

## Post Construction Stormwater Management/Site Restoration Plans Narrative

### Atlantic Sunrise Project Phase 2

Zick Meter Station  
Lenox Township  
Susquehanna County  
Pennsylvania

Prepared For:



**Transcontinental Gas Pipe Line Company, LLC**

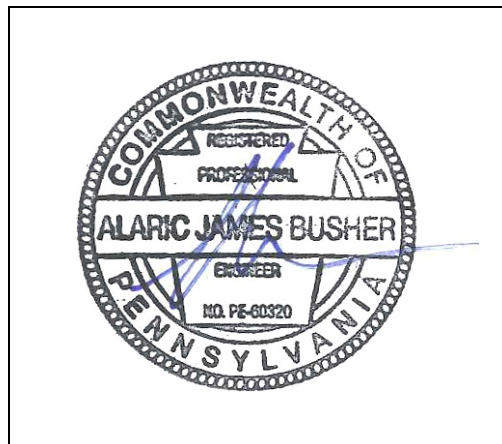
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BL Project No. 14C4909

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(USDA) Natural Resources Conservation  
Service (NRCS) Custom Soil Resource Report

## **1.0 GENERAL INFORMATION**

The following narrative was prepared as a supplement to the Transcontinental Gas Pipe Line Company, LLC.'s (Transco's) Environmental Construction Plan (ECP) provided in Section 4 of the Erosion and Sediment Control General Permit 2 (ESCGP-2) Notice of Intent (NOI), which was prepared for the Atlantic Sunrise Project ("Project"). This PCSM/SR narrative is intended to describe the post construction stormwater management/site restoration (PCSM/SR) design for the Zick Meter Station ("Site") to be constructed as part of the Project, within Lenox Township, Susquehanna County, Pennsylvania. Similar narratives were prepared, under separate cover, for facilities in other affected counties, as well as for the pipeline construction.

The facility proposed to be constructed as part of Phase 2 of the Atlantic Sunrise Project in Susquehanna County is the following:

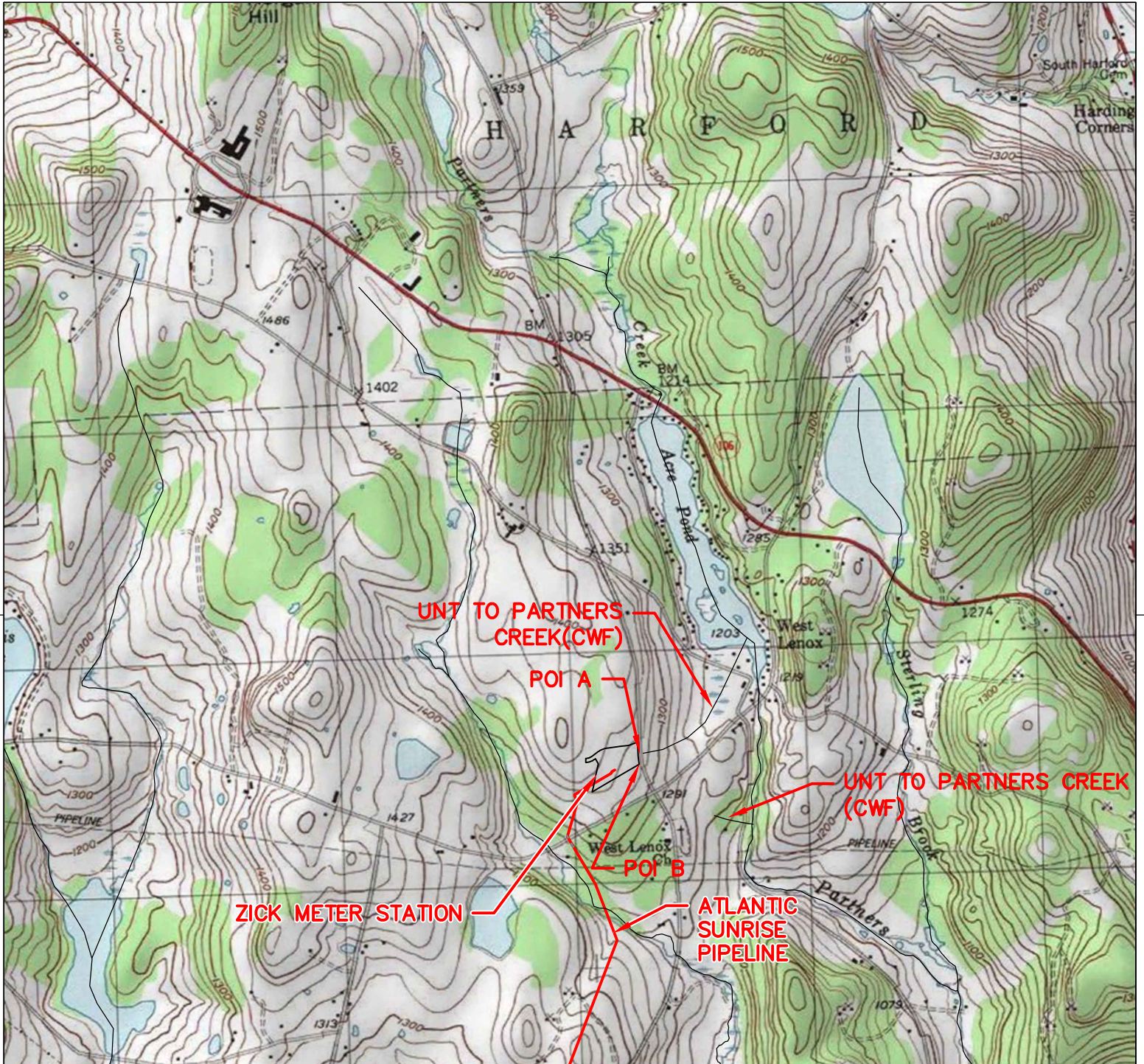
Facility Name	Facility Description	Facility Coordinates
Zick Meter Station	Meter Station	N41°42'57.97", W75°42'25.30"

The Zick Meter Station will be approximately 5.22 acres in area including a 176 linear foot new gravel access road, 65,444 square feet (1.50 acre) of new gravel pad, 1,203 square feet (0.03 acre) of new buildings, totaling 66,647 square feet (1.53 acre) of impervious area. The Site will utilize existing public and private roads for access to the Site during and after construction. PCSM/SR Best Management Practices (BMPs), in accordance with the standards and specifications in the Pennsylvania Department of Environmental Protection's (PADEP's) "Pennsylvania Stormwater Best Management Practices Manual", Technical Guidance No. 363-300-002, as amended and "Erosion and Sediment Pollution Control (E&S) Program Manual," Technical Guidance No. 363-2134-008, as amended and updated (E&S Manual) will be implemented to minimize and/or avoid potential adverse environmental impacts due to the construction, operation and maintenance activities associated with the Site. The proposed practices are designed to maximize volume reduction technologies, eliminate or minimize point source discharges to surface waters, preserve the integrity of stream channels, and protect the physical, biological, and chemical qualities of the receiving surface water. The intent is to keep the post construction runoff rate no greater than the pre-construction conditions while maintaining water quality. Impervious areas, land clearing and soil compaction are minimized and natural drainage features and vegetation are protected wherever possible. E&SC and PCSM BMP measures will be installed and maintained as needed to control stormwater movement in the Site area.

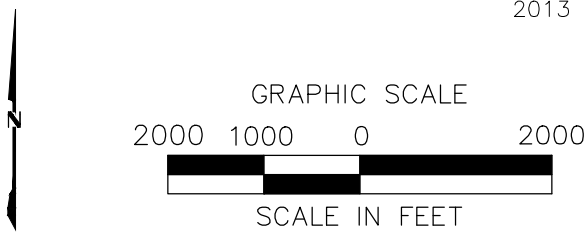
Refer to the ECP (**Section 4 of the ESCGP-2 NOI**) for overall Project information.

There are no impacts to regulated wetlands associated with this proposed Site. Refer to the Wetland Delineation Report provided in **Section 5 of the ESCGP-2 NOI** for information supporting wetland mapping as shown on the Erosion and Sediment Control (E&SC) Plans (**Section 2 of the ESCGP-2 NOI**).


**1.1 Location Map**



2013 USGS LENOXVILLE QUADRANGLE

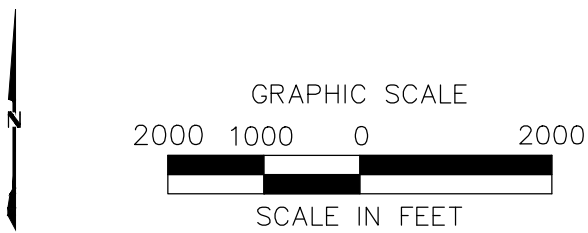


**ATLANTIC SUNRISE PROJECT**  
**ZICK METER STATION**  
LOCATION MAP  
LENOX TOWNSHIP  
SUSQUEHANNA COUNTY, PENNSYLVANIA




NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.	DRAWN BY:	DATE:	ISSUED FOR BID:	SCALE:
0	08-28-15	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	1161483	SMK		JEC	04/24/17		1"=2,000'
1	12-02-15	BL	ISSUED FOR PADEP RESUBMITTAL	<b>1161483</b>	AJB					
2	09-01-16	BL	MOD 1 ISSUED FOR PADEP SUBMITTAL	1161481	AJB		AOE	04/24/17	ISSUED FOR CONSTRUCTION:	
3	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	1161481	AJB		AJB	04/24/17	DRAWING NUMBER:	ZICK MS LOCATION
4	Apr. 2017	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #2	1161481	AJB					SHEET 1 OF 1





**ATLANTIC SUNRISE PROJECT**  
**ZICK METER STATION**  
AERIAL LOCATION MAP  
LENOX TOWNSHIP  
SUSQUEHANNA COUNTY, PENNSYLVANIA



NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.	DRAWN BY:	JEC	DATE: 04/03/15	ISSUED FOR BID:	SCALE: 1"=2,000'
0	08-28-15	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	1161483	SMK		CHECKED BY:	AOE	DATE: 04/03/15	ISSUED FOR CONSTRUCTION:	
1	12-02-15	BL	ISSUED FOR PADEP RESUBMITTAL	<b>1161483</b>	AJB		APPROVED BY:	AJB	DATE: 04/03/15	DRAWING NUMBER:	ZICK MS LOCATION
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4	Apr. 2017	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #2	1161481	AJB						OF 1



## 1.2 Soil Characteristics

In addition to the below use limitations and resolutions, refer to Appendix C for the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Custom Soil Resource Report for the Site.

### Soil Type and Use Limitations

Map Symbol	Soil Name	Slope	Cut Banks Cave	Corrosive to Concrete or Steel	Droughty	Easily Erodeable	Flooding	High Water Table	Hydric/Hydric Inclusions	Low Strength	Slow Percolation	Piping	Poor Source of Topsoil	Frost Action	Shrink-Swell	Potential Sinkhole	Ponding	Wetness
LsD	Lordstown and Oquaga very stony silt loams	12-30%	X	C/S		X	X	X	X	X	X	X		X	X			X
MgB	Mardin channery silt loam, very stony	0-8%	X	S	X	X		X	X	X	X	X		X				X
MoB2	Morris channery silt loam, moderately eroded	3-8%	X	C/S	X	X		X	X	X	X		X	X				X
WeB2	Wellsboro channery silt loam, moderately eroded	3-8%	X	C/S	X	X		X	X	X	X	X		X				X
WIB2	Wellsboro flaggy silt loam, moderately eroded	3-8%	X	C/S	X	X		X	X	X	X	X		X				X
WIC2	Wellsboro flaggy silt loam, moderately eroded	8-15%	X	C/S	X	X		X	X	X	X	X		X				X

Source: Appendix E, Table E-1, PADEP, *Erosion and Sediment Pollution Control (E&S) Program Manual* Technical Guidance Number 363-2134-008.

### Soil Use Limitations Resolutions

Limitation	Resolution
Cut Banks Cave	Excavations will be properly supported by sheeting and shoring to prevent caves.
Corrosive to Concrete or Steel	No concrete or steel piping is proposed without appropriate coatings and protection.
Droughty	Existing suitable topsoil and soil amendments will be used during construction.
Easily Erodible	Temporary and permanent erosion control BMPs will be employed throughout the Site.
Flooding	Ensure that the Site has proper drainage.
High Water Table	A geotechnical investigation was conducted to minimize conflicts with saturated zones.
Hydric/Hydric Inclusions	A wetland investigation was completed to determine no wetlands are present in the development area.
Low Strength	A maximum of 3:1 slopes are proposed.
Slow Percolation	A field investigation of percolation rates at the infiltration areas was performed to verify the soils percolation capacity.
Piping	Watertight pipe, antiseep collars, clay cores through basin berms, and concrete endwalls will be used to minimize the danger of piping.
Poor Source of Topsoil	Existing topsoil, which has proven to be suitable, will be reused on the Site.
Frost Action	Pavement subbase will be provided to minimize frost effects.
Shrink-Swell	Stone base will be provided to prevent shrink-swell from effecting pavement.
Potential Sinkhole	Geotechnical engineer of record recommendations will be followed for any potential occurrences.
Ponding	Surface grading and drainage facilities will be provided to minimize ponding affects.
Wetness	Wet weather construction recommendations, per the geotechnical engineer's recommendations, will be employed to minimize the effects of wetness during construction, surface grading. Surface grading and drainage will be provided to minimize wetness affects after construction.

### 1.3 Earth Disturbance Activity Characterization

#### Proposed Improvements and Land Use

The proposed Zick Meter Station will be constructed in Lenox Township, Susquehanna County, Pennsylvania. Zick Meter Station will include the construction of a meter station. The earthmoving activity will involve the stripping and stockpiling of topsoil, Site grading, Site excavation, placement of fill, trenching and backfill, construction of equipment with gravel pad/parking lot, construction of a gravel access drive, construction of a stormwater management system, finish grading, and stabilization of disturbed surfaces. Approximately 65,444 square feet (1.50 acres) of additional gravel area and 1,203 square feet (0.03 acre) of new building will result on-site.

#### Present/Past Land Use

This section identifies the land requirements for construction and operation of the proposed CPL North, CPL South, and Associated Facilities. Table 1.3.1 summarizes the land requirements for the proposed Zick Meter Station associated with the CPL North and CPL South mainlines. Land uses remain similar over the past 50 years.

The characterization of land use within the proposed CPL North, CPL South, and Associated Facilities project areas is based on interpretation of aerial photographs taken in the spring of 2014 and information gathered from field surveys conducted during 2014 and 2015. Transco classified land uses within the proposed CPL North, CPL South, and Associated Facilities project areas into the following eight broad types:

- Agricultural Land – land associated with active cultivation of row and field crops; areas of grasses planted for livestock grazing or for the production of hay crops; orchards; and specialty crops, including vineyards, Christmas trees, and fruits and vegetables.
- Upland Forest/Woodland – includes upland deciduous forest, evergreen forest, and mixed (deciduous and evergreen) forest, but does not include forested wetlands.
- Industrial/Commercial Land – land used for mines or quarries and associated processing plants; manufacturing or other industrial facilities; and land developed for commercial or retail uses, including malls, strip plazas, business parks, and medical facilities.
- Transportation Land – land used for transportation purposes, including interstate highways; state, county, and local highways and roads; and railroad lines.

- Residential Land – residential areas, including yards of individual residences.
- Open Land – non-forested and undeveloped land not classified for another use, including land maintained as utility ROWs for overhead and underground electric transmission, natural gas transmission, and oil transmission facilities.
- Wetlands – includes wetlands covered with emergent, scrub-shrub, and forested vegetation.
- Open Water – include rivers, streams, creeks, canals, and other linear waterbodies, as well as lakes, ponds, and other non-flowing waterbodies.

New MLVs will be wholly located within the permanent ROWs for the proposed CPL North and CPL South mainlines. Construction will primarily occur within the proposed CPL North and CPL South construction ROWs.

**Table 1.3.1  
Land Requirements for the New Aboveground Facilities<sup>a</sup>**

Facility	Milepost	County	Agricultural Land (acres)		Upland Forest / Woodland (acres)		Open Land (acres)		Total (acres)	
			Cons	Op	Cons	Op	Cons	Op	Cons	Op
Zick Meter Station with pig launcher and receiver	CPL North 57.3	Susquehanna	9.1	4.1	0.0	0.0	0.0	0.0	9.1	4.1
<b>Zick Meter Station Subtotal</b>			<b>9.1</b>	<b>4.1</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>9.1</b>	<b>4.1</b>
Notes: <sup>a</sup> Land use acreages for construction and operation are provided for reference only. Acreages provided were calculated by using kmz files and prepared as part of the June 8, 2015 FERC Supplement. Refer to plans and ESCGP-2 NOI for actual site conditions.  Key: Cons = Construction L = Leidy Line system milepost Op = Operation										

Please refer to the PCSM/SR Plans and Detail Sheets, as provided in **Section 3 of the ESCGP-2 NOI**, and Section 1.2 and Appendix C of this PCSM/SR Narrative for information on the Site soils.

#### 1.4 Stormwater Management Calculation Methodology & Net Change in Volume and Rate of Runoff

Runoff volume and rate calculations have been performed for the Site are included in Appendix A.

Pre-development and post development runoff hydrographs were developed for the 1-, 2-, 10-, 25-, 50-, and 100-year storm events using the Soil Conservation Service's TR-55 Method. Given the shallow depth of limiting zones throughout the site (less than 24"), volume reduction cannot be met for POI B. Therefore, worksheets #12 and #13 were used to verify the PCSM BMP's will meet the pollutant loading reduction requirements. Additionally, an overall watershed analysis was performed to verify the 2 year volume increase from the site will not increase the volume at the nearest regulated water by more than 1%. Stormwater models were created using the Hydroflow Hydrographs Version 10.3 computer program produced by Autodesk. Stormwater conveyance calculations were performed using Worksheet 11 of the Pennsylvania Erosion and Sediment Pollution Control (E&S) Program Manual. (Analysis of rates and flows at each point of interest were completed to meet CG 1 Requirements.) National Oceanic Atmospheric Administration (NOAA) Atlas 14 rainfall intensities were used in the calculations. See Appendix A for calculations and results.

##### POI Summary:

POI A: Existing culvert across Russel Road

POI B: Low point at the southeastern corner of property

Overall Site: Partners Creek to Tunkhannock Creek Watershed

**Volume Summary Table**

	2- YR PRE (FT <sup>3</sup> )	2- YR POST (FT <sup>3</sup> )	2- YR VOLUME INCREASE (FT <sup>3</sup> )	2- YR STRUCTURAL AND NONSTRUCTURAL CREDITS (FT <sup>3</sup> )	DIFFERENCE (FT <sup>3</sup> )
POI A	1,176	523	(654)	-	(654)
POI B	15,881	20,537	4,655	3,369	1,287

\*See Appendix A for calculations. **Runoff Rate Summary Table**

STORM EVENT	POI A PRE-DEV PEAK FLOW (CFS)	POI A POST DEV PEAK FLOW (CFS)	POI A REDUCTION (CFS)	POI B PRE-DEV PEAK FLOW (CFS)	POI B POST DEV PEAK FLOW (CFS)	POI B REDUCTION (CFS)
1-yr	7.48	6.76	0.72	4.23	0.71	3.52
2-yr	11.15	10.13	1.02	6.30	1.05	5.25
5-yr	16.83	15.26	1.57	9.47	1.56	7.91
10-yr	21.98	19.96	2.02	12.45	2.03	10.42
25-yr	29.98	27.35	2.63	17.09	2.76	14.33
50-yr	37.36	34.18	3.18	21.38	3.47	17.92
100-yr	45.86	42.05	3.81	26.33	4.37	21.96

\*See Appendix A.1 for Pre-Development Calculations with Mapping and Appendix A.2 for Post Development Calculations with Mapping.

### Act 167 Summary

The Site is not located within a current, PADEP approved Act 167 Stormwater Management Watershed Plan. Therefore, the Site was designed to meet CG 1 requirements.

### **1.5 Surface Water Classification**

The PCSM/SR drawings in **Section 3 of the ESCGP-2 NOI** depict the locations of the streams and wetlands in and near the LOD for the Site. The Site area surface water runoff drains to UNT to Partners Creek at two different locations, which is not a High Quality (HQ) or Exceptional Value (EV) stream. The receiving waters are designated as Cold Water Fishery (CWF) under PA Code 25 Chapter 93. The Site's watershed is not listed as impaired in the PADEP Chapter 93 Integrated List.

### **1.6 BMP Description Narrative**

The structural PCSM BMPs listed below are to be used for this Site. The calculations used to design the PCSM BMPs are included in Appendix A. The locations of the PCSM

BMPs are shown on the PCSM/SR Plans and Detail Sheets (**Section 3 of the ESCGP-2 NOI**).

Vegetated Swales: A vegetated swale will be utilized to convey and treat stormwater runoff.

Rain Gardens: Rain Gardens will provide water quality benefits by reducing the phosphates, nitrates and suspended solids within the runoff leaving the site.

Disconnection from Storm Sewers: In order to enhance infiltration and pollutant removal, reduce stormwater runoff volume, slow runoff velocities, and reduce peak discharge rates, stormwater runoff from impervious areas will be directed to infiltration areas and vegetated swales. This will also reduce or eliminate the need for curbs, gutters, inlets, and storm sewers.

Soil Amendment and Restoration: Soil amendments shall be added to after construction in order to restore soil porosity and enhance water quality.

Reduce parking impervious area: Impervious parking areas will be minimized to the maximum extent practicable. All roads and pads will be gravel areas.

Landscape Restoration: Landscape restoration shall be installed after construction is complete to improve water quality and treat stormwater runoff.

## 1.7 BMP Installation Sequence Narrative

**\* indicates a critical stage of PCSM installation to be observed by a licensed professional or designee. Contractor to provide three working days' notice to Design Engineer.**

1. At least 7 days prior to starting any earth disturbance activities, including clearing and grubbing, the owner and/or operator shall invite all contractors, Environmental Inspectors, the landowner, appropriate municipal officials, the E&S plan preparer, the PCSM plan preparer, the licensed professional responsible for oversight of critical stages of implementation of the PCSM plan, and a representative from the local conservation district to an on-site preconstruction meeting.
2. At least 3 days prior to starting any earth disturbance activities, or expanding into an area previously unmarked, the Pennsylvania One Call System Inc. shall be notified at 1-800-242-1776 for the location of existing underground utilities.
3. Locate staging areas and access points including construction entrances. Field locate limits of disturbance.
4. Install rock construction entrances (RCEs).
5. Remove brush to effectively install perimeter controls, level side cuts to grant access for vehicles and workers to safely perform the installation of sediment barriers on the Site as shown on the construction drawings.
6. The Compliance Manager shall provide PADEP and CCD at least three days' notice prior to bulk earth disturbance and upon completed installation of perimeter erosion controls.
7. Utilize existing permanent access road.
8. **\* Install Sediment Trap with concrete riser, including clay core, antiseep collars, slope liners, cleanout stake, and associated improvements.**
9. **\* Install Vegetated Swale #1 and temporary swale #2.**
10. Proceed with major clearing and grubbing.
11. Begin construction staking for grading.

12. Begin grading and strip and stockpile topsoil within the meter station area and install sediment barriers around stockpiles.
13. Upon temporary cessation of an earth disturbance activity or any stage of an activity where the cessation of earth disturbance activities will exceed four days, the Site shall be immediately seeded, mulched, or otherwise protected from accelerated erosion and sedimentation pending future earth disturbance activities. For an earth disturbance activity or any stage of an activity to be considered temporarily stabilized, the disturbed areas shall be covered with one of the following: A minimum uniform coverage of mulch and seed, with a density capable of resisting accelerated erosion and sedimentation, or an acceptable BMP which temporarily minimizes accelerated erosion and sedimentation. Temporary stabilization will not occur on active vehicular travel ways within the ROW. The on-site environmental inspector will log daily activity within the LOD and notify the Contractor of areas requiring temporary stabilization (i.e., areas where work has ceased for at least four days).
14. Rough grade Site.
15. Grade the meter station pad as shown on the E&SC and PCSM/SR Plans (**Sections 2 and 3 of the ESCGP-2 NOI**).
16. Immediately stabilize side slopes with erosion control matting when slopes are 3:1 or greater. See PCSM/SR Plans and Detail Sheets, as provided in **Section 3 of the ESCGP-2 NOI**, (patterns differ by slope category). Install rip rap slope stabilization where shown on the PCSM/SR Plans.
17. Establish final grade.
18. Surface Stabilization, apply permanent stabilization measures immediately to any disturbed areas where work has reached final grade.
19. Upon completion of all earthwork activities and permanent stabilization of all disturbed areas, the Owner and/or Operators shall contact the local CCD for an inspection prior to the removal/conversion of the E&SC BMPs.
20. \* **Install rain gardens #1 and #2 with associated underdrains and engineered soil. Remove temporary swale #2. Convert sediment trap #1 to rain garden #3. Remove seal from orifice in outlet structure. Over excavate the bottom of all rain gardens for the installation of engineered soil and underdrain as identified on the PCSM Plans.**

21. After finish grading and topsoil placement is completed, disturbed areas shall be immediately fertilized, seeded, and mulched. Seed mixtures, fertilizer and mulch applications rates and dates shall conform to the tables provided on the PCSM/SR Plans and Detail Sheets (**Section 3 of the ESCGP-2 NOI**), land owner agreements and/or the **ECP (Section 4 of the ESCGP-2 NOI)**.
22. After seeding, fertilizing and mulching is complete, install ECBs as required or ordered or on slopes of 3:1 or greater.
23. After the Site is permanently stabilized and upon PADEP or local CCD and Owner approval of stabilization and re-vegetation, remove temporary erosion and sediment control measures and stabilize areas disturbed by removal.
24. **\* Complete Site stabilization, including soil amendment, seed application, ECB installing in basin, and mulching (Install composite filter sock at toe of slope in interior of rain gardens).**
25. Upon completion of all earth disturbance activities and permanent stabilization of all disturbed areas, the Owner and/or Operators shall contact the local CCD for a final inspection.
26. Maintain E&SC BMPs until Site work is complete and uniform 70% perennial vegetative cover is established.
27. Remove and properly dispose/recycle E&SC BMPs. Remove orange construction fence. Repair and permanently stabilize areas disturbed during E&SC BMP removal upon establishment of uniform 70% vegetative cover.

## 1.8 Supporting Calculations

Supporting calculations are included in Appendix A.

## 1.9 Plan Drawings

PCSM/SR Plans, including sensitive resource mapping, are included in **Section 3 of the ESCGP-2 NOI**.

## 1.10 Long Term Operation and Maintenance Schedule

### Monitoring

Transco's personnel (Operations) will perform visual inspections on an annual basis after permit closure, by qualified personnel, trained and experienced in PCSM/SR, to ascertain that the BMPs are functioning and operating effectively to ensure Zick Meter Station are causing no undue burden on the property owner or adjacent owners. Repairs of deficiencies will be initiated within ten business days of discovery.

### Maintenance

The Contractor will be responsible for the maintenance of the system during construction. After construction, the stormwater management facilities will be owned and maintained by Transco.

Where maintenance of the storm system after acceptance by the Owner will primarily consist of routine cleaning of accumulated sediment and debris by facility staff or private contractors, the specific maintenance steps and schedule are listed below:

#### 1. Rain Gardens

Inspect the rain gardens annually and inspect soil, landscaping, repair eroded areas and remove litter and debris as needed. Inspect twice a year for sediment buildup, erosion and vegetative conditions. Remove and replace dead and diseased vegetation. Any litter, debris, sediment, vegetation, or other items removed during maintenance activities will be disposed of in a manner consistent with the ESCGP-2 requirements.

#### 2. Vegetated Swales

Vegetated swales are to be inspected annually for sediment, build-up, erosion debris, and damage due to traffic. Ditches should be maintained to ensure that the specified design dimensions and vegetative lining are available at all times. No more than one-third of the shoot (grass leaf) shall be removed in any mowing. Grass height shall be maintained between 3 and 6 inches unless otherwise specified. Excess vegetation shall be removed from permanent channels to ensure sufficient channel capacity. Any litter, debris, sediment, vegetation, or other items removed during maintenance activities will be disposed of in a manner consistent with the ESCGP-2 requirements.

### 3. Disconnection from Storm Sewers

Disconnected impervious areas shall continue to be directed to infiltration areas and vegetated swales as shown on the PCSM/SR Plans (**Section 3 of the ESCGP-2 NOI**). Infiltration areas and vegetated swales shall be maintained as indicated on the PCSM/SR Plans (**Section 3 of the ESCGP-2 NOI**).

### 4. Soil Amendment and Restoration

Restrict vehicle access. Monitor water drawdown time in infiltration areas and scarify subsoils to a depth of 1' and replace amended soils if dewatering time increases to more than three days. Maintain Infiltration areas and vegetated swales as indicated on the PCSM/SR Plans.

### 5. Reduce Parking Area Imperviousness

Gravel areas will be maintained in good condition and will not be paved without obtaining prior approval from the PADEP or the County Conservation District.

### 6. Annual Records of Maintenance Procedures

The facility shall maintain a checklist whenever the storm system is inspected and cleaned. An annual list of inspections and major cleaning operations and repairs (pumping, sweeping parking lots, cleaning catch basin, etc.) shall be maintained. The local CCD or enforcement officials shall have access to those records.

### 7. Landscape Restoration

Seasonal mowing shall take place and areas shall be reseeded which need reestablished. First year: weeds shall be controlled by mowing to 4-6 inches once they reach 12 inches in height. Second/Third year: Weeds shall continue to be controlled. The meadow shall be mowed very close to the ground and the mowed material shall be removed.

### 8. ESCGP-2

The facility Owner and Operator shall ensure compliance with ESCGP-2 requirements by meeting all ongoing record, keeping maintenance, and other applicable ESCGP-2 and PADEP permit conditions.

## 1.11 Material Recycling and Disposal

The restoration of the temporary gravel will require the removal of the temporary materials. The temporary materials include, but may not be limited to, stone surface and associated geotextiles. The contractors are required to dispose of materials at suitable disposals or recycling sites and in compliance with local, state and federal regulations.

Transco has prepared a Spill Plan for Oil and Hazardous Materials to assist in prevention of any spills that may occur at the Site and to respond to any spills that do occur. The Contractor will be required to become familiar with the Spill Plan for Oil and Hazardous Materials and its contents prior to commencing any construction-related activities. The Spill Plan for Oil and Hazardous Materials is included as **Attachment 9 to the ECP** provided as **Section 4 of the ESCGP-2 NOI**.

Contractors are required to inventory and manage their construction site materials. The goal is to be aware of the materials on-site; ensure they are properly maintained, used, and disposed of; and to make sure the materials are not exposed to stormwater.

Silt, sediment, trash, construction wastes and all other wastes generated during operation and maintenance activities shall be properly managed and disposed of in accordance with local, state and federal requirements.

### ***Materials Covered***

The following materials or substances are expected to be present on-site during construction (**Note: this list is not an all-inclusive list and the Materials Management Practices can be modified to address additional materials used on-site**):

- Acids
- Detergents
- Fertilizers (nitrogen/phosphorus)
- Hydroseeding mixtures
- Petroleum based products
- Sanitary wastes
- Soil stabilization additives
- Solder
- Solvents
- Other

These materials must be stored as appropriate and shall not contact storm or non-stormwater discharges. Contractor shall provide a weather proof container to store chemicals or erodible substances that must be kept on the Site. Contractor is responsible for reading, maintaining, and making employees and subcontractors aware of safety data sheets (SDSs).

### ***Material Management Practices***

The following are material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff.

#### 1. Good Housekeeping Practices

The following good housekeeping practices will be followed on Site during construction:

- Store only enough material required to do the job.
- Store materials in a neat, orderly manner.
- Store chemicals in watertight containers or in a storage shed, under a roof, completely enclosed, with appropriate secondary containment to prevent spill or leakage. Drip pans shall be provided under dispensers.
- Substances will not be mixed with one another unless recommended by the Manufacturer.
- Manufacturer's recommendations for proper use and disposal will be followed.
- Inspections will be performed to ensure proper use and disposal of materials.
- Cover and berm loose stockpiled construction materials that are not actively being used (i.e. Soil, spoils, aggregate, etc.).
- Minimize exposure of construction materials to precipitation.
- Minimize the potential for off-site tracking of loose construction and landscape materials.

## 2. Hazardous Products

These practices will be used to reduce the risks associated with hazardous materials. SDSs for each substance with hazardous properties that is used on the job site(s) will be obtained and used for the proper management of potential wastes that may result from these products. A SDS will be posted in the immediate area where such product is stored and/or used and another copy of each SDS will be maintained in a file at the job site construction trailer office. Each employee, who must handle a substance with hazardous properties, will be instructed on the use of SDS and the specific information in the applicable SDS for the product he/she is using, particularly regarding spill control techniques.

- Products will be kept in original containers with the original labels in legible condition.
- Original labels and SDSs will be produced and used for each material.
- If surplus product must be disposed of, manufacturers or local/state/federal recommended methods for proper disposal will be followed.

## 3. Hazardous Wastes

All hazardous waste materials will be disposed of by the Contractor in the manner specified by local, state, and/or federal regulations and by the manufacturer of such products. Site personnel will be instructed.

## 4. Concrete and Other Wash Waters

Prevent disposal of rinse, wash waters, or materials on impervious or pervious surfaces, into streams, wetlands or other water bodies.

Concrete trucks will be allowed to wash out or discharge surplus concrete or drum wash water on the Site, but only in either (1) specifically designated diked areas which have been prepared to prevent contact between the concrete and/or washout and soil and stormwater having the potential to be discharged from the Site; or (2) in locations where waste concrete can be poured into forms to make riprap or other useful concrete products.

The hardened residue from the concrete washout diked areas will be disposed of in the same manner as other non-hazardous construction waste materials or may

be broken up and used on the Site as deemed appropriate by the Contractor and Owner or Owner's representative. The Contractor will be responsible for seeing that these procedures are followed.

All concrete washout areas will be located in an area where the likelihood of the area contributing to stormwater discharge is negligible. If required, additional E&SC BMPs must be implemented to prevent concrete wastes from contributing to stormwater discharges. The location of the concrete washout area(s) must be identified, by the Contractor/Job Site Superintendent, on the job site copy of the E&SC Plans (**Section 2 of the ESCGP-2 NOI**) and in the E&SC Narrative.

#### 5. Sanitary Wastes

All sanitary waste units will be located in an area where the likelihood of the unit contributing to stormwater discharges is negligible. Additional E&SC BMPs must be implemented, such as containment trays (provided by the rental company) or special containment created with 2" x 4" lumber, impervious plastic, and gravel. The location of the sanitary waste units must be identified on the job site copy of the E&SC Plans (**Section 2 of the ESCGP-2 NOI**), in the E&SC Narrative, by the Contractor/Job Site Superintendent.

#### 6. Solid and Construction Wastes

All waste materials will be collected and stored in a securely lidded metal dumpster. The dumpster will comply with all local and state solid waste management regulations. The dumpster/container lids shall be closed at the end of every business day and during rain events. Appropriate measures shall be taken to prevent discharges from waste disposal containers to the receiving water.

#### 7. Construction Access

A stabilized construction exit will be provided to help reduce vehicle tracking of sediments. The paved roads adjacent to the Site entrance will be inspected daily and swept as necessary to remove any excess mud, dirt, or rock tracked from the Site. Dump trucks hauling material from the construction site will be covered with a tarpaulin as necessary.

#### 8. Petroleum Products

On-site vehicles will be monitored for leaks and receive regular preventative maintenance. Petroleum products will be stored in tightly sealed containers which

are clearly labeled. Petroleum storage tanks on-site will have a dike or berm containment structure constructed around it to contain spills which may occur (containment volume to be 110% of volume stored). The dike or bermed area shall be lined with an impervious material such as a heavy duty plastic sheet. Drip pans shall be provided for all dispensers. Any asphalt substances used on the Site will be applied according to the manufacturer's recommendations.

#### 9. Fertilizers and Landscape Materials

Fertilizers will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to minimize the potential for exposure to stormwater. Storage will be under cover. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to minimize the potential for spills. The bin shall be labeled appropriately.

Contain stockpiled materials, such as but not limited to, mulches, top soil, rocks and gravel, and decomposed granite, when they are not actively being used.

Apply erodible landscape material at quantities and application rates according to the manufacturer's recommendations or based on written specifications by knowledgeable and experienced field personnel. Discontinue the application of any erodible landscape material within two days prior to a forecasted rain event or during periods of precipitation.

#### 10. Paints, Paint Solvents and Cleaning Solvents

Containers will be tightly sealed and stored when not in use. Excess paint and solvents will be properly disposed of according to the manufacturer's recommendations or local, state, and/or federal regulations.

#### 11. Contaminated Soils

Any contaminated soils (resulting from spills of materials with hazardous properties) which may result from construction activities will be contained and cleaned up immediately in accordance with applicable local, state and federal regulations.

### 1.12 Soil Conditions and Geologic Formations

There are no naturally occurring geologic formations or soils on-site are expected that may have the potential to cause pollution during earth disturbance activities. See E&SC

Detail Sheets (**Section 2 of the ESCGP-2 NOI**) for Acid-Producing Soils and Bedrock Control Plan should any unexpected acid runoff producing soils be encountered.

### 1.13 Thermal Impacts

Thermal impacts associated with CPL North, CPL South, and Associated Facilities will be avoided to the maximum extent practicable. The following provisions related to thermal impacts are included in the **E&SC Plan** within **Section 2 of the ESCGP-2 NOI**:

- The minimum permanent changes in land cover, necessary to construct the required facilities are being proposed.
- Runoff from the permanent impervious areas will be collected as part of the Post Construction Stormwater Management/Site Restoration (PCSM/SR) Plan and routed to PCSM/SR BMPs. In addition, impervious areas will be gravel instead of asphalt wherever practical.
- The removal of vegetation, especially tree cover, will be limited to only that necessary for construction.
- The receiving waters for this site are approximately 40 feet and 1,200 feet from the site for POI A and B, respectively. Travel time of site runoff will allow runoff to reach a temperature not expected to impact the receiving waters.

### 1.14 Riparian Forest Buffer Management Plan

There are no regulated riparian buffers within the Site area.

### 1.15 Antidegradation Requirements

The Site is not located in a special protection or siltation impaired watershed; therefore, no antidegradation analysis is necessary.

### 1.16 Preparedness Prevention and Contingency Plan

See Attachment 9 of the **ECP** within **Section 4 of the ESCGP-2 NOI** for the Preparedness Prevention and Contingency Plan provided.

## **APPENDICES**

Appendix A	Zick Meter Station Supporting Calculations
	A.1 Pre-Development Calculations
	A.2 Post Development Calculations
	A.3 Conveyance Calculations
	A.4 PCSM BMP Calculations
	A.5 Water Quality Worksheets
	A.6 Site Characterization Assessment
	A.7 Supporting Documentation
Appendix B	Preparer Qualifications
Appendix C	United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Custom Soil Resource Report



## **APPENDIX A**

### **Zick Meter Station Supporting Calculations**

- A.1 Pre-Development Calculations & Nearest Regulated Watercourse Watershed Analysis
- A.2 Post Development Calculations
- A.3 Conveyance Calculations
- A.4 PCSM BMP Calculations
- A.5 Water Quality Worksheets
- A.6 Site Characterization Assessment
- A.7 Supporting Documentation



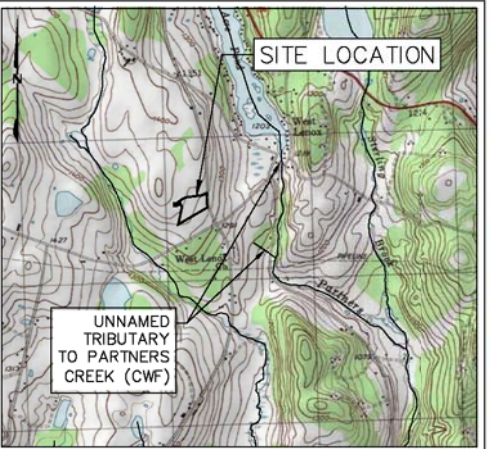
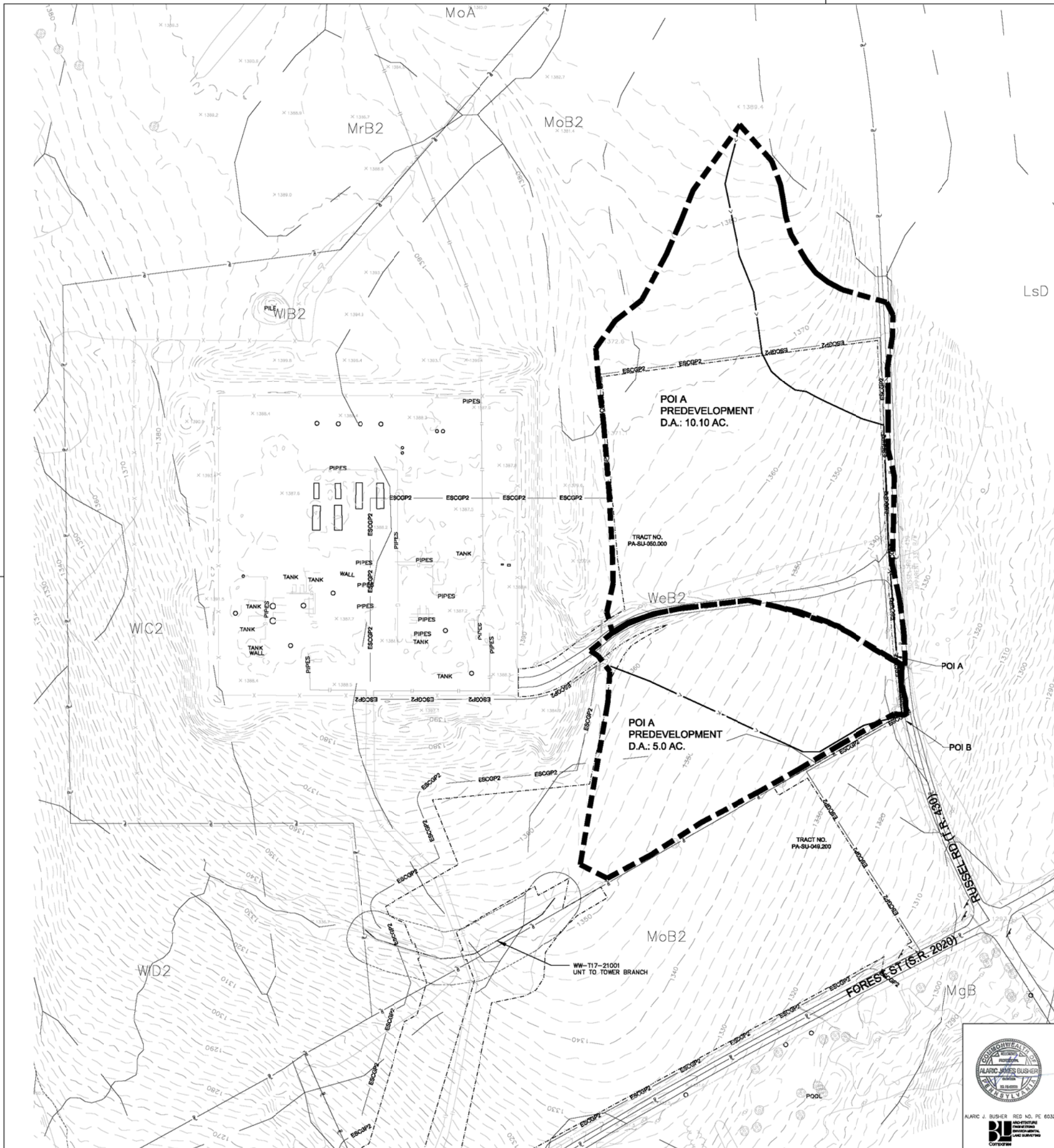


An Employee-Owned Company

## **A.1 Pre-Development Calculations & Nearest Regulated Watercourse Watershed Analysis**



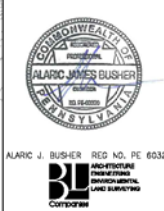
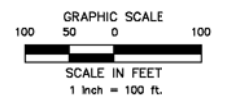
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**LOCATION MAP**  
 USGS LENOXVILLE QUADRANGLE  
 SCALE: 1"=2,000'

**LEGEND**

- PROPERTY BOUNDARY LINE (APPROXIMATE)
- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' INTERVAL)
- FENCE
- STONE ROW
- SOIL BOUNDARY
- TREELINE
- CENTERLINE STREAM/EDGE WATERBODY
- DELINEATED WETLANDS
- SPOT ELEVATION
- TREE OR BUSH
- UTILITY POLE AND UTILITY LINE
- GUY POLE
- GUY POLE OR ANCHOR
- POST
- SIGN
- WATER WELL
- UTILITY BOX
- MONUMENT (PROPERTY BOUNDARY MARKER)
- IRON PIPE OR PIN (PROPERTY BOUNDARY MARKER)
- SOIL TYPE DESIGNATION
- ESCOP-2 PERMIT BOUNDARY
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- LIMIT OF DISTURBANCE (ZICK METER STATION)
- EXISTING ROAD
- ROW
- FLOODLINE
- DRAINAGE AREA BOUNDARIES
- TIME OF CONCENTRATION FLOW PATH



REVISIONS			
NO.	DATE	BY	DESCRIPTION
0	08/28/2015	BL	ISSUED FOR PADEP PERMIT SUBMITTAL
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL
3	03/29/2016	BL	ISSUED FOR PADEP RESUBMITTAL
4	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1
5	Apr. 2017	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #2

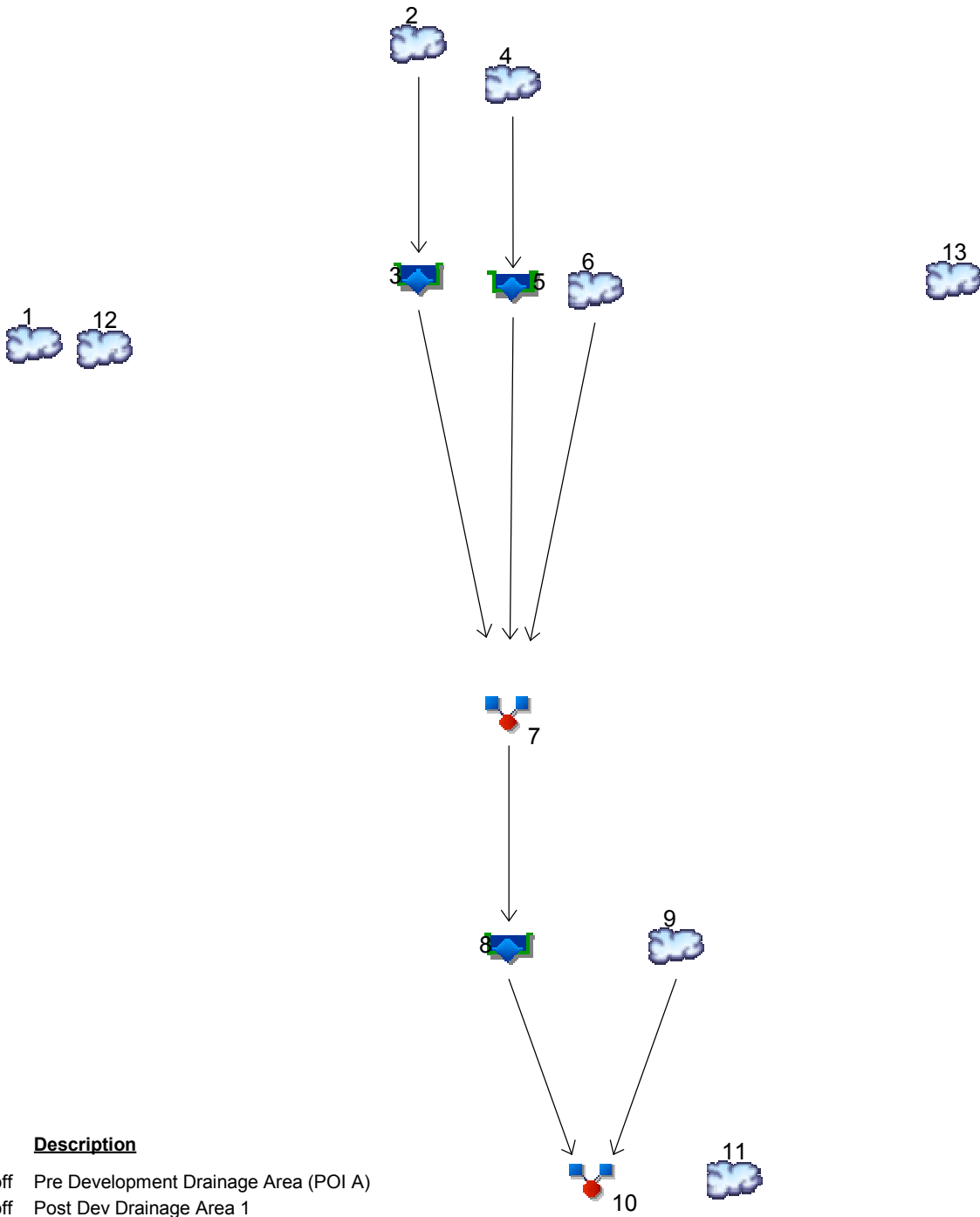
TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC			
ATLANTIC SUNRISE PROJECT- PROPOSED 30" NATURAL GAS PIPELINE			
POST CONSTRUCTION STORMWATER MANAGEMENT PLANS			
FOR ZICK METER STATION & ASSOCIATED PERMANENT ACCESS ROADS			
LENOX TOWNSHIP, SUSQUEHANNA COUNTY, PENNSYLVANIA			
PRE-DEVELOPMENT DRAINAGE AREA MAP			
DRAWN BY:	JEC	DATE:	04/03/15
CHECKED BY:	AJB	DATE:	04/03/15
APPROVED BY:	AJB	DATE:	07/17/15
WC:	1161483	SCALE:	AS NOTED
		REVISION:	5
		DRAWING NUMBER:	(30-3680)MF-1A-9
		SHEET:	1 OF 1





# Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3



## Legend

Hyd. Origin	Description
1	SCS Runoff Pre Development Drainage Area (POI A)
2	SCS Runoff Post Dev Drainage Area 1
3	Reservoir Rain Garden #1 Outflow
4	SCS Runoff Post Development Drainage Area #2
5	Reservoir Rain Garden #2 Outflow
6	SCS Runoff Post Dev Drainage Area #3
7	Combine Post Dev Inflow to Rain Garden #3
8	Reservoir Rain Garden #3 Outflow
9	SCS Runoff Post Development Bypass
10	Combine Post Dev POI B
11	SCS Runoff Pre-Development Drainage Area (POI B)
12	SCS Runoff Post Dev POI A
13	SCS Runoff Downstream Watershed

# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

## Hyd. No. 1

Pre Development Drainage Area (POI A)

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.60	0.00	0.00	
Land slope (%)	= 2.60	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 9.79</b>	<b>+</b>	<b>0.00</b>	<b>+</b>
			<b>0.00</b>	<b>= 9.79</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 444.00	221.00	480.00	
Watercourse slope (%)	= 4.17	9.04	2.87	
Surface description	= Unpaved	Unpaved	Unpaved	
Average velocity (ft/s)	=3.29	4.85	2.73	
<b>Travel Time (min)</b>	<b>= 2.25</b>	<b>+</b>	<b>0.76</b>	<b>+</b>
			<b>2.93</b>	<b>= 5.93</b>
<b>Channel Flow</b>				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	0.0	0.0	0.0	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b>	<b>0.00</b>	<b>+</b>
			<b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc</b> .....				<b>15.70 min</b>

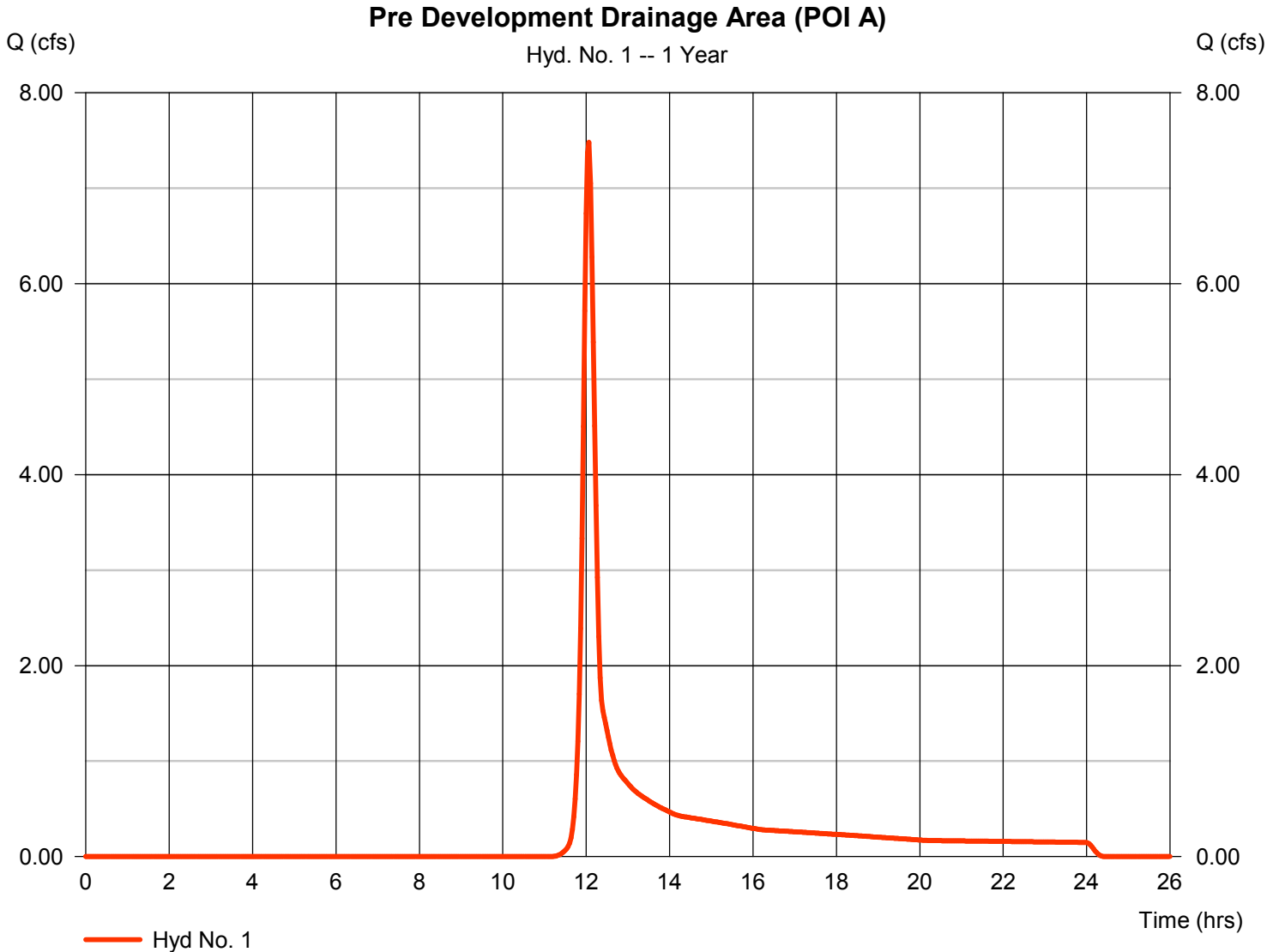
# Hydrograph Report

## Hyd. No. 1

Pre Development Drainage Area (POI A)

Hydrograph type	= SCS Runoff	Peak discharge	= 7.480 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 22,332 cuft
Drainage area	= 10.100 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.70 min
Total precip.	= 2.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.670 x 78) + (0.230 x 91) + (0.200 x 98)] / 10.100



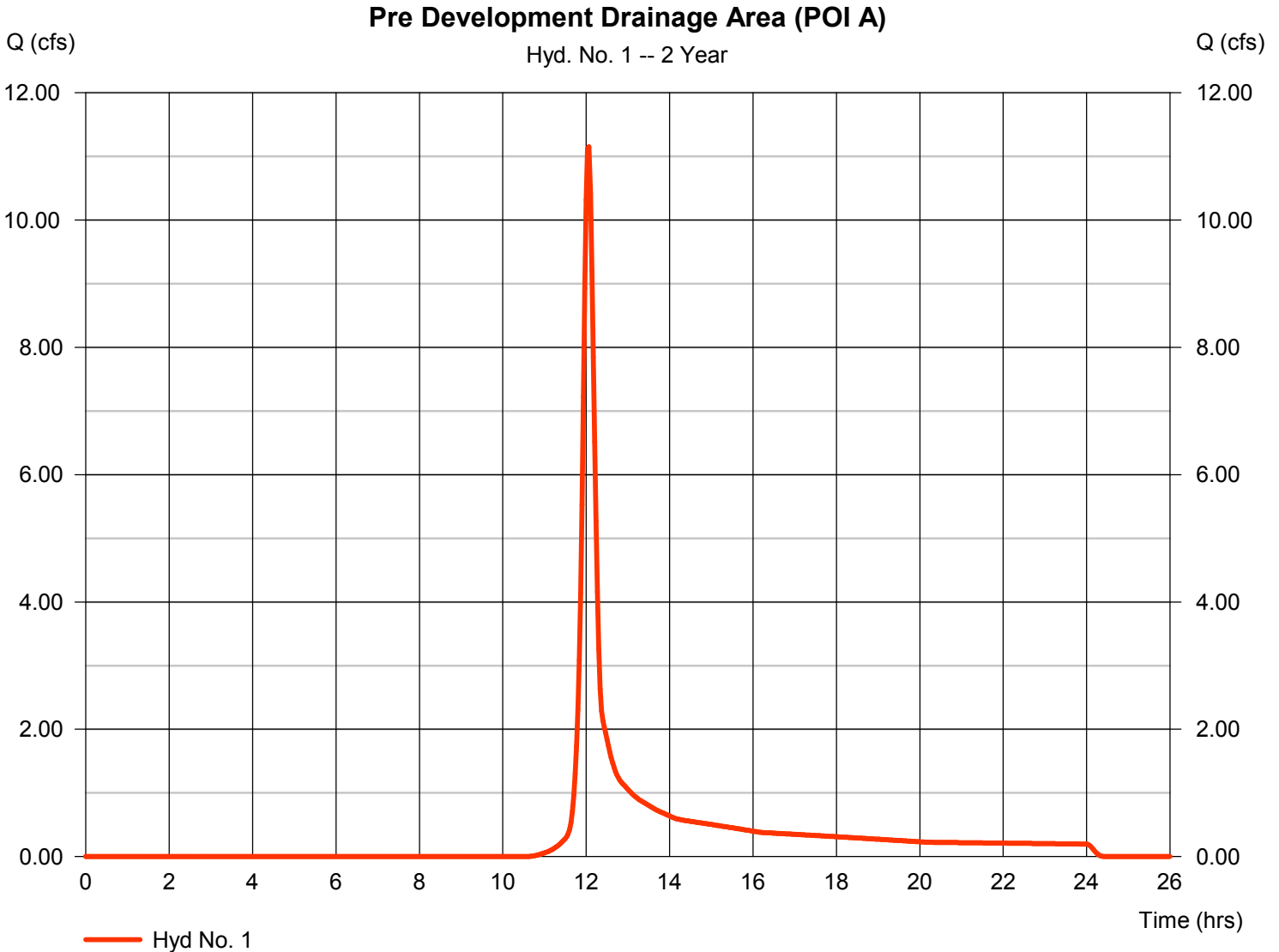
# Hydrograph Report

## Hyd. No. 1

Pre Development Drainage Area (POI A)

Hydrograph type	= SCS Runoff	Peak discharge	= 11.15 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 32,355 cuft
Drainage area	= 10.100 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.70 min
Total precip.	= 2.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.670 x 78) + (0.230 x 91) + (0.200 x 98)] / 10.100



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

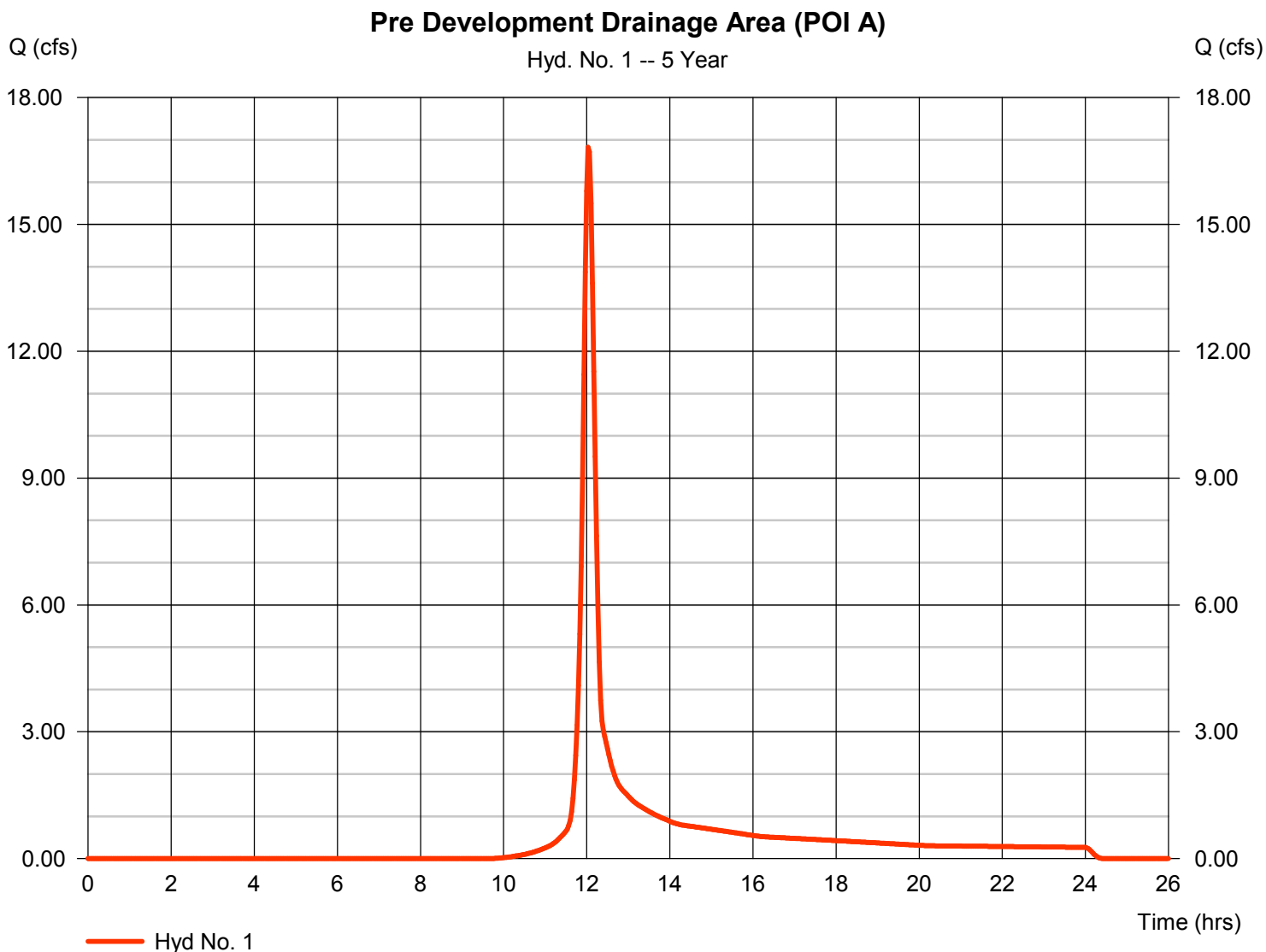
Thursday, 04 / 6 / 2017

## Hyd. No. 1

Pre Development Drainage Area (POI A)

Hydrograph type	= SCS Runoff	Peak discharge	= 16.83 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 47,783 cuft
Drainage area	= 10.100 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.70 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.670 x 78) + (0.230 x 91) + (0.200 x 98)] / 10.100



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

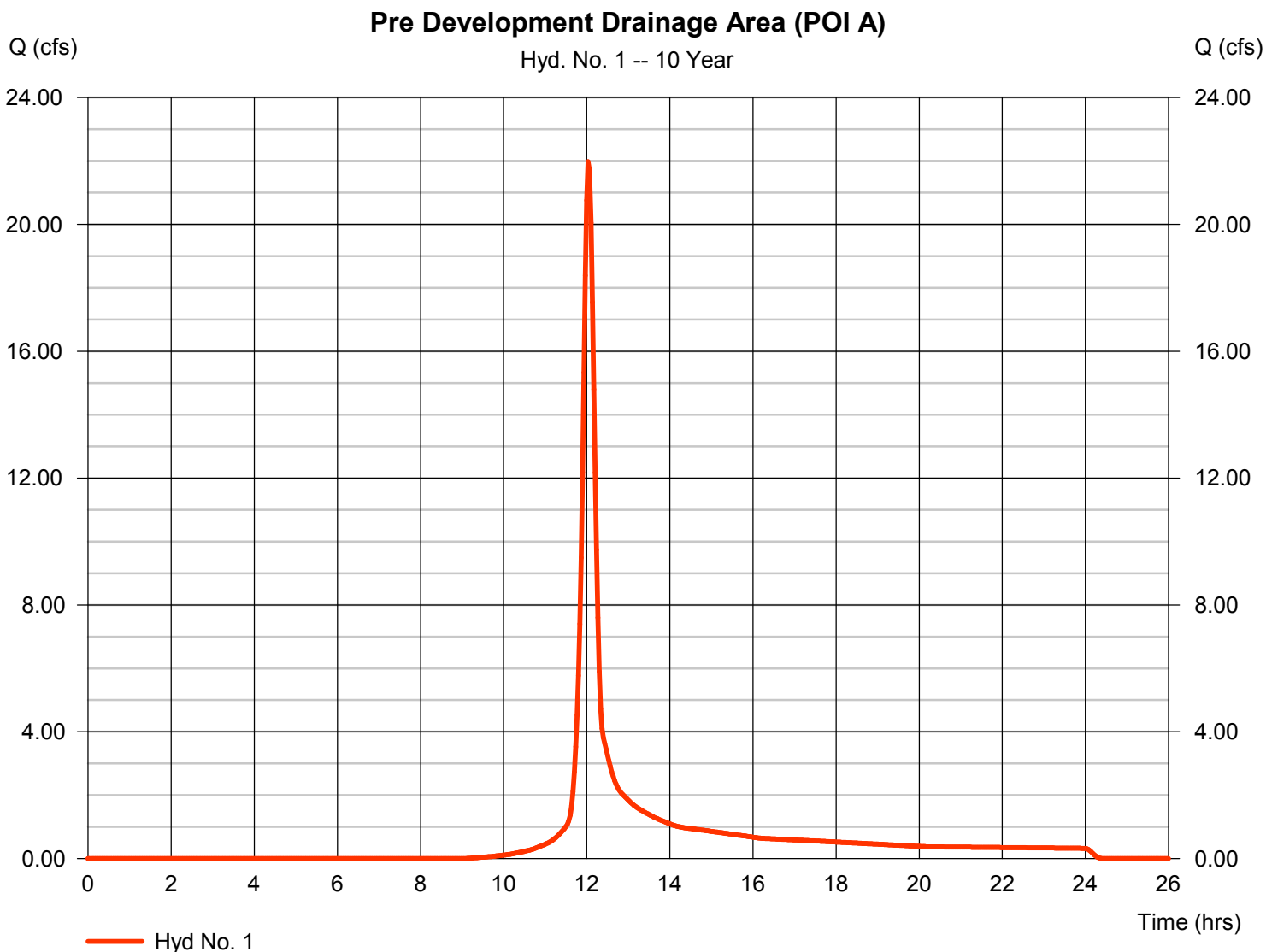
Thursday, 04 / 6 / 2017

## Hyd. No. 1

Pre Development Drainage Area (POI A)

