# ***STORMWATER REPORT***

***Proposed Site Redevelopment***
***71 Bishop Street***
***Framingham, MA***

*Prepared for:* ***Herb Chambers Companies***
***259 McGrath Highway***
***Somerville, MA 02143***

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

***November, 2015***

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# CHAPTER 1: HYDROLOGIC ANALYSIS

# ***Hydrologic Analysis:***
# ***Proposed Site Redevelopment***
# ***Herb Chambers Companies***
# ***71 Bishop Street, Framingham MA***

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**Hydrologic Assessment**
**Proposed Site Redevelopment**
**71 Bishop Street, Framingham MA**

## Introduction

The project site is located on the easterly side of Bishop Street in Framingham, Massachusetts approximately 500-feet north of Waverly Street (Route 135.) The project site is shown on Figure One, entitled *Locus Map: 71 Bishop Street, Framingham MA*. The property is bounded on the north by Lawrence Street, on the east by the M.B.T. A. commuter rail line and southerly by a discontinued portion of Clark Street.

The project site is shown on Framingham Assessors Map 84, Block 165, Lot 4 and has an area of approximately 273,206 square feet (6.27 acres). The property is part of the former Dennison Manufacturing campus and is heavily industrialized. A large manufacturing/warehouse building (footprint 88,116 square feet) is located on the westerly portion of the site adjacent to Bishop, Clark and Lawrence Street. A large paved area is located east of the existing building. The paved area in the central portion of the site is the former location of two former buildings on the site which were recently razed. A lawn/wooded area is presently located along the easterly edge of the property near the M.B.T.A. rail line.

According to the NRCS Soil Survey, soils on and around the site belong to the Urban Land complex (602) and are not classified within a hydrologic soil group. Abutting soil groups are classified within hydrologic group A. For the purposes of a conservative hydrologic analysis, soils on the site are assumed to exhibit B hydrologic soil group characteristics. The project site is currently restricted by Area of Use Limitations (AUL) listed within Deed Book 30829, page 32 at the Middlesex County Registry of Deeds. The AUL specifies that impervious coverage, either building or pavement, is the preferred ground coverage for the site. Soil borings were performed on the site were performed in September 2013 and additional borings were done in August 2015. Fill materials were present in the majority of the test pits down to a depth of approximately six-feet. Underlying parent soils are sandy with groundwater levels found at a depth of approximately four to five-feet below the existing ground surface. No Title V soil analysis of existing soil conditions were performed at the site.

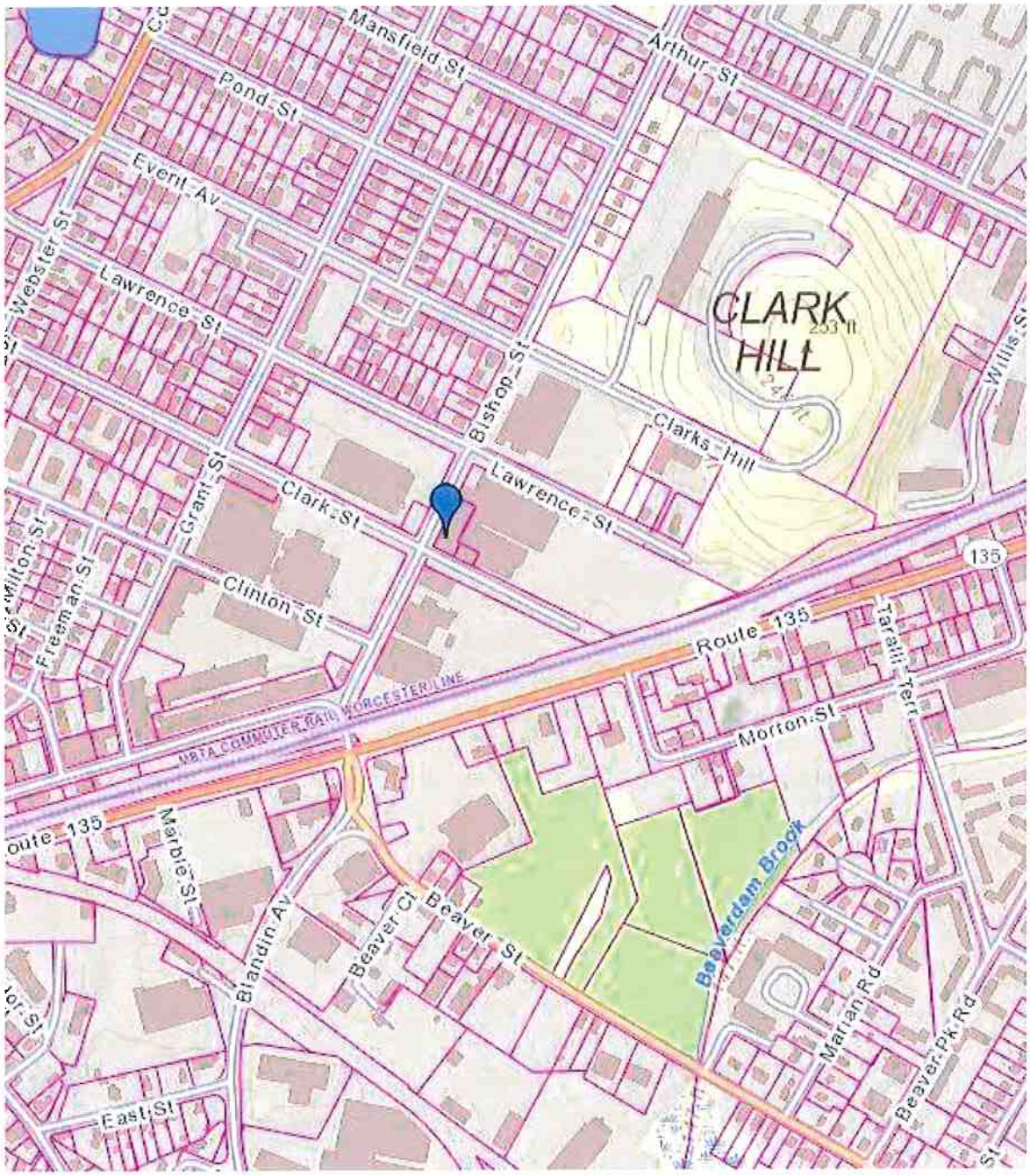
The proposed site development includes the demolition of the existing building, construction of a new building paved parking lot, stormwater management system and supporting utilities. Total proposed impervious footprint is 250,054 feet, an increase of 42,992 square feet compared to the existing impervious coverage of 207,062 square feet

## Drainage Approach

The site currently contains a stormwater management system to capture runoff, from the roof of the building and other impervious surfaces, and route it to the Town's street drainage system. Roof drain runoff is presently captured by internal drains and routed to

# Figure One:

# Locus Map: 71 Bishop Street, Framingham MA



the municipal storm drain system in Clark Street and Lawrence Street. Surface flows from impervious and pervious areas drain into existing drain catch basins on Clark Street and Lawrence Street. The existing storm drain system located in Lawrence street flows in an easterly direction to the end of the paved section where it turns southerly and southwesterly across the eastern portion of the locus in a drainage easement. The existing storm drain system in Clark Street also runs in an easterly direction toward the M.B.T.A. rail line. Subsurface drain lines in Clark Street and the drain easement merge and cross the M.B.T.A. rail bed and Waverly Street in two culverts ultimately discharging into Beaver Dam Brook.

AUL restrictions on the property encourage the use of impervious coverage on the site. Infiltration and recharge of stormwater is permissible within the AUL. A stormwater management system has been designed to capture and treat runoff from the new impervious surfaces. Impervious coverage on the site will increase by approximately 42,992 square feet in the post-development condition.

A stormwater management system is proposed to reduce runoff rates for runoff leaving the project site compared to existing conditions. This will be achieved through the use of a subsurface infiltration system located under the proposed parking area behind the building. The system will be comprised of a series of pre-cast, concrete chambers with a controlled outlet structure. The proposed stormwater management system will provide treatment of runoff, reduce the peak rates of runoff leaving the project site.

## Hydrologic Analysis

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

### Existing Conditions

The existing conditions model analyzes the site as four drainage basins; Existing Conditions Basins One through Four. Existing Conditions Basin 1 (E.C.B.-1) contains 45,237 square feet of surface area and flows in a southerly direction to design point A, located on the northerly side of Clark Street.

Existing Conditions Basin 2 (E.C.B.-2) contains 95,270 square feet of surface area and flows in a northerly direction to design point B, located along the southerly sideline of Lawrence Street.

Existing Conditions Basin 3 (E.C.B.-3) contains 85,546 square feet of surface area and flows in a northerly direction to design point C, located along the southerly sideline of Lawrence Street.

Existing Conditions Basin 4 (E.C.B.-4) contains 47,175 square feet of surface area and flows in a southeasterly direction to Design Point D, located along the northerly sideline of Clark Street near its easterly terminus.

Runoff from all Existing Conditions Basins enters the municipal storm drain system located within Clark Street and Lawrence Street and then routed through a 48-inch diameter culvert crossing under the M.B.T.A. rail line and Waverley Street.

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

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

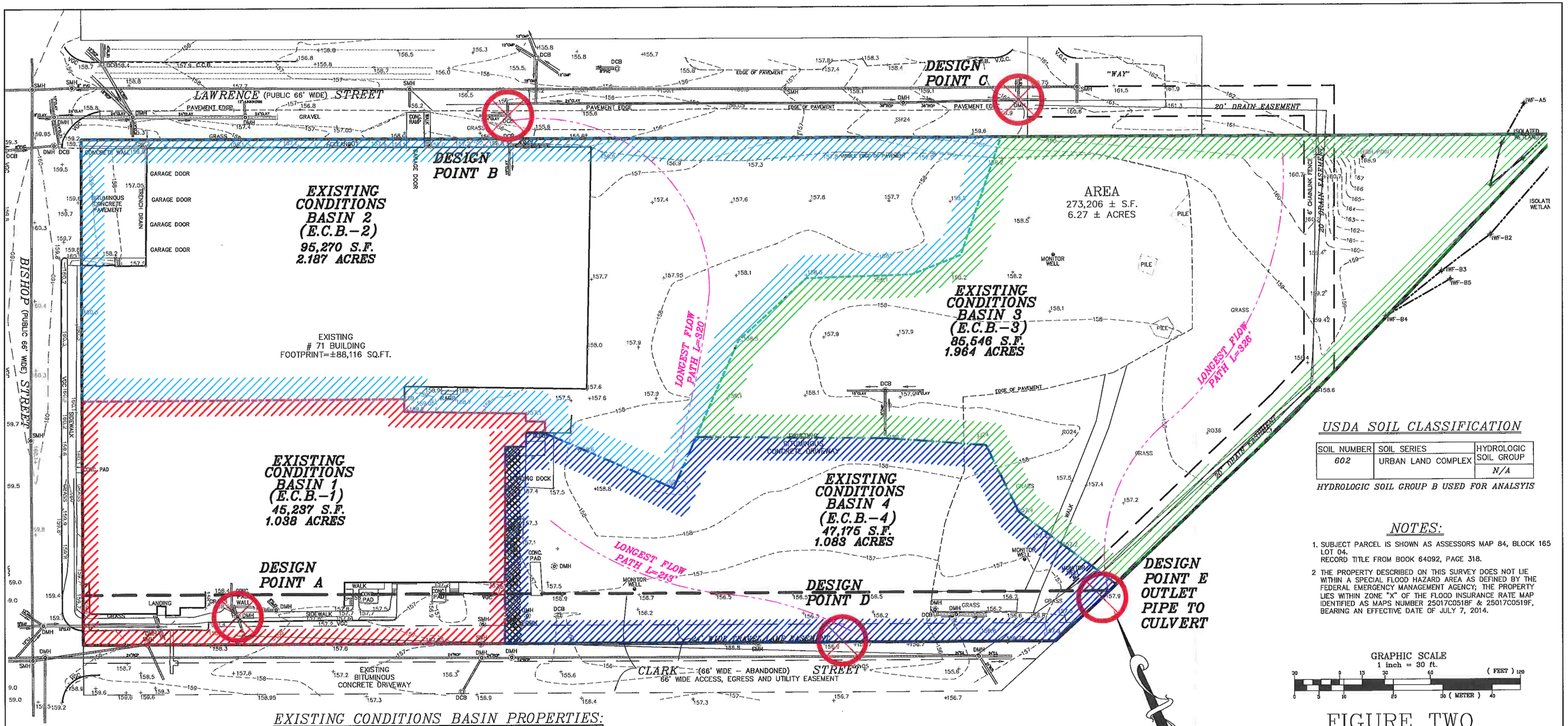
Area = 45,237 square feet
Impervious area = 37,432 square feet; curve number = 98.0
Lawn area (good condition) = 7,805 square feet; curve number = 61.0
Hydrologic soil group B
Weighted Curve Number = 91.4
Basin slope = 0.8%
Hydraulic length = 166 feet
Time of concentration = 4.0 minutes (Manually Entered)

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

Area = 95,270 square feet
Impervious area = 90,248 square feet; curve number = 98.0
Lawn area (good condition) = 5,022 square feet; curve number = 61.0
Hydrologic soil group B
Weighted Curve Number = 96.1
Basin slope = 1.2%
Hydraulic length = 320 feet
Time of concentration = 6.2 minutes (LAG Method)

*Existing Conditions Basin 3 (E.C.B.-3)*

Area = 85,546 square feet
Impervious area = 38,425 square feet; curve number = 98.0
Lawn area (good condition) = 47,120 square feet; curve number = 61.0
Hydrologic soil group B
Weighted Curve Number = 93.9




## USDA SOIL CLASSIFICATION

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

*HYDROLOGIC SOIL GROUP B USED FOR ANALSYIS*

## NOTES:

1. SUBJECT PARCEL IS SHOWN AS ASSESSORS MAP 84, BLOCK 165 LOT 04.
RECORD TITLE FROM BOOK 64092, PAGE 318.
2. THE PROPERTY DESCRIBED ON THIS SURVEY DOES NOT LIE WITHIN A SPECIAL FLOOD HAZARD AREA AS DEFINED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY; THE PROPERTY LIES WITHIN ZONE "X" OF THE FLOOD INSURANCE RATE MAP IDENTIFIED AS MAPS NUMBER 25017C0518F & 25017C0519F, BEARING AN EFFECTIVE DATE OF JULY 7, 2014.

## EXISTING CONDITIONS BASIN PROPERTIES:

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

TOTAL BASIN AREA = 45,237 S.F. (1.038 ACRES)
HYDRAULIC LENGTH = 166 FEET
CHANGE IN ELEVATION = 1.3 FEET
BASIN SLOPE = 0.008 (0.8%)

| GROUND COVER | Cn | AREA (ACRES) | PRODUCT |
|---|---|---|---|
| IMPERVIOUS AREA = 37,432 S.F. (0.859 ACRES) | 98 | 0.859 | 84.182 |
| LAWN AREA (GOOD COND.) = 7,805 S.F. (0.176 ACRES) | 61 | 0.176 | 10.736 |
| | | SUM 1.038 | SUM 94.918 |

WEIGHTED CURVE NUMBER ($C_N$) = (94.918/1.038) = 91.4

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

TOTAL BASIN AREA = 95,270 S.F. (2.187 ACRES)
HYDRAULIC LENGTH = 320 FEET
CHANGE IN ELEVATION = 4.0 FEET
BASIN SLOPE = 0.012 (1.2%)

| GROUND COVER | Cn | AREA (ACRES) | PRODUCT |
|---|---|---|---|
| IMPERVIOUS AREA = 90,248 S.F. (2.072 ACRES) | 98 | 2.072 | 203.056 |
| LAWN AREA (GOOD COND.) = 5,022 S.F. (0.115 ACRES) | 61 | 0.115 | 7.015 |
| | | SUM 2.187 | SUM 210.071 |

WEIGHTED CURVE NUMBER ($C_N$) = (210.071/2.187) = 96.1

### EXISTING CONDITIONS BASIN 3 (E.C.B.-3)

TOTAL BASIN AREA = 85,546 S.F. (1.964 ACRES)
HYDRAULIC LENGTH = 326 FEET.
CHANGE IN ELEVATION = 3.2 FEET
BASIN SLOPE = 0.010 (1.0%)

| GROUND COVER | Cn | AREA (ACRES) | PRODUCT |
|---|---|---|---|
| IMPERVIOUS AREA = 38,425 S.F. (0.882 ACRES) | 98 | 0.882 | 86.436 |
| LAWN AREA (GOOD COND.) = 47,120 S.F. (1.082 ACRES) | 61 | 1.082 | 66.002 |
| | | SUM 1.964 | SUM 152.438 |

WEIGHTED CURVE NUMBER ($C_N$) = (152.438/1.964) = 77.6

### EXISTING CONDITIONS BASIN 4 (E.C.B.-4)

TOTAL BASIN AREA = 47,175 S.F. (1.083 ACRES)
HYDRAULIC LENGTH = 213 FEET
CHANGE IN ELEVATION = 1.8 FEET
BASIN SLOPE = 0.008 (0.8%)

| GROUND COVER | Cn | AREA (ACRES) | PRODUCT |
|---|---|---|---|
| IMPERVIOUS AREA = 40,515 S.F. (0.930 ACRES) | 98 | 0.930 | 91.140 |
| LAWN AREA (GOOD COND.) = 6,660 S.F. (0.153 ACRES) | 61 | 0.153 | 9.333 |
| | | SUM 1.083 | SUM 100.473 |

WEIGHTED CURVE NUMBER ($C_N$) = (100.473/1.083) = 92.8

# FIGURE TWO

# PRE-DEVELOPMENT WATERSHED DELINEATION PLAN
#71 BISHOP STREET
IN
FRAMINGHAM, MASS

PREPARED FOR:
*HERB CHAMBERS COMPANIES*
*259 McGRATH HIGHWAY*
*SOMERVILLE, MA 02143*

PROPERTY OF:
*CLINTON 100 CPI, LLC*
*43 BROAD ST*
*HUDSON, MA 01749*

ENGINEERS & SURVEYORS:
MWE
*METROWEST ENGINEERING, INC.*
*75 FRANKLIN STREET*
*FRAMINGHAM, MA 01702*
*TEL.: (508)626-0063*
*FAX: (508)875-6440*
*ROBERT A. GEMMA, P.E.(CIVIL) # 31967 P.L.S. # 37046*

| | | |
|---|---|---|
| SHEET 1 OF 1 | | DATE: NOVEMBER 24, 2015 |
| CALC'D BY: BTN/RAG | FIELD BK: 632 | CAD FILE: EC_HYDRO2.dwg |
| DRAFTER: BTN | PROJECT: FRM_CLI | DWG FILE:SK112415.dwg |

Basin slope = 1.0%
Hydraulic length = 326 feet
Time of concentration = 10.0 minutes (LAG Method)

*Existing Conditions Basin 4 (E.C.B.-4)*

Area = 47,175 square feet
Impervious area = 40,515 square feet; curve number = 98.0
Lawn area (good condition) = 6,660 square feet; curve number = 61.0
Hydrologic soil group B
Weighted Curve Number = 92.8
Basin slope = 0.8%
Hydraulic length = 213 feet
Time of concentration = 4.0 minutes (Manually Entered)

Proposed Conditions

The proposed condition model analyzes the site as five drainage basins, Post-Development basins One through Five. Post-Development Basin 1 (P.D.B.-1) contains 43,500 square feet of land and flows in a southerly direction to design point A located along the southerly sideline of Lawrence Street near Bishop Street.

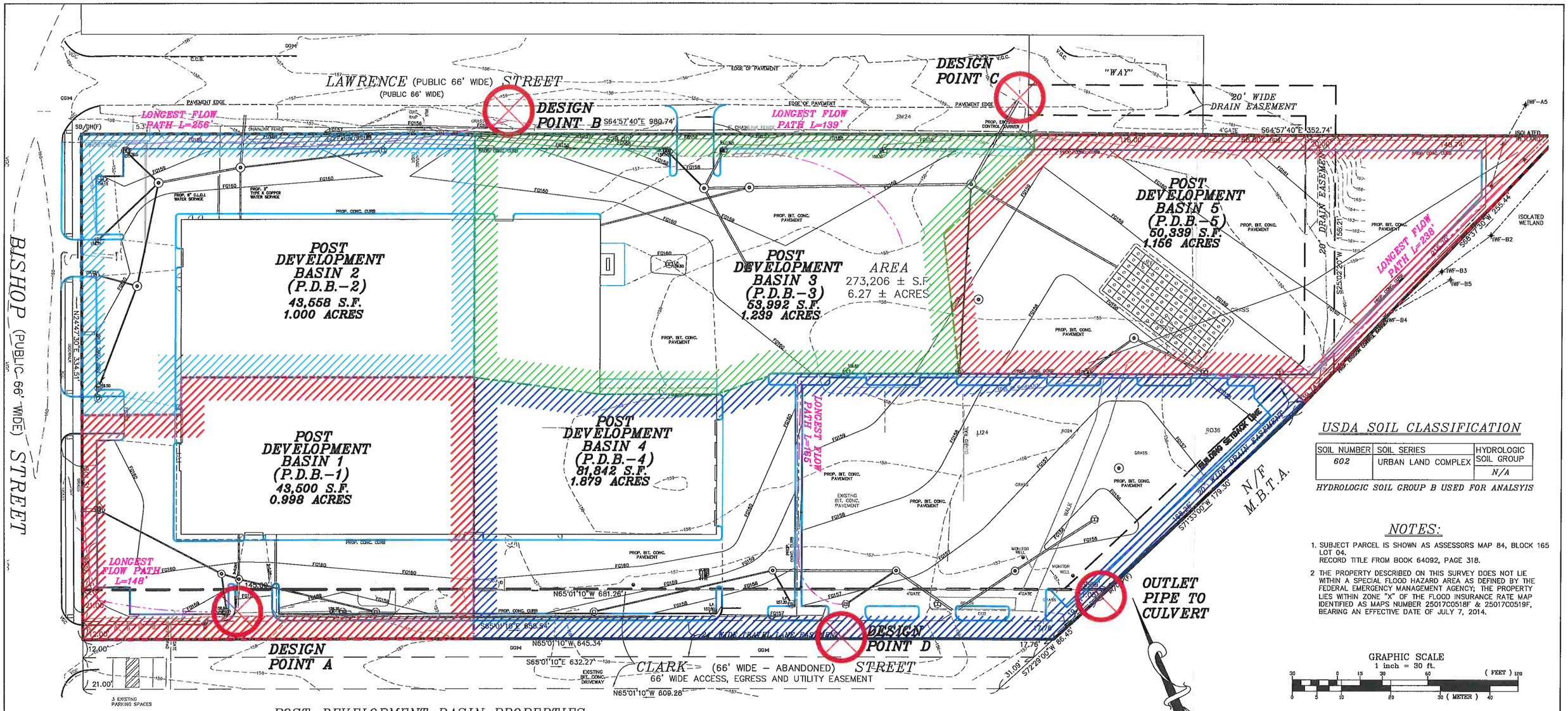
Post-Development Basin 2 (P.D.B.-2) contains 43,558 square feet of surface area and flows in a northerly direction to design point B, located along the southerly sideline of Lawrence Street near Bishop Street.

Post-Development Basin 3 (P.D.B.-3) contains 53,992 square feet of surface area and flows in a northerly direction to design point C, located along the southerly sideline of Lawrence Street.

Post-Development Basin 4 (P.D.B.-4) contains 81,842 square feet of surface area and flows in a southeasterly direction to Design Point D, located along northerly side of Clark Street near its easterly terminus.

Post-Development Basin 5 (P.D.B.-5) contains 50,339 square feet of surface area and flows into proposed infiltration system 1 located east of the proposed building.

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

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GRAPHIC SCALE
1 inch = 30 ft.
30 0 15 30 60 ( FEET ) 120
0 5 10 20 30 ( METER ) 40

# FIGURE THREE

## POST-DEVELOPMENT BASIN PROPERTIES:

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

TOTAL BASIN AREA = 43,500 S.F. (0.999 ACRES)
HYDRAULIC LENGTH = 148 FEET
CHANGE IN ELEVATION = 1.0 FEET
BASIN SLOPE = 0.007 (0.7%)

| GROUND COVER | Cn | AREA (ACRES) | PRODUCT |
|---|---|---|---|
| IMPERVIOUS AREA = 40,607 S.F. (0.932 ACRES) | 98 | 0.932 | 91.336 |
| LANDSCAPED AREA (GOOD COND.) = 2,893 S.F. (0.067 ACRES) | 55 | 0.067 | 3.685 |
| | | SUM 0.999 | SUM 95.021 |

WEIGHTED CURVE NUMBER ($C_N$) = (95.021/0.997) = 95.1

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

TOTAL BASIN AREA = 43,558 S.F. (1.00 ACRES)
HYDRAULIC LENGTH = 256 FEET
CHANGE IN ELEVATION = 2.2 FEET
BASIN SLOPE = 0.009 (0.9%)

| GROUND COVER | Cn | AREA (ACRES) | PRODUCT |
|---|---|---|---|
| IMPERVIOUS AREA = 39,311 S.F. (0.902 ACRES) | 98 | 0.902 | 88.396 |
| LANDSCAPED AREA (GOOD COND.) = 4,247 S.F. (0.098 ACRES) | 55 | 0.098 | 5.390 |
| | | SUM 1.000 | SUM 93.786 |

WEIGHTED CURVE NUMBER ($C_N$) = (93.786/1.00) = 93.8

### POST-DEVELOPMENT BASIN 3 (P.D.B.-3)

TOTAL BASIN AREA = 53,992 S.F. (1.239 ACRES)
HYDRAULIC LENGTH = 139 FEET
CHANGE IN ELEVATION = 1.2 FEET
BASIN SLOPE = 0.009 (0.9%)

| GROUND COVER | Cn | AREA (ACRES) | PRODUCT |
|---|---|---|---|
| IMPERVIOUS AREA = 50,566 S.F. (1.160 ACRES) | 98 | 1.160 | 113.680 |
| LANDSCAPED AREA (GOOD COND.) = 3,426 S.F. (0.079 ACRES) | 55 | 0.079 | 4.345 |
| | | SUM 1.239 | SUM 118.025 |

WEIGHTED CURVE NUMBER ($C_N$) = (118.025/1.239) = 95.3

### POST-DEVELOPMENT BASIN 4 (P.D.B.-4)

TOTAL BASIN AREA = 81,842 S.F. (1.879 ACRES)
HYDRAULIC LENGTH = 165 FEET
CHANGE IN ELEVATION = 2.5 FEET
BASIN SLOPE = 0.015 (1.5%)

| GROUND COVER | Cn | AREA (ACRES) | PRODUCT |
|---|---|---|---|
| IMPERVIOUS AREA = 75,285 S.F. (1.728 ACRES) | 98 | 1.728 | 169.344 |
| LANDSCAPED AREA (GOOD COND.) = 6,556 S.F. (0.151 ACRES) | 55 | 0.151 | 8.305 |
| | | SUM 1.879 | SUM 177.649 |

WEIGHTED CURVE NUMBER ($C_N$) = (177.649/1.879) = 94.5

### POST-DEVELOPMENT BASIN 5 (P.D.B.-5)

TOTAL BASIN AREA = 50,339 S.F. (1.156 ACRES)
HYDRAULIC LENGTH = 238 FEET
CHANGE IN ELEVATION = 2.9 FEET
BASIN SLOPE = 0.012 (1.2%)

| GROUND COVER | Cn | AREA (ACRES) | PRODUCT |
|---|---|---|---|
| IMPERVIOUS AREA = 44,283 S.F. (1.017 ACRES) | 98 | 1.017 | 99.666 |
| LANDSCAPED AREA (GOOD COND.) = 6,055 S.F. (0.139 ACRES) | 55 | 0.139 | 7.645 |
| | | SUM 1.156 | SUM 107.311 |

WEIGHTED CURVE NUMBER ($C_N$) = (107.311/0.1.156) = 92.8

NOT TO SCALE

# POST-DEVELOPMENT WATERSHED DELINEATION PLAN
#71 BISHOP STREET
IN
FRAMINGHAM, MASS

PREPARED FOR:
HERB CHAMBERS COMPANIES
259 McGRATH HIGHWAY
SOMERVILLE, MA 02143

PROPERTY OF:
CLINTON 100 CPI, LLC
43 BROAD ST
HUDSON, MA 01749

ENGINEERS & SURVEYORS:
MWE
METROWEST ENGINEERING, INC.
75 FRANKLIN STREET
FRAMINGHAM, MA 01702
TEL.: (508)626-0063
FAX: (508)875-6440
ROBERT A. GEMMA, P.E.(CIVIL) # 31967 P.L.S. # 37046

| | | |
|---|---|---|
| SHEET 1 OF 1 | | DATE: NOVEMBER 25, 2015 |
| CALC'D BY: BTN/RAG | FIELD BK: 632 | CAD FILE: PD_HYDRO2.dwg |
| DRAFTER: BTN | PROJECT: FRM_CLI | DWG FILE: SK112515.dwg |

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

Area = 43,500 square feet
Impervious area = 40,607 square feet; curve number = 98.0
Landscaped area (good condition) = 2,893 square feet; curve number = 55.0
Hydrologic soil group B
Weighted Curve Number = 95.1
Basin slope = 0.7%
Hydraulic length = 148 feet
Time of concentration = 4.0 minutes (Manually Entered)

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

Area = 43,558 square feet
Impervious area = 39,311 square feet; curve number = 98.0
Landscaped area (good condition) = 4,247 square feet; curve number = 55.0
Hydrologic soil group B
Weighted Curve Number = 93.8
Basin slope = 1.0%
Hydraulic length = 203 feet
Time of concentration = 4.0 minutes (Manually Entered)

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

Area = 53,992 square feet
Impervious area = 50,566 square feet; curve number = 98.0
Landscaped area (good condition) =3,426 square feet; curve number = 55.0
Hydrologic soil group B
Weighted Curve Number = 95.3
Basin slope = 0.9%
Hydraulic length = 139 feet
Time of concentration = 4.0 minutes (Manually Entered)

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

Area = 81,842 square feet
Impervious area = 75,285 square feet; curve number = 98.0
Landscaped area (good condition) = 6,556 square feet; curve number = 55.0
Hydrologic soil group B
Weighted Curve Number = 94.5
Basin slope = 1.8%
Hydraulic length = 165 feet
Time of concentration = 5.0 minutes (Manually Entered)

*Post-Development Basin 5 (P.D.B.-5)*

Area = 50,339 square feet
Impervious area = 44,283 square feet; curve number = 98.0
Landscaped area (good condition) = 6,055 square feet; curve number = 55.0
Hydrologic soil group B
Weighted Curve Number = 92.8
Basin slope = 1.2%
Hydraulic length = 238 feet
Time of concentration = 5.0 minutes (Manually Entered)

***Subsurface Infiltration System***

*Proposed Infiltration System 1*

| | |
|---|---|
| Basic geometry: | 84.0-foot long by 40.4-foot wide bed |
| System type: | Shea DW-SDW leaching galleys; 500 gallons each |
| | Use 70 Galleys; 8.0-feet long by 5.2 feet wide by 2.8-feet high |
| Infiltration rate: | 8.27 inches per hour over 3,394 square foot bed |

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

**Model Results**

The model results for runoff rates and volumes leaving the project site are shown in Tables One and Two below:

**Table One: Comparison of Pre and Post-Development Peak Runoff Rates at Design Point E (Outlet to Culvert at End of Clark Street)**

| Drainage Basin | 2-year storm | 10-year storm | 25-year storm | 100-year storm |
|---|---|---|---|---|
| **Existing** | 11.2 CFS | 19.5 CFS | 24.2 CFS | 31.2 CFS |
| **Proposed** | 10.5 CFS | 17.5 CFS | 21.3 CFS | 27.8 CFS |
| **Difference** | -0.7 CFS | -2.0 CFS | -2.9 CFS | -3.4 CFS |

**Table Two: Comparison of Pre and Post-Development Runoff Volumes at Design Point E (Outlet to Culvert at End of Clark Street)**

| Drainage Basin | 2-year storm | 10-year storm | 25-year storm | 100-year storm |
|---|---|---|---|---|
| **Existing** | 46,759 CF | 76,917 CF | 93,472 CF | 118,666 CF |
| **Proposed** | 45,459 CF | 71,142 CF | 86,111 CF | 108,903 CF |
| **Difference** | -1,300 CF | -5,775 CF | -7,361 CF | -9,763 CF |

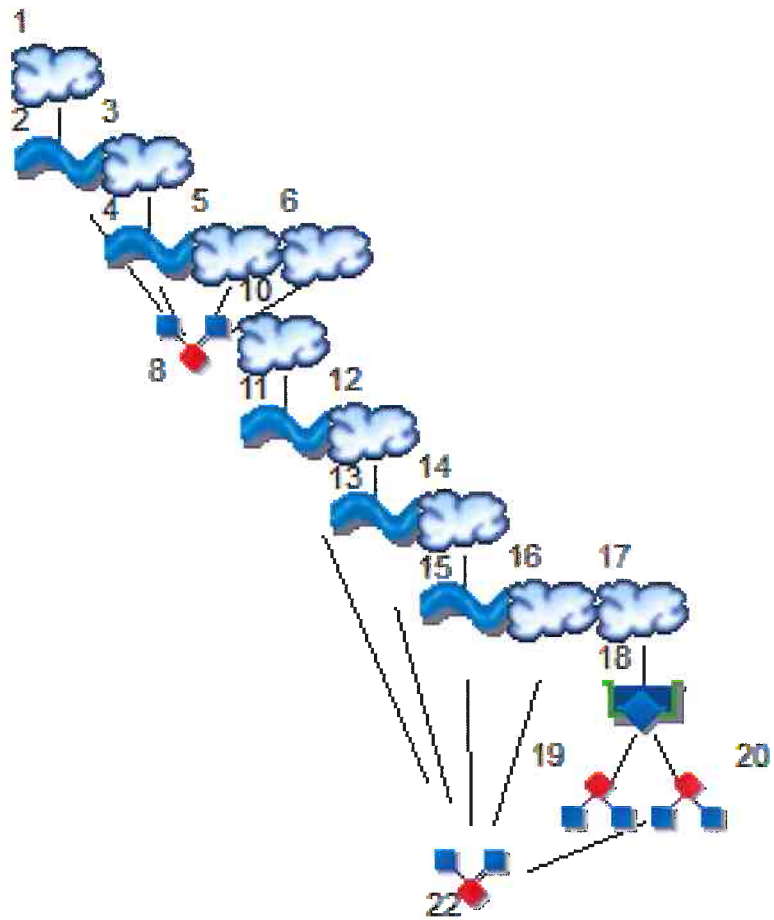
## Conclusion

The results provided in Tables One and Two demonstrate that the project, with the stormwater controls in place, will result in a decrease in peak runoff rates and an increase in total runoff volumes discharged from the project site. The site is constrained by an AUL encouraging impervious coverage and restricting on site recharge.

The stormwater management system as designed is consistent with MADEP Stormwater Management Policy and accepted design practice to the maximum extent practicable.

# Appendix A:
# Hydrologic Assessment

# 2-Year Storm, Pre and Post-Development




## Legend

| Hyd. | Origin | Description |
|---|---|---|
| 1 | SCS Runoff | E.C.B.-1 |
| 2 | Reach | E.C.B-1 |
| 3 | SCS Runoff | E.C.B.-2 |
| 4 | Reach | E.C.B.-2 |
| 5 | SCS Runoff | E.C.B.-3 |
| 6 | SCS Runoff | E.C.B.-4 |
| 8 | Combine | Ex. Flow at Culvert |
| 10 | SCS Runoff | P.D.B.-1 |
| 11 | Reach | P.D.B.-1 |
| 12 | SCS Runoff | P.D.B.-2 |
| 13 | Reach | P.D.B.-2 |
| 14 | SCS Runoff | P.D.B.-3 |
| 15 | Reach | P.D.B.-3 |
| 16 | SCS Runoff | P.D.B.-4 |
| 17 | SCS Runoff | P.D.B.-5 |
| 18 | Reservoir | Infiltration System 1 |
| 19 | Diversion1 | Infiltration |
| 20 | Diversion2 | Overflow |
| 22 | Combine | Post Dev.Flow to Culvert |

# 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 | 2.65 | 2 | 724 | 8,107 | ---- | ------ | ------ | E.C.B.-1 |
| 2 | Reach | 1.82 | 2 | 730 | 8,101 | 1 | ------ | ------ | E.C.B-1 |
| 3 | SCS Runoff | 6.35 | 2 | 724 | 20,540 | ---- | ------ | ------ | E.C.B.-2 |
| 4 | Reach | 4.98 | 2 | 728 | 20,536 | 3 | ------ | ------ | E.C.B.-2 |
| 5 | SCS Runoff | 2.33 | 2 | 730 | 9,179 | ---- | ------ | ------ | E.C.B.-3 |
| 6 | SCS Runoff | 2.89 | 2 | 724 | 8,943 | ---- | ------ | ------ | E.C.B.-4 |
| 8 | Combine | 11.15 | 2 | 728 | 46,759 | 2, 4, 5, 6, | ------ | ------ | Ex. Flow at Culvert |
| 10 | SCS Runoff | 2.83 | 2 | 724 | 9,018 | ---- | ------ | ------ | P.D.B.-1 |
| 11 | Reach | 1.99 | 2 | 728 | 9,013 | 10 | ------ | ------ | P.D.B.-1 |
| 12 | SCS Runoff | 2.75 | 2 | 724 | 8,589 | ---- | ------ | ------ | P.D.B.-2 |
| 13 | Reach | 1.62 | 2 | 730 | 8,580 | 12 | ------ | ------ | P.D.B.-2 |
| 14 | SCS Runoff | 3.53 | 2 | 724 | 11,283 | ---- | ------ | ------ | P.D.B.-3 |
| 15 | Reach | 2.67 | 2 | 728 | 11,279 | 14 | ------ | ------ | P.D.B.-3 |
| 16 | SCS Runoff | 5.26 | 2 | 724 | 16,587 | ---- | ------ | ------ | P.D.B.-4 |
| 17 | SCS Runoff | 3.08 | 2 | 724 | 9,546 | ---- | ------ | ------ | P.D.B.-5 |
| 18 | Reservoir | 0.71 | 2 | 746 | 9,546 | 17 | 155.45 | 2,319 | Infiltration System 1 |
| 19 | Diversion1 | 0.71 | 2 | 746 | 9,546 | 18 | ------ | ------ | Infiltration |
| 20 | Diversion2 | 0.00 | 2 | 702 | 0 | 18 | ------ | ------ | Overflow |
| 22 | Combine | 10.48 | 2 | 726 | 45,459 | 11, 13, 15, 16, 20, | ---- | ------ | Post Dev.Flow to Culvert |

# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

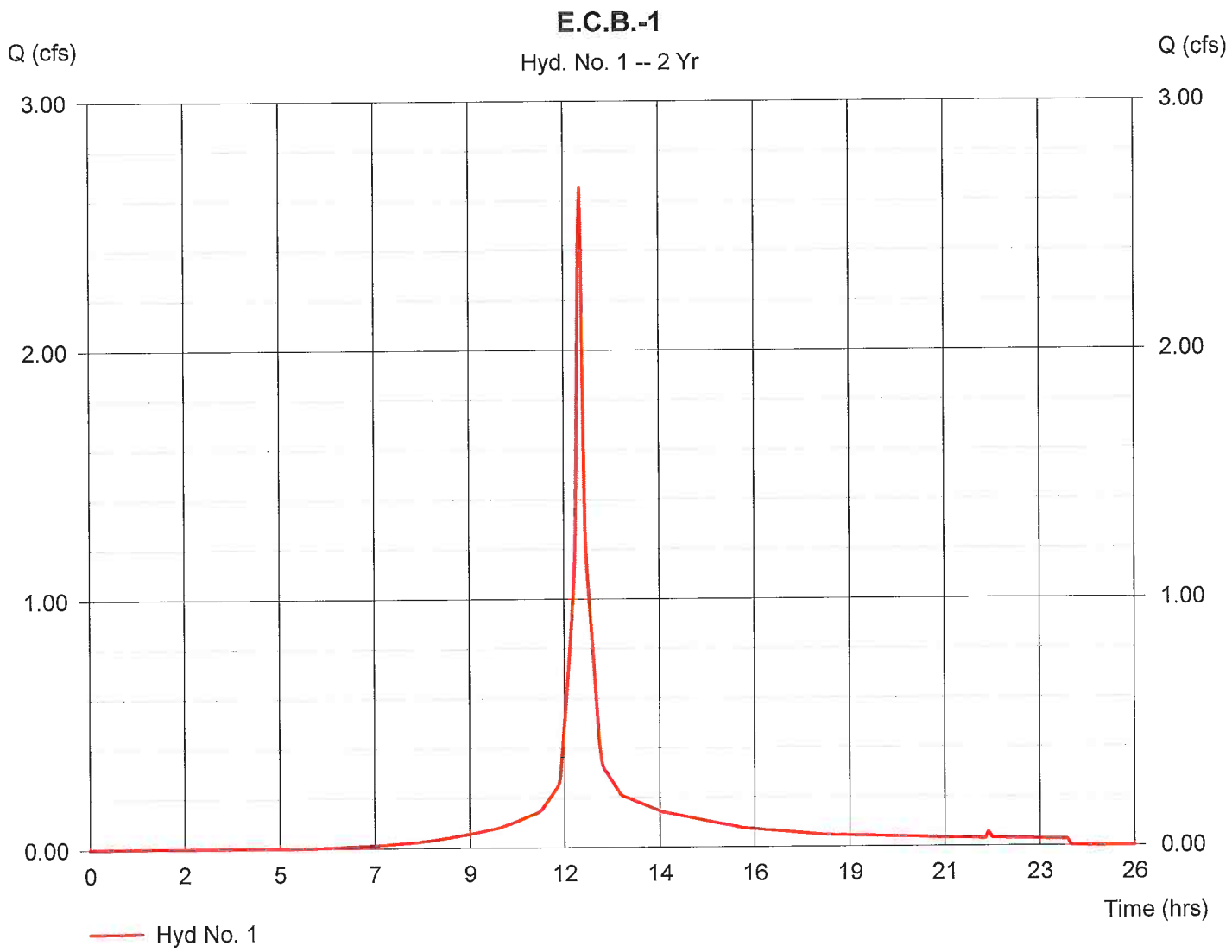
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 1

E.C.B.-1

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.65 cfs |
| Storm frequency | = 2 yrs | Time interval | = 2 min |
| Drainage area | = 1.04 ac | Curve number | = 91.4 |
| Basin Slope | = 0.8 % | Hydraulic length | = 166 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 3.20 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 8,107 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

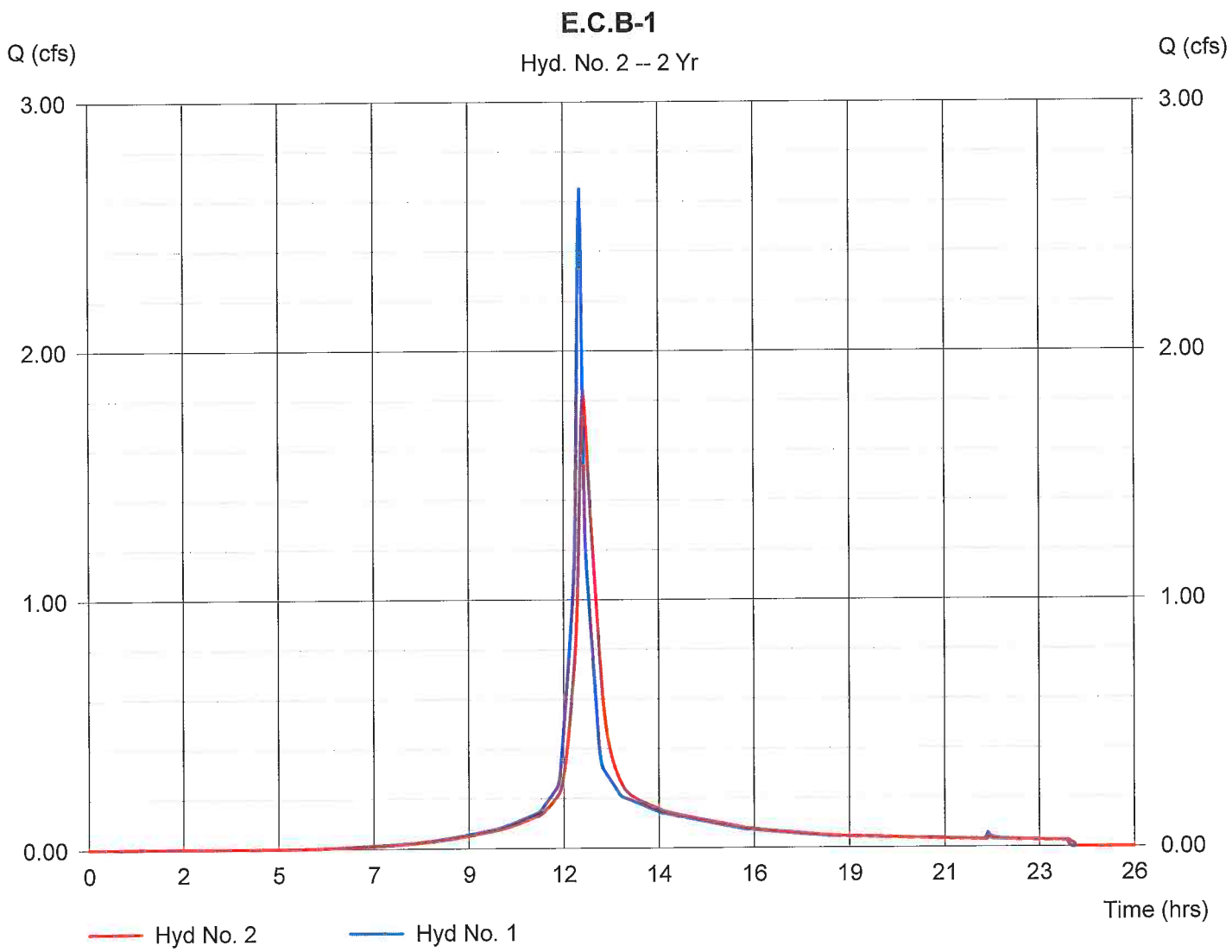
## Hyd. No. 2

E.C.B-1

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 1.82 cfs |
| Storm frequency | = | 2 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 1 | Section type | = | Circular |
| Reach length | = | 578.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.1974 |

Modified Att-Kin routing method used.

Hydrograph Volume = 8,101 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

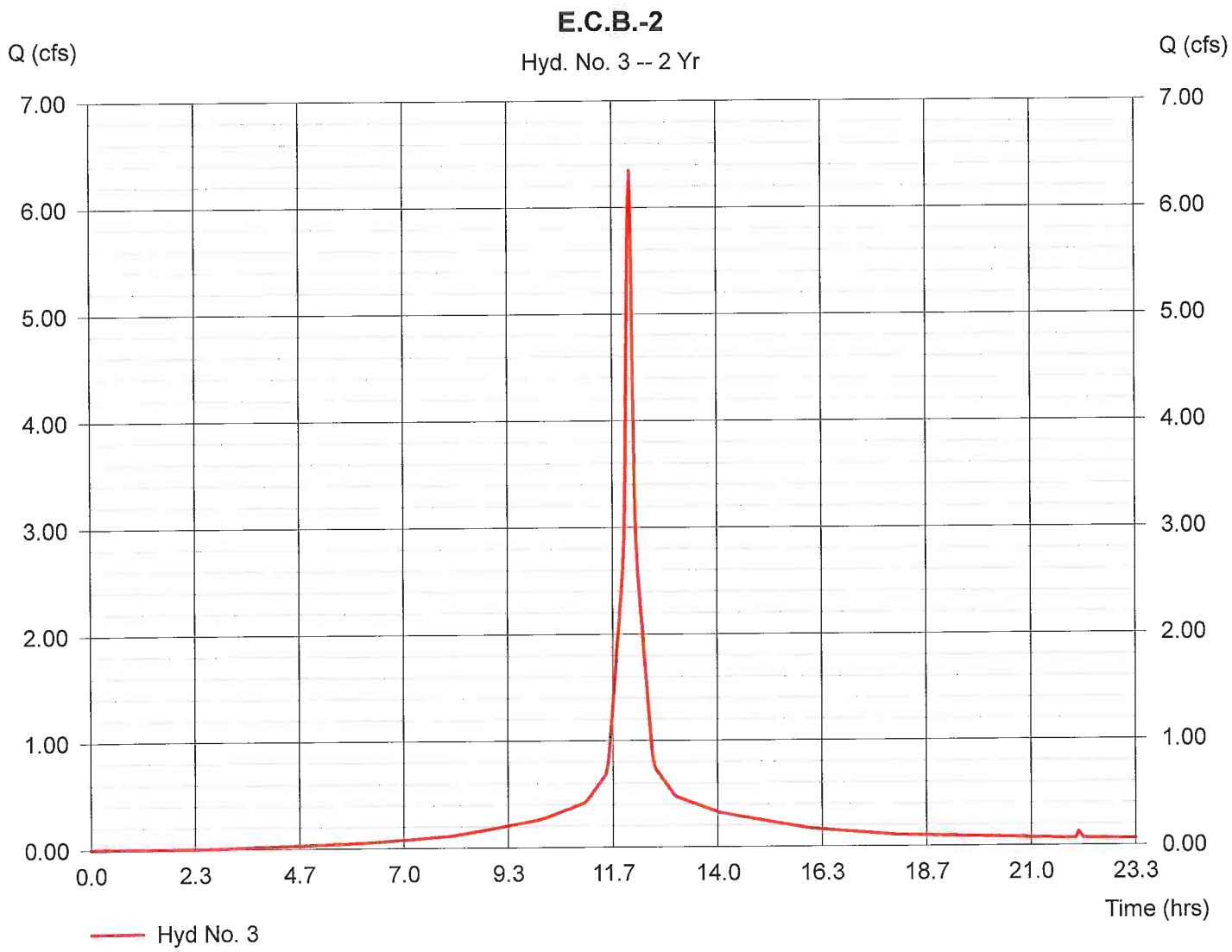
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 3

E.C.B.-2

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 6.35 cfs |
| Storm frequency | = 2 yrs | Time interval | = 2 min |
| Drainage area | = 2.19 ac | Curve number | = 96.1 |
| Basin Slope | = 1.2 % | Hydraulic length | = 320 ft |
| Tc method | = LAG | Time of conc. (Tc) | = 6.168732 min |
| Total precip. | = 3.20 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 20,540 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

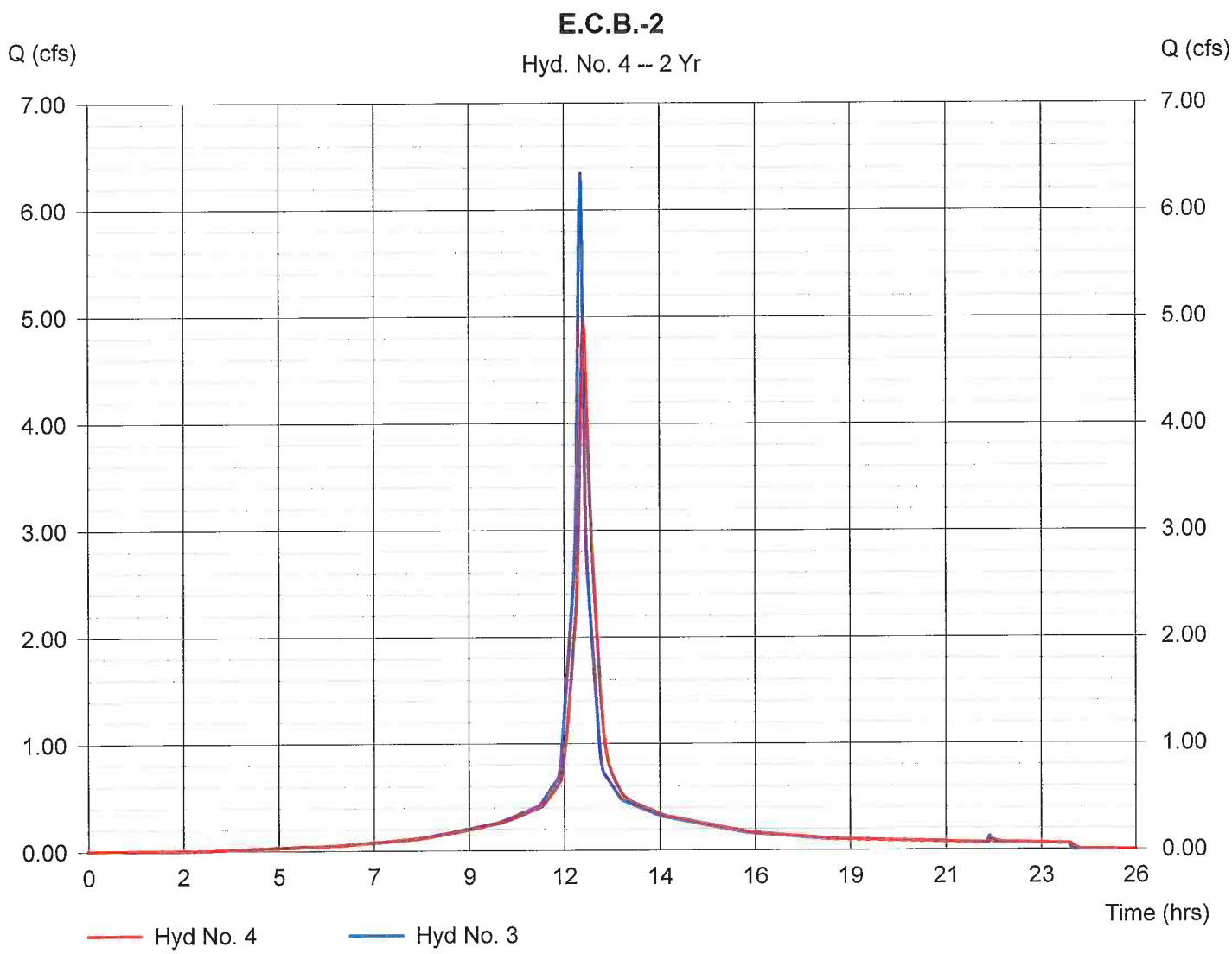
## Hyd. No. 4

E.C.B.-2

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 4.98 cfs |
| Storm frequency | = | 2 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 3 | Section type | = | Circular |
| Reach length | = | 917.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.2836 |

Modified Att-Kin routing method used.

