STORMWATER REPORT
655 Cochituate Road
Framingham, MA

Prepared for: ***Paul Finger Associates***
14 Spring Street
Waltham, MA 02451-4429

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

September, 2014

Revised December 2014

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CHAPTER 1: HYDROLOGIC ANALYSIS

Hydrologic Analysis:
Proposed Site Redevelopment
655 Cochituate Road
Framingham, MA

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Hydrologic Assessment
Proposed Site Redevelopment
655 Cochituate Road, Framingham MA

Introduction

The project site is located at 655 Cochituate Road, approximately 530 feet west of the intersection of Speen Street at Cochituate Road and south of Interstate 90 (Massachusetts Turnpike). The locus is shown on *Figure One: Locus Map, 655 Cochituate Road, Framingham, MA*.

The subject parcel (Assessors' Map 346, Block 110, Lot 3) has an area of approximately 48,350 square feet (1.11 acres) and is presently improved with a one-story building occupied by Central Pools, a single story building occupied by North End Treats, a vacant two-story warehouse, bituminous concrete pavement and supporting utilities. The lot is mostly covered by impervious surfaces. The site is relatively flat with a slight gradient from north to south.

Two bordering vegetated wetland areas are located just off the locus to the west and south of the property.

According to the NRCS Soil Survey, soils on the site belong to the Urban Land soil series. These soils are not classified within a hydrologic soil group due to the high level of development in the area and disturbance to natural soils.

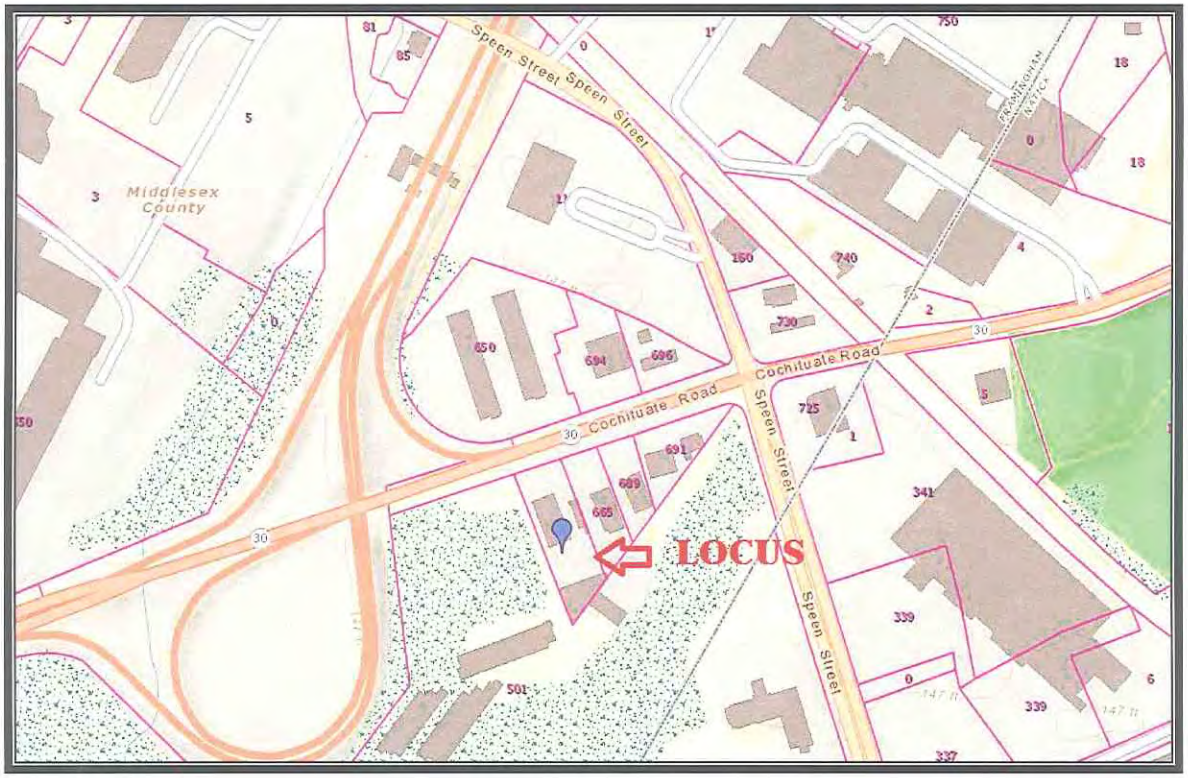
The site redevelopment program includes demolition of the existing one-story building (presently occupied by Central Pools), demolition of the existing one-story building (presently occupied by North End Treats), construction of a new two-story retail building using the same footprint as the Central Pools building, permeable pavers, bituminous concrete pavement, supporting utilities and landscaping. See site plans for details regarding the proposed development.

The existing property contains 45,822 square feet of impervious area. Redevelopment of the property will reduce the impervious area by 9,381 square, for a total of 36,441 square feet.

Drainage Approach

There are presently no stormwater controls in place to manage runoff rates or volumes. Runoff drains to the east and southeast on to the abutting property and into Cochituate Road. The goal of the proposed stormwater management system is to reduce runoff rates and volumes for all design storms compared to the existing condition and to promote groundwater recharge through the use of permeable pavers.

Figure One: Locus Map, 655 Cochituate Rd, Framingham MA



The proposed permeable pavers are located within the footprint of the proposed parking areas to the south, east and north ends of the property and will store and infiltrate runoff from the bituminous concrete pavement, the roof surfaces and surrounding landscaped areas.

Overall reductions in runoff rates and volumes can be found in the Model Results section of this report and detailed hydrologic analysis and basin models can be found in Appendix A.

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 systems. 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. Time of concentration values were determined by the LAG Method or manually entered at five minutes for watersheds having relatively small areas or hydraulic lengths 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 Condition

The existing conditions model analyzes the site as two drainage basins; Existing Conditions Basins One and Two.

Existing Conditions Basin 1 (E.C.B.-1) has an area of 18,944 square feet and flows in a southeasterly direction to by Design Point A located northeast of the property.

Existing Conditions Basin 2 (E.C.B.-2) has an area of 29,406 square feet and flows in a southeasterly direction to Design Point B located southeasterly of the property.

The Existing Conditions Basins are shown on Figure Two, *Existing Conditions Watershed Delineation Plan* and information for all Existing Conditions Basins is listed on the plan and below.

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

Area = 18,944 square feet
Impervious Area = 17,672 square feet, curve number = 98.0
Herbaceous area (good condition) = 1,272 square feet; curve number = 74.0
Hydrologic soil group C
Weighted Curve Number = 96.6
Basin slope = 0.3%
Hydraulic length = 150 feet

EXISTING CONDITIONS BASIN PROPERTIES:

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

TOTAL BASIN AREA = 18,944 S.F. (0.434 ACRES)
HYDRAULIC LENGTH = 149.7 FEET
CHANGE IN ELEVATION = .5 FEET
BASIN SLOPE = .003 (0.3%)

GROUND COVER	Cn	AREA (ACRES)	PRODUCT
IMPERVIOUS AREA = 17,672 S.F. (0.406 ACRES)	98	0.406	39.788
HERBACEOUS AREA = 1,272 S.F. (0.028 ACRES)	74	0.028	2.072
		SUM 0.434	SUM 41.934

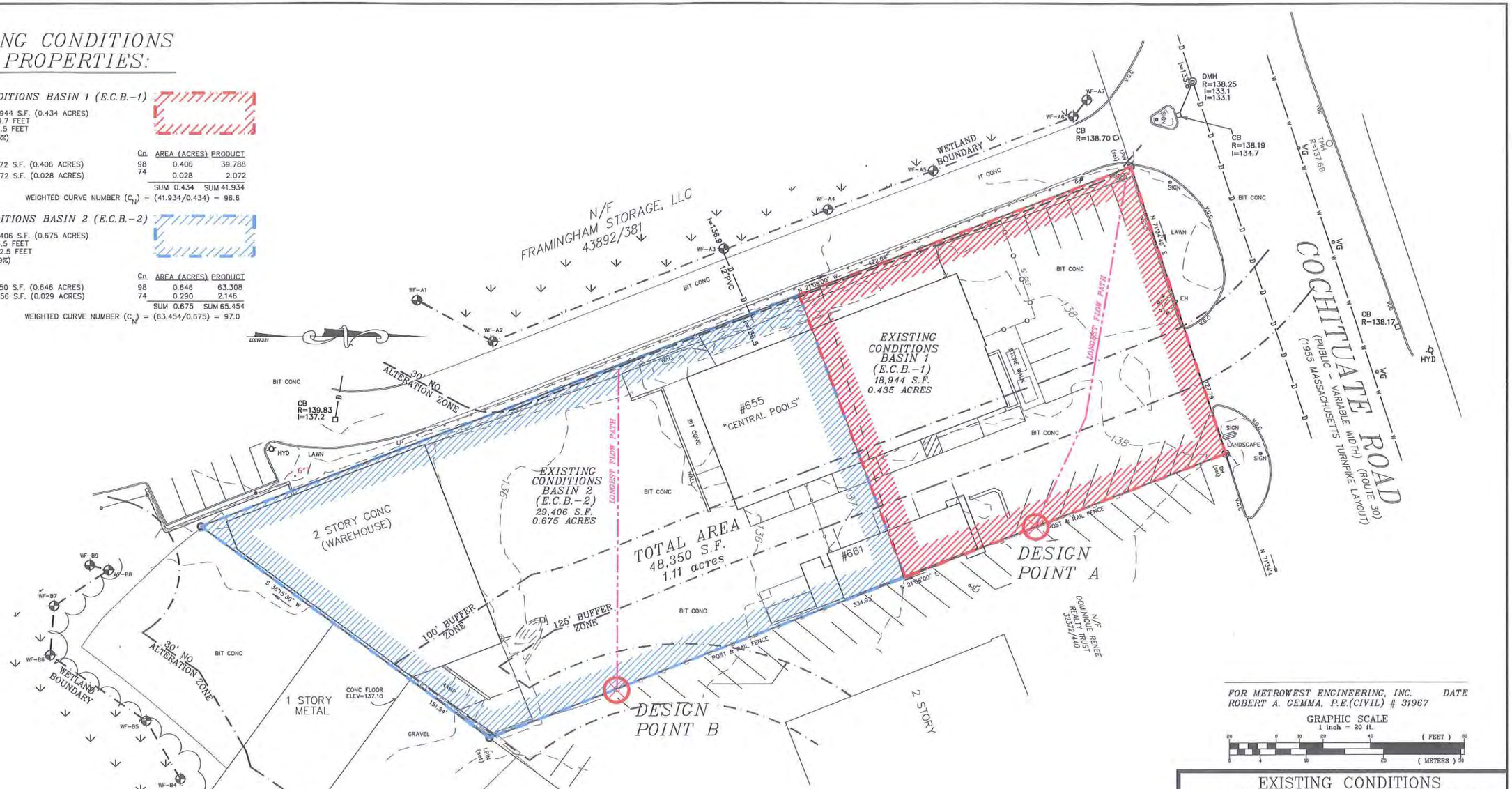
WEIGHTED CURVE NUMBER (C_N) = (41.934/0.434) = 96.6

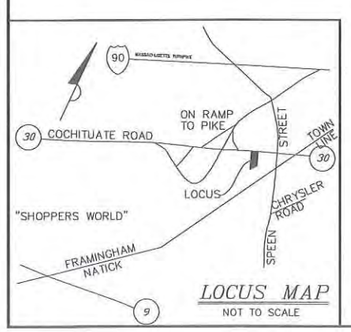
EXISTING CONDITIONS BASIN 2 (E.C.B.-2)

TOTAL BASIN AREA = 29,406 S.F. (0.675 ACRES)
HYDRAULIC LENGTH = 134.5 FEET
CHANGE IN ELEVATION = 2.5 FEET
BASIN SLOPE = 0.019 (1.9%)

GROUND COVER	Cn	AREA (ACRES)	PRODUCT
IMPERVIOUS AREA = 28,150 S.F. (0.646 ACRES)	98	0.646	63.308
HERBACEOUS AREA = 1,256 S.F. (0.029 ACRES)	74	0.290	2.146
		SUM 0.675	SUM 65.454

WEIGHTED CURVE NUMBER (C_N) = (63.454/0.675) = 97.0





LOCUS MAP
NOT TO SCALE

LEGEND

	BERM	(B)	NUMBER OF PARKING SPACES
BIT. CONC.	BITUMINOUS CONCRETE	(W)	OBSERVATION WELL
	CURB		OVERHEAD WIRES
	DEEP TEST HOLE		PAVEMENT EDGE
	DRAIN CATCH BASIN		PERC TEST
—D—	DRAIN LINE	—S—	SEWER LINE
(D)	DRAIN MANHOLE		SIGN
—E—	ELECTRIC LINE	(S)	SEWER MANHOLE
TBM III	ELEVATION BENCHMARK	(T)	TELEPHONE MANHOLE
—144—	EXISTING CONTOUR	—T—	TELEPHONE LINE
152x4	EXISTING SPOT GRADE		TREE LINE
	FENCE	(U)	UTILITY MANHOLE
—G—	GAS LINE		UTILITY POLE
	GAS GATE	WV	WATER GATE
	HANDICAP PARKING SPACE	—W—	WATER LINE
	HYDRANT	V.G.C.	VERTICAL GRANITE CURB
	LIGHTPOST	S.G.C.	SLOPED GRANITE CURB

FOR METROWEST ENGINEERING, INC. DATE
ROBERT A. CEMMA, P.E.(CIVIL) # 31967

GRAPHIC SCALE
1 inch = 20 ft.
20 0 10 20 40 (FEET) 60
5 0 5 10 20 (METERS) 30

EXISTING CONDITIONS WATERSHED DELINEATION PLAN
#655 COCHITUATE ROAD
IN
FRAMINGHAM, MASS

PREPARED FOR:
PAUL FINGER ASSOCIATES
14 SPRING STREET
WALTHAM, MA 02451-4429

PROPERTY OF:
CLAIRMONT REALTY LLC
225 PROSPECT STREET
BELMONT, MA 02478

ENGINEERS & SURVEYORS:
MWE
METROWEST ENGINEERING, INC.
75 FRANKLIN STREET
FRAMINGHAM, MA 01702
TEL.: (508)626-0063
FAX: (508)875-6440

SHEET 1 OF 1		DATE: SEPTEMBER 15, 2014
CALC'D BY: PLS	FIELD BK:	CAD FILE: EC_HYDRO.dwg
DRAFTER: MAA	PROJECT: FRM_COCH3	DWG FILE: SK091514.dwg

Time of concentration = 5.0 minutes (Manually Entered)

Existing Conditions Basin 2 (E.C.B.-2)

Area = 29,406 square feet
Impervious Area = 28,150 square feet, curve number = 98.0
Herbaceous area (good condition) = 1,256 square feet; curve number = 74.0
Hydrologic soil group C
Weighted Curve Number = 97.0
Basin slope = 1.9%
Hydraulic length = 135 feet
Time of concentration = 5.0 minutes (Manually Entered)

Proposed Condition

The proposed condition model analyzes the site as four Post-Development drainage basins, Post-Development Basins One through Four.

Post-Development Basin 1 (P.D.B.-1) contains a portion of the permeable pavers located along the easterly side of the property and a portion of the roof surface. Basin 1 has an area of 14,564 square feet and flows into the proposed permeable pavers.

Post-Development Basin 2 (P.D.B.-2) contains a portion of the permeable pavers located along the easterly side of the property and a portion of the roof surface. Basin 2 has an area of 9,676 square feet and flows into the proposed permeable pavers in a southeasterly direction.

Post-Development Basin 3 (P.D.B.-3) contains the permeable pavers located north of the existing 2-story warehouse and the roof surface of the existing two-story warehouse. Basin 3 has an area of 14,848 square feet and flows into the proposed permeable pavers.

Post-Development Basin 4 (P.D.B.-4) includes the permeable pavers located north of the property and a portion of the roof surface. It has an area of 9,248 square feet and flows into the proposed permeable pavers.

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

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

Area = 14,564 square feet
Impervious Area = 10,965 square feet, curve number = 98.0
Landscape Area (good condition) = 490 square feet; curve number = 70.0
Permeable Pavers (good condition) = 3,109 square feet; curve number = 89.0
Hydrologic soil group C

POST–DEVELOPMENT BASIN PROPERTIES:

POST–DEVELOPMENT BASIN 1 (P.D.B.–1)

TOTAL BASIN AREA = 14,564 S.F. (0.334 ACRES)
HYDRAULIC LENGTH = 130 FEET
CHANGE IN ELEVATION = 3.4 FEET
BASIN SLOPE = .026 (2.6%)

GROUND COVER	Cn	AREA (ACRES)	PRODUCT
IMPERVIOUS AREA = 10,965 S.F. (0.252 ACRES)	98	0.252	24.969
PERMEABLE PAVERS = 3,109 S.F. (0.071 ACRES)	89	0.071	6.319
LANDSCAPE AREA = 490 S.F. (0.012 ACRES)	70	0.012	0.840
	SUM	0.334	SUM 32.128

WEIGHTED CURVE NUMBER (C_N) = (31.972/0.334) = 96.2

POST–DEVELOPMENT BASIN 2 (P.D.B.–2)

TOTAL BASIN AREA = 9,676 S.F. (0.222 ACRES)
HYDRAULIC LENGTH = 84 FEET
CHANGE IN ELEVATION = 0.5 FEET
BASIN SLOPE = 0.006 (0.6%)

GROUND COVER	Cn	AREA (ACRES)	PRODUCT
IMPERVIOUS AREA = 6,175 S.F. (0.142 ACRES)	98	0.142	13.916
PERMEABLE PAVERS = 2,614 S.F. (0.060 ACRES)	89	0.060	5.340
LANDSCAPE AREA = 887 S.F. (0.020 ACRES)	70	0.020	1.400
	SUM	0.222	SUM 20.656

WEIGHTED CURVE NUMBER (C_N) = (20.656/0.222) = 93.0

POST–DEVELOPMENT BASIN 3 (P.D.B.–3)

TOTAL BASIN AREA = 14,848 S.F. (0.341 ACRES)
HYDRAULIC LENGTH = 182 FEET
CHANGE IN ELEVATION = 1.8 FEET
BASIN SLOPE = .010 (1.0%)

GROUND COVER	Cn	AREA (ACRES)	PRODUCT
IMPERVIOUS AREA = 11,762 S.F. (0.270 ACRES)	98	0.270	26.460
PERMEABLE PAVERS = 2,592 S.F. (0.060 ACRES)	89	0.060	5.340
LANDSCAPE AREA = 494 S.F. (0.011 ACRES)	70	0.011	0.770
	SUM	0.341	SUM 32.570

WEIGHTED CURVE NUMBER (C) = (32.570/0.341) = 95.5

POST–DEVELOPMENT BASIN 4 (P.D.B.–4)

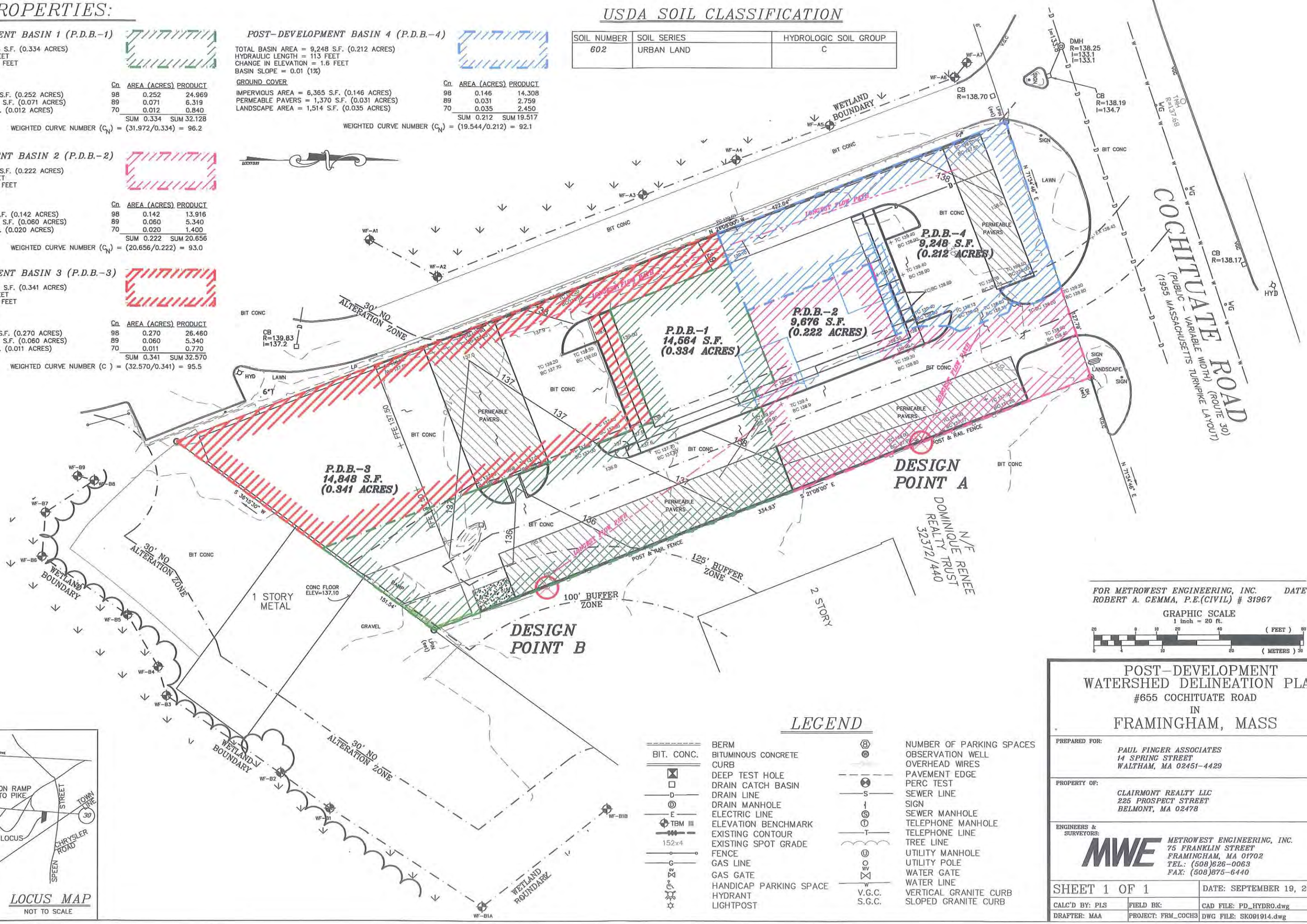
TOTAL BASIN AREA = 9,248 S.F. (0.212 ACRES)
HYDRAULIC LENGTH = 113 FEET
CHANGE IN ELEVATION = 1.6 FEET
BASIN SLOPE = 0.01 (1%)

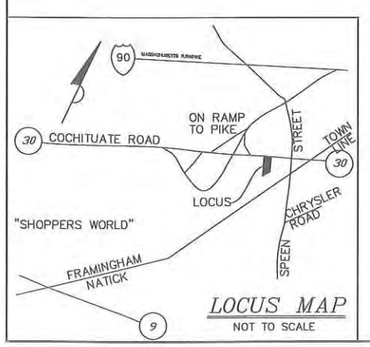
GROUND COVER	Cn	AREA (ACRES)	PRODUCT
IMPERVIOUS AREA = 6,365 S.F. (0.146 ACRES)	98	0.146	14.308
PERMEABLE PAVERS = 1,370 S.F. (0.031 ACRES)	89	0.031	2.759
LANDSCAPE AREA = 1,514 S.F. (0.035 ACRES)	70	0.035	2.450
	SUM	0.212	SUM 19.517

WEIGHTED CURVE NUMBER (C_N) = (19.544/0.212) = 92.1

USDA SOIL CLASSIFICATION

SOIL NUMBER	SOIL SERIES	HYDROLOGIC SOIL GROUP
602	URBAN LAND	C





LOCUS MAP
NOT TO SCALE

LEGEND

	BERM		NUMBER OF PARKING SPACES
BIT. CONC.	BITUMINOUS CONCRETE		OBSERVATION WELL
	CURB		OVERHEAD WIRES
	DEEP TEST HOLE		PAVEMENT EDGE
	DRAIN CATCH BASIN		PERC TEST
D	DRAIN LINE	S	SEWER LINE
	DRAIN MANHOLE		SIGN
E	ELECTRIC LINE		SEWER MANHOLE
TBM III	ELEVATION BENCHMARK		TELEPHONE MANHOLE
	EXISTING CONTOUR	T	TELEPHONE LINE
152x4	EXISTING SPOT GRADE		TREE LINE
	FENCE		UTILITY MANHOLE
G	GAS LINE		UTILITY POLE
	GAS GATE		WATER GATE
	HANDICAP PARKING SPACE	W	WATER LINE
	HYDRANT	V.G.C.	VERTICAL GRANITE CURB
	LIGHTPOST	S.G.C.	SLOPED GRANITE CURB

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

GRAPHIC SCALE
1 inch = 20 ft.
(FEET) 20 0 10 20 40 80
(METERS) 0 4 10 20 30

POST–DEVELOPMENT WATERSHED DELINEATION PLAN
#655 COCHITUATE ROAD
IN
FRAMINGHAM, MASS

PREPARED FOR:
PAUL FINGER ASSOCIATES
14 SPRING STREET
WALTHAM, MA 02451–4429

PROPERTY OF:
CLAIRMONT REALTY LLC
225 PROSPECT STREET
BELMONT, MA 02478

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METROWEST ENGINEERING, INC.
75 FRANKLIN STREET
FRAMINGHAM, MA 01702
TEL.: (508)626–0063
FAX: (508)875–6440

SHEET 1 OF 1		DATE: SEPTEMBER 19, 2014
CALC'D BY: PLS	FIELD BK:	CAD FILE: PD_HYDRO.dwg
DRAFTER: MAA	PROJECT: FRM_COCH3	DWG FILE: SK091914.dwg

Weighted Curve Number = 96.2
Basin slope = 2.6%
Hydraulic length = 130 feet
Time of concentration = 5.0 minutes (Manually Entered)

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

Area = 9,676 square feet
Impervious Area = 6,175 square feet, curve number = 98.0
Landscape Area (good condition) = 887 square feet; curve number = 70.0
Permeable Pavers (good condition) = 2,614 square feet; curve number = 89.0
Hydrologic soil group C
Weighted Curve Number = 93.0
Basin slope = 0.6%
Hydraulic length = 84 feet
Time of concentration = 5.0 minutes (Manually Entered)

Post-Development Basin 3 (P.D.B.-3)

Area = 14,848 square feet
Impervious Area = 11,762 square feet, curve number = 98.0
Landscape Area = 494 square feet, curve number = 70.0
Permeable Pavers = 2,592 square feet, curve number = 89.0
Hydrologic soil group C
Weighted Curve Number = 95.5
Basin slope = 1%
Hydraulic length = 182 feet
Time of concentration = 5.0 minutes (Manually Entered)

Post-Development Basin 4 (P.D.B.-4)

Area = 9,248 square feet
Impervious area = 6,365 square feet; curve number = 98.0
Landscape Area (good condition) = 1,514 square feet; curve number = 70.0
Permeable Pavers (good condition) = 1,514 square feet; curve number = 89.0
Hydrologic soil group C
Weighted Curve Number = 92.1
Basin slope = 1%
Hydraulic length = 113 feet
Time of concentration = 5.0 minutes (Manually Entered)

Infiltration Systems

Proposed Permeable Pavers 1 (along east of property)
Basic geometry: 5,724 square foot bed
System type: Permeable Concrete Unit Pavers
2-foot deep stone reservoir under permeable pavers
Infiltration rate: 1.02 inches per hour over 5,724 square foot bed

Proposed Permeable Pavers 2 (south of prop. two-story retail building)
Basic geometry: 2,592 square foot bed
System type: Permeable Concrete Unit Pavers
1.5-foot deep stone reservoir under permeable pavers
Infiltration rate: 1.02 inches per hour over 2,592 square foot bed

Proposed Permeable Pavers 3 (north of prop. two-story retail building)
Basic geometry: 1,370 square foot bed
System type: Permeable Concrete Unit Pavers
1.5-foot deep stone reservoir under permeable pavers
Infiltration rate: 1.02 inches per hour over 1,370 square foot bed

The proposed condition model analyzes the infiltration systems using a reservoir-analysis method. Consistent with DEP stormwater management standards, design infiltration rates are based on the Rawls table for soils with sandy loam textures.

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	1.14 CFS	1.67 CFS	2.01 CFS	2.45 CFS
P.D.B.2 Overflow + P.D.B.4 Overflow	0 CFS	0.51 CFS	1.23 CFS	2.36 CFS
Difference	-1.14 CFS	-1.16CFS	-0.78 CFS	-0.09 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	4,155 CF	6,208 CF	7,531 CF	9,298 CF
P.D.B.2 Overflow + P.D.B.4 Overflow	0 CF	437 CF	1,236 CF	2,399 CF
Difference	-4,155 CF	-5,771 CF	-6,295 CF	-6,899 CF

Table Three: Comparison of Pre and Post Development Peak Runoff Rates at Design Point B

Drainage Basin	2-year storm	10-year storm	25-year storm	100-year storm
E.C.B.2	1.79 CFS	2.61 CFS	3.13 CFS	3.82 CFS
P.D.B.1 Overflow + P.D.B.3 Overflow	0.15 CFS	1.32 CFS	3.10 CFS	3.59 CFS
Difference	-1.64 CFS	-1.29 CFS	-0.03 CFS	-0.23 CFS

Table Four: Comparison of Pre and Post-Development Runoff Volumes at Design Point B

Drainage Basin	2-year storm	10-year storm	25-year storm	100-year storm
E.C.B.2	6,562 CF	9,759 CF	11,820 CF	14,570 CF
P.D.B.1 Overflow + P.D.B.3 Overflow	0 CF	1,623 CF	2,946 CF	4,862 CF
Difference	-6,562 CF	-8,136 CF	-8,874 CF	-9,708 CF

Table Five: Comparison of Pre and Post Development Peak Runoff Rates Leaving the Project Site

Drainage Basin	2-year storm	10-year storm	25-year storm	100-year storm
Total Pre-Development	2.93 CFS	4.28 CFS	5.14 CFS	6.28 CFS
Total Post-Development	0 CFS	1.32 CFS	3.23 CFS	5.70 CFS
Difference	-2.93 CFS	-2.96 CFS	-1.91 CFS	-0.58 CFS

Table Six: Comparison of Pre and Post-Development Runoff Volumes Leaving the Project Site

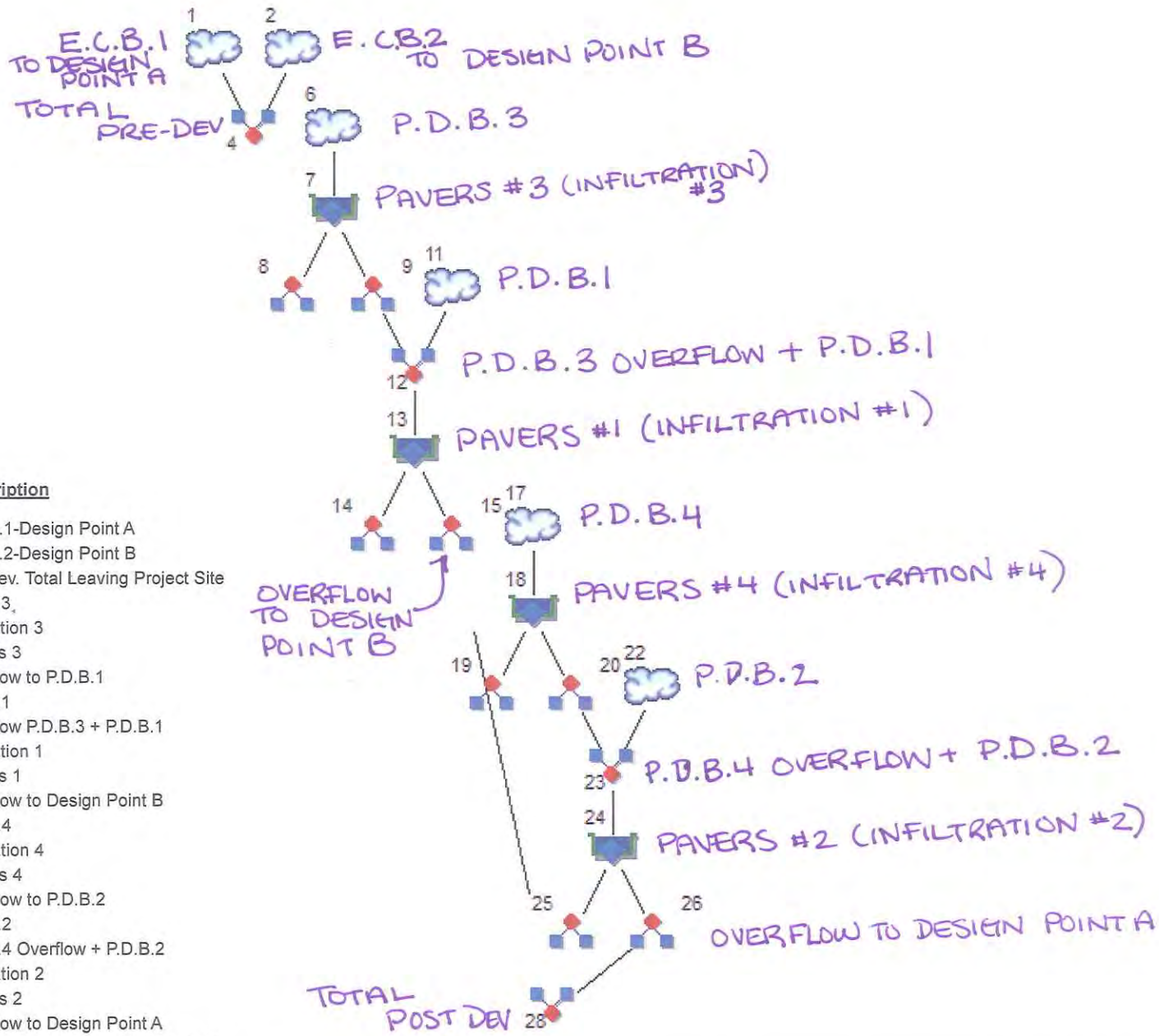
Drainage Basin	2-year storm	10-year storm	25-year storm	100-year storm
Total Pre-Development	10,717 CF	15,967 CF	19,351 CF	23,868 CF
Total Post-Development	0 CF	2,061 CF	4,182 CF	7,261 CF
Difference	-10,717 CF	-13,906 CF	-15,169 CF	-16,607 CF

Conclusion

The results provided in Tables One through Six demonstrate that the project, with the stormwater controls in place, will result in a major overall decrease both in peak runoff rates and total runoff volume discharged from the project site. The project will not impact the municipal stormwater drainage system.

The stormwater management system as designed is consistent with MADEP Stormwater Management Policy and accepted design practice.

Appendix A:
Hydrologic Assessment



Legend

Hyd.	Origin	Description
1	SCS Runoff	E.C.B.1-Design Point A
2	SCS Runoff	E.C.B.2-Design Point B
4	Combine	Pre-Dev. Total Leaving Project Site
6	SCS Runoff	P.D.B.3
7	Reservoir	Infiltration 3
8	Diversion1	Pavers 3
9	Diversion2	Overflow to P.D.B.1
11	SCS Runoff	P.D.B.1
12	Combine	Overflow P.D.B.3 + P.D.B.1
13	Reservoir	Infiltration 1
14	Diversion1	Pavers 1
15	Diversion2	Overflow to Design Point B
17	SCS Runoff	P.D.B.4
18	Reservoir	Infiltration 4
19	Diversion1	Pavers 4
20	Diversion2	Overflow to P.D.B.2
22	SCS Runoff	P.D.B.2
23	Combine	P.D.B.4 Overflow + P.D.B.2
24	Reservoir	Infiltration 2
25	Diversion1	Pavers 2
26	Diversion2	Overflow to Design Point A
28	Combine	Post-Dev. Total Leaving Project Site

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	1.14	3	726	4,155	----	------	------	E.C.B.1-Design Point A
2	SCS Runoff	1.79	3	726	6,562	----	------	------	E.C.B.2-Design Point B
4	Combine	2.93	3	726	10,717	1, 2,	------	------	Pre-Dev. Total Leaving Project Site
6	SCS Runoff	0.88	3	726	3,129	----	------	------	P.D.B.3
7	Reservoir	0.27	3	747	3,128	6	136.38	1,176	Infiltration 3
8	Diversion1	0.07	3	747	2,959	7	------	------	Pavers 3
9	Diversion2	0.20	3	747	169	7	------	------	Overflow to P.D.B.1
11	SCS Runoff	0.87	3	726	3,149	----	------	------	P.D.B.1
12	Combine	0.87	3	726	3,318	9, 11	------	------	Overflow P.D.B.3 + P.D.B.1
13	Reservoir	0.09	3	786	3,317	12	135.33	1,402	Infiltration 1
14	Diversion1	0.09	3	786	3,317	13	------	------	Pavers 1
15	Diversion2	0.00	3	648	0	13	------	------	Overflow to Design Point B
17	SCS Runoff	0.50	3	726	1,703	----	------	------	P.D.B.4
18	Reservoir	0.19	3	744	1,702	17	137.33	631	Infiltration 4
19	Diversion1	0.04	3	744	1,583	18	------	------	Pavers 4
20	Diversion2	0.15	3	744	119	18	------	------	Overflow to P.D.B.2
22	SCS Runoff	0.54	3	726	1,848	----	------	------	P.D.B.2
23	Combine	0.54	3	726	1,967	20, 22	------	------	P.D.B.4 Overflow + P.D.B.2
24	Reservoir	0.07	3	777	1,965	23	136.91	789	Infiltration 2
25	Diversion1	0.07	3	777	1,965	24	------	------	Pavers 2
26	Diversion2	0.00	3	657	0	24	------	------	Overflow to Design Point A
28	Combine	0.00	3	1212	0	15, 26,	------	------	Post-Dev. Total Leaving Project Site

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

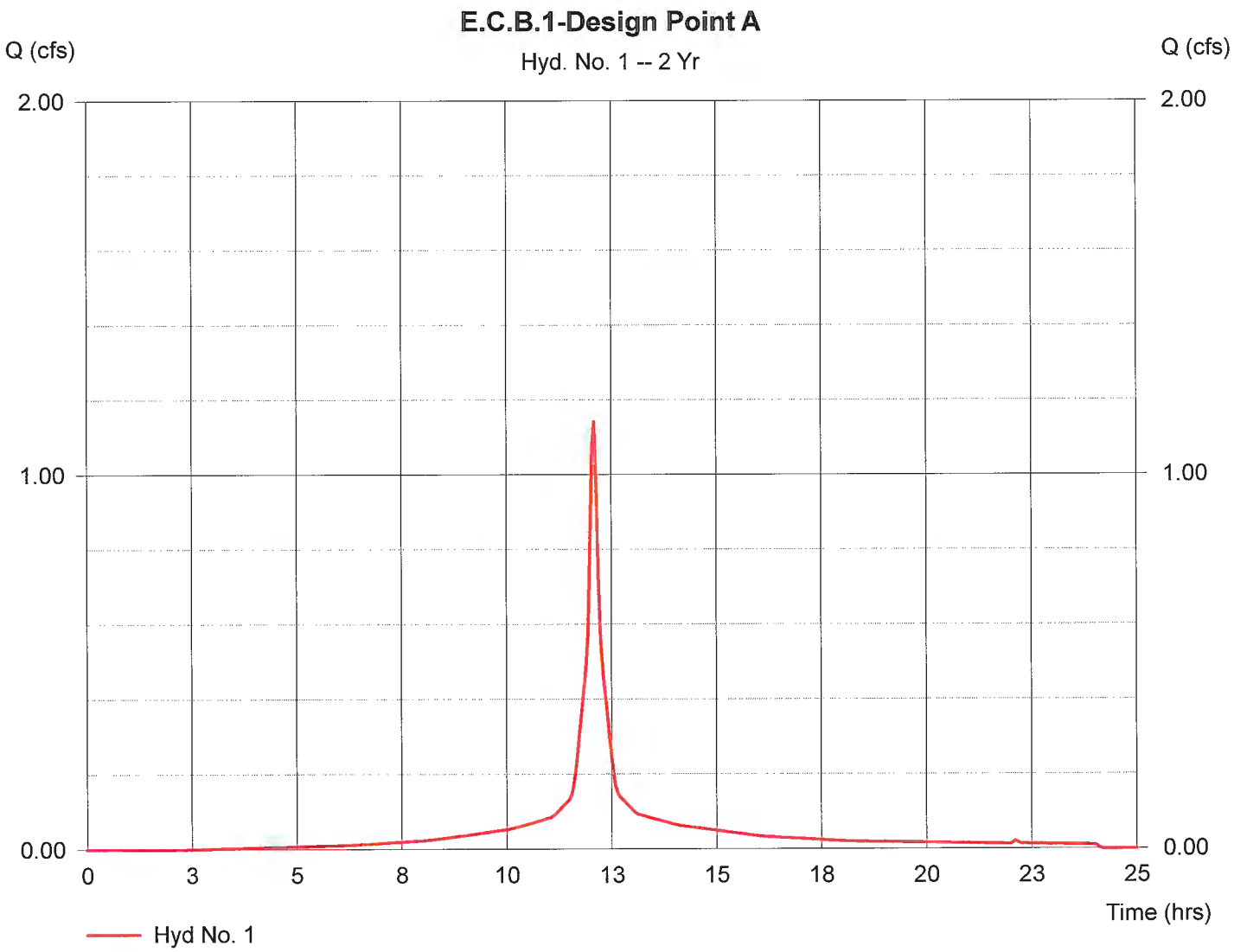
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 1

E.C.B.1-Design Point A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.14 cfs
Storm frequency	= 2 yrs	Time interval	= 3 min
Drainage area	= 0.43 ac	Curve number	= 96.6
Basin Slope	= 0.3 %	Hydraulic length	= 150 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 3.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,155 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

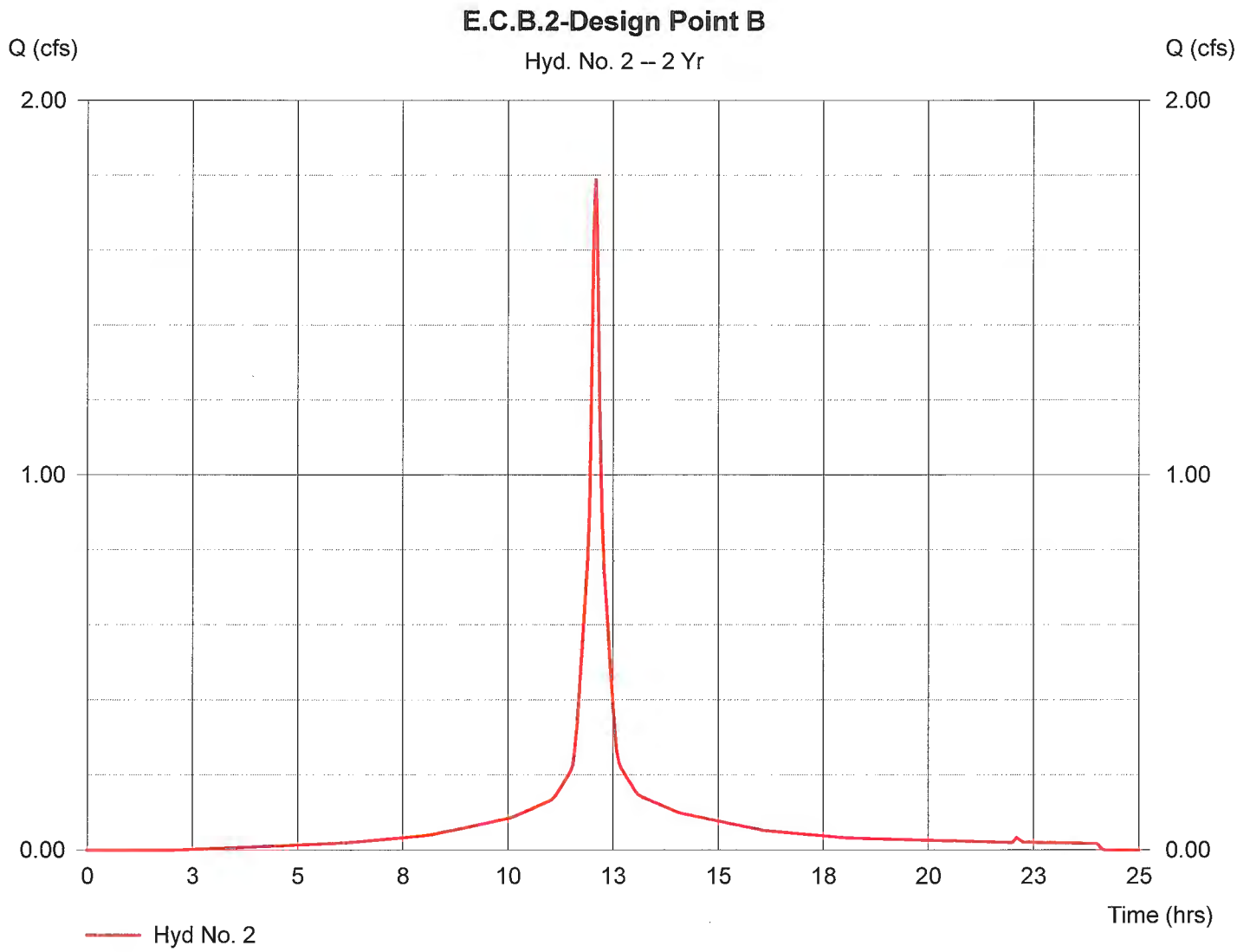
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 2

E.C.B.2-Design Point B

Hydrograph type	= SCS Runoff	Peak discharge	= 1.79 cfs
Storm frequency	= 2 yrs	Time interval	= 3 min
Drainage area	= 0.68 ac	Curve number	= 97
Basin Slope	= 1.9 %	Hydraulic length	= 135 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 3.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,562 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

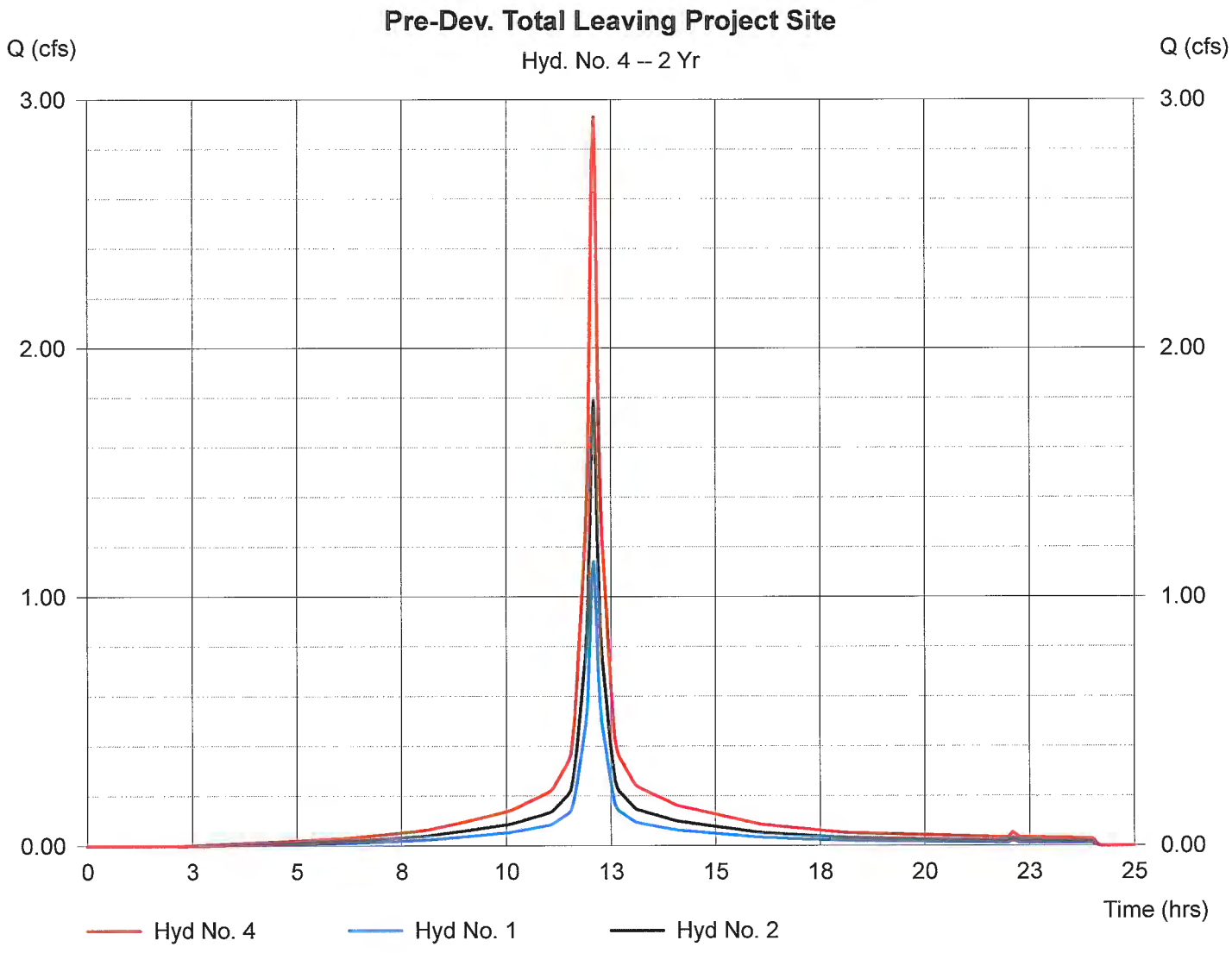
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 4

Pre-Dev. Total Leaving Project Site

Hydrograph type	= Combine	Peak discharge	= 2.93 cfs
Storm frequency	= 2 yrs	Time interval	= 3 min
Inflow hyds.	= 1, 2		

Hydrograph Volume = 10,717 cuft



Hydrograph Plot

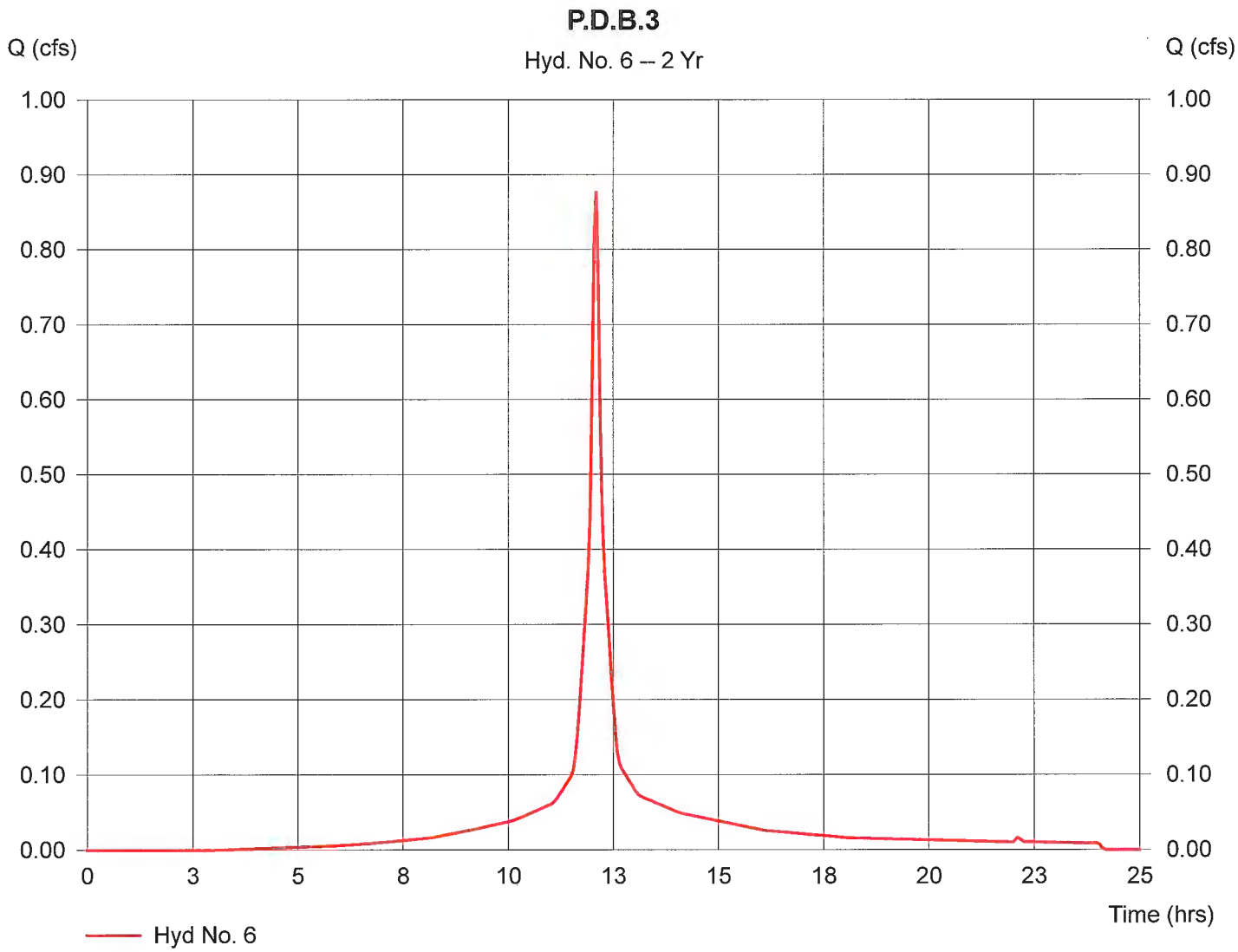
Hydraflow Hydrographs by Intelisolve | Friday, Sep 26 2014, 9:2 AM

Hyd. No. 6

P.D.B.3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.88 cfs
Storm frequency	= 2 yrs	Time interval	= 3 min
Drainage area	= 0.34 ac	Curve number	= 95.5
Basin Slope	= 1.0 %	Hydraulic length	= 107 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 3.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,129 cuft



Hydrograph Plot

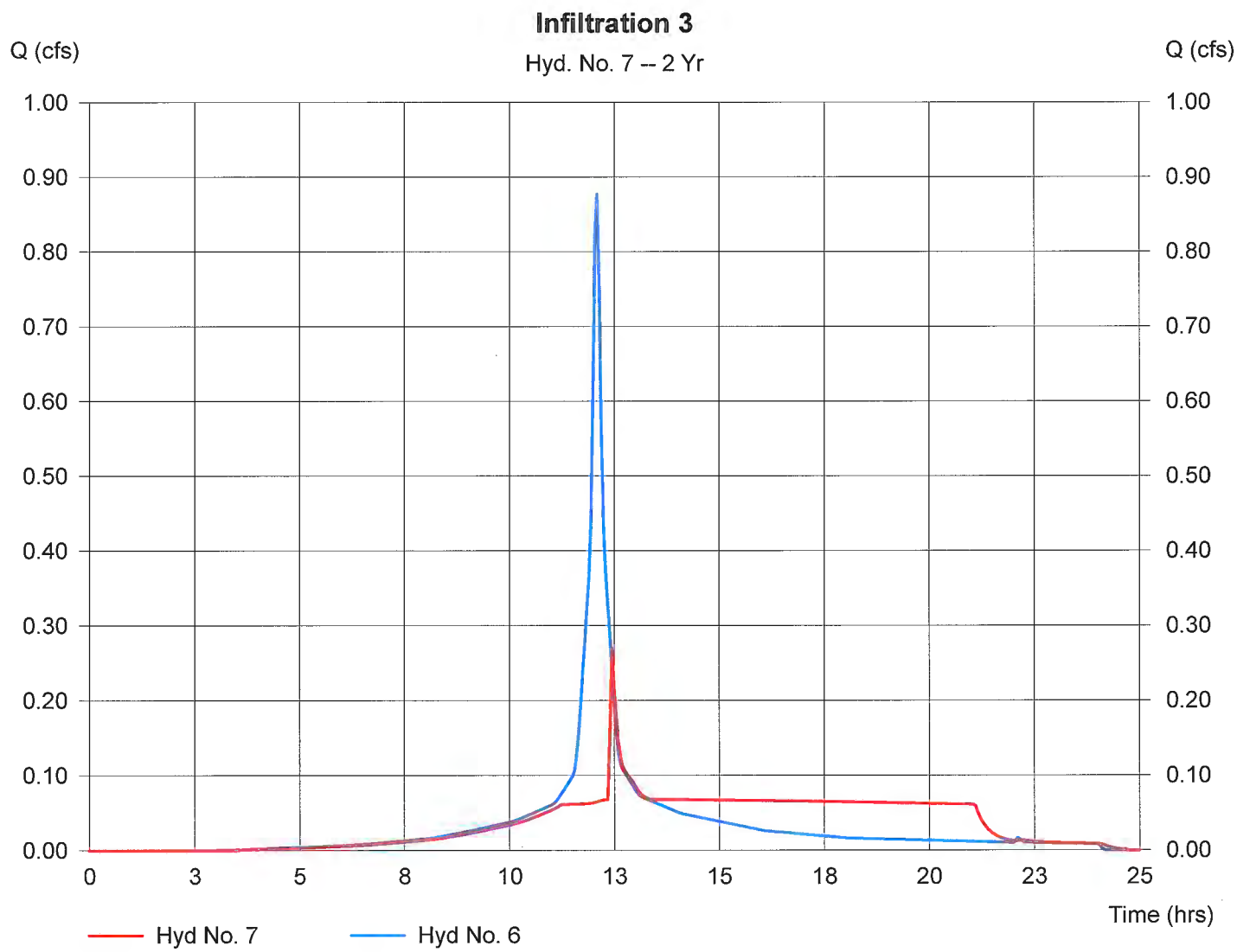
Hydraflow Hydrographs by Intelisolve | Friday, Sep 26 2014, 9:2 AM

Hyd. No. 7

Infiltration 3

Hydrograph type	=	Reservoir	Peak discharge	=	0.27 cfs
Storm frequency	=	2 yrs	Time interval	=	3 min
Inflow hyd. No.	=	6	Max. Elevation	=	136.38 ft
Reservoir name	=	Pavers 3	Max. Storage	=	1,176 cuft

Storage Indication method used. | Hydrograph Volume = 3,128 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:2 AM

Pond No. 4 - Pavers 3

Pond Data

Bottom LxW = 72.0 x 36.0 ft Side slope = 0.0:1 Bottom elev. = 135.00 ft Depth = 1.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	135.00	2,592	0	0
0.08	135.08	2,592	64	64
0.15	135.15	2,592	64	128
0.23	135.23	2,592	64	192
0.30	135.30	2,592	64	257
0.38	135.38	2,592	64	321
0.45	135.45	2,592	64	385
0.53	135.53	2,592	64	449
0.60	135.60	2,592	64	513
0.68	135.68	2,592	64	577
0.75	135.75	2,592	64	642
0.82	135.83	2,592	64	706
0.90	135.90	2,592	64	770
0.97	135.98	2,592	64	834
1.05	136.05	2,592	64	898
1.13	136.13	2,592	64	962
1.20	136.20	2,592	64	1,026
1.28	136.28	2,592	64	1,091
1.35	136.35	2,592	64	1,155
1.43	136.43	2,592	64	1,219
1.50	136.50	2,592	64	1,283

(*33.00% voids applied)

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

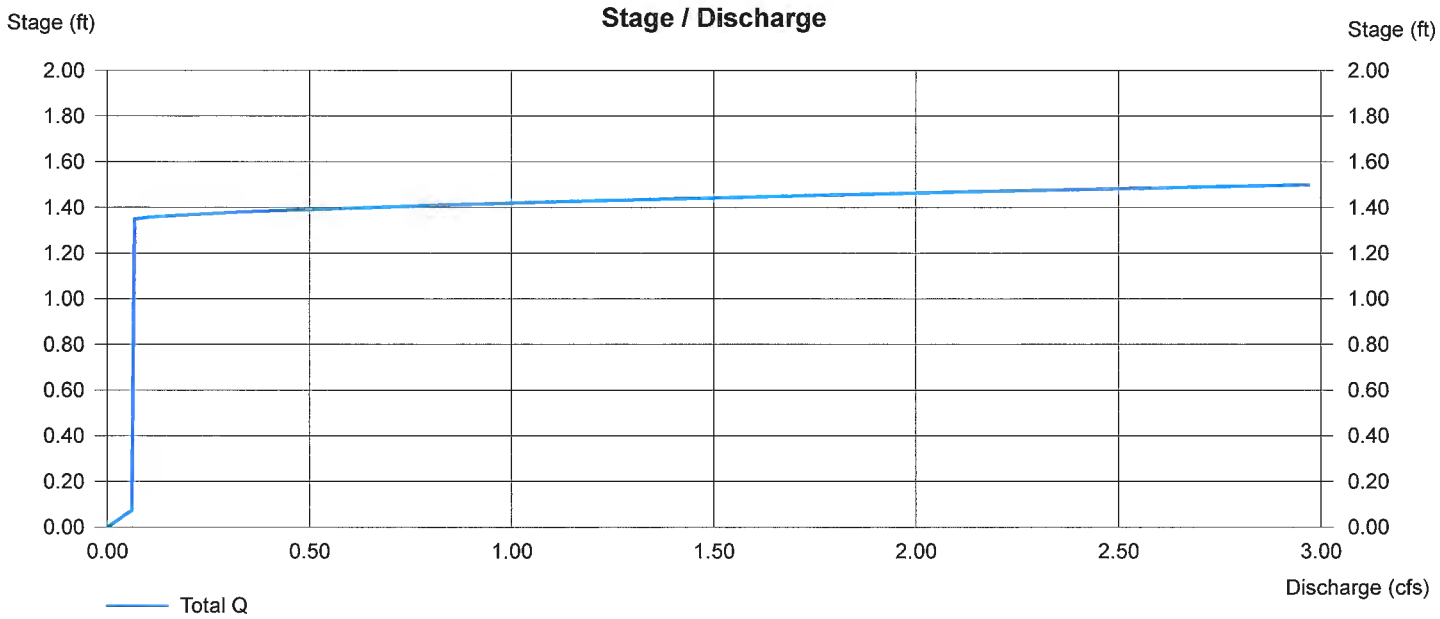
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 136.35	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 = 1.020 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