Hydrograph type	= SCS Runoff	Peak discharge	= 21.98 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 61,870 cuft
Drainage area	= 10.100 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.70 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.670 x 78) + (0.230 x 91) + (0.200 x 98)] / 10.100



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

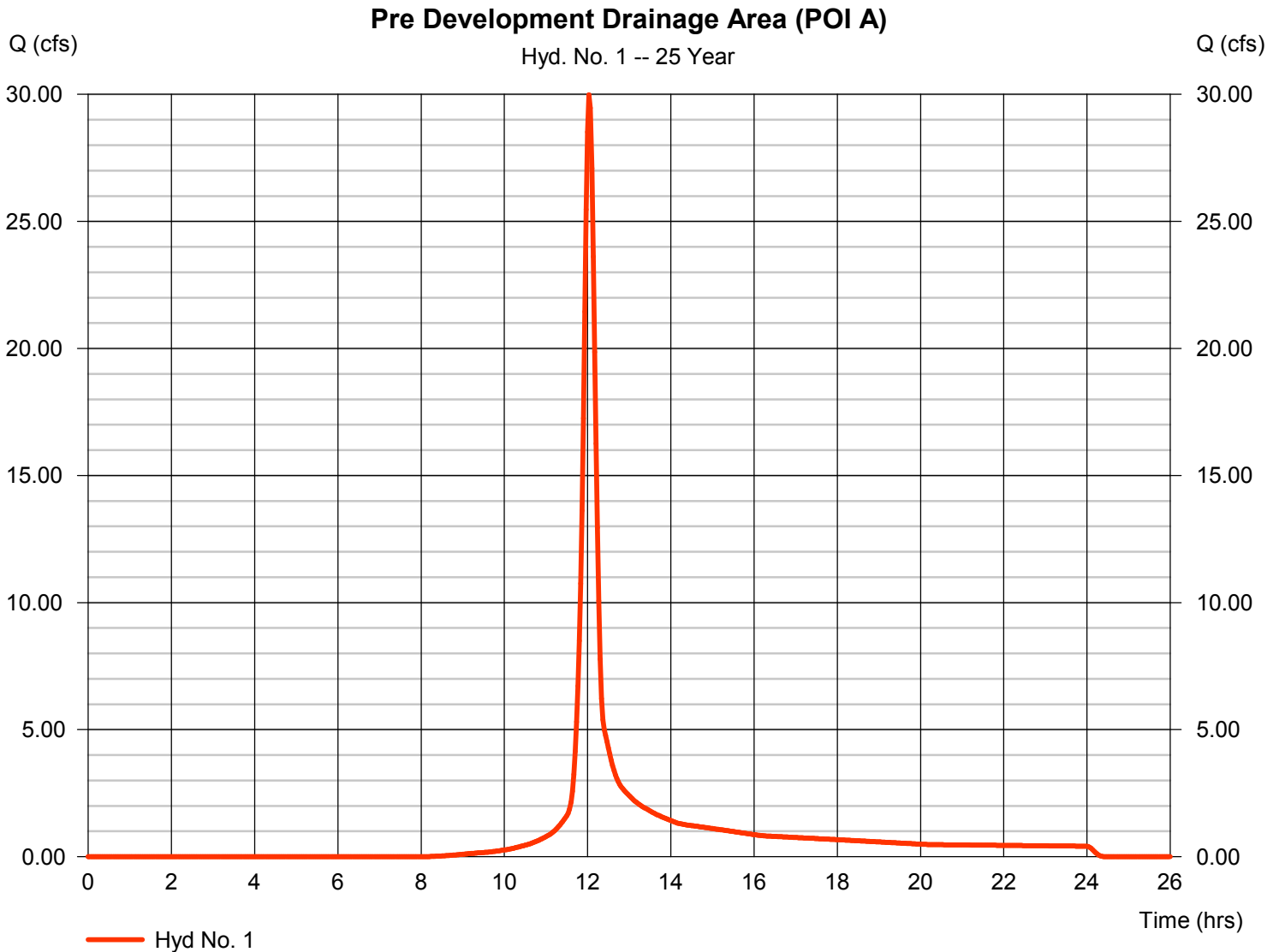
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## Hyd. No. 1

Pre Development Drainage Area (POI A)

Hydrograph type	= SCS Runoff	Peak discharge	= 29.98 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 84,051 cuft
Drainage area	= 10.100 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.70 min
Total precip.	= 4.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.670 x 78) + (0.230 x 91) + (0.200 x 98)] / 10.100



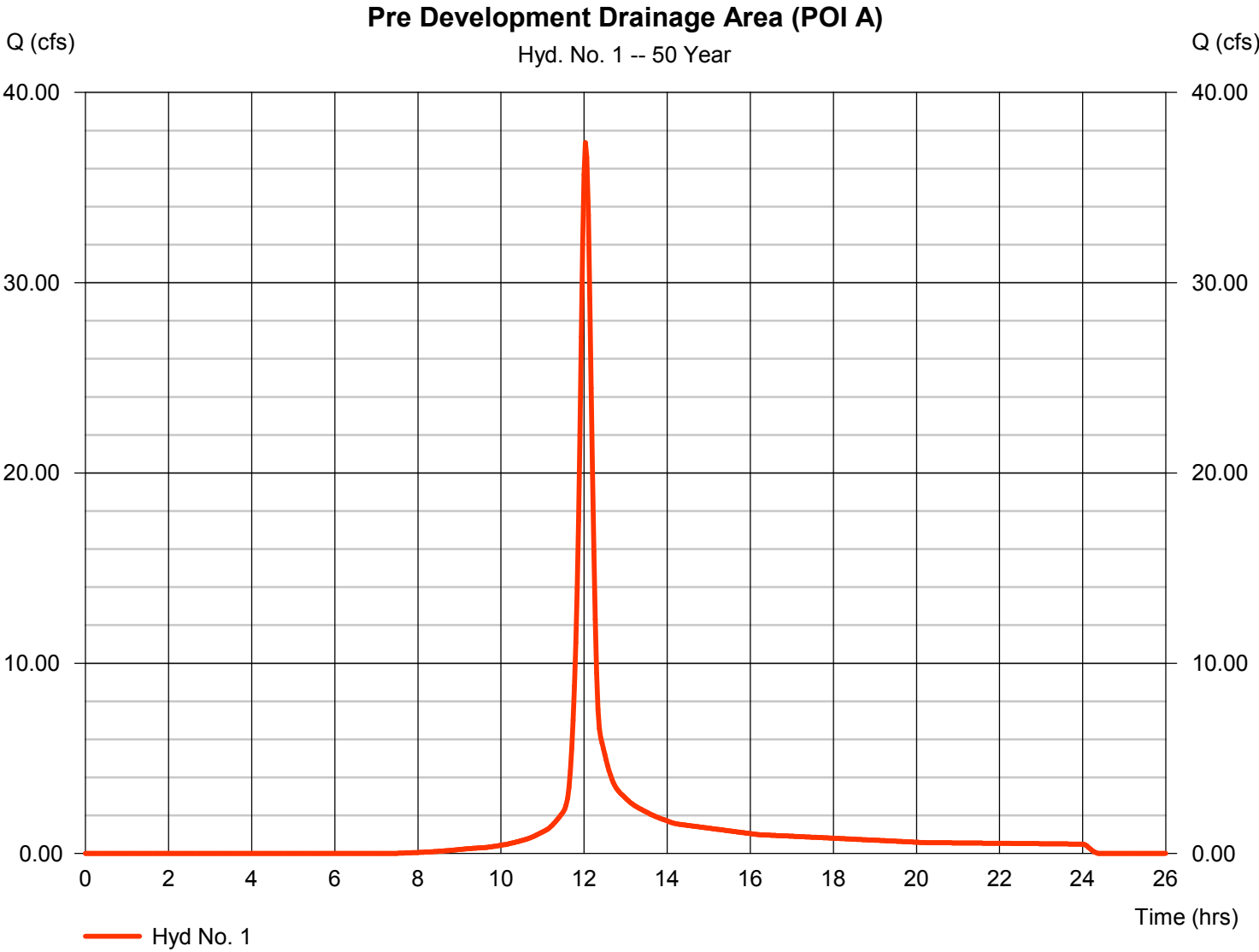
# Hydrograph Report

## Hyd. No. 1

Pre Development Drainage Area (POI A)

Hydrograph type	= SCS Runoff	Peak discharge	= 37.36 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 104,780 cuft
Drainage area	= 10.100 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.70 min
Total precip.	= 5.15 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.670 x 78) + (0.230 x 91) + (0.200 x 98)] / 10.100



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

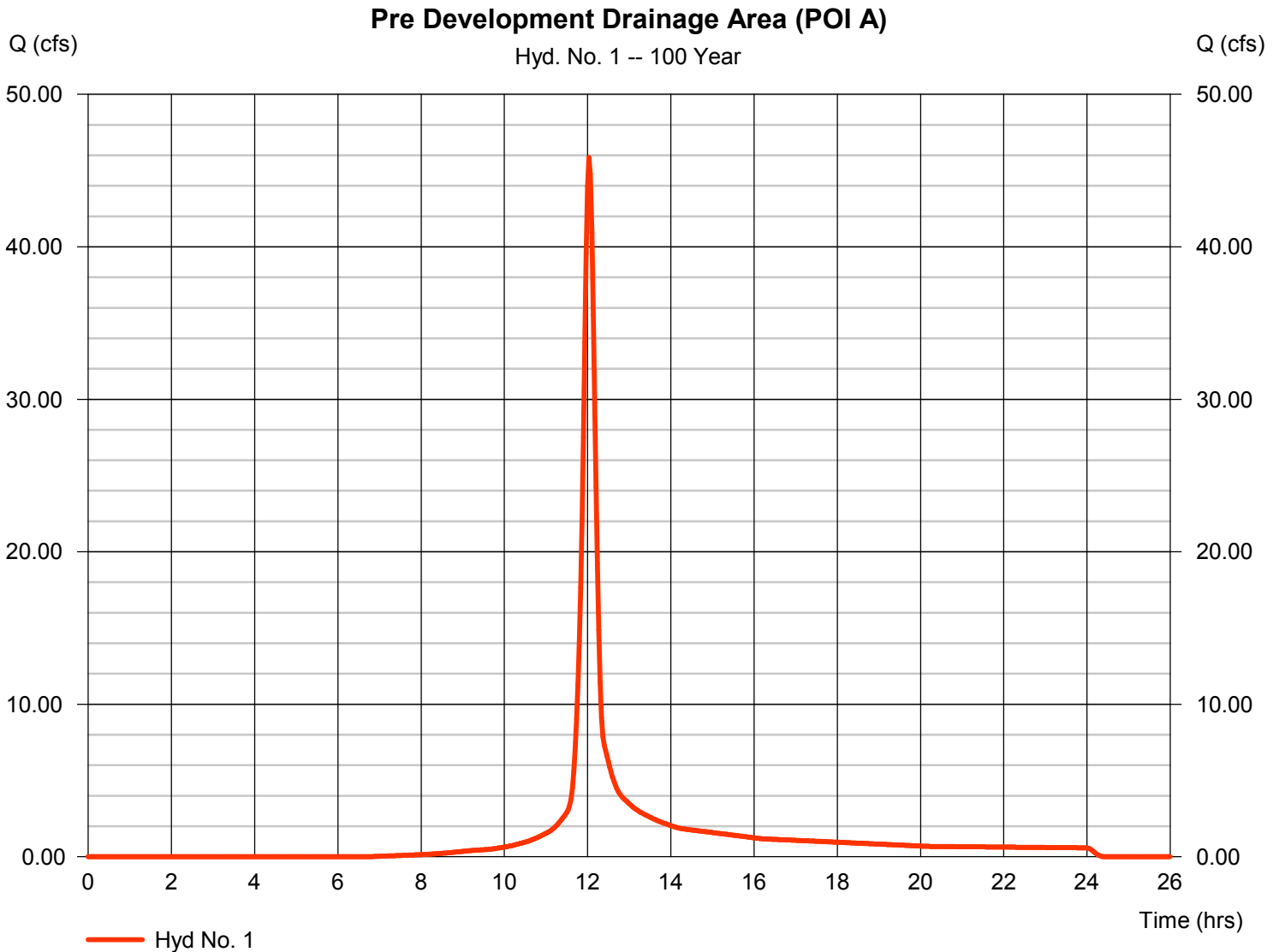
Thursday, 04 / 6 / 2017

## Hyd. No. 1

Pre Development Drainage Area (POI A)

Hydrograph type	= SCS Runoff	Peak discharge	= 45.86 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 128,983 cuft
Drainage area	= 10.100 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.70 min
Total precip.	= 5.92 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.670 x 78) + (0.230 x 91) + (0.200 x 98)] / 10.100



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

## Hyd. No. 11

Pre-Development Drainage Area (POI B)

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.60	0.00	0.00	
Land slope (%)	= 5.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 7.53</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 7.53</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 470.00	0.00	0.00	
Watercourse slope (%)	= 5.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=3.61	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 2.17</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 2.17</b>
<b>Channel Flow</b>				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	({0})0.0	0.0	0.0	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>9.70 min</b>

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

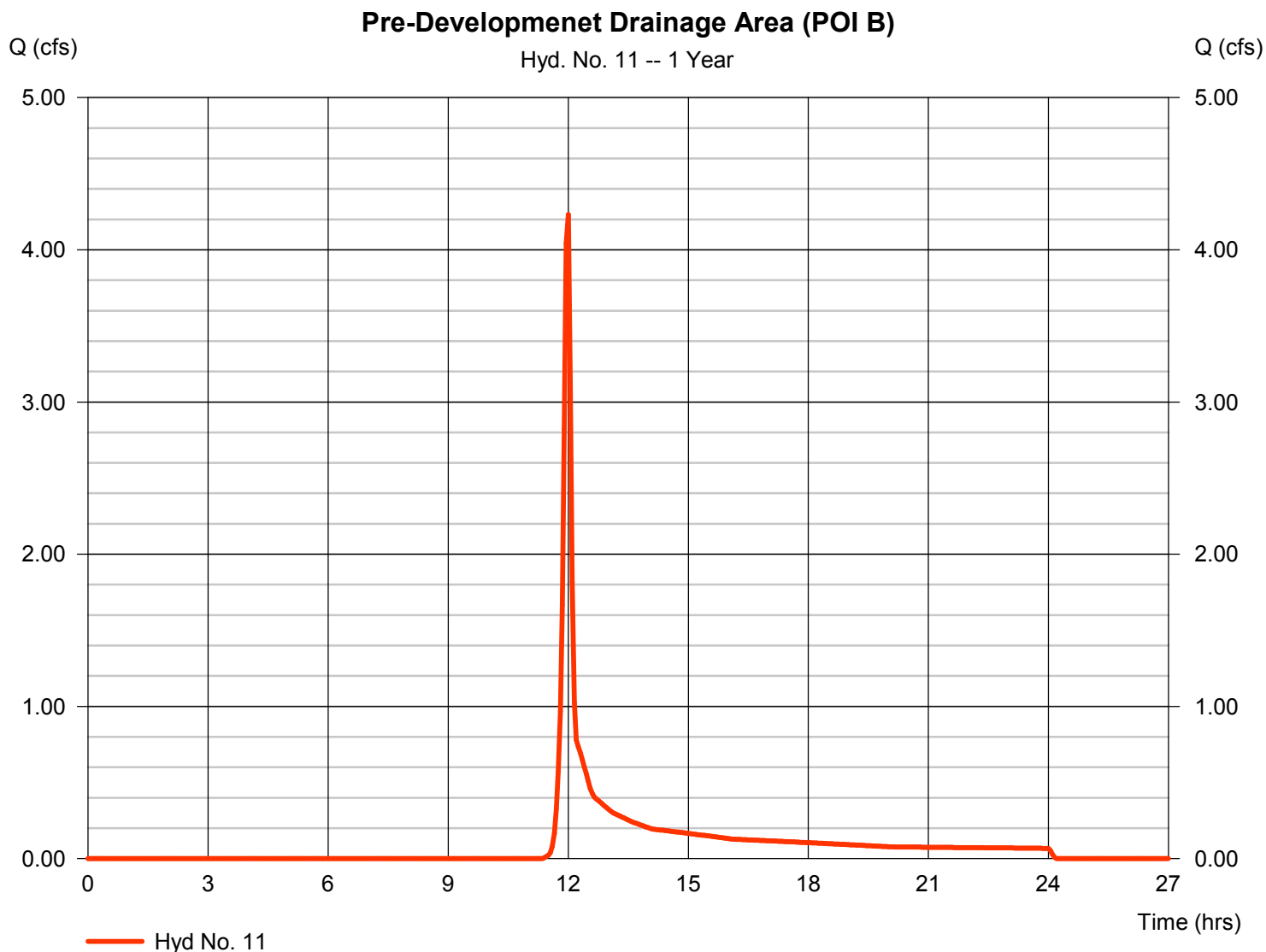
Thursday, 04 / 6 / 2017

## Hyd. No. 11

Pre-Development Drainage Area (POI B)

Hydrograph type	= SCS Runoff	Peak discharge	= 4.232 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 9,914 cuft
Drainage area	= 5.000 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 2.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (4.920 x 78)] / 5.000



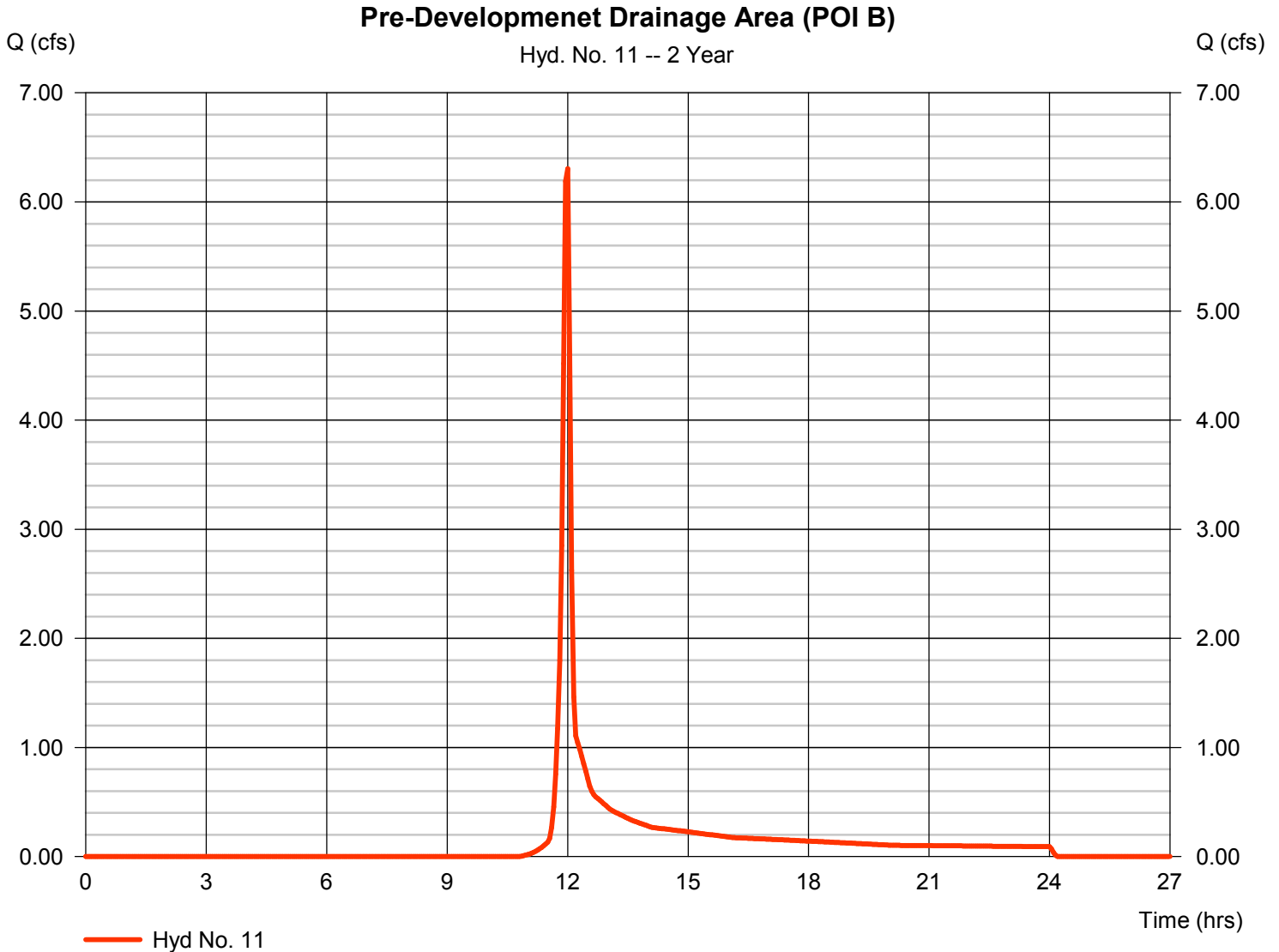
# Hydrograph Report

## Hyd. No. 11

### Pre-Development Drainage Area (POI B)

Hydrograph type	= SCS Runoff	Peak discharge	= 6.304 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 14,523 cuft
Drainage area	= 5.000 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 2.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (4.920 x 78)] / 5.000



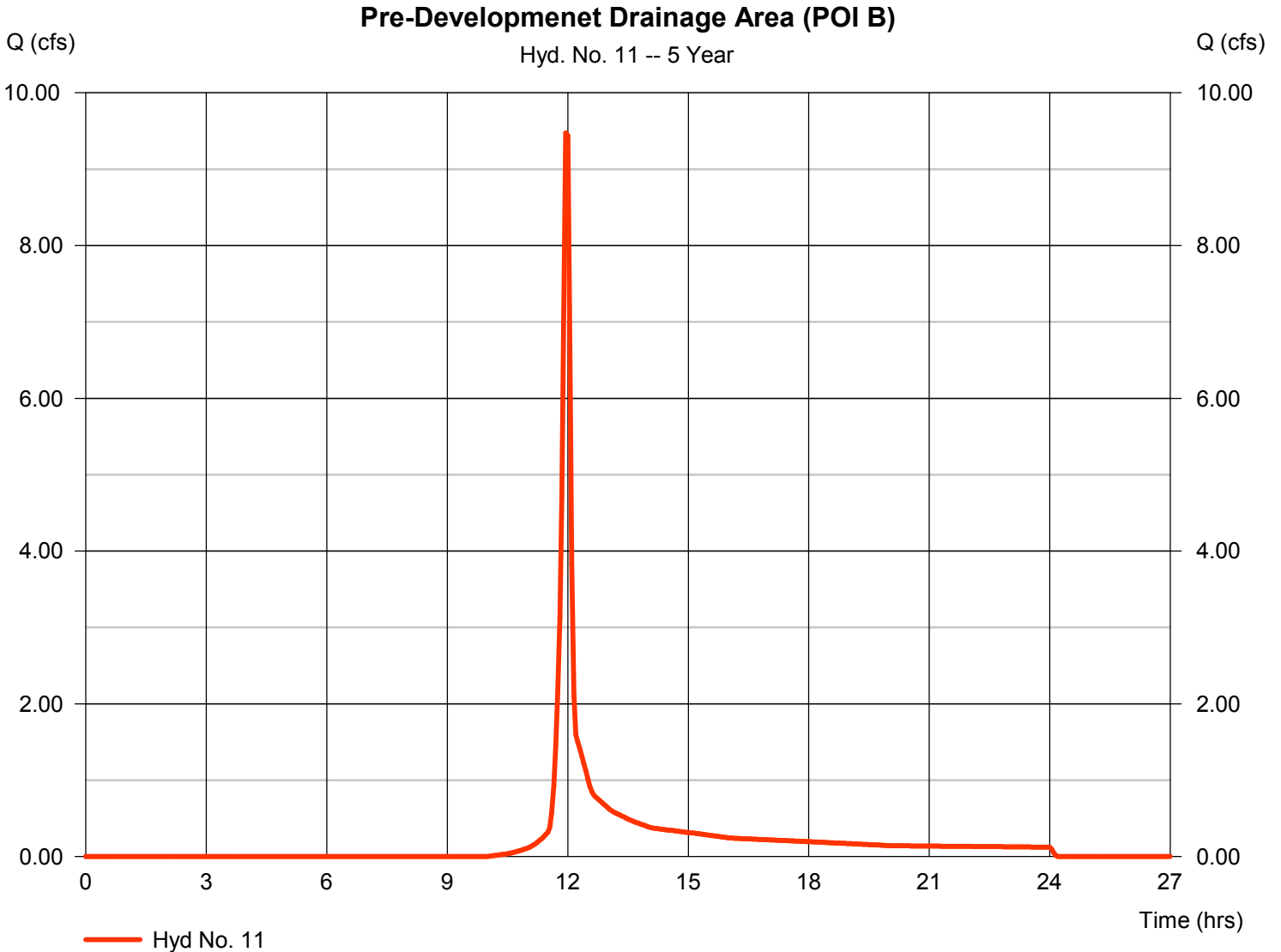
# Hydrograph Report

## Hyd. No. 11

### Pre-Development Drainage Area (POI B)

Hydrograph type	= SCS Runoff	Peak discharge	= 9.472 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 21,667 cuft
Drainage area	= 5.000 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (4.920 x 78)] / 5.000



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

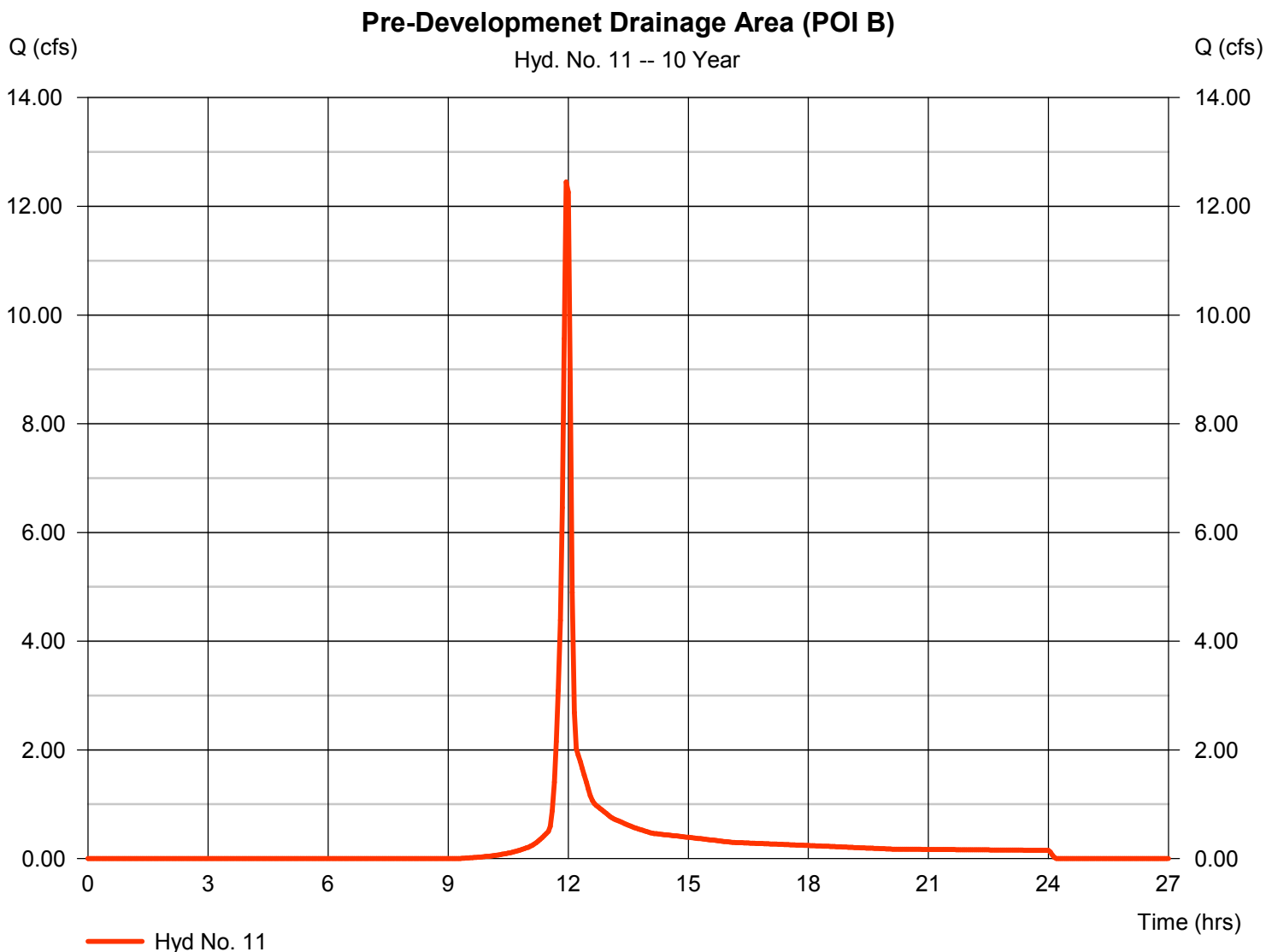
Thursday, 04 / 6 / 2017

## Hyd. No. 11

Pre-Development Drainage Area (POI B)

Hydrograph type	= SCS Runoff	Peak discharge	= 12.45 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 28,224 cuft
Drainage area	= 5.000 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (4.920 x 78)] / 5.000



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

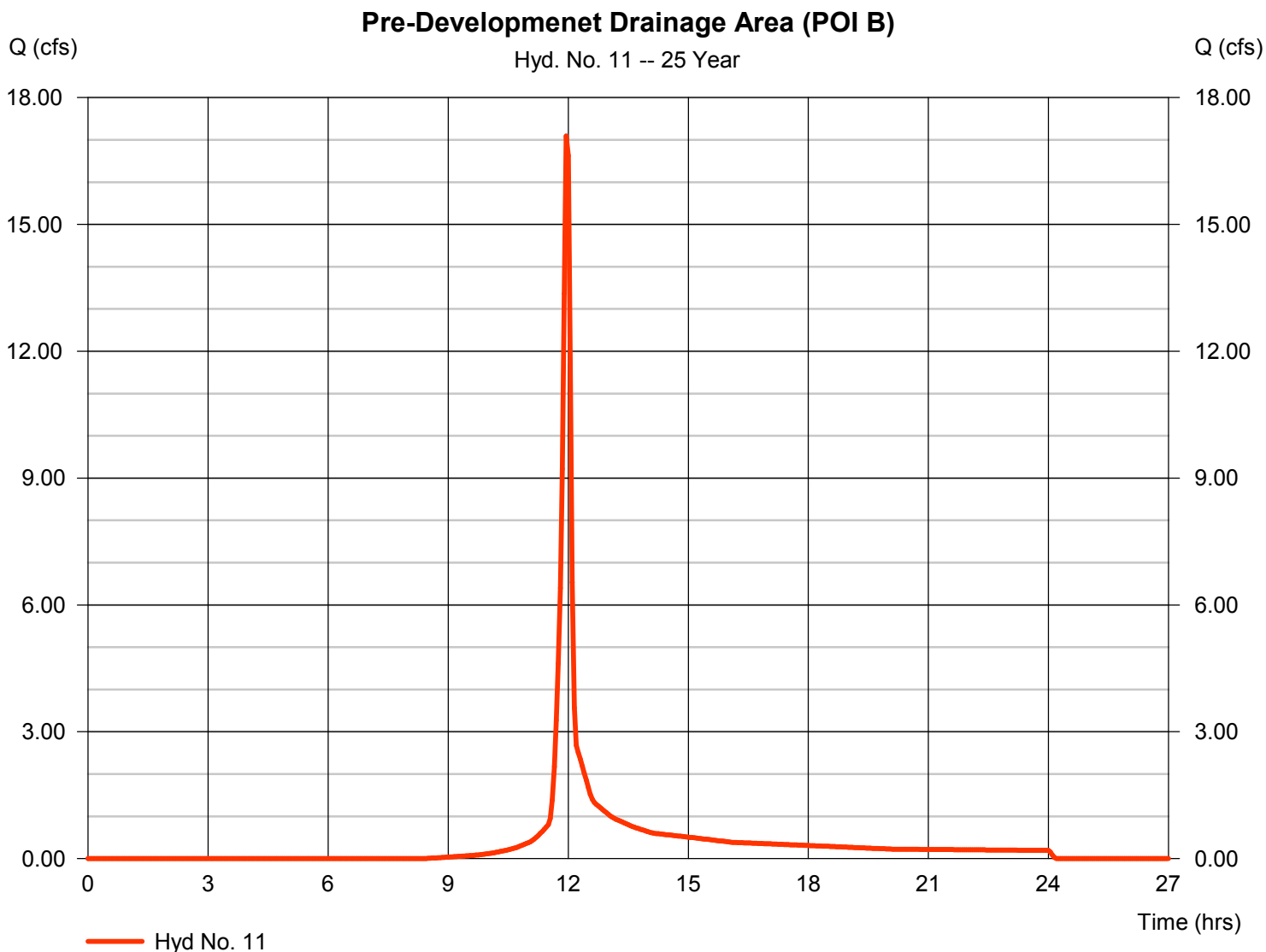
Thursday, 04 / 6 / 2017

## Hyd. No. 11

Pre-Development Drainage Area (POI B)

Hydrograph type	= SCS Runoff	Peak discharge	= 17.09 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 38,593 cuft
Drainage area	= 5.000 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 4.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (4.920 x 78)] / 5.000



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

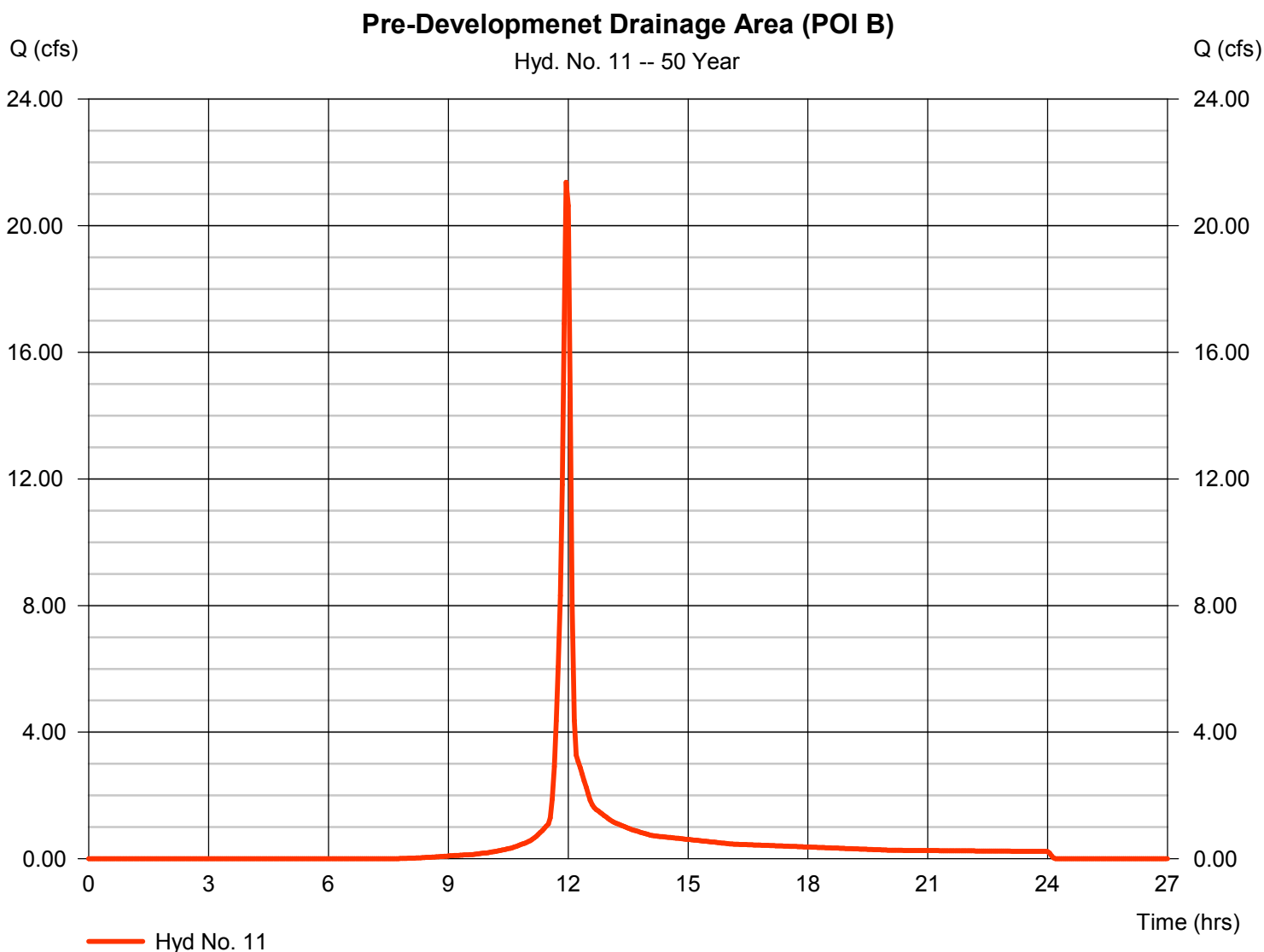
Thursday, 04 / 6 / 2017

## Hyd. No. 11

### Pre-Development Drainage Area (POI B)

Hydrograph type	= SCS Runoff	Peak discharge	= 21.38 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 48,316 cuft
Drainage area	= 5.000 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 5.15 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.080 \times 98) + (4.920 \times 78)] / 5.000$



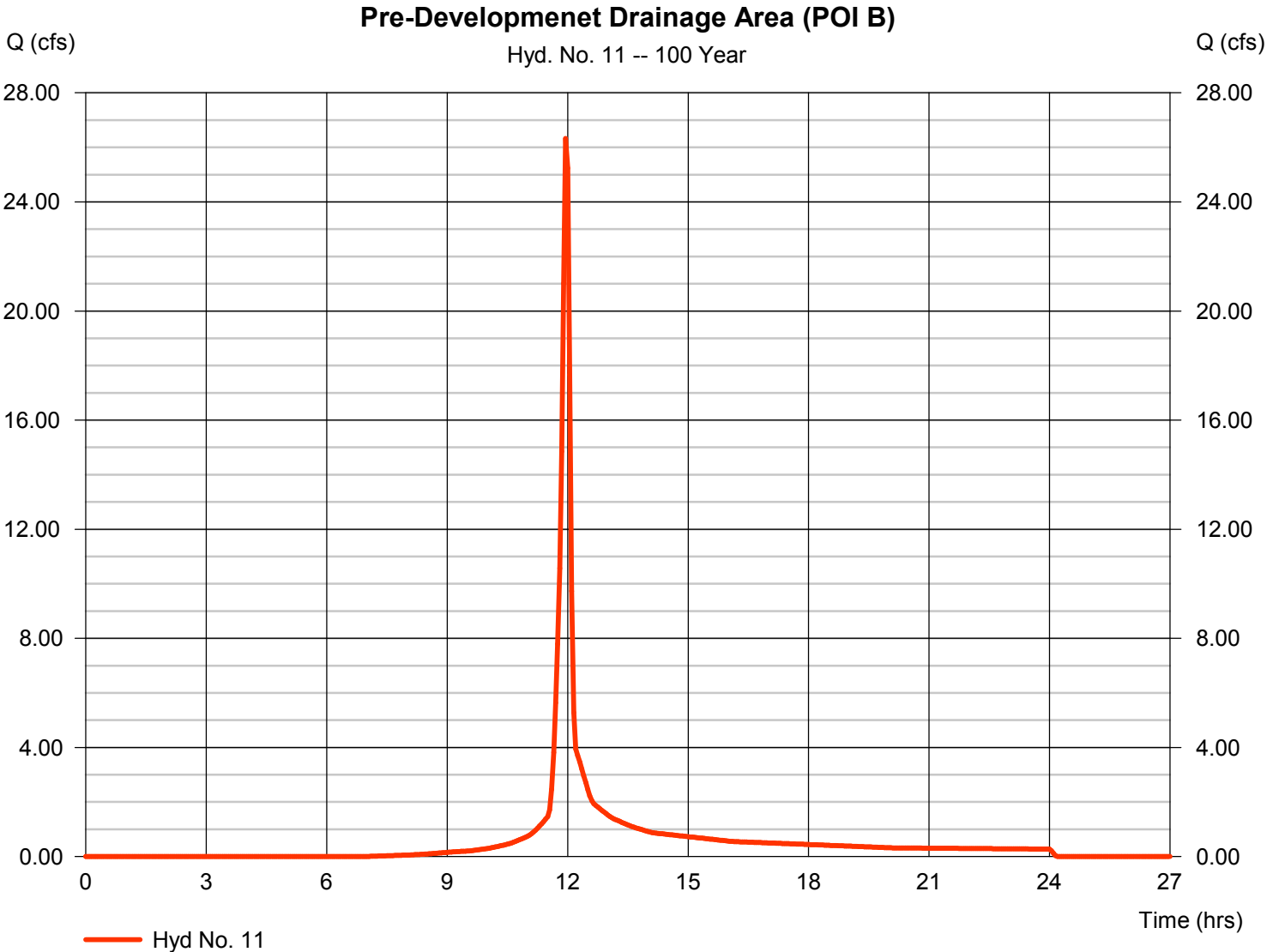
# Hydrograph Report

## Hyd. No. 11

### Pre-Development Drainage Area (POI B)

Hydrograph type	= SCS Runoff	Peak discharge	= 26.33 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 59,697 cuft
Drainage area	= 5.000 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 5.92 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

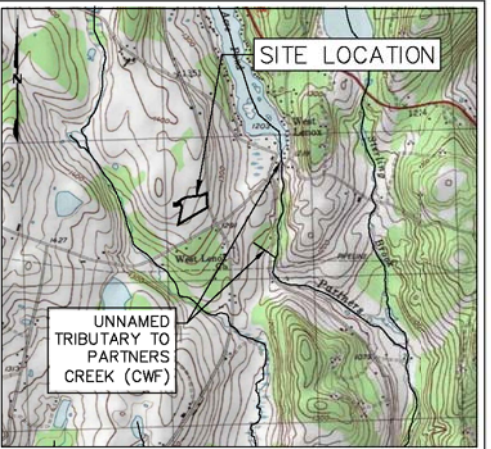
\* Composite (Area/CN) = [(0.080 x 98) + (4.920 x 78)] / 5.000





## **A.2 Post Development Calculations**

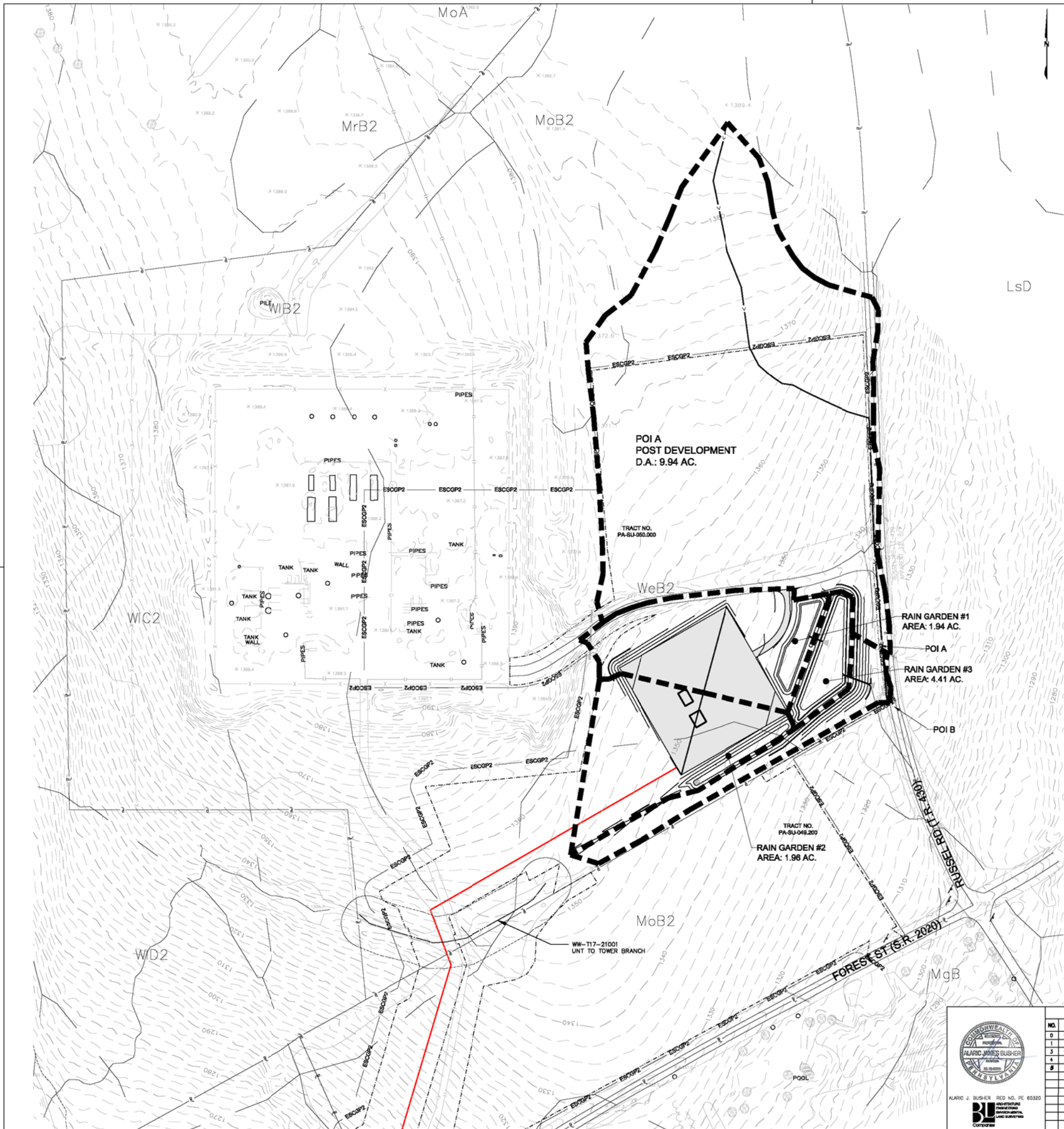
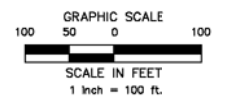




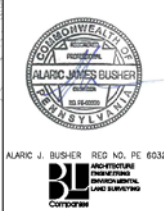
**LOCATION MAP**  
USGS LENOXVILLE QUADRANGLE  
SCALE: 1"=2,000'

**LEGEND**

- PROPERTY BOUNDARY LINE (APPROXIMATE)
- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' INTERVAL)
- FENCE
- STONE ROW
- SOIL BOUNDARY
- TREELINE
- CENTERLINE STREAM/EDGE WATERBODY
- DELINEATED WETLANDS
- SPOT ELEVATION
- TREE OR BUSH
- UTILITY POLE AND UTILITY LINE
- GUY POLE
- GUY POLE OR ANCHOR
- POST
- SIGN
- WATER WELL
- UTILITY BOX
- MONUMENT (PROPERTY BOUNDARY MARKER)
- IRON PIPE OR PIN (PROPERTY BOUNDARY MARKER)
- SOIL TYPE DESIGNATION
- CENTERLINE GAS PIPELINE
- ESCGP-2 PERMIT BOUNDARY
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- LIMIT OF DISTURBANCE (ZICK METER STATION)
- EXISTING ROAD
- ROW
- FLOODLINE
- PROPOSED MAJOR CONTOUR (10' INTERVAL)
- PROPOSED MINOR CONTOUR (2' INTERVAL)
- PROPOSED MINOR CONTOUR (1' INTERVAL)
- PROPOSED ACCESS ROAD
- DRAINAGE AREA BOUNDARIES
- TIME OF CONCENTRATION FLOW PATH



Drawn By & Date/Time: j.jones Apr 25, 2017 - 9:36am  
Drawing Location & Name: G:\008514\14C\14C9499\DWG\010-CP\14C-FMS\_PCSM14C-909(10)\_ZICK.dwg



REVISIONS			
NO.	DATE	BY	DESCRIPTION
0	08/28/2015	BL	ISSUED FOR PADEP PERMIT SUBMITTAL
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL
3	03/29/2016	BL	ISSUED FOR PADEP RESUBMITTAL
4	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1
5	Apr. 2017	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #2

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC			
ATLANTIC SUNRISE PROJECT- PROPOSED 30" NATURAL GAS PIPELINE			
POST CONSTRUCTION STORMWATER MANAGEMENT PLANS			
FOR ZICK METER STATION & ASSOCIATED PERMANENT ACCESS ROADS			
LENOX TOWNSHIP, SUSQUEHANNA COUNTY, PENNSYLVANIA			
POST DEVELOPMENT DRAINAGE AREA MAP			
DRAWN BY:	JJC	DATE:	04/03/15
CHECKED BY:	AJB	DATE:	04/03/15
APPROVED BY:	AJB	DATE:	07/17/15
NO.	1161483	SCALE:	AS NOTED
REVISON:	5	DRAWING NUMBER:	(30-3680)MF-1A-9
SHEET:	1	OF:	1





# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

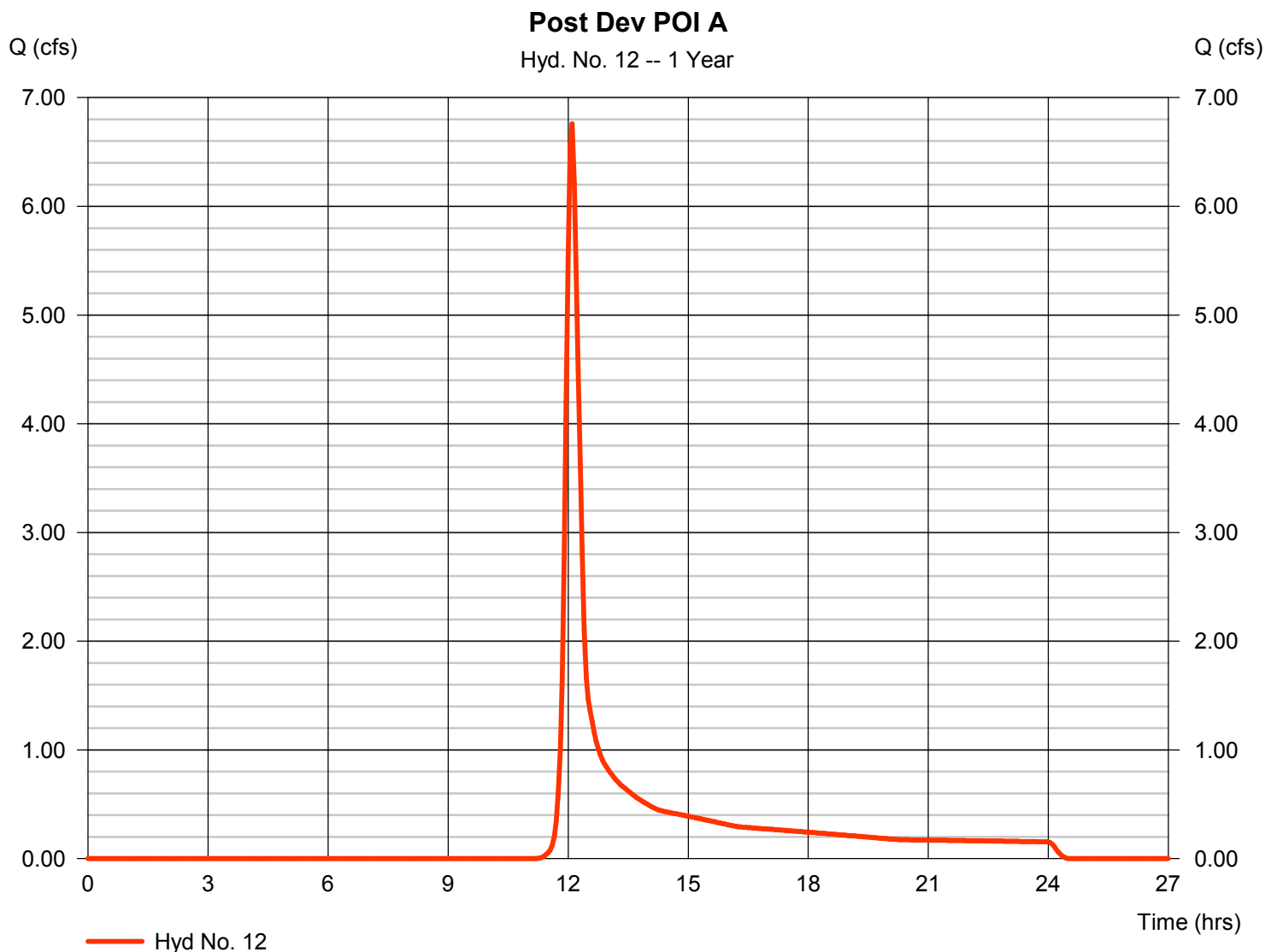
Thursday, 04 / 6 / 2017

## Hyd. No. 12

Post Dev POI A

Hydrograph type	= SCS Runoff	Peak discharge	= 6.759 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 23,246 cuft
Drainage area	= 9.940 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.70 min
Total precip.	= 2.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.510 x 78) + (0.230 x 91) + (0.200 x 98)] / 9.940



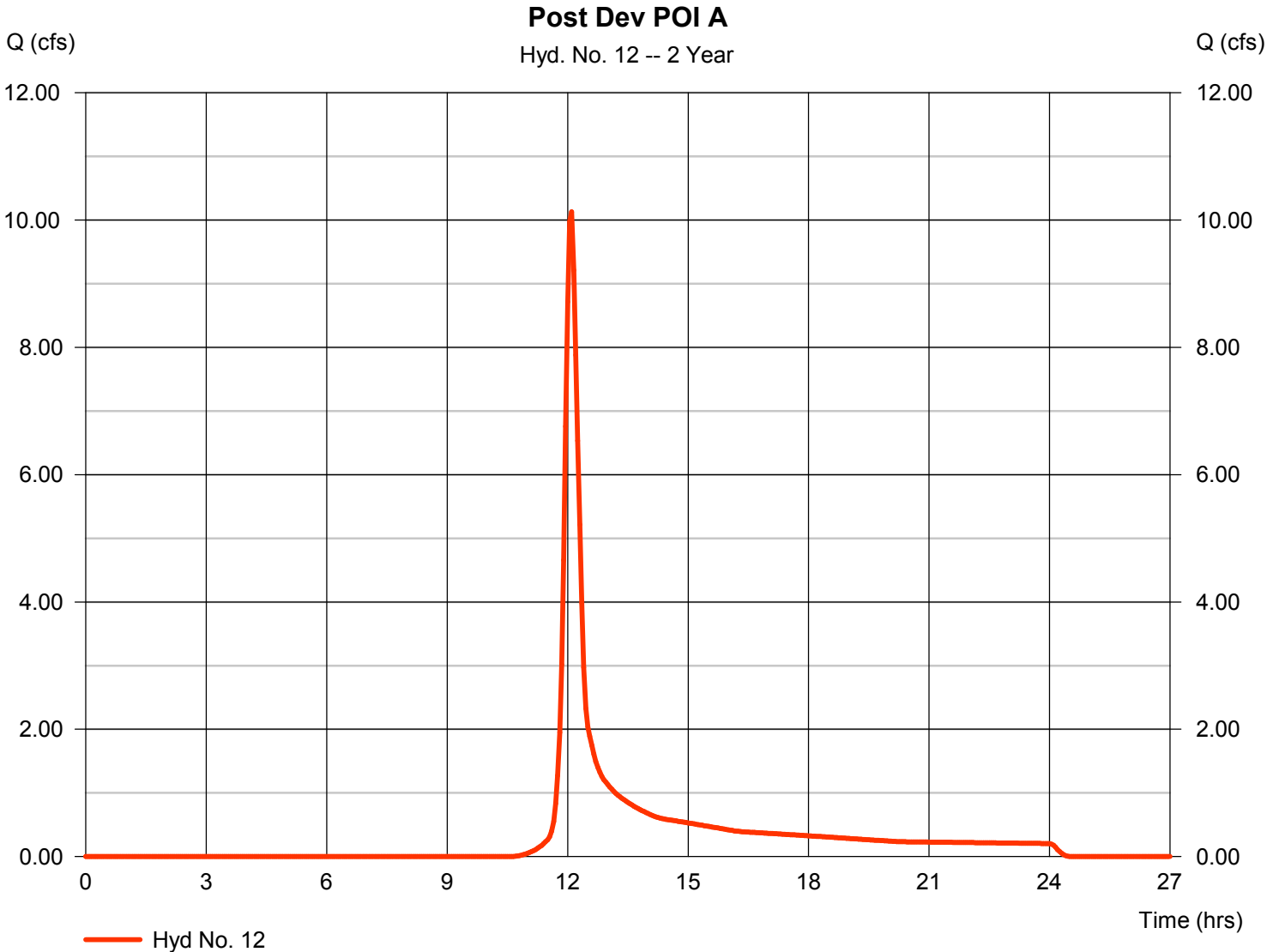
# Hydrograph Report

## Hyd. No. 12

Post Dev POI A

Hydrograph type	= SCS Runoff	Peak discharge	= 10.13 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 33,679 cuft
Drainage area	= 9.940 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.70 min
Total precip.	= 2.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.510 x 78) + (0.230 x 91) + (0.200 x 98)] / 9.940



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

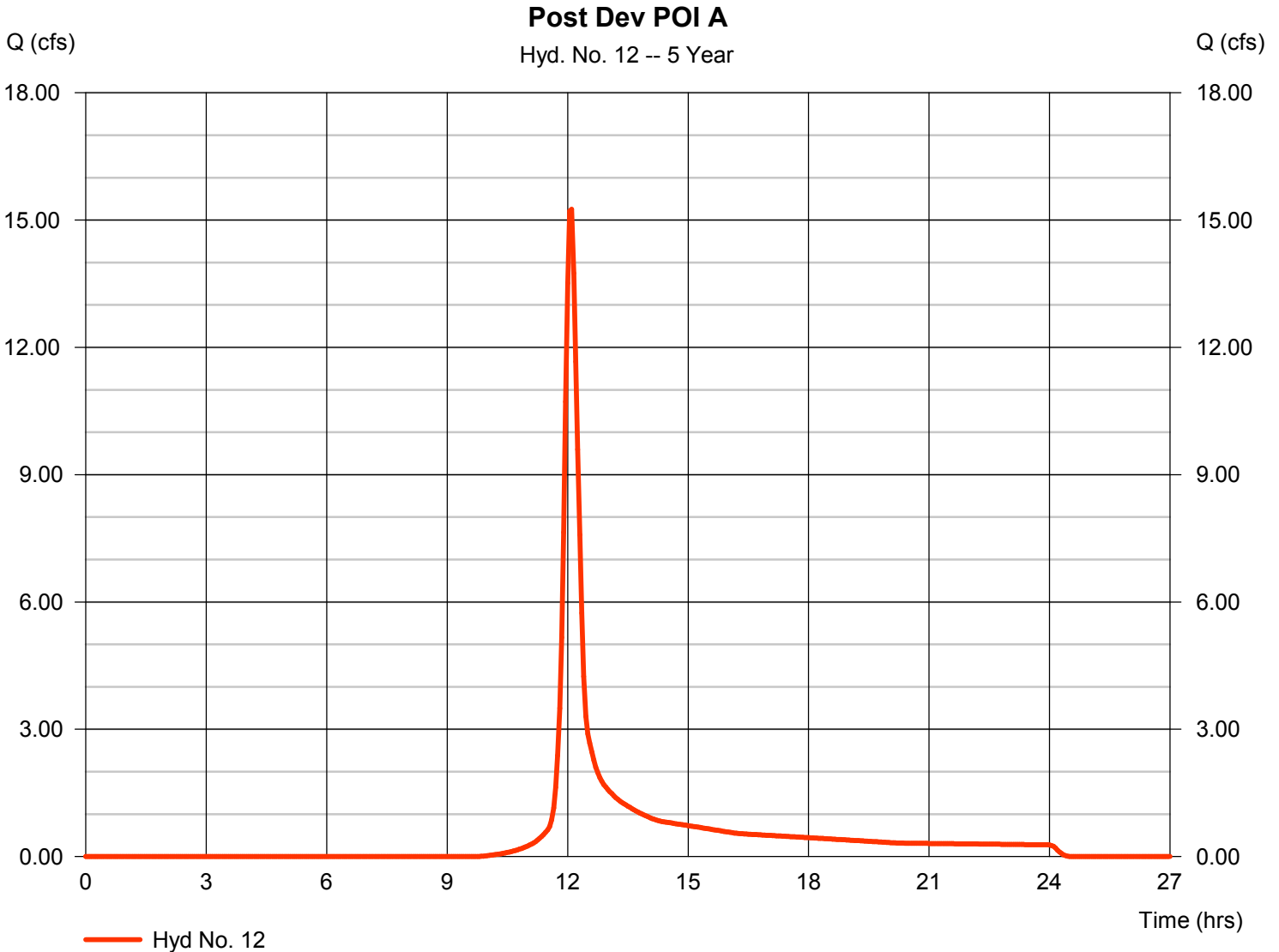
Thursday, 04 / 6 / 2017

## Hyd. No. 12

Post Dev POI A

Hydrograph type	= SCS Runoff	Peak discharge	= 15.26 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 49,739 cuft
Drainage area	= 9.940 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.70 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.510 x 78) + (0.230 x 91) + (0.200 x 98)] / 9.940



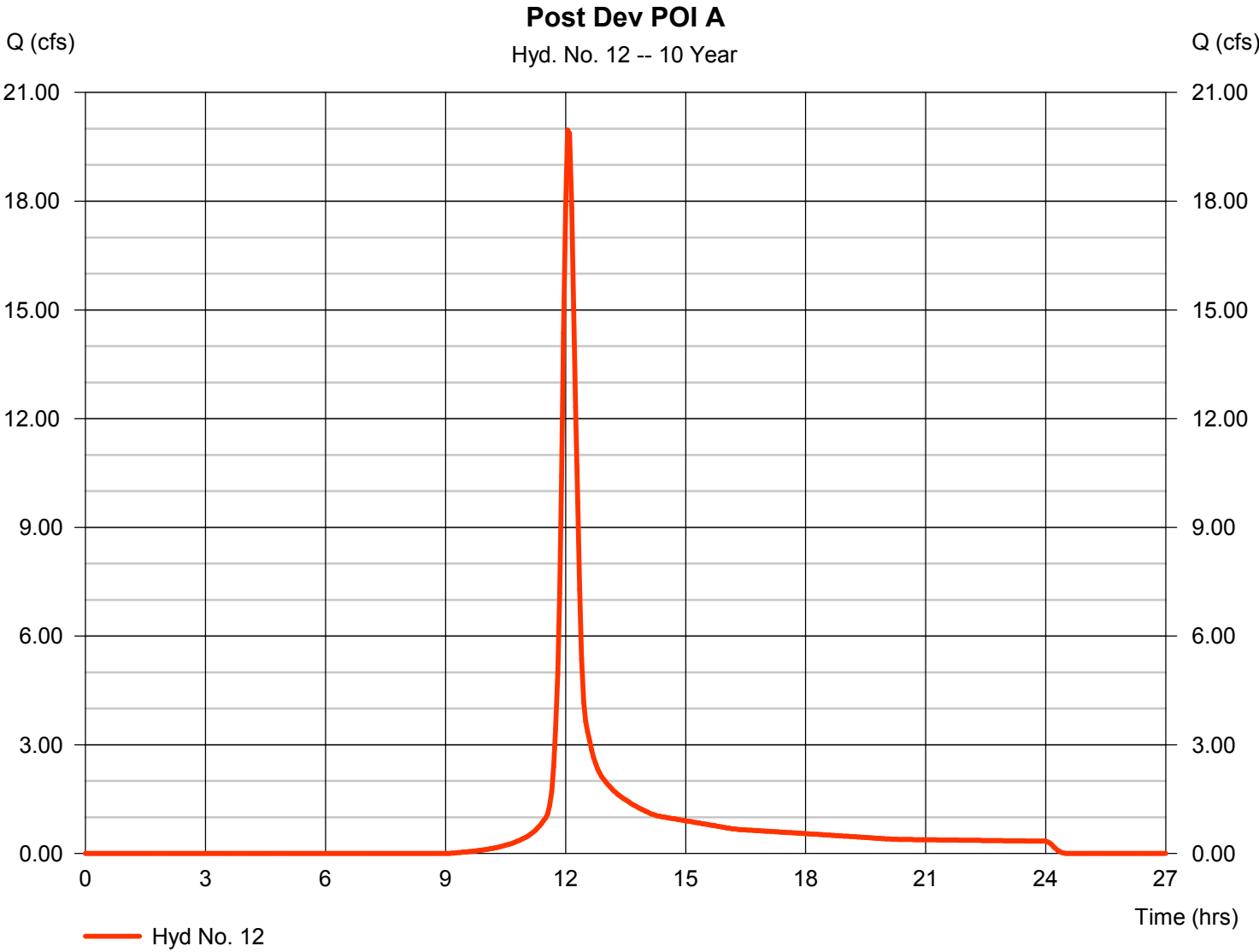
# Hydrograph Report

## Hyd. No. 12

Post Dev POI A

Hydrograph type	= SCS Runoff	Peak discharge	= 19.96 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.05 hrs
Time interval	= 3 min	Hyd. volume	= 64,402 cuft
Drainage area	= 9.940 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.70 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.510 x 78) + (0.230 x 91) + (0.200 x 98)] / 9.940