Hydrograph Volume = 20,536 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

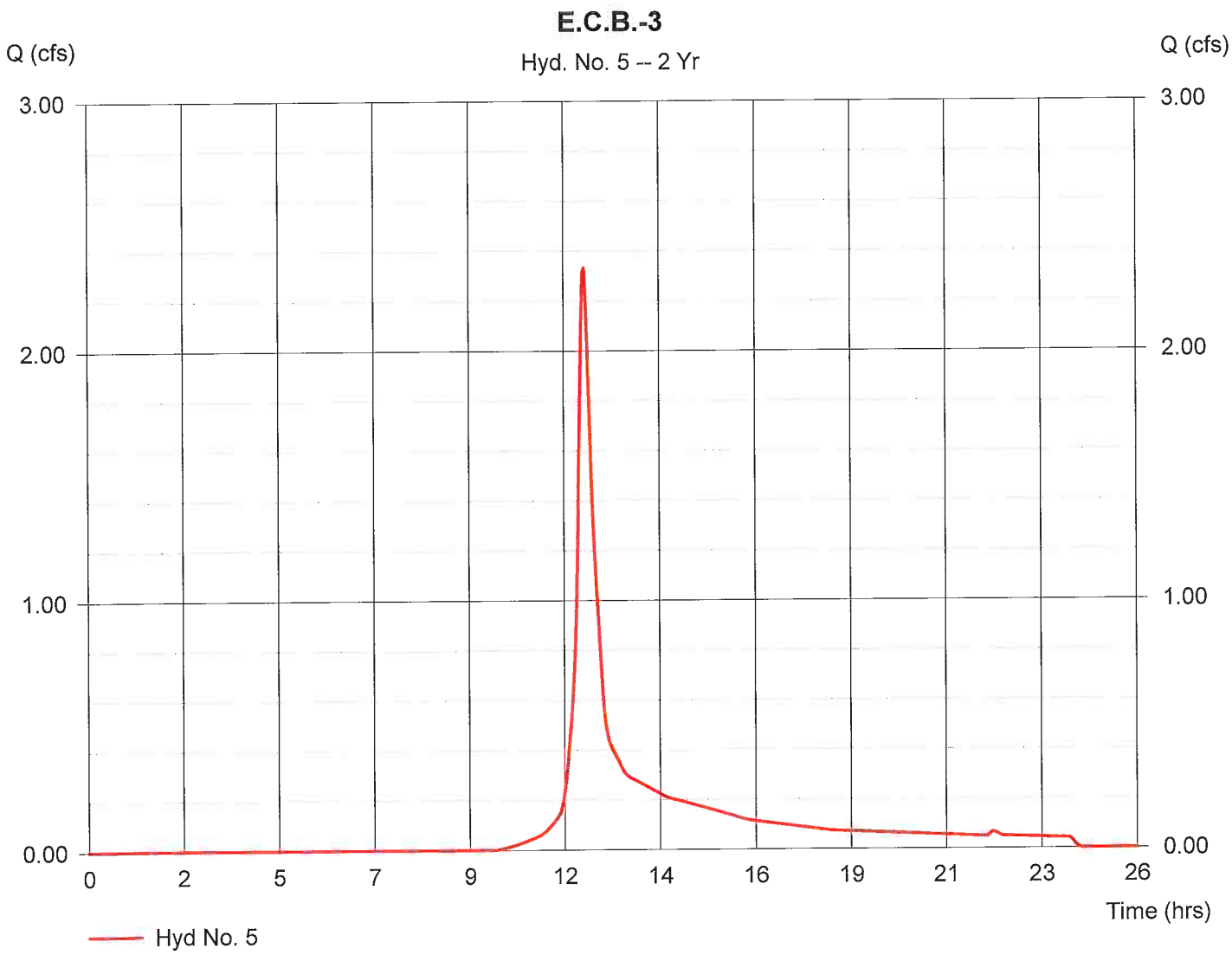
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 5

E.C.B.-3

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.33 cfs |
| Storm frequency | = 2 yrs | Time interval | = 2 min |
| Drainage area | = 1.96 ac | Curve number | = 77.6 |
| Basin Slope | = 1.0 % | Hydraulic length | = 326 ft |
| Tc method | = USER | Time of conc. (Tc) | = 10 min |
| Total precip. | = 3.20 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 9,179 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

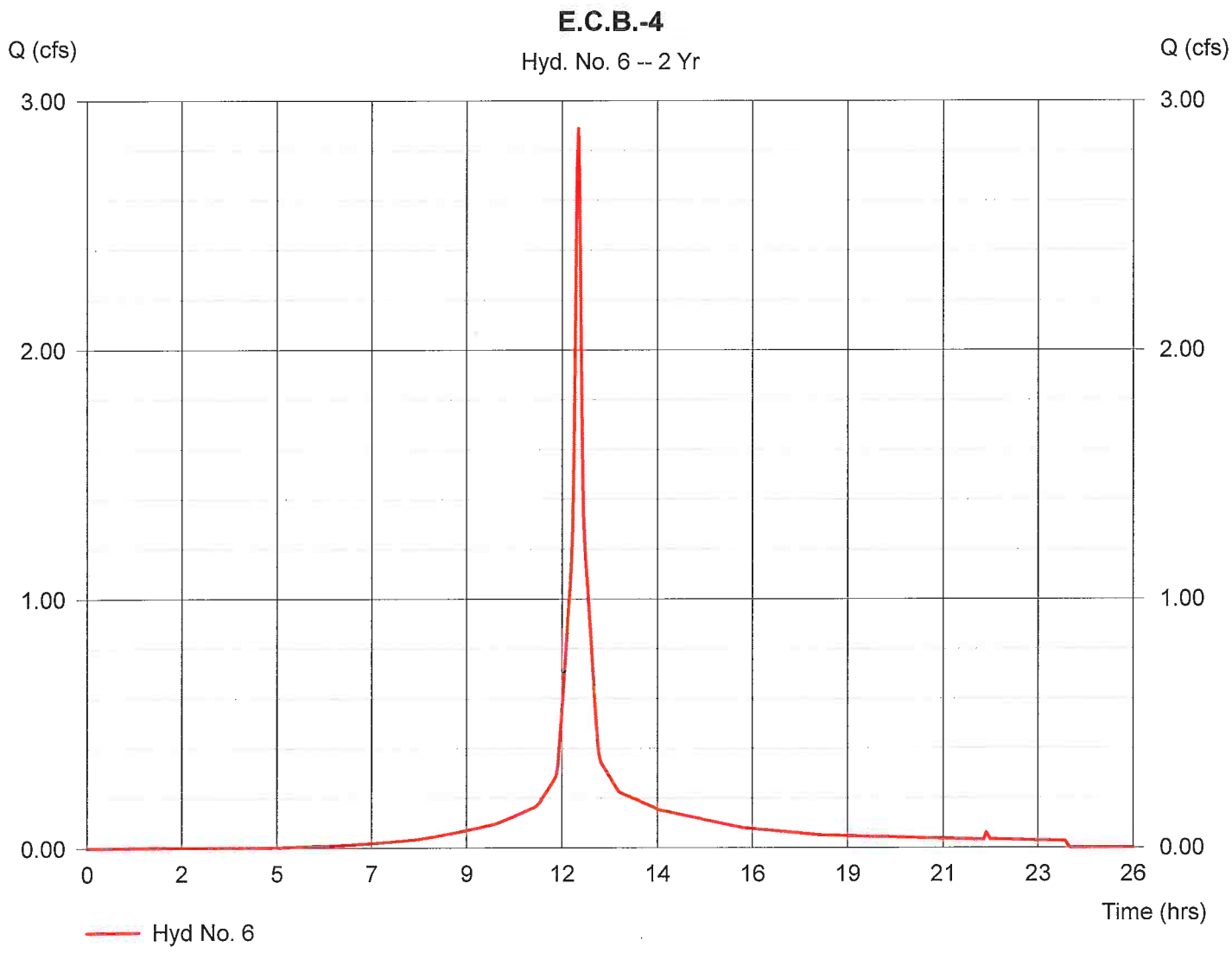
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 6

E.C.B.-4

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.89 cfs |
| Storm frequency | = 2 yrs | Time interval | = 2 min |
| Drainage area | = 1.08 ac | Curve number | = 92.8 |
| Basin Slope | = 0.8 % | Hydraulic length | = 213 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 3.20 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 8,943 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

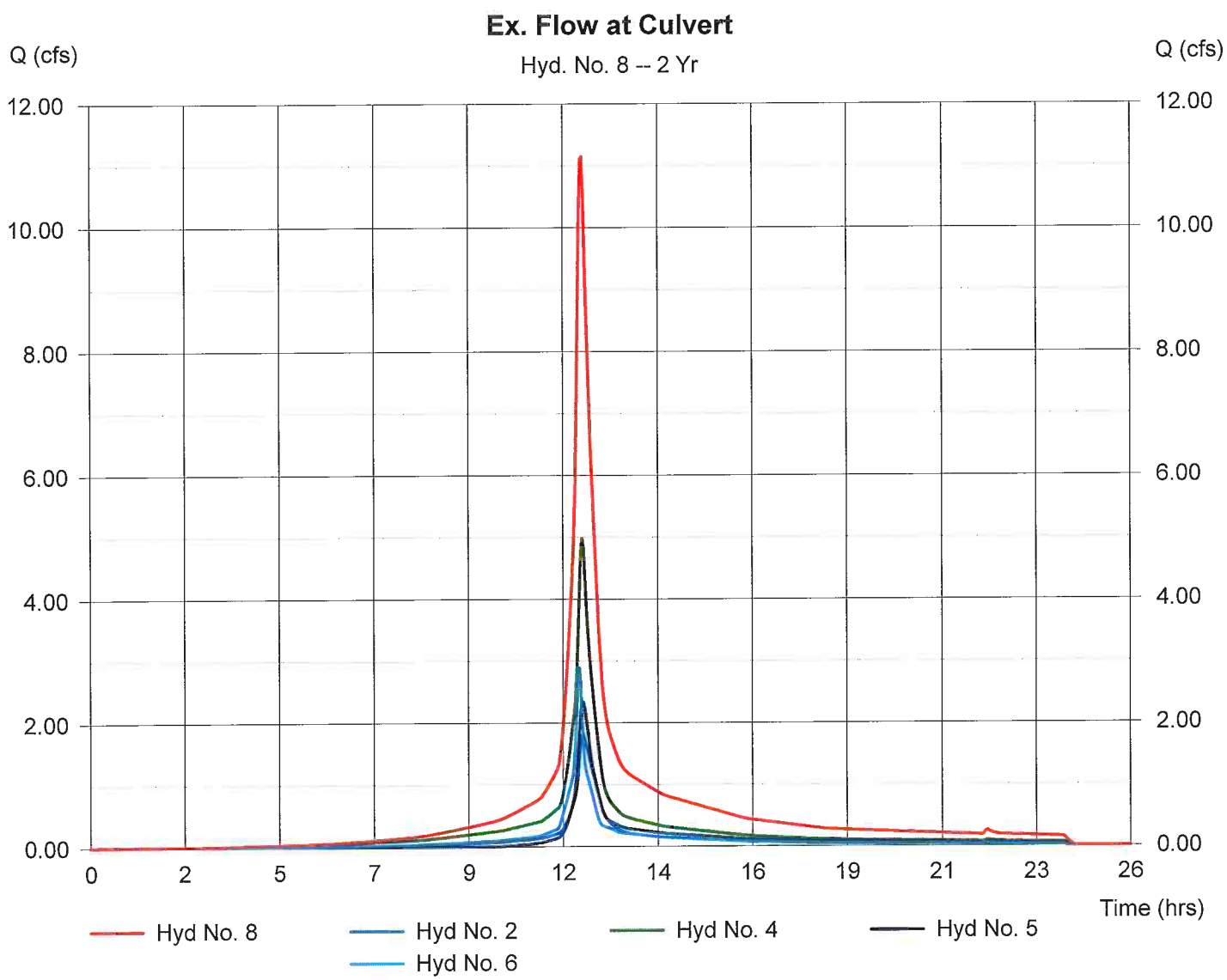
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 8

Ex. Flow at Culvert

| | | | |
|---|---|---|---|
| Hydrograph type | = Combine | Peak discharge | = 11.15 cfs |
| Storm frequency | = 2 yrs | Time interval | = 2 min |
| Inflow hyds. | = 2, 4, 5, 6 | | |

Hydrograph Volume = 46,759 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

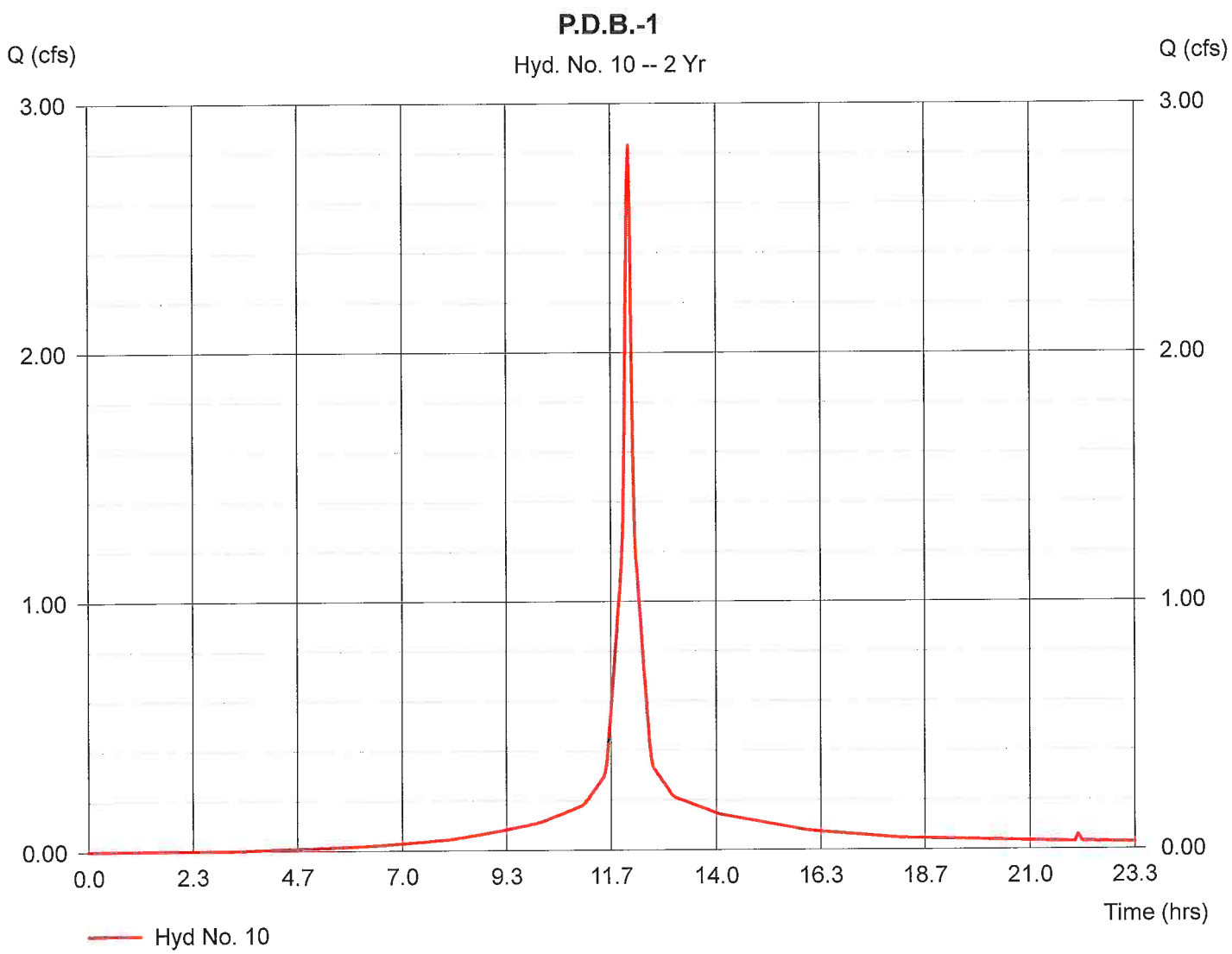
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 10

P.D.B.-1

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.83 cfs |
| Storm frequency | = 2 yrs | Time interval | = 2 min |
| Drainage area | = 1.00 ac | Curve number | = 95.1 |
| Basin Slope | = 0.7 % | Hydraulic length | = 148 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 3.20 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 9,018 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

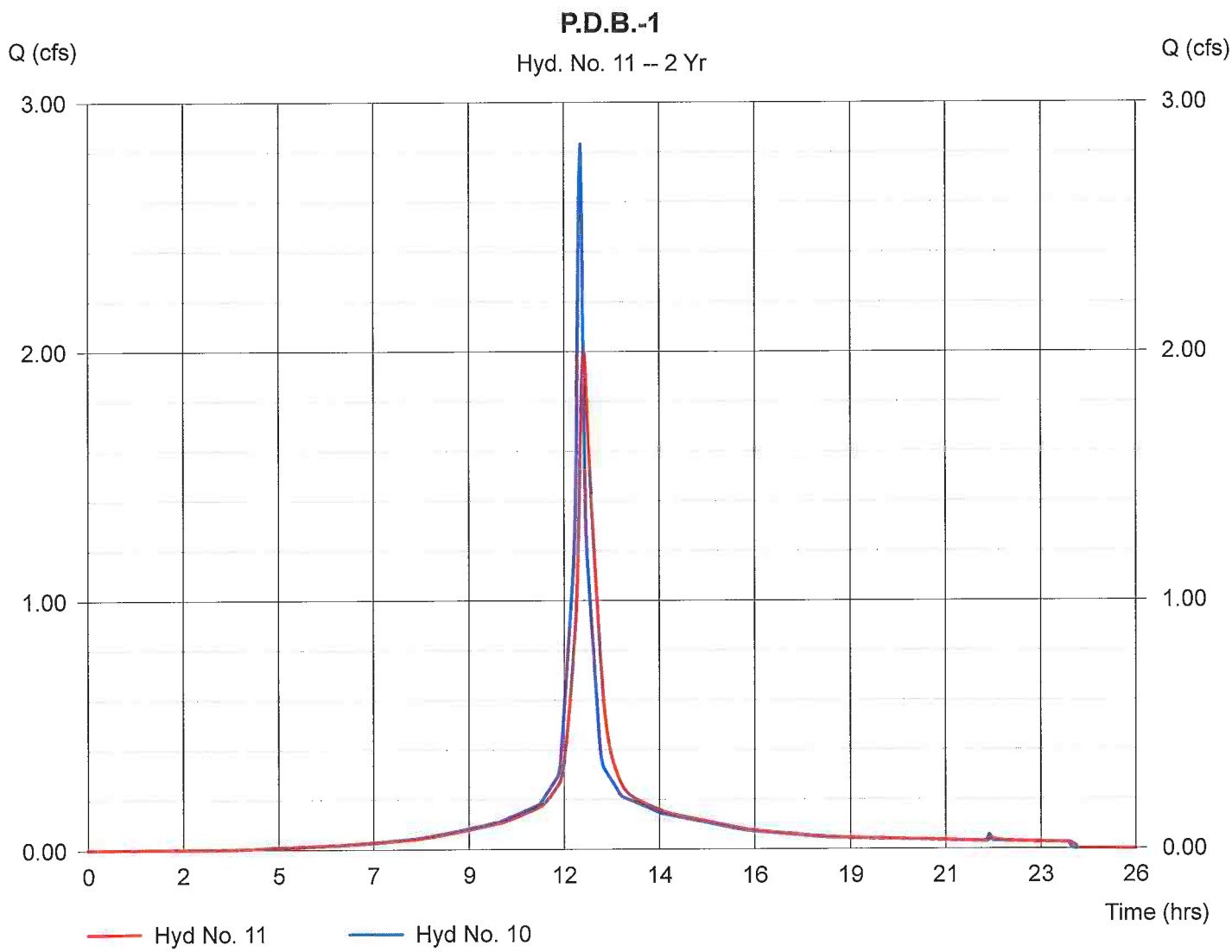
## Hyd. No. 11

P.D.B.-1

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 1.99 cfs |
| Storm frequency | = | 2 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 10 | Section type | = | Circular |
| Reach length | = | 578.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.2095 |

Modified Att-Kin routing method used.

Hydrograph Volume = 9,013 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

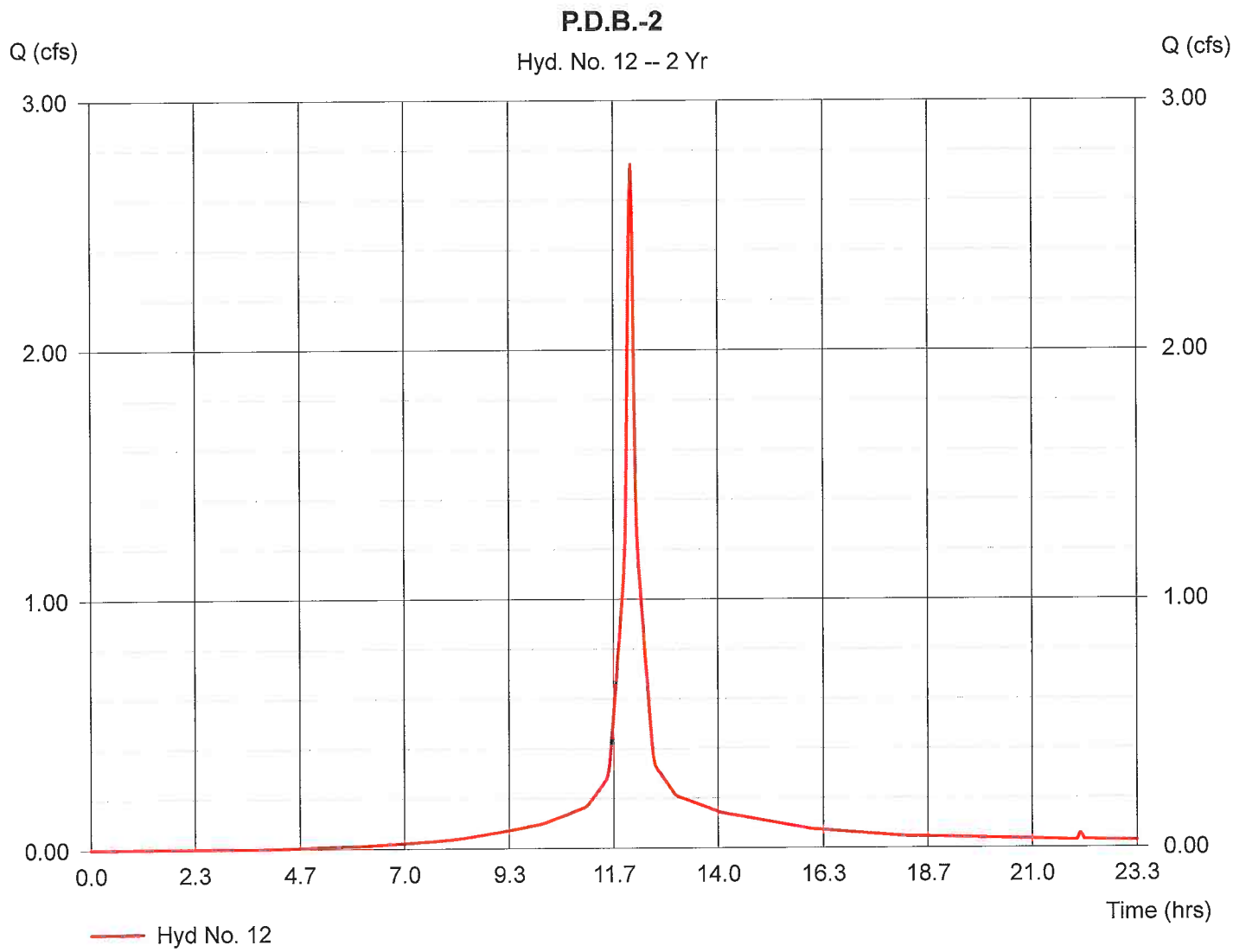
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 12

P.D.B.-2

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.75 cfs |
| Storm frequency | = 2 yrs | Time interval | = 2 min |
| Drainage area | = 1.00 ac | Curve number | = 93.8 |
| Basin Slope | = 0.9 % | Hydraulic length | = 256 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 3.20 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 8,589 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

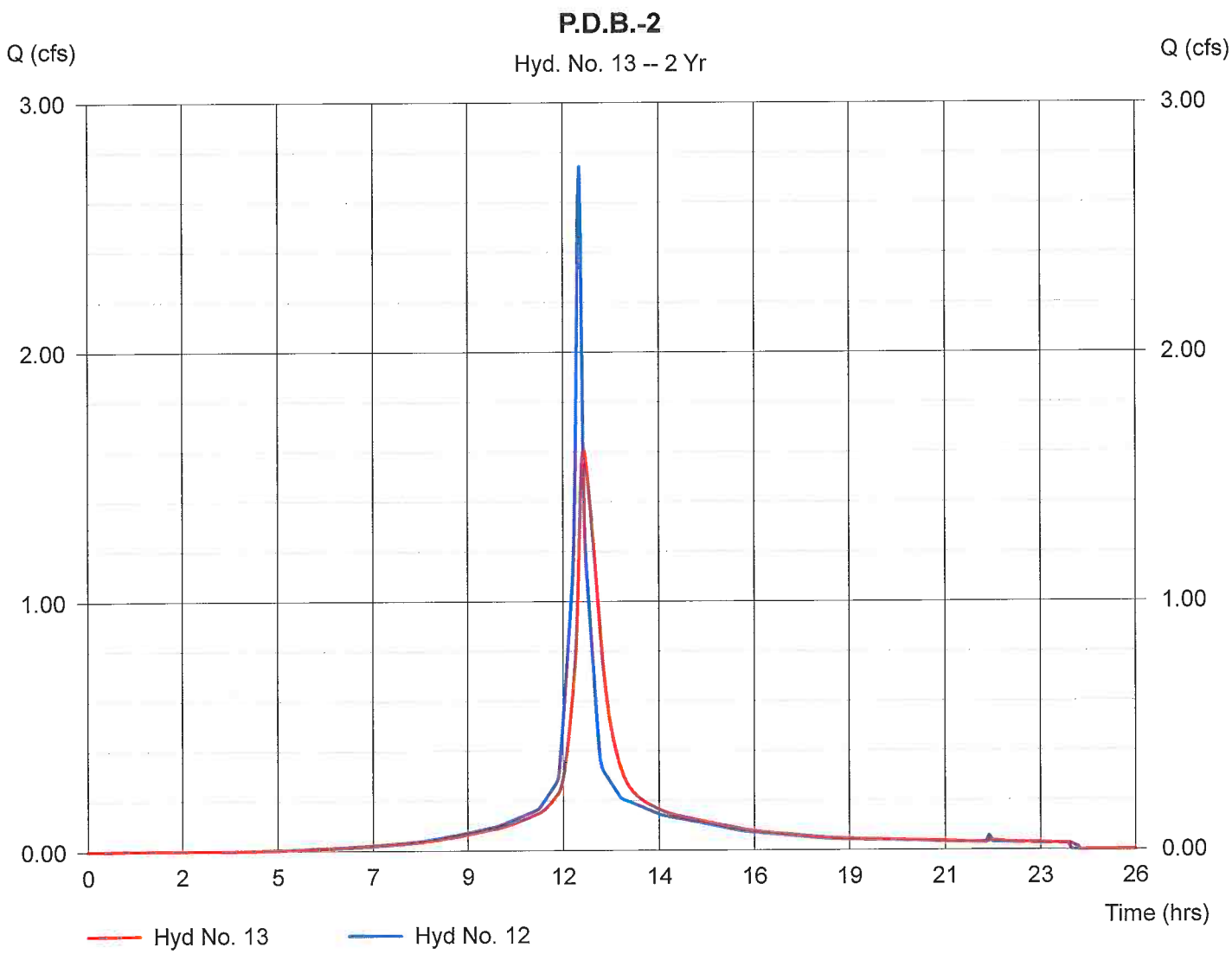
## Hyd. No. 13

P.D.B.-2

| | | | |
|---|---|---|---|
| Hydrograph type | = Reach | Peak discharge | = 1.62 cfs |
| Storm frequency | = 2 yrs | Time interval | = 2 min |
| Inflow hyd. No. | = 12 | Section type | = Circular |
| Reach length | = 917.0 ft | Channel slope | = 1.0 % |
| Manning's n | = 0.009 | Bottom width | = 2.0 ft |
| Side slope | = 0.0:1 | Max. depth | = 0.0 ft |
| Rating curve x | = 10.028 | Rating curve m | = 1.250 |
| Ave. velocity | = 0.00 ft/s | Routing coeff. | = 0.1334 |

Modified Att-Kin routing method used.

Hydrograph Volume = 8,580 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

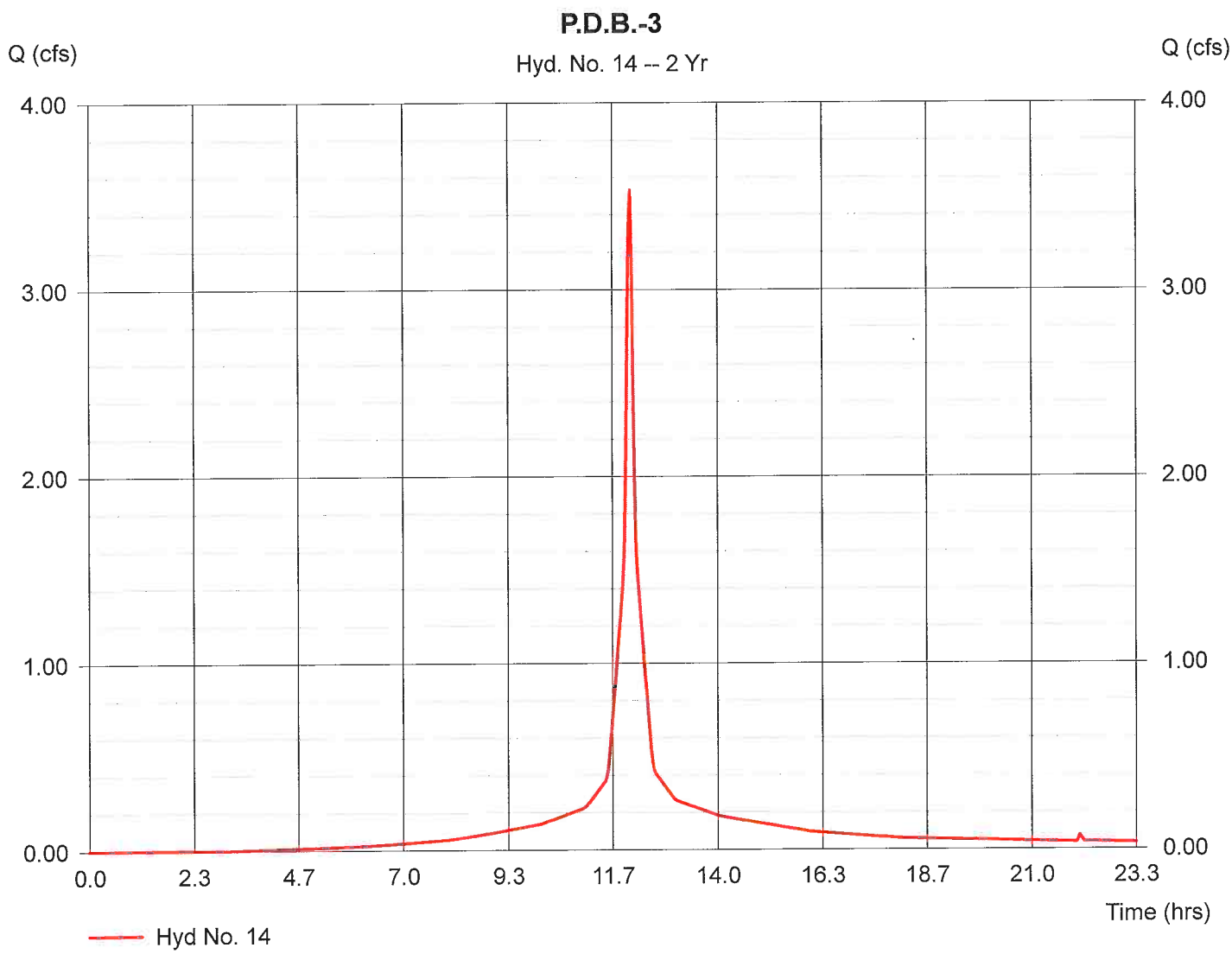
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 14

P.D.B.-3

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 3.53 cfs |
| Storm frequency | = 2 yrs | Time interval | = 2 min |
| Drainage area | = 1.24 ac | Curve number | = 95.3 |
| Basin Slope | = 0.9 % | Hydraulic length | = 139 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 3.20 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 11,283 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

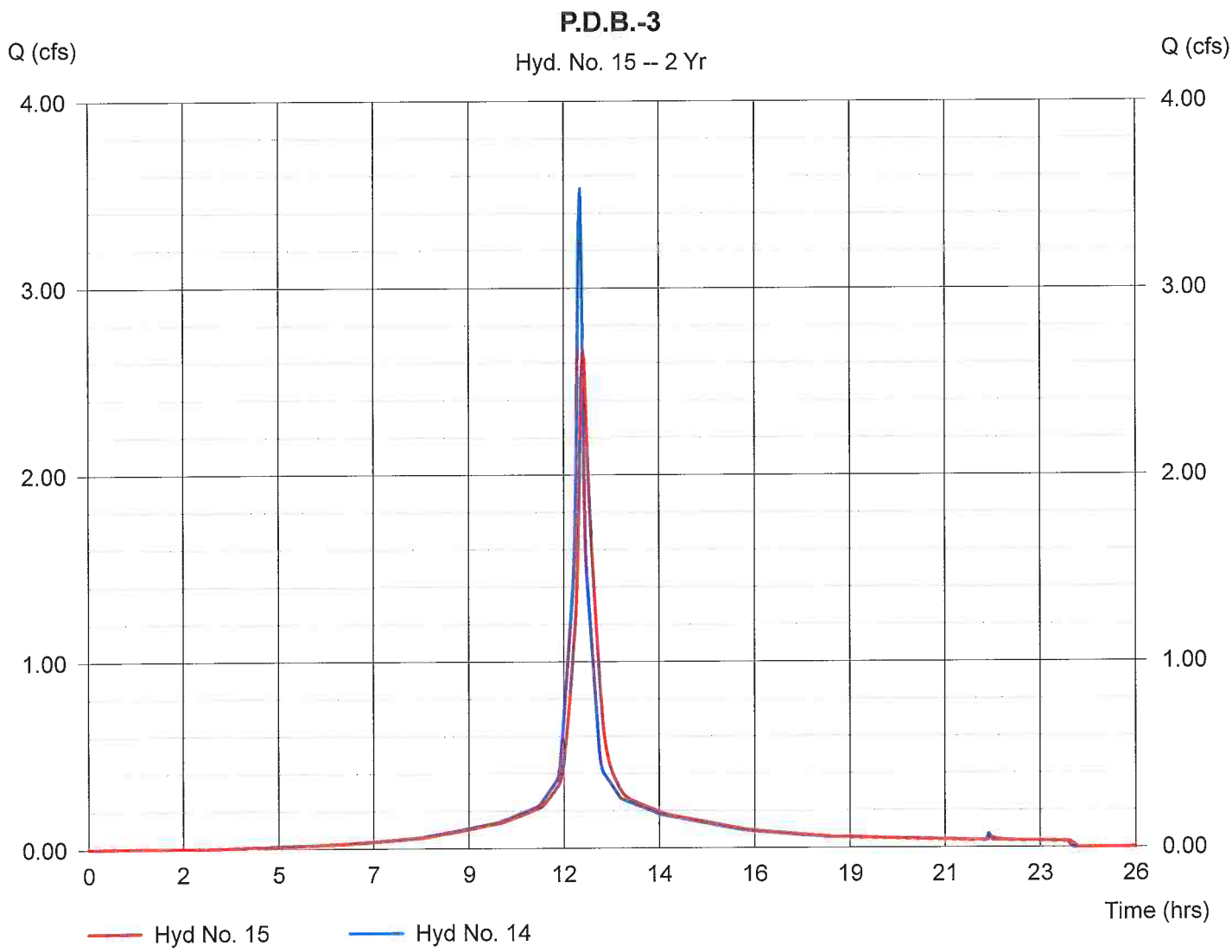
## Hyd. No. 15

P.D.B.-3

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 2.67 cfs |
| Storm frequency | = | 2 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 14 | Section type | = | Circular |
| Reach length | = | 582.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.2532 |

Modified Att-Kin routing method used.

Hydrograph Volume = 11,279 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

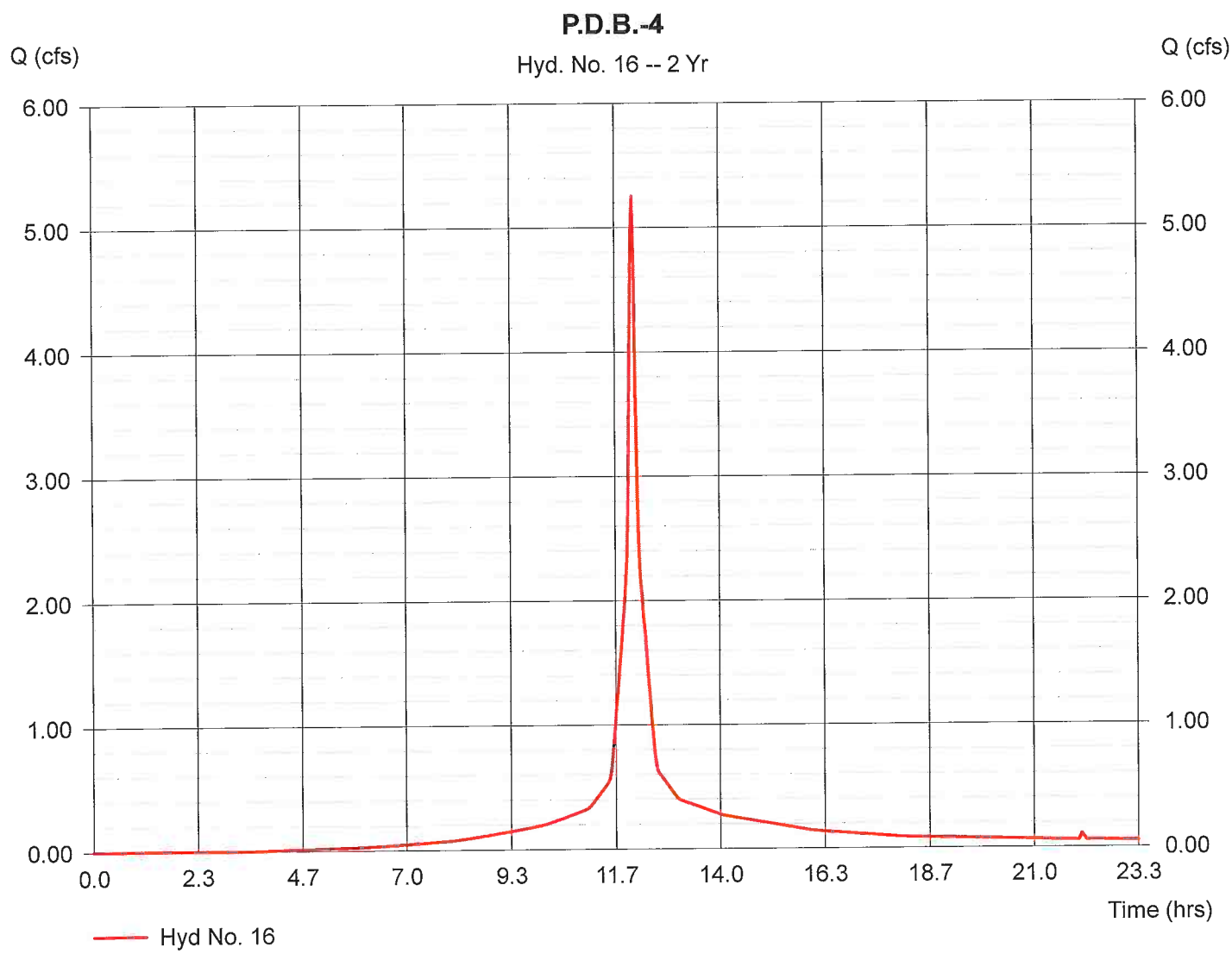
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 16

P.D.B.-4

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.26 cfs |
| Storm frequency | = 2 yrs | Time interval | = 2 min |
| Drainage area | = 1.88 ac | Curve number | = 94.5 |
| Basin Slope | = 1.5 % | Hydraulic length | = 144 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 = 16,587 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

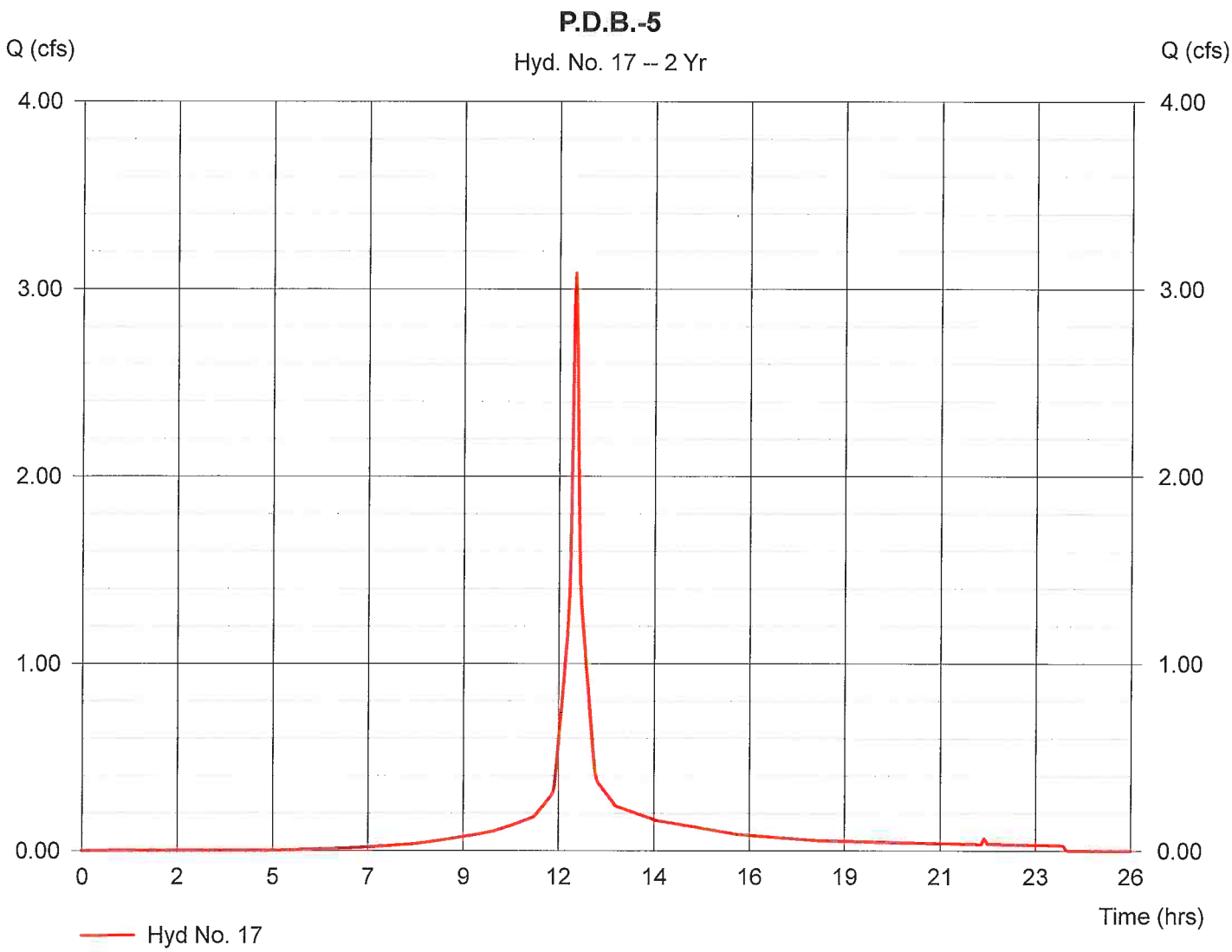
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 17

P.D.B.-5

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 3.08 cfs |
| Storm frequency | = 2 yrs | Time interval | = 2 min |
| Drainage area | = 1.16 ac | Curve number | = 92.8 |
| Basin Slope | = 1.2 % | Hydraulic length | = 100 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 = 9,546 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

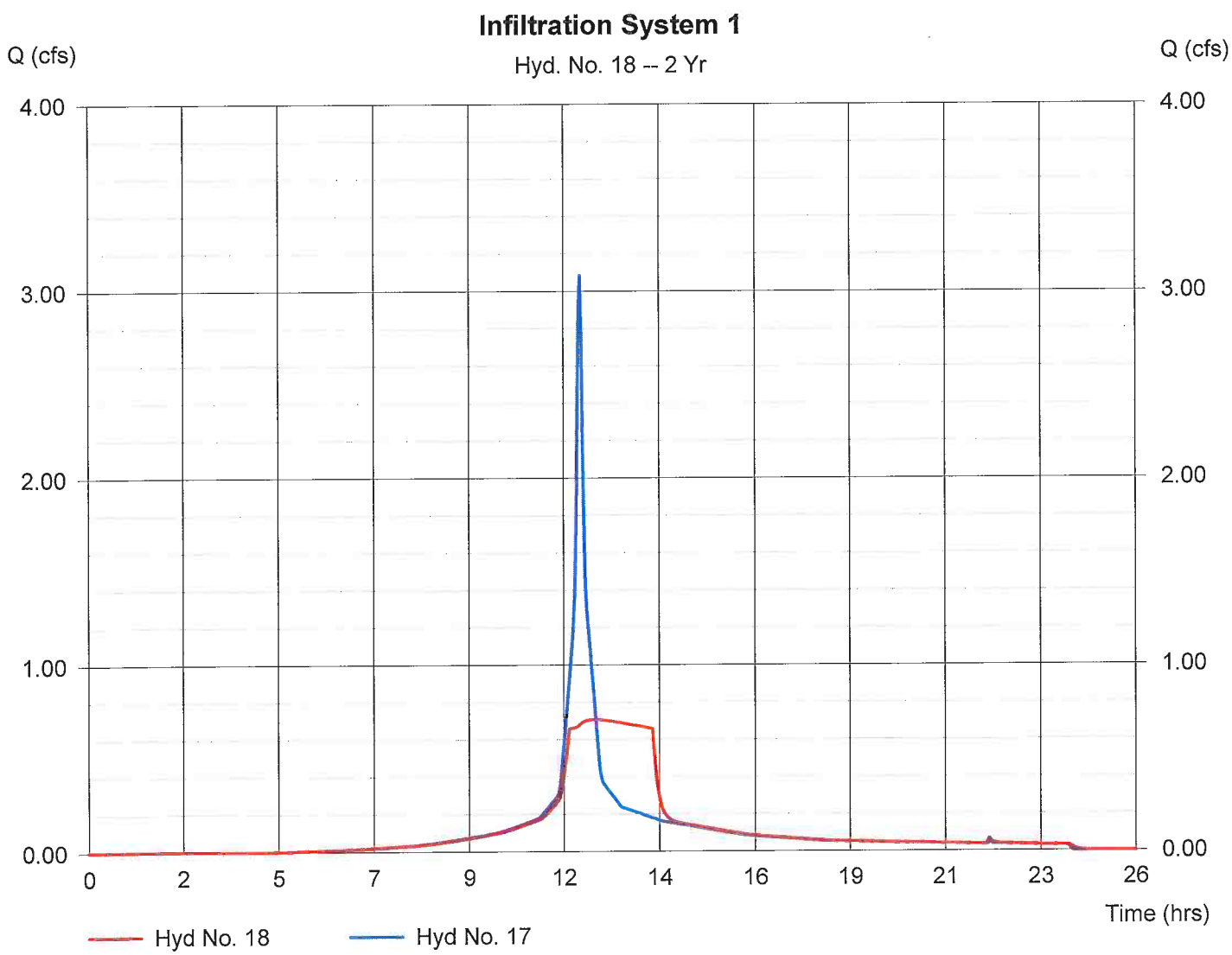
## Hyd. No. 18

Infiltration System 1

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 0.71 cfs |
| Storm frequency | = | 2 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 17 | Max. Elevation | = | 155.45 ft |
| Reservoir name | = | Infiltration System | Max. Storage | = | 2,319 cuft |

Storage Indication method used.

Hydrograph Volume = 9,546 cuft



# Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

## Pond No. 1 - Infiltration System

### Pond Data

Bottom LxW = 84.0 x 40.4 ft  Side slope = 0.0:1  Bottom elev. = 154.25 ft  Depth = 2.80 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft)* | Total storage (cuft)* |
|---|---|---|---|---|
| 0.00 | 154.25 | 3,394 | 0 | 0 |
| 0.14 | 154.39 | 3,394 | 271 | 271 |
| 0.28 | 154.53 | 3,394 | 271 | 542 |
| 0.42 | 154.67 | 3,394 | 271 | 812 |
| 0.56 | 154.81 | 3,394 | 271 | 1,083 |
| 0.70 | 154.95 | 3,394 | 271 | 1,354 |
| 0.84 | 155.09 | 3,394 | 271 | 1,625 |
| 0.98 | 155.23 | 3,394 | 271 | 1,896 |
| 1.12 | 155.37 | 3,394 | 271 | 2,166 |
| 1.26 | 155.51 | 3,394 | 271 | 2,437 |
| 1.40 | 155.65 | 3,394 | 271 | 2,708 |
| 1.54 | 155.79 | 3,394 | 271 | 2,979 |
| 1.68 | 155.93 | 3,394 | 271 | 3,250 |
| 1.82 | 156.07 | 3,394 | 271 | 3,521 |
| 1.96 | 156.21 | 3,394 | 271 | 3,791 |
| 2.10 | 156.35 | 3,394 | 271 | 4,062 |
| 2.24 | 156.49 | 3,394 | 271 | 4,333 |
| 2.38 | 156.63 | 3,394 | 271 | 4,604 |
| 2.52 | 156.77 | 3,394 | 271 | 4,875 |
| 2.66 | 156.91 | 3,394 | 271 | 5,145 |
| 2.80 | 157.05 | 3,394 | 271 | 5,416 |

(*57.00% voids applied)

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| Rise (in) | = 6.00 | 0.00 | 0.00 | 0.00 |
| Span (in) | = 6.00 | 0.00 | 0.00 | 0.00 |
| No. Barrels | = 8 | 0 | 0 | 0 |
| Invert El. (ft) | = 156.60 | 0.00 | 0.00 | 0.00 |
| Length (ft) | = 15.00 | 0.00 | 0.00 | 0.00 |
| Slope (%) | = 3.00 | 0.00 | 0.00 | 0.00 |
| N-Value | = .013 | .000 | .000 | .000 |
| Orif. Coeff. | = 0.60 | 0.00 | 0.00 | 0.00 |
| Multi-Stage | = n/a | No | No | No |

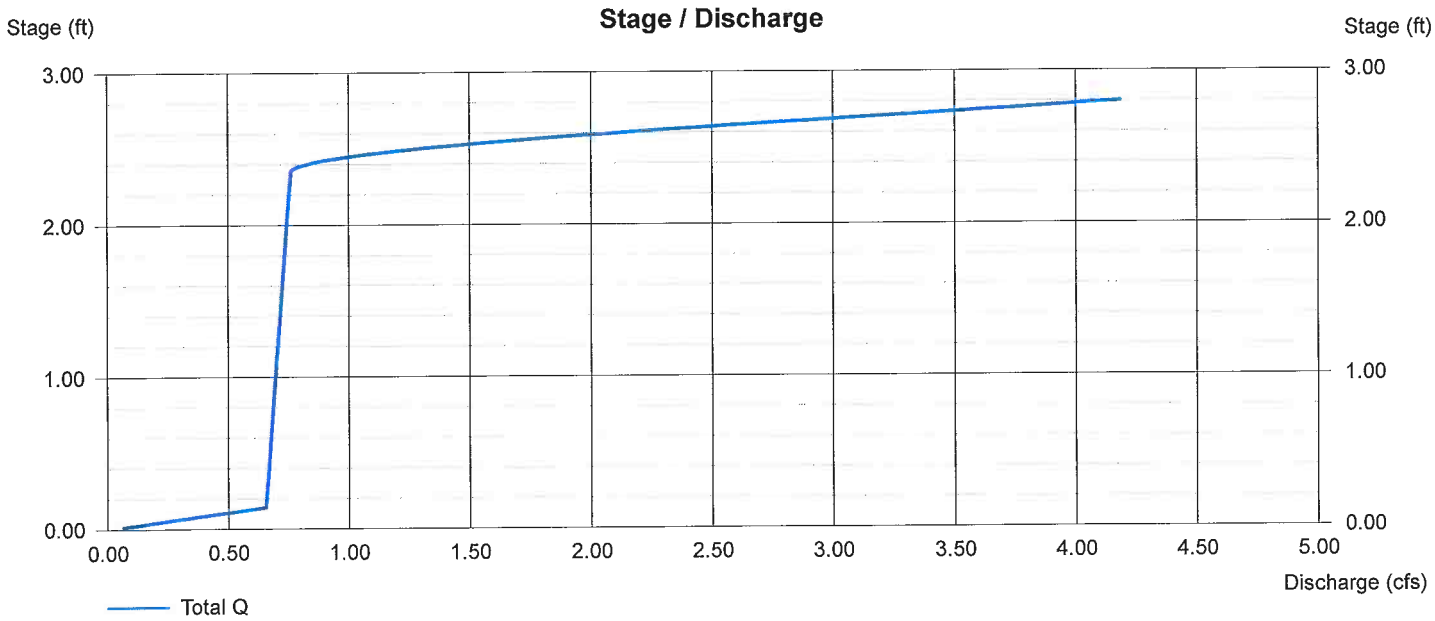
### Weir Structures

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

Exfiltration = 8.270 in/hr (Wet area)  Tailwater Elev. = 0.00 ft

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

### Stage / Discharge



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

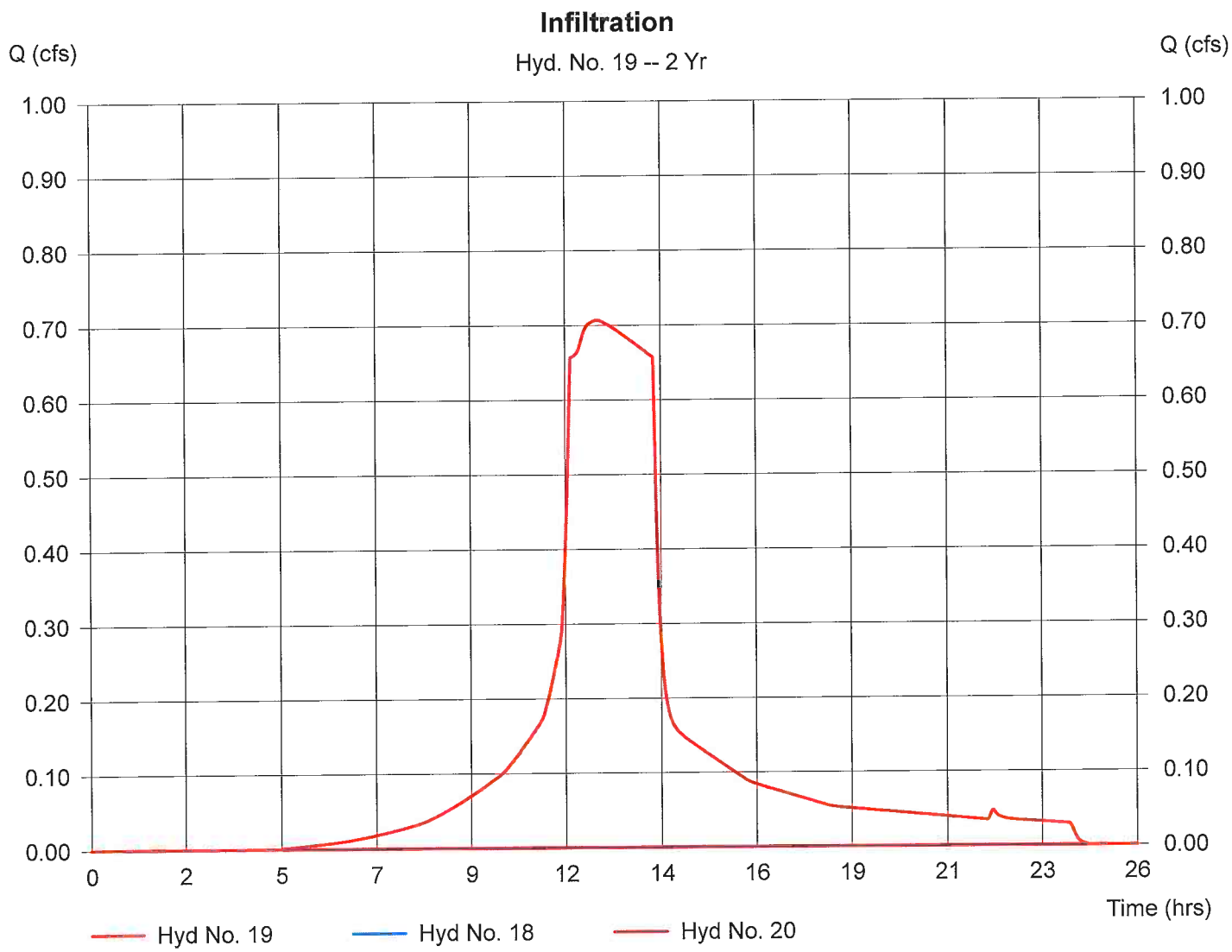
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 19

Infiltration

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Diversion1 | Peak discharge | = | 0.71 cfs |
| Storm frequency | = | 2 yrs | Time interval | = | 2 min |
| Inflow hydrograph | = | 18 | 2nd diverted hyd. | = | 20 |
| Diversion method | = | Pond - Infiltration System | Pond structure | = | Exfiltration |

Hydrograph Volume = 9,546 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

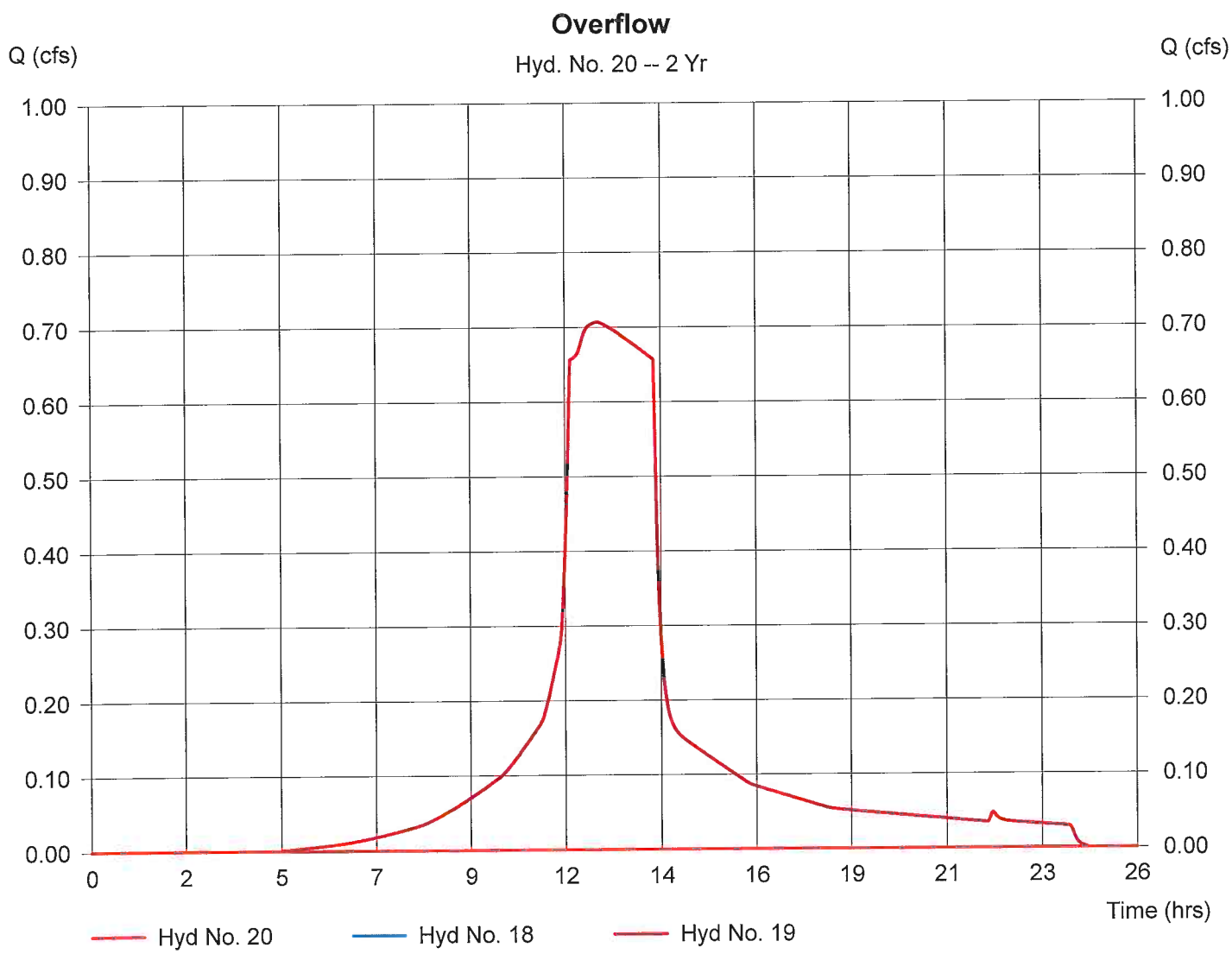
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 20

Overflow

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Diversion2 | Peak discharge | = | 0.00 cfs |
| Storm frequency | = | 2 yrs | Time interval | = | 2 min |
| Inflow hydrograph | = | 18 | 2nd diverted hyd. | = | 19 |
| Diversion method | = | Pond - Infiltration System | Pond structure | = | Exfiltration |

Hydrograph Volume = 0 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

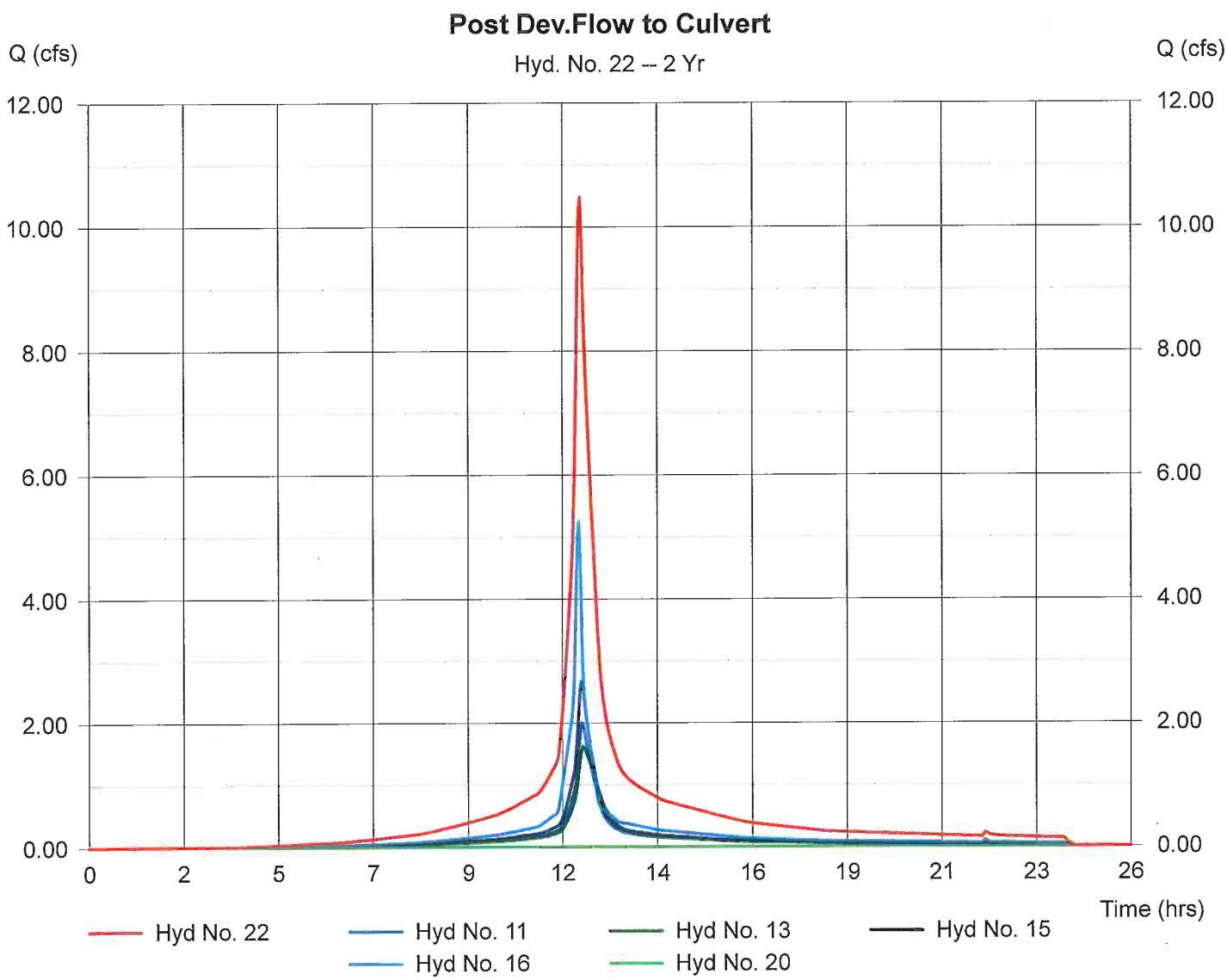
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 22

Post Dev.Flow to Culvert

| | | | |
|---|---|---|---|
| Hydrograph type | = Combine | Peak discharge | = 10.48 cfs |
| Storm frequency | = 2 yrs | Time interval | = 2 min |
| Inflow hyds. | = 11, 13, 15, 16, 20 | | |

Hydrograph Volume = 45,459 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 | 4.21 | 2 | 724 | 13,188 | ---- | ------ | ------ | E.C.B.-1 |
| 2 | Reach | 3.34 | 2 | 728 | 13,184 | 1 | ------ | ------ | E.C.B-1 |
| 3 | SCS Runoff | 9.53 | 2 | 724 | 31,600 | ---- | ------ | ------ | E.C.B.-2 |
| 4 | Reach | 8.18 | 2 | 728 | 31,597 | 3 | ------ | ------ | E.C.B.-2 |
| 5 | SCS Runoff | 4.64 | 2 | 728 | 17,828 | ---- | ------ | ------ | E.C.B.-3 |
| 6 | SCS Runoff | 4.50 | 2 | 724 | 14,308 | ---- | ------ | ------ | E.C.B.-4 |
| 8 | Combine | 19.53 | 2 | 726 | 76,917 | 2, 4, 5, 6, | ------ | ------ | Ex. Flow at Culvert |
| 10 | SCS Runoff | 4.30 | 2 | 724 | 14,039 | ---- | ------ | ------ | P.D.B.-1 |
| 11 | Reach | 3.44 | 2 | 728 | 14,036 | 10 | ------ | ------ | P.D.B.-1 |
| 12 | SCS Runoff | 4.23 | 2 | 724 | 13,580 | ---- | ------ | ------ | P.D.B.-2 |
| 13 | Reach | 2.92 | 2 | 730 | 13,574 | 12 | ------ | ------ | P.D.B.-2 |
| 14 | SCS Runoff | 5.35 | 2 | 724 | 17,523 | ---- | ------ | ------ | P.D.B.-3 |
| 15 | Reach | 4.49 | 2 | 728 | 17,520 | 14 | ------ | ------ | P.D.B.-3 |
| 16 | SCS Runoff | 8.02 | 2 | 724 | 26,007 | ---- | ------ | ------ | P.D.B.-4 |
| 17 | SCS Runoff | 4.81 | 2 | 724 | 15,272 | ---- | ------ | ------ | P.D.B.-5 |
| 18 | Reservoir | 0.77 | 2 | 752 | 15,272 | 17 | 156.62 | 4,583 | Infiltration System 1 |
| 19 | Diversion1 | 0.76 | 2 | 752 | 15,268 | 18 | ------ | ------ | Infiltration |
| 20 | Diversion2 | 0.01 | 2 | 752 | 4 | 18 | ------ | ------ | Overflow |
| 22 | Combine | 17.45 | 2 | 726 | 71,141 | 11, 13, 15, 16, 20, | ---- | ------ | Post Dev.Flow to Culvert |

# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

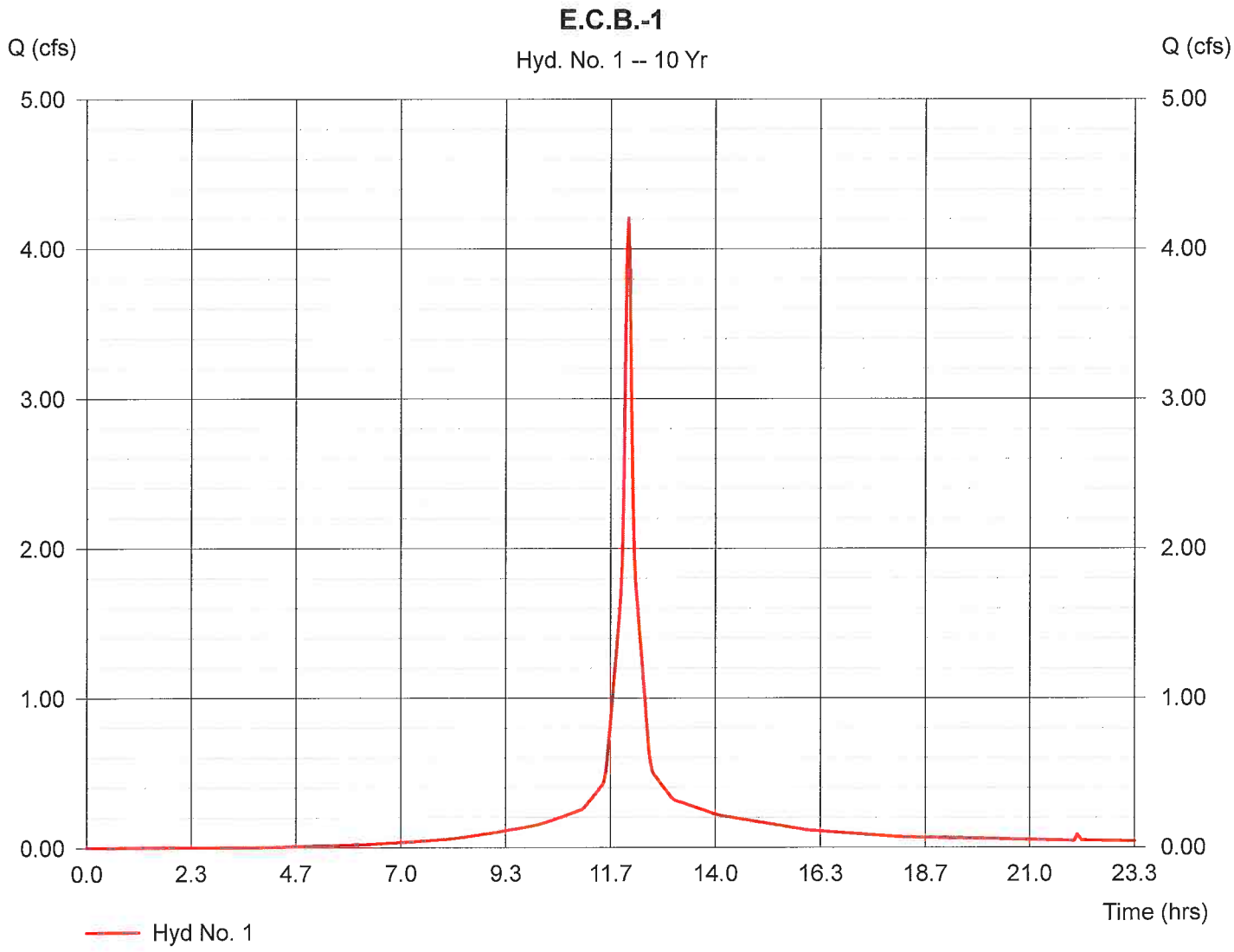
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 1

E.C.B.-1

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 4.21 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Drainage area | = 1.04 ac | Curve number | = 91.4 |
| Basin Slope | = 0.8 % | Hydraulic length | = 166 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 4.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 13,188 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

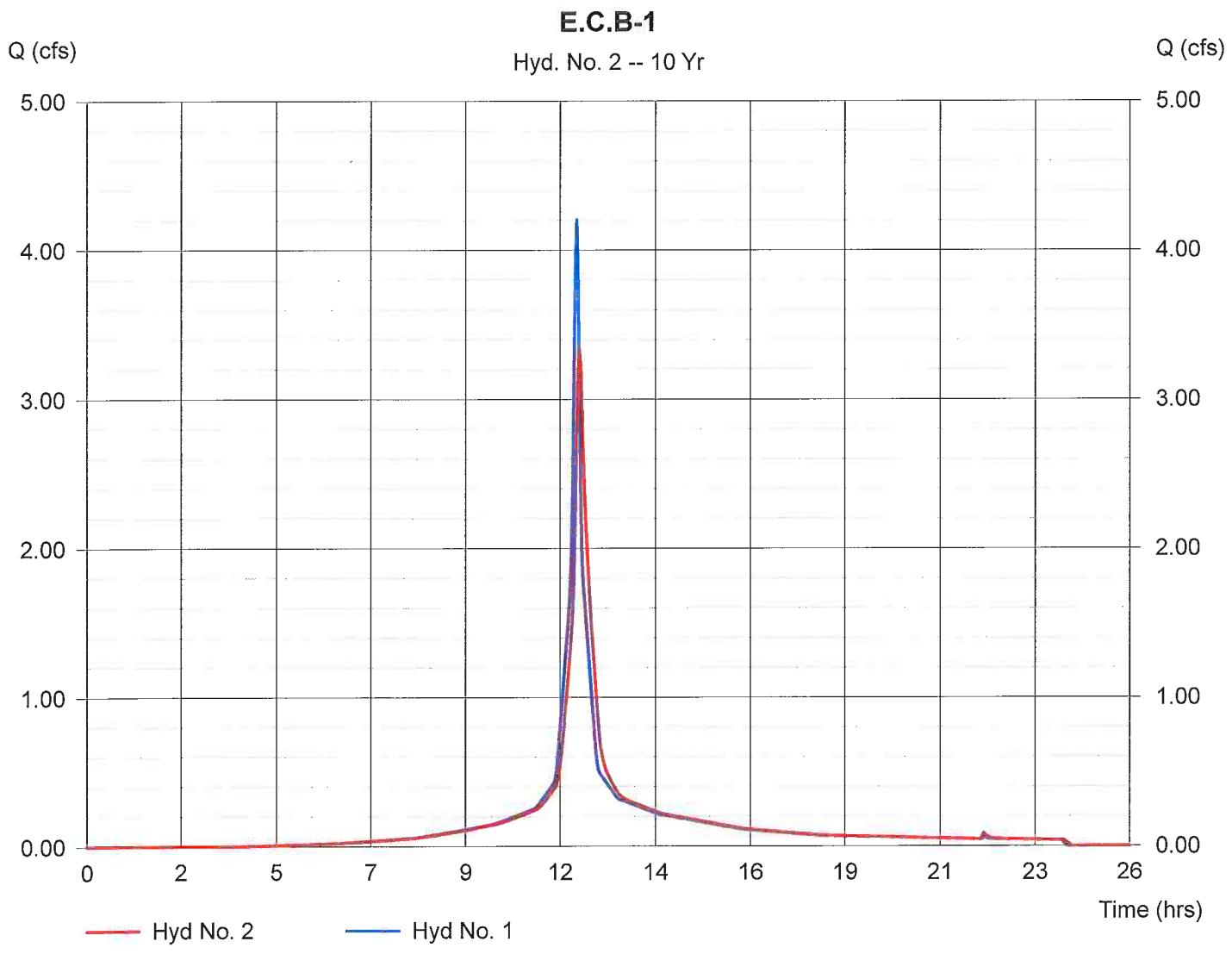
## Hyd. No. 2

E.C.B-1

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 3.34 cfs |
| Storm frequency | = | 10 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 1 | Section type | = | Circular |
| Reach length | = | 578.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.2960 |

Modified Att-Kin routing method used.

