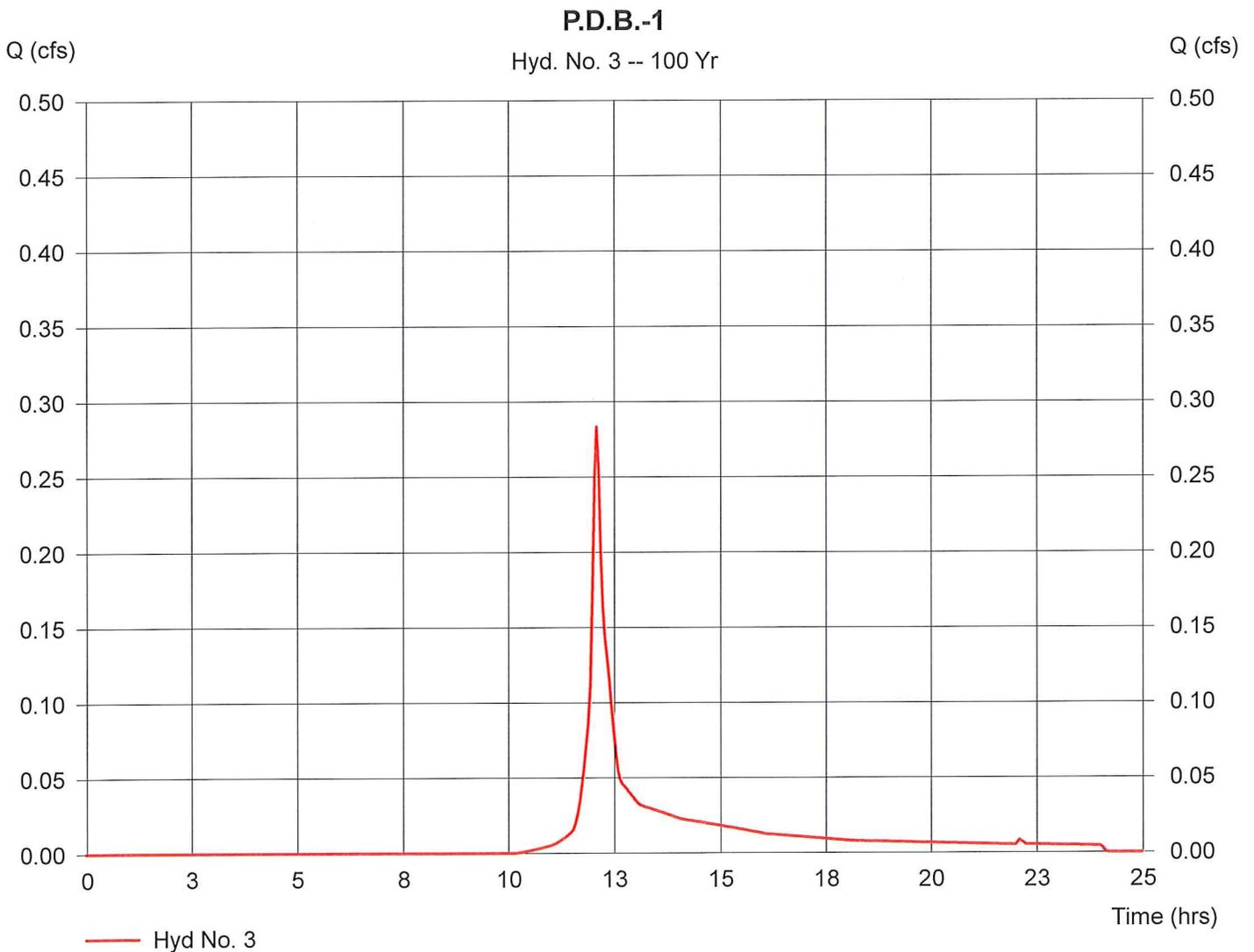
Hyd. No. 3

P.D.B.-1

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Drainage area = 0.12 ac
 Basin Slope = 2.5 %
 Tc method = LAG
 Total precip. = 6.50 in
 Storm duration = 24 hrs

Peak discharge = 0.28 cfs
 Time interval = 3 min
 Curve number = 61.5
 Hydraulic length = 141 ft
 Time of conc. (Tc) = 7.001351 min
 Distribution = Type III
 Shape factor = 484