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

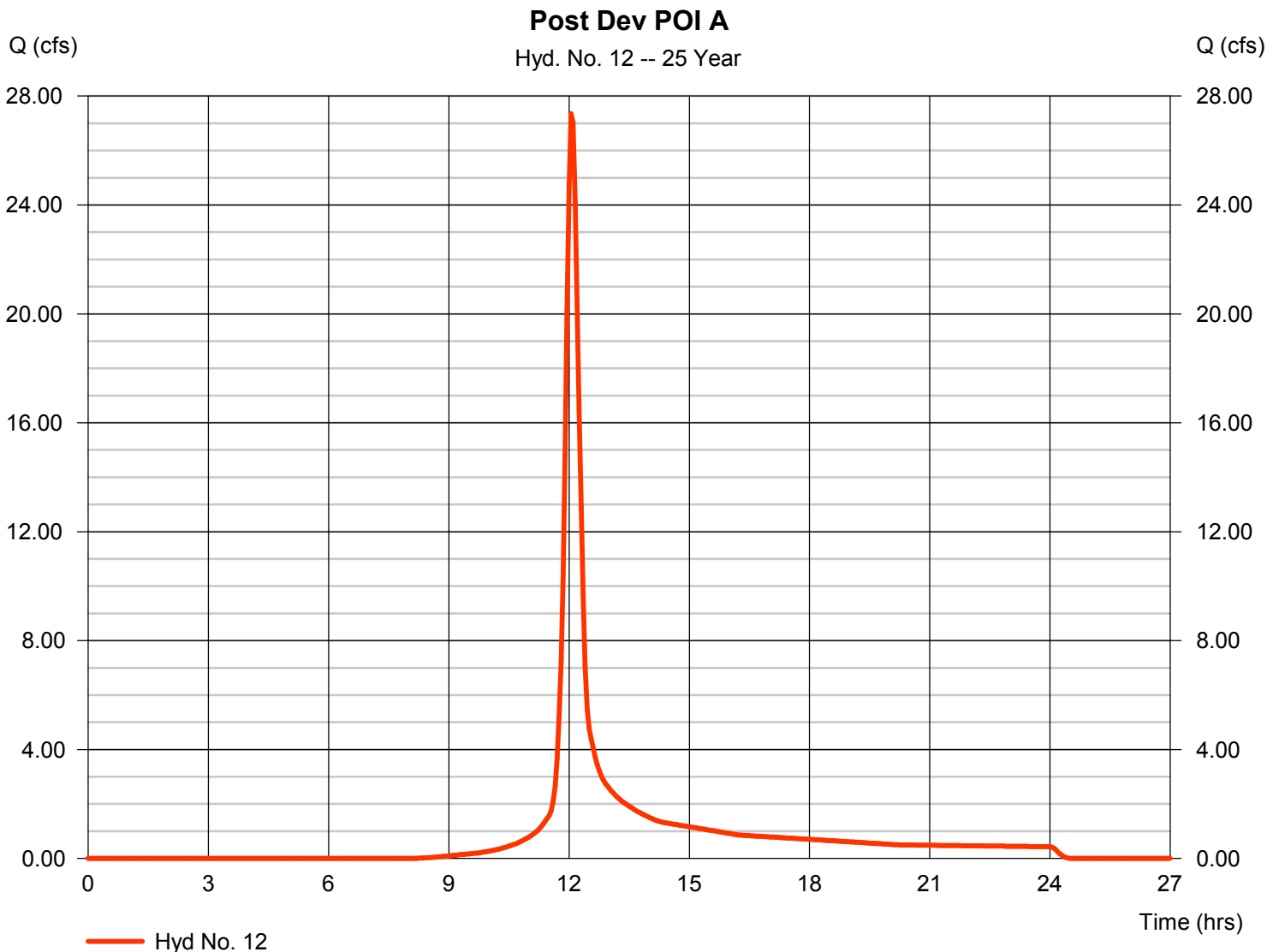
Thursday, 04 / 6 / 2017

## Hyd. No. 12

Post Dev POI A

Hydrograph type	= SCS Runoff	Peak discharge	= 27.35 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.05 hrs
Time interval	= 3 min	Hyd. volume	= 87,492 cuft
Drainage area	= 9.940 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.70 min
Total precip.	= 4.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.510 x 78) + (0.230 x 91) + (0.200 x 98)] / 9.940



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

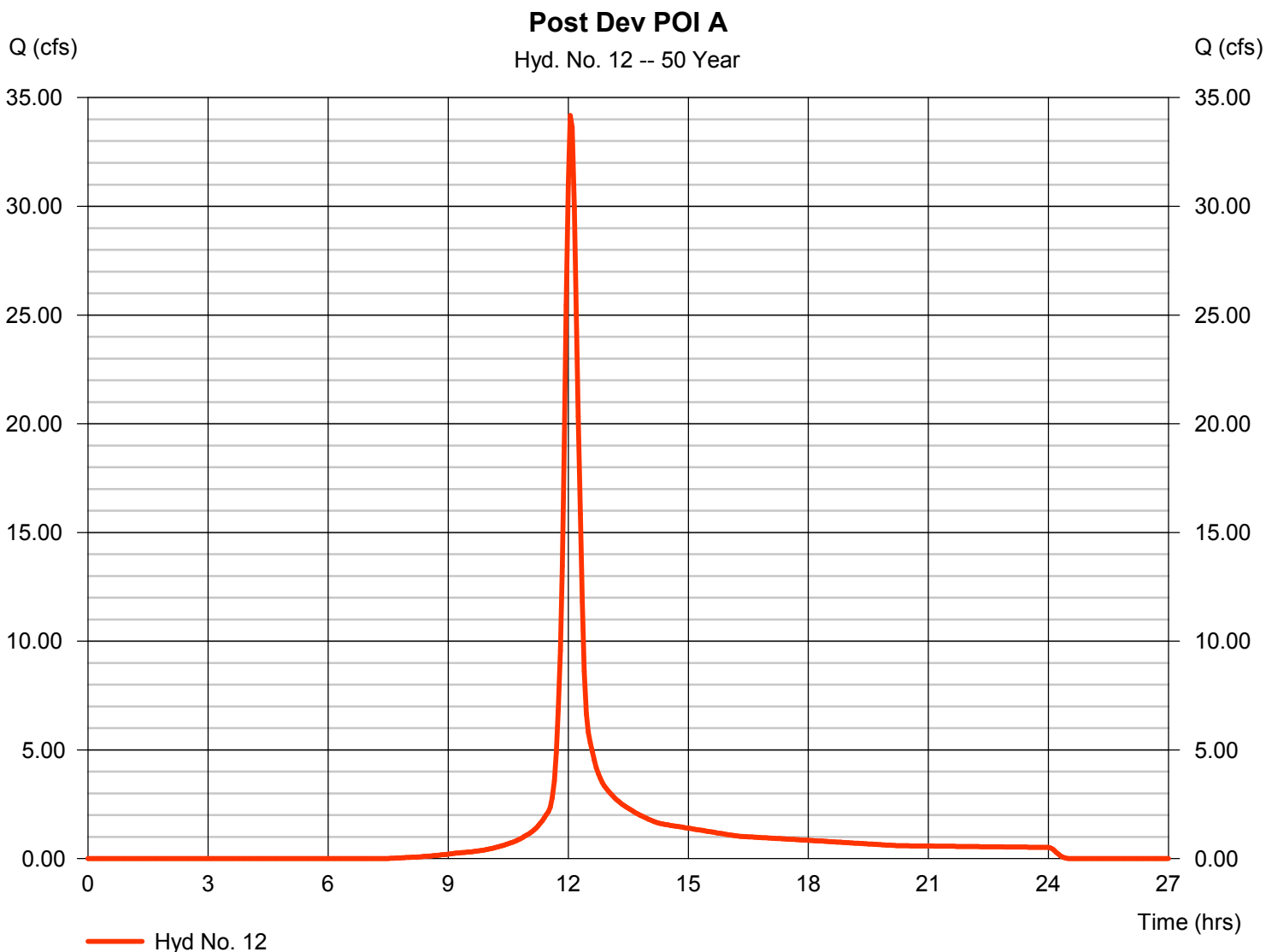
Thursday, 04 / 6 / 2017

## Hyd. No. 12

Post Dev POI A

Hydrograph type	= SCS Runoff	Peak discharge	= 34.18 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.05 hrs
Time interval	= 3 min	Hyd. volume	= 109,070 cuft
Drainage area	= 9.940 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.70 min
Total precip.	= 5.15 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.510 x 78) + (0.230 x 91) + (0.200 x 98)] / 9.940



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

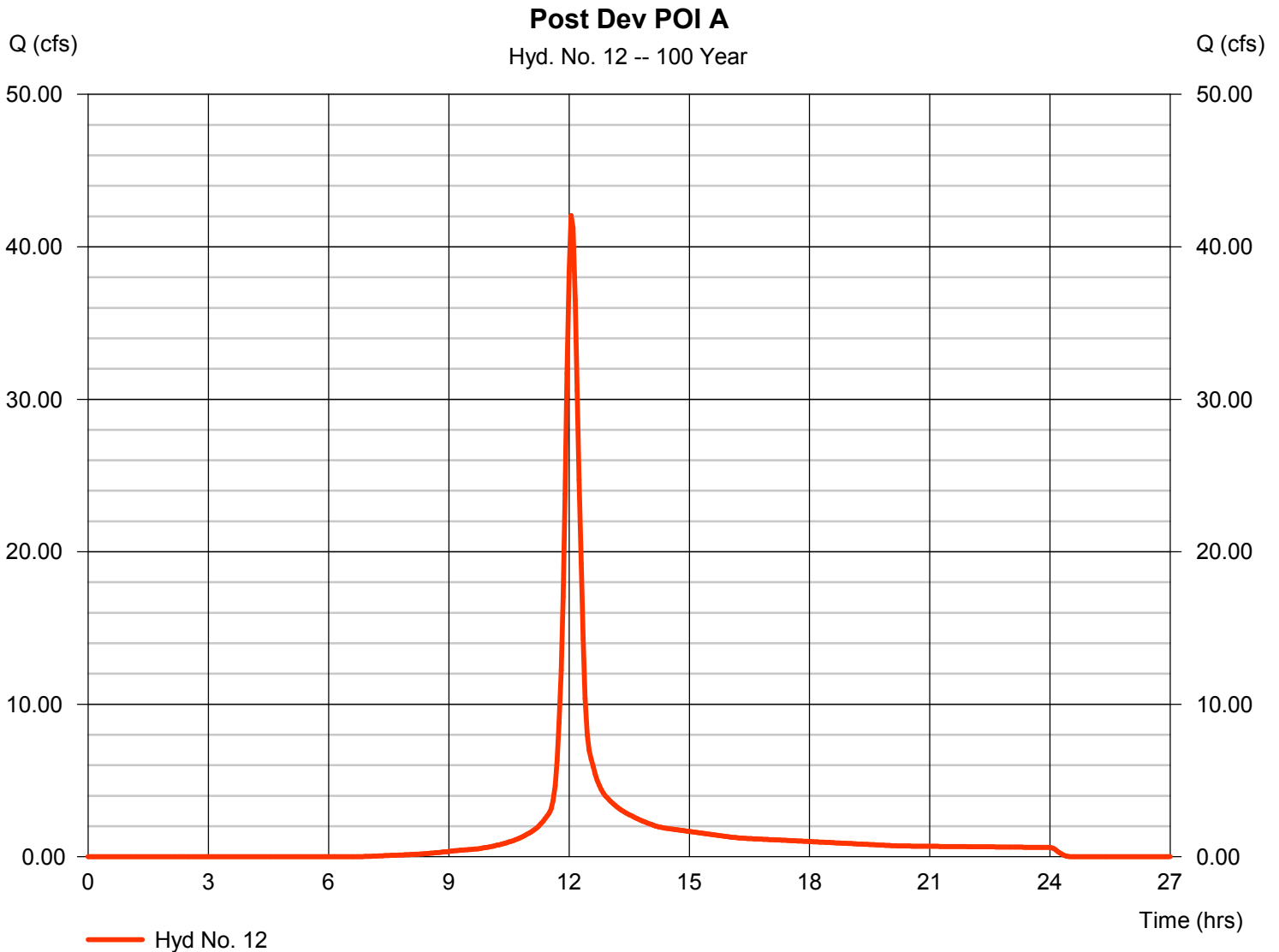
Thursday, 04 / 6 / 2017

## Hyd. No. 12

Post Dev POI A

Hydrograph type	= SCS Runoff	Peak discharge	= 42.05 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.05 hrs
Time interval	= 3 min	Hyd. volume	= 134,263 cuft
Drainage area	= 9.940 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.70 min
Total precip.	= 5.92 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(9.510 x 78) + (0.230 x 91) + (0.200 x 98)] / 9.940



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

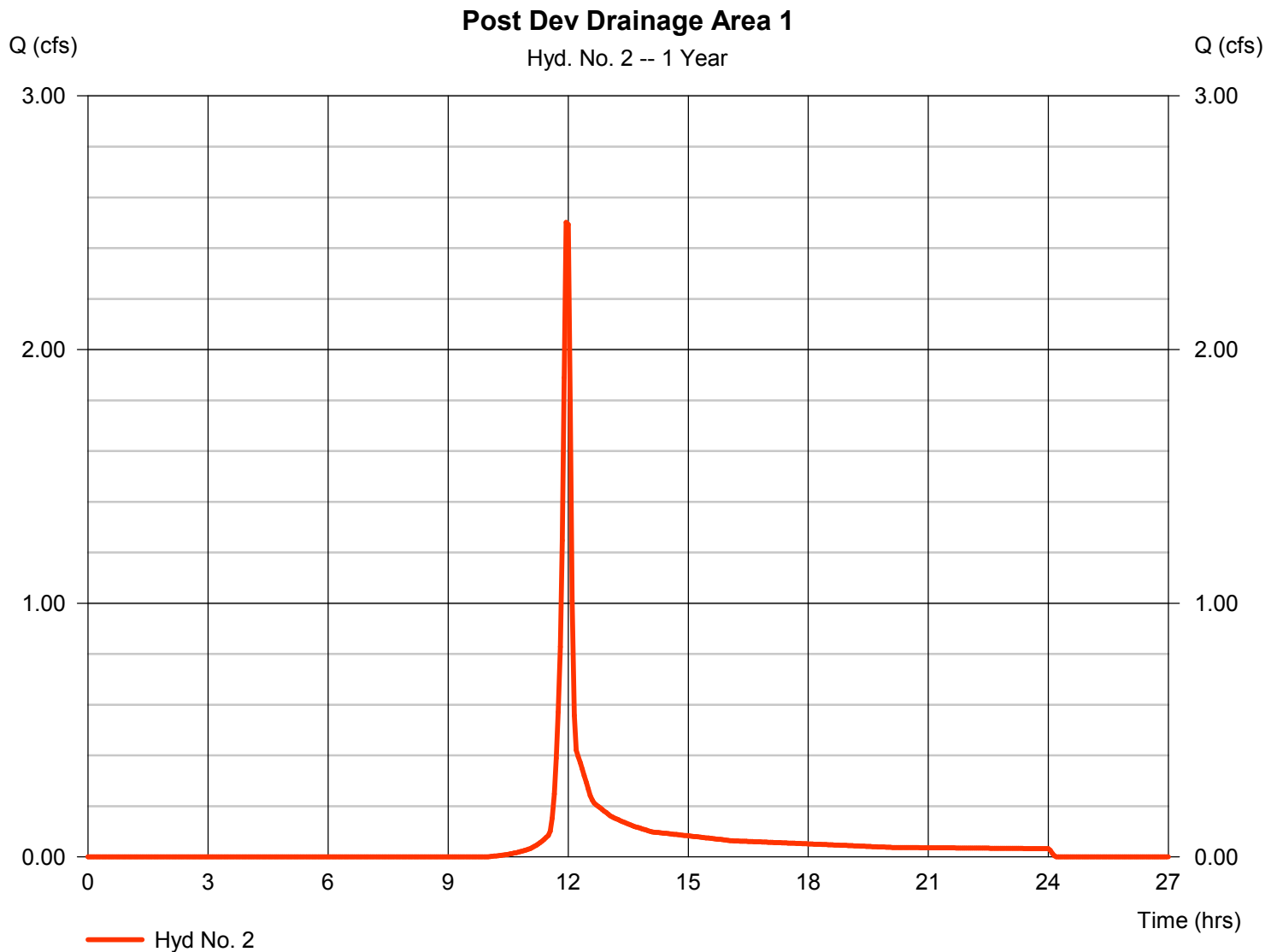
Thursday, 04 / 6 / 2017

## Hyd. No. 2

### Post Dev Drainage Area 1

Hydrograph type	= SCS Runoff	Peak discharge	= 2.502 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 5,721 cuft
Drainage area	= 1.940 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.920 \times 91) + (1.020 \times 78)] / 1.940$



## Pond No. 1 - Rain Garden #1

### Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 1341.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1341.00	5,127	0	0
1.00	1342.00	6,414	5,771	5,771
3.00	1344.00	9,156	15,570	21,341

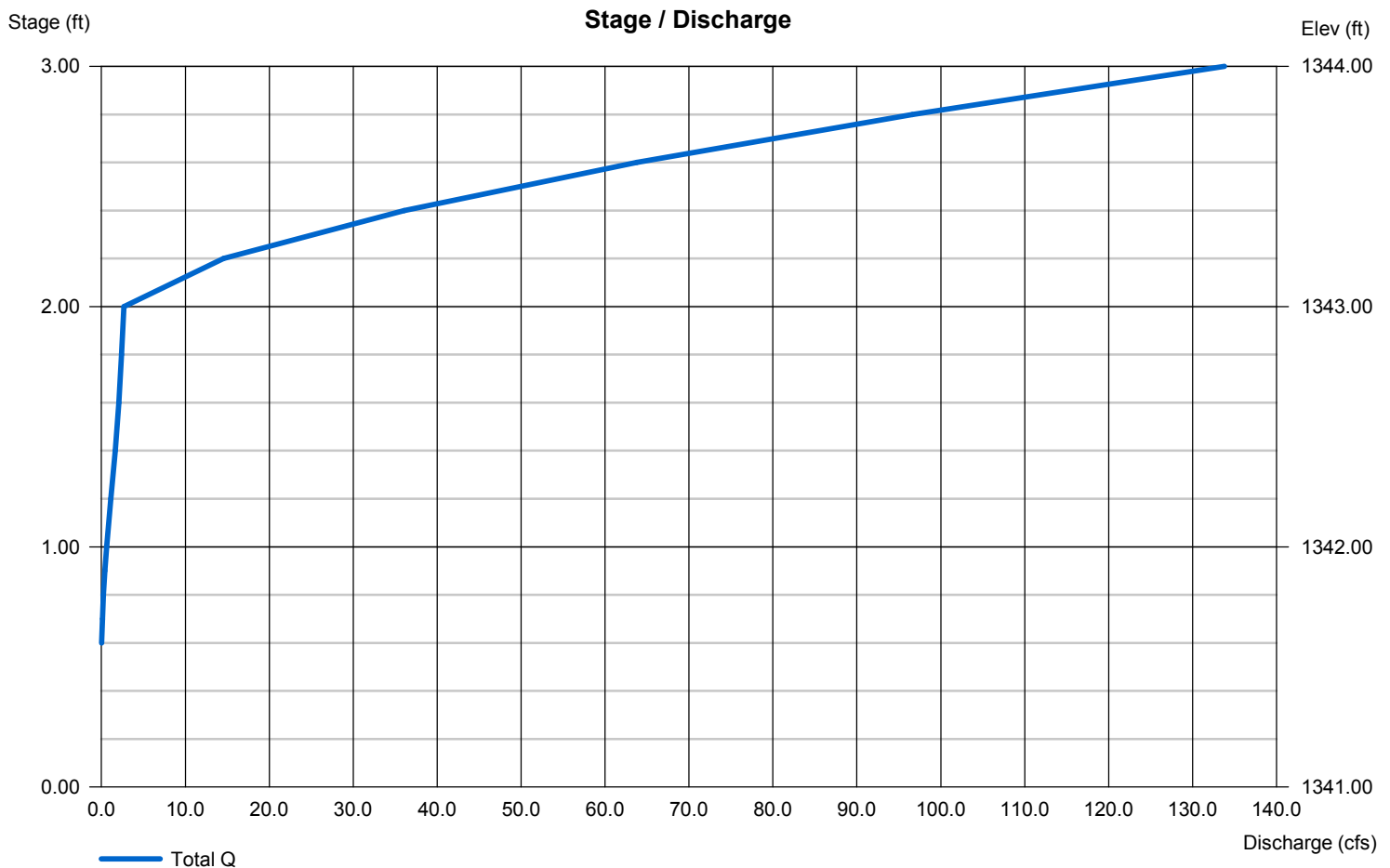
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	12.00	0.00	0.00
Span (in)	= 12.00	12.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 1341.50	1341.50	0.00	0.00
Length (ft)	= 32.00	0.00	0.00	0.00
Slope (%)	= 12.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	50.00	0.00	0.00
Crest El. (ft)	= 0.00	1343.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= Rect	Broad	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

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



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

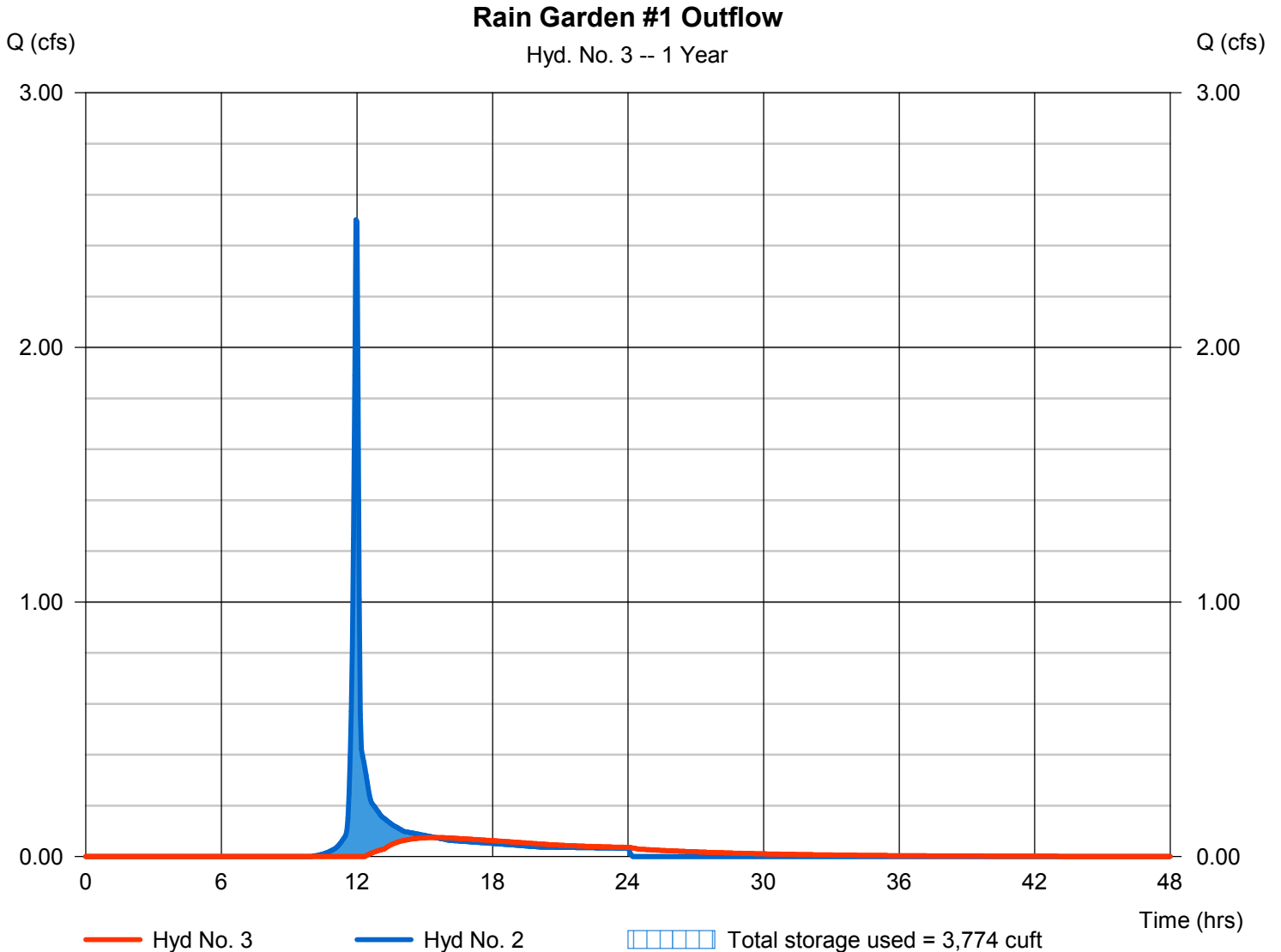
Thursday, 04 / 6 / 2017

## Hyd. No. 3

### Rain Garden #1 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.075 cfs
Storm frequency	= 1 yrs	Time to peak	= 15.45 hrs
Time interval	= 3 min	Hyd. volume	= 2,816 cuft
Inflow hyd. No.	= 2 - Post Dev Drainage Area 1	Max. Elevation	= 1341.65 ft
Reservoir name	= Rain Garden #1	Max. Storage	= 3,774 cuft

Storage Indication method used.



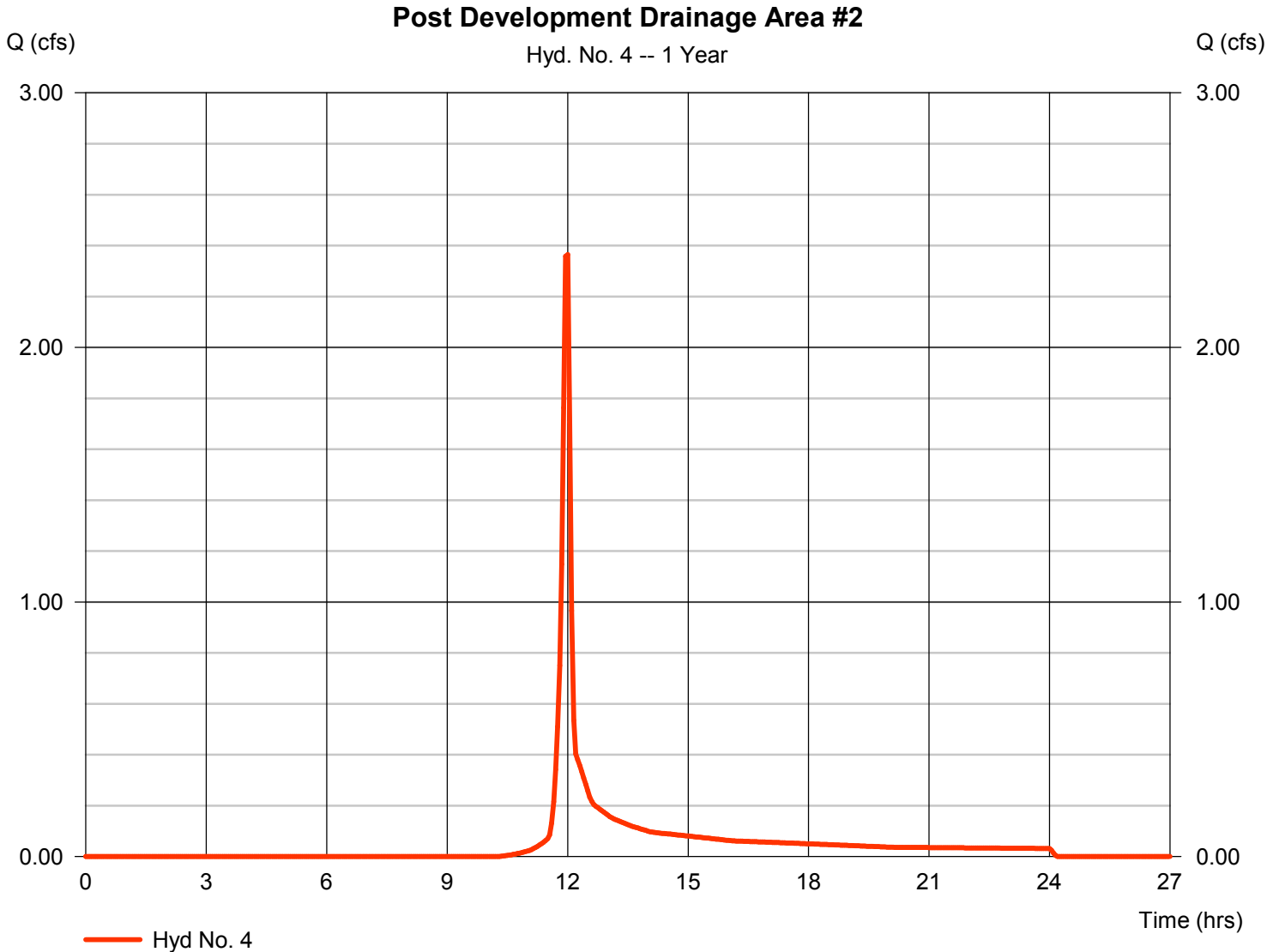
# Hydrograph Report

## Hyd. No. 4

### Post Development Drainage Area #2

Hydrograph type	= SCS Runoff	Peak discharge	= 2.365 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 5,427 cuft
Drainage area	= 1.960 ac	Curve number	= 83*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.030 x 98) + (0.660 x 91) + (1.270 x 78)] / 1.960



## Pond No. 2 - Rain Garden #2

### Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 1342.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1342.00	2,884	0	0
2.00	1344.00	5,811	8,695	8,695

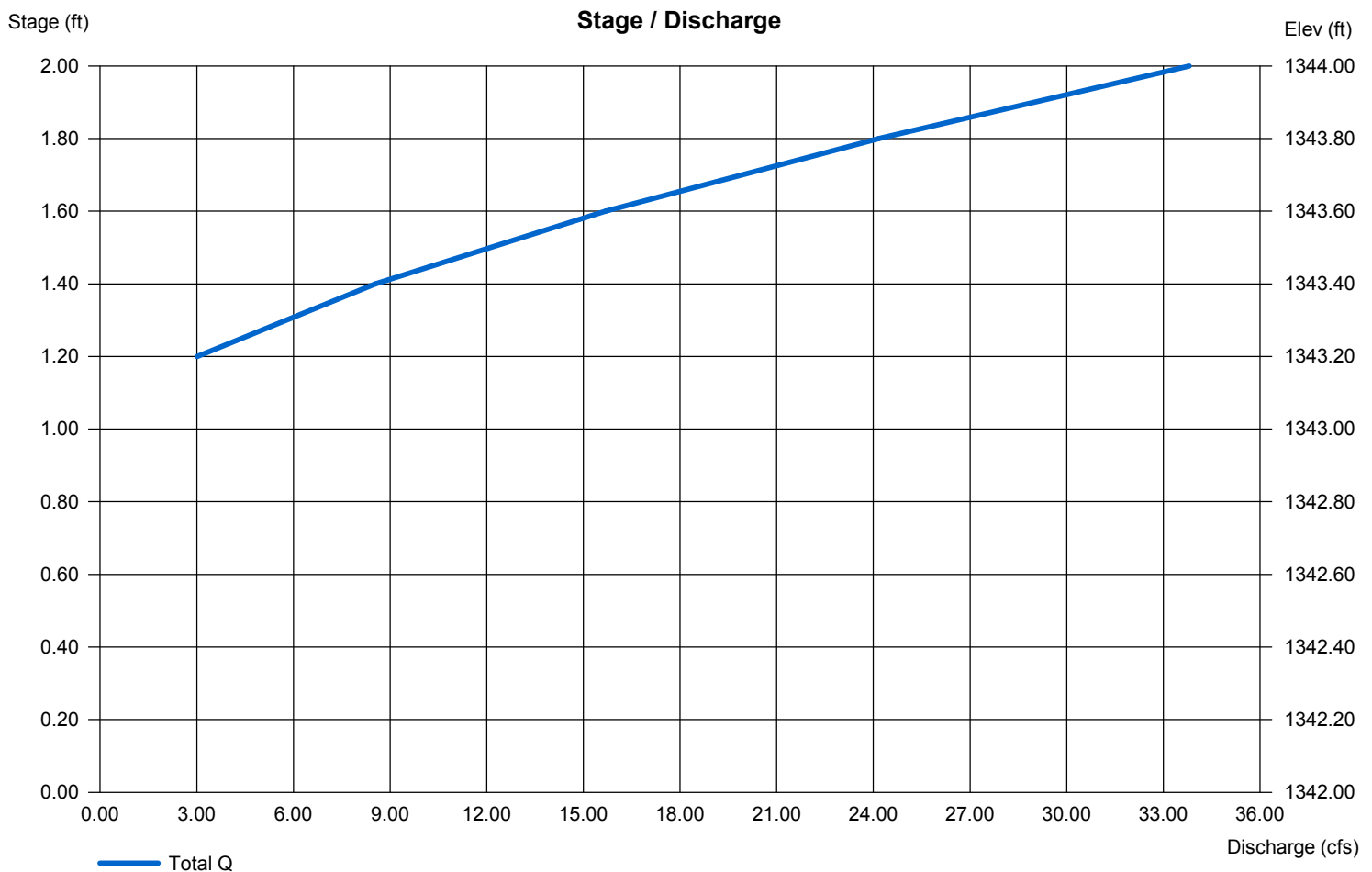
### Culvert / Orifice Structures

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

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	13.00	0.00	0.00
Crest El. (ft)	= 0.00	1343.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= ---	Broad	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

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



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

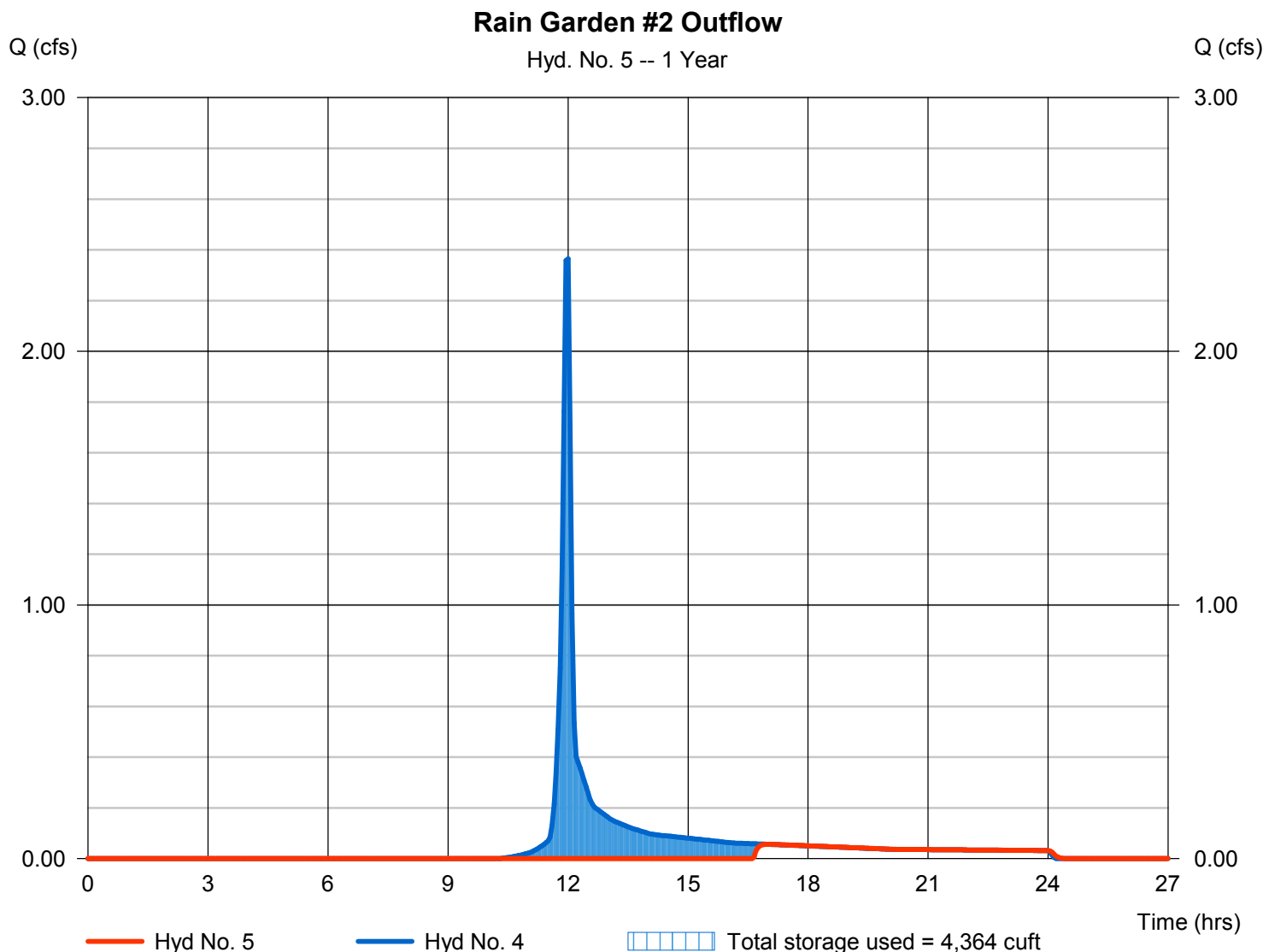
Thursday, 04 / 6 / 2017

## Hyd. No. 5

### Rain Garden #2 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.056 cfs
Storm frequency	= 1 yrs	Time to peak	= 17.00 hrs
Time interval	= 3 min	Hyd. volume	= 1,079 cuft
Inflow hyd. No.	= 4 - Post Development Drainage Area #2	Area #2	= 1343.00 ft
Reservoir name	= Rain Garden #2	Max. Storage	= 4,364 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

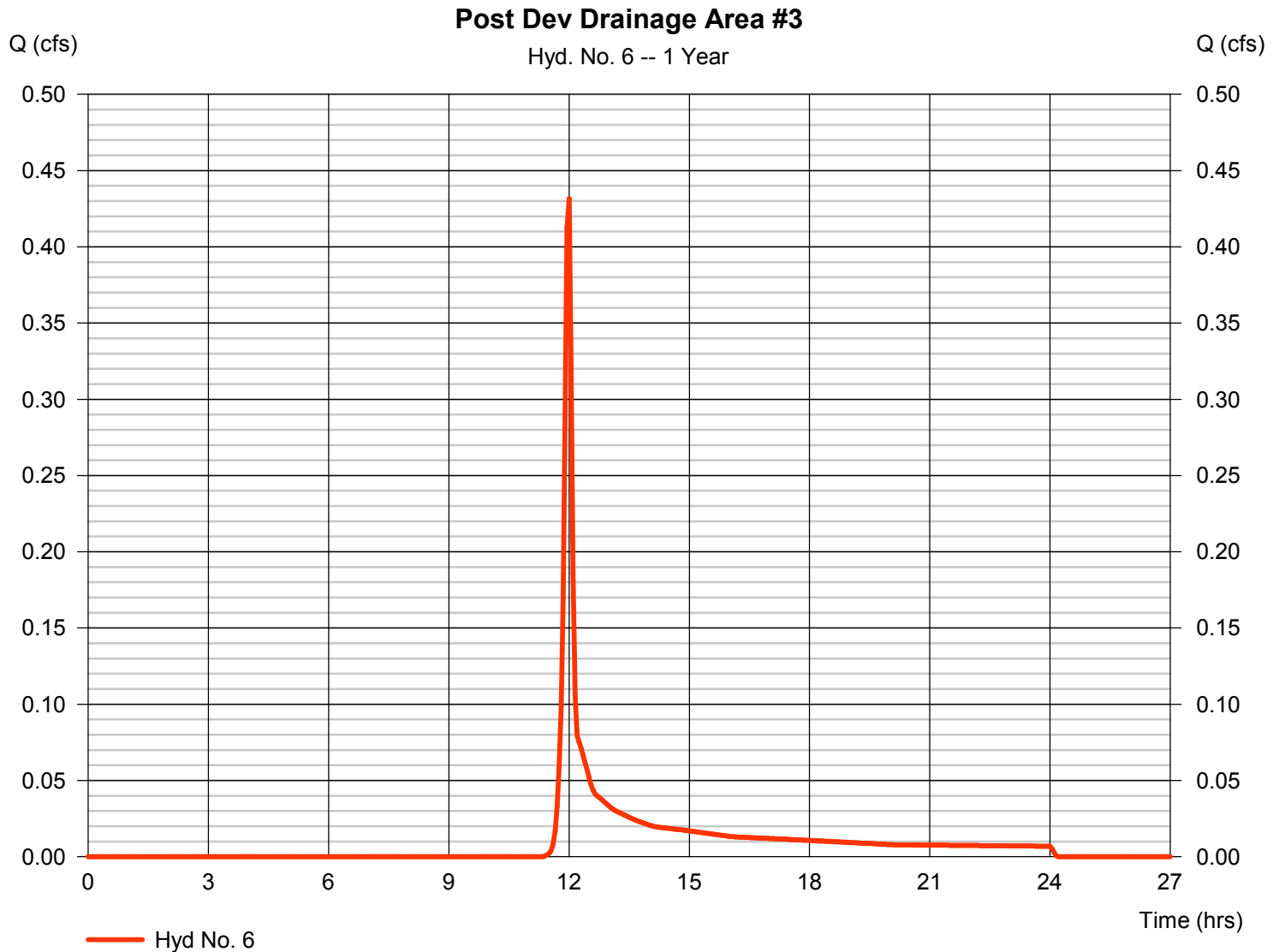
Thursday, 04 / 6 / 2017

## Hyd. No. 6

### Post Dev Drainage Area #3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.432 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 1,011 cuft
Drainage area	= 0.510 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.510 x 78)] / 0.510



# Hydrograph Report

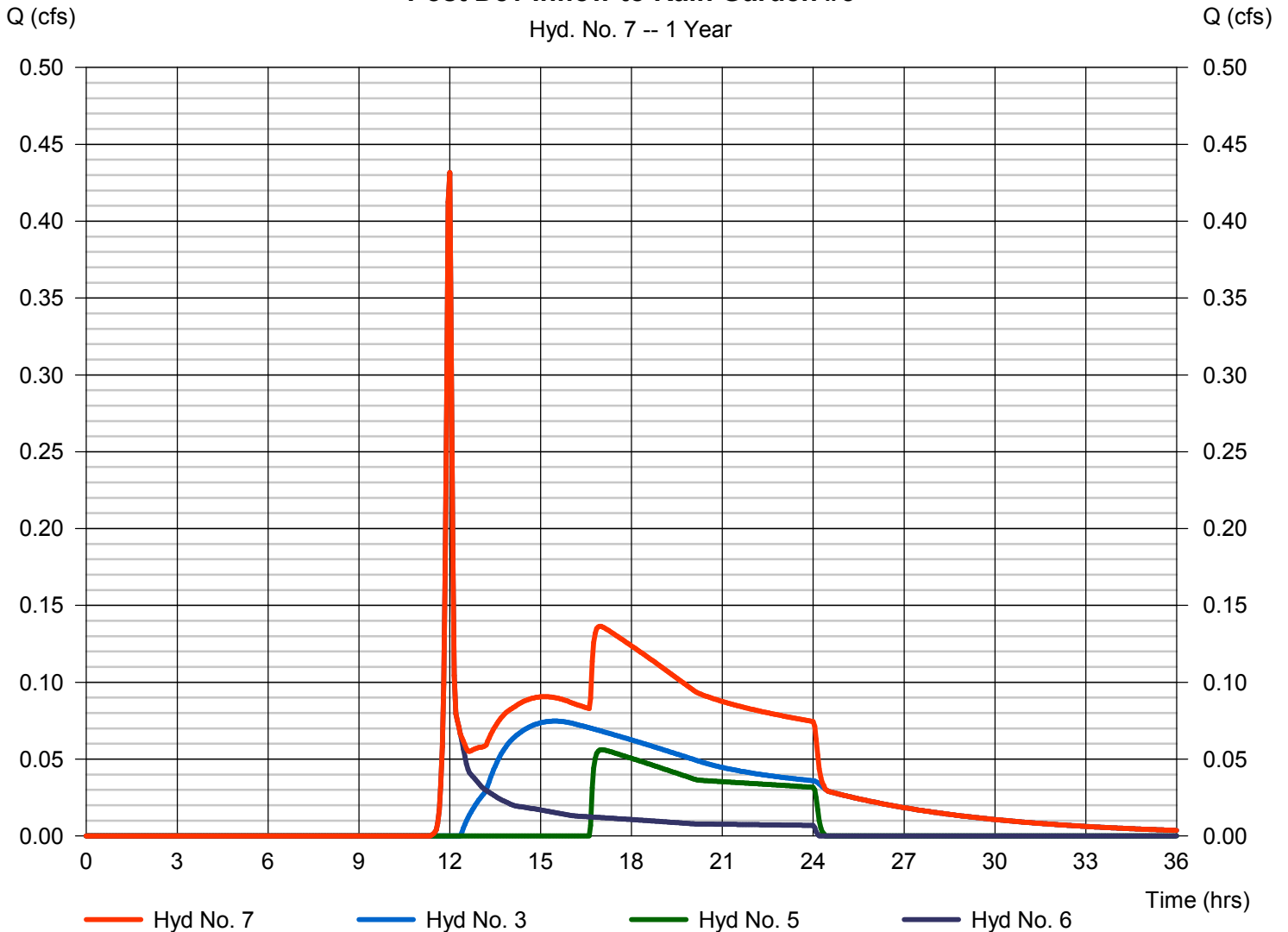
## Hyd. No. 7

Post Dev Inflow to Rain Garden #3

Hydrograph type	= Combine	Peak discharge	= 0.432 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 4,906 cuft
Inflow hyds.	= 3, 5, 6	Contrib. drain. area	= 0.510 ac

Post Dev Inflow to Rain Garden #3

Hyd. No. 7 -- 1 Year



## Pond No. 3 - Rain Garden #3

### Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 1338.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1338.00	9,309	0	0
2.00	1340.00	12,740	22,049	22,049
4.00	1342.00	16,357	29,097	51,146

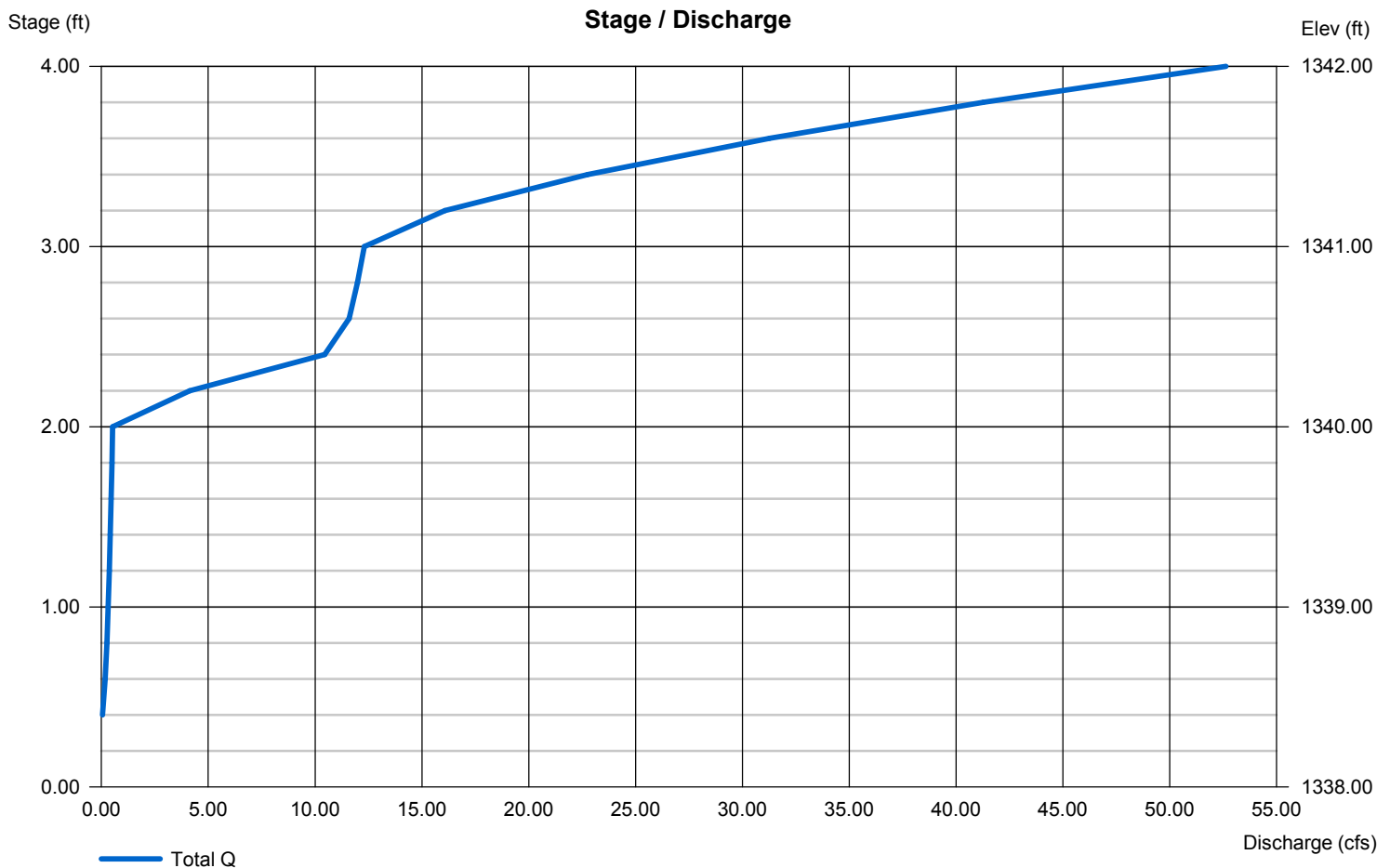
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	4.00	0.00	0.00
Span (in)	= 15.00	4.00	0.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 1336.00	1338.25	0.00	0.00
Length (ft)	= 55.00	0.00	0.00	0.00
Slope (%)	= 6.30	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	15.00	0.00	0.00
Crest El. (ft)	= 1340.00	1341.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

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



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

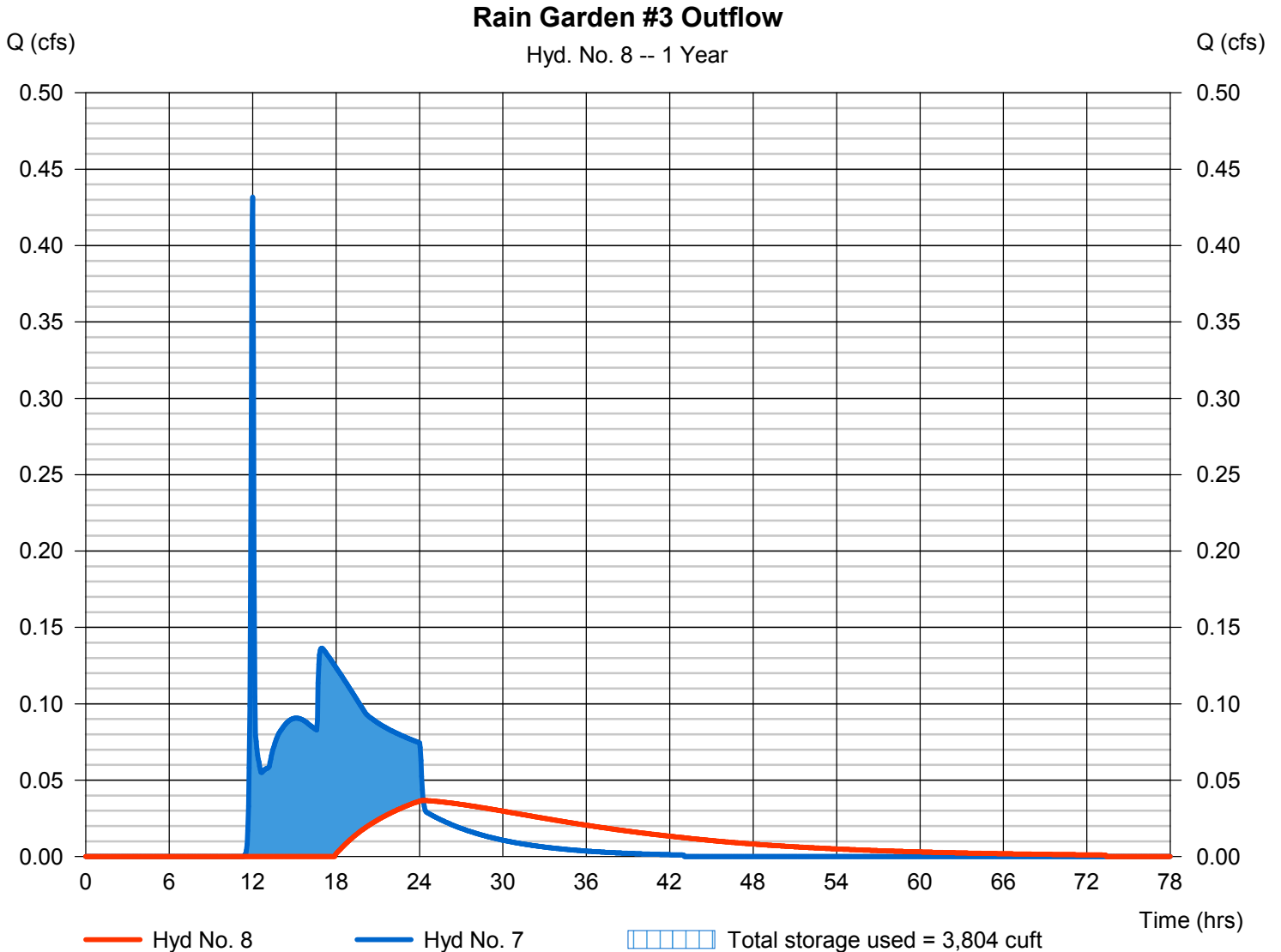
Thursday, 04 / 6 / 2017

## Hyd. No. 8

### Rain Garden #3 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.037 cfs
Storm frequency	= 1 yrs	Time to peak	= 24.25 hrs
Time interval	= 3 min	Hyd. volume	= 2,658 cuft
Inflow hyd. No.	= 7 - Post Dev Inflow to Rain Garden #3	Max. Elevation	= 1338.35 ft
Reservoir name	= Rain Garden #3	Max. Storage	= 3,804 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

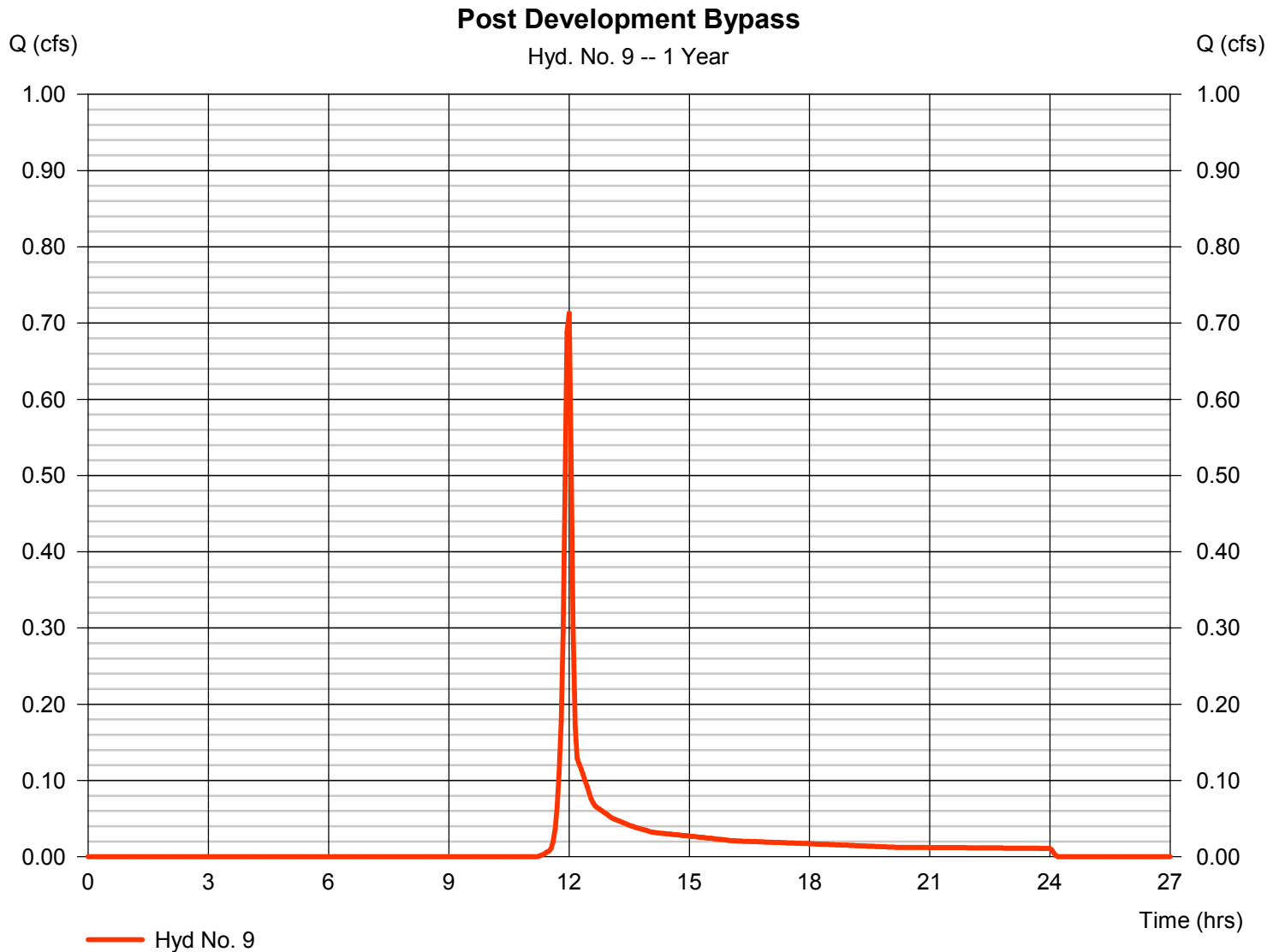
Thursday, 04 / 6 / 2017

## Hyd. No. 9

### Post Development Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 0.713 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 1,658 cuft
Drainage area	= 0.780 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = + (0.020 x 98) + (0.760 x 78)] / 0.780



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

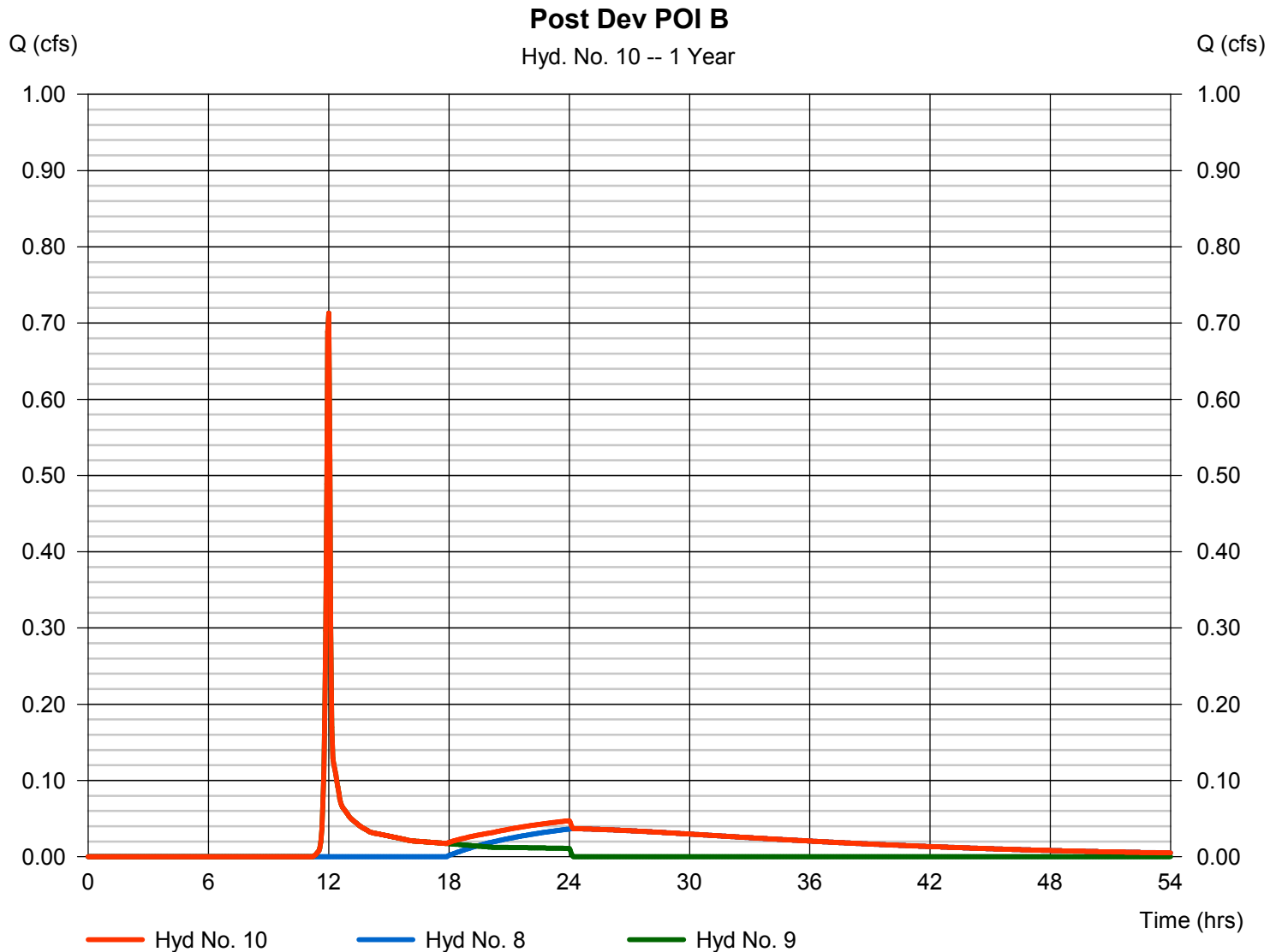
Thursday, 04 / 6 / 2017

## Hyd. No. 10

Post Dev POI B

Hydrograph type = Combine  
Storm frequency = 1 yrs  
Time interval = 3 min  
Inflow hyds. = 8, 9

Peak discharge = 0.713 cfs  
Time to peak = 12.00 hrs  
Hyd. volume = 4,316 cuft  
Contrib. drain. area = 0.780 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

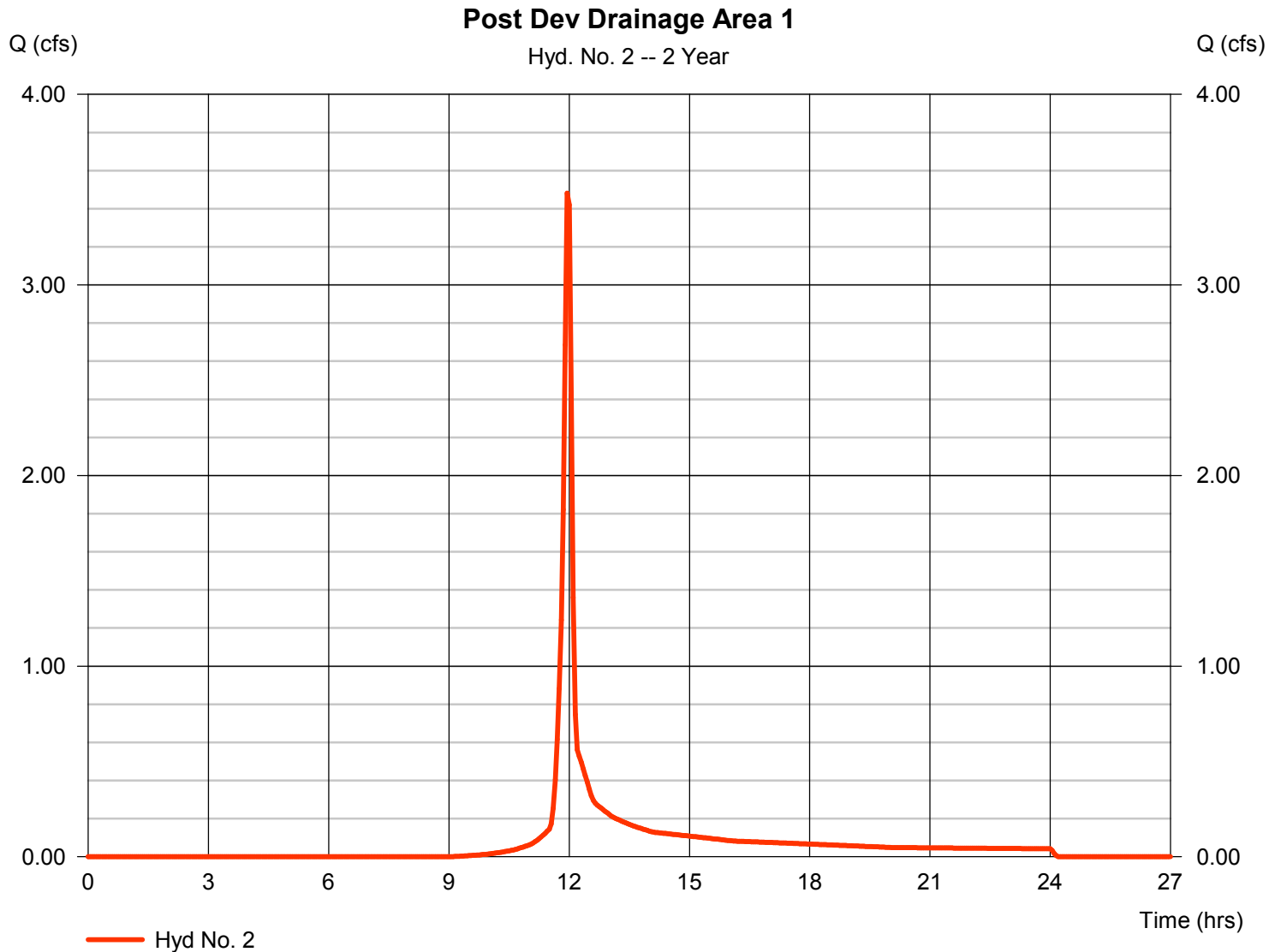
Thursday, 04 / 6 / 2017

## Hyd. No. 2

### Post Dev Drainage Area 1

Hydrograph type	= SCS Runoff	Peak discharge	= 3.482 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 7,883 cuft
Drainage area	= 1.940 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.920 x 91) + (1.020 x 78)] / 1.940