Hydrograph Volume = 13,184 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

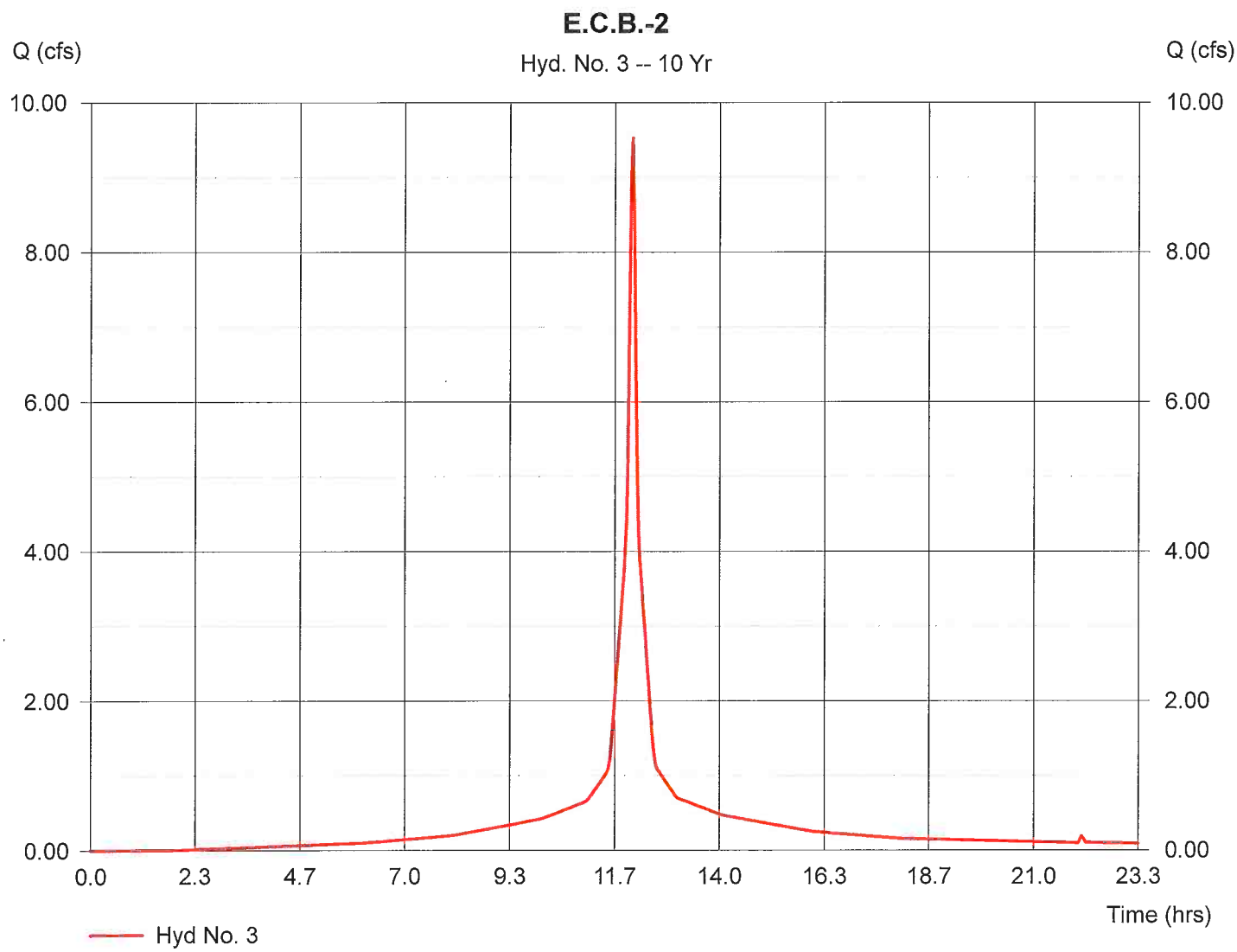
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 3

E.C.B.-2

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 9.53 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Drainage area | = 2.19 ac | Curve number | = 96.1 |
| Basin Slope | = 1.2 % | Hydraulic length | = 320 ft |
| Tc method | = LAG | Time of conc. (Tc) | = 6.168732 min |
| Total precip. | = 4.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 31,600 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

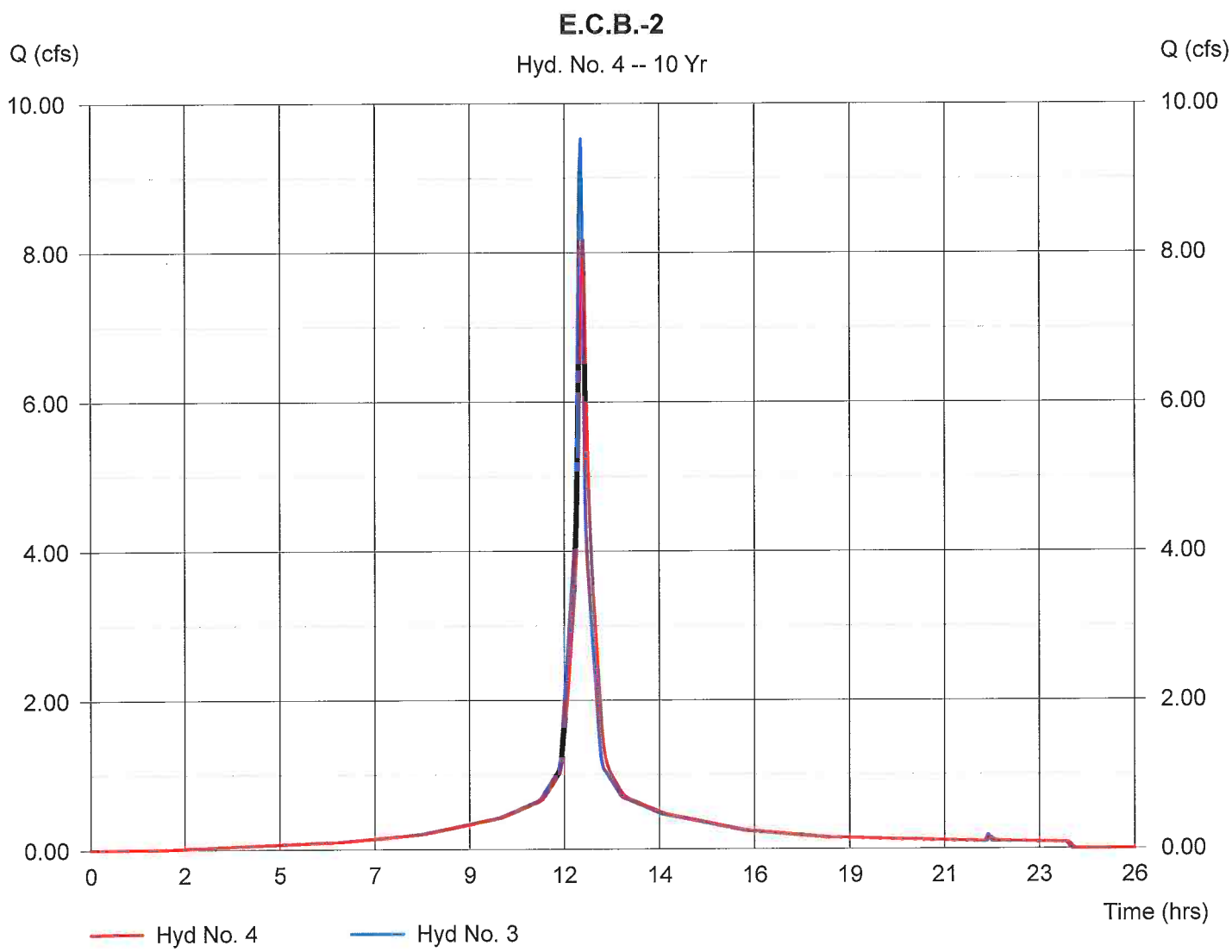
## Hyd. No. 4

E.C.B.-2

| | | | |
|---|---|---|---|
| Hydrograph type | = Reach | Peak discharge | = 8.18 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Inflow hyd. No. | = 3 | Section type | = Circular |
| Reach length | = 917.0 ft | Channel slope | = 1.0 % |
| Manning's n | = 0.009 | Bottom width | = 2.0 ft |
| Side slope | = 0.0:1 | Max. depth | = 0.0 ft |
| Rating curve x | = 10.028 | Rating curve m | = 1.250 |
| Ave. velocity | = 0.00 ft/s | Routing coeff. | = 0.3975 |

Modified Att-Kin routing method used.

Hydrograph Volume = 31,597 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

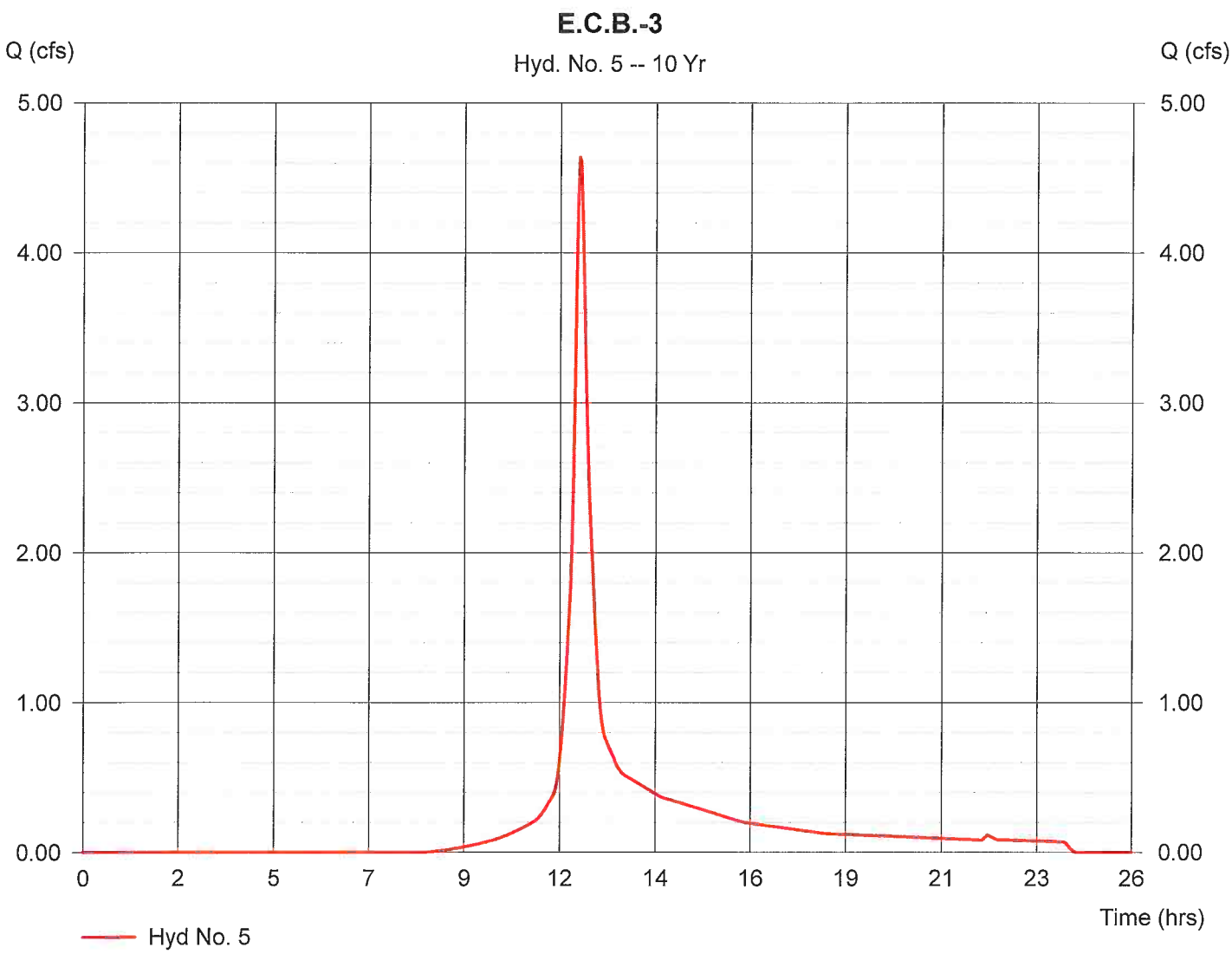
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 5

E.C.B.-3

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 4.64 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Drainage area | = 1.96 ac | Curve number | = 77.6 |
| Basin Slope | = 1.0 % | Hydraulic length | = 326 ft |
| Tc method | = USER | Time of conc. (Tc) | = 10 min |
| Total precip. | = 4.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 17,828 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

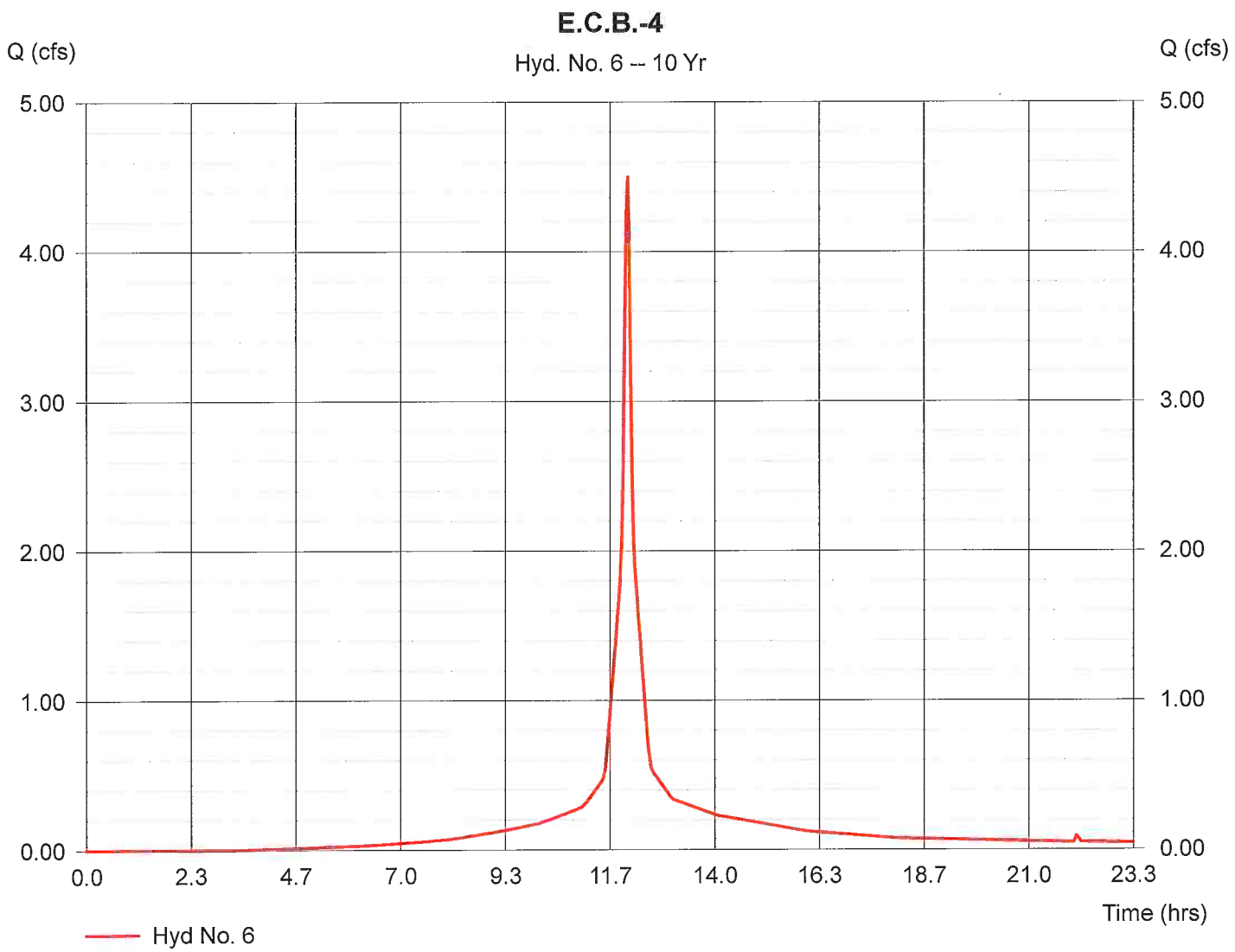
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 6

E.C.B.-4

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 4.50 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Drainage area | = 1.08 ac | Curve number | = 92.8 |
| Basin Slope | = 0.8 % | Hydraulic length | = 213 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 4.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 14,308 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

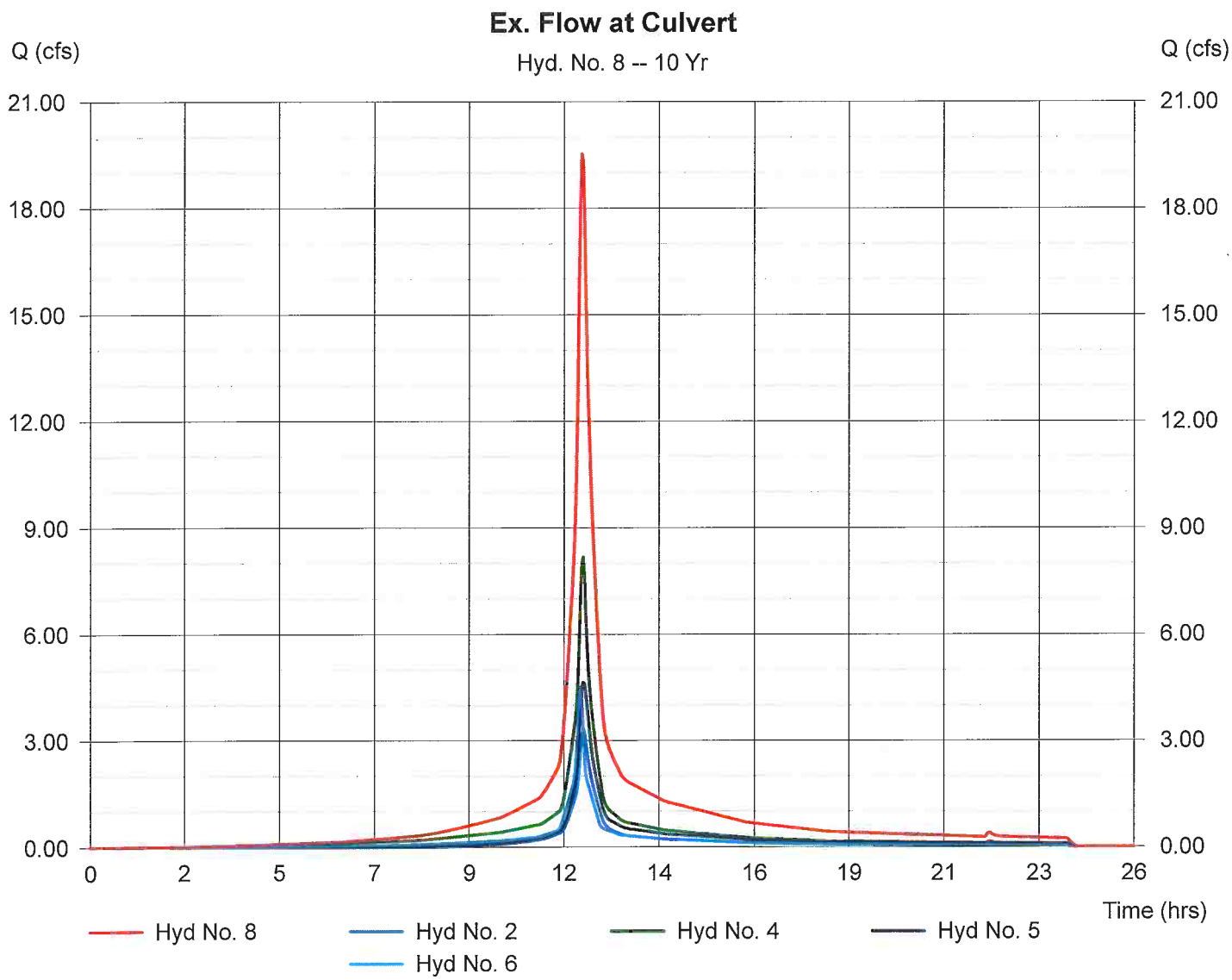
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 8

Ex. Flow at Culvert

| | | | |
|---|---|---|---|
| Hydrograph type | = Combine | Peak discharge | = 19.53 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Inflow hyds. | = 2, 4, 5, 6 | | |

Hydrograph Volume = 76,917 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

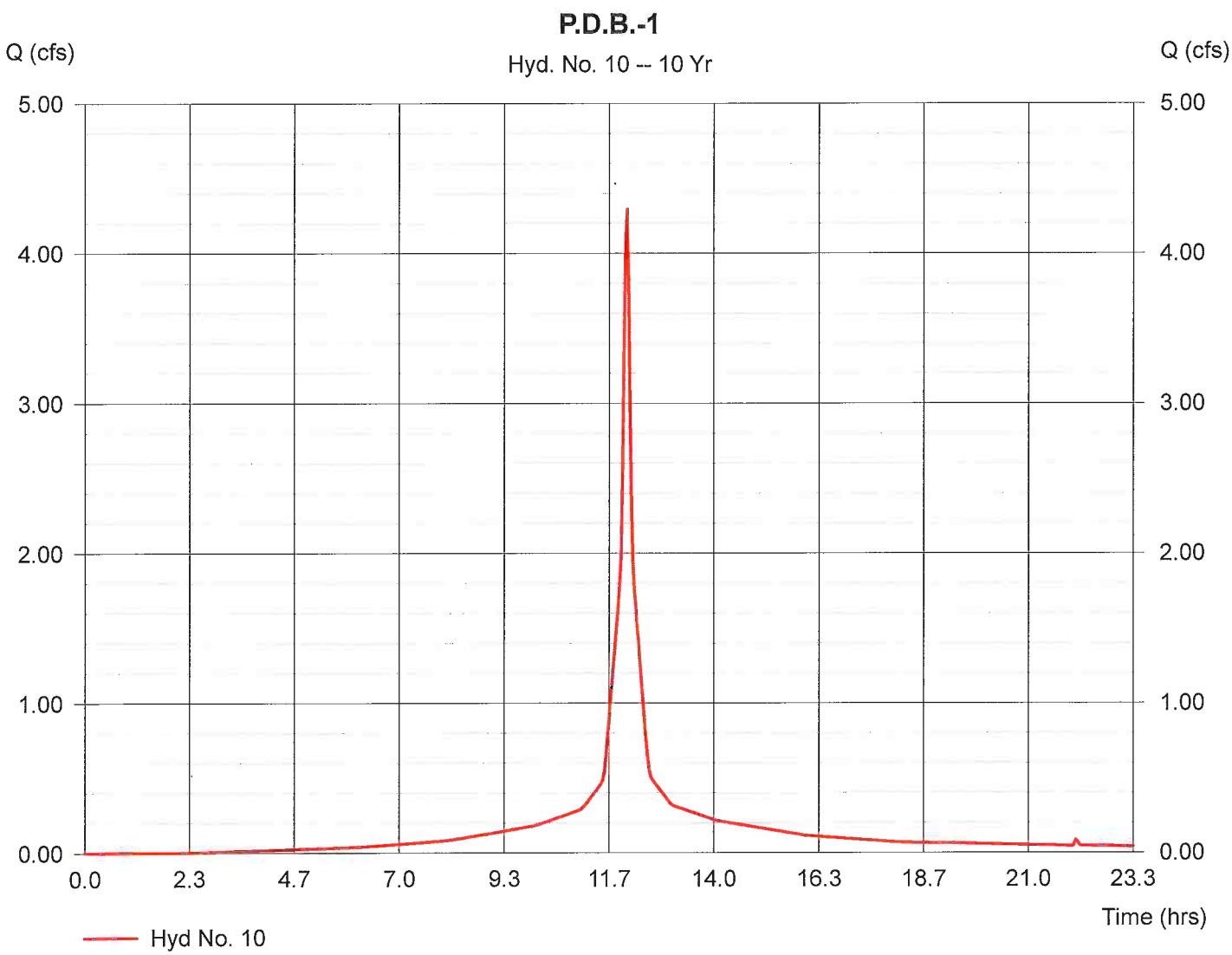
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 10

P.D.B.-1

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 4.30 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Drainage area | = 1.00 ac | Curve number | = 95.1 |
| Basin Slope | = 0.7 % | Hydraulic length | = 148 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 4.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 14,039 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

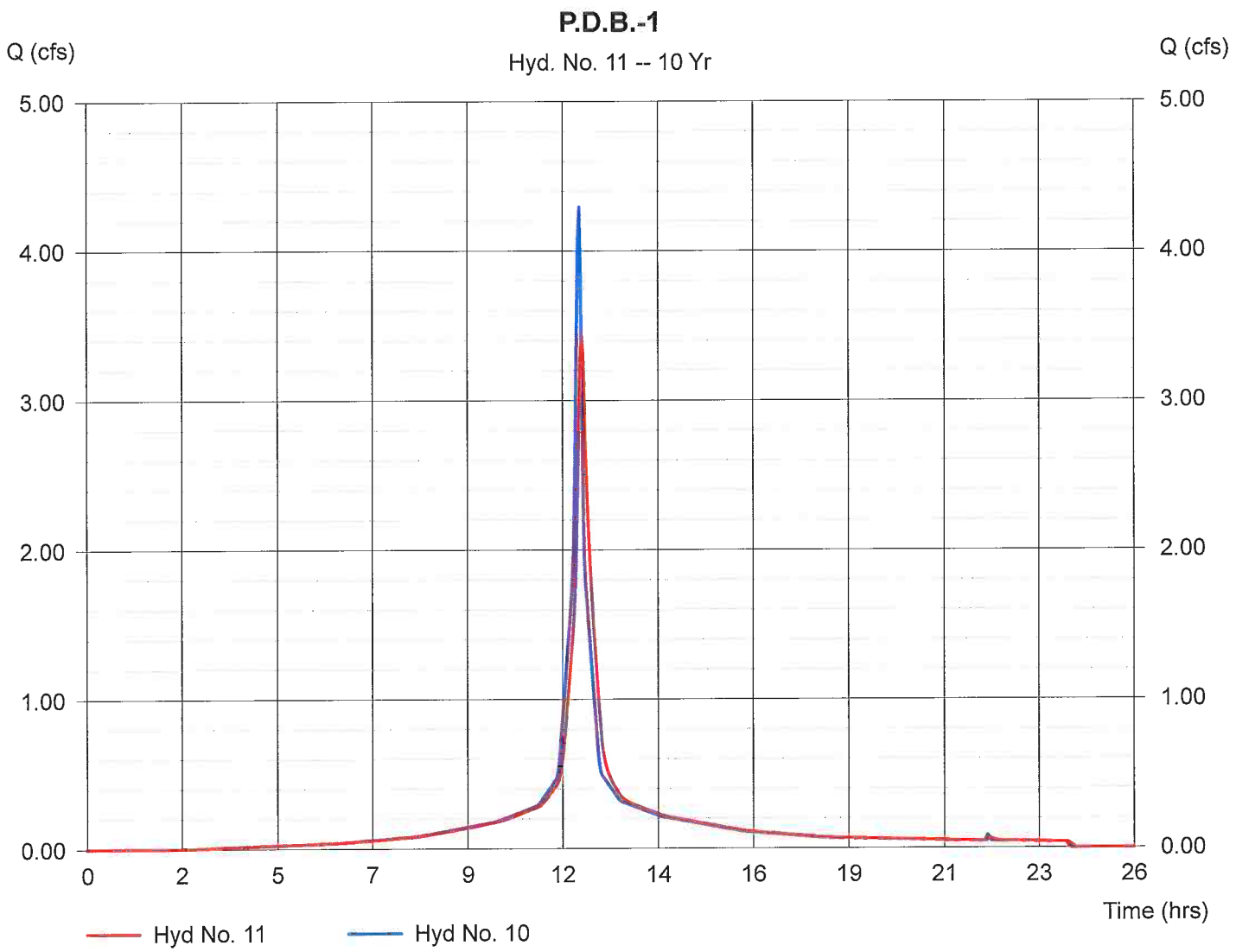
## Hyd. No. 11

P.D.B.-1

| | | | |
|---|---|---|---|
| Hydrograph type | = Reach | Peak discharge | = 3.44 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Inflow hyd. No. | = 10 | Section type | = Circular |
| Reach length | = 578.0 ft | Channel slope | = 1.0 % |
| Manning's n | = 0.009 | Bottom width | = 2.0 ft |
| Side slope | = 0.0:1 | Max. depth | = 0.0 ft |
| Rating curve x | = 10.028 | Rating curve m | = 1.250 |
| Ave. velocity | = 0.00 ft/s | Routing coeff. | = 0.3014 |

Modified Att-Kin routing method used.

Hydrograph Volume = 14,036 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

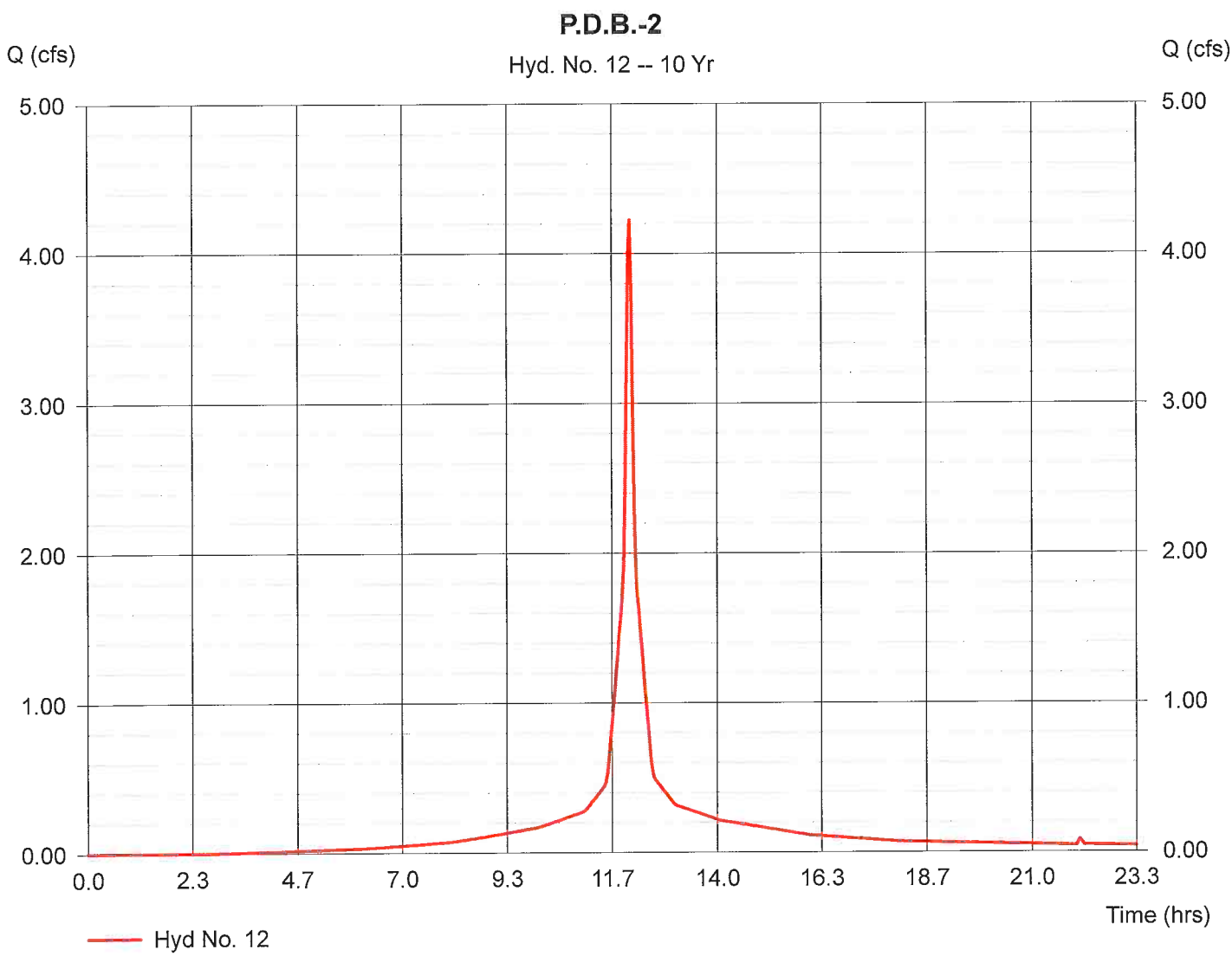
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 12

P.D.B.-2

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 4.23 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Drainage area | = 1.00 ac | Curve number | = 93.8 |
| Basin Slope | = 0.9 % | Hydraulic length | = 256 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 4.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 13,580 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

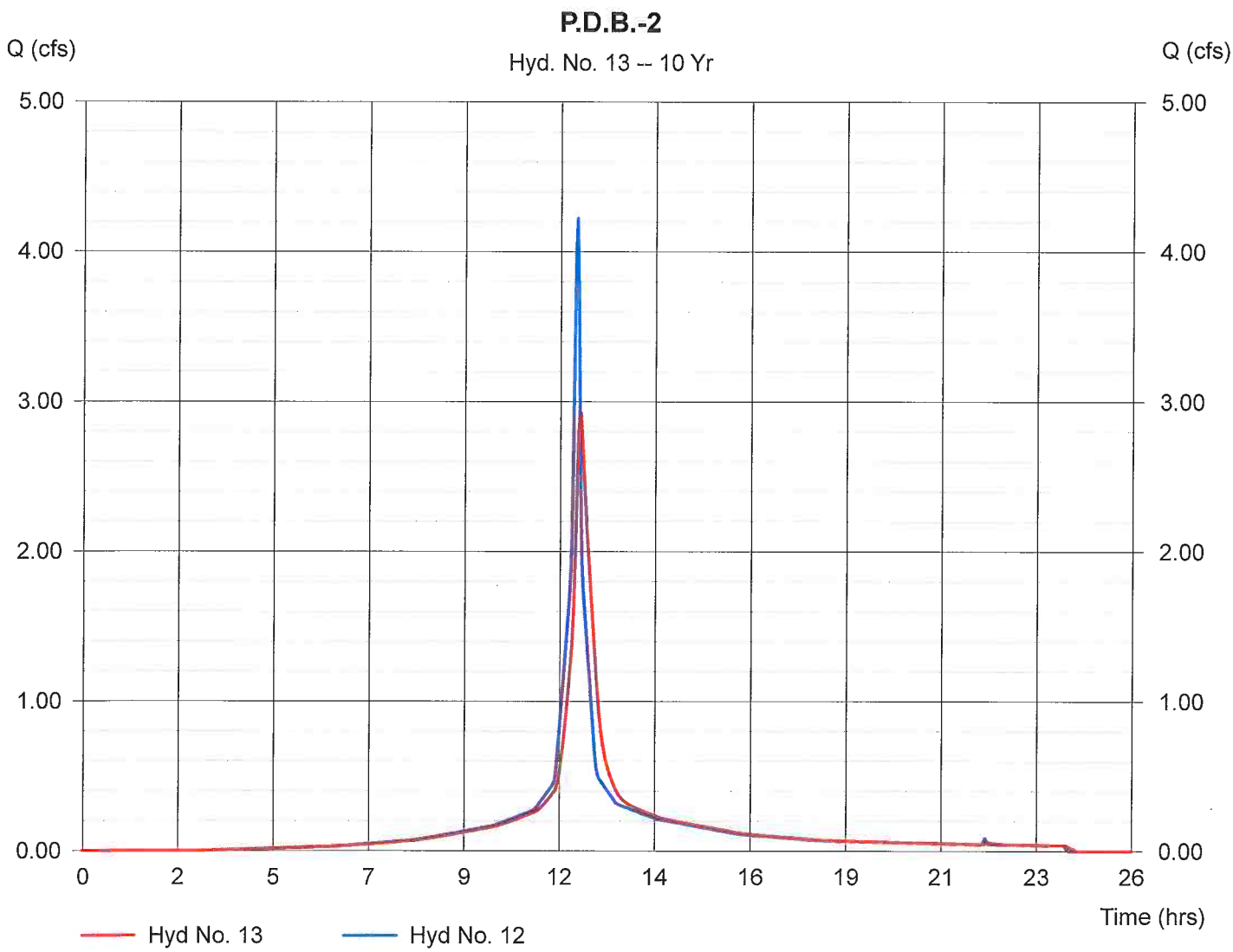
## Hyd. No. 13

P.D.B.-2

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 2.92 cfs |
| Storm frequency | = | 10 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 12 | Section type | = | Circular |
| Reach length | = | 917.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.1982 |

Modified Att-Kin routing method used.

Hydrograph Volume = 13,574 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

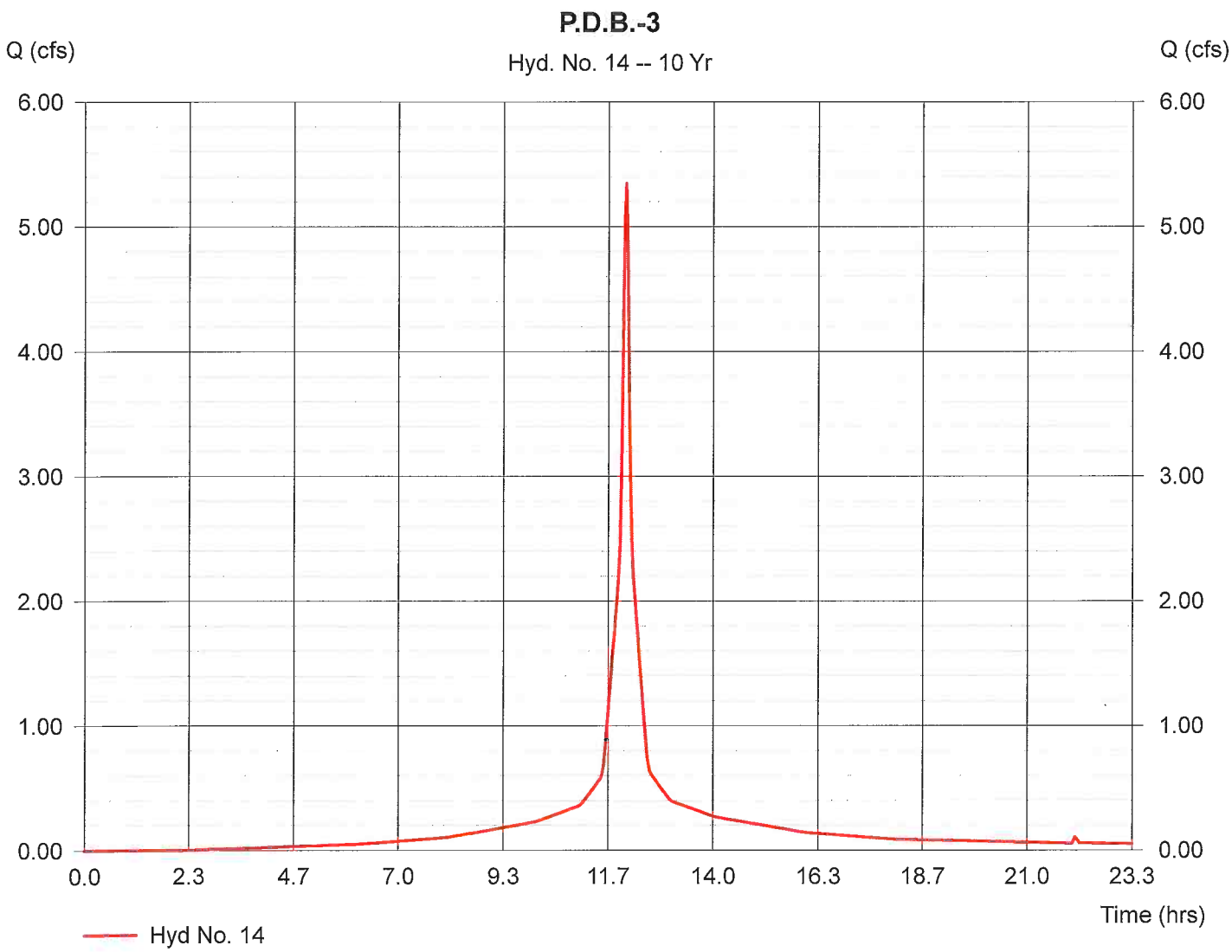
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 14

P.D.B.-3

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.35 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Drainage area | = 1.24 ac | Curve number | = 95.3 |
| Basin Slope | = 0.9 % | Hydraulic length | = 139 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 4.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 17,523 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

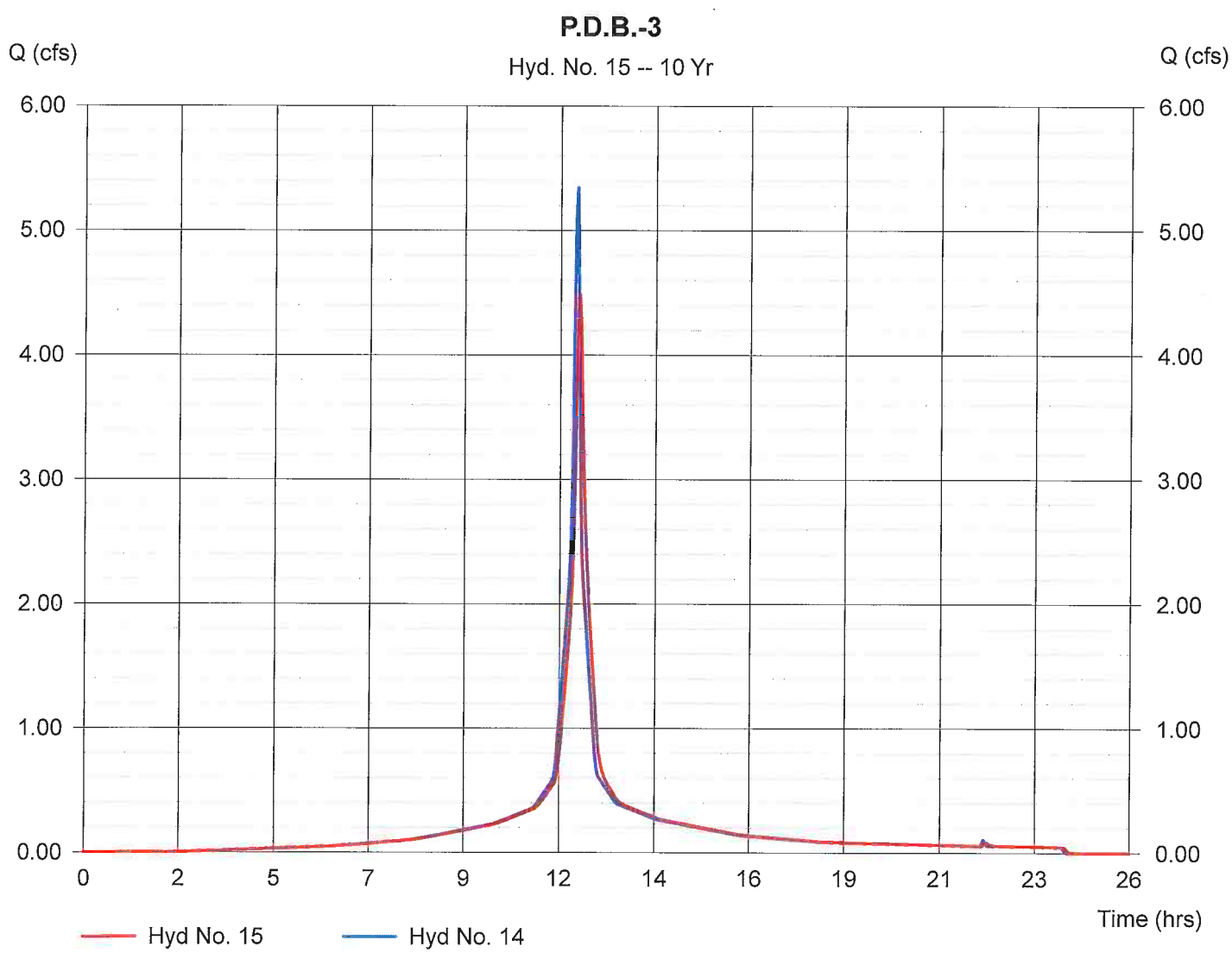
## Hyd. No. 15

P.D.B.-3

| | | | |
|---|---|---|---|
| Hydrograph type | = Reach | Peak discharge | = 4.49 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Inflow hyd. No. | = 14 | Section type | = Circular |
| Reach length | = 582.0 ft | Channel slope | = 1.0 % |
| Manning's n | = 0.009 | Bottom width | = 2.0 ft |
| Side slope | = 0.0:1 | Max. depth | = 0.0 ft |
| Rating curve x | = 10.028 | Rating curve m | = 1.250 |
| Ave. velocity | = 0.00 ft/s | Routing coeff. | = 0.3598 |

Modified Att-Kin routing method used.

Hydrograph Volume = 17,520 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

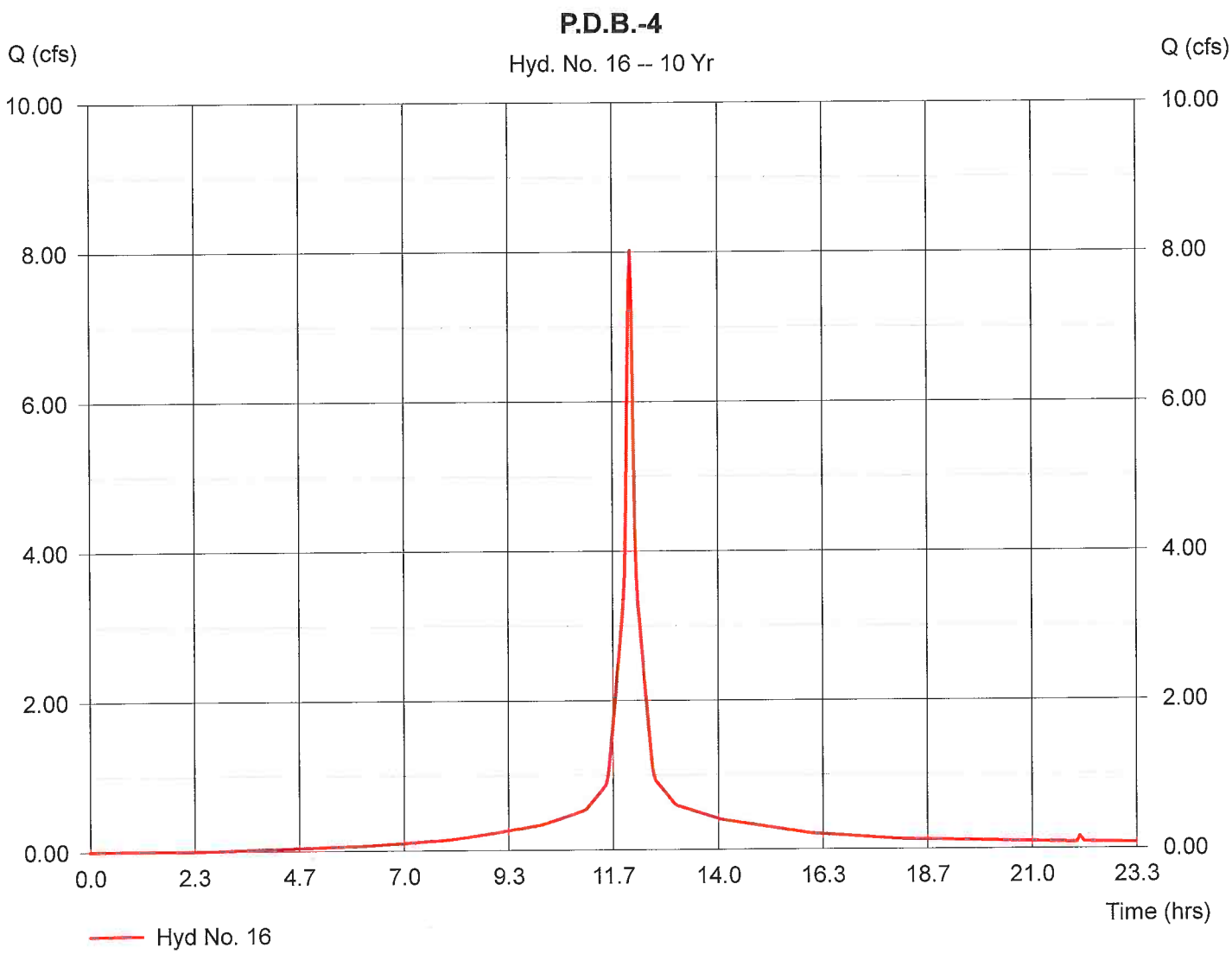
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 16

P.D.B.-4

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 8.02 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Drainage area | = 1.88 ac | Curve number | = 94.5 |
| Basin Slope | = 1.5 % | Hydraulic length | = 144 ft |
| Tc method | = USER | Time of conc. (Tc) | = 5 min |
| Total precip. | = 4.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 26,007 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

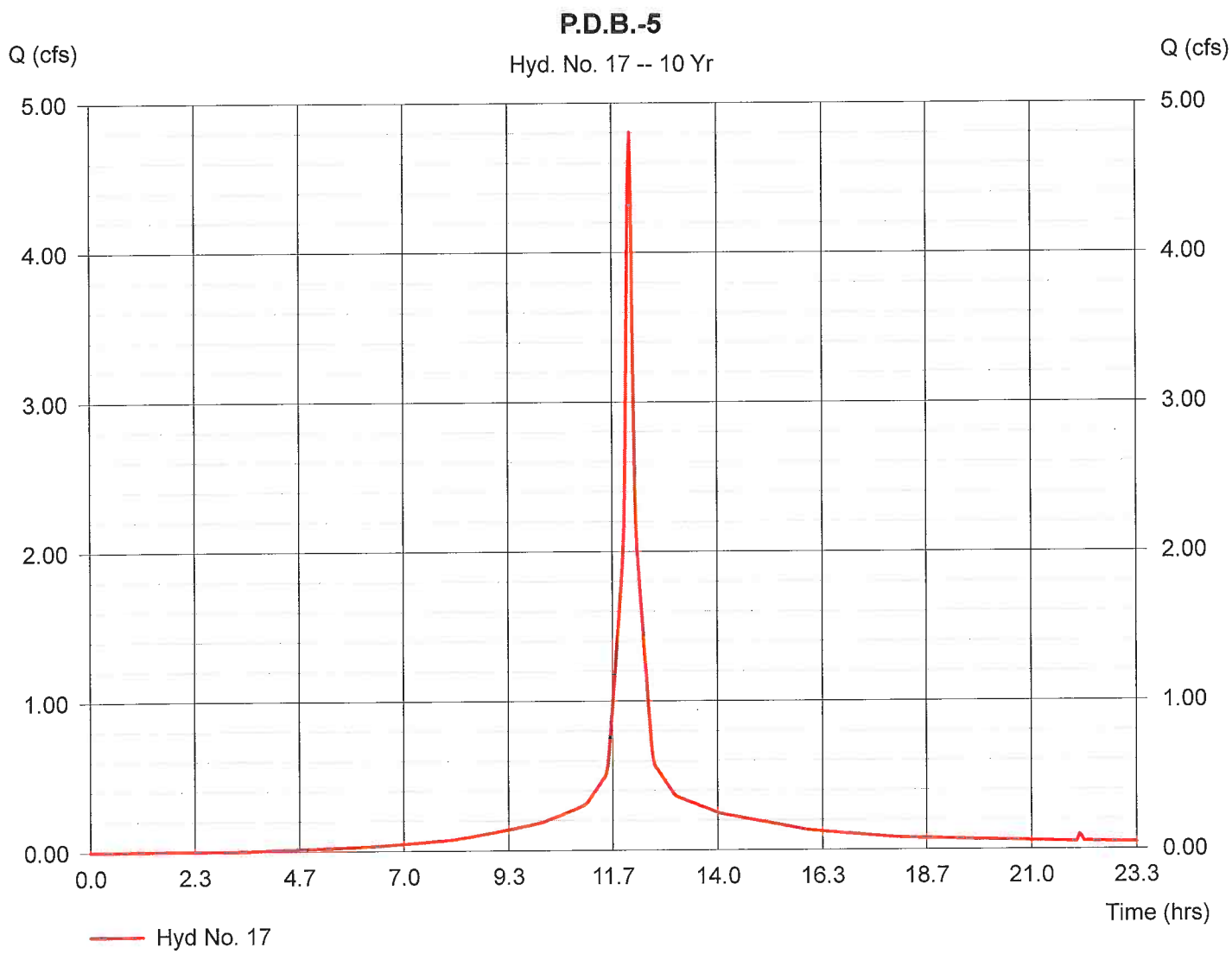
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 17

P.D.B.-5

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 4.81 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Drainage area | = 1.16 ac | Curve number | = 92.8 |
| Basin Slope | = 1.2 % | Hydraulic length | = 100 ft |
| Tc method | = USER | Time of conc. (Tc) | = 5 min |
| Total precip. | = 4.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 15,272 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

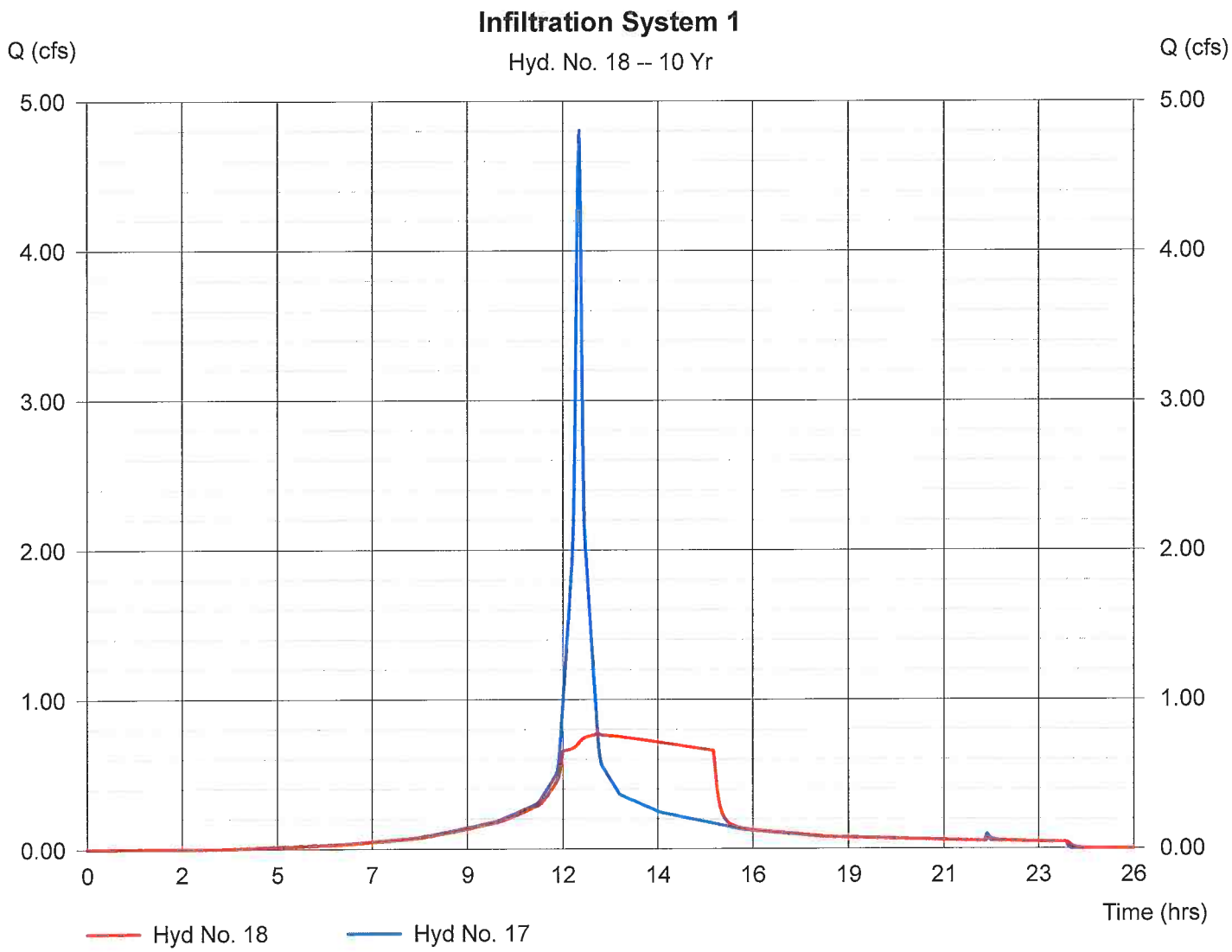
## Hyd. No. 18

Infiltration System 1

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 0.77 cfs |
| Storm frequency | = | 10 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 17 | Max. Elevation | = | 156.62 ft |
| Reservoir name | = | Infiltration System | Max. Storage | = | 4,583 cuft |

Storage Indication method used.