Hydrograph Volume = 969 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

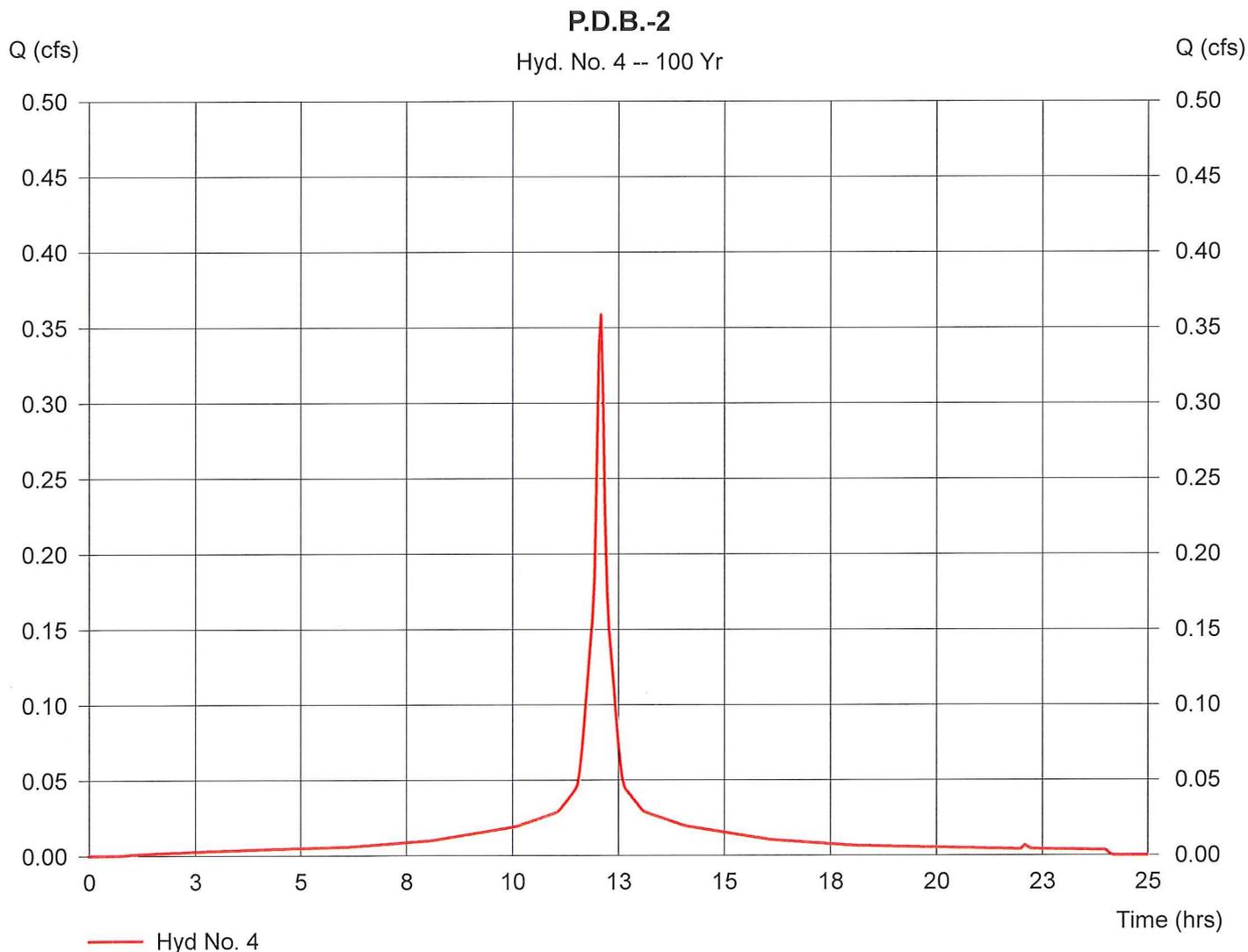
Hyd. No. 4

P.D.B.-2

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Drainage area = 0.07 ac
 Basin Slope = 2.0 %
 Tc method = USER
 Total precip. = 6.50 in
 Storm duration = 24 hrs

Peak discharge = 0.36 cfs
 Time interval = 3 min
 Curve number = 98
 Hydraulic length = 50 ft
 Time of conc. (Tc) = 5 min
 Distribution = Type III
 Shape factor = 484