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

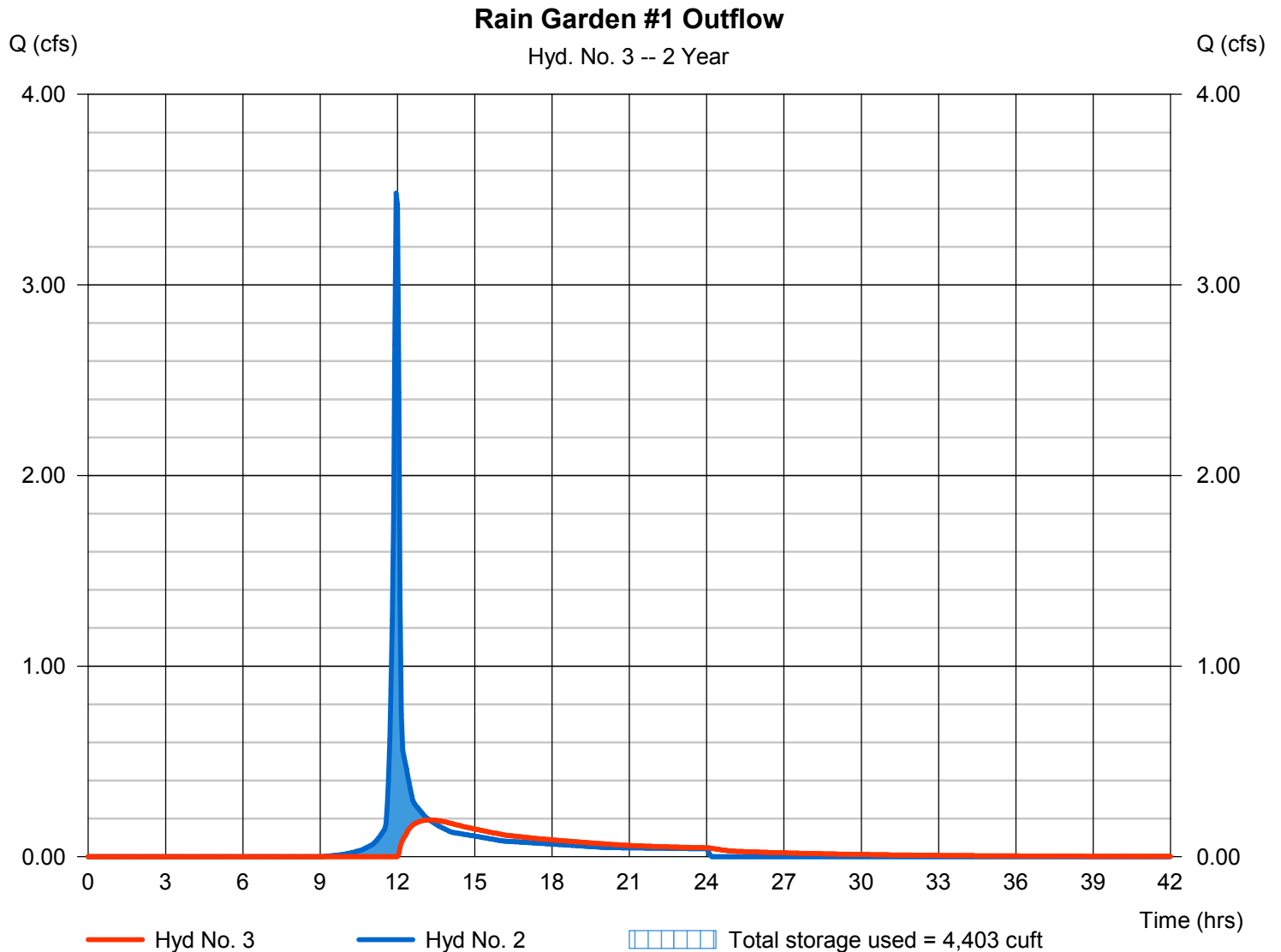
Thursday, 04 / 6 / 2017

## Hyd. No. 3

### Rain Garden #1 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.193 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.25 hrs
Time interval	= 3 min	Hyd. volume	= 4,978 cuft
Inflow hyd. No.	= 2 - Post Dev Drainage Area 1	Max. Elevation	= 1341.76 ft
Reservoir name	= Rain Garden #1	Max. Storage	= 4,403 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

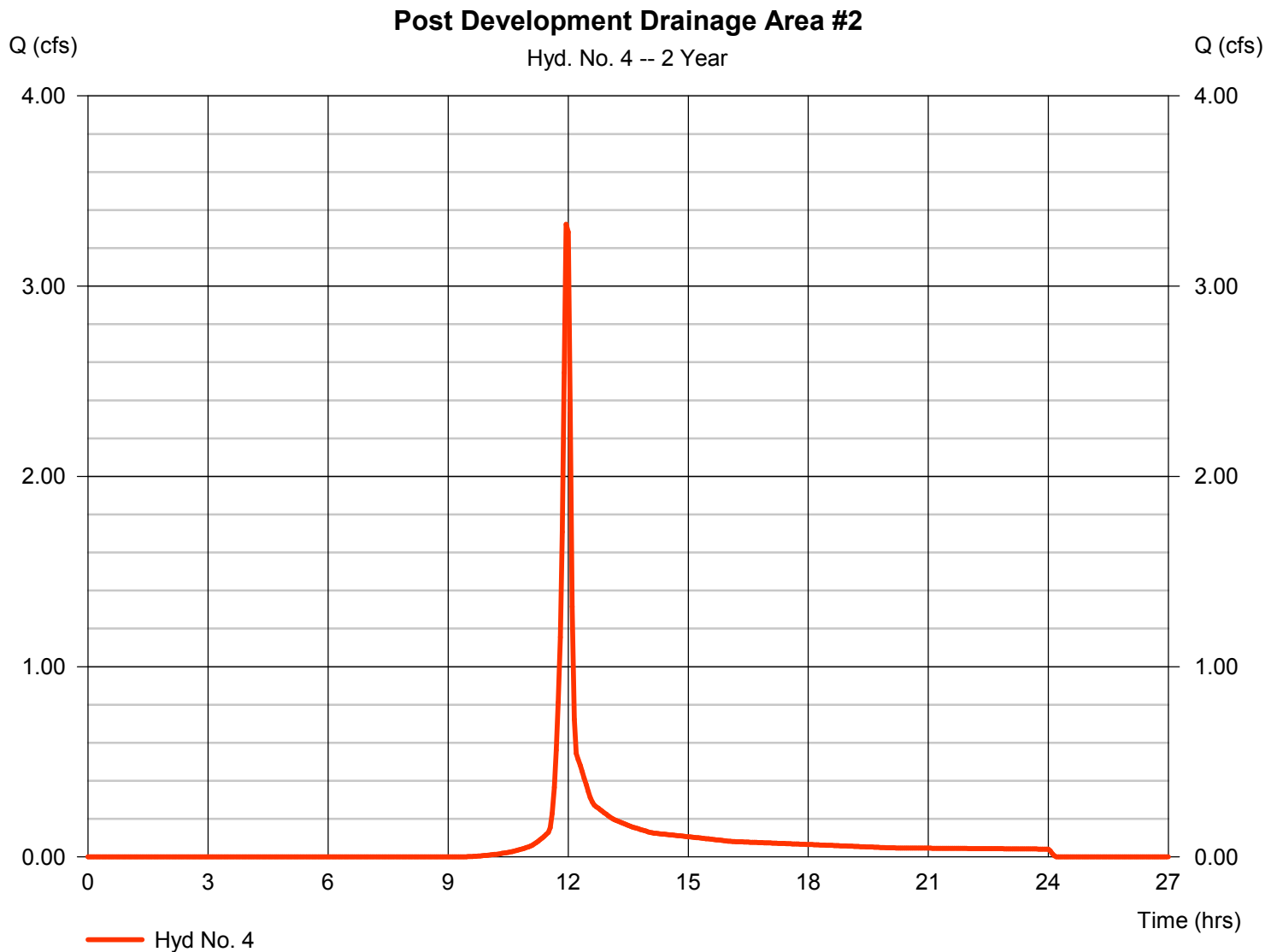
Thursday, 04 / 6 / 2017

## Hyd. No. 4

### Post Development Drainage Area #2

Hydrograph type	= SCS Runoff	Peak discharge	= 3.325 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 7,550 cuft
Drainage area	= 1.960 ac	Curve number	= 83*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.030 x 98) + (0.660 x 91) + (1.270 x 78)] / 1.960



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

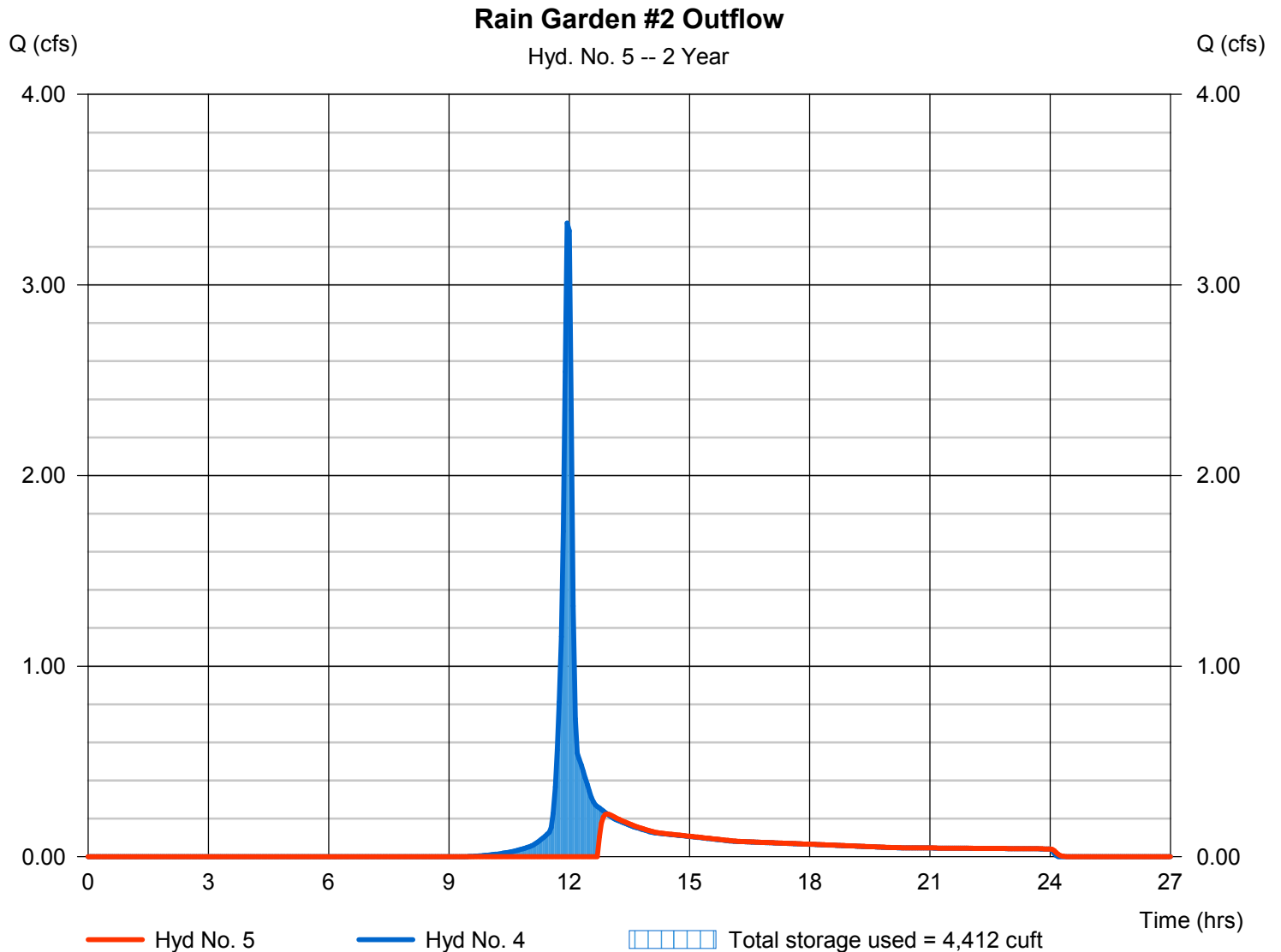
Thursday, 04 / 6 / 2017

## Hyd. No. 5

### Rain Garden #2 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.224 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.95 hrs
Time interval	= 3 min	Hyd. volume	= 3,202 cuft
Inflow hyd. No.	= 4 - Post Development Drainage Area #2	Area #2	= 1343.01 ft
Reservoir name	= Rain Garden #2	Max. Storage	= 4,412 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

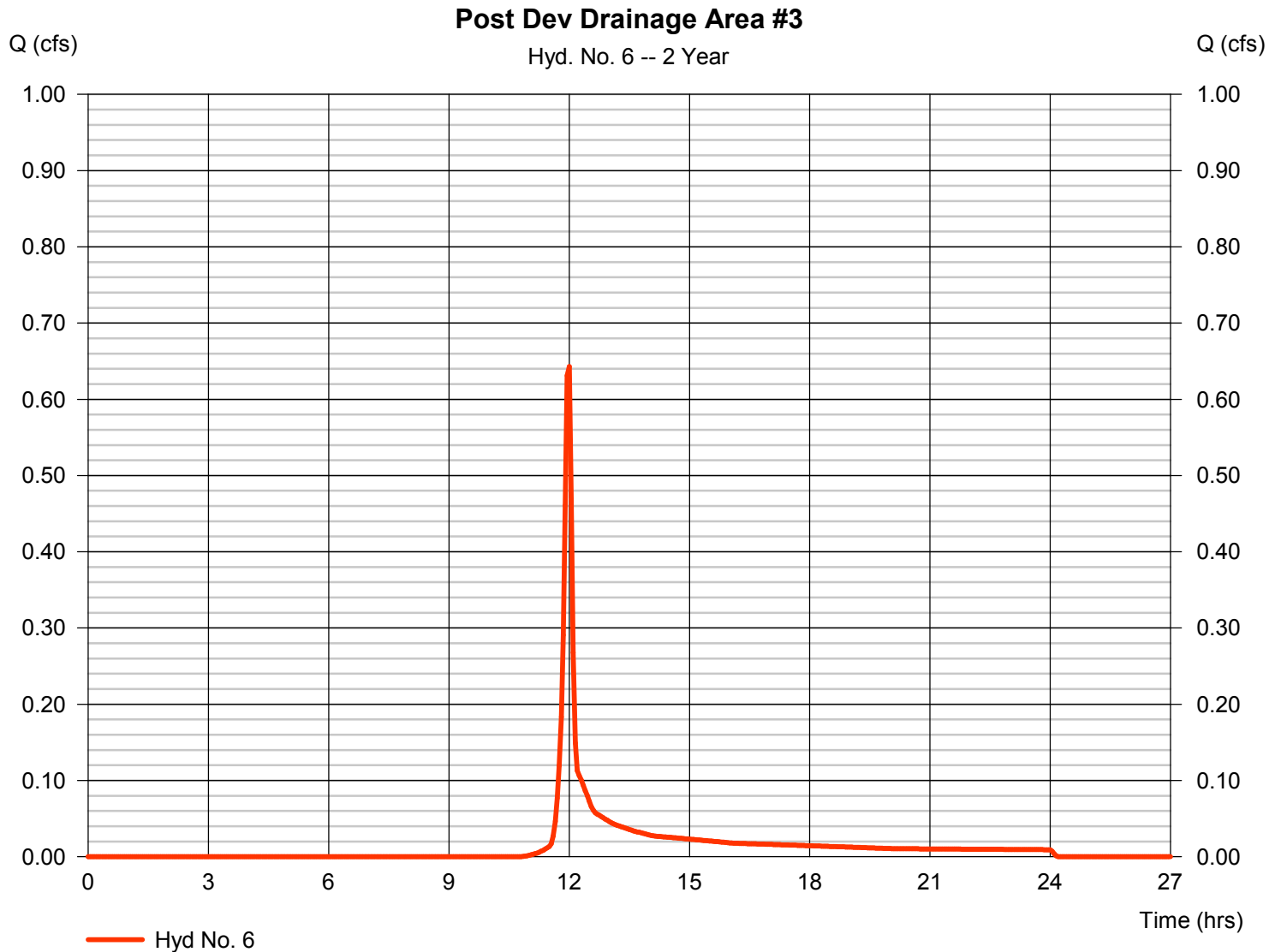
Thursday, 04 / 6 / 2017

## Hyd. No. 6

### Post Dev Drainage Area #3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.643 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 1,481 cuft
Drainage area	= 0.510 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.510 x 78)] / 0.510



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Thursday, 04 / 6 / 2017

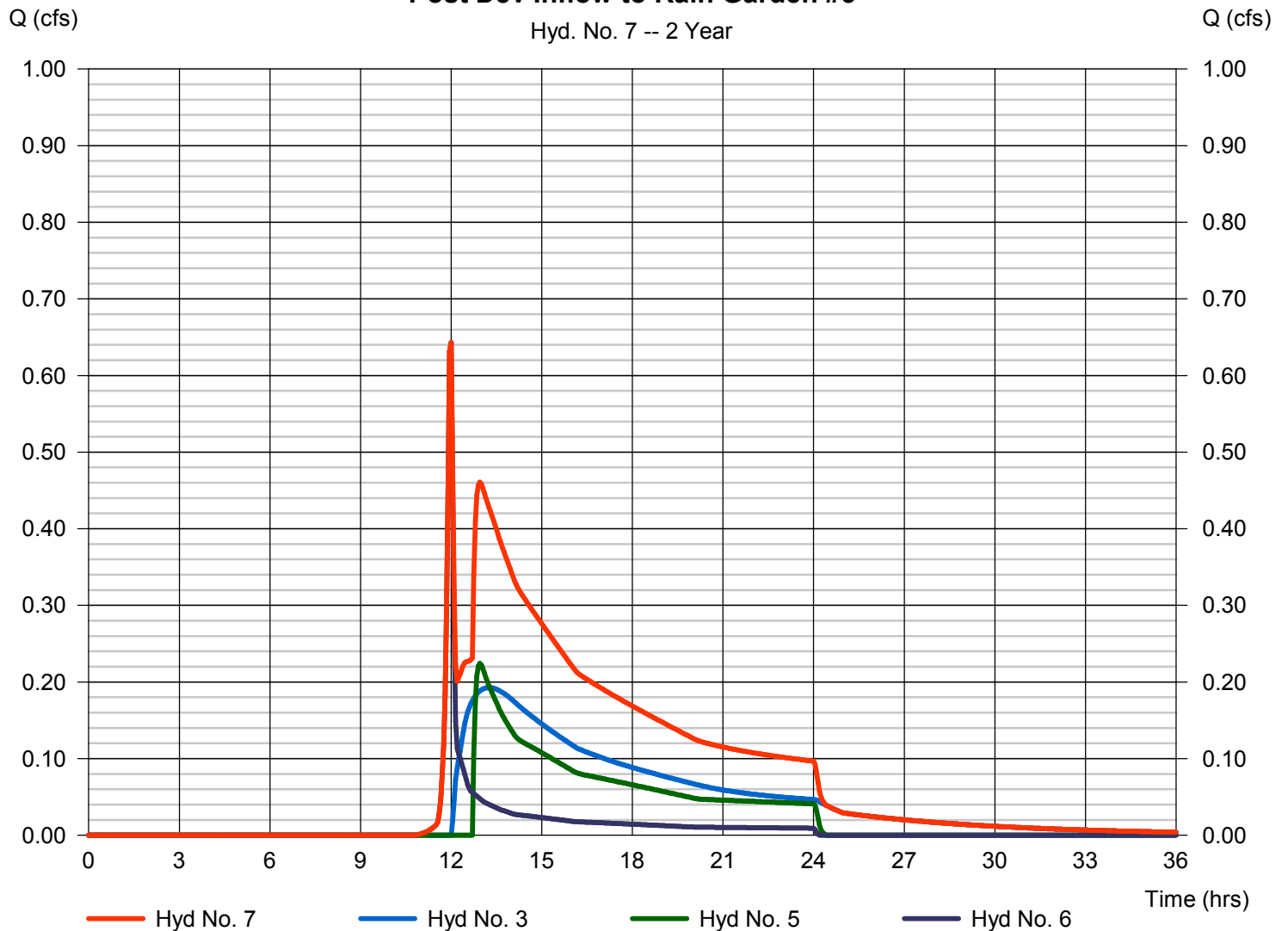
## Hyd. No. 7

Post Dev Inflow to Rain Garden #3

Hydrograph type	= Combine	Peak discharge	= 0.643 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 9,662 cuft
Inflow hyds.	= 3, 5, 6	Contrib. drain. area	= 0.510 ac

Post Dev Inflow to Rain Garden #3

Hyd. No. 7 -- 2 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

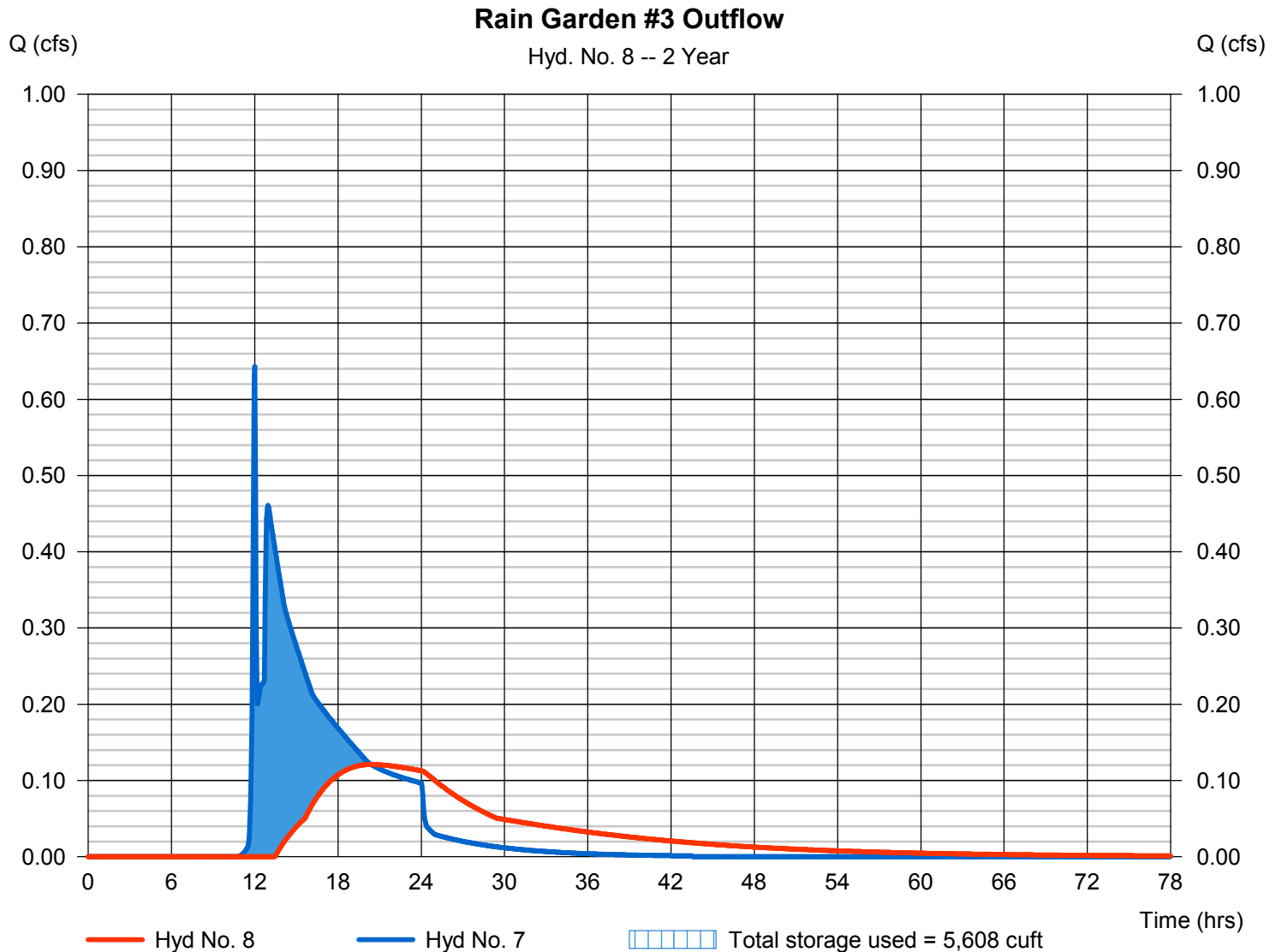
Thursday, 04 / 6 / 2017

## Hyd. No. 8

### Rain Garden #3 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.121 cfs
Storm frequency	= 2 yrs	Time to peak	= 20.40 hrs
Time interval	= 3 min	Hyd. volume	= 7,413 cuft
Inflow hyd. No.	= 7 - Post Dev Inflow to Rain Garden #3	Max. Elevation	= 1338.51 ft
Reservoir name	= Rain Garden #3	Max. Storage	= 5,608 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

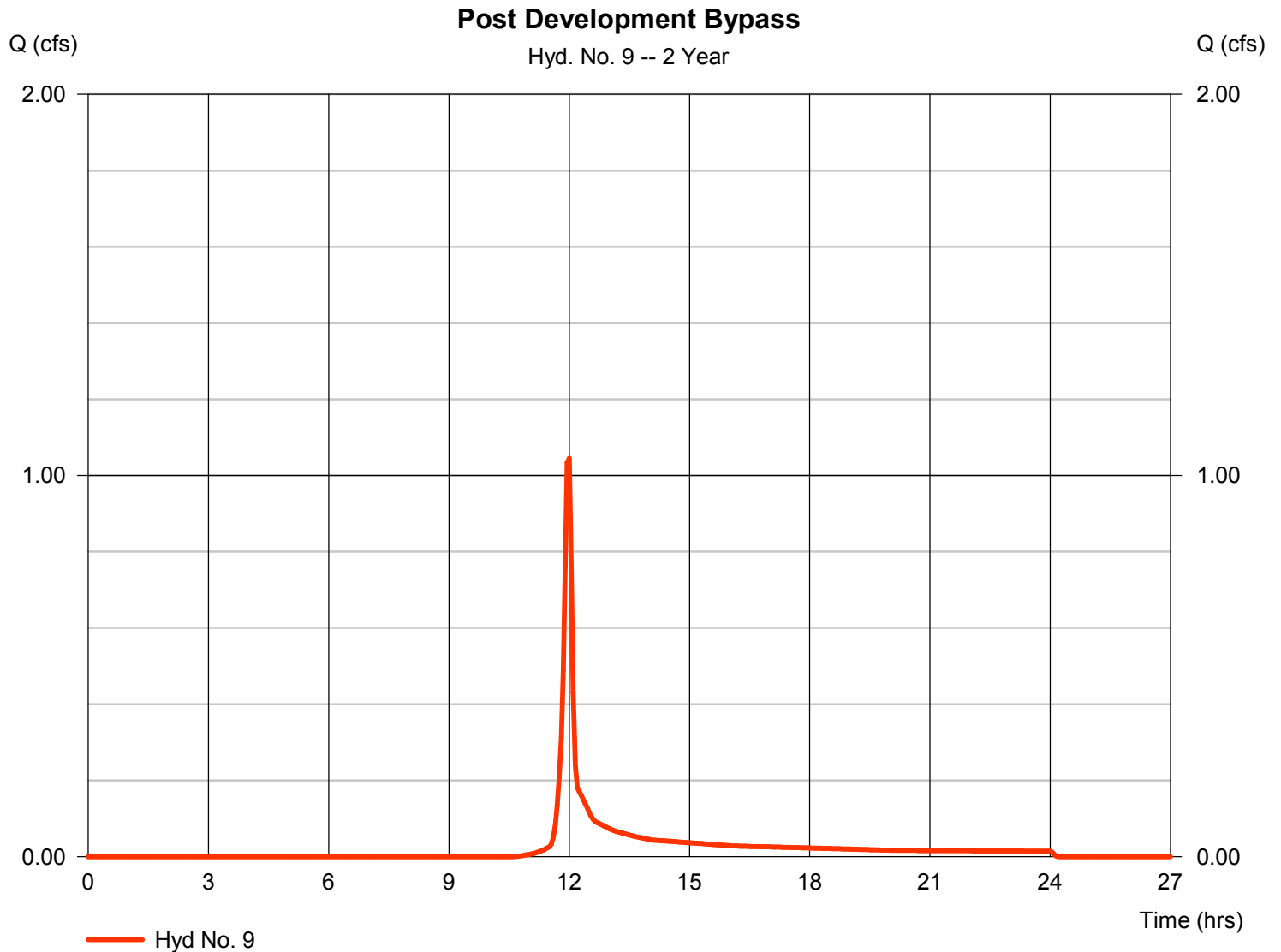
Thursday, 04 / 6 / 2017

## Hyd. No. 9

### Post Development Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 1.045 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 2,403 cuft
Drainage area	= 0.780 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = + (0.020 x 98) + (0.760 x 78)] / 0.780



# Hydrograph Report

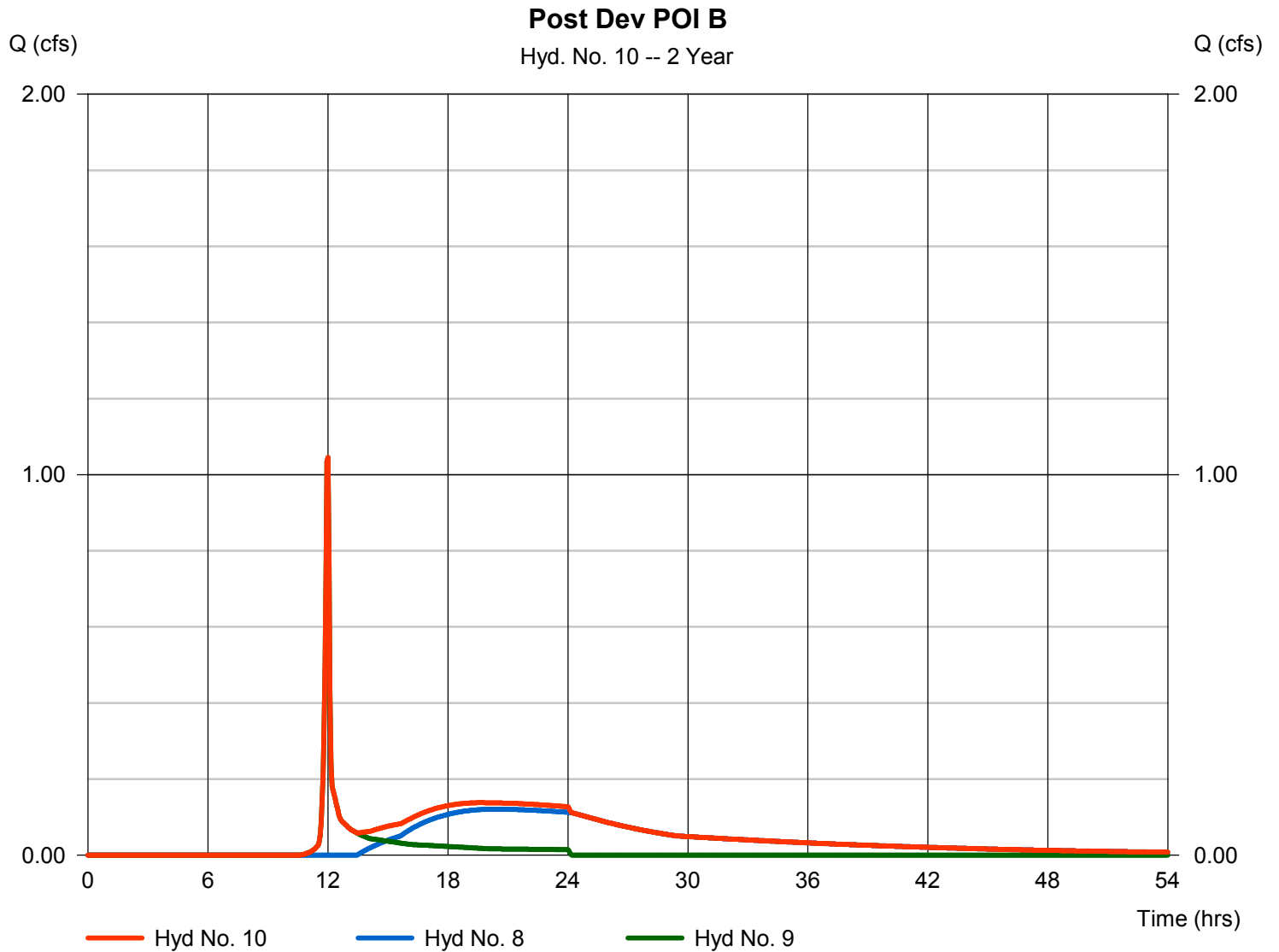
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Thursday, 04 / 6 / 2017

## Hyd. No. 10

Post Dev POI B

Hydrograph type	= Combine	Peak discharge	= 1.045 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 9,816 cuft
Inflow hyds.	= 8, 9	Contrib. drain. area	= 0.780 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

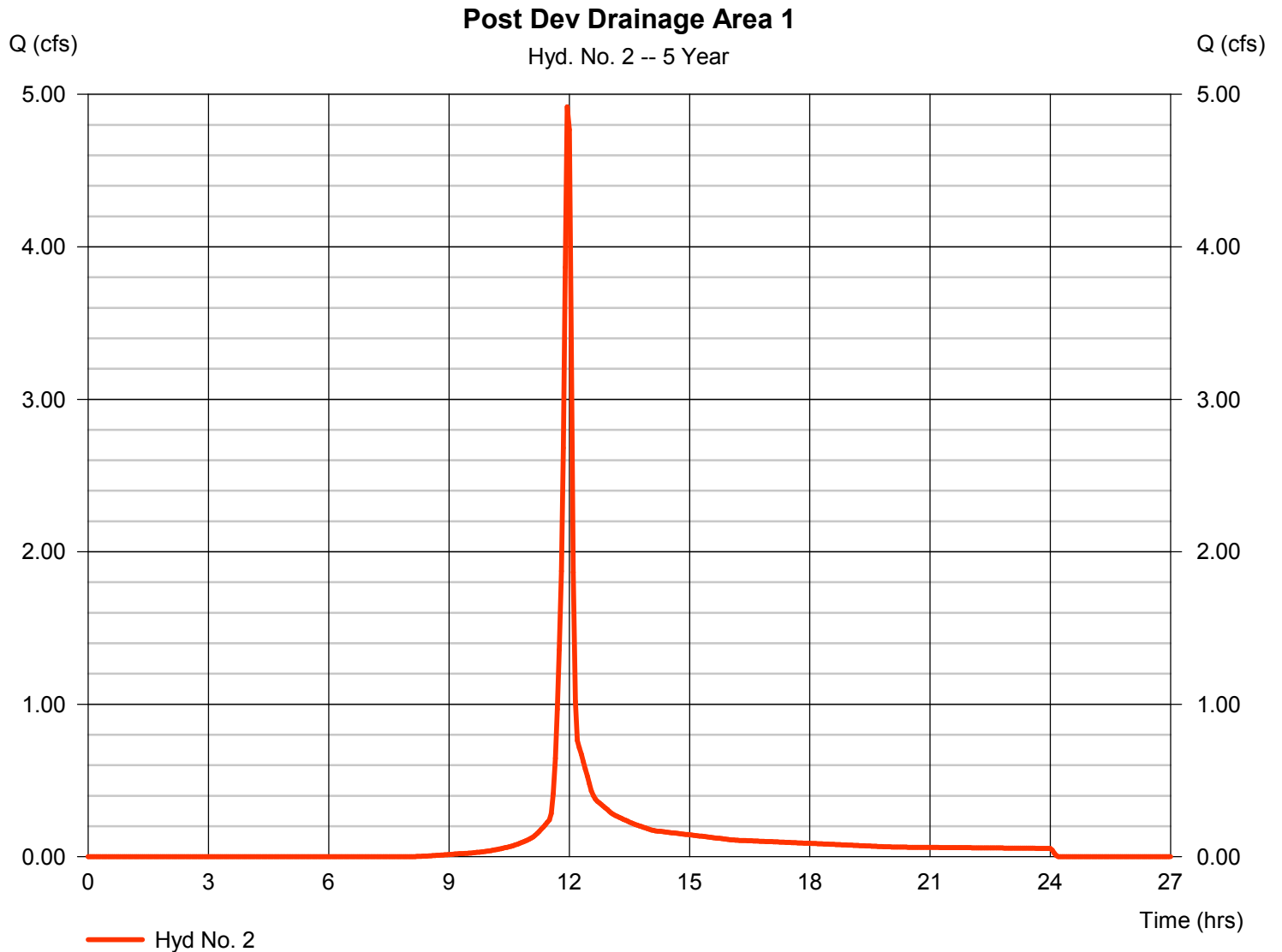
Thursday, 04 / 6 / 2017

## Hyd. No. 2

### Post Dev Drainage Area 1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.918 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 11,107 cuft
Drainage area	= 1.940 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.920 x 91) + (1.020 x 78)] / 1.940



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

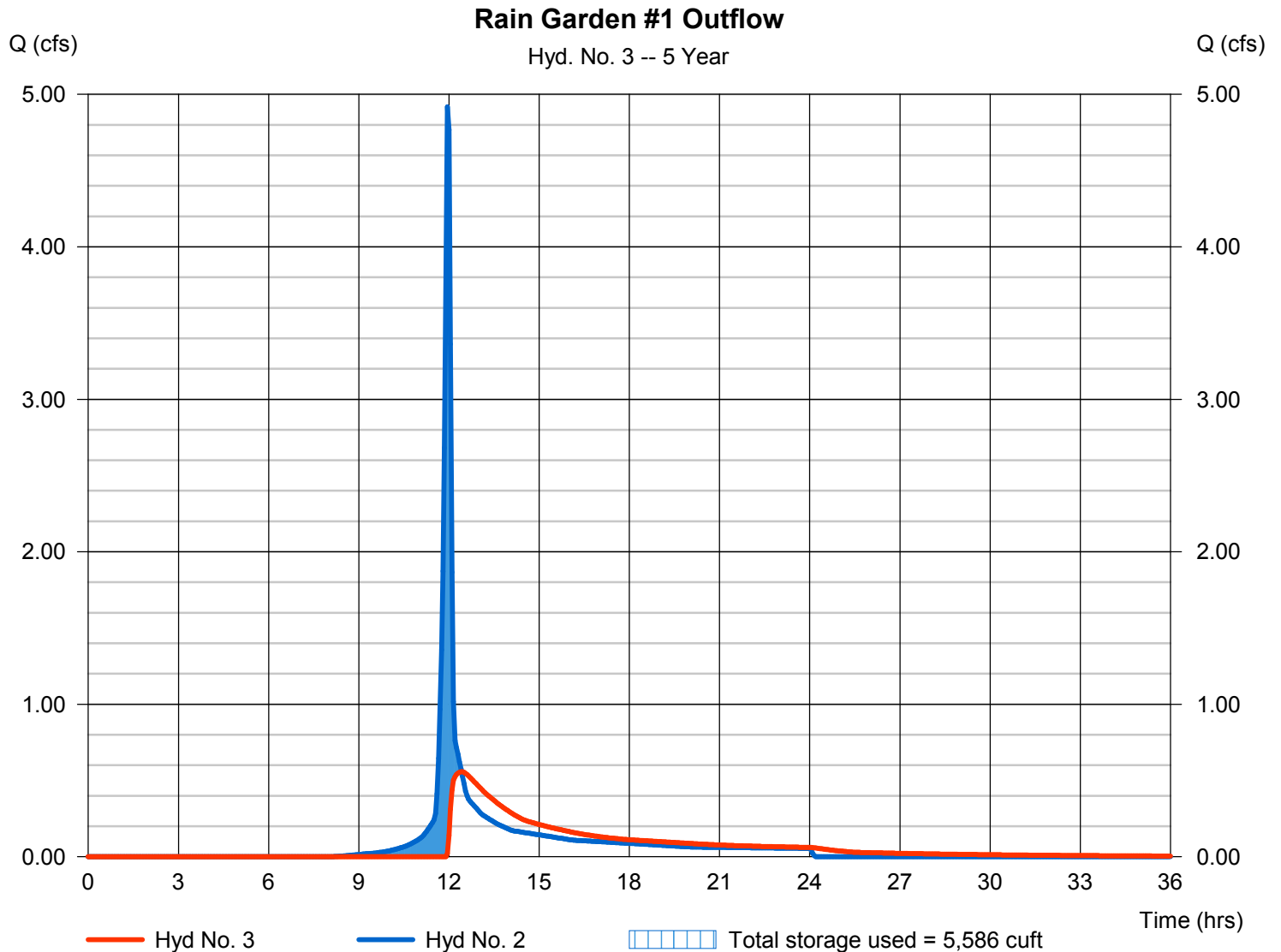
Thursday, 04 / 6 / 2017

## Hyd. No. 3

### Rain Garden #1 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.557 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.40 hrs
Time interval	= 3 min	Hyd. volume	= 8,202 cuft
Inflow hyd. No.	= 2 - Post Dev Drainage Area 1	Max. Elevation	= 1341.97 ft
Reservoir name	= Rain Garden #1	Max. Storage	= 5,586 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

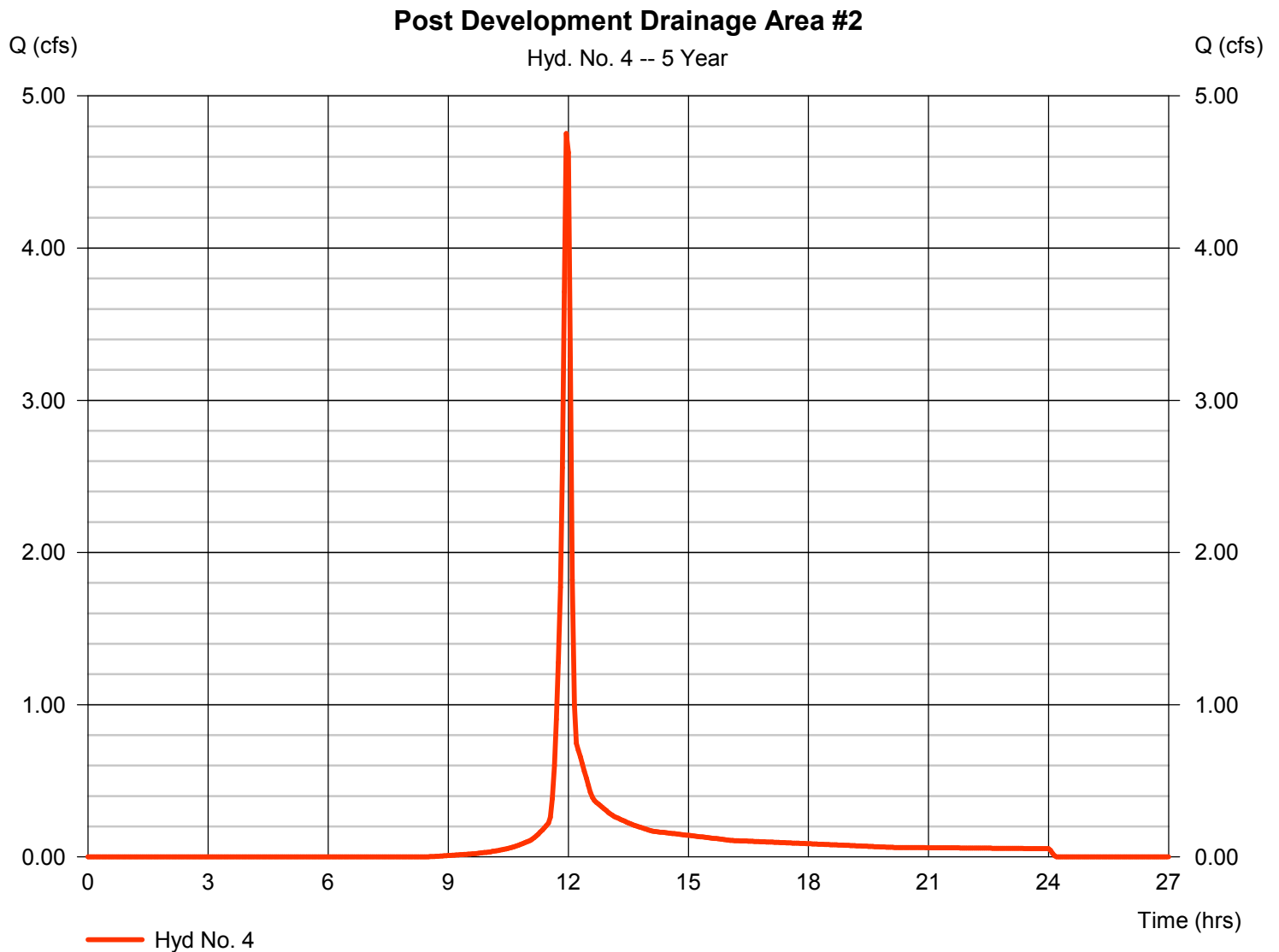
Thursday, 04 / 6 / 2017

## Hyd. No. 4

### Post Development Drainage Area #2

Hydrograph type	= SCS Runoff	Peak discharge	= 4.753 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 10,733 cuft
Drainage area	= 1.960 ac	Curve number	= 83*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.030 x 98) + (0.660 x 91) + (1.270 x 78)] / 1.960



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

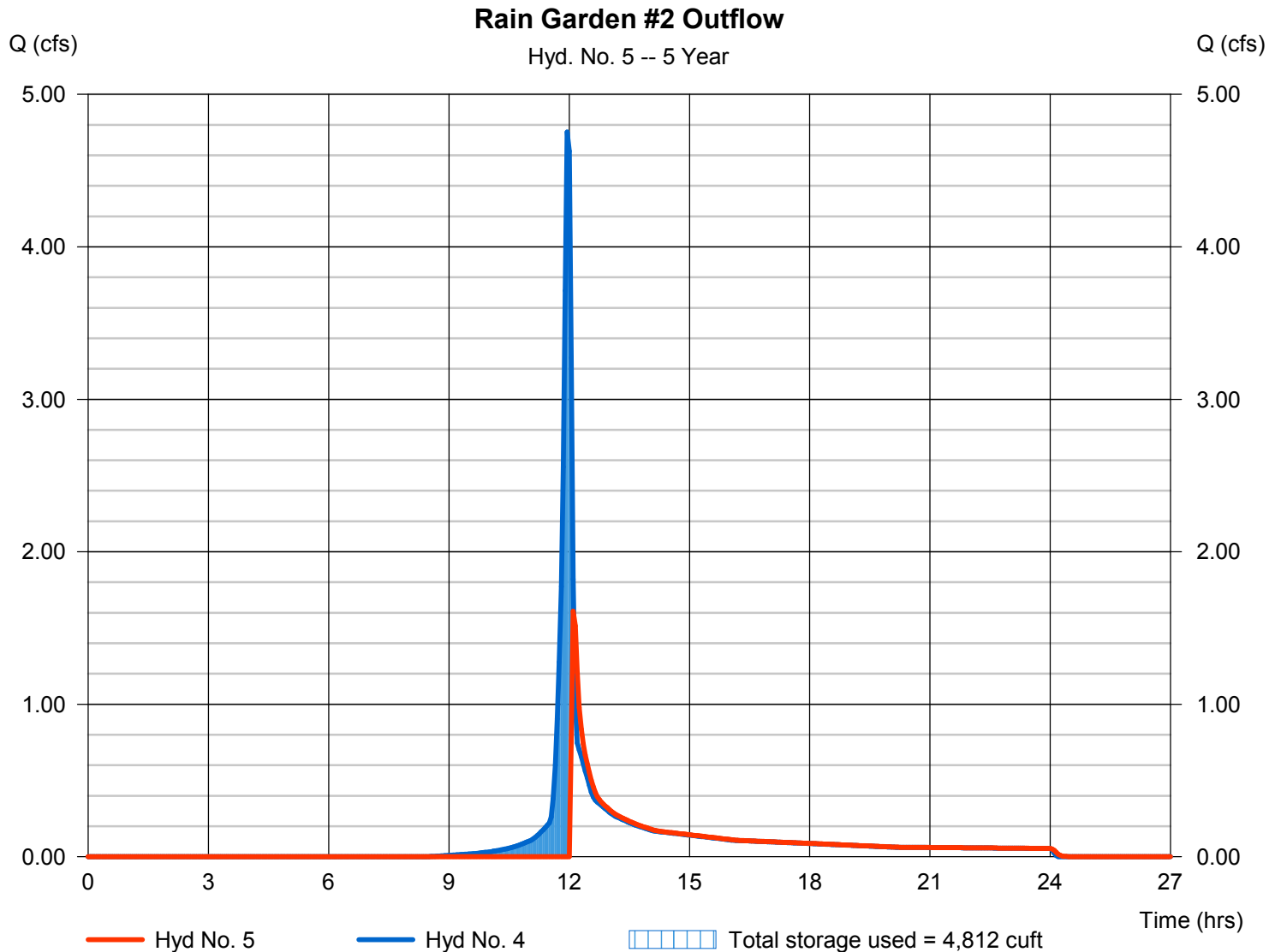
Thursday, 04 / 6 / 2017

## Hyd. No. 5

### Rain Garden #2 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 1.610 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 6,386 cuft
Inflow hyd. No.	= 4 - Post Development Drainage Area #2	Area Elevation	= 1343.11 ft
Reservoir name	= Rain Garden #2	Max. Storage	= 4,812 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

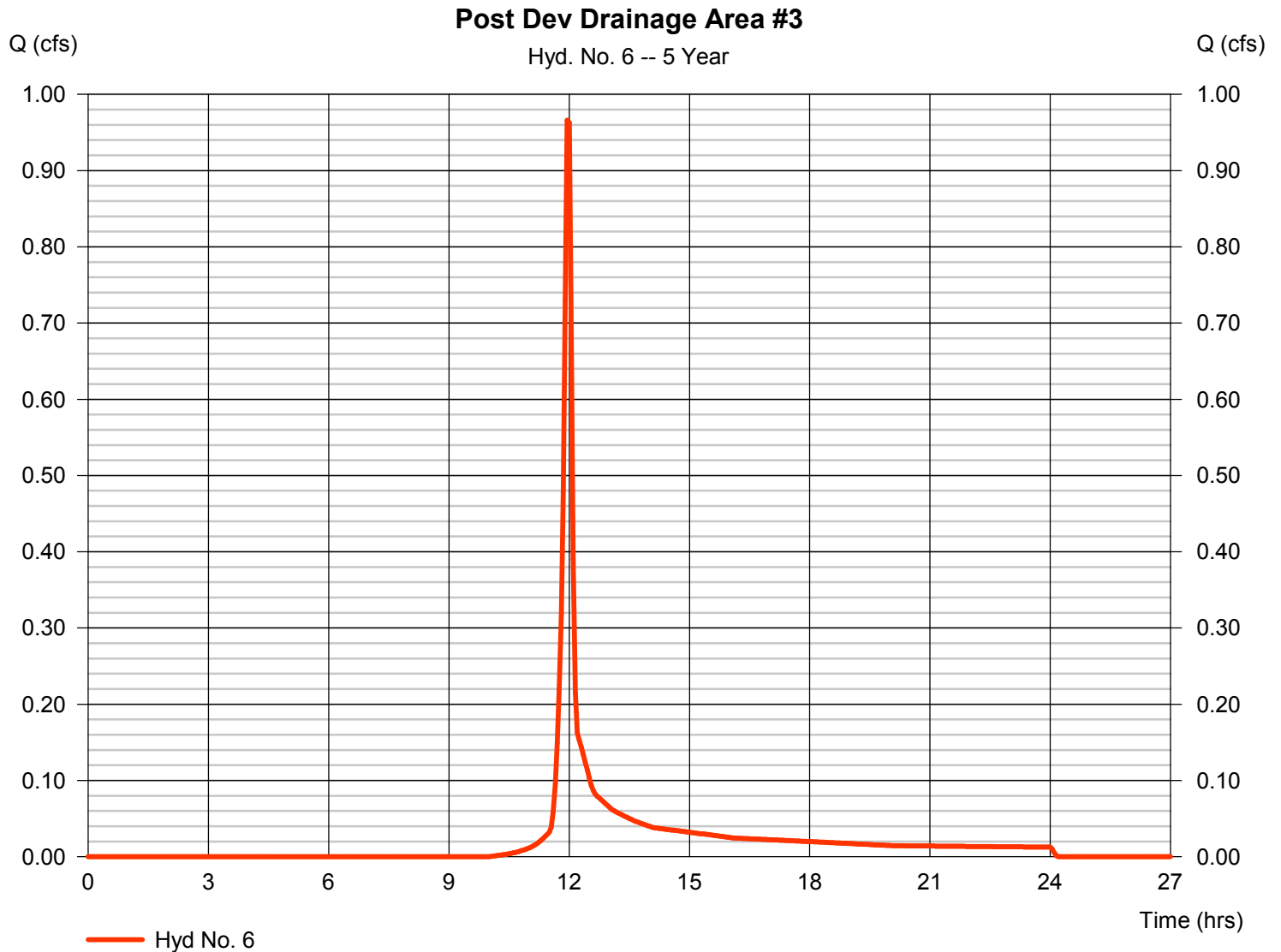
Thursday, 04 / 6 / 2017

## Hyd. No. 6

### Post Dev Drainage Area #3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.966 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 2,210 cuft
Drainage area	= 0.510 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.510 x 78)] / 0.510



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

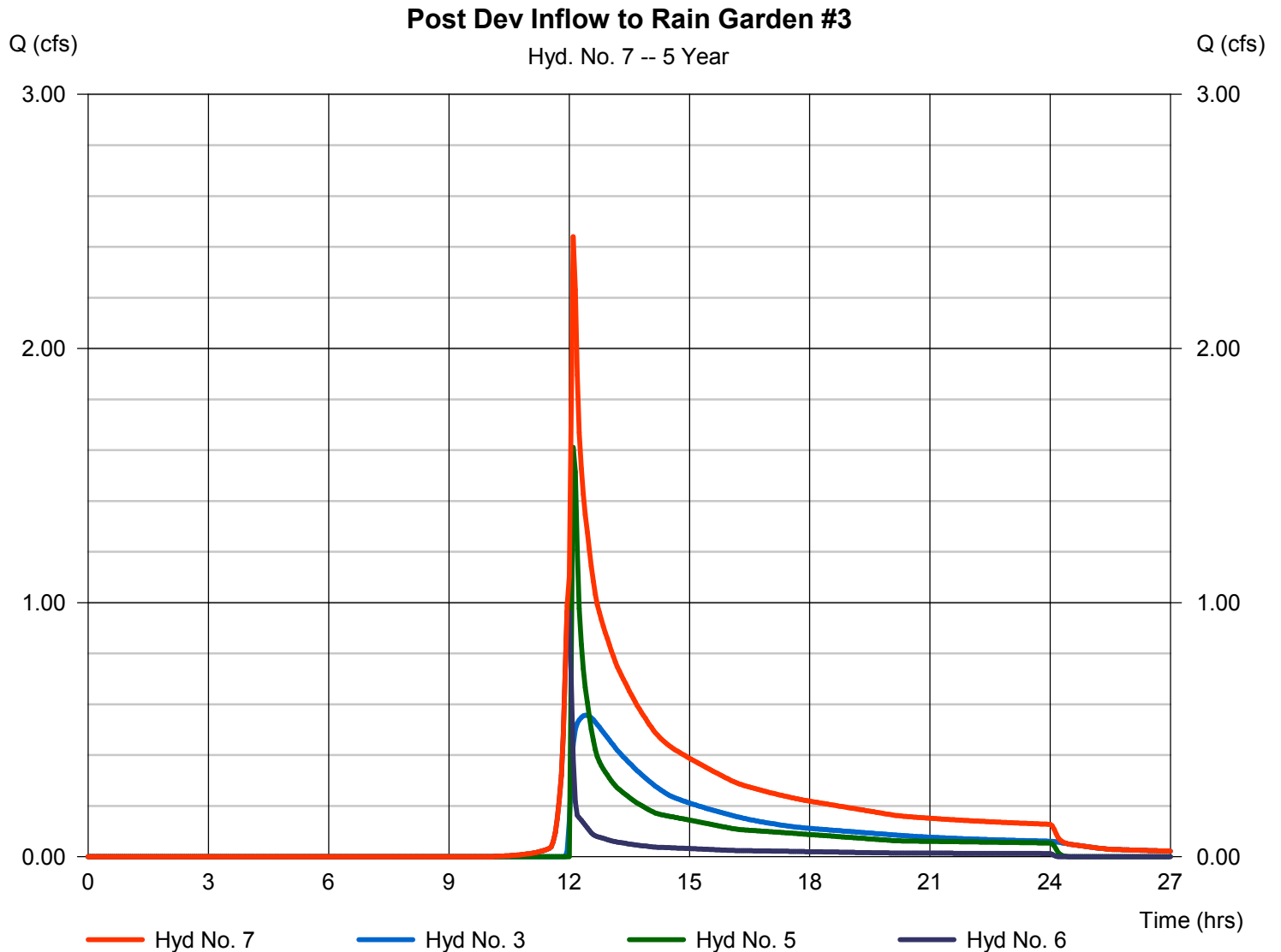
Thursday, 04 / 6 / 2017

## Hyd. No. 7

Post Dev Inflow to Rain Garden #3

Hydrograph type = Combine  
 Storm frequency = 5 yrs  
 Time interval = 3 min  
 Inflow hyds. = 3, 5, 6

Peak discharge = 2.440 cfs  
 Time to peak = 12.10 hrs  
 Hyd. volume = 16,797 cuft  
 Contrib. drain. area = 0.510 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

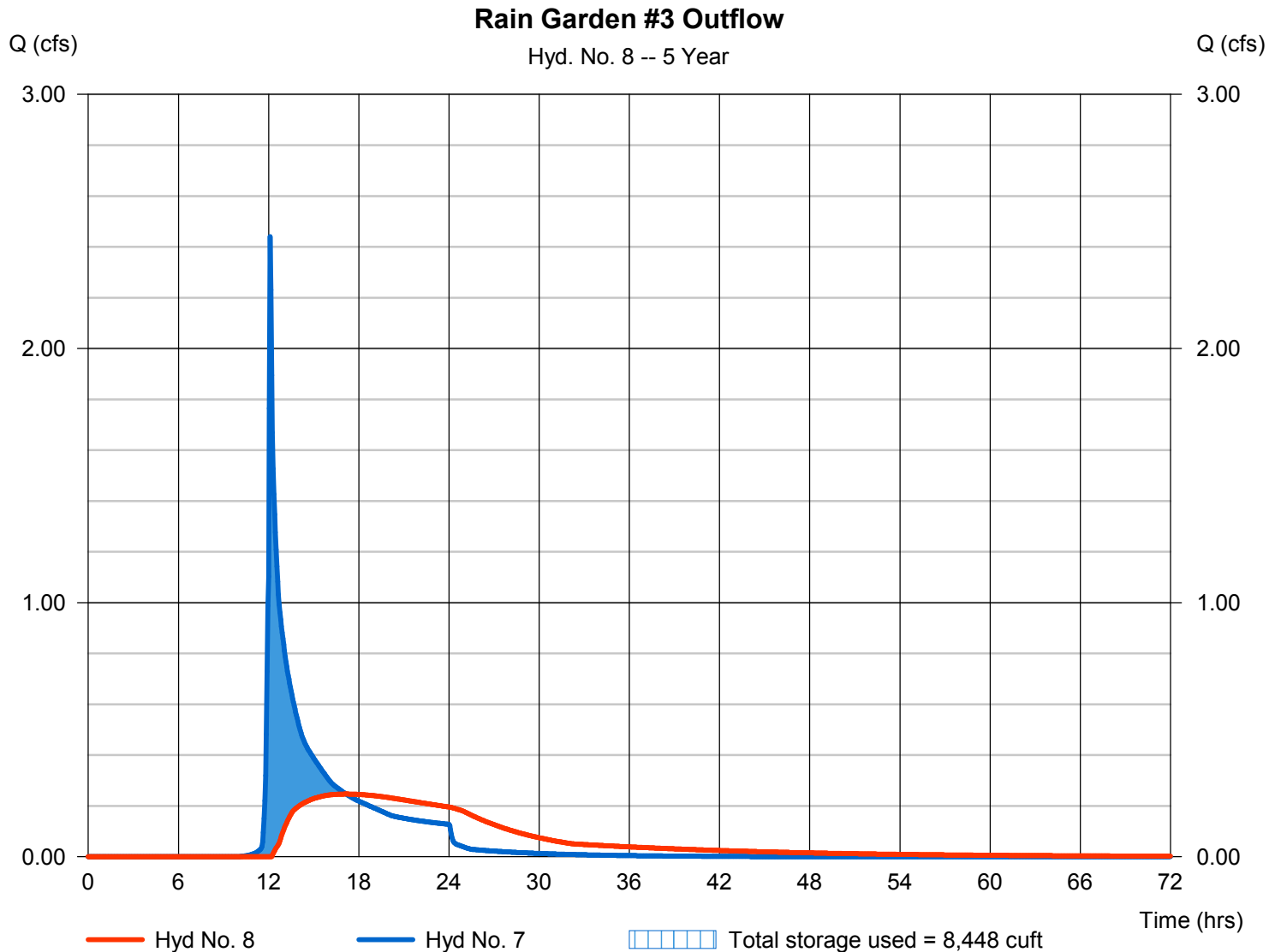
Thursday, 04 / 6 / 2017

## Hyd. No. 8

### Rain Garden #3 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.247 cfs
Storm frequency	= 5 yrs	Time to peak	= 17.15 hrs
Time interval	= 3 min	Hyd. volume	= 14,549 cuft
Inflow hyd. No.	= 7 - Post Dev Inflow to Rain Garden #3	Max. Elevation	= 1338.77 ft
Reservoir name	= Rain Garden #3	Max. Storage	= 8,448 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

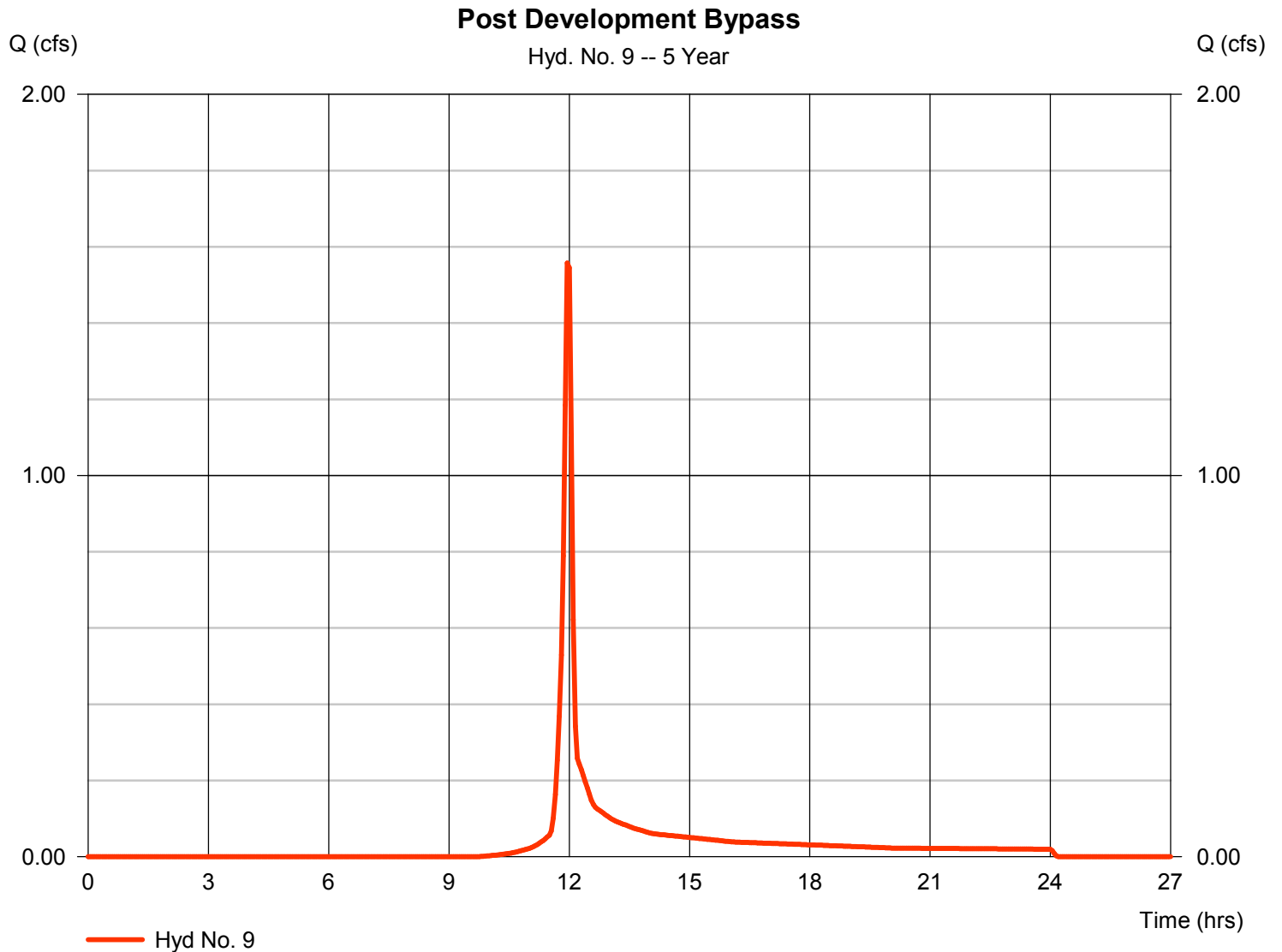
Thursday, 04 / 6 / 2017

## Hyd. No. 9

### Post Development Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 1.558 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 3,548 cuft
Drainage area	= 0.780 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = + (0.020 x 98) + (0.760 x 78)] / 0.780