Hydrograph Volume = 15,272 cuft



# Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

## Pond No. 1 - Infiltration System

### Pond Data

Bottom LxW = 84.0 x 40.4 ft  Side slope = 0.0:1  Bottom elev. = 154.25 ft  Depth = 2.80 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft)* | Total storage (cuft)* |
|---|---|---|---|---|
| 0.00 | 154.25 | 3,394 | 0 | 0 |
| 0.14 | 154.39 | 3,394 | 271 | 271 |
| 0.28 | 154.53 | 3,394 | 271 | 542 |
| 0.42 | 154.67 | 3,394 | 271 | 812 |
| 0.56 | 154.81 | 3,394 | 271 | 1,083 |
| 0.70 | 154.95 | 3,394 | 271 | 1,354 |
| 0.84 | 155.09 | 3,394 | 271 | 1,625 |
| 0.98 | 155.23 | 3,394 | 271 | 1,896 |
| 1.12 | 155.37 | 3,394 | 271 | 2,166 |
| 1.26 | 155.51 | 3,394 | 271 | 2,437 |
| 1.40 | 155.65 | 3,394 | 271 | 2,708 |
| 1.54 | 155.79 | 3,394 | 271 | 2,979 |
| 1.68 | 155.93 | 3,394 | 271 | 3,250 |
| 1.82 | 156.07 | 3,394 | 271 | 3,521 |
| 1.96 | 156.21 | 3,394 | 271 | 3,791 |
| 2.10 | 156.35 | 3,394 | 271 | 4,062 |
| 2.24 | 156.49 | 3,394 | 271 | 4,333 |
| 2.38 | 156.63 | 3,394 | 271 | 4,604 |
| 2.52 | 156.77 | 3,394 | 271 | 4,875 |
| 2.66 | 156.91 | 3,394 | 271 | 5,145 |
| 2.80 | 157.05 | 3,394 | 271 | 5,416 |

(*57.00% voids applied)

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| Rise (in) | = 6.00 | 0.00 | 0.00 | 0.00 |
| Span (in) | = 6.00 | 0.00 | 0.00 | 0.00 |
| No. Barrels | = 8 | 0 | 0 | 0 |
| Invert El. (ft) | = 156.60 | 0.00 | 0.00 | 0.00 |
| Length (ft) | = 15.00 | 0.00 | 0.00 | 0.00 |
| Slope (%) | = 3.00 | 0.00 | 0.00 | 0.00 |
| N-Value | = .013 | .000 | .000 | .000 |
| Orif. Coeff. | = 0.60 | 0.00 | 0.00 | 0.00 |
| Multi-Stage | = n/a | No | No | No |

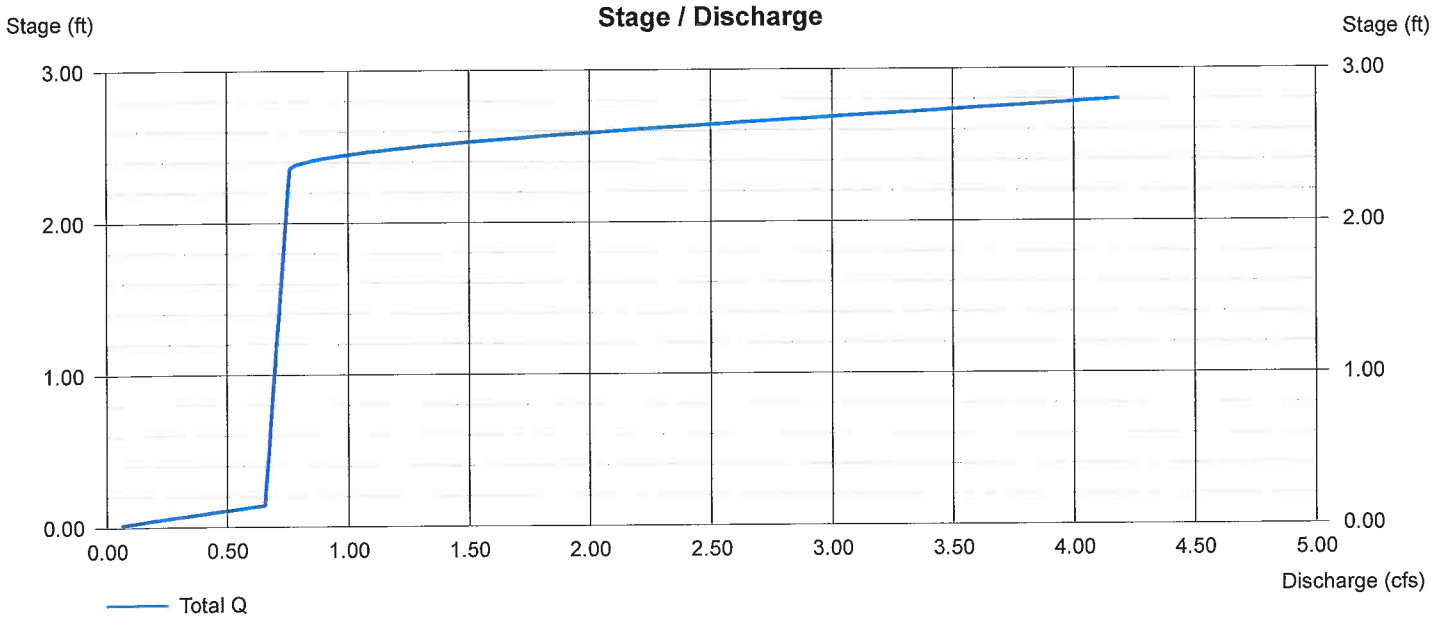
### Weir Structures

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

**Exfiltration =** 8.270 in/hr (Wet area) Tailwater Elev. = 0.00 ft

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

### Stage / Discharge



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

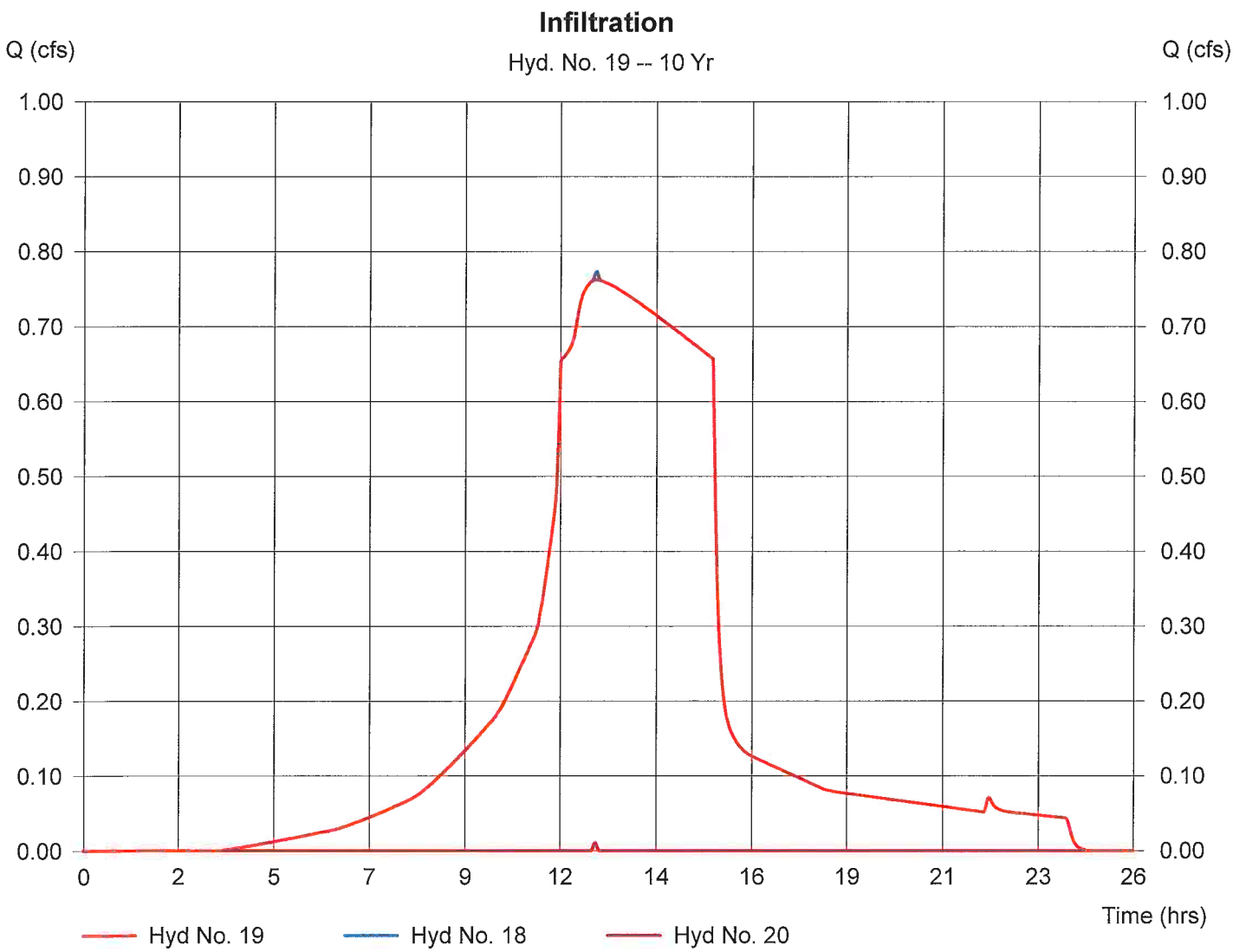
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 19

Infiltration

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Diversion1 | Peak discharge | = | 0.76 cfs |
| Storm frequency | = | 10 yrs | Time interval | = | 2 min |
| Inflow hydrograph | = | 18 | 2nd diverted hyd. | = | 20 |
| Diversion method | = | Pond - Infiltration System | Pond structure | = | Exfiltration |

Hydrograph Volume = 15,268 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

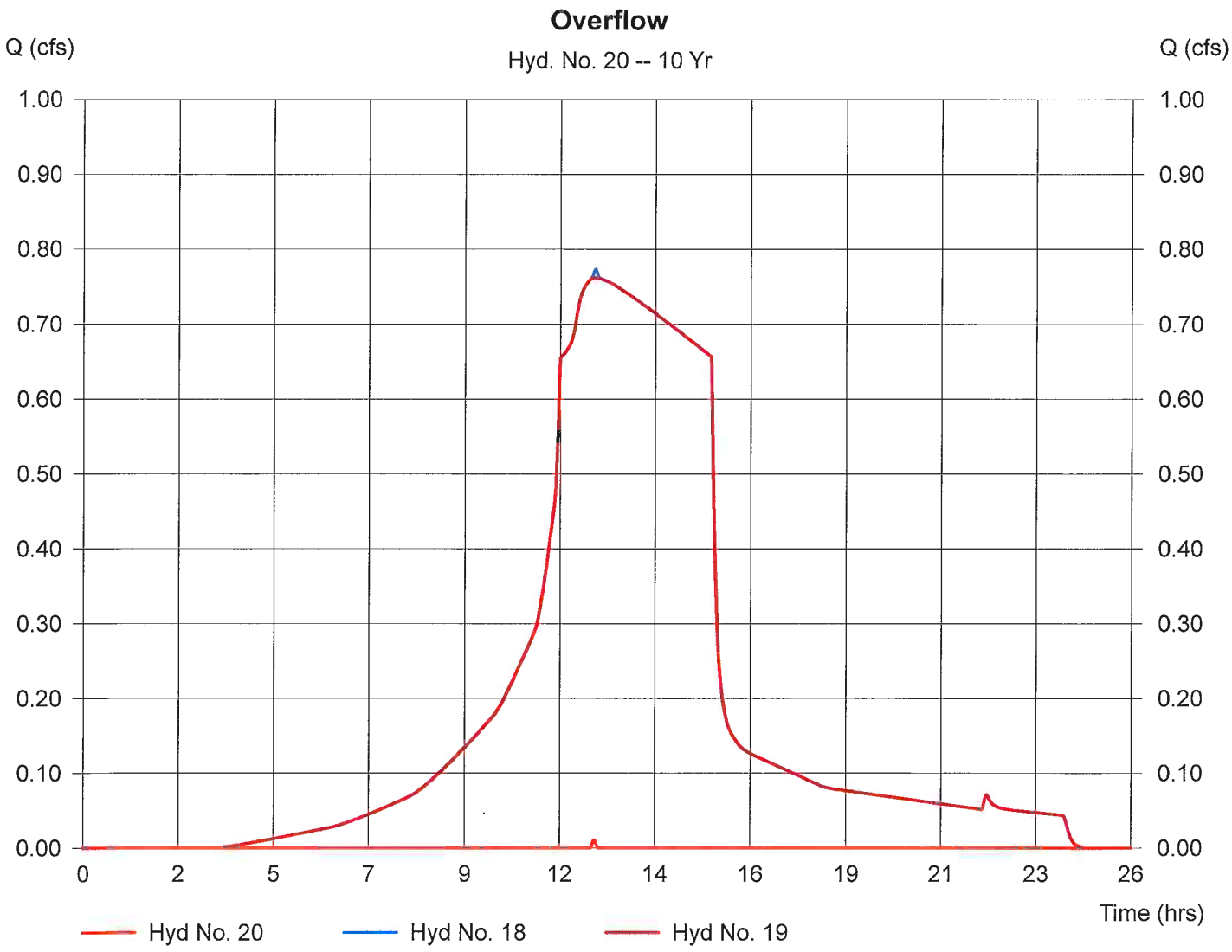
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 20

Overflow

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Diversion2 | Peak discharge | = | 0.01 cfs |
| Storm frequency | = | 10 yrs | Time interval | = | 2 min |
| Inflow hydrograph | = | 18 | 2nd diverted hyd. | = | 19 |
| Diversion method | = | Pond - Infiltration System | Pond structure | = | Exfiltration |

Hydrograph Volume = 4 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

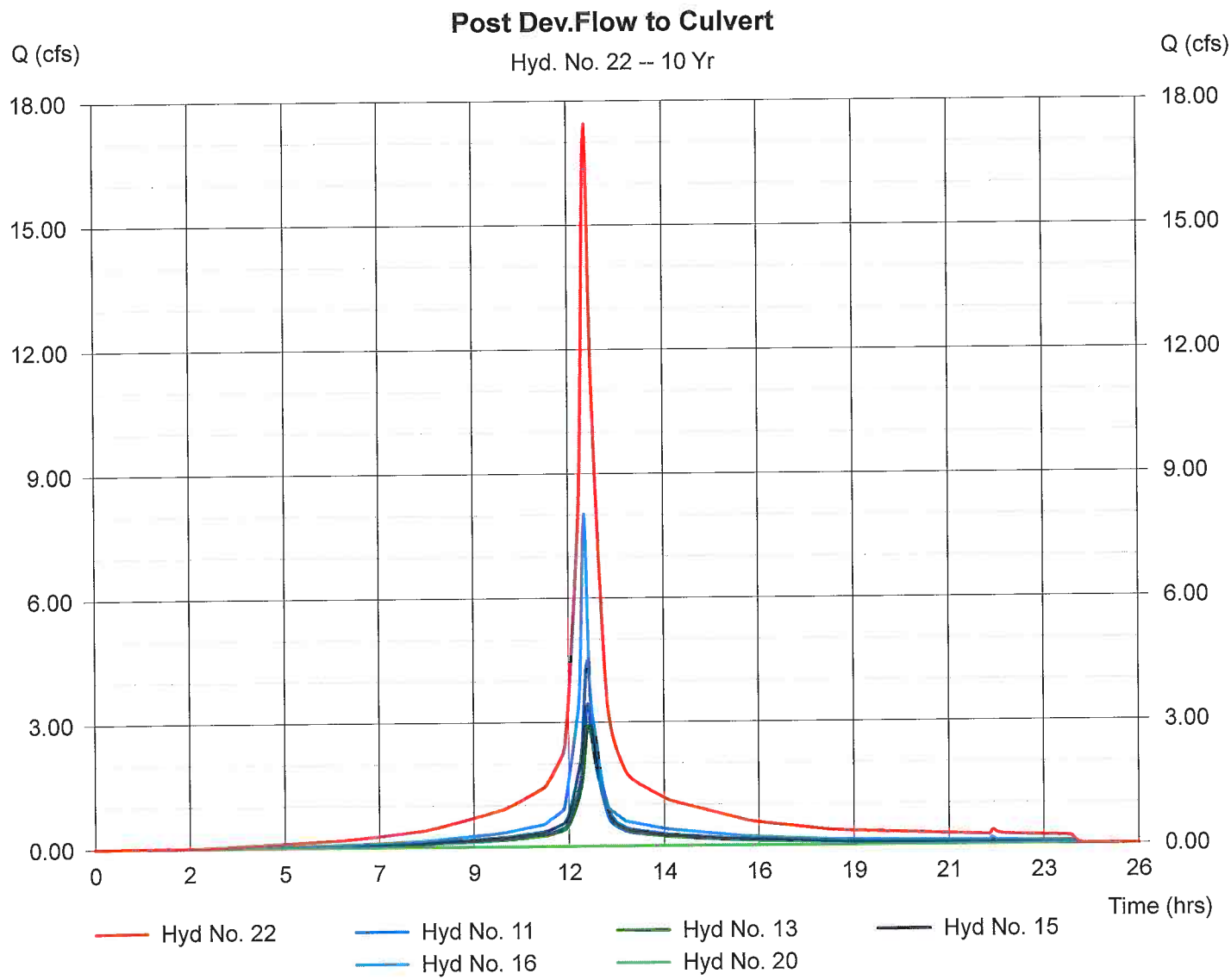
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 22

Post Dev.Flow to Culvert

| | | | |
|---|---|---|---|
| Hydrograph type | = Combine | Peak discharge | = 17.45 cfs |
| Storm frequency | = 10 yrs | Time interval | = 2 min |
| Inflow hyds. | = 11, 13, 15, 16, 20 | | |

Hydrograph Volume = 71,141 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 | 5.03 | 2 | 724 | 15,940 | ---- | ------ | ------ | E.C.B.-1 |
| 2 | Reach | 4.17 | 2 | 728 | 15,938 | 1 | ------ | ------ | E.C.B-1 |
| 3 | SCS Runoff | 11.21 | 2 | 724 | 37,520 | ---- | ------ | ------ | E.C.B.-2 |
| 4 | Reach | 9.85 | 2 | 728 | 37,519 | 3 | ------ | ------ | E.C.B.-2 |
| 5 | SCS Runoff | 5.95 | 2 | 728 | 22,814 | ---- | ------ | ------ | E.C.B.-3 |
| 6 | SCS Runoff | 5.35 | 2 | 724 | 17,202 | ---- | ------ | ------ | E.C.B.-4 |
| 8 | Combine | 24.17 | 2 | 726 | 93,472 | 2, 4, 5, 6, | ------ | ------ | Ex. Flow at Culvert |
| 10 | SCS Runoff | 5.07 | 2 | 724 | 16,732 | ---- | ------ | ------ | P.D.B.-1 |
| 11 | Reach | 4.22 | 2 | 728 | 16,730 | 10 | ------ | ------ | P.D.B.-1 |
| 12 | SCS Runoff | 5.01 | 2 | 724 | 16,265 | ---- | ------ | ------ | P.D.B.-2 |
| 13 | Reach | 3.67 | 2 | 728 | 16,260 | 12 | ------ | ------ | P.D.B.-2 |
| 14 | SCS Runoff | 6.31 | 2 | 724 | 20,869 | ---- | ------ | ------ | P.D.B.-3 |
| 15 | Reach | 5.45 | 2 | 728 | 20,867 | 14 | ------ | ------ | P.D.B.-3 |
| 16 | SCS Runoff | 9.48 | 2 | 724 | 31,067 | ---- | ------ | ------ | P.D.B.-4 |
| 17 | SCS Runoff | 5.71 | 2 | 724 | 18,361 | ---- | ------ | ------ | P.D.B.-5 |
| 18 | Reservoir | 1.94 | 2 | 738 | 18,361 | 17 | 156.83 | 4,994 | Infiltration System 1 |
| 19 | Diversion1 | 0.77 | 2 | 738 | 17,173 | 18 | ------ | ------ | Infiltration |
| 20 | Diversion2 | 1.17 | 2 | 738 | 1,188 | 18 | ------ | ------ | Overflow |
| 22 | Combine | 21.27 | 2 | 726 | 86,111 | 11, 13, 15, 16, 20, | ---- | ------ | Post Dev.Flow to Culvert |

# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

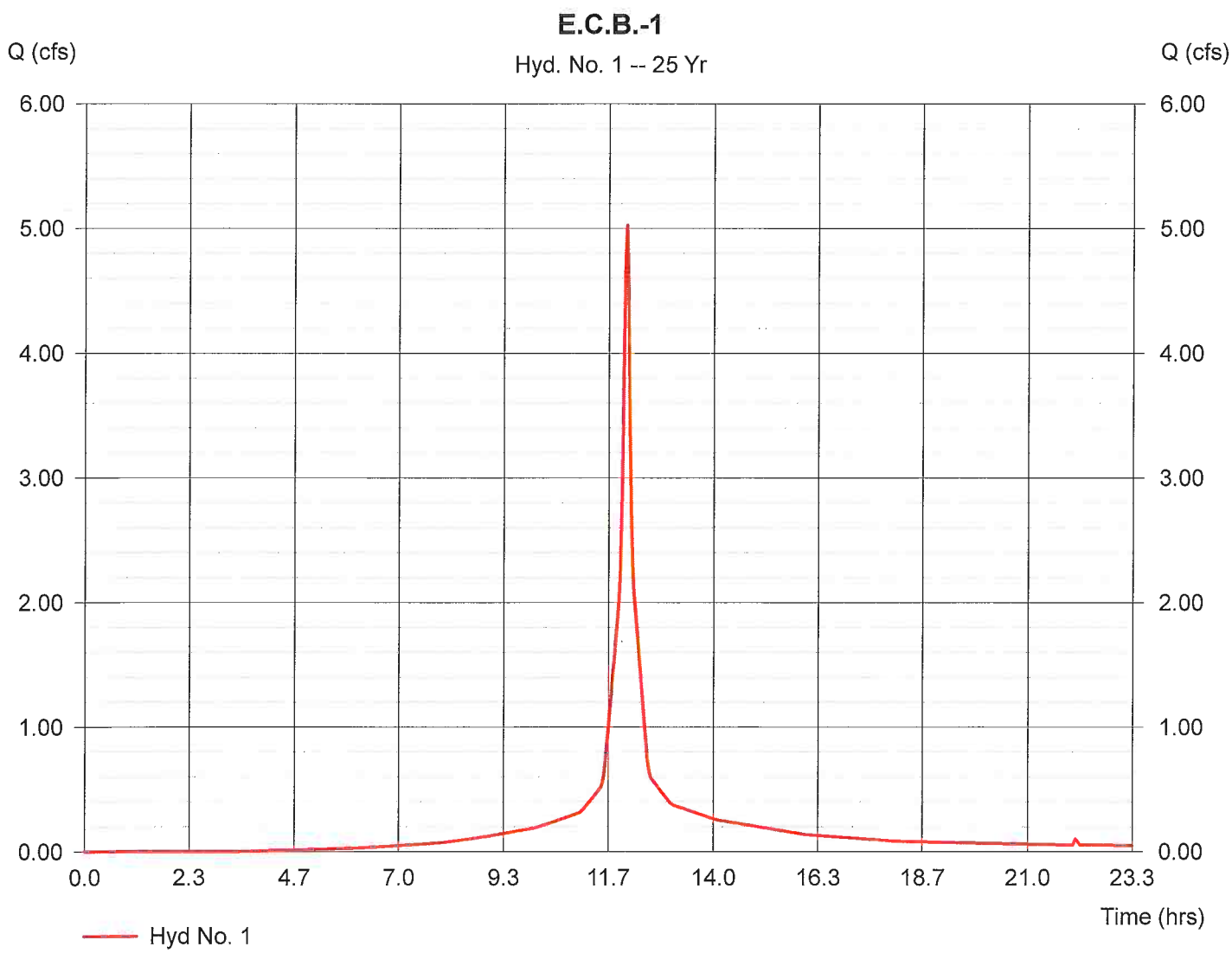
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 1

E.C.B.-1

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.03 cfs |
| Storm frequency | = 25 yrs | Time interval | = 2 min |
| Drainage area | = 1.04 ac | Curve number | = 91.4 |
| Basin Slope | = 0.8 % | Hydraulic length | = 166 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 5.50 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 15,940 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

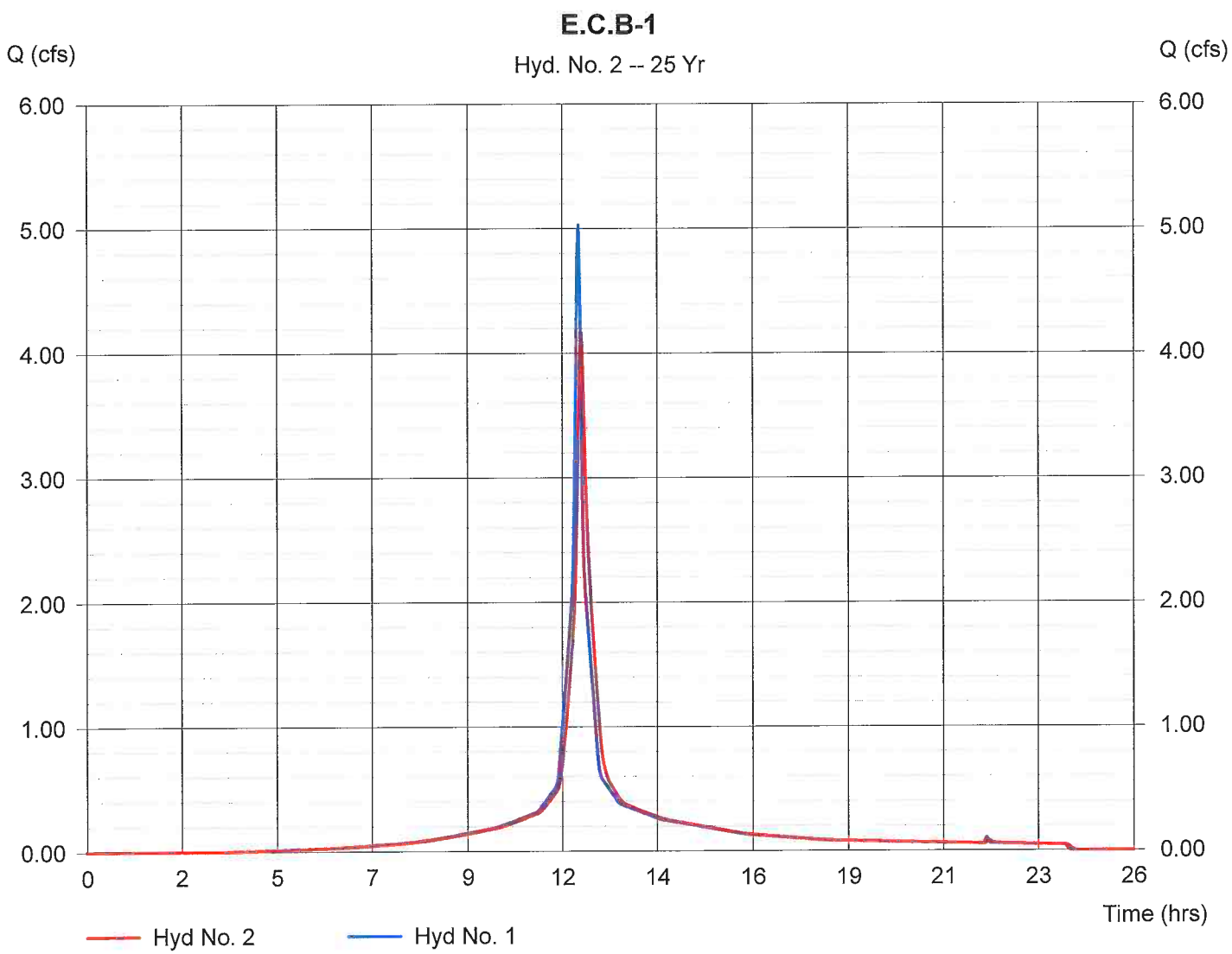
## Hyd. No. 2

E.C.B-1

| | | | |
|---|---|---|---|
| Hydrograph type | = Reach | Peak discharge | = 4.17 cfs |
| Storm frequency | = 25 yrs | Time interval | = 2 min |
| Inflow hyd. No. | = 1 | Section type | = Circular |
| Reach length | = 578.0 ft | Channel slope | = 1.0 % |
| Manning's n | = 0.009 | Bottom width | = 2.0 ft |
| Side slope | = 0.0:1 | Max. depth | = 0.0 ft |
| Rating curve x | = 10.028 | Rating curve m | = 1.250 |
| Ave. velocity | = 0.00 ft/s | Routing coeff. | = 0.3439 |

Modified Att-Kin routing method used.

Hydrograph Volume = 15,938 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

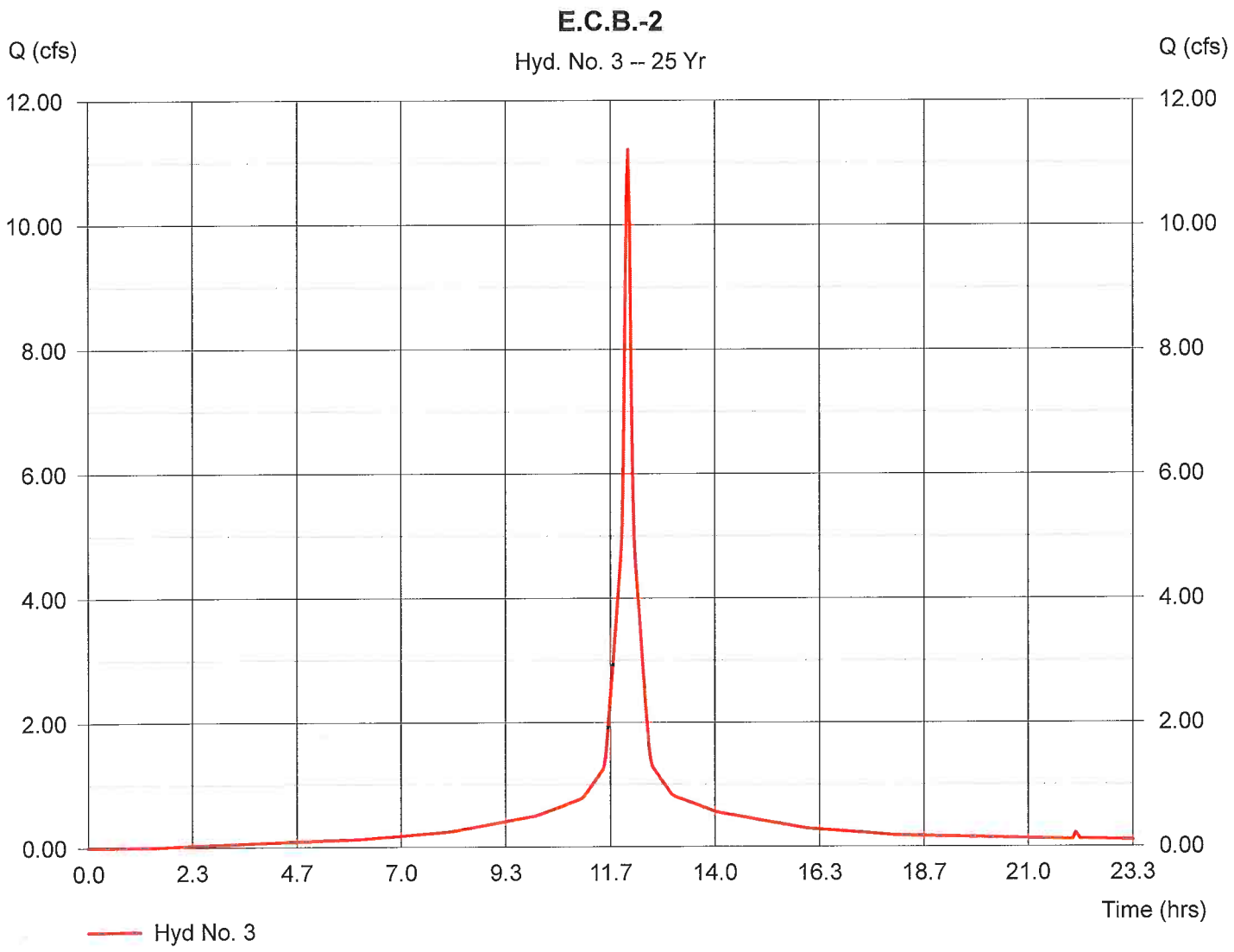
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 3

E.C.B.-2

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 11.21 cfs |
| Storm frequency | = 25 yrs | Time interval | = 2 min |
| Drainage area | = 2.19 ac | Curve number | = 96.1 |
| Basin Slope | = 1.2 % | Hydraulic length | = 320 ft |
| Tc method | = LAG | Time of conc. (Tc) | = 6.168732 min |
| Total precip. | = 5.50 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 37,520 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

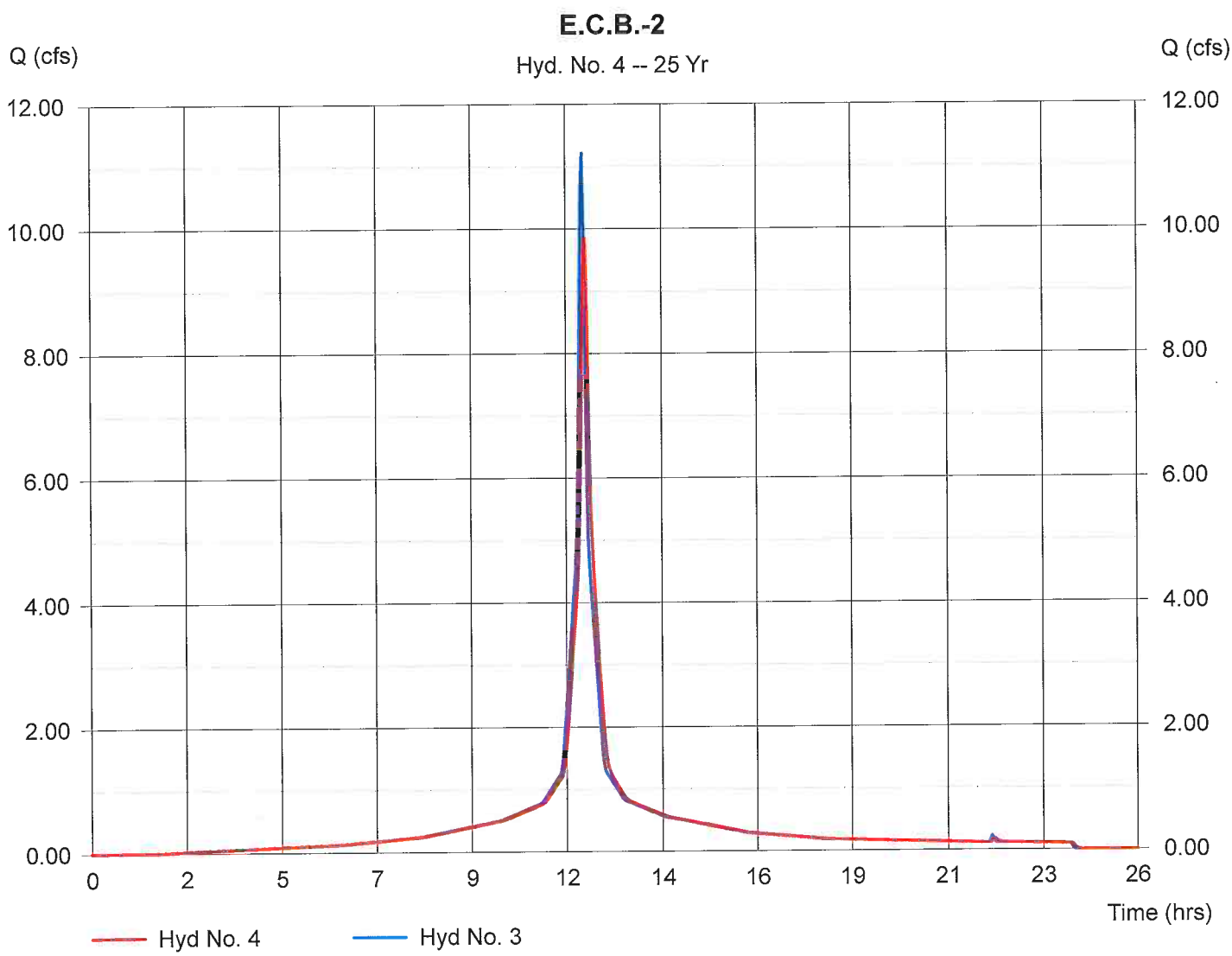
## Hyd. No. 4

E.C.B.-2

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 9.85 cfs |
| Storm frequency | = | 25 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 3 | Section type | = | Circular |
| Reach length | = | 917.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.4519 |

Modified Att-Kin routing method used.

Hydrograph Volume = 37,519 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

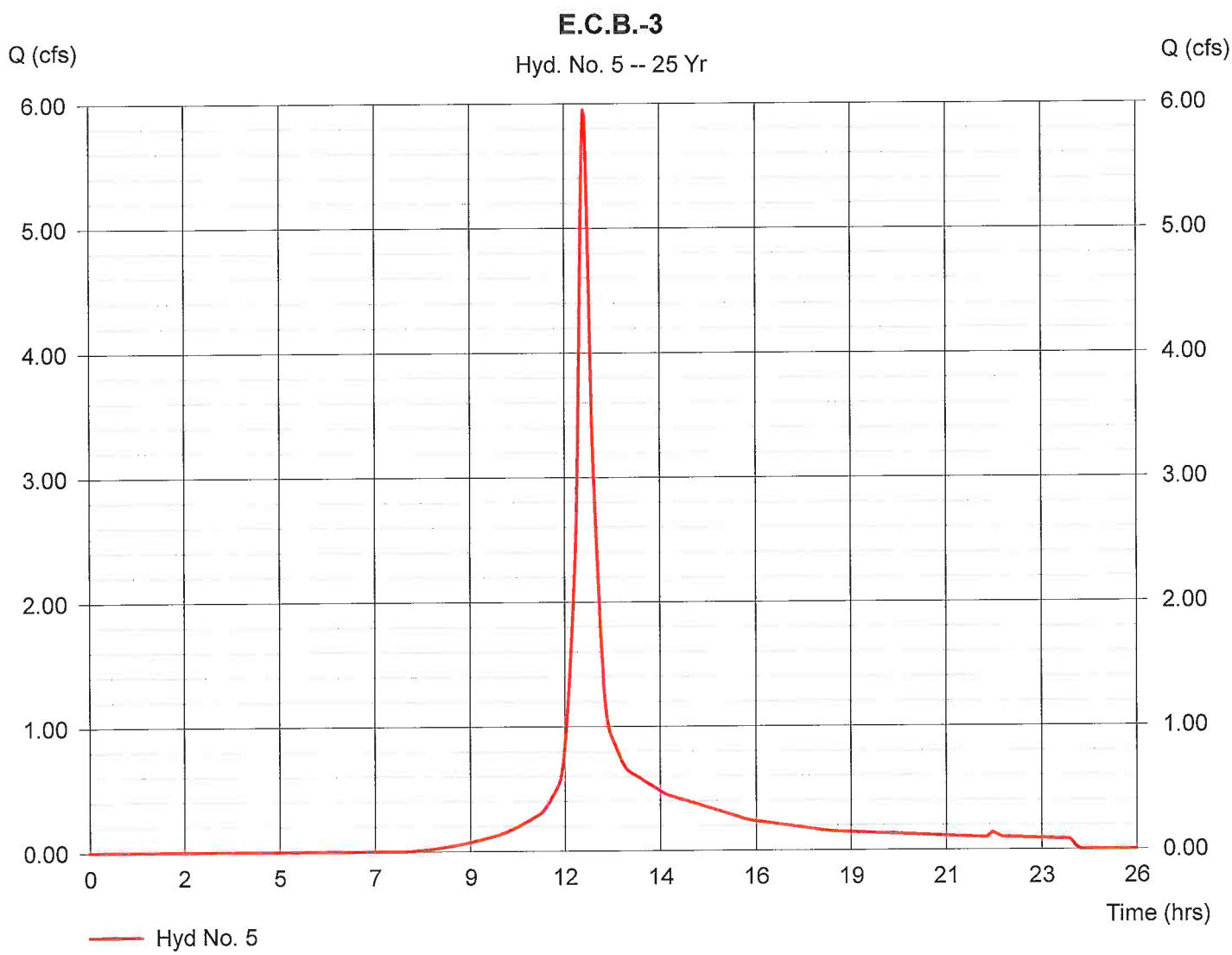
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 5

E.C.B.-3

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 5.95 cfs |
| Storm frequency | = | 25 yrs | Time interval | = | 2 min |
| Drainage area | = | 1.96 ac | Curve number | = | 77.6 |
| Basin Slope | = | 1.0 % | Hydraulic length | = | 326 ft |
| Tc method | = | USER | Time of conc. (Tc) | = | 10 min |
| Total precip. | = | 5.50 in | Distribution | = | Type III |
| Storm duration | = | 24 hrs | Shape factor | = | 484 |

Hydrograph Volume = 22,814 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

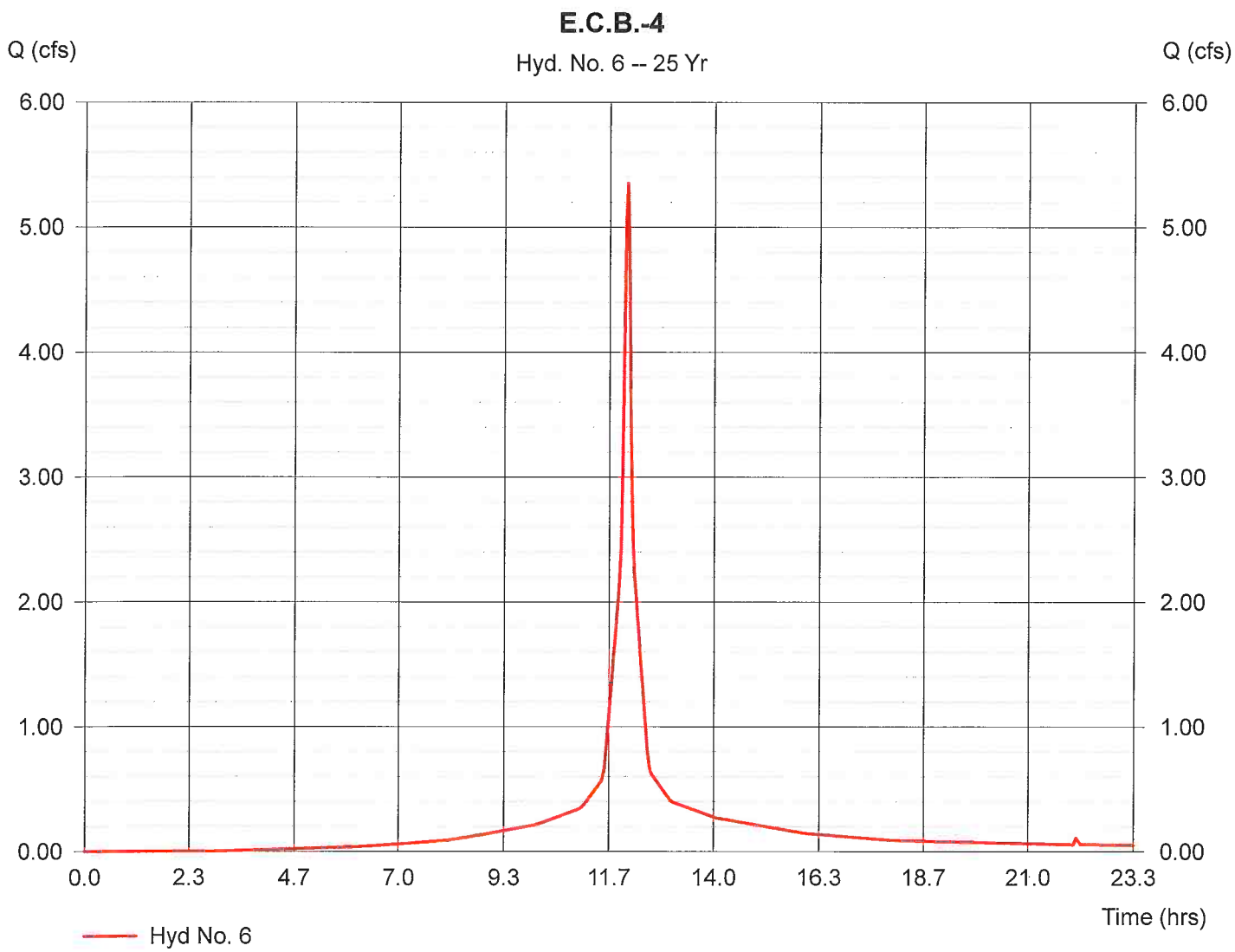
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 6

E.C.B.-4

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.35 cfs |
| Storm frequency | = 25 yrs | Time interval | = 2 min |
| Drainage area | = 1.08 ac | Curve number | = 92.8 |
| Basin Slope | = 0.8 % | Hydraulic length | = 213 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 5.50 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 17,202 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

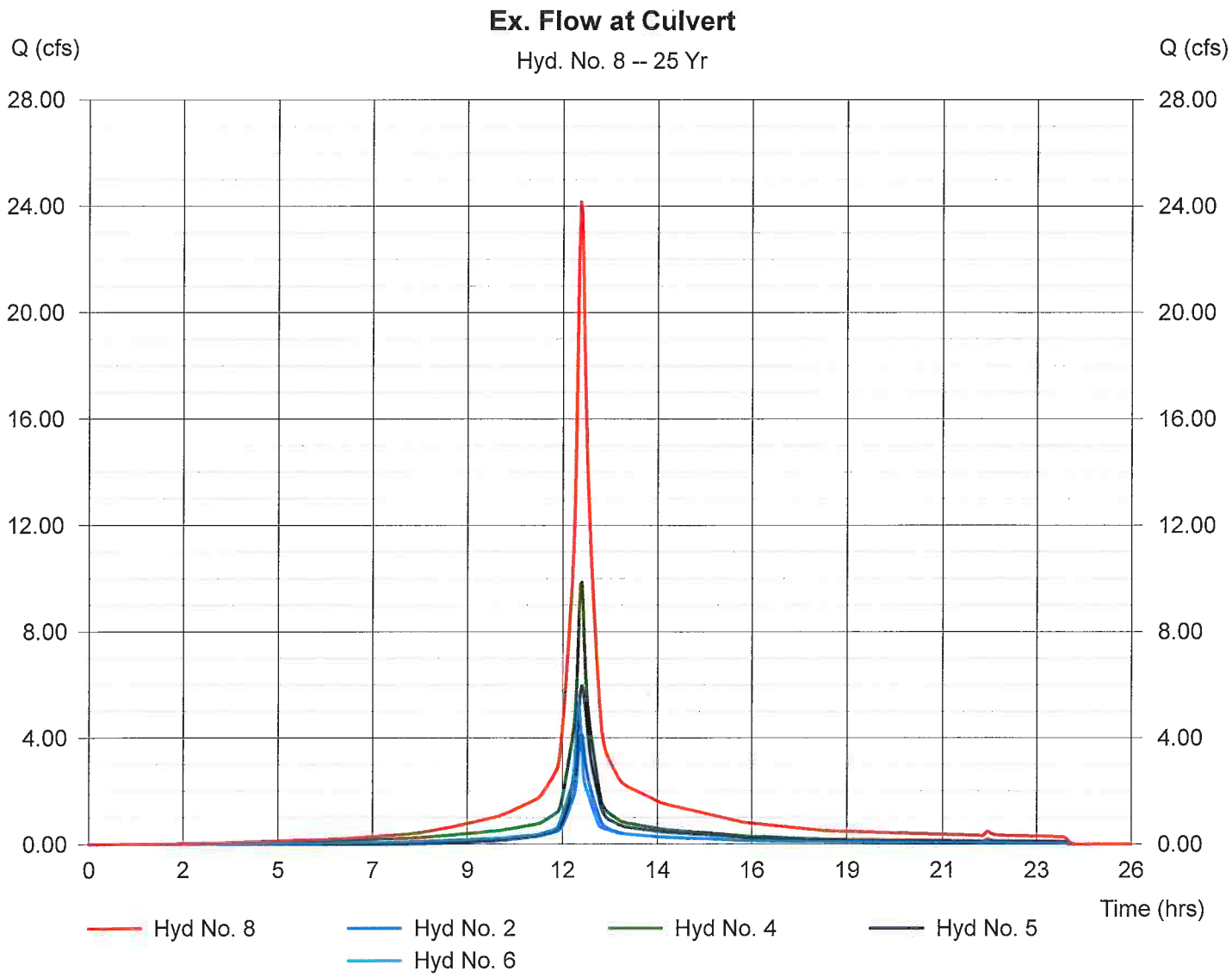
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 8

Ex. Flow at Culvert

| | | | |
|---|---|---|---|
| Hydrograph type | = Combine | Peak discharge | = 24.17 cfs |
| Storm frequency | = 25 yrs | Time interval | = 2 min |
| Inflow hyds. | = 2, 4, 5, 6 | | |

Hydrograph Volume = 93,472 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

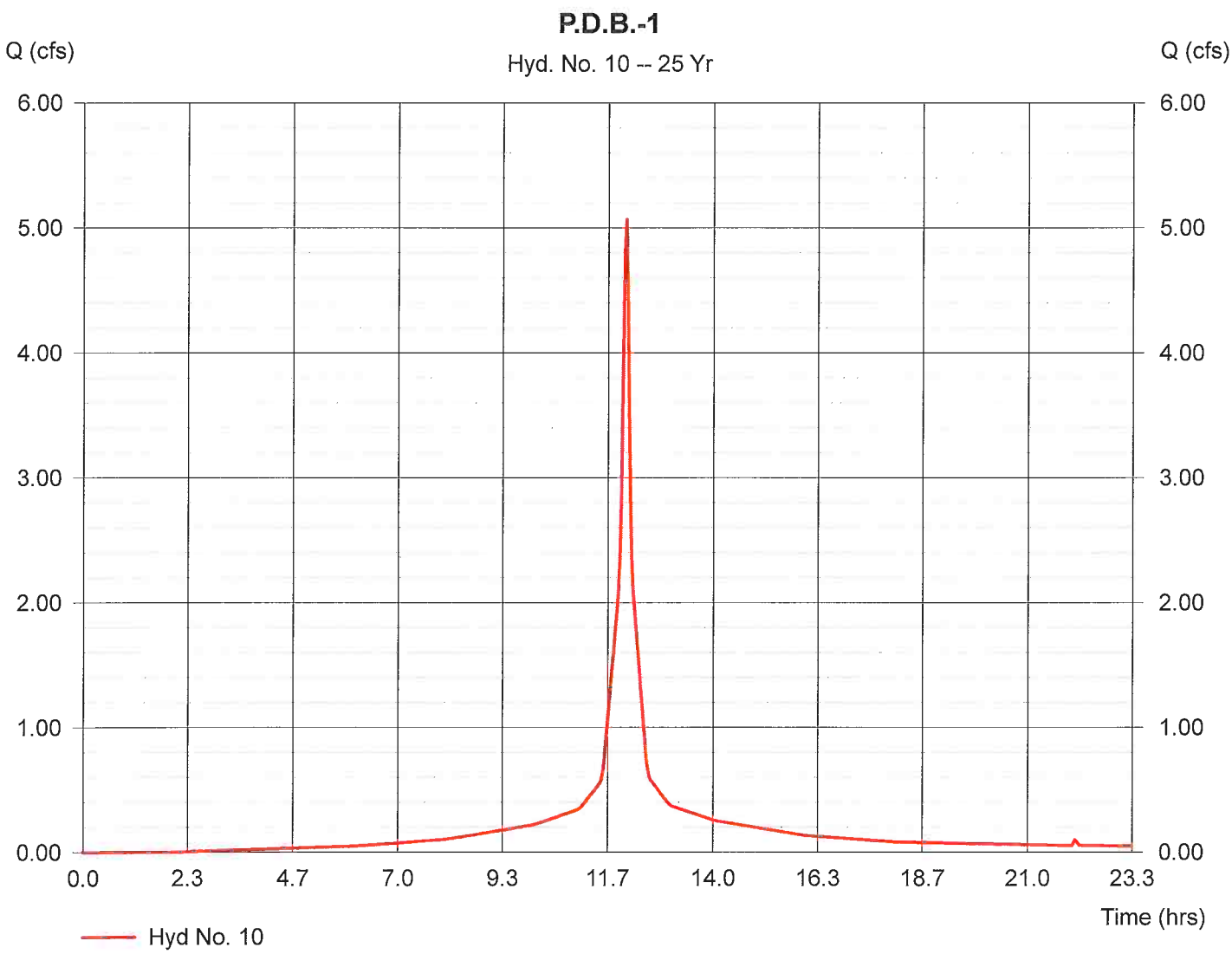
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 10

P.D.B.-1

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.07 cfs |
| Storm frequency | = 25 yrs | Time interval | = 2 min |
| Drainage area | = 1.00 ac | Curve number | = 95.1 |
| Basin Slope | = 0.7 % | Hydraulic length | = 148 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 5.50 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 16,732 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

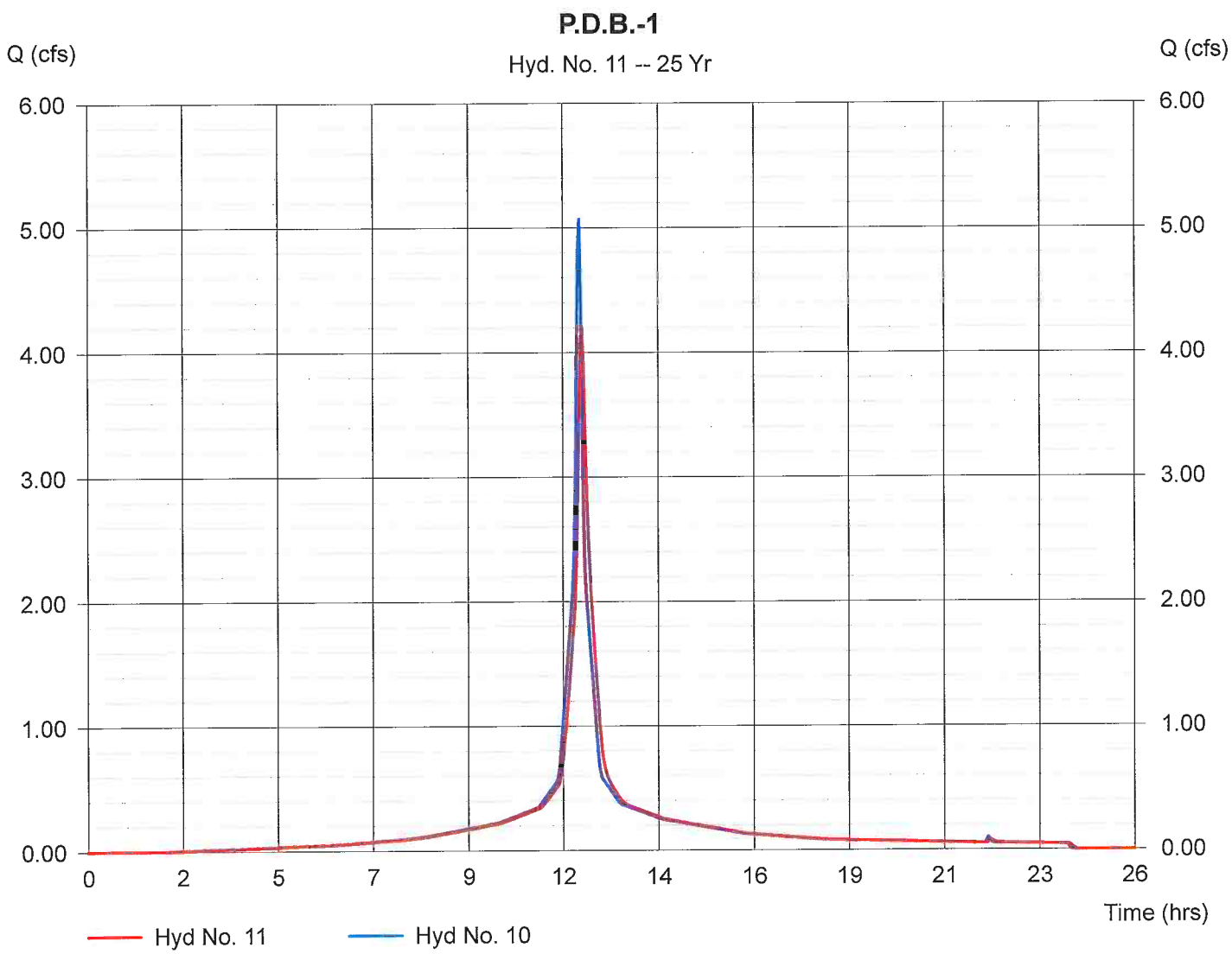
## Hyd. No. 11

P.D.B.-1

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 4.22 cfs |
| Storm frequency | = | 25 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 10 | Section type | = | Circular |
| Reach length | = | 578.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.3463 |

Modified Att-Kin routing method used.

Hydrograph Volume = 16,730 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

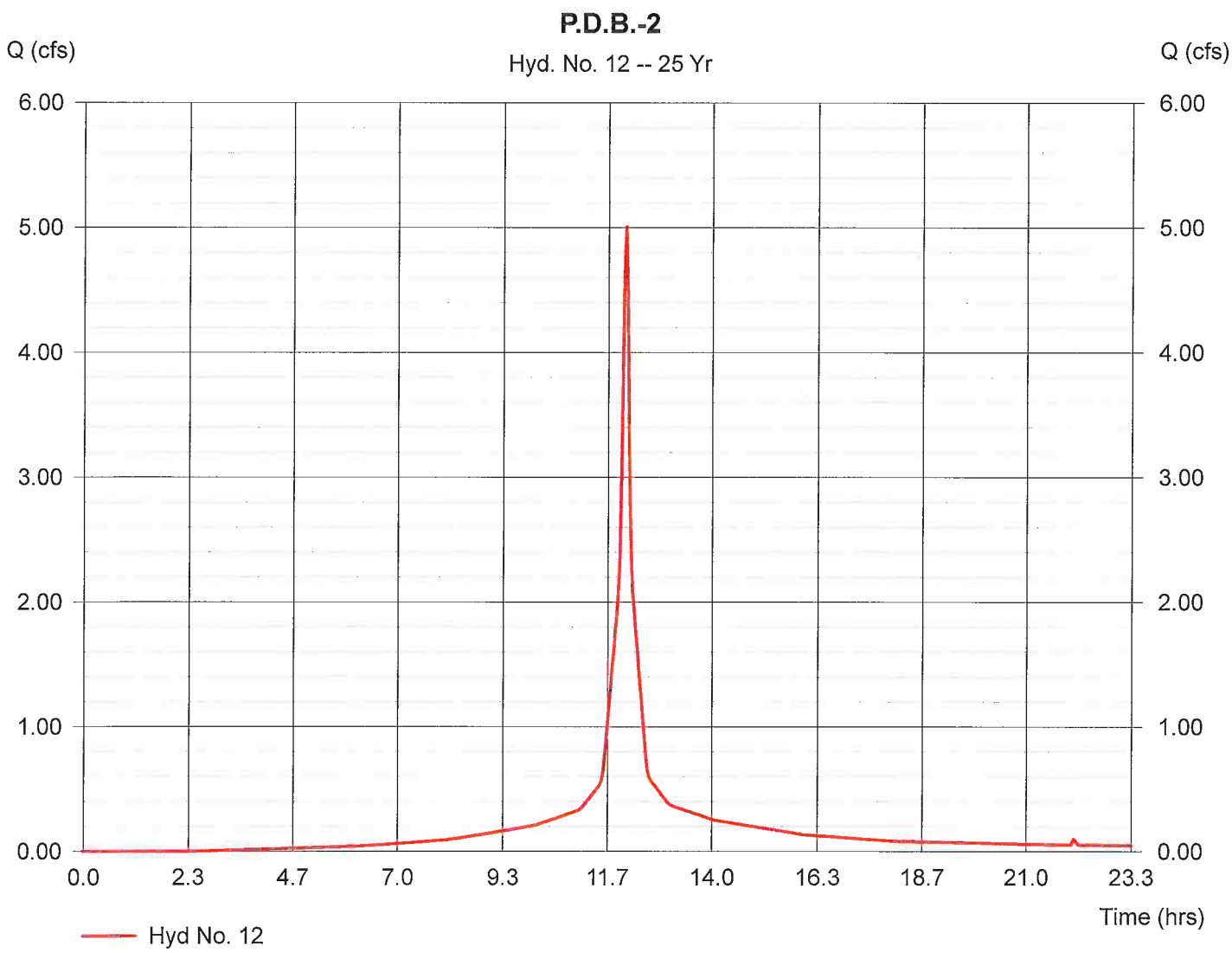
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 12

P.D.B.-2

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.01 cfs |
| Storm frequency | = 25 yrs | Time interval | = 2 min |
| Drainage area | = 1.00 ac | Curve number | = 93.8 |
| Basin Slope | = 0.9 % | Hydraulic length | = 256 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 5.50 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 16,265 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

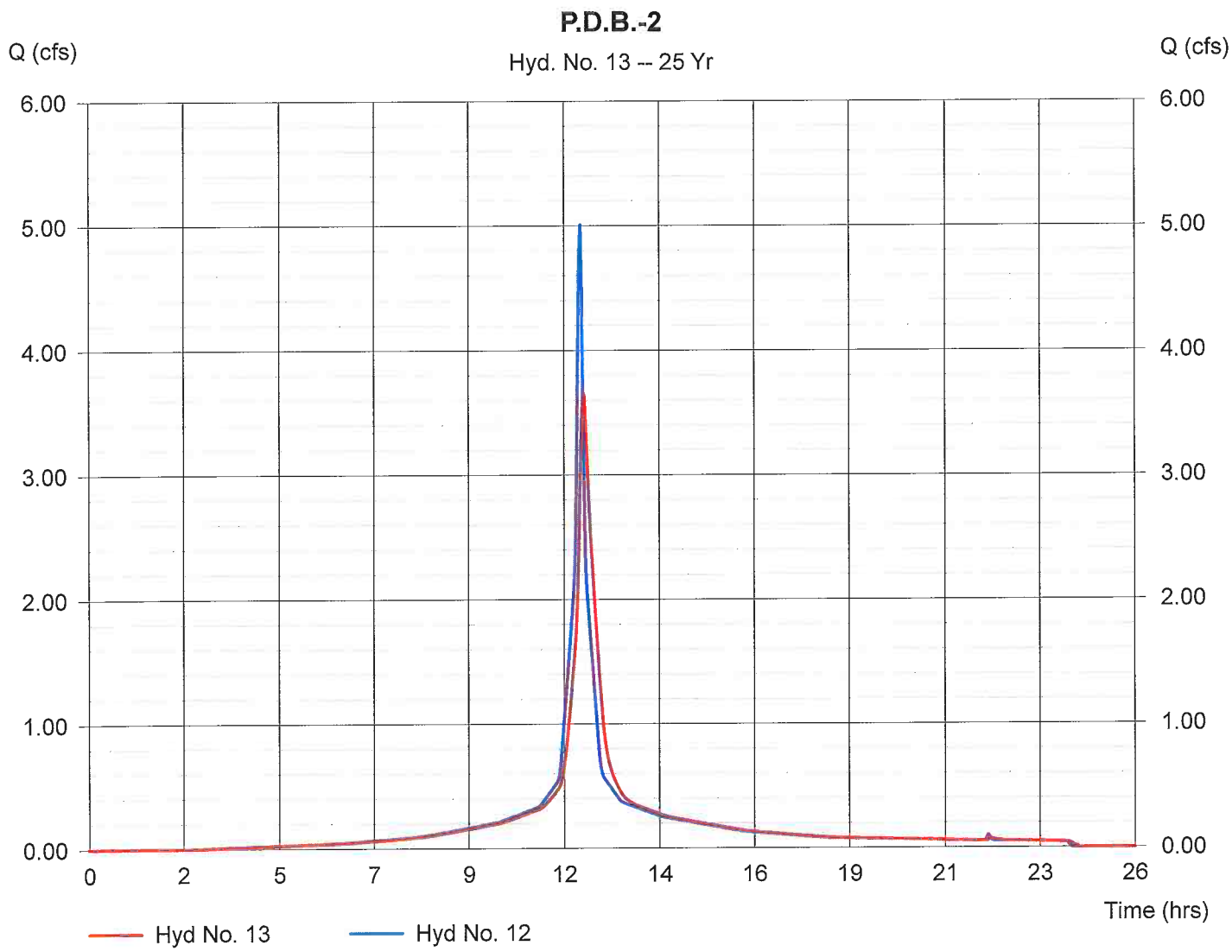
## Hyd. No. 13

P.D.B.-2

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 3.67 cfs |
| Storm frequency | = | 25 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 12 | Section type | = | Circular |
| Reach length | = | 917.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.2306 |

Modified Att-Kin routing method used.