Hydrograph Volume = 1,385 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

Hyd. No. 6

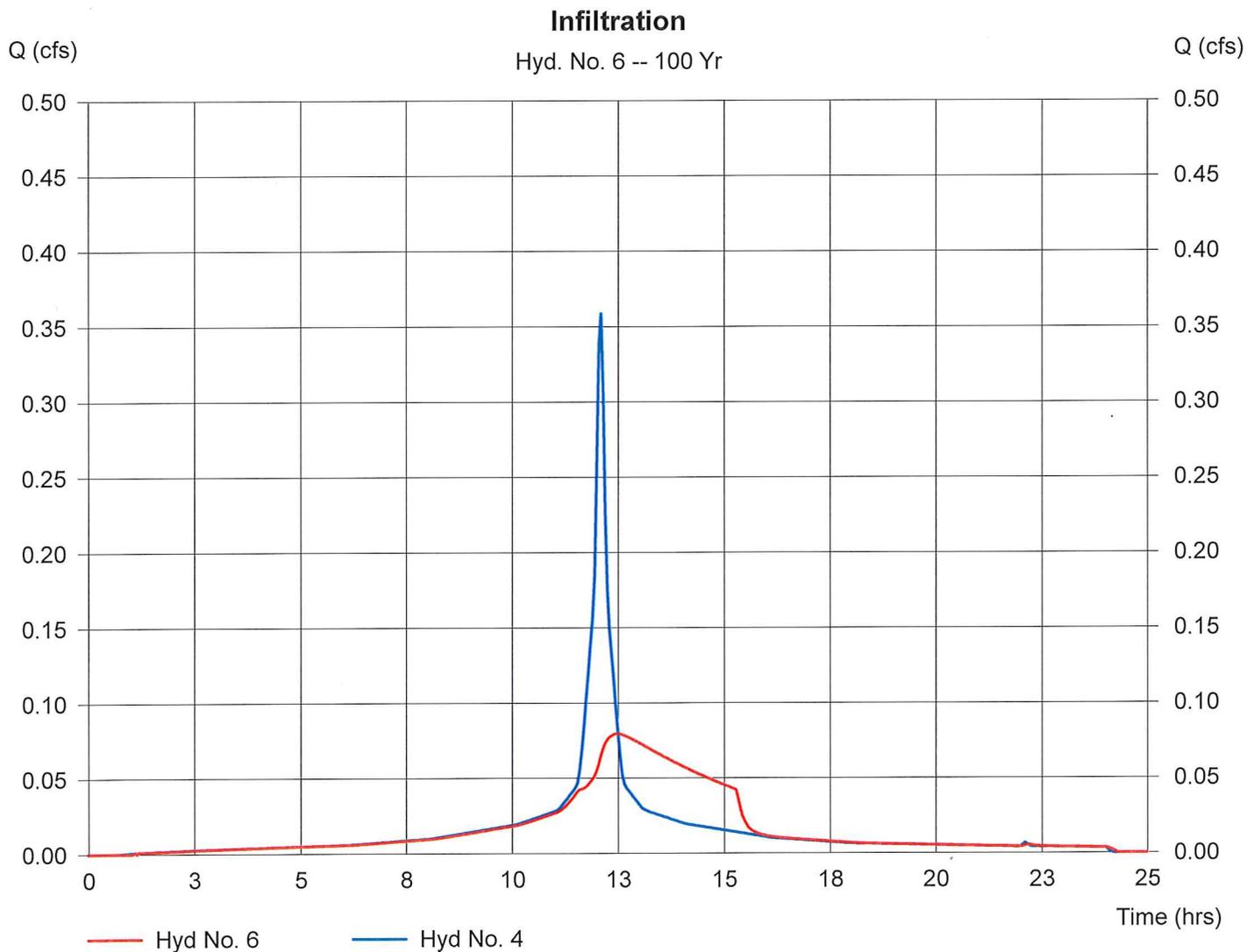
Infiltration

Hydrograph type = Reservoir
 Storm frequency = 100 yrs
 Inflow hyd. No. = 4
 Reservoir name = Infiltration System

Peak discharge = 0.08 cfs
 Time interval = 3 min
 Max. Elevation = 153.58 ft
 Max. Storage = 379 cuft

Storage Indication method used.

Hydrograph Volume = 1,385 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

Pond No. 1 - Infiltration System

Pond Data

Bottom LxW = 16.0 x 13.0 ft Side slope = 0.0:1 Bottom elev. = 150.00 ft Depth = 4.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)* (*51.00% voids applied)
0.00	150.00	208	0	0
0.20	150.20	208	21	21
0.40	150.40	208	21	42
0.60	150.60	208	21	64
0.80	150.80	208	21	85
1.00	151.00	208	21	106
1.20	151.20	208	21	127
1.40	151.40	208	21	149
1.60	151.60	208	21	170
1.80	151.80	208	21	191
2.00	152.00	208	21	212
2.20	152.20	208	21	233
2.40	152.40	208	21	255
2.60	152.60	208	21	276
2.80	152.80	208	21	297
3.00	153.00	208	21	318
3.20	153.20	208	21	339
3.40	153.40	208	21	361
3.60	153.60	208	21	382
3.80	153.80	208	21	403
4.00	154.00	208	21	424