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

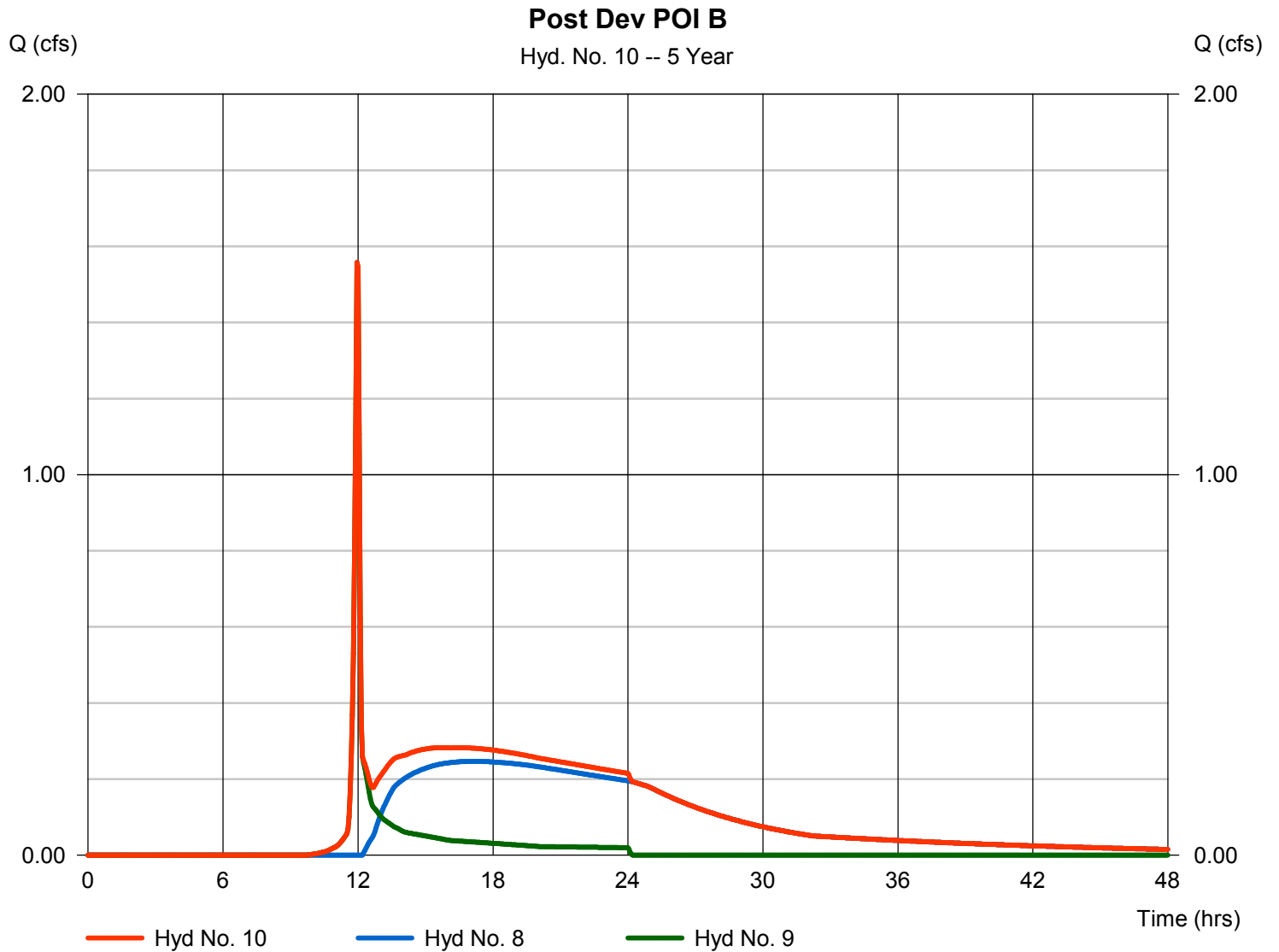
Thursday, 04 / 6 / 2017

## Hyd. No. 10

Post Dev POI B

Hydrograph type = Combine  
 Storm frequency = 5 yrs  
 Time interval = 3 min  
 Inflow hyds. = 8, 9

Peak discharge = 1.558 cfs  
 Time to peak = 11.95 hrs  
 Hyd. volume = 18,097 cuft  
 Contrib. drain. area = 0.780 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

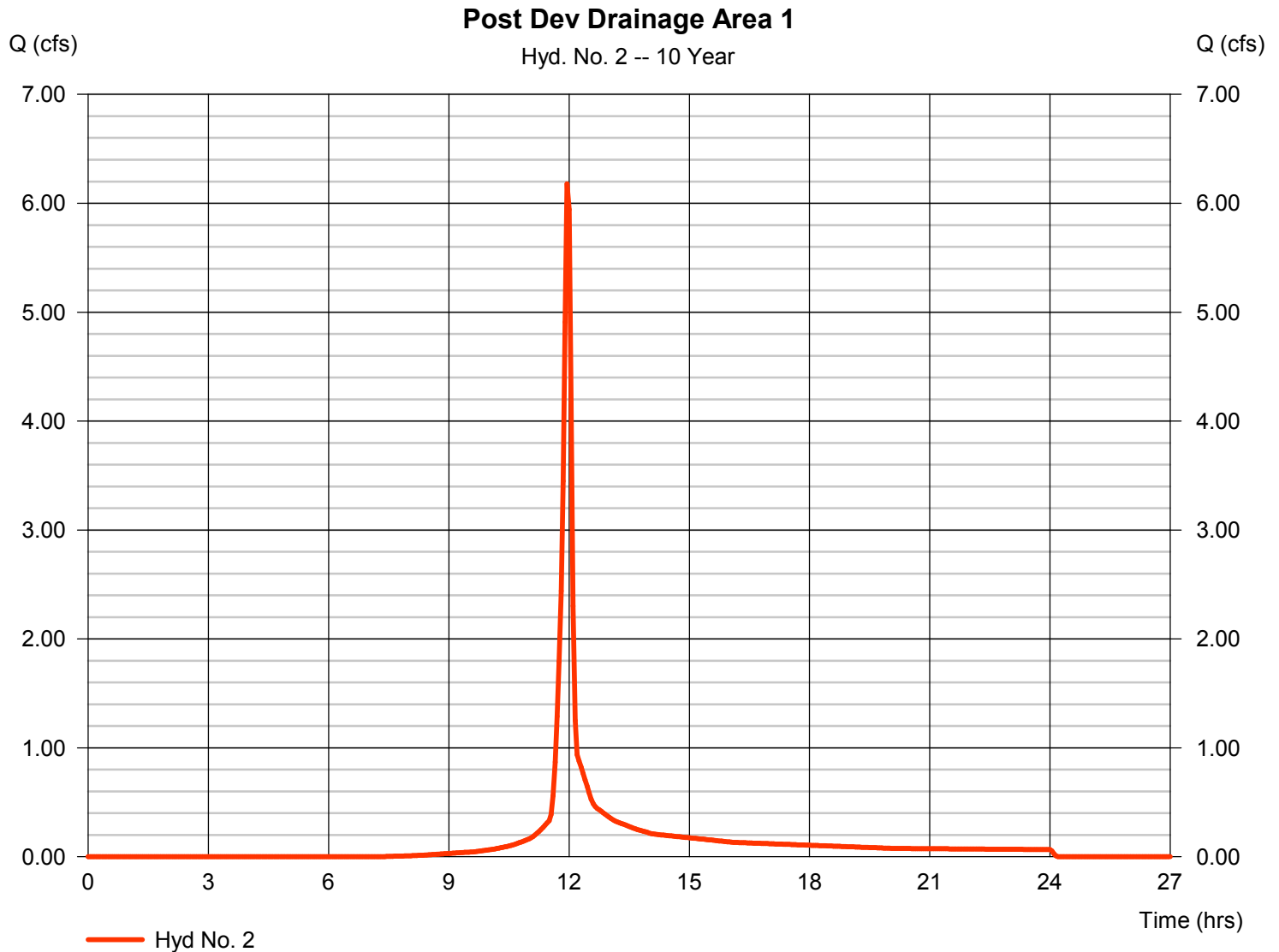
Thursday, 04 / 6 / 2017

## Hyd. No. 2

### Post Dev Drainage Area 1

Hydrograph type	= SCS Runoff	Peak discharge	= 6.178 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 13,980 cuft
Drainage area	= 1.940 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.920 x 91) + (1.020 x 78)] / 1.940



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

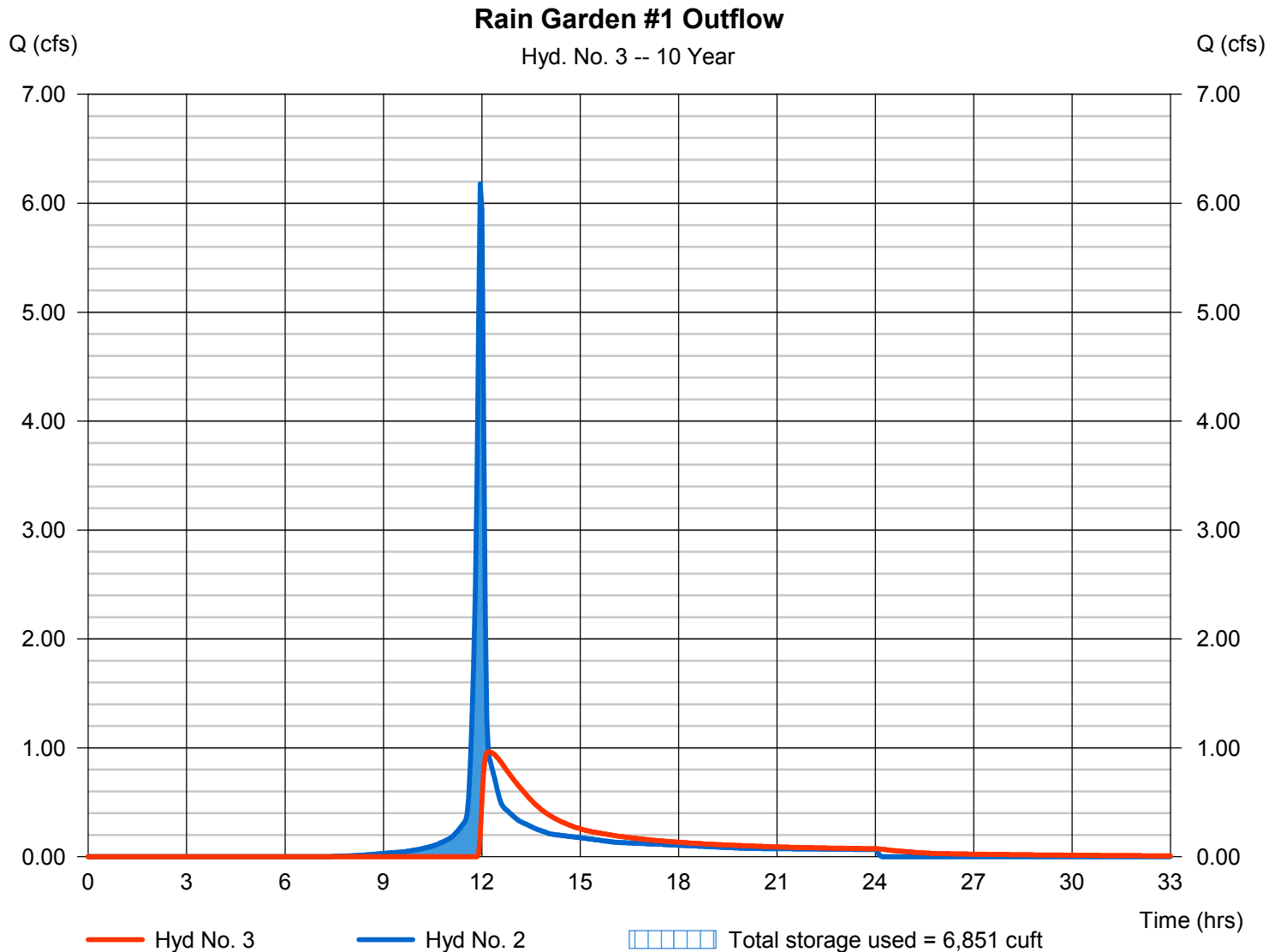
Thursday, 04 / 6 / 2017

## Hyd. No. 3

### Rain Garden #1 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.964 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.20 hrs
Time interval	= 3 min	Hyd. volume	= 11,075 cuft
Inflow hyd. No.	= 2 - Post Dev Drainage Area 1	Max. Elevation	= 1342.14 ft
Reservoir name	= Rain Garden #1	Max. Storage	= 6,851 cuft

Storage Indication method used.



# Hydrograph Report

## Hyd. No. 4

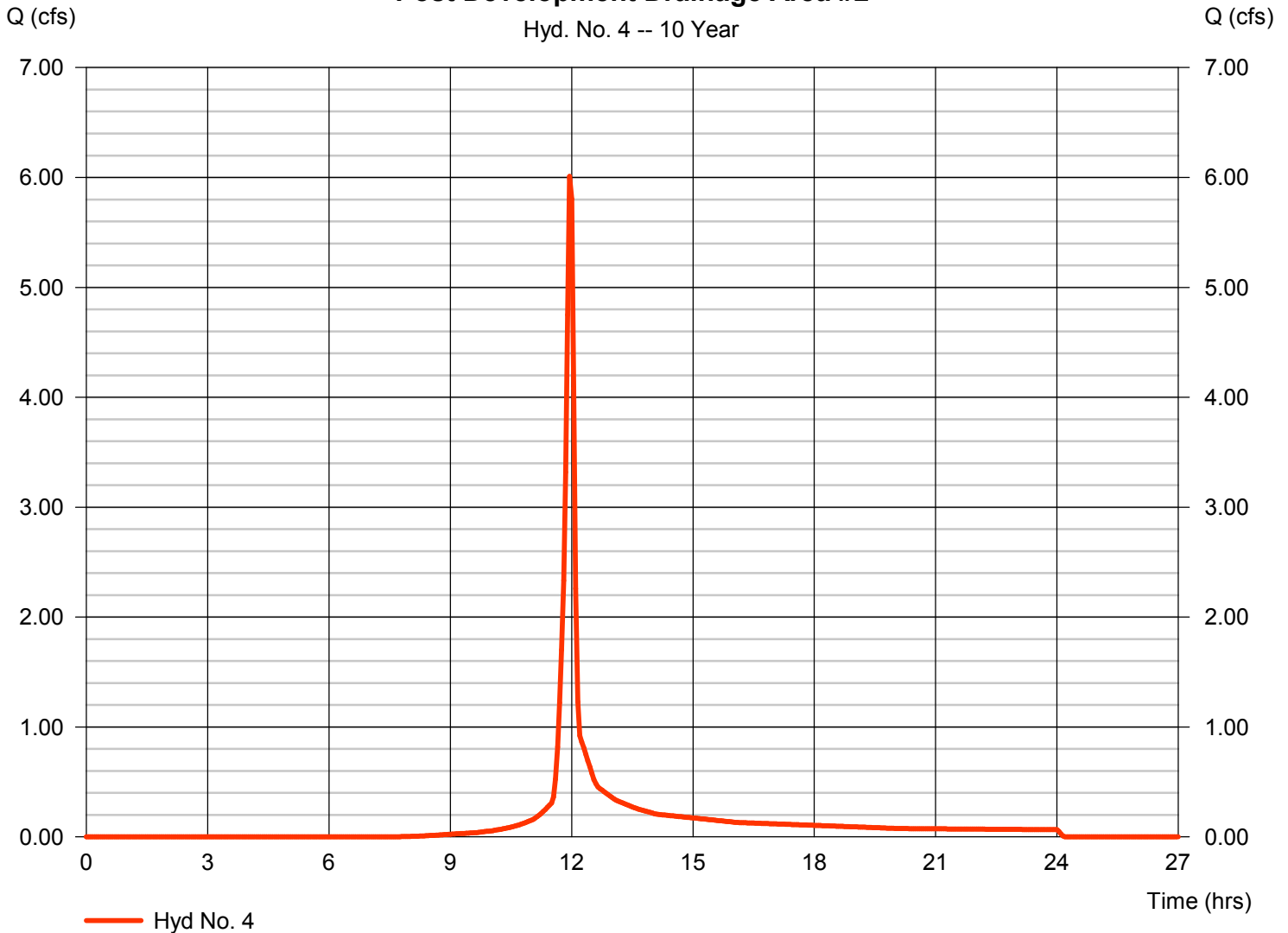
### Post Development Drainage Area #2

Hydrograph type	= SCS Runoff	Peak discharge	= 6.011 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 13,584 cuft
Drainage area	= 1.960 ac	Curve number	= 83*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.030 x 98) + (0.660 x 91) + (1.270 x 78)] / 1.960

### Post Development Drainage Area #2

Hyd. No. 4 -- 10 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

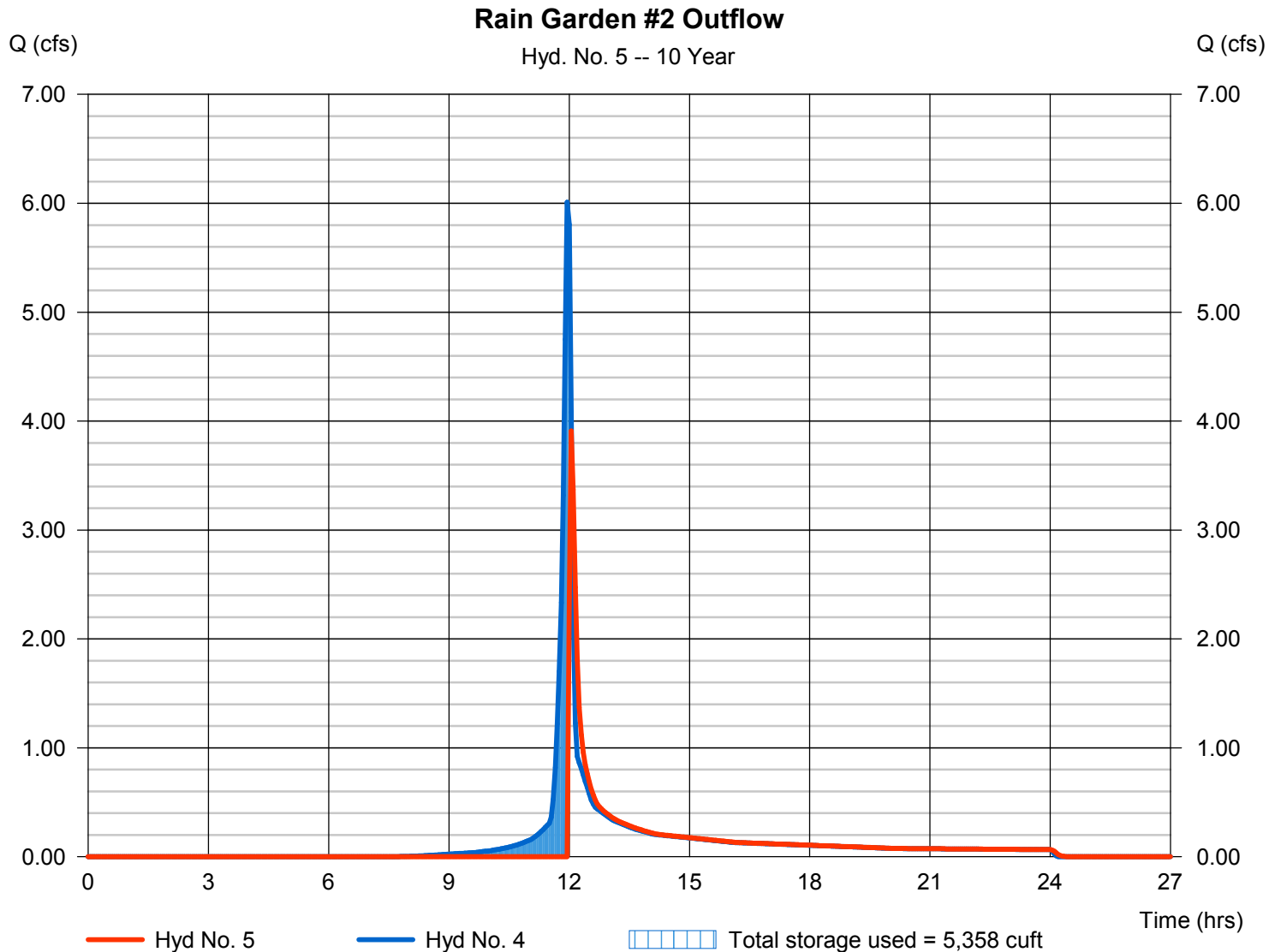
Thursday, 04 / 6 / 2017

## Hyd. No. 5

### Rain Garden #2 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 3.909 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.05 hrs
Time interval	= 3 min	Hyd. volume	= 9,236 cuft
Inflow hyd. No.	= 4 - Post Development Drainage Area #2	Area Elevation	= 1343.24 ft
Reservoir name	= Rain Garden #2	Max. Storage	= 5,358 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

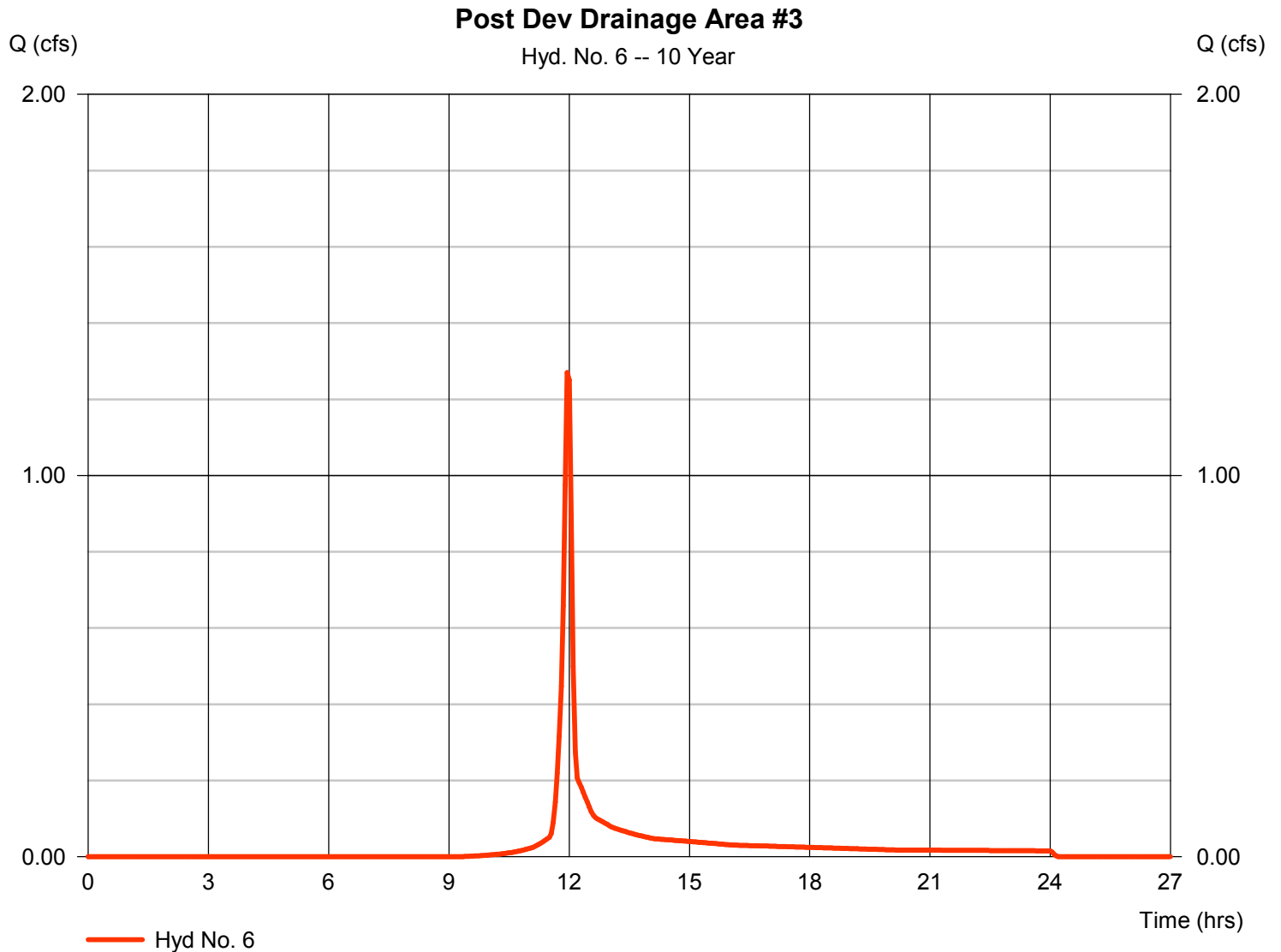
Thursday, 04 / 6 / 2017

## Hyd. No. 6

### Post Dev Drainage Area #3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.270 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 2,879 cuft
Drainage area	= 0.510 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.510 x 78)] / 0.510



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Thursday, 04 / 6 / 2017

## Hyd. No. 7

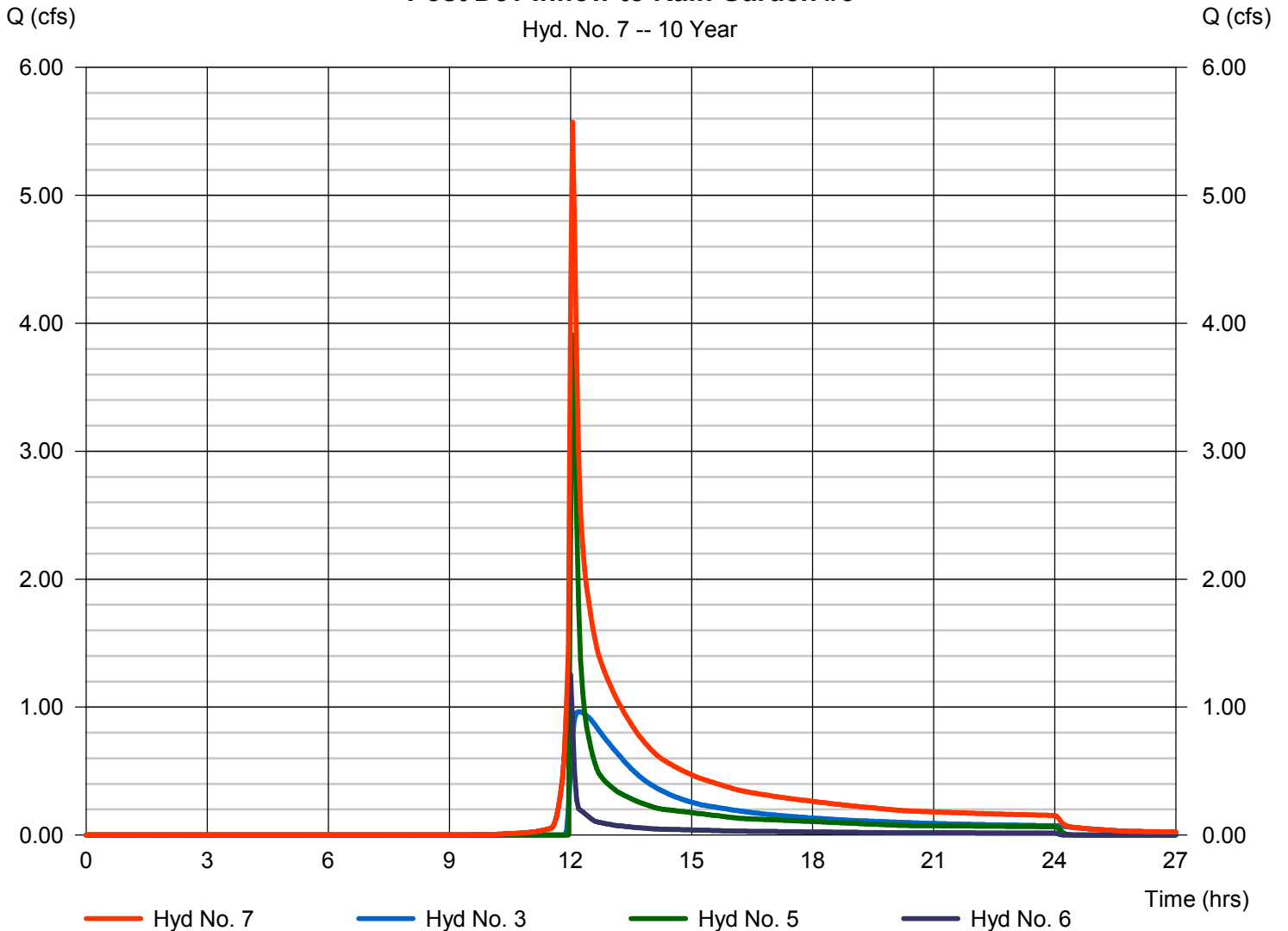
Post Dev Inflow to Rain Garden #3

Hydrograph type = Combine  
Storm frequency = 10 yrs  
Time interval = 3 min  
Inflow hyds. = 3, 5, 6

Peak discharge = 5.573 cfs  
Time to peak = 12.05 hrs  
Hyd. volume = 23,190 cuft  
Contrib. drain. area = 0.510 ac

Post Dev Inflow to Rain Garden #3

Hyd. No. 7 -- 10 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

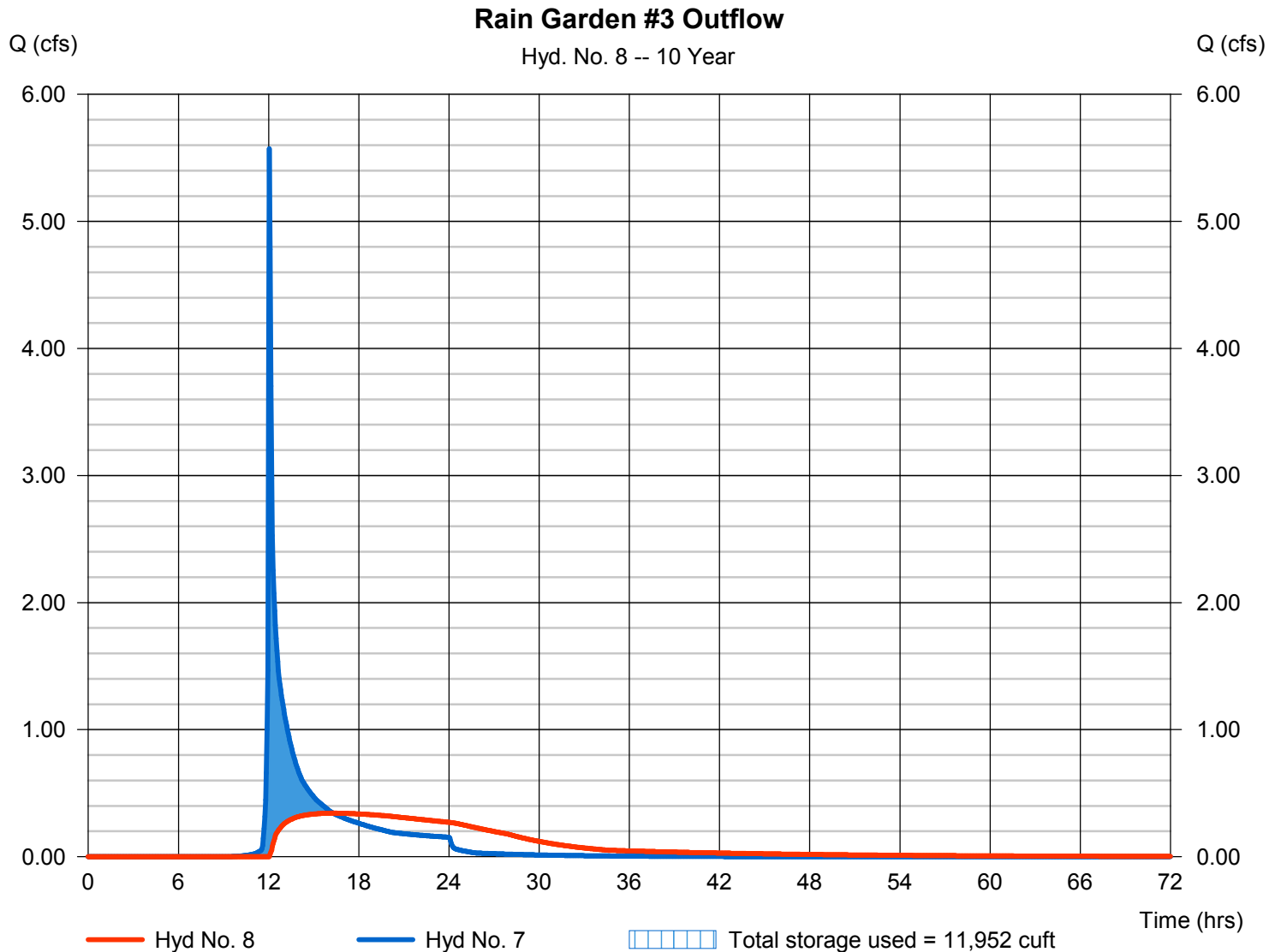
Thursday, 04 / 6 / 2017

## Hyd. No. 8

### Rain Garden #3 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.342 cfs
Storm frequency	= 10 yrs	Time to peak	= 16.30 hrs
Time interval	= 3 min	Hyd. volume	= 20,941 cuft
Inflow hyd. No.	= 7 - Post Dev Inflow to Rain Garden #3	Max. Elevation	= 1339.08 ft
Reservoir name	= Rain Garden #3	Max. Storage	= 11,952 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

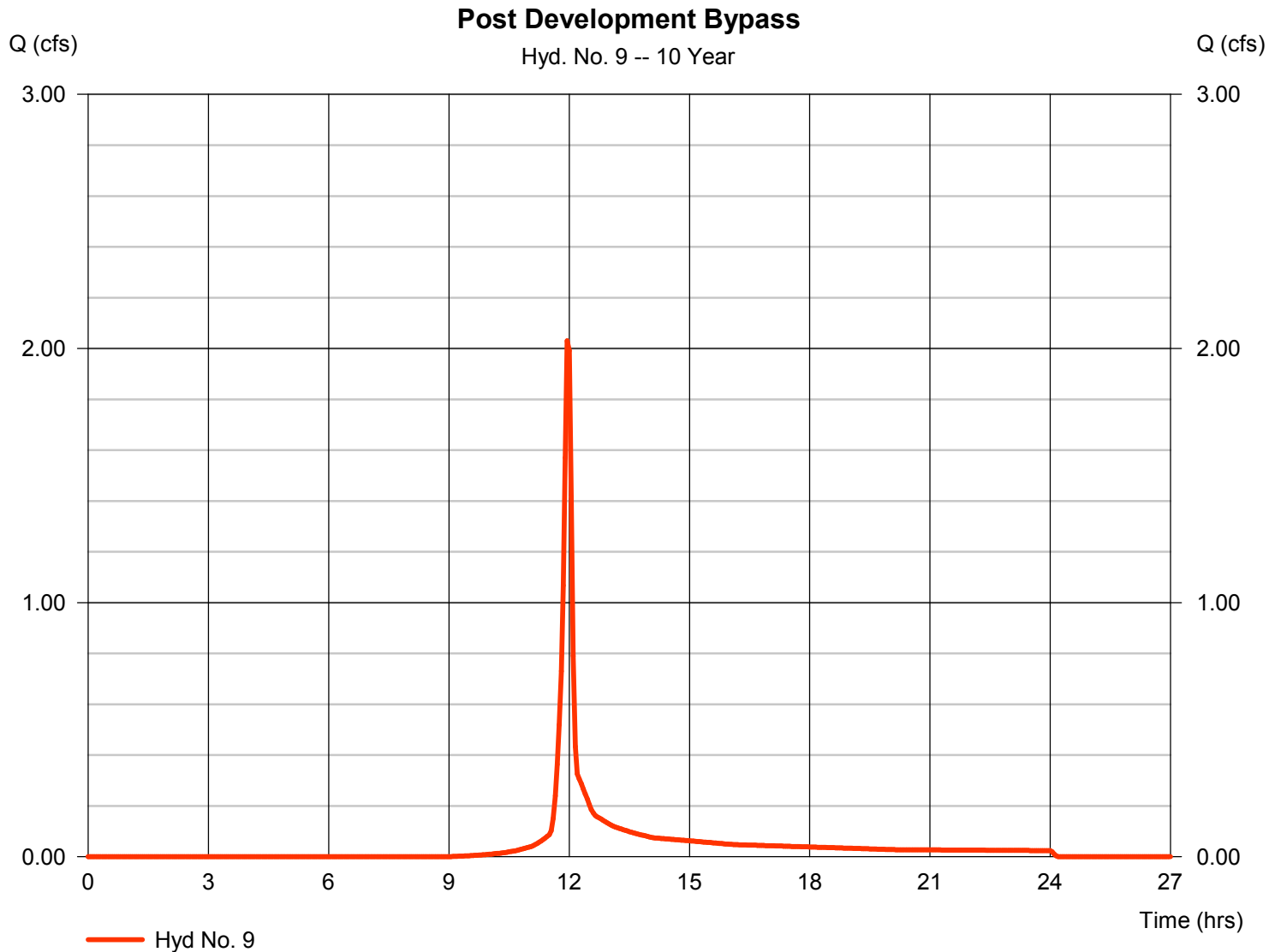
Thursday, 04 / 6 / 2017

## Hyd. No. 9

### Post Development Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 2.030 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 4,594 cuft
Drainage area	= 0.780 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = + (0.020 x 98) + (0.760 x 78)] / 0.780



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

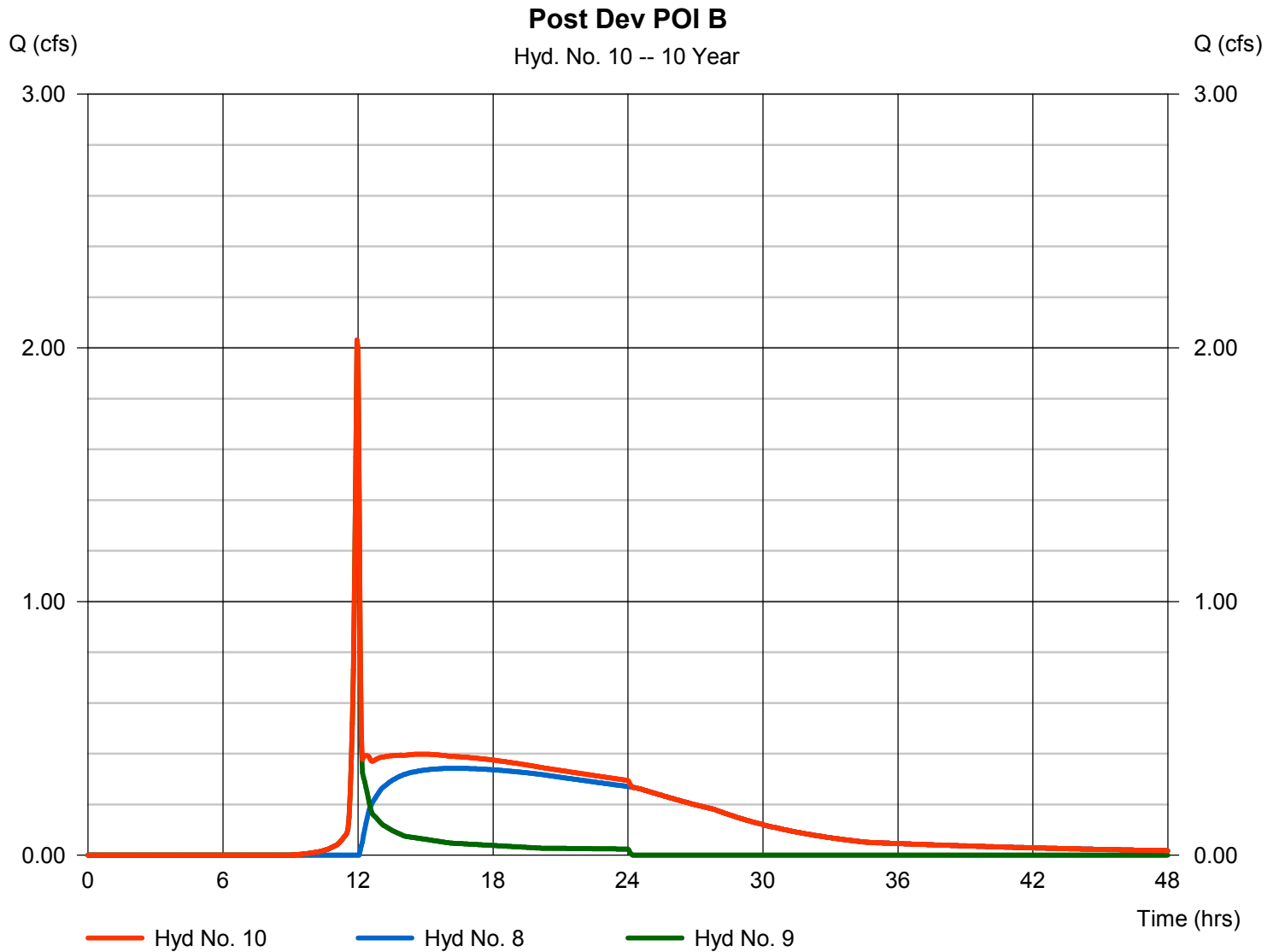
Thursday, 04 / 6 / 2017

## Hyd. No. 10

Post Dev POI B

Hydrograph type = Combine  
 Storm frequency = 10 yrs  
 Time interval = 3 min  
 Inflow hyds. = 8, 9

Peak discharge = 2.030 cfs  
 Time to peak = 11.95 hrs  
 Hyd. volume = 25,535 cuft  
 Contrib. drain. area = 0.780 ac



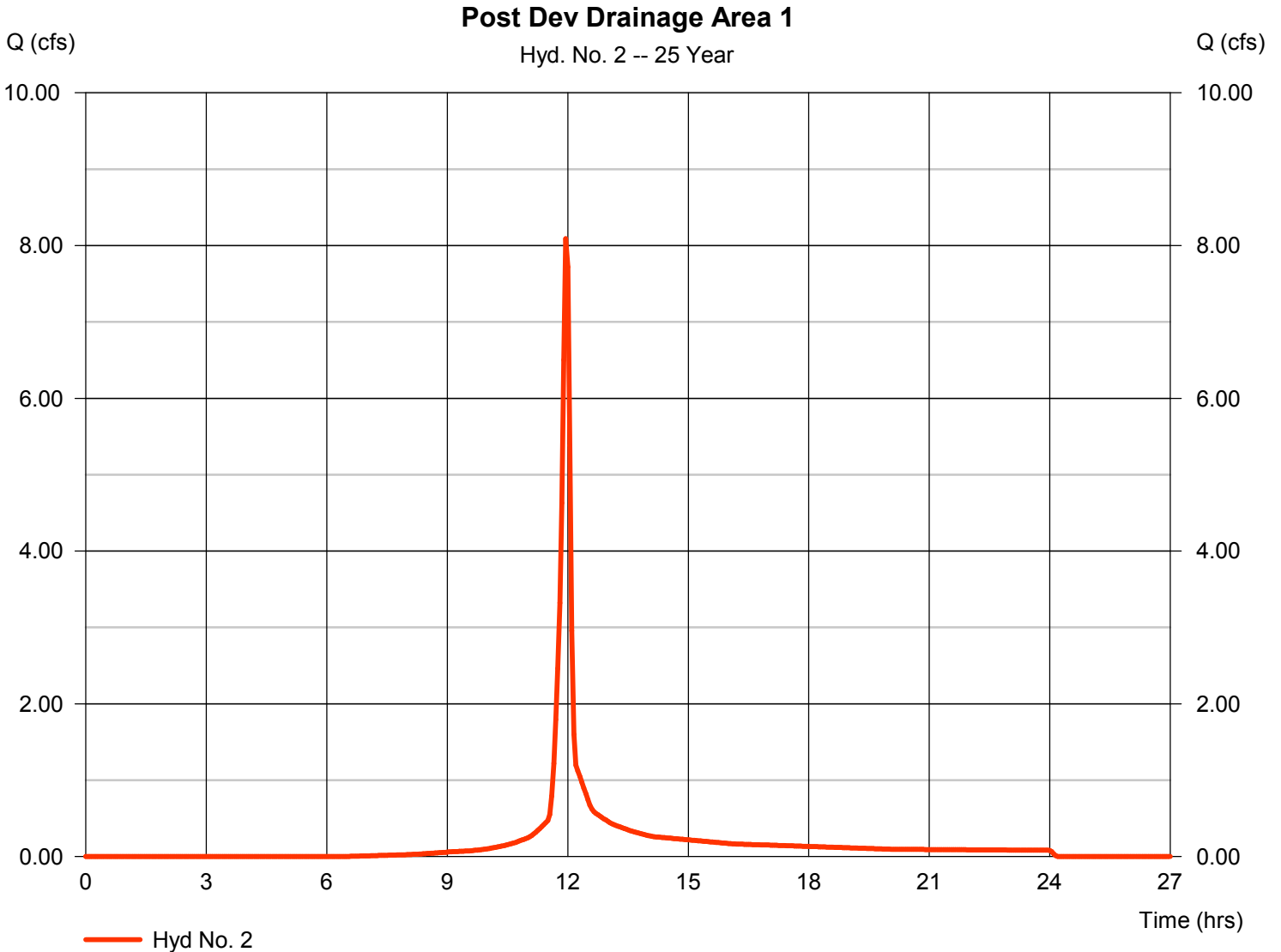
# Hydrograph Report

## Hyd. No. 2

### Post Dev Drainage Area 1

Hydrograph type	= SCS Runoff	Peak discharge	= 8.089 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 18,417 cuft
Drainage area	= 1.940 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.920 x 91) + (1.020 x 78)] / 1.940



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

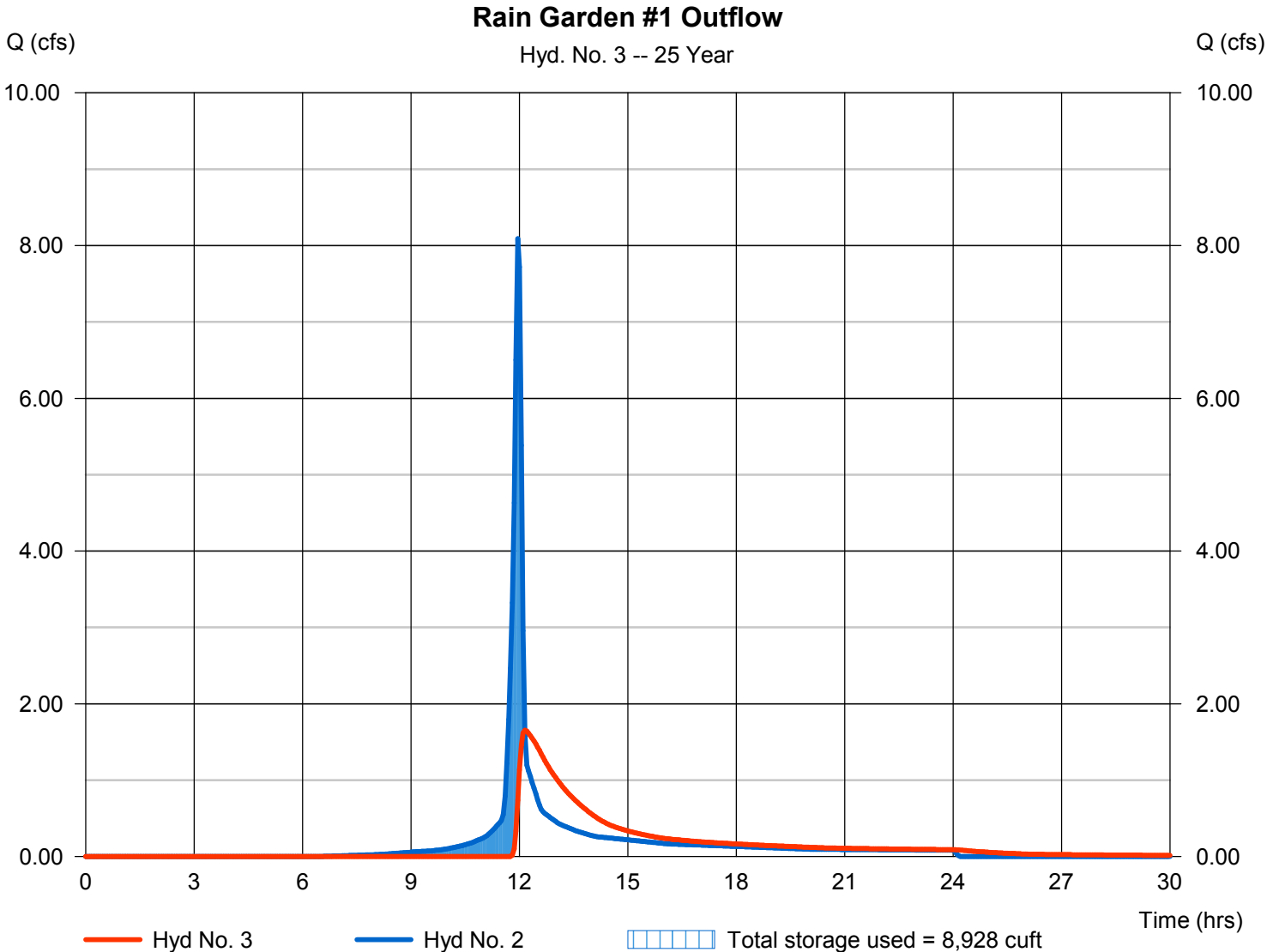
Thursday, 04 / 6 / 2017

## Hyd. No. 3

### Rain Garden #1 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 1.655 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.15 hrs
Time interval	= 3 min	Hyd. volume	= 15,512 cuft
Inflow hyd. No.	= 2 - Post Dev Drainage Area 1	Max. Elevation	= 1342.41 ft
Reservoir name	= Rain Garden #1	Max. Storage	= 8,928 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Thursday, 04 / 6 / 2017

## Hyd. No. 4

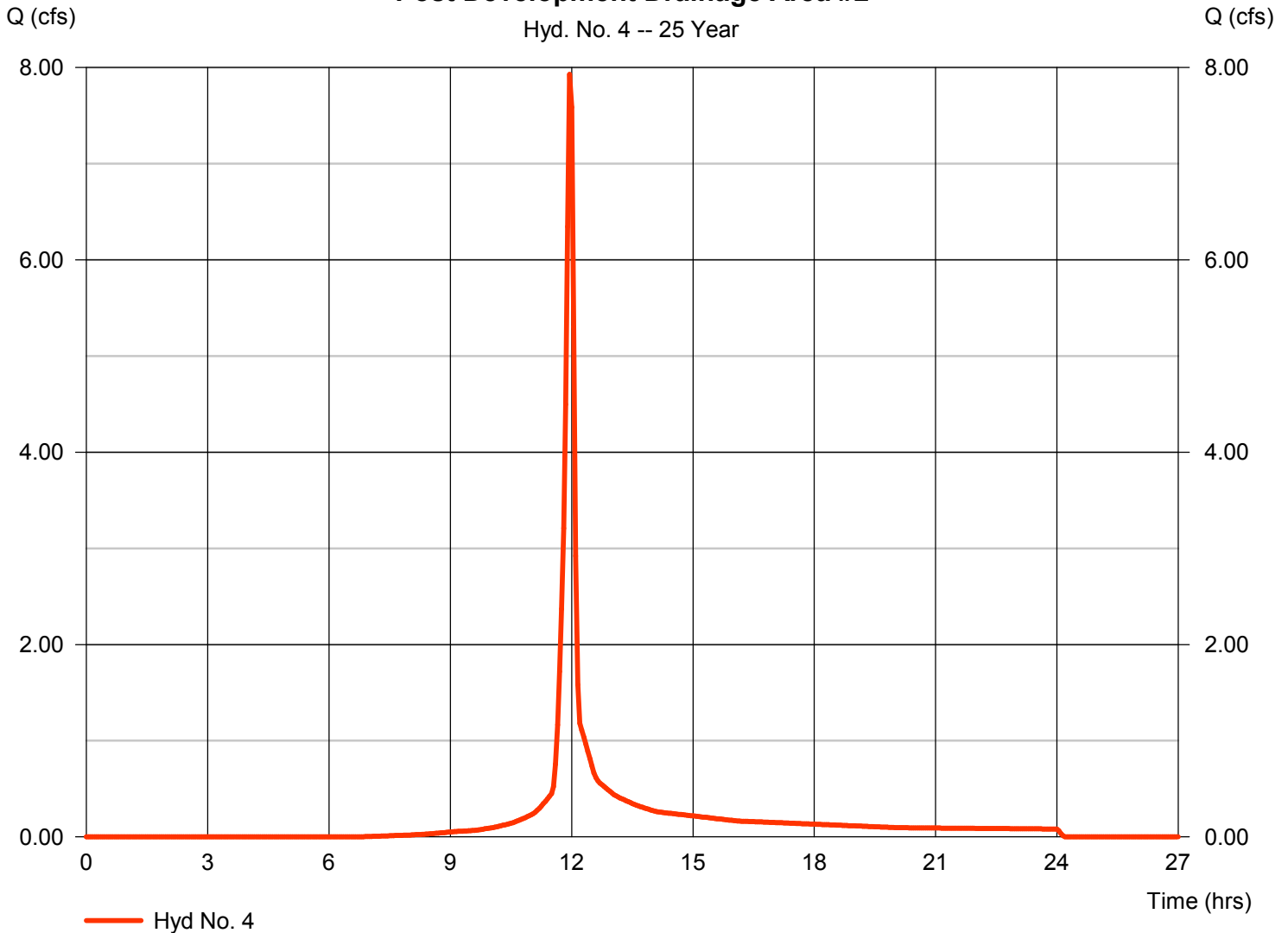
### Post Development Drainage Area #2

Hydrograph type	= SCS Runoff	Peak discharge	= 7.929 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 18,002 cuft
Drainage area	= 1.960 ac	Curve number	= 83*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.030 x 98) + (0.660 x 91) + (1.270 x 78)] / 1.960

### Post Development Drainage Area #2

Hyd. No. 4 -- 25 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

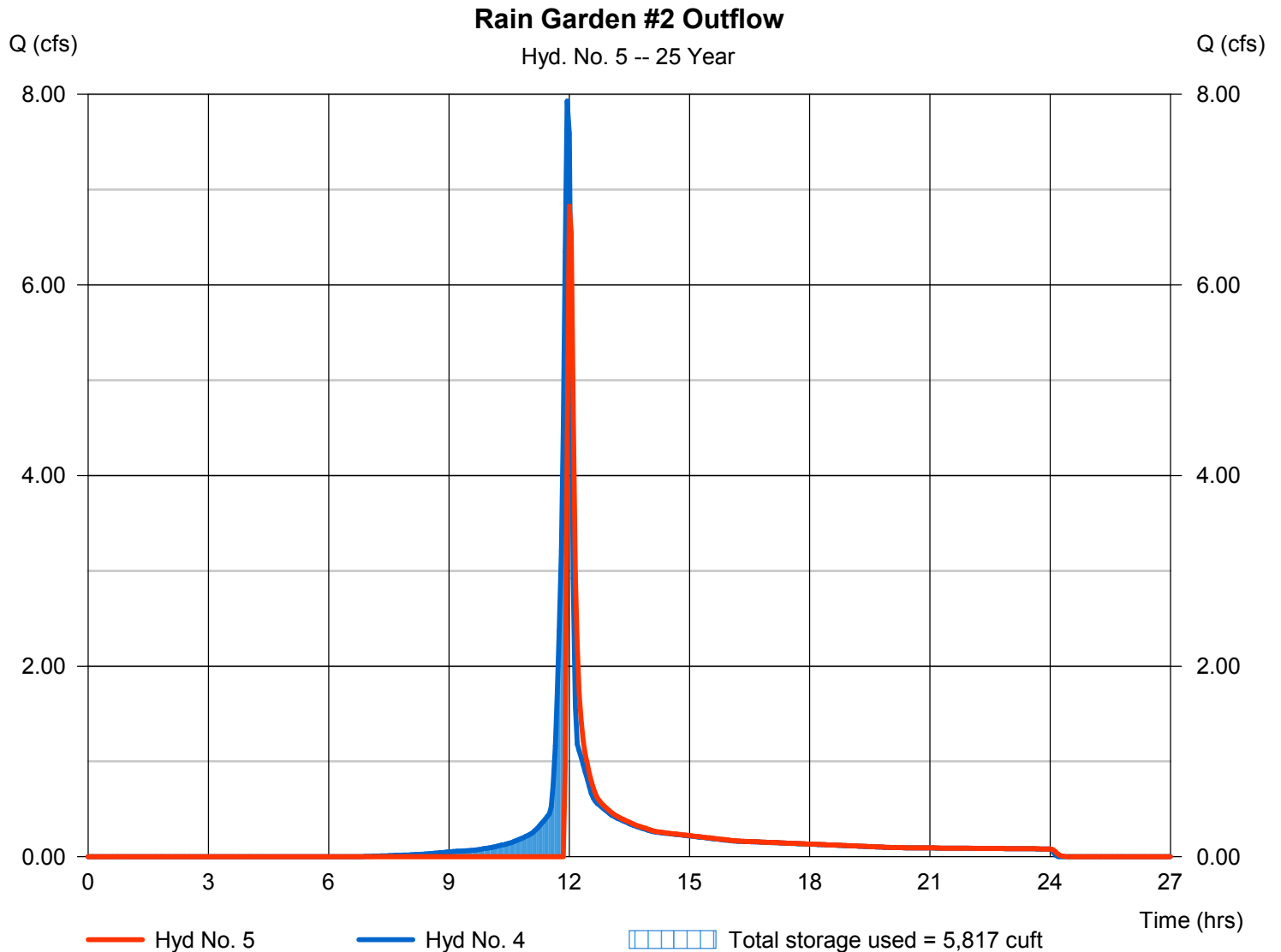
Thursday, 04 / 6 / 2017

## Hyd. No. 5

### Rain Garden #2 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 6.829 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 13,654 cuft
Inflow hyd. No.	= 4 - Post Development Drainage Area #2	Area Elevation	= 1343.35 ft
Reservoir name	= Rain Garden #2	Max. Storage	= 5,817 cuft

Storage Indication method used.



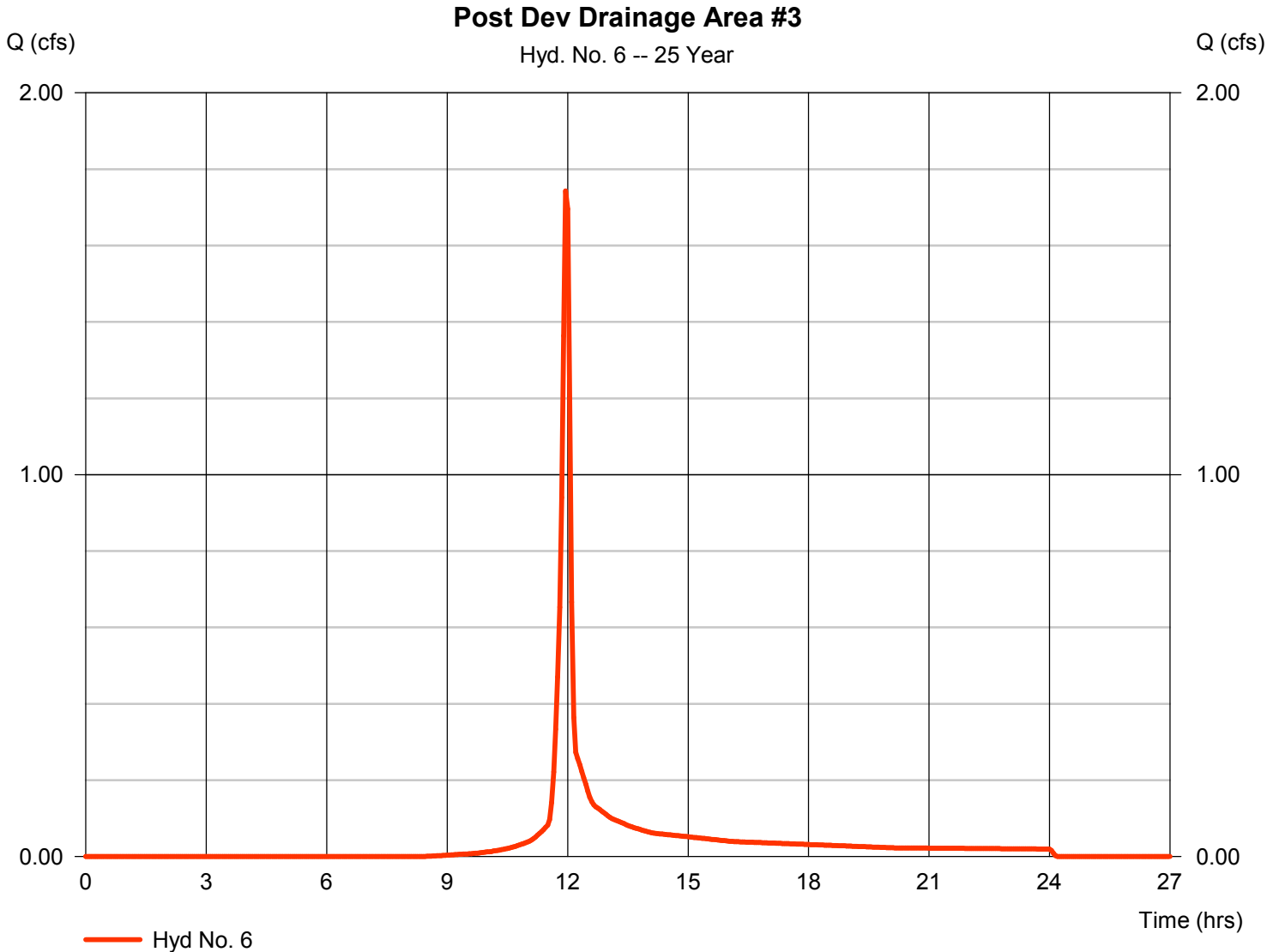
# Hydrograph Report

## Hyd. No. 6

### Post Dev Drainage Area #3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.743 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 3,936 cuft
Drainage area	= 0.510 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.510 x 78)] / 0.510



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Thursday, 04 / 6 / 2017

## Hyd. No. 7

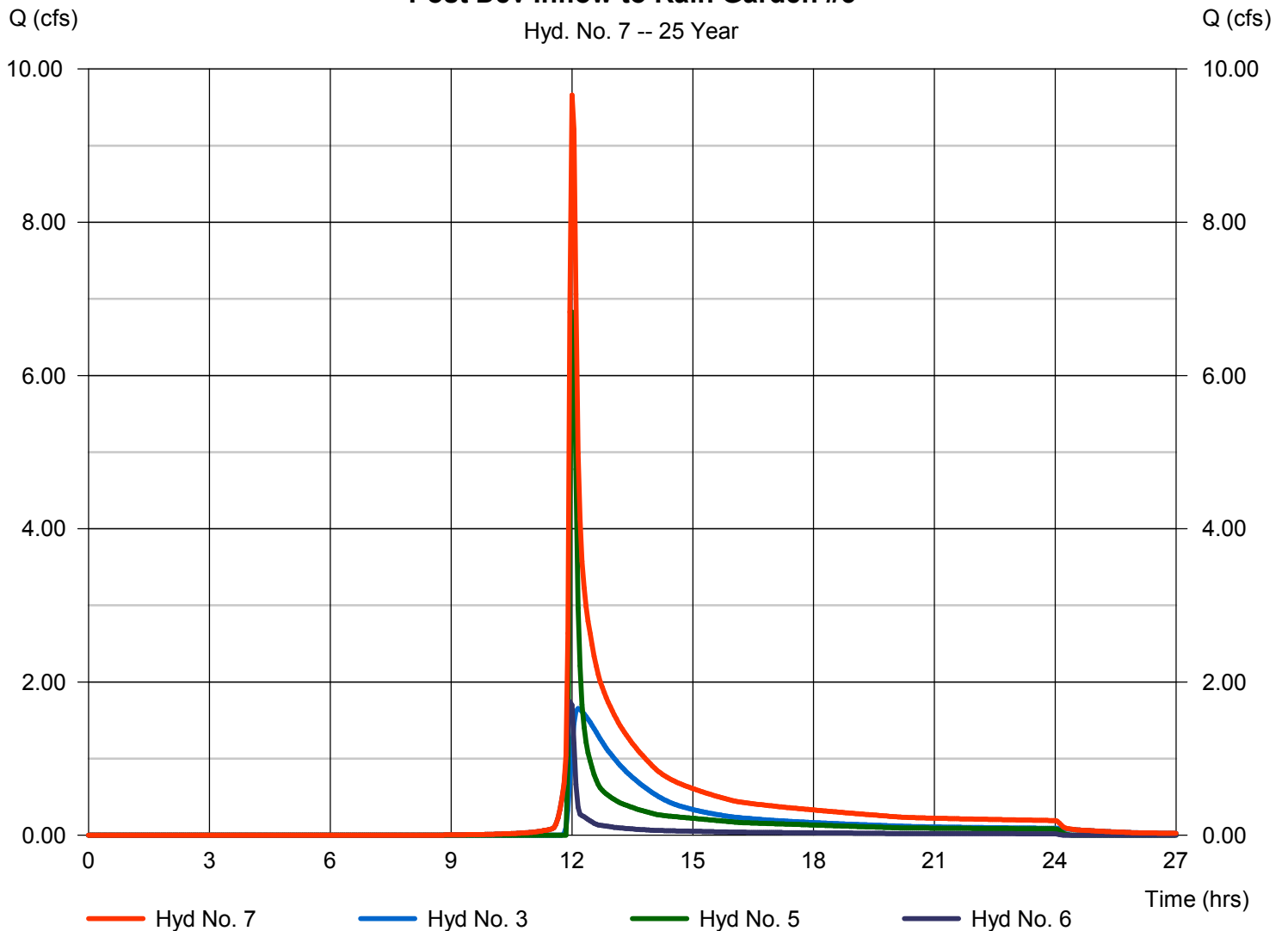
Post Dev Inflow to Rain Garden #3

Hydrograph type = Combine  
Storm frequency = 25 yrs  
Time interval = 3 min  
Inflow hyds. = 3, 5, 6

Peak discharge = 9.662 cfs  
Time to peak = 12.00 hrs  
Hyd. volume = 33,103 cuft  
Contrib. drain. area = 0.510 ac

Post Dev Inflow to Rain Garden #3

Hyd. No. 7 -- 25 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

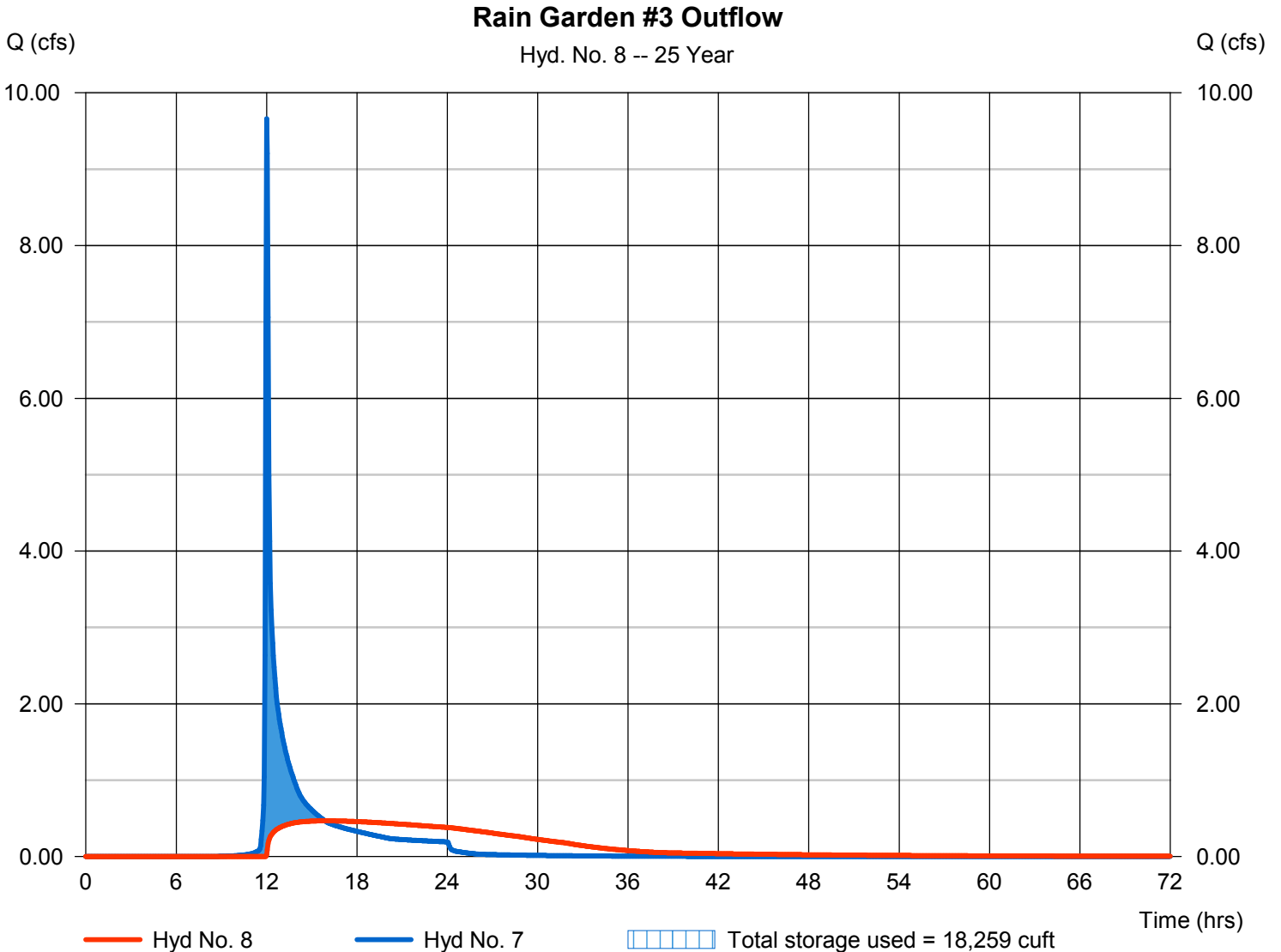
Thursday, 04 / 6 / 2017

## Hyd. No. 8

### Rain Garden #3 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.467 cfs
Storm frequency	= 25 yrs	Time to peak	= 15.90 hrs
Time interval	= 3 min	Hyd. volume	= 30,854 cuft
Inflow hyd. No.	= 7 - Post Dev Inflow to Rain Garden #3	Max. Elevation	= 1339.66 ft
Reservoir name	= Rain Garden #3	Max. Storage	= 18,259 cuft

Storage Indication method used.