Hydrograph Volume = 16,260 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

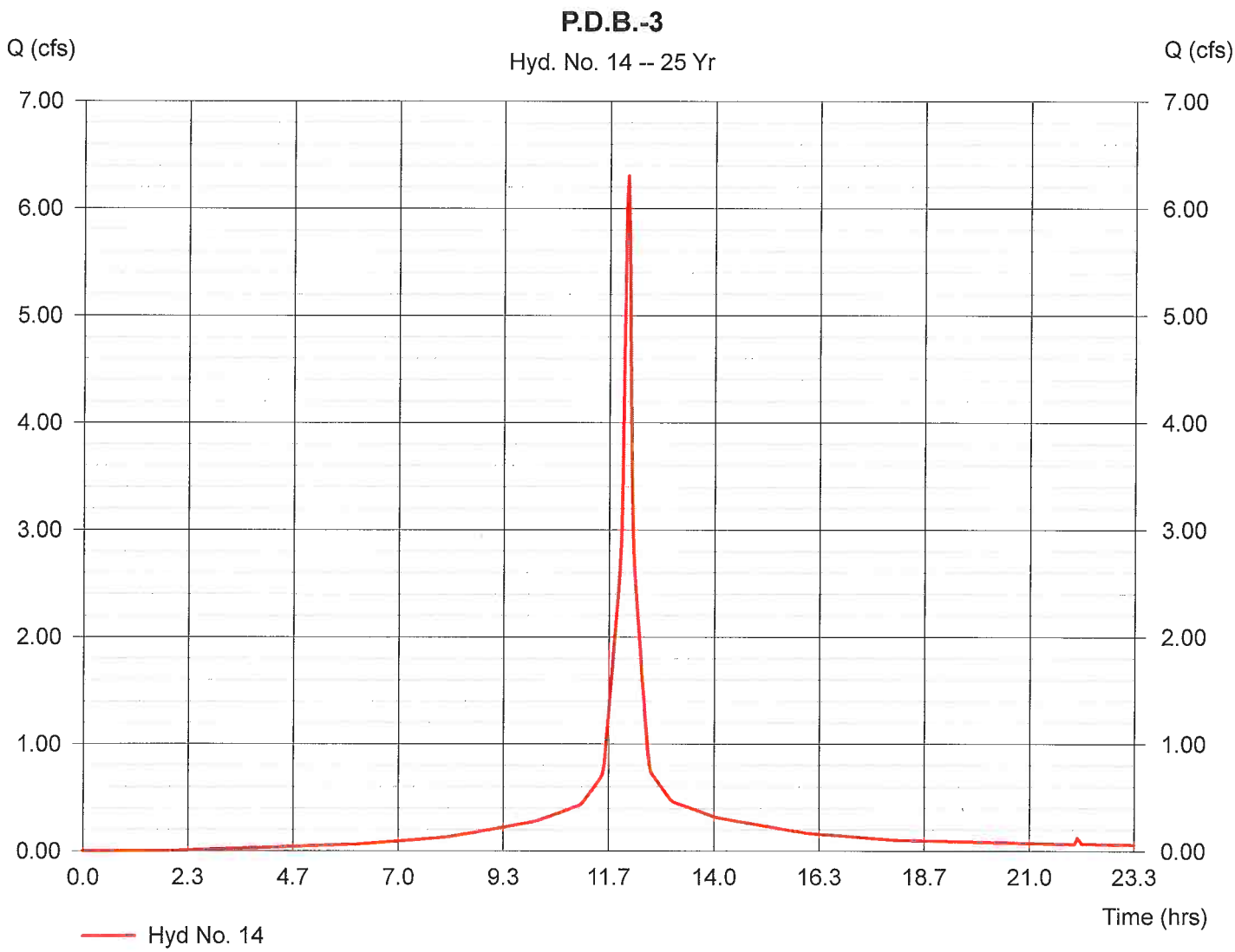
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 14

P.D.B.-3

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 6.31 cfs |
| Storm frequency | = 25 yrs | Time interval | = 2 min |
| Drainage area | = 1.24 ac | Curve number | = 95.3 |
| Basin Slope | = 0.9 % | Hydraulic length | = 139 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 5.50 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 20,869 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

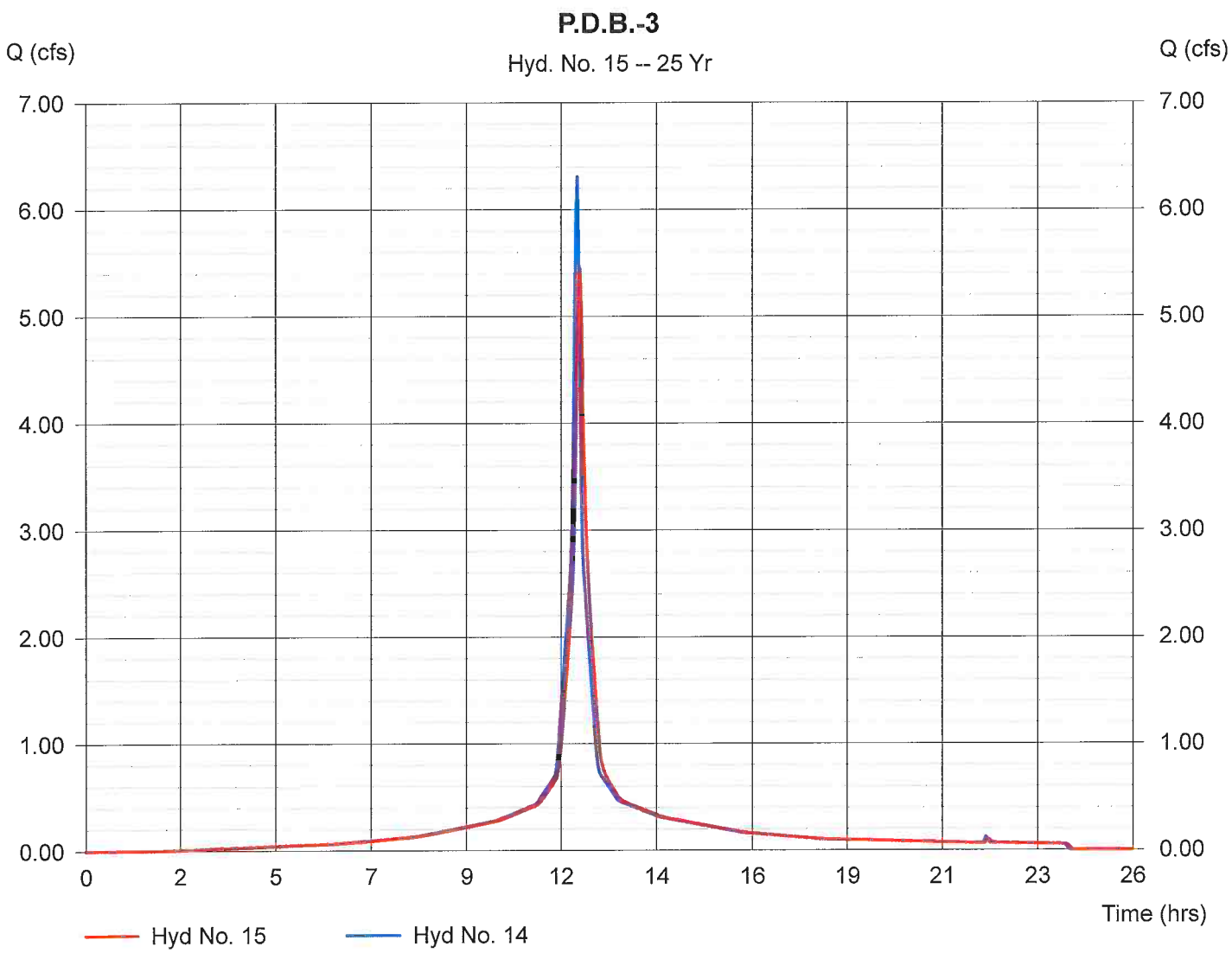
## Hyd. No. 15

P.D.B.-3

| | | | |
|---|---|---|---|
| Hydrograph type | = Reach | Peak discharge | = 5.45 cfs |
| Storm frequency | = 25 yrs | Time interval | = 2 min |
| Inflow hyd. No. | = 14 | Section type | = Circular |
| Reach length | = 582.0 ft | Channel slope | = 1.0 % |
| Manning's n | = 0.009 | Bottom width | = 2.0 ft |
| Side slope | = 0.0:1 | Max. depth | = 0.0 ft |
| Rating curve x | = 10.028 | Rating curve m | = 1.250 |
| Ave. velocity | = 0.00 ft/s | Routing coeff. | = 0.4110 |

Modified Att-Kin routing method used.

Hydrograph Volume = 20,867 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

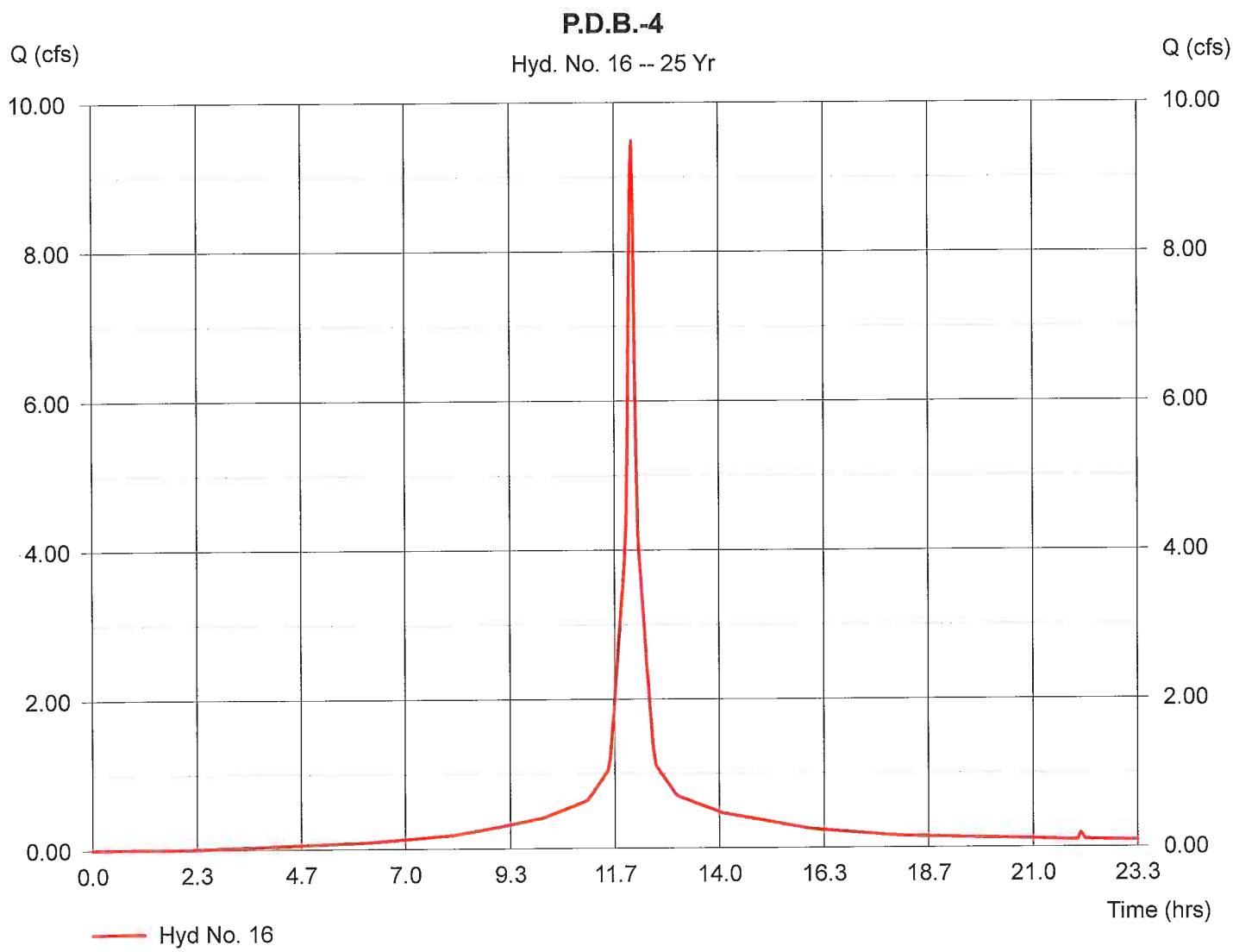
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 16

P.D.B.-4

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 9.48 cfs |
| Storm frequency | = 25 yrs | Time interval | = 2 min |
| Drainage area | = 1.88 ac | Curve number | = 94.5 |
| Basin Slope | = 1.5 % | Hydraulic length | = 144 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 = 31,067 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

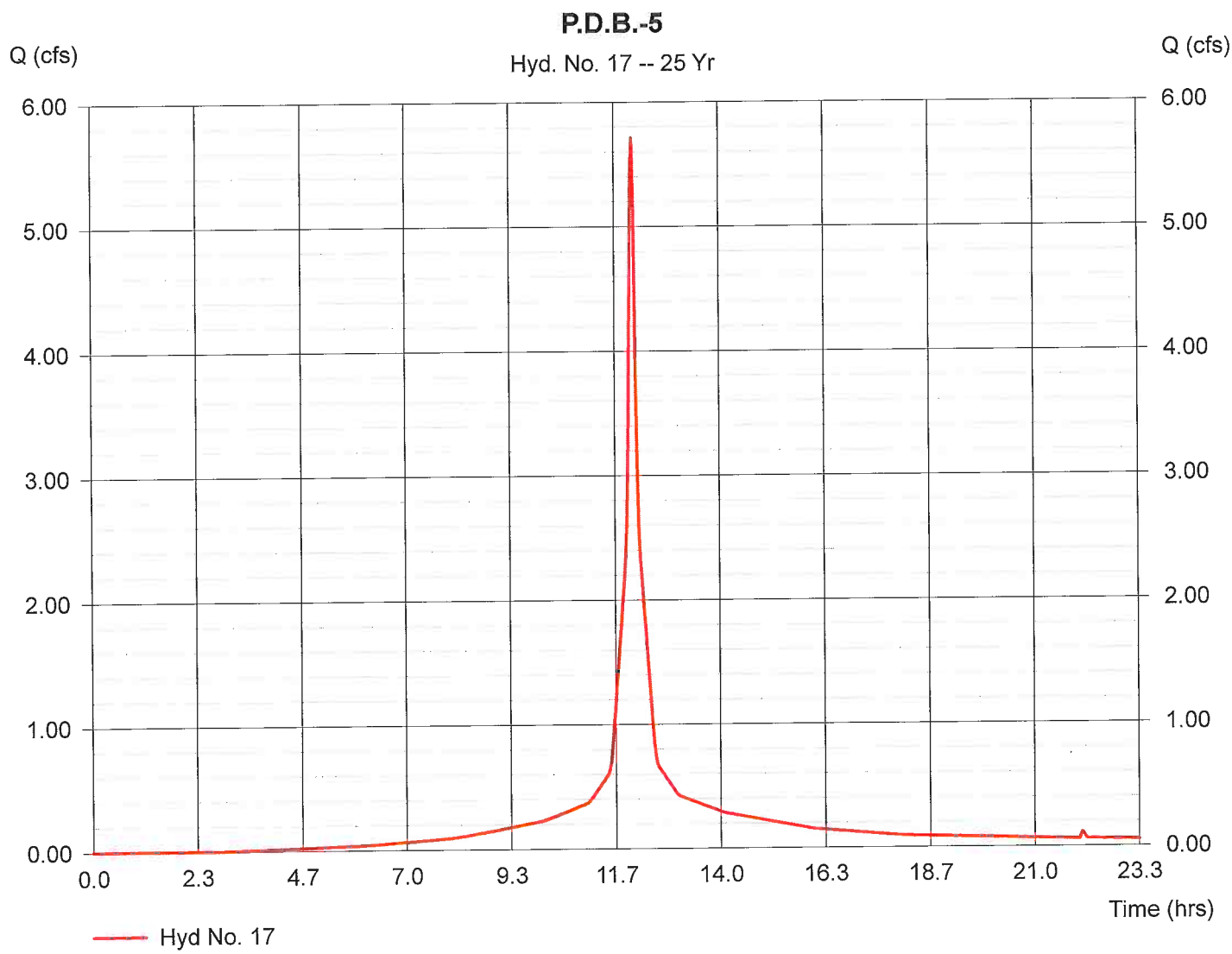
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 17

P.D.B.-5

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 5.71 cfs |
| Storm frequency | = | 25 yrs | Time interval | = | 2 min |
| Drainage area | = | 1.16 ac | Curve number | = | 92.8 |
| Basin Slope | = | 1.2 % | Hydraulic length | = | 100 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 = 18,361 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

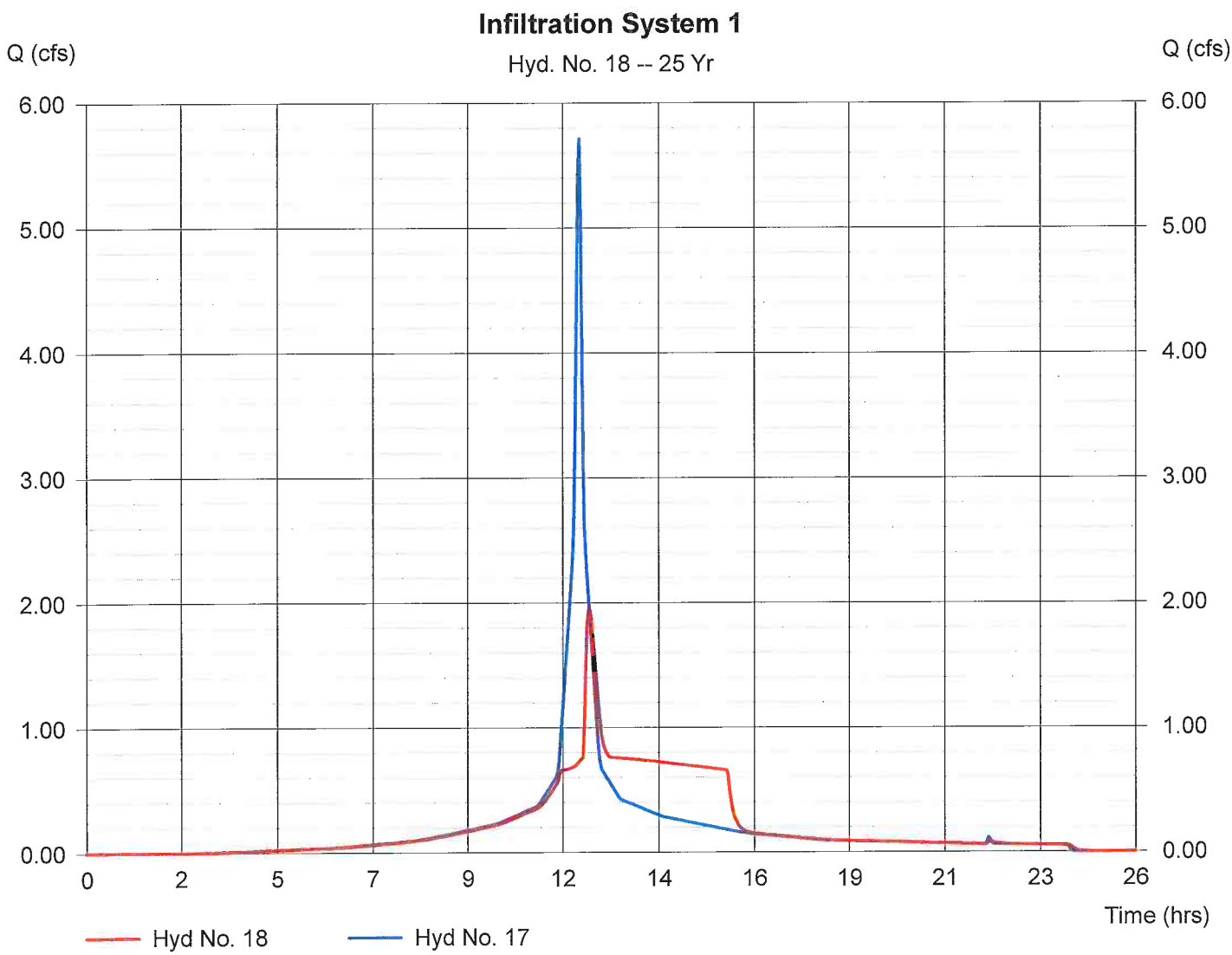
## Hyd. No. 18

Infiltration System 1

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 1.94 cfs |
| Storm frequency | = | 25 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 17 | Max. Elevation | = | 156.83 ft |
| Reservoir name | = | Infiltration System | Max. Storage | = | 4,994 cuft |

Storage Indication method used.

Hydrograph Volume = 18,361 cuft



# Pond Report

Hydraflow Hydrographs by Intelisolve — Wednesday, Nov 25 2015, 2:28 PM

## Pond No. 1 - Infiltration System

### Pond Data

Bottom LxW = 84.0 x 40.4 ft  Side slope = 0.0:1  Bottom elev. = 154.25 ft  Depth = 2.80 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft)* | Total storage (cuft)* (*57.00% voids applied) |
|---|---|---|---|---|
| 0.00 | 154.25 | 3,394 | 0 | 0 |
| 0.14 | 154.39 | 3,394 | 271 | 271 |
| 0.28 | 154.53 | 3,394 | 271 | 542 |
| 0.42 | 154.67 | 3,394 | 271 | 812 |
| 0.56 | 154.81 | 3,394 | 271 | 1,083 |
| 0.70 | 154.95 | 3,394 | 271 | 1,354 |
| 0.84 | 155.09 | 3,394 | 271 | 1,625 |
| 0.98 | 155.23 | 3,394 | 271 | 1,896 |
| 1.12 | 155.37 | 3,394 | 271 | 2,166 |
| 1.26 | 155.51 | 3,394 | 271 | 2,437 |
| 1.40 | 155.65 | 3,394 | 271 | 2,708 |
| 1.54 | 155.79 | 3,394 | 271 | 2,979 |
| 1.68 | 155.93 | 3,394 | 271 | 3,250 |
| 1.82 | 156.07 | 3,394 | 271 | 3,521 |
| 1.96 | 156.21 | 3,394 | 271 | 3,791 |
| 2.10 | 156.35 | 3,394 | 271 | 4,062 |
| 2.24 | 156.49 | 3,394 | 271 | 4,333 |
| 2.38 | 156.63 | 3,394 | 271 | 4,604 |
| 2.52 | 156.77 | 3,394 | 271 | 4,875 |
| 2.66 | 156.91 | 3,394 | 271 | 5,145 |
| 2.80 | 157.05 | 3,394 | 271 | 5,416 |

### Culvert / Orifice Structures

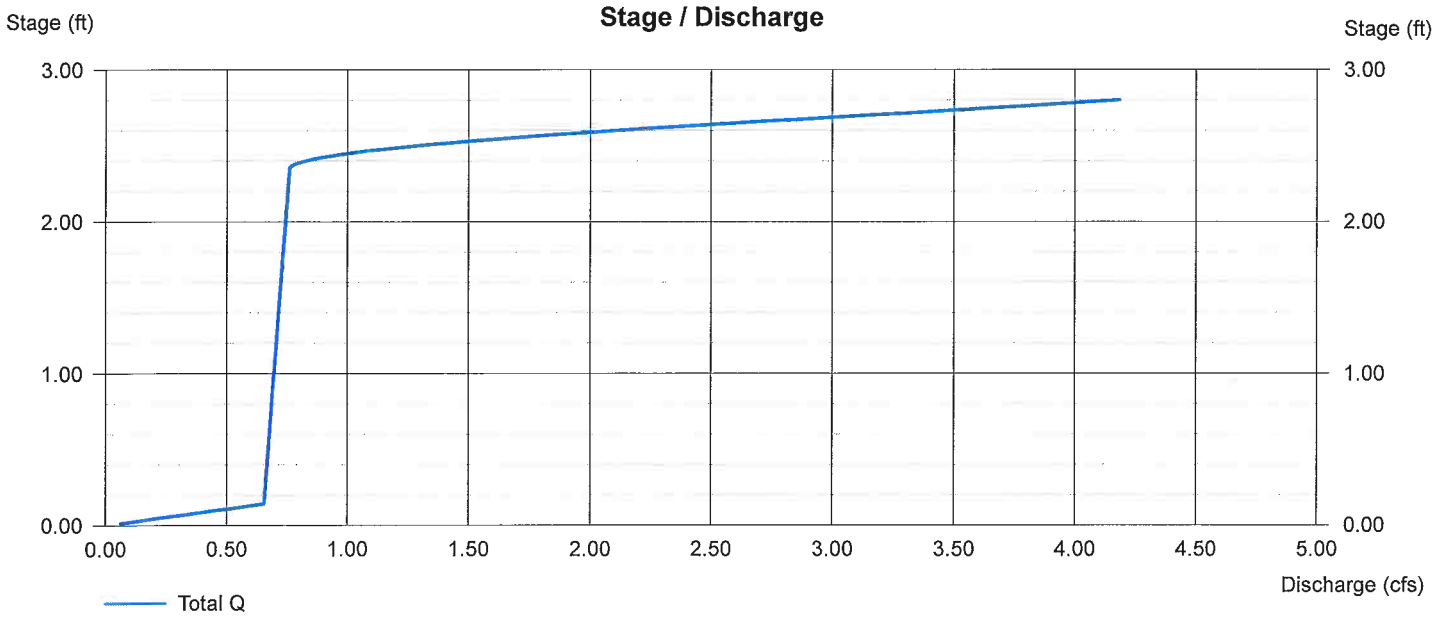
| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| Rise (in) | = 6.00 | 0.00 | 0.00 | 0.00 |
| Span (in) | = 6.00 | 0.00 | 0.00 | 0.00 |
| No. Barrels | = 8 | 0 | 0 | 0 |
| Invert El. (ft) | = 156.60 | 0.00 | 0.00 | 0.00 |
| Length (ft) | = 15.00 | 0.00 | 0.00 | 0.00 |
| Slope (%) | = 3.00 | 0.00 | 0.00 | 0.00 |
| N-Value | = .013 | .000 | .000 | .000 |
| Orif. Coeff. | = 0.60 | 0.00 | 0.00 | 0.00 |
| Multi-Stage | = n/a | No | No | No |

### Weir Structures

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

**Exfiltration =** 8.270 in/hr (Wet area) Tailwater Elev. = 0.00 ft

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



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

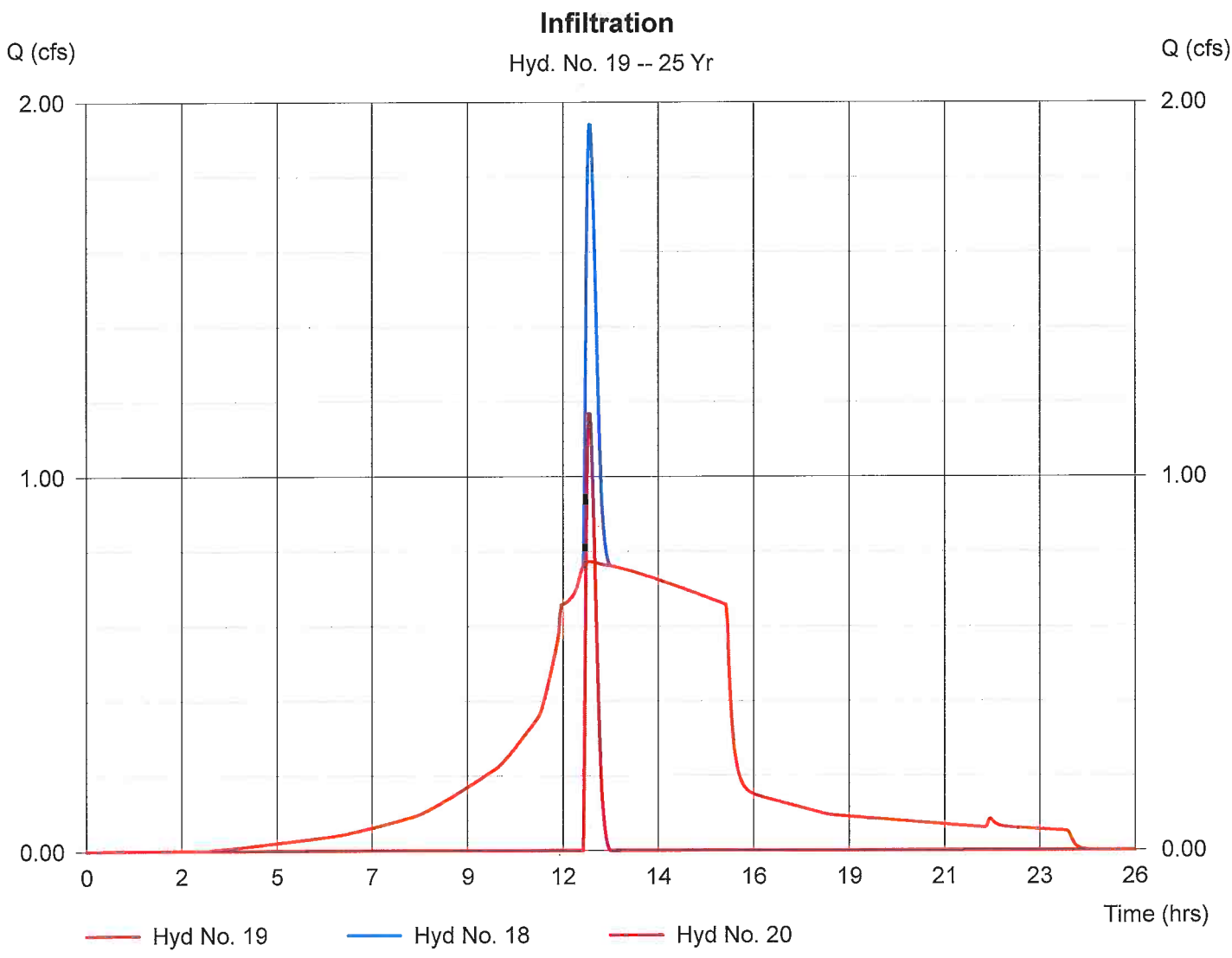
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 19

Infiltration

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Diversion1 | Peak discharge | = | 0.77 cfs |
| Storm frequency | = | 25 yrs | Time interval | = | 2 min |
| Inflow hydrograph | = | 18 | 2nd diverted hyd. | = | 20 |
| Diversion method | = | Pond - Infiltration System | Pond structure | = | Exfiltration |

Hydrograph Volume = 17,173 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

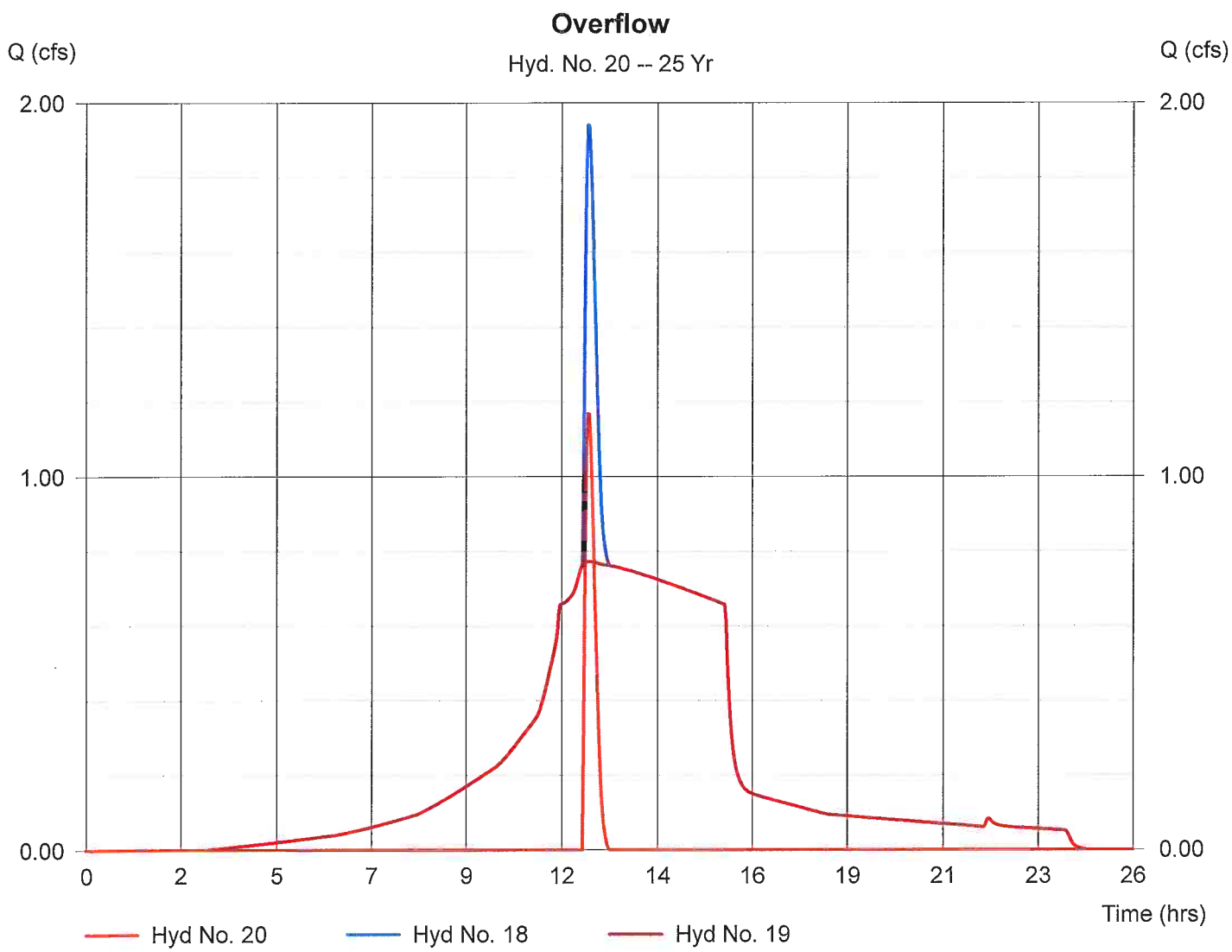
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 20

Overflow

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Diversion2 | Peak discharge | = | 1.17 cfs |
| Storm frequency | = | 25 yrs | Time interval | = | 2 min |
| Inflow hydrograph | = | 18 | 2nd diverted hyd. | = | 19 |
| Diversion method | = | Pond - Infiltration System | Pond structure | = | Exfiltration |

Hydrograph Volume = 1,188 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

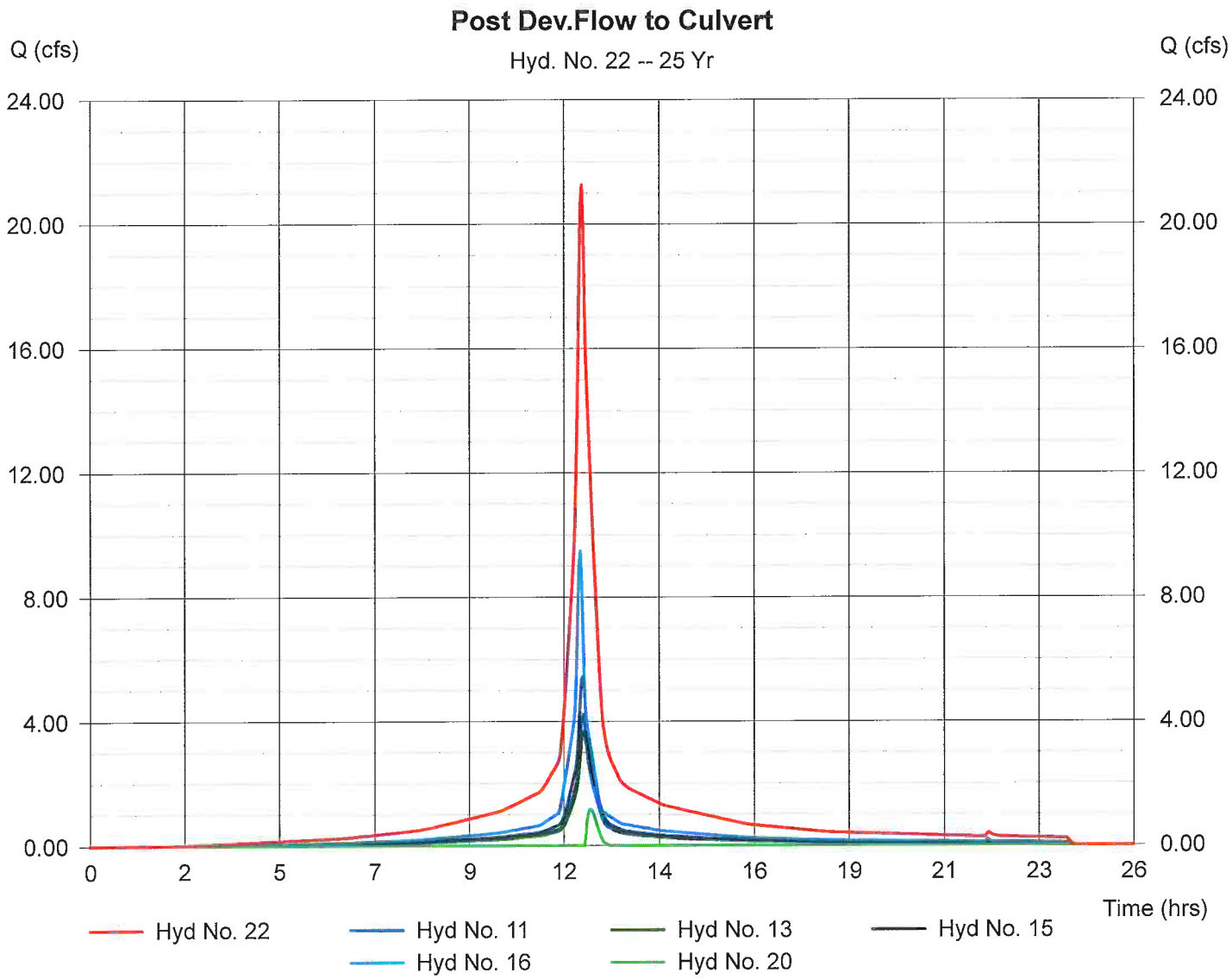
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 22

Post Dev.Flow to Culvert

| | | | |
|---|---|---|---|
| Hydrograph type | = Combine | Peak discharge | = 21.27 cfs |
| Storm frequency | = 25 yrs | Time interval | = 2 min |
| Inflow hyds. | = 11, 13, 15, 16, 20 | | |

Hydrograph Volume = 86,111 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 | 6.25 | 2 | 724 | 20,099 | ---- | ------ | ------ | E.C.B.-1 |
| 2 | Reach | 5.40 | 2 | 728 | 20,096 | 1 | ------ | ------ | E.C.B-1 |
| 3 | SCS Runoff | 13.73 | 2 | 724 | 46,416 | ---- | ------ | ------ | E.C.B.-2 |
| 4 | Reach | 12.47 | 2 | 726 | 46,413 | 3 | ------ | ------ | E.C.B.-2 |
| 5 | SCS Runoff | 7.97 | 2 | 728 | 30,592 | ---- | ------ | ------ | E.C.B.-3 |
| 6 | SCS Runoff | 6.62 | 2 | 724 | 21,565 | ---- | ------ | ------ | E.C.B.-4 |
| 8 | Combine | 31.21 | 2 | 726 | 118,666 | 2, 4, 5, 6, | ------ | ------ | Ex. Flow at Culvert |
| 10 | SCS Runoff | 6.22 | 2 | 724 | 20,782 | ---- | ------ | ------ | P.D.B.-1 |
| 11 | Reach | 5.37 | 2 | 728 | 20,780 | 10 | ------ | ------ | P.D.B.-1 |
| 12 | SCS Runoff | 6.17 | 2 | 724 | 20,307 | ---- | ------ | ------ | P.D.B.-2 |
| 13 | Reach | 4.82 | 2 | 728 | 20,303 | 12 | ------ | ------ | P.D.B.-2 |
| 14 | SCS Runoff | 7.74 | 2 | 724 | 25,900 | ---- | ------ | ------ | P.D.B.-3 |
| 15 | Reach | 6.87 | 2 | 726 | 25,898 | 14 | ------ | ------ | P.D.B.-3 |
| 16 | SCS Runoff | 11.67 | 2 | 724 | 38,679 | ---- | ------ | ------ | P.D.B.-4 |
| 17 | SCS Runoff | 7.07 | 2 | 724 | 23,019 | ---- | ------ | ------ | P.D.B.-5 |
| 18 | Reservoir | 3.89 | 2 | 730 | 23,018 | 17 | 157.02 | 5,358 | Infiltration System 1 |
| 19 | Diversion1 | 0.78 | 2 | 730 | 19,775 | 18 | ------ | ------ | Infiltration |
| 20 | Diversion2 | 3.11 | 2 | 730 | 3,243 | 18 | ------ | ------ | Overflow |
| 22 | Combine | 27.83 | 2 | 728 | 108,903 | 11, 13, 15, 16, 20, | ---- | ------ | Post Dev.Flow to Culvert |

# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

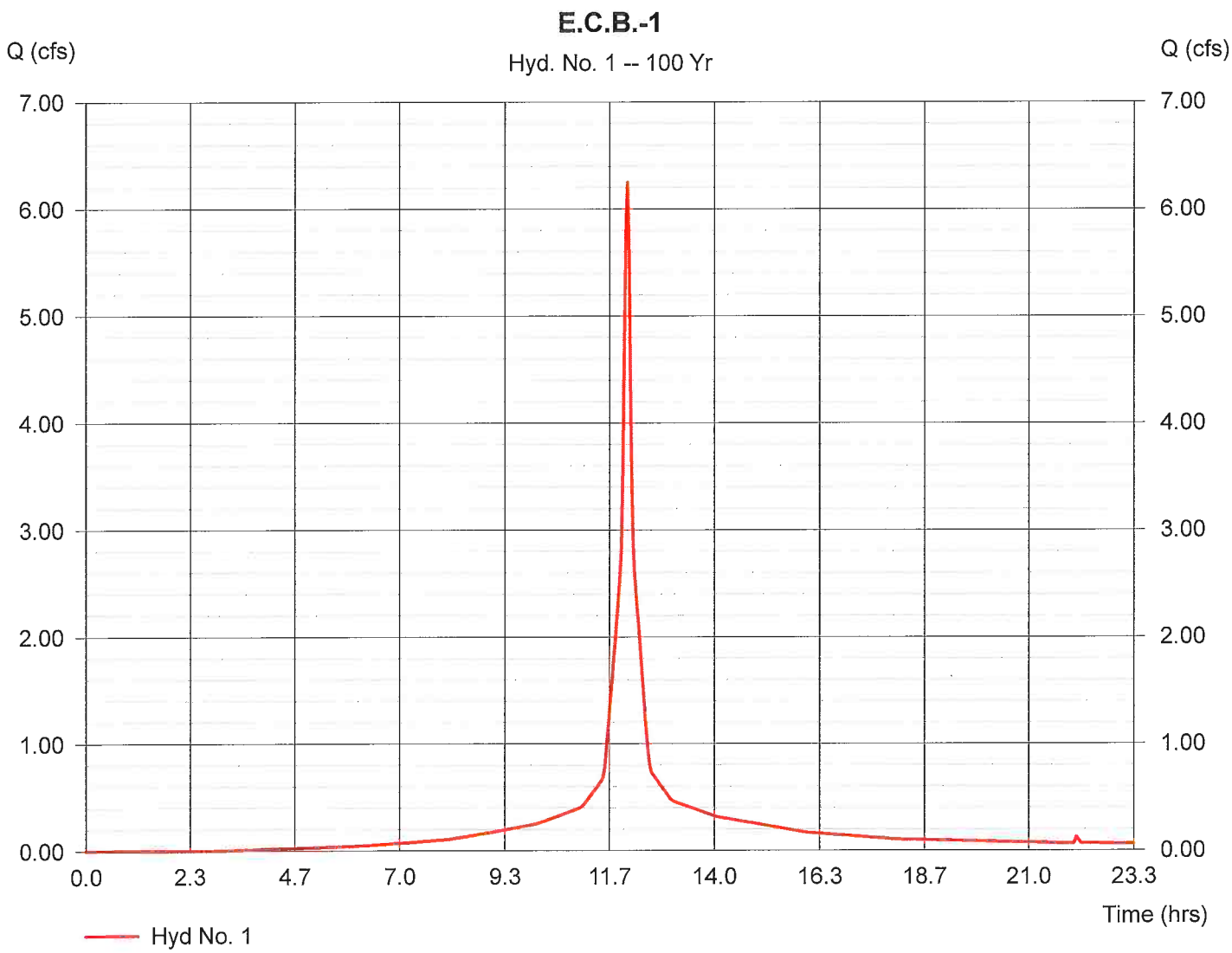
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 1

E.C.B.-1

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 6.25 cfs |
| Storm frequency | = 100 yrs | Time interval | = 2 min |
| Drainage area | = 1.04 ac | Curve number | = 91.4 |
| Basin Slope | = 0.8 % | Hydraulic length | = 166 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 6.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 20,099 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

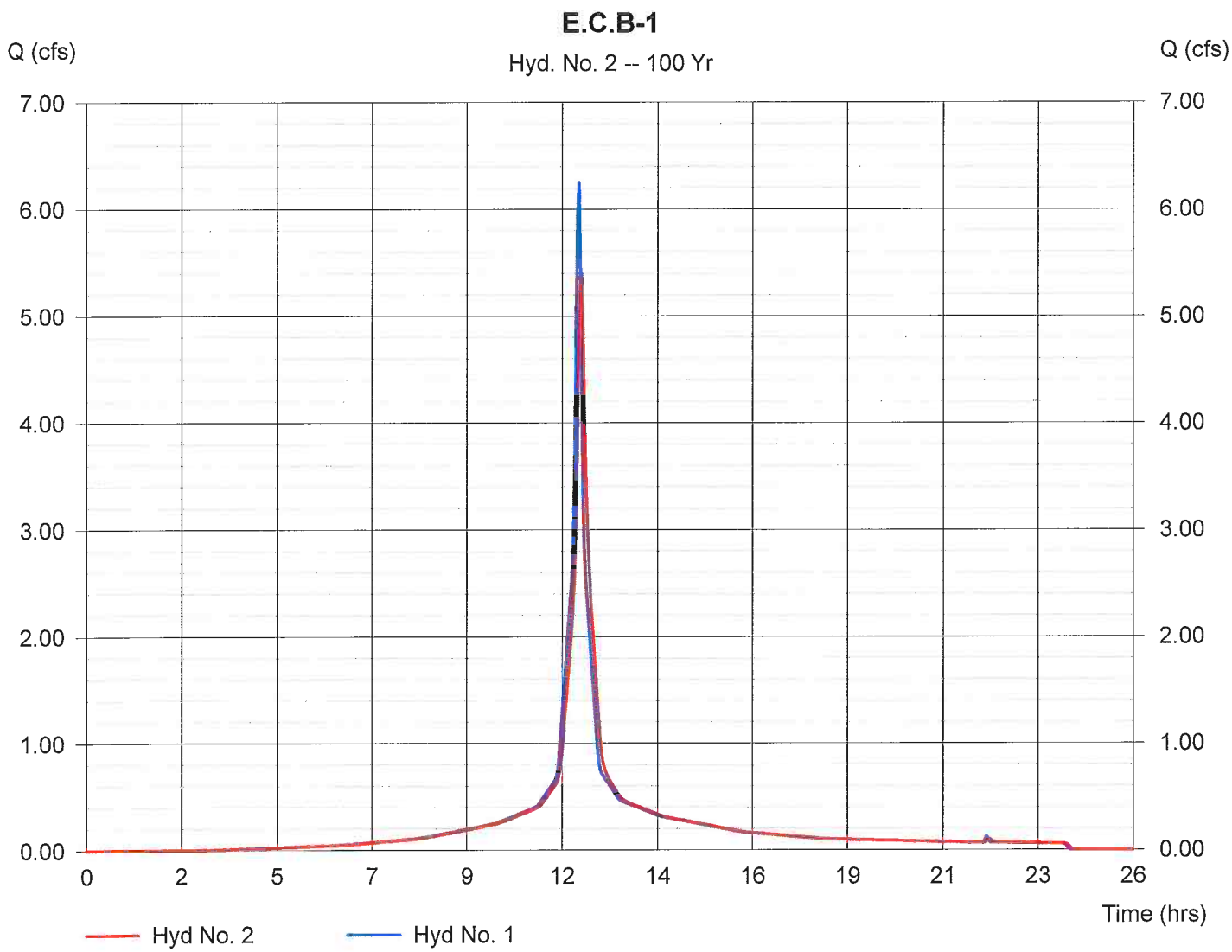
## Hyd. No. 2

E.C.B-1

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 5.40 cfs |
| Storm frequency | = | 100 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 1 | Section type | = | Circular |
| Reach length | = | 578.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.4105 |

Modified Att-Kin routing method used.

Hydrograph Volume = 20,096 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

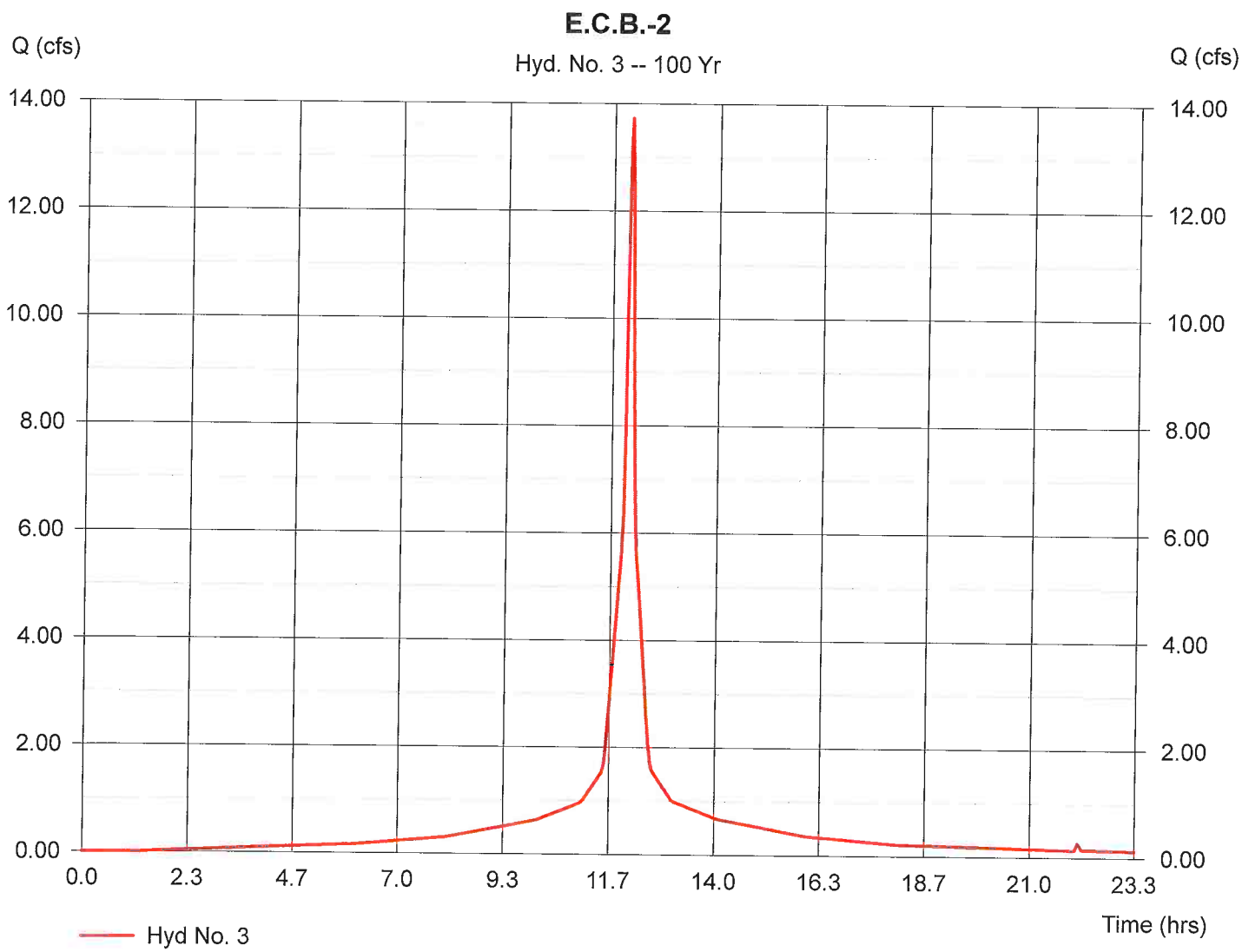
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 3

E.C.B.-2

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = SCS Runoff | | Peak discharge | = | 13.73 cfs |
| Storm frequency | = 100 yrs | | Time interval | = | 2 min |
| Drainage area | = 2.19 ac | | Curve number | = | 96.1 |
| Basin Slope | = 1.2 % | | Hydraulic length | = | 320 ft |
| Tc method | = LAG | | Time of conc. (Tc) | = | 6.168732 min |
| Total precip. | = 6.70 in | | Distribution | = | Type III |
| Storm duration | = 24 hrs | | Shape factor | = | 484 |

Hydrograph Volume = 46,416 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

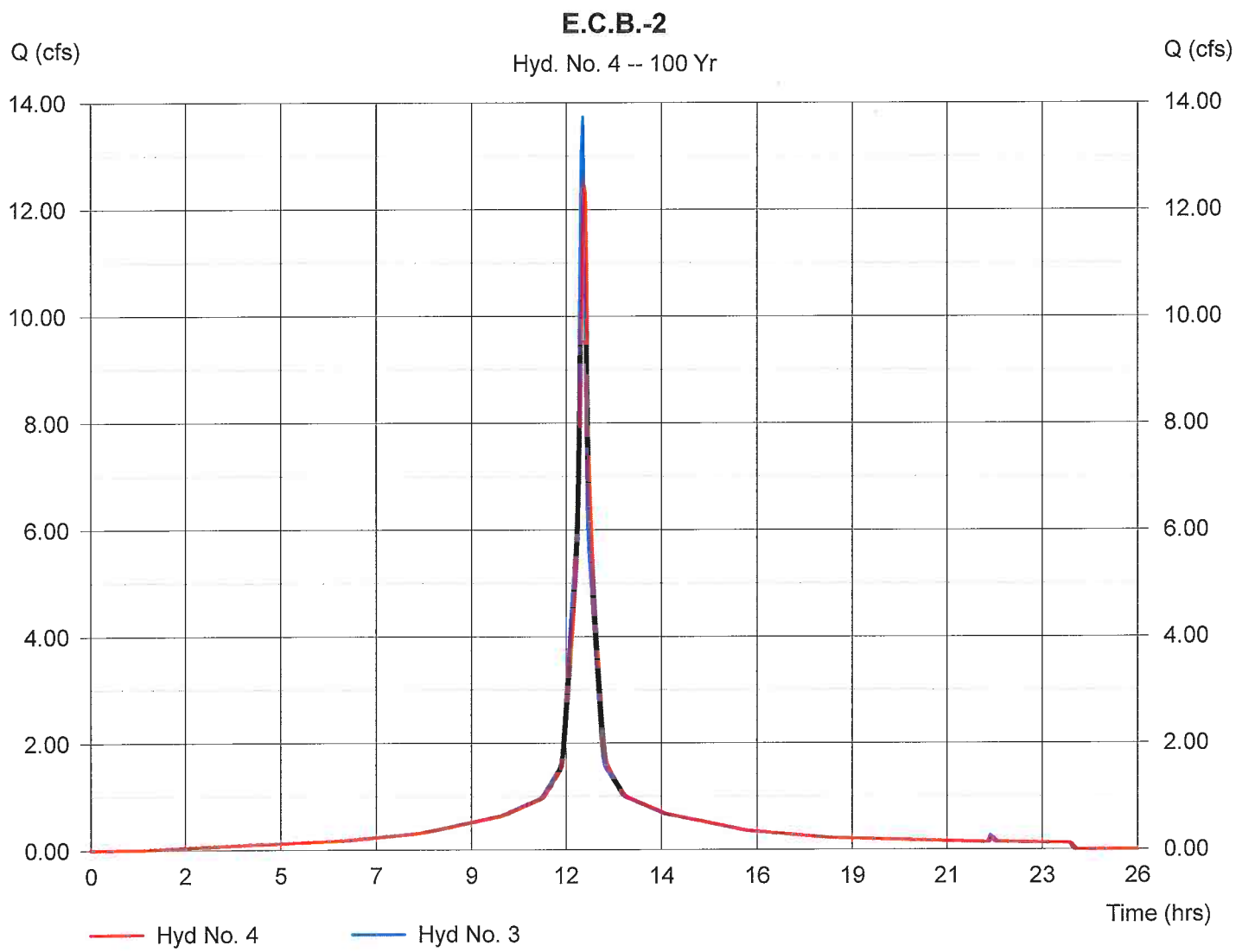
## Hyd. No. 4

E.C.B.-2

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 12.47 cfs |
| Storm frequency | = | 100 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 3 | Section type | = | Circular |
| Reach length | = | 917.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.5267 |

Modified Att-Kin routing method used.

Hydrograph Volume = 46,413 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

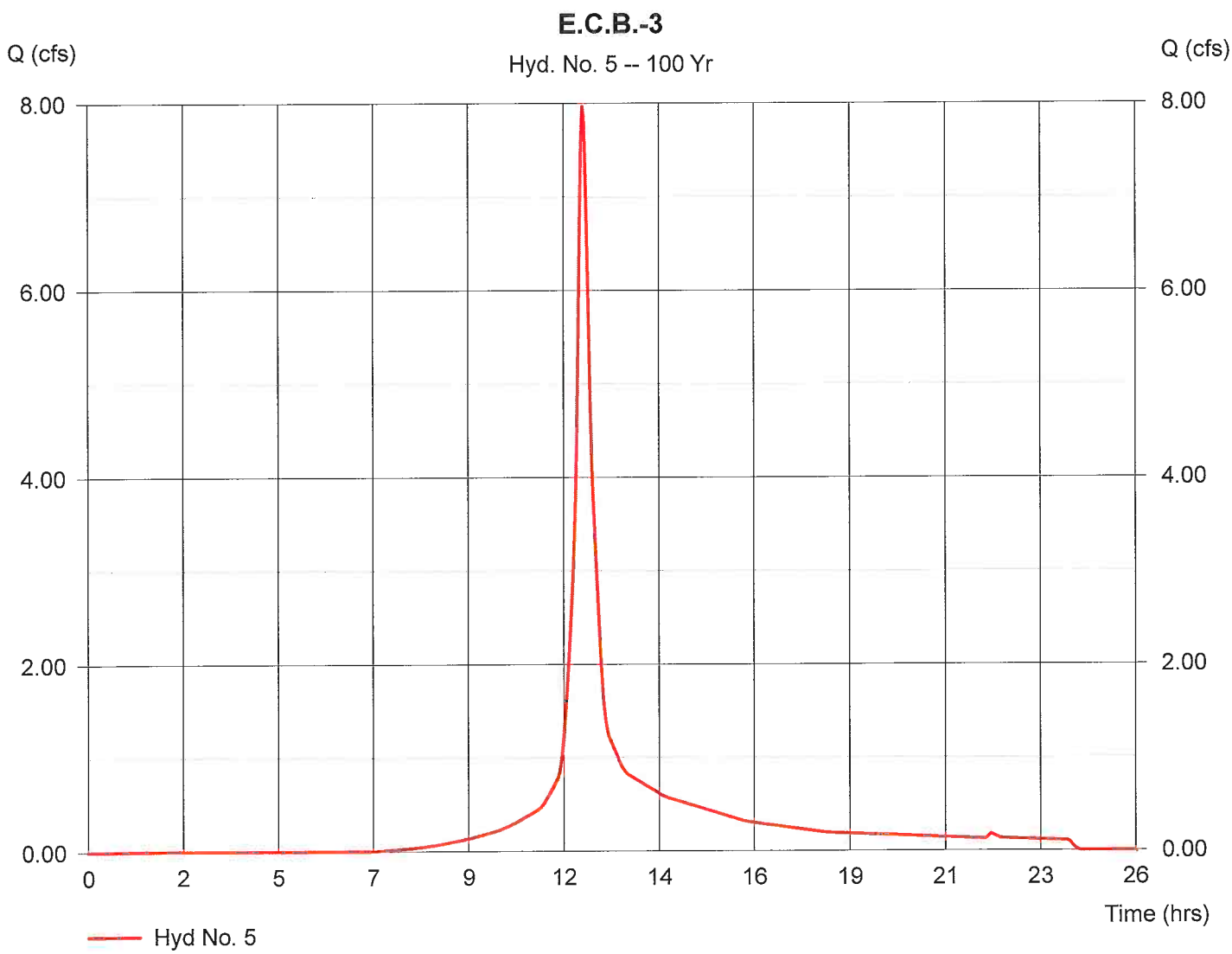
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 5

E.C.B.-3

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 7.97 cfs |
| Storm frequency | = 100 yrs | Time interval | = 2 min |
| Drainage area | = 1.96 ac | Curve number | = 77.6 |
| Basin Slope | = 1.0 % | Hydraulic length | = 326 ft |
| Tc method | = USER | Time of conc. (Tc) | = 10 min |
| Total precip. | = 6.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 30,592 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

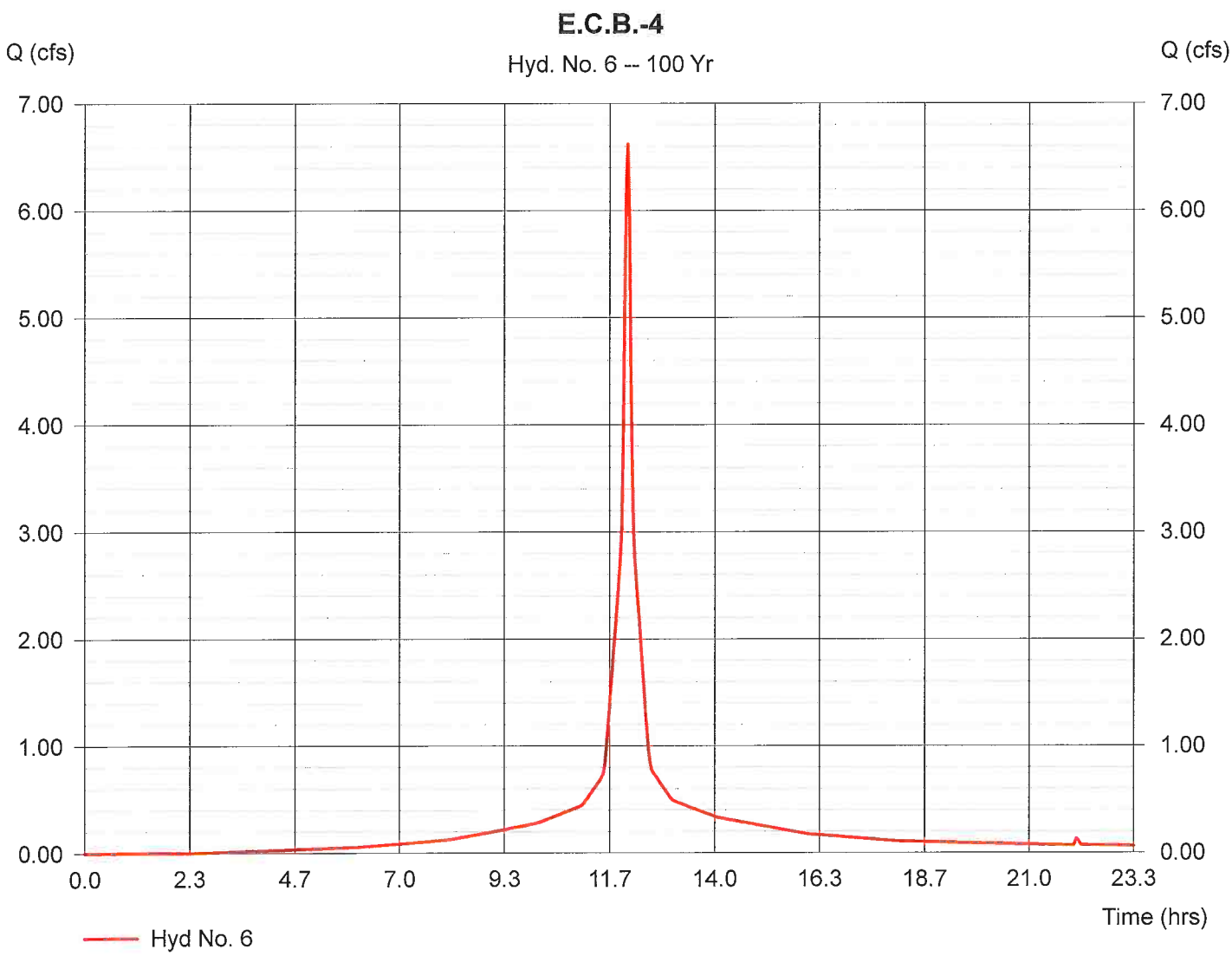
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 6

E.C.B.-4

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 6.62 cfs |
| Storm frequency | = 100 yrs | Time interval | = 2 min |
| Drainage area | = 1.08 ac | Curve number | = 92.8 |
| Basin Slope | = 0.8 % | Hydraulic length | = 213 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 6.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 21,565 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

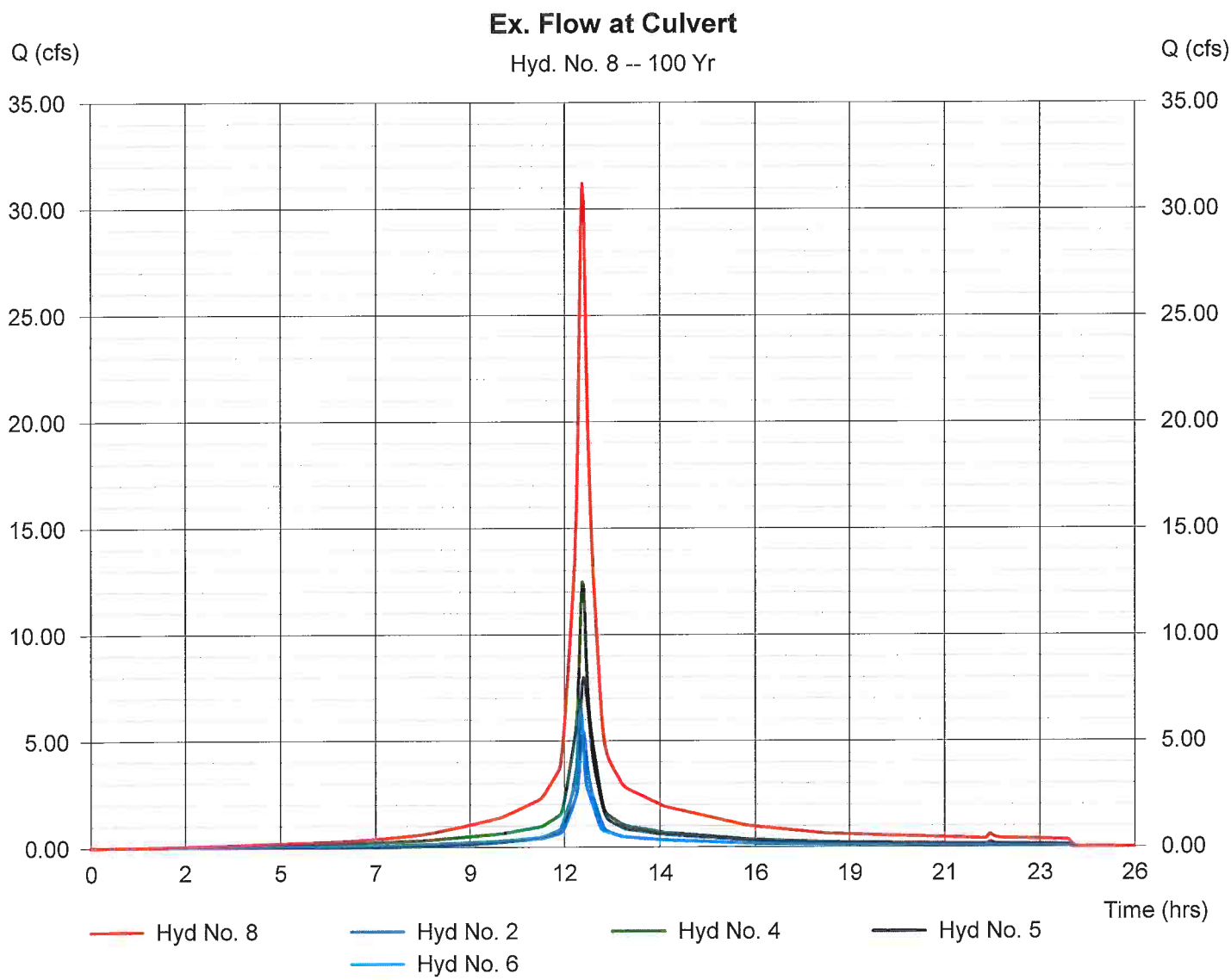
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 8

Ex. Flow at Culvert

| | | | |
|---|---|---|---|
| Hydrograph type | = Combine | Peak discharge | = 31.21 cfs |
| Storm frequency | = 100 yrs | Time interval | = 2 min |
| Inflow hyds. | = 2, 4, 5, 6 | | |

Hydrograph Volume = 118,666 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

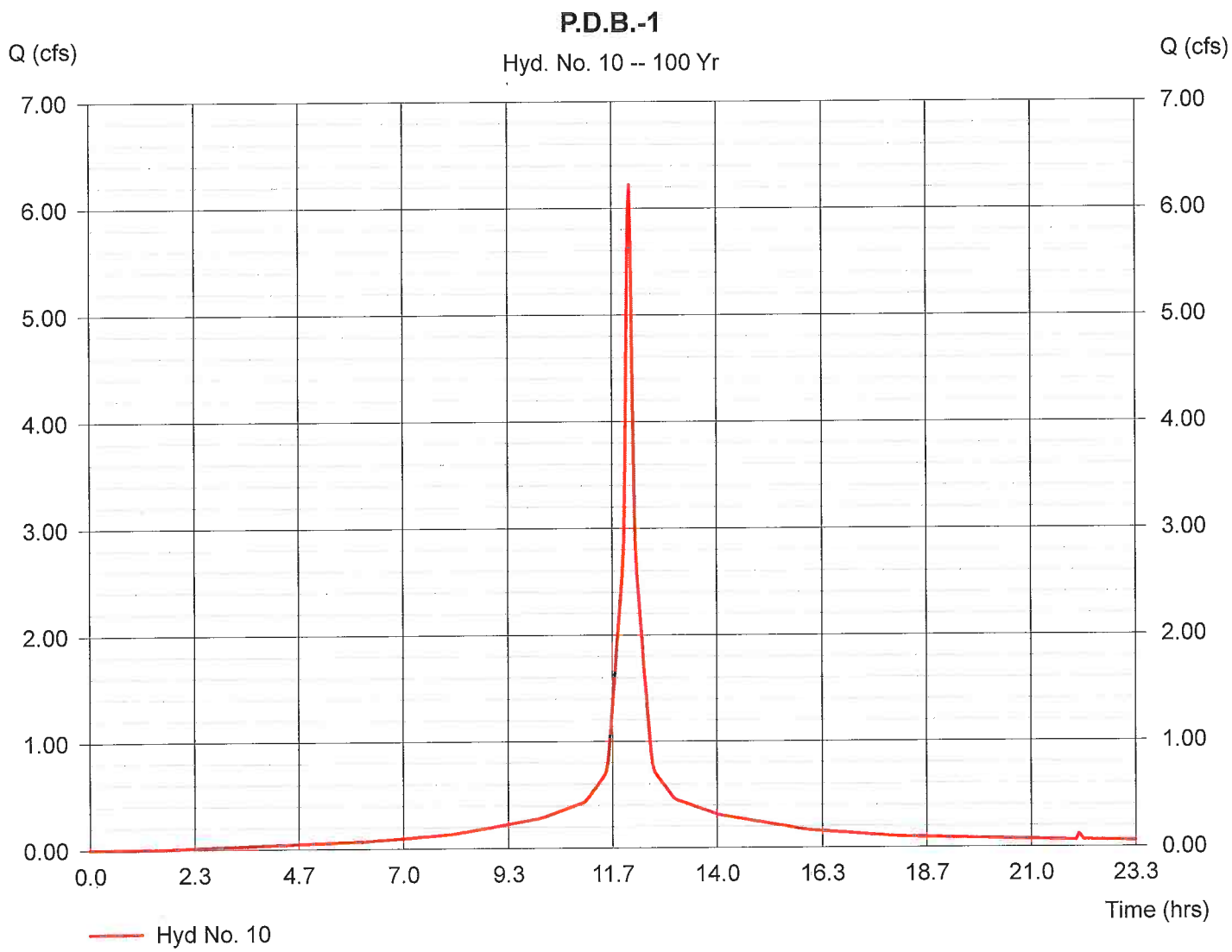
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 10

P.D.B.-1

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 6.22 cfs |
| Storm frequency | = | 100 yrs | Time interval | = | 2 min |
| Drainage area | = | 1.00 ac | Curve number | = | 95.1 |
| Basin Slope | = | 0.7 % | Hydraulic length | = | 148 ft |
| Tc method | = | USER | Time of conc. (Tc) | = | 4 min |
| Total precip. | = | 6.70 in | Distribution | = | Type III |
| Storm duration | = | 24 hrs | Shape factor | = | 484 |

Hydrograph Volume = 20,782 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

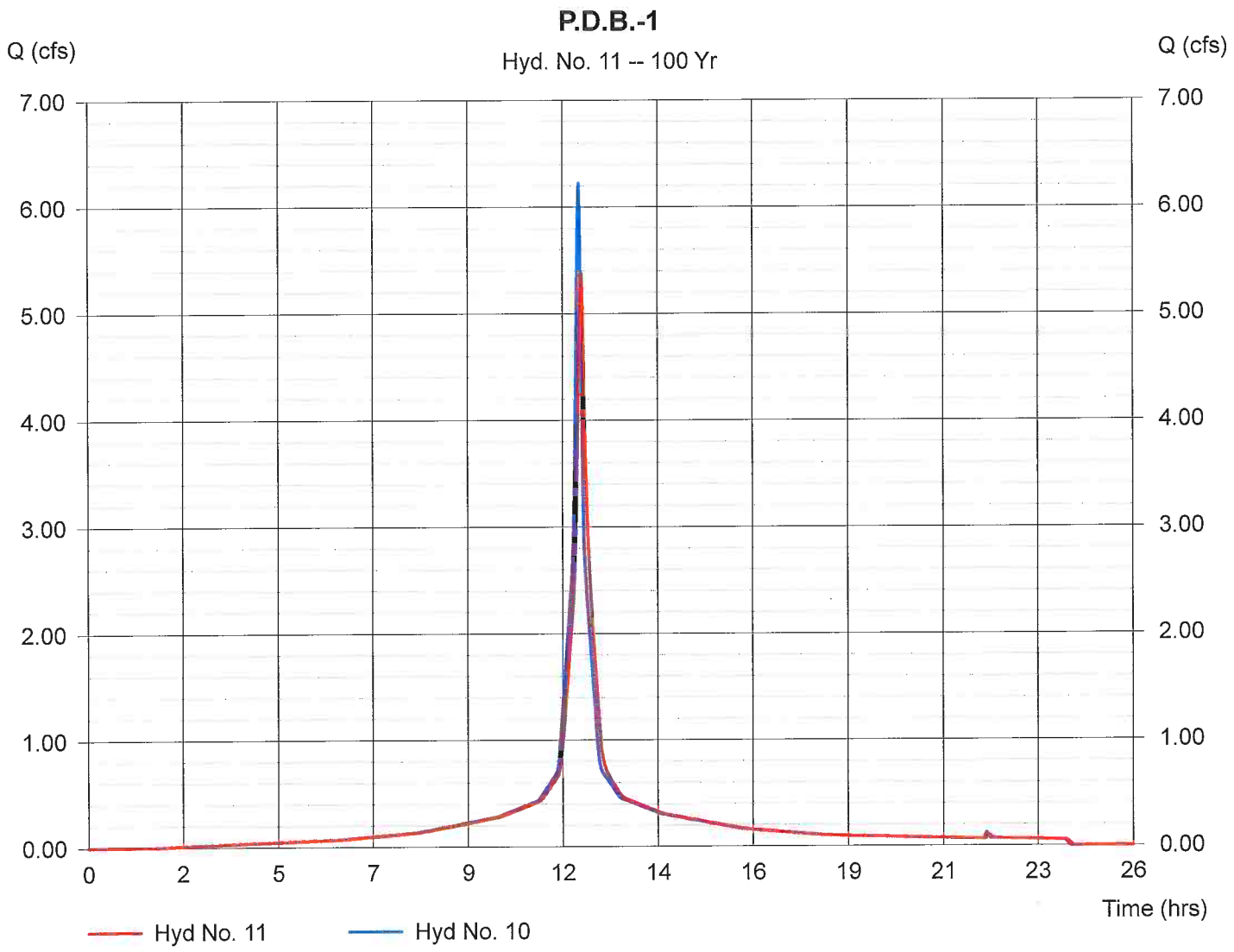
## Hyd. No. 11

P.D.B.-1

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 5.37 cfs |
| Storm frequency | = | 100 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 10 | Section type | = | Circular |
| Reach length | = | 578.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.4090 |

Modified Att-Kin routing method used.

Hydrograph Volume = 20,780 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

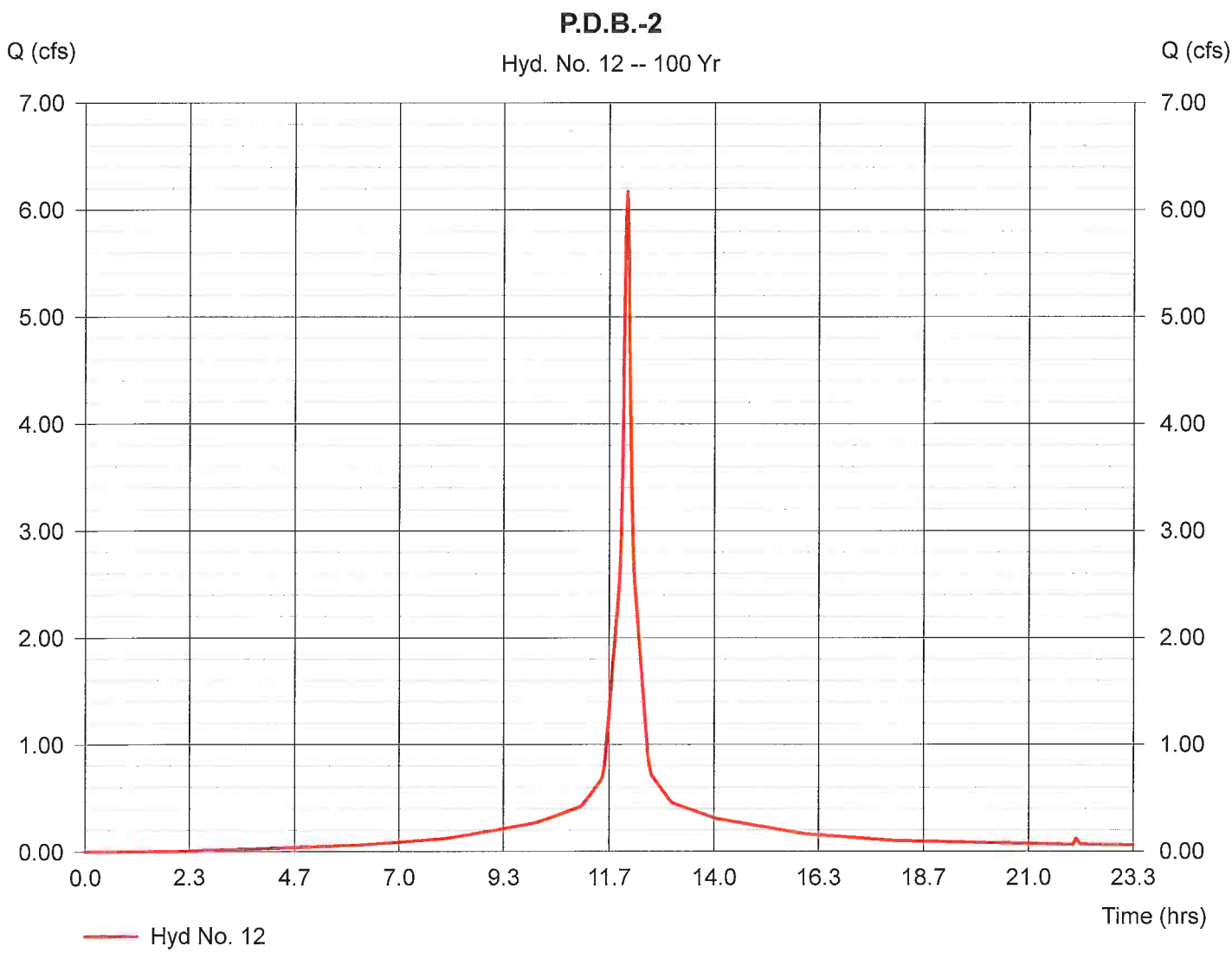
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 12

P.D.B.-2

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 6.17 cfs |
| Storm frequency | = | 100 yrs | Time interval | = | 2 min |
| Drainage area | = | 1.00 ac | Curve number | = | 93.8 |
| Basin Slope | = | 0.9 % | Hydraulic length | = | 256 ft |
| Tc method | = | USER | Time of conc. (Tc) | = | 4 min |
| Total precip. | = | 6.70 in | Distribution | = | Type III |
| Storm duration | = | 24 hrs | Shape factor | = | 484 |

Hydrograph Volume = 20,307 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

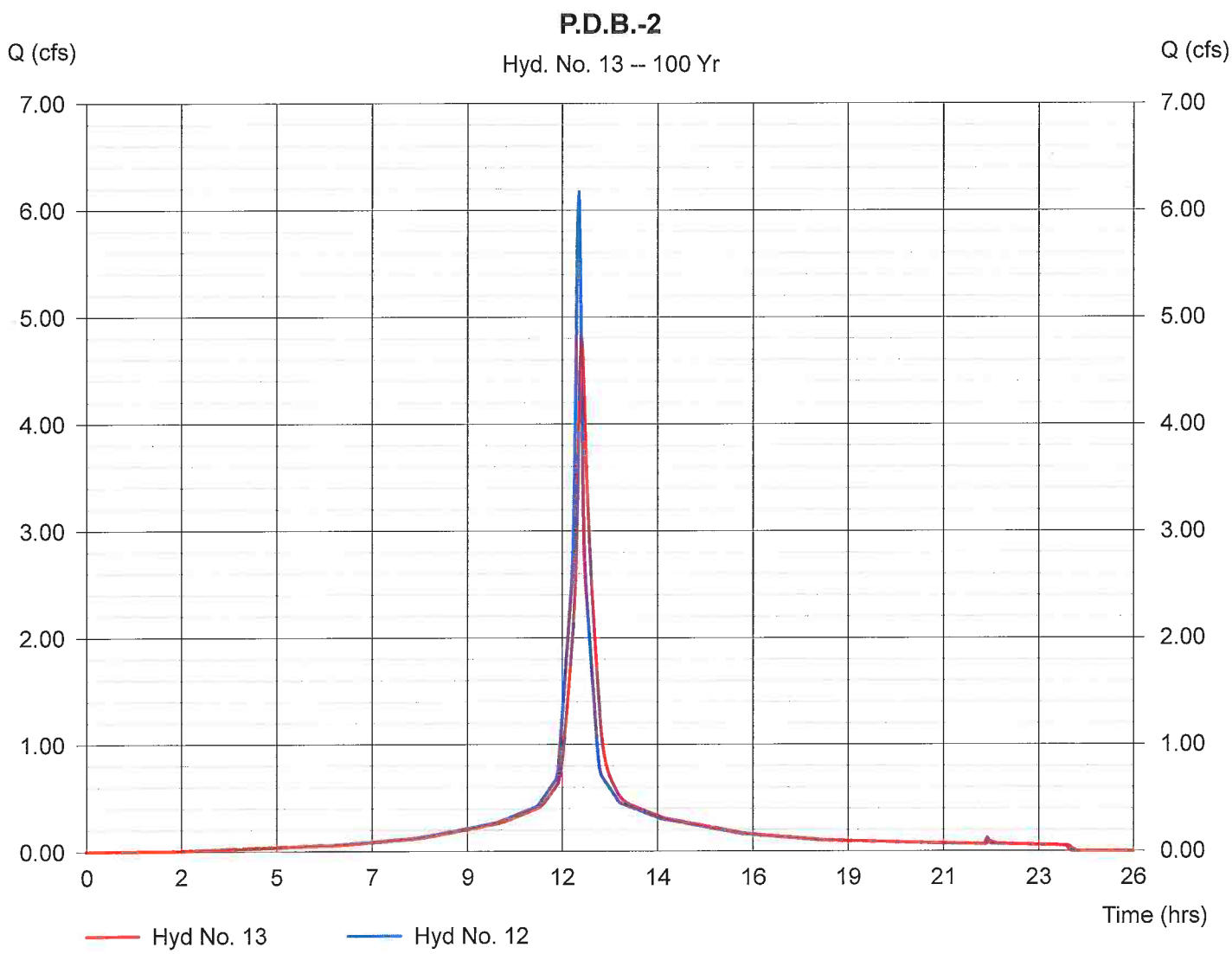
## Hyd. No. 13

P.D.B.-2

| | | | |
|---|---|---|---|
| Hydrograph type | = Reach | Peak discharge | = 4.82 cfs |
| Storm frequency | = 100 yrs | Time interval | = 2 min |
| Inflow hyd. No. | = 12 | Section type | = Circular |
| Reach length | = 917.0 ft | Channel slope | = 1.0 % |
| Manning's n | = 0.009 | Bottom width | = 2.0 ft |
| Side slope | = 0.0:1 | Max. depth | = 0.0 ft |
| Rating curve x | = 10.028 | Rating curve m | = 1.250 |
| Ave. velocity | = 0.00 ft/s | Routing coeff. | = 0.2769 |

Modified Att-Kin routing method used.

Hydrograph Volume = 20,303 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

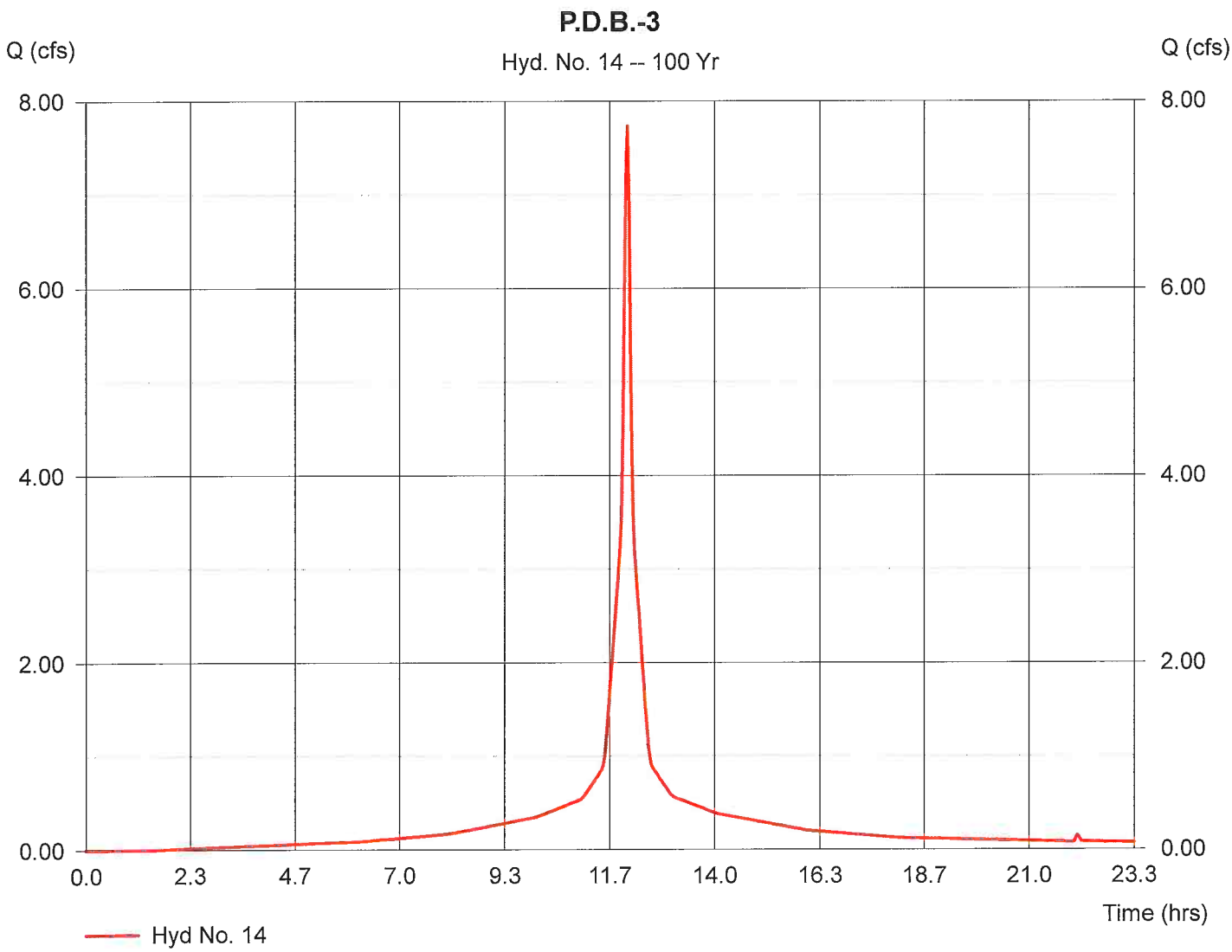
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 14

P.D.B.-3

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 7.74 cfs |
| Storm frequency | = 100 yrs | Time interval | = 2 min |
| Drainage area | = 1.24 ac | Curve number | = 95.3 |
| Basin Slope | = 0.9 % | Hydraulic length | = 139 ft |
| Tc method | = USER | Time of conc. (Tc) | = 4 min |
| Total precip. | = 6.70 in | Distribution | = Type III |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 25,900 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

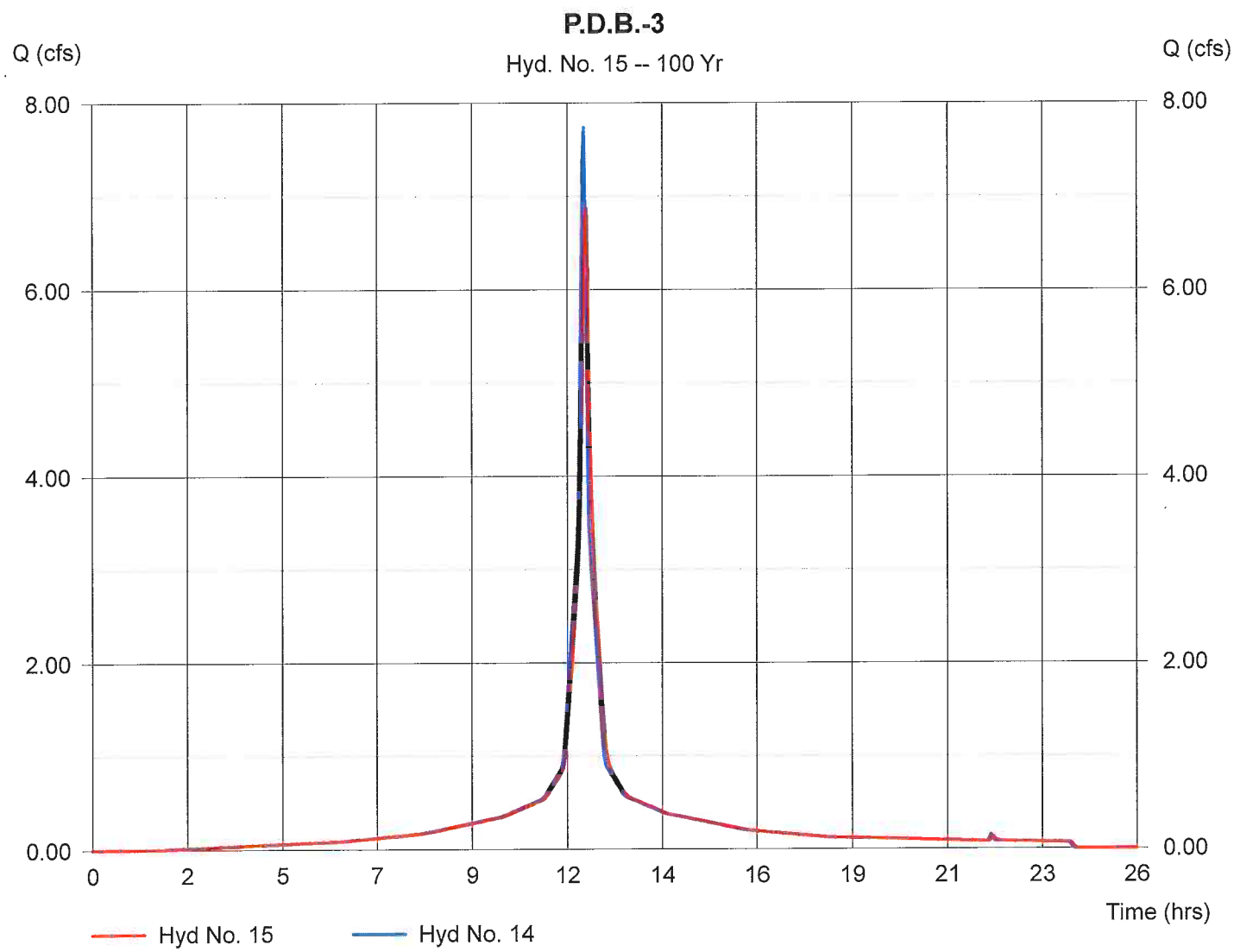
## Hyd. No. 15

P.D.B.-3

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reach | Peak discharge | = | 6.87 cfs |
| Storm frequency | = | 100 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 14 | Section type | = | Circular |
| Reach length | = | 582.0 ft | Channel slope | = | 1.0 % |
| Manning's n | = | 0.009 | Bottom width | = | 2.0 ft |
| Side slope | = | 0.0:1 | Max. depth | = | 0.0 ft |
| Rating curve x | = | 10.028 | Rating curve m | = | 1.250 |
| Ave. velocity | = | 0.00 ft/s | Routing coeff. | = | 0.4819 |

Modified Att-Kin routing method used.

Hydrograph Volume = 25,898 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

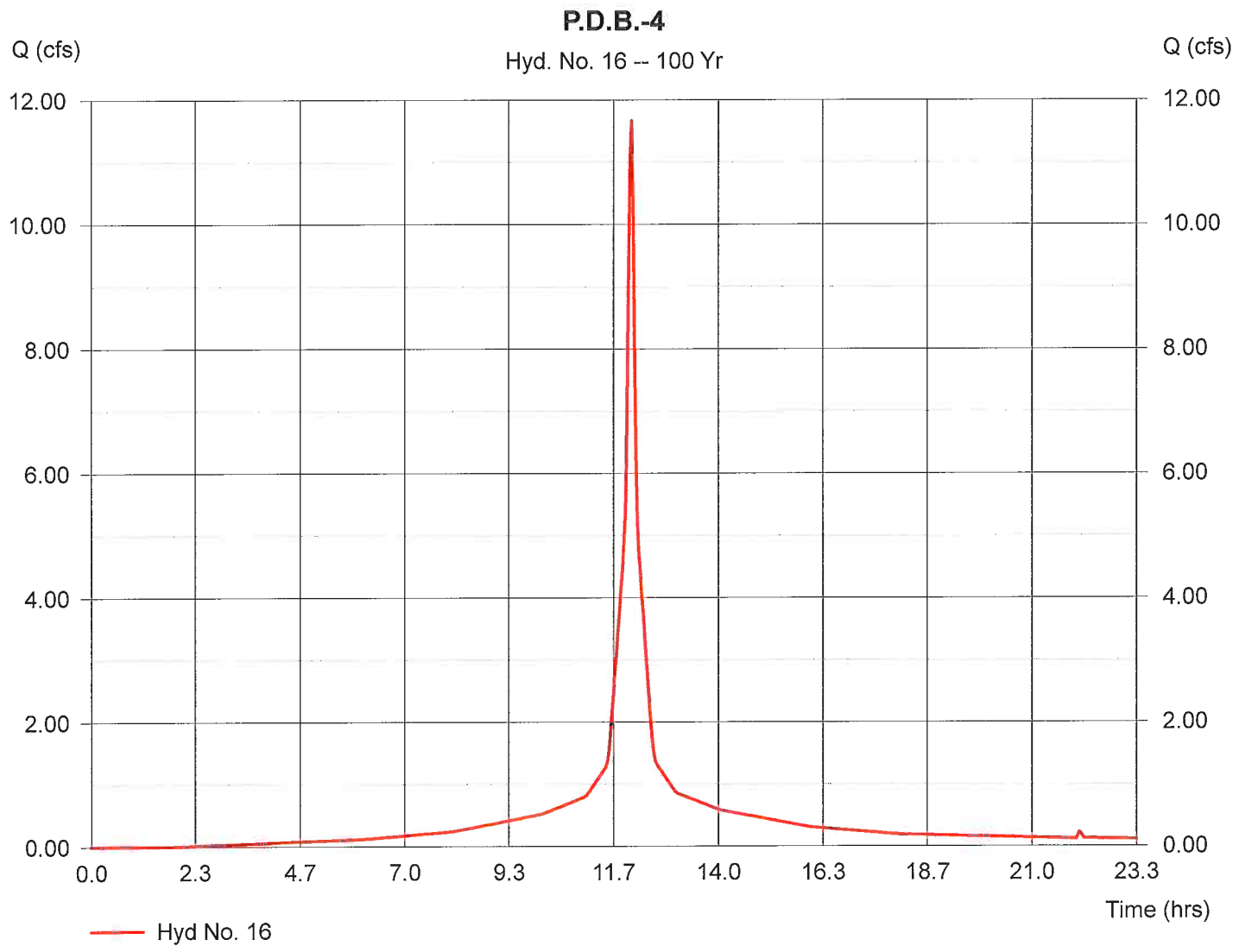
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 16

P.D.B.-4

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 11.67 cfs |
| Storm frequency | = 100 yrs | Time interval | = 2 min |
| Drainage area | = 1.88 ac | Curve number | = 94.5 |
| Basin Slope | = 1.5 % | Hydraulic length | = 144 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 = 38,679 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

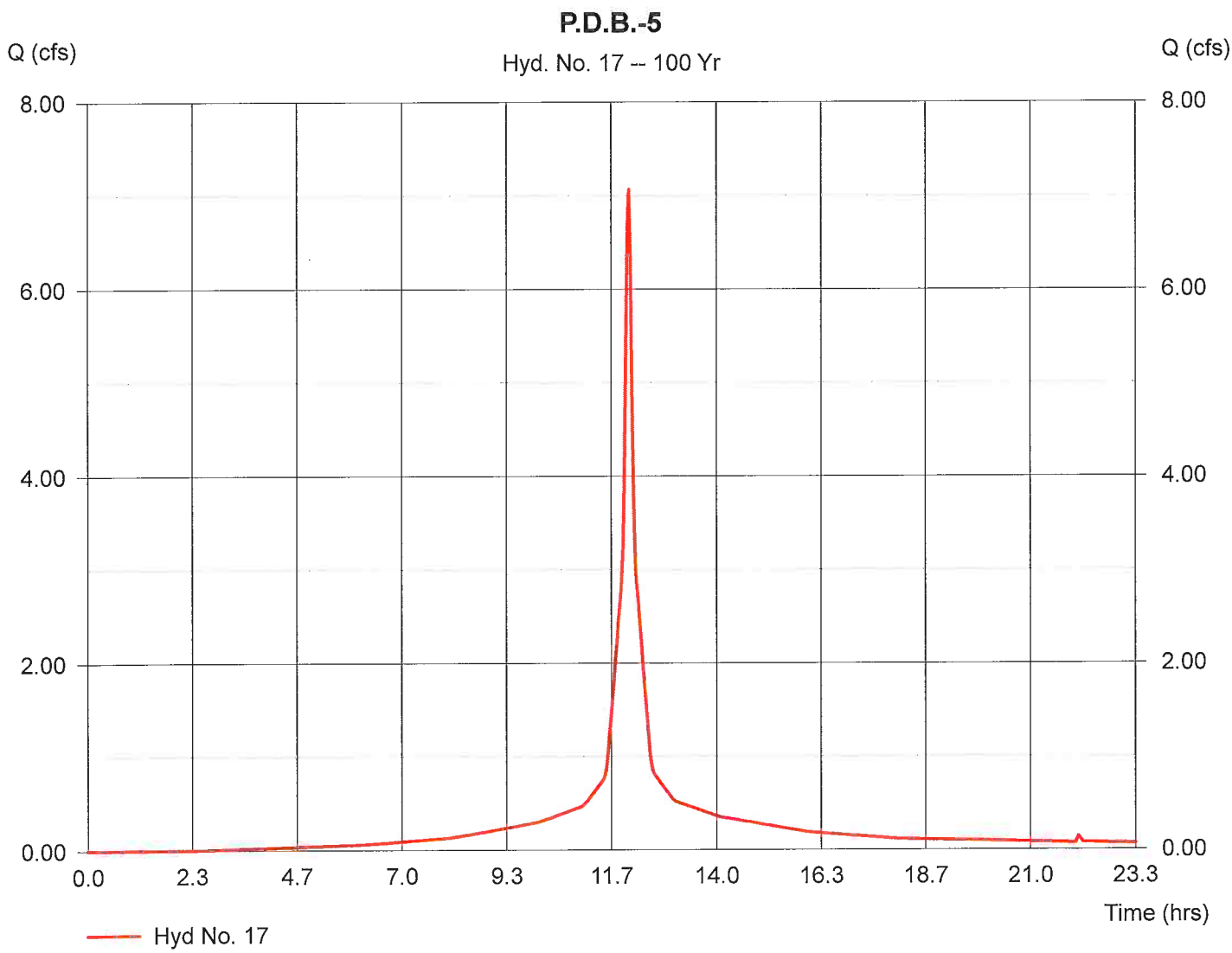
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 17

P.D.B.-5

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 7.07 cfs |
| Storm frequency | = 100 yrs | Time interval | = 2 min |
| Drainage area | = 1.16 ac | Curve number | = 92.8 |
| Basin Slope | = 1.2 % | Hydraulic length | = 100 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 = 23,019 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Nov 25 2015, 2:28 PM

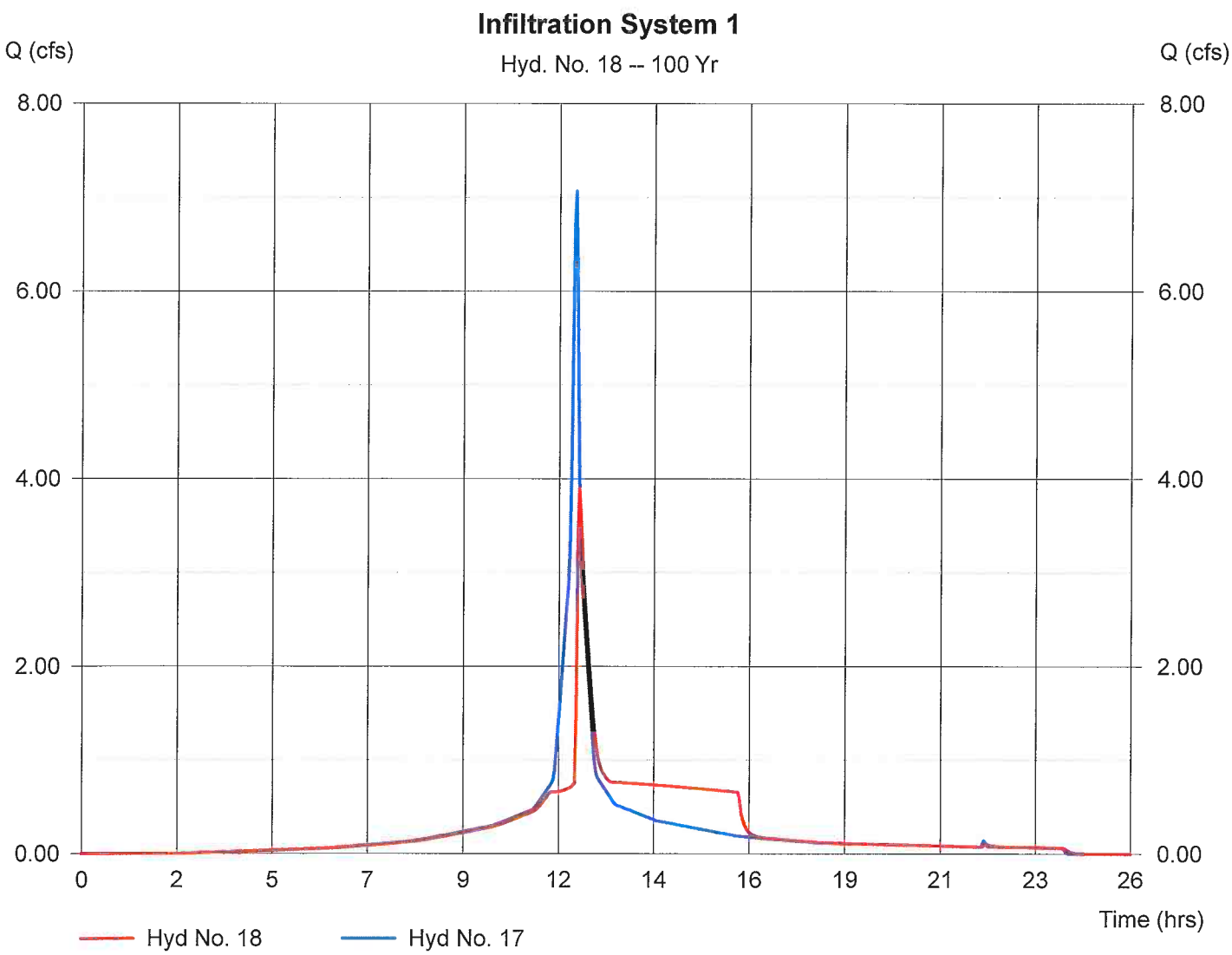
## Hyd. No. 18

Infiltration System 1

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 3.89 cfs |
| Storm frequency | = | 100 yrs | Time interval | = | 2 min |
| Inflow hyd. No. | = | 17 | Max. Elevation | = | 157.02 ft |
| Reservoir name | = | Infiltration System | Max. Storage | = | 5,358 cuft |

Storage Indication method used.

Hydrograph Volume = 23,018 cuft



# Pond Report

Hydraflow Hydrographs by Intelisolve — Wednesday, Nov 25 2015, 2:28 PM

## Pond No. 1 - Infiltration System

### Pond Data

Bottom LxW = 84.0 x 40.4 ft  Side slope = 0.0:1  Bottom elev. = 154.25 ft  Depth = 2.80 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft)* | Total storage (cuft)* |
|---|---|---|---|---|
| 0.00 | 154.25 | 3,394 | 0 | 0 |
| 0.14 | 154.39 | 3,394 | 271 | 271 |
| 0.28 | 154.53 | 3,394 | 271 | 542 |
| 0.42 | 154.67 | 3,394 | 271 | 812 |
| 0.56 | 154.81 | 3,394 | 271 | 1,083 |
| 0.70 | 154.95 | 3,394 | 271 | 1,354 |
| 0.84 | 155.09 | 3,394 | 271 | 1,625 |
| 0.98 | 155.23 | 3,394 | 271 | 1,896 |
| 1.12 | 155.37 | 3,394 | 271 | 2,166 |
| 1.26 | 155.51 | 3,394 | 271 | 2,437 |
| 1.40 | 155.65 | 3,394 | 271 | 2,708 |
| 1.54 | 155.79 | 3,394 | 271 | 2,979 |
| 1.68 | 155.93 | 3,394 | 271 | 3,250 |
| 1.82 | 156.07 | 3,394 | 271 | 3,521 |
| 1.96 | 156.21 | 3,394 | 271 | 3,791 |
| 2.10 | 156.35 | 3,394 | 271 | 4,062 |
| 2.24 | 156.49 | 3,394 | 271 | 4,333 |
| 2.38 | 156.63 | 3,394 | 271 | 4,604 |
| 2.52 | 156.77 | 3,394 | 271 | 4,875 |
| 2.66 | 156.91 | 3,394 | 271 | 5,145 |
| 2.80 | 157.05 | 3,394 | 271 | 5,416 |

(*57.00% voids applied)

### Culvert / Orifice Structures

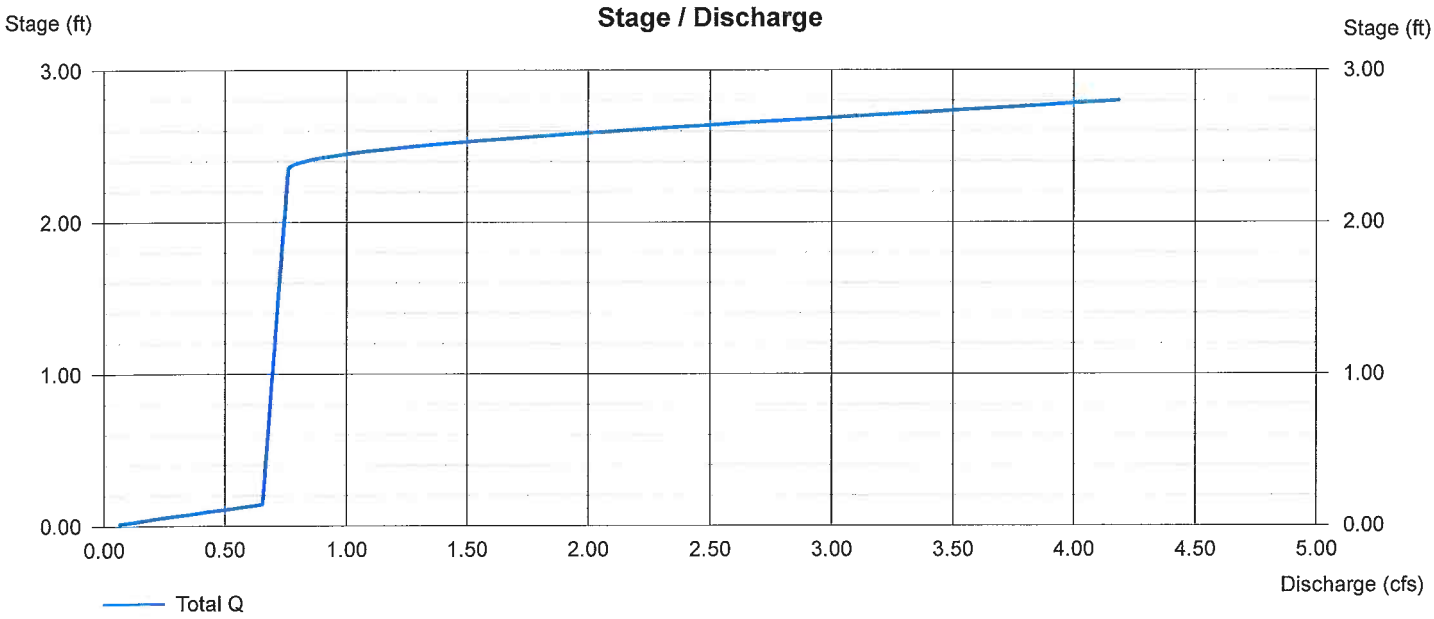
| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| Rise (in) | = 6.00 | 0.00 | 0.00 | 0.00 |
| Span (in) | = 6.00 | 0.00 | 0.00 | 0.00 |
| No. Barrels | = 8 | 0 | 0 | 0 |
| Invert El. (ft) | = 156.60 | 0.00 | 0.00 | 0.00 |
| Length (ft) | = 15.00 | 0.00 | 0.00 | 0.00 |
| Slope (%) | = 3.00 | 0.00 | 0.00 | 0.00 |
| N-Value | = .013 | .000 | .000 | .000 |
| Orif. Coeff. | = 0.60 | 0.00 | 0.00 | 0.00 |
| Multi-Stage | = n/a | No | No | No |

### Weir Structures

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

Exfiltration = 8.270 in/hr (Wet area)  Tailwater Elev. = 0.00 ft

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



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

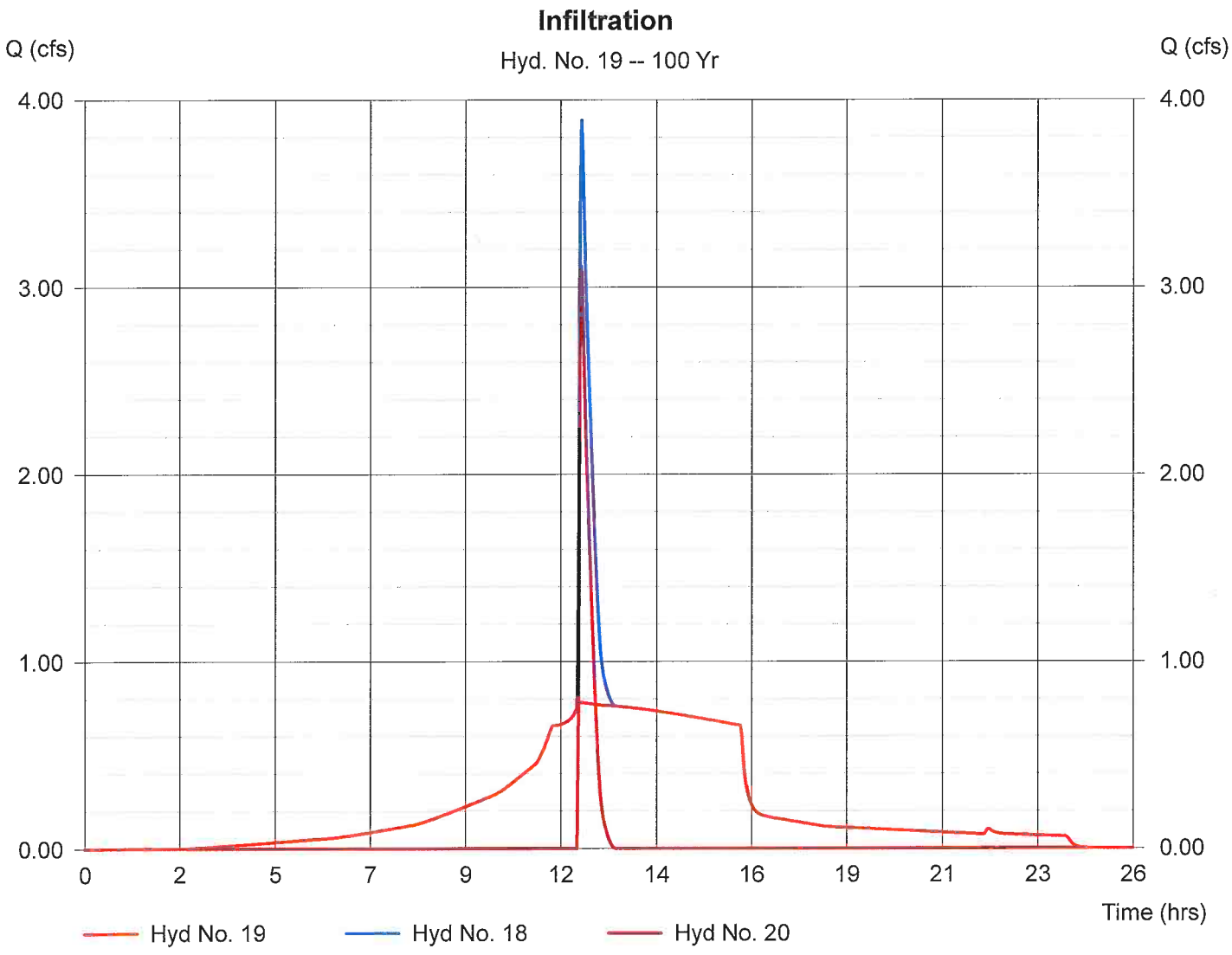
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 19

Infiltration

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Diversion1 | Peak discharge | = | 0.78 cfs |
| Storm frequency | = | 100 yrs | Time interval | = | 2 min |
| Inflow hydrograph | = | 18 | 2nd diverted hyd. | = | 20 |
| Diversion method | = | Pond - Infiltration System | Pond structure | = | Exfiltration |

Hydrograph Volume = 19,775 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

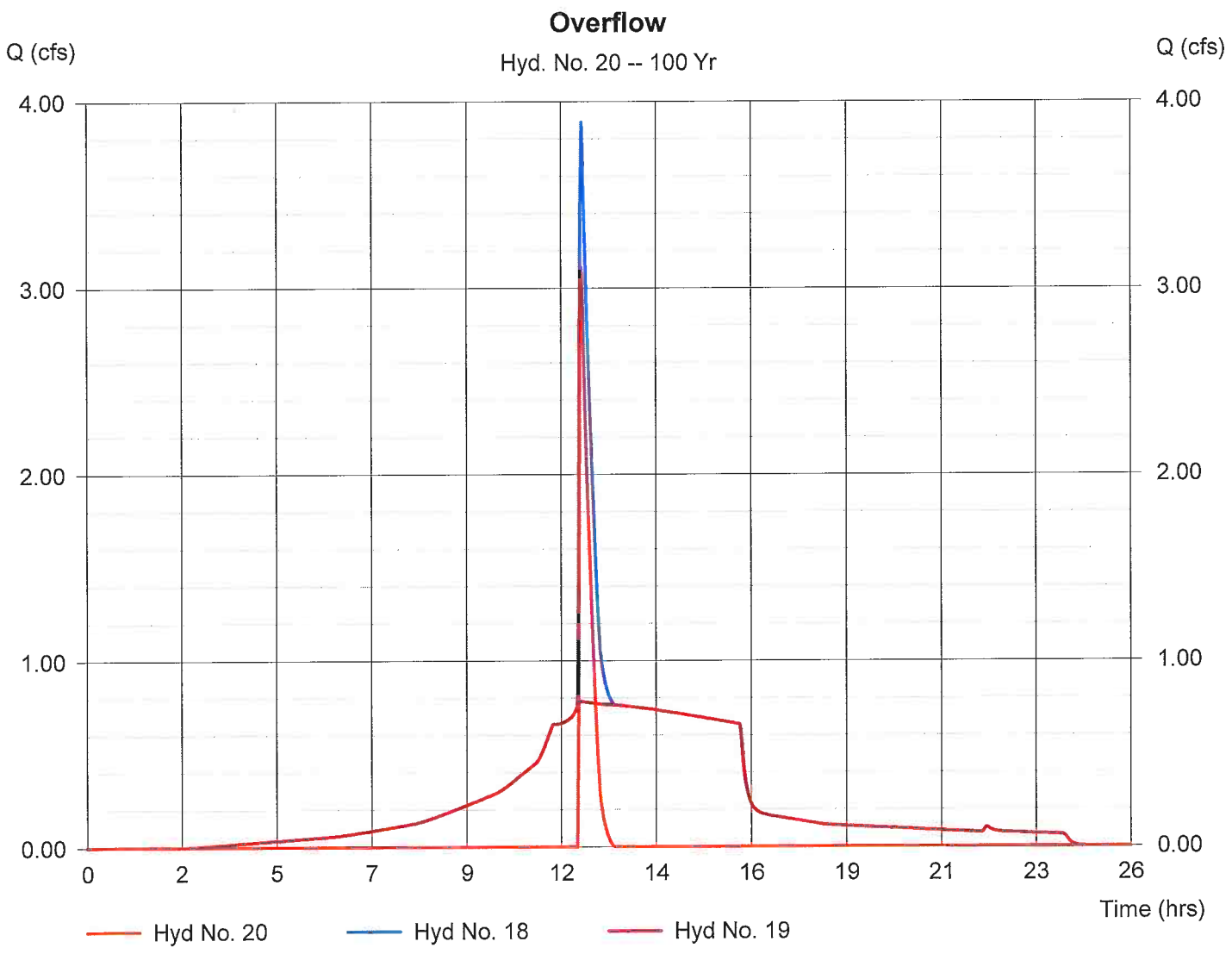
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 20

Overflow

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Diversion2 | Peak discharge | = | 3.11 cfs |
| Storm frequency | = | 100 yrs | Time interval | = | 2 min |
| Inflow hydrograph | = | 18 | 2nd diverted hyd. | = | 19 |
| Diversion method | = | Pond - Infiltration System | Pond structure | = | Exfiltration |

Hydrograph Volume = 3,243 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

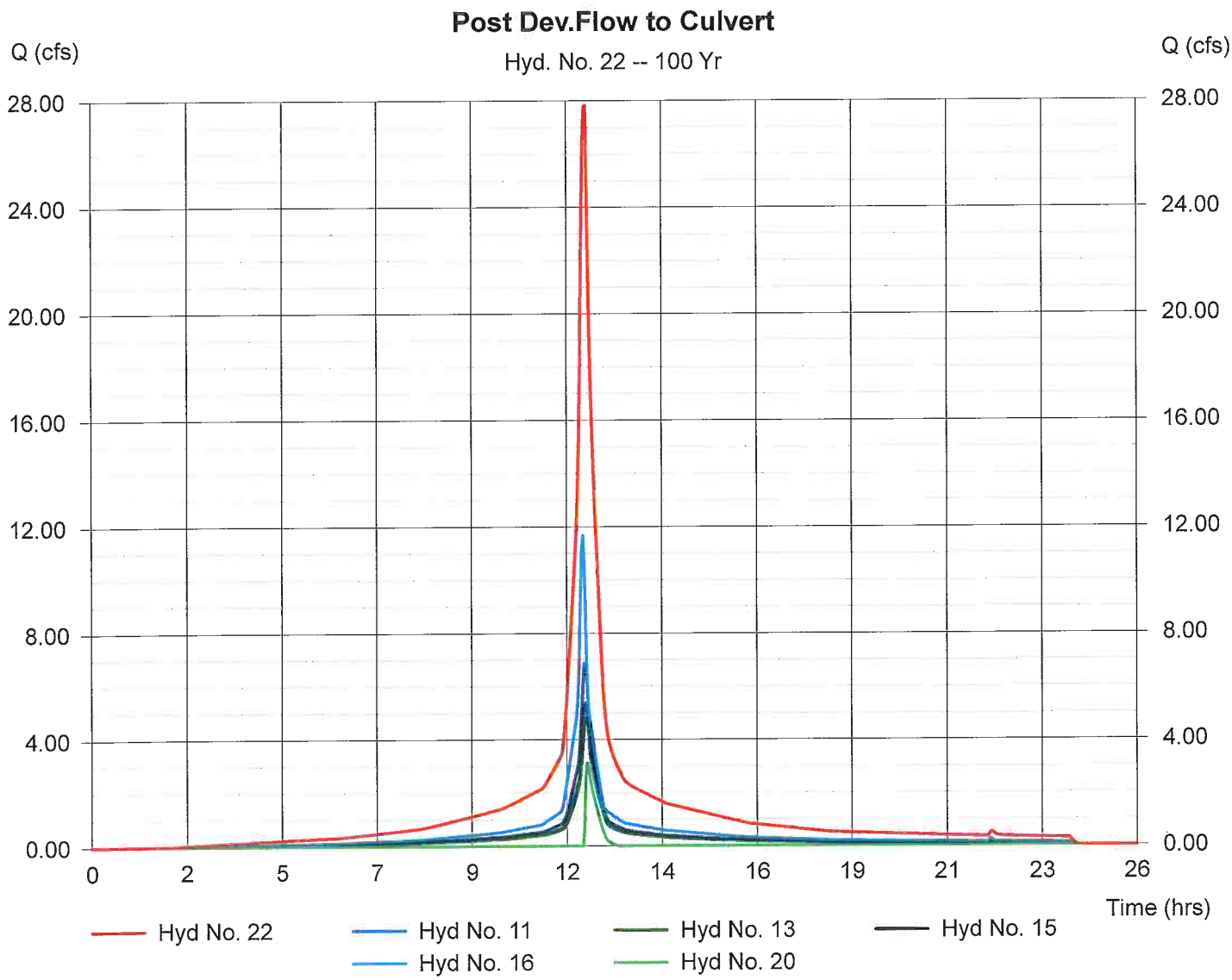
Wednesday, Nov 25 2015, 2:28 PM

## Hyd. No. 22

Post Dev.Flow to Culvert

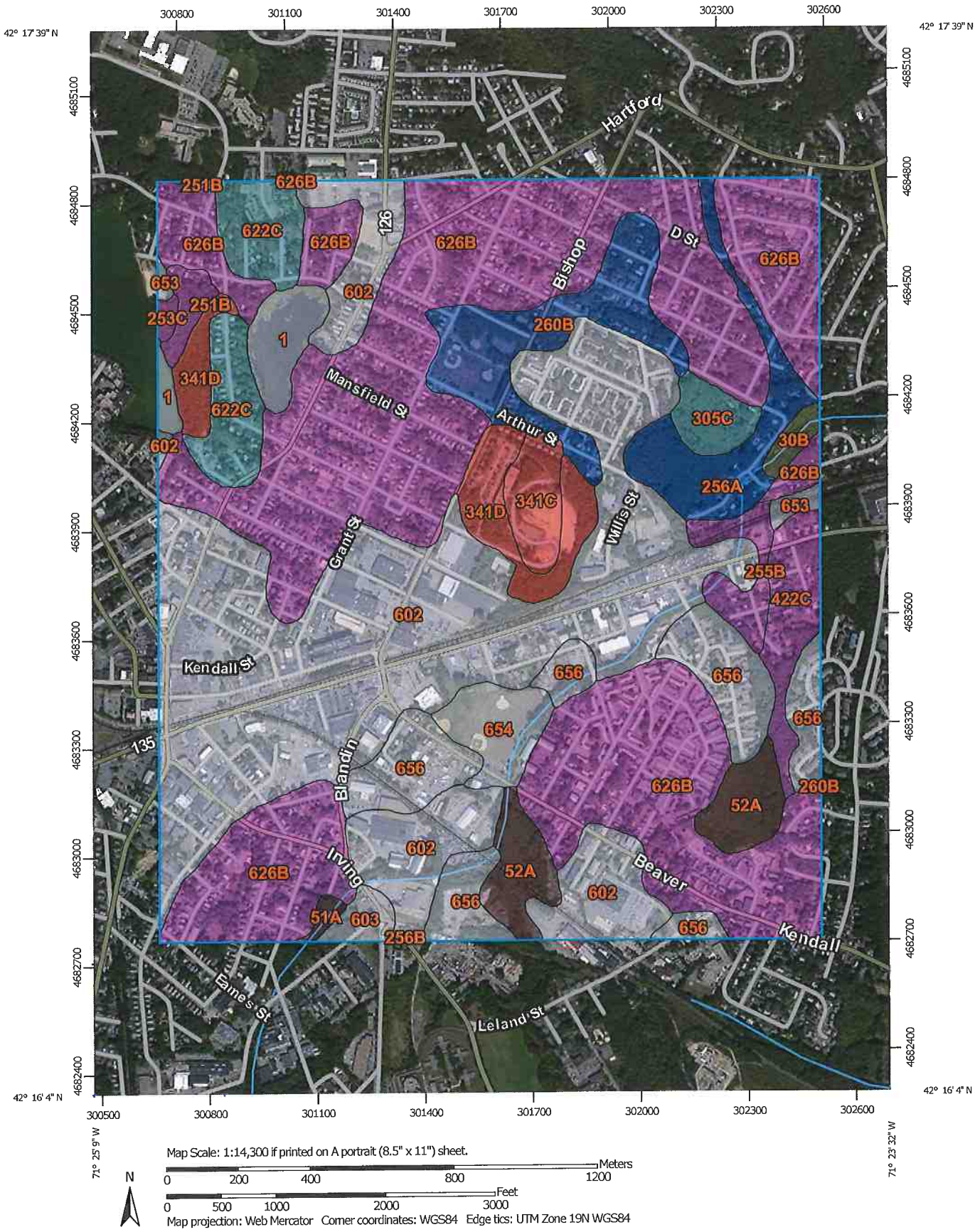
| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Combine | Peak discharge | = | 27.83 cfs |
| Storm frequency | = | 100 yrs | Time interval | = | 2 min |
| Inflow hyds. | = | 11, 13, 15, 16, 20 | | | |

Hydrograph Volume = 108,903 cuft



# Appendix B:
# NRCS Soil Survey Data

Hydrologic Soil Group—Middlesex County, Massachusetts
(NRCS Soil Survey, 71 Bishop Street, Famingham MA)




Map Scale: 1:14,300 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 200 400 800 1200

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 15, Sep 28, 2015

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

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

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

# Hydrologic Soil Group

| Hydrologic Soil Group— Summary by Map Unit — Middlesex County, Massachusetts (MA017) | | | | |
|---|---|---|---|---|
| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
| 1 | Water | | 14.9 | 1.6% |
| 30B | Raynham silt loam, 0 to 5 percent slopes | C/D | 3.8 | 0.4% |
| 51A | Swansea muck, 0 to 1 percent slopes | B/D | 1.8 | 0.2% |
| 52A | Freetown muck, 0 to 1 percent slopes | B/D | 25.0 | 2.6% |
| 251B | Haven silt loam, 3 to 8 percent slopes | A | 5.7 | 0.6% |
| 253C | Hinckley loamy sand, 8 to 15 percent slopes | A | 1.5 | 0.2% |
| 255B | Windsor loamy sand, 3 to 8 percent slopes | A | 11.1 | 1.2% |
| 256A | Deerfield loamy sand, 0 to 3 percent slopes | B | 27.7 | 2.9% |
| 256B | Deerfield loamy sand, 3 to 8 percent slopes | B | 0.4 | 0.0% |
| 260B | Sudbury fine sandy loam, 3 to 8 percent slopes | B | 40.6 | 4.2% |
| 305C | Paxton fine sandy loam, 8 to 15 percent slopes | C | 9.3 | 1.0% |
| 341C | Broadbrook very fine sandy loam, 8 to 15 percent slopes, very stony | D | 12.4 | 1.3% |
| 341D | Broadbrook very fine sandy loam, 15 to 25 percent slopes, very stony | D | 27.1 | 2.8% |
| 422C | Canton fine sandy loam, 8 to 15 percent slopes, extremely stony | A | 18.1 | 1.9% |
| 602 | Urban land | | 292.6 | 30.5% |
| 603 | Urban land, wet substratum | | 5.3 | 0.5% |
| 622C | Paxton-Urban land complex, 3 to 15 percent slopes | C | 31.5 | 3.3% |
| 626B | Merrimac-Urban land complex, 0 to 8 percent slopes | A | 350.8 | 36.6% |
| 653 | Udorthents, sandy | | 3.2 | 0.3% |

| Hydrologic Soil Group— Summary by Map Unit — Middlesex County, Massachusetts (MA017) | | | | |
|---|---|---|---|---|
| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
| 654 | Udorthents, loamy | | 15.5 | 1.6% |
| 656 | Udorthents-Urban land complex | | 60.9 | 6.3% |
| **Totals for Area of Interest** | | | **959.1** | **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.

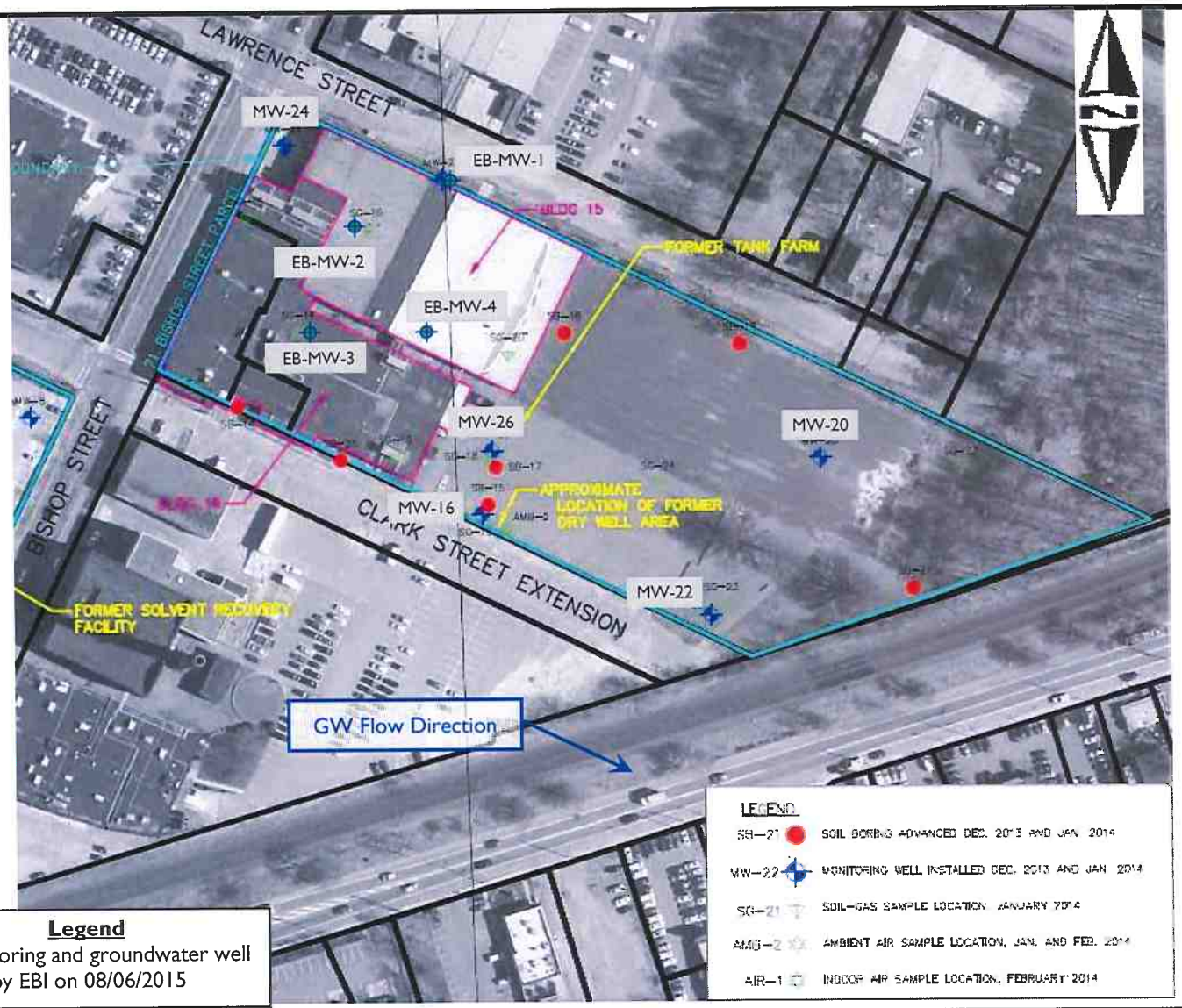
## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* *None Specified*

*Tie-break Rule:* Higher

# CHAPTER 2: TITLE V SOIL BORING RESULTS




**Legend**

Soil boring and groundwater well installed by EBI on 08/06/2015

EBI Consulting
environmental | engineering | due diligence

**FIGURE 3: SITE PLAN**

*EBI Job No: 1215000196 - Revised 08/18/2015*

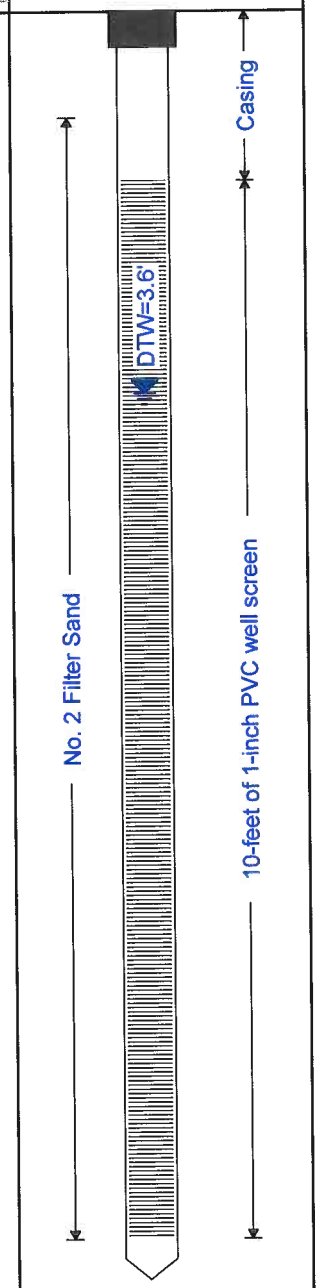
**Drilling Company:** *Bronson Drilling*
**Drilling Foreman:** *Dan Bronson*
**EBI Geologist/Scientist:** *Daniel Bellucci*
**Drilling Method:** *Direct Push*
**Borehole Diameter:** *2.25-inch*

**Date Started:** *08/06/15*
**Date Ended:** *08/06/15*
**Project Location:** *Framingham, MA*
**Project Number:** *1215000196*
**Sheet:** *1 of 1*

# Log of Borehole: EB-MW-1

EBI Consulting
21 B Street
Burlington, MA

| SUBSURFACE PROFILE | | | SAMPLE | | | | | Well Construction |
|---|---|---|---|---|---|---|---|---|
| Depth | Description | Strata | No. | Rec. | SPT Blows | Type | FID/PID Readings (ppm) 100 300 | |
| | Topsoil; brown; moist | | | | | | | |
| 1 | Fill material- Fine to medium SAND with some SILT, ash and coal fragments; black; moist | | S-1 | 2/4 | NA | Core | 0 | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | Fill material- Fine to medium SAND with some SILT, ash and coal fragments; black; wet | | S-2 | 2.5/4 | NA | Core | 0 | |
| 5 | | | | | | | | |
| 6 | Native organic peat layer; black; moist; root fibers | | | | | | | |
| 7 | | | | | | | | |
| 8 | Fine SAND with some SILT; light brown; moist | | | | | | | |
| | Medium SAND with some SILT; grey; wet | | | | | | | |
| 9 | Fine SAND and SILT; grey; wet | | S-3 | 3/4 | NA | Core | 0 | |
| 10 | | | | | | | | |
| 11 | | | | | | | | |
| 12 | Boring terminated at 12 feet bgs | | | | | | | |
| 13 | | | | | | | | |



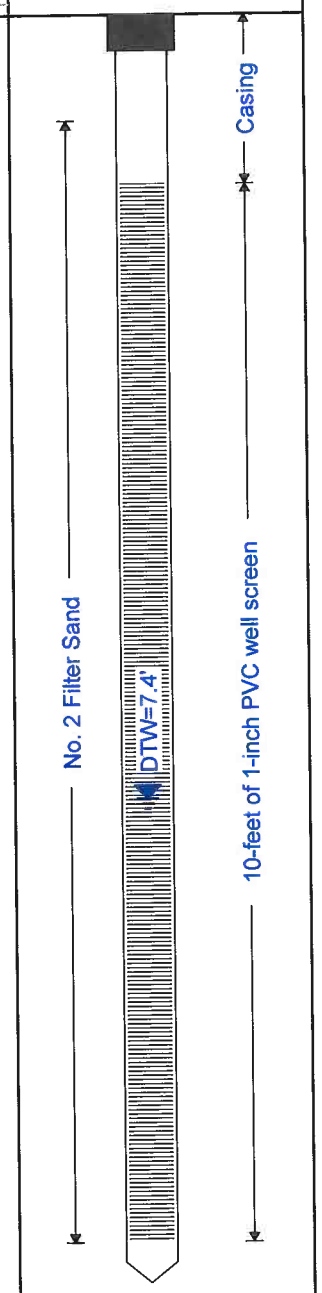
**Drilling Company:** *Bronson Drilling*
**Drilling Foreman:** *Dan Bronson*
**EBI Geologist/Scientist:** *Daniel Bellucci*
**Drilling Method:** *Direct Push*
**Borehole Diameter:** *2.25-inch*

**Date Started:** *08/06/15*
**Date Ended:** *08/06/15*
**Project Location:** *Framingham, MA*
**Project Number:** *1215000196*
**Sheet:** *1 of 1*

# Log of Borehole: EB-MW-2

EBI Consulting
21 B Street
Burlington, MA

| SUBSURFACE PROFILE | | | SAMPLE | | | | | Well Construction |
|---|---|---|---|---|---|---|---|---|
| Depth | Description | Strata | No. | Rec. | SPT Blows | Type | FID/PID Readings (ppm) 100 300 | |
| | 5-inch concrete slab | | | | | | | |
| 1 | Fill material- Fine to coarse SAND and gravel with some ash; light brown to brown; dry | | | | | | | |
| 2 | | | S-1 | 1.5/4 | NA | Core | 0 | |
| 3 | | | | | | | | |
| 4 | Fill material- Fine to coarse SAND and gravel with some ash; light brown to brown; wet | | | | | | | |
| 5 | | | | | | | | |
| 6 | Fill material- Medium SAND with some ash; light brown; moist | | S-2 | 2/4 | NA | Core | 0 | |
| 7 | SILT with fine SAND; tan; moist | | | | | | | |
| 8 | SILT with fine SAND; tan; moist | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | S-3 | 4/4 | NA | Core | 0 | |
| 11 | | | | | | | | |
| 12 | Boring terminated at 12 feet bgs | | | | | | | |
| 13 | | | | | | | | |



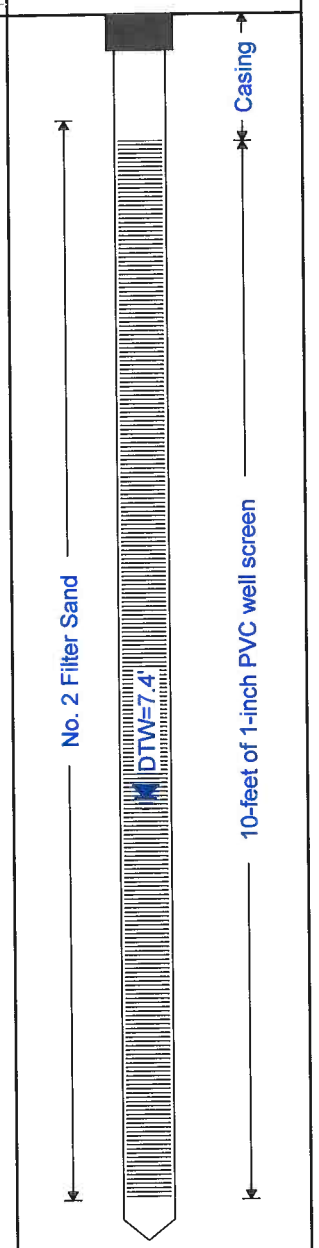
**Drilling Company:** *Bronson Drilling*
**Drilling Foreman:** *Dan Bronson*
**EBI Geologist/Scientist:** *Daniel Bellucci*
**Drilling Method:** *Direct Push*
**Borehole Diameter:** *2.25-inch*

**Date Started:** *08/06/15*
**Date Ended:** *08/06/15*
**Project Location:** *Framingham, MA*
**Project Number:** *1215000196*
**Sheet:** *1 of 1*

# Log of Borehole: EB-MW-3

EBI Consulting
21 B Street
Burlington, MA

| SUBSURFACE PROFILE | | | SAMPLE | | | | | Well Construction |
|---|---|---|---|---|---|---|---|---|
| Depth | Description | Strata | No. | Rec. | SPT Blows | Type | FID/PID Readings (ppm) 100 300 | |
| | 6-inch concrete slab | | | | | | | |
| 1 | Fill material- Fine to coarse SAND, SILT and gravel; light brown; dry | | | | | | | |
| 2 | Fill material- Ash and coal fragments with fine to coarse SAND and gravel; black; dry | | S-1 | 2/4 | NA | Core | 0 | |
| 3 | | | | | | | | |
| 4 | Fill material- Ash and coal fragments with fine to coarse SAND and gravel; black; moist | | | | | | | |
| 5 | Fill material- Medium SAND; brown; moist | | | | | | | |
| 6 | SILT with fine SAND; tan; wet | | S-2 | 2.5/4 | NA | Core | 0 | |
| 7 | | | | | | | | |
| 8 | SILT with fine SAND; tan; wet; Red-Ox staining from 9-10 feet bgs | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | S-3 | 4/4 | NA | Core | 0 | |
| 11 | | | | | | | | |
| 12 | Boring terminated at 12 feet bgs | | | | | | | |
| 13 | | | | | | | | |



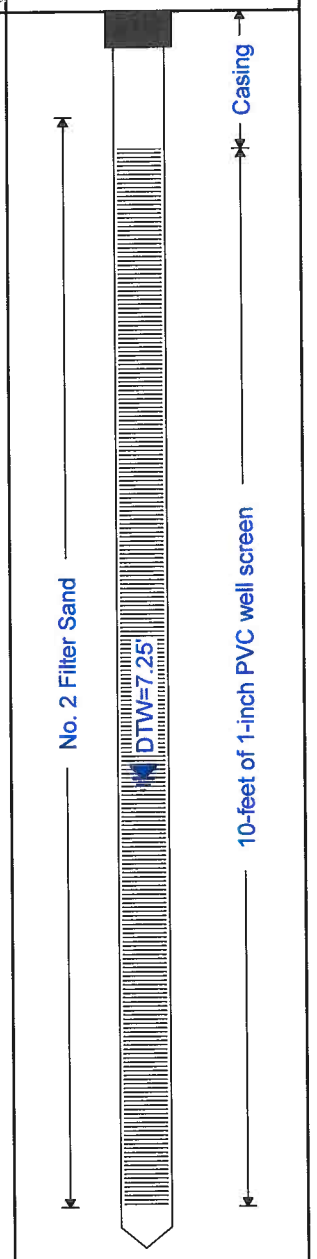
**Drilling Company:** *Bronson Drilling*
**Drilling Foreman:** *Dan Bronson*
**EBI Geologist/Scientist:** *Daniel Bellucci*
**Drilling Method:** *Direct Push*
**Borehole Diameter:** *2.25-inch*

**Date Started:** *08/06/15*
**Date Ended:** *08/06/15*
**Project Location:** *Framingham, MA*
**Project Number:** *1215000196*
**Sheet:** *1 of 1*

# Log of Borehole: EB-MW-4

EBI Consulting
21 B Street
Burlington, MA

| SUBSURFACE PROFILE | | | SAMPLE | | | | | Well Construction |
|---|---|---|---|---|---|---|---|---|
| Depth | Description | Strata | No. | Rec. | SPT Blows | Type | FID/PID Readings (ppm) 100 300 | |
| 1 | 18-inch concrete slab | | | | | | | |
| 2–3 | Fill material- Ash, coal fragments, fine to coarse SAND and gravel; black; dry | | S-1 | 1/4 | NA | Core | 0 | |
| 4–5 | Fill material- Ash, coal fragments, fine to coarse SAND and gravel; black; dry | | S-2 | 1/4 | NA | Core | 0 | |
| 6–7 | Fill material- Ash, coal fragments, fine to coarse SAND and gravel; black; moist | | | | | | | |
| 8–9 | Medium SAND; brown; wet | | S-3 | 4/4 | NA | Core | 0 | |
| 10–11 | Organic peat layer; black; wet | | | | | | | |
| 12 | Boring terminated at 12 feet bgs | | | | | | | |
| 13 | | | | | | | | |



FUSS & O'NEILL

# Appendix B

## Soil Boring Logs and Monitoring Well Completion Reports

Project Name: Avery Dennison Facilities
Township/Range: Framingham, Massachusetts

Site Id: MW-16
Project Number: 2013-1016 B10

FUSS & O'NEILL
317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070

Location: S central 71 Bishop Street
Description: Monitoring Well, Shallow
Date(s): 12/30/13 – 12/30/13
Completed Depth: 14.00'
Total Depth: 15.00'

Datum: Benchmark
Ground Elevation: 0.00'
Coordinate X: 0.00
Coordinate Y: 0.00

Logged By: D. H. Baker
Contractor: Fuss & O'Neill
Drilling Method: Direct Push
Blank Casing:
type: PVC dia: 2.00in fm: 0.0' to: 4.00'
Screens:
type: Slotted size: 0.010in dia: 2.00in fm: 4.00' to: 14.00'
Annular Fill:
type: Concrete fm: 0.00' to: 0.75'
type: Bentonite Pellets fm: 0.75' to: 2.50'
type: #0 Sand fm: 2.50' to: 14.00'
type: Native Material fm: 14.00' to: 15.00'
type: fm: to:

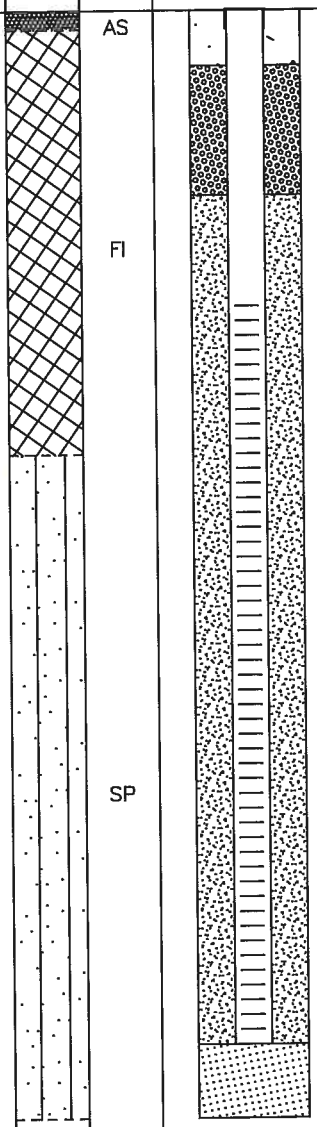
Driller: D. Levesque
Borehole Dia.: 3.25in

Remarks: Field Instrument: OVM MiniRAE RI
Development Method: Surge block and peristaltic pump on 12/31/2013
No refusal.

| Elevation | Depth | Sample No. | Recovery | Material Description | USCS Code | OVM |
|---|---|---|---|---|---|---|
| 0 | | N/A | | 0–0.25': ASPHALT. | AS | |
| | | | | 0.25–5.0': SAND, F; some gravel; trace brick; trace ash; dark brown (7.5YR 3/2) to 0.5 feet, then light olive brown (2.5Y 5/3) to 1.0 foot, then black (2.5Y 2.5/1), moist. (Fill). | | 0.8 ppm |
| -2 | 2 | | | | | |
| | | | | | Fl | 8 ppm |
| -4 | 4 | | | | | |
| | | | | | | 5 ppm |
| | | N/A | | 5.0–6.0': SAND, F; trace brick; trace ash; trace gravel; light olive brown (2.5Y 5/3). (Fill). | | 1.5 ppm |
| -6 | 6 | | | 6.0–10': SAND, F; little wood fibers 8.0 to 10 feet; very dark gray (2.5Y 3/1) to 6.5 feet, then black (2.5Y 2.5/1) to 7.5 feet, then gray (2.5Y 5/1), moist to wet at 9.5 feet. | | 3.0 ppm |
| | | | | | | 5.4 ppm |
| -8 | 8 | | | | | 1.1 ppm |
| | | -30 | | | | |
| -10 | 10 | N/A | | SAND, F; little wood fibers to 11 feet; gray (2.5Y 5/1), wet. | SP | |
| | | | | | | 8.0 ppm |
| -12 | 12 | | | | | |
| | | | | | | 20.0 ppm |
| -14 | 14 | | | | | 54.0 ppm |
| | | | | End of boring at 15 feet. | | |
| -16 | 16 | | | | | |

Graphic Log

Well Construction



Proportions used: Trace 0 to 10%/Some 20 to 35%/Little 10 to 20%/And 35 to 50%

Checked By: DMHB

Project Name: **Avery Dennison Facilities**
Township/Range: **Framingham, Massachusetts**

Site Id: **MW-20**
Project Number: **2013-1016 B10**

**FUSS & O'NEILL**
317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070

Location: **NE 71 Bishop Street**
Description: **Monitoring Well, Shallow**
Date(s): **12/30/13 – 12/30/13**
Completed Depth: **13.00'**
Total Depth: **15.00'**
Remarks: Field Instrument: OVM MiniRAE RI
Development Method: Surge block and peristaltic pump on 12/31/2013
No refusal.

Datum: **Benchmark**
Ground Elevation: **0.00'**
Coordinate X: **0.00**
Coordinate Y: **0.00**

Logged By: **D. H. Baker**
Contractor: **Fuss & O'Neill**
Drilling Method: **Direct Push**
Blank Casing:
type: PVC dia: 2.00in fm: 0.0' to: 3.00'
Screens:
type: Slotted size: 0.010in dia: 2.00in fm: 3.00' to: 13.00'
Annular Fill:
type: Concrete fm: 0.00' to: 0.75'
type: Bentonite Pellets fm: 0.75' to: 2.50'
type: #0 Sand fm: 2.50' to: 13.00'
type: Native Material fm: 13.00' to: 15.00'
type: fm: to:

Driller: **D. Levesque**
Borehole Dia.: **3.25in**

| Elevation | Depth | Sample No. | Recovery | Material Description | Graphic Log | USCS Code | Well Construction | OVM |
|---|---|---|---|---|---|---|---|---|
| 0 | | N/A -36 | | 0–0.25': ASPHALT. 0.25–2.0': SAND, F–C; trace brick; trace ash; trace gravel; very dark brown (10YR 2/2). (Fill). 2.0–2.5': CONCRETE, fragments. 2.5–3.0': SAND, F–M, light olive brown (2.5Y 5/4), moist. 3.0–5.0': SAND, F; trace silt; gray (2.5Y 5/1) to 3.25 feet, then yellowish brown (10YR 5/6), moist. | | AS | | 0 ppm |
| | | | | | | FI | | |
| -2 | 2 | N/A | | | | CR | | 0 ppm |
| | | | | | | | | 0 ppm |
| -4 | 4 | | | | | | | |
| | | N/A -37 | | 5.0–7.5': SAND, F–C; layer of F sand; olive (5Y 5/3), except pale olive (5Y 6/4) from 6.25 to 6.5 feet, moist to wet at 6.0 feet. 7.5–10': SAND, F, olive (5Y 5/3), wet. | | | | 0 ppm |
| -6 | 6 | N/A | | | | | | |
| | | | | | | | | 0 ppm |
| -8 | 8 | | | | | SP | | |
| -10 | 10 | N/A | | SAND, F, olive gray (5Y 5/2), wet. | | | | 0 ppm |
| -12 | 12 | | | | | | | |
| -14 | 14 | | | | | | | |
| | | | | End of boring at 15 feet. | | | | |
| -16 | 16 | | | | | | | |

Proportions used: Trace 0 to 10%/Some 20 to 35%/Little 10 to 20%/And 35 to 50%

Checked By: DMHB

Project Name: Avery Dennison Facilities
Township/Range: Framingham, Massachusetts

Site Id: MW-22
Project Number: 2013-1016 B10

FUSS & O'NEILL
317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070

Location: SE corner 71 Bishop Street
Description: Monitoring Well, Shallow
Date(s): 12/30/13 – 12/30/13
Completed Depth: 13.00'
Total Depth: 15.00'
Remarks: Field Instrument: OVM MiniRAE RI
Development Method: Surge block and peristaltic pump on 12/31/2013
No refusal.

Datum: Benchmark
Ground Elevation: 142.93'
Coordinate X: 0.00
Coordinate Y: 0.00

Logged By: D. H. Baker
Contractor: Fuss & O'Neill
Drilling Method: Direct Push
Blank Casing:
type: PVC dia: 2.00in fm: 0.0' to: 3.00'
Screens:
type: Slotted size: 0.010in dia: 2.00in fm: 3.00' to: 13.00'
Annular Fill:
type: Concrete fm: 0.00' to: 0.75'
type: Bentonite Pellets fm: 0.75' to: 2.50'
type: #0 Sand fm: 2.50' to: 13.00'
type: Native Material fm: 13.00' to: 15.00'
type: fm: to:

Driller: D. Levesque
Borehole Dia.: 3.25in

| Elevation | Depth | Sample No. | Recovery | Material Description | Graphic Log | USCS Code | Well Construction | OVM |
|---|---|---|---|---|---|---|---|---|
| | | N/A | | 0–0.25': SAND, F; trace silt; trace roots; trace organics (dark brown (10YR 3/3), moist. (Topsoil). | | TS | | 0 ppm<br>0 ppm |
| 142 | | | | 0.25–2.0': SAND, F; trace silt; trace roots; dark brown (10YR 3/3), moist. (Fill).<br>2.0–5.0': SAND, F; trace silt; trace gravel; trace glass; trace ash; trace brick; yellowish brown (10YR 5/6), moist. (Fill). | | | | |
| | 2 | | | | | | | 0 ppm |
| | | | | | | Fl | | |
| 140 | | -39 | | | | | | |
| | 4 | | | | | | | |
| 138 | | N/A | | 5.0–6.0': SAND, F; trace silt; trace gravel; yellowish brown (10YR 5/6), moist.<br>6.0–6.5': Sand, F and silt; dark brown (7.5YR 3/3), moist to wet at 6.5 feet.<br>6.5–8.0': SAND, F, wet.<br>8.0–8.25': SAND, M–C, strong brown (7.5YR 4/6), wet.<br>8.25–10': SAND, F; some silt; gray (5Y 6/1), wet. | | | | 0 ppm |
| | | | | | | SP | | |
| | 6 | | | | | SM | | 0 ppm<br>0 ppm |
| | | -40 | | | | | | |
| 136 | | N/A | | | | SP | | |
| | 8 | | | | | | | 0 ppm<br>0 ppm |
| 134 | | | | | | | | |
| | 10 | N/A | | Same as above. | | | | 0 ppm |
| 132 | | | | | | | | |
| | | | | | | SM | | |
| | 12 | | | | | | | |
| 130 | | | | | | | | |
| | 14 | | | | | | | |
| 128 | | | | End of boring at 15 feet. | | | | |
| | 16 | | | | | | | |
| 126 | | | | | | | | |

Proportions used: Trace 0 to 10%/Some 20 to 35%/Little 10 to 20%/And 35 to 50%

Checked By: DMHB

| | | |
|---|---|---|
| Project Name: **Avery Dennison Facilities**<br>Township/Range: **Framingham, Massachusetts** | Site Id: **MW-24**<br>Project Number: **2013-1016 B10** | **FUSS & O'NEILL**<br>317 IRON HORSE WAY, SUITE 204<br>PROVIDENCE, RI 02908<br>401.861.3070 |

Location: **NW corner 71 Bishop**
Description: **Monitoring Well, Shallow**
Date(s): **12/30/13 – 12/30/13**
Completed Depth: **13.00'**
Total Depth: **15.00'**

Datum: **Benchmark**
Ground Elevation: **0.00'**
Coordinate X: **0.00**
Coordinate Y: **0.00**

Logged By: **D. H. Baker**
Contractor: **Fuss & O'Neill**
Drilling Method: **Direct Push**
Blank Casing:
type: PVC dia: 1.50in fm: 0.0' to: 3.00'
Screens:
type: Slotted size: 0.010in dia: 1.50in fm: 3.00' to: 13.00'
Annular Fill:
type: Concrete fm: 0.00' to: 0.75'
type: Bentonite Pellets fm: 0.75' to: 3.00'
type: #0 Sand fm: 3.00' to: 13.00'
type: Native Material fm: 13.00' to: 15.00'
type: fm: to:

Driller: **D. Levesque**
Borehole Dia.: **3.25in**

Remarks: Field Instrument: OVM MiniRAE RI
Development Method: Surge block and persialtic pump on 12/31/2013
No refusal.

| Elevation | Depth | Sample No. | Recovery | Material Description | Graphic Log | USCS Code | Well Construction | OVM |
|---|---|---|---|---|---|---|---|---|
| 0 | | N/A | | 0–0.25': ASPHALT.<br>0.25–2.0': SAND, F–M; little gravel; olive yellow (2.5Y 6/6) to 1.0 foot, then black (10YR 2/1), moist. (Fill).<br>2.0–2.5': SAND, F–M, yellowish brown (10YR 5/6), moist.<br>2.5–3.5': SAND, F, light yellowish brown (2.5Y 6/4), moist.<br>3.5–5.0': SAND, F; some silt; reddish yellow (7.5YR 6/8) to 4.5 feet, then light yellowish brown (2.5Y 6/4), moist. | | AS | | 0 ppm |
| | | | | | | Fl | | |
| -2 | 2 | | | | | | | 0 ppm |
| | | -43 | | | | SP | | 0 ppm |
| | | | | | | | | 0 ppm |
| | | N/A | | | | | | |
| -4 | 4 | | | | | SM | | |
| | | N/A | | SAND, F; little silt; light yellowish brown (2.5Y 6/4), moist to wet at 6.0 feet. | | | | 0 ppm |
| | | -44 | | | | | | |
| -6 | 6 | | | | | | | |
| | | N/A | | | | | | |
| -8 | 8 | | | | | | | |
| -10 | 10 | N/A | | SAND, F; little silt; light yellowish brown (2.5Y 6/4), wet. | | SP | | 0 ppm |
| -12 | 12 | | | | | | | |
| -14 | 14 | | | | | | | |
| | | | | End of boring at 15 feet. | | | | |
| -16 | 16 | | | | | | | |

Proportions used: Trace 0 to 10%/Some 20 to 35%/Little 10 to 20%/And 35 to 50%

Checked By: DMHB

| | | |
|---|---|---|
| Project Name: **Avery Dennison Facilities**<br>Township/Range: **Framingham, Massachusetts** | Site Id: **MW-26**<br>Project Number: **2013-1016 B10** | **FUSS & O'NEILL**<br>317 IRON HORSE WAY, SUITE 204<br>PROVIDENCE, RI 02908<br>401.861.3070 |

Location: **Center 71 Bishop, tank farm**
Description: **Monitoring Well, Shallow**
Date(s): **01/10/14 – 01/13/14**
Completed Depth: **57.00'**
Total Depth: **57.00'**
Remarks: Field Instrument: OVM MiniRAE RI
Development Method: Surge block and peristaltic pump on 01/14/2014

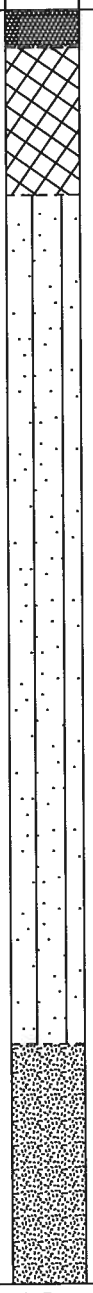
Datum: **Benchmark**
Ground Elevation: **0.00'**
Coordinate X: **-15.00**
Coordinate Y: **0.00**

Logged By: **D. H. Baker**
Contractor: **Soil Exploration**
Drilling Method: **Hollow Stem Auger/Drive & Wash**
Blank Casing:
type: PVC dia: 2.00in fm: 0.0' to: 47.00'
Screens:
type: Slotted size: 0.010in dia: 0.00in fm: 47.00' to: 57.00'
Annular Fill:
type: Concrete fm: 0.00' to: 0.50'
type: #2 Sand fm: 0.50' to: 1.00'
type: Native Material fm: 1.00' to: 43.50'
type: Bentonite Chips fm: 43.50' to: 45.50'
type: #2 Sand fm: 45.50' to: 57.00'

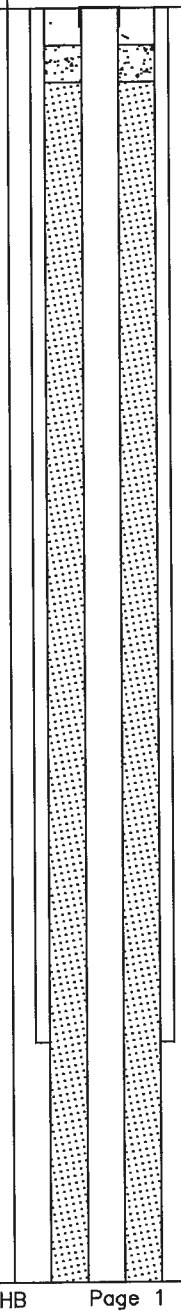
Driller: **G. Guinto**
Borehole Dia.: **3.00in**

| Elevation | Depth | Sample No. | Recovery | Material Description | USCS Code | OVM |
|---|---|---|---|---|---|---|
| 0 | | N/A | | ASPHALT.<br>SAND, F-M; trace gravel; trace brick. (Fill). | AS<br>Fl | 0.5 ppm |
| -2 | 2 | -48 | | SAND, F-M; little gravel; grayish brown (10YR 5/2), moist. | | 3.7 ppm |
| -4 | 4 | | | | | |
| | | N/A | | 5.0-6.0': Same as above.<br>6.0-7.0': SAND, F-C; trace gravel; dark gray (10YR 4/1), wet at 6.5 feet. | | 7.0 ppm |
| -6 | 6 | -49 | | | | 9.1 ppm |
| | | N/A | | 7.0-8.0': SAND, F-C; little gravel; dark gray (10YR 4/1) with staining, wet. Solvent odor.<br>8.0-9.0': SAND, F; trace silt; dark yellowish brown (10YR 3/4), wet. | | 1056 ppm |
| -8 | 8 | | | | SP | 56 ppm |
| -10 | 10 | N/A | | SAND, F; trace silt; trace gravel; little wood fibers; gray (5Y 5/1), wet. | | 243 ppm |
| -12 | 12 | | | | | |
| -14 | 14 | N/A | | SAND, F; some silt; gray (5Y 5/1), wet. | | 255 ppm |
| -16 | 16 | | | | | |

Graphic Log



Well Construction



Proportions used: Trace 0 to 10%/Some 20 to 35%/Little 10 to 20%/And 35 to 50%

Checked By: DMHB

Project Name: Avery Dennison Facilities
Township/Range: Framingham, Massachusetts

Site Id: MW-26
Project Number: 2013-1016 B10

FUSS & O'NEILL
317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070

| Elevation | Depth | Sample No. | Recovery | Material Description | Graphic Log | USCS Code | Well Construction | OVM |
|---|---|---|---|---|---|---|---|---|
| -18 | 18 | | | | | | | |
| | | N/A | | Sand and silt; gray (5Y 5/1), wet. | | | | 4.3 ppm |
| -20 | 20 | | | | | | | |
| -22 | 22 | | | | | | | |
| -24 | 24 | N/A | | Same as above. | | | | 0 ppm |
| -26 | 26 | | | | | | | |
| -28 | 28 | | | | | | | |
| | | N/A | | Sand and silt; gray (5Y 5/10, wet. | | | | 0 ppm |
| -30 | 30 | | | | | | | |
| | | | | | | SM | | |
| -32 | 32 | | | | | | | |
| -34 | 34 | N/A | | Same as above. | | | | 0 ppm |
| -36 | 36 | | | | | | | |
| -38 | 38 | | | | | | | |

Proportions used: Trace 0 to 10%/Some 20 to 35%/Little 10 to 20%/And 35 to 50%

Project Name: Avery Dennison Facilities
Township/Range: Framingham, Massachusetts

Site Id: MW-26
Project Number: 2013-1016 B10

FUSS & O'NEILL
317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070

| Elevation | Depth | Sample No. | Recovery | Material Description | Graphic Log | USCS Code | Well Construction | OVM |
|---|---|---|---|---|---|---|---|---|
| | | N/A | | Same as above. | | | | 0 ppm |
| -40 | 40 | | | | | | | |
| -42 | 42 | | | | | | | |
| -44 | 44 | N/A | | SAND, F; some silt; little gravel; gray (5Y 5/1), wet. | | | | 0 ppm |
| -46 | 46 | | | | | | | |
| -48 | 48 | | | | | | | |
| | | N/A | | SAND, F-C; some gravel; little silt; gray (5Y 5/1), wet. (Till). | | | | 0 ppm |
| -50 | 50 | | | | | | | |
| -52 | 52 | | | | | SW | | |
| -54 | 54 | N/A | | Same as above. | | | | 0 ppm |
| -56 | 56 | | | | | | | |
| | | | | Refusal and end of boring at 57 feet. | | | | |
| -58 | 58 | | | | | | | |
| -60 | 60 | | | | | | | |

Proportions used: Trace 0 to 10%/Some 20 to 35%/Little 10 to 20%/And 35 to 50%

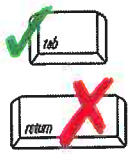
# CHAPTER 3: CHECKLIST FOR STORMWATER REPORT

**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

COMMONWEALTH OF MASSACHUSETTS
ROBERT
A.
GEMMA
No. 31967
REGISTERED
PROFESSIONAL ENGINEER

11/30/15

Signature and Date Re 31967 "Civil"

## 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): _____

**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 (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 for Stormwater Report

## 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 4: LID MEASURES

## Chapter 4:

The proposed redevelopment project will be utilizing various low impact development t(LID) approaches., to the maximum extent practicable, to minimize environmental impacts. 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 use of a subsurface infiltration system

**LID measures:**

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

*Subsurface Infiltration System*

A proposed subsurface infiltration system is designed to store and attenuate runoff from a portion of the proposed impervious surfaces for the project. Runoff rates and volumes leaving the project site will be reduced for all storm events.

# CHAPTER 5: STORMWATER MANAGEMENT STANDARDS 1 & 2

# Chapter 5:

## 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 (Stormceptor® Units, deep sump catch basins, etc.) to remove TSS and other pollutants.
- A portion of runoff from proposed impervious areas will be collected and recharged using a subsurface infiltration system, 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 and Two, 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 for Total Site**

| Drainage Basin | 2-year storm | 10-year storm | 25-year storm | 100-year storm |
|---|---|---|---|---|
| **Existing** | 11.2 CFS | 19.5 CFS | 24.2 CFS | 24.2 CFS |
| **Proposed** | 10.5 CFS | 17.5 CFS | 21.3 CFS | 21.3 CFS |
| **Difference** | -0.7 CFS | -2.0 CFS | -2.9 CFS | -3.4 CFS |
| **Difference** | -6.3% | -10.2% | -12.0% | -14.0% |

# CHAPTER 6: STORMWATER MANAGEMENT STANDARD 3

# Chapter 6:

## Standard 3: Recharge

- **The site is restricted by an Area of Use Limitation (AUL) and groundwater recharge is limited on the project site**
- **Soil Boring Data is provided in Chapter 2 of Stormwater Report**
- **The required recharge volume calculations:**

  The required Recharge Volume is based on sand with a NRCS Hydrologic Group rating of A and a Target Depth Factor (F) of 0.60-inch. Below is the calculation for the required recharge volume for the entire site:

  Required Recharge Volume
  Rv = (F) x (Impervious Area)
  Rv = (0.60 inch / 12) x (250,052 square feet)
  ***Rv = 12,503 cubic feet.***

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

*Subusrface Infiltration System 1*

| | |
|---|---|
| System configuration: | 70, 8.0 ft. by 5.2 ft. by 2.8 ft. leaching chambers |
| Bottom Area | 3,394 square feet |
| Total Storage Volume Available: | 5,400 cubic feet or 40,397 gallons |
| Exfiltration Rate: | 8.27 inches per hour |
| Bottom Exfiltration Capacity: | 0.65 CFS |

## Recharge Volumes from Hydrologic Analysis, Chapter 1.

*Subusrface Infiltration System 1*

2-Year Recharge Volume = 9,546 cubic feet
10-Year Recharge Volume = 15,268 cubic feet
25-Year Recharge Volume = 17,173 cubic feet
100-Year Recharge Volume = 19,775 cubic feet

- A more detailed analysis of the storage and infiltration capacities for the infiltration system can be found in the Hydrologic Analysis, Chapter 1.

## Chapter 6: (continued)

- Below are the calculations showing that the Infiltration BMP's will drain in 72 hours:

*Subusrface Infiltration System 1 (Based on Rv)*

$$Time_{drawdown} = \frac{(Rv)}{(K) \times (\text{Bottom Area})}$$

$$Time_{drawdown} = \frac{(12{,}503 \text{ cubic feet})}{(8.27 \text{ inches/hour})(1 \text{ foot/ } 12 \text{ inches}) \times (3{,}394 \text{ square feet})}$$

$Time_{drawdown}$ = **5.3 hours < 72 hours**

*Subusrface Infiltration System 1 (Based on System full))*

$$Time_{drawdown} = \frac{(Rv)}{(K) \times (\text{Bottom Area})}$$

$$Time_{drawdown} = \frac{(5{,}400 \text{ cubic feet})}{(8.27 \text{ inches/hour})(1 \text{ foot/ } 12 \text{ inches}) \times (3{,}394 \text{ square feet})}$$

$Time_{drawdown}$ = **2.3 hours < 72 hours**

- The bottom of both infiltration systems have a separation to the seasonal high water table of 2-feet or greater; therefore no mounding analysis is needed.

# CHAPTER 7: LONG-TERM POLLUTION PREVENTION PLAN STORMWATER MANAGEMENT STANDARDS 4-6

# Chapter 7:

## Long Term Pollution Prevention Plan:

- The Stormwater Pollution Prevention Plan from Chapter 8 and the Operation and Maintenance Plan from Chapter 11 address all necessary aspects of the Long Term Pollution Prevention Plan

## Standard 4: Water Quality

- Approximately 65% TSS Removal will be achieved prior to discharging to an infiltration BMP.
- Stormwater Runoff to be treated for Water Quality is based on 1-inch of runoff due to the post-development condition of exfiltrating soils with an infiltration rate greater than 2.4-inches per hour.
    - Requirement for Entire Site
      Amount of Runoff to be treated = (1.0 inch) x (impervious area)
      = (1.0 inch)/(1/12) x (250,052 square feet)
      = **20,838 cubic feet**
- Below is a sample TSS Removal calculation for a single sub basin on the post-development site:

**TSS Treatment Basin**

Driveway and parking lot sweeping - **5% (BMP1)**
Deep sump catch basins - **25% (BMP2)**
Stormceptor – **75% (BMP3)**
Infiltration System – **80% (BMP4)**

*Parking Lot Sweeping:*
Average Annual Load (1.00) * BMP1 Removal Rate (0.05) = **0.05**
(0.95 of the TSS load remains)

*Deep Sump Catch Basin:*
TSS load remaining (0.95) * BMP2 Removal Rate (0.25) = **0.24**
(0.71 of the TSS load remains)

*Stormceptor 900:*
TSS load remaining (0.71) * BMP3 Removal Rate (0.75) = **0.53**
(0.18 of the TSS load remains)

*Infiltration System:*
TSS load remaining (0.18) * BMP3 Removal Rate (0.80) = **0.14**
(0.04 of the TSS load remains)

Final TSS Removal Rate: 1.00 – 0.96= 0.04. **(96% TSS Removal)**

## Chapter 7: (continued)

- TSS Removal data and a sketch providing delineation for sub basins 1 through 10 are attached hereafter. A weighted post-development TSS Removal was determined to be **91.1%**.

### Standard 5: Land Use with Higher Potential Pollutant Loads

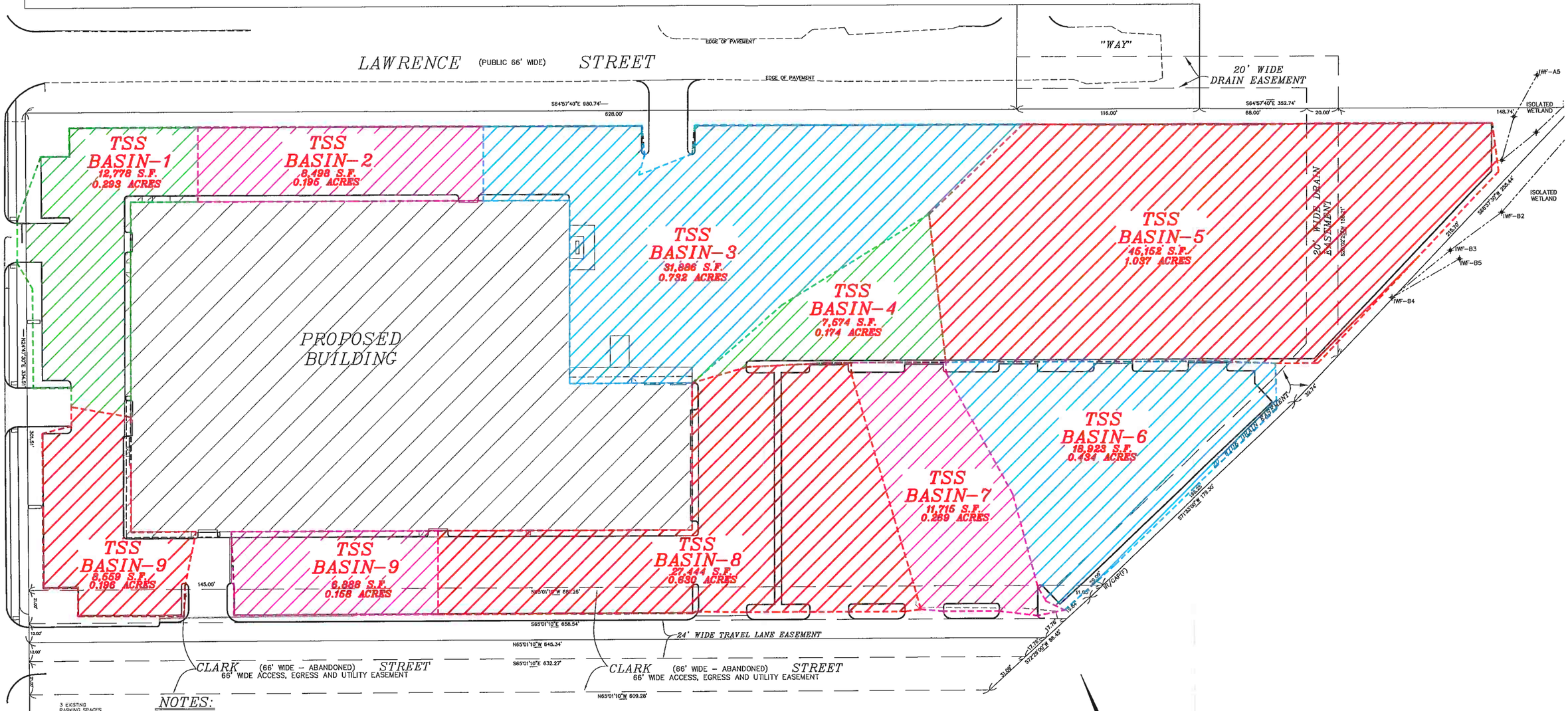
- The project does not include land uses with Higher Potential Pollutant Loads.

### Standard 6: Critical Areas

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

| | | | |
|---|---|---|---|
| ***71 Bishop Street, Framingham MA*** | | | 28-Nov-15 |
| ***Herb Chambers Proposed Sales and Service Facility*** | | | |
| **Stormwater Management Calculations, TSS Removal** | | | |
| | | | |
| **Treatment Basin 1** | **Basin Area (acres)** | 0.293 | **D.M.H.-2** |
| **BMP List** | **Removal Rate (%)** | **TSS Removed (%)** | **TSS Remaining (%)** |
| Street Sweeping | 5 | 5.0 | 95.0 |
| Deep Sump Catch Basins | 25 | 23.8 | 71.3 |
| StormCeptor 450* | 88 | 62.7 | 8.6 |
| | | **TSS Removal** | **91.5** |
| | | | |
| **Treatment Basin 2** | **Basin Area (acres)** | 0.195 | **D.C.B.-6** |
| **BMP List** | **Removal Rate (%)** | **TSS Removed (%)** | **TSS Remaining (%)** |
| Street Sweeping | 5 | 5.0 | 95.0 |
| Deep Sump Catch Basins | 25 | 23.8 | 71.3 |
| StormCeptor 450* | 90 | 64.1 | 7.1 |
| | | **TSS Removal** | **92.9** |
| | | | |
| **Treatment Basin 3** | **Basin Area (acres)** | 0.732 | **D.M.H.-4** |
| **BMP List** | **Removal Rate (%)** | **TSS Removed (%)** | **TSS Remaining (%)** |
| Street Sweeping | 5 | 5.0 | 95.0 |
| Deep Sump Catch Basins | 25 | 23.8 | 71.3 |
| StormCeptor 450* | 80 | 57.0 | 14.3 |
| | | **TSS Removal** | **85.8** |
| | | | |
| **Treatment Basin 4** | **Basin Area (acres)** | 0.174 | **D.C.B.-10** |
| **BMP List** | **Removal Rate (%)** | **TSS Removed (%)** | **TSS Remaining (%)** |
| Street Sweeping | 5 | 5.0 | 95.0 |
| Deep Sump Catch Basins | 25 | 23.8 | 71.3 |
| StormCeptor 450* | 91 | 64.8 | 6.4 |
| | | **TSS Removal** | **93.6** |
| | | | |
| **Treatment Basin 5** | **Basin Area (acres)** | 1.037 | **D.M.H.-7** |
| **BMP List** | **Removal Rate (%)** | **TSS Removed (%)** | **TSS Remaining (%)** |
| Street Sweeping | 5 | 5.0 | 95.0 |
| Deep Sump Catch Basins | 25 | 23.8 | 71.3 |
| StormCeptor 450* | 75 | 53.4 | 17.8 |
| Infiltration System | 80 | 14.3 | 3.6 |
| | | **TSS Removal** | **96.4** |
| | | | |
| **Treatment Basin 6** | **Basin Area (acres)** | 0.434 | **D.M.H.-8** |
| **BMP List** | **Removal Rate (%)** | **TSS Removed (%)** | **TSS Remaining (%)** |
| Street Sweeping | 5 | 5.0 | 95.0 |
| Deep Sump Catch Basins | 25 | 23.8 | 71.3 |
| StormCeptor 450* | 85 | 60.6 | 10.7 |
| | | **TSS Removal** | **89.3** |
| | | | |
| (*) - TSS Removal Rates based on 90% of TSS removal shown on Imbrium Systems Sizing Calculations | | | |
| **Page 1** | | | |

| | | | |
|---|---|---|---|
| **Treatment Basin 7** | **Basin Area (acres)** | 0.269 | **D.C.B.-8** |
| **BMP List** | **Removal Rate (%)** | **TSS Removed (%)** | **TSS Remaining (%)** |
| Street Sweeping | 5 | 5.0 | 95.0 |
| Deep Sump Catch Basins | 25 | 23.8 | 71.3 |
| | | **TSS Removal** | **28.8** |
| | | | |
| **Treatment Basin 8** | **Basin Area (acres)** | 0.63 | **D.M.H.-9** |
| **BMP List** | **Removal Rate (%)** | **TSS Removed (%)** | **TSS Remaining (%)** |
| Street Sweeping | 5 | 5.0 | 95.0 |
| Deep Sump Catch Basins | 25 | 23.8 | 71.3 |
| StormCeptor 450* | 82 | 58.4 | 12.8 |
| | | **TSS Removal** | **87.2** |
| | | | |
| **Treatment Basin 9** | **Basin Area (acres)** | 0.158 | **D.C.B.-17** |
| **BMP List** | **Removal Rate (%)** | **TSS Removed (%)** | **TSS Remaining (%)** |
| Street Sweeping | 5 | 5.0 | 95.0 |
| Deep Sump Catch Basins | 25 | 23.8 | 71.3 |
| StormCeptor 450* | 91 | 64.8 | 6.4 |
| | | **TSS Removal** | **93.6** |
| | | | |
| **Treatment Basin 10** | **Basin Area (acres)** | 0.197 | **D.M.H.-12** |
| **BMP List** | **Removal Rate (%)** | **TSS Removed (%)** | **TSS Remaining (%)** |
| Street Sweeping | 5 | 5.0 | 95.0 |
| Deep Sump Catch Basins | 25 | 23.8 | 71.3 |
| StormCeptor 450* | 90 | 64.1 | 7.1 |
| | | **TSS Removal** | **92.9** |
| | | | |
| **Weighted Average TSS Removal Calculation** | | | |
| **Location** | **Area** | **TSS Removal** | **Product** |
| Treatment Basin 1 | 0.293 | 91.5 | 26.79 |
| Treatment Basin 2 | 0.195 | 92.9 | 18.11 |
| Treatment Basin 3 | 0.732 | 85.8 | 62.77 |
| Treatment Basin 4 | 0.174 | 93.6 | 16.28 |
| Treatment Basin 5 | 1.037 | 96.4 | 100.01 |
| Treatment Basin 6 | 0.434 | 89.3 | 38.76 |
| Treatment Basin 7 | 0.269 | 28.8 | 7.73 |
| Treatment Basin 8 | 0.63 | 87.2 | 54.92 |
| Treatment Basin 9 | 0.158 | 93.6 | 14.79 |
| Treatment Basin 10 | 0.197 | 92.9 | 18.30 |
| | | | |
| Totals | **4.119** | | **358.46** |
| | | Weighted Average for TSS Removal (%) | **87.0** |
| | | | |
| (*) - TSS Removal Rates based on 90% of TSS removal shown on Imbrium Systems Sizing Calculations | | | |
| **Page 2** | | | |




## NOTES:

1. SUBJECT PARCEL IS SHOWN AS ASSESSORS MAP 84, BLOCK 165 LOT 04.
   RECORD TITLE FROM BOOK 64092, PAGE 318.

2. UTILITY LOCATIONS DEPICTED ON THIS PLAN, BOTH ABOVE-- AND BELOW-GROUND, ARE BASED UPON DIRECT FIELD OBSERVATIONS MADE BY METROWEST ENGINEERING, INC. PERSONNEL DURING A FIELD SURVEY, RECORD PLAN LOCATIONS, OR DIGSAFE PAINT-INDICATORS. METROWEST ENGINEERING, INC. DOES NOT WARRANT THAT ALL UTILITIES ARE SHOWN OR THAT UTILITIES THAT ARE DEPICTED ARE SHOWN IN THE CORRECT LOCATION, OR WITH THE PROPER MATERIAL DESIGNATION. METROWEST ENGINEERING, INC. DOES NOT WARRANT OR PROVIDE AN EXPRESS OR IMPLIED WARRANTY THAT ALL SUBSURFACE IMPROVEMENTS ARE SHOWN OR ARE SHOWN CORRECTLY, INCLUDING, BUT NOT LIMITED TO, UTILITIES, UNDERGROUND VAULTS, UNDERGROUND TANKS OR CHAMBERS, BUNKERS, DUCT BANKS, AND/OR OTHER MAN-MADE IMPROVEMENTS THAT LIE BENEATH THE GROUND SURFACE AT THE TIME OF THE SURVEY.

3. CONTRACTOR IS SOLELY RESPONSIBLE FOR ESTABLISHING EXISTING LOCATIONS OF ALL SUB-SURFACE UTILITIES AND MAN-MADE IMPROVEMENTS AND FOR THE REQUIREMENTS TO REPLACE, RELOCATE OR REPAIR EXISTING UTILITIES IN THE EVENT OF DAMAGE OCCURRING DURING CONSTRUCTION. MWE IS NOT RESPONSIBLE OR LIABLE FOR DELAYS OR COSTS ASSOCIATED WITH REMOVING/REPLACING/RELOCATING OF EXISTING UTILITIES REGARDLESS OF WHETHER SAID UTILITIES ARE ACCURATELY DEPICTED ON THIS SURVEY.

4. THE PROPERTY DESCRIBED ON THIS SURVEY DOES NOT LIE WITHIN A SPECIAL FLOOD HAZARD AREA AS DEFINED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY; THE PROPERTY LIES WITHIN ZONE "X" OF THE FLOOD INSURANCE RATE MAP IDENTIFIED AS MAP'S NUMBER 25017C0518F & 25017C0519F, BEARING AN EFFECTIVE DATE OF JULY 7, 2014.

5. SEE SYMBOL LEGEND ON COVER SHEET.

NOT TO SCALE

# TSS BASIN DELINEATION PLAN IN FRAMINGHAM, MASS

PREPARED FOR:

*HERB CHAMBERS COMPANIES*
*259 McGRATH HIGHWAY*
*SOMERVILLE, MA 02143*

PROPERTY OF:

*CLINTON 100 CPI, LLC*
*43 BROAD ST*
*HUDSON, MA 01749*

ENGINEERS & SURVEYORS:


MWE
*METROWEST ENGINEERING, INC.*
*75 FRANKLIN STREET*
*FRAMINGHAM, MA 01702*
*TEL.: (508)626-0063*
*FAX: (508)875-6440*
*ROBERT A. GEMMA, P.E.(CIVIL) # 31967* *P.L.S. # 37046*


| | | |
|---|---|---|
| SHEET 1 OF 1 | | DATE: NOVEMBER 28, 2015 |
| CALC'D BY: BTN/RAG | FIELD BK: 632 | CAD FILE: PROP_SP2_TSS.dwg |
| DRAFTER: BTN | PROJECT: FRM_CLI | DWG FILE: SK112815.dwg |

# Stormceptor Design Summary

**PCSWMM for Stormceptor**

## Project Information

| | |
|---|---|
| Date | 11/28/2015 |
| Project Name | Herb Chambers |
| Project Number | D.M.H.-2 |
| Location | 71 Bishop Street, Framingman |

## Designer Information

| | |
|---|---|
| Company | N/A |
| Contact | N/A |

## Notes

D.M.H.-2

## Drainage Area

| | |
|---|---|
| Total Area (ac) | 0.293 |
| Imperviousness (%) | 92.5 |

The Stormceptor System model STC 450i achieves the water quality objective removing 88% TSS for a Fine (organics, silts and sand) particle size distribution.

## Rainfall

| | |
|---|---|
| Name | BOSTON WSFO AP |
| State | MA |
| ID | 770 |
| Years of Records | 1948 to 2005 |
| Latitude | 42°21'38"N |
| Longitude | 71°0'38"W |

## Water Quality Objective

| | |
|---|---|
| TSS Removal (%) | 80 |

## Upstream Storage

| Storage (ac-ft) | Discharge (cfs) |
|---|---|
| 0 | 0 |

## Stormceptor Sizing Summary

| Stormceptor Model | TSS Removal % |
|---|---|
| STC 450i | 88 |
| STC 900 | 93 |
| STC 1200 | 93 |
| STC 1800 | 93 |
| STC 2400 | 95 |
| STC 3600 | 95 |
| STC 4800 | 96 |
| STC 6000 | 97 |
| STC 7200 | 97 |
| STC 11000 | 98 |
| STC 13000 | 98 |
| STC 16000 | 98 |

Stormceptor®

## Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

| Fine (organics, silts and sand) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s | | Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s |
| 20 | 20 | 1.3 | 0.0013 | | | | | |
| 60 | 20 | 1.8 | 0.0051 | | | | | |
| 150 | 20 | 2.2 | 0.0354 | | | | | |
| 400 | 20 | 2.65 | 0.2123 | | | | | |
| 2000 | 20 | 2.65 | 0.9417 | | | | | |

## Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

**Inlet and Outlet Pipe Invert Elevations Differences**

| Inlet Pipe Configuration | STC 450i | STC 900 to STC 7200 | STC 11000 to STC 16000 |
|---|---|---|---|
| Single inlet pipe | 3 in. | 1 in. | 3 in. |
| Multiple inlet pipes | 3 in. | 3 in. | Only one inlet pipe. |

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Rinker Materials 1 (800) 909-7763 www.rinkerstormceptor.com



Rinker MATERIALS™

# Stormceptor Design Summary

**PCSWMM for Stormceptor**

## Project Information

| | |
|---|---|
| Date | 11/28/2015 |
| Project Name | Herb Chambers |
| Project Number | D.C.B,-6 |
| Location | 71 Bishop Street, Framingman |

## Designer Information

| | |
|---|---|
| Company | N/A |
| Contact | N/A |

## Notes

D.C.B.-6

## Drainage Area

| | |
|---|---|
| Total Area (ac) | 0.195 |
| Imperviousness (%) | 100 |

The Stormceptor System model STC 450i achieves the water quality objective removing 90% TSS for a Fine (organics, silts and sand) particle size distribution.

## Rainfall

| | |
|---|---|
| Name | BOSTON WSFO AP |
| State | MA |
| ID | 770 |
| Years of Records | 1948 to 2005 |
| Latitude | 42°21'38"N |
| Longitude | 71°0'38"W |

## Water Quality Objective

| | |
|---|---|
| TSS Removal (%) | 80 |

## Upstream Storage

| Storage (ac-ft) | Discharge (cfs) |
|---|---|
| 0 | 0 |

## Stormceptor Sizing Summary

| Stormceptor Model | TSS Removal % |
|---|---|
| STC 450i | 90 |
| STC 900 | 94 |
| STC 1200 | 94 |
| STC 1800 | 94 |
| STC 2400 | 96 |
| STC 3600 | 96 |
| STC 4800 | 97 |
| STC 6000 | 97 |
| STC 7200 | 98 |
| STC 11000 | 98 |
| STC 13000 | 99 |
| STC 16000 | 99 |

Stormceptor®

## Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

| Fine (organics, silts and sand) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s | | Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s |
| 20 | 20 | 1.3 | 0.0013 | | | | | |
| 60 | 20 | 1.8 | 0.0051 | | | | | |
| 150 | 20 | 2.2 | 0.0354 | | | | | |
| 400 | 20 | 2.65 | 0.2123 | | | | | |
| 2000 | 20 | 2.65 | 0.9417 | | | | | |

## Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

**Inlet and Outlet Pipe Invert Elevations Differences**

| Inlet Pipe Configuration | STC 450i | STC 900 to STC 7200 | STC 11000 to STC 16000 |
|---|---|---|---|
| Single inlet pipe | 3 in. | 1 in. | 3 in. |
| Multiple inlet pipes | 3 in. | 3 in. | Only one inlet pipe. |

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Rinker Materials 1 (800) 909-7763 www.rinkerstormceptor.com



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# Stormceptor Design Summary

**PCSWMM for Stormceptor**

## Project Information

| | |
|---|---|
| Date | 11/28/2015 |
| Project Name | Herb Chambers |
| Project Number | D.M.H.-4 |
| Location | 71 Bishop Street, Framingman |

## Designer Information

| | |
|---|---|
| Company | N/A |
| Contact | N/A |

## Notes

D.M.H.-4

## Drainage Area

| | |
|---|---|
| Total Area (ac) | 0.732 |
| Imperviousness (%) | 100 |

The Stormceptor System model STC 450i achieves the water quality objective removing 80% TSS for a Fine (organics, silts and sand) particle size distribution.

## Rainfall

| | |
|---|---|
| Name | BOSTON WSFO AP |
| State | MA |
| ID | 770 |
| Years of Records | 1948 to 2005 |
| Latitude | 42°21'38"N |
| Longitude | 71°0'38"W |

## Water Quality Objective

| | |
|---|---|
| TSS Removal (%) | 80 |

## Upstream Storage

| Storage (ac-ft) | Discharge (cfs) |
|---|---|
| 0 | 0 |

## Stormceptor Sizing Summary

| Stormceptor Model | TSS Removal % |
|---|---|
| **STC 450i** | **80** |
| STC 900 | 87 |
| STC 1200 | 87 |
| STC 1800 | 87 |
| STC 2400 | 90 |
| STC 3600 | 91 |
| STC 4800 | 93 |
| STC 6000 | 93 |
| STC 7200 | 94 |
| STC 11000 | 96 |
| STC 13000 | 96 |
| STC 16000 | 97 |

Stormceptor®

## Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

| Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s | | Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s |
|---|---|---|---|---|---|---|---|---|
| 20 | 20 | 1.3 | 0.0013 | | | | | |
| 60 | 20 | 1.8 | 0.0051 | | | | | |
| 150 | 20 | 2.2 | 0.0354 | | | | | |
| 400 | 20 | 2.65 | 0.2123 | | | | | |
| 2000 | 20 | 2.65 | 0.9417 | | | | | |

## Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

**Inlet and Outlet Pipe Invert Elevations Differences**

| Inlet Pipe Configuration | STC 450i | STC 900 to STC 7200 | STC 11000 to STC 16000 |
|---|---|---|---|
| Single inlet pipe | 3 in. | 1 in. | 3 in. |
| Multiple inlet pipes | 3 in. | 3 in. | Only one inlet pipe. |

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Rinker Materials 1 (800) 909-7763 www.rinkerstormceptor.com



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# Stormceptor Design Summary

**PCSWMM for Stormceptor**

## Project Information

| | |
|---|---|
| Date | 11/28/2015 |
| Project Name | Herb Chambers |
| Project Number | D.C.B.-10 |
| Location | 71 Bishop Street, Framingman |

## Designer Information

| | |
|---|---|
| Company | N/A |
| Contact | N/A |

## Notes

D.C.B.-10

## Drainage Area

| | |
|---|---|
| Total Area (ac) | 0.174 |
| Imperviousness (%) | 100 |

The Stormceptor System model STC 450i achieves the water quality objective removing 91% TSS for a Fine (organics, silts and sand) particle size distribution.

## Rainfall

| | |
|---|---|
| Name | BOSTON WSFO AP |
| State | MA |
| ID | 770 |
| Years of Records | 1948 to 2005 |
| Latitude | 42°21'38"N |
| Longitude | 71°0'38"W |

## Water Quality Objective

| | |
|---|---|
| TSS Removal (%) | 80 |

## Upstream Storage

| Storage (ac-ft) | Discharge (cfs) |
|---|---|
| 0 | 0 |

## Stormceptor Sizing Summary

| Stormceptor Model | TSS Removal % |
|---|---|
| STC 450i | 91 |
| STC 900 | 95 |
| STC 1200 | 95 |
| STC 1800 | 95 |
| STC 2400 | 96 |
| STC 3600 | 97 |
| STC 4800 | 97 |
| STC 6000 | 98 |
| STC 7200 | 98 |
| STC 11000 | 99 |
| STC 13000 | 99 |
| STC 16000 | 99 |

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## Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

| Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s | | Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s |
|---|---|---|---|---|---|---|---|---|
| 20 | 20 | 1.3 | 0.0013 | | | | | |
| 60 | 20 | 1.8 | 0.0051 | | | | | |
| 150 | 20 | 2.2 | 0.0354 | | | | | |
| 400 | 20 | 2.65 | 0.2123 | | | | | |
| 2000 | 20 | 2.65 | 0.9417 | | | | | |

## Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

**Inlet and Outlet Pipe Invert Elevations Differences**

| Inlet Pipe Configuration | STC 450i | STC 900 to STC 7200 | STC 11000 to STC 16000 |
|---|---|---|---|
| Single inlet pipe | 3 in. | 1 in. | 3 in. |
| Multiple inlet pipes | 3 in. | 3 in. | Only one inlet pipe. |

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Rinker Materials 1 (800) 909-7763 www.rinkerstormceptor.com



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# Stormceptor Design Summary

**PCSWMM for Stormceptor**

## Project Information

| | |
|---|---|
| Date | 11/28/2015 |
| Project Name | Herb Chambers |
| Project Number | D.M.H.-7 |
| Location | 71 Bishop Street, Framingman |

## Designer Information

| | |
|---|---|
| Company | N/A |
| Contact | N/A |

## Notes

D.M.H.-7

## Drainage Area

| | |
|---|---|
| Total Area (ac) | 1.037 |
| Imperviousness (%) | 98 |

The Stormceptor System model STC 900 achieves the water quality objective removing 84% TSS for a Fine (organics, silts and sand) particle size distribution.

## Rainfall

| | |
|---|---|
| Name | BOSTON WSFO AP |
| State | MA |
| ID | 770 |
| Years of Records | 1948 to 2005 |
| Latitude | 42°21'38"N |
| Longitude | 71°0'38"W |

## Water Quality Objective

| | |
|---|---|
| TSS Removal (%) | 80 |

## Upstream Storage

| Storage (ac-ft) | Discharge (cfs) |
|---|---|
| 0 | 0 |

## Stormceptor Sizing Summary

| Stormceptor Model | TSS Removal % |
|---|---|
| STC 450i | 75 |
| **STC 900** | **84** |
| STC 1200 | 84 |
| STC 1800 | 84 |
| STC 2400 | 87 |
| STC 3600 | 88 |
| STC 4800 | 91 |
| STC 6000 | 91 |
| STC 7200 | 92 |
| STC 11000 | 94 |
| STC 13000 | 95 |
| STC 16000 | 96 |

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## Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

| Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s | | Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s |
|---|---|---|---|---|---|---|---|---|
| 20 | 20 | 1.3 | 0.0013 | | | | | |
| 60 | 20 | 1.8 | 0.0051 | | | | | |
| 150 | 20 | 2.2 | 0.0354 | | | | | |
| 400 | 20 | 2.65 | 0.2123 | | | | | |
| 2000 | 20 | 2.65 | 0.9417 | | | | | |

## Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

**Inlet and Outlet Pipe Invert Elevations Differences**

| Inlet Pipe Configuration | STC 450i | STC 900 to STC 7200 | STC 11000 to STC 16000 |
|---|---|---|---|
| Single inlet pipe | 3 in. | 1 in. | 3 in. |
| Multiple inlet pipes | 3 in. | 3 in. | Only one inlet pipe. |

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Rinker Materials 1 (800) 909-7763 www.rinkerstormceptor.com



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# Stormceptor Design Summary

**PCSWMM for Stormceptor**

## Project Information

| | |
|---|---|
| Date | 11/28/2015 |
| Project Name | Herb Chambers |
| Project Number | D.M.H.-8 |
| Location | 71 Bishop Street, Framingman |

## Designer Information

| | |
|---|---|
| Company | N/A |
| Contact | N/A |

## Notes

D.M.H.-8

## Drainage Area

| | |
|---|---|
| Total Area (ac) | 0.434 |
| Imperviousness (%) | 89.4 |

The Stormceptor System model STC 450i achieves the water quality objective removing 85% TSS for a Fine (organics, silts and sand) particle size distribution.

## Rainfall

| | |
|---|---|
| Name | BOSTON WSFO AP |
| State | MA |
| ID | 770 |
| Years of Records | 1948 to 2005 |
| Latitude | 42°21'38"N |
| Longitude | 71°0'38"W |

## Water Quality Objective

| | |
|---|---|
| TSS Removal (%) | 80 |

## Upstream Storage

| Storage (ac-ft) | Discharge (cfs) |
|---|---|
| 0 | 0 |

## Stormceptor Sizing Summary

| Stormceptor Model | TSS Removal % |
|---|---|
| STC 450i | 85 |
| STC 900 | 91 |
| STC 1200 | 91 |
| STC 1800 | 91 |
| STC 2400 | 93 |
| STC 3600 | 94 |
| STC 4800 | 95 |
| STC 6000 | 95 |
| STC 7200 | 96 |
| STC 11000 | 97 |
| STC 13000 | 98 |
| STC 16000 | 98 |

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## Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

| Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s | | Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s |
|---|---|---|---|---|---|---|---|---|
| 20 | 20 | 1.3 | 0.0013 | | | | | |
| 60 | 20 | 1.8 | 0.0051 | | | | | |
| 150 | 20 | 2.2 | 0.0354 | | | | | |
| 400 | 20 | 2.65 | 0.2123 | | | | | |
| 2000 | 20 | 2.65 | 0.9417 | | | | | |

## Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

**Inlet and Outlet Pipe Invert Elevations Differences**

| Inlet Pipe Configuration | STC 450i | STC 900 to STC 7200 | STC 11000 to STC 16000 |
|---|---|---|---|
| Single inlet pipe | 3 in. | 1 in. | 3 in. |
| Multiple inlet pipes | 3 in. | 3 in. | Only one inlet pipe. |

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Rinker Materials 1 (800) 909-7763 www.rinkerstormceptor.com



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# Stormceptor Design Summary

**PCSWMM for Stormceptor**

## Project Information

| | |
|---|---|
| Date | 11/28/2015 |
| Project Name | Herb Chambers |
| Project Number | D.M.H.-9 |
| Location | 71 Bishop Street, Framingman |

## Designer Information

| | |
|---|---|
| Company | N/A |
| Contact | N/A |

## Notes

D.M.H.-9

## Drainage Area

| | |
|---|---|
| Total Area (ac) | 0.63 |
| Imperviousness (%) | 96.3 |

The Stormceptor System model STC 450i achieves the water quality objective removing 82% TSS for a Fine (organics, silts and sand) particle size distribution.

## Rainfall

| | |
|---|---|
| Name | BOSTON WSFO AP |
| State | MA |
| ID | 770 |
| Years of Records | 1948 to 2005 |
| Latitude | 42°21'38"N |
| Longitude | 71°0'38"W |

## Water Quality Objective

| | |
|---|---|
| TSS Removal (%) | 80 |

## Upstream Storage

| Storage (ac-ft) | Discharge (cfs) |
|---|---|
| 0 | 0 |

## Stormceptor Sizing Summary

| Stormceptor Model | TSS Removal % |
|---|---|
| STC 450i | 82 |
| STC 900 | 88 |
| STC 1200 | 89 |
| STC 1800 | 89 |
| STC 2400 | 91 |
| STC 3600 | 92 |
| STC 4800 | 94 |
| STC 6000 | 94 |
| STC 7200 | 95 |
| STC 11000 | 96 |
| STC 13000 | 97 |
| STC 16000 | 97 |

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## Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

| Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s | | Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s |
|---|---|---|---|---|---|---|---|---|
| 20 | 20 | 1.3 | 0.0013 | | | | | |
| 60 | 20 | 1.8 | 0.0051 | | | | | |
| 150 | 20 | 2.2 | 0.0354 | | | | | |
| 400 | 20 | 2.65 | 0.2123 | | | | | |
| 2000 | 20 | 2.65 | 0.9417 | | | | | |

## Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

**Inlet and Outlet Pipe Invert Elevations Differences**

| Inlet Pipe Configuration | STC 450i | STC 900 to STC 7200 | STC 11000 to STC 16000 |
|---|---|---|---|
| Single inlet pipe | 3 in. | 1 in. | 3 in. |
| Multiple inlet pipes | 3 in. | 3 in. | Only one inlet pipe. |

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Rinker Materials 1 (800) 909-7763 www.rinkerstormceptor.com



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# Stormceptor Design Summary

**PCSWMM for Stormceptor**

## Project Information

| | |
|---|---|
| Date | 11/28/2015 |
| Project Name | Herb Chambers |
| Project Number | D.C.B.-17 |
| Location | 71 Bishop Street, Framingman |

## Designer Information

| | |
|---|---|
| Company | N/A |
| Contact | N/A |

## Notes

D.C.B.-17

## Drainage Area

| | |
|---|---|
| Total Area (ac) | 0.158 |
| Imperviousness (%) | 100 |

The Stormceptor System model STC 450i achieves the water quality objective removing 91% TSS for a Fine (organics, silts and sand) particle size distribution.

## Rainfall

| | |
|---|---|
| Name | BOSTON WSFO AP |
| State | MA |
| ID | 770 |
| Years of Records | 1948 to 2005 |
| Latitude | 42°21'38"N |
| Longitude | 71°0'38"W |

## Water Quality Objective

| | |
|---|---|
| TSS Removal (%) | 80 |

## Upstream Storage

| Storage (ac-ft) | Discharge (cfs) |
|---|---|
| 0 | 0 |

## Stormceptor Sizing Summary

| Stormceptor Model | TSS Removal % |
|---|---|
| STC 450i | 91 |
| STC 900 | 95 |
| STC 1200 | 95 |
| STC 1800 | 95 |
| STC 2400 | 96 |
| STC 3600 | 97 |
| STC 4800 | 98 |
| STC 6000 | 98 |
| STC 7200 | 98 |
| STC 11000 | 99 |
| STC 13000 | 99 |
| STC 16000 | 99 |

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## Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

| Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s | | Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s |
|---|---|---|---|---|---|---|---|---|
| 20 | 20 | 1.3 | 0.0013 | | | | | |
| 60 | 20 | 1.8 | 0.0051 | | | | | |
| 150 | 20 | 2.2 | 0.0354 | | | | | |
| 400 | 20 | 2.65 | 0.2123 | | | | | |
| 2000 | 20 | 2.65 | 0.9417 | | | | | |

## Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

**Inlet and Outlet Pipe Invert Elevations Differences**

| Inlet Pipe Configuration | STC 450i | STC 900 to STC 7200 | STC 11000 to STC 16000 |
|---|---|---|---|
| Single inlet pipe | 3 in. | 1 in. | 3 in. |
| Multiple inlet pipes | 3 in. | 3 in. | Only one inlet pipe. |

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
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# Stormceptor Design Summary

**PCSWMM for Stormceptor**

## Project Information

| | |
|---|---|
| Date | 11/28/2015 |
| Project Name | Herb Chambers |
| Project Number | D.M.H.-12 |
| Location | 71 Bishop Street, Framingman |

## Designer Information

| | |
|---|---|
| Company | N/A |
| Contact | N/A |

## Notes

D.M.H.-12

## Drainage Area

| | |
|---|---|
| Total Area (ac) | 0.197 |
| Imperviousness (%) | 100 |

The Stormceptor System model STC 450i achieves the water quality objective removing 90% TSS for a Fine (organics, silts and sand) particle size distribution.

## Rainfall

| | |
|---|---|
| Name | BOSTON WSFO AP |
| State | MA |
| ID | 770 |
| Years of Records | 1948 to 2005 |
| Latitude | 42°21'38"N |
| Longitude | 71°0'38"W |

## Water Quality Objective

| | |
|---|---|
| TSS Removal (%) | 80 |

## Upstream Storage

| Storage (ac-ft) | Discharge (cfs) |
|---|---|
| 0 | 0 |

## Stormceptor Sizing Summary

| Stormceptor Model | TSS Removal % |
|---|---|
| STC 450i | 90 |
| STC 900 | 94 |
| STC 1200 | 94 |
| STC 1800 | 94 |
| STC 2400 | 96 |
| STC 3600 | 96 |
| STC 4800 | 97 |
| STC 6000 | 97 |
| STC 7200 | 98 |
| STC 11000 | 98 |
| STC 13000 | 99 |
| STC 16000 | 99 |

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## Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

| Particle Size µm | Distribution % | Specific Gravity | Settling Velocity ft/s | | Particle Size µm | Distribution . % | Specific Gravity | Settling Velocity ft/s |
|---|---|---|---|---|---|---|---|---|
| 20 | 20 | 1.3 | 0.0013 | | | | | |
| 60 | 20 | 1.8 | 0.0051 | | | | | |
| 150 | 20 | 2.2 | 0.0354 | | | | | |
| 400 | 20 | 2.65 | 0.2123 | | | | | |
| 2000 | 20 | 2.65 | 0.9417 | | | | | |

## Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

**Inlet and Outlet Pipe Invert Elevations Differences**

| Inlet Pipe Configuration | STC 450i | STC 900 to STC 7200 | STC 11000 to STC 16000 |
|---|---|---|---|
| Single inlet pipe | 3 in. | 1 in. | 3 in. |
| Multiple inlet pipes | 3 in. | 3 in. | Only one inlet pipe. |

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
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# CHAPTER 8: CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN (SWPPP)

# *STORM WATER POLLUTION PREVENTION PLAN*

**for**

**Proposed Automotive Sales and Service Center**
**71 Bishop Street**
**Framingham, MA 01702**

Prepared for: **Herb Chambers Companies**
**259 McGrath Highway**
**Somerville, MA 02143**

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

***November, 2015***

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## A. Project Name and Location

| | |
|---|---|
| Name: | Proposed Automotive Sales and Service Center |
| Street: | 71 Bishop Street, Framingham, Massachusetts |
| Landmark: | Locus has frontage along Bishop Street, north of Waverly Street |
| Latitude: | 42° - 16' - 49" |
| Longitude: | 71° - 24' - 12" |

## B. Project Owner and Operator

The Herb Chambers Companies
259 McGrath Highway
Somerville, MA 02143

## 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

## F. CERTIFICATION OF STORMWATER POLLUTION PREVENTION PLAN

**Project: Proposed Automotive Sales and Service Facility, 71 Bishop Street 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: _____

Company: Herb Chambers Companies

Address: 259 McGrath Highway, Somerville MA 02143

Telephone: Office: (617) 666-8333

Date: _____

## G. CONTRACTOR/SUB-CONTRACTOR CERTIFICATION

**Project: Proposed Automotive Sales and Service Facility, 71 Bishop Street 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 subject property is located on the easterly side of Bishop Street in Framingham Massachusetts approximately five hundred feet north of Waverley Street (Route 135). The site is presently developed with an existing building and paved parking area covering the majority of the site. The property contains approximately 6.27-acres of land, of which, 4.89-acres is impervious area. Existing topography decreases in elevation approximately 5-feet from north to south across the site.

The project involves the demolition of the existing building followed by the construction of a new building, paved parking areas, stormwater management system and supporting utilities. A new parking area will also be constructed on the southeasterly portion of the property for use by the property located at 100 Clinton Street. Stormwater runoff from the proposed project will be collected and treated by a stormwater management system and routed to a proposed infiltration system prior to being discharged into the municipal storm drain system

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 6.27 acres.
Existing impervious area is approximately 4.89 acres
Proposed impervious area is approximately 5.74 acres
Total developed area is approximately 6.0 acres

## K. Surrounding Developments

The project is surrounded by commercial buildings on the south, north and west. The M.B.T.A. commuter line is located along the easterly boundary line.

## L. Soil Description

Soils on site belong to the Urban land complex (602) according to the NRCS Soil Survey. Abutting soil groups are classified within the Merrimac-Urban land soil group (626B). The site is constrained by a use restriction (AUL) which covers the entire property. The AUL promotes the coverage of existing soils with impervious surfaces including buildings and pavement. Soil borings performed at the property indicate a layer of fill approximately six-feet deep. Underlying parent soils are sandy in composition with a relatively high seasonal high groundwater elevation. No Title V soil analysis was performed at the property as on site recharge is not feasible at the project due to the AUL restrictions.

## M. Runoff Coefficient

Existing soils have varying permeability rates therefore runoff will be generated from major storm events. The pre-development runoff coefficient for the site is 0.78 and the post-development runoff coefficient will be 0.89.

## 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 Wetland Resource Areas

No wetlands occur on the locus. An isolated wetland is located off property at the easterly corner

## Q. Sequence of Major Activities

1. The project is scheduled to begin in April 2016.
2. The existing building will be razed in May 2016.
3. Construction of the new building will begin in June 2016.
4. The site grading will be completed in September 2016.
5. All construction will be complete by January 2017.

## R. Construction Sequence

1. **Erosion Control**
   An erosion control barrier consisting of either filter mitt mulch tubes or haybales and silt fence will be placed at the limit of work around the majority of the parcel as needed and in any sensitive areas.

2. **Site Access**
   Site access, for construction equipment, will be made from access points located off Clark ad Lawrence Streets. An erosion control barrier to the work area 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 in the existing paved parking area. All construction materials, supplies, trailers and offices, portable toilets, and equipment shall be stored within the limits of the staging area. Construction fence and filter mitt erosion control measures shall demarcate the limits of the staging area.

4. **Site Work**
   Site work, including excavation for the building, parking lots, excavation for drainage system, grading 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 or abutting properties.

## S. Pollution Prevention Measures

1. Before, during and after construction, functional erosion and sedimentation controls shall be implemented to prevent the silting of abutting, down-gradient properties and roads. Siltation 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 landscaping 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 2 horizontal to 1 vertical.

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 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 Department of Public Works 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, the Stormceptor treatment tanks, 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 and access driveway adjacent to the site will be swept or scraped weekly, or as needed, 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 structural controls.

- **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 |
|---|---|---|---|---|---|
| | | | | | |
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| | | | | | |

**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? |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
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**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: Bernardi Toyota, 1624 Worcester 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:

- Lime (trucked onto the site for soil stabilization purposes)
- 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: PERMIT REQUIREMENTS*

# *APPENDIX B: EPA NOTICES*

## *Notice of Intent (NOI)*

## *Notice of Termination (NOT)*

# *APPENDIX C: 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 9: STORMWATER MANAGEMENT STANDARD 7

# Chapter 9:

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

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

# CHAPTER 10: STORMWATER MANAGEMENT STANDARD 8

# Chapter 10:

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

- The Stormwater Pollution Prevention Plan is included in Chapter 8 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 11: OPERATION AND MAINTENANCE PLAN STORMWATER MANAGEMENT STANDARD 9

# Stormwater Operation and Maintenance Plan
## 71 Bishop Street, Framingham MA
## Prepared By: MetroWest Engineering Inc.
## Prepared For: Herb Chambers Companies

### General

The project site is located on the easterly side of Bishop Street in Framingham, Massachusetts. The property is bounded on the west by Bishop Street, northerly by Lawrence Street, easterly by the M.B.T.A. commuter rail line and southerly by a discontinued portion of Clark Street.

The project site is shown on Framingham Assessors Map 84, Block 165, Lot 4 and has an area of approximately 273,206 square feet (6.27 acres). An existing 88,116 square foot warehouse building occupies the westerly portion of the site. The central portion of the site was formerly occupied by a warehouse/manufacturing building and is currently paved. The easterly portion of the site is not paved with sparse tree and vegetation cover. Total proposed impervious area on the site, including pavement is approximately 250,054 square feet. Existing topography slopes gently from northwest to southeast across the site with approximately 5-feet of vertical relief across the site.

### Resource Areas

There are no wetland resource areas protected by the Massachusetts Wetlands Protection Act on or adjacent to the project site. An isolated wetland is located off property to the east.

### Drainage Approach

There is presently a stormwater management system on site to handle runoff from the roof of the existing building and a portion of the impervious surfaces. The site drains into the municipal storm drain system with connection to the system located along Clark Street and Lawrence Street.

A stormwater management system is designed for the site that will reduce runoff rates from the project site but will increase volumes from the project site in the post-development condition. Furthermore, all storm water runoff from paved parking areas will be directed into the existing street drainage system will be pretreated in Stormceptor™ manhole units.

### 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 property owner shall be responsible for all maintenance and repair activities throughout the site relating to the grounds, pavement surface, stormwater collection system and subsurface infiltration systems. Contact information for the owner/responsible party is listed below:

Owner/Responsible Party
Herb Chambers Companies
259 McGrath Highway
Somerville, MA 02143

Peter O'Callaghan – Director of Construction and Facilities (617) 666-8333
Email: pocallaghan@herbchambers.com

If ownership of the subject property changes, the new owner shall become the responsible party. This Operation and Maintenance Plan shall run with the land.

The owner/responsible party shall be responsible for the implementation of this Operation and Maintenance Plan and the proper training of employees to ensure compliance with all daily and long term aspects of the plan.

## Required Maintenance

*Grounds*

All slopes shall be inspected and any exposed areas or other locations susceptible to erosion shall be stabilized with mulch, sod, seed, stone or other suitable measures. All litter and trash shall be picked up and removed from all paved, landscaped and wooded areas on a regular basis. 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.

Fertilizers and pesticides shall be applied in accordance with manufacturer's instructions and all applicable local and state regulations. They shall be applied sparingly by trained personnel.

*BMP1 - Parking Lot*

The driveway and parking areas shall be vacuum-swept at least four times per year to remove sediments. One cleaning shall be performed during the mid-winter period of late January to early February, and another cleaning shall be performed in the spring during April or May. All sediment removed shall be disposed of in accordance with DEP policy and requirements for the disposal of road sediments.

During winter months the use of de-icing compounds shall be kept to a minimum. Untreated sand shall be used to the minimum extent necessary to provide for tire traction. During extreme events sand treated with a non-sodium de-icer may be used.

*BMP 2 - Catch Basins*

All catch basins shall include a deep sump and an MDC type oil/water separation hood. Catch basin sumps shall be cleaned and inspected twice per year, once in the spring and again in the fall. Catch basins may be cleaned with either clamshell bucket or by vacuum truck. Pipe inlets, outlets and MDC hoods shall be inspected at the time of the sump cleaning and shall be immediately repaired as necessary. All sediment removed shall be disposed of in accordance with DEP policy and requirements for the disposal of road sediments.

*BMP 3 - Stormceptor Model 450i & 900 Treatment Systems*

The Stormceptor Models 450i and 900 systems shall be cleaned a minimum of once per year. Additionally, the depth of sediment in the sumps of the units shall be measured quarterly. Additional cleaning shall commence when the depth of sediment in the sump reaches 8-inches or when oil is observed in the sump of the unit. A vacuum truck shall remove sediment and oil from the sump and dispose of the sediment in accordance with the current standards and requirements of the MADEP. Refer to the attached maintenance procedures provided by Rinker Industries.

*BMP 4 - Stormwater Retention System*

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

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

*Snow Removal*

There shall be no storage or stockpiling of snow within any wetland resource areas on or abutting the project site. Parking lot de-icing materials shall be stored inside the building or a location that is protected from precipitation and wind. De-icing material shall consist of sand mixed with a non-sodium based de-icing agent. Snow shall be removed from all drain inlets immediately after a snow event to prevent the accumulation of ice in parking lot areas.

*Storage and Use of Chemicals*

Chemical storage on the site shall be limited and all chemicals stored on site shall be done in accordance with the manufacturer's recommendations and all applicable local and state regulations.

*Hazardous Waste*

All hazardous waste materials shall be stored and disposed of in accordance with all applicable local and state regulations. In the event of an accident or spill involving and/or other hazardous materials the facilities manager shall contact a hazardous waste removal contractor and immediately notify local and state regulatory agencies.

There shall be no illicit discharges into the stormwater management system.

*Waste Storage and Handling*

All waste material shall be stored in a covered metal dumpster provided by a solid waste management company licensed in the Town of Framingham and the Commonwealth of Massachusetts. The dumpster shall be emptied on a regular basis or when full. Loose trash around the site and near the dumpster shall be picked up on a weekly basis.

## Recommended Personnel

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

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

## Record Keeping

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

## Emergency Contacts

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

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

*Town of Framingham Conservation Commission*
*(508) 532-5460*

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

*Massachusetts Department of Environmental Protection*
*(617) 654-6500*

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

**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 |
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**Comments and Stabilization Required:**

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

**Form 2** - *INSPECTION FORM FOR DRAIN CATCH BASIN* – **Ongoing Maintenance**

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

| Structure Number | Rim Elev. | Sediment Depth | Condition | Date and Description of Cleaning |
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**Comments and Maintenance Required:**

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

**Form 3** - *INSPECTION FORM FOR STORMCEPTOR INLINEUNIT*
**StormCeptor STC-900 (D.M.H. 2) Ongoing Maintenance**

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

| Structure Number | Rim Elev. | Sediment Depth | Condition | Date and Description of Cleaning |
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**Comments and Maintenance Required:**

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

**Form 4** - *INSPECTION FORM FOR STORMCEPTOR INLINE UNIT*
**StormCeptor STC-900 (D.M.H. 5) Ongoing Maintenance**

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

| Structure Number | Rim Elev. | Sediment Depth | Condition | Date and Description of Cleaning |
|---|---|---|---|---|
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**To be performed by:**_____ **On or Before:** _____

**Form 5** - *INSPECTION FORM FOR STORMCEPTOR INLINE UNIT*
**StormCeptor STC-900 (D.M.H. 8) Ongoing Maintenance**

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

| Structure Number | Rim Elev. | Sediment Depth | Condition | Date and Description of Cleaning |
|---|---|---|---|---|
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**Comments and Maintenance Required:**

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

**Form 6** - *INSPECTION FORM FOR STORMCEPTOR INLINE UNIT*
**StormCeptor STC-900 (D.M.H. 9) Ongoing Maintenance**

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

| Structure Number | Rim Elev. | Sediment Depth | Condition | Date and Description of Cleaning |
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**Comments and Maintenance Required:**

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

**Form 7** - *INSPECTION FORM FOR STORMCEPTOR INLINE UNIT*
**StormCeptor STC-900 (D.M.H. 12) Ongoing Maintenance**

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

| Structure Number | Rim Elev. | Sediment Depth | Condition | Date and Description of Cleaning |
|---|---|---|---|---|
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**Comments and Maintenance Required:**

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

**Form 8** - *INSPECTION FORM FOR STORMWATER RETENTION SYSTEM*

**Ongoing Maintenance**

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

| Rim Location | Rim Elev. | Sediment Depth | Condition | Date and Description of Cleaning |
|---|---|---|---|---|
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**Comments and Maintenance Required:**

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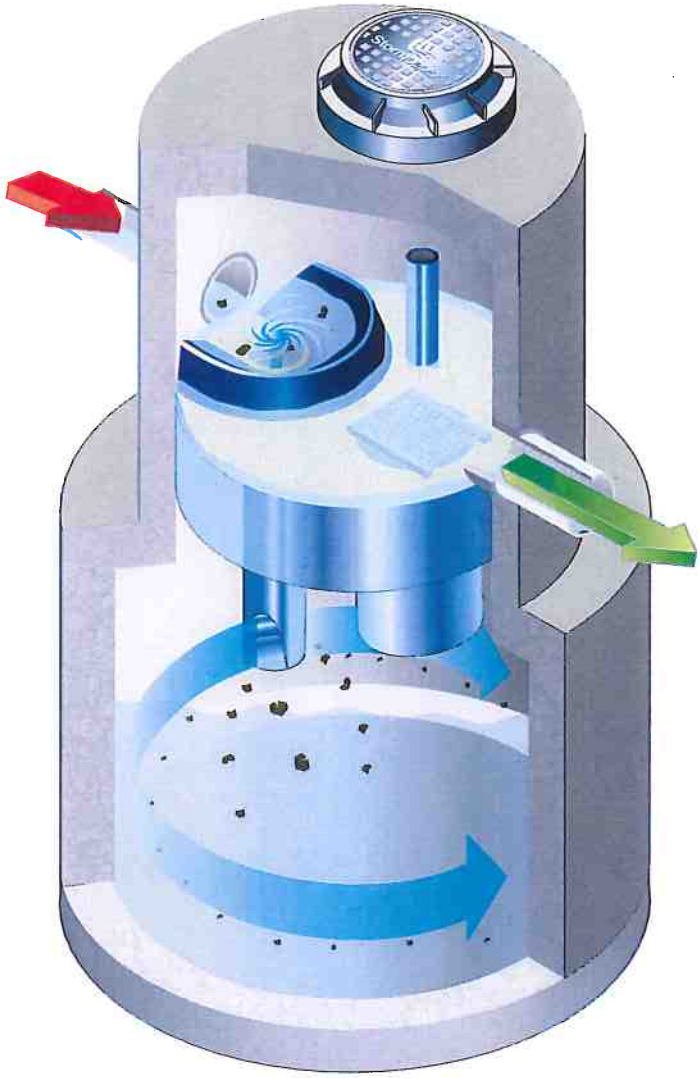
_____

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

# Stormceptor®

# Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,175,277
Canadian Patent No. 2,180,305
Canadian Patent No. 2,180,338
Canadian Patent No. 2,206,338
Canadian Patent No. 2,327,768
U.S. Patent No. 5,753,115
U.S. Patent No. 5,849,181
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 707,133
Australia Patent No. 729,096
Australia Patent No. 779,401
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Indonesia Patent No. 0007058
Japan Patent No. 3581233
Japan Patent No. 9-11476
Korean Patent No. 0519212
Malaysia Patent No. 118987
New Zealand Patent No. 314,646
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Other Patents Pending

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1 – Stormceptor Overview

2 – Stormceptor Operation & Components

3 – Stormceptor Identification

4 – Stormceptor Inspection & Maintenance
    Recommended Stormceptor Inspection Procedure
    Recommended Stormceptor Maintenance Procedure

5 – Contact Information (Stormceptor Licensees)

Congratulations!

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a "Hydrodynamic Separator (HDS)" or an "Oil Grit Separator (OGS)", engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

## 1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

**Key benefits of Stormceptor include:**

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- "STORMCEPTOR" is *clearly* marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

**Model Types:**

- STC (Standard)
- STF (Fiberglass)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

**Configuration Types:**

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site's tailwater conditions)
- Series Unit (combines treatment in two systems)

## Please Maintain Your Stormceptor

To ensure long-term environmental protection through continued performance as originally designed for your site, **Stormceptor must be maintained**, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call your local Stormceptor Licensee or Imbrium® Systems.

## 2 – Stormceptor Operation & Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology.

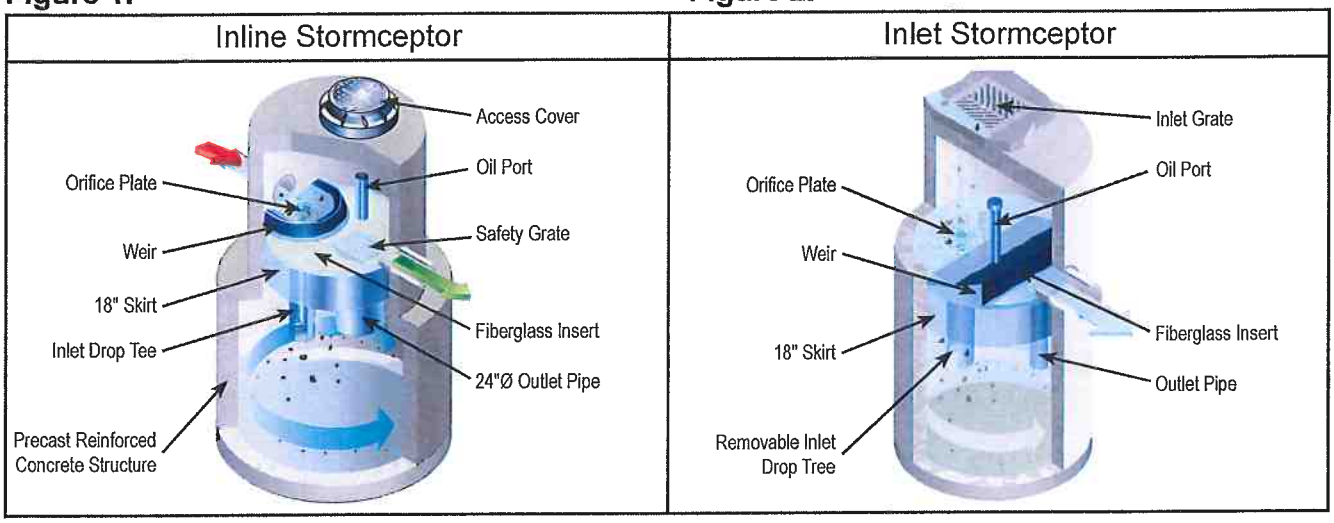
Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

### *Stormceptor Schematic and Component Functions*

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

**Figure 1.** **Figure 2.**




- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

## 3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS, MAX and STF) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/ approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using **Table 1**.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Stormceptor Representative for assistance.

***Sizes/Models***

Typical general dimensions and capacities of the standard precast STC, EOS & OSR Stormceptor models in both USA and Canada/International (excluding South East Asia and Australia) are provided in **Tables 1 and 2**. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

**Table 1A. (US) Stormceptor Dimensions – Insert to Base of Structure**

| STC Model | Insert to Base (in.) | EOS Model | Insert to Base (in.) | OSR Model | Insert to Base (in.) | Typical STF m (in.) |
|---|---|---|---|---|---|---|
| 450 | 60 | 4-175 | 60 | 65 | 60 | 1.5 (60) |
| 900 | 55 | 9-365 | 55 | 140 | 55 | 1.5 (61) |
| 1200 | 71 | 12-590 | 71 | | | 1.8 (73) |
| 1800 | 105 | 18-1000 | 105 | | | 2.9 (115) |
| 2400 | 94 | 24-1400 | 94 | 250 | 94 | 2.3 (89) |
| 3600 | 134 | 36-1700 | 134 | | | 3.2 (127) |
| 4800 | 128 | 48-2000 | 128 | 390 | 128 | 2.9 (113) |
| 6000 | 150 | 60-2500 | 150 | | | 3.5 (138) |
| 7200 | 134 | 72-3400 | 134 | 560 | 134 | 3.3 (128) |
| 11000* | 128 | 110-5000* | 128 | 780* | 128 | |
| 13000* | 150 | 130-6000* | 150 | | | |
| 16000* | 134 | 160-7800* | 134 | 1125* | 134 | |

*Notes:*

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

## Table 1B. (CA & Int'l) Stormceptor Dimensions – Insert to Base of Structure

| STC Model | Insert to Base (m) | EOS Model | Insert to Base (m) | OSR Model | Insert to Base (m) | Typical STF m (in.) |
|---|---|---|---|---|---|---|
| 300 | 1.5 | 300 | 1.5 | 300 | 1.7 | 1.5 (60) |
| 750 | 1.5 | 750 | 1.5 | 750 | 1.6 | 1.5 (61) |
| 1000 | 1.8 | 1000 | 1.8 | | | 1.8 (73) |
| 1500 | 2.8 | | | | | 2.9 (115) |
| 2000 | 2.8 | 2000 | 2.8 | 2000 | 2.6 | 2.3 (89) |
| 3000 | 3.7 | 3000 | 3.7 | | | 3.2 (127) |
| 4000 | 3.4 | 4000 | 3.4 | 4000 | 3.6 | 2.9 (113) |
| 5000 | 4.0 | 5000 | 4.0 | | | 3.5 (138) |
| 6000 | 3.7 | 6000 | 3.7 | 6000 | 3.7 | 3.3 (128) |
| 9000* | 3.4 | 9000* | 3.4 | 9000* | 3.6 | |
| 11000* | 4.0 | 10000* | 4.0 | | | |
| 14000* | 3.7 | 14000* | 3.7 | 14000* | 3.7 | |

*Notes:*

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

## Table 2A. (US) Storage Capacities

| **STC Model** | Hydrocarbon Storage Capacity gal | Sediment Capacity $ft^3$ | **EOS Model** | Hydrocarbon Storage Capacity gal | **OSR Model** | Hydrocarbon Storage Capacity gal | Sediment Capacity $ft^3$ |
|---|---|---|---|---|---|---|---|
| **450** | 86 | 46 | **4-175** | 175 | **065** | 115 | 46 |
| **900** | 251 | 89 | **9-365** | 365 | **140** | 233 | 58 |
| **1200** | 251 | 127 | **12-590** | 591 | | | |
| **1800** | 251 | 207 | **18-1000** | 1198 | | | |
| **2400** | 840 | 205 | **24-1400** | 1457 | **250** | 792 | 156 |
| **3600** | 840 | 373 | **36-1700** | 1773 | | | |
| **4800** | 909 | 543 | **48-2000** | 2005 | **390** | 1233 | 465 |
| **6000** | 909 | 687 | **60-2500** | 2514 | | | |
| **7200** | 1059 | 839 | **72-3400** | 3418 | **560** | 1384 | 690 |
| **11000*** | 2797 | 1089 | **110-5000*** | 5023 | **780*** | 2430 | 930 |
| **13000*** | 2797 | 1374 | **130-6000*** | 6041 | | | |
| **16000*** | 3055 | 1677 | **160-7800*** | 7850 | **1125*** | 2689 | 1378 |

*Notes:*

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

## Table 2B. (CA & Int'l) Storage Capacities

| STC Model | Hydrocarbon Storage Capacity L | Sediment Capacity L | EOS Model | Hydrocarbon Storage Capacity L | OSR Model | Hydrocarbon Storage Capacity L | Sediment Capacity L |
|---|---|---|---|---|---|---|---|
| **300** | 300 | 1450 | **300** | 662 | **300** | 300 | 1500 |
| **750** | 915 | 3000 | **750** | 1380 | **750** | 900 | 3000 |
| **1000** | 915 | 3800 | **1000** | 2235 | | | |
| **1500** | 915 | 6205 | | | | | |
| **2000** | 2890 | 7700 | **2000** | 5515 | **2000** | 2790 | 7700 |
| **3000** | 2890 | 11965 | **3000** | 6710 | | | |
| **4000** | 3360 | 16490 | **4000** | 7585 | **4000** | 4700 | 22200 |
| **5000** | 3360 | 20940 | **5000** | 9515 | | | |
| **6000** | 3930 | 26945 | **6000** | 12940 | **6000** | 5200 | 26900 |
| **9000*** | 10555 | 32980 | **9000*** | 19010 | **9000*** | 9300 | 33000 |
| **11000*** | 10555 | 37415 | **10000*** | 22865 | | | |
| **14000*** | 11700 | 53890 | **14000*** | 29715 | **14000*** | 10500 | 53900 |

*Notes:*

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

## 4 – Stormceptor Inspection & Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

### *When is inspection needed?*

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

### *When is maintenance cleaning needed?*

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see **Table 2**). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.

- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

***What conditions can compromise Stormceptor performance?***

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in **Table 2**, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

***What training is required?***

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. For typical inspection and maintenance activities, no specific supplemental training is required for the Stormceptor. Information provided within this Manual (provided to the site owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

***What equipment is typically required for inspection?***

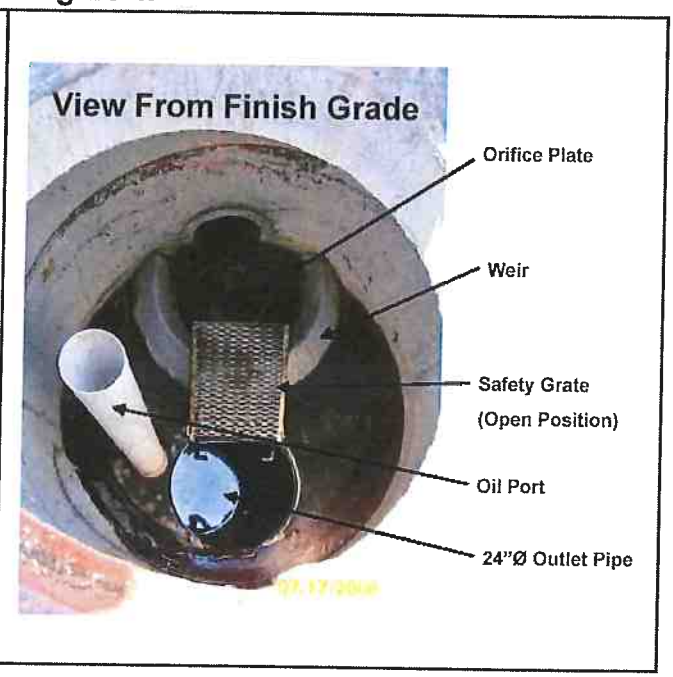
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

**Recommended Stormceptor Inspection Procedure:**

- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch (100 mm) or 6-inch (150 mm) diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch (610 mm) diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

**Figure 3.**

**Figure 4.**




***What equipment is typically required for maintenance?***

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required

## Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck.

No entry into the unit is required for maintenance. ***DO NOT ENTER THE STORMCEPTOR CHAMBER*** unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146 or Canada Occupational Safety and Health Regulations – SOR/86-304). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local, provincial, and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
    - For 6-ft (1800 mm) diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch (610 mm) outlet riser pipe.
    - For 4-ft (1200 mm) diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch (305 mm) drop tee hole.

**Figure 5.**

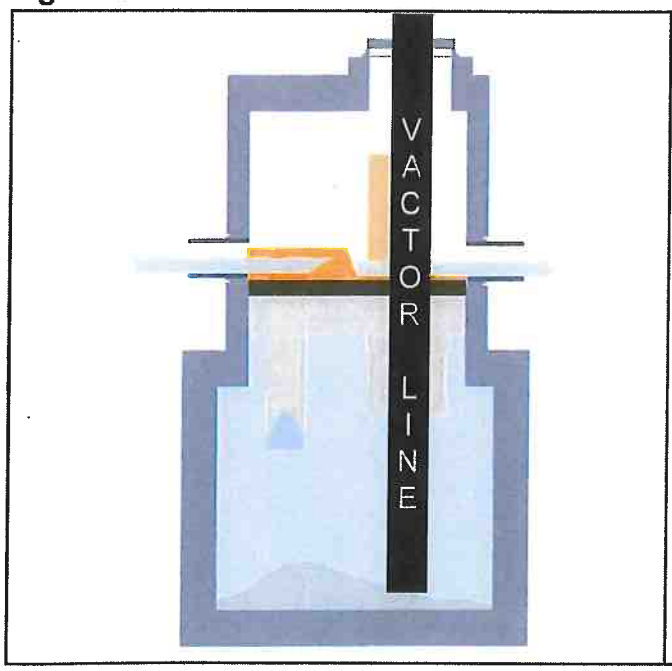
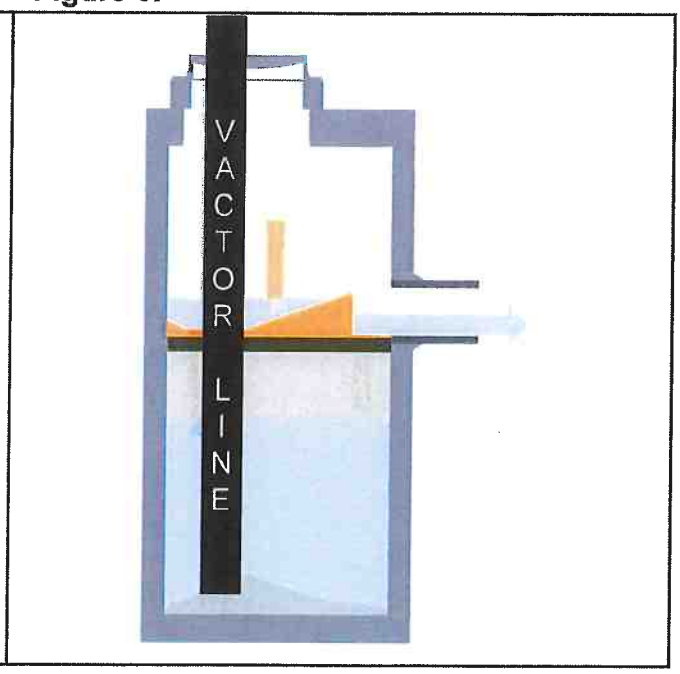


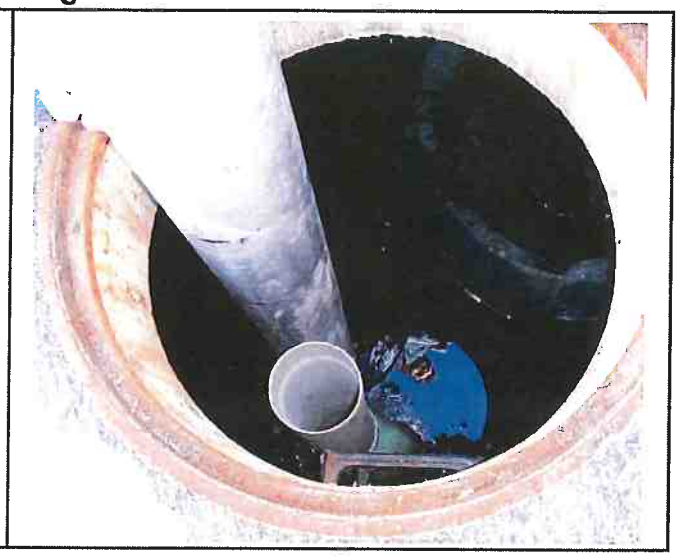

**Figure 6.**



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

**Figure 7.**

**Figure 8.**



*A maintenance worker stationed at the above ground surface uses a vacuum hose to evacuate water, sediment, and debris from the system.*

### *What is required for proper disposal?*

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

### *What about oil spills?*

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

### *What if I see an oil rainbow or sheen at the Stormceptor outlet?*

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at

very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean that the unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

***What factors affect the costs involved with inspection/maintenance?***

The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

***What factors predict maintenance frequency?***

Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in **Table 3** based on the unit size.

**Table 3A. (US) Recommended Sediment Depths Indicating Maintenance**

| **STC Model** | Maintenance Sediment depth (in) | **EOS Model** | Maintenance Sediment depth (in) | Oil Storage Depth (in) | **OSR Model** | Maintenance Sediment depth (in) |
|---|---|---|---|---|---|---|
| **450** | 8 | **4-175** | 9 | 24 | **065** | 8 |
| **900** | 8 | **9-365** | 9 | 24 | **140** | 8 |
| **1200** | 10 | **12-590** | 11 | 39 | | |
| **1800** | 15 | | | | | |
| **2400** | 12 | **24-1400** | 14 | 68 | **250** | 12 |
| **3600** | 17 | **36-1700** | 19 | 79 | | |
| **4800** | 15 | **48-2000** | 16 | 68 | **390** | 17 |
| **6000** | 18 | **60-2500** | 20 | 79 | | |
| **7200** | 15 | **72-3400** | 17 | 79 | **560** | 17 |
| **11000*** | 17 | **110-5000*** | 16 | 68 | **780*** | 17 |
| **13000*** | 20 | **130-6000*** | 20 | 79 | | |
| **16000*** | 17 | **160-7800*** | 17 | 79 | **1125*** | 17 |

*Note:*

1. *The values above are for typical standard units.*

**Per structure.*

## Table 3B. (CA & Int'l) Recommended Sediment Depths Indicating Maintenance

| STC Model | Maintenance Sediment depth (mm) | EOS Model | Maintenance Sediment depth (mm) | Oil Storage Depth (mm) | OSR Model | Maintenance Sediment depth (mm) |
|---|---|---|---|---|---|---|
| **300** | 225 | **300** | 225 | 610 | **300** | 200 |
| **750** | 230 | **750** | 230 | 610 | **750** | 200 |
| **1000** | 275 | **1000** | 275 | 990 | | |
| **1500** | 400 | | | | | |
| **2000** | 350 | **2000** | 350 | 1727 | **2000** | 300 |
| **3000** | 475 | **3000** | 475 | 2006 | | |
| **4000** | 400 | **4000** | 400 | 1727 | **4000** | 375 |
| **5000** | 500 | **5000** | 500 | 2006 | | |
| **6000** | 425 | **6000** | 425 | 2006 | **6000** | 375 |
| **9000*** | 400 | **9000*** | 400 | 1727 | **9000*** | 425 |
| **11000*** | 500 | **10000*** | 500 | 2006 | | |
| **14000*** | 425 | **14000*** | 425 | 2006 | **14000*** | 425 |

*Note:*

1. *The values above are for typical standard units.*

   **Per structure.*

### *Replacement parts*

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Stormceptor Representative, or Imbrium Systems.

**The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.**

**Stormceptor Inspection and Maintenance Log**

Stormceptor Model No: _____

Allowable Sediment Depth: _____

Serial Number: _____

Installation Date: _____

Location Description of Unit: _____

Other Comments: _____

## Contact Information

Questions regarding the Stormceptor can be addressed by contacting your area Stormceptor Licensee, Imbrium Systems, or visit our website at www.stormceptor.com.

**Stormceptor Licensees:**

**CANADA**

| | |
|---|---|
| Lafarge Canada Inc. | |
| www.lafargepipe.com | |
| 403-292-9502 / 1-888-422-4022 | Calgary, AB |
| 780-468-5910 | Edmonton, AB |
| 204-958-6348 | Winnipeg, MB, NW. ON, SK |
| | |
| Langley Concrete Group | |
| www.langleyconcretegroup.com | |
| 604-502-5236 | BC |
| | |
| Hanson Pipe & Precast Inc. | |
| www.hansonpipeandprecast.com | |
| 519-622-7574 / 1-888-888-3222 | ON |
| | |
| Lécuyer et Fils Ltée. | |
| www.lecuyerbeton.com | |
| 450-454-3928 / 1-800-561-0970 | QC |
| | |
| Strescon Limited | |
| www.strescon.com | |
| 902-494-7400 | NS, NF |
| 506-633-8877 | NB, PE |

**UNITED STATES**

Rinker Materials
www.rinkerstormceptor.com
1-800-909-7763

**AUSTRALIA & SOUTHEAST ASIA, including New Zealand & Japan**

Humes Water Solutions
www.humes.com.au
+61 7 3364 2894

**Imbrium Systems Inc. & Imbrium Systems LLC**

| | |
|---|---|
| Canada | 1-416-960-9900 / 1-800-565-4801 |
| United States | 1-301-279-8827 / 1-888-279-8826 |
| International | +1-416-960-9900 / +1-301-279-8827 |
| Email | info@imbriumsystems.com |

www.imbriumsystems.com
www.stormceptor.com

# CHAPTER 12: STORMWATER MANAGEMENT STANDARD 10

## Chapter 12:

### Standard 10: Prohibition of Illicit Discharges

- The Long Term Pollution Prevention Plan includes the required measures to prevent the illicit discharges.
- All Catch basins and drain inlets shall be labeled with signage to prohibit the release of any illicit substance into the drainage system.
- No floor drains will be connected to the drainage system.
- No washing of vehicles shall be permitted outside the building
- All operations and managers of the facility will be provided with training and education concerning the danger of illicit discharges into the drainage system.

### 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 the proposed Herb Chambers sales and service facility located at 71 Bishop Street 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