Culvert / Orifice Structures

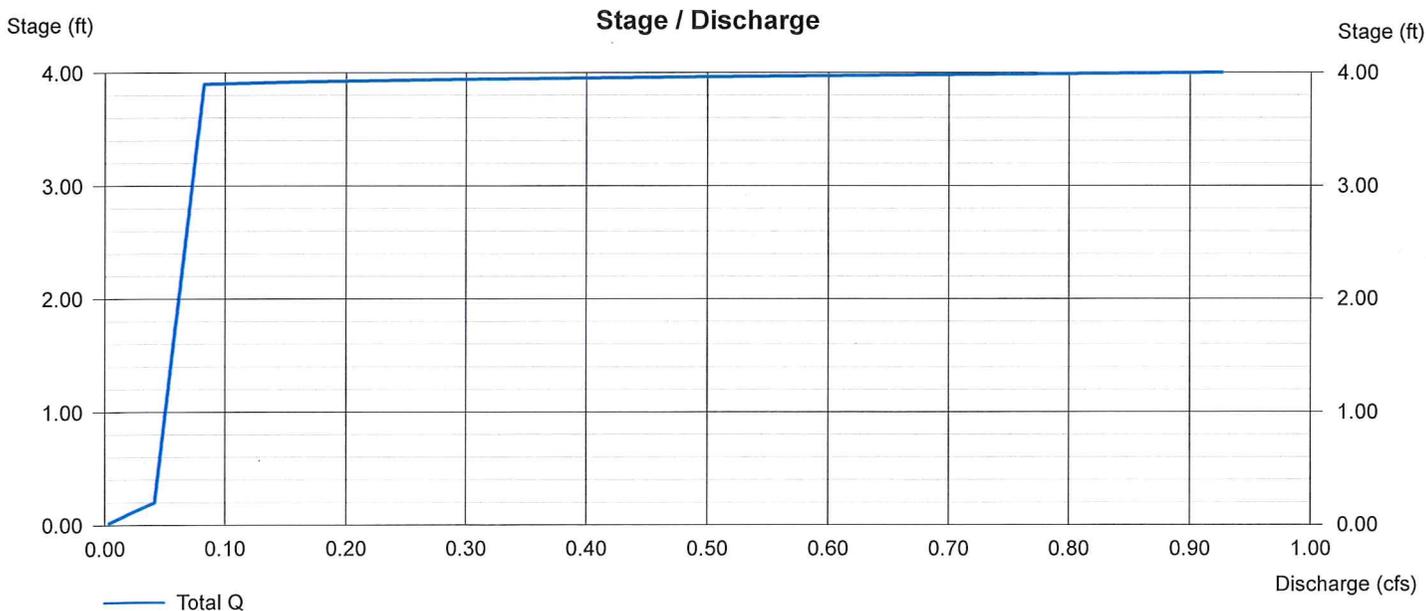
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 153.90	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 8.270 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, Mar 9 2016, 7:23 AM