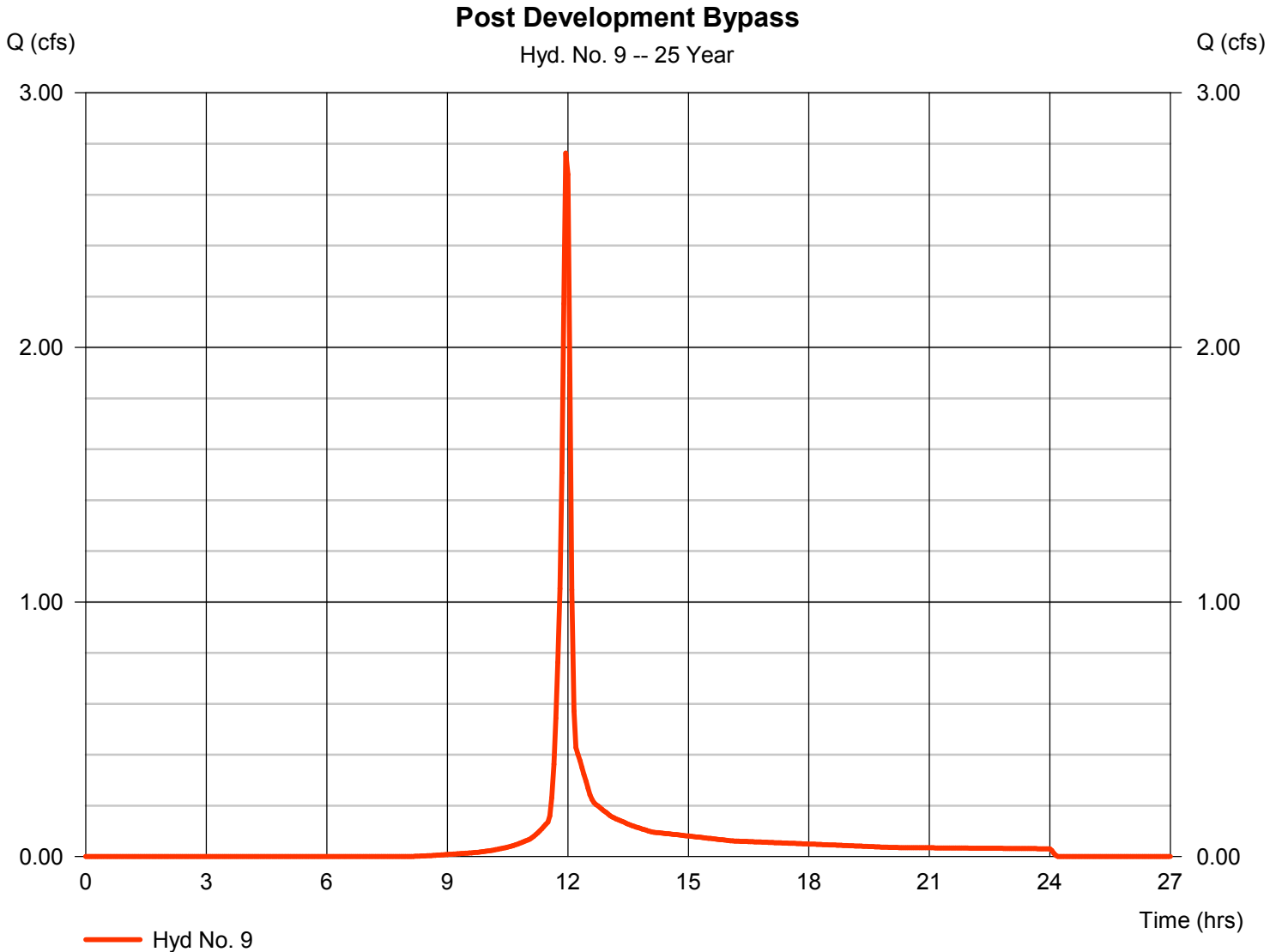
# Hydrograph Report

## Hyd. No. 9

### Post Development Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 2.764 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 6,241 cuft
Drainage area	= 0.780 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = + (0.020 x 98) + (0.760 x 78)] / 0.780



# Hydrograph Report

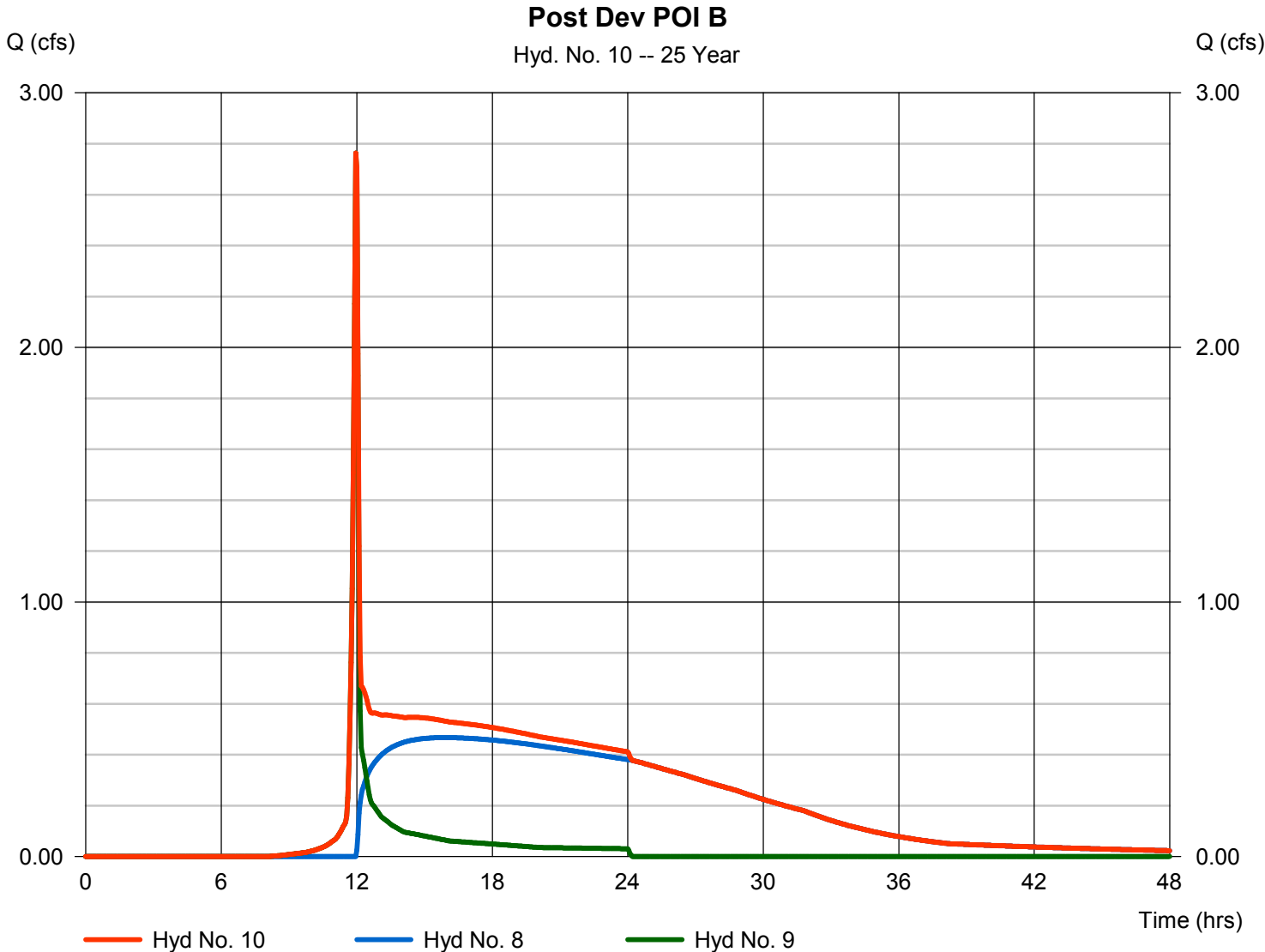
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Thursday, 04 / 6 / 2017

## Hyd. No. 10

Post Dev POI B

Hydrograph type	= Combine	Peak discharge	= 2.764 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 37,096 cuft
Inflow hyds.	= 8, 9	Contrib. drain. area	= 0.780 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

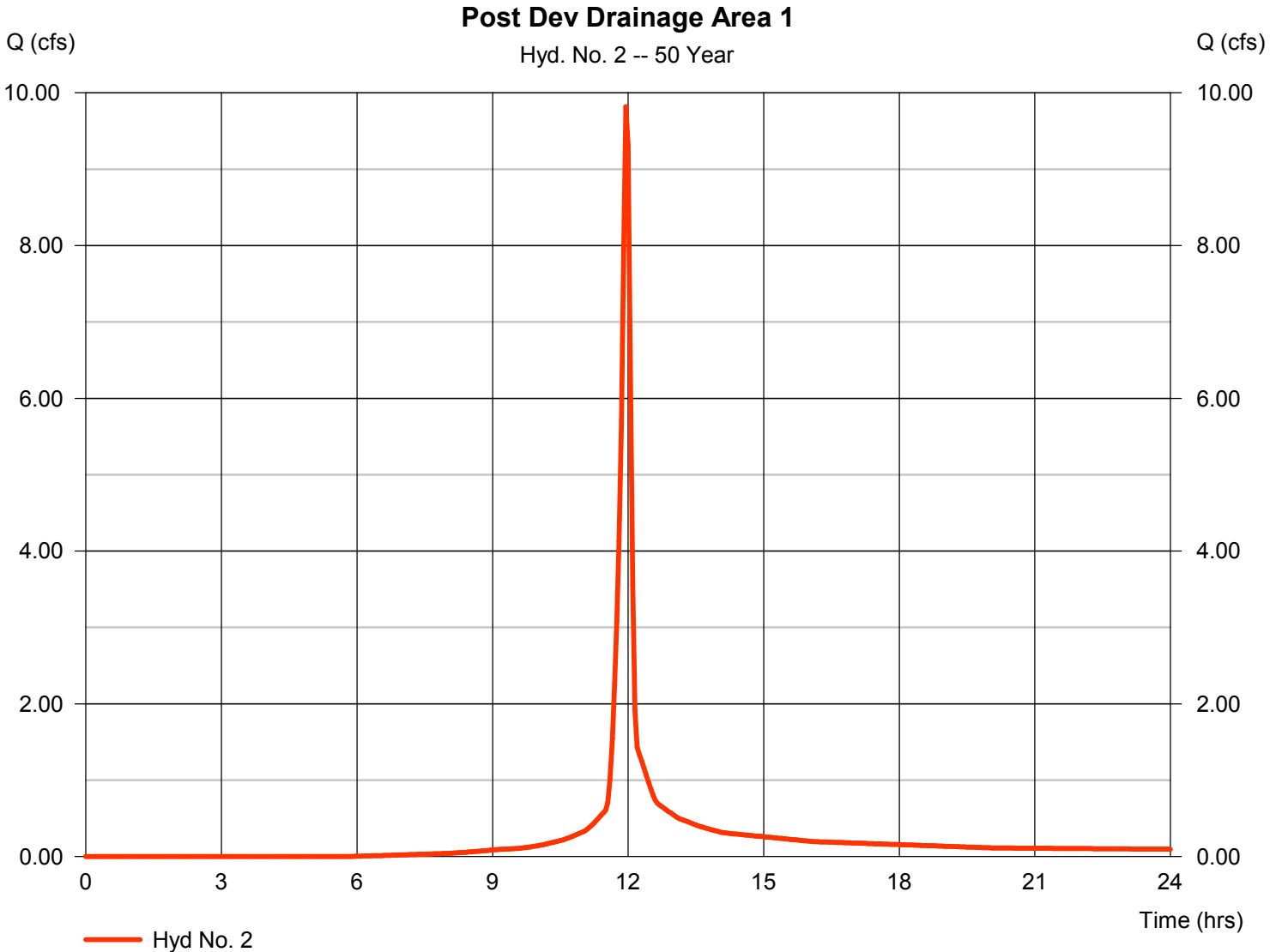
Thursday, 04 / 6 / 2017

## Hyd. No. 2

### Post Dev Drainage Area 1

Hydrograph type	= SCS Runoff	Peak discharge	= 9.817 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 22,499 cuft
Drainage area	= 1.940 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.15 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.920 x 91) + (1.020 x 78)] / 1.940



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

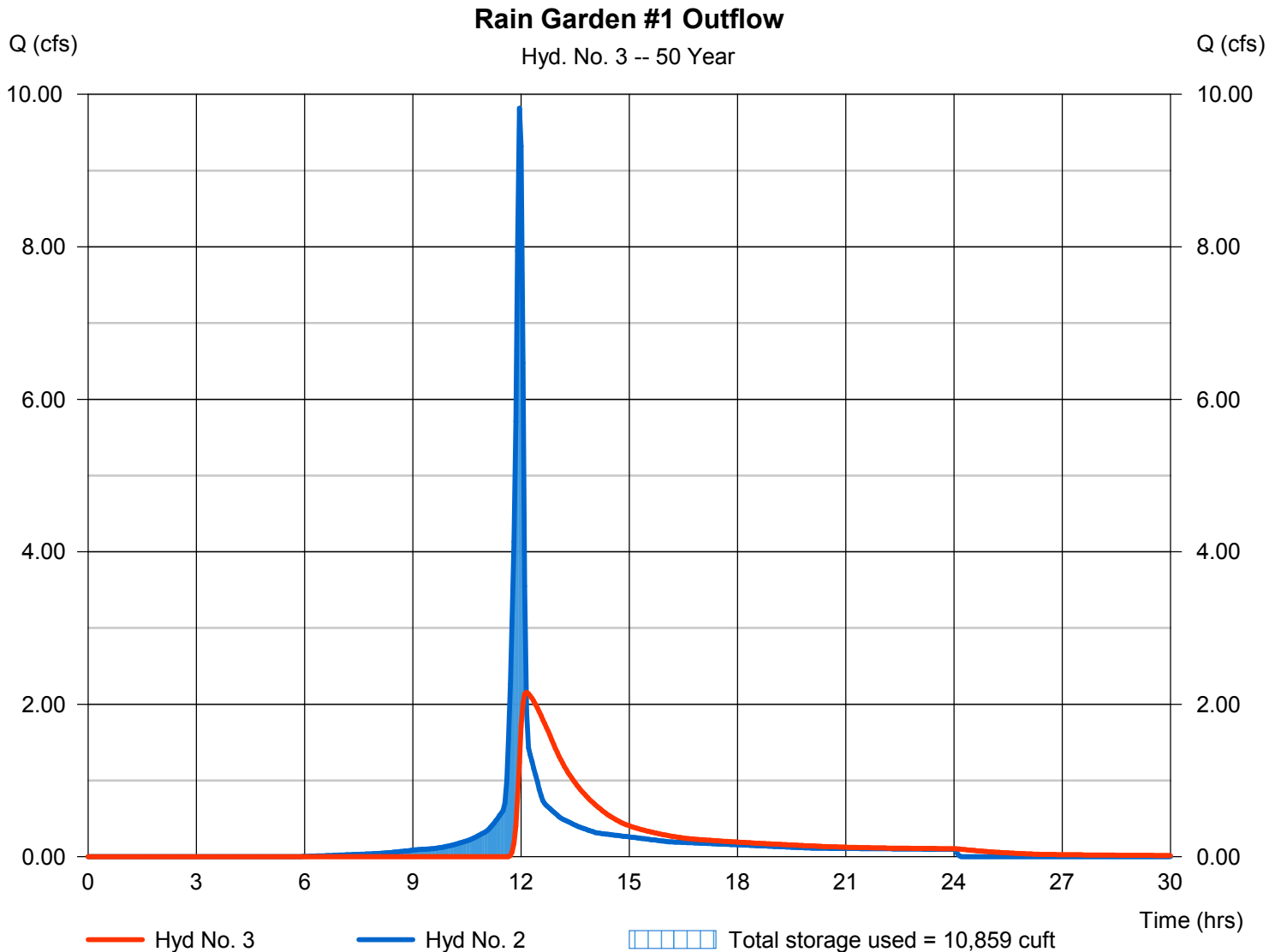
Thursday, 04 / 6 / 2017

## Hyd. No. 3

### Rain Garden #1 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 2.157 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.15 hrs
Time interval	= 3 min	Hyd. volume	= 19,594 cuft
Inflow hyd. No.	= 2 - Post Dev Drainage Area 1	Max. Elevation	= 1342.66 ft
Reservoir name	= Rain Garden #1	Max. Storage	= 10,859 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

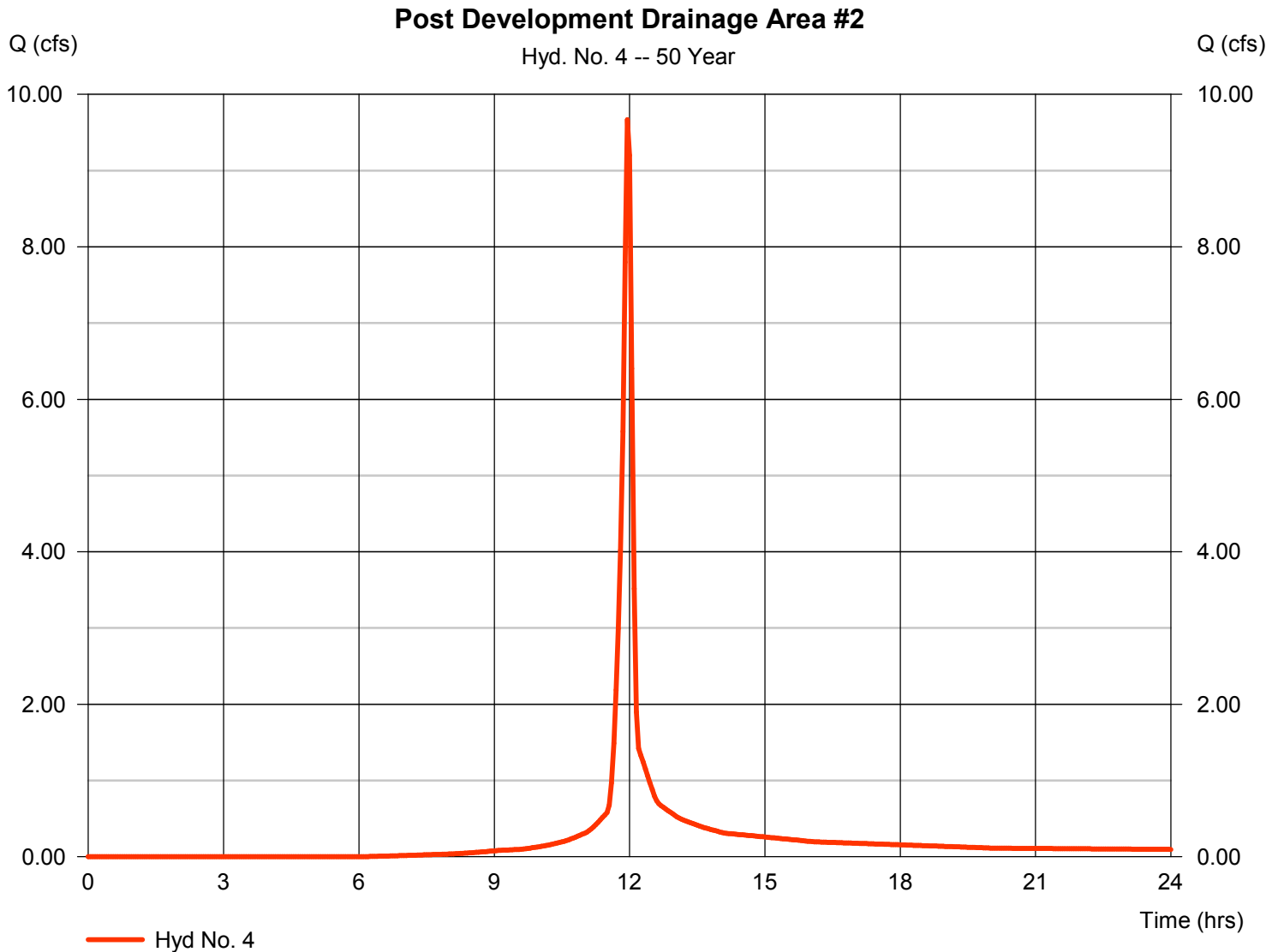
Thursday, 04 / 6 / 2017

## Hyd. No. 4

### Post Development Drainage Area #2

Hydrograph type	= SCS Runoff	Peak discharge	= 9.668 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 22,079 cuft
Drainage area	= 1.960 ac	Curve number	= 83*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.15 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.030 x 98) + (0.660 x 91) + (1.270 x 78)] / 1.960



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

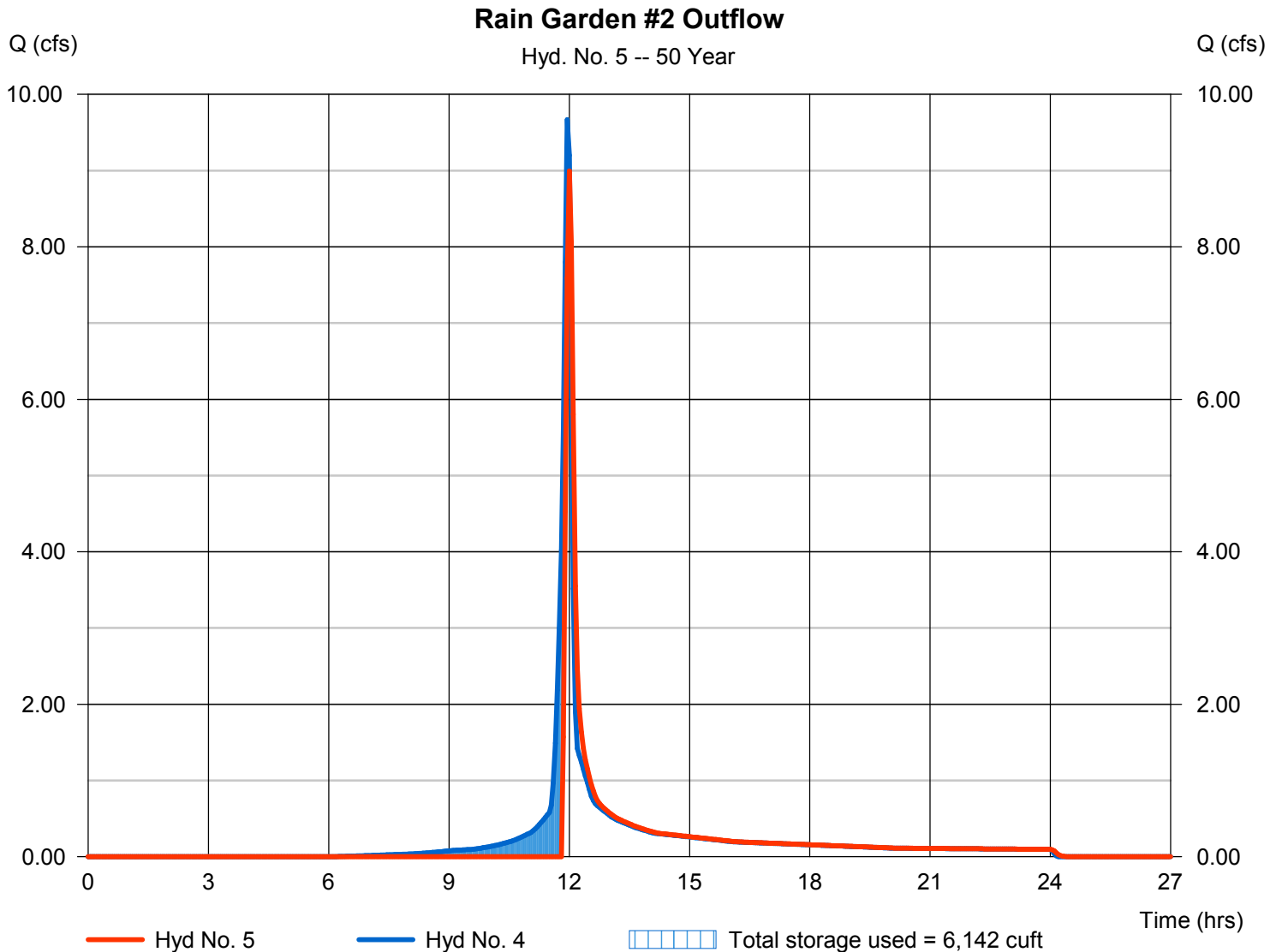
Thursday, 04 / 6 / 2017

## Hyd. No. 5

### Rain Garden #2 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 8.997 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 17,731 cuft
Inflow hyd. No.	= 4 - Post Development Drainage Area #2	Area #2	= 1343.42 ft
Reservoir name	= Rain Garden #2	Max. Storage	= 6,142 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

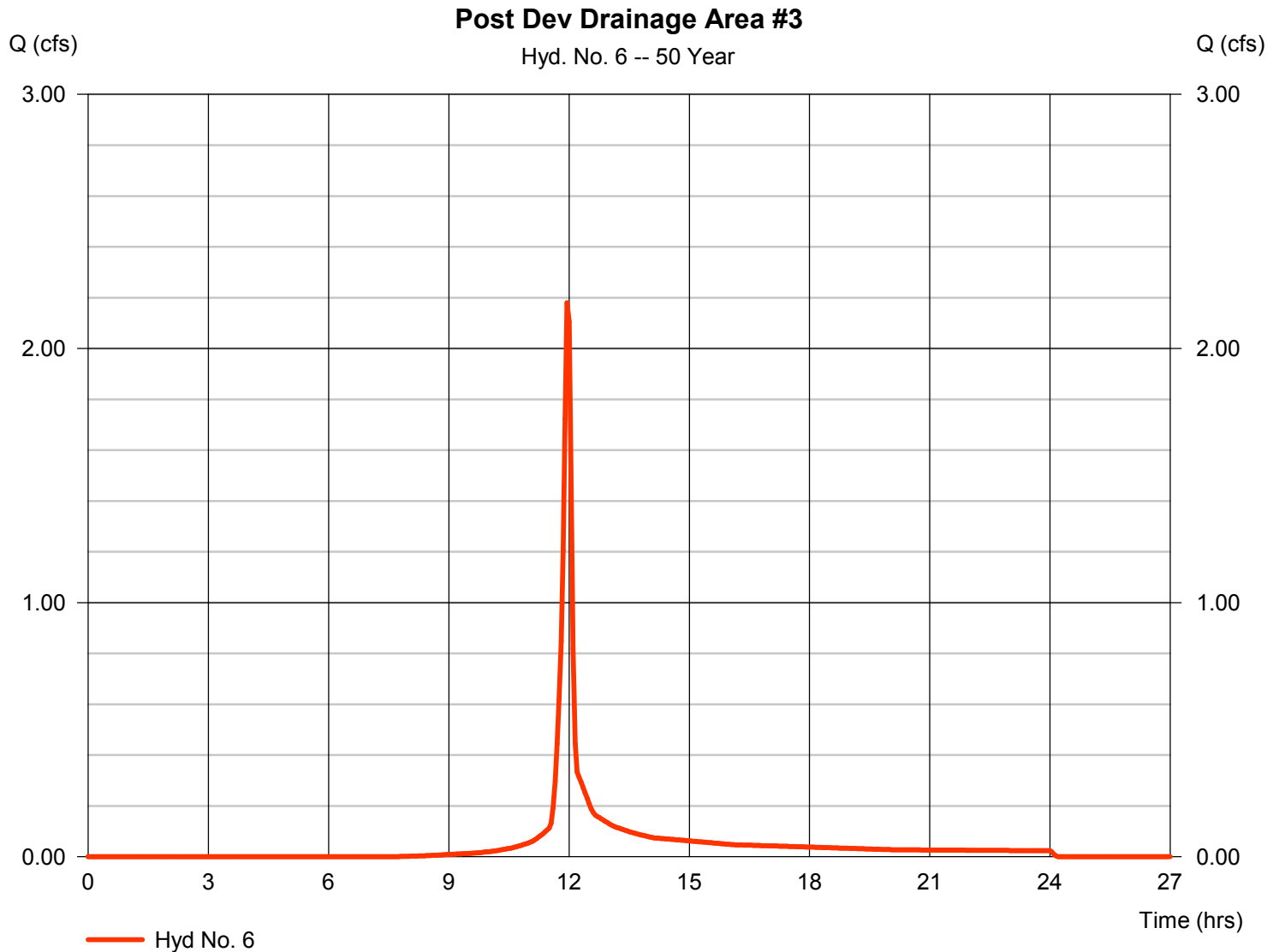
Thursday, 04 / 6 / 2017

## Hyd. No. 6

### Post Dev Drainage Area #3

Hydrograph type	= SCS Runoff	Peak discharge	= 2.181 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 4,928 cuft
Drainage area	= 0.510 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.15 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.510 x 78)] / 0.510



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Thursday, 04 / 6 / 2017

## Hyd. No. 7

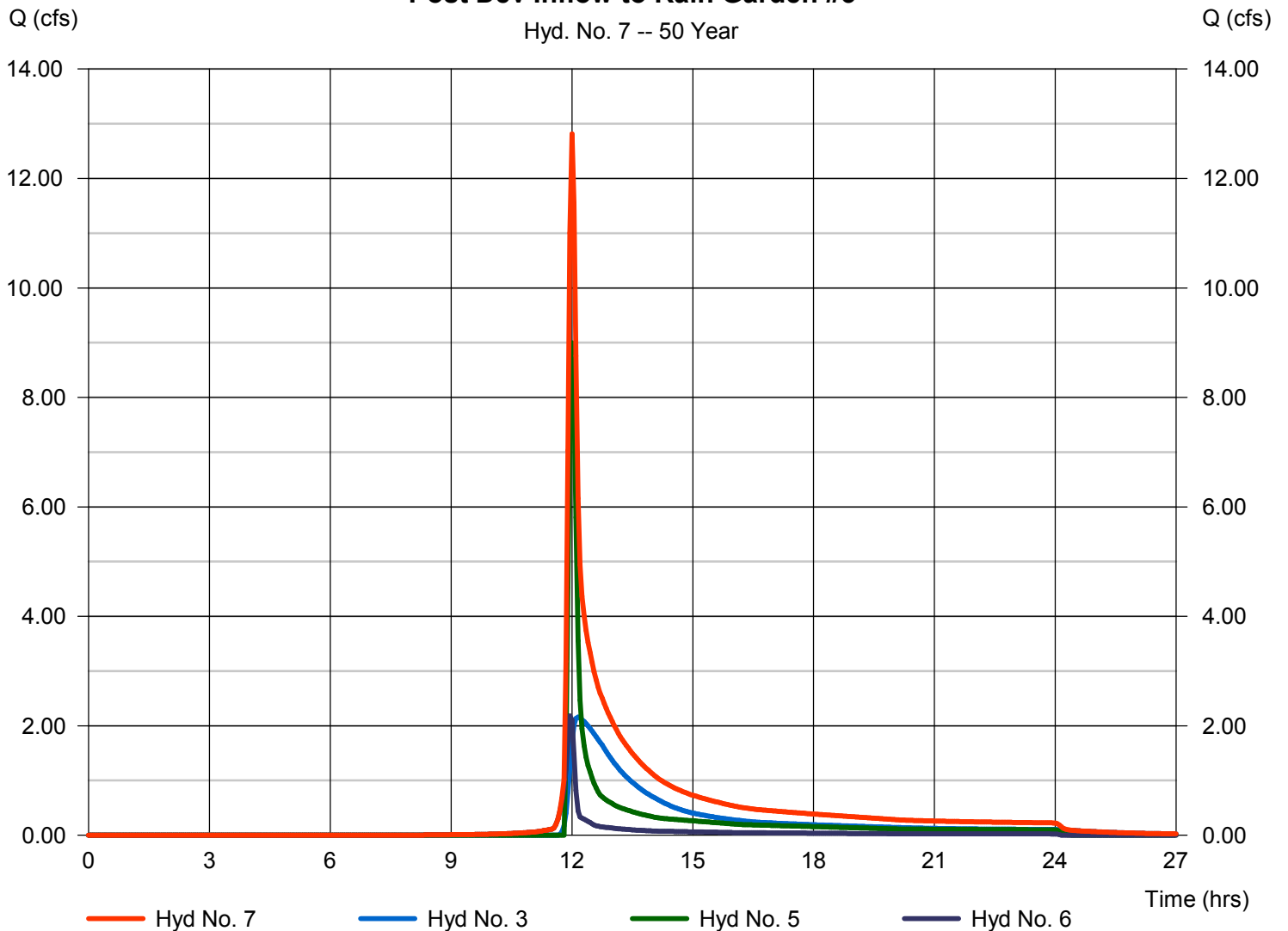
Post Dev Inflow to Rain Garden #3

Hydrograph type = Combine  
 Storm frequency = 50 yrs  
 Time interval = 3 min  
 Inflow hyds. = 3, 5, 6

Peak discharge = 12.81 cfs  
 Time to peak = 12.00 hrs  
 Hyd. volume = 42,254 cuft  
 Contrib. drain. area = 0.510 ac

Post Dev Inflow to Rain Garden #3

Hyd. No. 7 -- 50 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

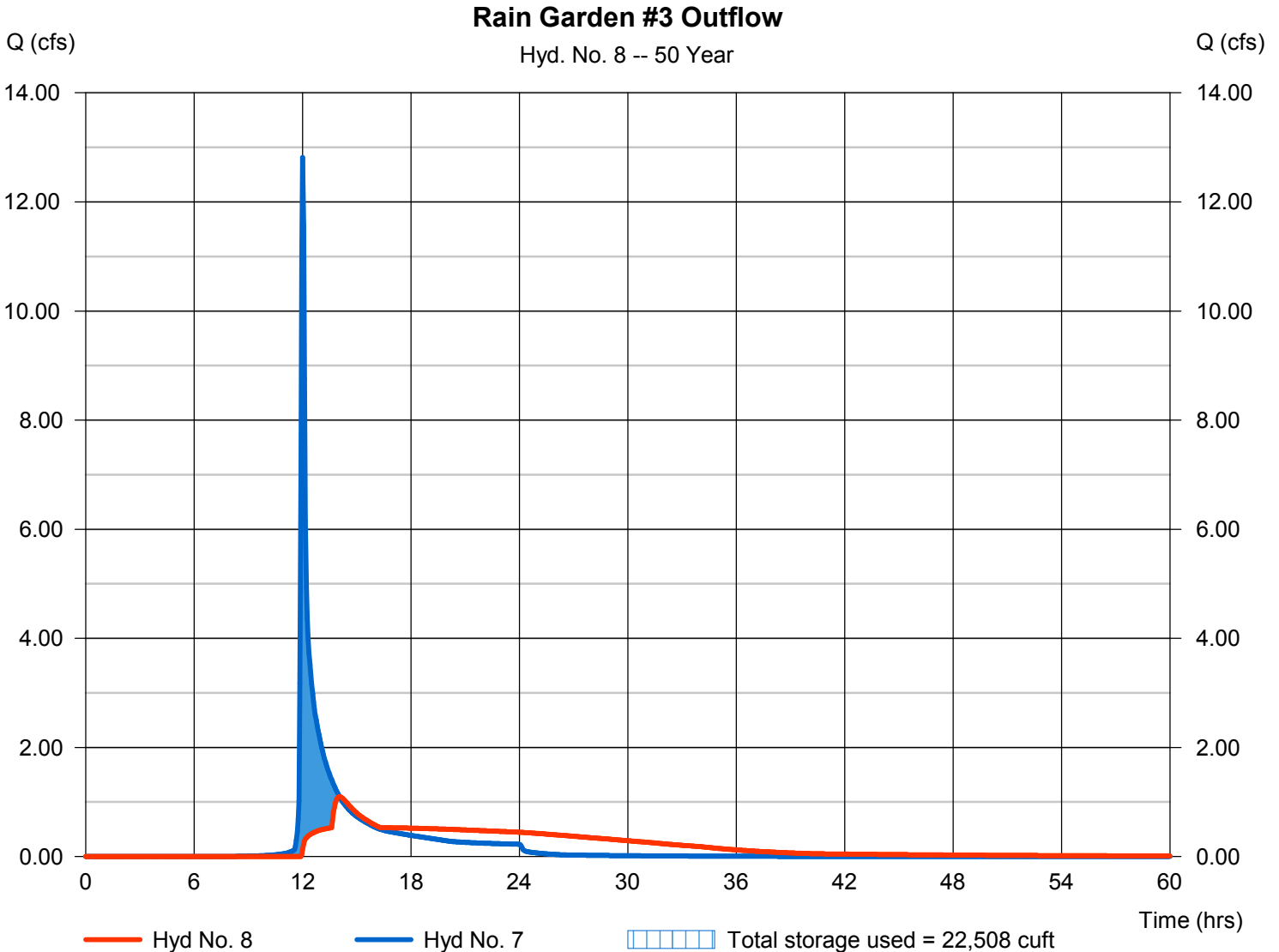
Thursday, 04 / 6 / 2017

## Hyd. No. 8

### Rain Garden #3 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 1.097 cfs
Storm frequency	= 50 yrs	Time to peak	= 14.05 hrs
Time interval	= 3 min	Hyd. volume	= 40,005 cuft
Inflow hyd. No.	= 7 - Post Dev Inflow to Rain Garden #3	Max. Elevation	= 1340.03 ft
Reservoir name	= Rain Garden #3	Max. Storage	= 22,508 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

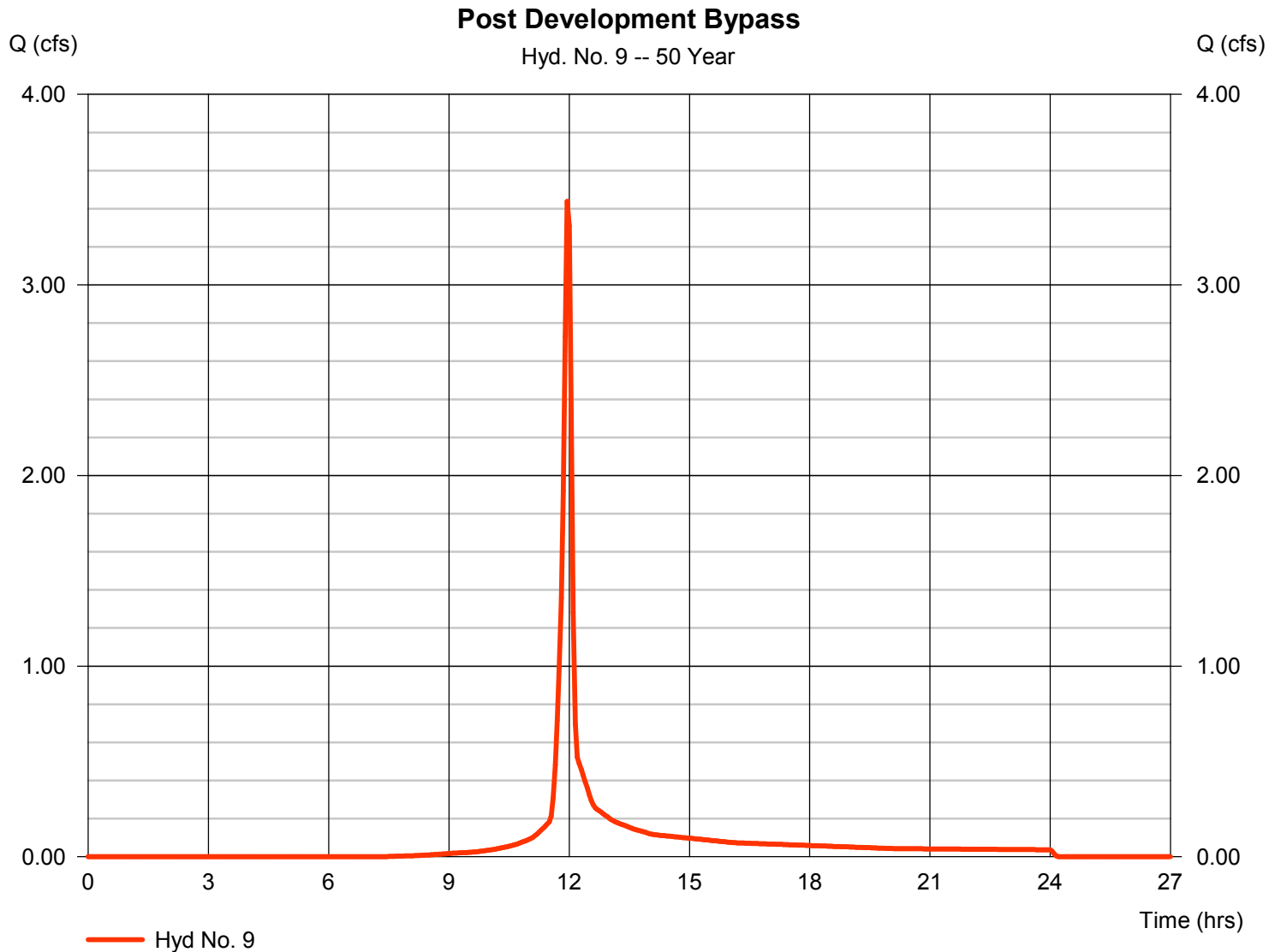
Thursday, 04 / 6 / 2017

## Hyd. No. 9

### Post Development Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 3.439 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 7,781 cuft
Drainage area	= 0.780 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.15 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = + (0.020 x 98) + (0.760 x 78)] / 0.780



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

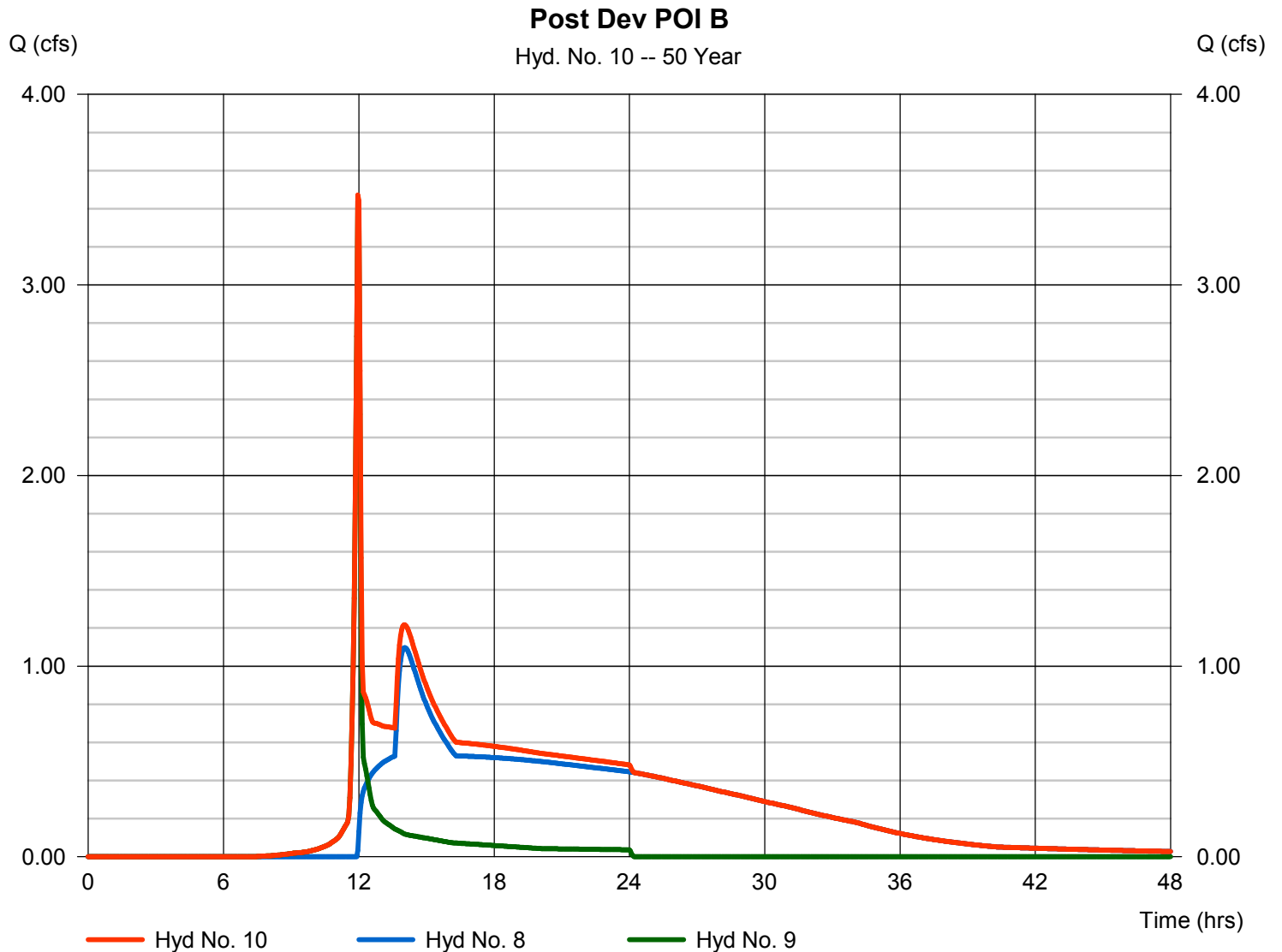
Thursday, 04 / 6 / 2017

## Hyd. No. 10

Post Dev POI B

Hydrograph type = Combine  
 Storm frequency = 50 yrs  
 Time interval = 3 min  
 Inflow hyds. = 8, 9

Peak discharge = 3.472 cfs  
 Time to peak = 11.95 hrs  
 Hyd. volume = 47,786 cuft  
 Contrib. drain. area = 0.780 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

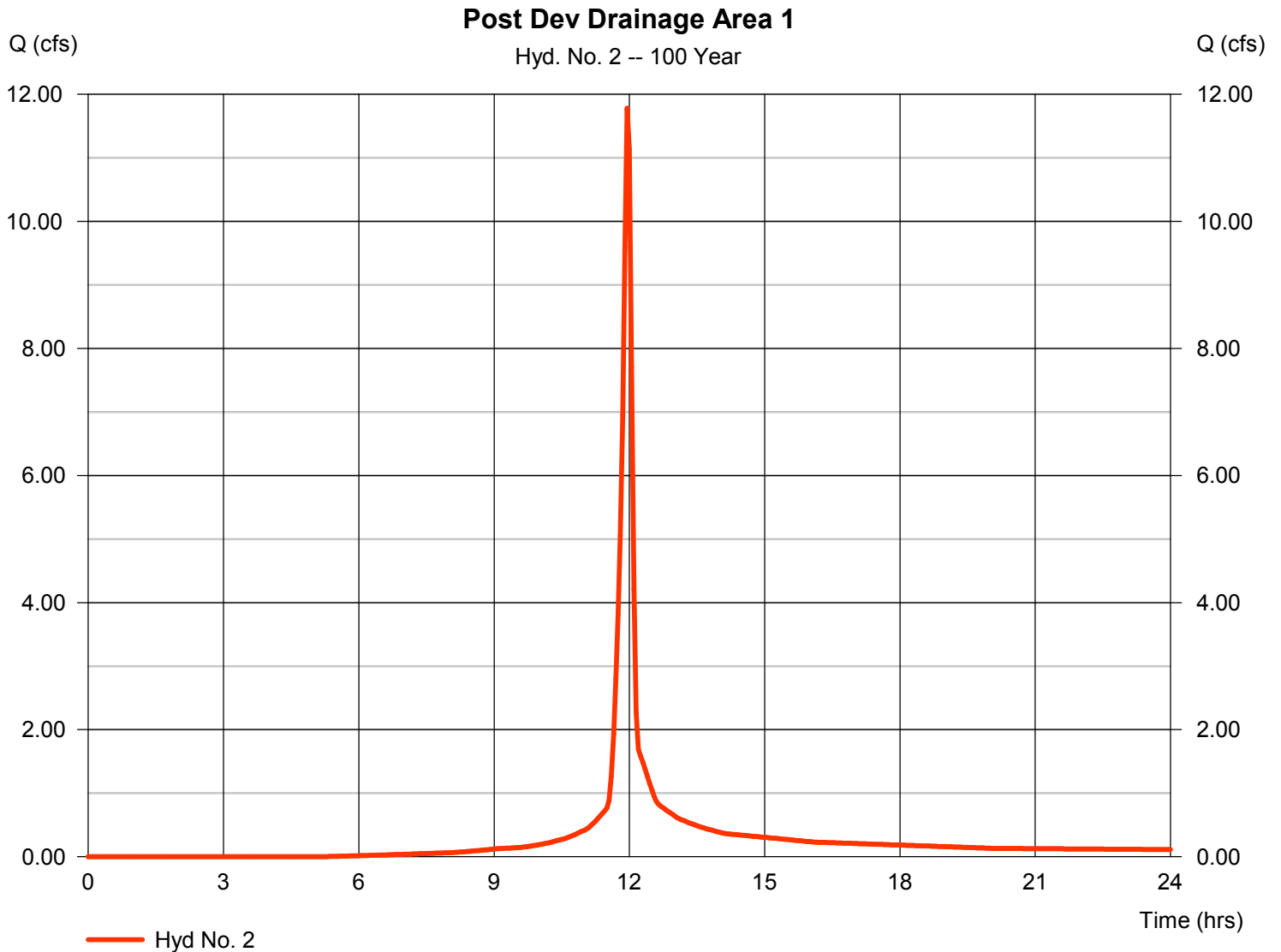
Thursday, 04 / 6 / 2017

## Hyd. No. 2

### Post Dev Drainage Area 1

Hydrograph type	= SCS Runoff	Peak discharge	= 11.78 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 27,212 cuft
Drainage area	= 1.940 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.92 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.920 x 91) + (1.020 x 78)] / 1.940



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

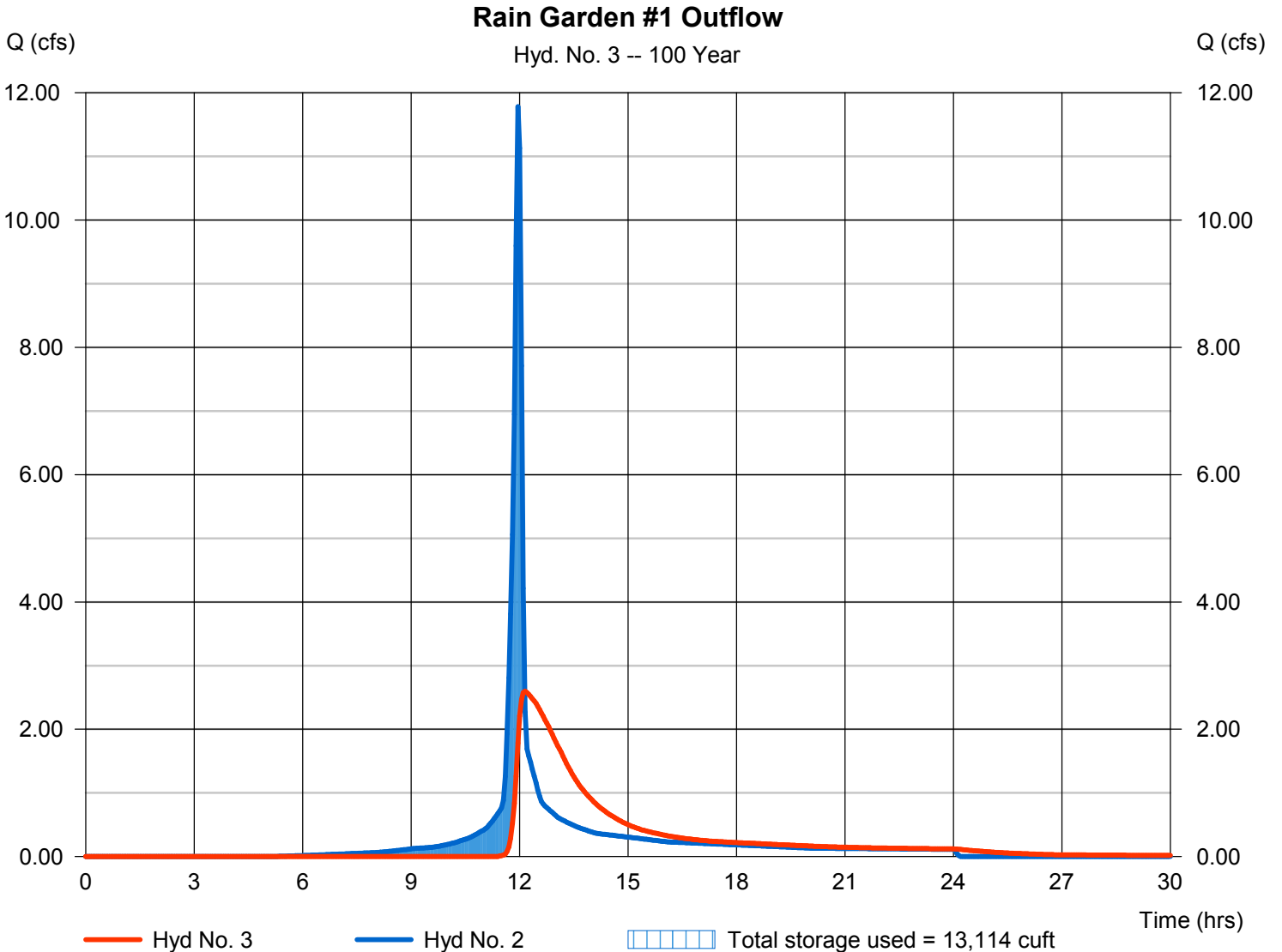
Thursday, 04 / 6 / 2017

## Hyd. No. 3

### Rain Garden #1 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 2.596 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.15 hrs
Time interval	= 3 min	Hyd. volume	= 24,306 cuft
Inflow hyd. No.	= 2 - Post Dev Drainage Area 1	Max. Elevation	= 1342.95 ft
Reservoir name	= Rain Garden #1	Max. Storage	= 13,114 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

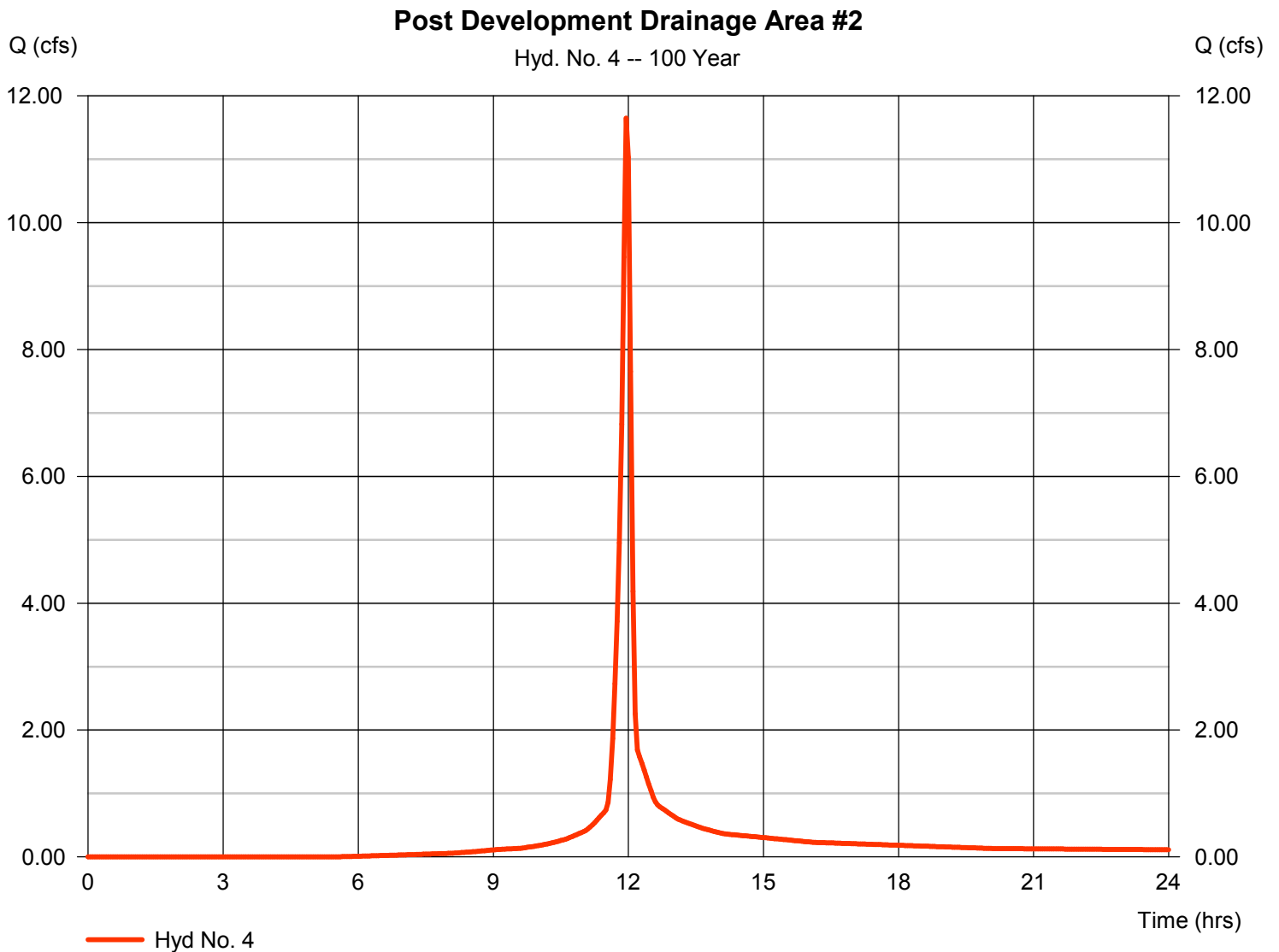
Thursday, 04 / 6 / 2017

## Hyd. No. 4

### Post Development Drainage Area #2

Hydrograph type	= SCS Runoff	Peak discharge	= 11.65 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 26,795 cuft
Drainage area	= 1.960 ac	Curve number	= 83*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.92 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.030 \times 98) + (0.660 \times 91) + (1.270 \times 78)] / 1.960$



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

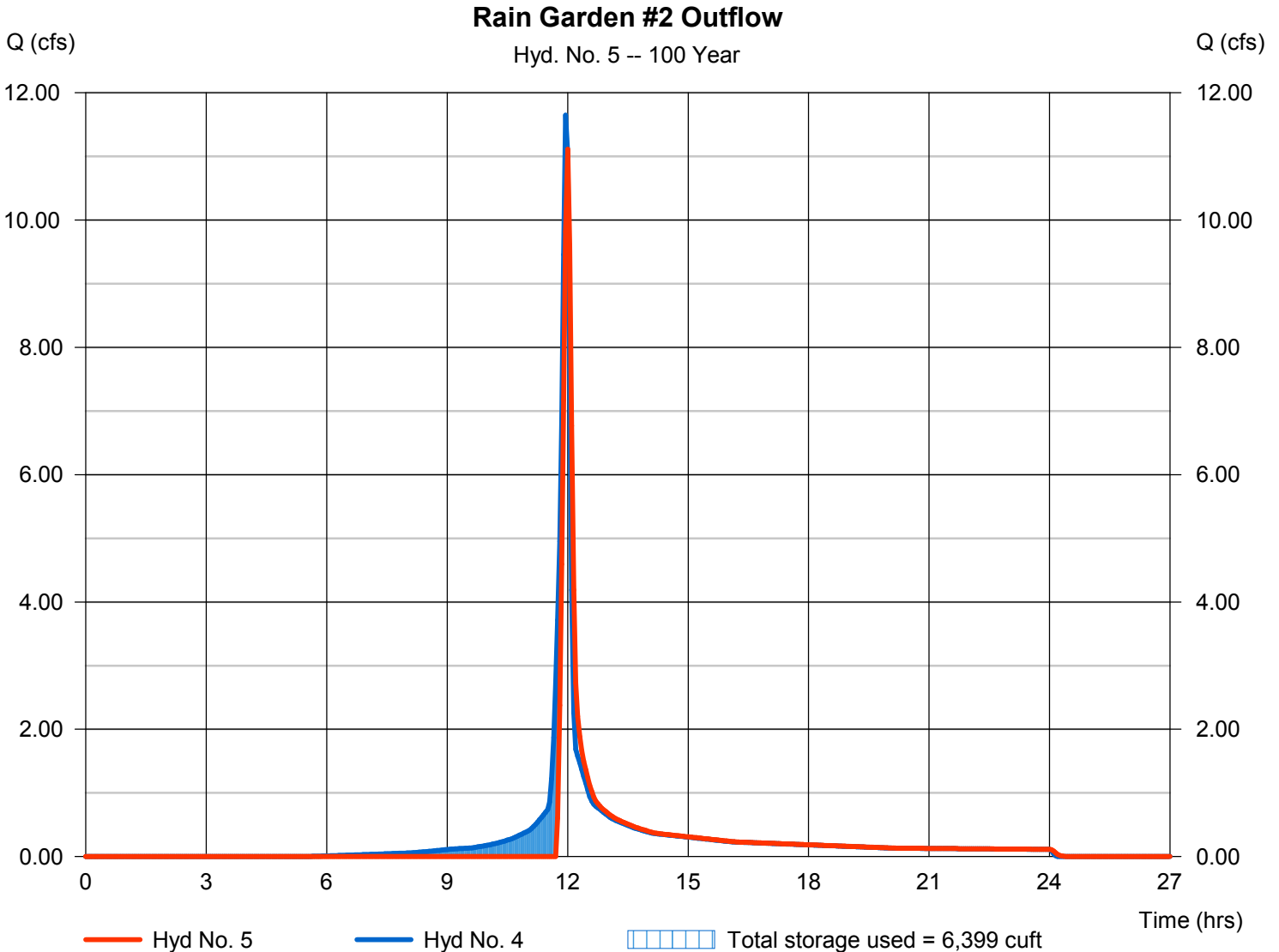
Thursday, 04 / 6 / 2017

## Hyd. No. 5

### Rain Garden #2 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 11.11 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 3 min	Hyd. volume	= 22,447 cuft
Inflow hyd. No.	= 4 - Post Development Drainage Area #2	Area #2	= 1343.47 ft
Reservoir name	= Rain Garden #2	Max. Storage	= 6,399 cuft

Storage Indication method used.