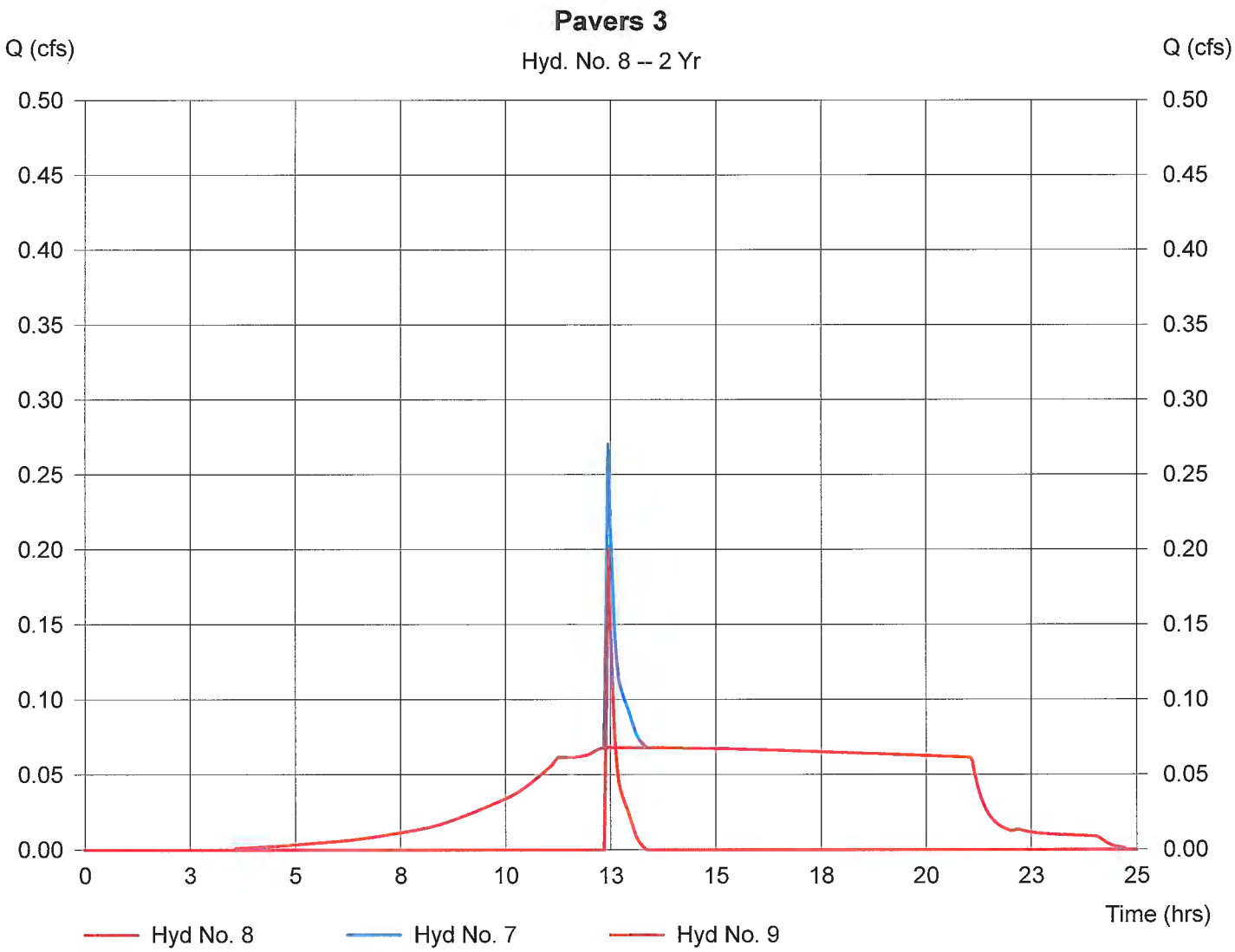
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 8

Pavers 3

Hydrograph type	=	Diversion1	Peak discharge	=	0.07 cfs
Storm frequency	=	2 yrs	Time interval	=	3 min
Inflow hydrograph	=	7	2nd diverted hyd.	=	9
Diversion method	=	Pond - Pavers 3	Pond structure	=	Exfiltration

Hydrograph Volume = 2,959 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

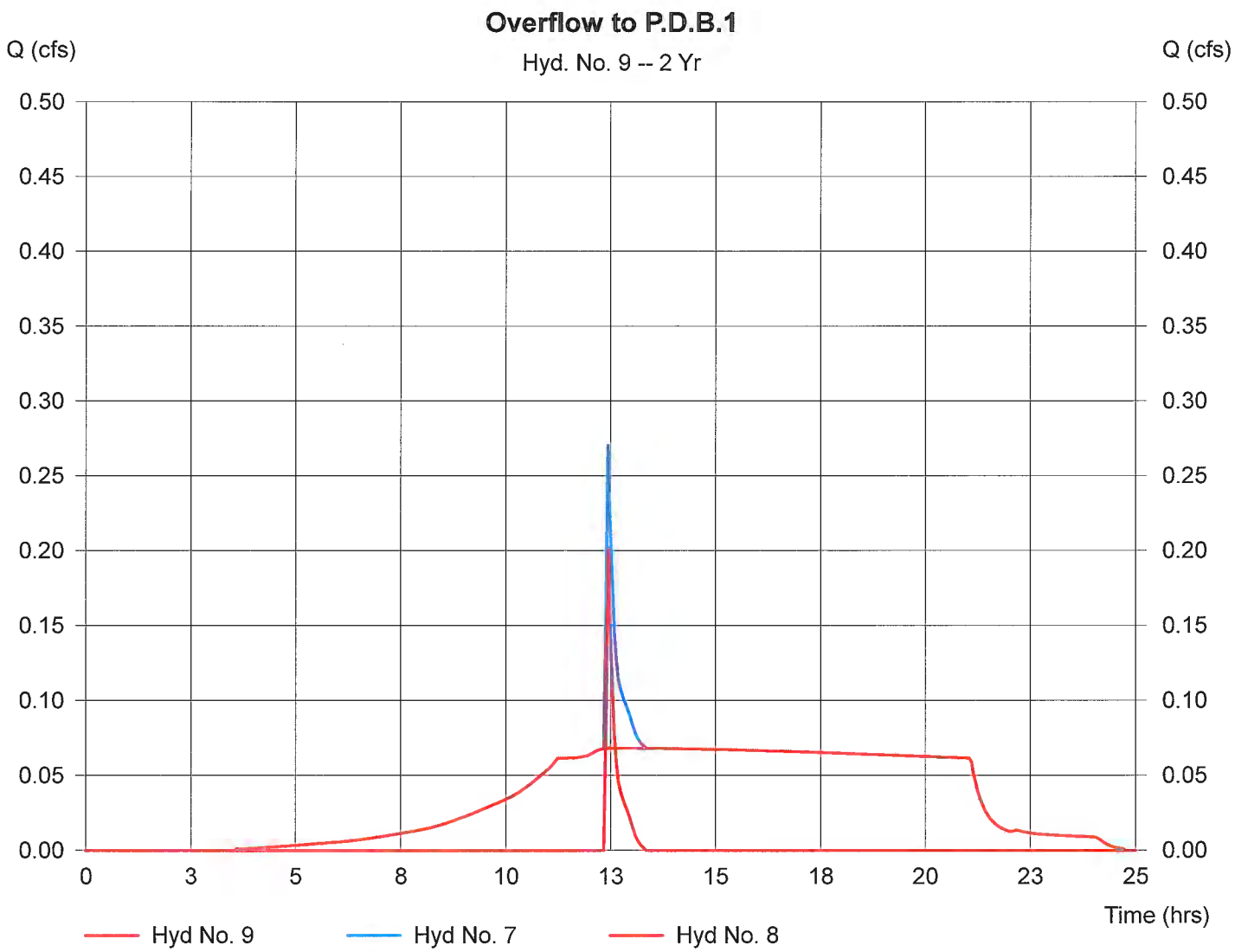
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 9

Overflow to P.D.B.1

Hydrograph type	=	Diversion2	Peak discharge	=	0.20 cfs
Storm frequency	=	2 yrs	Time interval	=	3 min
Inflow hydrograph	=	7	2nd diverted hyd.	=	8
Diversion method	=	Pond - Pavers 3	Pond structure	=	Exfiltration

Hydrograph Volume = 169 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

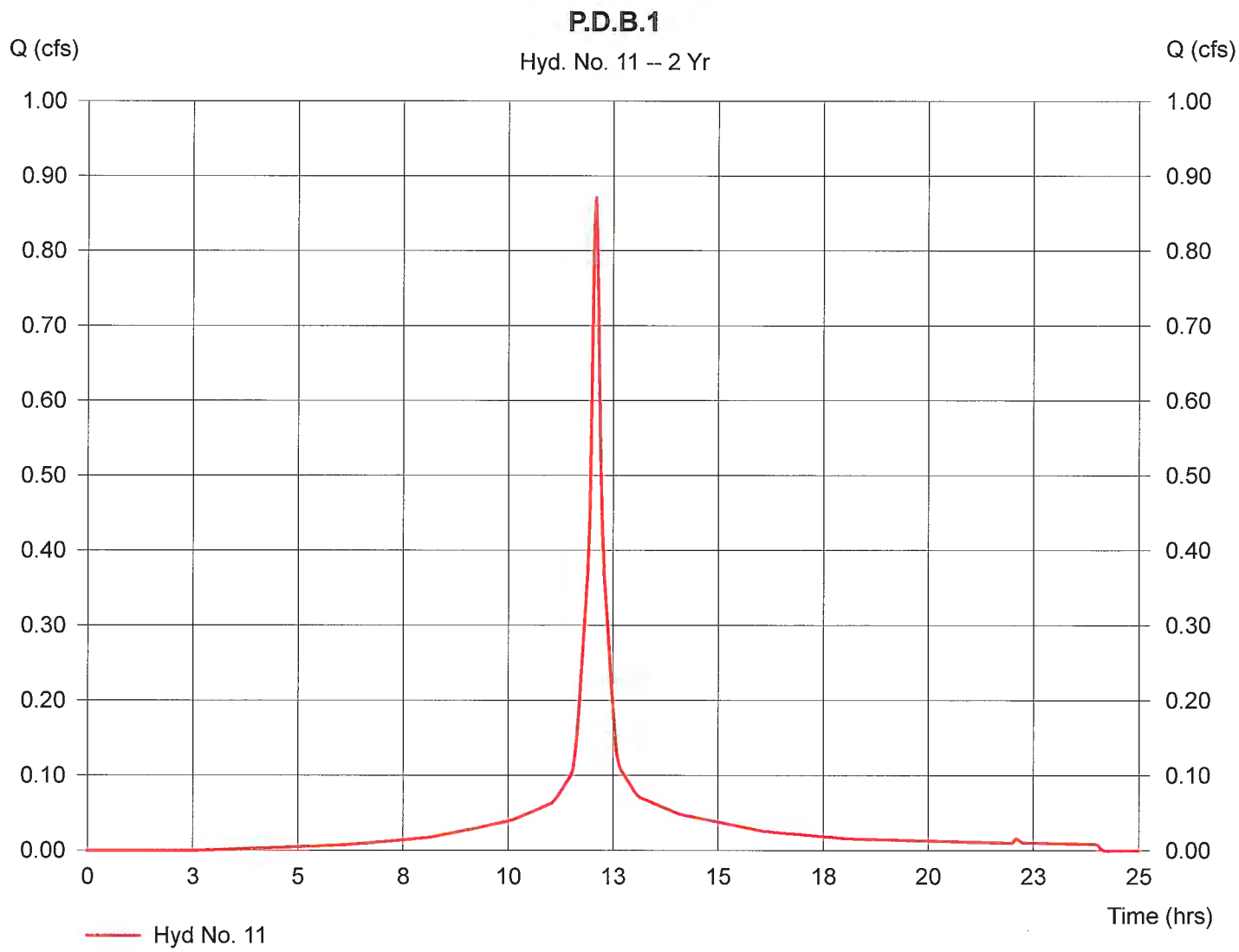
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 11

P.D.B.1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.87 cfs
Storm frequency	= 2 yrs	Time interval	= 3 min
Drainage area	= 0.33 ac	Curve number	= 96.2
Basin Slope	= 2.7 %	Hydraulic length	= 118 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 3.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,149 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

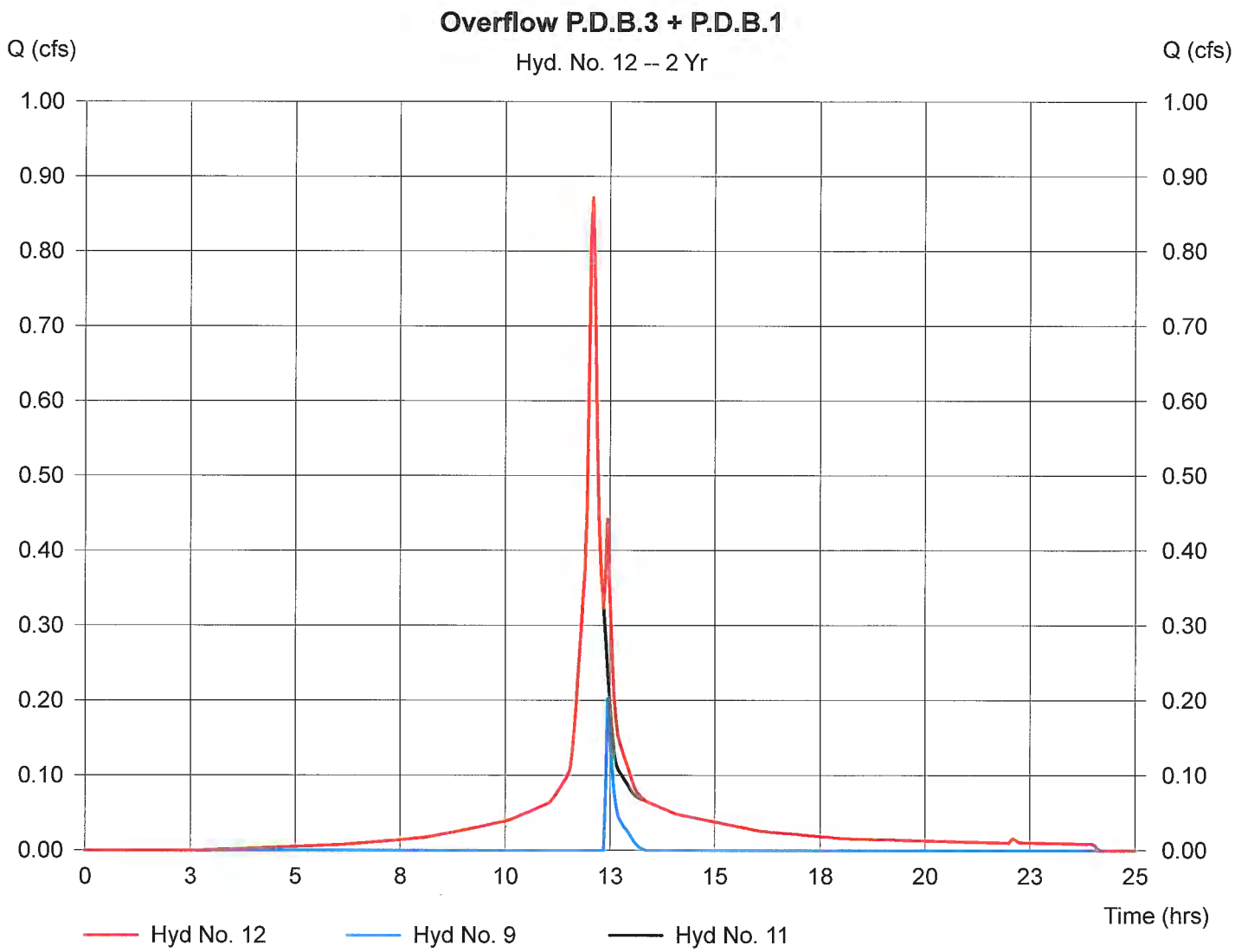
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 12

Overflow P.D.B.3 + P.D.B.1

Hydrograph type	= Combine	Peak discharge	= 0.87 cfs
Storm frequency	= 2 yrs	Time interval	= 3 min
Inflow hyds.	= 9, 11		

Hydrograph Volume = 3,318 cuft



Hydrograph Plot

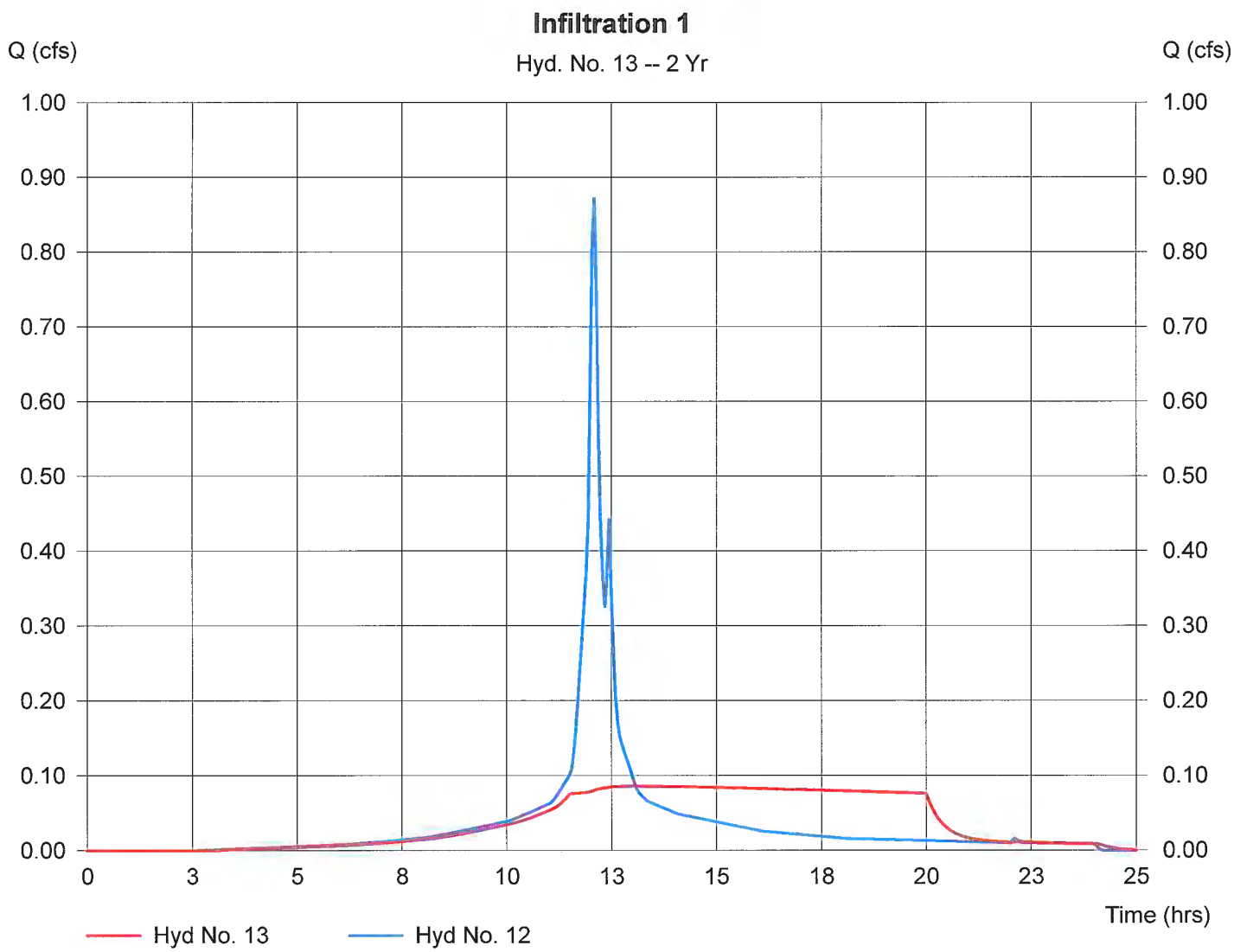
Hydraflow Hydrographs by Intelisolve | Friday, Sep 26 2014, 9:2 AM

Hyd. No. 13

Infiltration 1

Hydrograph type	=	Reservoir	Peak discharge	=	0.09 cfs
Storm frequency	=	2 yrs	Time interval	=	3 min
Inflow hyd. No.	=	12	Max. Elevation	=	135.33 ft
Reservoir name	=	Pavers 1	Max. Storage	=	1,402 cuft

Storage Indication method used. | Hydrograph Volume = 3,317 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve — Friday, Sep 26 2014, 9:2 AM

Pond No. 2 - Pavers 1

Pond Data

Bottom LxW = 145.5 x 22.0 ft Side slope = 0.0:1 Bottom elev. = 134.00 ft Depth = 2.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)* (*33.00% voids applied)
0.00	134.00	3,201	0	0
0.10	134.10	3,201	106	106
0.20	134.20	3,201	106	211
0.30	134.30	3,201	106	317
0.40	134.40	3,201	106	423
0.50	134.50	3,201	106	528
0.60	134.60	3,201	106	634
0.70	134.70	3,201	106	739
0.80	134.80	3,201	106	845
0.90	134.90	3,201	106	951
1.00	135.00	3,201	106	1,056
1.10	135.10	3,201	106	1,162
1.20	135.20	3,201	106	1,268
1.30	135.30	3,201	106	1,373
1.40	135.40	3,201	106	1,479
1.50	135.50	3,201	106	1,584
1.60	135.60	3,201	106	1,690
1.70	135.70	3,201	106	1,796
1.80	135.80	3,201	106	1,901
1.90	135.90	3,201	106	2,007
2.00	136.00	3,201	106	2,113

Culvert / Orifice Structures

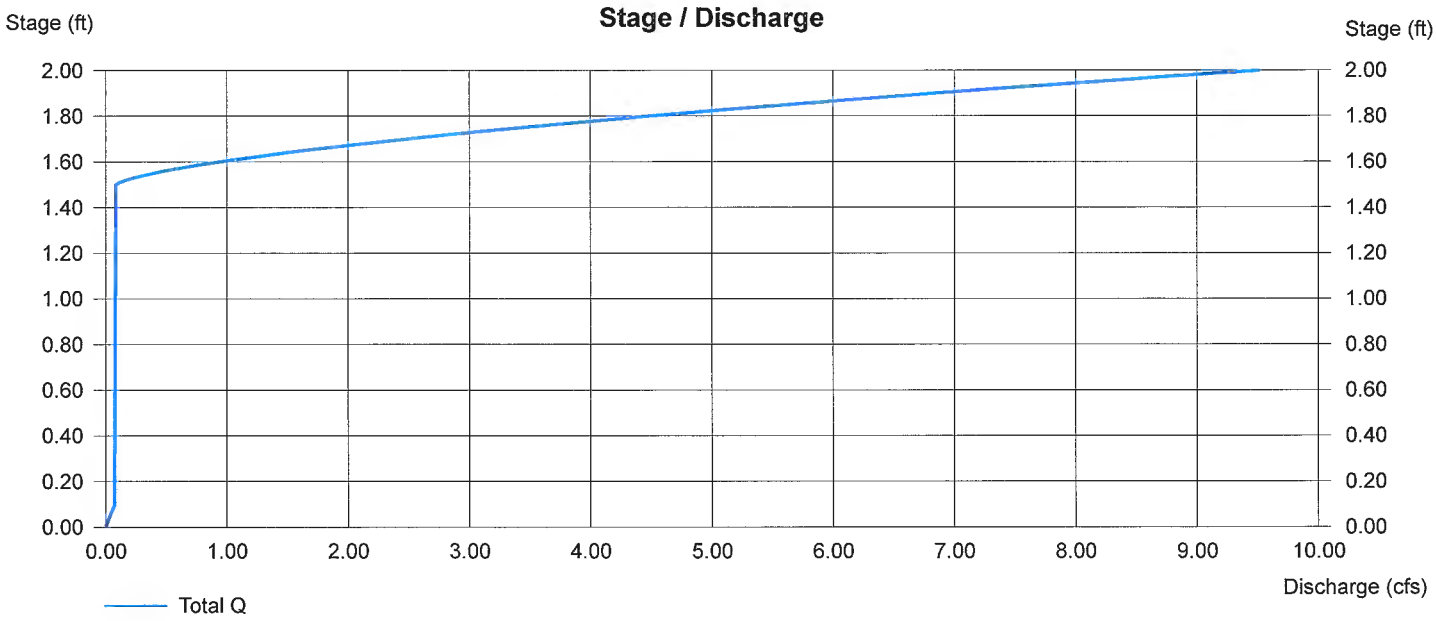
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 135.50	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 = 1.020 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

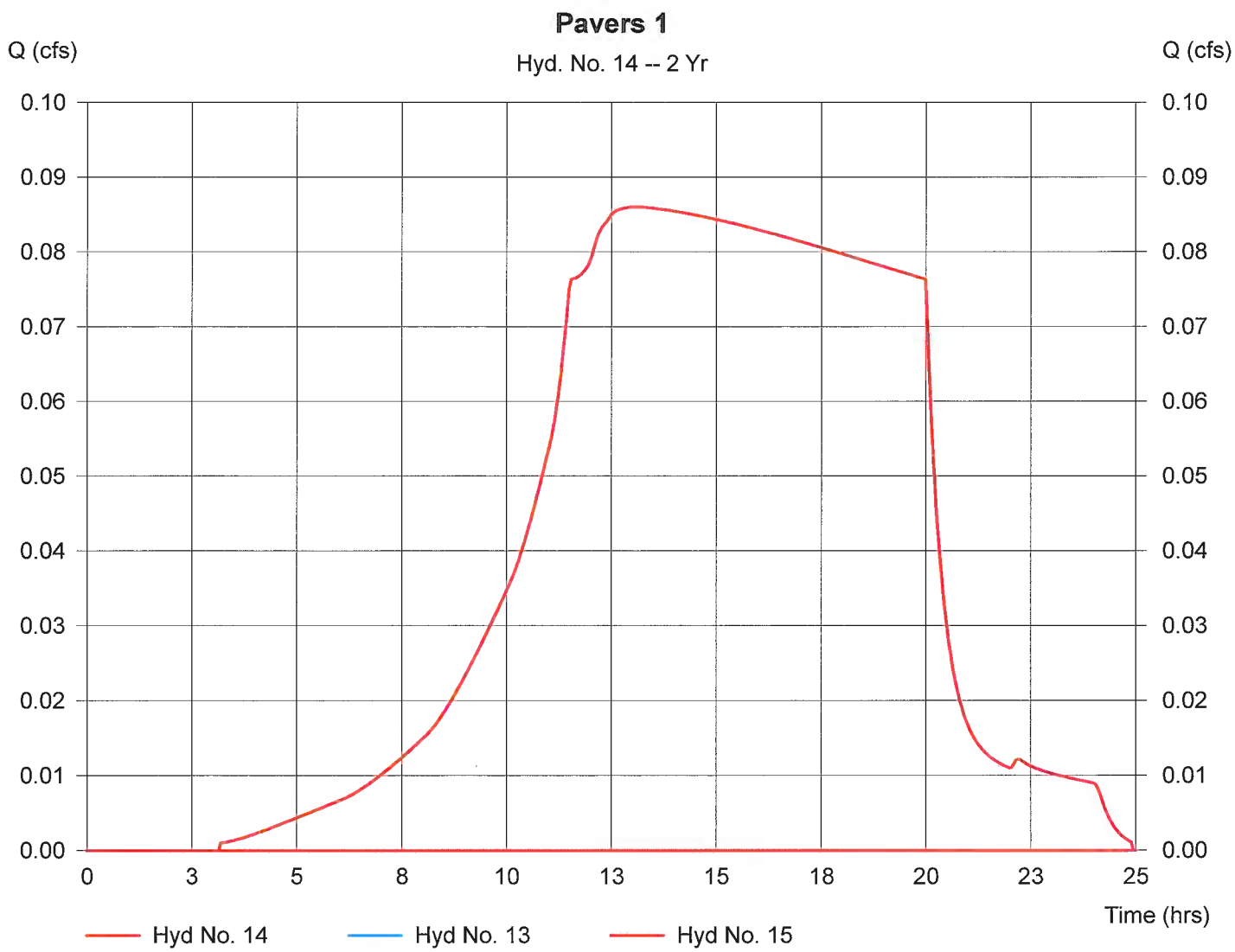
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 14

Pavers 1

Hydrograph type	=	Diversion1	Peak discharge	=	0.09 cfs
Storm frequency	=	2 yrs	Time interval	=	3 min
Inflow hydrograph	=	13	2nd diverted hyd.	=	15
Diversion method	=	Pond - Pavers 1	Pond structure	=	Exfiltration

Hydrograph Volume = 3,317 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

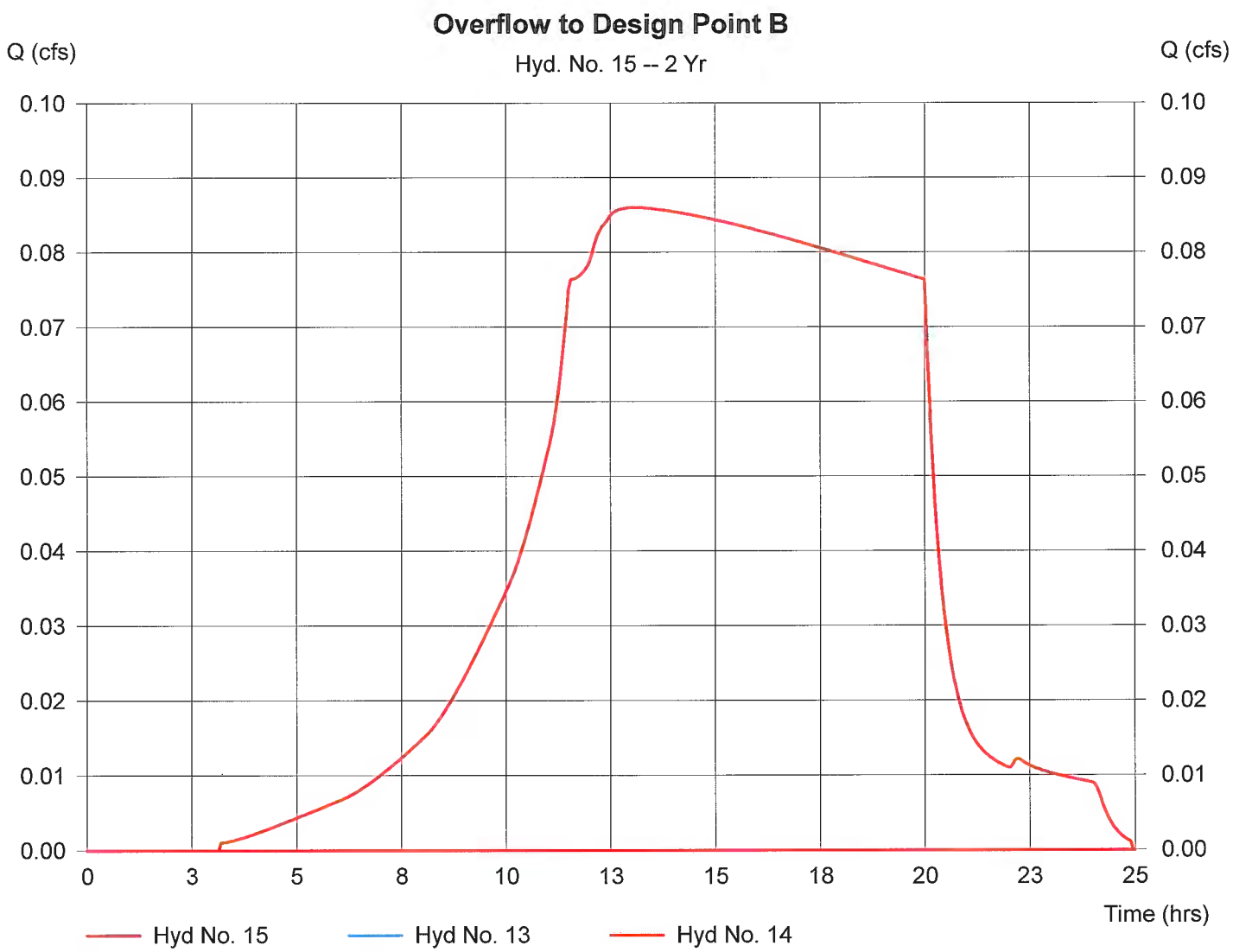
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 15

Overflow to Design Point B

Hydrograph type	=	Diversion2	Peak discharge	=	0.00 cfs
Storm frequency	=	2 yrs	Time interval	=	3 min
Inflow hydrograph	=	13	2nd diverted hyd.	=	14
Diversion method	=	Pond - Pavers 1	Pond structure	=	Exfiltration

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

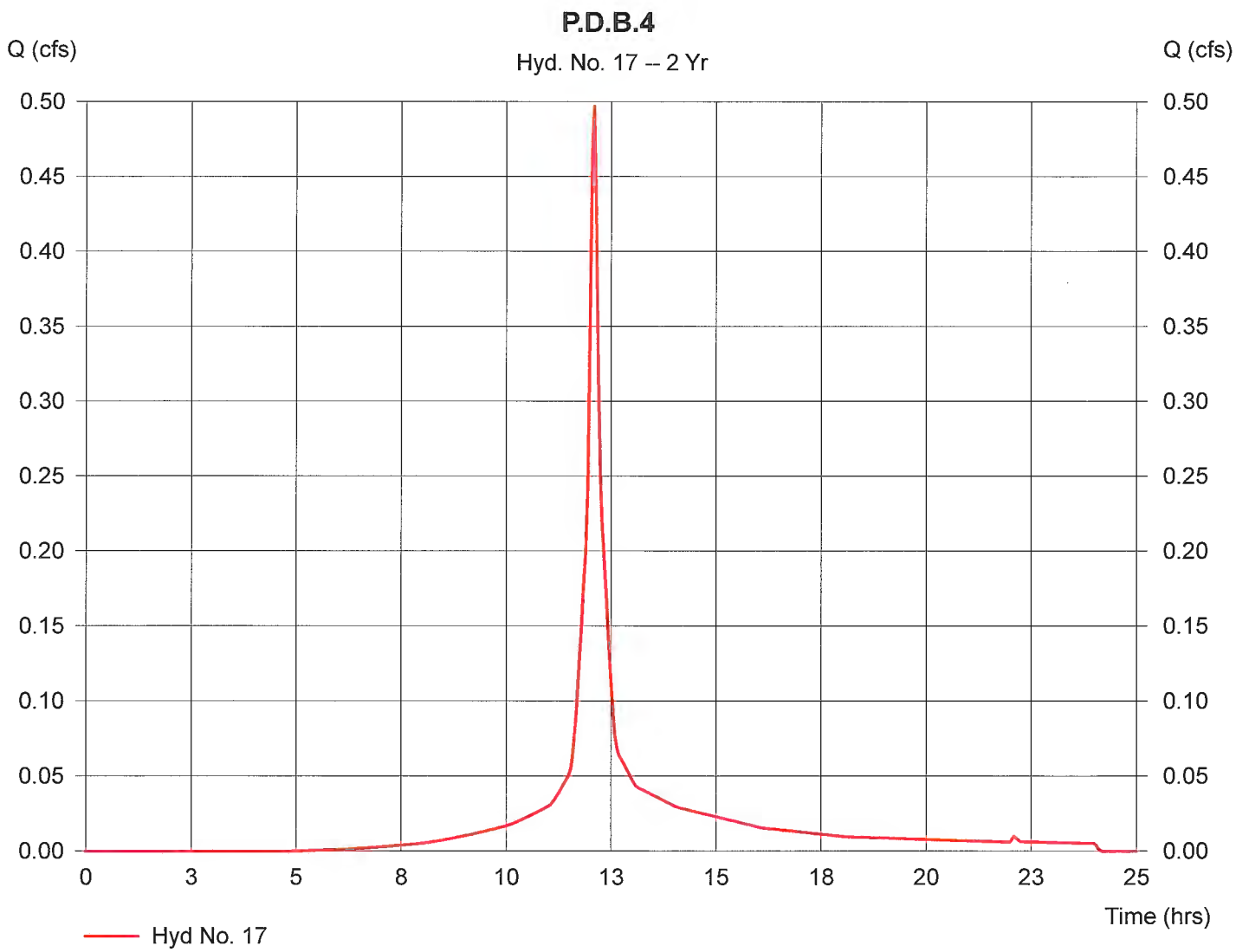
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 17

P.D.B.4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.50 cfs
Storm frequency	= 2 yrs	Time interval	= 3 min
Drainage area	= 0.21 ac	Curve number	= 92.1
Basin Slope	= 1.0 %	Hydraulic length	= 113 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 3.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,703 cuft



Hydrograph Plot

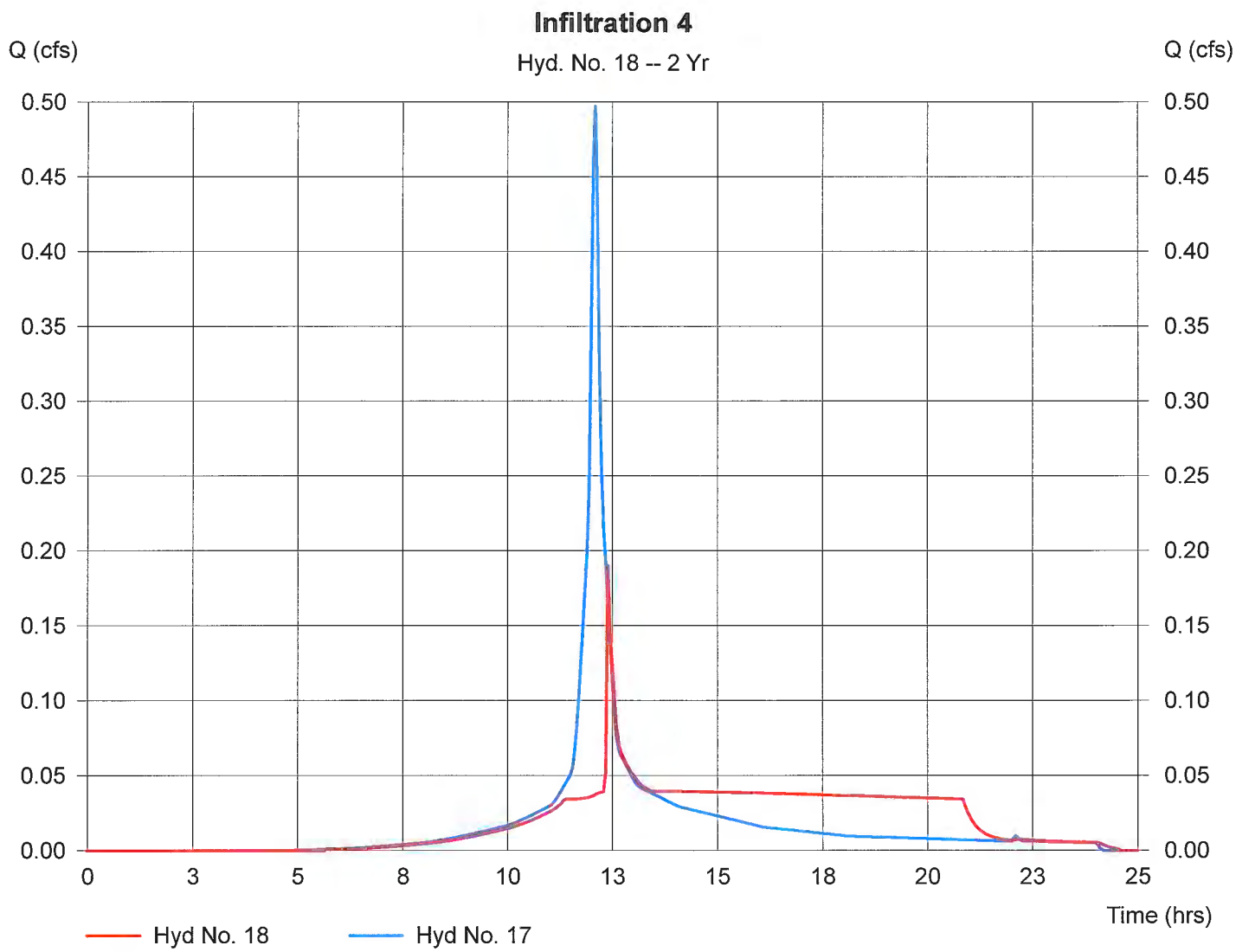
Hydraflow Hydrographs by Intelisolve | Friday, Sep 26 2014, 9:2 AM

Hyd. No. 18

Infiltration 4

Hydrograph type	=	Reservoir	Peak discharge	=	0.19 cfs
Storm frequency	=	2 yrs	Time interval	=	3 min
Inflow hyd. No.	=	17	Max. Elevation	=	137.33 ft
Reservoir name	=	Pavers 4	Max. Storage	=	631 cuft

Storage Indication method used. | Hydrograph Volume = 1,702 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve — Friday, Sep 26 2014, 9:2 AM

Pond No. 5 - Pavers 4

Pond Data

Bottom LxW = 72.0 x 20.0 ft Side slope = 0.0:1 Bottom elev. = 136.00 ft Depth = 1.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	136.00	1,440	0	0
0.08	136.08	1,440	36	36
0.15	136.15	1,440	36	71
0.23	136.23	1,440	36	107
0.30	136.30	1,440	36	143
0.38	136.38	1,440	36	178
0.45	136.45	1,440	36	214
0.53	136.53	1,440	36	249
0.60	136.60	1,440	36	285
0.68	136.68	1,440	36	321
0.75	136.75	1,440	36	356
0.82	136.83	1,440	36	392
0.90	136.90	1,440	36	428
0.97	136.98	1,440	36	463
1.05	137.05	1,440	36	499
1.13	137.13	1,440	36	535
1.20	137.20	1,440	36	570
1.28	137.28	1,440	36	606
1.35	137.35	1,440	36	642
1.43	137.43	1,440	36	677
1.50	137.50	1,440	36	713

(*33.00% voids applied)

Culvert / Orifice Structures

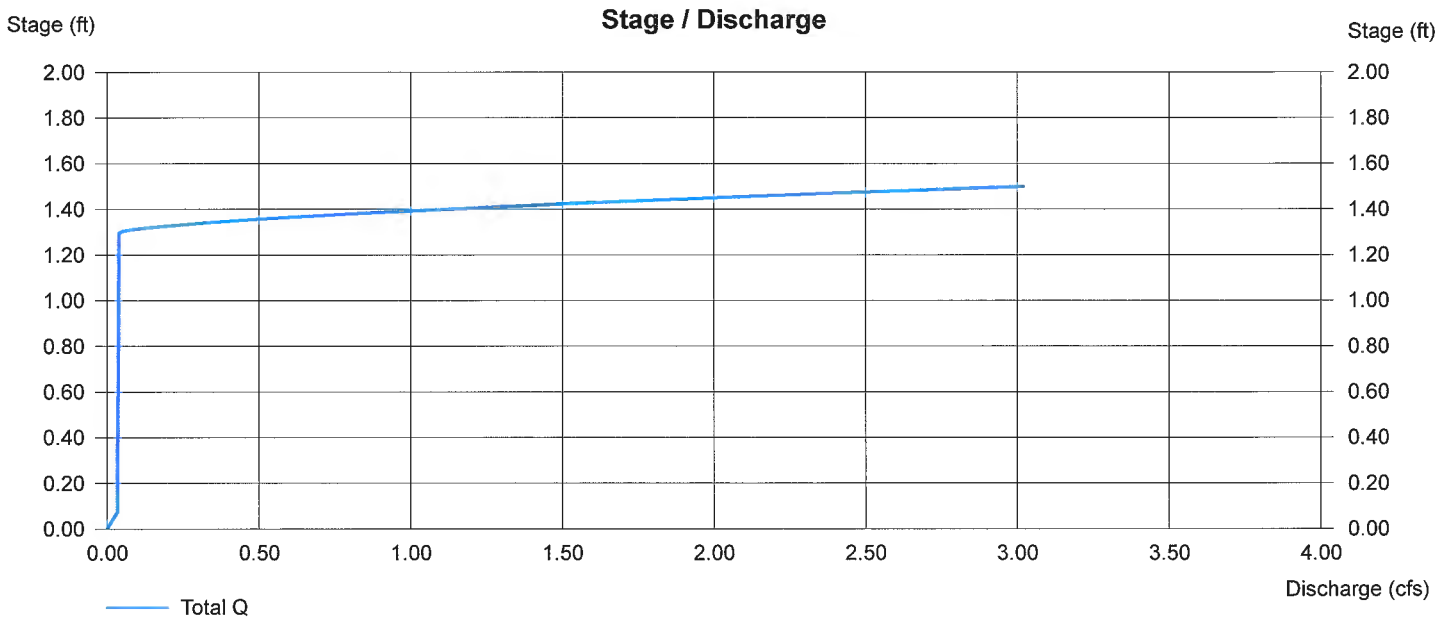
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 137.30	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 = 1.020 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

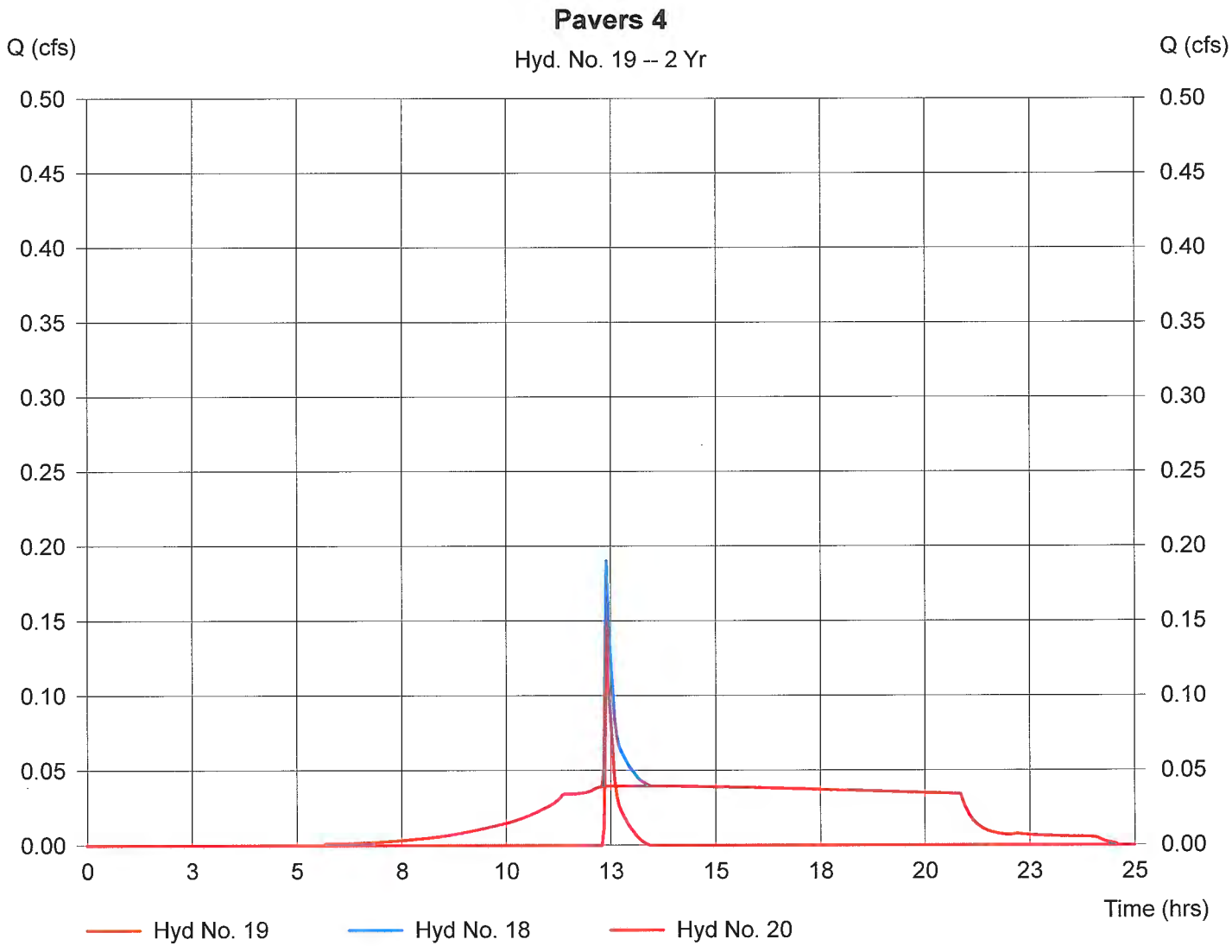
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 19

Pavers 4

Hydrograph type	=	Diversion1	Peak discharge	=	0.04 cfs
Storm frequency	=	2 yrs	Time interval	=	3 min
Inflow hydrograph	=	18	2nd diverted hyd.	=	20
Diversion method	=	Pond - Pavers 4	Pond structure	=	Exfiltration

Hydrograph Volume = 1,583 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

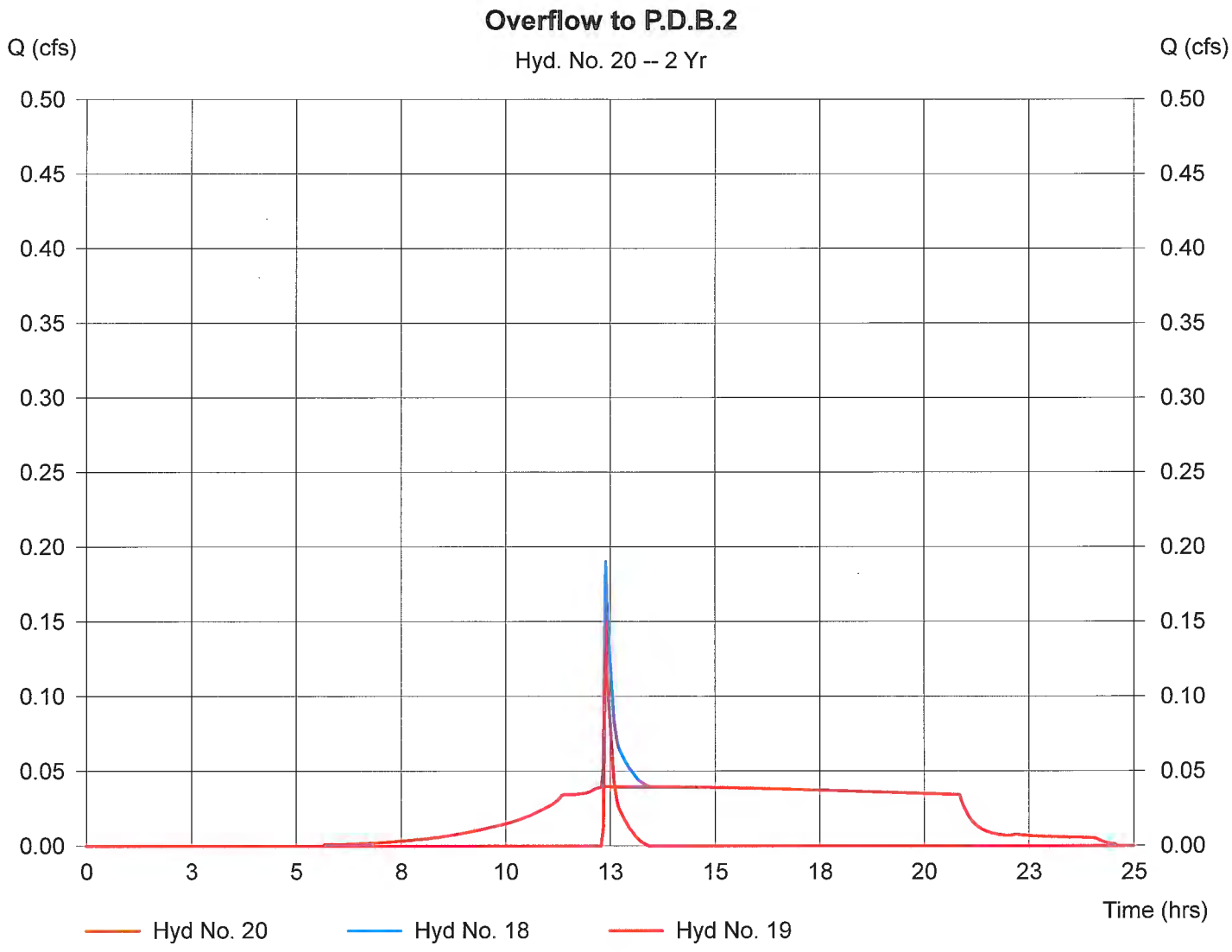
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 20

Overflow to P.D.B.2

Hydrograph type	=	Diversion2	Peak discharge	=	0.15 cfs
Storm frequency	=	2 yrs	Time interval	=	3 min
Inflow hydrograph	=	18	2nd diverted hyd.	=	19
Diversion method	=	Pond - Pavers 4	Pond structure	=	Exfiltration

Hydrograph Volume = 119 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

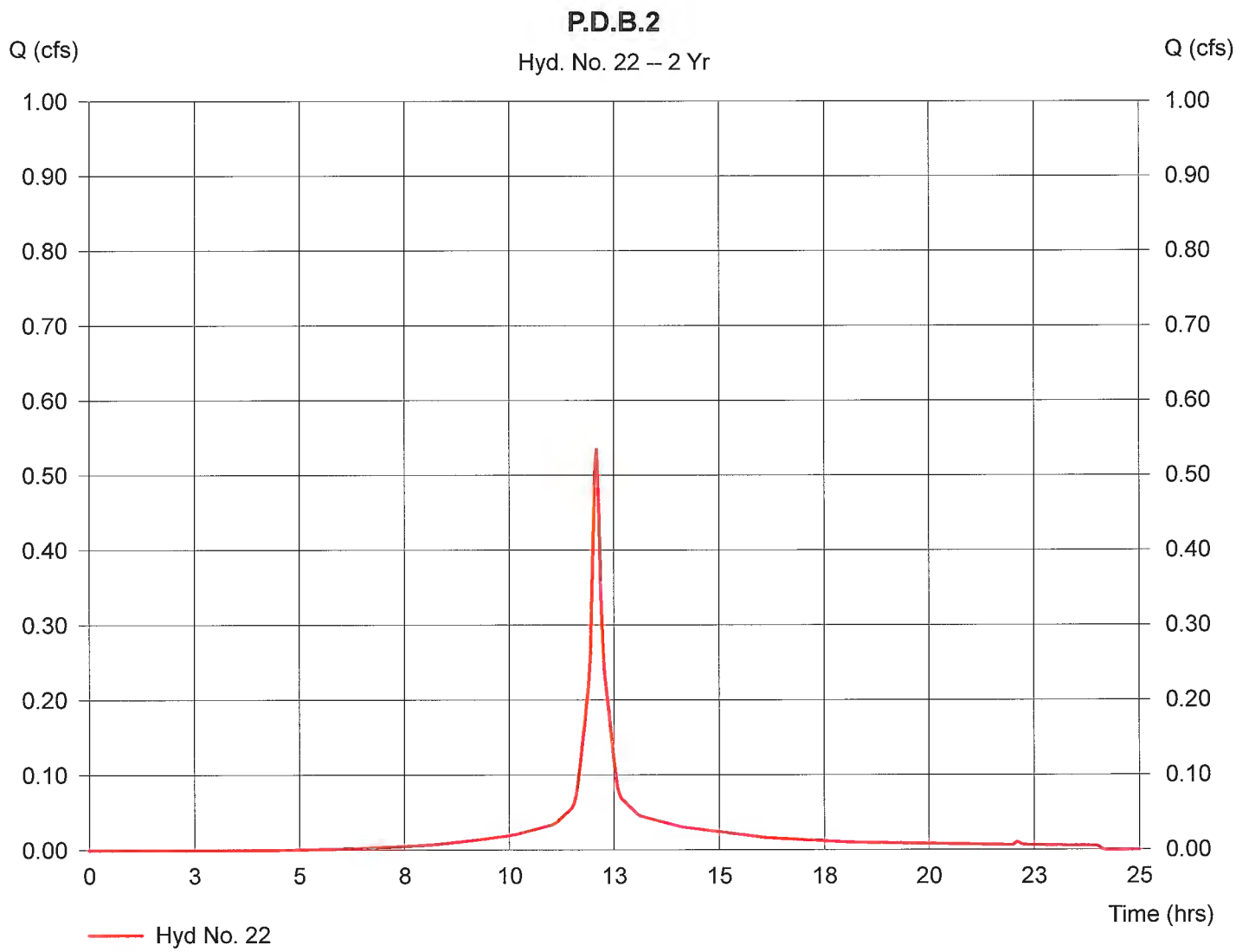
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 22

P.D.B.2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.54 cfs
Storm frequency	= 2 yrs	Time interval	= 3 min
Drainage area	= 0.22 ac	Curve number	= 93
Basin Slope	= 0.6 %	Hydraulic length	= 84 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 3.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,848 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

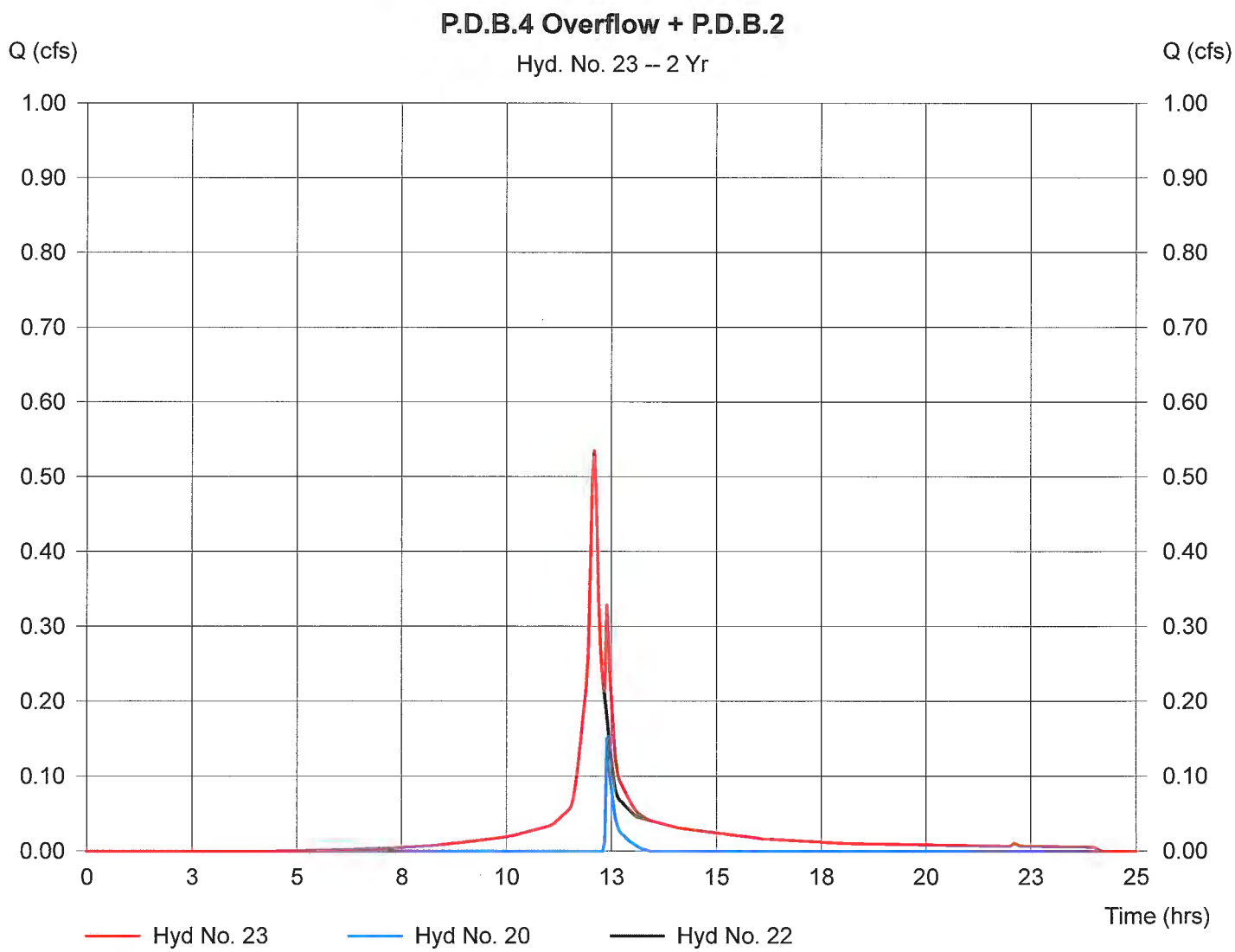
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 23

P.D.B.4 Overflow + P.D.B.2

Hydrograph type	= Combine	Peak discharge	= 0.54 cfs
Storm frequency	= 2 yrs	Time interval	= 3 min
Inflow hyds.	= 20, 22		

Hydrograph Volume = 1,967 cuft



Hydrograph Plot

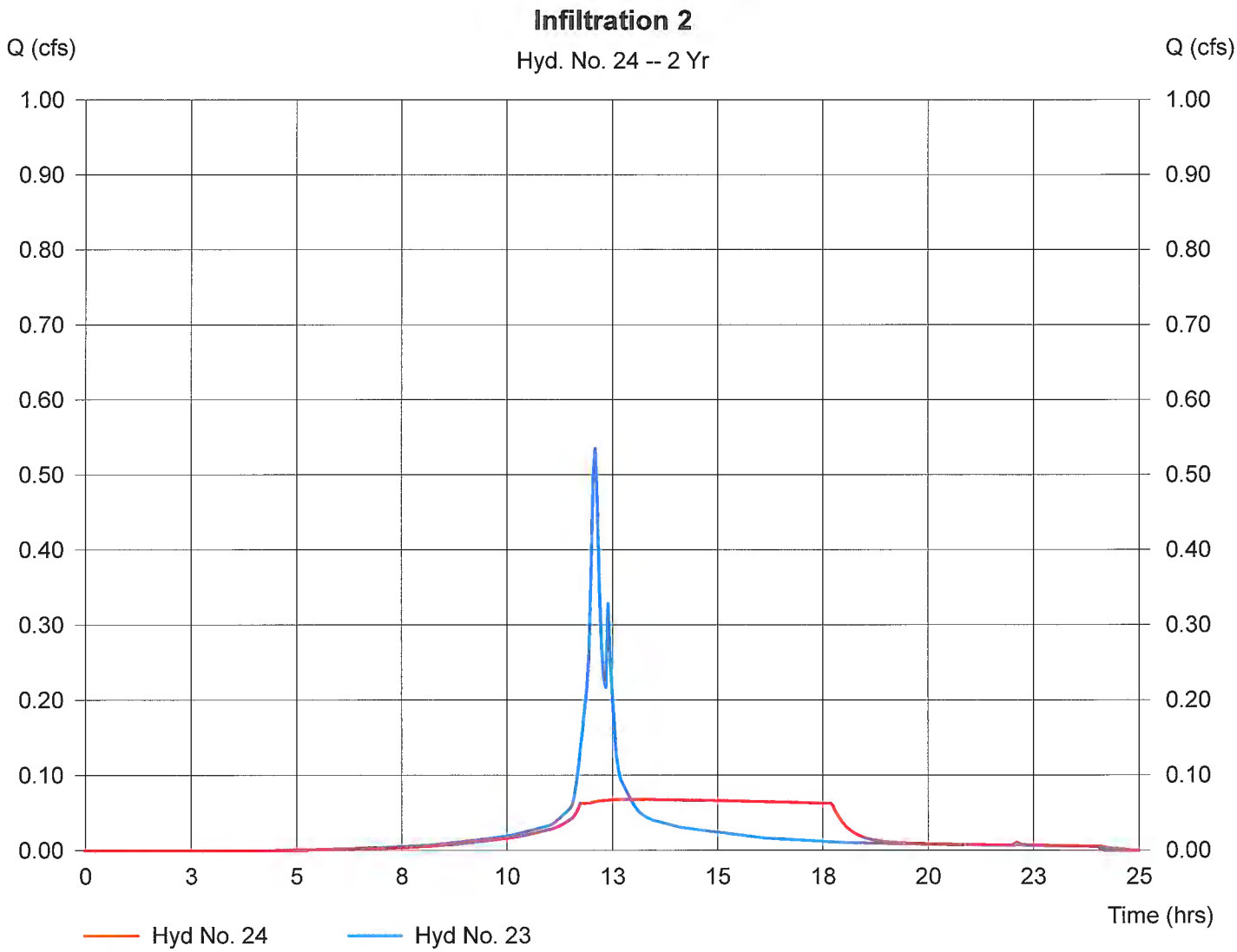
Hydraflow Hydrographs by Intelisolve | Friday, Sep 26 2014, 9:2 AM

Hyd. No. 24

Infiltration 2

Hydrograph type	=	Reservoir	Peak discharge	=	0.07 cfs
Storm frequency	=	2 yrs	Time interval	=	3 min
Inflow hyd. No.	=	23	Max. Elevation	=	136.91 ft
Reservoir name	=	Pavers 2	Max. Storage	=	789 cuft

Storage Indication method used. | Hydrograph Volume = 1,965 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:2 AM

Pond No. 3 - Pavers 2

Pond Data

Bottom LxW = 119.5 x 22.0 ft Side slope = 0.0:1 Bottom elev. = 136.00 ft Depth = 2.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	136.00	2,629	0	0
0.10	136.10	2,629	87	87
0.20	136.20	2,629	87	174
0.30	136.30	2,629	87	260
0.40	136.40	2,629	87	347
0.50	136.50	2,629	87	434
0.60	136.60	2,629	87	521
0.70	136.70	2,629	87	607
0.80	136.80	2,629	87	694
0.90	136.90	2,629	87	781
1.00	137.00	2,629	87	868
1.10	137.10	2,629	87	954
1.20	137.20	2,629	87	1,041
1.30	137.30	2,629	87	1,128
1.40	137.40	2,629	87	1,215
1.50	137.50	2,629	87	1,301
1.60	137.60	2,629	87	1,388
1.70	137.70	2,629	87	1,475
1.80	137.80	2,629	87	1,562
1.90	137.90	2,629	87	1,648
2.00	138.00	2,629	87	1,735

(*33.00% voids applied)

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

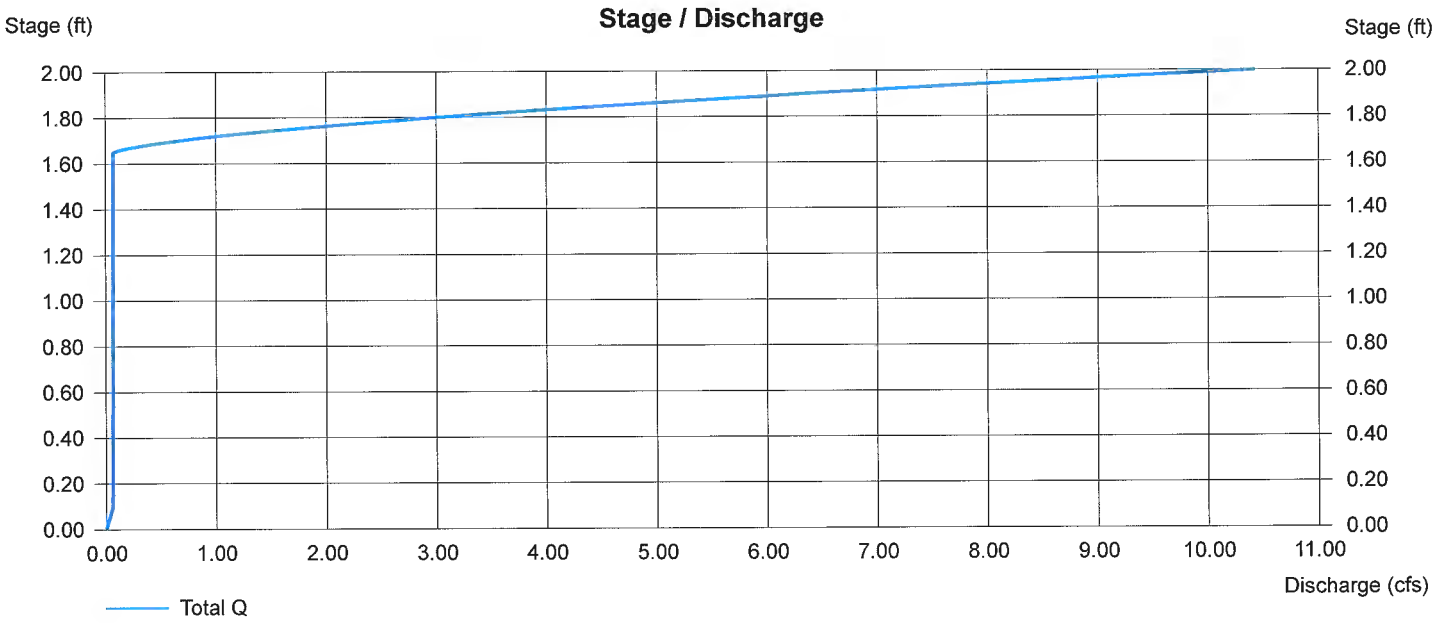
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 137.65	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 = 1.020 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

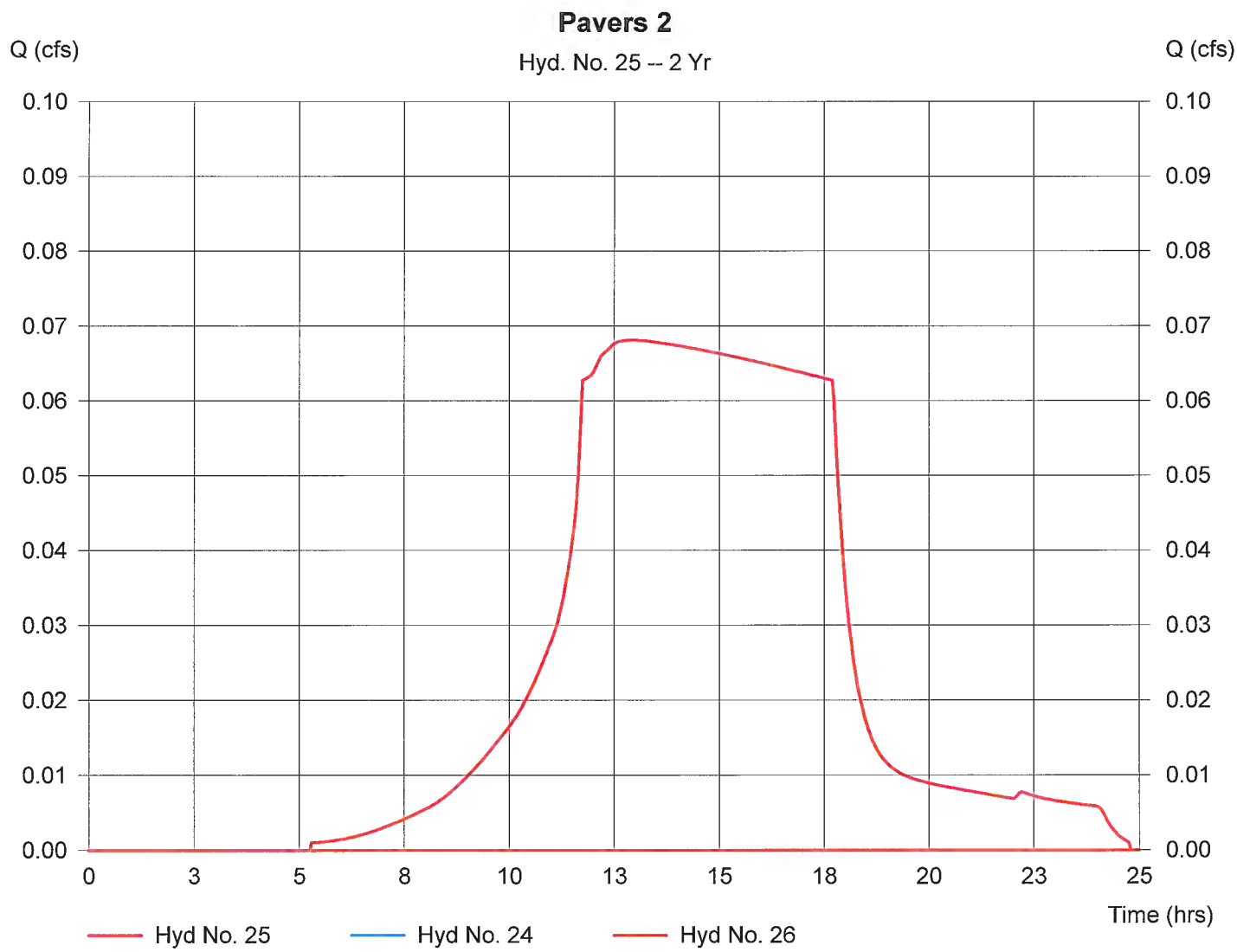
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 25

Pavers 2

Hydrograph type	=	Diversion1	Peak discharge	=	0.07 cfs
Storm frequency	=	2 yrs	Time interval	=	3 min
Inflow hydrograph	=	24	2nd diverted hyd.	=	26
Diversion method	=	Pond - Pavers 2	Pond structure	=	Exfiltration

Hydrograph Volume = 1,965 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

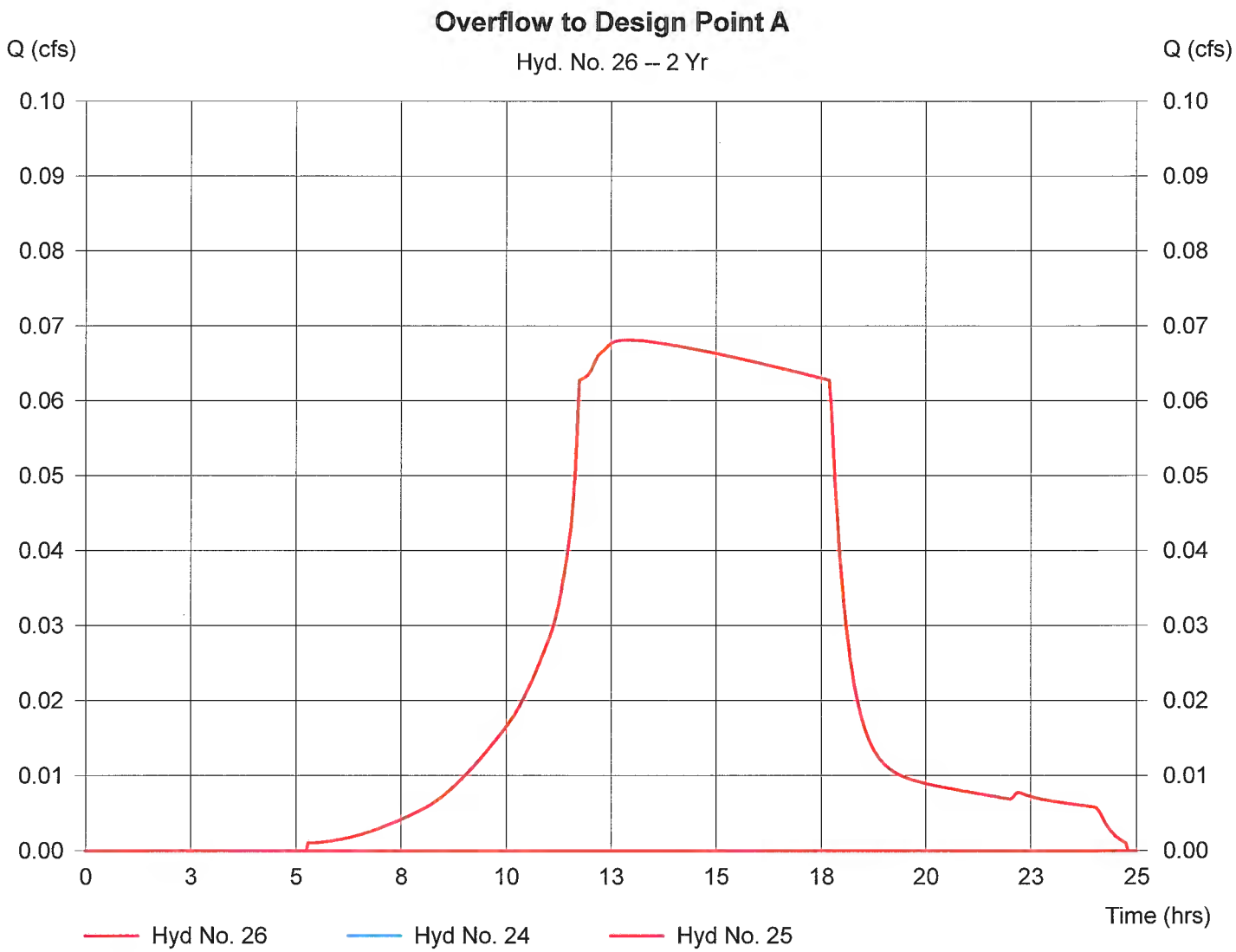
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 26

Overflow to Design Point A

Hydrograph type	=	Diversion2	Peak discharge	=	0.00 cfs
Storm frequency	=	2 yrs	Time interval	=	3 min
Inflow hydrograph	=	24	2nd diverted hyd.	=	25
Diversion method	=	Pond - Pavers 2	Pond structure	=	Exfiltration

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

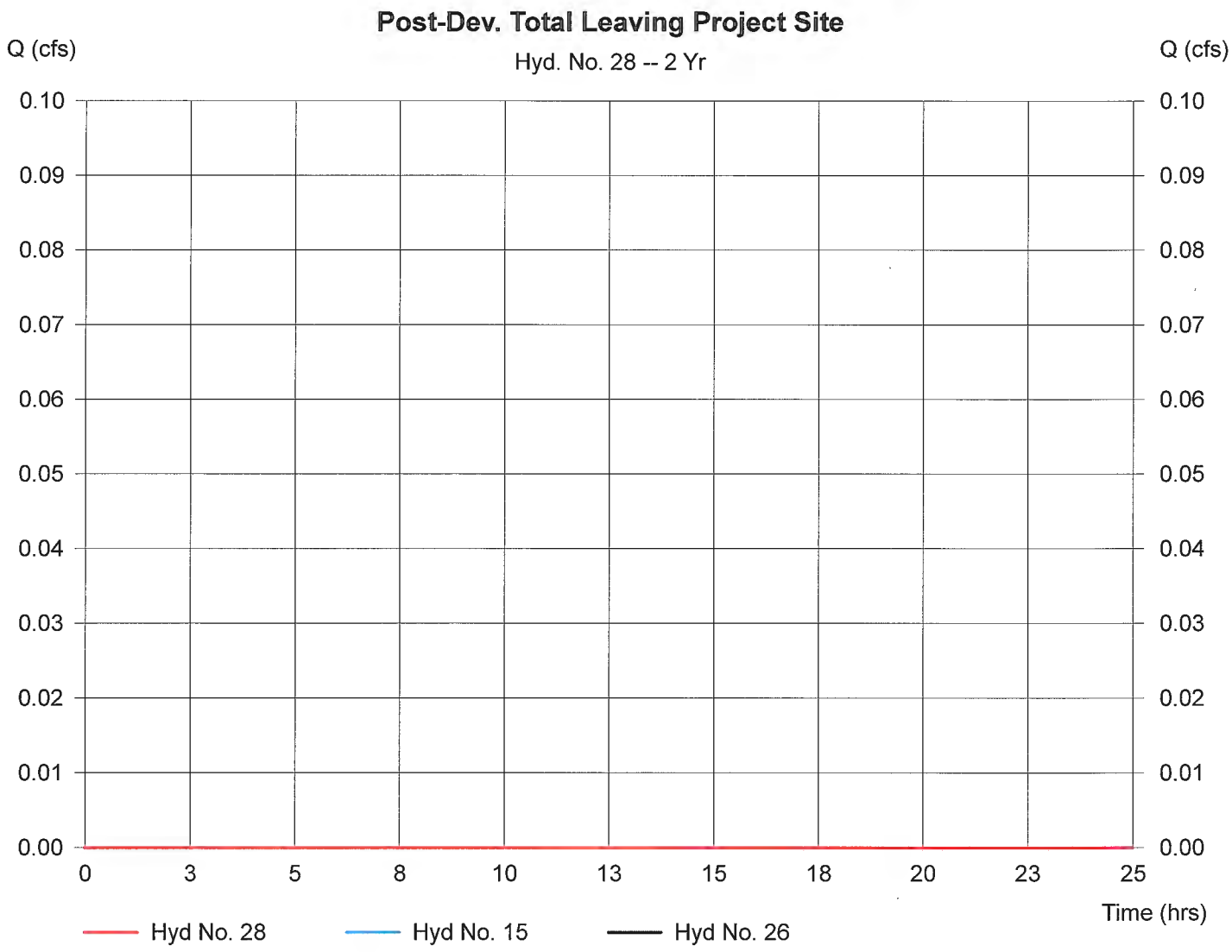
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 28

Post-Dev. Total Leaving Project Site

Hydrograph type	= Combine	Peak discharge	= 0.00 cfs
Storm frequency	= 2 yrs	Time interval	= 3 min
Inflow hyds.	= 15, 26		

Hydrograph Volume = 0 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	1.67	3	726	6,208	----	------	------	E.C.B.1-Design Point A
2	SCS Runoff	2.61	3	726	9,759	----	------	------	E.C.B.2-Design Point B
4	Combine	4.28	3	726	15,967	1, 2,	------	------	Pre-Dev. Total Leaving Project Site
6	SCS Runoff	1.30	3	726	4,734	----	------	------	P.D.B.3
7	Reservoir	1.48	3	729	4,733	6	136.44	1,234	Infiltration 3
8	Diversion1	0.07	3	729	3,590	7	------	------	Pavers 3
9	Diversion2	1.41	3	729	1,143	7	------	------	Overflow to P.D.B.1
11	SCS Runoff	1.28	3	726	4,726	----	------	------	P.D.B.1
12	Combine	2.49	3	729	5,869	9, 11	------	------	Overflow P.D.B.3 + P.D.B.1
13	Reservoir	1.41	3	732	5,867	12	135.63	1,727	Infiltration 1
14	Diversion1	0.09	3	732	4,244	13	------	------	Pavers 1
15	Diversion2	1.32	3	732	1,623	13	------	------	Overflow to Design Point B
17	SCS Runoff	0.76	3	726	2,677	----	------	------	P.D.B.4
18	Reservoir	0.83	3	729	2,675	17	137.38	657	Infiltration 4
19	Diversion1	0.04	3	729	1,951	18	------	------	Pavers 4
20	Diversion2	0.79	3	729	725	18	------	------	Overflow to P.D.B.2
22	SCS Runoff	0.81	3	726	2,875	----	------	------	P.D.B.2
23	Combine	1.48	3	729	3,600	20, 22	------	------	P.D.B.4 Overflow + P.D.B.2
24	Reservoir	0.58	3	744	3,598	23	137.70	1,472	Infiltration 2
25	Diversion1	0.07	3	744	3,161	24	------	------	Pavers 2
26	Diversion2	0.51	3	744	437	24	------	------	Overflow to Design Point A
28	Combine	1.32	3	732	2,061	15, 26,	------	------	Post-Dev. Total Leaving Project Site

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

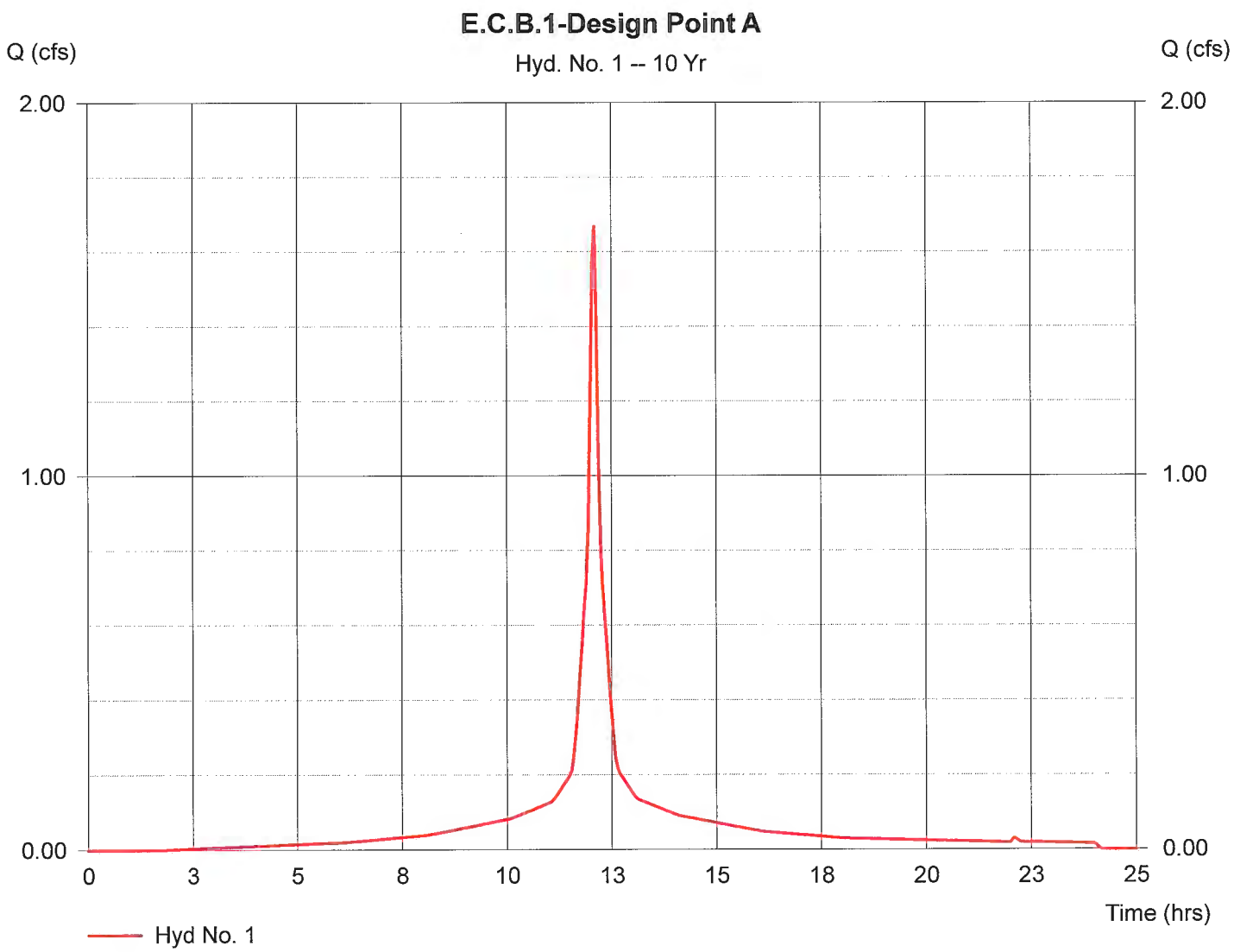
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 1

E.C.B.1-Design Point A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.67 cfs
Storm frequency	= 10 yrs	Time interval	= 3 min
Drainage area	= 0.43 ac	Curve number	= 96.6
Basin Slope	= 0.3 %	Hydraulic length	= 150 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 4.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,208 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

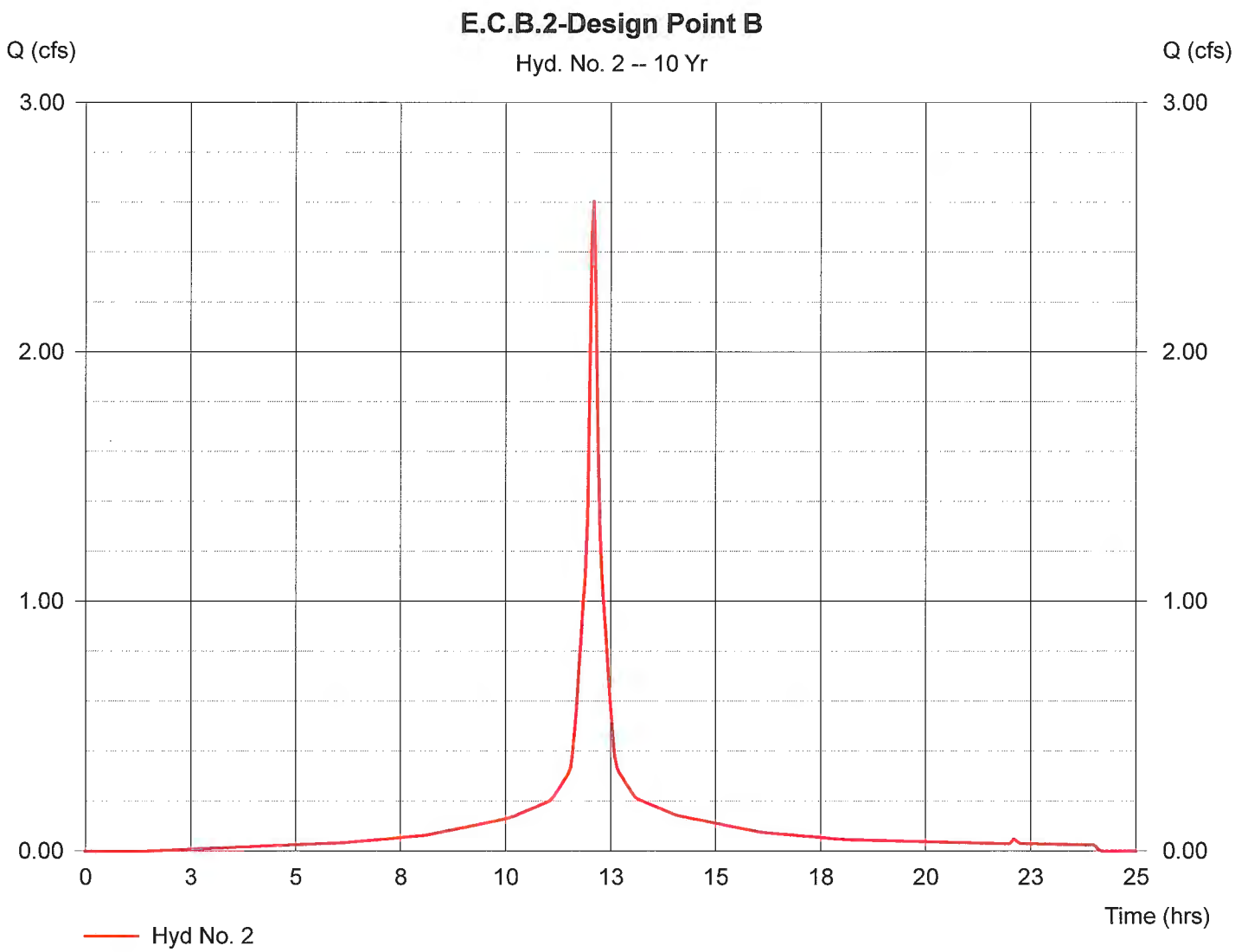
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 2

E.C.B.2-Design Point B

Hydrograph type	= SCS Runoff	Peak discharge	= 2.61 cfs
Storm frequency	= 10 yrs	Time interval	= 3 min
Drainage area	= 0.68 ac	Curve number	= 97
Basin Slope	= 1.9 %	Hydraulic length	= 135 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 4.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 9,759 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

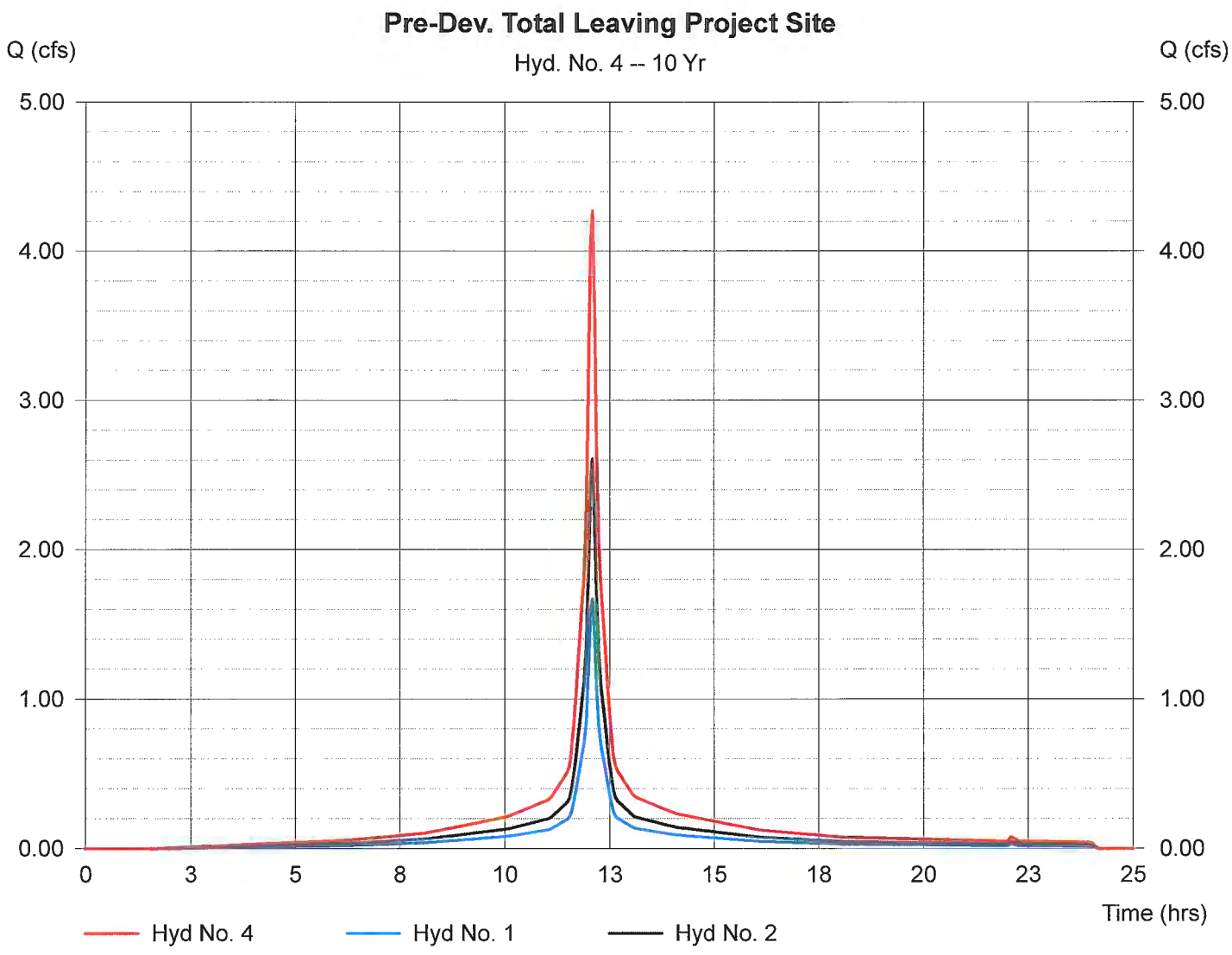
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 4

Pre-Dev. Total Leaving Project Site

Hydrograph type	= Combine	Peak discharge	= 4.28 cfs
Storm frequency	= 10 yrs	Time interval	= 3 min
Inflow hyds.	= 1, 2		

Hydrograph Volume = 15,967 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

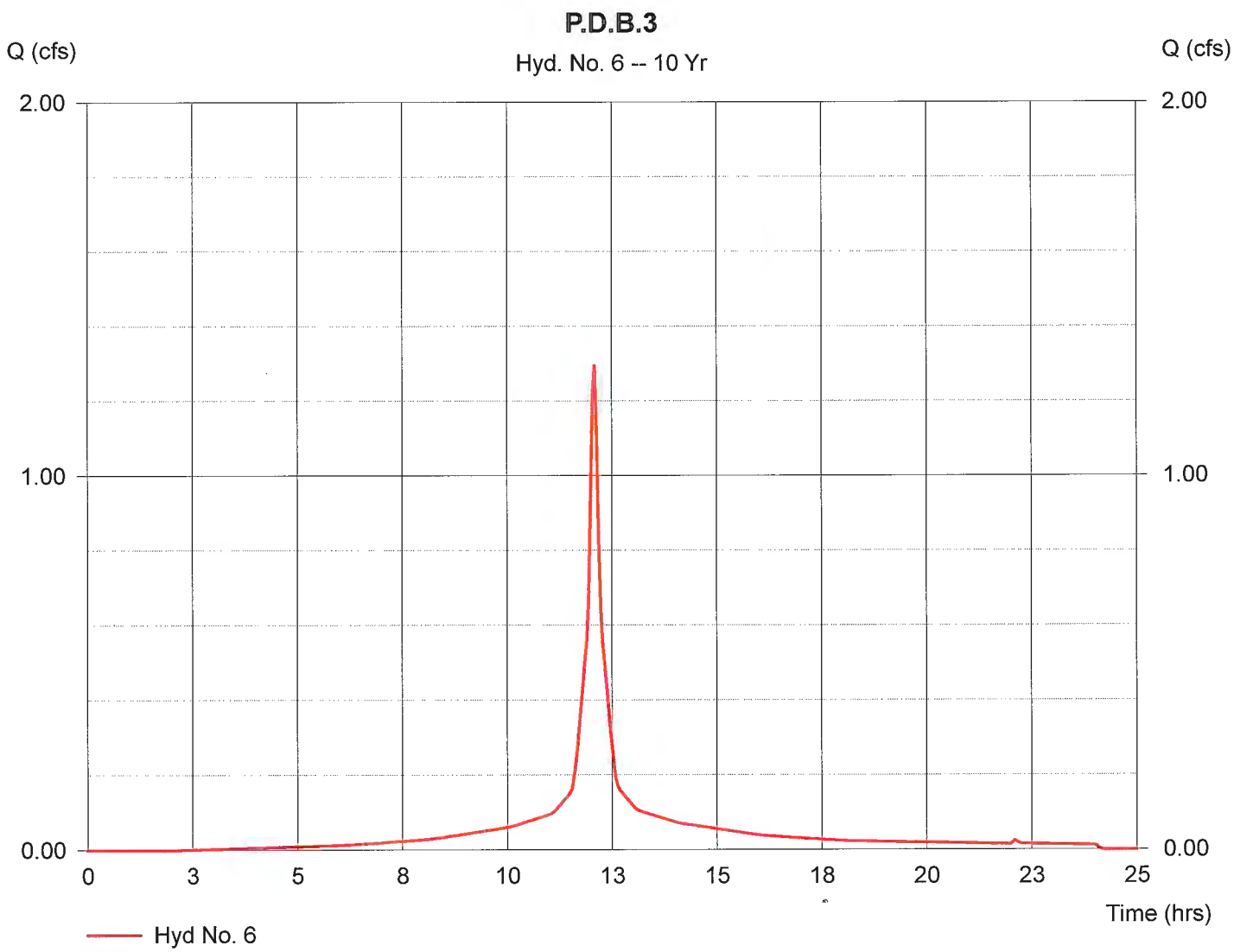
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 6

P.D.B.3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.30 cfs
Storm frequency	= 10 yrs	Time interval	= 3 min
Drainage area	= 0.34 ac	Curve number	= 95.5
Basin Slope	= 1.0 %	Hydraulic length	= 107 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 4.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,734 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:2 AM

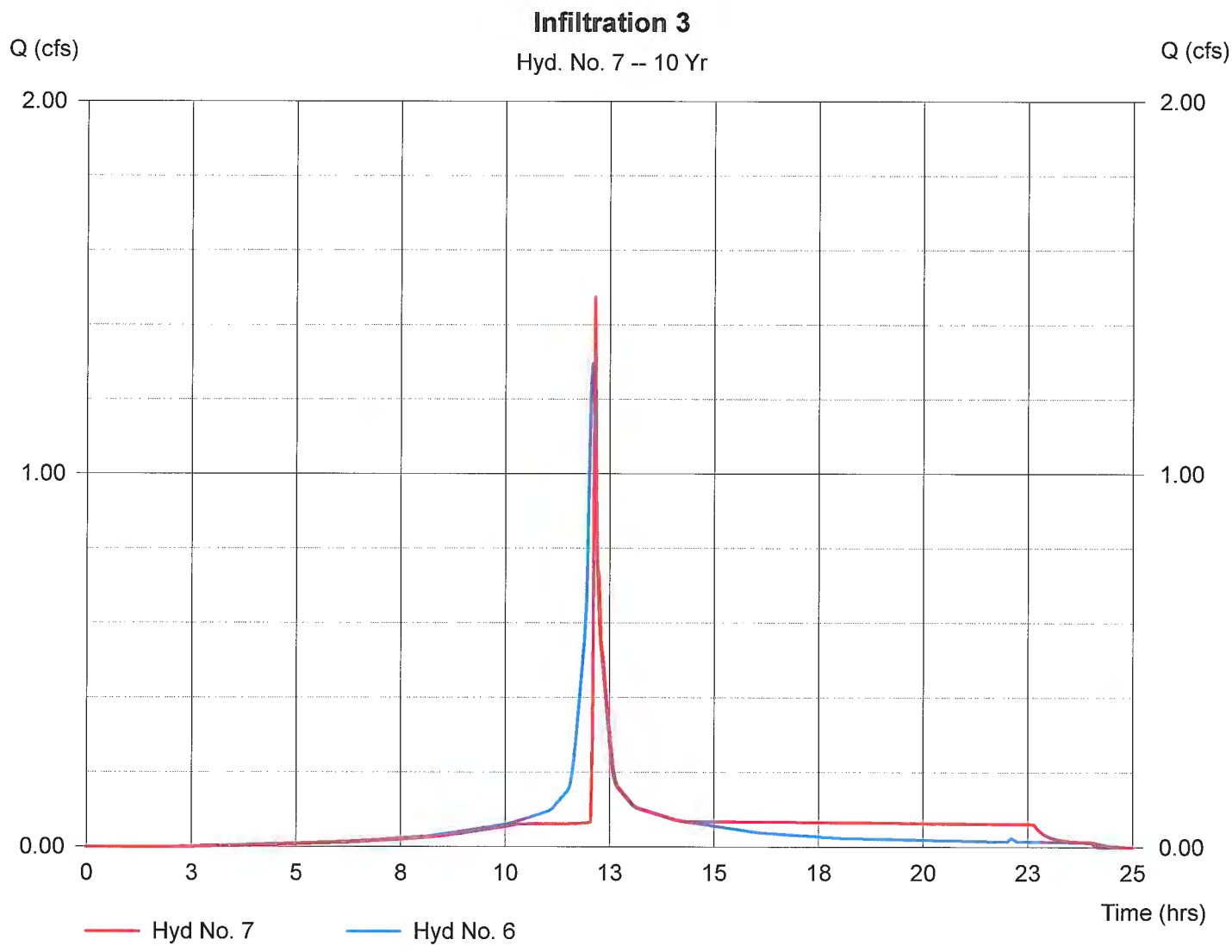
Hyd. No. 7

Infiltration 3

Hydrograph type	=	Reservoir	Peak discharge	=	1.48 cfs
Storm frequency	=	10 yrs	Time interval	=	3 min
Inflow hyd. No.	=	6	Max. Elevation	=	136.44 ft
Reservoir name	=	Pavers 3	Max. Storage	=	1,234 cuft

Storage Indication method used.

Hydrograph Volume = 4,733 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:2 AM

Pond No. 4 - Pavers 3

Pond Data

Bottom LxW = 72.0 x 36.0 ft Side slope = 0.0:1 Bottom elev. = 135.00 ft Depth = 1.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	135.00	2,592	0	0
0.08	135.08	2,592	64	64
0.15	135.15	2,592	64	128
0.23	135.23	2,592	64	192
0.30	135.30	2,592	64	257
0.38	135.38	2,592	64	321
0.45	135.45	2,592	64	385
0.53	135.53	2,592	64	449
0.60	135.60	2,592	64	513
0.68	135.68	2,592	64	577
0.75	135.75	2,592	64	642
0.82	135.83	2,592	64	706
0.90	135.90	2,592	64	770
0.97	135.98	2,592	64	834
1.05	136.05	2,592	64	898
1.13	136.13	2,592	64	962
1.20	136.20	2,592	64	1,026
1.28	136.28	2,592	64	1,091
1.35	136.35	2,592	64	1,155
1.43	136.43	2,592	64	1,219
1.50	136.50	2,592	64	1,283

(*33.00% voids applied)

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

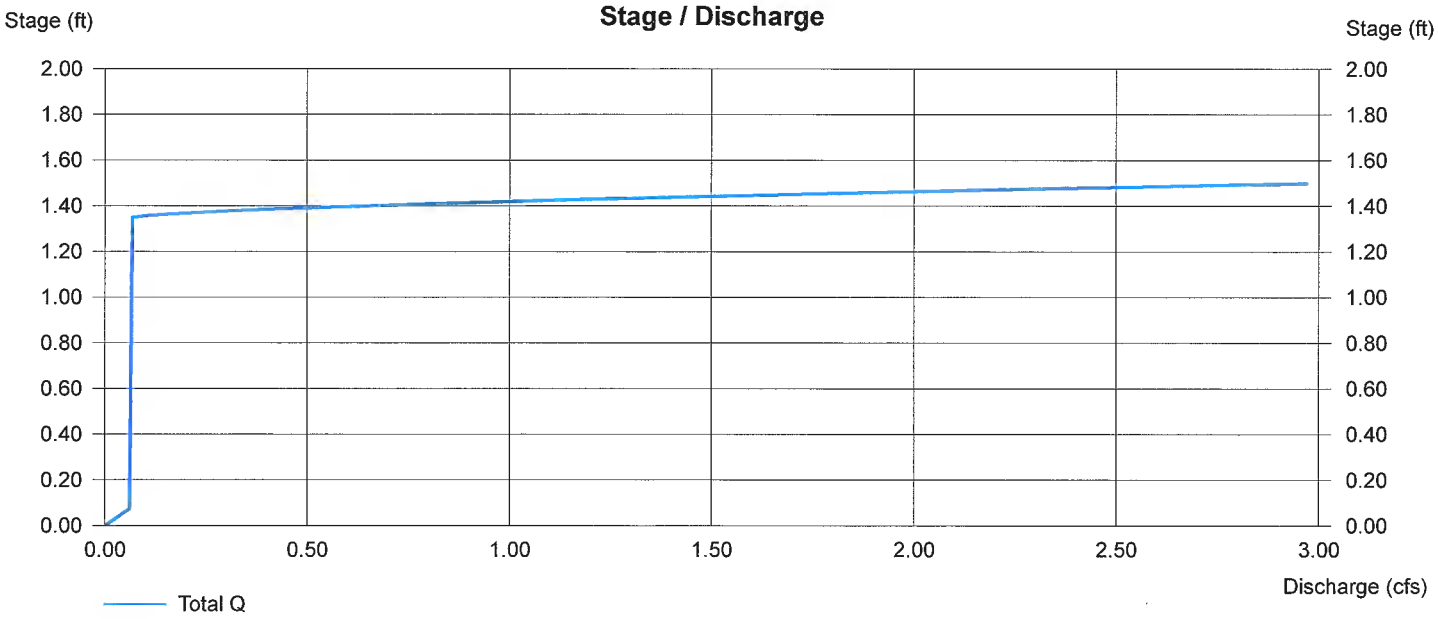
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 136.35	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 = 1.020 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

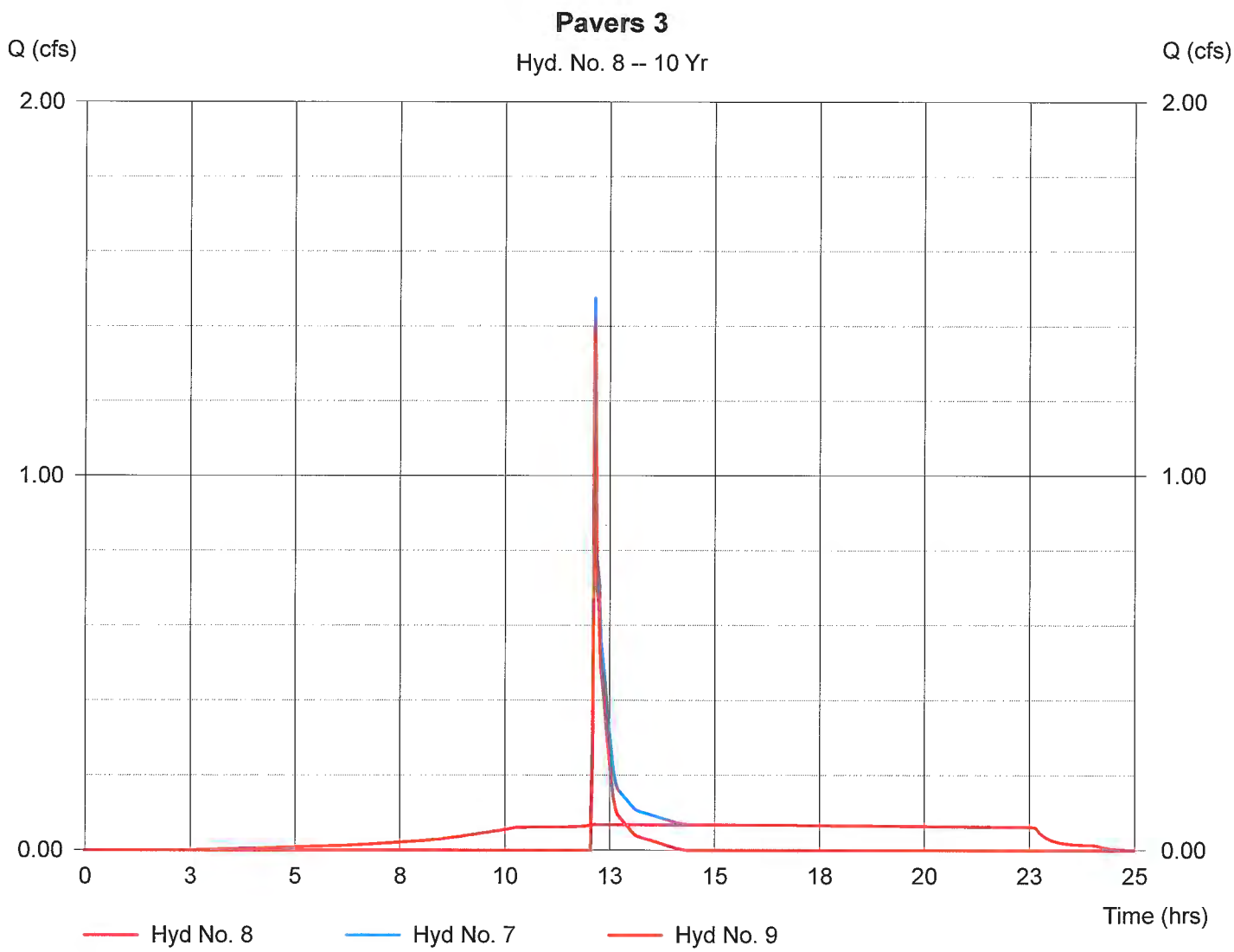
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 8

Pavers 3

Hydrograph type	=	Diversion1	Peak discharge	=	0.07 cfs
Storm frequency	=	10 yrs	Time interval	=	3 min
Inflow hydrograph	=	7	2nd diverted hyd.	=	9
Diversion method	=	Pond - Pavers 3	Pond structure	=	Exfiltration

Hydrograph Volume = 3,590 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

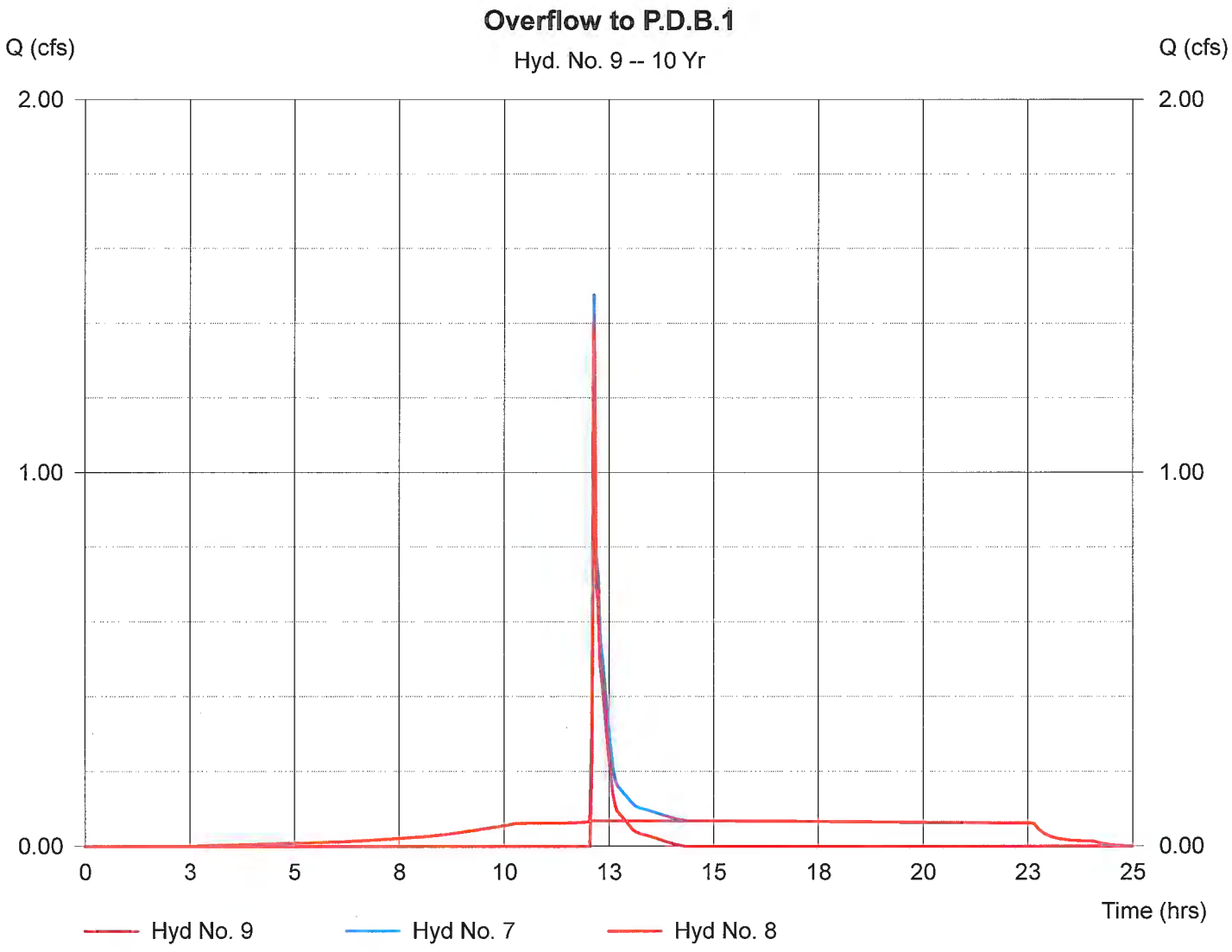
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 9

Overflow to P.D.B.1

Hydrograph type	=	Diversion2	Peak discharge	=	1.41 cfs
Storm frequency	=	10 yrs	Time interval	=	3 min
Inflow hydrograph	=	7	2nd diverted hyd.	=	8
Diversion method	=	Pond - Pavers 3	Pond structure	=	Exfiltration

Hydrograph Volume = 1,143 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

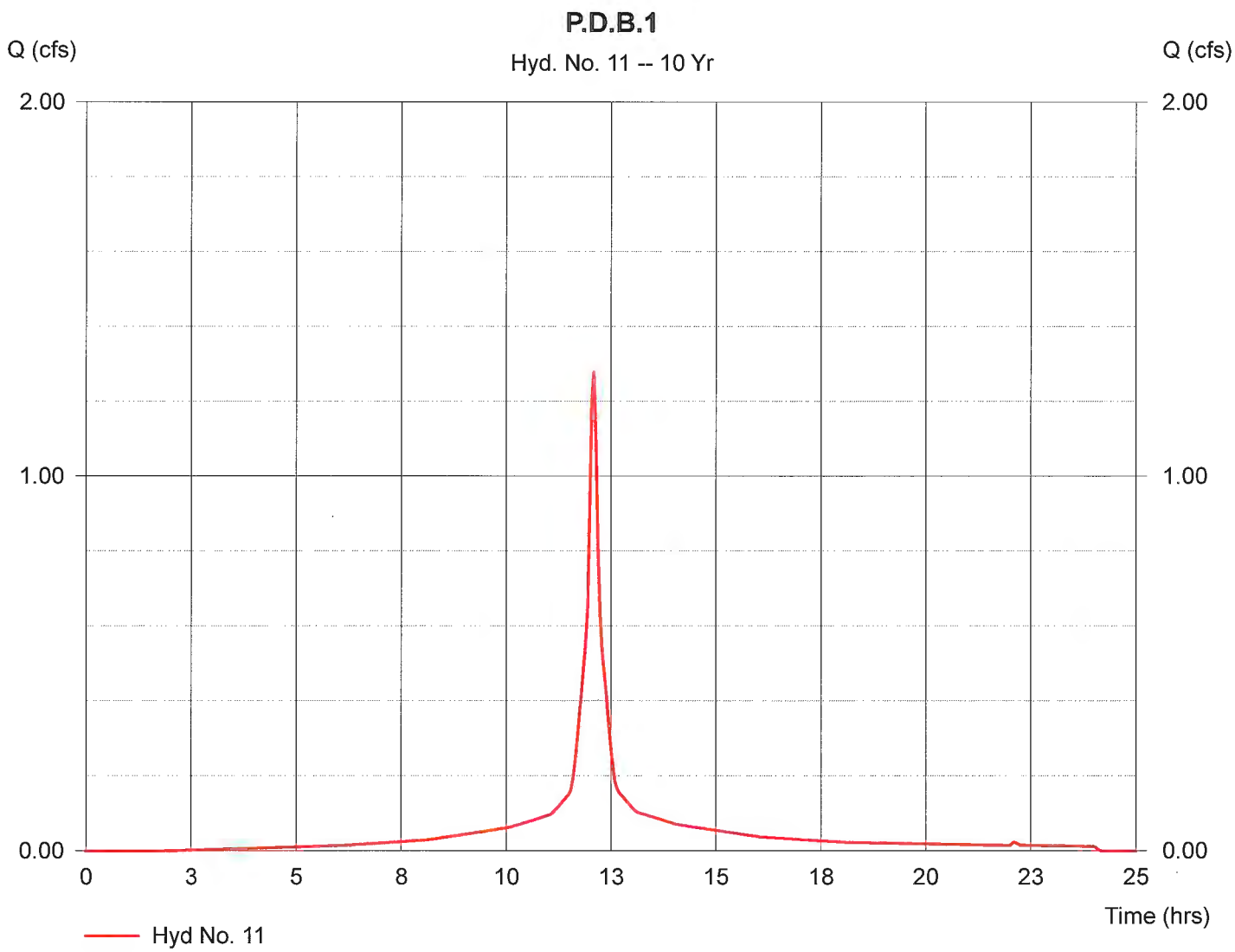
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 11

P.D.B.1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.28 cfs
Storm frequency	= 10 yrs	Time interval	= 3 min
Drainage area	= 0.33 ac	Curve number	= 96.2
Basin Slope	= 2.7 %	Hydraulic length	= 118 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 4.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,726 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

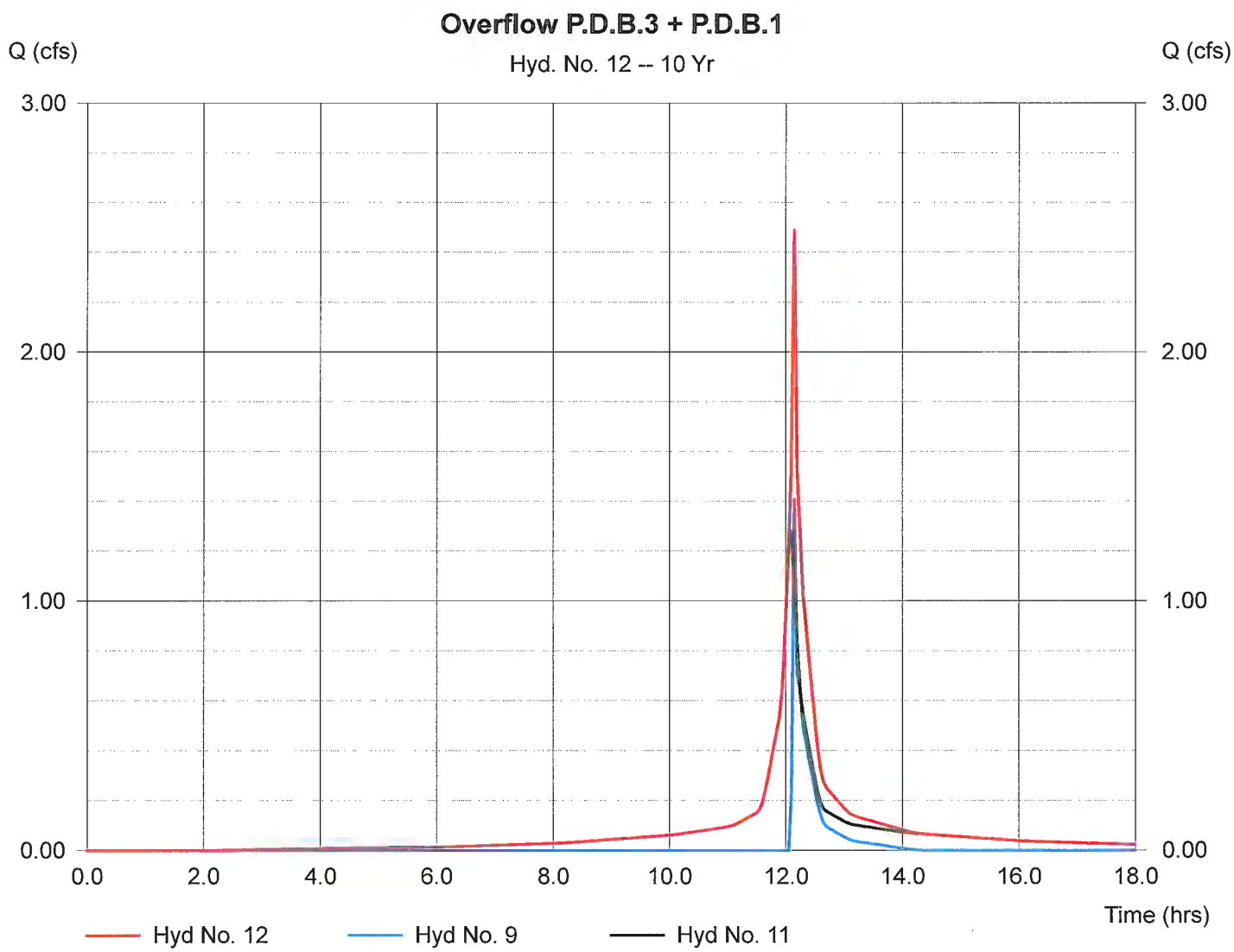
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 12

Overflow P.D.B.3 + P.D.B.1

Hydrograph type	= Combine	Peak discharge	= 2.49 cfs
Storm frequency	= 10 yrs	Time interval	= 3 min
Inflow hyds.	= 9, 11		

Hydrograph Volume = 5,869 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:2 AM

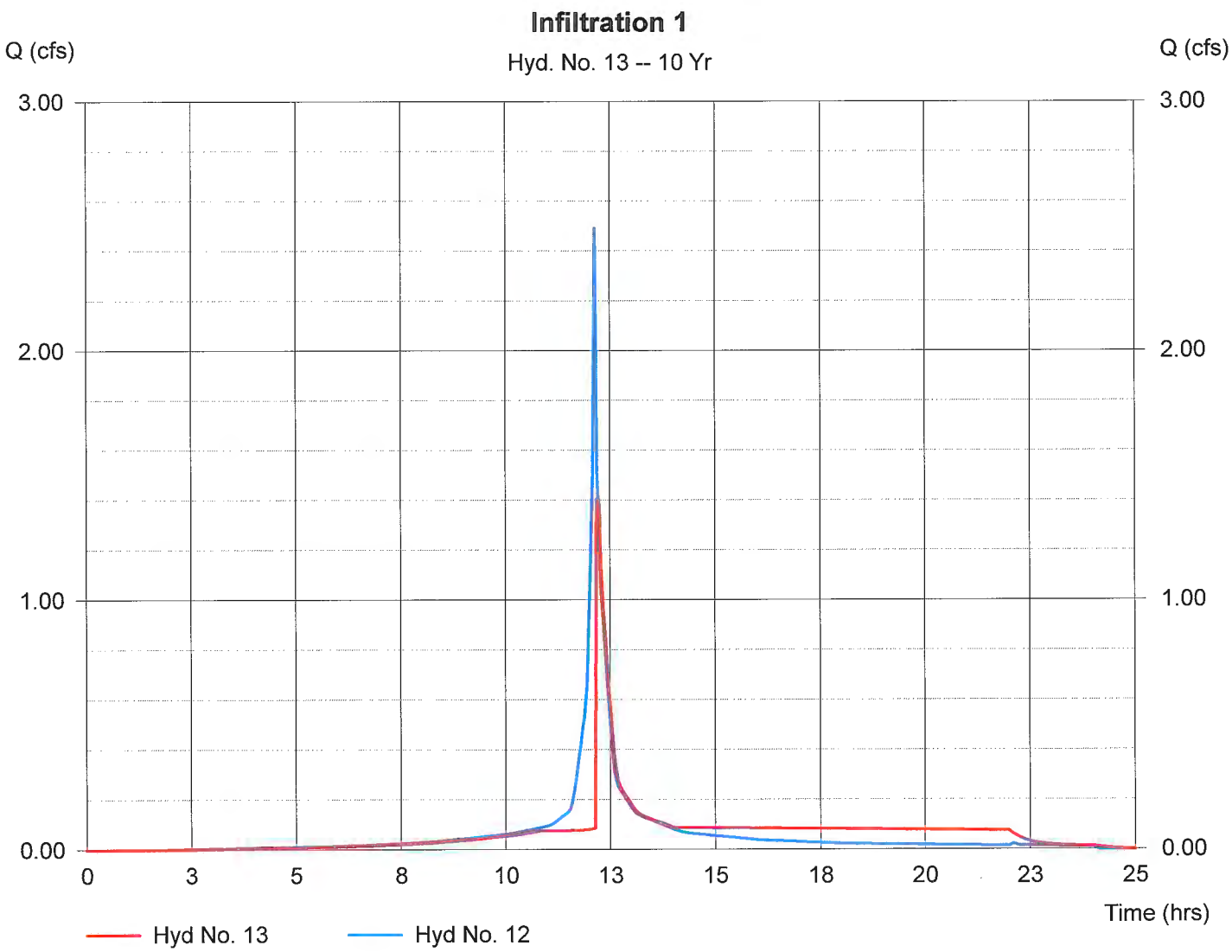
Hyd. No. 13

Infiltration 1

Hydrograph type	=	Reservoir	Peak discharge	=	1.41 cfs
Storm frequency	=	10 yrs	Time interval	=	3 min
Inflow hyd. No.	=	12	Max. Elevation	=	135.63 ft
Reservoir name	=	Pavers 1	Max. Storage	=	1,727 cuft

Storage Indication method used.

Hydrograph Volume = 5,867 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:2 AM

Pond No. 2 - Pavers 1

Pond Data

Bottom LxW = 145.5 x 22.0 ft Side slope = 0.0:1 Bottom elev. = 134.00 ft Depth = 2.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	134.00	3,201	0	0
0.10	134.10	3,201	106	106
0.20	134.20	3,201	106	211
0.30	134.30	3,201	106	317
0.40	134.40	3,201	106	423
0.50	134.50	3,201	106	528
0.60	134.60	3,201	106	634
0.70	134.70	3,201	106	739
0.80	134.80	3,201	106	845
0.90	134.90	3,201	106	951
1.00	135.00	3,201	106	1,056
1.10	135.10	3,201	106	1,162
1.20	135.20	3,201	106	1,268
1.30	135.30	3,201	106	1,373
1.40	135.40	3,201	106	1,479
1.50	135.50	3,201	106	1,584
1.60	135.60	3,201	106	1,690
1.70	135.70	3,201	106	1,796
1.80	135.80	3,201	106	1,901
1.90	135.90	3,201	106	2,007
2.00	136.00	3,201	106	2,113

(*33.00% voids applied)

Culvert / Orifice Structures

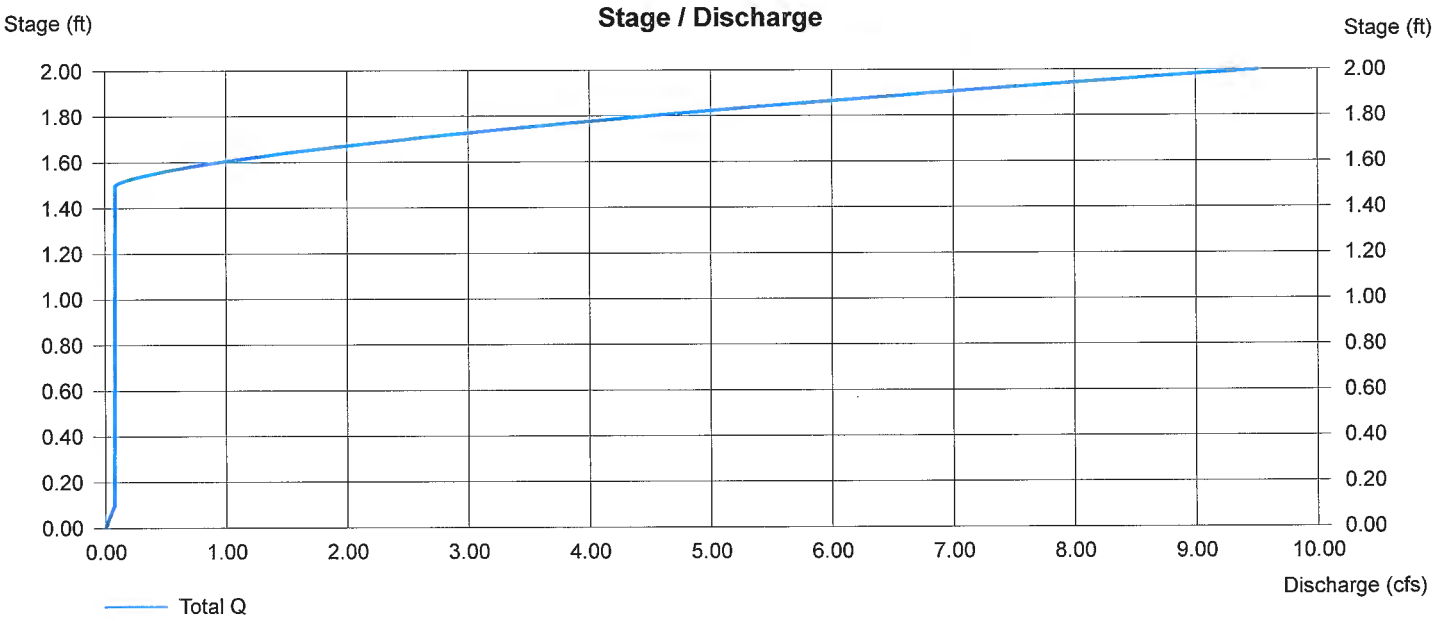
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 135.50	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 = 1.020 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

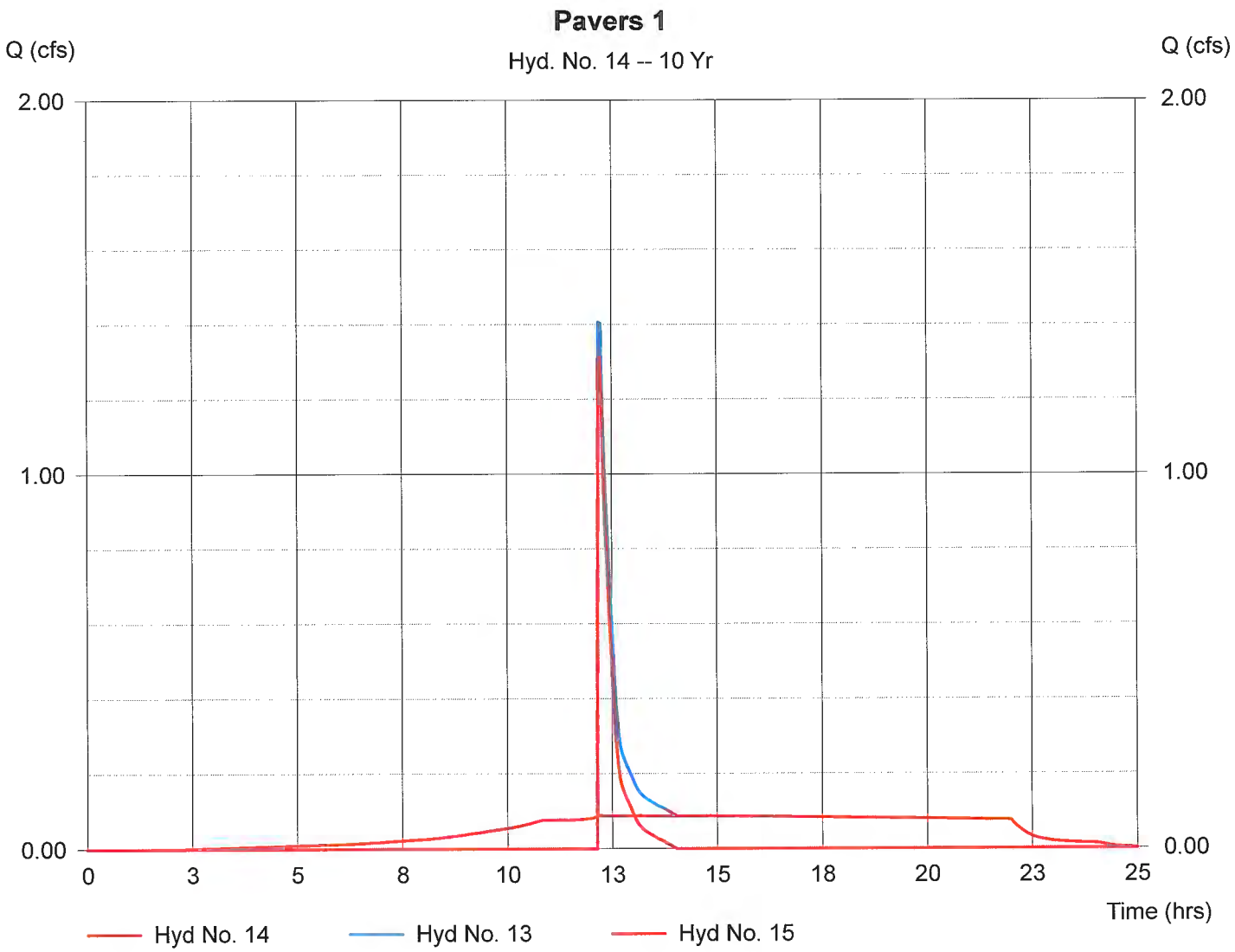
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 14

Pavers 1

Hydrograph type	=	Diversion1	Peak discharge	=	0.09 cfs
Storm frequency	=	10 yrs	Time interval	=	3 min
Inflow hydrograph	=	13	2nd diverted hyd.	=	15
Diversion method	=	Pond - Pavers 1	Pond structure	=	Exfiltration

Hydrograph Volume = 4,244 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

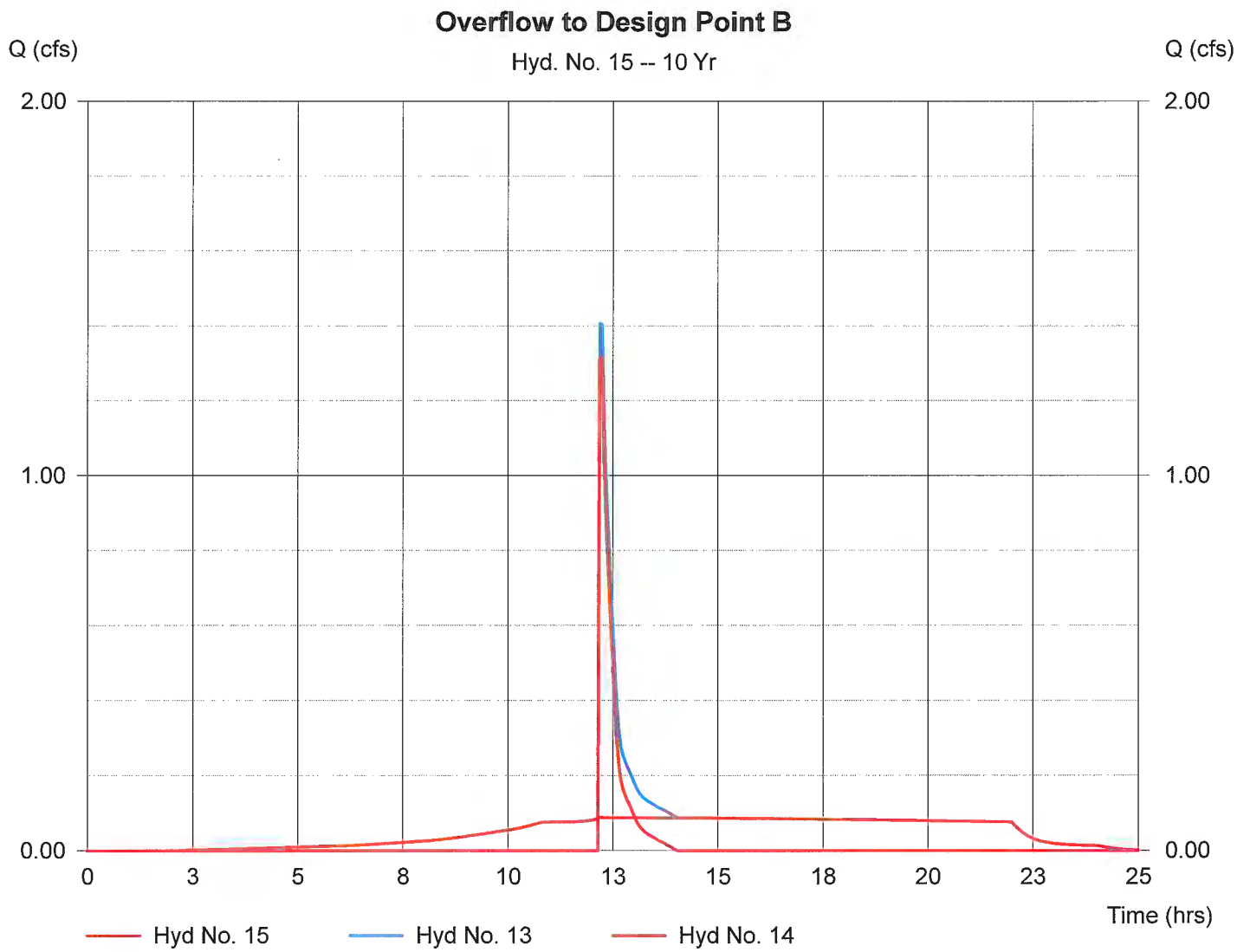
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 15

Overflow to Design Point B

Hydrograph type	=	Diversion2	Peak discharge	=	1.32 cfs
Storm frequency	=	10 yrs	Time interval	=	3 min
Inflow hydrograph	=	13	2nd diverted hyd.	=	14
Diversion method	=	Pond - Pavers 1	Pond structure	=	Exfiltration

Hydrograph Volume = 1,623 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

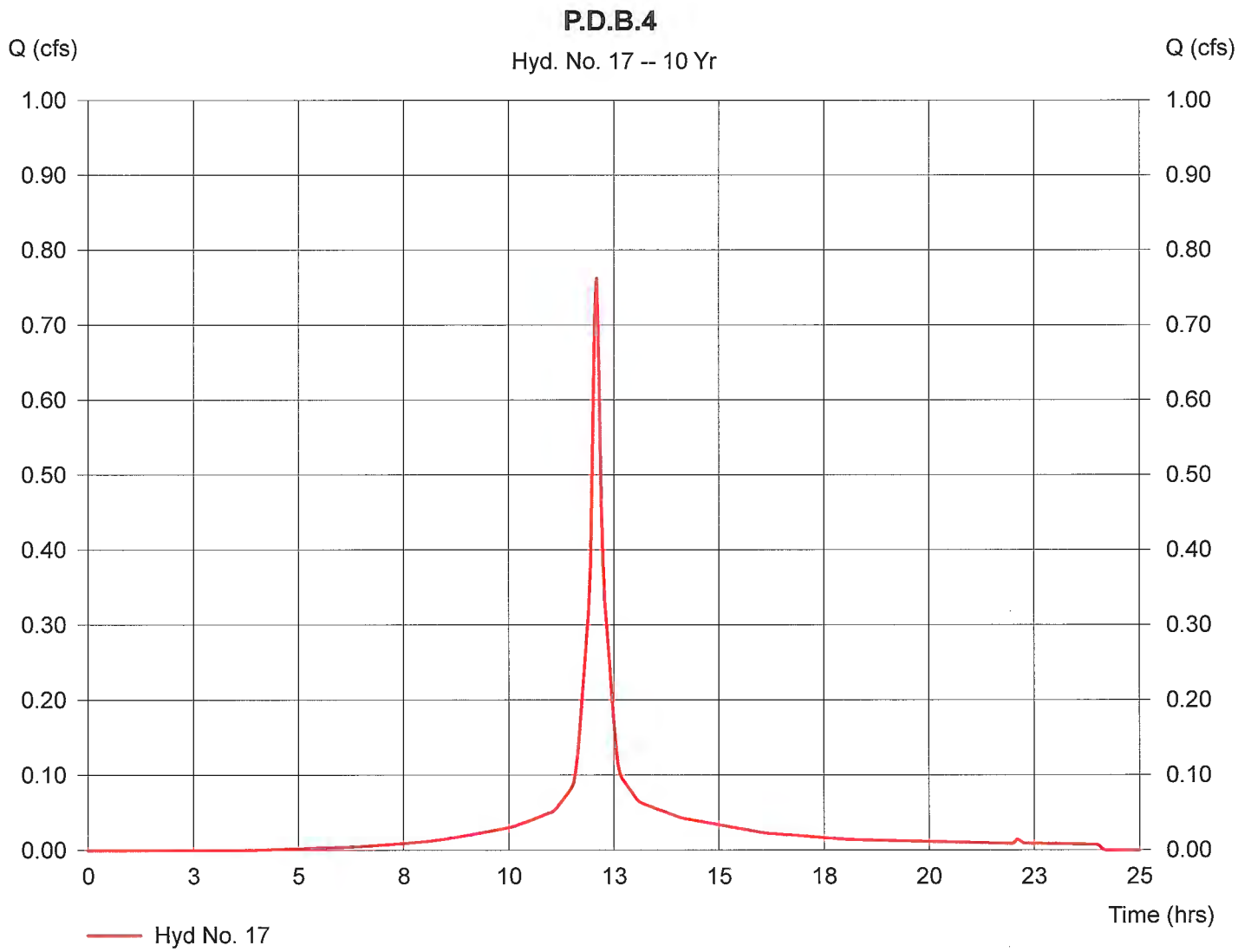
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 17

P.D.B.4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.76 cfs
Storm frequency	= 10 yrs	Time interval	= 3 min
Drainage area	= 0.21 ac	Curve number	= 92.1
Basin Slope	= 1.0 %	Hydraulic length	= 113 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 4.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,677 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:2 AM

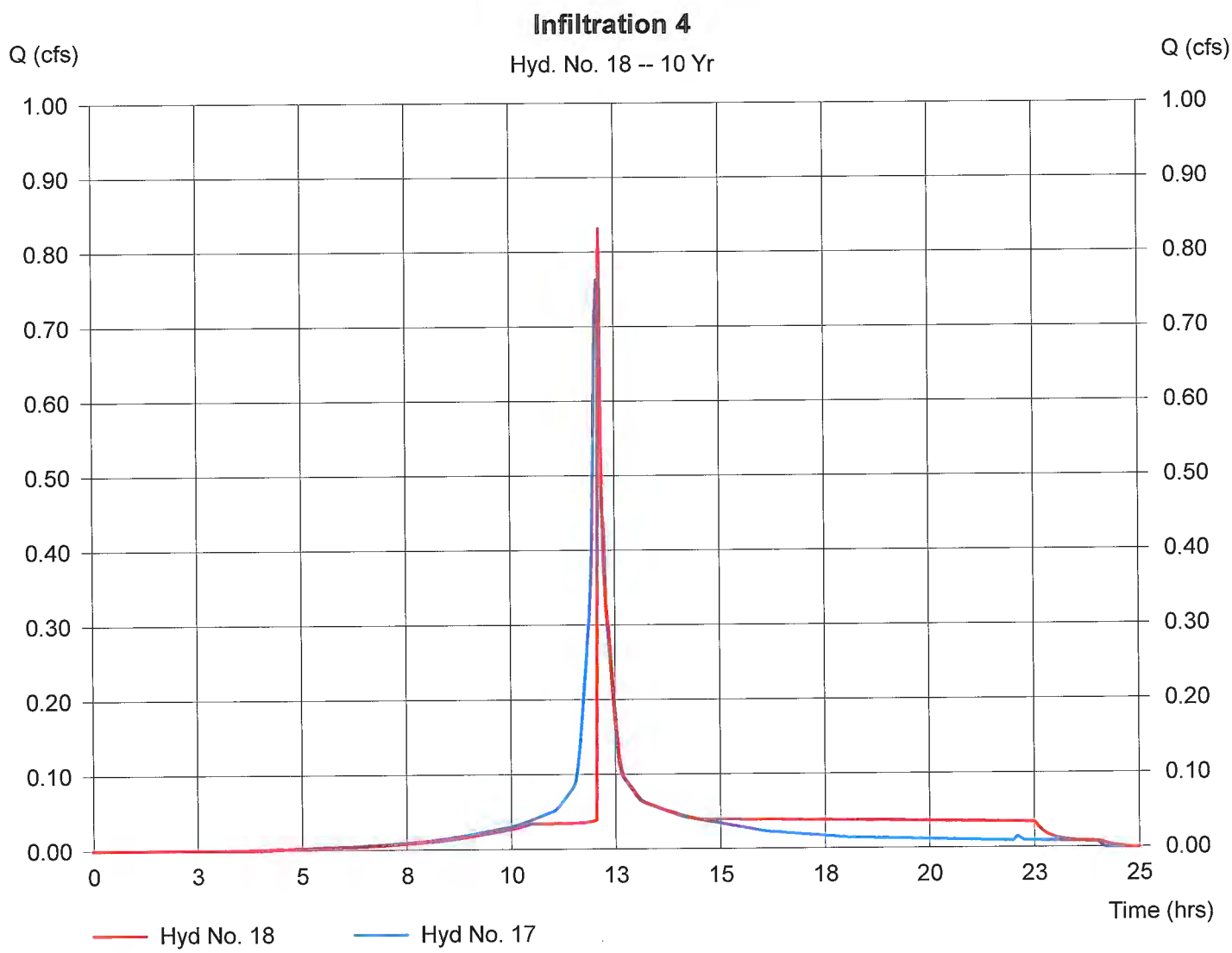
Hyd. No. 18

Infiltration 4

Hydrograph type	=	Reservoir	Peak discharge	=	0.83 cfs
Storm frequency	=	10 yrs	Time interval	=	3 min
Inflow hyd. No.	=	17	Max. Elevation	=	137.38 ft
Reservoir name	=	Pavers 4	Max. Storage	=	657 cuft

Storage Indication method used.

Hydrograph Volume = 2,675 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:2 AM

Pond No. 5 - Pavers 4

Pond Data

Bottom LxW = 72.0 x 20.0 ft Side slope = 0.0:1 Bottom elev. = 136.00 ft Depth = 1.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)* (*33.00% voids applied)
0.00	136.00	1,440	0	0
0.08	136.08	1,440	36	36
0.15	136.15	1,440	36	71
0.23	136.23	1,440	36	107
0.30	136.30	1,440	36	143
0.38	136.38	1,440	36	178
0.45	136.45	1,440	36	214
0.53	136.53	1,440	36	249
0.60	136.60	1,440	36	285
0.68	136.68	1,440	36	321
0.75	136.75	1,440	36	356
0.82	136.83	1,440	36	392
0.90	136.90	1,440	36	428
0.97	136.98	1,440	36	463
1.05	137.05	1,440	36	499
1.13	137.13	1,440	36	535
1.20	137.20	1,440	36	570
1.28	137.28	1,440	36	606
1.35	137.35	1,440	36	642
1.43	137.43	1,440	36	677
1.50	137.50	1,440	36	713

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

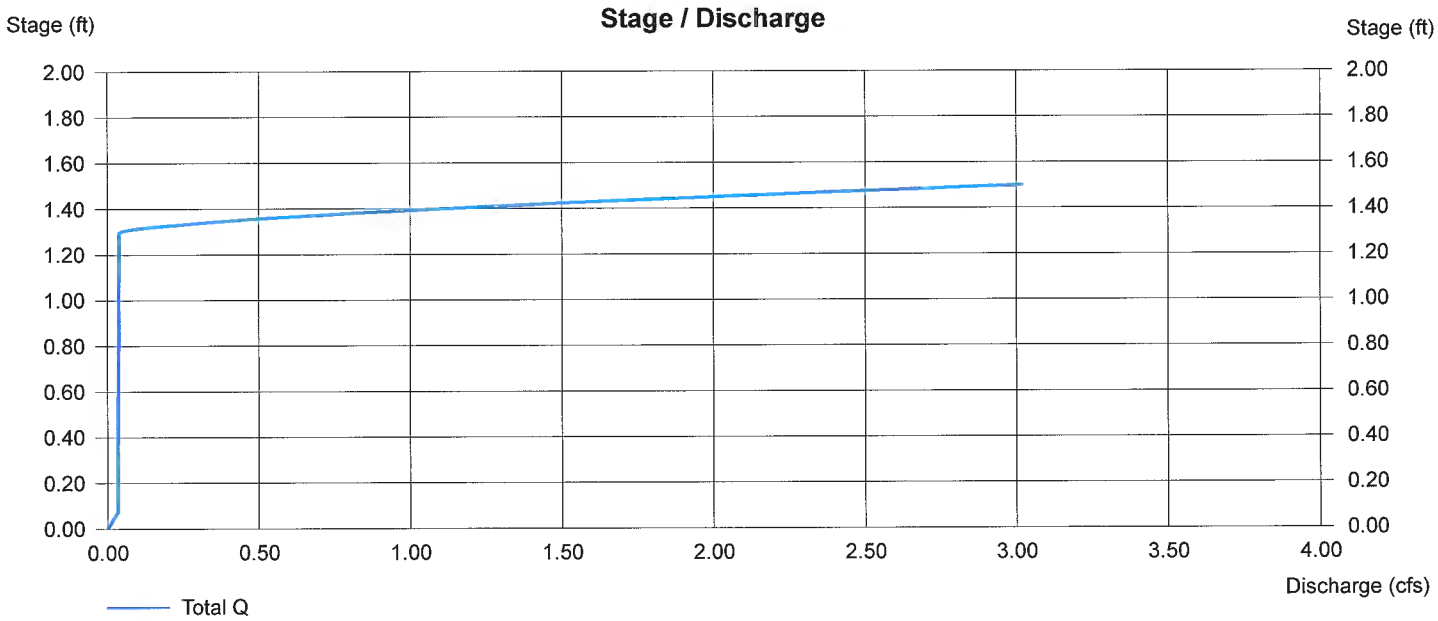
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 137.30	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 = 1.020 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

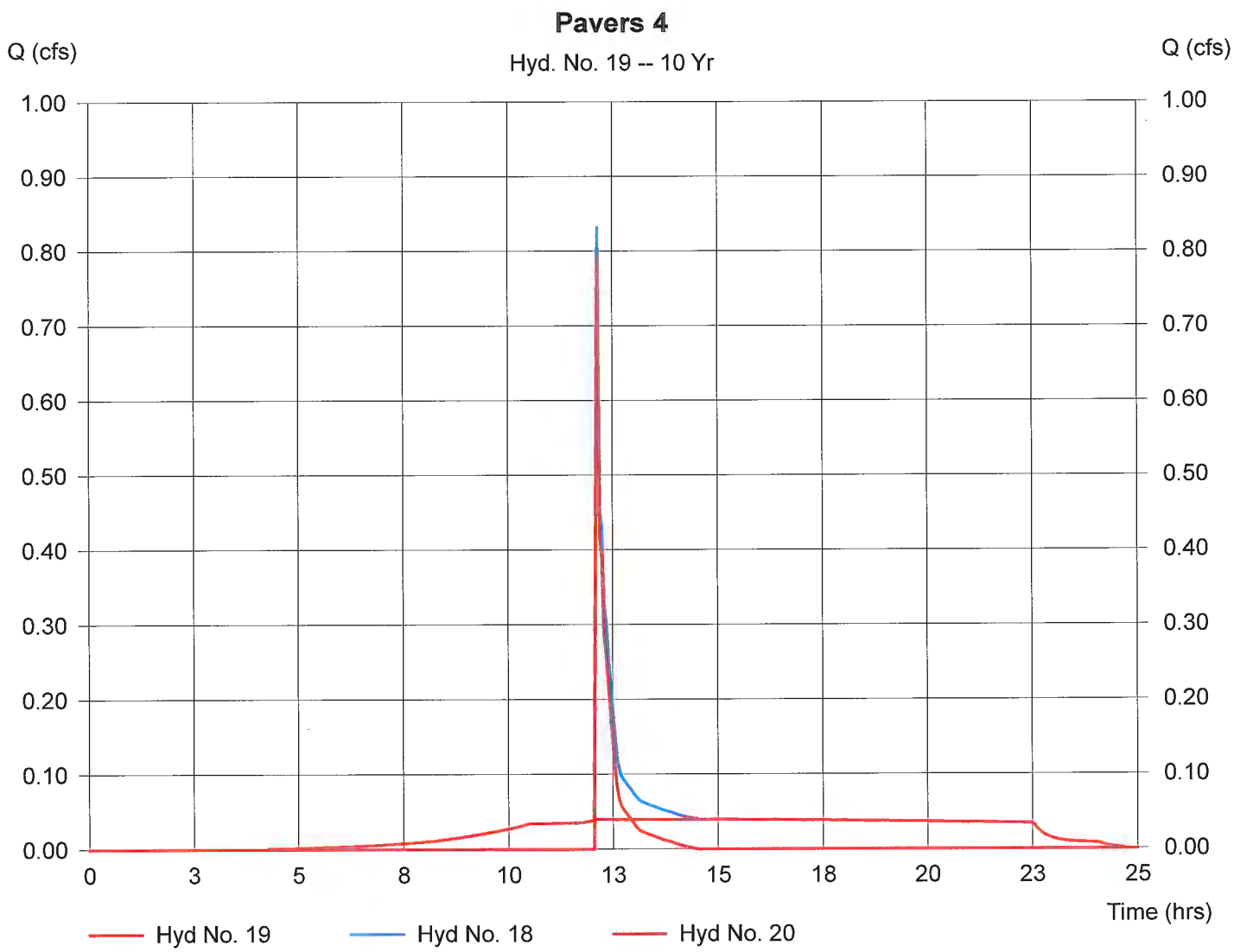
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 19

Pavers 4

Hydrograph type	=	Diversion1	Peak discharge	=	0.04 cfs
Storm frequency	=	10 yrs	Time interval	=	3 min
Inflow hydrograph	=	18	2nd diverted hyd.	=	20
Diversion method	=	Pond - Pavers 4	Pond structure	=	Exfiltration

Hydrograph Volume = 1,951 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

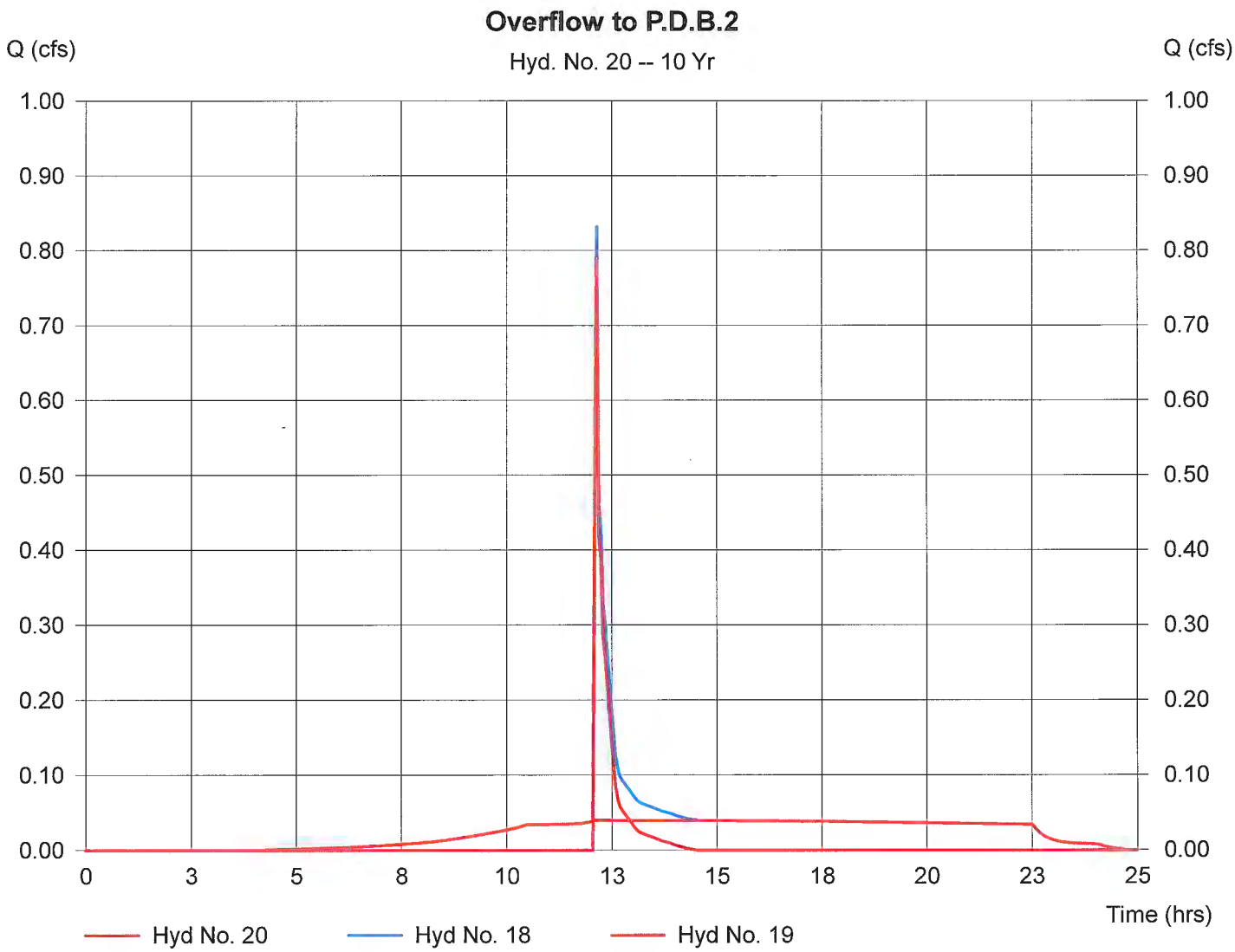
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 20

Overflow to P.D.B.2

Hydrograph type	=	Diversion2	Peak discharge	=	0.79 cfs
Storm frequency	=	10 yrs	Time interval	=	3 min
Inflow hydrograph	=	18	2nd diverted hyd.	=	19
Diversion method	=	Pond - Pavers 4	Pond structure	=	Exfiltration

Hydrograph Volume = 725 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

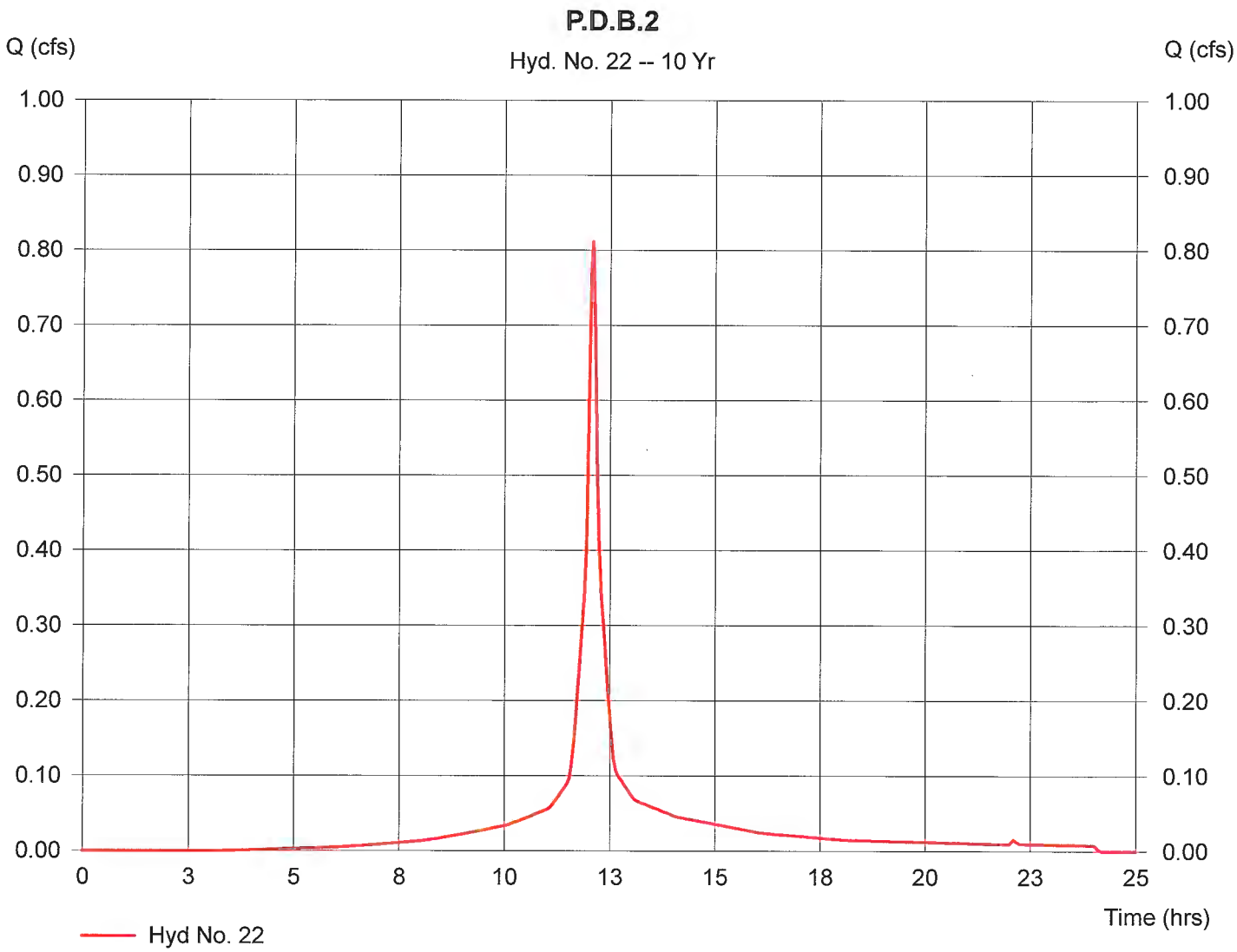
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 22

P.D.B.2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.81 cfs
Storm frequency	= 10 yrs	Time interval	= 3 min
Drainage area	= 0.22 ac	Curve number	= 93
Basin Slope	= 0.6 %	Hydraulic length	= 84 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 4.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,875 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

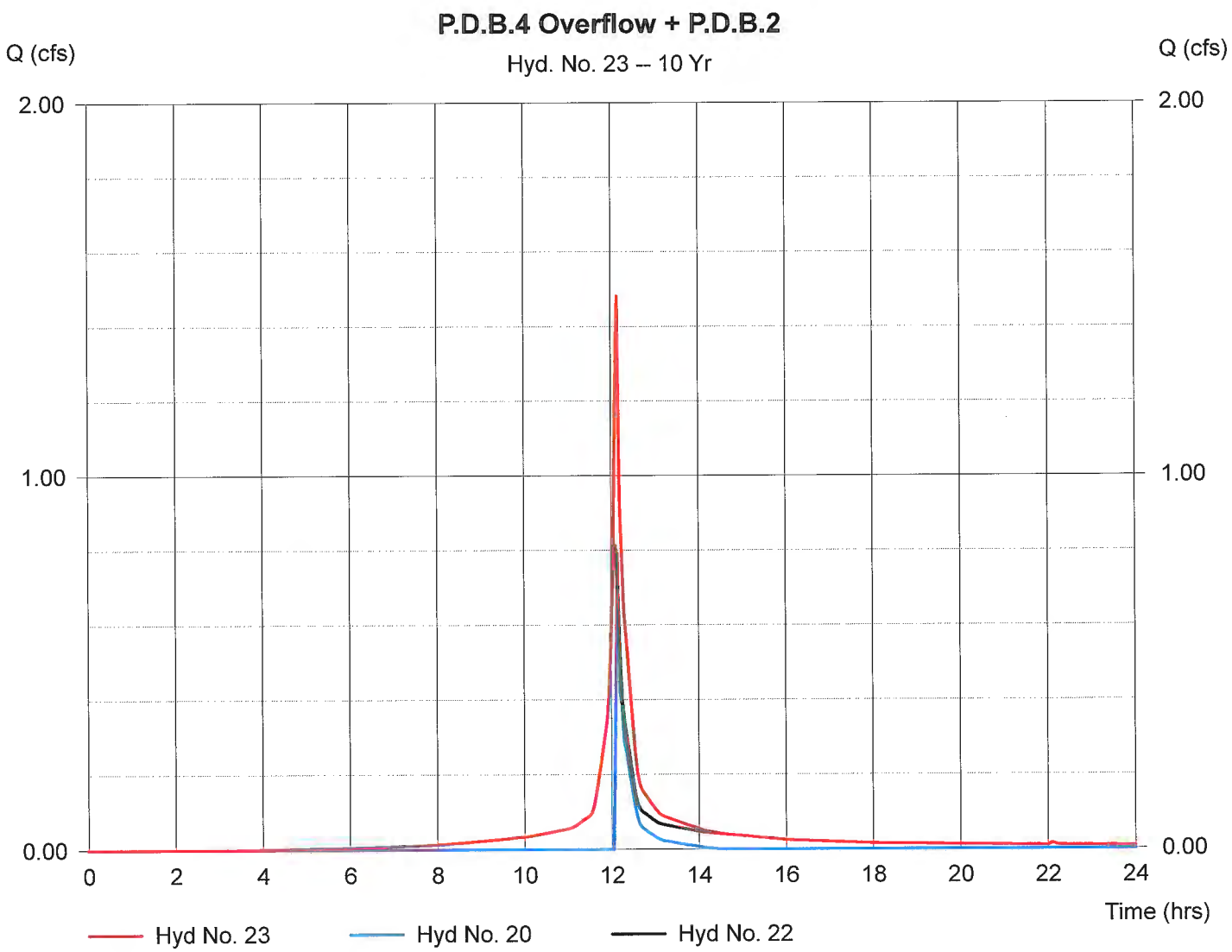
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 23

P.D.B.4 Overflow + P.D.B.2

Hydrograph type	= Combine	Peak discharge	= 1.48 cfs
Storm frequency	= 10 yrs	Time interval	= 3 min
Inflow hyds.	= 20, 22		

Hydrograph Volume = 3,600 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:2 AM

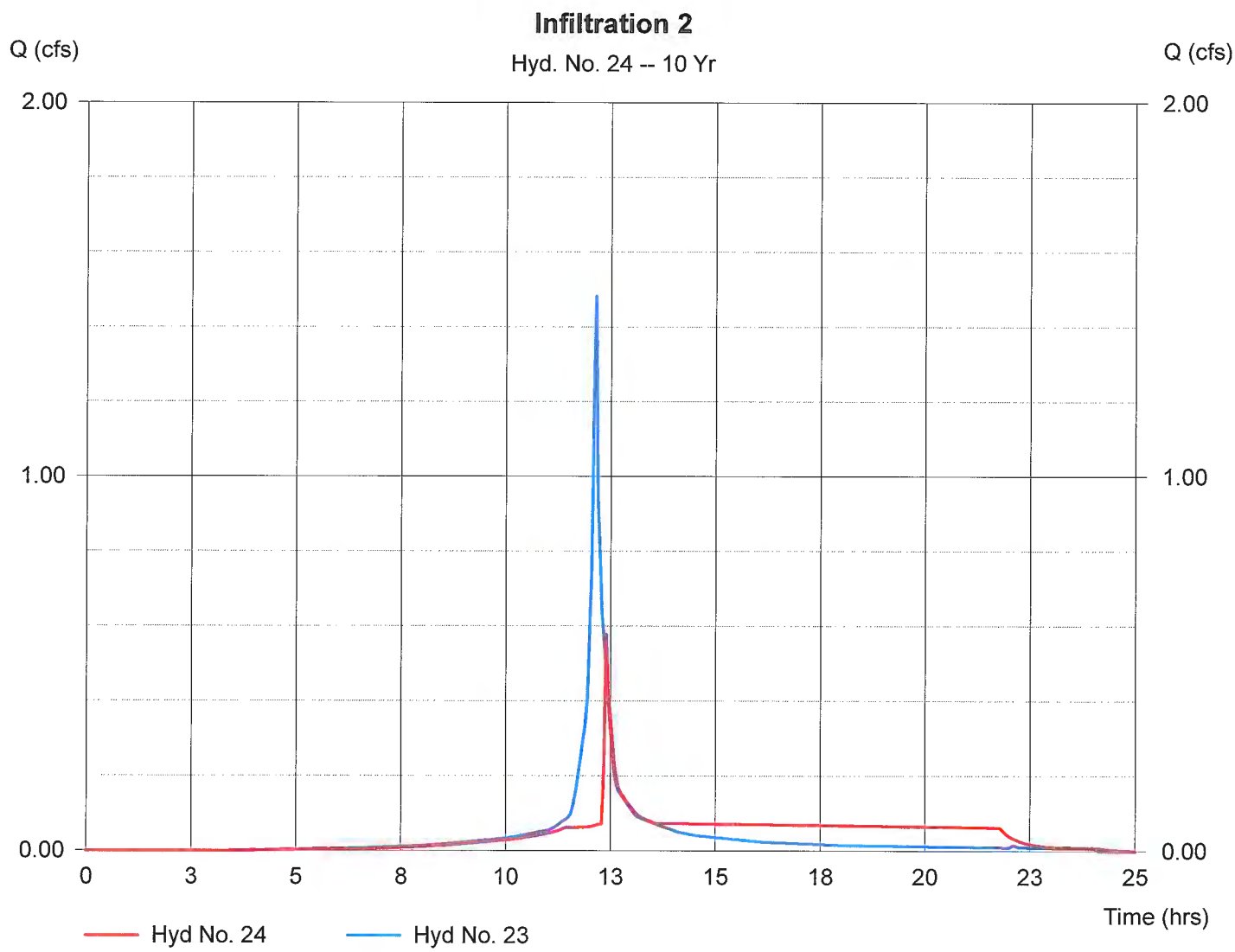
Hyd. No. 24

Infiltration 2

Hydrograph type	=	Reservoir	Peak discharge	=	0.58 cfs
Storm frequency	=	10 yrs	Time interval	=	3 min
Inflow hyd. No.	=	23	Max. Elevation	=	137.70 ft
Reservoir name	=	Pavers 2	Max. Storage	=	1,472 cuft

Storage Indication method used.

Hydrograph Volume = 3,598 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:2 AM

Pond No. 3 - Pavers 2

Pond Data

Bottom LxW = 119.5 x 22.0 ft Side slope = 0.0:1 Bottom elev. = 136.00 ft Depth = 2.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	136.00	2,629	0	0
0.10	136.10	2,629	87	87
0.20	136.20	2,629	87	174
0.30	136.30	2,629	87	260
0.40	136.40	2,629	87	347
0.50	136.50	2,629	87	434
0.60	136.60	2,629	87	521
0.70	136.70	2,629	87	607
0.80	136.80	2,629	87	694
0.90	136.90	2,629	87	781
1.00	137.00	2,629	87	868
1.10	137.10	2,629	87	954
1.20	137.20	2,629	87	1,041
1.30	137.30	2,629	87	1,128
1.40	137.40	2,629	87	1,215
1.50	137.50	2,629	87	1,301
1.60	137.60	2,629	87	1,388
1.70	137.70	2,629	87	1,475
1.80	137.80	2,629	87	1,562
1.90	137.90	2,629	87	1,648
2.00	138.00	2,629	87	1,735

(*33.00% voids applied)

Culvert / Orifice Structures

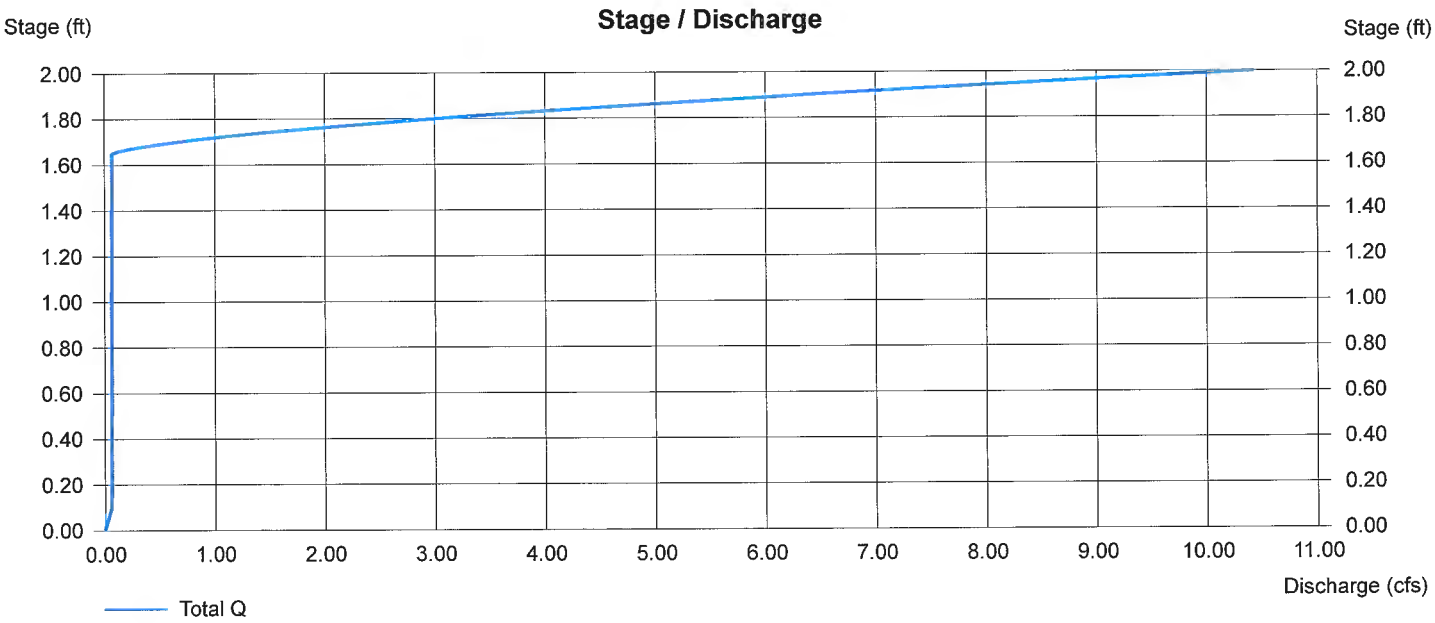
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 137.65	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 = 1.020 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

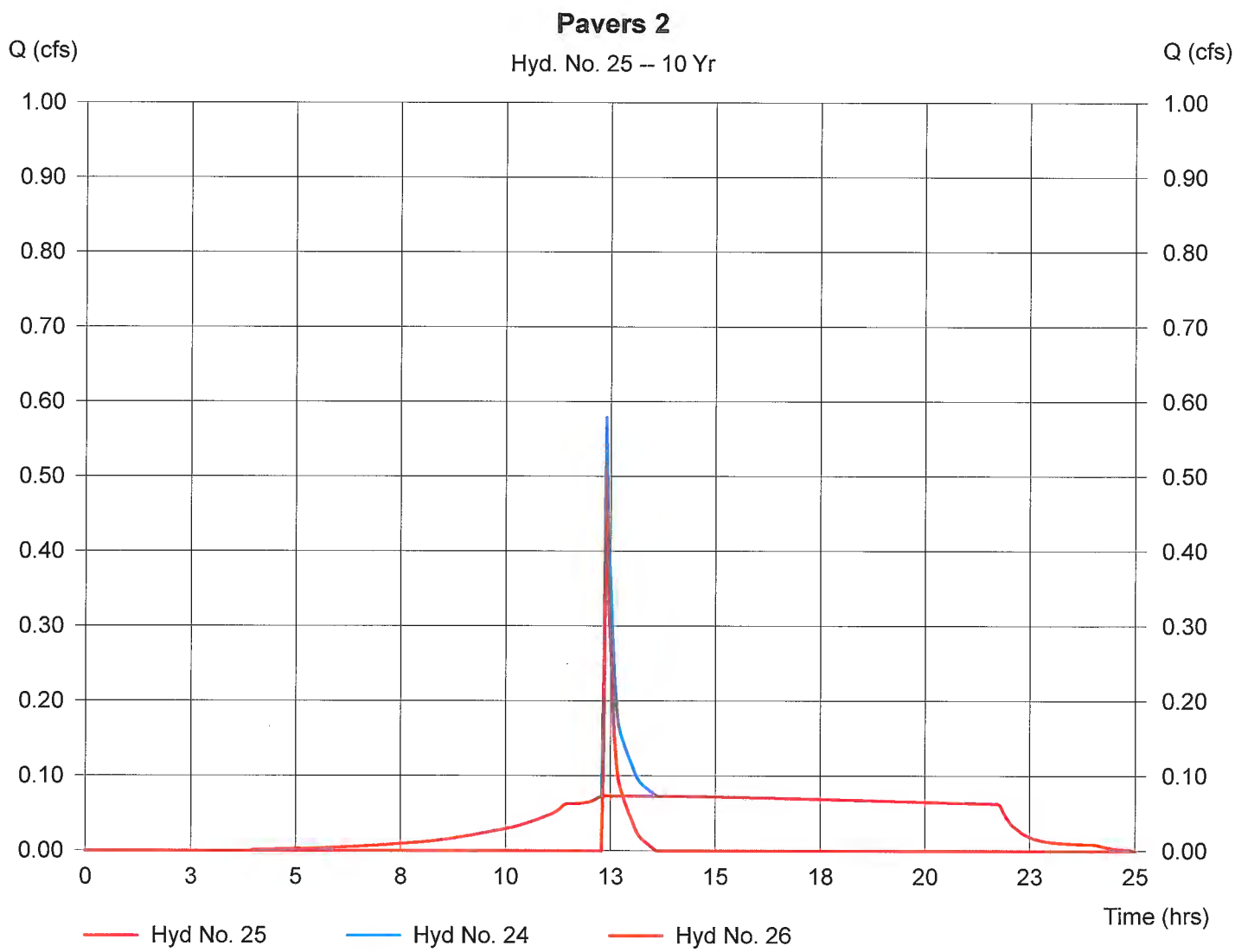
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 25

Pavers 2

Hydrograph type	=	Diversion1	Peak discharge	=	0.07 cfs
Storm frequency	=	10 yrs	Time interval	=	3 min
Inflow hydrograph	=	24	2nd diverted hyd.	=	26
Diversion method	=	Pond - Pavers 2	Pond structure	=	Exfiltration

Hydrograph Volume = 3,161 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

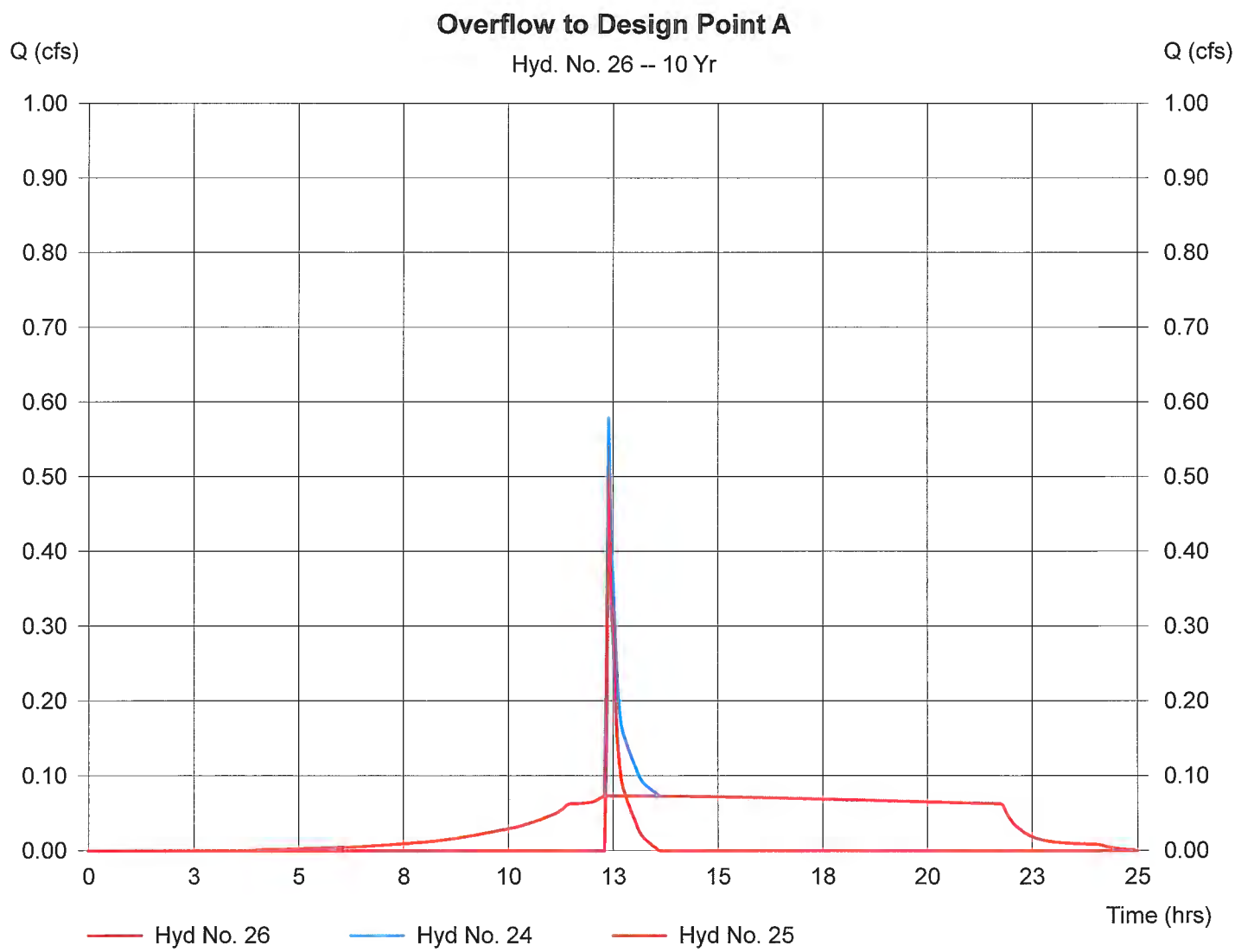
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 26

Overflow to Design Point A

Hydrograph type	=	Diversion2	Peak discharge	=	0.51 cfs
Storm frequency	=	10 yrs	Time interval	=	3 min
Inflow hydrograph	=	24	2nd diverted hyd.	=	25
Diversion method	=	Pond - Pavers 2	Pond structure	=	Exfiltration

Hydrograph Volume = 437 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

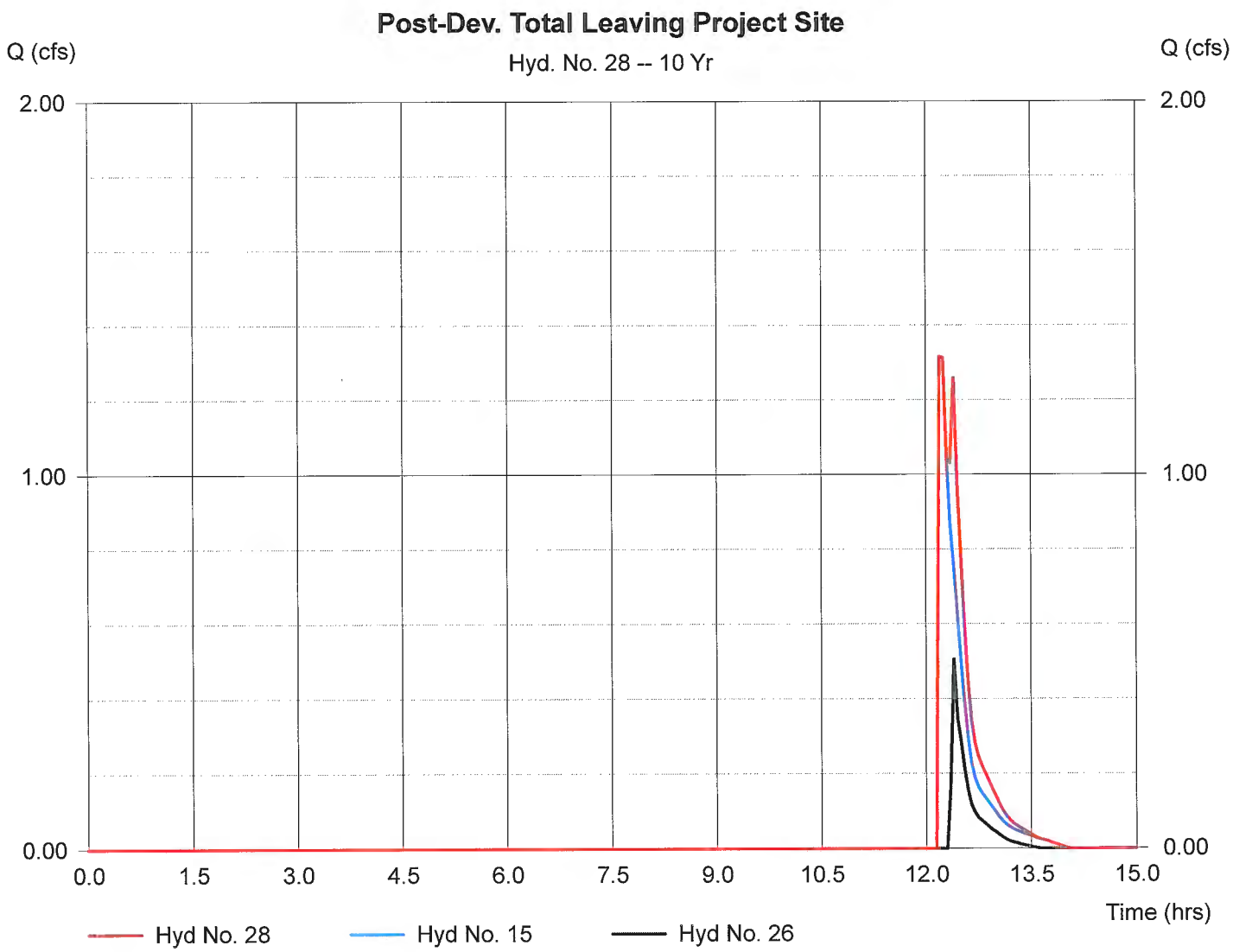
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 28

Post-Dev. Total Leaving Project Site

Hydrograph type	= Combine	Peak discharge	= 1.32 cfs
Storm frequency	= 10 yrs	Time interval	= 3 min
Inflow hyds.	= 15, 26		

Hydrograph Volume = 2,061 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	2.01	3	726	7,531	----	------	------	E.C.B.1-Design Point A
2	SCS Runoff	3.13	3	726	11,820	----	------	------	E.C.B.2-Design Point B
4	Combine	5.14	3	726	19,351	1, 2,	------	------	Pre-Dev. Total Leaving Project Site
6	SCS Runoff	1.56	3	726	5,770	----	------	------	P.D.B.3
7	Reservoir	1.72	3	726	5,769	6	136.45	1,243	Infiltration 3
8	Diversion1	0.07	3	726	3,918	7	------	------	Pavers 3
9	Diversion2	1.65	3	726	1,851	7	------	------	Overflow to P.D.B.1
11	SCS Runoff	1.54	3	726	5,743	----	------	------	P.D.B.1
12	Combine	3.19	3	726	7,594	9, 11	------	------	Overflow P.D.B.3 + P.D.B.1
13	Reservoir	3.19	3	729	7,593	12	135.74	1,836	Infiltration 1
14	Diversion1	0.09	3	729	4,647	13	------	------	Pavers 1
15	Diversion2	3.10	3	729	2,946	13	------	------	Overflow to Design Point B
17	SCS Runoff	0.93	3	726	3,311	----	------	------	P.D.B.4
18	Reservoir	0.91	3	723	3,310	17	137.39	660	Infiltration 4
19	Diversion1	0.04	3	723	2,142	18	------	------	Pavers 4
20	Diversion2	0.87	3	723	1,168	18	------	------	Overflow to P.D.B.2
22	SCS Runoff	0.99	3	726	3,543	----	------	------	P.D.B.2
23	Combine	1.85	3	726	4,711	20, 22	------	------	P.D.B.4 Overflow + P.D.B.2
24	Reservoir	1.30	3	732	4,710	23	137.73	1,505	Infiltration 2
25	Diversion1	0.07	3	732	3,473	24	------	------	Pavers 2
26	Diversion2	1.23	3	732	1,236	24	------	------	Overflow to Design Point A
28	Combine	3.23	3	732	4,182	15, 26,	------	------	Post-Dev. Total Leaving Project Site

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

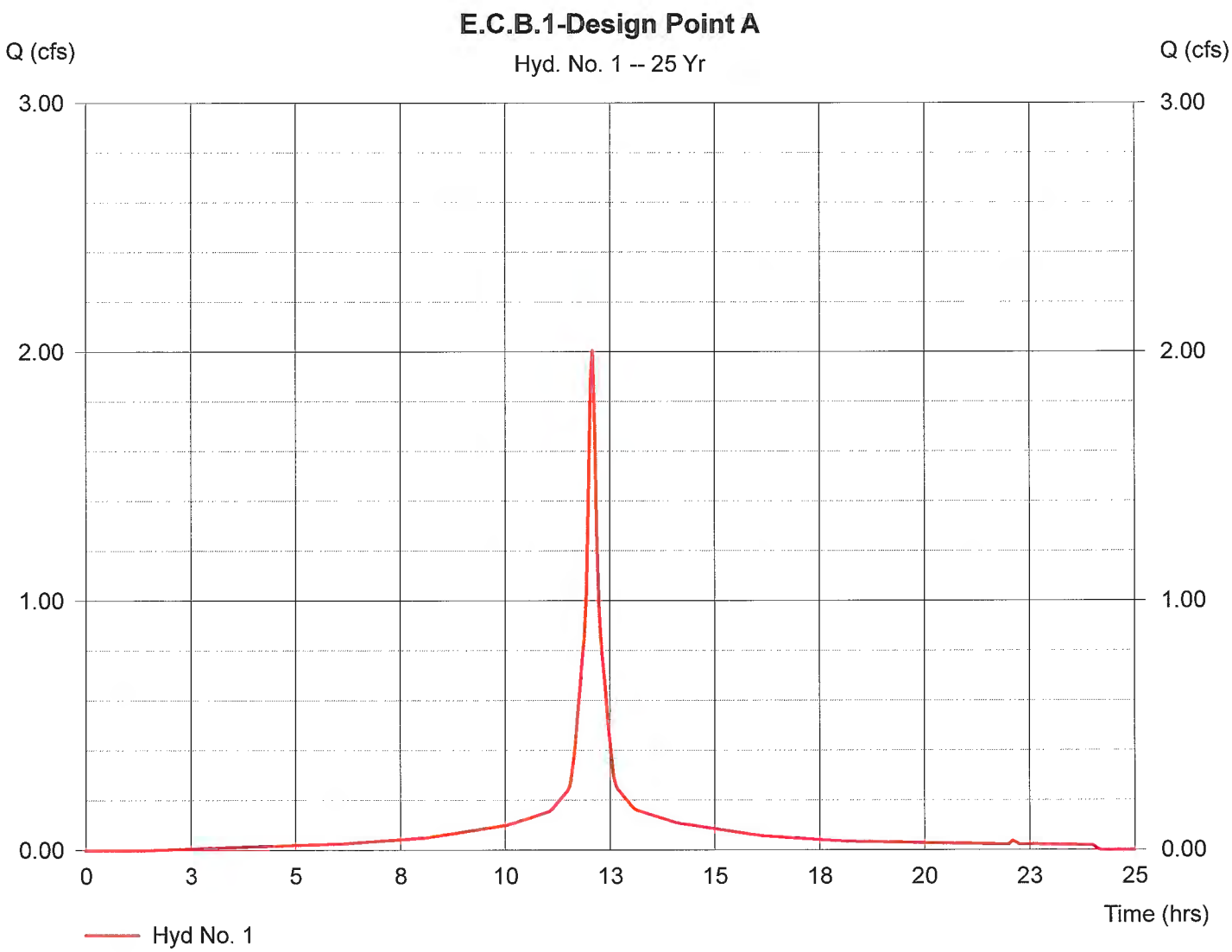
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 1

E.C.B.1-Design Point A

Hydrograph type	= SCS Runoff	Peak discharge	= 2.01 cfs
Storm frequency	= 25 yrs	Time interval	= 3 min
Drainage area	= 0.43 ac	Curve number	= 96.6
Basin Slope	= 0.3 %	Hydraulic length	= 150 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 5.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 7,531 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

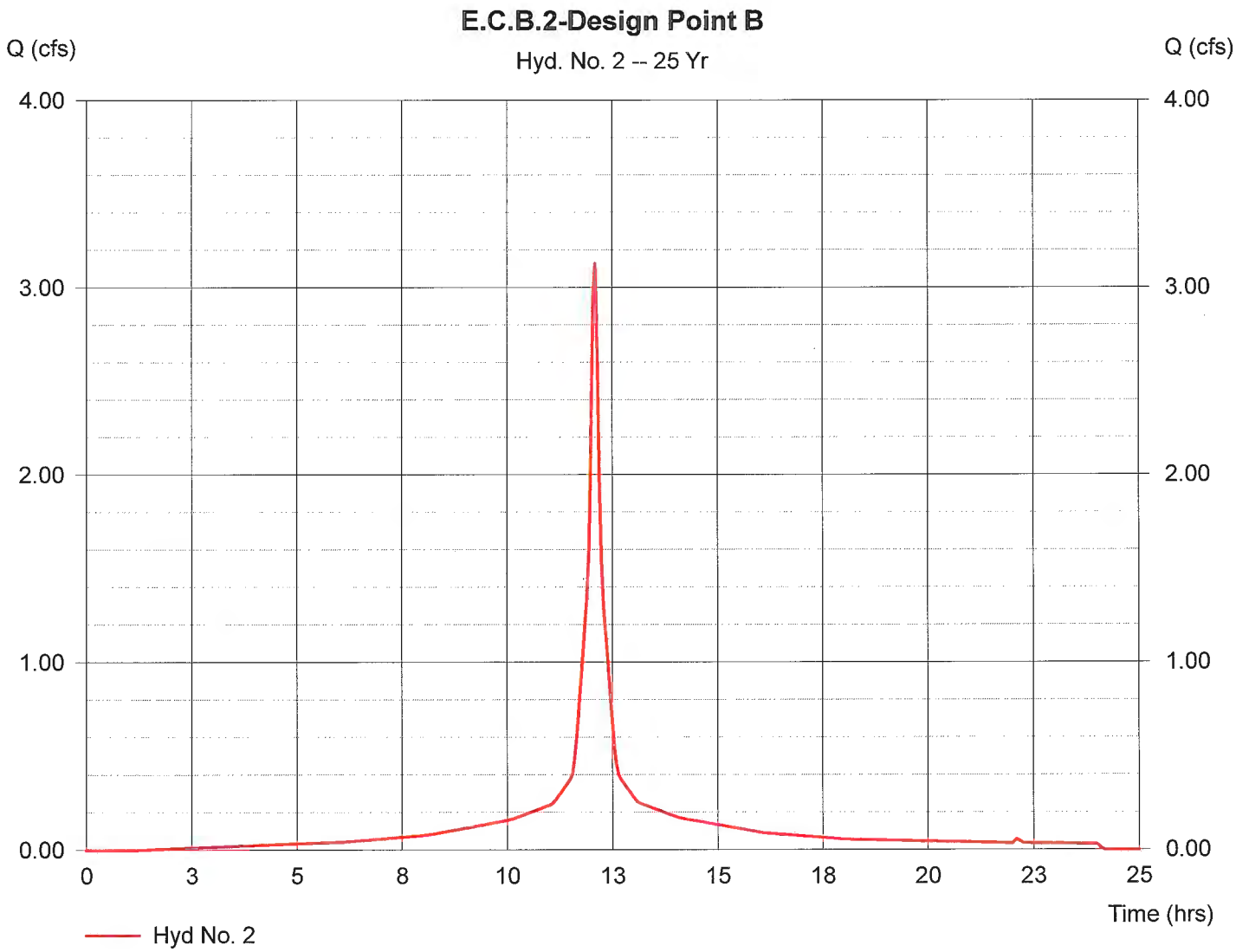
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 2

E.C.B.2-Design Point B

Hydrograph type	= SCS Runoff	Peak discharge	= 3.13 cfs
Storm frequency	= 25 yrs	Time interval	= 3 min
Drainage area	= 0.68 ac	Curve number	= 97
Basin Slope	= 1.9 %	Hydraulic length	= 135 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 5.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 11,820 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

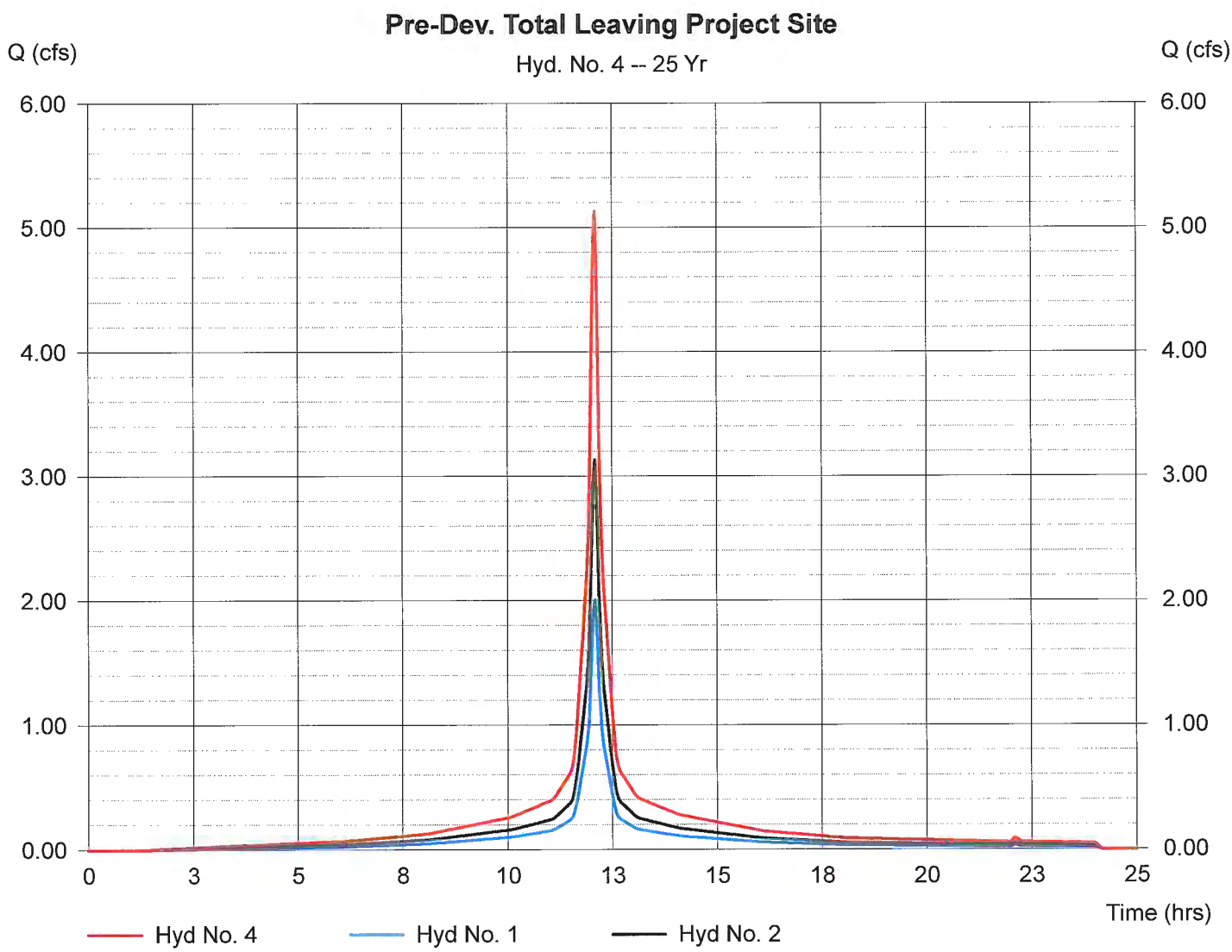
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 4

Pre-Dev. Total Leaving Project Site

Hydrograph type	= Combine	Peak discharge	= 5.14 cfs
Storm frequency	= 25 yrs	Time interval	= 3 min
Inflow hyds.	= 1, 2		

Hydrograph Volume = 19,351 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

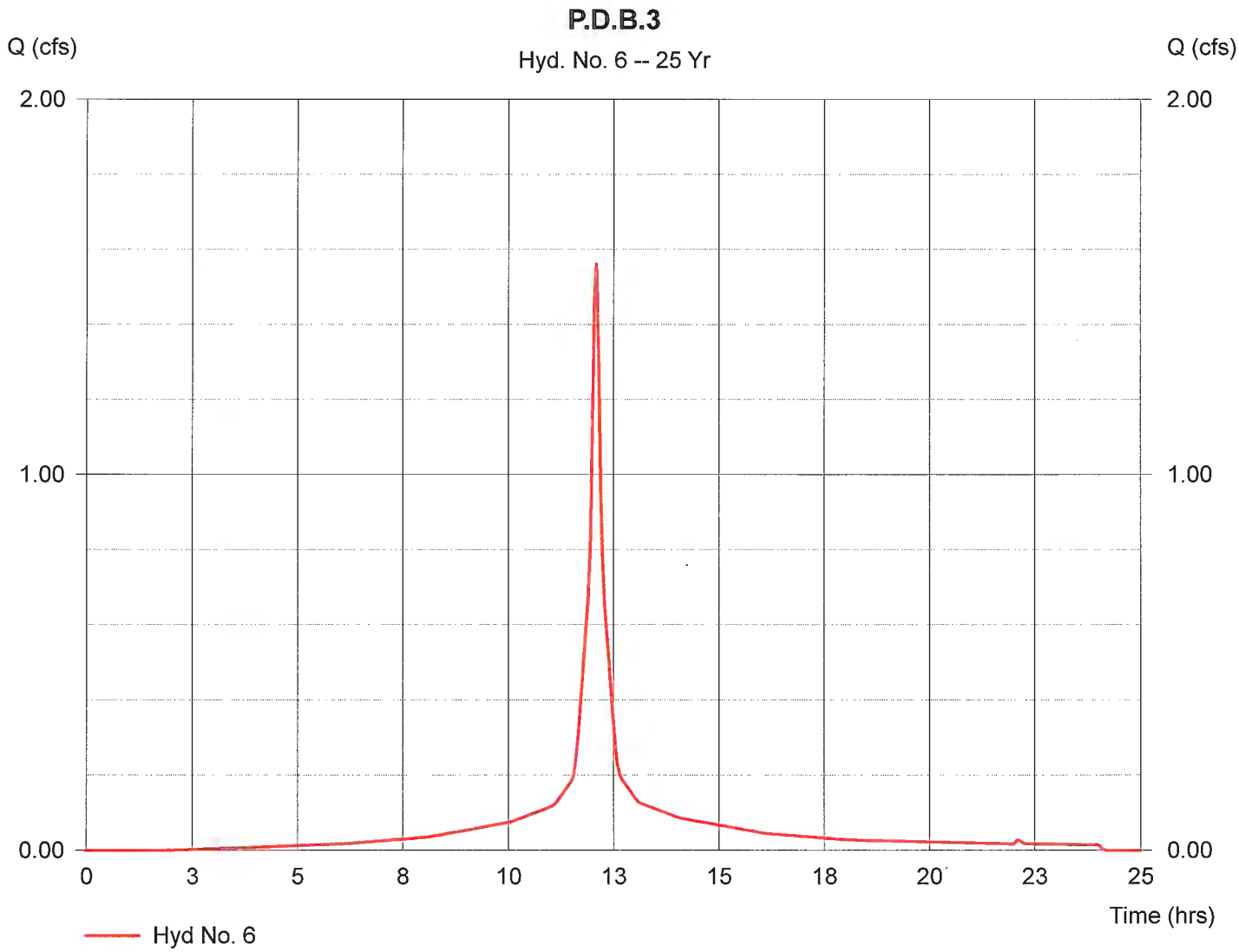
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 6

P.D.B.3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.56 cfs
Storm frequency	= 25 yrs	Time interval	= 3 min
Drainage area	= 0.34 ac	Curve number	= 95.5
Basin Slope	= 1.0 %	Hydraulic length	= 107 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 5.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 5,770 cuft



Hydrograph Plot

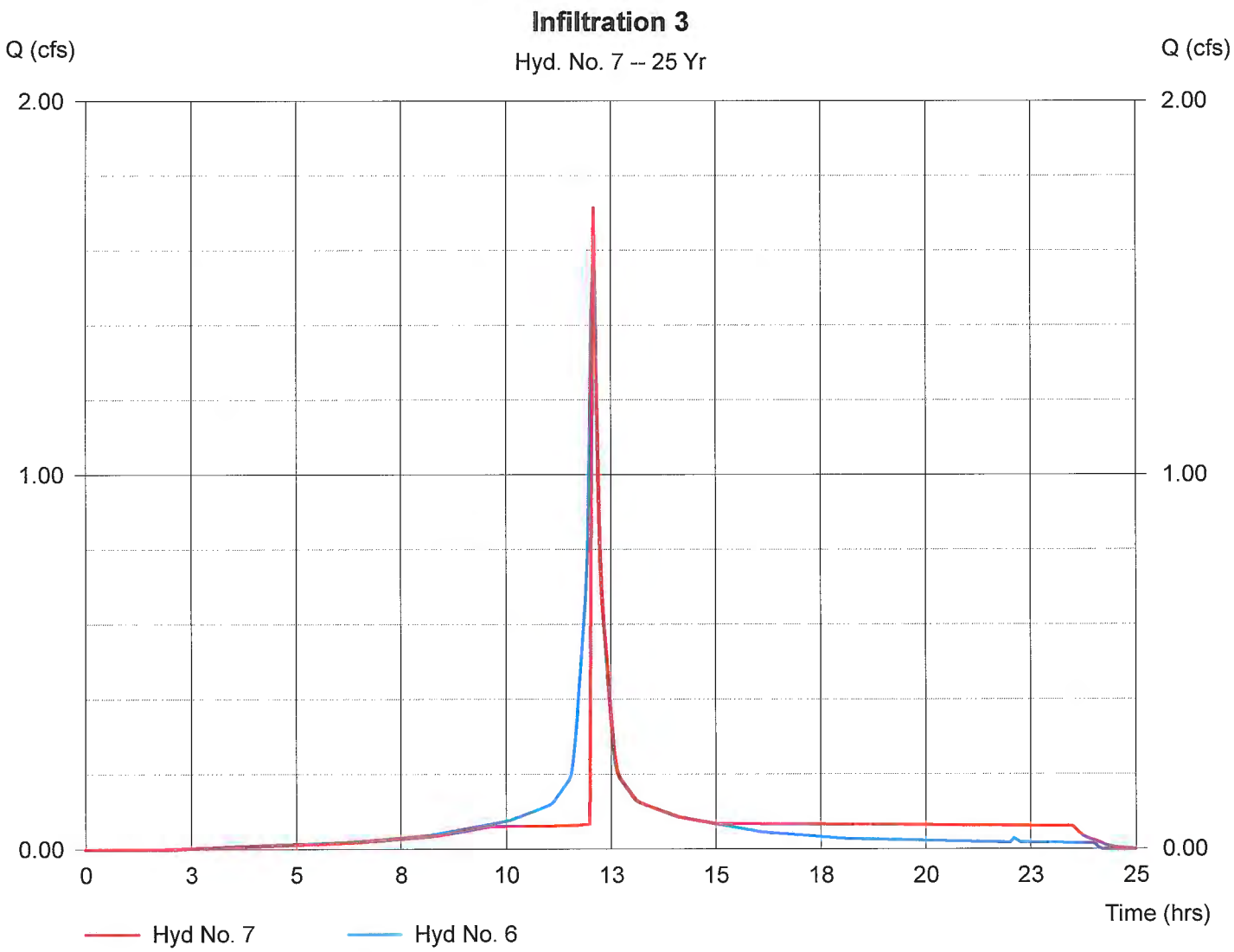
Hydraflow Hydrographs by Intelisolve | Friday, Sep 26 2014, 9:2 AM

Hyd. No. 7

Infiltration 3

Hydrograph type	=	Reservoir	Peak discharge	=	1.72 cfs
Storm frequency	=	25 yrs	Time interval	=	3 min
Inflow hyd. No.	=	6	Max. Elevation	=	136.45 ft
Reservoir name	=	Pavers 3	Max. Storage	=	1,243 cuft

Storage Indication method used. | Hydrograph Volume = 5,769 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve — Friday, Sep 26 2014, 9:2 AM

Pond No. 4 - Pavers 3

Pond Data

Bottom LxW = 72.0 x 36.0 ft Side slope = 0.0:1 Bottom elev. = 135.00 ft Depth = 1.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)* (*33.00% voids applied)
0.00	135.00	2,592	0	0
0.08	135.08	2,592	64	64
0.15	135.15	2,592	64	128
0.23	135.23	2,592	64	192
0.30	135.30	2,592	64	257
0.38	135.38	2,592	64	321
0.45	135.45	2,592	64	385
0.53	135.53	2,592	64	449
0.60	135.60	2,592	64	513
0.68	135.68	2,592	64	577
0.75	135.75	2,592	64	642
0.82	135.83	2,592	64	706
0.90	135.90	2,592	64	770
0.97	135.98	2,592	64	834
1.05	136.05	2,592	64	898
1.13	136.13	2,592	64	962
1.20	136.20	2,592	64	1,026
1.28	136.28	2,592	64	1,091
1.35	136.35	2,592	64	1,155
1.43	136.43	2,592	64	1,219
1.50	136.50	2,592	64	1,283

Culvert / Orifice Structures

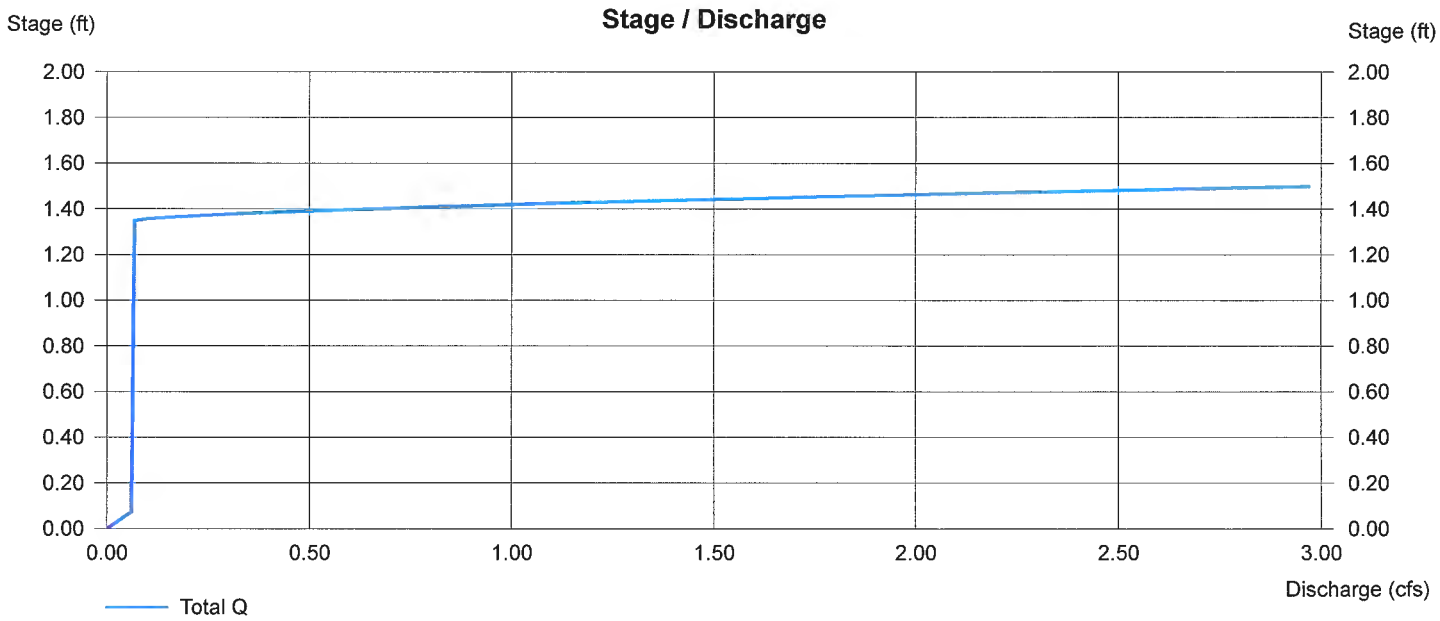
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 136.35	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 = 1.020 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

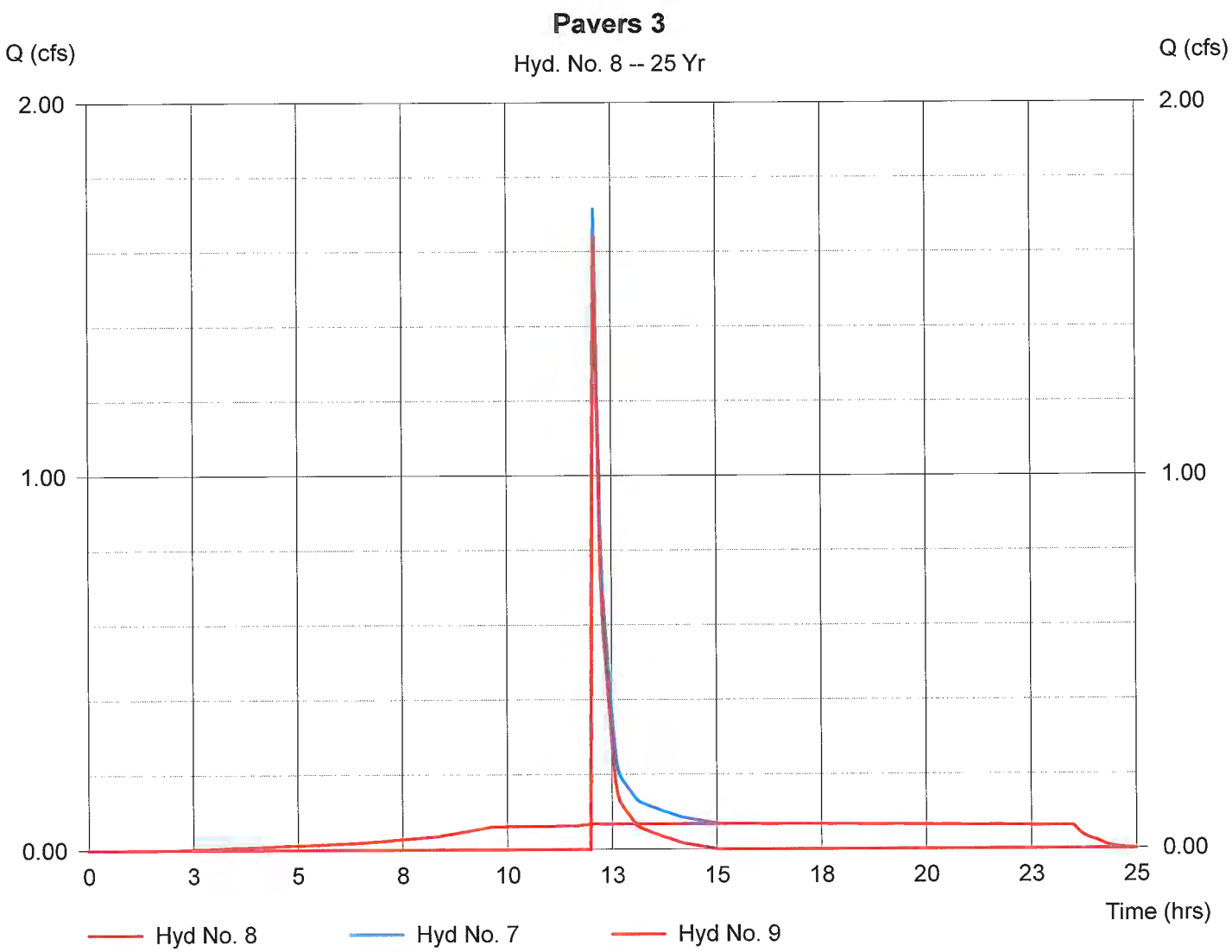
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 8

Pavers 3

Hydrograph type	=	Diversion1	Peak discharge	=	0.07 cfs
Storm frequency	=	25 yrs	Time interval	=	3 min
Inflow hydrograph	=	7	2nd diverted hyd.	=	9
Diversion method	=	Pond - Pavers 3	Pond structure	=	Exfiltration

Hydrograph Volume = 3,918 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

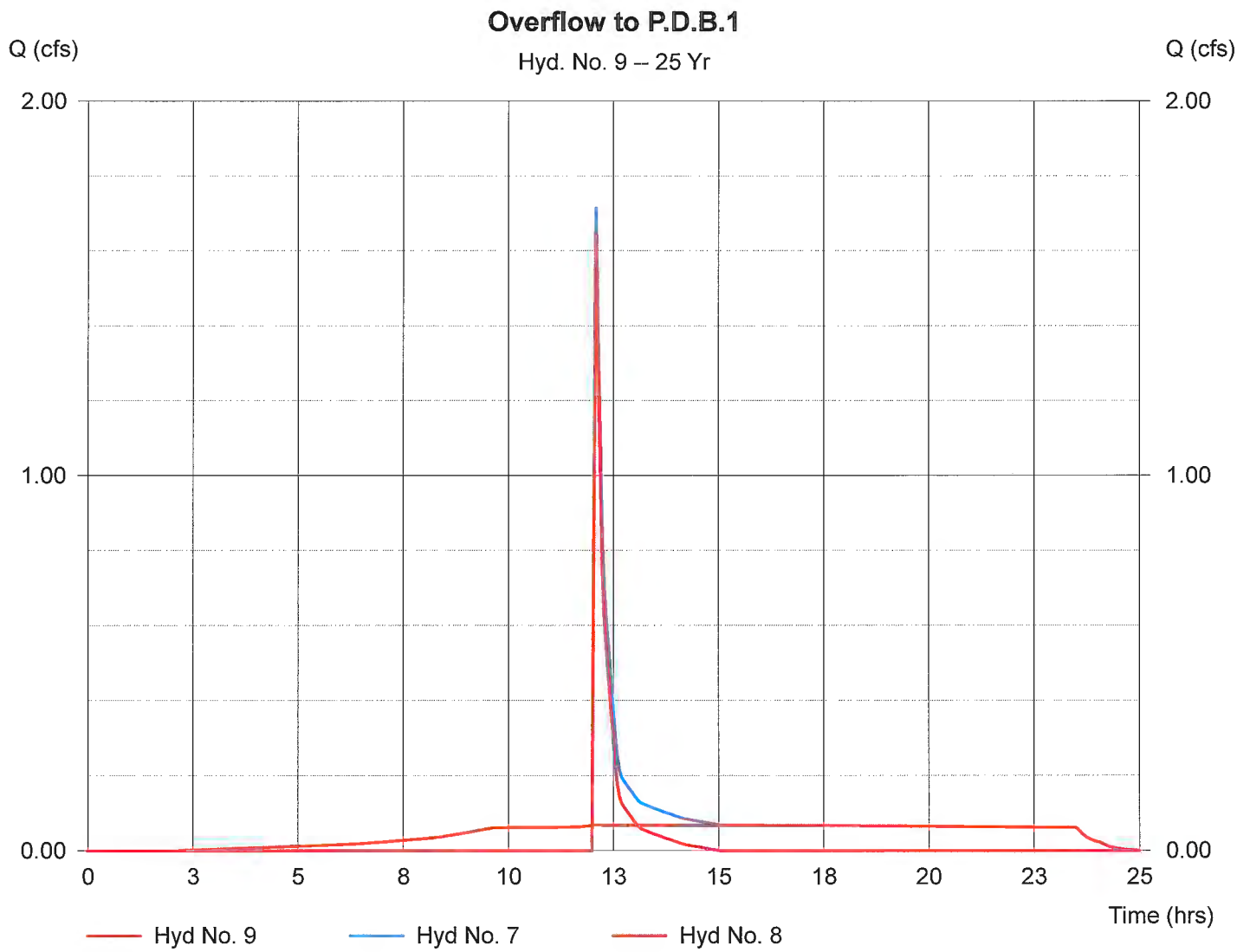
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 9

Overflow to P.D.B.1

Hydrograph type	=	Diversion2	Peak discharge	=	1.65 cfs
Storm frequency	=	25 yrs	Time interval	=	3 min
Inflow hydrograph	=	7	2nd diverted hyd.	=	8
Diversion method	=	Pond - Pavers 3	Pond structure	=	Exfiltration

Hydrograph Volume = 1,851 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

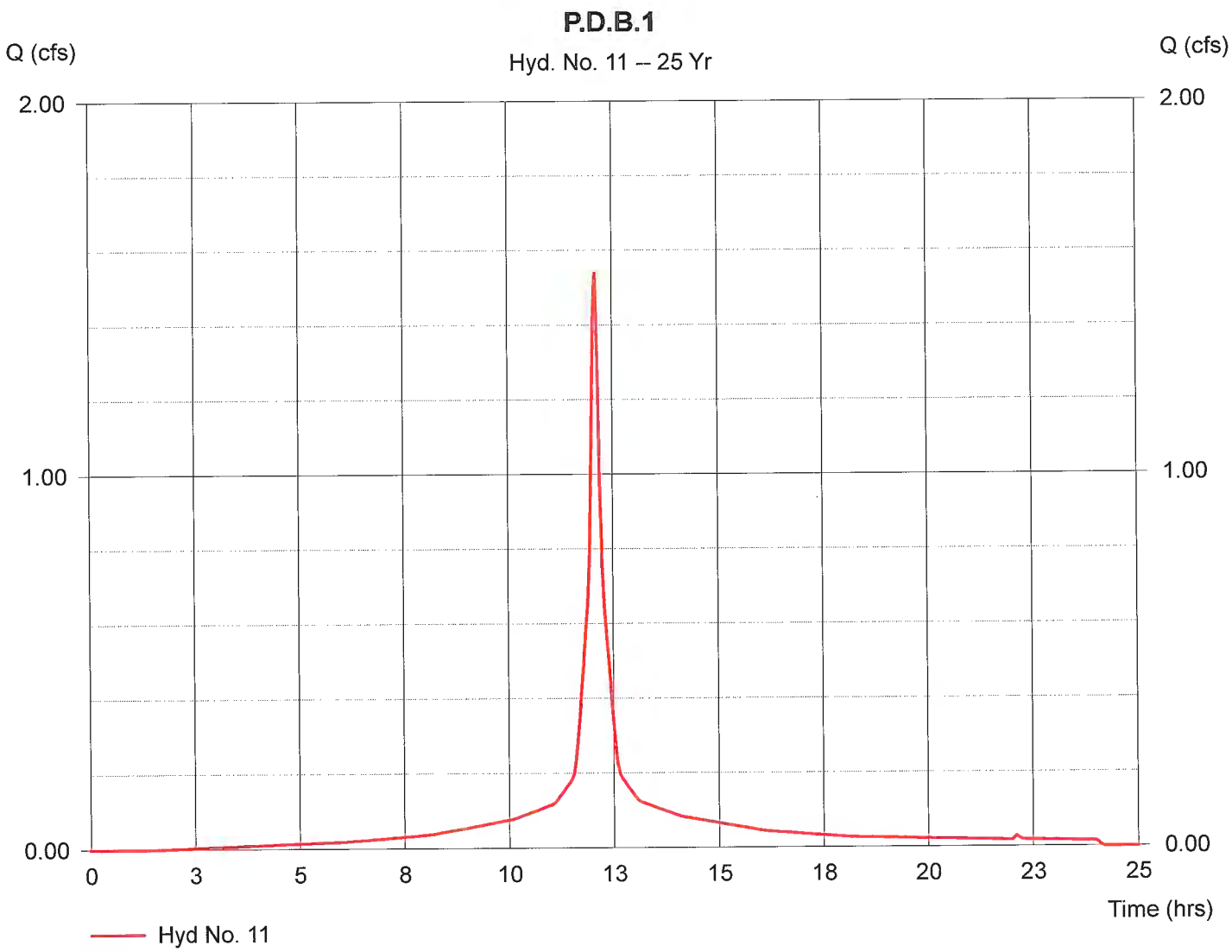
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 11

P.D.B.1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.54 cfs
Storm frequency	= 25 yrs	Time interval	= 3 min
Drainage area	= 0.33 ac	Curve number	= 96.2
Basin Slope	= 2.7 %	Hydraulic length	= 118 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 5.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 5,743 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

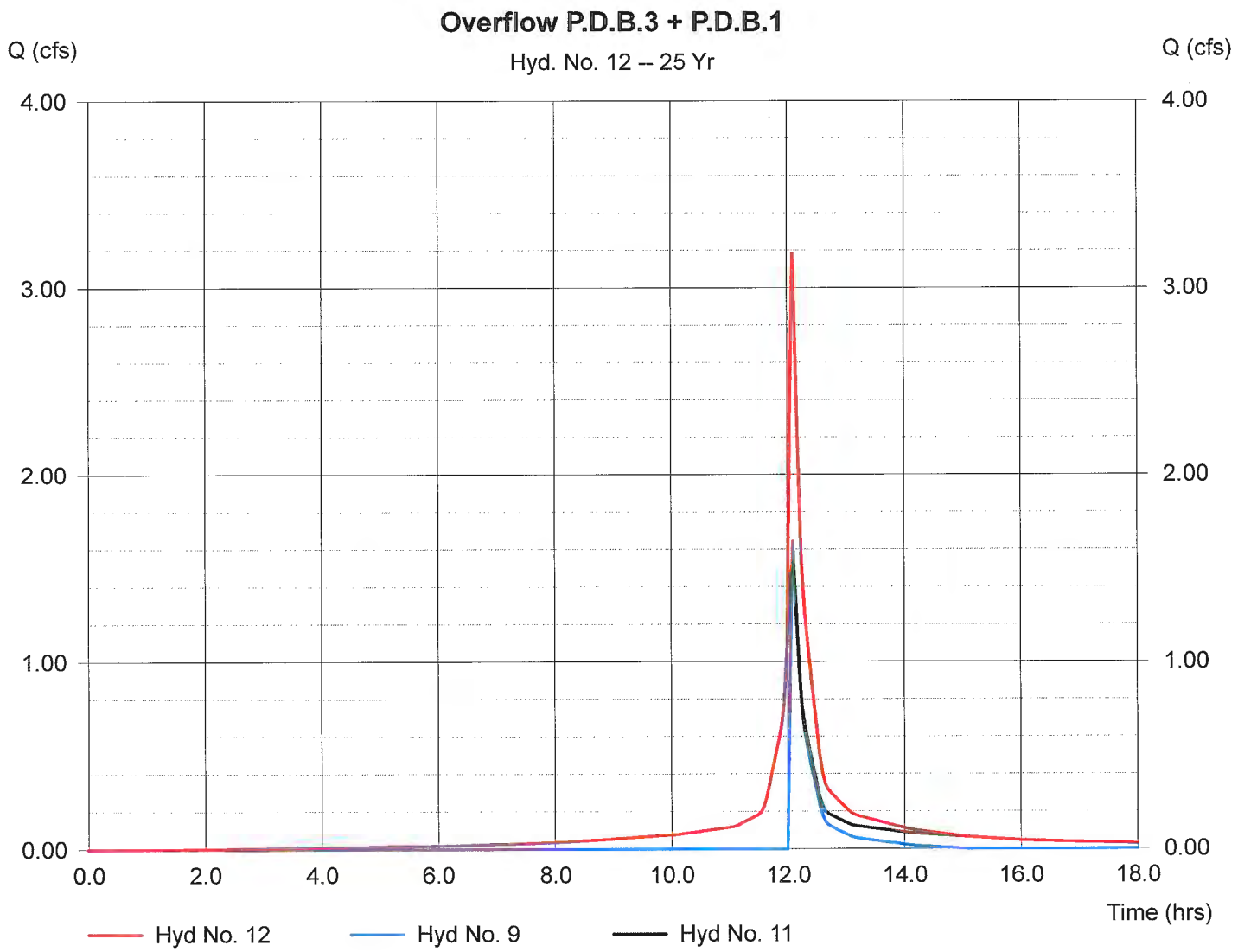
Friday, Sep 26 2014, 9:2 AM

Hyd. No. 12

Overflow P.D.B.3 + P.D.B.1

Hydrograph type	= Combine	Peak discharge	= 3.19 cfs
Storm frequency	= 25 yrs	Time interval	= 3 min
Inflow hyds.	= 9, 11		

Hydrograph Volume = 7,594 cuft



Hydrograph Plot

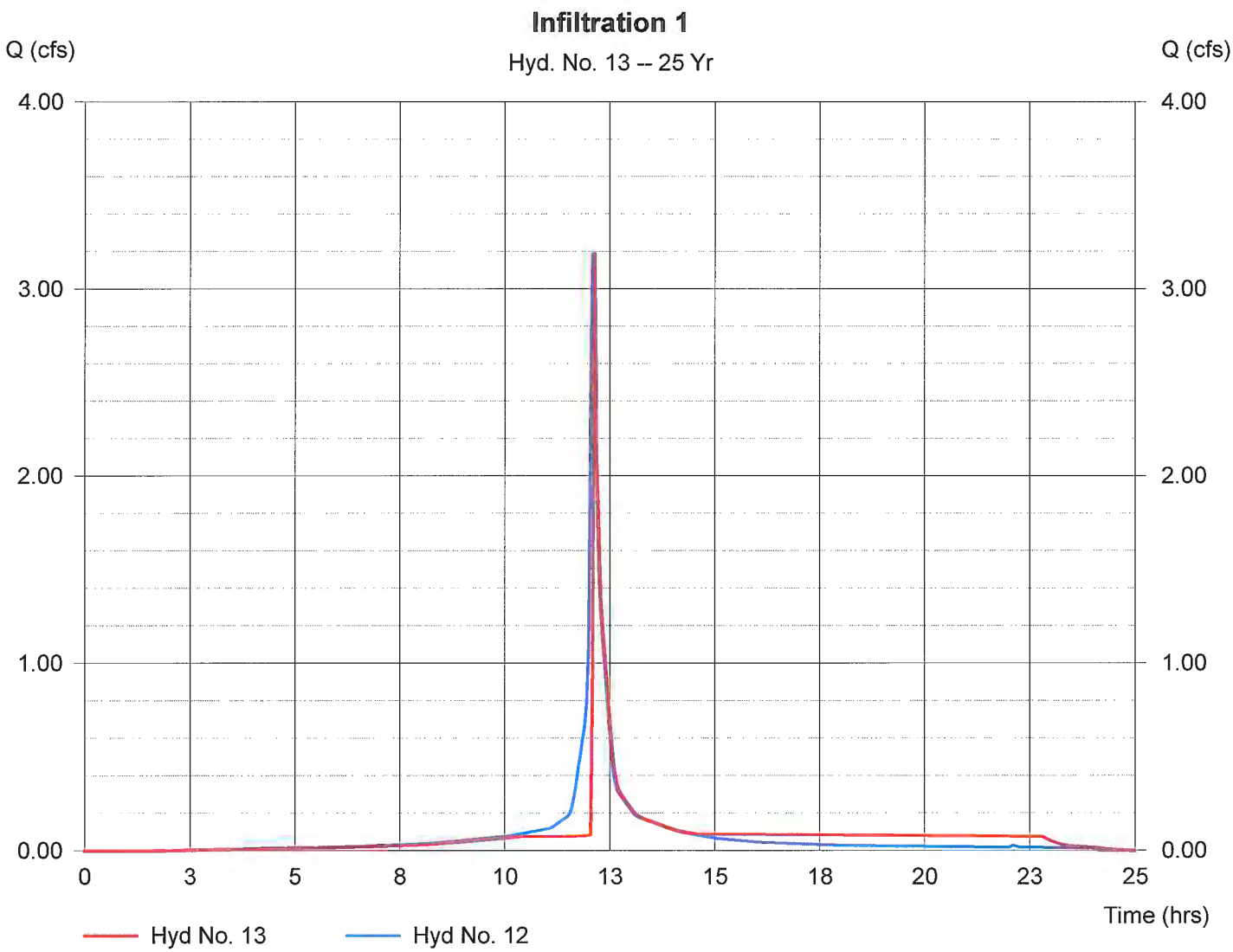
Hydraflow Hydrographs by Intelisolve | Friday, Sep 26 2014, 9:3 AM

Hyd. No. 13

Infiltration 1

Hydrograph type	=	Reservoir	Peak discharge	=	3.19 cfs
Storm frequency	=	25 yrs	Time interval	=	3 min
Inflow hyd. No.	=	12	Max. Elevation	=	135.74 ft
Reservoir name	=	Pavers 1	Max. Storage	=	1,836 cuft

Storage Indication method used. | Hydrograph Volume = 7,593 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:3 AM

Pond No. 2 - Pavers 1

Pond Data

Bottom LxW = 145.5 x 22.0 ft Side slope = 0.0:1 Bottom elev. = 134.00 ft Depth = 2.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	134.00	3,201	0	0
0.10	134.10	3,201	106	106
0.20	134.20	3,201	106	211
0.30	134.30	3,201	106	317
0.40	134.40	3,201	106	423
0.50	134.50	3,201	106	528
0.60	134.60	3,201	106	634
0.70	134.70	3,201	106	739
0.80	134.80	3,201	106	845
0.90	134.90	3,201	106	951
1.00	135.00	3,201	106	1,056
1.10	135.10	3,201	106	1,162
1.20	135.20	3,201	106	1,268
1.30	135.30	3,201	106	1,373
1.40	135.40	3,201	106	1,479
1.50	135.50	3,201	106	1,584
1.60	135.60	3,201	106	1,690
1.70	135.70	3,201	106	1,796
1.80	135.80	3,201	106	1,901
1.90	135.90	3,201	106	2,007
2.00	136.00	3,201	106	2,113

(*33.00% voids applied)

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

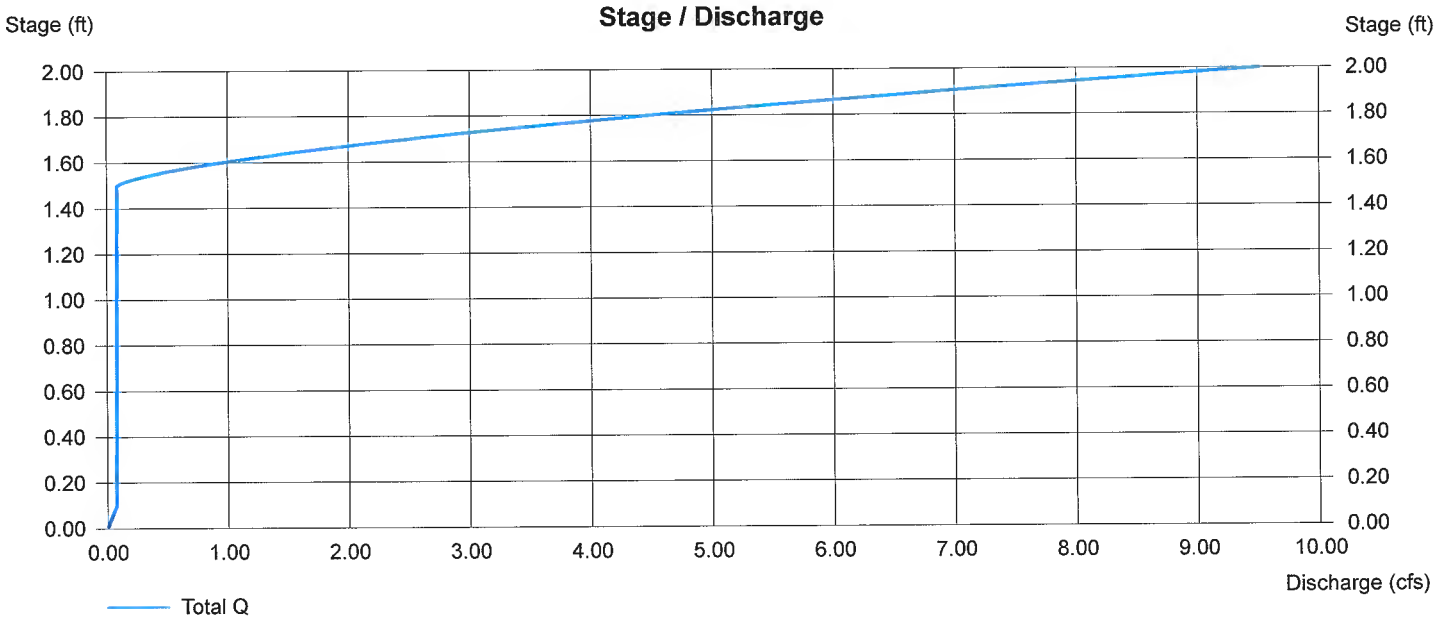
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 135.50	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 = 1.020 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

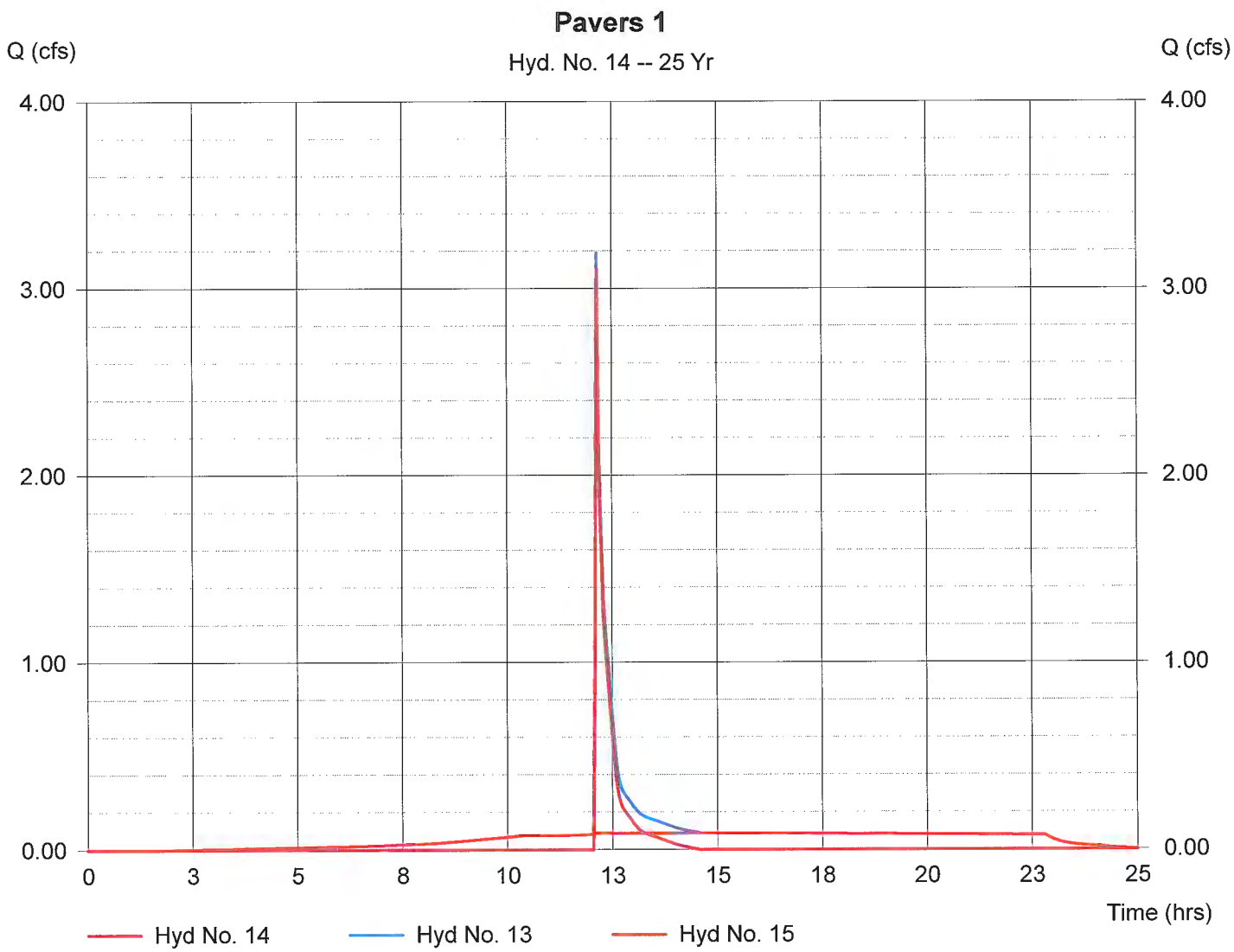
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 14

Pavers 1

Hydrograph type	=	Diversion1	Peak discharge	=	0.09 cfs
Storm frequency	=	25 yrs	Time interval	=	3 min
Inflow hydrograph	=	13	2nd diverted hyd.	=	15
Diversion method	=	Pond - Pavers 1	Pond structure	=	Exfiltration

Hydrograph Volume = 4,647 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

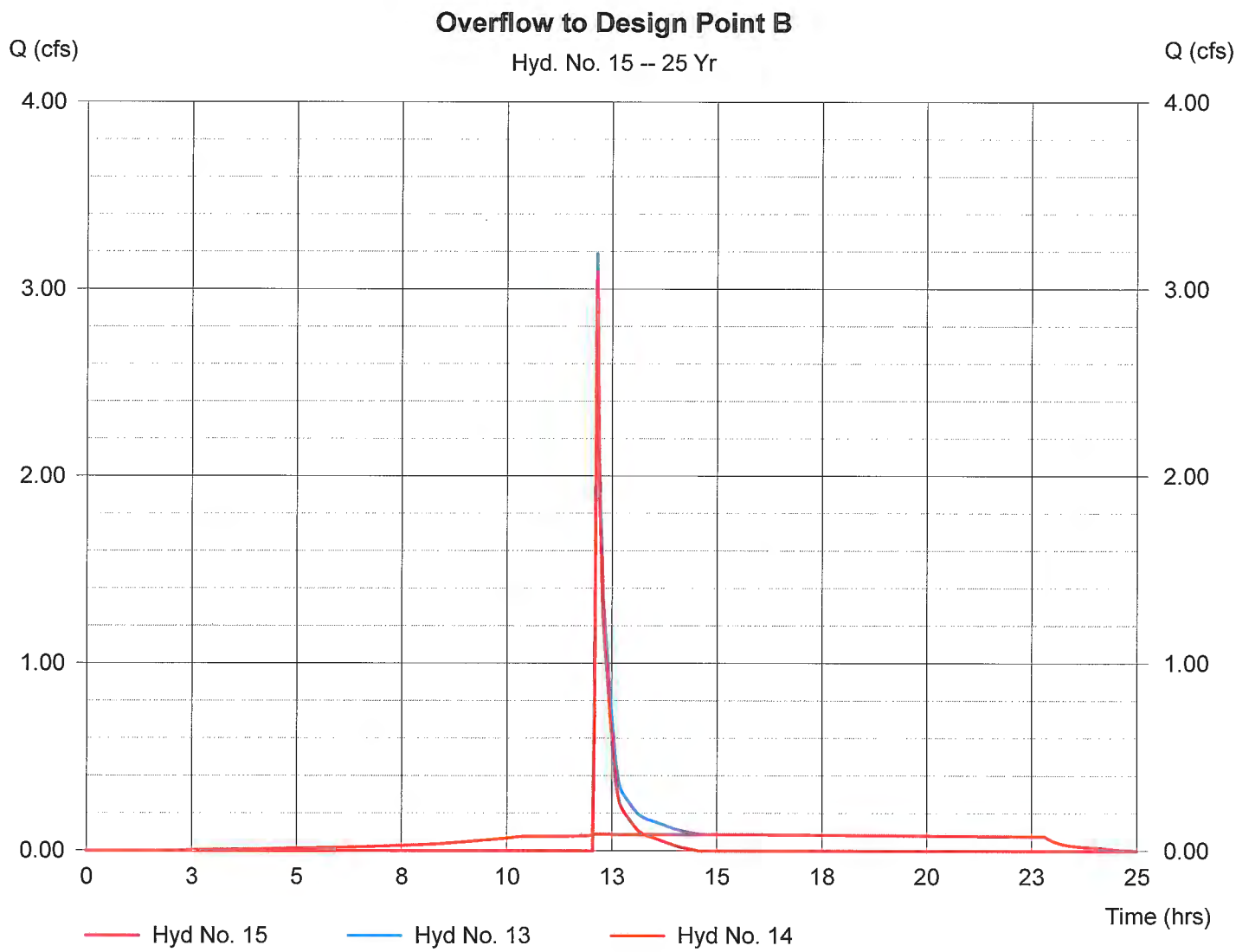
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 15

Overflow to Design Point B

Hydrograph type	=	Diversion2	Peak discharge	=	3.10 cfs
Storm frequency	=	25 yrs	Time interval	=	3 min
Inflow hydrograph	=	13	2nd diverted hyd.	=	14
Diversion method	=	Pond - Pavers 1	Pond structure	=	Exfiltration

Hydrograph Volume = 2,946 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

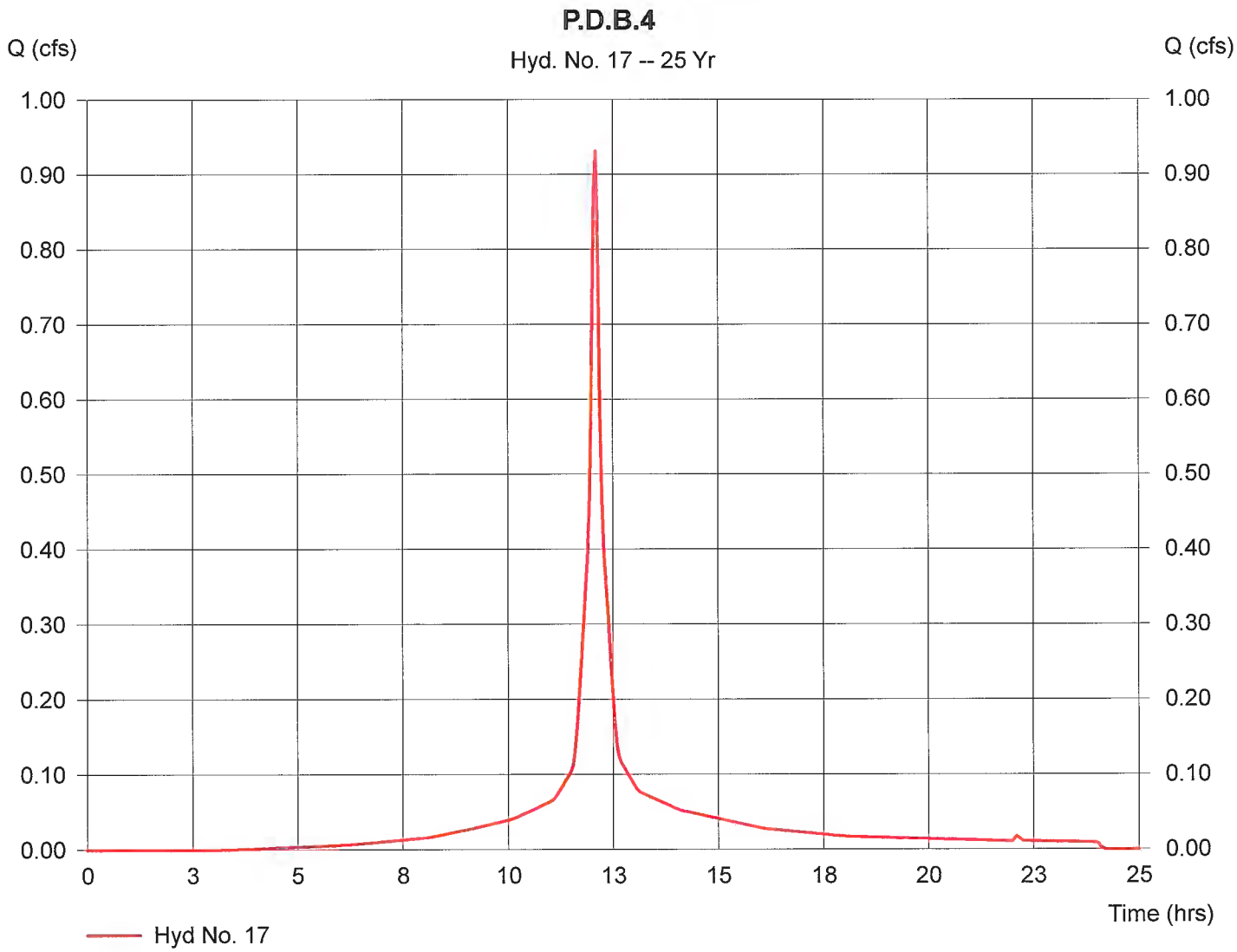
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 17

P.D.B.4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.93 cfs
Storm frequency	= 25 yrs	Time interval	= 3 min
Drainage area	= 0.21 ac	Curve number	= 92.1
Basin Slope	= 1.0 %	Hydraulic length	= 113 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 5.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,311 cuft



Hydrograph Plot

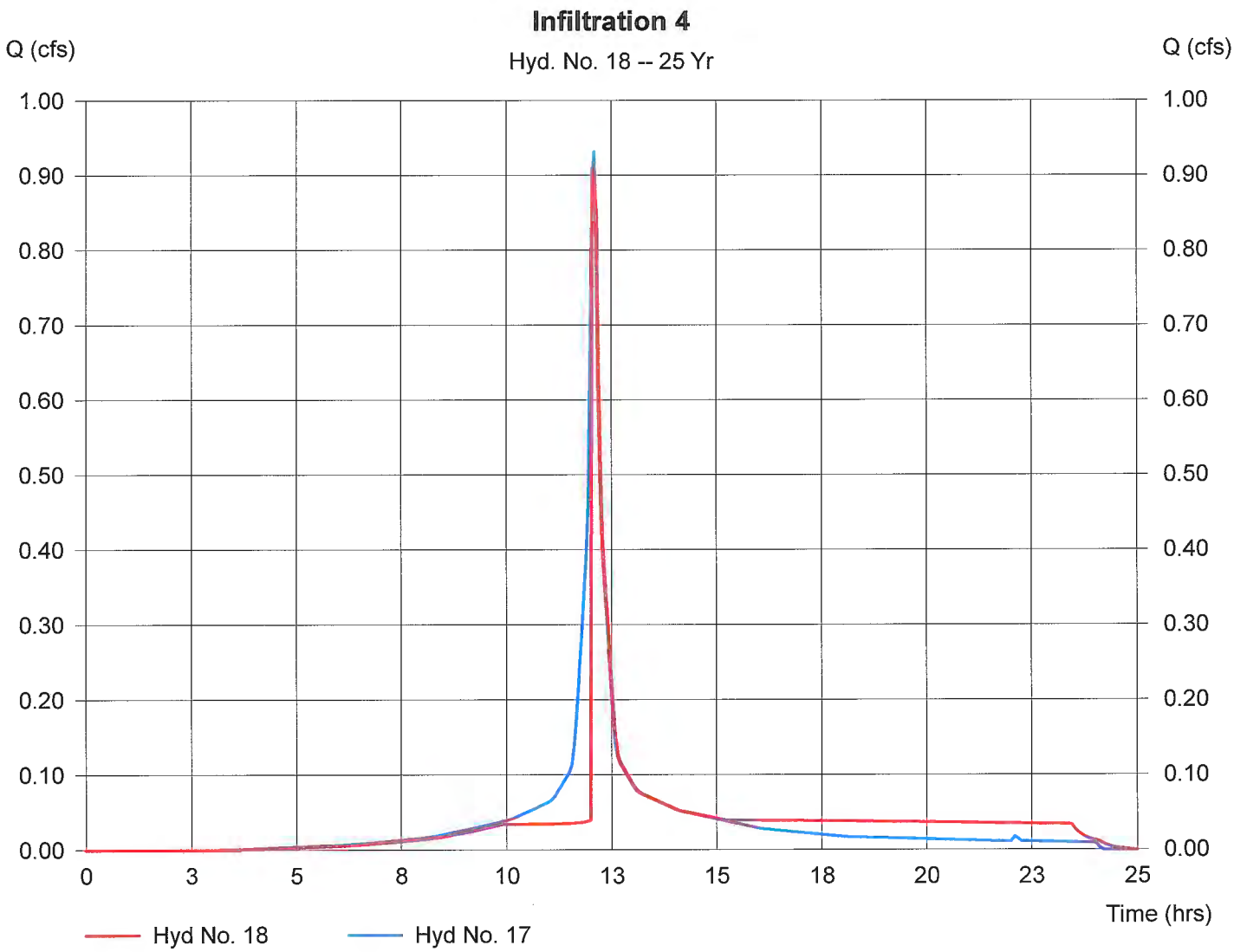
Hydraflow Hydrographs by Intelisolve | Friday, Sep 26 2014, 9:3 AM

Hyd. No. 18

Infiltration 4

Hydrograph type	=	Reservoir	Peak discharge	=	0.91 cfs
Storm frequency	=	25 yrs	Time interval	=	3 min
Inflow hyd. No.	=	17	Max. Elevation	=	137.39 ft
Reservoir name	=	Pavers 4	Max. Storage	=	660 cuft

Storage Indication method used. | Hydrograph Volume = 3,310 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:3 AM

Pond No. 5 - Pavers 4

Pond Data

Bottom LxW = 72.0 x 20.0 ft Side slope = 0.0:1 Bottom elev. = 136.00 ft Depth = 1.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	136.00	1,440	0	0
0.08	136.08	1,440	36	36
0.15	136.15	1,440	36	71
0.23	136.23	1,440	36	107
0.30	136.30	1,440	36	143
0.38	136.38	1,440	36	178
0.45	136.45	1,440	36	214
0.53	136.53	1,440	36	249
0.60	136.60	1,440	36	285
0.68	136.68	1,440	36	321
0.75	136.75	1,440	36	356
0.82	136.83	1,440	36	392
0.90	136.90	1,440	36	428
0.97	136.98	1,440	36	463
1.05	137.05	1,440	36	499
1.13	137.13	1,440	36	535
1.20	137.20	1,440	36	570
1.28	137.28	1,440	36	606
1.35	137.35	1,440	36	642
1.43	137.43	1,440	36	677
1.50	137.50	1,440	36	713

(*33.00% voids applied)

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

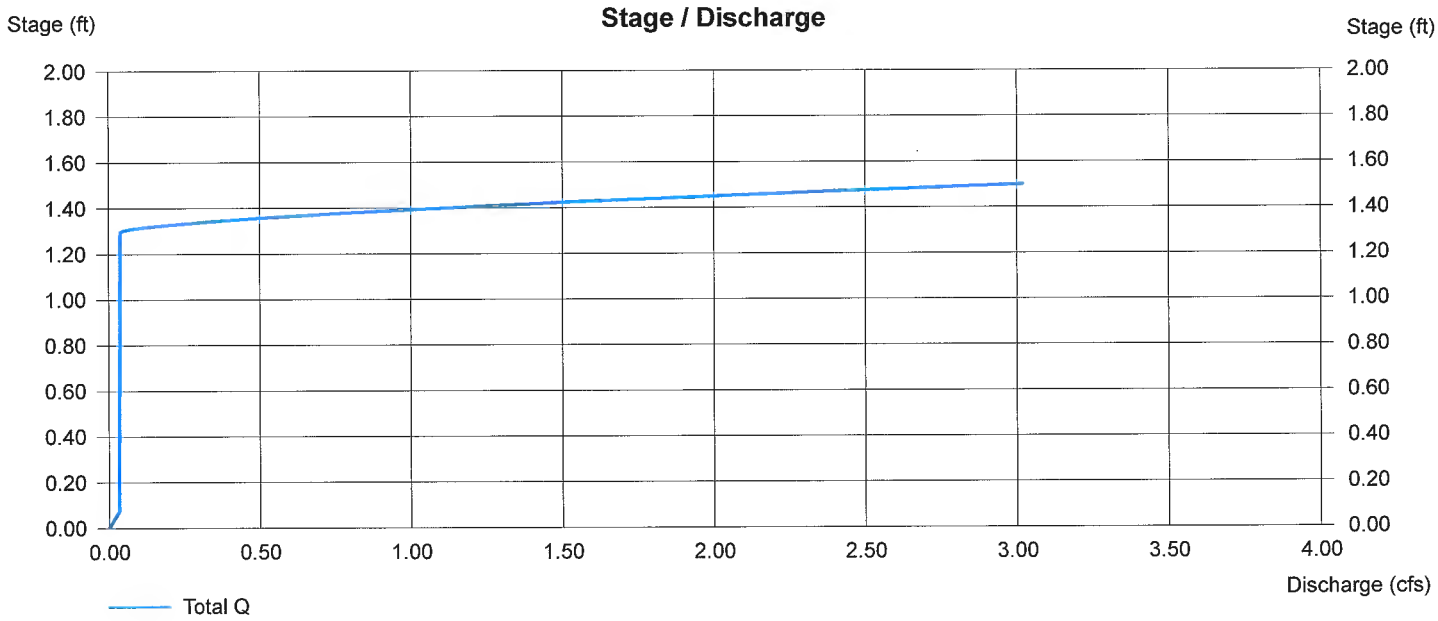
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 137.30	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 = 1.020 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

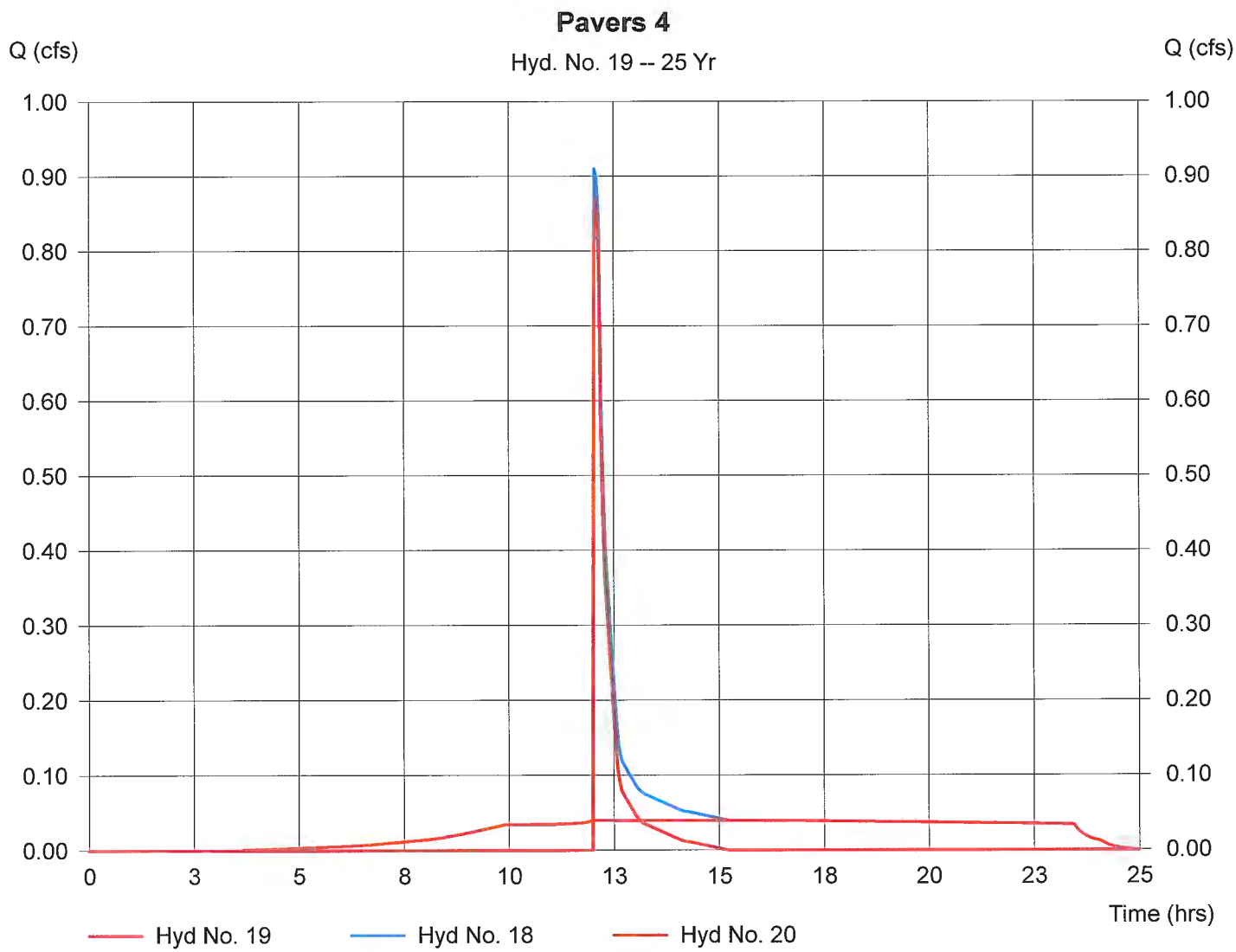
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 19

Pavers 4

Hydrograph type	=	Diversion1	Peak discharge	=	0.04 cfs
Storm frequency	=	25 yrs	Time interval	=	3 min
Inflow hydrograph	=	18	2nd diverted hyd.	=	20
Diversion method	=	Pond - Pavers 4	Pond structure	=	Exfiltration

Hydrograph Volume = 2,142 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

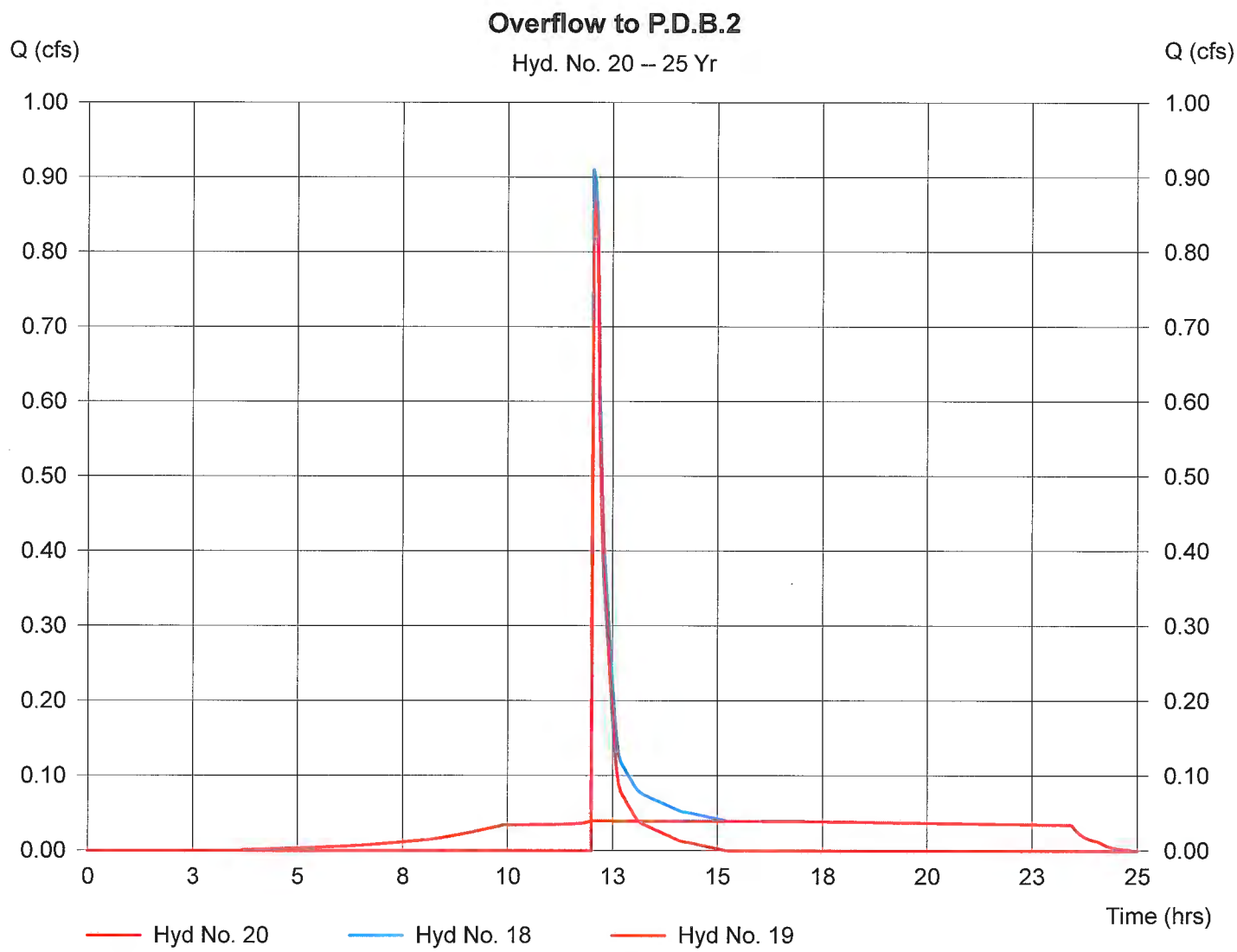
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 20

Overflow to P.D.B.2

Hydrograph type	=	Diversion2	Peak discharge	=	0.87 cfs
Storm frequency	=	25 yrs	Time interval	=	3 min
Inflow hydrograph	=	18	2nd diverted hyd.	=	19
Diversion method	=	Pond - Pavers 4	Pond structure	=	Exfiltration

Hydrograph Volume = 1,168 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

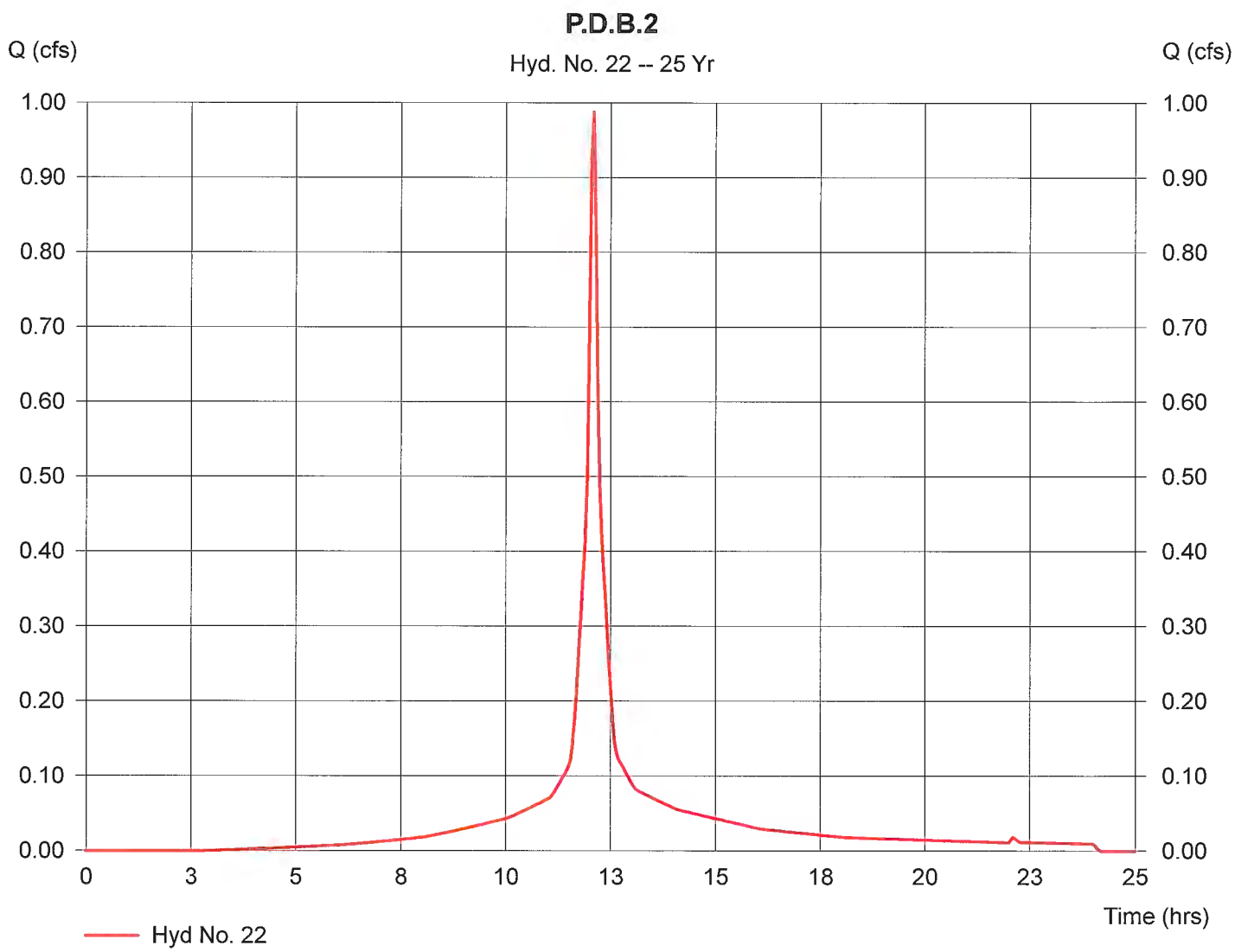
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 22

P.D.B.2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.99 cfs
Storm frequency	= 25 yrs	Time interval	= 3 min
Drainage area	= 0.22 ac	Curve number	= 93
Basin Slope	= 0.6 %	Hydraulic length	= 84 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 5.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,543 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

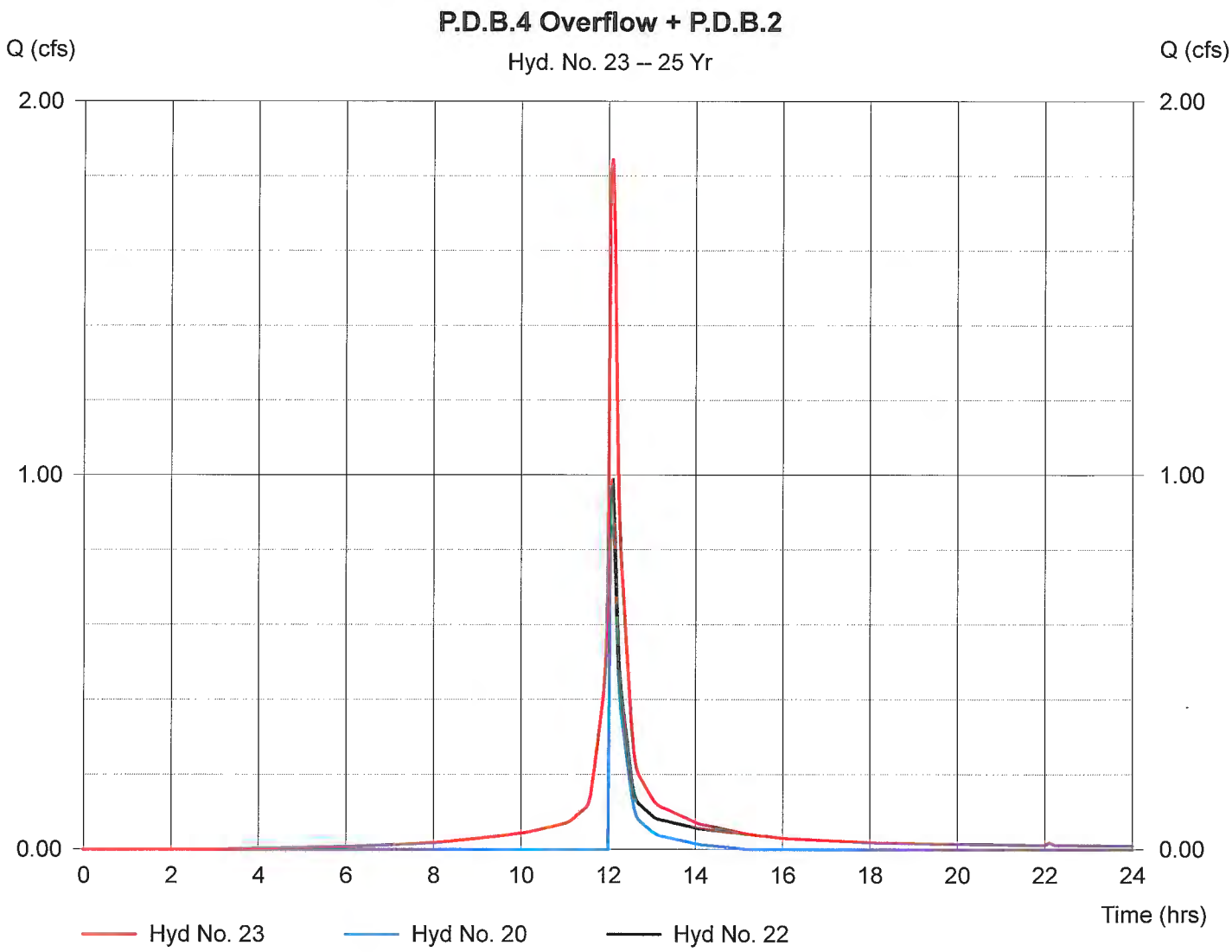
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 23

P.D.B.4 Overflow + P.D.B.2

Hydrograph type	= Combine	Peak discharge	= 1.85 cfs
Storm frequency	= 25 yrs	Time interval	= 3 min
Inflow hyds.	= 20, 22		

Hydrograph Volume = 4,711 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:3 AM

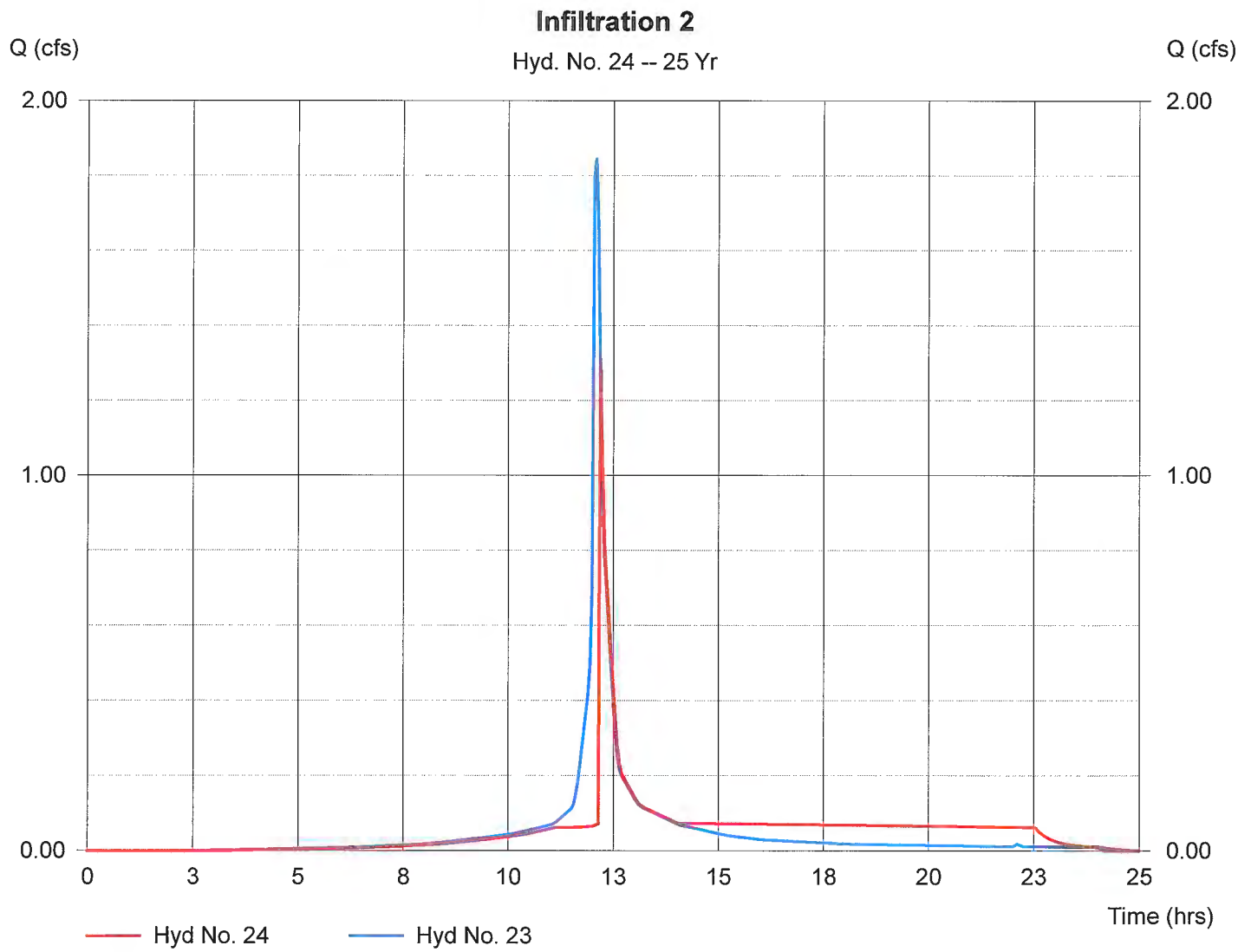
Hyd. No. 24

Infiltration 2

Hydrograph type	=	Reservoir	Peak discharge	=	1.30 cfs
Storm frequency	=	25 yrs	Time interval	=	3 min
Inflow hyd. No.	=	23	Max. Elevation	=	137.73 ft
Reservoir name	=	Pavers 2	Max. Storage	=	1,505 cuft

Storage Indication method used.

Hydrograph Volume = 4,710 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:3 AM

Pond No. 3 - Pavers 2

Pond Data

Bottom LxW = 119.5 x 22.0 ft Side slope = 0.0:1 Bottom elev. = 136.00 ft Depth = 2.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	136.00	2,629	0	0
0.10	136.10	2,629	87	87
0.20	136.20	2,629	87	174
0.30	136.30	2,629	87	260
0.40	136.40	2,629	87	347
0.50	136.50	2,629	87	434
0.60	136.60	2,629	87	521
0.70	136.70	2,629	87	607
0.80	136.80	2,629	87	694
0.90	136.90	2,629	87	781
1.00	137.00	2,629	87	868
1.10	137.10	2,629	87	954
1.20	137.20	2,629	87	1,041
1.30	137.30	2,629	87	1,128
1.40	137.40	2,629	87	1,215
1.50	137.50	2,629	87	1,301
1.60	137.60	2,629	87	1,388
1.70	137.70	2,629	87	1,475
1.80	137.80	2,629	87	1,562
1.90	137.90	2,629	87	1,648
2.00	138.00	2,629	87	1,735

(*33.00% voids applied)

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

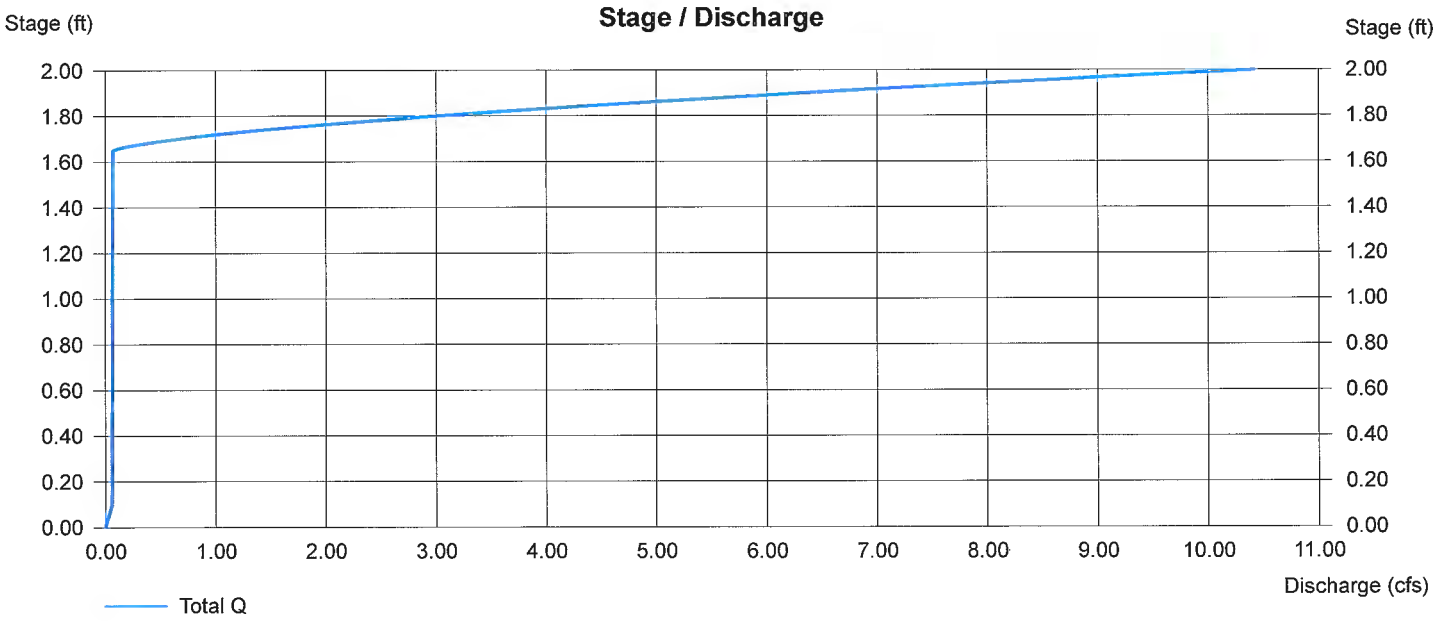
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 137.65	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 = 1.020 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

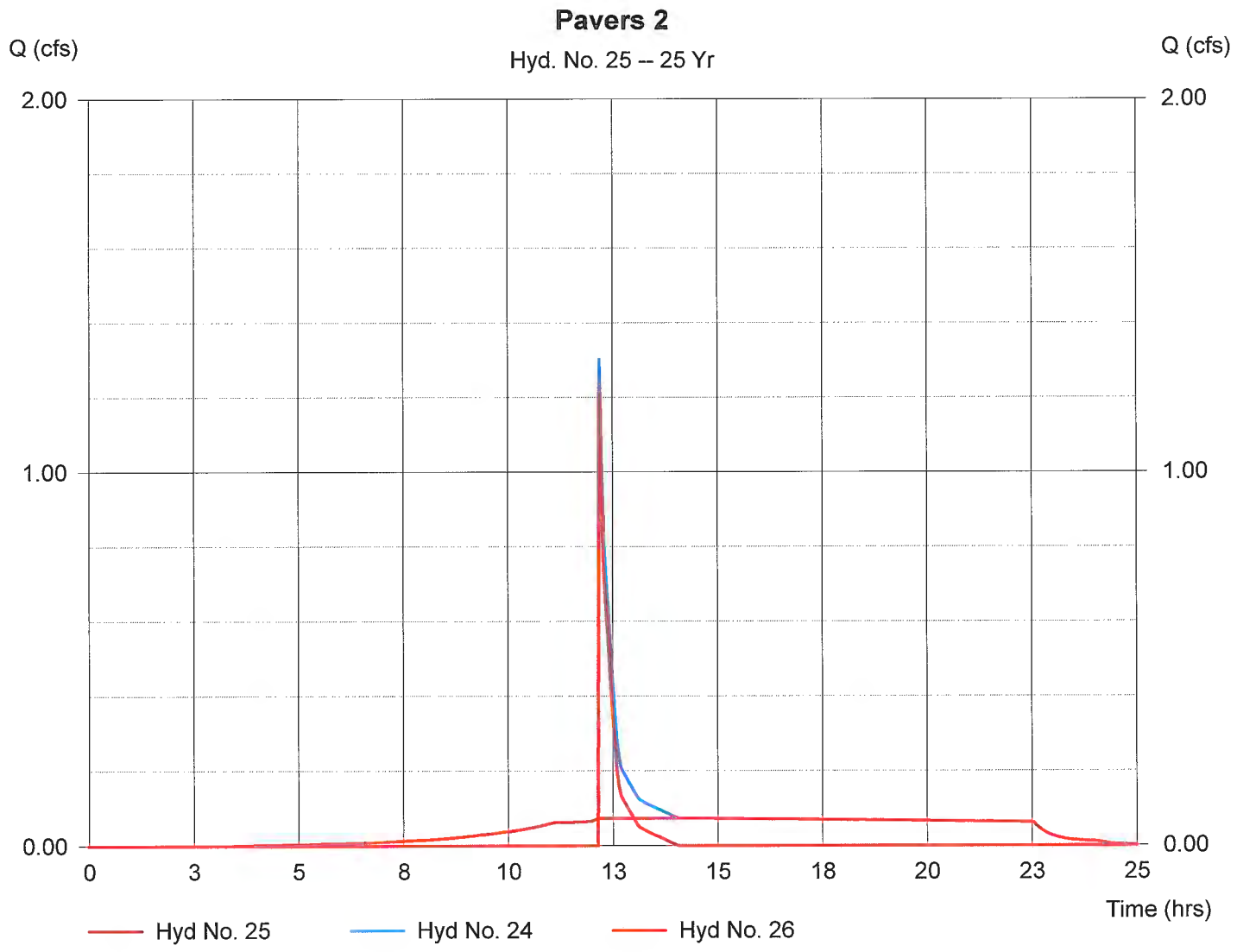
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 25

Pavers 2

Hydrograph type	=	Diversion1	Peak discharge	=	0.07 cfs
Storm frequency	=	25 yrs	Time interval	=	3 min
Inflow hydrograph	=	24	2nd diverted hyd.	=	26
Diversion method	=	Pond - Pavers 2	Pond structure	=	Exfiltration

Hydrograph Volume = 3,473 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

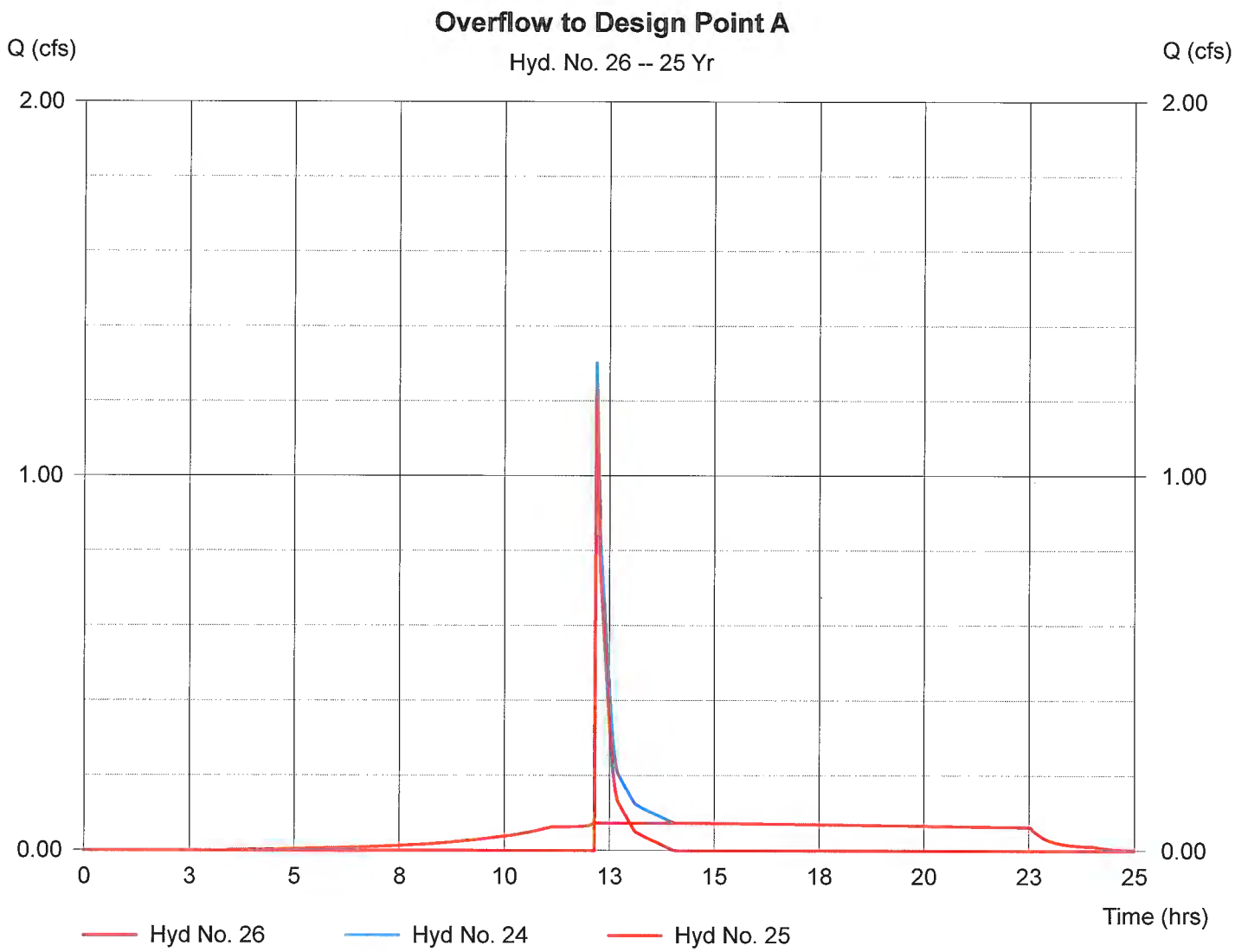
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 26

Overflow to Design Point A

Hydrograph type	=	Diversion2	Peak discharge	=	1.23 cfs
Storm frequency	=	25 yrs	Time interval	=	3 min
Inflow hydrograph	=	24	2nd diverted hyd.	=	25
Diversion method	=	Pond - Pavers 2	Pond structure	=	Exfiltration

Hydrograph Volume = 1,236 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

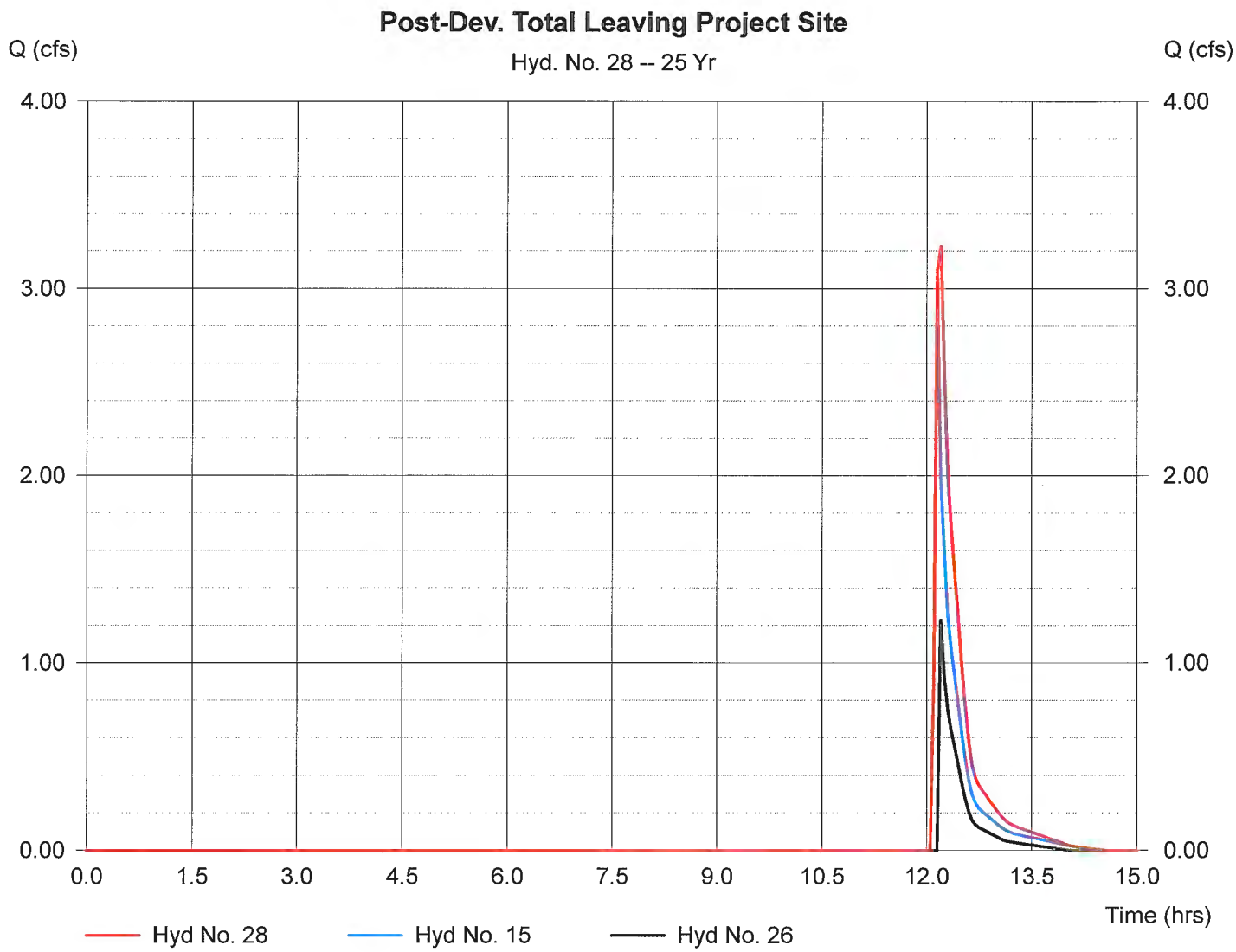
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 28

Post-Dev. Total Leaving Project Site

Hydrograph type	= Combine	Peak discharge	= 3.23 cfs
Storm frequency	= 25 yrs	Time interval	= 3 min
Inflow hyds.	= 15, 26		

Hydrograph Volume = 4,182 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	2.45	3	726	9,298	----	------	------	E.C.B.1-Design Point A
2	SCS Runoff	3.82	3	726	14,570	----	------	------	E.C.B.2-Design Point B
4	Combine	6.28	3	726	23,868	1, 2,	------	------	Pre-Dev. Total Leaving Project Site
6	SCS Runoff	1.92	3	726	7,155	----	------	------	P.D.B.3
7	Reservoir	1.93	3	726	7,154	6	136.46	1,250	Infiltration 3
8	Diversion1	0.07	3	726	4,291	7	------	------	Pavers 3
9	Diversion2	1.86	3	726	2,864	7	------	------	Overflow to P.D.B.1
11	SCS Runoff	1.88	3	726	7,102	----	------	------	P.D.B.1
12	Combine	3.74	3	726	9,966	9, 11	------	------	Overflow P.D.B.3 + P.D.B.1
13	Reservoir	3.68	3	726	9,964	12	135.76	1,862	Infiltration 1
14	Diversion1	0.09	3	726	5,103	13	------	------	Pavers 1
15	Diversion2	3.59	3	726	4,862	13	------	------	Overflow to Design Point B
17	SCS Runoff	1.16	3	726	4,163	----	------	------	P.D.B.4
18	Reservoir	1.15	3	726	4,162	17	137.40	667	Infiltration 4
19	Diversion1	0.04	3	726	2,360	18	------	------	Pavers 4
20	Diversion2	1.11	3	726	1,802	18	------	------	Overflow to P.D.B.2
22	SCS Runoff	1.22	3	726	4,438	----	------	------	P.D.B.2
23	Combine	2.33	3	726	6,240	20, 22	------	------	P.D.B.4 Overflow + P.D.B.2
24	Reservoir	2.43	3	729	6,239	23	137.78	1,545	Infiltration 2
25	Diversion1	0.07	3	729	3,839	24	------	------	Pavers 2
26	Diversion2	2.36	3	729	2,399	24	------	------	Overflow to Design Point A
28	Combine	5.70	3	729	7,261	15, 26,	------	------	Post-Dev. Total Leaving Project Site

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

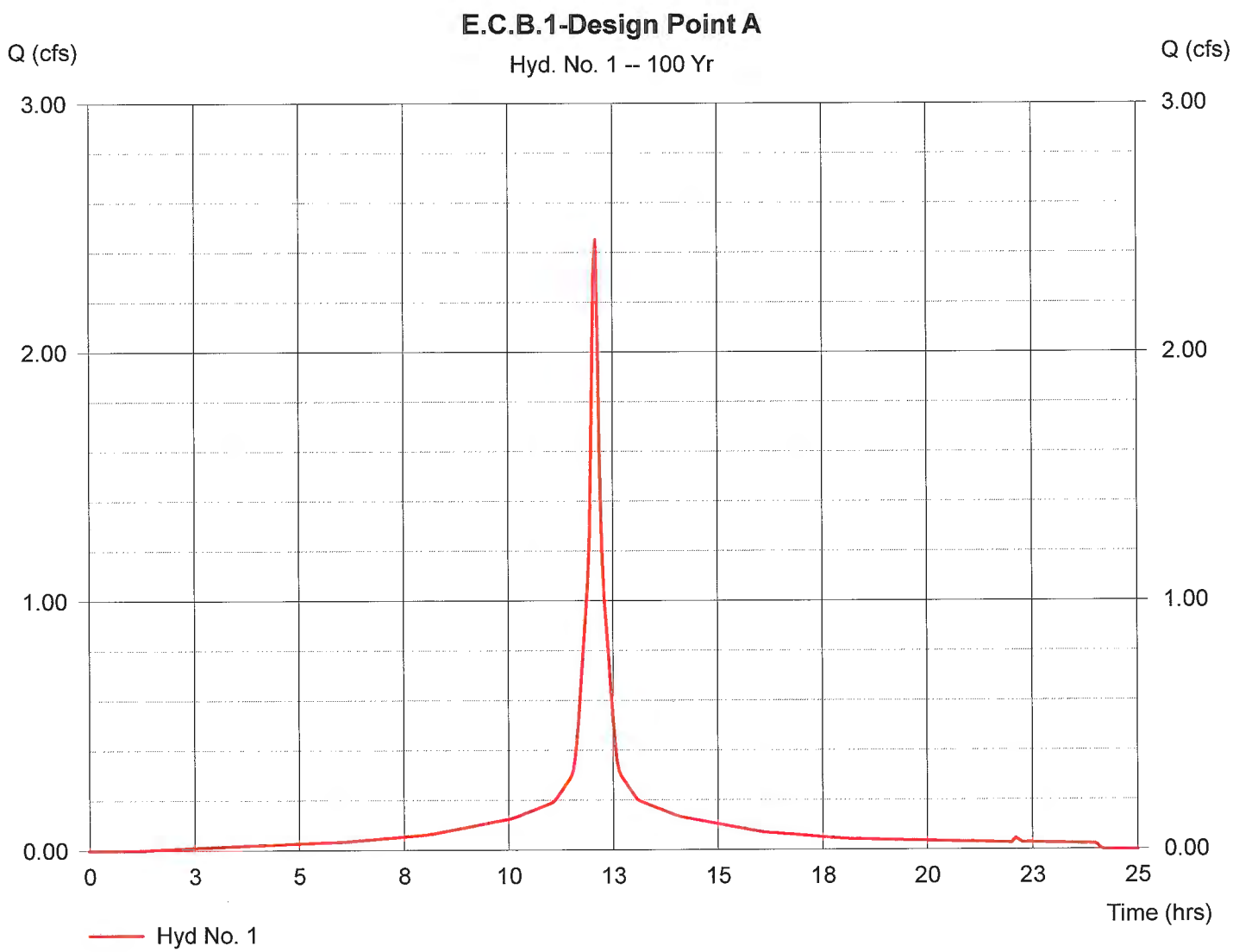
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 1

E.C.B.1-Design Point A

Hydrograph type	= SCS Runoff	Peak discharge	= 2.45 cfs
Storm frequency	= 100 yrs	Time interval	= 3 min
Drainage area	= 0.43 ac	Curve number	= 96.6
Basin Slope	= 0.3 %	Hydraulic length	= 150 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 6.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 9,298 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

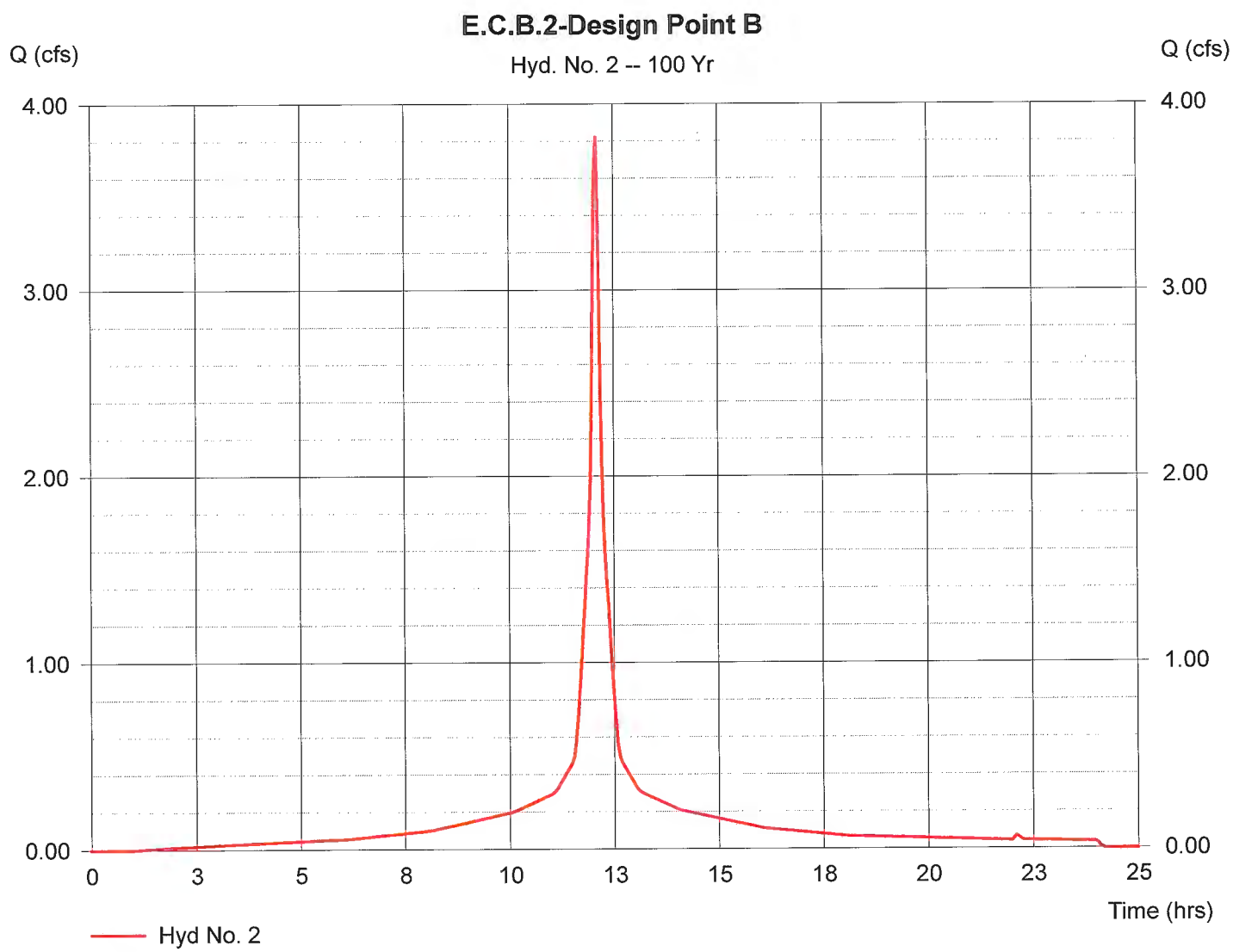
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 2

E.C.B.2-Design Point B

Hydrograph type	= SCS Runoff	Peak discharge	= 3.82 cfs
Storm frequency	= 100 yrs	Time interval	= 3 min
Drainage area	= 0.68 ac	Curve number	= 97
Basin Slope	= 1.9 %	Hydraulic length	= 135 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 6.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 14,570 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

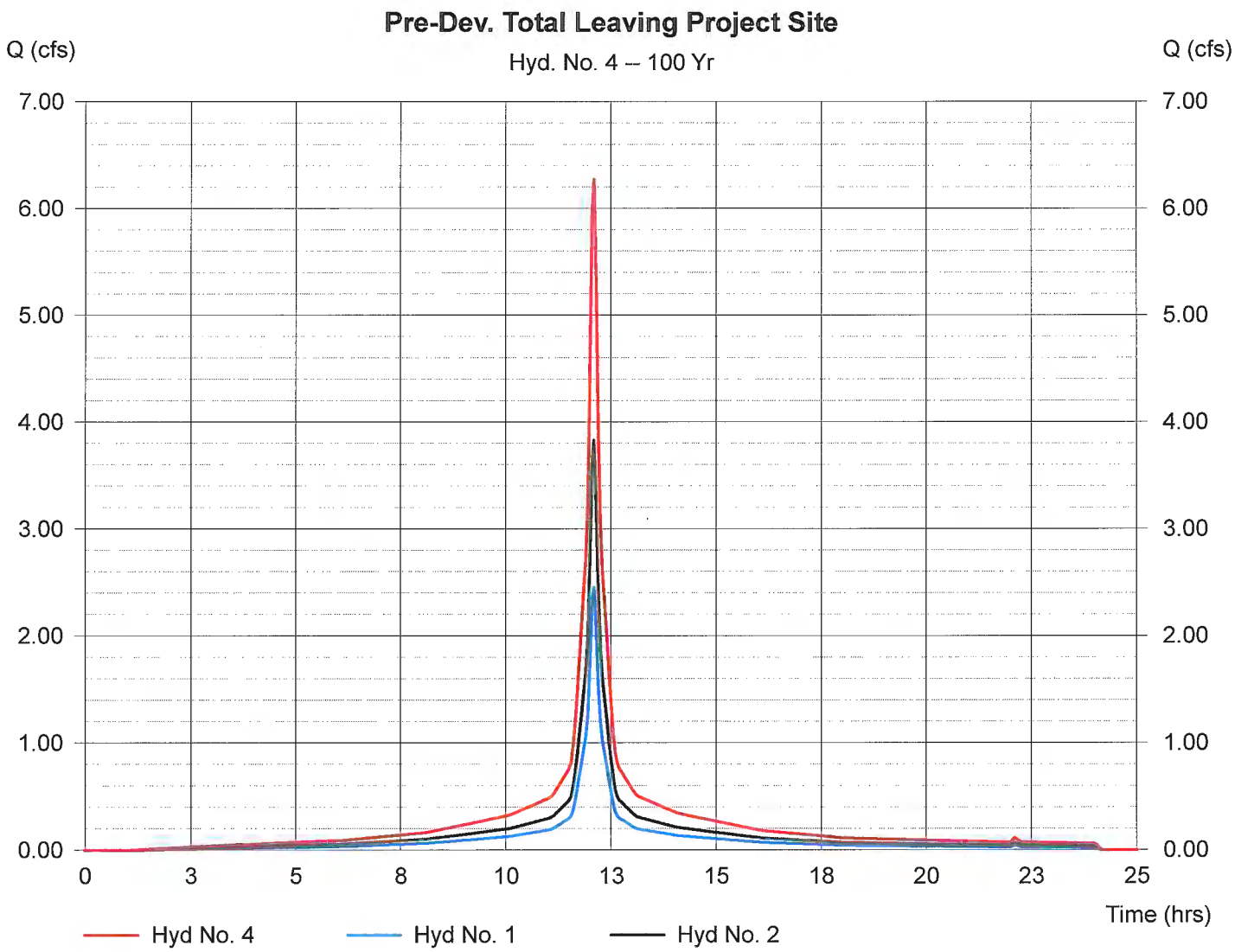
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 4

Pre-Dev. Total Leaving Project Site

Hydrograph type	= Combine	Peak discharge	= 6.28 cfs
Storm frequency	= 100 yrs	Time interval	= 3 min
Inflow hyds.	= 1, 2		

Hydrograph Volume = 23,868 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

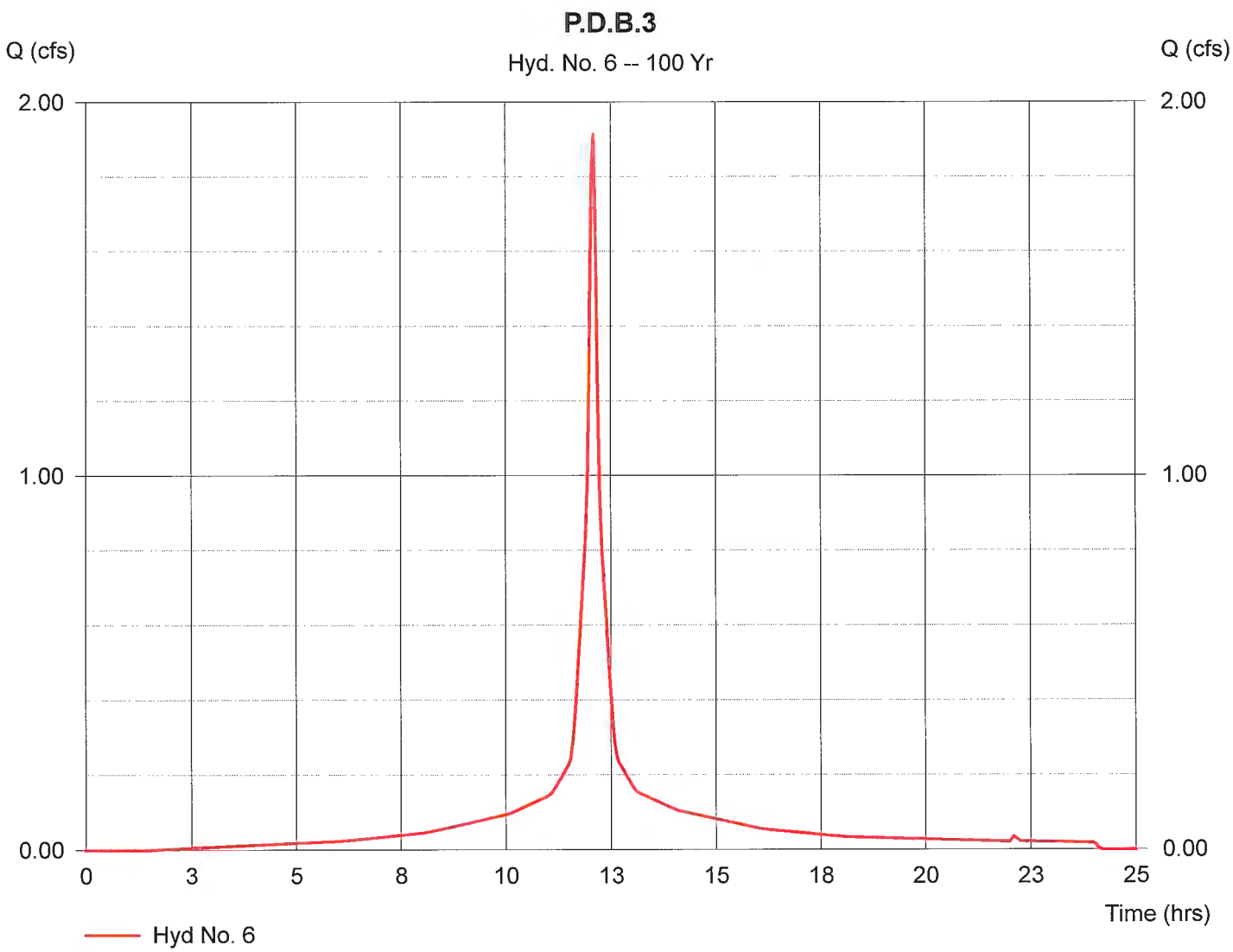
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 6

P.D.B.3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.92 cfs
Storm frequency	= 100 yrs	Time interval	= 3 min
Drainage area	= 0.34 ac	Curve number	= 95.5
Basin Slope	= 1.0 %	Hydraulic length	= 107 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 6.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 7,155 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:3 AM

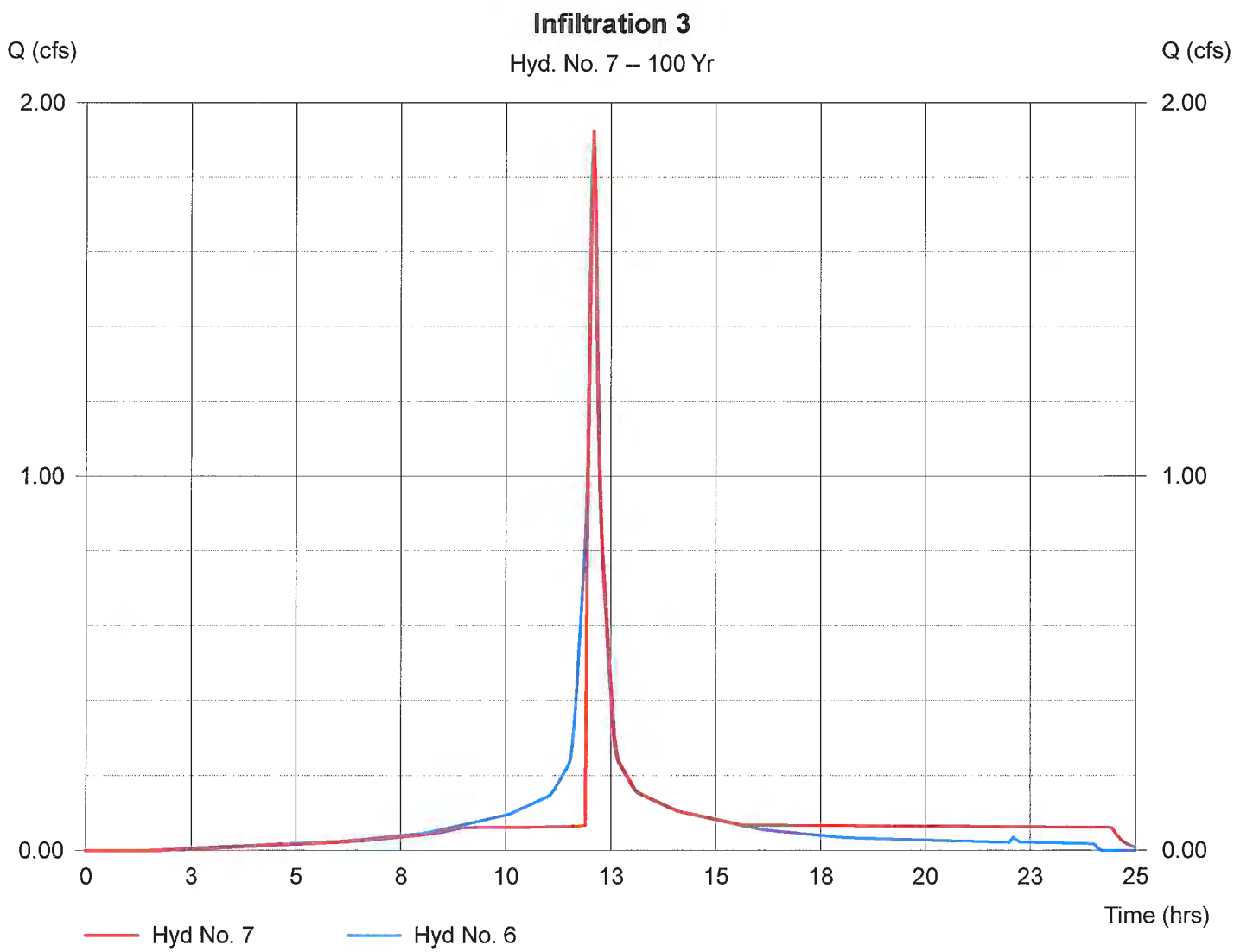
Hyd. No. 7

Infiltration 3

Hydrograph type	=	Reservoir	Peak discharge	=	1.93 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Inflow hyd. No.	=	6	Max. Elevation	=	136.46 ft
Reservoir name	=	Pavers 3	Max. Storage	=	1,250 cuft

Storage Indication method used.

Hydrograph Volume = 7,154 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:3 AM

Pond No. 4 - Pavers 3

Pond Data

Bottom LxW = 72.0 x 36.0 ft Side slope = 0.0:1 Bottom elev. = 135.00 ft Depth = 1.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	135.00	2,592	0	0
0.08	135.08	2,592	64	64
0.15	135.15	2,592	64	128
0.23	135.23	2,592	64	192
0.30	135.30	2,592	64	257
0.38	135.38	2,592	64	321
0.45	135.45	2,592	64	385
0.53	135.53	2,592	64	449
0.60	135.60	2,592	64	513
0.68	135.68	2,592	64	577
0.75	135.75	2,592	64	642
0.82	135.83	2,592	64	706
0.90	135.90	2,592	64	770
0.97	135.98	2,592	64	834
1.05	136.05	2,592	64	898
1.13	136.13	2,592	64	962
1.20	136.20	2,592	64	1,026
1.28	136.28	2,592	64	1,091
1.35	136.35	2,592	64	1,155
1.43	136.43	2,592	64	1,219
1.50	136.50	2,592	64	1,283

(*33.00% voids applied)

Culvert / Orifice Structures

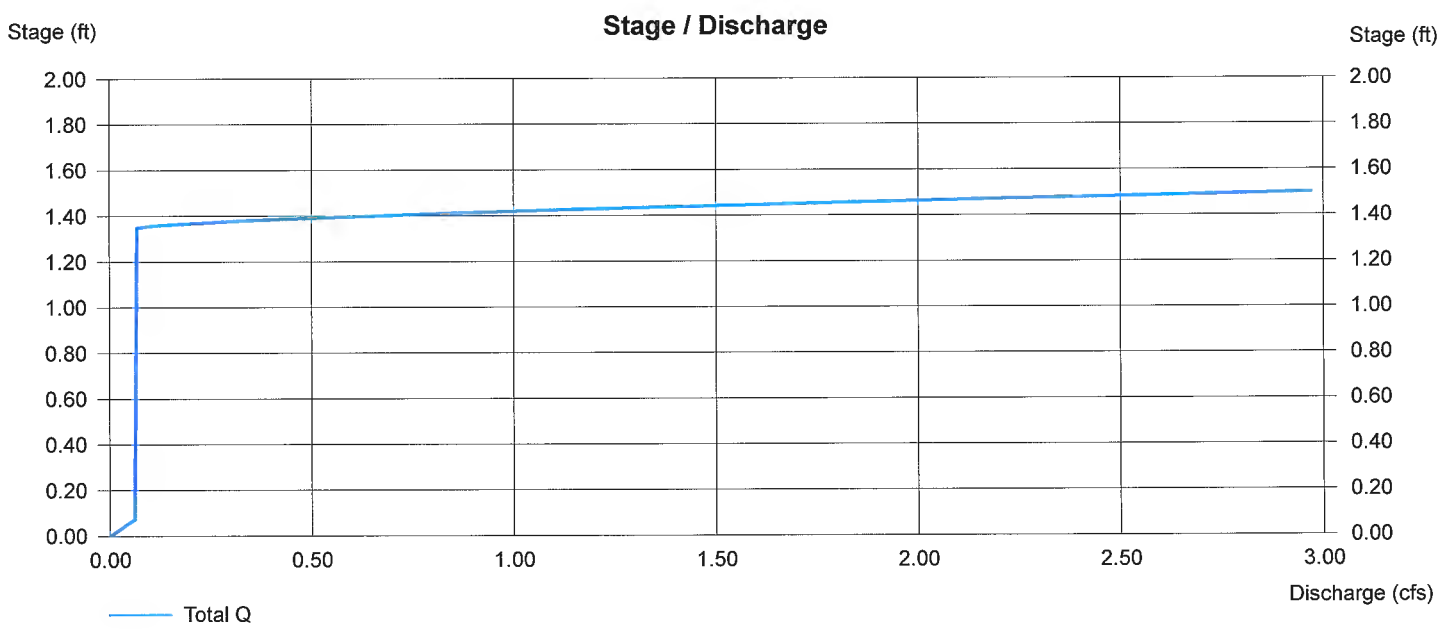
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 136.35	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 = 1.020 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

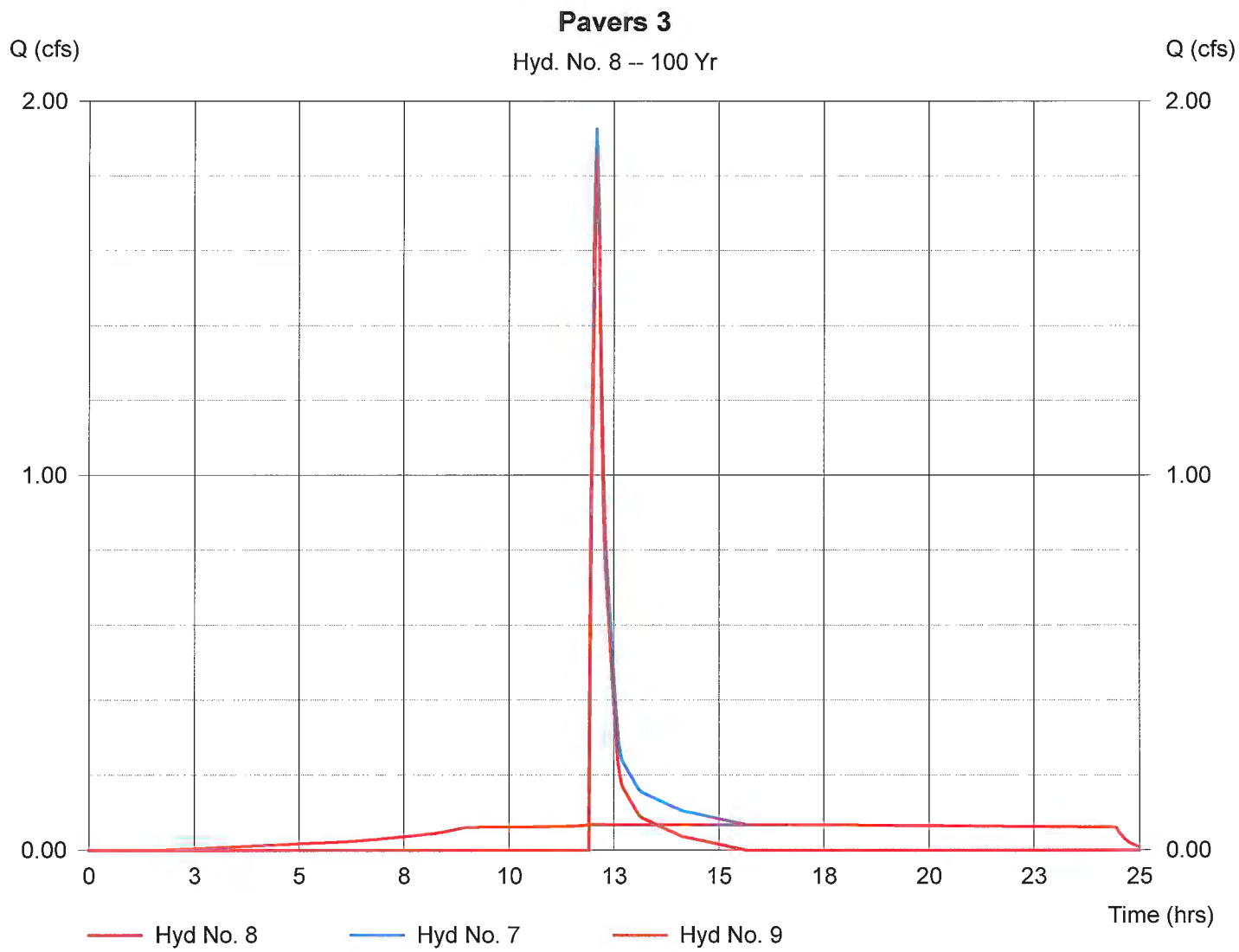
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 8

Pavers 3

Hydrograph type	=	Diversion1	Peak discharge	=	0.07 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Inflow hydrograph	=	7	2nd diverted hyd.	=	9
Diversion method	=	Pond - Pavers 3	Pond structure	=	Exfiltration

Hydrograph Volume = 4,291 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

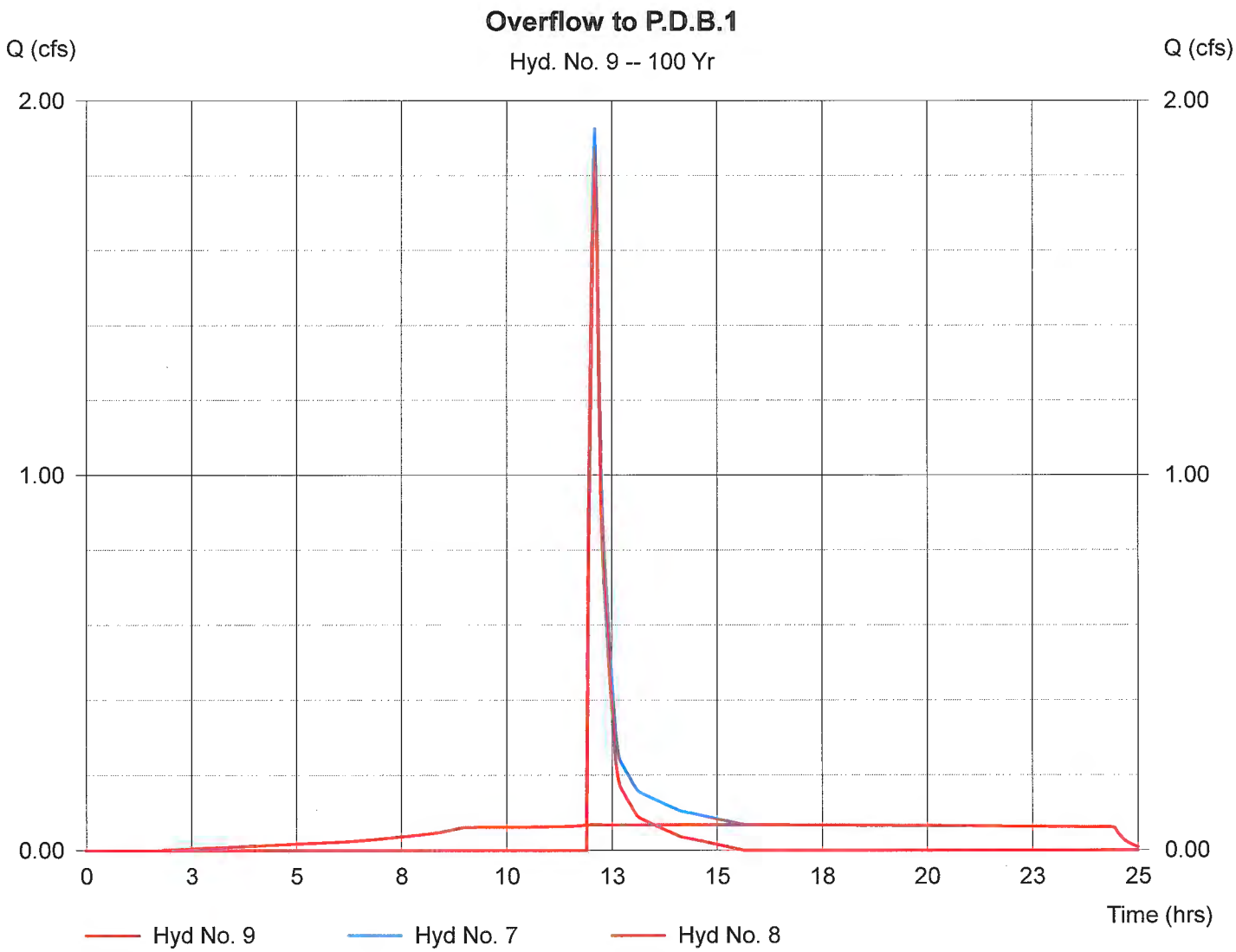
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 9

Overflow to P.D.B.1

Hydrograph type	=	Diversion2	Peak discharge	=	1.86 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Inflow hydrograph	=	7	2nd diverted hyd.	=	8
Diversion method	=	Pond - Pavers 3	Pond structure	=	Exfiltration

Hydrograph Volume = 2,864 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

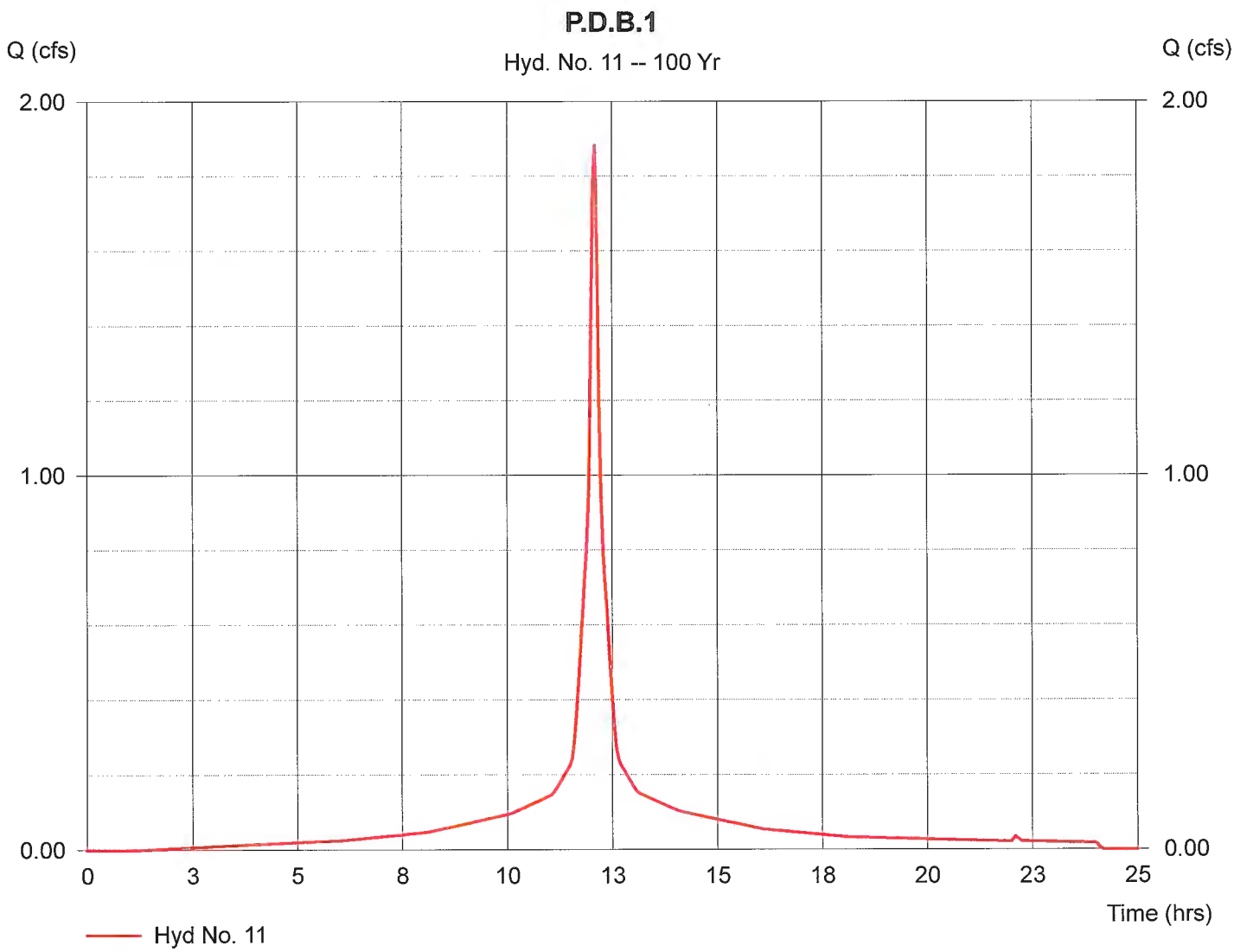
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 11

P.D.B.1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.88 cfs
Storm frequency	= 100 yrs	Time interval	= 3 min
Drainage area	= 0.33 ac	Curve number	= 96.2
Basin Slope	= 2.7 %	Hydraulic length	= 118 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 6.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 7,102 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

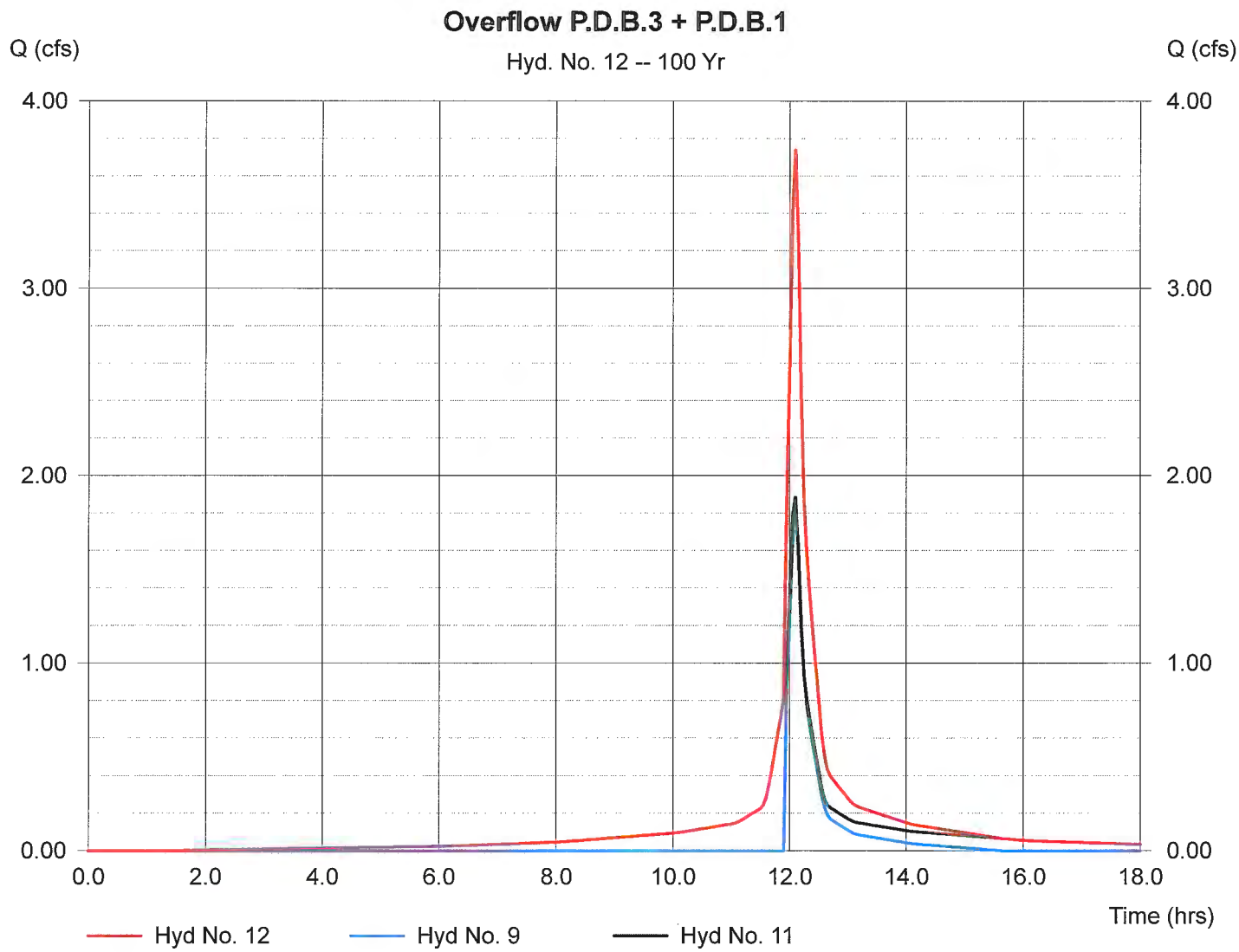
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 12

Overflow P.D.B.3 + P.D.B.1

Hydrograph type	= Combine	Peak discharge	= 3.74 cfs
Storm frequency	= 100 yrs	Time interval	= 3 min
Inflow hyds.	= 9, 11		

Hydrograph Volume = 9,966 cuft



Hydrograph Plot

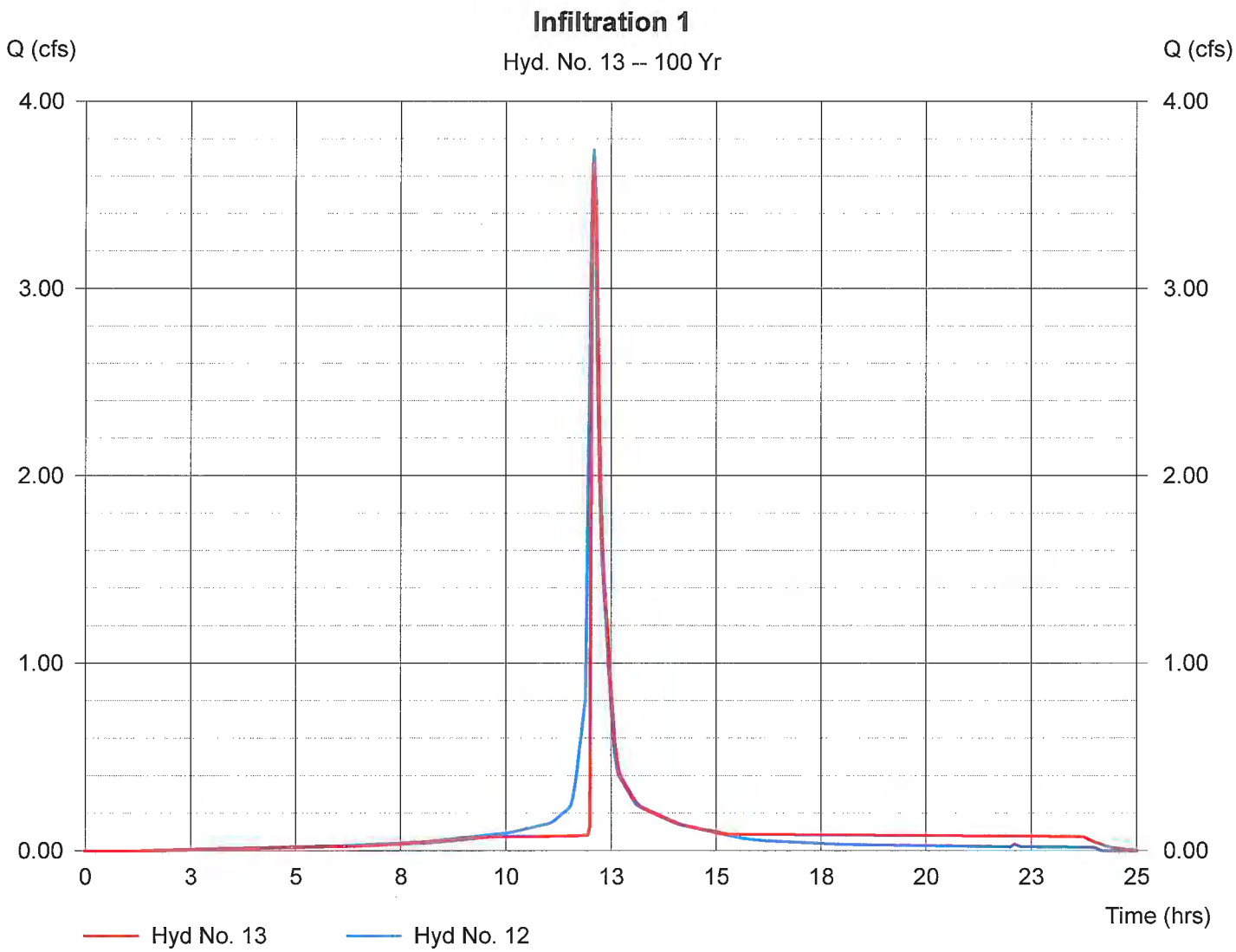
Hydraflow Hydrographs by Intelisolve | Friday, Sep 26 2014, 9:3 AM

Hyd. No. 13

Infiltration 1

Hydrograph type	=	Reservoir	Peak discharge	=	3.68 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Inflow hyd. No.	=	12	Max. Elevation	=	135.76 ft
Reservoir name	=	Pavers 1	Max. Storage	=	1,862 cuft

Storage Indication method used. | Hydrograph Volume = 9,964 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:3 AM

Pond No. 2 - Pavers 1

Pond Data

Bottom LxW = 145.5 x 22.0 ft Side slope = 0.0:1 Bottom elev. = 134.00 ft Depth = 2.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	134.00	3,201	0	0
0.10	134.10	3,201	106	106
0.20	134.20	3,201	106	211
0.30	134.30	3,201	106	317
0.40	134.40	3,201	106	423
0.50	134.50	3,201	106	528
0.60	134.60	3,201	106	634
0.70	134.70	3,201	106	739
0.80	134.80	3,201	106	845
0.90	134.90	3,201	106	951
1.00	135.00	3,201	106	1,056
1.10	135.10	3,201	106	1,162
1.20	135.20	3,201	106	1,268
1.30	135.30	3,201	106	1,373
1.40	135.40	3,201	106	1,479
1.50	135.50	3,201	106	1,584
1.60	135.60	3,201	106	1,690
1.70	135.70	3,201	106	1,796
1.80	135.80	3,201	106	1,901
1.90	135.90	3,201	106	2,007
2.00	136.00	3,201	106	2,113

(*33.00% voids applied)

Culvert / Orifice Structures

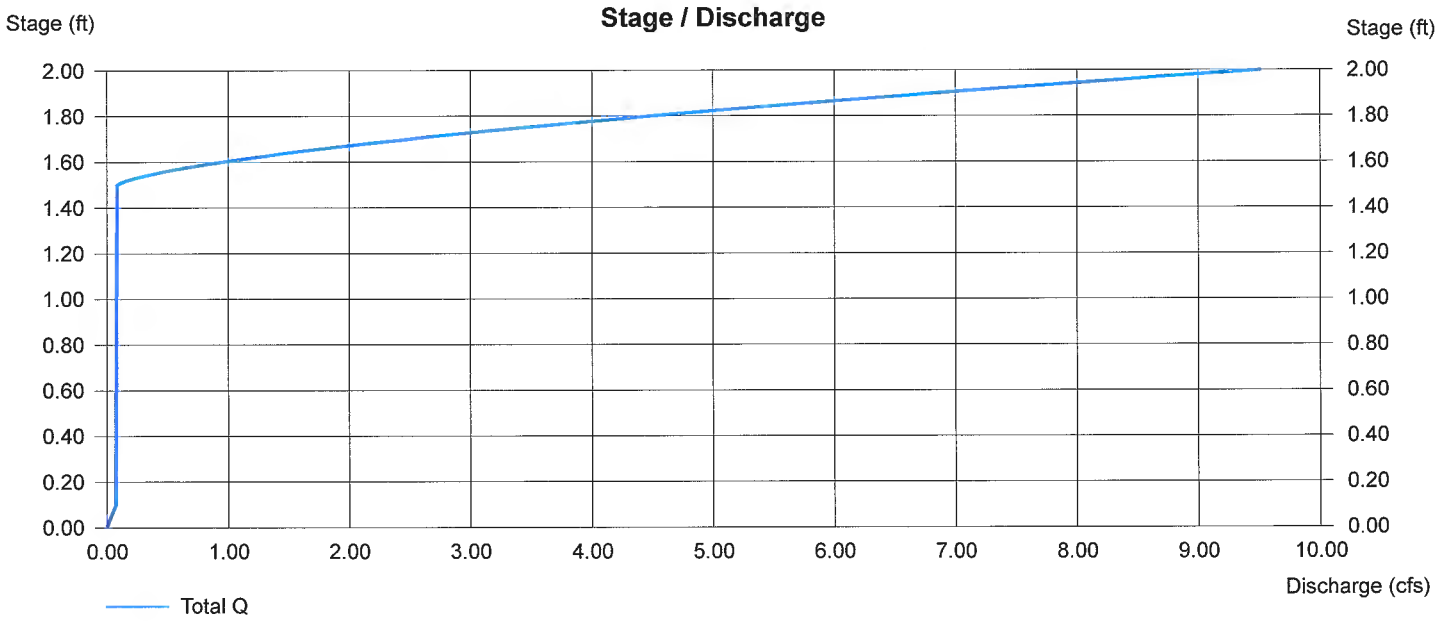
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 135.50	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 = 1.020 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

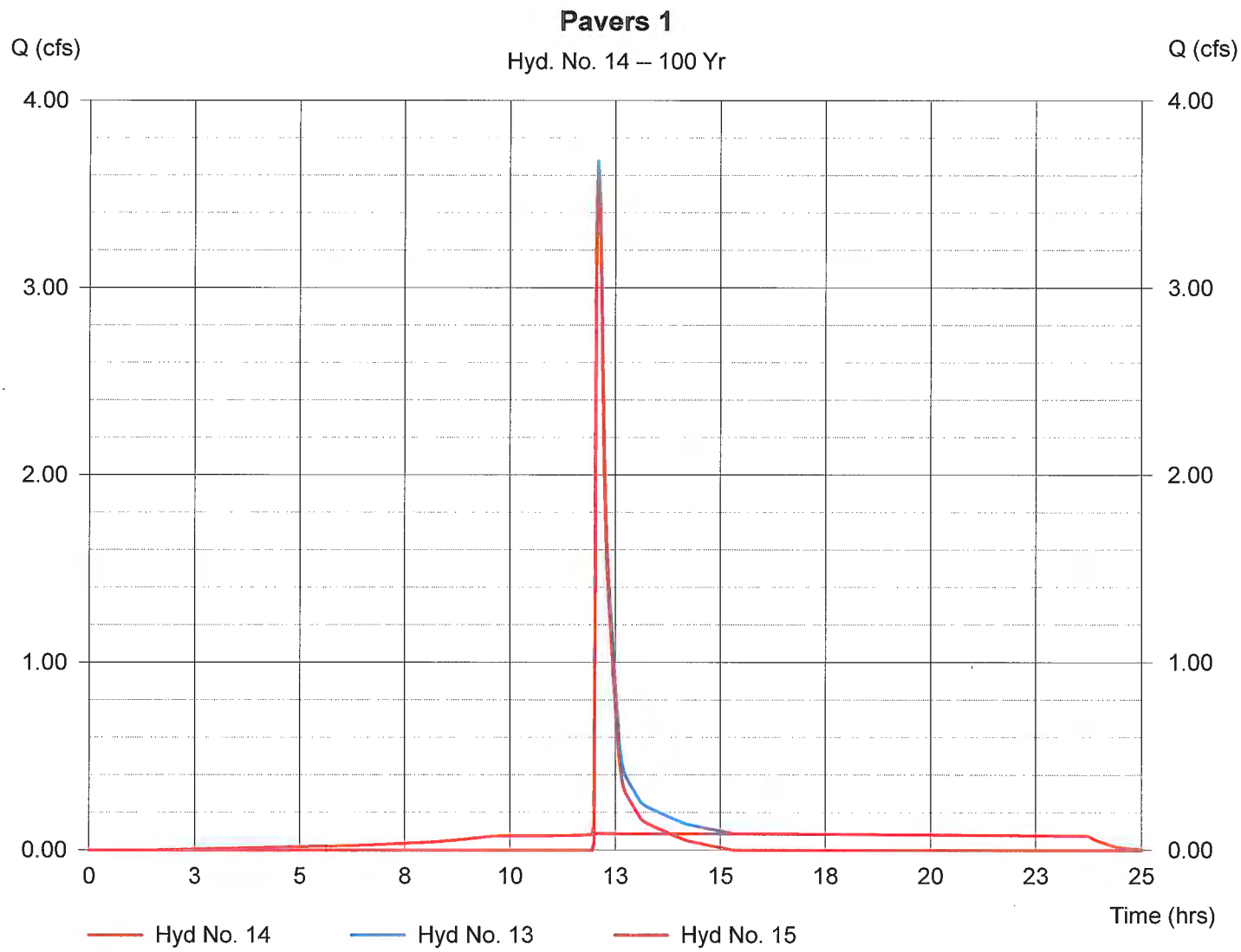
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 14

Pavers 1

Hydrograph type	=	Diversion1	Peak discharge	=	0.09 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Inflow hydrograph	=	13	2nd diverted hyd.	=	15
Diversion method	=	Pond - Pavers 1	Pond structure	=	Exfiltration

Hydrograph Volume = 5,103 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

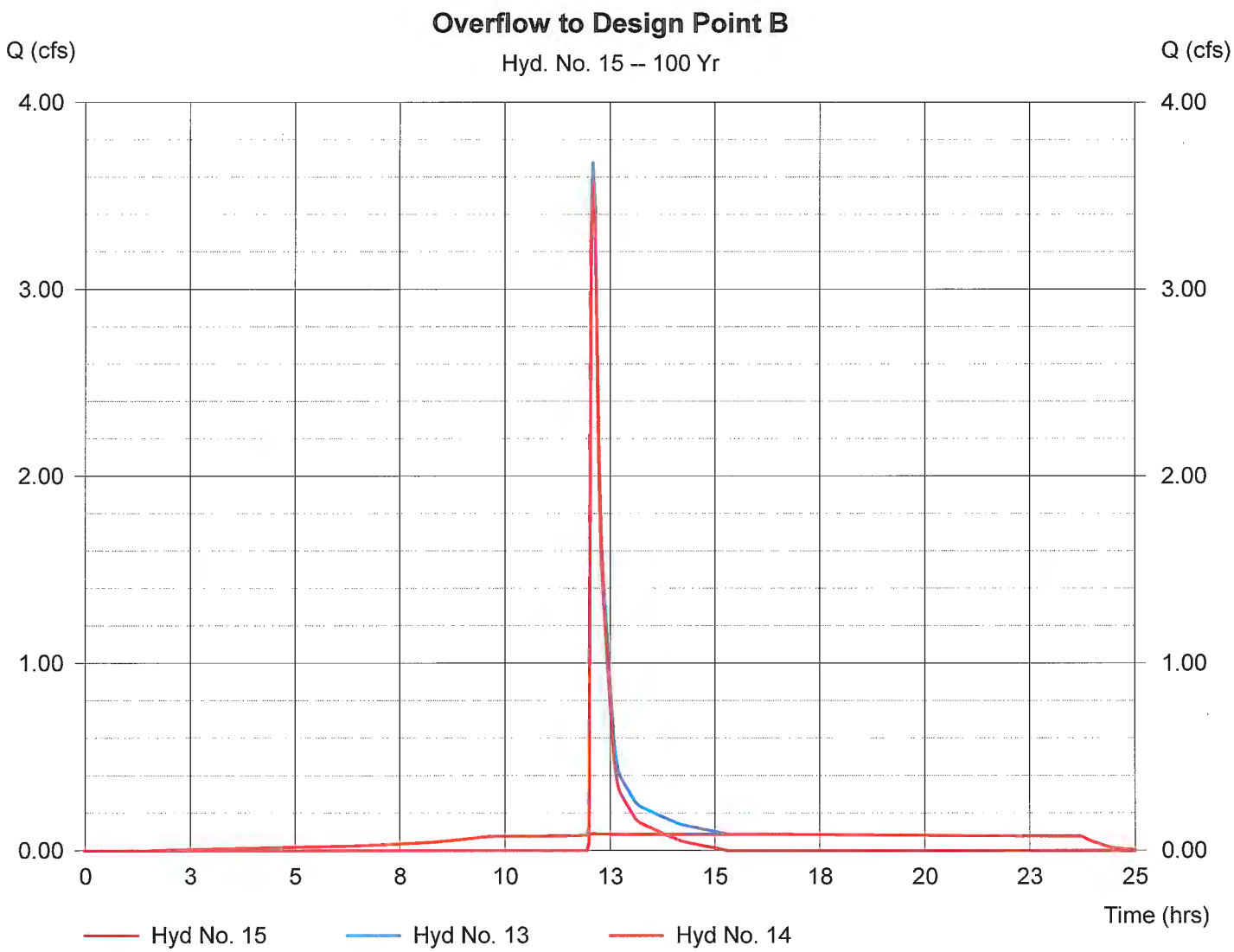
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 15

Overflow to Design Point B

Hydrograph type	=	Diversion2	Peak discharge	=	3.59 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Inflow hydrograph	=	13	2nd diverted hyd.	=	14
Diversion method	=	Pond - Pavers 1	Pond structure	=	Exfiltration

Hydrograph Volume = 4,862 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

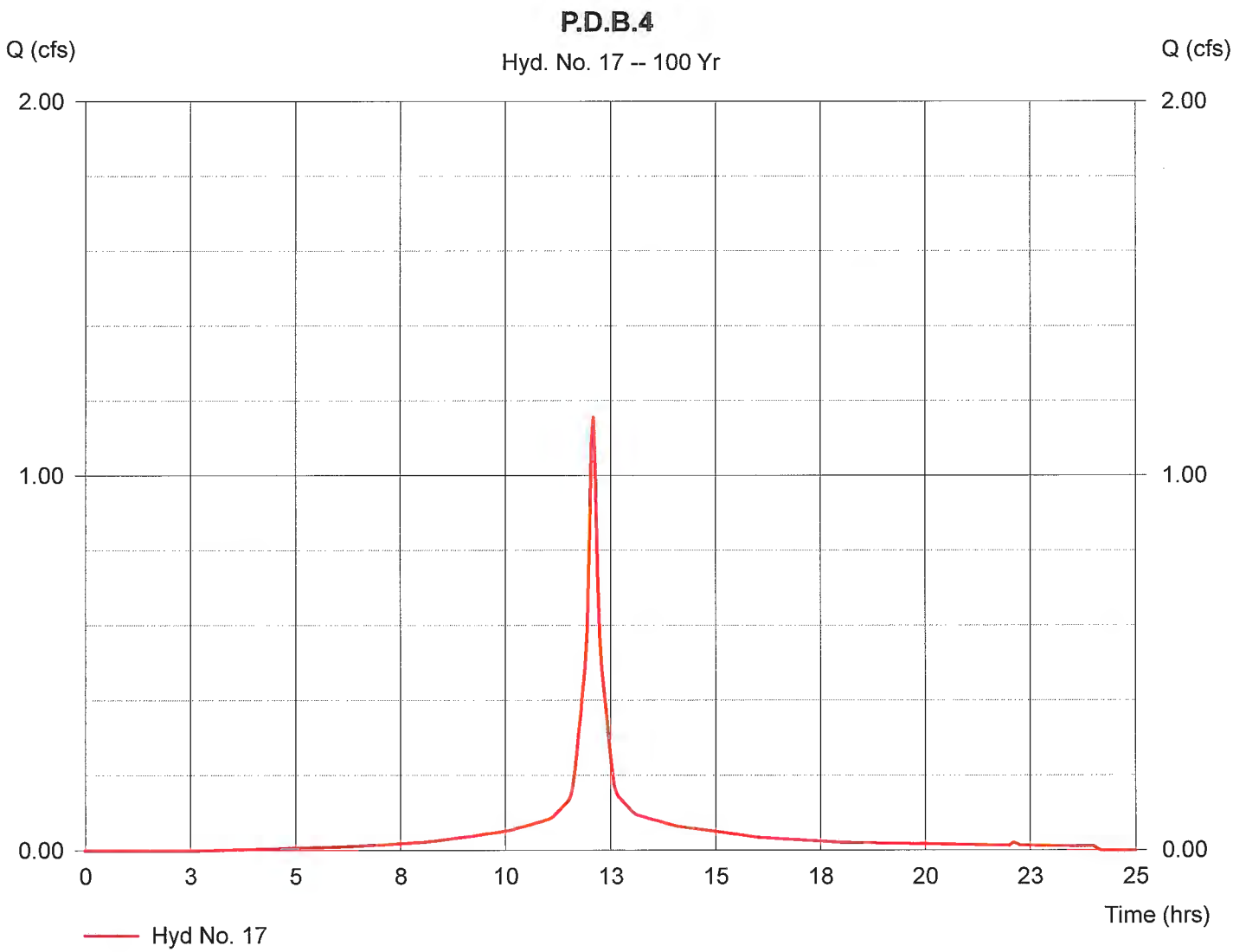
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 17

P.D.B.4

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.16 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Drainage area	=	0.21 ac	Curve number	=	92.1
Basin Slope	=	1.0 %	Hydraulic length	=	113 ft
Tc method	=	USER	Time of conc. (Tc)	=	5 min
Total precip.	=	6.70 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Volume = 4,163 cuft



Hydrograph Plot

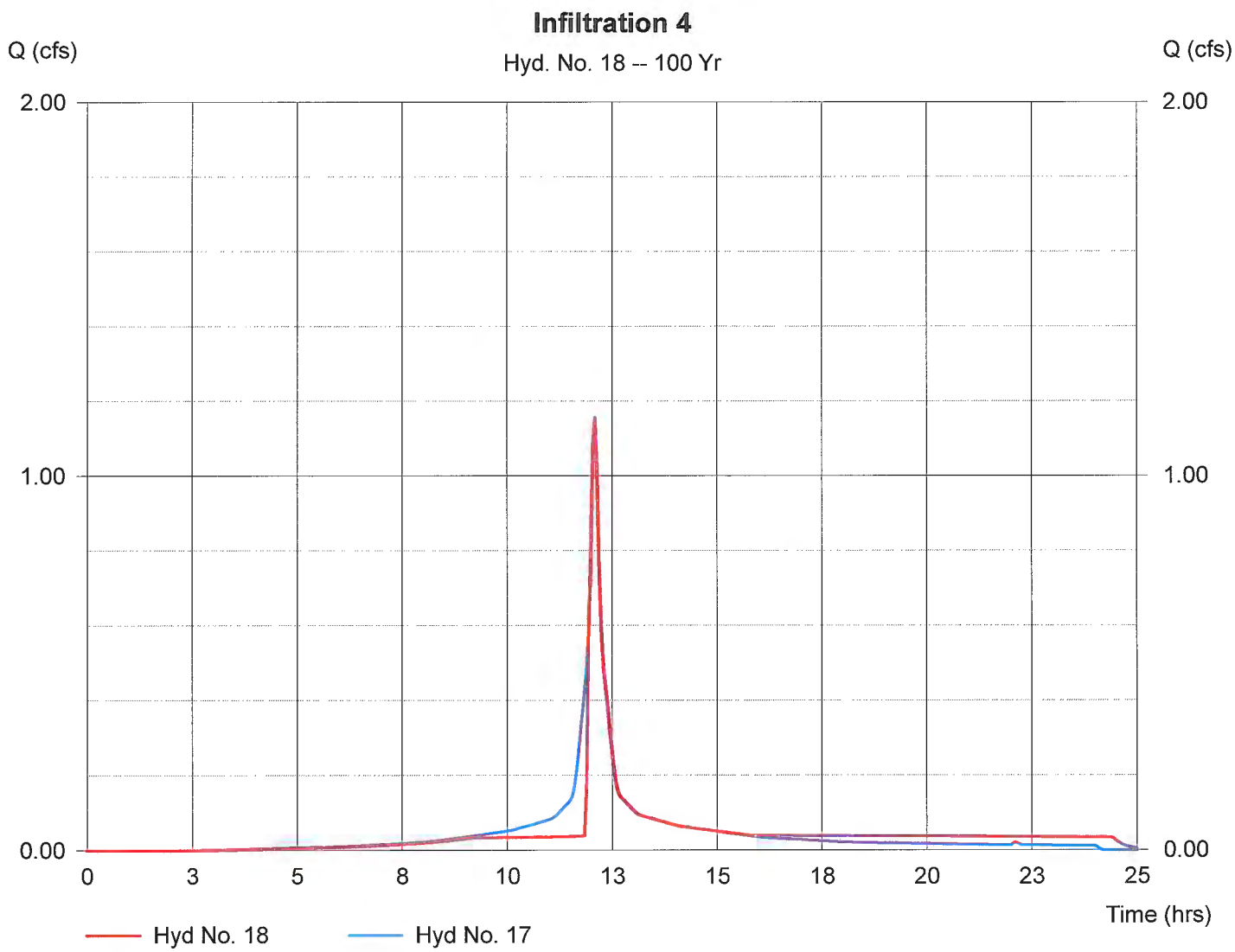
Hydraflow Hydrographs by Intelisolve | Friday, Sep 26 2014, 9:3 AM

Hyd. No. 18

Infiltration 4

Hydrograph type	=	Reservoir	Peak discharge	=	1.15 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Inflow hyd. No.	=	17	Max. Elevation	=	137.40 ft
Reservoir name	=	Pavers 4	Max. Storage	=	667 cuft

Storage Indication method used. | Hydrograph Volume = 4,162 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:3 AM

Pond No. 5 - Pavers 4

Pond Data

Bottom LxW = 72.0 x 20.0 ft Side slope = 0.0:1 Bottom elev. = 136.00 ft Depth = 1.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)* (*33.00% voids applied)
0.00	136.00	1,440	0	0
0.08	136.08	1,440	36	36
0.15	136.15	1,440	36	71
0.23	136.23	1,440	36	107
0.30	136.30	1,440	36	143
0.38	136.38	1,440	36	178
0.45	136.45	1,440	36	214
0.53	136.53	1,440	36	249
0.60	136.60	1,440	36	285
0.68	136.68	1,440	36	321
0.75	136.75	1,440	36	356
0.82	136.83	1,440	36	392
0.90	136.90	1,440	36	428
0.97	136.98	1,440	36	463
1.05	137.05	1,440	36	499
1.13	137.13	1,440	36	535
1.20	137.20	1,440	36	570
1.28	137.28	1,440	36	606
1.35	137.35	1,440	36	642
1.43	137.43	1,440	36	677
1.50	137.50	1,440	36	713

Culvert / Orifice Structures

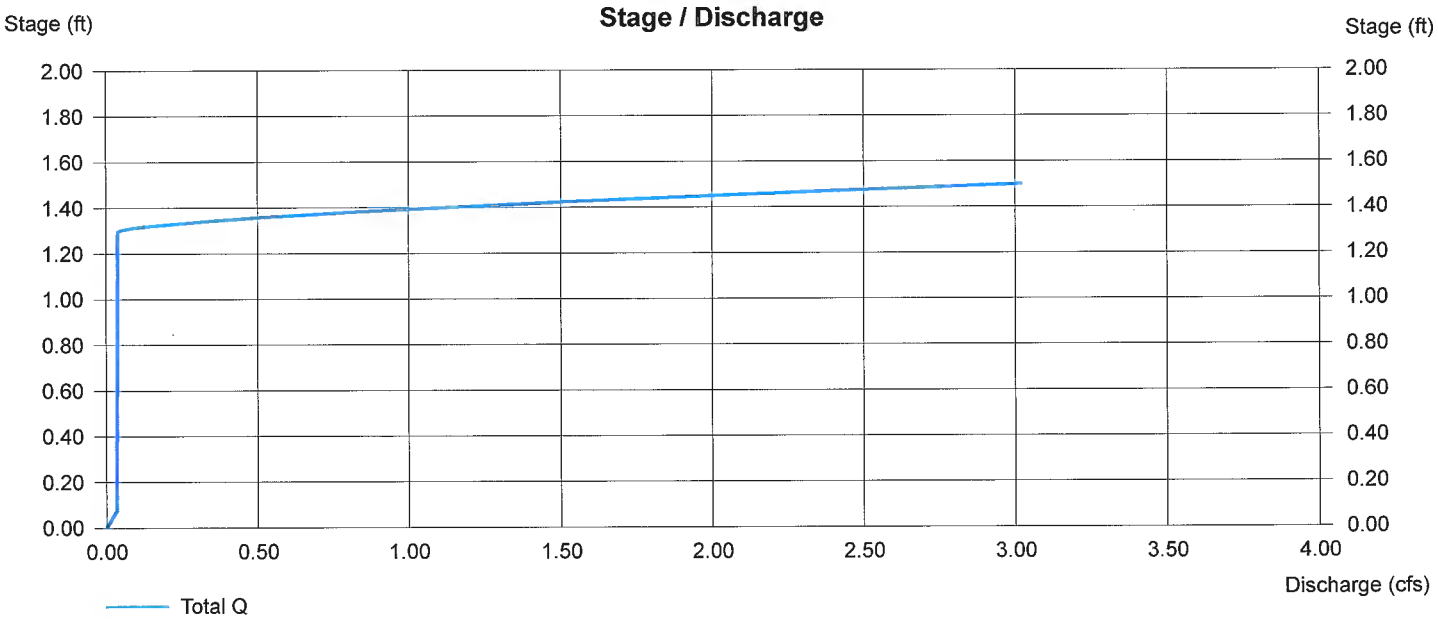
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 137.30	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 = 1.020 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

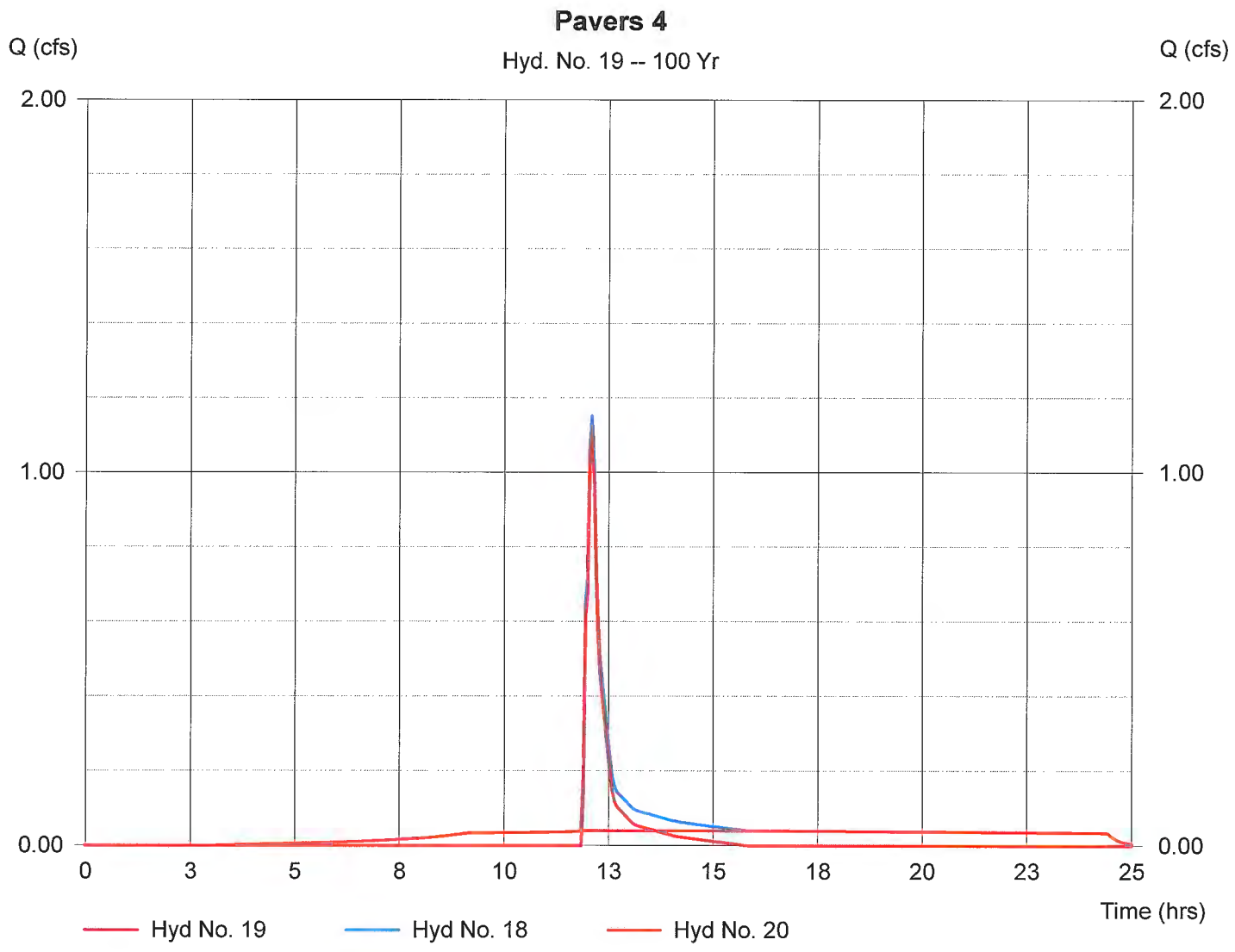
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 19

Pavers 4

Hydrograph type	=	Diversion1	Peak discharge	=	0.04 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Inflow hydrograph	=	18	2nd diverted hyd.	=	20
Diversion method	=	Pond - Pavers 4	Pond structure	=	Exfiltration

Hydrograph Volume = 2,360 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

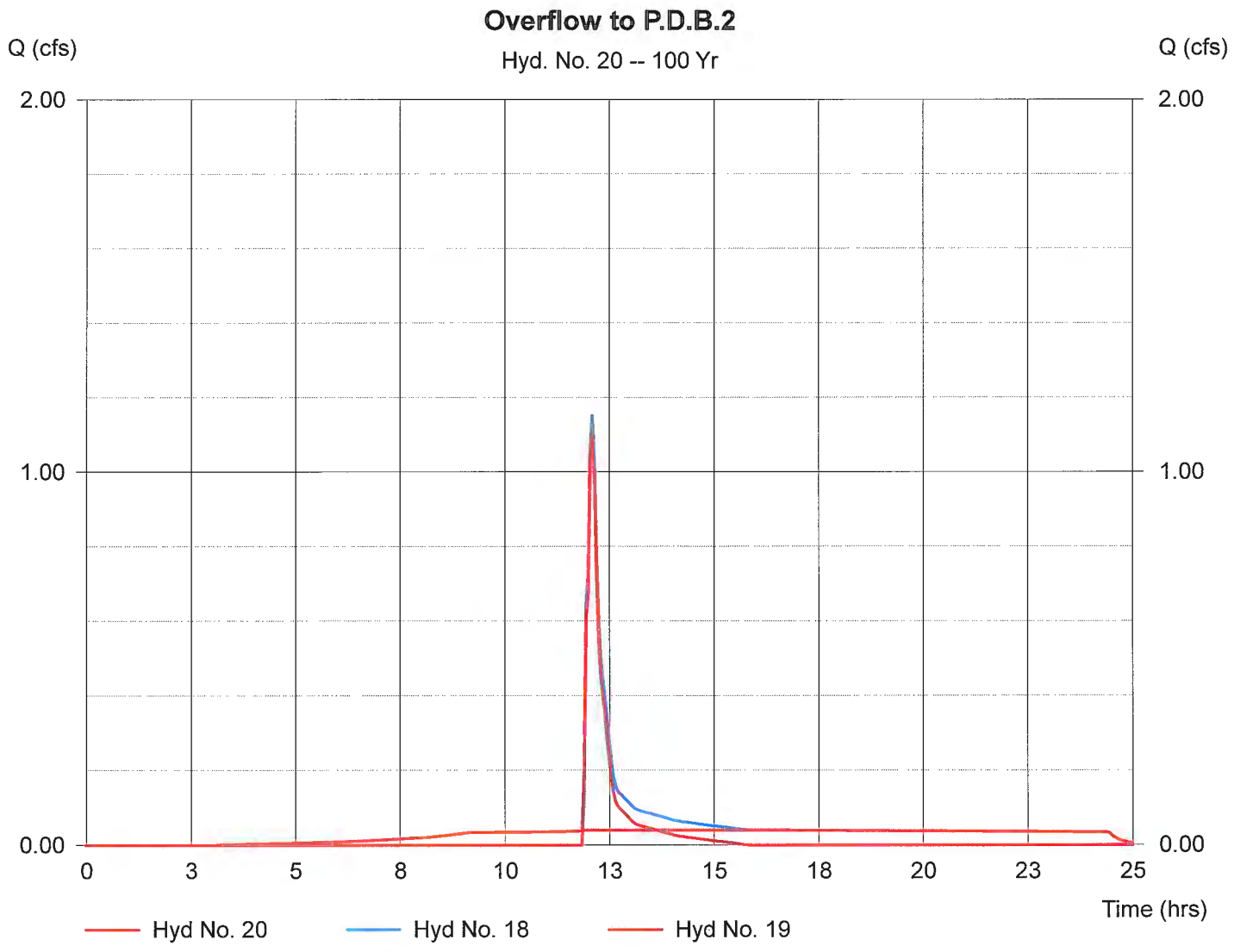
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 20

Overflow to P.D.B.2

Hydrograph type	=	Diversion2	Peak discharge	=	1.11 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Inflow hydrograph	=	18	2nd diverted hyd.	=	19
Diversion method	=	Pond - Pavers 4	Pond structure	=	Exfiltration

Hydrograph Volume = 1,802 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

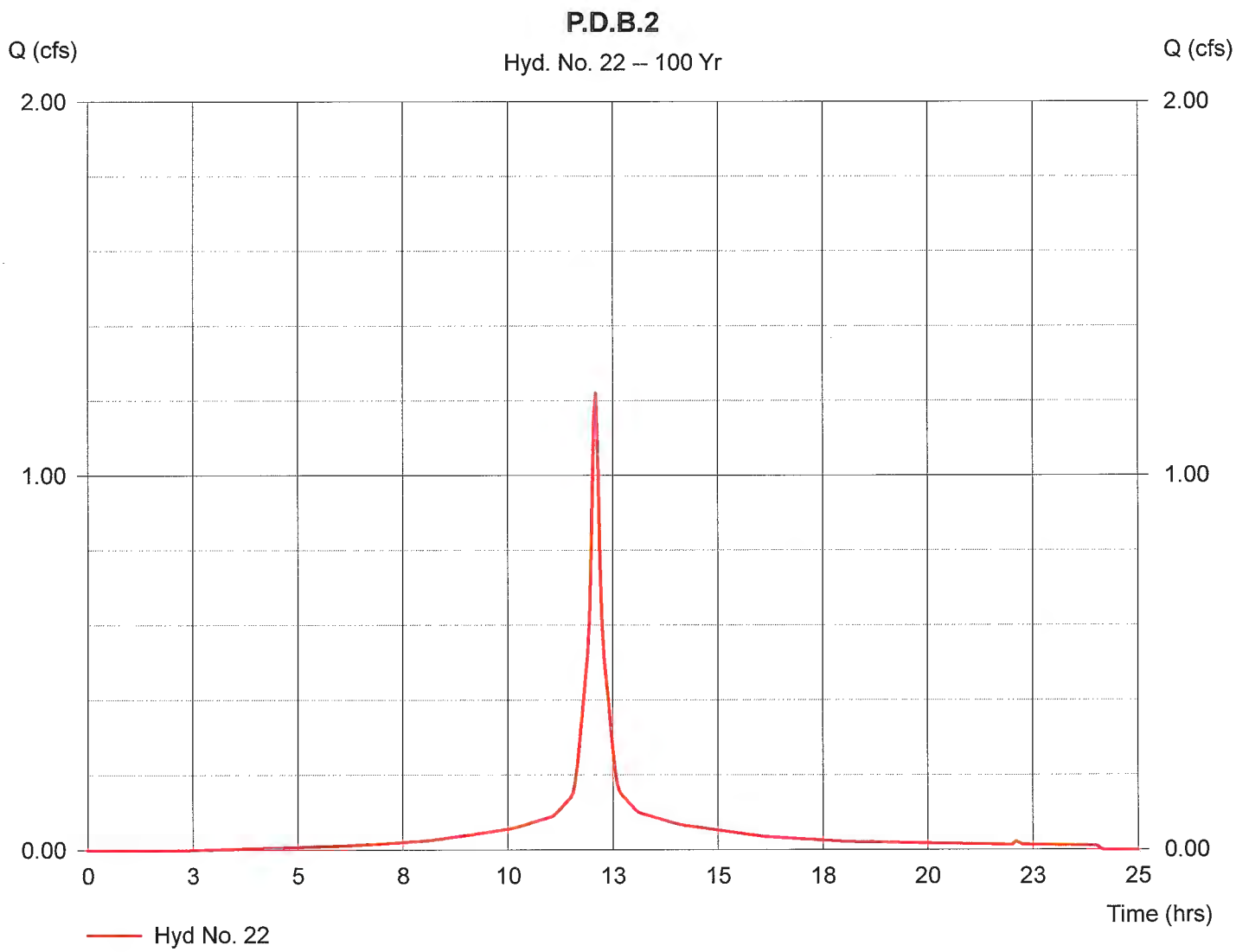
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 22

P.D.B.2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.22 cfs
Storm frequency	= 100 yrs	Time interval	= 3 min
Drainage area	= 0.22 ac	Curve number	= 93
Basin Slope	= 0.6 %	Hydraulic length	= 84 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 6.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,438 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

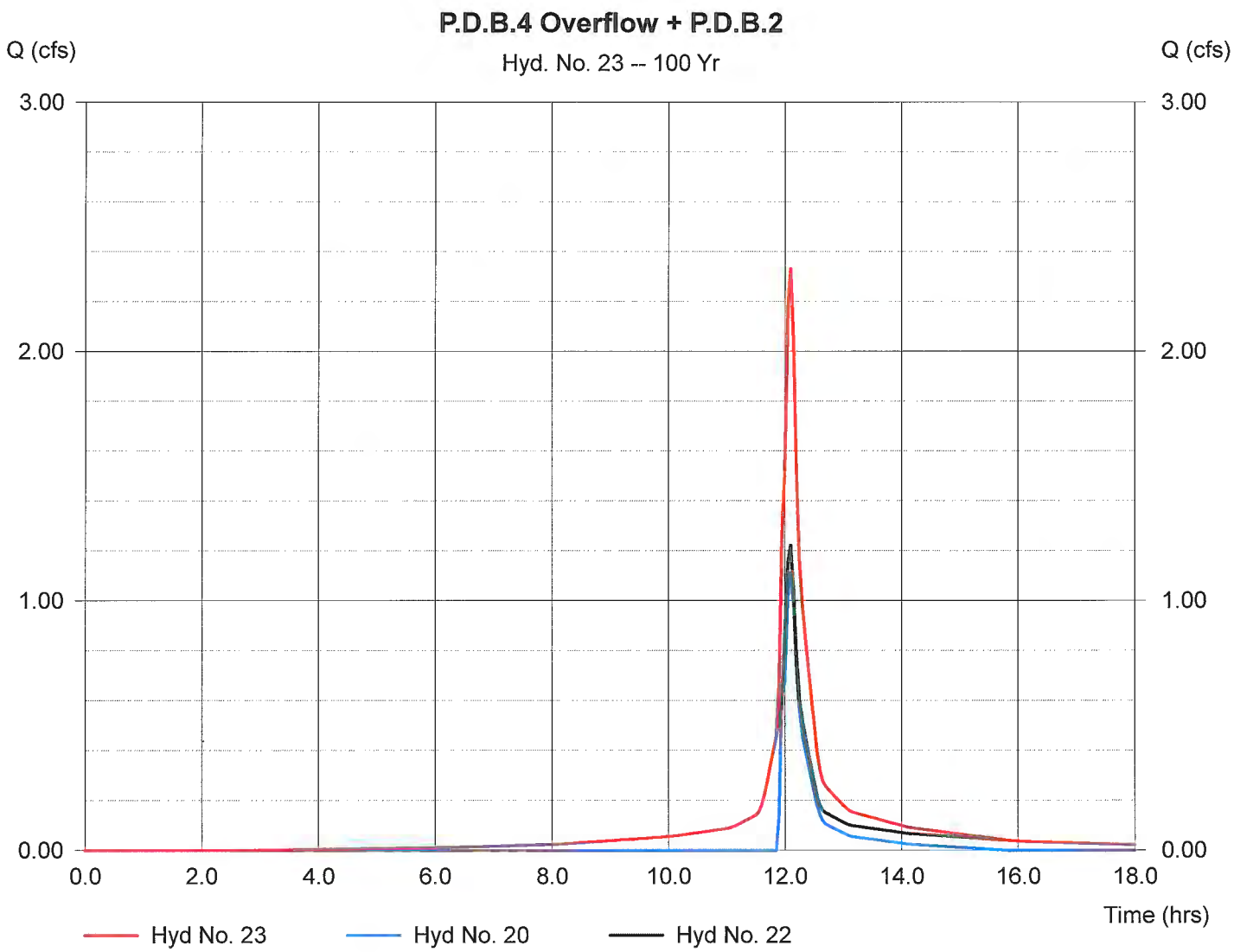
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 23

P.D.B.4 Overflow + P.D.B.2

Hydrograph type	= Combine	Peak discharge	= 2.33 cfs
Storm frequency	= 100 yrs	Time interval	= 3 min
Inflow hyds.	= 20, 22		

Hydrograph Volume = 6,240 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Friday, Sep 26 2014, 9:3 AM

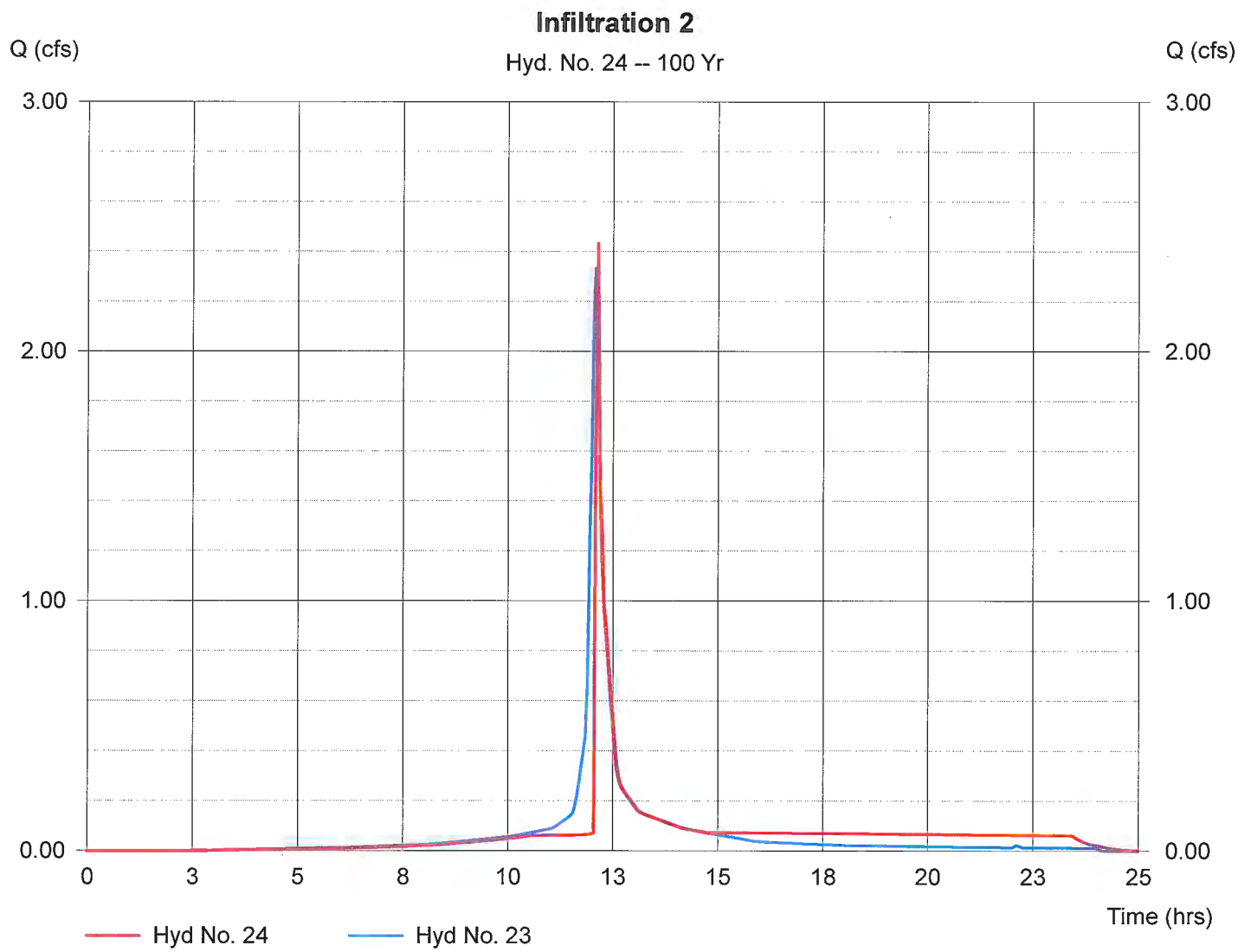
Hyd. No. 24

Infiltration 2

Hydrograph type	=	Reservoir	Peak discharge	=	2.43 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Inflow hyd. No.	=	23	Max. Elevation	=	137.78 ft
Reservoir name	=	Pavers 2	Max. Storage	=	1,545 cuft

Storage Indication method used.

Hydrograph Volume = 6,239 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve — Friday, Sep 26 2014, 9:3 AM

Pond No. 3 - Pavers 2

Pond Data

Bottom LxW = 119.5 x 22.0 ft Side slope = 0.0:1 Bottom elev. = 136.00 ft Depth = 2.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	136.00	2,629	0	0
0.10	136.10	2,629	87	87
0.20	136.20	2,629	87	174
0.30	136.30	2,629	87	260
0.40	136.40	2,629	87	347
0.50	136.50	2,629	87	434
0.60	136.60	2,629	87	521
0.70	136.70	2,629	87	607
0.80	136.80	2,629	87	694
0.90	136.90	2,629	87	781
1.00	137.00	2,629	87	868
1.10	137.10	2,629	87	954
1.20	137.20	2,629	87	1,041
1.30	137.30	2,629	87	1,128
1.40	137.40	2,629	87	1,215
1.50	137.50	2,629	87	1,301
1.60	137.60	2,629	87	1,388
1.70	137.70	2,629	87	1,475
1.80	137.80	2,629	87	1,562
1.90	137.90	2,629	87	1,648
2.00	138.00	2,629	87	1,735

(*33.00% voids applied)

Culvert / Orifice Structures

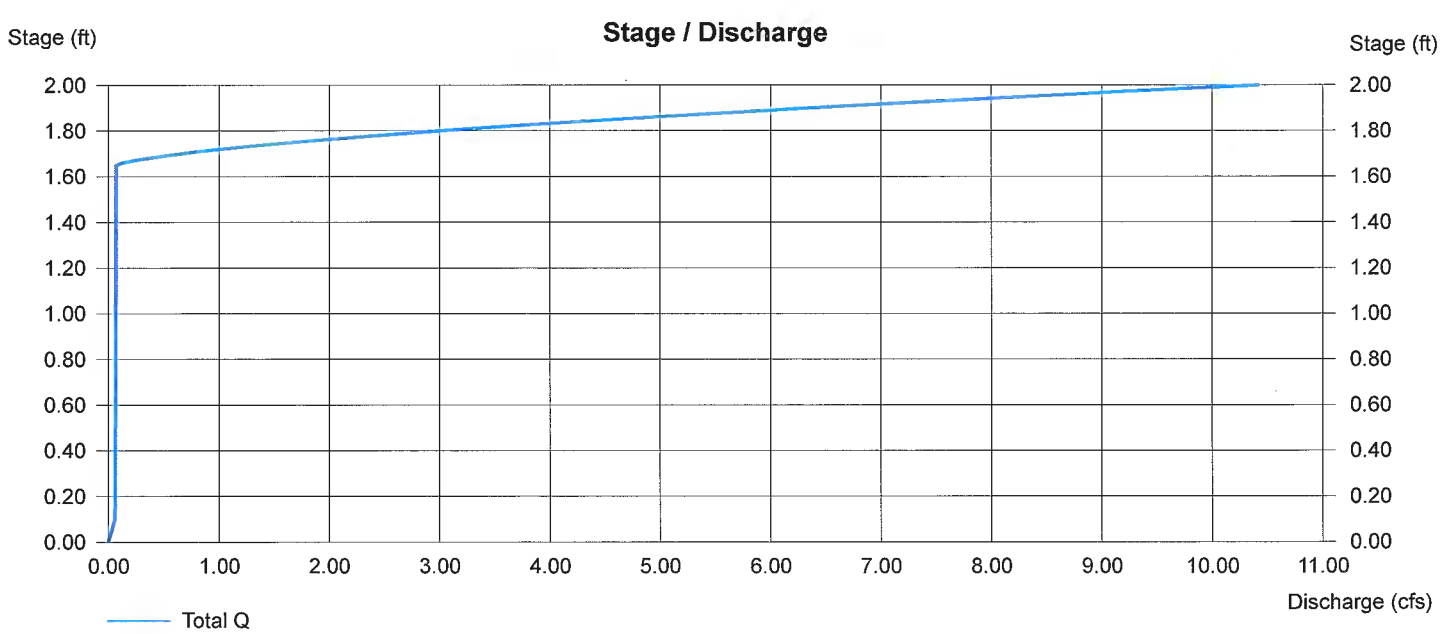
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 137.65	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 = 1.020 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

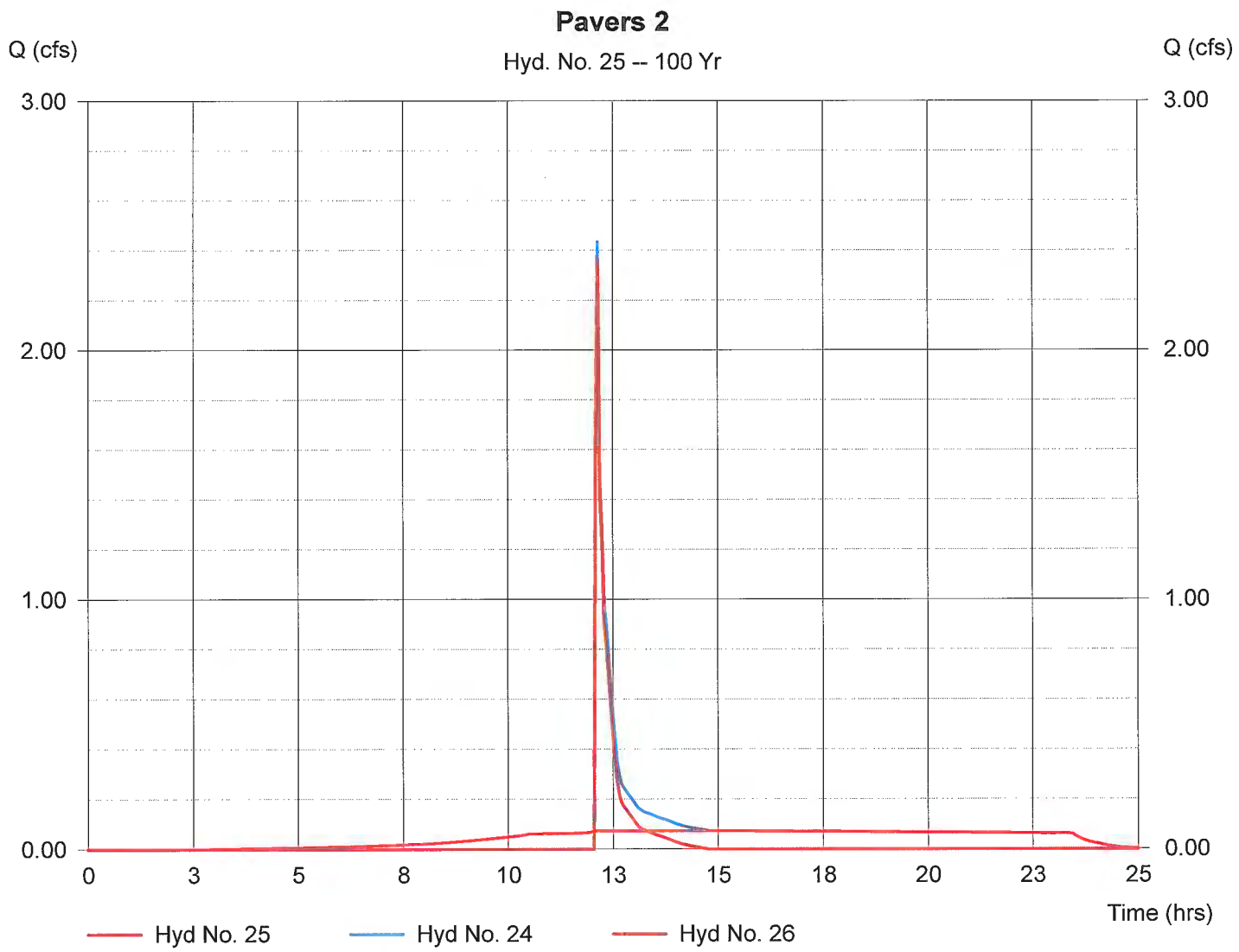
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 25

Pavers 2

Hydrograph type	=	Diversion1	Peak discharge	=	0.07 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Inflow hydrograph	=	24	2nd diverted hyd.	=	26
Diversion method	=	Pond - Pavers 2	Pond structure	=	Exfiltration

Hydrograph Volume = 3,839 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

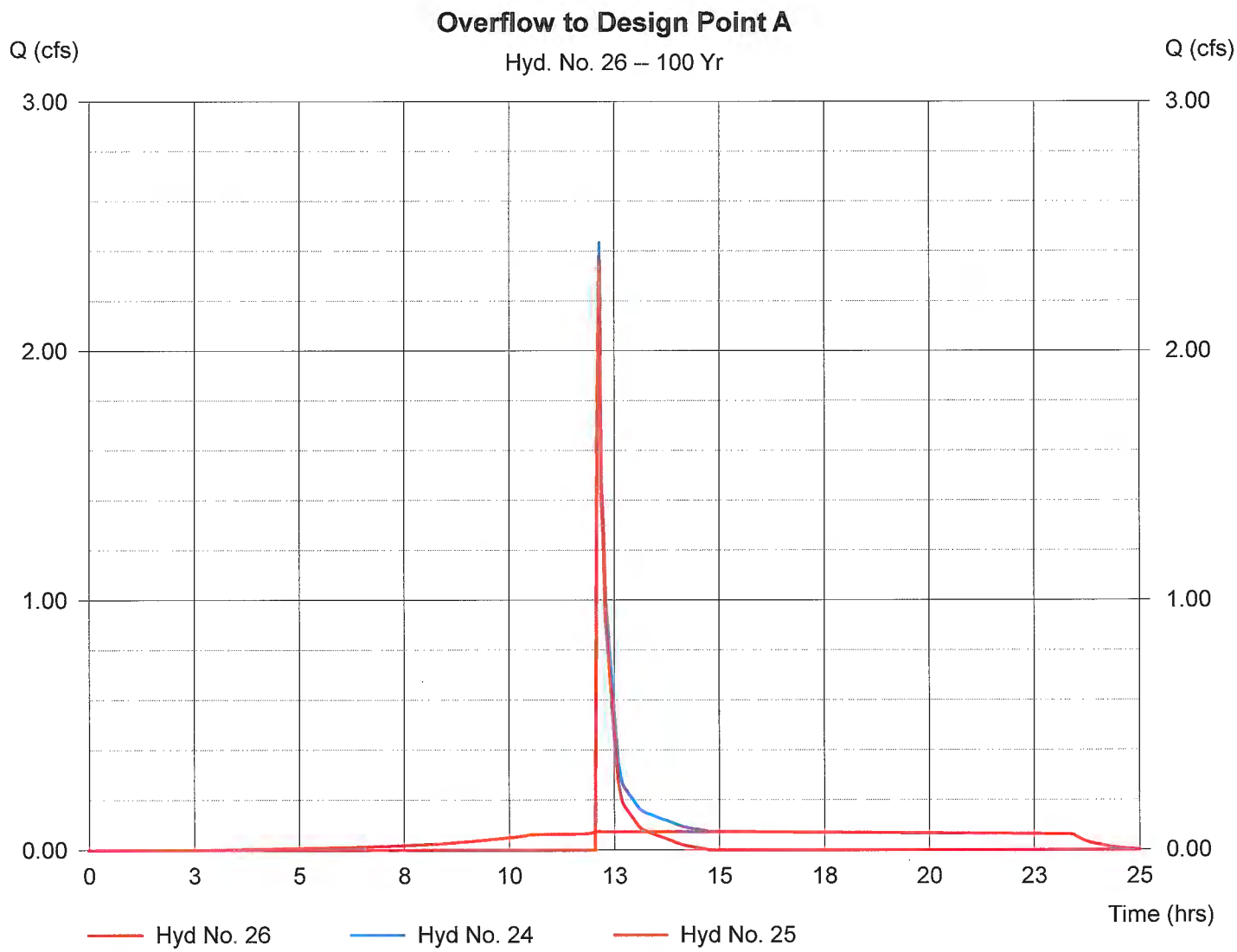
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 26

Overflow to Design Point A

Hydrograph type	=	Diversion2	Peak discharge	=	2.36 cfs
Storm frequency	=	100 yrs	Time interval	=	3 min
Inflow hydrograph	=	24	2nd diverted hyd.	=	25
Diversion method	=	Pond - Pavers 2	Pond structure	=	Exfiltration

Hydrograph Volume = 2,399 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

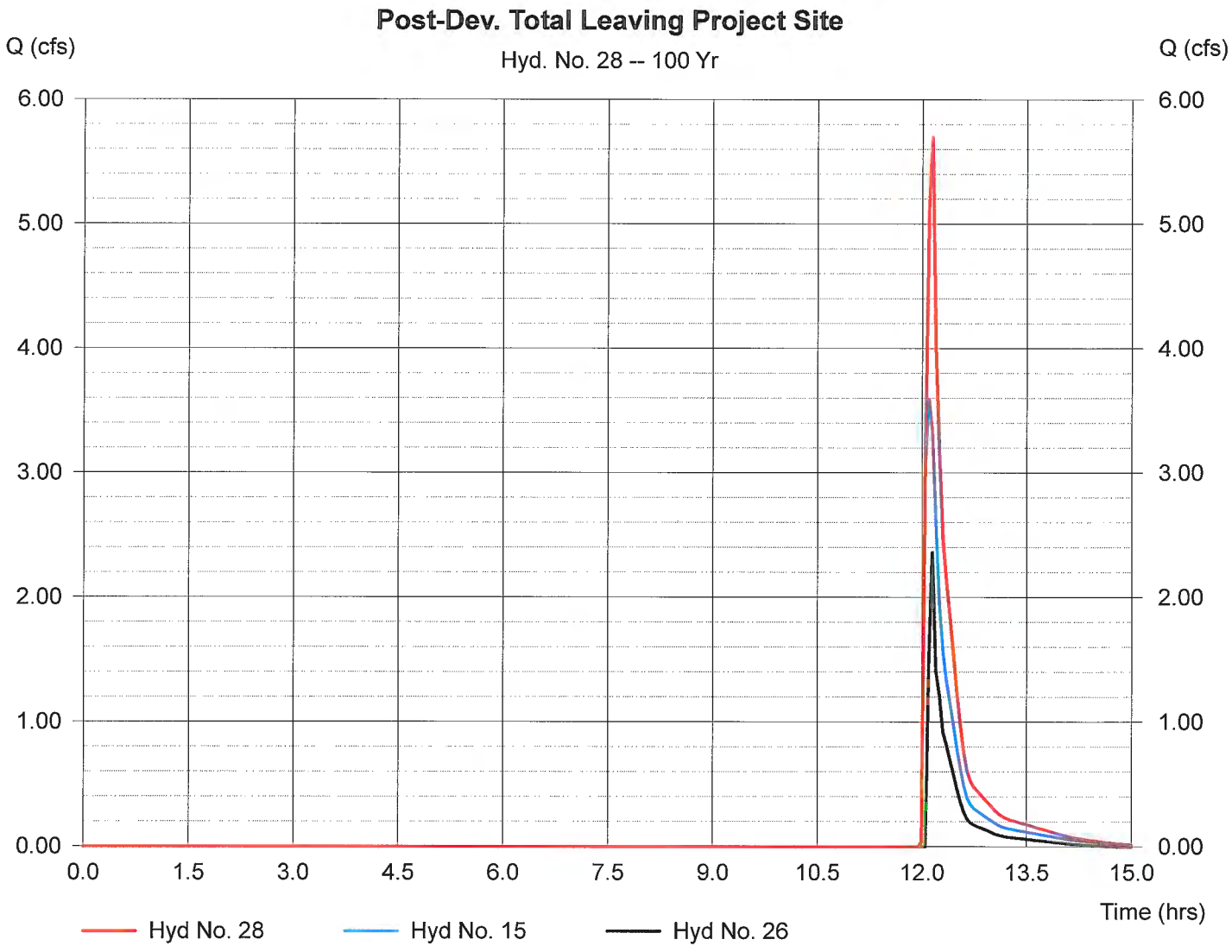
Friday, Sep 26 2014, 9:3 AM

Hyd. No. 28

Post-Dev. Total Leaving Project Site

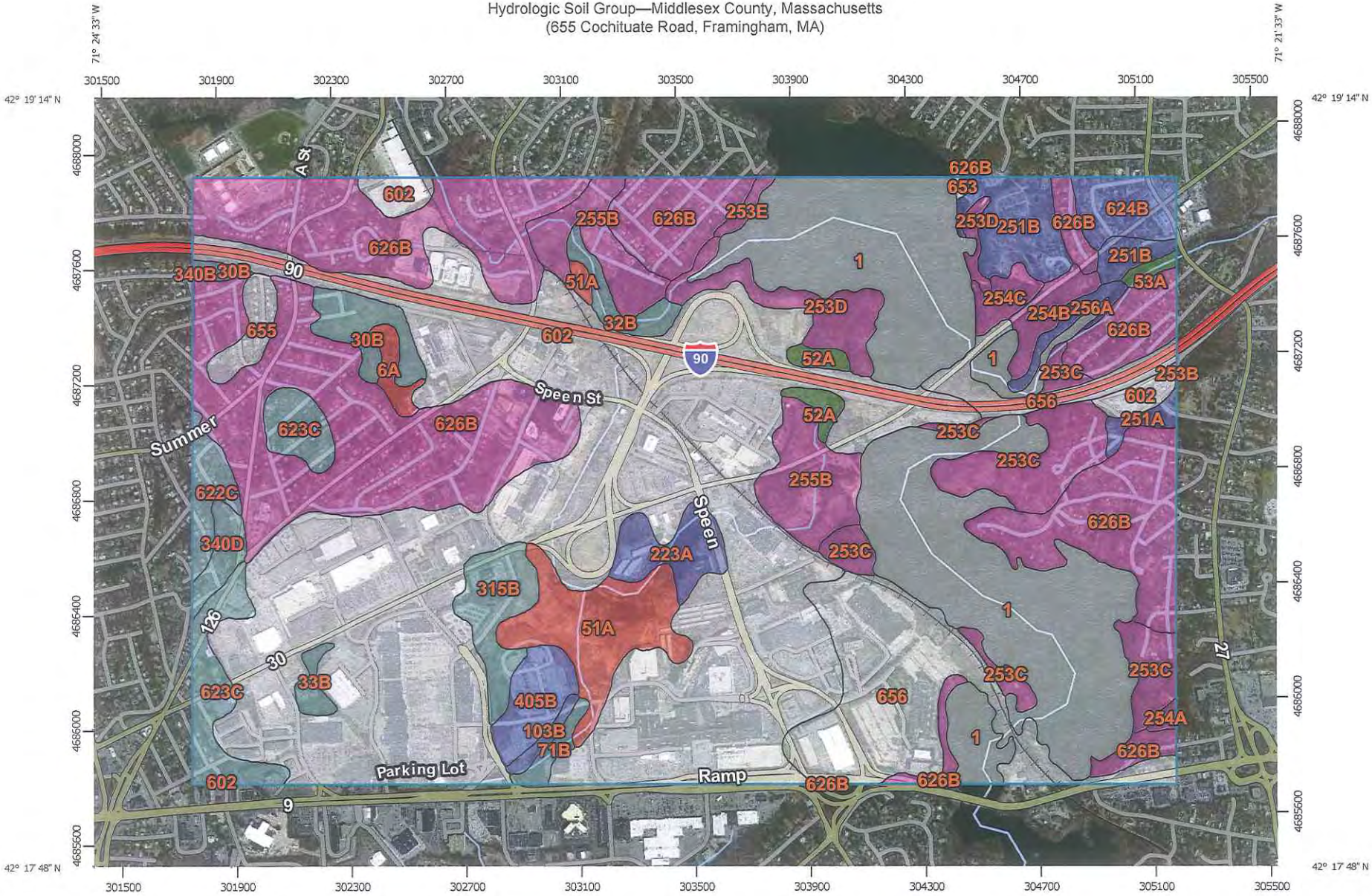
Hydrograph type	= Combine	Peak discharge	= 5.70 cfs
Storm frequency	= 100 yrs	Time interval	= 3 min
Inflow hyds.	= 15, 26		

Hydrograph Volume = 7,261 cuft



Appendix B:
NRCS Soil Survey Data

Hydrologic Soil Group—Middlesex County, Massachusetts
(655 Cochituate Road, Framingham, MA)



Map Scale: 1:18,800 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 250 500 1000 1500

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- 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

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

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 13, Dec 17, 2013

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

Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

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		263.7	14.7%
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	D	6.1	0.3%
30B	Raynham silt loam, 0 to 5 percent slopes	C	19.1	1.1%
32B	Wareham loamy fine sand, 0 to 5 percent slopes	C	10.0	0.6%
33B	Raypol silt loam, 0 to 5 percent slopes	C	4.7	0.3%
51A	Swansea muck, 0 to 1 percent slopes	D	46.4	2.6%
52A	Freetown muck, 0 to 1 percent slopes	A/D	7.7	0.4%
53A	Freetown muck, ponded, 0 to 1 percent slopes MLRA 144A	A/D	2.7	0.2%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	C	5.5	0.3%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	B	3.5	0.2%
223A	Scio very fine sandy loam, 0 to 3 percent slopes	B	18.8	1.1%
251A	Haven silt loam, 0 to 3 percent slopes	B	5.0	0.3%
251B	Haven silt loam, 3 to 8 percent slopes	B	32.0	1.8%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	0.1	0.0%
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	58.0	3.2%
253D	Hinckley loamy sand, 15 to 25 percent slopes	A	26.7	1.5%
253E	Hinckley loamy sand, 25 to 35 percent slopes	A	3.0	0.2%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	1.8	0.1%

Hydrologic Soil Group— Summary by Map Unit — Middlesex County, Massachusetts (MA017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	11.2	0.6%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	A	8.1	0.4%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	53.2	3.0%
256A	Deerfield loamy sand, 0 to 3 percent slopes	B	6.5	0.4%
315B	Scituate fine sandy loam, 3 to 8 percent slopes	C	23.1	1.3%
340B	Broadbrook very fine sandy loam, 3 to 8 percent slopes	C	0.0	0.0%
340D	Broadbrook very fine sandy loam, 8 to 25 percent slopes	C	9.0	0.5%
405B	Charlton fine sandy loam, 3 to 8 percent slopes	B	17.7	1.0%
602	Urban land		597.5	33.3%
622C	Paxton-Urban land complex, 3 to 15 percent slopes	C	12.6	0.7%
623C	Woodbridge-Urban land complex, 3 to 15 percent slopes	C	37.0	2.1%
624B	Haven-Urban land complex, 0 to 8 percent slopes	B	19.0	1.1%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	360.4	20.1%
653	Udorthents, sandy		0.8	0.0%
655	Udorthents, wet substratum		10.4	0.6%
656	Udorthents-Urban land complex		112.6	6.3%
Totals for Area of Interest			**1,794.1**	**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

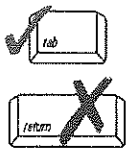
CHAPTER 2: CHECKLIST FOR STORMWATER REPORT

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

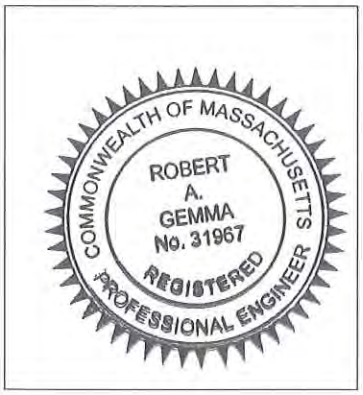
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



9/25/14

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☒ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Permeable Pavers Parking Areas

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☐ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☒ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☒ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☐ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

CHAPTER 3: LID MEASURES

Chapter 3:

The proposed redevelopment project will be utilizing various low impact development (LID) approaches to minimize environmental impacts and these LID measures include stormwater management aspects of the project. Stormwater from the project will be managed by two primary techniques:

1. Treatment of stormwater runoff using current design best management practices.
2. Stormwater will be managed by the extensive use of infiltration measures

LID measures:

Design of the project has utilized Low Impact Development (LID) techniques to the maximum extent practicable. The following LID approach have been employed in the design of this project:

Permeable Pavers

Portions of the proposed parking will be constructed using Eco-Stone permeable pavers. All runoff from the proposed bituminous concrete pavement driveway, parking area, roof surfaces and landscaped areas will be collected and infiltrated through the permeable pavers and recharged into the ground. The system will have an overall reduction of the peak flow and volume for all major storm events.

CHAPTER 4: STORMWATER MANAGEMENT STANDARDS 1 & 2

Chapter 4:

Standard 1: No New Untreated Discharges

- No New Untreated Discharges will occur in the post-development condition.
- All discharges off site will be treated using both structural and non-structural Best Management Practices (i.e. permeable pavers) to remove TSS and other pollutants.
- All runoff from proposed impervious areas will be collected and recharged using permeable pavers, thereby decreasing discharge to resource areas from pre-development conditions.
- Supporting calculations specified in Volume 3 are attached with the Hydrologic Analysis, Chapter 1.

Standard 2: Peak Rate Attenuation

- The Hydrologic Analysis provided in Chapter 1 demonstrates that no off-site flooding will be increased in the post-development state during the 100-year 24-hour storm.
- The Hydrologic Analysis provided in Chapter 1, Tables One through Four, demonstrate that the peak runoff rates will be reduced in the post development state during the 100-year 24 hour storm event. The table shown below shows that peak runoff rates in the post-development condition will be significantly reduced in comparison to the pre-development condition for runoff leaving the project site for all storm events.

Table One: Comparison of Pre and Post Development Peak Runoff Rates Leaving the Project Site

Drainage Basin	2-year storm	10-year storm	25-year storm	100-year storm
Total Pre-Development	2.93 CFS	4.28 CFS	5.14 CFS	6.28 CFS
Total Post-Development	0 CFS	1.32 CFS	3.23 CFS	5.70 CFS
Difference	-2.93 CFS	-2.96 CFS	-1.91 CFS	-0.58 CFS

CHAPTER 5: STORMWATER MANAGEMENT STANDARD 3

Chapter 5:

Standard 3: Recharge

Re-development of the project will **reduce** the impervious area from 45,822 square feet to 36,441 square feet. Therefore, no recharge volume is required. The project will, however, provide 4,828 cubic feet of recharge volume.

- The sizing of the infiltration BMP's is based on a "Static Method."
- Runoff from the proposed parking and roof surfaces on the site are being discharged into the permeable pavers BMP.
- The recharge BMP's have been sized to infiltrate the required Recharge Volume:

Infiltration Systems

Proposed Permeable Pavers 1 (along east of property)

Basic geometry: Prop. Impervious Area = 8,960 square foot (s.f.)
System type: Ideal Concrete Block Eco-Stone
Infiltrate 100-Year Storm 6.7" runoff (0.56-feet) per s.f.
Permeable Pavers requirement= 1 s.f. per 4 s.f. impervious area
Permeable Pavers required = 8,960 s.f./4 s.f. = 2,240 s.f.
Permeable Pavers provided = 5,724 s.f.

Proposed Permeable Pavers 2 (south of prop. two-story retail building)

Basic geometry: Prop. Impervious Area = 6,010 square foot (s.f.)
System type: Ideal Concrete Block Eco-Stone
Infiltrate 100-Year Storm 6.7" runoff (0.56-feet) per s.f.
Permeable Pavers requirement= 1 s.f. per 4 s.f. impervious area
Permeable Pavers required = 6,010 s.f./4 s.f. = 1,505 s.f.
Permeable Pavers provided = 2,592 s.f.

Proposed Permeable Pavers 3 (north of prop. two-story retail building)

Basic geometry: Prop. Impervious Area = 4,770 square foot (s.f.)
System type: Ideal Concrete Block Eco-Stone
Infiltrate 100-Year Storm 6.7" runoff (0.56-feet) per s.f.
Permeable Pavers requirement= 1 s.f. per 4 s.f. impervious area
Permeable Pavers required = 4,770 s.f./4 s.f. = 1,195 s.f.
Permeable Pavers provided = 1,370 s.f.

- A more detailed analysis of the storage and infiltration capacities for both infiltration systems can be found in the Hydrologic Analysis, Chapter

CHAPTER 6: LONG-TERM POLLUTION PREVENTION PLAN
STORMWATER MANAGEMENT STANDARDS 4-6

Chapter 6:

Long Term Pollution Prevention Plan:

- The Stormwater Pollution Prevention Plan from Chapter 8 and the Operation and Maintenance Plan from Chapter 10 address all necessary aspects of the Long Term Pollution Prevention Plan

Standard 4: Water Quality

- Stormwater Runoff to be treated for Water Quality is based on 0.5-inch of runoff due to the post-development condition of exfiltrating soils with an infiltration rate of 1.02-inches per hour.
    - Requirement for Entire Site
      Amount of Runoff to be treated = (0.5 inch) x (impervious area)
      = (0.5 inch)/(1/12) x (36,441 square feet)
      = **1,518 cubic feet**
- TSS Removal data for sub basins 1 through 4 are attached hereafter. A weighted post-development TSS Removal was determined to be **82.0%**.

Standard 5: Land Use with Higher Potential Pollutant Loads

- There are no land uses with higher potential pollutant loads applicable to this project.

Standard 6: Critical Areas

- The project does not affect a critical area as defined by the MADEP Stormwater Handbook.

655 Cochituate Road, Framingham MA

Stormwater Management Calculations, TSS Removal 9/22/2014

Treatment Basin 1

BMP List	Removal Rate (%)	TSS Removed (%)	TSS Remaining (%)	Basin Area (Ac)	Basin Area x TSS Removal
Street Sweeping	10	10.0	90.0	0.334	27.388
Permeable Pavers	80	72.0	18.0		
	Total Basin 1 TSS Removal		82.0		

Treatment Basin 2

BMP List	Removal Rate (%)	TSS Removed (%)	TSS Remaining (%)	Basin Area (Ac)	Basin Area x TSS Removal
Street Sweeping	10	10.0	90.0	0.222	18.20
Permeable Pavers	80	72.0	18.0		
	Total Basin 2 TSS Removal		82.0		

Treatment Basin 3

BMP List	Removal Rate (%)	TSS Removed (%)	TSS Remaining (%)	Basin Area (Ac)	Basin Area x TSS Removal
Street Sweeping	10	10.0	90.0	0.341	27.96
Permeable Pavers	80	72.0	18.0		
	Total Basin 2 TSS Removal		82.0		

Treatment Basin 4

BMP List	Removal Rate (%)	TSS Removed (%)	TSS Remaining (%)	Basin Area (Ac)	Basin Area x TSS Removal
Street Sweeping	10	10.0	90.0	0.212	17.38
Permeable Pavers	80	72.0	18.0		
	Total Basin 2 TSS Removal		82.0		

			Totals	1.11	
					90.94
		Weighted TSS Removal (%)		82.0	

BASIN 1 (0.334 ACRES)

BASIN 2 (0.222 ACRES)

BASIN 3 (0.341 ACRES)

BASIN 4 (0.212 ACRES)

COCHITUATE ROAD (ROUTE 30) (PUBLIC - VARIABLE WIDTH) (1955 MASSACHUSETTS TURNPIKE LAYOUT)

WETLAND BOUNDARY

30' NO ALTERATION ZONE

100' BUFFER ZONE

125' BUFFER ZONE

1 STORY METAL

2 STORY

N/F DOMINIQUE RENEE REALTY TRUST 32372/440

PERMEABLE PAVERS

BIT CONC

POST & RAIL FENCE

GRAVEL

LANDSCAPE

LAWN

CB R=138.70

CB R=138.19 I=134.7

DMH R=138.25 I=133.1 I=133.1

CB R=138.17

CB R=139.83 I=137.2

TMH R=137.69

HYD

SIGN

CONC FLOOR ELEV=137.10

S 36°5'30" W

S 21°08'00" E

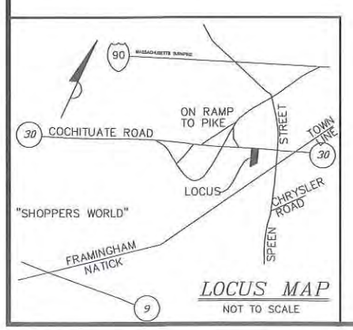
N 73°14'46" E

334.93'

151.54'

LEGEND

	BERM		NUMBER OF PARKING SPACES
BIT. CONC.	BITUMINOUS CONCRETE		OBSERVATION WELL
	CURB		OVERHEAD WIRES
	DEEP TEST HOLE		PAVEMENT EDGE
	DRAIN CATCH BASIN		PERC TEST
—D—	DRAIN LINE	—S—	SEWER LINE
	DRAIN MANHOLE		SIGN
—E—	ELECTRIC LINE		SEWER MANHOLE
TBM III	ELEVATION BENCHMARK		TELEPHONE MANHOLE
—144—	EXISTING CONTOUR	—T—	TELEPHONE LINE
152x4	EXISTING SPOT GRADE		TREE LINE
	FENCE		UTILITY MANHOLE
—G—	GAS LINE		UTILITY POLE
	GAS GATE		WATER GATE
	HANDICAP PARKING SPACE	—W—	WATER LINE
	HYDRANT	V.G.C.	VERTICAL GRANITE CURB
	LIGHTPOST	S.G.C.	SLOPED GRANITE CURB



LOCUS MAP

NOT TO SCALE

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

GRAPHIC SCALE
1 inch = 20 ft.

(FEET) (METERS)

STANDARD 4: TSS REMOVAL

#655 COCHITUATE ROAD IN FRAMINGHAM, MASS

PREPARED FOR:
PAUL FINGER ASSOCIATES
14 SPRING STREET
WALTHAM, MA 02451-4429

PROPERTY OF:
CLAIRMONT REALTY LLC
225 PROSPECT STREET
BELMONT, MA 02478

ENGINEERS & SURVEYORS:
MWE
METROWEST ENGINEERING, INC.
75 FRANKLIN STREET
FRAMINGHAM, MA 01702
TEL.: (508)626-0063
FAX: (508)875-6440

SHEET 1 OF 1		DATE: SEPTEMBER 22, 2014
CALC'D BY: PLS	FIELD BK:	CAD FILE: TSS_REMOVAL.dwg
DRAFTER: MAA	PROJECT: FRM_COCH3	DWG FILE: SK092214.dwg

CHAPTER 7: CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN (SWPPP)

STORM WATER POLLUTION PREVENTION PLAN

for

655 Cochituate Road
Framingham, MA 01702

Prepared for: **Paul Finger Associates**
14 Spring Street
Waltham, MA 02451-4429

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

September, 2014

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Emergency Contact Sheet

A. Project Name and Location

Name:	Cochituate Road Re-development
Street:	655 Cochituate Road, Framingham, MA
Landmark:	Locus has frontage along Cochituate Road
Latitude:	42° - 18' - 26" N
Longitude:	71° -'23' - 07" W

B. Project Owner

Clairmont Realty LLC
225 Prospect Street
Belmont, MA 02478

C. Project Engineer

MetroWest Engineering, Inc.
75 Franklin Street
Framingham, MA 01702
(508)-626-0063
Attn: Robert A. Gemma

D. Environmental Consultant

MetroWest Engineering, Inc.
75 Franklin Street
Framingham, MA 01702
(508)-626-0063
Attn: Robert A. Gemma

E. General Contractor

T.B.D

F. CERTIFICATION OF STORMWATER POLLUTION PREVENTION PLAN

Project: 655 Cochituate Road, Framingham, MA

This certification must be completed by an authorized signatory of each operator (generally the owner and the General Contractor) before the effective date of the Plan.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____

Name: _____

Title: Owner

Company: _____

Address: _____

Telephone: _____

Date: _____

G. CONTRACTOR/SUB-CONTRACTOR CERTIFICATION

Project: 655 Cochituate Road, Framingham, MA

This Certification is to be completed by the General Contractor and each Sub-Contractor involved in any on-site activities related to the construction.

I certify under penalty of law that I understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the stormwater discharges associated with industrial activity from the construction site identified as part of this certification.

Signed: _____

Name: _____

Title: _____

Company: _____

Address: _____

Telephone: _____

Date: _____

H. SUB-CONTRACTOR NAMES AND ADDRESSES

The following list includes all subcontractors working on the project site at any time. The general contractor and all subcontractors must sign the certification included in Section G., page 3.

Subcontractor:_____

Subcontractor:_____

Subcontractor:_____

Subcontractor:_____

Subcontractor:_____

I. Project Description

The project site is located on the southerly side of Cochituate Road (Route 30) approximately five-hundred and thirty feet west of the intersection of Speen Street at Cochituate Road and south of Interstate 90 (Massachusetts Turnpike).

The subject parcel has an area of approximately 48,350 square feet (1.11 acres) and is presently improved with a one-story building occupied by Central Pools, a single story building occupied by North End Treats, a vacant two-story warehouse, bituminous concrete pavement and supporting utilities. The lot is mostly covered by impervious surfaces. The site is relatively flat with a slight slope downhill from north to south.

The site redevelopment program includes demolition of the existing one-story building, presently occupied by Central Pools, and the one-story building occupied by North End Treats, construction of a new two-story retail building using the existing foundation of the building presently occupied by Central Pools, pervious pavers, bituminous concrete pavement, supporting utilities and landscaping.

The property presently has 45,822 square feet of impervious area. Redevelopment of the property will reduce the impervious area by of 9,381 square feet, for a total of 36,441 square feet. The permeable pavers are located within the footprint of the proposed parking areas and will store and infiltrate runoff from the parking areas, roof surfaces, and surrounding areas.

Complete sets of site development plans are included as an attachment to this SWPPP.

J. Total Site Area and Disturbed Area

Total site area is 1.11 acres.
Existing impervious area is approximately 1.05 acres.
Proposed impervious area is approximately 0.84 acres.
Total developed area is approximately 1.11 acres.

K. Surrounding Developments

The project is surrounded by commercial properties.

L. Soil Description

According to the NRCS Soil survey, soils on and around the site belong to the Urban Land soil series. These soils are not classified within a hydrologic soil group due to the high level of development in the area and disturbance to natural soils. The hydrologic soil group 'C' was used based on the surrounding soils (Scion soil (223A) Group B and Swansea muck (51A) Group D).

M. Runoff Coefficient

Existing soils varying permeability rates therefore runoff will be generated from major storm events. The pre-development runoff coefficient for the site is 0.89 and the post-development runoff coefficient will be 0.84.

N. Site Map and Plans

Complete project site plans are attached to this SWPPP.

O. Receiving Water

No direct discharge will occur into any near body of water.

P. Extent of Wetlands

Two bordering vegetated wetland areas are located just off the locus to the west and south of the property.

Q. Sequence of Major Activities

1. The project is scheduled to begin in April 2015.
2. The existing buildings will be demolished in April 2015.
3. The proposed building construction will begin in May 2015.
4. The site grading will be completed in July 2015.
5. All construction will be complete by October 2015.

R. Construction Sequence

1. Erosion Control

An erosion control barrier consisting of filter mitt mulch tubes will be placed at the limit of work around the entire parcel as needed and in any sensitive areas.

2. Site Access

Site access, for construction equipment, will be made from Cochituate Road. An erosion control barrier at the entrance along Cochituate Road shall be removed at the start of each workday and replaced at the end of each workday. The erosion control barriers will be in place during periods of inclement weather when so directed by the Environmental Consultant. The barriers will remain in place during all non-work periods until the site has been deemed to be stable by the Environmental Consultant.

3. **Construction Staging**

   A construction staging area will be established on the site east of existing building, presently occupied by Central Pools. All construction materials, supplies, trailers and offices, portable toilets, and equipment shall be stored within the limits of the staging area. Silt fence or other erosion control measures shall demarcate the limits of the staging area.

4. **Site Work**

   Site work, including excavation and grading of the building site, excavation for drainage systems, as well as other utilities may commence only when the site is stable from erosion and all required control measures are in place and functional. Site work during wet periods should be avoided if possible and limited to only those areas that will not have adverse impacts on wetland resource areas.

S. Pollution Prevention Measures

1. Before, during and after construction, functional erosion and sedimentation controls shall be implemented to prevent the silting of abutting, and down-gradient properties. Siltation fencing and other controls shall be properly maintained and are not to be removed until so approved by the Environmental Engineer. Other controls shall be added as warranted during construction to protect the environmentally sensitive areas. Sufficient extra materials (e.g. siltation fencing and other control materials) shall be stored on site for emergencies.

2. Casting of excavated materials shall be stored away from any sensitive land areas.

3. Any stockpiling of loose materials shall be properly stabilized to prevent erosion and siltation. Preventive controls such as hay bales or jute covering shall be implemented to prevent such an occurrence.

4. There shall be no flooding, ponding, or flood related damage caused by the project or surface run-off emanating from the project on lands of an abutter, nearby or down-gradient properties.

5. All surface discharge shall meet the water quality standards for the Mass. Division of Water Pollution Control for Class "B" Water.

6. Proper stabilization of embankments and run-off areas (that is, the use of grass, vegetation, shrubbery, and crushed stone) shall be implemented before the project is completed.

7. Finish grades shall be no steeper than a slope of 3 horizontal to 1 vertical (33%).

8. There shall be no contaminant migration caused by the project to nearby and down-gradient properties, nearby aquifers, wetlands and nearby wells.

9. The use of salt and sand on paved surfaces shall be kept to an absolute minimum during the winter months.

10. The applicant shall make sufficient provisions to control any unexpected drainage and erosion conditions that may rise during construction that may create damage on abutting properties and wetland areas. Said control measures are to be implemented at once and the Environmental Engineer shall be notified in writing.

11. During construction flood prevention, erosion, and sedimentation controls shall be in place before the natural ground cover is disturbed. Said controls shall be in place prior to other construction work and shall be monitored and approved by the Environmental Engineer before other work is commenced. They shall be properly maintained and are not to be removed until so approved by the Environmental Engineer.

12. The applicant shall designate a person or persons to inspect and supervise the drainage and erosion controls for the project and the Environmental Engineer shall be notified as to the means to contact said individual or individuals on a 24 hour basis on all working and non-working days of the project. Said means of contact shall include the telephone number of said designated person or persons.

13. There shall be periodic inspection of the fabric fencing and other controls by the applicant's designee to assure their continued effectiveness.

14. The Planning Board and Conservation conditions of approval shall be included as part of the contracts and subcontracts and shall be posted in the supervisory office on-site.

15. Any changes in the construction plans must be submitted in writing in advance for approval by the Engineer.

16. Upon completion of this project, the project engineer shall certify that the work completed conforms to the plans as submitted. Certification must include registered engineers stamp. In addition, an as-built plan shall be submitted to the Planning Board and Conservation Commission for approval prior to the issuance of a Certificate of Compliance.

17. Upon completion of the project, the permanent functional erosion, sedimentation, and flood control measures that are installed according to the presented plans and specifications submitted and revised shall be maintained in perpetuity.

18. Upon completion of the project, the contractor shall clean all deep sump catch basins and the Stormceptor treatment tank to remove all silt and sediment.

T. Other Control Measures

Off-site Vehicle Tracking. A stabilized construction entrance will be provided to help reduce vehicle tracking of sediments. The paved streets adjacent to the site will be swept or scraped weekly to remove

any excess mud, dirt, or rock tracked from the construction area. A source of fresh water for washing sediment from trucks, especially during periods of wet weather, may be provided in order to minimize the amount of street sweeping and scraping required. Any wash water resulting from this operation will be directed into a sediment trap.

Waste Materials. All trash and construction debris from the site will be hauled to an approved landfill. No construction waste material will be buried on the site. All personnel will receive instructions regarding the correct procedure for waste disposal. Notices describing these practices will be posted in the construction office. The site superintendent will be responsible for seeing that these procedures are followed. Employee waste and other loose materials will be collected so as to prevent the release of floatables during runoff events.

Hazardous Waste. No hazardous waste is expected to be generated or encountered in this project. In the event that hazardous waste is encountered, all hazardous waste materials will be disposed of in the manner specified by local or state regulation or by the manufacturer. The site superintendent will be responsible for seeing that these practices are followed.

Sanitary Waste. Portable sanitary units will be provided for use by all workers throughout the life of the project. A licensed sanitary waste management contractor will regularly collect all sanitary waste from the portable units.

U. Maintenance

To maintain the erosion and sediment controls, the following procedures will be performed:

- **Sediment Capture Devices:** Sediment will be removed from the upstream or upslope side of the filter fabric fences, straw bale barriers, siltation ponds, diversion trenches, or other devices, when the depth of accumulated sediment reaches about one-third the height of the structure or device.

- **Storm Sewer Inlets:** Any sediment in the storm sewer inlets will be removed and disposed of properly.

- **Temporary Controls:** All temporary controls will be maintained until final site stabilization and landscaping is complete, and the Environmental Engineer approves removal.

Sediment that is removed from structural barriers; either will be hauled off the site and disposed of properly or will be used as backfill. Sediment temporarily stockpiled on site will be placed in such areas and in such manner as to minimize erosion of sediments back into the local drainage system. Berms, filter fabric fencing, straw bale barriers, and polyethylene or polypropylene covers are measures that may be utilized in minimizing erosion of stockpiled sediment.

V. Inspection Procedures

Inspections will be conducted by the responsible person(s) at least once every 7 calendar days and within 24 hrs after each storm event producing 0.5 inch of rainfall or greater. Areas that have been

reseeded will be inspected regularly after seed germination to ensure complete coverage of exposed areas.

The contractor will designate a qualified person or persons to perform the following inspections:

- **Stabilization Measures:** Disturbed areas and other areas used for storage of materials that are exposed to precipitation will be inspected for evidence of, or the potential for, pollutants entering the drainage system. After a portion of the site is finally stabilized, inspections will be conducted at least once every month throughout the life of the project. Form 1 shows the inspection form to be used for stabilization measures.

- **Structural Controls:** Filter fabric fences, straw bale barriers, and all other erosion and sediment control measures identified in the plan will be inspected regularly for proper positioning, anchoring, and effectiveness in trapping sediments. Sediment will be removed from the upstream or upslope side of the filter fabric. Form 2 shows the inspection form to be used for stabilization measures.

- **Discharge Points:** Discharge points or locations will be inspected to determine whether erosion control measures are effective in preventing significant amounts of pollutants from entering receiving waters.

- **Construction Entrances:** Locations where vehicles enter or exit the site will be inspected for evidence of off-site sediment tracking.

Form 1 - **INSPECTION REPORT FORM FOR STABILIZATION MEASURES**

INSPECTOR: _____ DATE: _____

Days since last rainfall: _____ Amount of Last Rainfall: _____inches

Area	Date last disturbed	Date of next Disturbance	Stabilized?	Stabilized With	Condition

Stabilization Required:

_____
_____
_____
_____
_____
_____
_____
_____

To be performed by:_____ **On or Before:** _____

Form 2 - **INSPECTION FORM FOR STRUCTURAL CONTROLS**

INSPECTOR: _____ DATE: _____

Days since last rainfall: _____ Amount of Last Rainfall: _____inches

Location of Control	In place?	Condition	Sediment Depth	Washed out or overtopped?

Maintenance Required:

_____
_____
_____
_____
_____
_____
_____
_____

To be performed by:_____ **On or Before:** _____

W. Revisions to the SWPPP

Based on the results of the inspection, the site description and control measures of this pollution prevention plan will be revised as appropriate, but in no case later than 7 calendar days following the inspection. Form 3 shows the form to be used to record necessary changes to the SWPPP.

X. Inspection Report Summary

A report summarizing the scope of each inspection, name(s) and qualifications of personnel making the inspection, date(s) of the inspection, major observations relating to the implementation of the SWPPP, and actions taken to revise the plan will be completed and retained as part of the SWPPP for at least 3 years from the date that the site is finally stabilized. Form 4 shows the form to be used for certification of the inspection report. The report will be signed by one of the following persons:

Owner of the property.

A duly authorized representative of the property owner.

Y. Non-Storm-Water Discharges

It is expected that the following non-storm-water discharges will occur at the site during the construction period:

- **Dewatering discharges:** Water pumped from the construction area during dewatering operations (this may or may not be storm water).
- **Pressure test water:** Water used to pressure-test the potable water system.
- **Disinfectant water:** Water used to disinfect the potable water system.

Dewatering discharges will be done in such a manner as to avoid erosion problems and will pass through a portable sediment tank or temporary siltation pond. No direct discharge to surface waters or wetlands will be permitted.

Form 3 - **REPORT FORM FOR CHANGES IN POLLUTION PREVENTION PLAN**

INSPECTOR:_____ DATE: _____

SUMMARY OF REQUIRED CHANGES:

_____
_____
_____
_____
_____
_____
_____
_____
_____

REASON(S) FOR CHANGES:

_____
_____
_____
_____
_____
_____
_____
_____
_____

INSPECTOR'S SIGNATURE:_____ **DATE:**_____

Form 4 - **INSPECTION CERTIFICATION FORM**

Project: 655 Cochituate Road, Framingham, MA

This certification must be completed after each inspection to signify that the inspection has been properly completed and the site has been found to be in compliance with the Storm Water Pollution Prevention Plan.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____

Name: _____

Title: _____

Company: _____

Address: _____

Telephone: _____

Date: _____

Z. Significant-Materials Inventory

Significant materials expected to be found at the construction site include:

- Concrete mix (trucked onto the site for construction)
- Steel reinforcing bars and related materials
- Lumber
- Diesel and Gasoline fuel and lubricating oils
- Pre-cast concrete structures
- Ductile iron pipe
- Steel pipe
- Paints
- Fertilizers
- Plastic and p.v.c. pipe
- Earth materials, stone and aggregate
- Asphalt
- Cements and adhesives
- Waterproofing tar
- Block, brick and masonry materials
- Fiberglass and foam insulation
- Propane fuel for space heaters
- Acetylene fuel for welding

This list of significant materials may be reduced or expanded once a contractor has been chosen and the materials to be used have been specified. If fewer or additional materials are required, the SWPPP will be amended to reflect these changes.

AA. Spill Prevention and Response Procedures

Spill prevention and response include good housekeeping as well as specific practices for certain products and established procedures for responding to spills.

Good Housekeeping

The following good housekeeping practices will be followed onsite during the construction project.

- **Minimize materials:** An effort will be made to store only enough material required to do the job.

- **Storage:** All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials will be covered with polyethylene or polypropylene sheeting to protect them from the elements.

- **Labeling:** Products will be kept in their original containers with the original manufacturer's label affixed to each container.

- **Mixing:** Substances will not be mixed with one another unless this is recommended by the manufacturer.

- **Disposal:** Whenever possible, all of a product will be used prior to disposal of the container. Manufacturer's recommendations for proper use and disposal will be followed.

- **Inspections:** The site superintendent will inspect the site daily to ensure proper use and disposal of materials onsite.

- **Spoil materials:** Any excavated earth that will not be used for fill material and all demolished pavement will be hauled off site immediately and will be disposed of properly.

Product-Specific Practices

- **Petroleum Products.** All on-site vehicles will be monitored for leaks and will receive regular preventive maintenance to reduce the chance of leakage. If petroleum products will be present at the site, they will be stored in tightly sealed containers that are clearly labeled. Any asphalt substances used on site will be applied according to the manufacturer's recommendations.

- **Concrete Trucks.** Concrete trucks will not be allowed to wash out or discharge surplus concrete or drum wash water at the site.

- **Paints.** All containers will be tightly sealed and stored when not required for use. Excess paint will not be poured into the storm sewer system but will be properly disposed of according to manufacturers' instructions or state and local regulations.

- **Fertilizers.** Fertilizers will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. The fertilizer will be stored in a covered area, and any partially used bags will be transferred to a sealable plastic bin to avoid spills.

Spill Control and Response Practices

A spill prevention and response team will be designated by the owner or the site superintendent. In addition, the following practices will be followed for spill cleanup:

- **Information:** Manufacturers' recommended methods for spill cleanup will be clearly posted, and site personnel will be made aware of the procedures and location of the information and cleanup supplies.

- **Equipment:** Materials and equipment necessary for spill cleanup will be present on the site at all times. Equipment and materials will include but not be limited to brooms, shovels, rags,

gloves, goggles, absorbent materials (sand, sawdust, etc.) and plastic or metal trash containers specifically designed for this purpose. The materials and equipment necessary for spill cleanup will be dependent upon the nature and quantity of the material stored on site.

- **Response:** All spills will be cleaned up immediately upon discovery.

- **Safety:** The spill area will be kept well ventilated, and personnel will wear appropriate protective clothing to prevent injury from contact with hazardous substances.

- **Reporting:** Spills of toxic of hazardous material (if present on site) will be reported to the appropriate state or local government agency, regardless of the spills size.

- **Record Keeping:** The spill prevention plan will be modified to include measures to prevent this type of spill from recurring as well as improved methods for cleaning up any future spills. A description of each spill, what caused it, and the cleanup measures used will be kept with the plan.

BB. Plan Location and Public Access

The SWPPP is not submitted to the EPA for review unless requested. The SWPPP must be available at the construction site from the date of project initiation to the date of final stabilization. The SWPPP and all reports required by the permit must be retained for at least 3 years front he date on which the site is finally stabilized.

Despite the fact that the SWPPP and associated reports are not necessarily required to be submitted with the Notice of Intent, these documents are considered to be reports according to section 308(b) of the Clean Water Act and therefore are available to the public. The permittee, however, may claim certain parts of the SWPPP as confidential according to regulations in 40 CFR part 2. These regulations state that records that contain trade secrets may be claimed as confidential.

The SWPPP shall also be at the offices of the Environmental Consultant, MetroWest Engineering, Inc (75 Franklin Street, Framingham, MA 01702).

APPENDIX A: EMERGENCY & INSPECTION INFORMATION

Emergency Contact Sheet

Form 1. Emergency Contact Numbers

Framingham Fire Department	
Emergency	911
Business	(508) 532-5930
Framingham Police Department	
Emergency	911
Business	(508) 872-1212
Massachusetts Department of Environmental Protection	
Northeast Regional Office	(617) 654-6500
Framingham Conservation Commission	(508) 532-5460
Framingham Board of Health	(508) 532-5470
National Response Center	1-800-424-8802
US EPA	1-888-372-7341

CHAPTER 8: STORMWATER MANAGEMENT STANDARD 7

Chapter 8:

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

- The project will result in a decrease of impervious area and, therefore, is considered a redevelopment.
- The project will comply with Stormwater Management Policy to the maximum extent practicable.

CHAPTER 9: STORMWATER MANAGEMENT STANDARD 8

Chapter 9:

Standard 8: Construction Period Pollution and Erosion and Sedimentation Control

- The Stormwater Pollution Prevention Plan is included in Chapter 7 of this Stormwater Report.
- The project is covered by a NPDES general construction permit as the project will result in over an acre of disturbance.

CHAPTER 10: OPERATION AND MAINTENANCE PLAN STORMWATER MANAGEMENT STANDARD 9

Stormwater Operation and Maintenance Plan
655 Cochituate Road, Framingham MA
Prepared By: MetroWest Engineering Inc.

General

The project site is located at 655 Cochituate Road, approximately 530 feet west of the intersection of Speen Street at Cochituate Road and south of Interstate 90 (Massachusetts Turnpike).

The subject parcel (Assessors' Map 346, Block 110, Lot 3) has an area of approximately 48,350 square feet (1.11 acres) and is presently improved with a one-story building occupied by Central Pools, a single story building occupied by North End Treats, a vacant two-story warehouse, bituminous concrete pavement and supporting utilities. The lot is mostly covered by impervious surfaces. The site is relatively flat with a slight slope downhill from north to south. The site is relatively flat with a slight slope downhill from north to south.

The site redevelopment program includes demolition of the existing one-story building, presently occupied by Central Pools, demolition of the existing one-story building, presently occupied by North End Treats, construction of a new one-story retail building using the same footprint of the Central Pools building, permeable pavers, bituminous concrete pavement, supporting utilities and landscaping. See site plans for details regarding the proposed development.

The existing property contains 45,822 square feet of impervious area. Redevelopment of the property will reduce the impervious area by 9,381 square, for a total of 36,441 square feet.

Drainage Approach

There are presently no stormwater controls in place to manage runoff rates or volumes. Runoff drains to the east and southeast on to the abutting property and into Cochituate Road. The goal of the proposed stormwater management system is to reduce runoff rates and volumes for all design storms compared to the existing condition and to promote groundwater recharge through the use of permeable pavers.

The proposed permeable pavers are located within the footprint of the proposed parking areas to the south, east and north ends of the property and will store and infiltrate runoff from the bituminous concrete pavement, the roof surfaces and surrounding landscaped areas.

Overall reductions in runoff rates and volumes can be found in the Model Results section of this report and detailed hydrologic analysis and basin models can be found in the Hydrologic Assessment Report.

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.

Responsible Party

The owner shall be responsible for all maintenance and repair activities throughout the site and to the proposed parking area relating to the pavement surface and stormwater collection system.

Owner
Clairmont Realty LLC
225 Prospect Street
Belmont, MA

If ownership or operation of the subject property changes, the new Owner or Site Operator shall become the responsible party. This Operation and Maintenance Plan shall run with the land.

Required Maintenance

Snow Storage and Removal

Snow will be stored in the proposed landscape area on the northerly side of the property and/or within the parking area located between the existing warehouse and proposed one-story retail building. Snow will be removed from the site by the snow removal contractor and properly disposed off site, as required by weather conditions.

Parking Areas

Parking areas shall be vacuum-swept monthly to remove sediments. Additionally, supplemental cleanings shall be performed as needed during January, February, March and April. All sediment removed shall be disposed of in accordance with DEP policy and requirements for the disposal of road sediments. A road-cleaning contractor assigned by the property owner shall perform this activity.

In addition to vacuum sweeping operations, the parking lot will be inspected and cleaned weekly by a landscaping contractor. The weekly cleaning operation will include removal of litter and other trash and surface cleaning with a leaf blower.

Grounds

All litter and trash shall be picked up and removed from all paved, landscaped and wooded areas on a weekly basis. All grass clippings, leaves, brush and other natural materials generated by

landscape maintenance on the property shall be transported to an approved composting facility. No clippings or leaves shall be deposited in wooded areas or on abutting properties.

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.

Permeable Pavers

The permeable pavers of the proposed parking lot shall be visually inspected annually. Upon inspection, if the pavers appears to be obstructed with sand or fine dirt, it shall be maintained according to the attached Maintenance Guide provided by Ideal Concrete Block Co., Inc. Any sediment removed shall be disposed of in accordance with DEP policy and requirements for the disposal of road sediments. This activity shall be performed by a contractor assigned by the owner.

Recommended Personnel

A landscaping contractor will perform routine weekly cleaning activities. Annual inspections shall be performed by a Professional Engineer with specific experience with stormwater management systems.

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 permeable pavers infiltration systems. 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 shall be submitted to the site operator and kept on site, and will be available for public inspection upon request.

Emergency Contact

In the event of a major drainage system failure, a release of dangerous materials or other unforeseen accident, the property owner or manager shall be contacted first:

Owner
Clairmont Realty LLC
225 Prospect Street
Belmont, MA
(781) 893-6300

If ownership of the subject property changes, the new Owner shall become the emergency contact.

Other Contacts

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

Town of Framingham, Building Department
(508) 532-5500

Town of Framingham Fire Department
(508) 532-5930

Massachusetts Department of Environmental Protection
(617) 292-5500

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

Permeable Interlocking Concrete Pavements
Maintenance Guide

Permeable interlocking concrete pavements offer years of structural performance and, with reasonable care and attention, meet hydrological objectives for managing stormwater runoff. Fines and debris naturally accumulate on the surface of walkways, plazas, driveways, parking lots and roadways. With porous pavements, if these particulates are allowed to build up over time, the pavement's ability to infiltrate stormwater diminishes. To maintain infiltration, cleaning at regular intervals is prescribed to remove sediment. The protocol for monolithic porous pavements, such as asphalt and concrete, calls for vacuuming as many as 4 times per year. Permeable pavers, on the other hand, can be easily maintained with routine cleaning because the aggregate in the drainage openings trap sediment at the surface, where it is accessible to conventional sweepers. If permeable interlocking pavements become severely clogged, aggregate in the openings can be removed and replenished to restore full infiltration.

Provisions in stormwater permit maintenance covenants are sometimes used to stipulate cleaning frequency. While the intention is worthy, the regimen may be relaxed over time or, if the property changes hands, not conveyed to the new owner. We suggest a more practical and plausible approach to determining when deep cleaning is required for pavements comprised of permeable interlocking concrete pavers - visual inspection. A good indication that infiltration must be restored is the presence of persistent standing water on the pavement surface following a rainfall or evidence of sediment deposit that cannot be removed by sweeping. As simple as it sounds, pouring a bucket of water onto various areas will show if the pavement is draining or clogged. After all, why incur the added expense of prescribed vacuum cleaning if not needed?

We recommend the following for routine cleaning, snow removal and general maintenance.

Cleaning

- Keep pavement clean of leaves and debris.
- Sweep on routine basis. Perform in dry weather to remove encrusted sediment.
- Sweeper types:
  - Conventional broom sweeper
    - Acceptable for removing crust when joints/apertures are accessible to brushes
  - Regenerative air sweepers
    - Better option for maintaining permeable pavements
  - Pure vacuum machines
    - Best for restoration if clogged
- Do NOT pressure wash pavement as water jet can drive residue into the setting bed and base below.

Snow Removal

- Remove snow promptly with conventional snow removal equipment. (Blade height adjustment typically not required.)
- Use sand and deicing chemicals sparingly. Unlike impervious surfaces where puddles re-freeze at night, melt water from snow and ice drains into the openings, reducing slip and skid hazards.

General Maintenance

- Replenish aggregate in joints/voids as needed. Use correct size stone-sand to sweep into cleaned openings.
- Remove or spray weeds that grow in pavement openings with a biodegradable herbicide.
- Maintain groundcover around the perimeter of the pavement to filter run-off overflow and reduce sediment running onto the pavement.
- If overflow openings in curbing are present, keep clean of debris.
- Visually inspect pavement once a quarter and within 24 hours after storm events greater than 1.0 inch in a 24 hour period. Check outflow from observation well if installed. Retain records of inspection and maintenance.
- Repair ruts or deformations exceeding ½".
- Remove & replace broken pavers that compromise structural integrity of surface.
  - See Ideal's *Contractor's Guide to Installing Concrete Pavers* for more information

CHAPTER 11: STORMWATER MANAGEMENT STANDARD 10

Chapter 11:

Standard 10: Prohibition of Illicit Discharges

- The Long Term Pollution Prevention Plan includes the required measures to prevent the illicit discharges.
- No floor drains will be connected to the drainage system.
- No washing of vehicles shall be permitted

Illicit Discharge Certification

I have read Standard 10 of the Massachusetts Stormwater Management Policy regarding Illicit Discharges. I have also studied the Proposed Site Plans and Stormwater Operation and Maintenance Plan and am aware of the components of the Stormwater Management System proposed at 655 Cochituate Road in Framingham, Massachusetts. I hereby certify that there will be no illicit discharges, as defined by the Policy, from the site through any part of the Stormwater Management System.

_____
Signature

_____
Name and Title Date