Hyd. No. 7

Infiltration

Hydrograph type = Diversion1

Storm frequency = 100 yrs

Inflow hydrograph = 6

Diversion method = Pond - Infiltration System

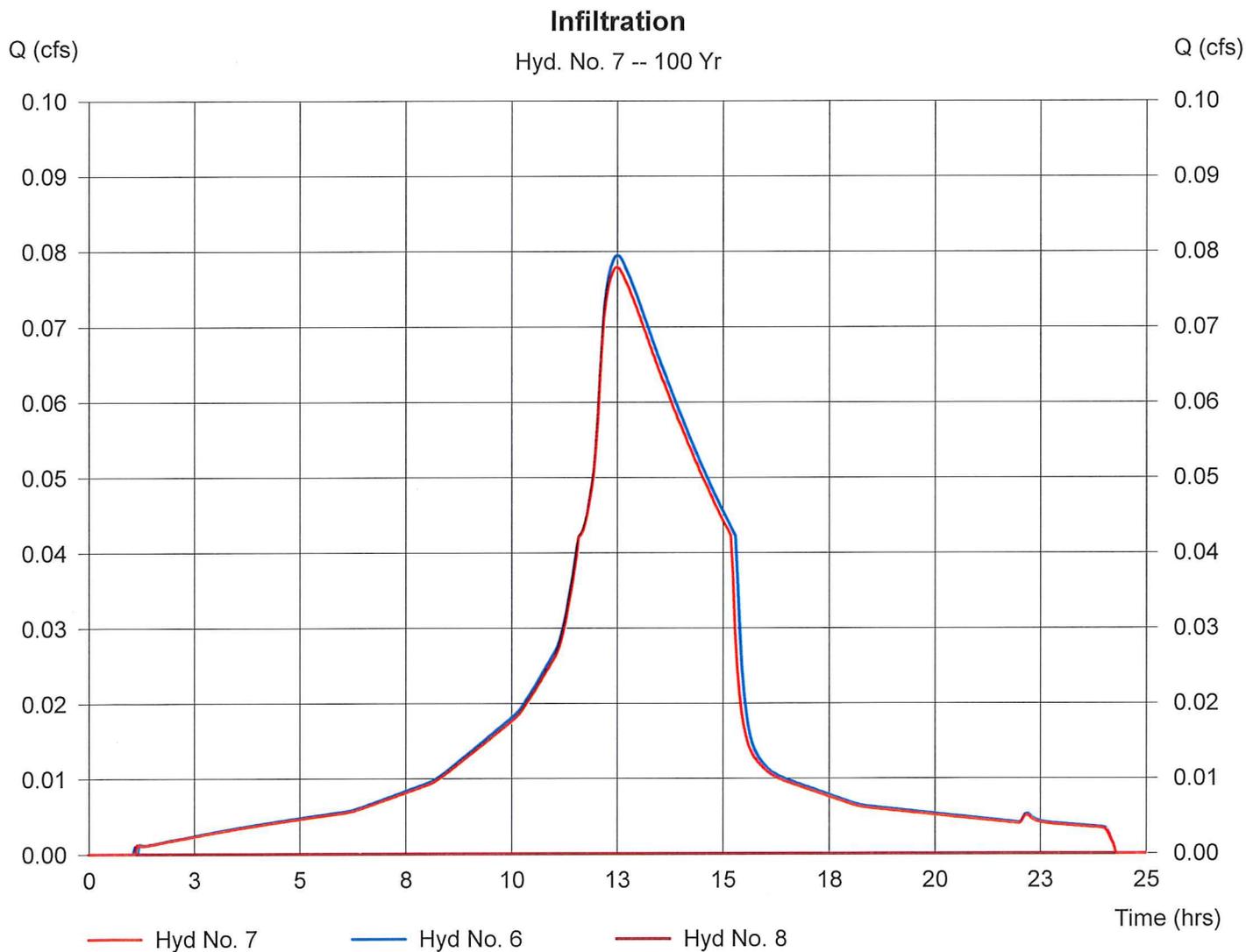
Peak discharge = 0.08 cfs

Time interval = 3 min

2nd diverted hyd. = 8

Pond structure = Exfiltration