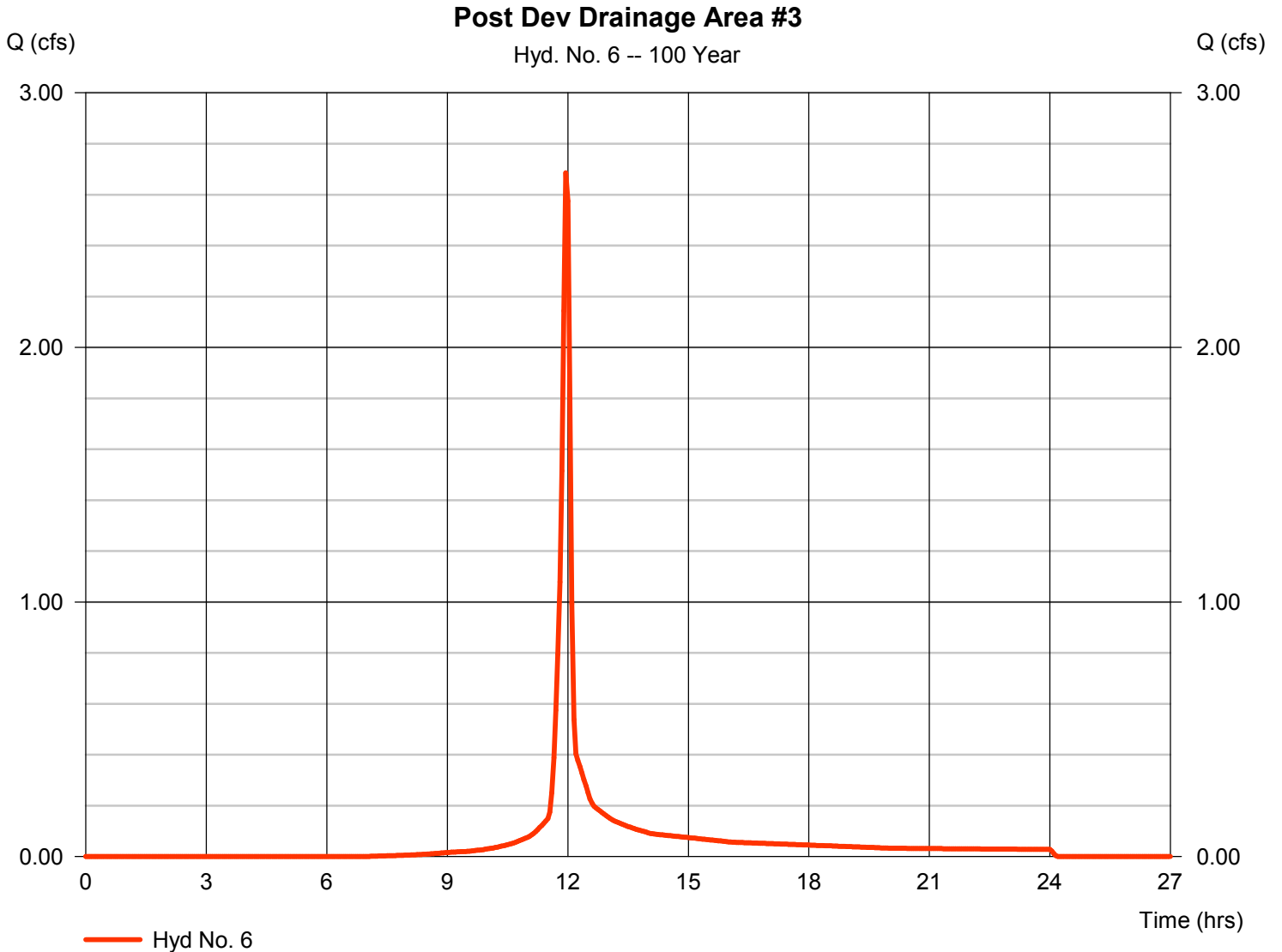
# Hydrograph Report

## Hyd. No. 6

### Post Dev Drainage Area #3

Hydrograph type	= SCS Runoff	Peak discharge	= 2.685 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 6,089 cuft
Drainage area	= 0.510 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.92 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.510 x 78)] / 0.510



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Thursday, 04 / 6 / 2017

## Hyd. No. 7

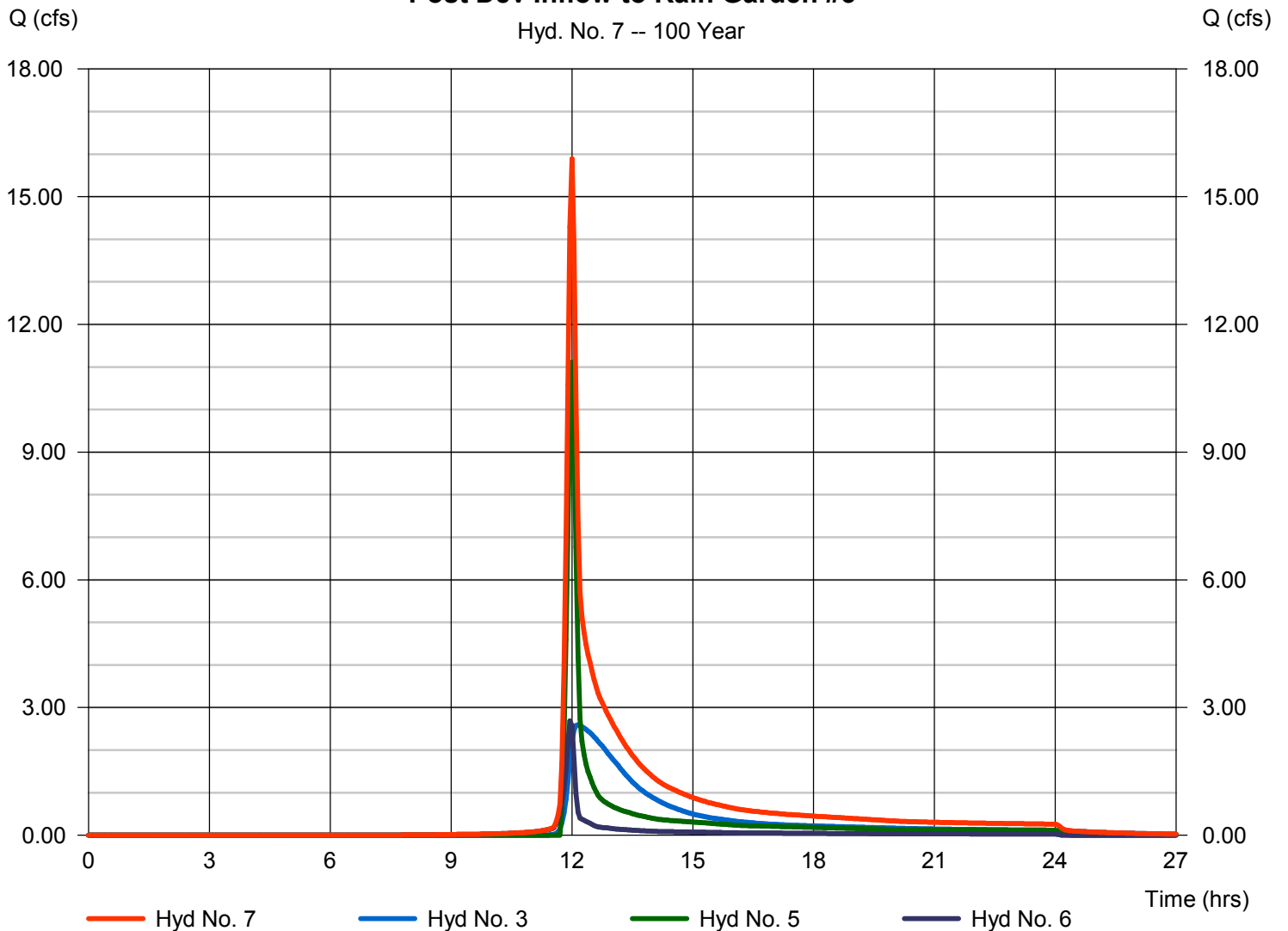
Post Dev Inflow to Rain Garden #3

Hydrograph type = Combine  
 Storm frequency = 100 yrs  
 Time interval = 3 min  
 Inflow hyds. = 3, 5, 6

Peak discharge = 15.90 cfs  
 Time to peak = 12.00 hrs  
 Hyd. volume = 52,843 cuft  
 Contrib. drain. area = 0.510 ac

Post Dev Inflow to Rain Garden #3

Hyd. No. 7 -- 100 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

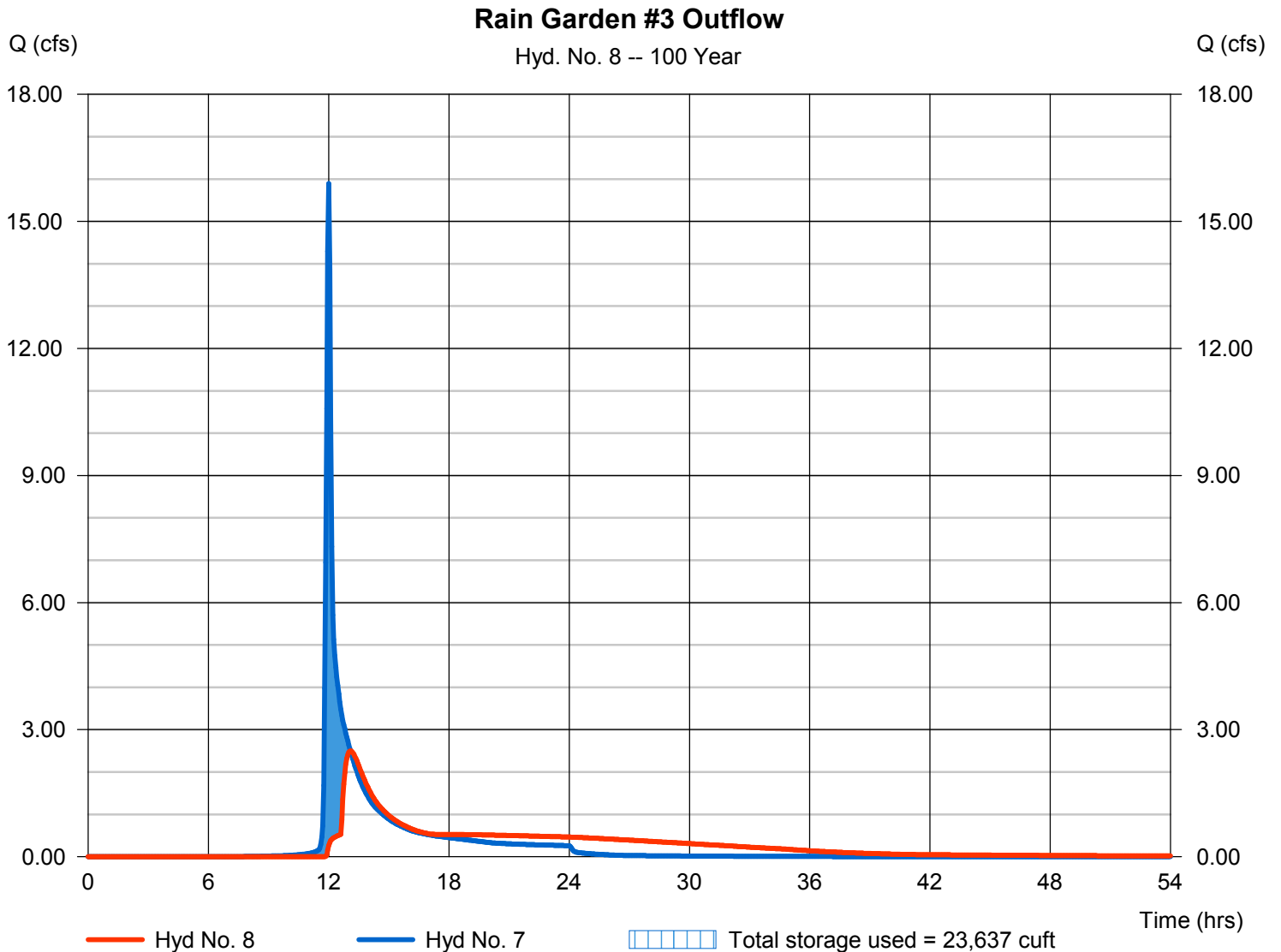
Thursday, 04 / 6 / 2017

## Hyd. No. 8

### Rain Garden #3 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 2.496 cfs
Storm frequency	= 100 yrs	Time to peak	= 13.10 hrs
Time interval	= 3 min	Hyd. volume	= 50,594 cuft
Inflow hyd. No.	= 7 - Post Dev Inflow to Rain Garden #3	Max. Elevation	= 1340.11 ft
Reservoir name	= Rain Garden #3	Max. Storage	= 23,637 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

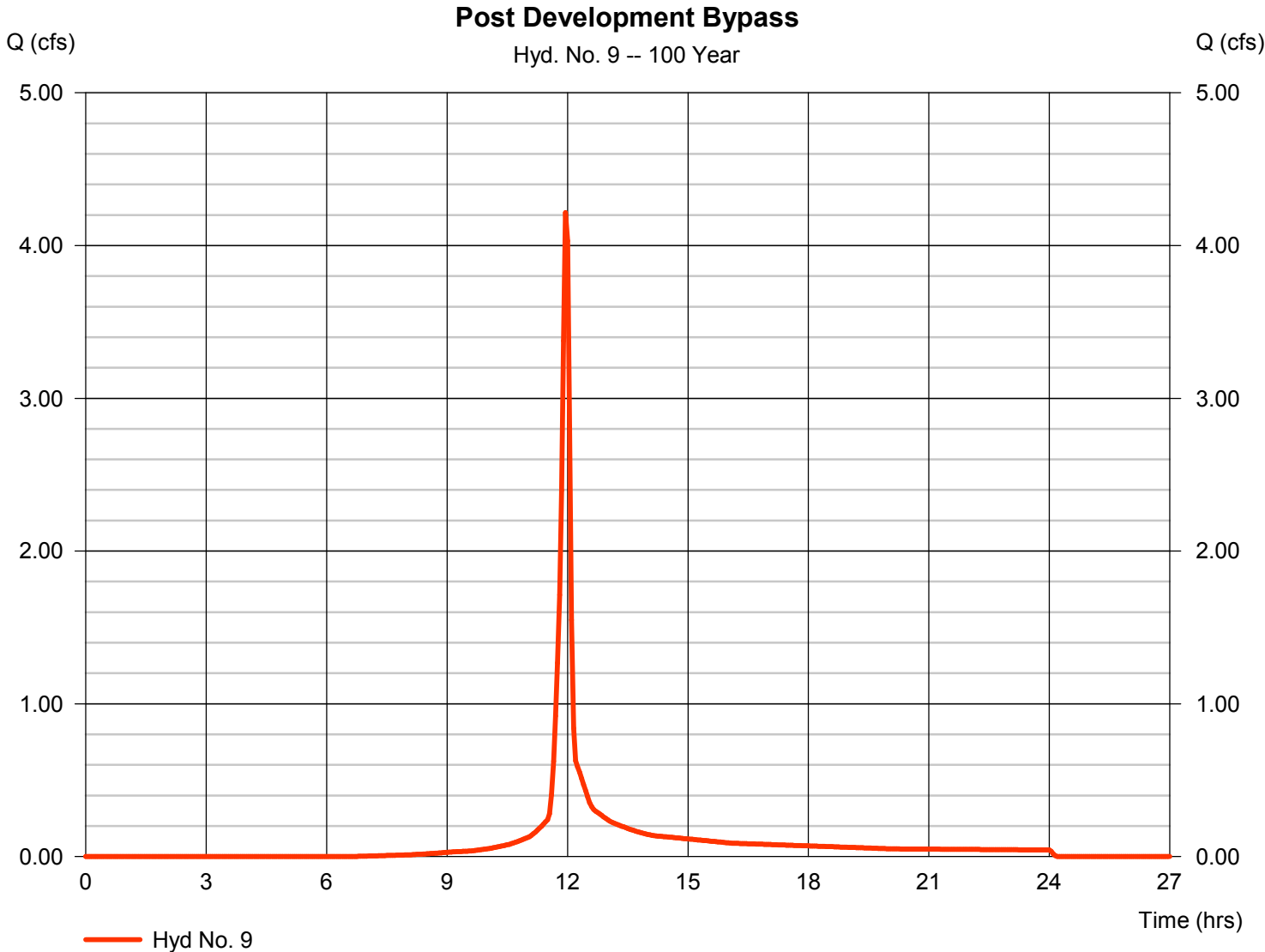
Thursday, 04 / 6 / 2017

## Hyd. No. 9

### Post Development Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 4.215 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.95 hrs
Time interval	= 3 min	Hyd. volume	= 9,578 cuft
Drainage area	= 0.780 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.92 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = + (0.020 x 98) + (0.760 x 78)] / 0.780



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

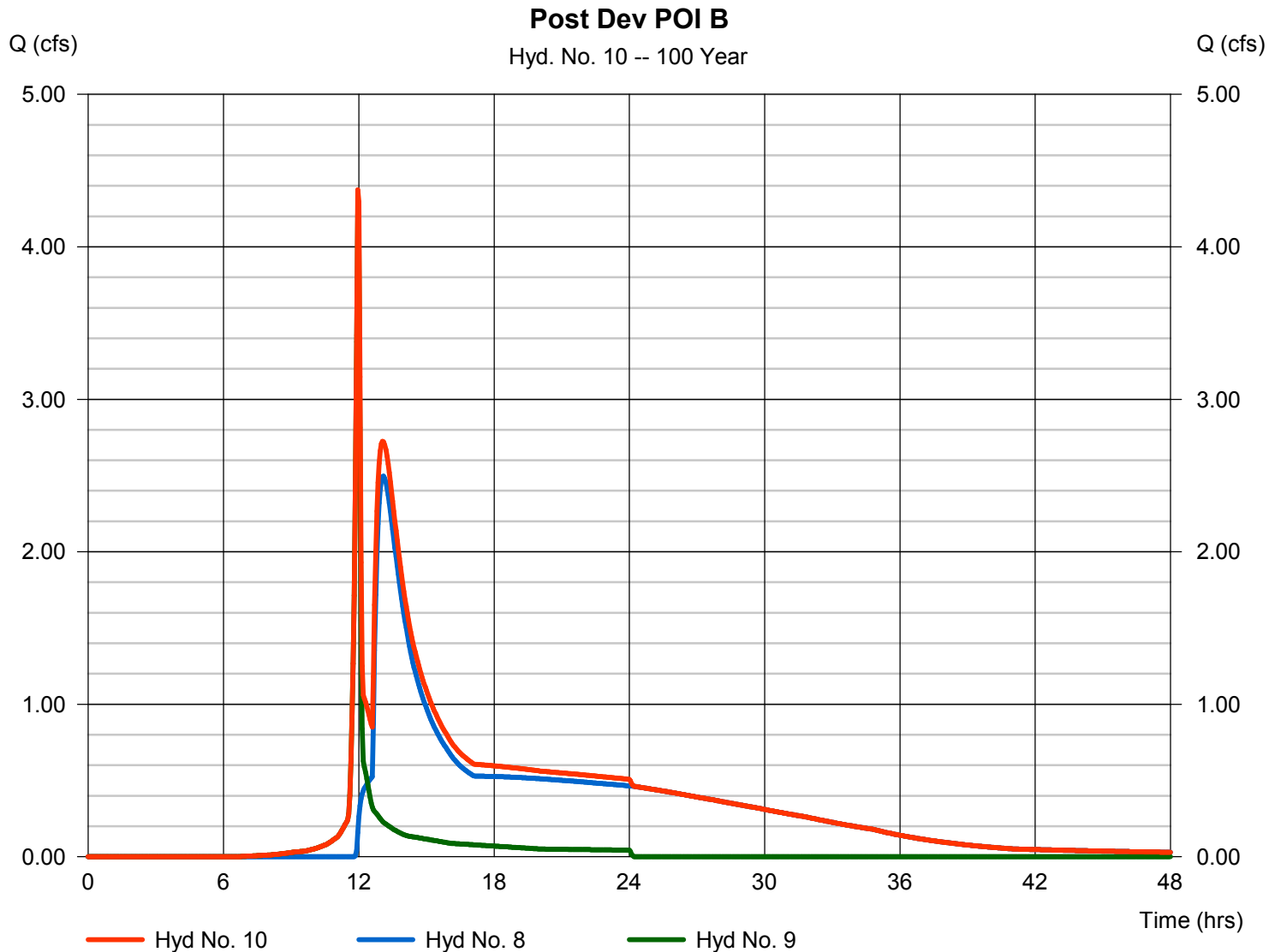
Thursday, 04 / 6 / 2017

## Hyd. No. 10

Post Dev POI B

Hydrograph type = Combine  
Storm frequency = 100 yrs  
Time interval = 3 min  
Inflow hyds. = 8, 9

Peak discharge = 4.374 cfs  
Time to peak = 11.95 hrs  
Hyd. volume = 60,172 cuft  
Contrib. drain. area = 0.780 ac





## **A.3 Conveyance Calculations**



**E&S WORKSHEET # 11**

**Channel Design Data**

PROJECT NAME: ATLANTIC SUNRISE PROJECT - ZICK METER STATION

LOCATION: LENOX TOWNSHIP, SUSQUEHANNA COUNTY, PENNSYLVANIA

PREPARED BY: AJD DATE: 04/24/2017

CHECKED BY: AJB DATE: 04/24/2017

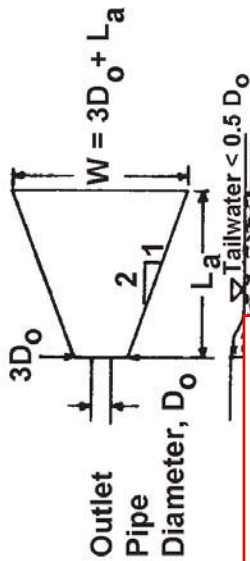
CHANNEL OR CHANNEL SECTION	VEGETATED SWALE 1 SECTION 1 LINING	VEGETATED SWALE 1 SECTION 1 GRASS	VEGETATED SWALE 1 SECTION 2 LINING	VEGETATED SWALE 1 SECTION 2 GRASS	TEMPORARY SWALE 2 LINING
TEMPORARY OR PERMANENT? (T OR P)	P	P	P	P	T
DESIGN STORM (2, 5, OR 10 YR)	10	10	10	10	10
ACRES (AC)	0.67	0.67	0.67	0.67	1.23
MULTIPLIER <sup>1</sup> (1.6, 2.25, or 2.75) <sup>1</sup>	2.75	2.75	2.75	2.75	1.6
Qr (REQUIRED CAPACITY) (CFS)	1.84	1.84	1.84	1.84	1.97
Q (CALCULATED AT FLOW DEPTH d) (CFS)	1.86	1.86	1.83	1.88	2.03
PROTECTIVE LINING <sup>2</sup>	SC150	GRASS	SC250	GRASS	SC150
n (MANNING'S COEFFICIENT) <sup>2</sup>	0.05	0.056	0.04	0.084	0.05
Va (ALLOWABLE VELOCITY) (FPS)	N/A	N/A	N/A	N/A	N/A
V (CALCULATED AT FLOW DEPTH d) (FPS)	1.96	1.81	3.75	2.26	1.83
ta (MAX ALLOWABLE SHEAR STRESS) (LB/FT <sup>2</sup> )	2.00	8.00	3.00	10.00	2.00
td (CALC'D SHEAR STRESS AT FLOW DEPTH d) (LB/FT <sup>2</sup> )	0.60	0.64	1.48	2.26	0.52
CHANNEL BOTTOM WIDTH (FT)	2	2	2	2	2
CHANNEL SIDE SLOPES (H:V)	3	3	3	3	3
D (TOTAL DEPTH) (FT)	1.5	1.5	1.5	1.5	1.5
CHANNEL TOP WIDTH @ D (FT)	11	11	11	11	11
d (CALCULATED FLOW DEPTH) (FT)	0.32	0.34	0.19	0.29	0.36
CHANNEL TOP WIDTH @ FLOW DEPTH d (FT)	3.92	4.04	3.14	3.74	4.16
BOTTOM WIDTH: FLOW DEPTH RATIO (12:1 MAX)	6.25	5.88	10.53	6.90	5.56
d50 STONE SIZE (IN)	N/A	N/A	N/A	N/A	N/A
A (GROSS-SECTIONAL AREA) (SQ. FT.)	0.95	1.03	0.49	0.83	1.11
R (HYDRAULIC RADIUS)	0.24	0.25	0.15	0.22	0.26
S (BED SLOPE) <sup>3</sup> (FT/FT)	0.03	0.03	0.125	0.125	0.023
Sc (CRITICAL SLOPE) (FT/FT)	0.061	0.075	0.044	0.175	0.059
.7Sc (FT/FT)	0.042	0.052	0.031	0.123	0.041
1.3Sc (FT/FT)	0.079	0.097	0.058	0.228	0.076
STABLE FLOW? (Y/N)	Y	Y	Y	N	Y
FREEBOARD BASED ON UNSTABLE FLOW (FT)	0.05	0.05	0.05	0.05	0.05
FREEBOARD BASED ON STABLE FLOW (FT)	0.50	0.5	0.5	0.5	0.5
MINIMUM REQUIRED FREEBOARD <sup>4</sup> (FT)	0.50	0.5	0.5	0.5	0.5
DESIGN METHOD FOR PROTECTIVE LINING <sup>5</sup> PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S

1. Use 1.6 for Temporary Channels; 2.25 for Temporary Channels in Special Protection (HQ or EV) Watersheds; 2.75 for Permanent Channels. For Rational Method, enter "N/A" and attach E&S Worksheets 9 and 10. For TR-55 enter "N/A" and attach appropriate Worksheets.
2. Adjust "n" value for changes in channel liner and flow depth. For vegetated channels, provide data for manufactured linings without vegetation and with vegetation in separate columns.
3. Slopes may not be averaged.
4. Minimum Freeboard is 0.5 ft. or ¼ Total Channel Depth, whichever is greater
5. Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is required for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

**VEGETATED SWALE 1 - RIP RAP APRON DESIGN**

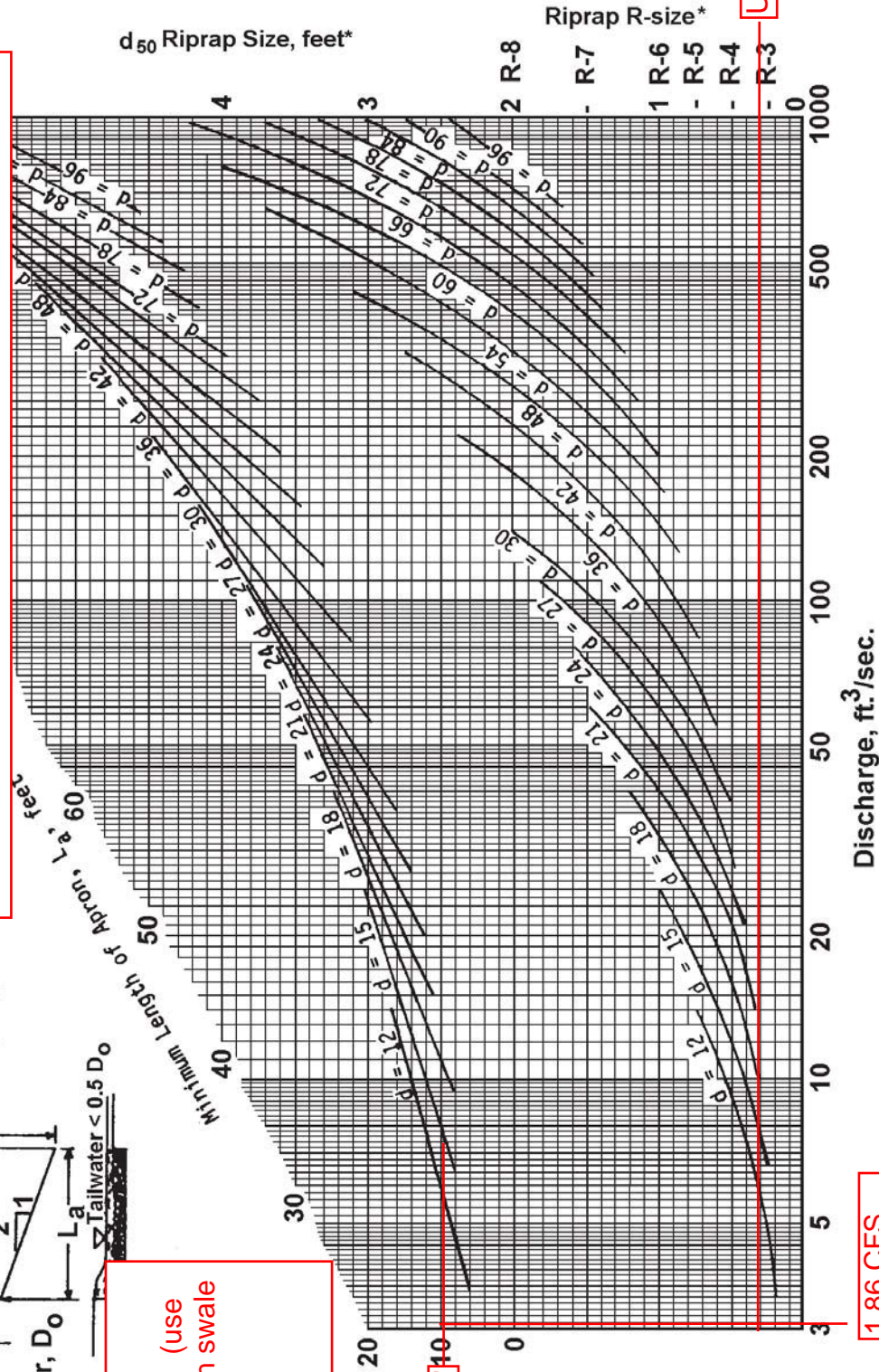
DESIGN OF RIPRAP APRON OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL  
 MINIMUM TAILWATER CONDITION ( $T_w < 0.5$  DIAMETER)

MAX. ALLOWABLE VELOCITY FOR R-4 RIP RAP = 9.0 FPS  
 (E&S MANUAL, TABLE 6.6, ATTACHED HERETO IN APP. A.7)  
 CALCULATED VELOCITY = 3.76 FPS  
 (WORKSHEET 11, VEGETATED SWALE 1)



$D_o = 1.0'$   
 $3D_o = 3.0'$  (use 6' to match swale width)  
 $L_a = 10'$   
 $W = 16'$

**FIGURE 9.3 Riprap Apron Design, Minimum Tailwater Condition**



NOTE: Do not extrapolate

Not to be used for Box Culverts

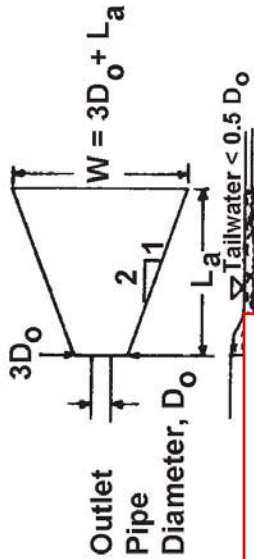
\* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase  $d_{50}$  stone size and/or provide velocity reduction device.

**TEMPORARY SWALE 2 - RIP RAP APRON DESIGN**

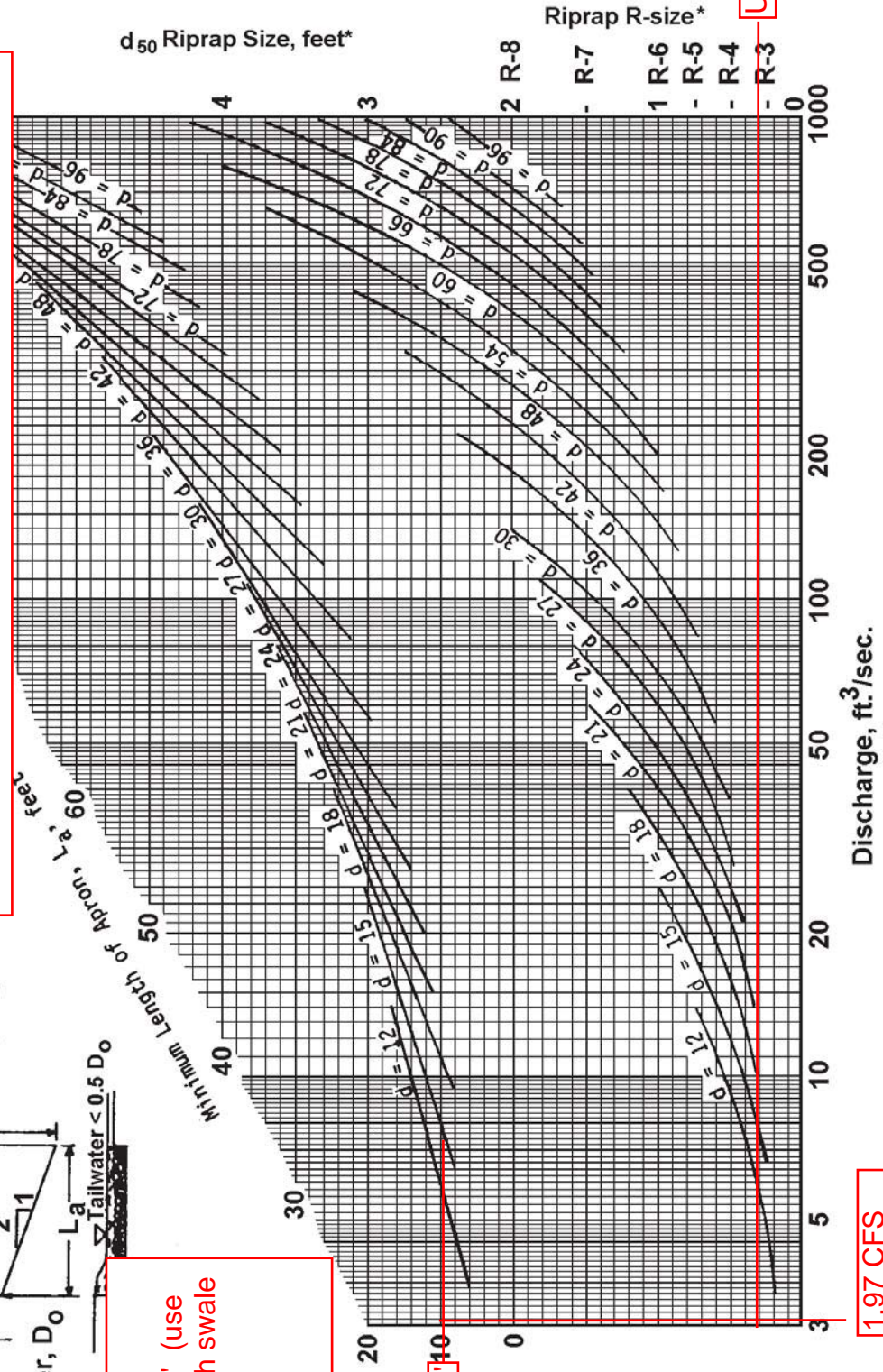
**FIGURE 9.3  
Riprap Apron Design, Minimum Tailwater Condition**

DESIGN OF RIPRAP APRON OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL  
MINIMUM TAILWATER CONDITION ( $T_w < 0.5$  DIAMETER)

MAX. ALLOWABLE VELOCITY FOR R-4 RIP RAP = 9.0 FPS  
(E&S MANUAL, TABLE 6.6, ATTACHED HERETO IN APP. A.7)  
CALCULATED VELOCITY = 3.76 FPS  
(WORKSHEET 11, VEGETATED SWALE 1)



$D_o = 1.0'$   
 $3D_o = 3.0'$  (use  
6' to match swale  
width)  
 $L_a = 10'$   
 $W = 16'$



NOTE: Do not extrapolate

1.97 CFS

\* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase  $d_{50}$  stone size and/or provide velocity reduction device.

Not to be used for Box Culverts



## **A.4 PCSM BMP Calculations**





# Channel Report

## Rain Garden #3 outfall

### Circular

Diameter (ft) = 1.25

Invert Elev (ft) = 1341.50

Slope (%) = 6.30

N-Value = 0.013

### Calculations

Compute by: Known Q

Known Q (cfs) = 2.50

### Highlighted

Depth (ft) = 0.34

Q (cfs) = 2.500

Area (sqft) = 0.27

Velocity (ft/s) = 9.20

Wetted Perim (ft) = 1.37

Crit Depth, Yc (ft) = 0.64

Top Width (ft) = 1.11

EGL (ft) = 1.66

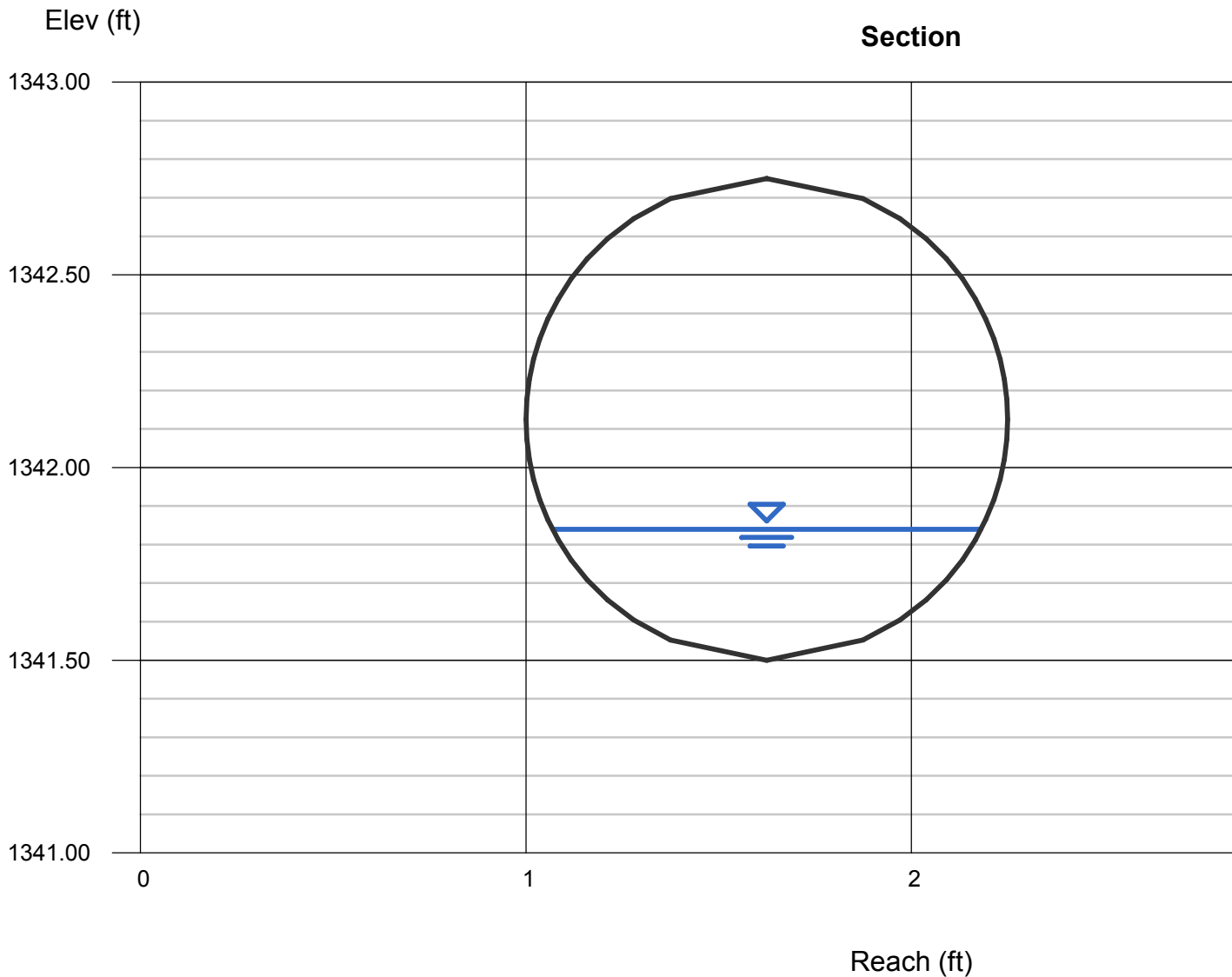


FIGURE 9.3

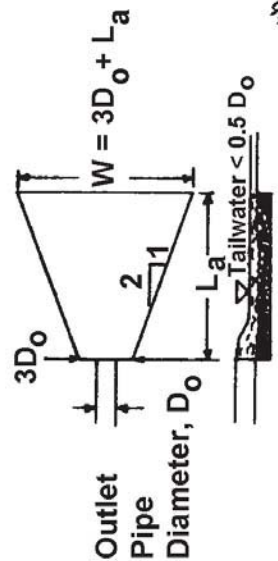
Riprap Apron Design, Minimum Tailwater Condition

RAIN GARDEN #3 FLARED END SECTION - RIP RAP APRON DESIGN

MAX. ALLOWABLE VELOCITY FOR R-4  
RIP RAP = 9.0 FPS  
(E&S MANUAL, TABLE 6.6, ATTACHED  
HERETO IN APP. A.7)  
CALCULATED VELOCITY = 9.2 FPS

USE R-5 RIP RAP.  
ALLOWABLE VELOCITY = 11.5 FPS

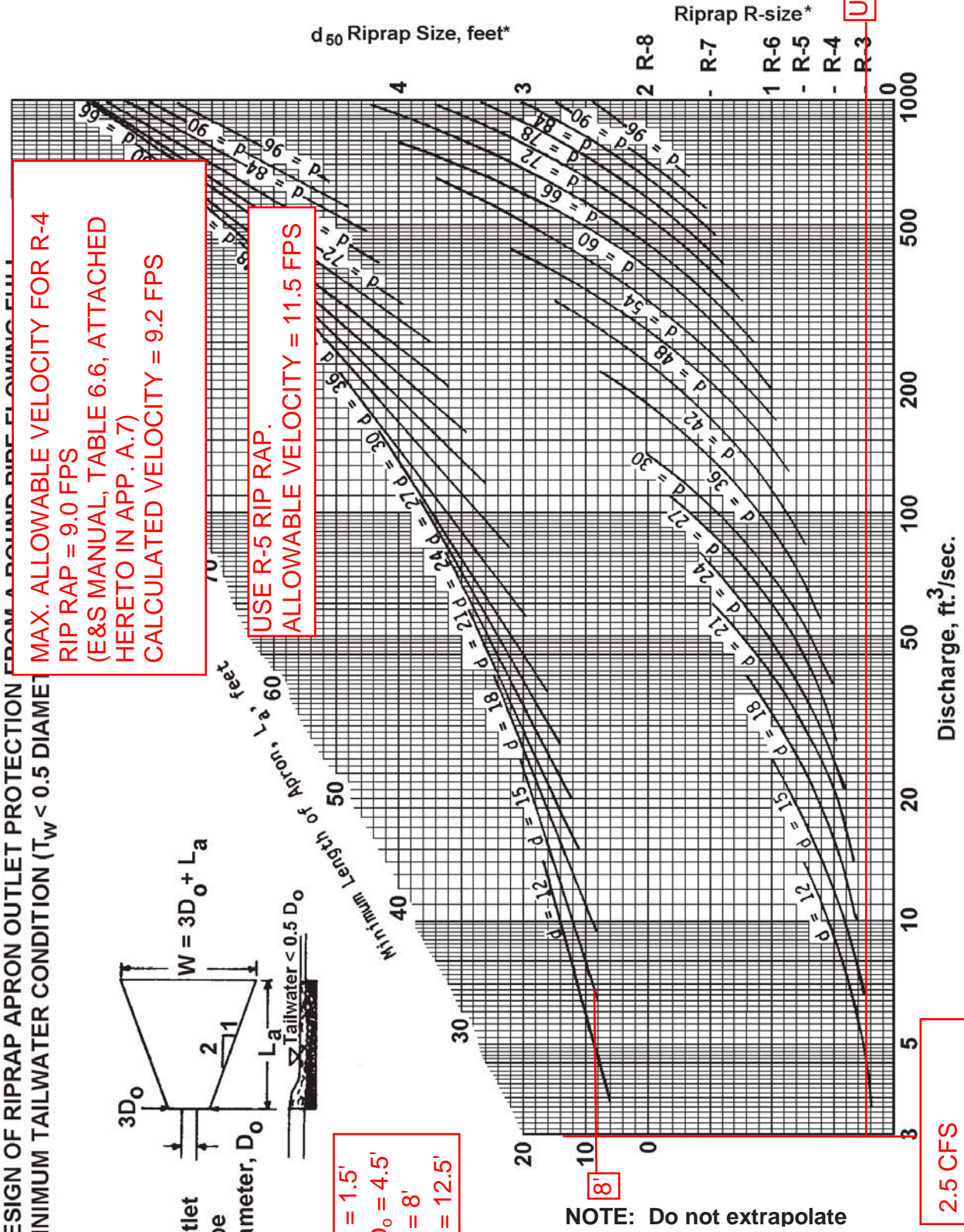
DESIGN OF RIPRAP APRON OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL  
MINIMUM TAILWATER CONDITION ( $T_w < 0.5$  DIAMETER)



$D_o = 1.5'$   
 $3D_o = 4.5'$   
 $L_a = 8'$   
 $W = 12.5'$

Adapted from USDA - NRCS

Not to be used for Box Culverts



2.5 CFS  
100 YR STORM

For velocities exceeding Maximum Allowable for Riprap indicated, increase  $d_{50}$  stone size and/or provide velocity reduction device.

Use R-4

# Channel Report

## Rain Garden #1 Outfall

### Circular

Diameter (ft) = 1.00

Invert Elev (ft) = 1341.50

Slope (%) = 11.00

N-Value = 0.015

### Calculations

Compute by: Known Q

Known Q (cfs) = 2.60

### Highlighted

Depth (ft) = 0.35

Q (cfs) = 2.600

Area (sqft) = 0.25

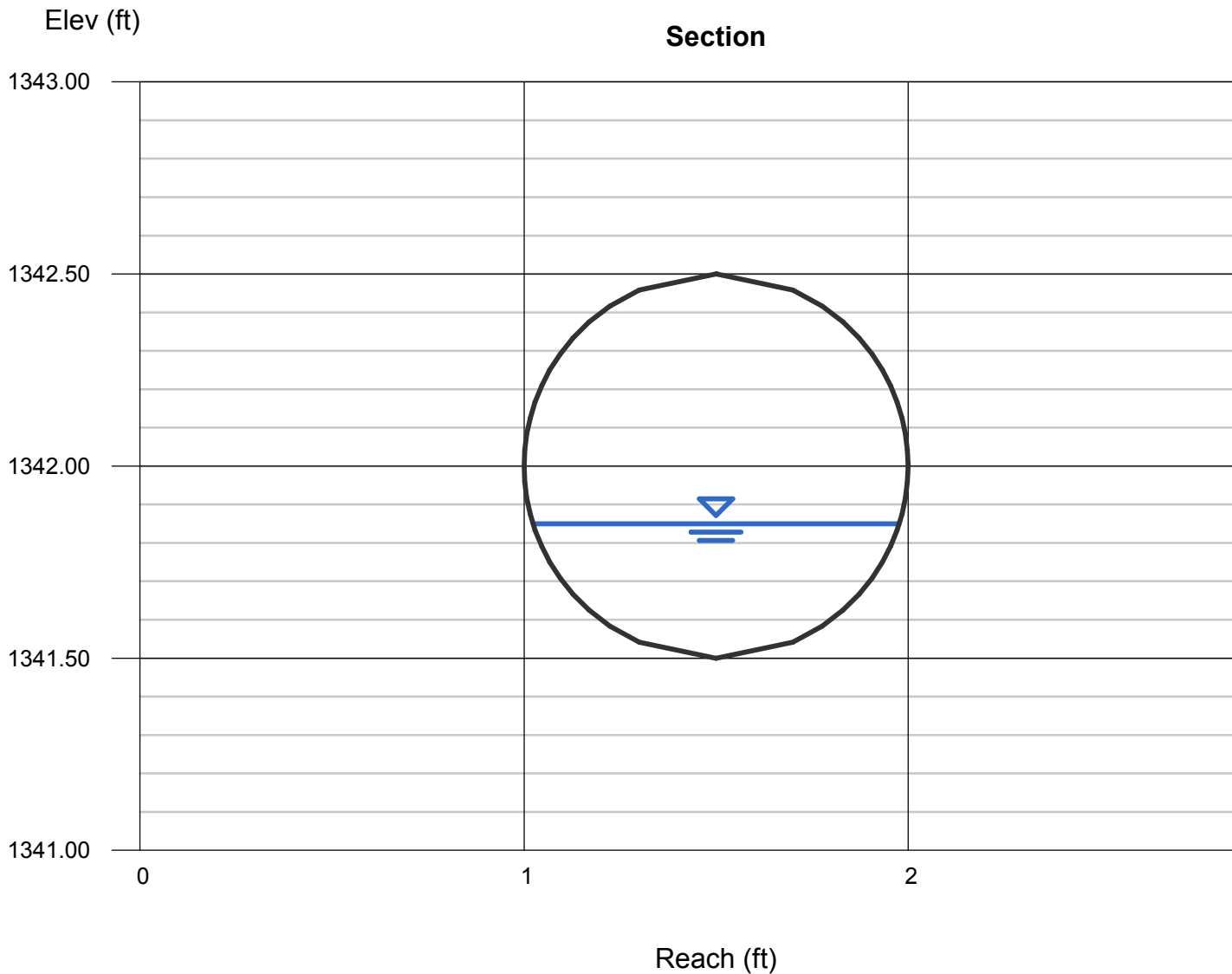
Velocity (ft/s) = 10.54

Wetted Perim (ft) = 1.27

Crit Depth, Yc (ft) = 0.69

Top Width (ft) = 0.96

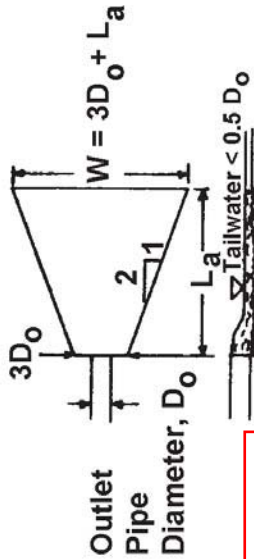
EGL (ft) = 2.08



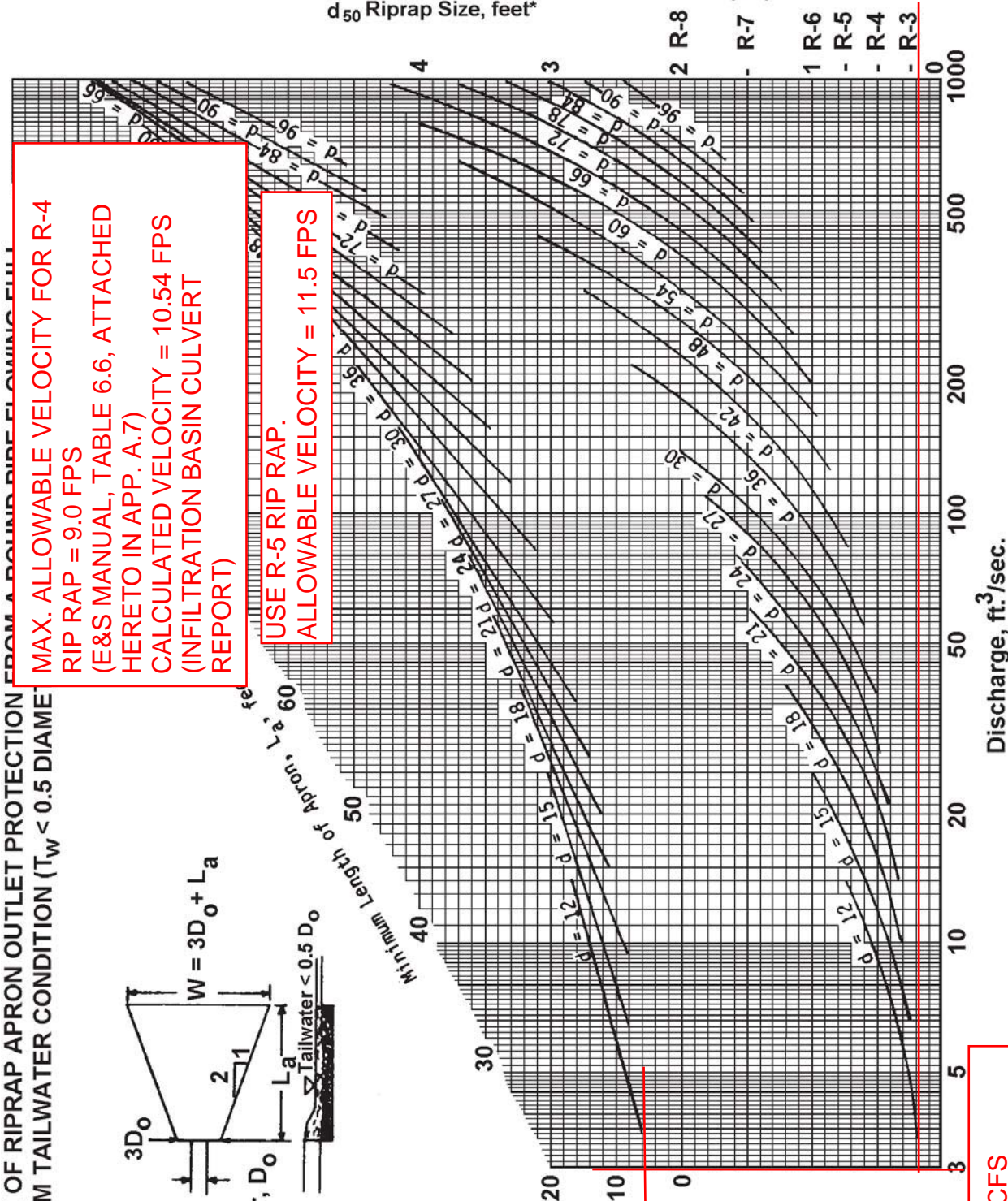
**FIGURE 9.3**  
**Riprap Apron Design, Minimum Tailwater Condition**

**RAIN GARDEN #1 FLARED END SECTION - RIP RAP APRON DESIGN**

DESIGN OF RIPRAP APRON OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL  
 MINIMUM TAILWATER CONDITION ( $T_w < 0.5$  DIAMETER)



$D_o = 1.0'$   
 $3D_o = 3.0'$   
 $L_a = 6'$   
 $W = 9'$



MAX. ALLOWABLE VELOCITY FOR R-4  
 RIP RAP = 9.0 FPS  
 (E&S MANUAL, TABLE 6.6, ATTACHED  
 HERETO IN APP. A.7)  
 CALCULATED VELOCITY = 10.54 FPS  
 (INFILTRATION BASIN CULVERT  
 REPORT)

USE R-5 RIP RAP.  
 ALLOWABLE VELOCITY = 11.5 FPS

2.6 CFS  
 100 YR STORM

NOTE: Do not extrapolate

Not to be used for Box Culverts

For velocities exceeding Maximum Allowable for Riprap indicated, increase  $d_{50}$  stone size and/or provide velocity reduction device.



North American Green  
 5401 St. Wendel-Cynthiana Rd.  
 Poseyville, Indiana 47633  
 Tel. 800.772.2040  
 Fax 812.867.0247  
 www.nagreen.com

**Control Materials Design Software  
 Version 5.0**

**Project Name: ASR Zick  
 Project Number: 114305  
 Spillway Name: RG #1**

Discharge	11.78
Peak Flow Period	0.5
Channel Slope	.33
Channel Bottom Width	50
Left Side Slope	
Right Side Slope	
Low Flow Liner	
Retardance Class	D
Vegetation Type	Bunch Type
Vegetation Density	Good 75-95%
Soil Type	Silt Loam

P300 - Class D - Bunch Type - Good 75-95%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
P300 Unvegetated	Straight	11.78 cfs	3.88 ft/s	0.06 ft	0.034	3 lbs/ft2	1.25 lbs/ft2	2.4	STABLE	E
P300 Reinforced Vegetation	Straight	11.78 cfs	1.81 ft/s	0.13 ft	0.12	8 lbs/ft2	2.68 lbs/ft2	2.99	STABLE	E
Underlying Substrate	Straight	11.78 cfs	1.81 ft/s	0.13 ft	--	2 lbs/ft2	0.107 lbs/ft2	18.71	STABLE	--



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**Control Materials Design Software  
 Version 5.0**

**Project Name: ASR Zick  
 Project Number: 114305  
 Spillway Name: RG#2**

Discharge	11.65
Peak Flow Period	0.5
Channel Slope	0.33
Channel Bottom Width	13
Left Side Slope	
Right Side Slope	
Low Flow Liner	
Retardance Class	D
Vegetation Type	Bunch Type
Vegetation Density	Good 75-95%
Soil Type	Silt Loam

P300 - Class D - Bunch Type - Good 75-95%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
P300 Unvegetated	Straight	11.65 cfs	6.57 ft/s	0.14 ft	0.034	3 lbs/ft2	2.81 lbs/ft2	1.07	STABLE	E
P300 Reinforced Vegetation	Straight	11.65 cfs	4.46 ft/s	0.2 ft	0.064	8 lbs/ft2	4.14 lbs/ft2	1.93	STABLE	E
Underlying Substrate	Straight	11.65 cfs	4.46 ft/s	0.2 ft	--	2 lbs/ft2	0.578 lbs/ft2	3.46	STABLE	--



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 Tel. 800.772.2040  
 Fax 812.867.0247  
 www.nagreen.com

**Control Materials Design Software  
 Version 5.0**

**Project Name: ASR Zick  
 Project Number: 114305  
 Spillway Name: RG #3**

Discharge	15.9
Peak Flow Period	0.5
Channel Slope	0.33
Channel Bottom Width	15
Left Side Slope	
Right Side Slope	
Low Flow Liner	
Retardance Class	D
Vegetation Type	Bunch Type
Vegetation Density	Good 75-95%
Soil Type	Silt Loam

P550 - Class D - Bunch Type - Good 75-95%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
P550 Unvegetated	Straight	15.9 cfs	6.27 ft/s	0.17 ft	0.041	4 lbs/ft <sup>2</sup>	3.48 lbs/ft <sup>2</sup>	1.15	STABLE	E
P550 Reinforced Vegetation	Straight	15.9 cfs	4.98 ft/s	0.21 ft	0.06	14 lbs/ft <sup>2</sup>	4.39 lbs/ft <sup>2</sup>	3.19	STABLE	E
Underlying Substrate	Straight	15.9 cfs	4.98 ft/s	0.21 ft	--	3.25 lbs/ft <sup>2</sup>	1.023 lbs/ft <sup>2</sup>	3.18	STABLE	--



An Employee-Owned Company

## **A.5 Water Quality Worksheets**



## Worksheet 1. General Site Information POI A

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: 24-Apr-17

Project Name: Atlantic Sunrise Project - Zick Meter Station

Municipality: Lenox Township

County: Susquehanna County

Total Area (acres): 0.16

Major River Basin: Susquehanna River

<http://www.dep.state.pa.us/dep/depupdate/watermgt/wc/default.htm#newtopics>

Watershed: Upper Susquehanna-Tunkhannock

Sub-Basin: Partners Creek

Nearest Surface Water(s) to Receive Runoff: UNT to Partners Creek

Chapter 93 - Designated Water Use: CWF

<http://www.pacode.com/secure/data/025/chapter93/chap93toc.html>

Impaired according to Chapter 303(d) List? Yes

<http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/303d-Report.htm> No

List Causes of Impairment: N/A

*Is project subject to, or part of:*

Municipal Separate Storm Sewer System (MS4) Requirements? Yes

[http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterM](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm) No

[anagement/GeneralPermits/default.htm](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm)

Existing or planned drinking water supply? Yes

No

If yes, distance from proposed discharge (miles): \_\_\_\_\_

Approved Act 167 Plan? Yes

[http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagem](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html) No

[ent/Approved\\_1.html](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html)

Existing River Conservation Plan? Yes

<http://www.dcnr.state.pa.us/brc/rivers/riversconservation/planningprojects/> No

## Worksheet 2. Sensitive Natural Resources POI A

**INSTRUCTIONS:**

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	N/A	0.00	0.00
Floodplains	N/A	0.00	0.00
Riparian Areas	N/A	0.00	0.00
Wetlands	N/A	0.00	0.00
Woodlands	N/A	0.00	0.00
Natural Drainage Ways	N/A	0.00	0.00
Steep Slopes, 15% - 25%	N/A	0.00	0.00
Steep Slopes, over 25%	N/A	0.00	0.00
Other:	N/A	0.00	0.00
Other:	N/A	0.00	0.00
<b>TOTAL EXISTING:</b>		0.00	0.00

**Worksheet 3. Nonstructural BMP Credits POI A**

**PROTECTED AREA**

<b>1.1 Area of Protected Sensitive/Special Value Features (see WS 2)</b>	-	Ac.
<b>1.2 Area of Riparian Forest Buffer Protection</b>	-	Ac.
<b>3.1 Area of Minimum Disturbance/Reduced Grading</b>	-	Ac.
<b>TOTAL</b>	-	Ac.

Site Area	minus	Protected Area	=	Stormwater Management Area
0.16	-	-	=	0.16
		<small>This is the area that requires stormwater management</small>		

**VOLUME CREDITS**

**3.1 Minimum Soil Compaction**

Lawn	ft <sup>2</sup>	x 1/4" x 1/12	=	- ft <sup>3</sup>
Meadow	ft <sup>2</sup>	x 1/3" x 1/12	=	- ft <sup>3</sup>

**3.3 Protect Existing Trees**

*For Trees within 100 feet of impervious area:*

Tree Canopy	ft <sup>2</sup>	x 1/2" x 1/12	=	- ft <sup>3</sup>
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*For Trees within 20 feet of impervious area:*

Tree Canopy		x 1/12	=	- ft <sup>3</sup>
-------------	--	--------	---	-------------------

**5.1 Disconnect Roof Leaders to Vegetated Areas**

*For Runoff directed to areas protected under 5.8.1 and 5.8.2*

Roof Area	ft <sup>2</sup>	x 1/12	=	- ft <sup>3</sup>
-----------	-----------------	--------	---	-------------------

*For all other disconnected roof areas*

Roof Area	ft <sup>2</sup>	x 1/4" x 1/12	=	- ft <sup>3</sup>
-----------	-----------------	---------------	---	-------------------

**5.2 Disconnect Non-Roof impervious to Vegetated Areas**

*For Runoff directed to areas protected under 5.8.1 and 5.8.2*

Impervious Area	ft <sup>2</sup>	x 1/3" x 1/12	=	- ft <sup>3</sup>
-----------------	-----------------	---------------	---	-------------------

*For all other disconnected roof areas*

Impervious Area	ft <sup>2</sup>	x 1/4" x 1/12	=	- ft <sup>3</sup>
-----------------	-----------------	---------------	---	-------------------

**TOTAL NON-STRUCTURAL VOLUME CREDIT\***      - ft<sup>3</sup>

\* For use on Worksheet 5

**WORKSHEET 4 . CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT - POI A**

**PROJECT:** Atlantic Sunrise Project - Zick Meter Station

**DA:**

**2-Year Rainfall:** 2.67 in

**Total Site Area:** 0.16 acres  
**Protected Site Area:** - acres  
**Managed Area:** 0.16 acres

**Existing Conditions:**

Cover Type/ Condition	Soil Type	Area (sf)	Area* (ac)	CN	S	Ia (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Meadow	D	15,681.60	0.36	78	2.82	0.56	0.90	1,176
20% Meadow	D	-	0.00	78	2.82	0.56	0.90	-
Impervious	D	-	0.00	98	0.20	0.04	2.44	-
<b>TOTAL:</b>		15,681.60	0.36					1,176

**Developed Conditions:**

Cover Type/ Condition	Soil Type	Area (sf)	Area* (ac)	CN	S	Ia (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Meadow	D	6,969.60	0.16	78	2.82	0.56	0.90	523
Woods	D	-	0.00	77	2.99	0.60	0.85	-
Gravel	D	-	0.00	89	1.24	0.25	1.60	-
Impervious	D	-	0.00	98	0.20	0.04	2.44	-
<b>TOTAL:</b>		6,969.60	0.16				5.79	523

**2-Year Volume Increase (ft<sup>3</sup>) (654)**

**2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume**

1. Runoff (in) =  $Q = (P - 0.2S)^2 / (P + 0.8S)$  where

P = 2-Year Rainfall (in)

S =  $(1000 / CN) - 10$

2. Runoff Volume (CF) =  $Q \times \text{Area} \times 1/12$

Q = Runoff (in)

Area = Land use area (sq. ft.)

**Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.**

\* A portion of area tributary to POI A in pre-development is redirected to POI B in post-development conditions, resulting in a reduced drainage area for pre-development to post-development.

\*\* Meadow was analyzed in post-development conditions as a result of all pervious areas receiving meadow seed mixture

**WORKSHEET 5. STRUCTURAL BMP VOLUME CREDITS**

**POI A**

**PROJECT:** Atlantic Sunrise Project - Zick Meter Station

**SUB-BASIN:** \_\_\_\_\_

Required Control Volume (ft<sup>3</sup>) - from Worksheet 4: (654)  
 Non-structural Volume Credit (ft<sup>3</sup>) - from Worksheet 3: - 0

Structural Volume Reqmt (ft<sup>3</sup>) (654)  
 (Required Control Volume minus Non-structural Credit)

Proposed BMP		Area (ft <sup>2</sup> )	Volume Reduction Permanently Removed (ft <sup>3</sup> )
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretenion	-	-
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale	-	-
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.7.1	Riparian Buffer/Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment	-	-
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other	Check Dams in Vegetated Swales		

Total Structural Volume (ft<sup>3</sup>): 0  
 Structural Volume Requirement (ft<sup>3</sup>): -654  
**DIFFERENCE** 654

Project Name: Zick MS  
 Project No.: 14C4909  
 Date: 4/24/2017

**WORKSHEET 12. WATER QUALITY ANALYSIS OF POLLUTANT LOADING FROM ALL DISTURBED AREAS POI A**

Total Site Area (AC)	0.16
Total Disturbed Area (AC)	0.16
Disturbed Area controlled by BMP's (AC)	0.16

**Total Disturbed Areas:**

	LAND COVER CLASSIFICATION	POLLUTANT					POLLUTANT LOAD			
		TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.16	0.90	0.01	1.52	0.01	0.01
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL LOAD (PROPOSED)							1.52	0.01	0.01	
REQUIRED REDUCTION							85%	85%	50%	
REQUIRED REDUCTION (LBS)							1.29	0.01	0.00	

\*Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]

\*\*TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

Project Name: Zick MS  
 Project No.: 14C4909  
 Date: 4/24/2017

**WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS**

BMP type: \_\_\_\_\_ WQ Train No. 1: Landscape Restoration

DISTURBED AREA CONTROLLED BY BMP      0.16 AC.

	LAND COVER CLASSIFICATION	POLLUTANT					POLLUTANT LOAD			
		TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.16	0.90	0.01	1.52	0.01	0.01
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00	
TOTAL LOAD							1.52	0.01	0.01	
REMOVAL EFFICIENCIES							85.00%	85.00%	50.00%	
POLLUTANT REDUCTION (LBS)							1.29	0.01	0.00	

Series	BMP No.	REMOVAL EFFICIENCIES		
		TSS	TP	NO3
1	6.7.2	85%	85%	50%
Equivalent Series Efficiency		85.00%	85.00%	50.00%

Project Name: Zick MS  
Project No.: 14C4909  
Date: 4/24/2017

	TSS (LBS)	TP (LBS)	NO3 (LBS)
TOTAL POLLUTANT REDUCTION PROVIDED (LBS)	1.29	0.01	0.00
TOTAL POLLUTANT REDUCTION REQUIRED (LBS)	1.29	0.01	0.00
Δ	0.00	0.00	0.00

## Worksheet 1. General Site Information POI B

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: 24-Apr-17

Project Name: Atlantic Sunrise Project - Zick Meter Station

Municipality: Lenox Township

County: Susquehanna County

Total Area (acres): 5.06

Major River Basin: Susquehanna River

<http://www.dep.state.pa.us/dep/depupdate/watermgt/wc/default.htm#newtopics>

Watershed: Upper Susquehanna- Tunkhannock

Sub-Basin: Partners Creek

Nearest Surface Water(s) to Receive Runoff: UNT to Partners Creek

Chapter 93 - Designated Water Use: CWF

<http://www.pacode.com/secure/data/025/chapter93/chap93toc.html>

Impaired according to Chapter 303(d) List? Yes

<http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/303d-Report.htm> No

List Causes of Impairment: N/A

*Is project subject to, or part of:*

Municipal Separate Storm Sewer System (MS4) Requirements? Yes

[http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterM](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm) No

[anagement/GeneralPermits/default.htm](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm)

Existing or planned drinking water supply? Yes

No

If yes, distance from proposed discharge (miles): \_\_\_\_\_

Approved Act 167 Plan? Yes

[http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagem](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html) No

[ent/Approved\\_1.html](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html)

Existing River Conservation Plan? Yes

<http://www.dcnr.state.pa.us/brc/rivers/riversconservation/planningprojects/> No

## Worksheet 2. Sensitive Natural Resources POI B

**INSTRUCTIONS:**

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	N/A	0.00	0.00
Floodplains	N/A	0.00	0.00
Riparian Areas	N/A	0.00	0.00
Wetlands	N/A	0.00	0.00
Woodlands	N/A	0.00	0.00
Natural Drainage Ways	N/A	0.00	0.00
Steep Slopes, 15% - 25%	N/A	0.00	0.00
Steep Slopes, over 25%	N/A	0.00	0.00
Other:	N/A	0.00	0.00
Other:	N/A	0.00	0.00
<b>TOTAL EXISTING:</b>		0.00	0.00

**Worksheet 3. Nonstructural BMP Credits POI B**

**PROTECTED AREA**

<b>1.1 Area of Protected Sensitive/Special Value Features (see WS 2)</b>	<u>    -    </u> Ac.
<b>1.2 Area of Riparian Forest Buffer Protection</b>	<u>    -    </u> Ac.
<b>3.1 Area of Minimum Disturbance/Reduced Grading</b>	<u>    -    </u> Ac.
<b>TOTAL</b>	<u>    -    </u> Ac.

Site Area	minus	Protected Area	=	Stormwater Management Area
<u>    5.06    </u>	-	<u>    -    </u>	=	<u>    5.06    </u>
		<i>This is the area that requires stormwater management</i>		

**VOLUME CREDITS**

**3.1 Minimum Soil Compaction**

Lawn	<u>    </u> ft <sup>2</sup>	x 1/4" x 1/12	=	<u>    -    </u> ft <sup>3</sup>
Meadow	<u>    </u> ft <sup>2</sup>	x 1/3" x 1/12	=	<u>    -    </u> ft <sup>3</sup>

**3.3 Protect Existing Trees**

*For Trees within 100 feet of impervious area:*

Tree Canopy	<u>    </u> ft <sup>2</sup>	x 1/2" x 1/12	=	<u>    -    </u> ft <sup>3</sup>
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*For Trees within 20 feet of impervious area:*

Tree Canopy	<u>    </u>	x 1/12	=	<u>    -    </u> ft <sup>3</sup>
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**5.1 Disconnect Roof Leaders to Vegetated Areas**

*For Runoff directed to areas protected under 5.8.1 and 5.8.2*

Roof Area	<u>    </u> ft <sup>2</sup>	x 1/12	=	<u>    -    </u> ft <sup>3</sup>
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*For all other disconnected roof areas*

Roof Area	<u>    </u> ft <sup>2</sup>	x 1/4" x 1/12	=	<u>    -    </u> ft <sup>3</sup>
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**5.2 Disconnect Non-Roof impervious to Vegetated Areas**

*For Runoff directed to areas protected under 5.8.1 and 5.8.2*

Impervious Area	<u>    65,295    </u> ft <sup>2</sup>	x 1/3" x 1/12	=	<u>    1,814    </u> ft <sup>3</sup>
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*For all other disconnected roof areas*

Impervious Area	<u>    </u> ft <sup>2</sup>	x 1/4" x 1/12	=	<u>    -    </u> ft <sup>3</sup>
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**TOTAL NON-STRUCTURAL VOLUME CREDIT\***     1,814     ft<sup>3</sup>

*\* For use on Worksheet 5*

**WORKSHEET 4 . CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT - POI B**

**PROJECT:** Atlantic Sunrise Project - Zick Meter Station

**DA:**

**2-Year Rainfall:** 2.67 in

**Total Site Area:** 5.06 acres  
**Protected Site Area:** - acres  
**Managed Area:** 5.06 acres

**Existing Conditions:**

Cover Type/ Condition	Soil Type	Area (sf)	Area* (ac)	CN	S	Ia (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Meadow	D	211,701.60	4.86	78	2.82	0.56	0.90	15,881
20% Meadow	D	-	0.00	78	2.82	0.56	0.90	-
Impervious	D	-	0.00	98	0.20	0.04	2.44	-
<b>TOTAL:</b>		211,701.60	4.86					15,881

**Developed Conditions:**

Cover Type/ Condition	Soil Type	Area (sf)	Area* (ac)	CN	S	Ia (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Meadow	D	153,766.80	3.53	78	2.82	0.56	0.90	11,535
Gravel	D	65,340.00	1.50	89	1.24	0.25	1.60	8,736
Impervious	D	1,306.80	0.03	98	0.20	0.04	2.44	266
<b>TOTAL:</b>		220,413.60	5.06				4.94	20,537

**2-Year Volume Increase (ft<sup>3</sup>)** 4,655

**2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume**

1. Runoff (in) =  $Q = (P - 0.2S)^2 / (P + 0.8S)$  where

P = 2-Year Rainfall (in)

S =  $(1000 / CN) - 10$

2. Runoff Volume (CF) = Q x Area x 1/12

Q = Runoff (in)

Area = Land use area (sq. ft.)

**Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.**

\* A portion of area tributary to POI A in pre-development is redirected to POI B in post-development conditions, resulting in a greater drainage area for pre-development to post-development.

\*\* Meadow was analyzed in post-development conditions as a result of all pervious areas receiving meadow seed mixture

**WORKSHEET 5. STRUCTURAL BMP VOLUME CREDITS  
B**

**POI**

**PROJECT:** Atlantic Sunrise Project - Zick Meter Station  
**SUB-BASIN:** \_\_\_\_\_

Required Control Volume (ft<sup>3</sup>) - from Worksheet 4: 4,655  
 Non-structural Volume Credit (ft<sup>3</sup>) - from Worksheet 3: - 1,164  
 Structural Volume Reqmt (ft<sup>3</sup>) 3,492  
 (Required Control Volume minus Non-structural Credit)

Proposed BMP		Area (ft <sup>2</sup> )	Volume Reduction Permanently Removed (ft <sup>3</sup> )
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretenion	17,320	-
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale	2,937	-
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.7.1	Riparian Buffer/Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment	52,911	2,205
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other	Check Dams in Vegetated Swales		

Total Structural Volume (ft<sup>3</sup>): 2,205  
 Structural Volume Requirement (ft<sup>3</sup>): 3,492  
 DIFFERENCE 1,287

Project Name: Zick MS  
 Project No.: 14C4909  
 Date: 4/24/2017

**WORKSHEET 12. WATER QUALITY ANALYSIS OF POLLUTANT LOADING FROM ALL DISTURBED AREAS POI B**

Total Site Area (AC)	5.22
Total Disturbed Area (AC)	5.22
Disturbed Area controlled by BMP's (AC)	4.60

**Total Disturbed Areas:**

	LAND COVER CLASSIFICATION	POLLUTANT					POLLUTANT LOAD			
		TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	3.71	0.90	0.28	35.32	0.14	0.23
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.03	2.44	0.01	0.35	0.00	0.01
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	1.50	1.60	0.20	31.41	0.08	0.21
	TOTAL LOAD (PROPOSED)							67.07	0.23	0.44
REQUIRED REDUCTION							85%	85%	50%	
REQUIRED REDUCTION (LBS)							57.01	0.19	0.22	

\*Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]

\*\*TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

Project Name: Zick MS  
 Project No.: 14C4909  
 Date: 4/24/2017

**WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS**

BMP type: WQ Train No. 1: Soil Amendments to Rain Garden #1 to Rain Garden #3

DISTURBED AREA CONTROLLED BY BMP 0.37 AC.

	LAND COVER CLASSIFICATION	POLLUTANT					POLLUTANT LOAD			
		TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.37	0.90	0.03	3.52	0.01	0.02
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL LOAD							3.52	0.01	0.02	
REMOVAL EFFICIENCIES							99.66%	99.66%	75.50%	
POLLUTANT REDUCTION (LBS)							3.51	0.01	0.02	

Series	BMP No.	REMOVAL EFFICIENCIES		
		TSS	TP	NO3
1	6.7.3	85%	85%	50%
2	6.4.5	85%	85%	30%
3	6.4.5	85%	85%	30%
Equivalent Series Efficiency		99.66%	99.66%	75.50%

Removal Efficiency TSS =  $1 - (1 - 0.85) * (1 - 0.85) * (1 - 0.85) = 99.66\%$   
 Removal Efficiency TP =  $1 - (1 - 0.85) * (1 - 0.85) * (1 - 0.85) = 99.66\%$   
 Removal Efficiency NO3 =  $1 - (1 - 0.50) * (1 - 0.30) * (1 - 0.30) = 75.5\%$

Project Name: Zick MS  
 Project No.: 14C4909  
 Date: 4/24/2017

**WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS**

BMP type: WQ Train No. 2 Rain Garden #1 to Rain Garden #3

DISTURBED AREA CONTROLLED BY BMP 1.57 AC.

	LAND COVER CLASSIFICATION	POLLUTANT					POLLUTANT LOAD			
		TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.75	0.90	0.06	7.14	0.03	0.05
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00	
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
LOW TRAFFIC PARKING	58	0.15	0.39	0.82	1.60	0.11	17.17	0.04	0.12	
TOTAL LOAD							24.31	0.07	0.16	
REMOVAL EFFICIENCIES							97.75%	97.75%	51.00%	
POLLUTANT REDUCTION (LBS)							23.76	0.07	0.08	

Series	BMP No.	REMOVAL EFFICIENCIES		
		TSS	TP	NO3
1	6.4.5	85%	85%	30%
2	6.4.5	85%	85%	30%
Equivalent Series Efficiency		97.75%	97.75%	51.00%

Project Name: Zick MS  
 Project No.: 14C4909  
 Date: 4/24/2017

**WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS**

BMP type: WQ Train No. 3 Rain Garden #3

DISTURBED AREA CONTROLLED BY BMP 0.51 AC.

	LAND COVER CLASSIFICATION	POLLUTANT					POLLUTANT LOAD			
		TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.51	0.90	0.04	4.86	0.02	0.03
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL LOAD							4.86	0.02	0.03	
REMOVAL EFFICIENCIES							85.00%	85.00%	30.00%	
POLLUTANT REDUCTION (LBS)							4.13	0.02	0.01	

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.4.8	85%	85%	30%
Equivalent Series Efficiency		85.00%	85.00%	30.00%

Project Name: Zick MS  
 Project No.: 14C4909  
 Date: 4/24/2017

**WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS**

BMP type: WQ Train No. 4 Rain Garden #2 to Rain Garden #3

DISTURBED AREA CONTROLLED BY BMP 0.86 AC.

	LAND COVER CLASSIFICATION	POLLUTANT					POLLUTANT LOAD			
		TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.15	0.90	0.01	1.43	0.01	0.01
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00	
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.03	2.44	0.01	0.35	0.00	0.01
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.68	1.60	0.09	14.24	0.04	0.10
TOTAL LOAD								16.01	0.04	0.11
REMOVAL EFFICIENCIES								97.75%	97.75%	51.00%
POLLUTANT REDUCTION (LBS)								15.65	0.04	0.06

Series	BMP No.	REMOVAL EFFICIENCIES		
		TSS	TP	NO3
1	6.4.8	85%	85%	30%
2	6.4.5	85%	85%	30%
Equivalent Series Efficiency		97.75%	97.75%	51.00%

Project Name: Zick MS  
 Project No.: 14C4909  
 Date: 4/24/2017

**WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS**

BMP type: WQ Train No. 5 Soil Amendments to Rain Garden #2 to Rain Garden #3

DISTURBED AREA CONTROLLED BY BMP 0.32 AC.

	LAND COVER CLASSIFICATION	POLLUTANT					POLLUTANT LOAD			
		TSS EMC	TP EMC	NITRATE NITRITE	COVER (AC.)	Runoff (in)	RUNOFF VOLUME	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.32	0.90	0.02	3.05	0.01	0.02
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL LOAD							3.05	0.01	0.02	
REMOVAL EFFICIENCIES							99.66%	99.66%	75.50%	
POLLUTANT REDUCTION (LBS)							3.04	0.01	0.01	

Series	BMP No.	TSS	TP	NO3
1	6.7.3	85%	85%	50%
2	6.4.8	85%	85%	30%
3	6.4.3	85%	85%	30%
Equivalent Series Efficiency		99.66%	99.66%	75.50%

Project Name: Zick MS  
 Project No.: 14C4909  
 Date: 4/24/2017

**WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS**

BMP type: WQ Train No. 6 Vegetated Swale to Rain Garden #2 to Rain Garden #3

DISTURBED AREA CONTROLLED BY BMP 0.47 AC.

	LAND COVER CLASSIFICATION	POLLUTANT			COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	POLLUTANT LOAD		
		TSS EMC	TP EMC	NITRATE NITRITE EMC				TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.47	0.90	0.04	4.47	0.02	0.03
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL LOAD								4.47	0.02	0.03
REMOVAL EFFICIENCIES								98.88%	98.88%	65.70%
POLLUTANT REDUCTION (LBS)								4.42	0.02	0.02

Series	BMP No.	TSS	TP	NO3
1	6.4.8	50%	50%	30%
2	6.4.5	85%	85%	30%
3	6.4.5	85%	85%	30%
Equivalent Series Efficiency		98.88%	98.88%	65.70%

Project Name: Zick MS  
 Project No.: 14C4909  
 Date: 4/24/2017

**WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS**

BMP type:

WQ Train No. 7 Soil Amendments to Vegetated Swale to Rain Garden #2 to Rain Garden #3

DISTURBED AREA CONTROLLED BY BMP

0.29 AC.

	LAND COVER CLASSIFICATION	POLLUTANT				Runoff (in)	RUNOFF VOLUME (AF)	POLLUTANT LOAD		
		TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)			TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.29	0.90	0.02	2.76	0.01	0.02
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00	
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00	
TOTAL LOAD								2.76	0.01	0.02
REMOVAL EFFICIENCIES								98.88%	98.88%	75.50%
POLLUTANT REDUCTION (LBS)								2.73	0.01	0.01

Series	BMP No.	TSS	TP	NO3
1	6.7.3	85%	85%	50%
2	6.4.8	50%	50%	30%
3	6.4.5	85%	85%	30%
Equivalent Series Efficiency		98.88%	98.88%	75.50%

Project Name: Zick MS  
 Project No.: 14C4909  
 Date: 4/24/2017

**WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS**

BMP type:

WQ Train No.8 Soil Amendments

DISTURBED AREA CONTROLLED BY BMP      0.21 AC.

	LAND COVER CLASSIFICATION	POLLUTANT					POLLUTANT LOAD			
		TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.21	0.90	0.02	2.00	0.01	0.01
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL LOAD								2.00	0.01	0.01
REMOVAL EFFICIENCIES								85.00%	85.00%	50.00%
POLLUTANT REDUCTION (LBS)								1.70	0.01	0.01

Series	BMP No.	TSS	TP	NO3
1	6.7.3	85%	85%	50%
Equivalent Series Efficiency		85.00%	85.00%	50.00%

Project Name: Zick MS  
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	TSS (LBS)	TP (LBS)	NO3 (LBS)
TOTAL POLLUTANT REDUCTION PROVIDED (LBS)	58.94	0.19	0.22
TOTAL POLLUTANT REDUCTION REQUIRED (LBS)	57.01	0.19	0.22
Δ	1.93	0.00	0.00





**LOCATION MAP**  
USGS LENOXVILLE QUADRANGLE  
SCALE: 1"=2,000'

**SITE SOIL TYPES**

WB2	WELLSBORO FLAGGY SILT LOAM, 3 TO 8 PERCENT SLOPES
WeB2	WELLSBORO CHANNERY SILT LOAM, 3 TO 8 PERCENT SLOPES
WC2	WELLSBORO FLAGGY SILT LOAM, 8 TO 15 PERCENT SLOPES
MgB	MARDIN CHANNERY SILT LOAM, 0 TO 8 PERCENT SLOPES
MoB2	MORRIS CHANNERY SILT LOAM, 3 TO 8 PERCENT SLOPES
LdD	LORDSTOWN AND OQUAGA VERY STONY SILT LOAMS, 12 TO 30 PERCENT SLOPES

**ESCGP-2 PERMIT TABLE**

LIMIT OF PERMIT BOUNDARY/SITE AREA	5.22
LIMIT OF DISTURBANCE	5.22
AREA OF PROTECTED/ SENSITIVE VALUE FEATURES	0.00
AREA OF RIPARIAN FOREST BUFFER PROTECTION	0.00
AREA OF MINIMUM DISTURBANCE/REDUCED GRADING	0.00
IMPERVIOUS AREA (ACCESS ROADS, BLDG. & PAD)	1.53
DEVELOPED AREA CONTROLLED BY BMPs	1.53

**PROPOSED FEATURES**

	PROPOSED MAJOR CONTOUR (10' INTERVAL)
	PROPOSED MINOR CONTOUR (2' INTERVAL)
	LIMIT OF DISTURBANCE (ZICK METER STATION)
	LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
	ESCGP-2 PERMIT BOUNDARY
	CENTERLINE GAS PIPELINE
	SWALE LINING
	EROSION CONTROL BLANKET (NAG SC150 OR APPROVED EQUAL)
	ROCK OUTLET/RIPRAP APRON
	SOIL AMENDMENT AREA
	LANDSCAPE RESTORATION AREA
	TRM LINING
	CLAY CORE LIMITS
	TEST PIT LOCATION
	INFILTRATION TEST LOCATION
	DISCONNECT STORM SEWERS IMPERVIOUS AREA

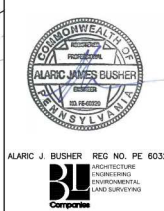
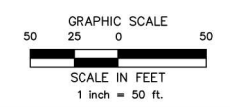
**NOTE:** WITHOUT APPROVAL FROM THE CONSERVATION DISTRICT OR PADEP OWNER/OPERATOR SHALL NOT INSTALL INLETS OR OTHER STORMWATER COLLECTION DEVICES, SO AS TO MAINTAIN DISSECTION OF GRAVEL AREAS FROM STORM SEWERS. OWNER/OPERATOR SHALL NOT PAVE GRAVEL AREAS WITHOUT APPROVAL FROM THE CONSERVATION DISTRICT OR PADEP, SO AS TO MAINTAIN REDUCED PARKING AREA IMPERVIOUSNESS.



**POI B WATER QUALITY TRAIN EXHIBIT**

**LANDSCAPE SCHEDULE**

Symbol	Quant	Botanical Name	Common Name	Caliper	Height	Spread	Root	Notes
CS	6	Cornus serica	Redosier Dogwood 'Winter Flame'	0	18-24"	18-24"	3 gal	Full
IV	6	Ilex verticillata	Common Winterberry	0	24-30"	18-24"	5 gal	Full plant to base



**REVISIONS**

NO.	DATE	BY	DESCRIPTION	NO.	CHK.	APP.
0	08/28/2015	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	W1161483	DAK	AJB
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL	W1161483	DAK	AJB
3	03/29/2016	BL	ISSUED FOR PADEP RESUBMITTAL	W1161483	AJB	AJB
4	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	W1161483	AJB	AJB
5	Apr. 2017	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #2	W1161483	AJB	AJB

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC  
ATLANTIC SUNRISE PROJECT- PROPOSED 30" NATURAL GAS PIPELINE  
POST CONSTRUCTION STORMWATER MANAGEMENT PLANS  
FOR ZICK METER STATION & ASSOCIATED PERMANENT ACCESS ROADS  
LENOX TOWNSHIP, SUSQUEHANNA COUNTY, PENNSYLVANIA  
POST CONSTRUCTION STORMWATER MANAGEMENT PLAN

DRAWN BY: JEC DATE: 04/03/15 ISSUED FOR BID: SCALE: AS NOTED  
CHECKED BY: AJB DATE: 04/03/15 ISSUED FOR CONSTRUCTION: REVISION: 5  
APPROVED BY: AJB DATE: 07/17/15 DRAWING NUMBER: (30-3680)MF-1A-9 SHEET 3 OF 6  
NO: 1161483

Drawn By & Date/Time: J. Jones Apr. 25, 2017 - 9:27am  
Drawing Location & Name: G:\008514\14C\14C9909\DMG\010-CPLIN FMS\_PCSM14C4909(10)\_ZICK.dwg

**RECEIVING WATERS**  
PARTNERS CREEK TO TUNKHANNOCK CREEK, CWF  
APPROXIMATE DISTANCE FROM SITE TO UNIT TO PARTNERS CREEK TO TUNKHANNOCK CREEK:  
POI A: 240 FT (EAST)  
POI B: 21,200 FT (SOUTH)





# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

## Hyd. No. 13

Downstream Watershed

<u>Description</u>	<u>A</u>		<u>B</u>		<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>						
Manning's n-value	= 0.150		0.011		0.011	
Flow length (ft)	= 100.0		0.0		0.0	
Two-year 24-hr precip. (in)	= 2.60		0.00		0.00	
Land slope (%)	= 5.00		0.00		0.00	
<b>Travel Time (min)</b>	<b>= 7.53</b>	<b>+</b>	<b>0.00</b>	<b>+</b>	<b>0.00</b>	<b>= 7.53</b>
<b>Shallow Concentrated Flow</b>						
Flow length (ft)	= 1435.00		0.00		0.00	
Watercourse slope (%)	= 7.50		0.00		0.00	
Surface description	= Unpaved		Unpaved		Paved	
Average velocity (ft/s)	=4.42		0.00		0.00	
<b>Travel Time (min)</b>	<b>= 5.41</b>	<b>+</b>	<b>0.00</b>	<b>+</b>	<b>0.00</b>	<b>= 5.41</b>
<b>Channel Flow</b>						
X sectional flow area (sqft)	= 1.08		0.00		0.00	
Wetted perimeter (ft)	= 3.79		0.00		0.00	
Channel slope (%)	= 15.00		0.00		0.00	
Manning's n-value	= 0.026		0.015		0.015	
Velocity (ft/s)	=9.57		0.00		0.00	
Flow length (ft)	1085.0		0.0		0.0	
<b>Travel Time (min)</b>	<b>= 1.89</b>	<b>+</b>	<b>0.00</b>	<b>+</b>	<b>0.00</b>	<b>= 1.89</b>
<b>Total Travel Time, Tc</b> .....						<b>14.80 min</b>

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Thursday, 04 / 6 / 2017

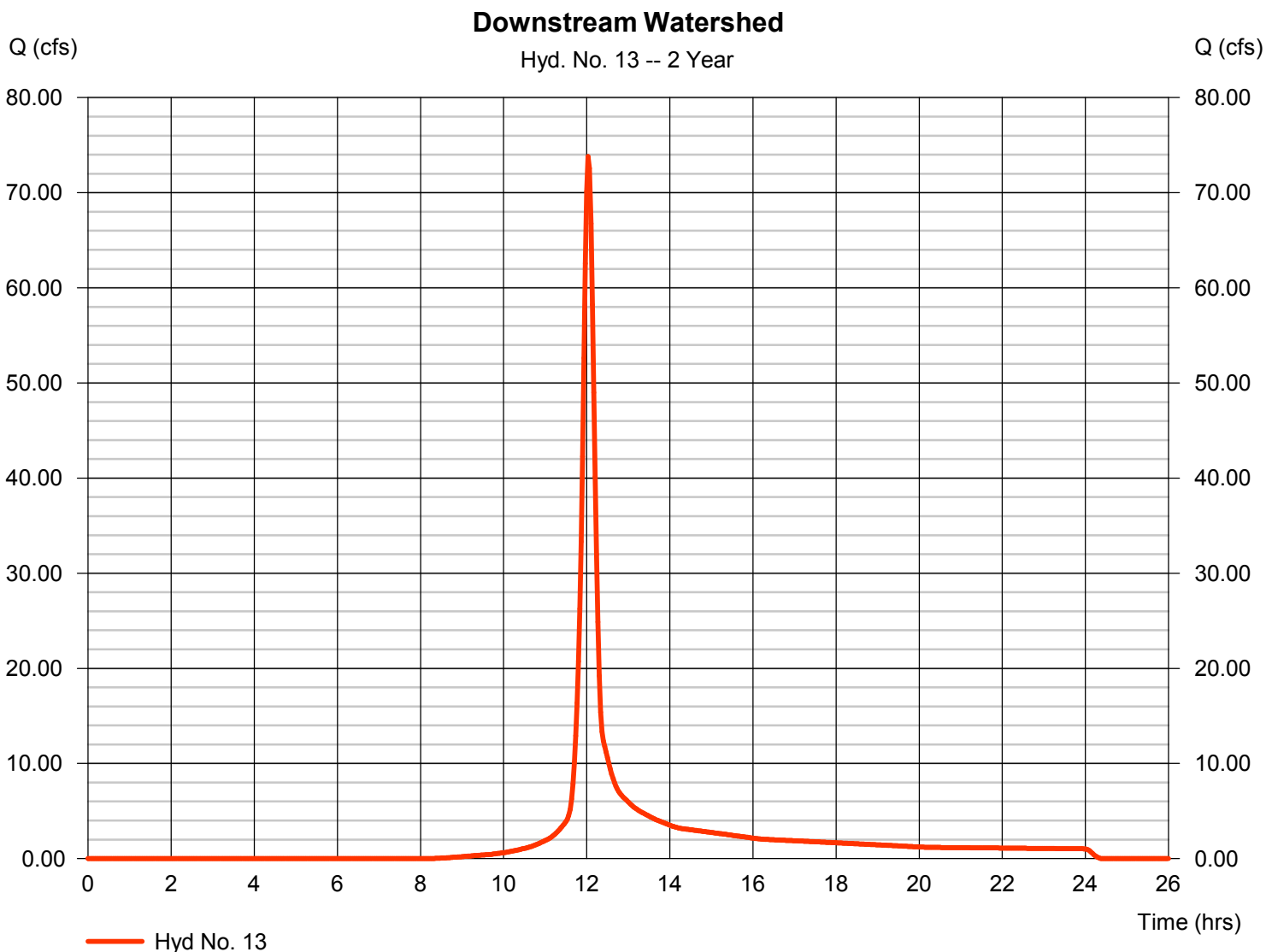
## Hyd. No. 13

### Downstream Watershed

Hydrograph type	= SCS Runoff	Peak discharge	= 73.81 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 206,950 cuft
Drainage area	= 42.260 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.80 min
Total precip.	= 2.67 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.620 x 98) + (5.000 x 77) + (3.680 x 84) + (7.460 x 78) + (0.820 x 80) + (23.680 x 91)] / 42.260

1% of volume = 2,069 cf  
 POI B volume increase = 1,287 cf < 2,069 cf





## **A.6 Site Characterization Assessment**





# Field Observation Report

Project Number: 14C4909  
Project Name: Atlantic Sunrise Project – Zick Meter Station  
Date of Field Visit: March 3, 2015; April 7, 2015  
Weather Conditions: Cloudy, windy, snowing;  
Overcast with light rain Temperature: Approximately 20-30°F;  
Approximately 48°F  
Prepared By: Krystal Bealing, APSS and Joseph Kempf

Copies of Report Have Been Sent To:  Client  Contractor  Other

Client:  
Transcontinental Gas Pipe Line  
Company, LLC  
2800 Post Oak Blvd  
Houston, TX 77251

Contractor:  
BL Companies  
4242 Carlisle Pike, Suite 260  
Camp Hill, PA 17011

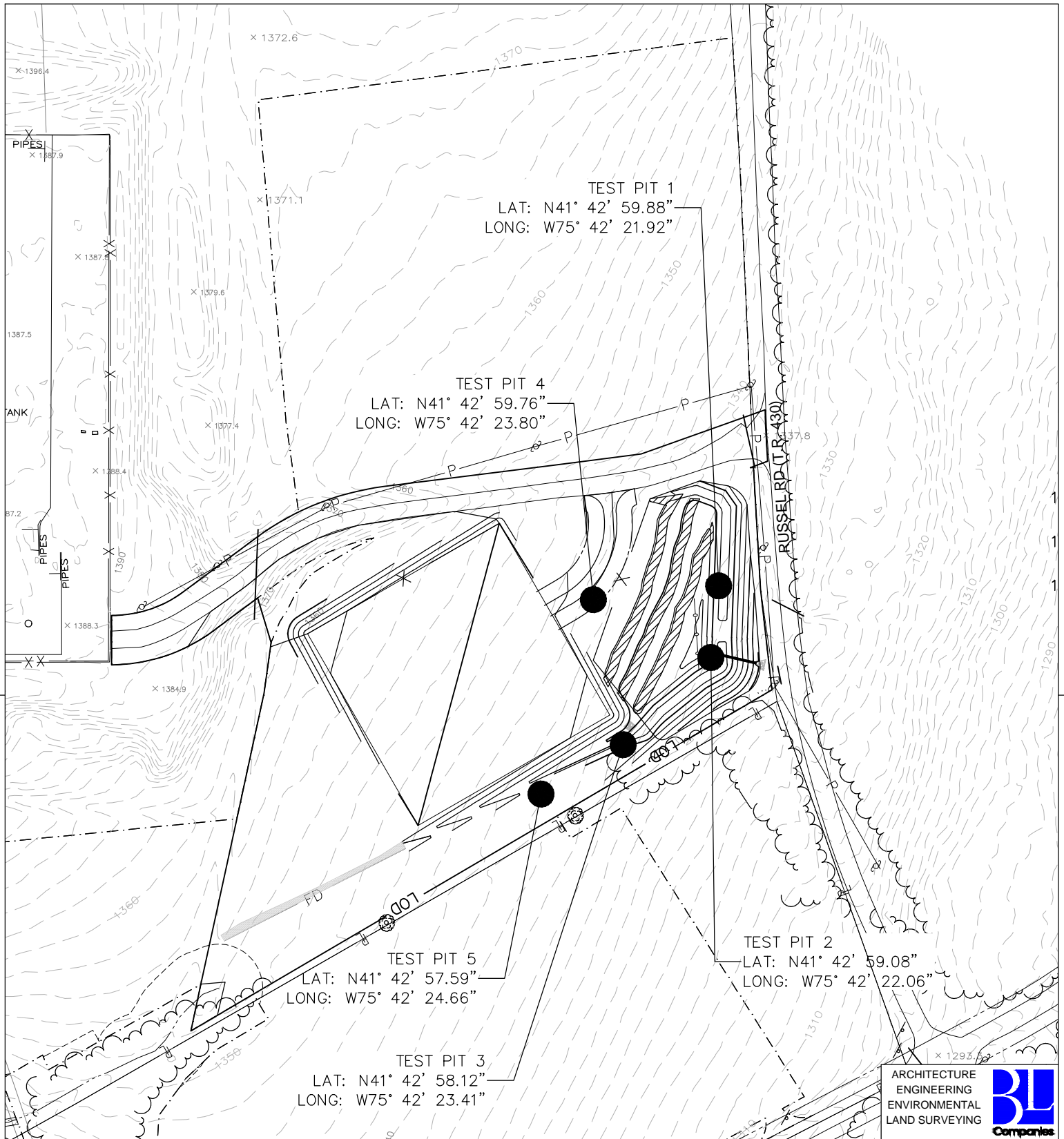
Five soil pits were excavated by backhoe and described to varying depths. Additionally, infiltration tests using the double ring infiltrometer method were conducted at each pit location, at depths ranging from the surface to two feet.

Weather conditions at the original time of testing limited infiltration results due to approximately 10 inches of frozen ground. Pits #2, #3 and #4 were revisited on April 7, 2015 to determine infiltration rates.

The test pit location map, soil profile descriptions, infiltration worksheet and photographs are attached. Determined limiting layer depths are listed below:

- Pit #1: 42 inches deep, Limiting Layer observed at 18 inches  
Infiltration conducted at 12 inches, Infiltration Rate = 4.219 inches/hour
- Pit #2: 36 inches deep, Limiting Layer observed at 16 inches  
Infiltration conducted at surface, Infiltration Rate = 0.813 inches/hour
- Pit #3: 48 inches deep, Limiting Layer observed at 18 inches  
Infiltration conducted at surface, Infiltration Rate = 1.188 inches/hour
- Pit #4: 42 inches deep, Limiting Layer observed at 16 inches  
Infiltration conducted at surface, Infiltration Rate = 1.094 inches/hour
- Pit #5: 48 inches deep, Limiting Layer observed at 10 inches  
Infiltration conducted at 24 inches, Infiltration Rate = 1.125 inches/hour





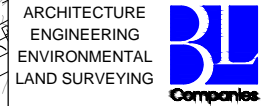
TEST PIT 1  
 LAT: N41° 42' 59.88"  
 LONG: W75° 42' 21.92"

TEST PIT 4  
 LAT: N41° 42' 59.76"  
 LONG: W75° 42' 23.80"

TEST PIT 5  
 LAT: N41° 42' 57.59"  
 LONG: W75° 42' 24.66"

TEST PIT 3  
 LAT: N41° 42' 58.12"  
 LONG: W75° 42' 23.41"

TEST PIT 2  
 LAT: N41° 42' 59.08"  
 LONG: W75° 42' 22.06"



**ATLANTIC SUNRISE PROJECT**  
**ZICK METER STATION**  
 INFILTRATION TEST PIT LOCATIONS  
 LENOX TOWNSHIP  
 SUSQUEHANNA COUNTY, PENNSYLVANIA



NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.	DRAWN BY:	AOE	DATE:	3/27/15	ISSUED FOR BID:	SCALE: 1"=150'
							CHECKED BY:	AJB	DATE:	3/27/15	ISSUED FOR CONSTRUCTION:	
							APPROVED BY:	AJB	DATE:	3/27/15	DRAWING NUMBER:	ZICK MS TEST PITS
							WO:					SHEET 1 OF 1



## Soil Profile Log

**Project** 14C4909-A Atlantic Sunrise Project - Zick Meter Station

**Test Pit #** 1

**Name** Krystal Bealing

**Date** March 3, 2015

**Weather** 20-30°F; Cloudy and windy

**Equipment** Mini Excavator

**Elevation** 1338 AMSL

**Soil Type** Wellsboro channery silt loam, 3-8% slopes

**Geology** Catskill Formation

**Landscape Position/Slope** Hillslope bench, 2-5%

**Land Use** Agriculture

**Additional Comments** Approximately 14" snow; approximately 10" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	10	SiL	-	7.5YR 3/3	-	*	-	-	* Horizon was frozen
Bw1	10	18	SiL	15-35% Channery	7.5YR 4/3	-	Roots Present; Weak, Granular	-	-	-
Bw2	18	28	SiL	15-35% Channery	7.5YR 5/2	20% 7.5YR 4/8	Weak, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table
Bx	28	36+	SiL	35-60% Flaggy	7.5YR 5/4	-	Moderate, Angular Blocky	-	-	Limiting Layer - Fragipan

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

**Project** 14C4909-A Atlantic Sunrise Project - Zick Meter Station

**Test Pit #** 2

**Name** Krystal Bealing

**Date** March 3, 2015

**Weather** 20-30°F; Cloudy and windy

**Equipment** Mini Excavator

**Elevation** 1336 AMSL

**Soil Type** Wellsboro channery silt loam, 3-8% slopes

**Geology** Catskill Formation

**Landscape Position/Slope** Hillslope bench, 2-5%

**Land Use** Agriculture

**Additional Comments** Approximately 14" snow; approximately 10" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	9	SiL	-	7.5YR 3/2	-	*	-	-	*Horizon was frozen
BE	9	16	L	-	10YR 6/4	-	Roots Present; Weak, Granular	-	-	-
Bw	16	36+	SiL	15-35% Flaggy	5YR 4/2	20% 7.5YR 6/2 15% 7.5YR 4/6	Weak, Angular Blocky	-	-	Limiting Layer - Seasonal High Water Table

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - Zick Meter Station

Test Pit # 3

Name Krystal Bealing

Date March 3, 2015

Weather 20-30°F; Cloudy and windy

Equipment Mini Excavator

Elevation 1339AMSL

Soil Type Wellsboro channery silt loam, 3-8% slopes

Geology Catskill Formation

Landscape Position/Slope Hillslope bench, 2-5%

Land Use Agriculture

Additional Comments Approximately 14" snow; approximately 10" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	12	Sil	-	7.5YR 4/2	-	Weak, Granular	-	-	First 10" of horizon was frozen
BE	12	18	L	-	7.5YR 5/3	-	Roots and Earthworm borrows present; Weak, Granular	-	-	-
Bw	18	30	Sil	15-35% Channery	5YR 4/3	10% 7.5YR 6/1 10% 5YR 4/6	Weak, Angular Blocky	-	-	Limiting Layer - Seasonal High Water Table
Bx	30	48+	Sil	15-35% Channery	5YR 4/3	-	Weak, Angular Blocky	-	-	Limiting Layer - Fragipan

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - Zick Meter Station

Test Pit # 4

Name Krystal Bealing

Date March 3, 2015

Weather 20-30°F; Cloudy and windy

Equipment Mini Excavator

Elevation 1347 AMSL

Soil Type Wellsboro channery silt loam, 3-8% slopes

Geology Catskill Formation

Landscape Position/Slope Hillslope bench, 2-5%

Land Use Agriculture

Additional Comments Approximately 14" snow; approximately 10" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	11	SIL	-	7.5YR 4/2	-	Weak, Granular	-	-	First 10" of horizon was frozen
Bw1	11	16	SIL	-	7.5YR 4/3	-	Roots present; Weak, Granular	-	-	-
Bw2	16	27	SIL	15-35% Channery	5YR 4/3	25% 7.5YR 7/1 20% 7.5YR 5/8	Weak, Angular Blocky	-	-	Limiting Layer - Seasonal High Water Table
Bx	27	42+	SIL	15-35% Channery	5YR 4/3	10% 7.5YR 7/1 5% 7.5YR 5/8	Moderate, Angular Blocky	-	-	Limiting Layer - Fragipan

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

**Project** 14C4909-A Atlantic Sunrise Project - Zick Meter Station

**Test Pit #** 5

**Name** Krystal Bealing

**Date** March 3, 2015

**Weather** 20-30°F; Cloudy and windy

**Equipment** Mini Excavator

**Elevation** 1338 AMSL

**Soil Type** Morris channery silt loam, 3-8% slopes

**Geology** Catskill Formation

**Landscape Position/Slope** Hillslope bench, 2-5%

**Land Use** Wooded

**Additional Comments** Approximately 14" snow; approximately 10" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	10	SiL	-	7.5YR 4/2	-	Weak, Granular	-	-	First 10" of horizon was frozen
Bw1	10	25	SiL	-	7.5YR 4/3	15% 7.5YR 7/1 10% 7.5YR 5/8	Moderate, Angular Blocky	-	-	Limiting Layer - Seasonal High Water Table
Bw2	25	48+	SiL	15-35% Channery	7.5YR 4/3	10% 7.5YR 7/1 5% 7.5YR 5/8	Moderate, Angular Blocky	-	-	Limiting Layer - Seasonal High Water Table

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

ATLANTIC SUNRISE PROJECT - ZICK METER STATION													
SOIL INFILTRATION WORKSHEET - DOUBLE RING INFILTROMETER METHOD													
Hole Number	Drop >2 inches after 30 minute presoak <sup>1</sup>	Reading Interval (minutes)	Reading 1 (Inches of Drop)	Reading 2 (Inches of Drop)	Reading 3 (Inches of Drop)	Reading 4 (Inches of Drop)	Reading 5 (Inches of Drop)	Reading 6 (Inches of Drop)	Reading 7 (Inches of Drop)	Reading 8 (Inches of Drop)	Average Stabilized Reading <sup>2</sup> (Inches of Drop)	Infiltration Rate <sup>3</sup> (in/hr)	Comments
1	Yes	10	0.688	0.75	0.625	0.75					0.70	4.219	Approx. 27 degrees, overcast, approx. snow cover 14". Frozen soil down to approx. 10". Test done at 12" below surface.
2	No	30	1.000	1.000	0.500	0.375	0.375	0.375			0.406	0.813	Approximately 48 degrees, overcast with a light rain. Test done at the surface.
3	No	30	0.313	0.625	0.563	0.563	0.625				0.594	1.188	Approximately 48 degrees, overcast with a light rain. Test done at the surface.
4	No	30	0.563	0.625	0.500	0.500					0.547	1.094	Approximately 48 degrees, overcast with a light rain. Test done at the surface.
5	No	30	0.625	0.625	0.5	0.5					0.56	1.125	Approx. 27 degrees, overcast, approx. snow cover 14". Frozen soil down to approx. 10". Snow fall. Test done at 24" below surface.

<sup>1</sup>Inches of drop greater than 2 inches after the 30 minute presoak? Yes, use 10 minute interval, No, use 30 minute interval.

<sup>2</sup>Calculated as the average of the last four stabilized (less than 0.25-inch difference overall) readings.

<sup>3</sup>Calculated as the average stabilized reading x 2 for 30 minute intervals; x 6 for 10 minute intervals.



View of Pit #1.



View of Pit #2.



View of Pit #3.



View of Pit #4.



View of Pit #5.





An Employee-Owned Company

## **A.7 Supporting Documentation**



**TABLE 6.6**  
**Riprap Gradation, Filter Blanket Requirements, Maximum Velocities**

Percent Passing (Square Openings)						
Class, Size NO.	R-8	R-7	R-6	R-5	R-4	R-3
Rock Size (Inches)						
42	100					
30		100				
24	15-50		100			
18		15-50		100		
15	0-15					
12		0-15	15-50		100	
9				15-50		
6			0-15		15-50	100
4				0-15		
3					0-15	15-50
2						0-15
Nominal Placement Thickness (inches)	63	45	36	27	18	9
Filter Stone <sup>1</sup>	AASHTO #1	AASHTO #1	AASHTO #1	AASHTO #3	AASHTO #3	AASHTO #57
V <sub>max</sub> (ft/sec)	17.0	14.5	13.0	11.5	9.0	6.5

Adapted from PennDOT Pub. 408, Section 703.2(c), Table C

- 1 This is a general standard. Soil conditions at each site should be analyzed to determine actual filter size. A suitable woven or non-woven geotextile underlayment, used according to the manufacturer's recommendations, may be substituted for the filter stone for gradients < 10%.

**TABLE 6.7**  
**Comparison of Various Gradations of Coarse Aggregates**

Total Percent Passing															
AASHTO NUMBER	6 ½"	4"	3 ½"	2 ½"	2"	1 ½"	1"	¾"	½"	⅜"	#4	#8	#16	#30	#100
1		100	90-100	25-60		0-15		0-5							
3				100	90-100	35-70	0-15		0-5						
5						100	90-100	20-55	0-10	0-5					
57						100	90-100		25-60		0-10	0-5			
67							100	90-100		20-55	0-10	0-5			
7								100	90-100	40-70	0-15	0-5			
8									100	85-100	10-30	0-10	0-5		
10										100	75-100				10-30

PennDOT Publication 408, Section 703.2(c), Table C

Tables 6.6 and 6.7 should be placed on the plan drawings of all sites where riprap channel linings are proposed.



**NOAA Atlas 14, Volume 2, Version 3**  
**Location name: Hop Bottom, Pennsylvania, US\***  
**Latitude: 41.7162°, Longitude: -75.7073°**  
**Elevation: 1352 ft\***  
 \* source: Google Maps



**POINT PRECIPITATION FREQUENCY ESTIMATES**

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley  
 NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerals](#)

**PF tabular**

<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
<b>Duration</b>	<b>Average recurrence interval (years)</b>									
	<b>1</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	<b>100</b>	<b>200</b>	<b>500</b>	<b>1000</b>
<b>5-min</b>	<b>0.299</b> (0.269-0.331)	<b>0.353</b> (0.319-0.391)	<b>0.416</b> (0.374-0.461)	<b>0.463</b> (0.416-0.513)	<b>0.523</b> (0.468-0.579)	<b>0.570</b> (0.508-0.632)	<b>0.617</b> (0.547-0.683)	<b>0.666</b> (0.588-0.738)	<b>0.735</b> (0.643-0.818)	<b>0.788</b> (0.684-0.879)
<b>10-min</b>	<b>0.464</b> (0.419-0.514)	<b>0.551</b> (0.498-0.611)	<b>0.646</b> (0.582-0.717)	<b>0.715</b> (0.643-0.793)	<b>0.800</b> (0.716-0.885)	<b>0.864</b> (0.770-0.958)	<b>0.928</b> (0.824-1.03)	<b>0.993</b> (0.877-1.10)	<b>1.08</b> (0.945-1.20)	<b>1.15</b> (0.996-1.28)
<b>15-min</b>	<b>0.569</b> (0.513-0.630)	<b>0.674</b> (0.608-0.747)	<b>0.793</b> (0.714-0.880)	<b>0.880</b> (0.791-0.975)	<b>0.988</b> (0.884-1.09)	<b>1.07</b> (0.954-1.19)	<b>1.15</b> (1.02-1.28)	<b>1.24</b> (1.09-1.37)	<b>1.35</b> (1.18-1.50)	<b>1.44</b> (1.25-1.60)
<b>30-min</b>	<b>0.753</b> (0.679-0.833)	<b>0.901</b> (0.814-1.00)	<b>1.09</b> (0.978-1.21)	<b>1.22</b> (1.10-1.35)	<b>1.40</b> (1.25-1.54)	<b>1.53</b> (1.36-1.70)	<b>1.67</b> (1.48-1.84)	<b>1.80</b> (1.59-2.00)	<b>2.00</b> (1.75-2.22)	<b>2.15</b> (1.87-2.40)
<b>60-min</b>	<b>0.919</b> (0.829-1.02)	<b>1.11</b> (0.999-1.23)	<b>1.36</b> (1.23-1.51)	<b>1.55</b> (1.40-1.72)	<b>1.81</b> (1.62-2.00)	<b>2.02</b> (1.80-2.23)	<b>2.23</b> (1.98-2.47)	<b>2.45</b> (2.16-2.71)	<b>2.77</b> (2.42-3.07)	<b>3.02</b> (2.62-3.37)
<b>2-hr</b>	<b>1.07</b> (0.967-1.19)	<b>1.28</b> (1.16-1.42)	<b>1.59</b> (1.44-1.76)	<b>1.83</b> (1.65-2.03)	<b>2.19</b> (1.96-2.42)	<b>2.49</b> (2.22-2.75)	<b>2.82</b> (2.49-3.11)	<b>3.18</b> (2.79-3.52)	<b>3.72</b> (3.22-4.14)	<b>4.18</b> (3.58-4.67)
<b>3-hr</b>	<b>1.16</b> (1.05-1.28)	<b>1.38</b> (1.26-1.53)	<b>1.71</b> (1.55-1.89)	<b>1.98</b> (1.79-2.18)	<b>2.37</b> (2.14-2.61)	<b>2.71</b> (2.43-2.99)	<b>3.09</b> (2.74-3.41)	<b>3.51</b> (3.08-3.89)	<b>4.16</b> (3.59-4.61)	<b>4.71</b> (4.02-5.25)
<b>6-hr</b>	<b>1.46</b> (1.33-1.61)	<b>1.74</b> (1.58-1.92)	<b>2.14</b> (1.95-2.35)	<b>2.47</b> (2.24-2.71)	<b>2.96</b> (2.67-3.24)	<b>3.38</b> (3.02-3.70)	<b>3.85</b> (3.41-4.22)	<b>4.38</b> (3.84-4.81)	<b>5.18</b> (4.47-5.71)	<b>5.87</b> (5.00-6.50)
<b>12-hr</b>	<b>1.82</b> (1.66-2.01)	<b>2.17</b> (1.98-2.40)	<b>2.66</b> (2.42-2.94)	<b>3.09</b> (2.80-3.40)	<b>3.72</b> (3.35-4.09)	<b>4.27</b> (3.81-4.70)	<b>4.90</b> (4.33-5.39)	<b>5.60</b> (4.89-6.18)	<b>6.69</b> (5.73-7.41)	<b>7.64</b> (6.46-8.50)
<b>24-hr</b>	<b>2.17</b> (2.00-2.39)	<b>2.60</b> (2.39-2.86)	<b>3.20</b> (2.94-3.51)	<b>3.71</b> (3.40-4.06)	<b>4.47</b> (4.07-4.88)	<b>5.15</b> (4.66-5.61)	<b>5.92</b> (5.30-6.42)	<b>6.78</b> (6.03-7.34)	<b>8.12</b> (7.12-8.78)	<b>9.31</b> (8.07-10.0)
<b>2-day</b>	<b>2.56</b> (2.36-2.79)	<b>3.06</b> (2.82-3.34)	<b>3.76</b> (3.46-4.10)	<b>4.36</b> (4.00-4.74)	<b>5.26</b> (4.80-5.71)	<b>6.07</b> (5.49-6.56)	<b>6.97</b> (6.25-7.52)	<b>8.00</b> (7.11-8.62)	<b>9.61</b> (8.42-10.3)	<b>11.0</b> (9.55-11.8)
<b>3-day</b>	<b>2.71</b> (2.51-2.95)	<b>3.24</b> (3.00-3.52)	<b>3.96</b> (3.66-4.30)	<b>4.57</b> (4.21-4.95)	<b>5.49</b> (5.04-5.94)	<b>6.31</b> (5.75-6.81)	<b>7.24</b> (6.54-7.78)	<b>8.29</b> (7.42-8.90)	<b>9.92</b> (8.77-10.6)	<b>11.4</b> (9.94-12.1)
<b>4-day</b>	<b>2.86</b> (2.66-3.10)	<b>3.41</b> (3.17-3.70)	<b>4.15</b> (3.86-4.49)	<b>4.78</b> (4.43-5.16)	<b>5.73</b> (5.28-6.17)	<b>6.56</b> (6.01-7.05)	<b>7.50</b> (6.83-8.05)	<b>8.57</b> (7.74-9.18)	<b>10.2</b> (9.13-10.9)	<b>11.7</b> (10.3-12.5)
<b>7-day</b>	<b>3.38</b> (3.15-3.66)	<b>4.02</b> (3.75-4.34)	<b>4.82</b> (4.49-5.21)	<b>5.50</b> (5.11-5.92)	<b>6.51</b> (6.02-6.99)	<b>7.38</b> (6.79-7.93)	<b>8.36</b> (7.65-8.96)	<b>9.46</b> (8.60-10.1)	<b>11.2</b> (10.0-11.9)	<b>12.6</b> (11.3-13.5)
<b>10-day</b>	<b>3.91</b> (3.66-4.20)	<b>4.63</b> (4.33-4.97)	<b>5.51</b> (5.15-5.91)	<b>6.25</b> (5.82-6.69)	<b>7.33</b> (6.80-7.83)	<b>8.25</b> (7.63-8.81)	<b>9.27</b> (8.54-9.89)	<b>10.4</b> (9.52-11.1)	<b>12.1</b> (11.0-12.9)	<b>13.6</b> (12.2-14.4)
<b>20-day</b>	<b>5.35</b> (5.04-5.72)	<b>6.29</b> (5.93-6.72)	<b>7.32</b> (6.88-7.80)	<b>8.17</b> (7.67-8.70)	<b>9.40</b> (8.80-10.0)	<b>10.4</b> (9.73-11.1)	<b>11.5</b> (10.7-12.3)	<b>12.8</b> (11.8-13.5)	<b>14.5</b> (13.4-15.4)	<b>16.0</b> (14.6-17.0)
<b>30-day</b>	<b>6.68</b> (6.33-7.09)	<b>7.82</b> (7.40-8.29)	<b>8.95</b> (8.47-9.49)	<b>9.89</b> (9.35-10.5)	<b>11.2</b> (10.6-11.9)	<b>12.3</b> (11.6-13.0)	<b>13.5</b> (12.6-14.2)	<b>14.7</b> (13.7-15.5)	<b>16.5</b> (15.3-17.4)	<b>17.9</b> (16.6-19.0)
<b>45-day</b>	<b>8.55</b> (8.12-9.02)	<b>9.96</b> (9.46-10.5)	<b>11.3</b> (10.7-11.9)	<b>12.3</b> (11.7-13.0)	<b>13.8</b> (13.0-14.5)	<b>14.9</b> (14.1-15.7)	<b>16.1</b> (15.2-17.0)	<b>17.4</b> (16.4-18.3)	<b>19.2</b> (18.0-20.2)	<b>20.6</b> (19.2-21.7)
<b>60-day</b>	<b>10.4</b> (9.87-10.9)	<b>12.0</b> (11.5-12.7)	<b>13.5</b> (12.8-14.2)	<b>14.7</b> (14.0-15.4)	<b>16.3</b> (15.5-17.2)	<b>17.7</b> (16.7-18.5)	<b>19.0</b> (18.0-20.0)	<b>20.4</b> (19.3-21.4)	<b>22.4</b> (21.0-23.5)	<b>24.0</b> (22.4-25.2)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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**PF graphical**



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## **APPENDIX B**

### **Preparer Qualifications**



**STANDARD E&S WORKSHEET # 22  
 PLAN PREPARER RECORD OF TRAINING AND EXPERIENCE IN EROSION AND  
 SEDIMENT POLLUTION CONTROL METHODS AND TECHNIQUES**

**NAME OF PLAN PREPARER:** Alaric J. Busher, PE, CPESC

**FORMAL EDUCATION:**

**Name of College or Technical Institute:** The Pennsylvania State University

**Curriculum or Program:** Civil Engineering

**Dates of Attendance:** **From:** 9/1995 **To:** 5/1999

**Degree Received** Bachelor of Science - Civil Engineering

**OTHER TRAINING:**

<b>Name of Training:</b>	<u>Annual Oil and Gas Training</u>	<u>Chapter 102 Update Training for the Regulated Community</u>
<b>Presented By:</b>	<u>PADEP</u>	<u>PADEP</u>
<b>Date:</b>	<u>7/10/2013</u>	<u>11/12/2010</u>

**EMPLOYMENT HISTORY:**

**Current Employer:** BL Companies

**Telephone:** 717-651-9850

**Former Employer:** N/A

**Telephone:** \_\_\_\_\_

**RECENT E&S PLANS PREPARED:**

<b>Name of Project:</b>	<u>Constitution Pipeline, Access Roads and Meter Station (ES, PCSM)</u>	<u>Reynolds Alford Pipeline (E&amp;S, PCSM)</u>	<u>Annville Medical Office (E&amp;S, PCSM)</u>
<b>County:</b>	<u>Susquehanna</u>	<u>Susquehanna</u>	<u>Lebanon</u>
<b>Municipality:</b>	<u>Multiple</u>	<u>Brooklyn, Harford</u>	<u>Annville Twp</u>
<b>Permit Number:</b>	<u>ESG0011540002</u>	<u>ESX13-115-0152(01)</u>	<u>PAG-02-0038-15-010</u>
<b>Approving Agency:</b>	<u>Susquehanna CCD</u>	<u>PADEP (O&amp;G)</u>	<u>Lebanon CCD</u>





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## **APPENDIX C**

### **United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Custom Soil Resource Report**



# Custom Soil Resource Report for Susquehanna County, Pennsylvania

## Zick Meter Station





# Preface

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Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<http://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist ([http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2\\_053951](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951)).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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# How Soil Surveys Are Made

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Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

## Custom Soil Resource Report

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

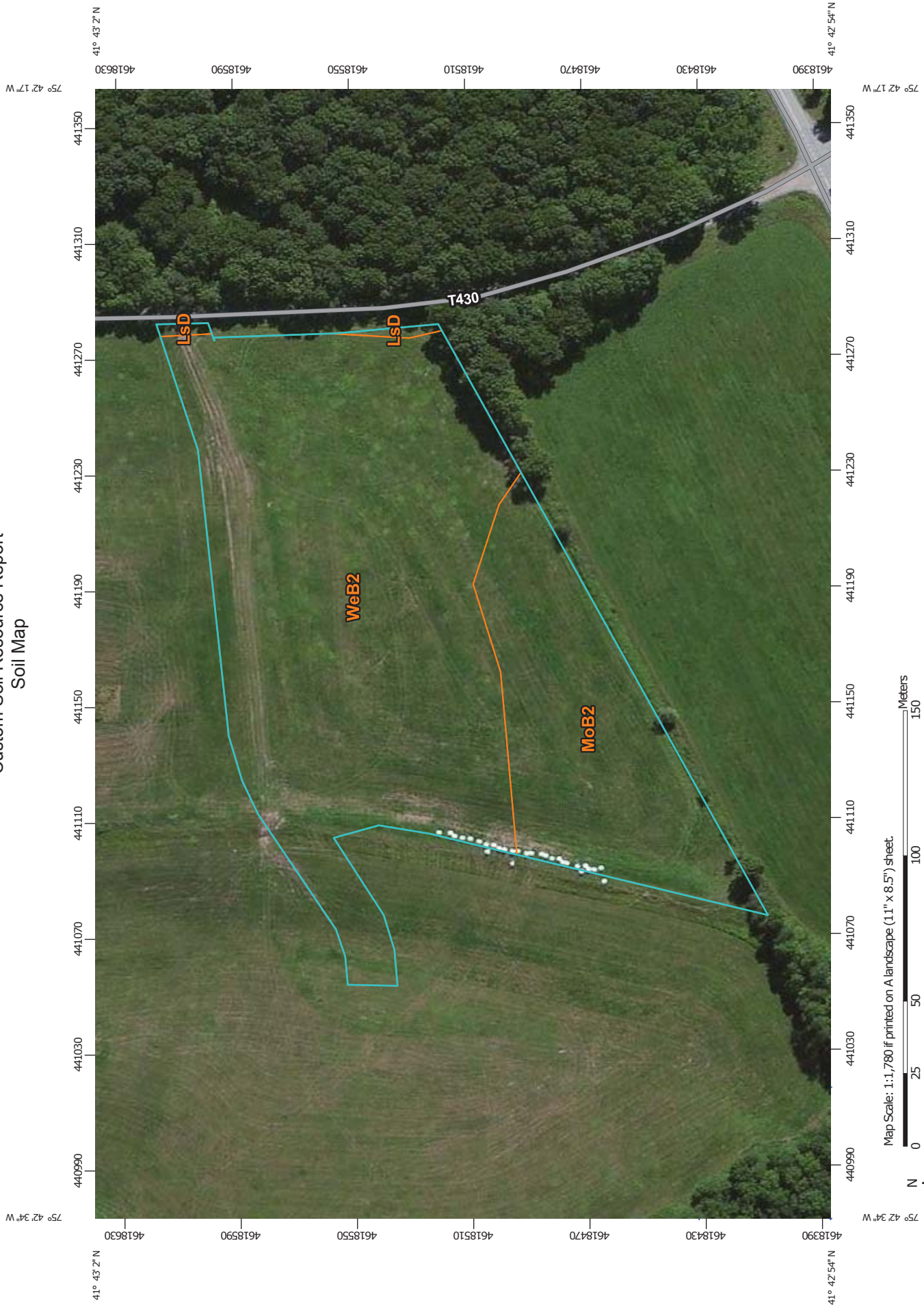
# Soil Map

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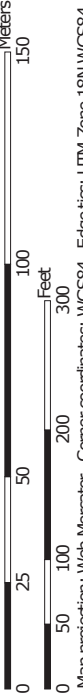
The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.



# Custom Soil Resource Report Soil Map



Map Scale: 1:1,780 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84



## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

**Warning:** Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Susquehanna County, Pennsylvania  
 Survey Area Data: Version 8, Sep 22, 2014

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

Date(s) aerial images were photographed: Mar 20, 2011—Jul 5, 2011

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

## MAP LEGEND

 Area of Interest (AOI)	 Spoil Area
 Soil Map Unit Polygons	 Stony Spot
 Soil Map Unit Lines	 Very Stony Spot
 Soil Map Unit Points	 Wet Spot
 Special Point Features	 Other
 Blowout	 Special Line Features
 Borrow Pit	<b>Water Features</b>
 Clay Spot	 Streams and Canals
 Closed Depression	<b>Transportation</b>
 Gravel Pit	 Rails
 Gravelly Spot	 Interstate Highways
 Landfill	 US Routes
 Lava Flow	 Major Roads
 Marsh or swamp	 Local Roads
 Mine or Quarry	<b>Background</b>
 Miscellaneous Water	 Aerial Photography
 Perennial Water	
 Rock Outcrop	
 Saline Spot	
 Sandy Spot	
 Severely Eroded Spot	
 Sinkhole	
 Slide or Slip	
 Sodic Spot	



## Map Unit Legend

Susquehanna County, Pennsylvania (PA115)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
LsD	Lordstown and Oquaga very stony silt loams, 12 to 30 percent slopes	0.0	0.6%
MoB2	Morris channery silt loam, 3 to 8 percent slopes, moderately eroded	1.6	27.0%
WeB2	Wellsboro channery silt loam, 3 to 8 percent slopes, moderately eroded	4.4	72.4%
<b>Totals for Area of Interest</b>		<b>6.1</b>	<b>100.0%</b>

## Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

## Susquehanna County, Pennsylvania

### LsD—Lordstown and Oquaga very stony silt loams, 12 to 30 percent slopes

#### Map Unit Setting

*National map unit symbol:* 9z3b  
*Elevation:* 700 to 1,800 feet  
*Mean annual precipitation:* 32 to 50 inches  
*Mean annual air temperature:* 45 to 52 degrees F  
*Frost-free period:* 110 to 180 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Oquaga and similar soils:* 50 percent  
*Lordstown and similar soils:* 50 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Lordstown

##### Setting

*Landform:* Hills  
*Landform position (two-dimensional):* Backslope  
*Landform position (three-dimensional):* Side slope, crest  
*Down-slope shape:* Convex, linear  
*Across-slope shape:* Convex, linear

##### Typical profile

*A - 0 to 7 inches:* channery silt loam  
*Bw - 7 to 26 inches:* channery loam  
*C - 26 to 30 inches:* very flaggy loam  
*2R - 30 to 42 inches:* unweathered bedrock

##### Properties and qualities

*Slope:* 12 to 30 percent  
*Percent of area covered with surface fragments:* 1.6 percent  
*Depth to restrictive feature:* 20 to 40 inches to lithic bedrock  
*Natural drainage class:* Well drained  
*Runoff class:* High  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Low (about 3.8 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 6s  
*Hydrologic Soil Group:* C

#### Description of Oquaga

##### Setting

*Landform:* Hillslopes  
*Landform position (two-dimensional):* Shoulder

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*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Reddish ablation till derived from sandstone and siltstone

### Typical profile

*A - 0 to 7 inches:* channery silt loam

*Bw - 7 to 30 inches:* very channery silt loam

*R - 30 to 42 inches:* unweathered bedrock

### Properties and qualities

*Slope:* 12 to 30 percent

*Percent of area covered with surface fragments:* 1.6 percent

*Depth to restrictive feature:* 20 to 40 inches to lithic bedrock

*Natural drainage class:* Well drained

*Runoff class:* High

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high  
(0.60 to 2.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Very low (about 2.7 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 6s

*Hydrologic Soil Group:* C

## MoB2—Morris channery silt loam, 3 to 8 percent slopes, moderately eroded

### Map Unit Setting

*National map unit symbol:* 9z3r

*Elevation:* 600 to 1,800 feet

*Mean annual precipitation:* 32 to 50 inches

*Mean annual air temperature:* 46 to 50 degrees F

*Frost-free period:* 120 to 165 days

*Farmland classification:* Farmland of statewide importance

### Map Unit Composition

*Morris and similar soils:* 80 percent

*Minor components:* 20 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Morris

#### Setting

*Landform:* Till plains

*Landform position (two-dimensional):* Toeslope

*Landform position (three-dimensional):* Base slope

*Down-slope shape:* Concave

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*Across-slope shape:* Concave

*Parent material:* Reddish ablation till derived from sandstone and siltstone

### Typical profile

*A - 0 to 8 inches:* channery silt loam

*Bw - 8 to 17 inches:* channery silt loam

*Bx - 17 to 70 inches:* channery silt loam

*C - 70 to 80 inches:* channery silt loam

### Properties and qualities

*Slope:* 3 to 8 percent

*Depth to restrictive feature:* 11 to 22 inches to fragipan

*Natural drainage class:* Somewhat poorly drained

*Runoff class:* Very high

*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)

*Depth to water table:* About 3 to 10 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Very low (about 1.6 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 3w

*Hydrologic Soil Group:* D

### Minor Components

#### Norwich

*Percent of map unit:* 20 percent

*Landform:* Depressions

*Down-slope shape:* Concave

*Across-slope shape:* Concave

## **WeB2—Wellsboro channery silt loam, 3 to 8 percent slopes, moderately eroded**

### Map Unit Setting

*National map unit symbol:* 9z4g

*Elevation:* 600 to 1,800 feet

*Mean annual precipitation:* 32 to 50 inches

*Mean annual air temperature:* 45 to 52 degrees F

*Frost-free period:* 110 to 180 days

*Farmland classification:* All areas are prime farmland

### Map Unit Composition

*Wellsboro and similar soils:* 90 percent

*Minor components:* 10 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

## Description of Wellsboro

### Setting

*Landform:* Valley sides  
*Landform position (two-dimensional):* Footslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Concave  
*Across-slope shape:* Linear  
*Parent material:* Reddish ablation till derived from sandstone and siltstone

### Typical profile

*A - 0 to 8 inches:* channery silt loam  
*Bw - 8 to 17 inches:* channery silt loam  
*BE - 17 to 21 inches:* channery silt loam  
*Bx - 21 to 60 inches:* channery loam  
*C - 60 to 80 inches:* channery loam

### Properties and qualities

*Slope:* 3 to 8 percent  
*Depth to restrictive feature:* 14 to 26 inches to fragipan  
*Natural drainage class:* Moderately well drained  
*Runoff class:* Very high  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)  
*Depth to water table:* About 11 to 22 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Very low (about 2.7 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 2w  
*Hydrologic Soil Group:* D

## Minor Components

### Oquaga

*Percent of map unit:* 4 percent

### Morris

*Percent of map unit:* 3 percent

### Norwich

*Percent of map unit:* 3 percent  
*Landform:* Valley sides  
*Landform position (two-dimensional):* Footslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave

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