Hydrograph Volume = 1,342 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

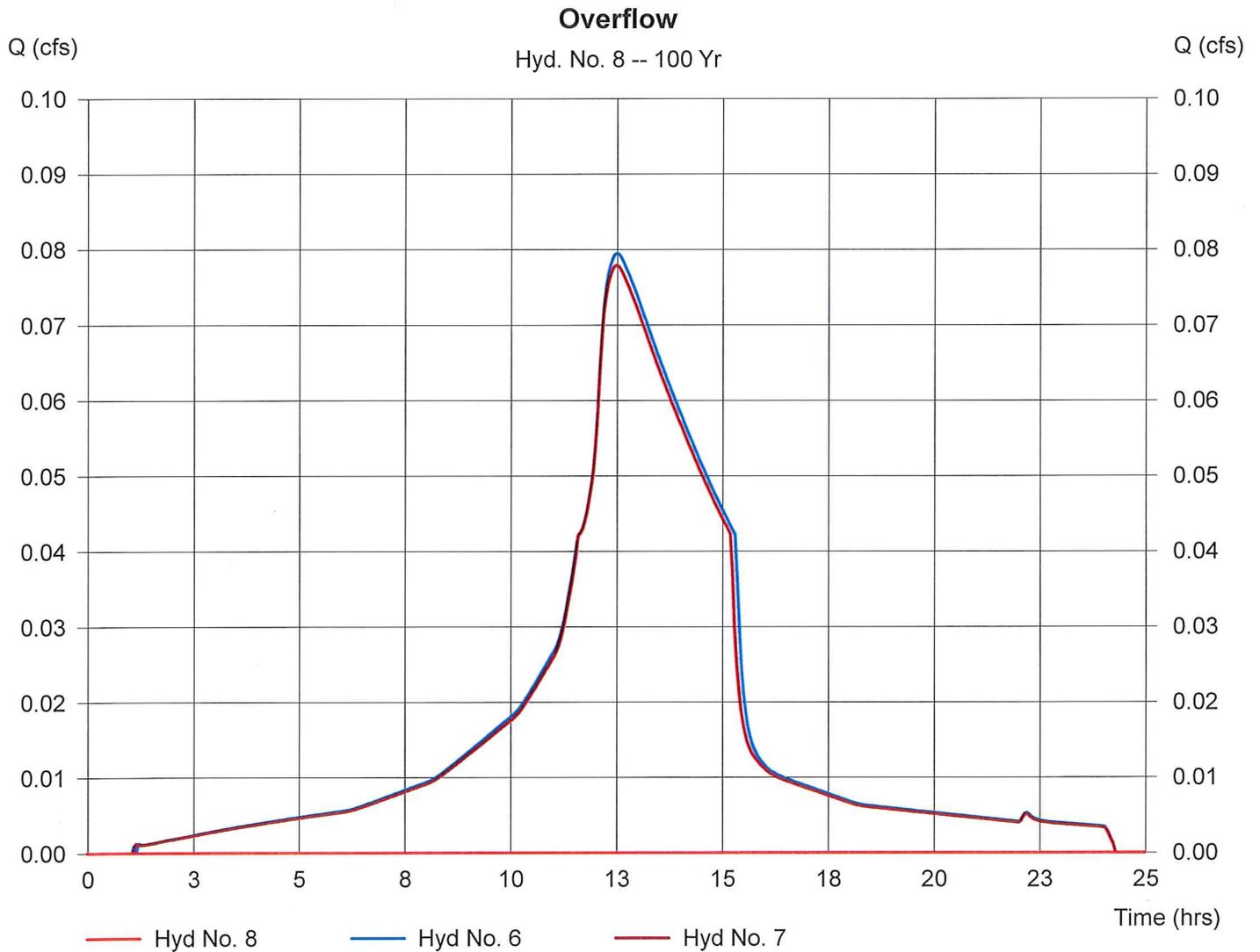
Hyd. No. 8

Overflow

Hydrograph type = Diversion2
 Storm frequency = 100 yrs
 Inflow hydrograph = 6
 Diversion method = Pond - Infiltration System

Peak discharge = 0.00 cfs
 Time interval = 3 min
 2nd diverted hyd. = 7
 Pond structure = Exfiltration

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 9 2016, 7:23 AM

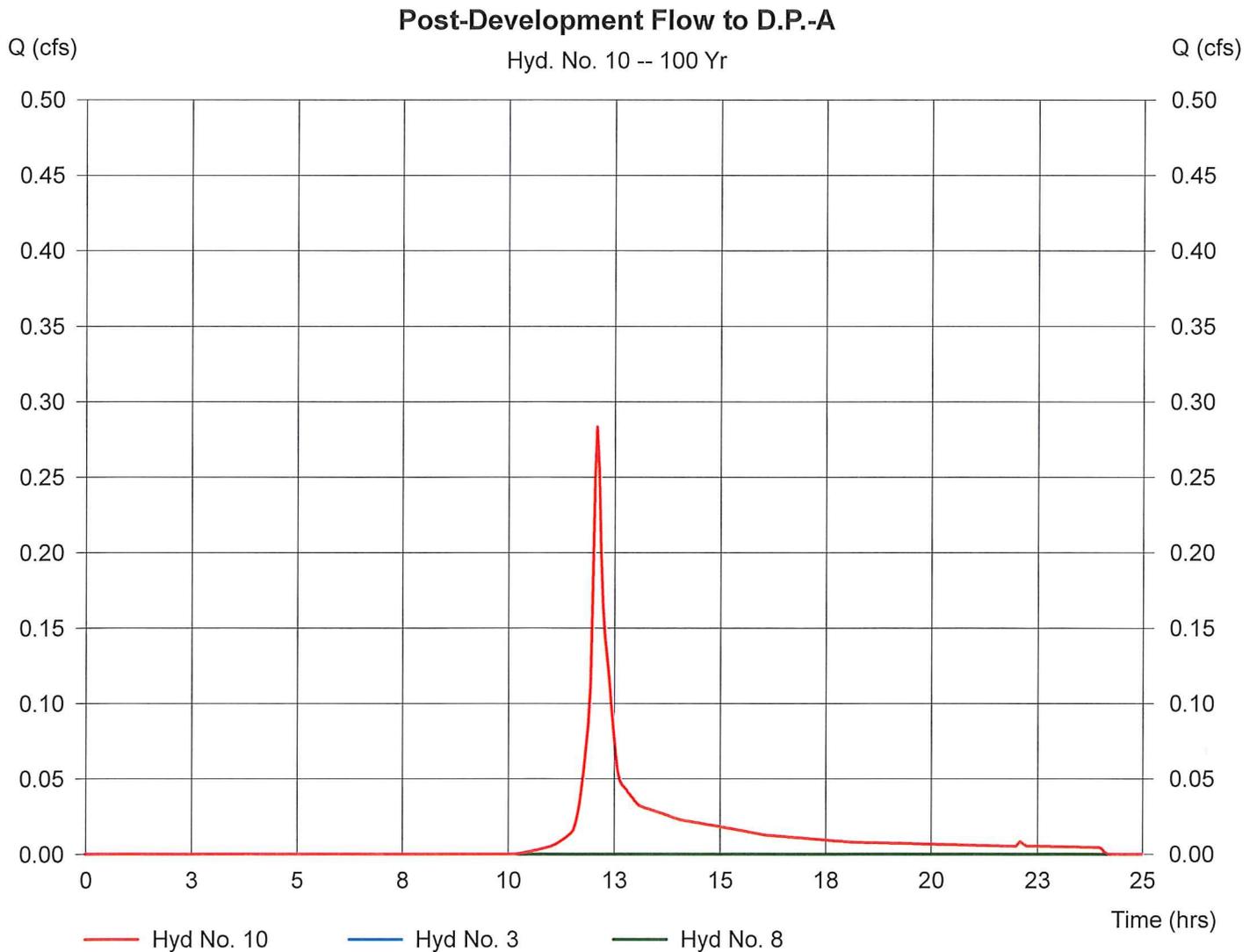
Hyd. No. 10

Post-Development Flow to D.P.-A

Hydrograph type = Combine
 Storm frequency = 100 yrs
 Inflow hyds. = 3, 8

Peak discharge = 0.28 cfs
 Time interval = 3 min

Hydrograph Volume = 969 cuft



Hydrologic Analysis:
Proposed Site Redevelopment
31 Frederick Street
Framingham, MA

Prepared for: ***VTT Frederick Street, LLC***
100 Concord Street
Framingham, MA 01702

Prepared by: ***MetroWest Engineering, Inc.***
75 Franklin Street
Framingham, MA 01702
(508) 626-0063

March, 2016

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Appendix B	Stormwater Operation and Maintenance Plan
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**Appendix B:
Stormwater Operation and
Maintenance Plan**

Stormwater Operation and Maintenance Plan
31 Frederick Street, Framingham MA
Prepared by: MetroWest Engineering Inc.

General

The project site is located on the southerly side of Frederick Street approximately four hundred feet east of the intersection of Concord Street and Frederick Street in the town of Framingham.

The subject parcel (Assessors' Map 4, Block 8, Lots and 5 and 5A) has an area of 7,991 square feet (0.18 acres) and is presently improved with a two-story building, driveway and supporting utilities. The existing house is located approximately 15-feet off the southerly sideline of Frederick Street.

The site redevelopment includes the demolition of the existing building followed by construction of a new multi-family building, paved driveways, stormwater management system and supporting utilities.

Drainage Approach

At the present time, the site has no stormwater management system in place to control runoff from existing impervious surfaces. The proposed project includes a stormwater management system designed to collect runoff from the existing roof surface. Runoff from the proposed roof will be stored and recharged in a proposed subsurface infiltration system. The goal of the proposed stormwater management system is to maintain or reduce runoff rates and volumes for all design storms compared to the existing condition and to promote groundwater recharge through the use of a subsurface infiltration system.

The proposed subsurface infiltration system is located at the rear of the property behind the proposed dwelling. It consists of 6 Rotondo G444 pre-cast, concrete infiltration galleys surrounded by two-feet of double-washed, crushed stone. The infiltration system will collect runoff from the roof surface of the proposed building and is designed to completely contain and infiltrate a 100-year design storm.

Overall reductions in runoff rate and volume can be found in the Model Results section of the Hydrologic Analysis.

Maintenance Requirements

The project's stormwater collection and treatment system is designed to collect and treat stormwater so that all discharges from the system are in compliance with all local, state and federal environmental regulations. Periodic routine inspection and maintenance of the system is critical if the system is to continue to meet required performance standards.

Stormwater Operation and Maintenance Plan for 31 Frederick Street, Framingham MA

Responsible Party

The owner shall be responsible for all maintenance and repair activities throughout the site relating to the pavement surface, stormwater collection system and the subsurface infiltration system.

The owner shall also grant the Framingham Engineering Department the right to enter the property periodically to inspect the stormwater management system.

Required Maintenance

Grounds

All slopes shall be inspected and any exposed areas or other locations susceptible to erosion shall be stabilized with mulch, sod, seed, stone or other suitable measures. All grass clippings, leaves, brush and other natural materials will be transported to an approved composting facility. No clippings or leaves will be deposited in wooded areas or on abutting properties.

Roof Gutters

Building gutters shall be cleaned twice per year, in the spring and fall. Leaves, pine needles and similar materials shall be removed from the gutters and disposed of by the landscaping contractor for the property.

Area Drains/Catch Basins

All area drains and catch basins contain a sump that should be cleaned twice per year, in the spring and fall. All debris shall be removed and disposed of in accordance with MADEP policy.

Infiltration System

The infiltration system shall be inspected twice per year to evaluate sediment accumulation and once per year during a storm event. Routine inspection for sediment accumulation shall consist of the inspection of each chamber where an inlet is located. An inspection port cover is located at each point. Any sediment that has entered into the system at the inlet locations shall be removed and disposed of in accordance with MADEP policy.

The system shall also be observed at least once per year during a major storm event. A major storm event shall be defined for this Operation and Maintenance Plan as one in which the 24-hour rainfall volume exceeds one-inch. The inspection shall include removal of an inspection port cover to measure the water depth inside the system. The inspection should take place after at least one inch of rainfall has fallen and prior to the end of storm. Following the inspection, the precipitation volume, based upon the nearest reporting weather station, should be recorded in the inspection log book.

Recommended Personnel

A commercial contractor should be engaged to perform the periodic cleaning and inspections required for the drainage and infiltration systems. A landscape contractor may perform gutter cleaning.

A professional engineer with expertise in drainage systems, hydrology or similar sciences should perform an annual inspection of the infiltration system and should evaluate the infiltration system during a major storm event.

Record Keeping

A logbook or other record should be maintained for all inspection, cleaning and maintenance activities. The logs or records should be provided to the drainage professional engaged to perform the annual inspection of the drainage and infiltration system. An annual report should be prepared by the drainage professional to summarize inspection and maintenance activities, review the performance of the infiltration system, and provide recommendations for repair or remedial measures required to maintain the performance of the system. The annual report should be submitted to the home owner and operator and kept on site.

Emergency Contacts

In the event of a major drainage system failure, a release of dangerous materials or other unforeseen accident, the following organizations may be contacted:

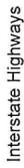
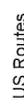
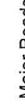
Town of Framingham, *Board of Health*
(508) 532-5470

Town of Framingham, *Engineering Department*
(508) 532-6010

MetroWest Engineering, Inc. (Design Engineer)
(508) 626-0063

**Appendix C:
NRCS Soil Survey Data**

MAP LEGEND

 Area of Interest (AOI)	 C
 Area of Interest (AOI)	 C/D
Soils	 D
Soil Rating Polygons	 Not rated or not available
 A	Water Features
 A/D	 Streams and Canals
 B	Transportation
 B/D	 Rails
 C	 Interstate Highways
 C/D	 US Routes
 D	 Major Roads
 Not rated or not available	 Local Roads
Soil Rating Lines	 Background
 A	 Aerial Photography
 A/D	
 B	
 B/D	
 C	
 C/D	
 D	
 Not rated or not available	
Soil Rating Points	
 A	
 A/D	
 B	
 B/D	
 C	
 C/D	
 D	
 Not rated or not available	

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000. Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 15, Sep 28, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 12, 2014—Sep 28, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Middlesex County, Massachusetts (MA017)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		193.2	11.3%
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	A/D	2.6	0.2%
30B	Raynham silt loam, 0 to 5 percent slopes	C/D	3.2	0.2%
51A	Swansea muck, 0 to 1 percent slopes	B/D	11.8	0.7%
52A	Freestown muck, 0 to 1 percent slopes	B/D	46.3	2.7%
53A	Freestown muck, ponded, 0 to 1 percent slopes	B/D	6.9	0.4%
223B	Scio very fine sandy loam, 3 to 8 percent slopes	B/D	2.4	0.1%
251B	Haven silt loam, 3 to 8 percent slopes	A	29.6	1.7%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	2.1	0.1%
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	1.5	0.1%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	0.8	0.0%
255A	Windsor loamy sand, 0 to 3 percent slopes	A	3.2	0.2%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	17.1	1.0%
256A	Deerfield loamy sand, 0 to 3 percent slopes	B	29.0	1.7%
256B	Deerfield loamy sand, 3 to 8 percent slopes	B	8.7	0.5%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	B	40.5	2.4%
300D	Montauk fine sandy loam, 15 to 25 percent slopes	C	0.1	0.0%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	C	15.8	0.9%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	6.6	0.4%

Hydrologic Soil Group— Summary by Map Unit — Middlesex County, Massachusetts (MA017)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
341C	Broadbrook very fine sandy loam, 8 to 15 percent slopes, very stony	D	12.4	0.7%
341D	Broadbrook very fine sandy loam, 15 to 25 percent slopes, very stony	D	27.1	1.6%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	A	15.7	0.9%
602	Urban land		485.7	28.4%
603	Urban land, wet substratum		17.1	1.0%
622C	Paxton-Urban land complex, 3 to 15 percent slopes	C	32.8	1.9%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	477.7	27.9%
652	Udorthents, refuse substratum		4.7	0.3%
653	Udorthents, sandy		53.6	3.1%
654	Udorthents, loamy		40.7	2.4%
655	Udorthents, wet substratum		21.3	1.2%
656	Udorthents-Urban land complex		99.1	5.8%
Totals for Area of Interest			1,709.5	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher