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Post Construction Stormwater Management/Site Restoration Plans Narrative

Atlantic Sunrise Project
Phase 2

North Diamond Regulator Station
Lehman Township
Luzerne County
Pennsylvania

Prepared For:

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

Issued: August 2015
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BL Project No. 14C4909

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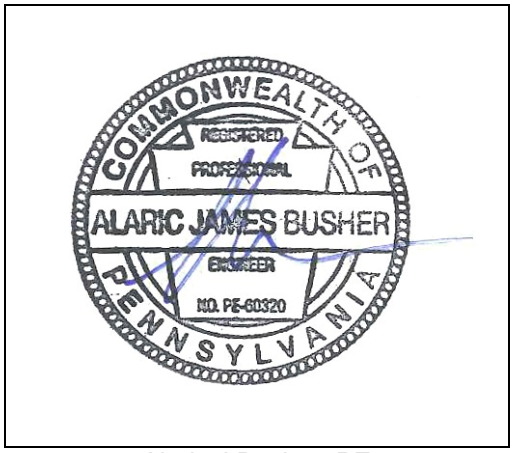

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APPENDICES

Appendix C United States Department of Agriculture (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 North Diamond Regulator Station ("Site") to be constructed as part of the Project, within Lehman Township, Luzerne 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 Luzerne County is the following:

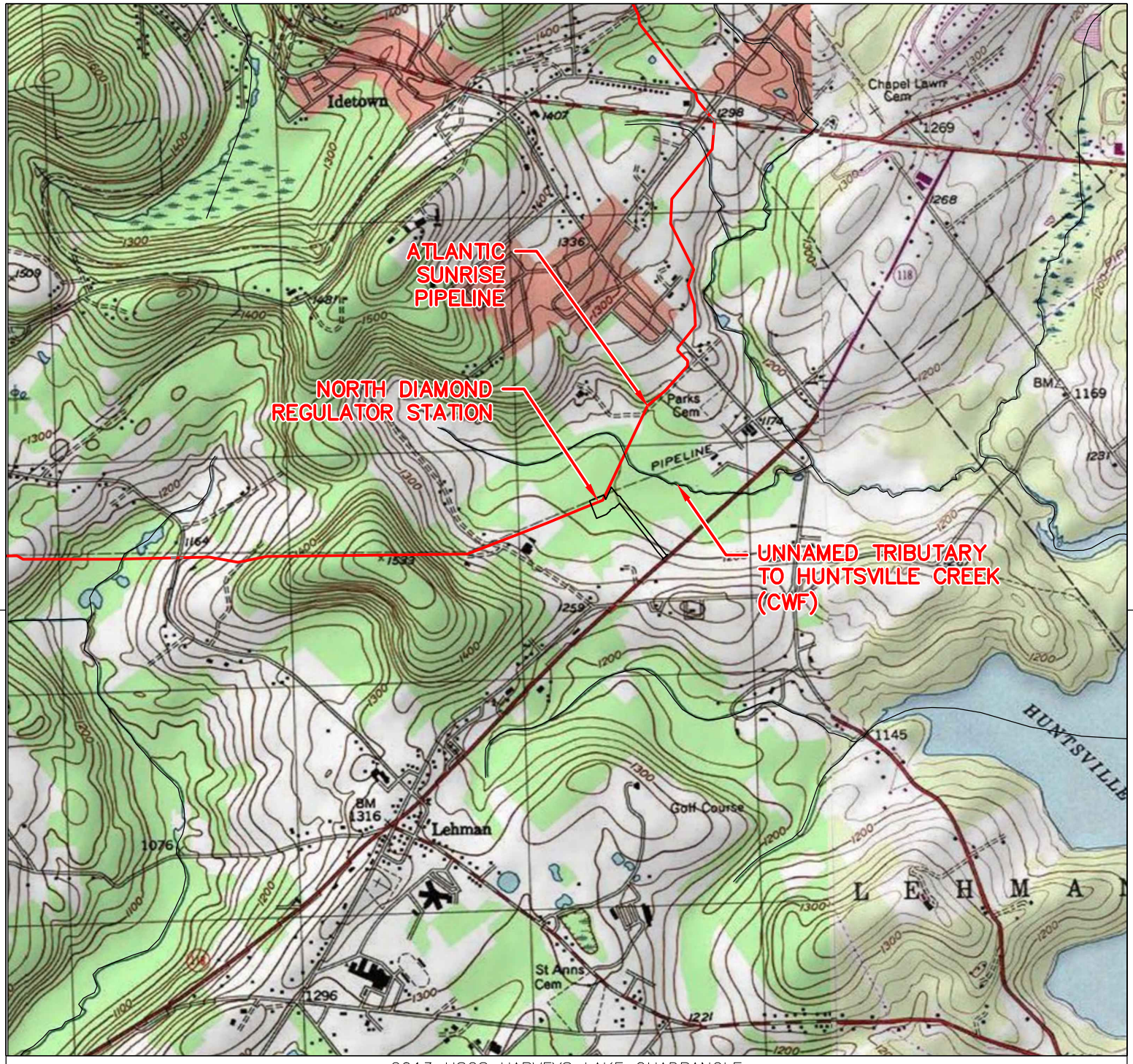
Facility Name	Facility Description	Facility Coordinates
North Diamond Regulator Station	Regulator Station	N41°19'43.07", W76°00'40.81"

The North Diamond Regulator Station will be approximately 3.76 acres in area including a 1,296 linear foot gravel access road, 27,007 square feet (0.62 acre) of gravel pad, 374 square feet (0.01 acres) of building, totaling 45,496 square feet (1.04 acres) 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) "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 volume and flow 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. Heavy equipment will be restricted from infiltration areas. 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 Topographic Features



2013 USGS HARVEYS LAKE QUADRANGLE

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GRAPHIC SCALE
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SCALE IN FEET

ATLANTIC SUNRISE PROJECT
NORTH DIAMOND REGULATOR STATION
USGS LOCATION MAP
LEHMAN TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

Williams

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.
0	08-28-15	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	1161499	SMK	
1	12-02-15	BL	ISSUED FOR PADEP RESUBMITTAL	*1161499*	AJB	
2	09-01-16	BL	MOD 1 ISSUED FOR PADEP SUBMITTAL	1161481	AJB	
3	*Oct. 2016*	*BL*	*PADEP TECHNICAL DEFICIENCY RESPONSE #1*	*1161481*	*AJB*	

DRAWN BY: JEC	DATE: 04/03/15	ISSUED FOR BID:	SCALE: 1"=2,000'
CHECKED BY: AOE	DATE: 04/03/15	ISSUED FOR CONSTRUCTION:	
APPROVED BY: AJB	DATE: 04/03/15	DRAWING NUMBER: NORTH DIAMOND RS LOCATION	SHEET 1 OF 1
WO: 1161499			

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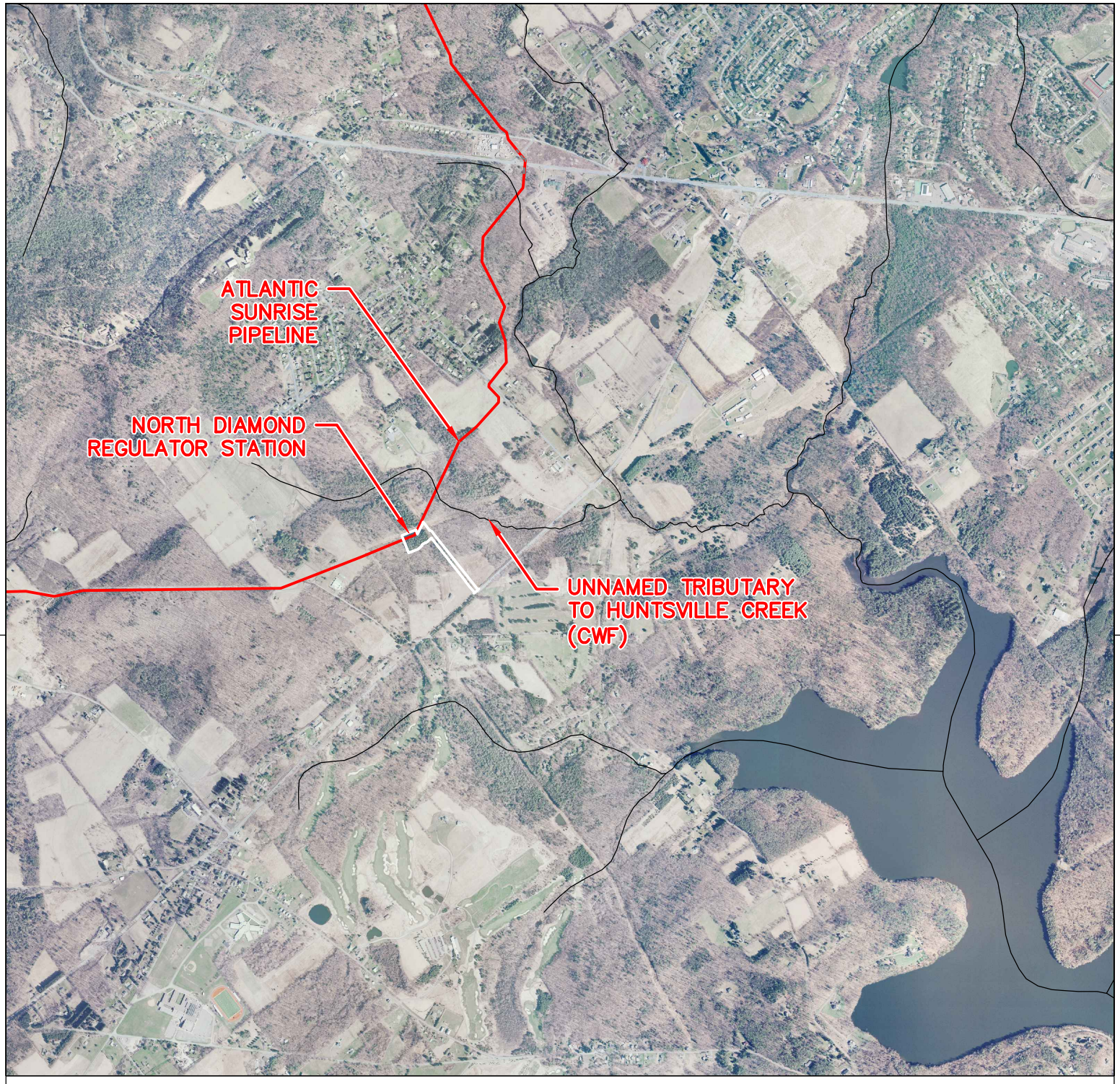

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GRAPHIC SCALE

2000 1000 0 2000

SCALE IN FEET

ATLANTIC SUNRISE PROJECT

NORTH DIAMOND REGULATOR STATION

AERIAL LOCATION MAP

LEHMAN TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

Williams

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.
0	08-28-15	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	1161499	SMK	
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WO: 1161499			

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 Erodible	Flooding	High Water Table	Hydric/Hydric Inclusions	Low Strength	Slow Percolation	Piping	Poor Source of Topsoil	Frost Action	Shrink-Swell	Potential Sinkhole	Ponding	Wetness
BrB	Braceville gravelly loam	3-8%	X	C/S	X	X		X	X	X	X	X	X	X				X
CIB	Chippewa silt loam	3-8%	X	C/S	X	X		X	X	X	X	X		X	X		X	
CnB	Chippewa silt loam	0-8%	X	C/S	X	X		X	X	X	X	X		X	X		X	
LaB	Lackawanna channery silt loam,	3-8%	X	C	X			X	X	X			X	X				X
WIB	Wellsboro channery silt loam	3-8%	X	C/S	X	X		X	X	X	X	X		X				X
WIC	Wellsboro channery silt loam	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 North Diamond Regulator Station will be constructed in Lehman Township, Luzerne County. North Diamond Regulator Station will include construction of a regulator station and associated access road. The earthmoving activity will involve the stripping and stockpiling of top soil, 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 45,496 square feet (1.04 acres) of additional gravel area and 374 square feet (0.01 acres) of 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 North Diamond Regulator Station associated with the CPL North and CPL South mainlines.

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. Land uses appear to be have been similar over the past 50 years.

Table 1.3.1
Land Requirements for the New Aboveground Facilities[a]

Facility	Milepost	County	Agricultural Land (acres)		Upland Forest / Woodland (acres)		Open Land (acres)		Total (acres)	
			Cons	Op	Cons	Op	Cons	Op	Cons	Op
North Diamond Regulator Station	L92.7	Luzerne	0.0	0.0	1.6	1.5	0.7	0.3	2.3	1.8
Luzerne County Subtotal			**0.0**	**0.0**	**1.6**	**1.5**	**0.7**	**0.3**	**2.3**	**1.8**

Notes:
[a] 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. The PCSM/SR BMPs will meet the water quality requirements of the local Act 167 study and PADEP requirements. Water Quality Worksheet #4 was used to complete the Control Guideline 1 (CG 1) volume analysis for the 2-year storm event. Stormwater models were created using the HydroCAD Version 7.10 computer program produced by HydroCAD Software Solutions, LLC. 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 (POI) were completed to meet Act 167 and PADEP 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: Downslope in existing stream.

Overall Site: Unnamed Tributary to Huntsville Creek

Volume Summary Table*

2- YR PRE (FT^3)	2- YR POST (FT^3)	2- YR VOLUME INCREASE (FT^3)	2- YR NONSTRUCTURAL CREDITS (FT^3)**	INCREASE (FT^3)
14,032	*16,380*	*2,348*	*580****	*1,768*

*See Appendix A for calculations.
** No structural volume credits have been taken.
*** Per PA BMP Manual Chapter 8, Section 8.8 no more than 25% of Volume Reduction can be met through Non-Structural BMP credits. Therefore only 580 c.f. (2,348*0.25=580) of the available 1,264 c.f. has been credited.

Runoff Rate Summary Table

STORM EVENT	PRE-DEVELOPMENT PEAK FLOW (CFS)	POST-DEVELOPMENT PEAK FLOW (CFS)	REDUCTION (CFS)
1-yr	***6.97***	***5.24***	***1.73***
2-yr	***10.41***	***8.71***	***1.70***
5-yr	***15.41***	***14.06***	***1.35***
10-yr	***19.70***	***18.45***	***1.25***
25-yr	***26.03***	***24.78***	***1.25***
50-yr	***31.10***	***29.92***	***1.18***
100-yr	***36.87***	***35.71***	***1.16***

*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 was designed to meet the Luzerne County Act 167 Phase II Stormwater Management Plan. This PCSM/SR narrative provides evidence that the Act 167 standards for stormwater runoff rate release, stormwater volume, and water quality are met.

Plan Requirements

The watersheds within Luzerne County were modeled to assess current and future drainage patterns. Release rates were recommended for some subbasins that are more restrictive than CG 1 requirements. However, the Site is not located in such a management district and will comply with release rates and water quality guidelines described in the Pennsylvania Stormwater Best Management Practices Manual (BMP Manual).

Rate Controls

Because the Site is not subject to more restrictive release rates, it has been designed to reduce the post-development flows to equal to or less than the pre-development flows for the 1-, 2-, 5-, 10-, 25-, 50- and 100-year storm events, as required by the Act 167 study.

Infiltration and Water Quality

The Luzerne County Act 167 Phase II requires that water quality and volume control design be provided to meet standards in the BMP Manual.

To minimize runoff volume increases a number of non-structural BMP's were considered for the site. Sensitive and natural resources were protected to the maximum extent practical. To minimize disturbance, the Site Limit of Disturbance was reduced to the minimum needed to construct the facility and associated pipeline. Gravel cover was used in lieu of pavement to minimize impervious cover. Impervious and gravel areas are disconnected from stormwater conveyance systems. As a result of these BMP's, some, but not all of the 2 year, 24-hr stormwater volume increase was managed. Therefore, non-structural BMP's were considered for further stormwater volume reduction.

Multiple structural volume reduction BMP's were evaluated to determine if CG1 volume control guidelines could be met. During evaluation of the site, it was discovered that seasonal high groundwater and bedrock elevations are almost at surface elevations. As a result, no excavation or construction of infiltration BMP's is feasible. Vegetative roofs and water reuse BMP's are impractical due to the nature of the use including operation and maintenance concerns. As a result the post development runoff volume will exceed the pre development runoff volume for the site.

Because the Site cannot meet volume control guidelines recommended in the BMP Manual the stormwater management design was developed to comply with water quality criteria set forth in the BMP Manual. PADEP water quality and pollutant removal worksheets 12 and 13 were prepared to demonstrate compliance with the BMP manual requirements.

Consistency Verification

The PCSM was prepared under the supervision of a Professional Engineer, licensed in Pennsylvania, with experience and training related to E&SC and PCSM/SR. The PCSM/SR Plans attached to this PCSM/SR Narrative demonstrates that the Site is consistent with the Luzerne County Act 167 Phase II Stormwater Management Plan.

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 an unnamed tributary (UNT) of Huntsville Creek, 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 provide pollutant removal and stormwater runoff rate managment.

Rain Garden: A rain garden will be utilized to provide runoff rate control. The rain garden will also provide nutrient pollutant removal.

Protect Sensitive and Special Value Features: Sensitive and special value features will be protected to reduce stormwater impacts. Construction activities will be conducted in a manner that avoids affecting and encroaching upon areas with important stormwater functions or stormwater impact sensitivities wherever practical so that the valuable functions are preserved. This BMP is proposed to account for a portion of the required volume reduction credit.

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 rain garden areas and vegetated swales. This BMP is proposed to account for a portion of the required volume reduction credit.

Soil Amendment and Restoration: Soil amendments shall be added to rain garden and floodway areas after construction to restore soil porosity and enhance long term pollutant removal. This BMP is proposed to account for any pollutant removal or volume reduction requirements over and above those of the rain garden.

Reduce parking impervious area: Impervious parking areas will be minimized to the maximum extent practicable. The access road and pad will be gravel areas. This BMP is proposed to account for a portion of the required volume reduction credit.

1.7 BMP Installation Sequence Narrative

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. Install orange construction fence around areas to be protected.

4. Locate staging areas and access points including construction entrances. Field locate limits of disturbance.

5. Install rock construction entrances (RCEs).

6. 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.

7. 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.

8. *** Install permanent access roads and associated BMPs (Vegetated Roadside Swales 1A and 1B and riprap outlet protection). Do not install Earthen Check Dams at this time. Immediately install channel lining, seed and mulch in swales.**

9. *** Install Vegetated Swale 2. Install drainage channel aprons as soon as swale grading is complete. Do not install Earthen Check Dams at this time. Immediately install channel lining, seed and mulch in swales.**

10. *** Begin installing rain garden with discharge culvert and associated headwall, outlet protection. Install orange construction fence at perimeter to prevent compaction of soils. Install filter sock at base of rain garden to**

prevent the migration of sediments during construction. Immediately stabilize disturbed areas as site reaches finished grade.

11. Proceed with major clearing and grubbing.

12. Begin construction staking for grading.

13. Begin grading and strip and stockpile topsoil within the regulator station area and install sediment barriers around stockpiles.

14. 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).

15. Rough grade Site.

16. Grade the regulator station pad as shown on the E&SC and PCSM/SR Plans (**Sections 2 and 3 of the ESCGP-2 NOI**).

17. 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.

18. Install ditch relief culverts with associated outlet protection. Immediately seed, stabilize and install erosion control blanket when channel reaches final grade.

19. Resurface access road.

20. Establish final grade.

21. Surface Stabilization, apply permanent stabilization measures immediately to any disturbed areas where work has reached final grade.

22. *** Complete soil amendment in areas designated on the PCSM/SR Plans (Section 3 of the ESCGP-2 NOI).**

23. 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.

24. *** Install emergency spillway and establish final grading for rain garden configuration. Amend soil, seed, and stabilize basin.**

25. ***Remove accumulated sediments in vegetative swales. Install *Earthen Check Dams* in swales 1A, 1B and 2**.

26. After finish grading and topsoil placement is completed, disturbed areas shall be 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**).

27. After seeding, fertilizing and mulching is complete, install ECBs as required or ordered or on slopes of than 3:1 or greater.

28. 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.

29. Complete Site stabilization, including seed application, slope blanket installation in rain garden, and mulching.

30. 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.

31. Maintain E&SC BMPs until Site work is complete and uniform 70% perennial vegetative cover is established.

32. Remove and properly dispose/recycle remaining composite filter socks. Remove orange construction fence. Repair and permanently stabilize areas disturbed during E&SC BMP removal upon establishment of uniform 70% vegetative cover.

*** 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.**

1.8 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 North Diamond Regulator 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 Garden Facility

   Inspect rain garden facility ***annually*** and inspect soil 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 with ***Earthen*** Check Dams

   Vegetated swales with Earthen Check Dams 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. Protect Sensitive/Special Value Features

   Protected areas shall remain undisturbed after construction activities cease. Orange construction fence will be used to protect special value/sensitive areas during construction.

4. 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**).

5. Soil Amendment and Restoration

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

6. 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.

7. 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.

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 waste and all other wastes generated during operation and maintenance activities shall be properly managed and disposed of in accordance with local, state and federal requirments.

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.

- PCSM/SR BMPs incorporate the use of water quality and rate managment facilities such as a rain garden and vegetated swales with ***Earthen*** Check Dams.

- The removal of vegetation, especially tree cover, will be limited to only that necessary for construction.

- The amount of impervious surfaces will be limited to only that necessary to support the construction of the facility.

- The impacts to existing riparian corridors will be limited to only that necessary for construction.

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

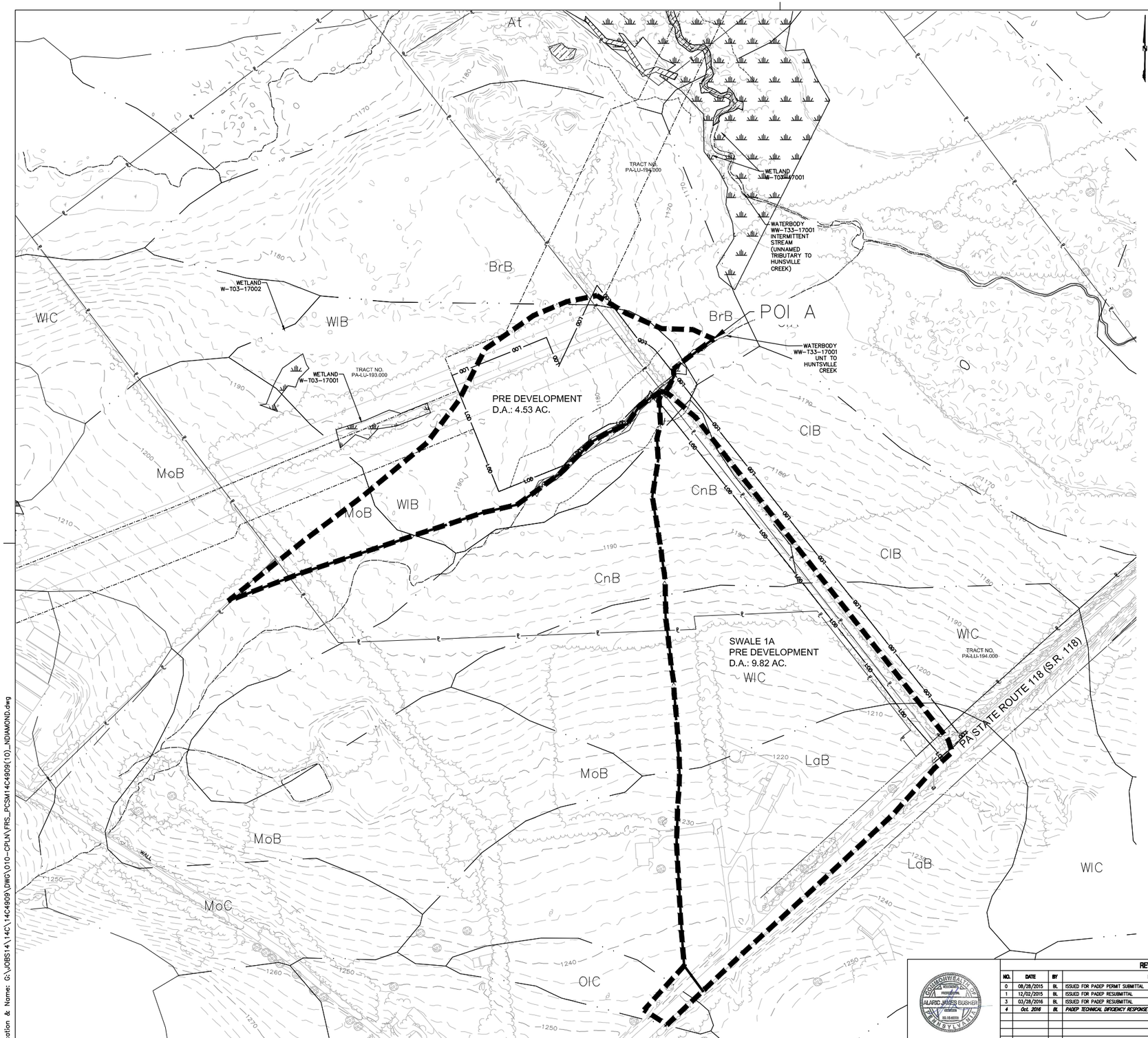
See Attachment 9 of the **ECP** within **Section 4 of the ESCGP-2 NOI** for the Preparedness Prevention and Contingency Plan provided.

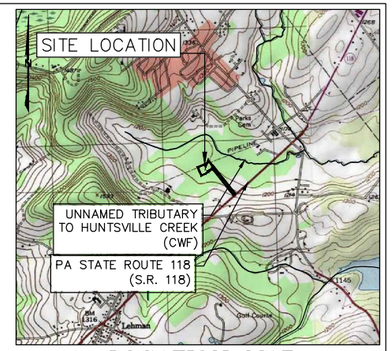
APPENDICES

APPENDIX A

North Diamond Regulator Station Supporting Calculations

A.1 Pre-Development Calculations





LOCATION MAP

USGS HARVEYS LAKE QUADRANGLE
SCALE: 1"=2,000'

LEGEND

- PROPERTY BOUNDARY LINE (APPROXIMATE)
- 1460 EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' INTERVAL)
- FENCE
- STONE ROW
- SOIL BOUNDARY
- TREELINE
- CENTERLINE STREAM/EDGE WATERBODY
- DELINEATED WETLANDS
- × 1353.0 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)
- WsB SOIL TYPE DESIGNATION
- ESCGP2 ESCGP-2 PERMIT BOUNDARY
- LOD LIMIT OF DISTURBANCE (NORTH DIAMOND REGULATOR STATION)
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- EXISTING ROAD
- ROW
- LIMITS OF FLOODWAY/ FLOODPLAN
- DRAINAGE AREA BOUNDARIES
- TIME OF CONCENTRATION FLOW PATH

GRAPHIC SCALE
100 50 0 100
SCALE IN FEET
1 inch = 100 ft.

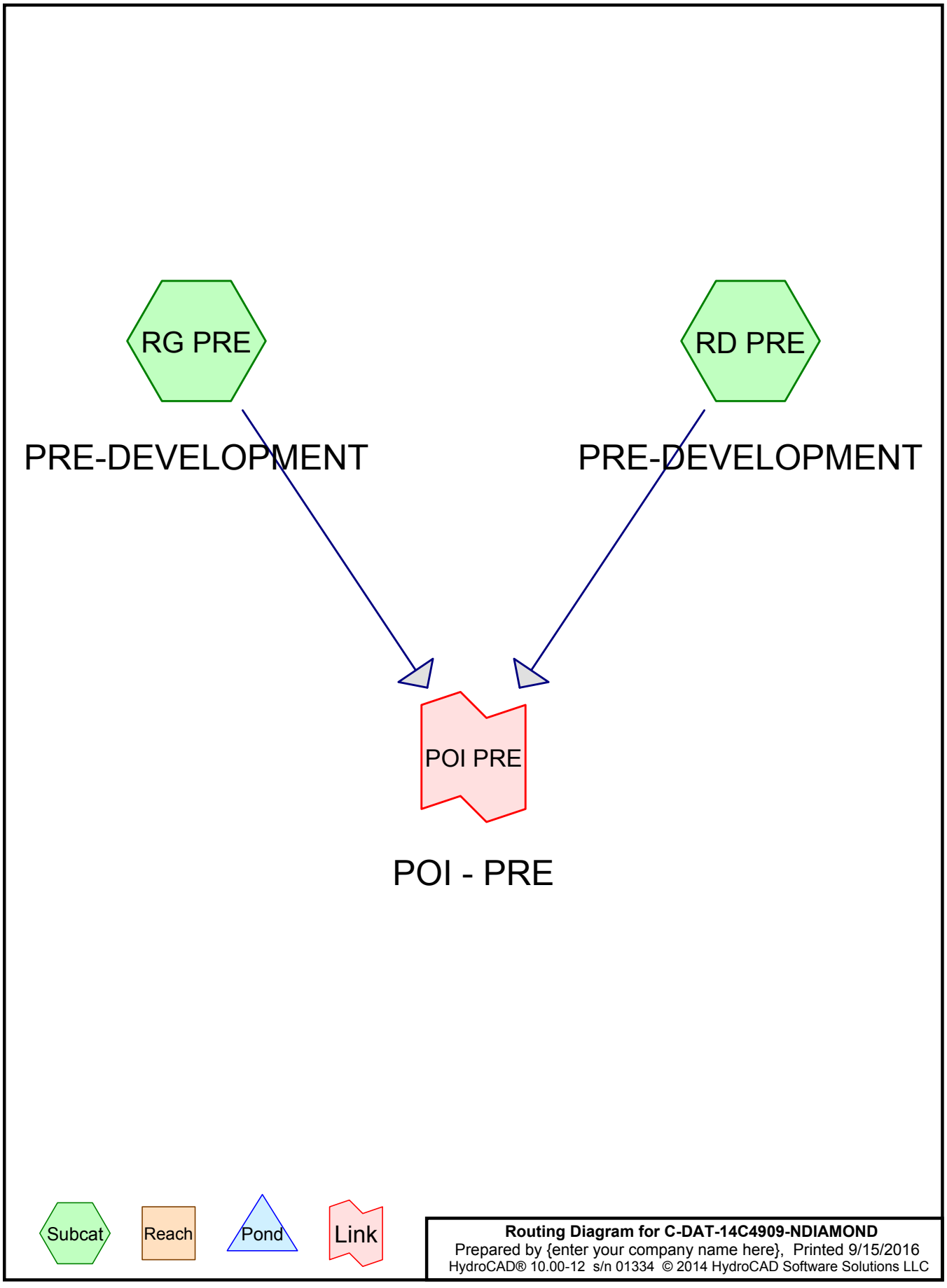
ALARIC J. BUSHER REG NO. PE 60320

REVISIONS						
NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
0	08/28/2015	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	W01161499	DAK	AJB
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL	W01161499	DAK	AJB
3	03/28/2016	BL	ISSUED FOR PADEP RESUBMITTAL	W01161499	AJB	AJB
4	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	W01161499	AJB	AJB

TRANSCONTINENTAL GAS PIPELINE COMPANY LLC
ATLANTIC SUNRISE PROJECT– PROPOSED 30" NATURAL GAS PIPELINE
POST CONSTRUCTION STORMWATER MANAGEMENT PLANS FOR NORTH
DIAMOND REGULATOR STATION & ASSOCIATED PERMANENT ACCESS ROADS
LEHMAN TOWNSHIP, LUZERNE COUNTY, PENNSYLVANIA
PRE–DEVELOPMENT DRAINAGE AREA MAP

DRAWN BY:	JEC	DATE:	04/03/15	ISSUED FOR BID:	SCALE: AS NOTED
CHECKED BY:	AJB	DATE:	04/03/15	ISSUED FOR CONSTRUCTION:	REVISION: 4
APPROVED BY:	AJB	DATE:	07/17/15	DRAWING NUMBER: (36–7935)MF–1A–9	SHEET 1 OF 1
WO:	1161499				

Drawing Location & Name: G:\JOBS14\14C\14C4909\DWG\010-CPLN\FRS_PCSM14C4909(10)_NDIAMOND.dwg



Routing Diagram for C-DAT-14C4909-NDIAMOND
Prepared by {enter your company name here}, Printed 9/15/2016
HydroCAD® 10.00-12 s/n 01334 © 2014 HydroCAD Software Solutions LLC

Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

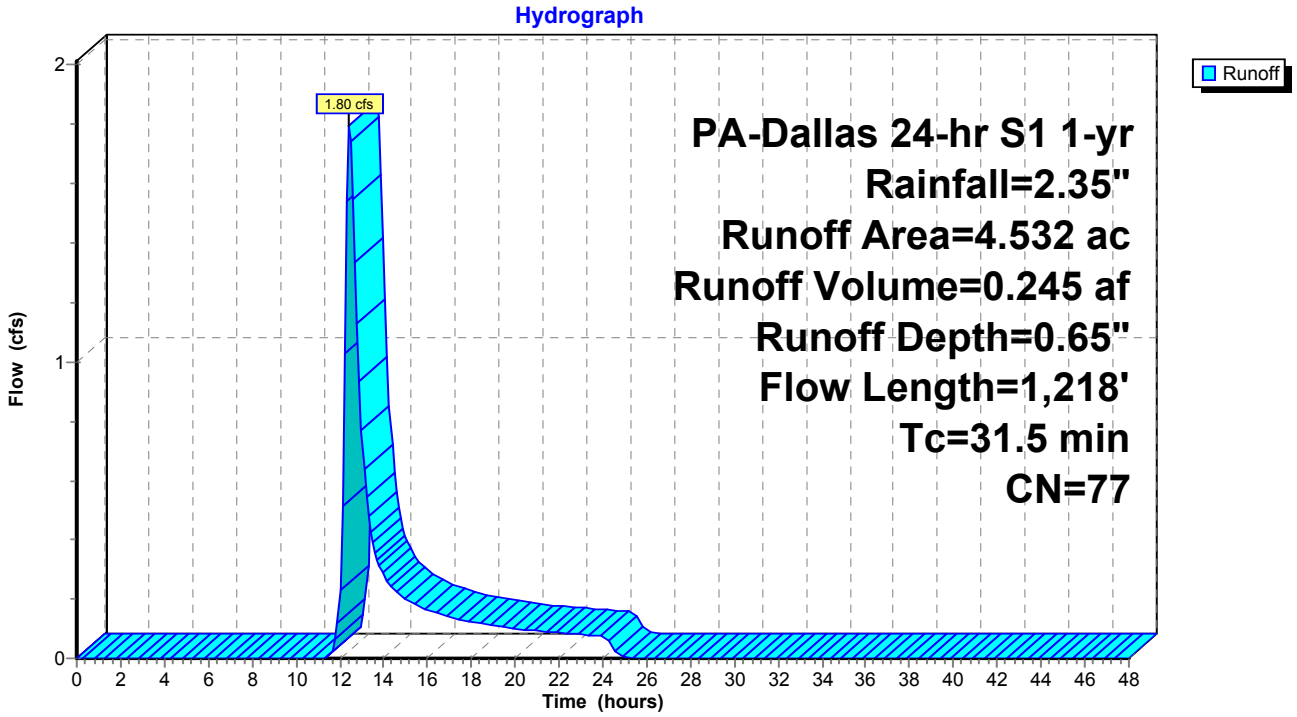
Runoff = 1.80 cfs @ 12.44 hrs, Volume= 0.245 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 1-yr Rainfall=2.35"

	Area (ac)	CN	Description
	3.700	77	Woods, Good, HSG D
	0.832	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	4.532	77	Weighted Average
	4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	100	0.0400	0.10		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
0.8	39	0.0256	0.80		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.6	53	0.0377	1.36		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
9.6	476	0.0273	0.83		**Shallow Concentrated Flow, SCF 3** Woodland Kv= 5.0 fps
3.1	550	0.0382	2.93		**Shallow Concentrated Flow, SCF 4** Grassed Waterway Kv= 15.0 fps
31.5	1,218	Total			

Subcatchment RG PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

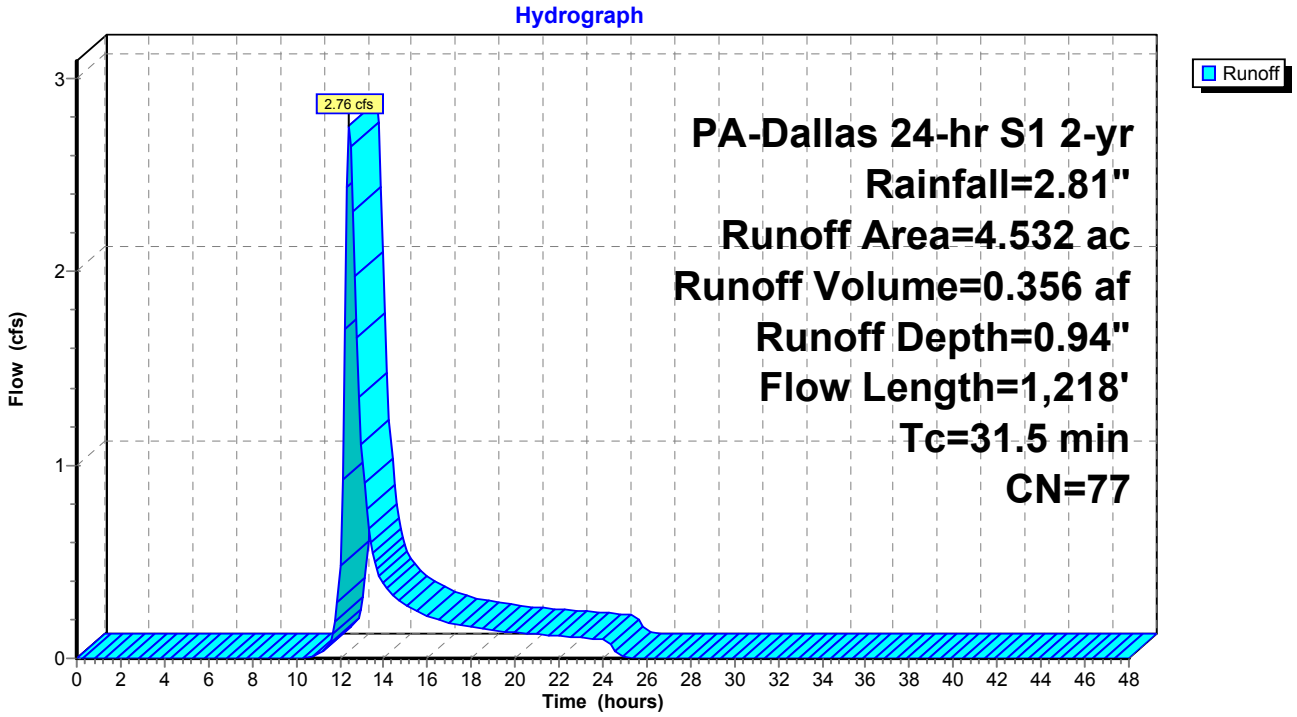
Runoff = 2.76 cfs @ 12.43 hrs, Volume= 0.356 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 2-yr Rainfall=2.81"

	Area (ac)	CN	Description
	3.700	77	Woods, Good, HSG D
	0.832	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	4.532	77	Weighted Average
	4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	100	0.0400	0.10		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
0.8	39	0.0256	0.80		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.6	53	0.0377	1.36		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
9.6	476	0.0273	0.83		**Shallow Concentrated Flow, SCF 3** Woodland Kv= 5.0 fps
3.1	550	0.0382	2.93		**Shallow Concentrated Flow, SCF 4** Grassed Waterway Kv= 15.0 fps
31.5	1,218	Total			

Subcatchment RG PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

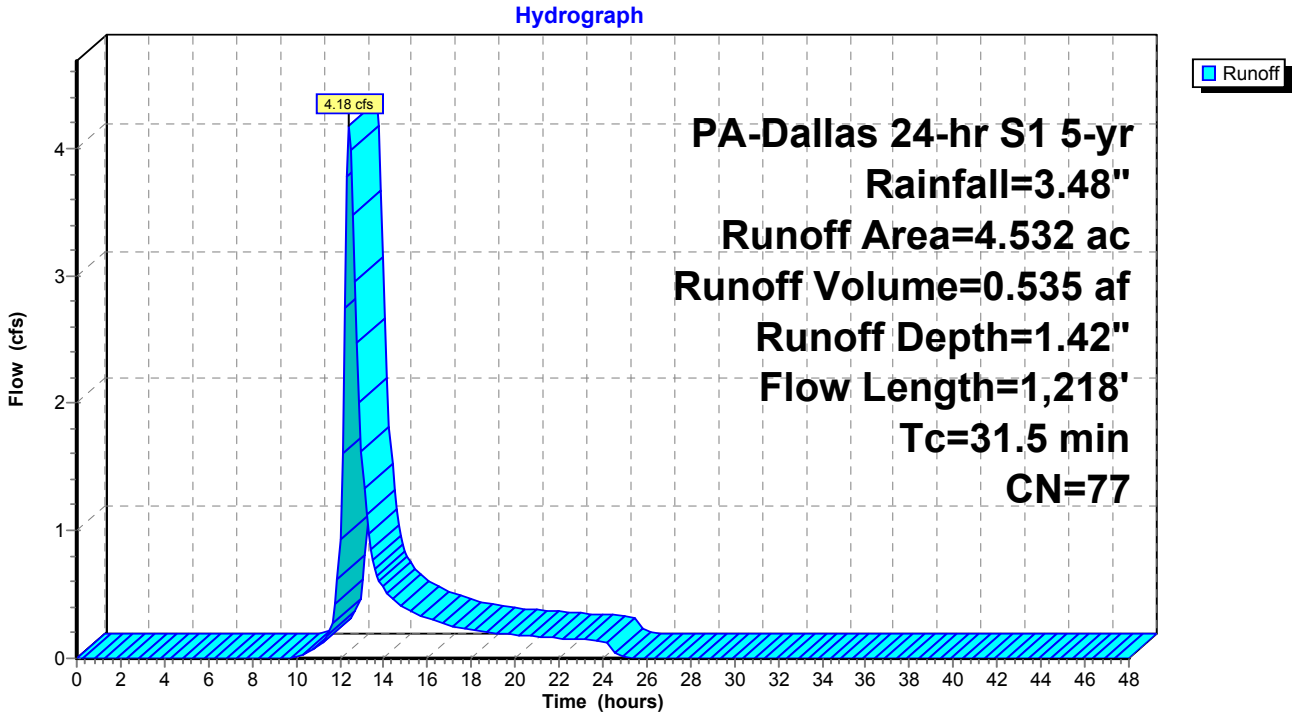
Runoff = 4.18 cfs @ 12.42 hrs, Volume= 0.535 af, Depth= 1.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 5-yr Rainfall=3.48"

	Area (ac)	CN	Description
	3.700	77	Woods, Good, HSG D
	0.832	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	4.532	77	Weighted Average
	4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	100	0.0400	0.10		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
0.8	39	0.0256	0.80		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.6	53	0.0377	1.36		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
9.6	476	0.0273	0.83		**Shallow Concentrated Flow, SCF 3** Woodland Kv= 5.0 fps
3.1	550	0.0382	2.93		**Shallow Concentrated Flow, SCF 4** Grassed Waterway Kv= 15.0 fps
31.5	1,218	Total			

Subcatchment RG PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

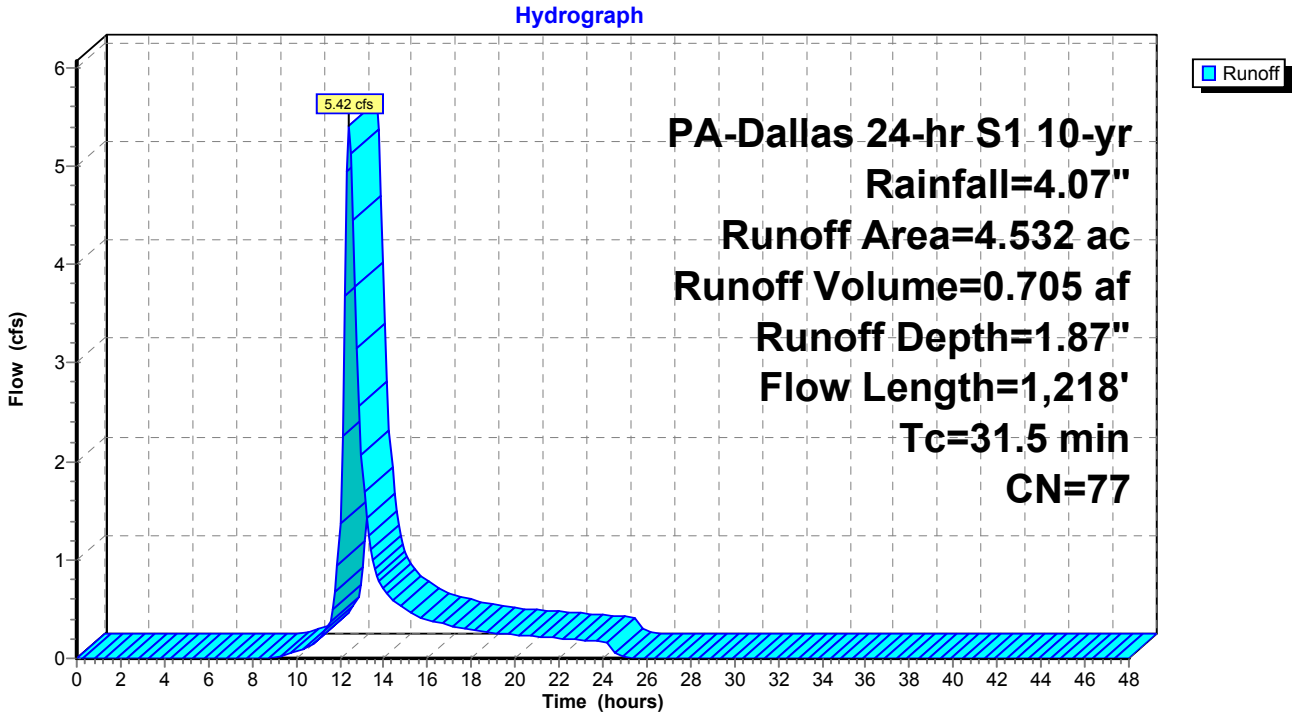
Runoff = 5.42 cfs @ 12.41 hrs, Volume= 0.705 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 10-yr Rainfall=4.07"

	Area (ac)	CN	Description
	3.700	77	Woods, Good, HSG D
	0.832	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	4.532	77	Weighted Average
	4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	100	0.0400	0.10		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
0.8	39	0.0256	0.80		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.6	53	0.0377	1.36		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
9.6	476	0.0273	0.83		**Shallow Concentrated Flow, SCF 3** Woodland Kv= 5.0 fps
3.1	550	0.0382	2.93		**Shallow Concentrated Flow, SCF 4** Grassed Waterway Kv= 15.0 fps
31.5	1,218	Total			

Subcatchment RG PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

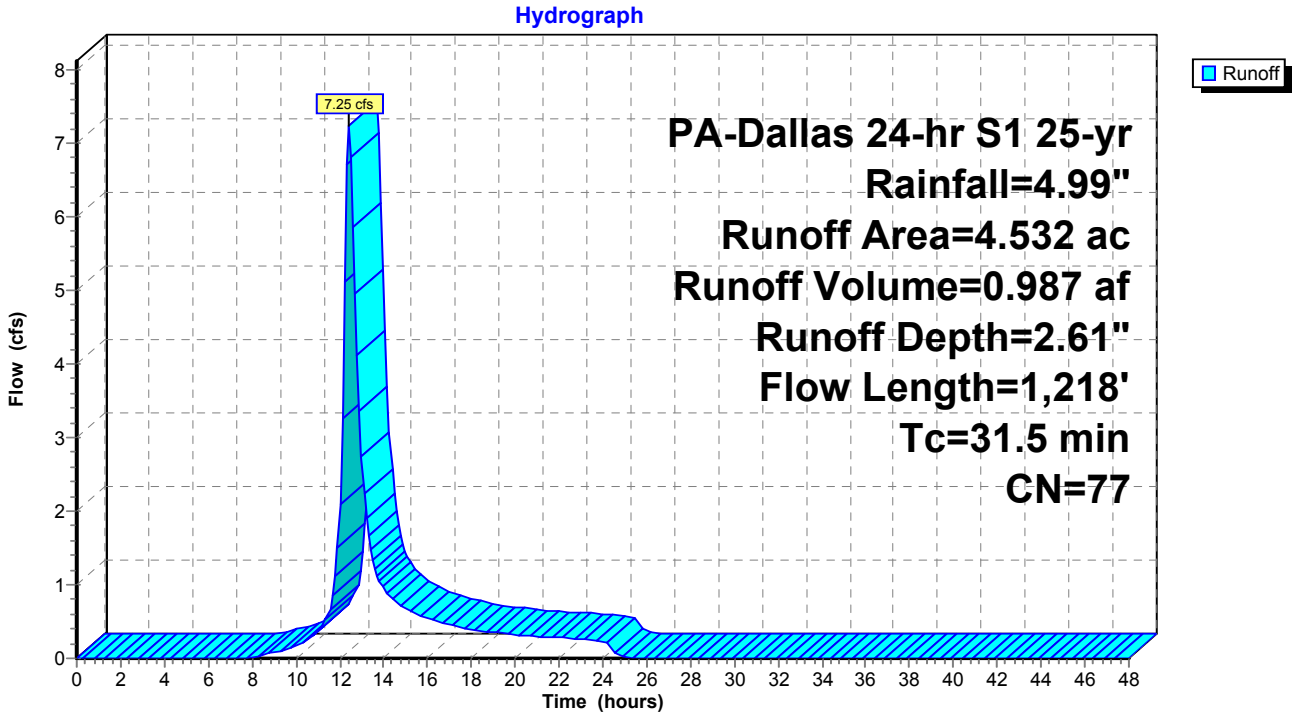
Runoff = 7.25 cfs @ 12.40 hrs, Volume= 0.987 af, Depth= 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 25-yr Rainfall=4.99"

	Area (ac)	CN	Description
	3.700	77	Woods, Good, HSG D
	0.832	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	4.532	77	Weighted Average
	4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	100	0.0400	0.10		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
0.8	39	0.0256	0.80		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.6	53	0.0377	1.36		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
9.6	476	0.0273	0.83		**Shallow Concentrated Flow, SCF 3** Woodland Kv= 5.0 fps
3.1	550	0.0382	2.93		**Shallow Concentrated Flow, SCF 4** Grassed Waterway Kv= 15.0 fps
31.5	1,218	Total			

Subcatchment RG PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

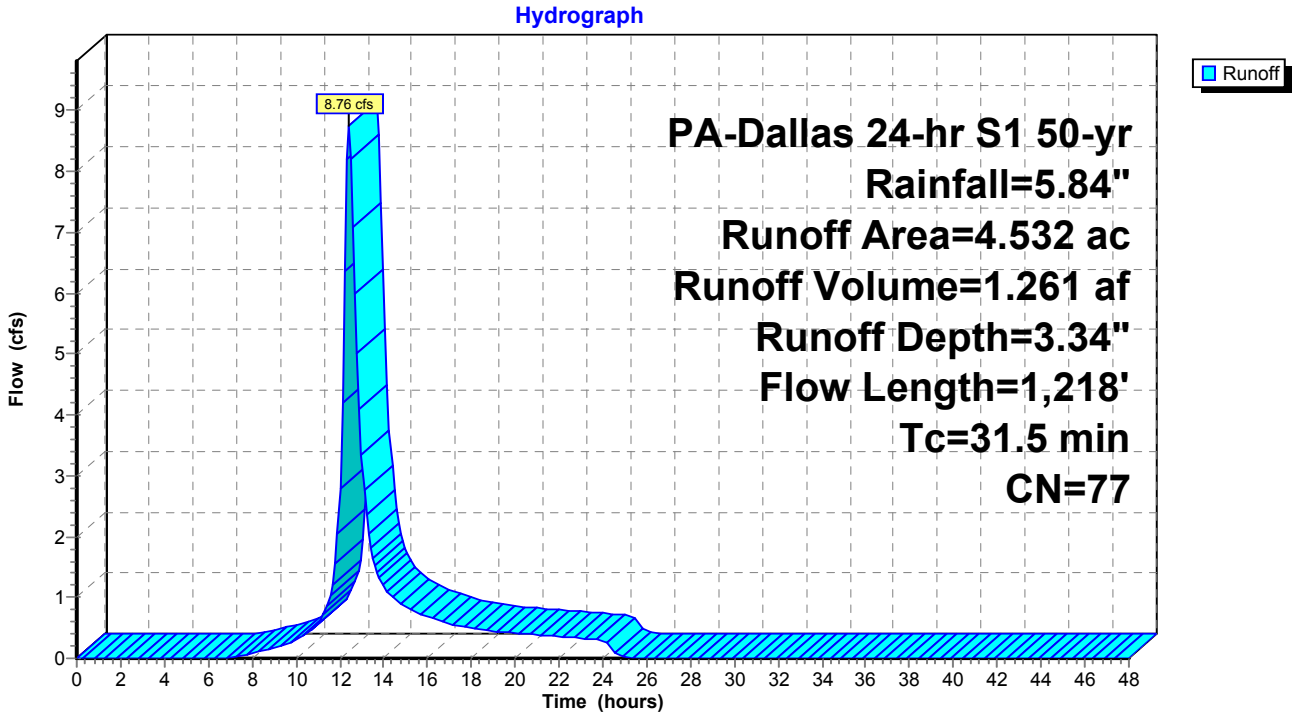
Runoff = 8.76 cfs @ 12.40 hrs, Volume= 1.261 af, Depth= 3.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 50-yr Rainfall=5.84"

	Area (ac)	CN	Description
	3.700	77	Woods, Good, HSG D
	0.832	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	4.532	77	Weighted Average
	4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	100	0.0400	0.10		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
0.8	39	0.0256	0.80		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.6	53	0.0377	1.36		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
9.6	476	0.0273	0.83		**Shallow Concentrated Flow, SCF 3** Woodland Kv= 5.0 fps
3.1	550	0.0382	2.93		**Shallow Concentrated Flow, SCF 4** Grassed Waterway Kv= 15.0 fps
31.5	1,218	Total			

Subcatchment RG PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

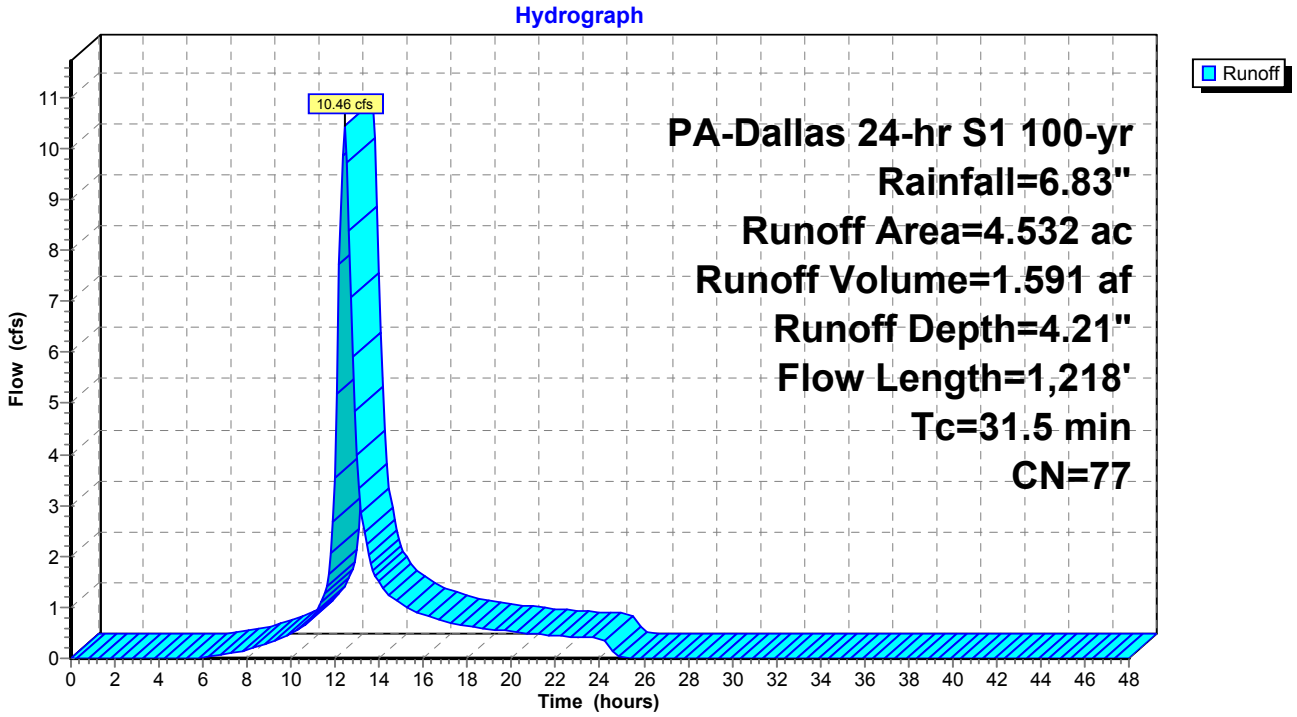
Runoff = 10.46 cfs @ 12.40 hrs, Volume= 1.591 af, Depth= 4.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 100-yr Rainfall=6.83"

	Area (ac)	CN	Description
	3.700	77	Woods, Good, HSG D
	0.832	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	4.532	77	Weighted Average
	4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	100	0.0400	0.10		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
0.8	39	0.0256	0.80		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.6	53	0.0377	1.36		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
9.6	476	0.0273	0.83		**Shallow Concentrated Flow, SCF 3** Woodland Kv= 5.0 fps
3.1	550	0.0382	2.93		**Shallow Concentrated Flow, SCF 4** Grassed Waterway Kv= 15.0 fps
31.5	1,218	Total			

Subcatchment RG PRE: PRE-DEVELOPMENT



Summary for Subcatchment RD PRE: PRE-DEVELOPMENT

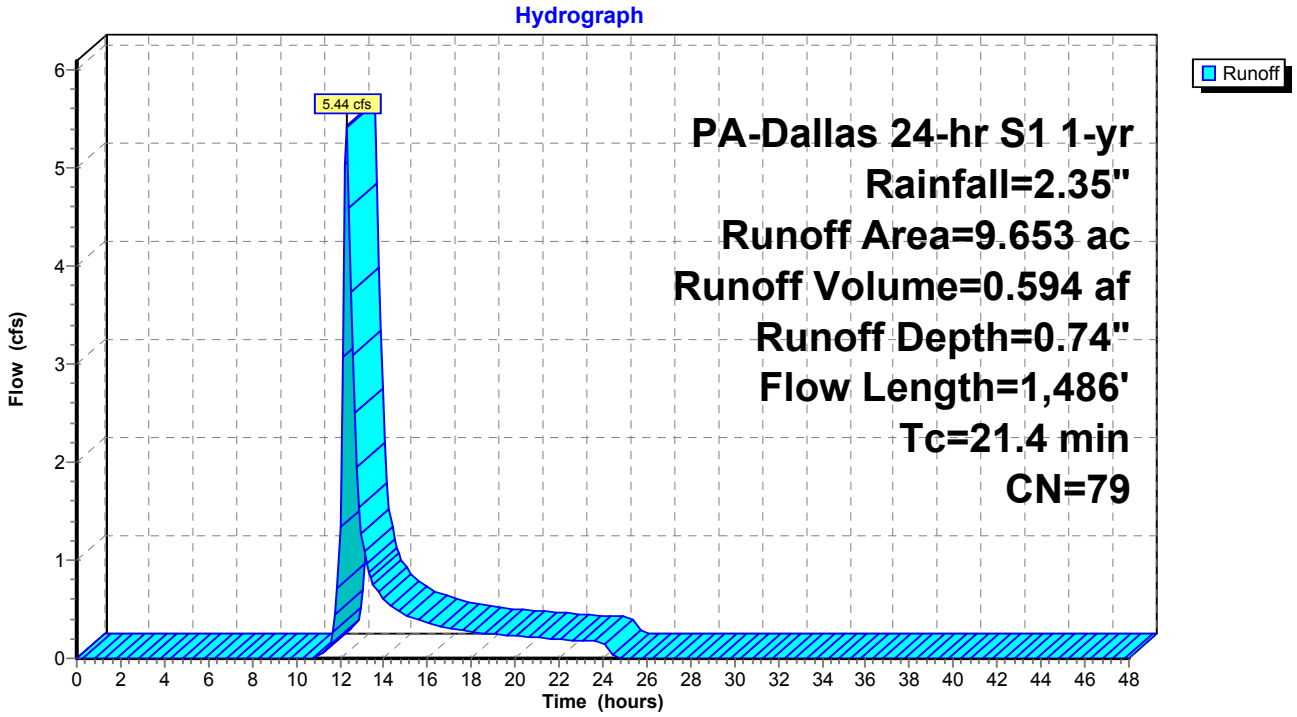
Runoff = 5.44 cfs @ 12.28 hrs, Volume= 0.594 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 1-yr Rainfall=2.35"

	Area (ac)	CN	Description
	2.982	77	Woods, Good, HSG D
	5.821	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.850	98	Impervious areas, HSG D
	9.653	79	Weighted Average
	8.803		91.19% Pervious Area
	0.850		8.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	44	0.0227	0.34		**Sheet Flow, SHT 1** Fallow n= 0.050 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
21.4	1,486	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RD PRE: PRE-DEVELOPMENT

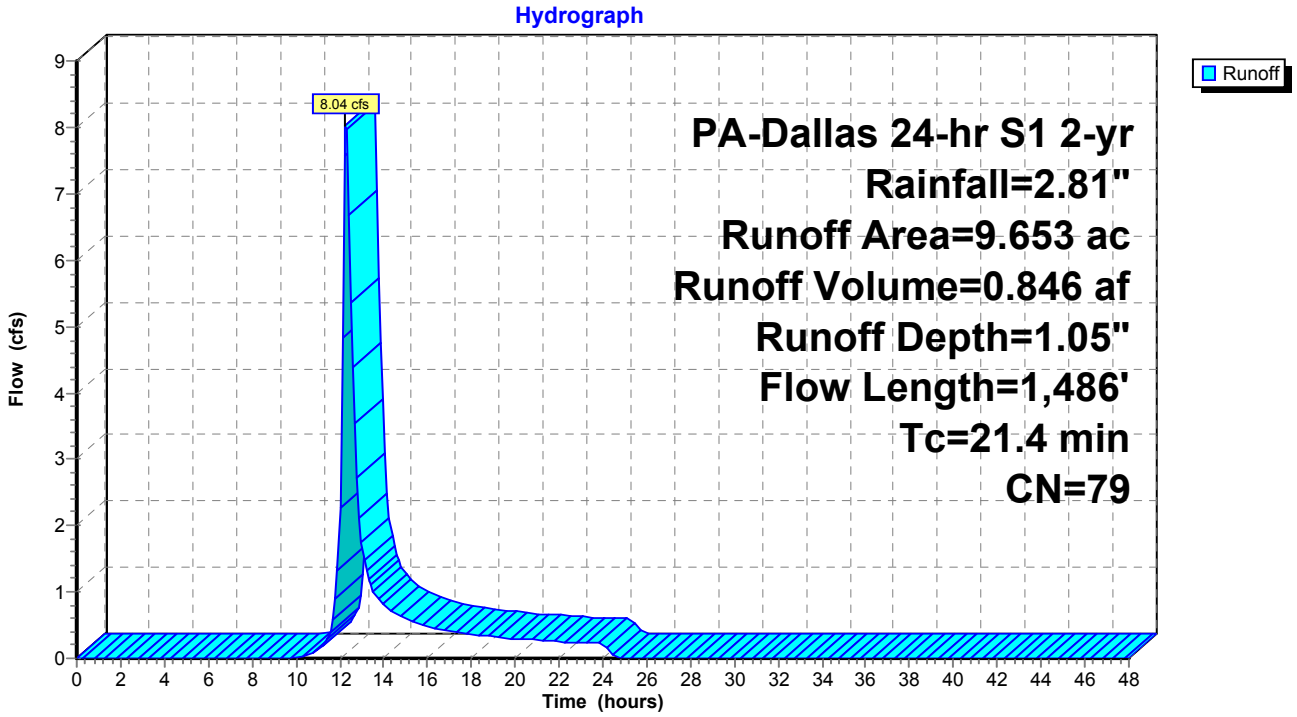
Runoff = 8.04 cfs @ 12.27 hrs, Volume= 0.846 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 2-yr Rainfall=2.81"

	Area (ac)	CN	Description
	2.982	77	Woods, Good, HSG D
	5.821	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.850	98	Impervious areas, HSG D
	9.653	79	Weighted Average
	8.803		91.19% Pervious Area
	0.850		8.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	44	0.0227	0.34		**Sheet Flow, SHT 1** Fallow n= 0.050 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
21.4	1,486	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RD PRE: PRE-DEVELOPMENT

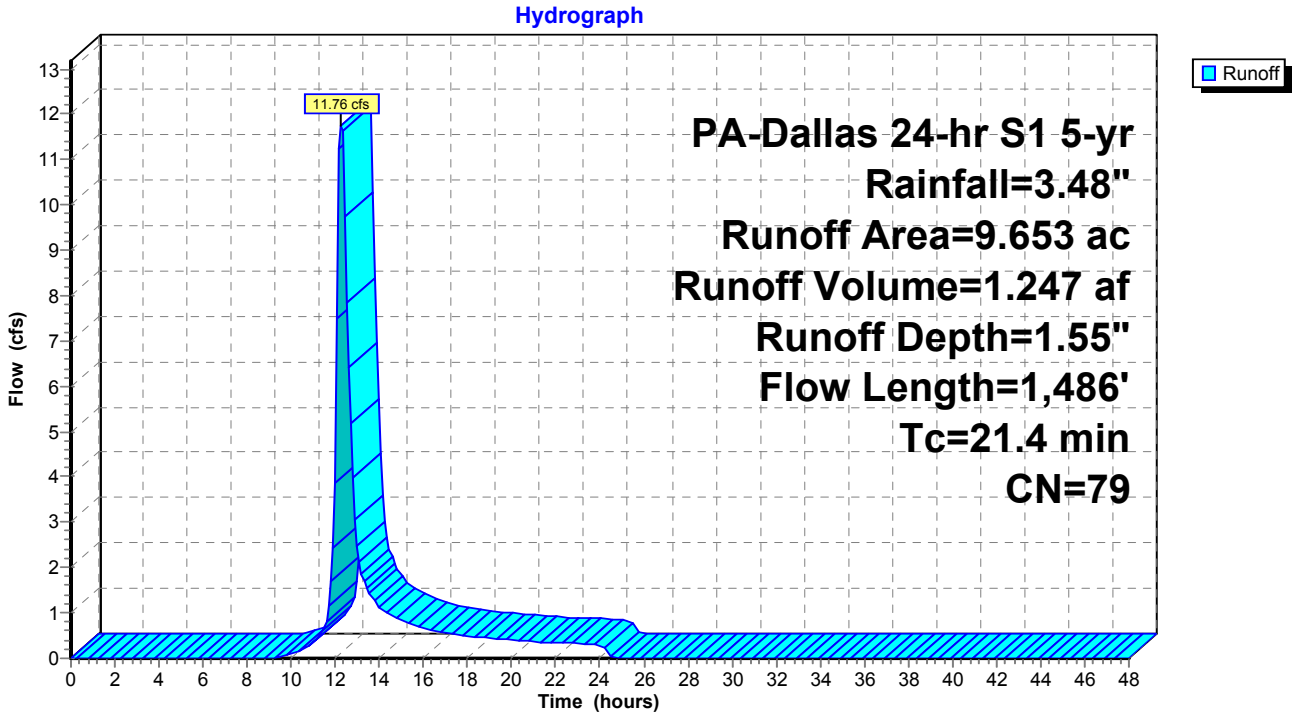
Runoff = 11.76 cfs @ 12.27 hrs, Volume= 1.247 af, Depth= 1.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 5-yr Rainfall=3.48"

	Area (ac)	CN	Description
	2.982	77	Woods, Good, HSG D
	5.821	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.850	98	Impervious areas, HSG D
	9.653	79	Weighted Average
	8.803		91.19% Pervious Area
	0.850		8.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	44	0.0227	0.34		**Sheet Flow, SHT 1** Fallow n= 0.050 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
21.4	1,486	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RD PRE: PRE-DEVELOPMENT

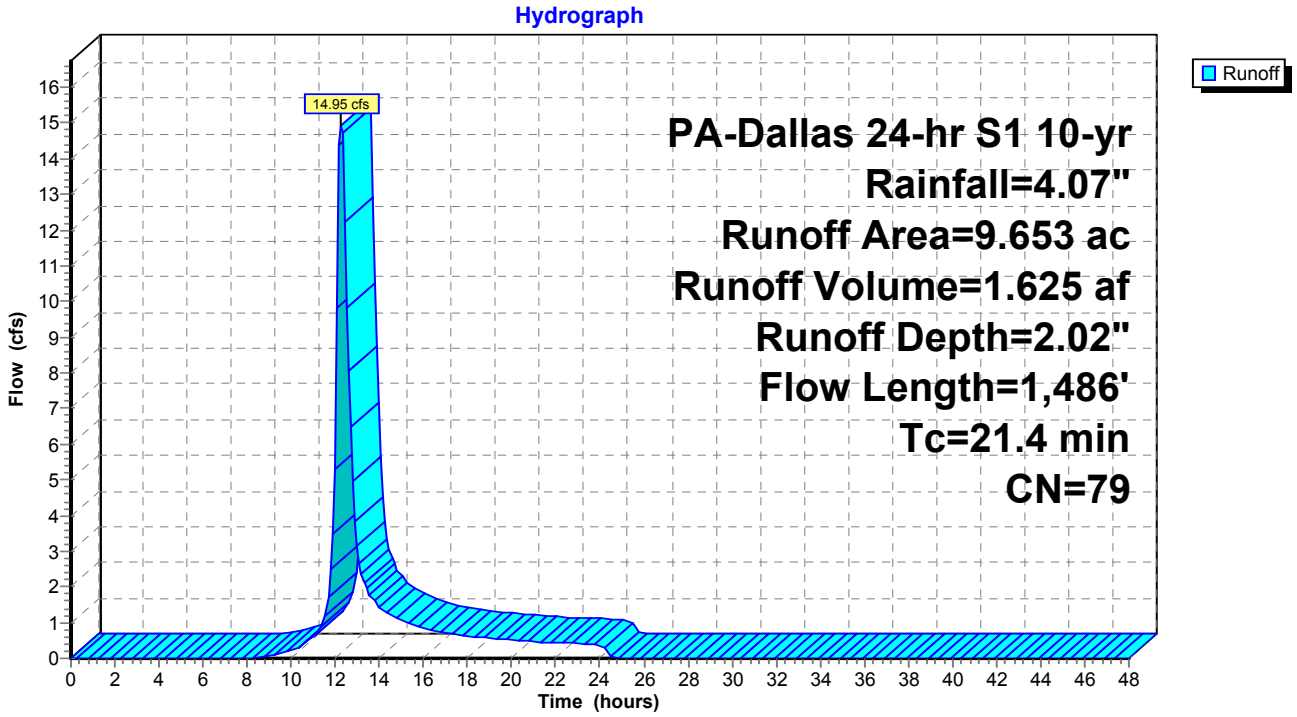
Runoff = 14.95 cfs @ 12.26 hrs, Volume= 1.625 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 10-yr Rainfall=4.07"

	Area (ac)	CN	Description
	2.982	77	Woods, Good, HSG D
	5.821	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.850	98	Impervious areas, HSG D
	9.653	79	Weighted Average
	8.803		91.19% Pervious Area
	0.850		8.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	44	0.0227	0.34		**Sheet Flow, SHT 1** Fallow n= 0.050 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
21.4	1,486	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RD PRE: PRE-DEVELOPMENT

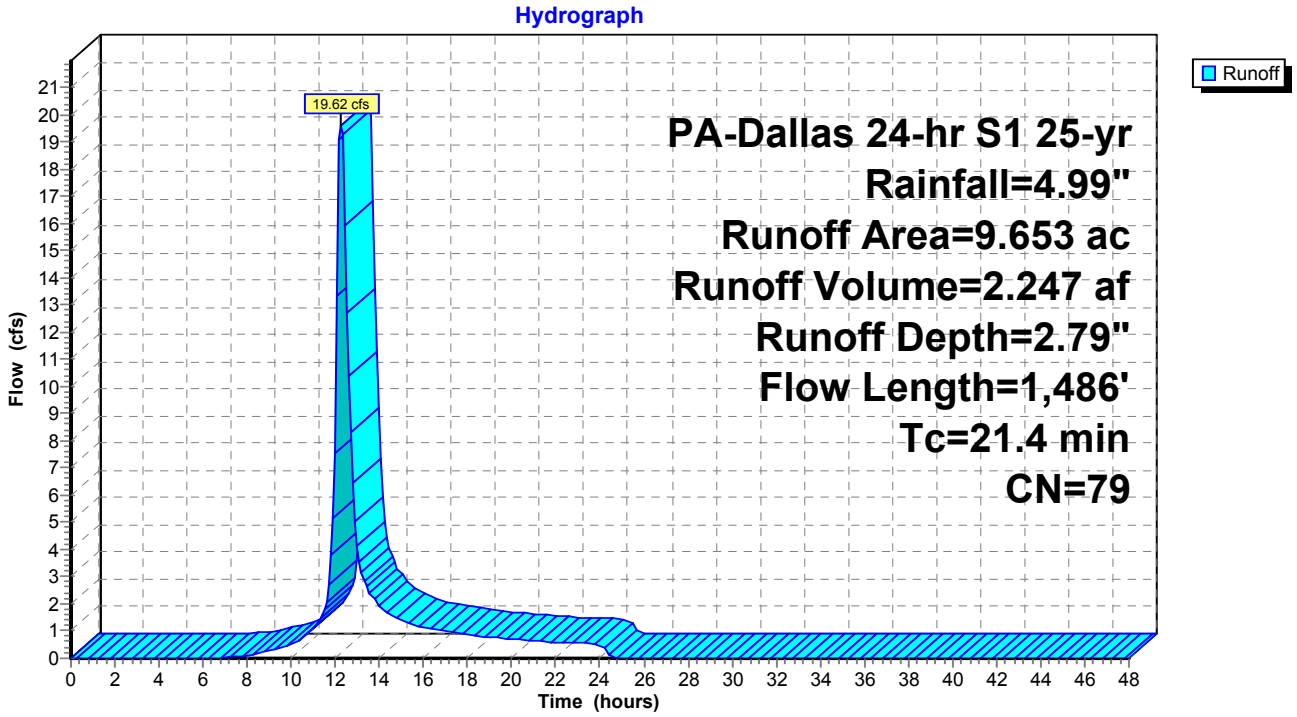
Runoff = 19.62 cfs @ 12.26 hrs, Volume= 2.247 af, Depth= 2.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 25-yr Rainfall=4.99"

	Area (ac)	CN	Description
	2.982	77	Woods, Good, HSG D
	5.821	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.850	98	Impervious areas, HSG D
	9.653	79	Weighted Average
	8.803		91.19% Pervious Area
	0.850		8.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	44	0.0227	0.34		**Sheet Flow, SHT 1** Fallow n= 0.050 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
21.4	1,486	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RD PRE: PRE-DEVELOPMENT

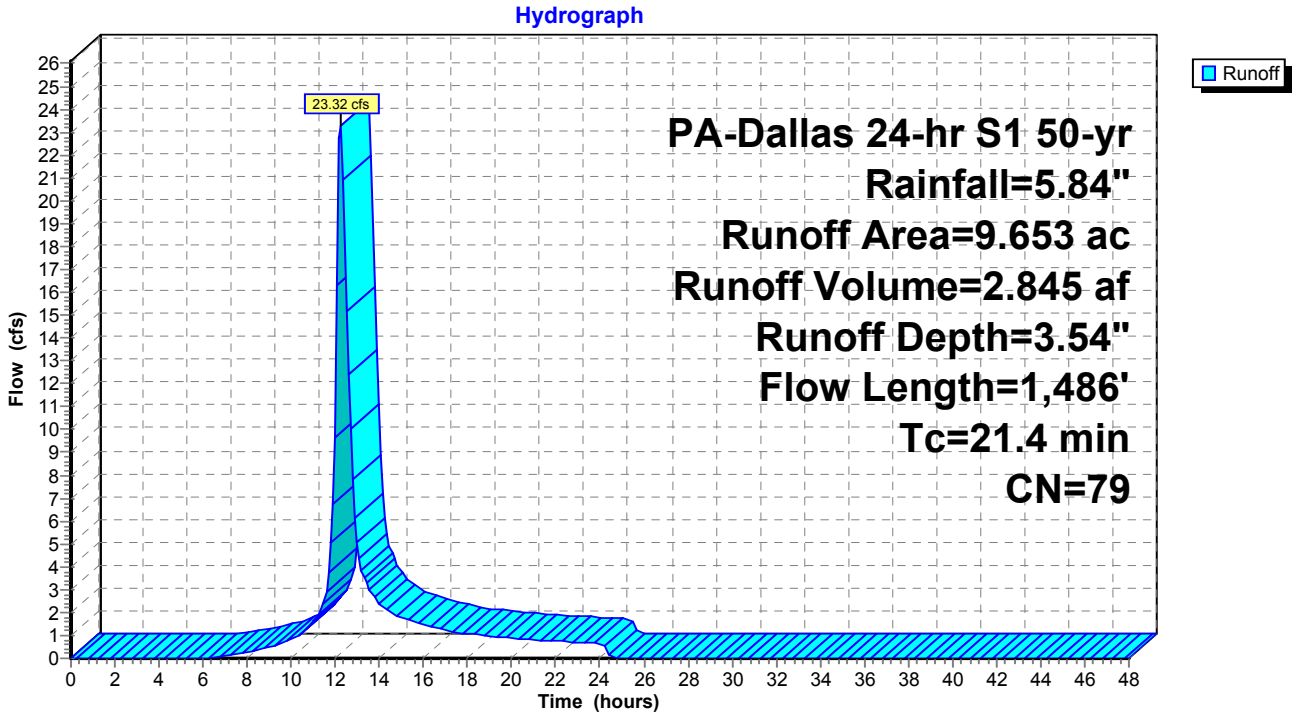
Runoff = 23.32 cfs @ 12.25 hrs, Volume= 2.845 af, Depth= 3.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 50-yr Rainfall=5.84"

	Area (ac)	CN	Description
	2.982	77	Woods, Good, HSG D
	5.821	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.850	98	Impervious areas, HSG D
	9.653	79	Weighted Average
	8.803		91.19% Pervious Area
	0.850		8.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	44	0.0227	0.34		**Sheet Flow, SHT 1** Fallow n= 0.050 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
21.4	1,486	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RD PRE: PRE-DEVELOPMENT

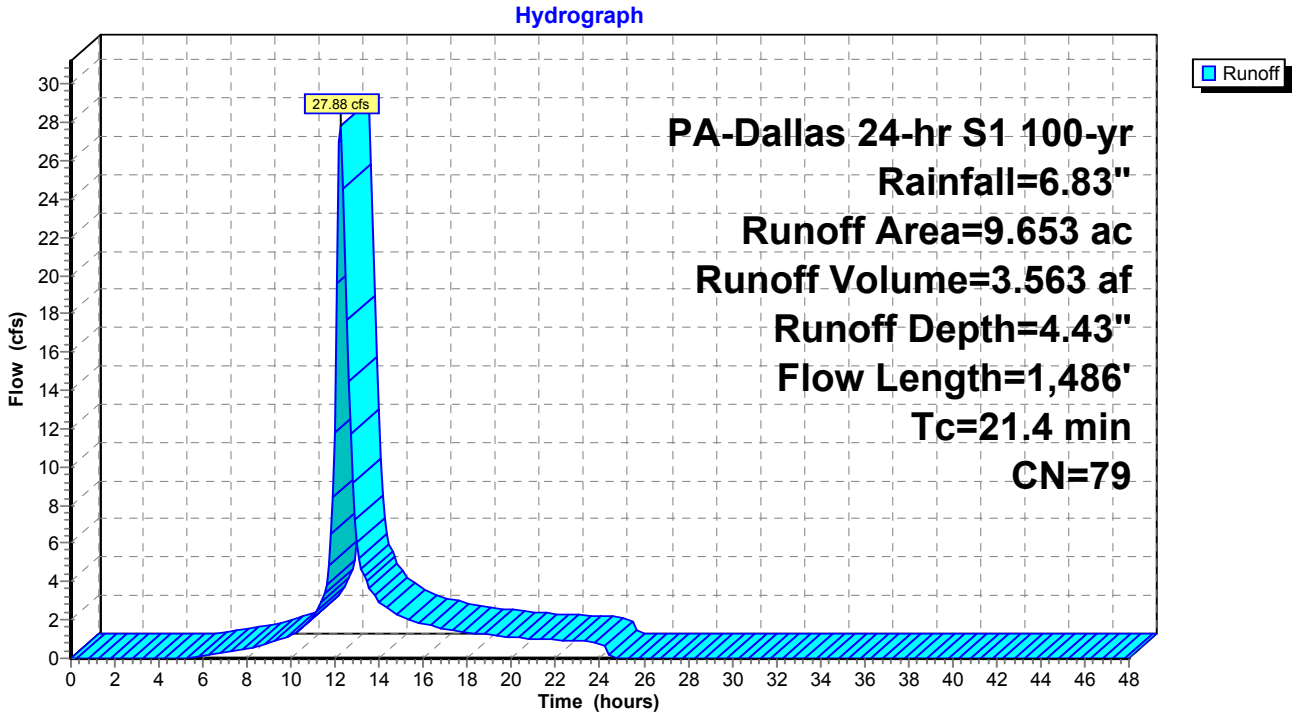
Runoff = 27.88 cfs @ 12.25 hrs, Volume= 3.563 af, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 100-yr Rainfall=6.83"

	Area (ac)	CN	Description
	2.982	77	Woods, Good, HSG D
	5.821	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.850	98	Impervious areas, HSG D
	9.653	79	Weighted Average
	8.803		91.19% Pervious Area
	0.850		8.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	44	0.0227	0.34		**Sheet Flow, SHT 1** Fallow n= 0.050 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
21.4	1,486	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT

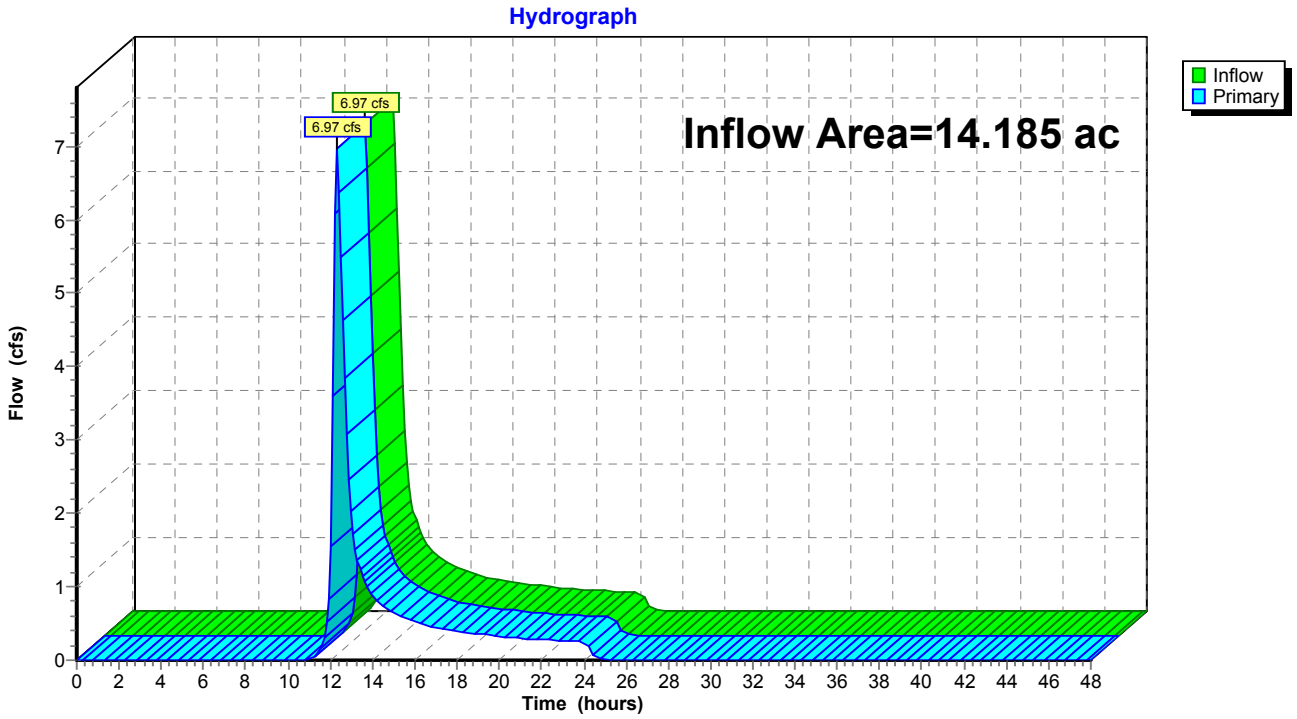


Summary for Link POI PRE: POI - PRE

Inflow Area = 14.185 ac, 5.99% Impervious, Inflow Depth = 0.71" for 1-yr event
Inflow = 6.97 cfs @ 12.31 hrs, Volume= 0.839 af
Primary = 6.97 cfs @ 12.31 hrs, Volume= 0.839 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI PRE: POI - PRE

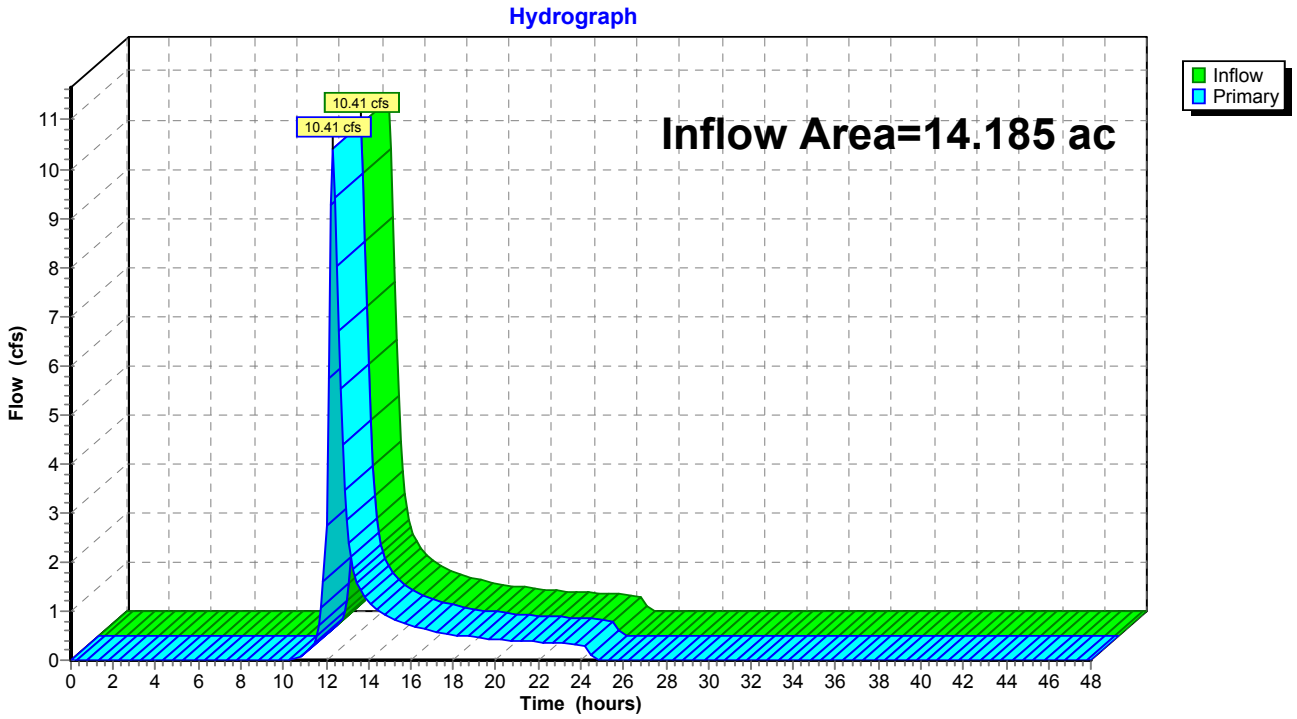


Summary for Link POI PRE: POI - PRE

Inflow Area = 14.185 ac, 5.99% Impervious, Inflow Depth = 1.02" for 2-yr event
Inflow = 10.41 cfs @ 12.30 hrs, Volume= 1.201 af
Primary = 10.41 cfs @ 12.30 hrs, Volume= 1.201 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI PRE: POI - PRE

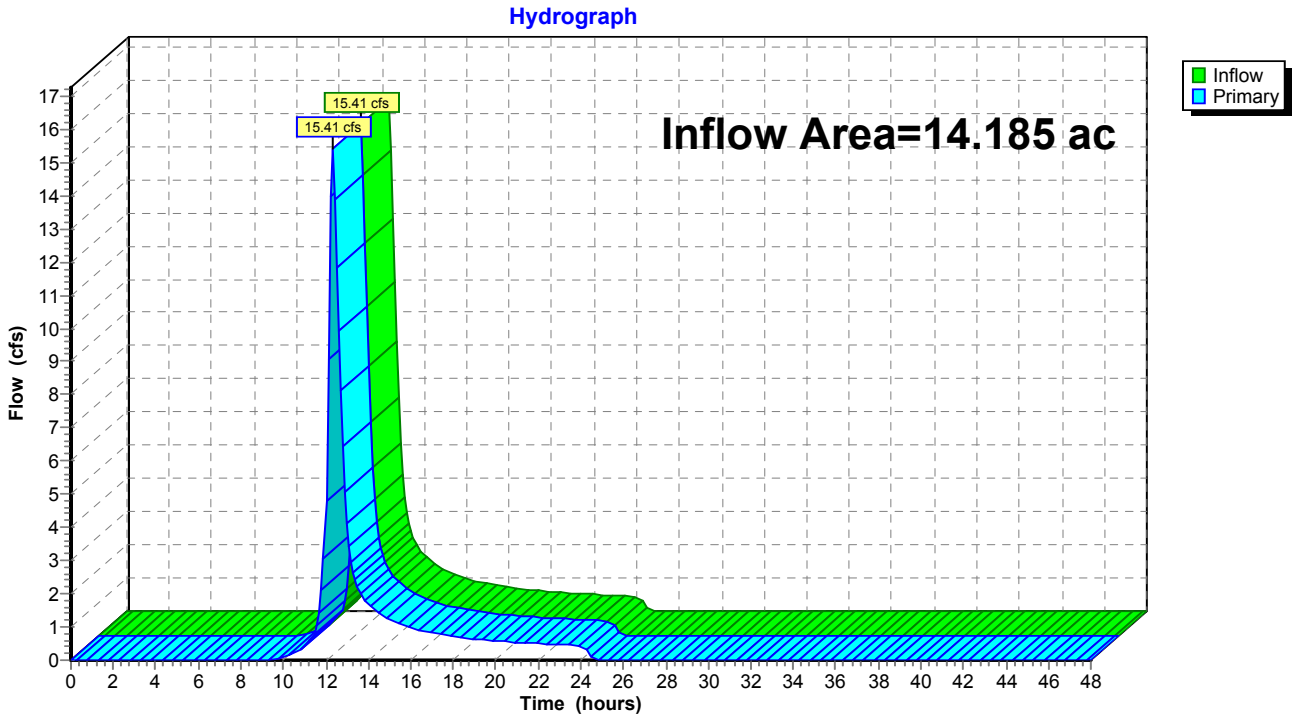


Summary for Link POI PRE: POI - PRE

Inflow Area = 14.185 ac, 5.99% Impervious, Inflow Depth = 1.51" for 5-yr event
Inflow = 15.41 cfs @ 12.30 hrs, Volume= 1.782 af
Primary = 15.41 cfs @ 12.30 hrs, Volume= 1.782 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI PRE: POI - PRE

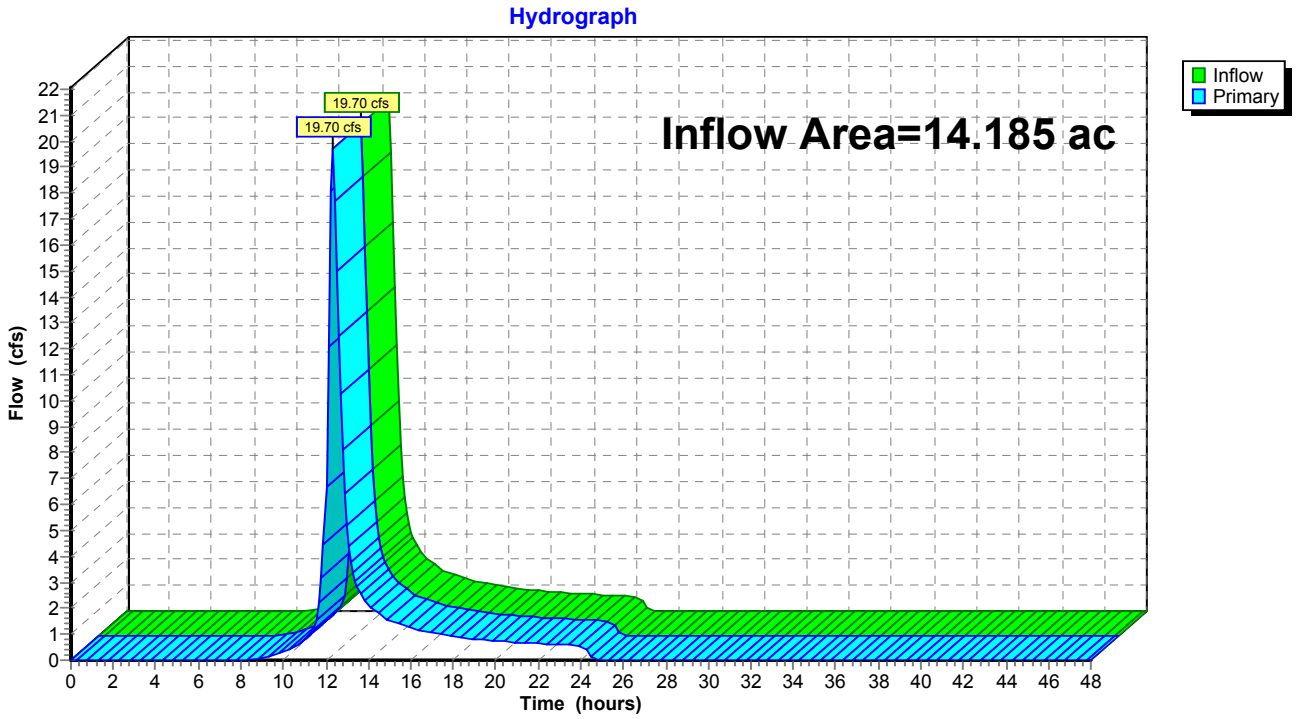


Summary for Link POI PRE: POI - PRE

Inflow Area = 14.185 ac, 5.99% Impervious, Inflow Depth = 1.97" for 10-yr event
Inflow = 19.70 cfs @ 12.29 hrs, Volume= 2.330 af
Primary = 19.70 cfs @ 12.29 hrs, Volume= 2.330 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI PRE: POI - PRE

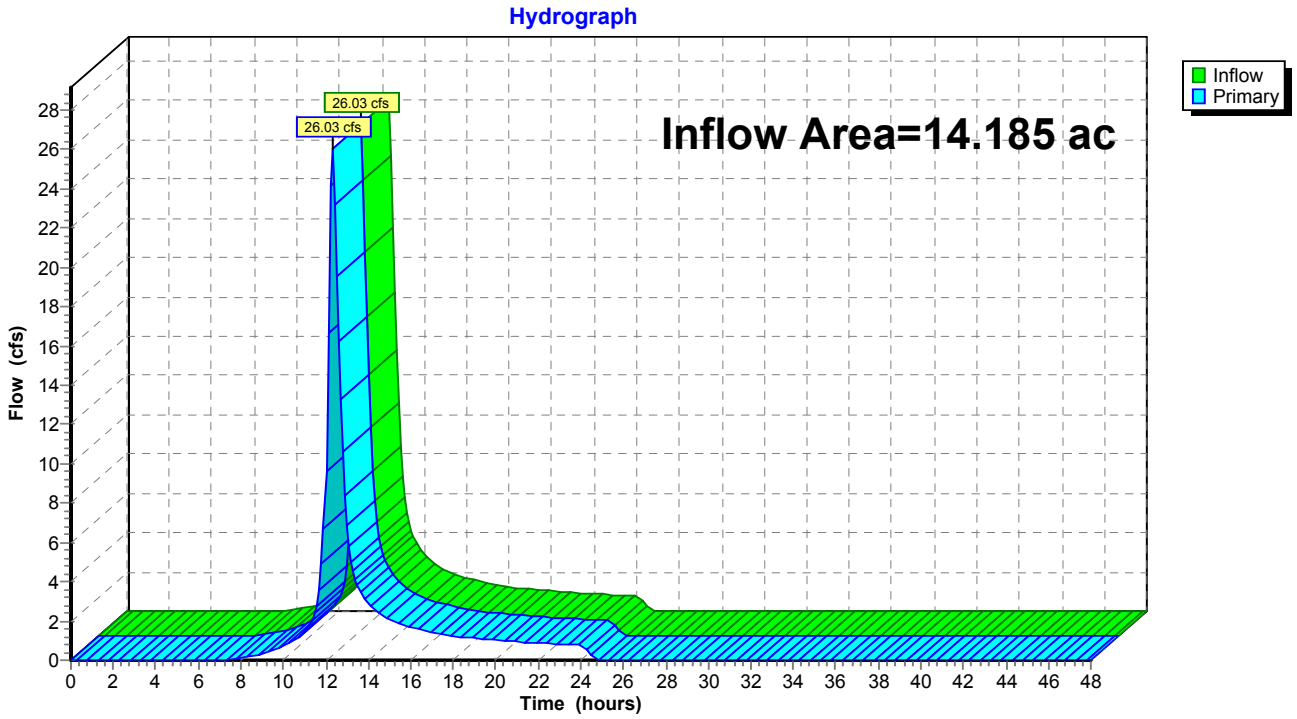


Summary for Link POI PRE: POI - PRE

Inflow Area = 14.185 ac, 5.99% Impervious, Inflow Depth = 2.74" for 25-yr event
Inflow = 26.03 cfs @ 12.29 hrs, Volume= 3.234 af
Primary = 26.03 cfs @ 12.29 hrs, Volume= 3.234 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI PRE: POI - PRE

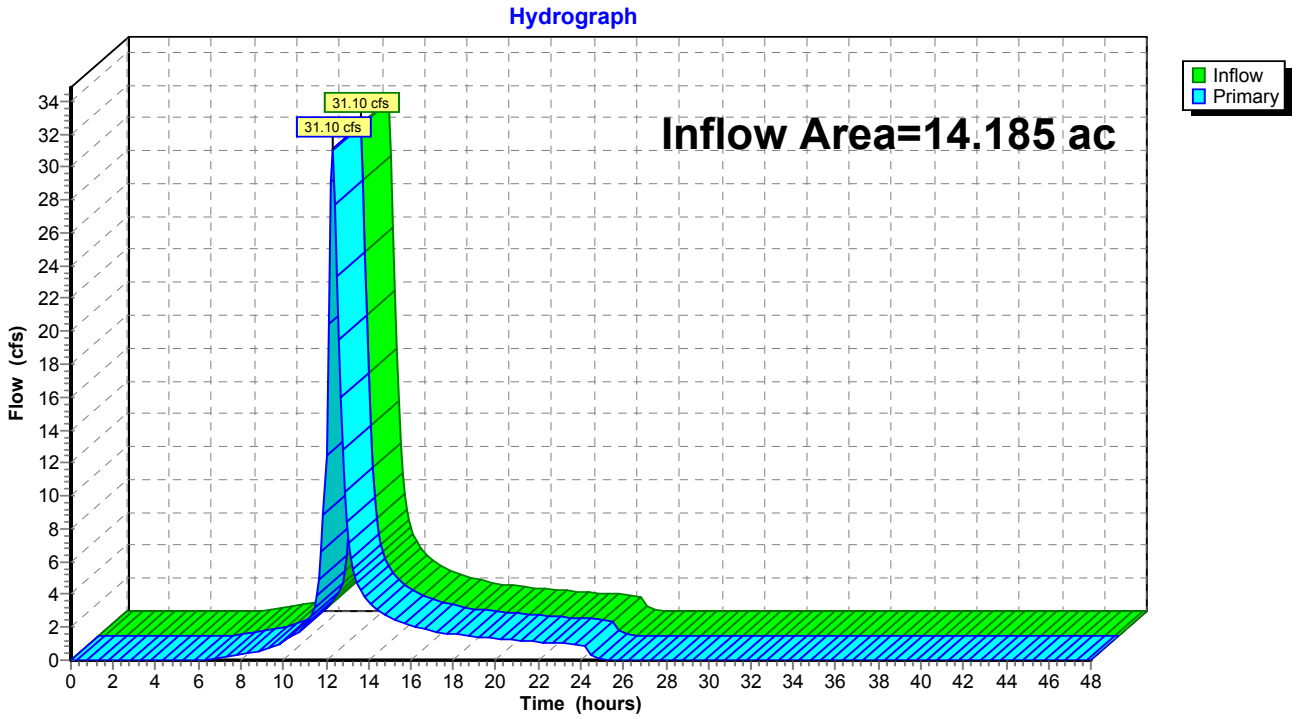


Summary for Link POI PRE: POI - PRE

Inflow Area = 14.185 ac, 5.99% Impervious, Inflow Depth = 3.47" for 50-yr event
Inflow = 31.10 cfs @ 12.29 hrs, Volume= 4.107 af
Primary = 31.10 cfs @ 12.29 hrs, Volume= 4.107 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI PRE: POI - PRE

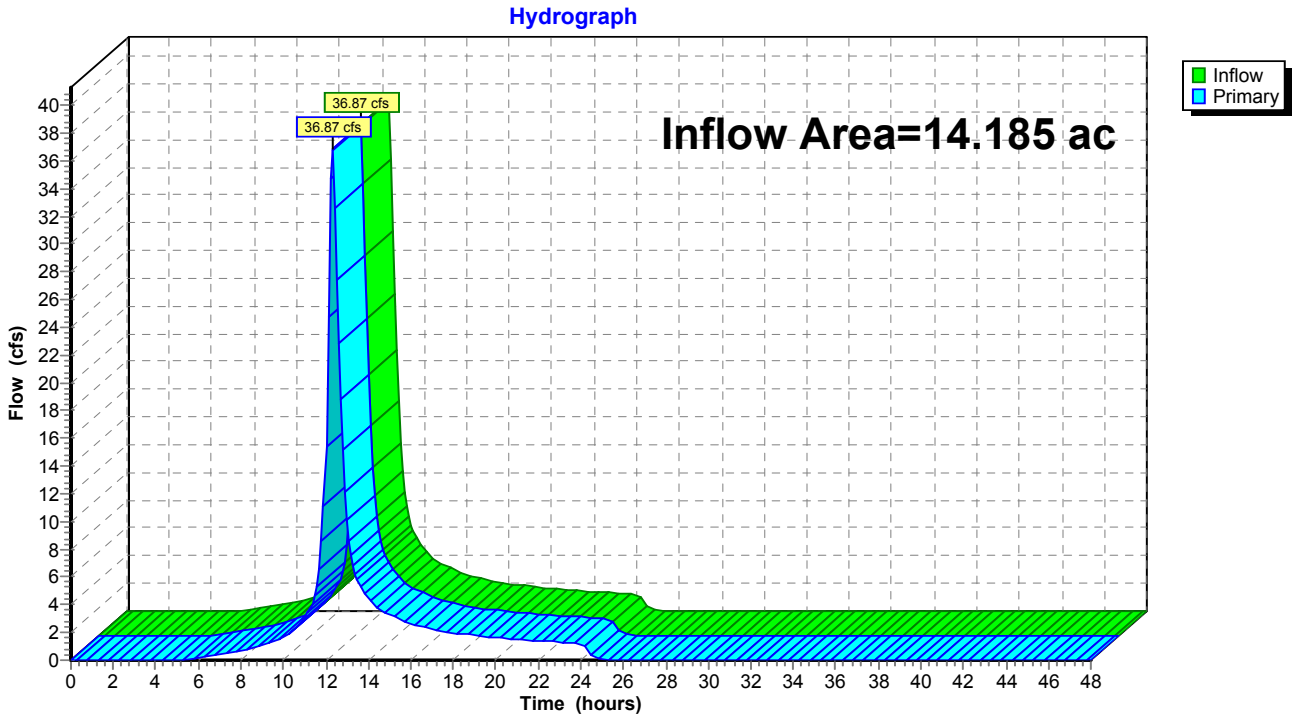


Summary for Link POI PRE: POI - PRE

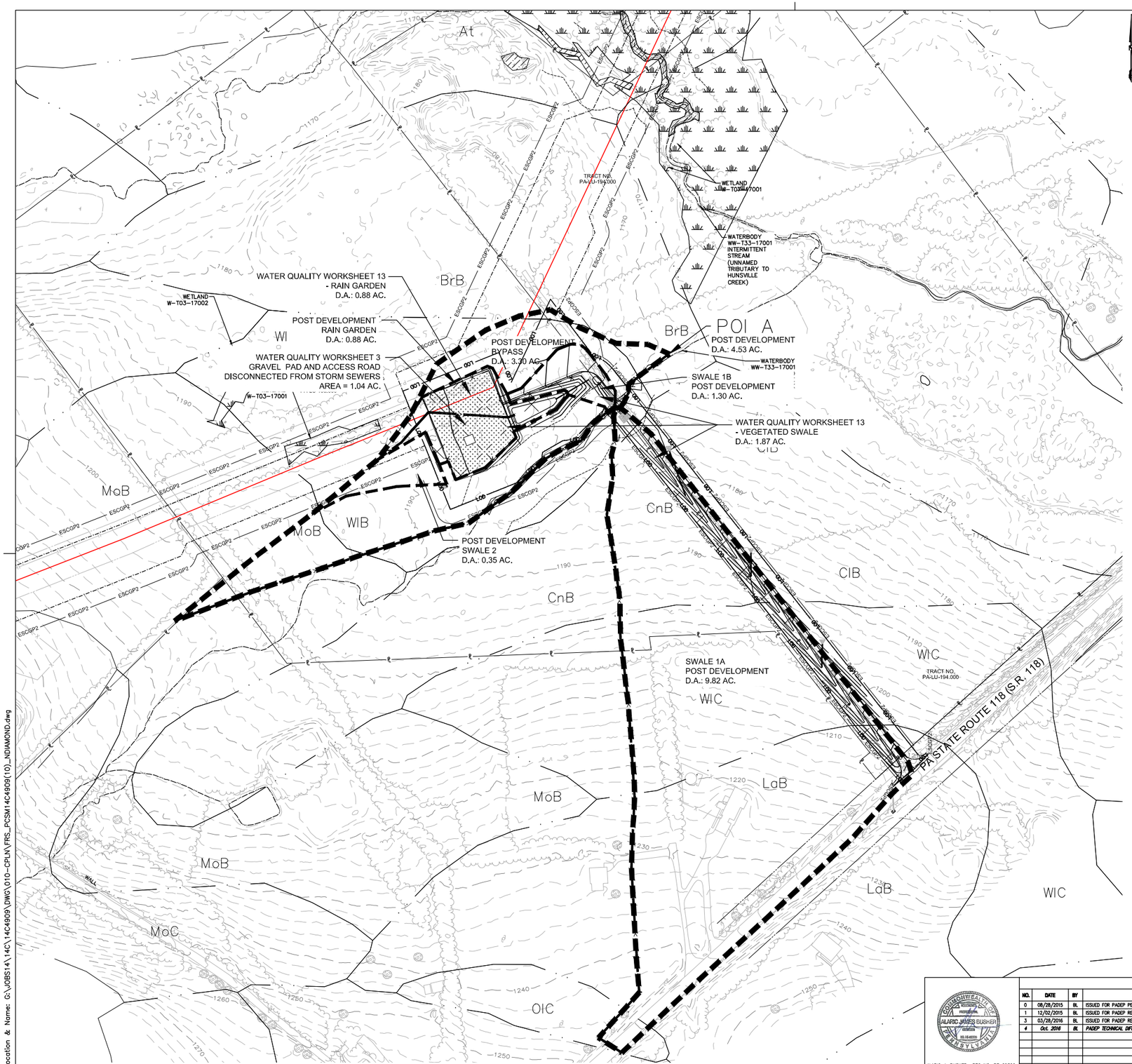
Inflow Area = 14.185 ac, 5.99% Impervious, Inflow Depth = 4.36" for 100-yr event
Inflow = 36.87 cfs @ 12.28 hrs, Volume= 5.154 af
Primary = 36.87 cfs @ 12.28 hrs, Volume= 5.154 af, Atten= 0%, Lag= 0.0 min

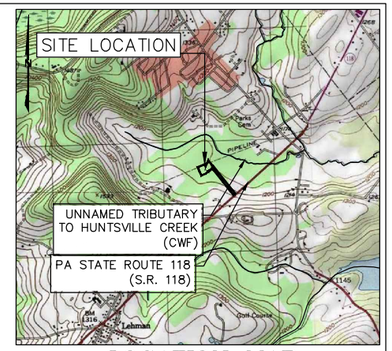
Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI PRE: POI - PRE



A.2 Post Development Calculations





LOCATION MAP

USGS HARVEYS LAKE QUADRANGLE
SCALE: 1"=2,000'

LEGEND

- PROPERTY BOUNDARY LINE (APPROXIMATE)
- 1460 EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' INTERVAL)
- FENCE
- STONE ROW
- SOIL BOUNDARY
- TREELINE
- CENTERLINE STREAM/EDGE WATERBODY
- DELINEATED WETLANDS
- × 1353.0 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)
- WsB SOIL TYPE DESIGNATION
- EXISTING ROAD
- ROW
- LIMITS OF FLOODWAY/ FLOODPLAN
- 1460 PROPOSED MAJOR CONTOUR (10' INTERVAL)
- PROPOSED MINOR CONTOUR (2' INTERVAL)
- PROPOSED MINOR CONTOUR (1' INTERVAL)
- LOD LIMIT OF DISTURBANCE (NORTH DIAMOND REGULATOR STATION)
- ESCGP2 ESCGP-2 PERMIT BOUNDARY
- CENTERLINE GAS PIPELINE
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- PROPOSED ACCESS ROAD
- DRAINAGE AREA BOUNDARIES
- TIME OF CONCENTRATION FLOW PATH
- DRAINAGE AREAS SPECIFIED ON WATER QUALITY WORKSHEET 13

GRAPHIC SCALE
100 50 0 100
SCALE IN FEET
1 inch = 100 ft.

ALARIC J. BUSHER REG NO. PE 60320

BLE Companies — ARCHITECTURE, ENGINEERING, ENVIRONMENTAL, LAND SURVEYING

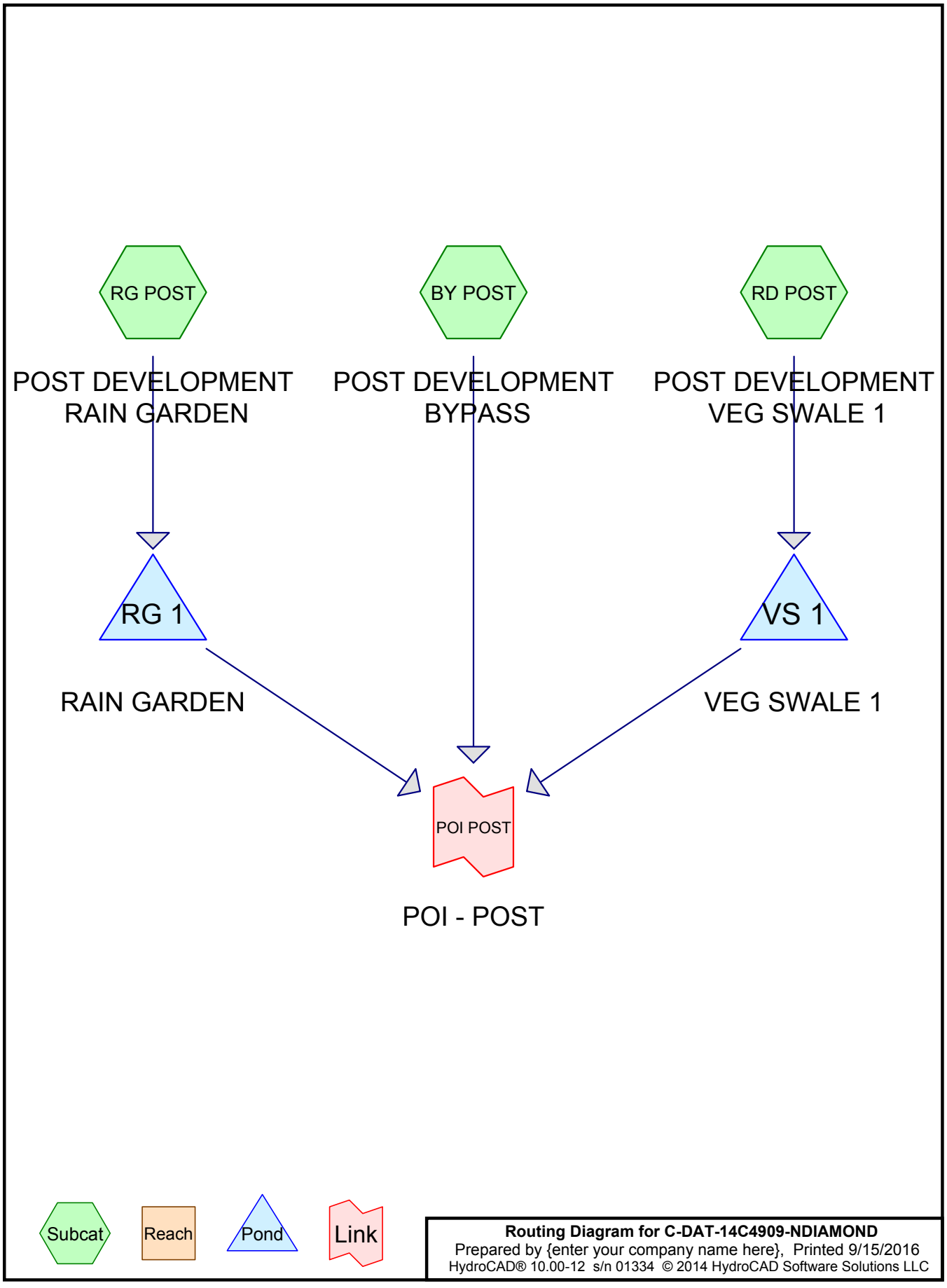
REVISIONS						
NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
0	08/28/2015	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	W01161499	DAK	AJB
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL	W01161499	DAK	AJB
3	03/28/2016	BL	ISSUED FOR PADEP RESUBMITTAL	W01161499	AJB	AJB
4	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	W01161499	AJB	AJB

TRANSCONTINENTAL GAS PIPELINE COMPANY LLC
ATLANTIC SUNRISE PROJECT– PROPOSED 30" NATURAL GAS PIPELINE
POST CONSTRUCTION STORMWATER MANAGEMENT PLANS FOR NORTH
DIAMOND REGULATOR STATION & ASSOCIATED PERMANENT ACCESS ROADS
LEHMAN TOWNSHIP, LUZERNE COUNTY, PENNSYLVANIA
POST DEVELOPMENT DRAINAGE AREA MAP

Williams

DRAWN BY:	JEC	DATE:	04/03/15	ISSUED FOR BID:	SCALE: AS NOTED
CHECKED BY:	AJB	DATE:	04/03/15	ISSUED FOR CONSTRUCTION:	REVISION: 4
APPROVED BY:	AJB	DATE:	07/17/15	DRAWING NUMBER: (36-7935)MF-1A-9	SHEET 1 OF 1
W.O.	1161499				

Drawing Location & Name: G:\OBS14\14C\14C4909\DWG\010-CPLN\FRS_PCSM14C4909(10)_NDIAMOND.dwg



Routing Diagram for C-DAT-14C4909-NDIAMOND
Prepared by {enter your company name here}, Printed 9/15/2016

Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

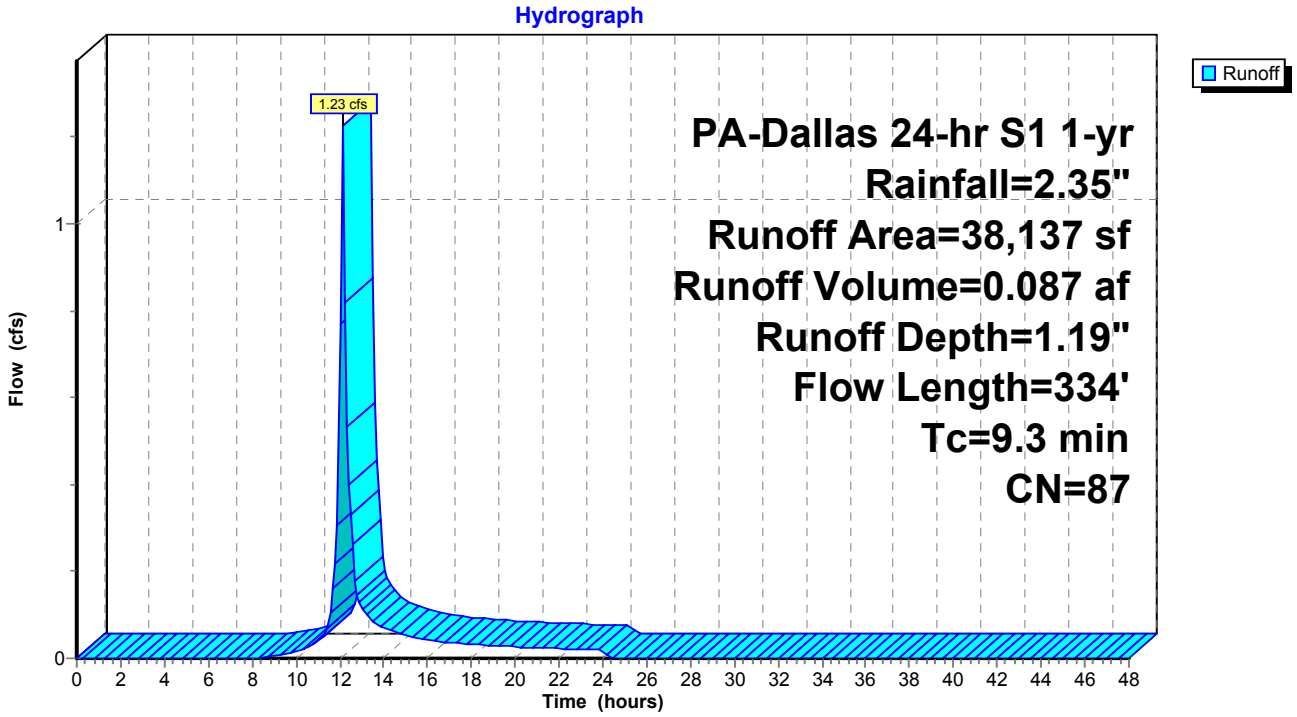
Runoff = 1.23 cfs @ 12.10 hrs, Volume= 0.087 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 1-yr Rainfall=2.35"

	Area (sf)	CN	Description
	0	77	Woods, Good, HSG D
	10,973	78	Meadow, non-grazed, HSG D
*	26,790	91	Gravel areas, HSG D
*	374	98	Impervious areas, HSG D
	38,137	87	Weighted Average
	37,763		99.02% Pervious Area
	374		0.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0400	0.24		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.81"
0.8	50	0.0200	0.99		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.3	169	0.0178	2.15		**Shallow Concentrated Flow, SCF 2** Unpaved Kv= 16.1 fps
0.1	15	0.2667	3.62		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
9.3	334	Total			

Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

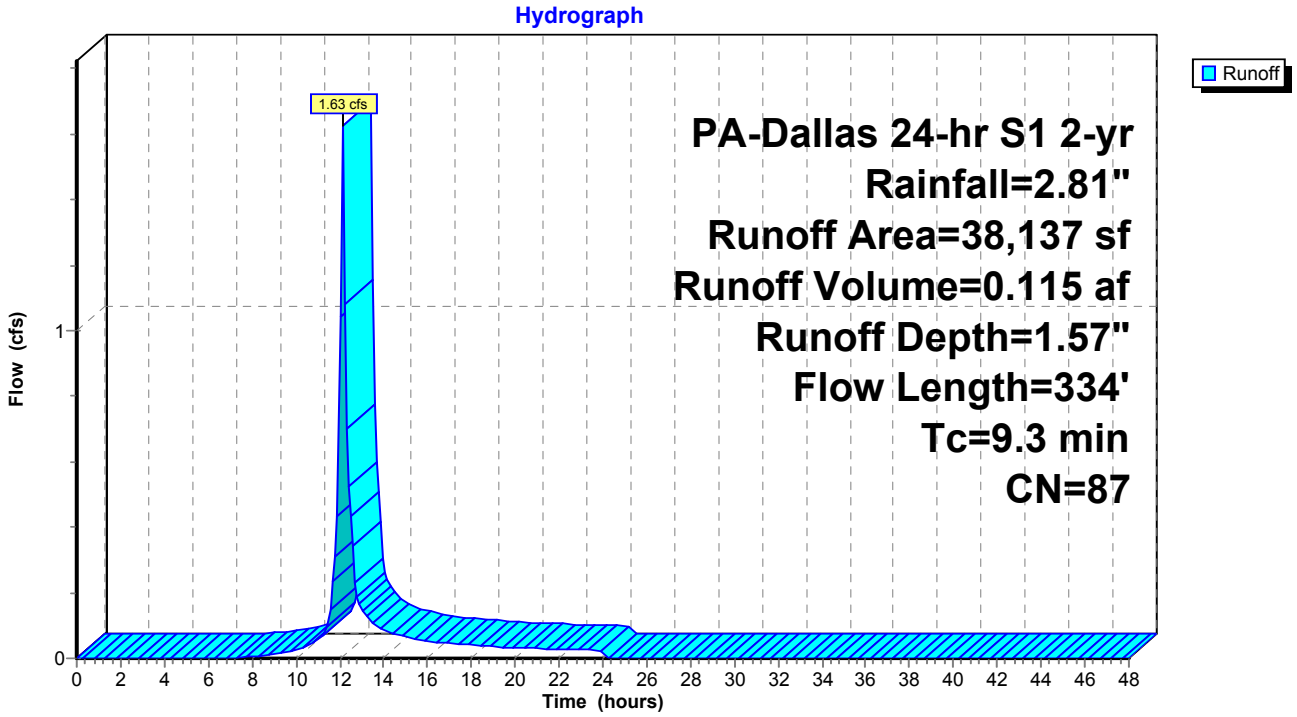
Runoff = 1.63 cfs @ 12.10 hrs, Volume= 0.115 af, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 2-yr Rainfall=2.81"

	Area (sf)	CN	Description
	0	77	Woods, Good, HSG D
	10,973	78	Meadow, non-grazed, HSG D
*	26,790	91	Gravel areas, HSG D
*	374	98	Impervious areas, HSG D
	38,137	87	Weighted Average
	37,763		99.02% Pervious Area
	374		0.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0400	0.24		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.81"
0.8	50	0.0200	0.99		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.3	169	0.0178	2.15		**Shallow Concentrated Flow, SCF 2** Unpaved Kv= 16.1 fps
0.1	15	0.2667	3.62		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
9.3	334	Total			

Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

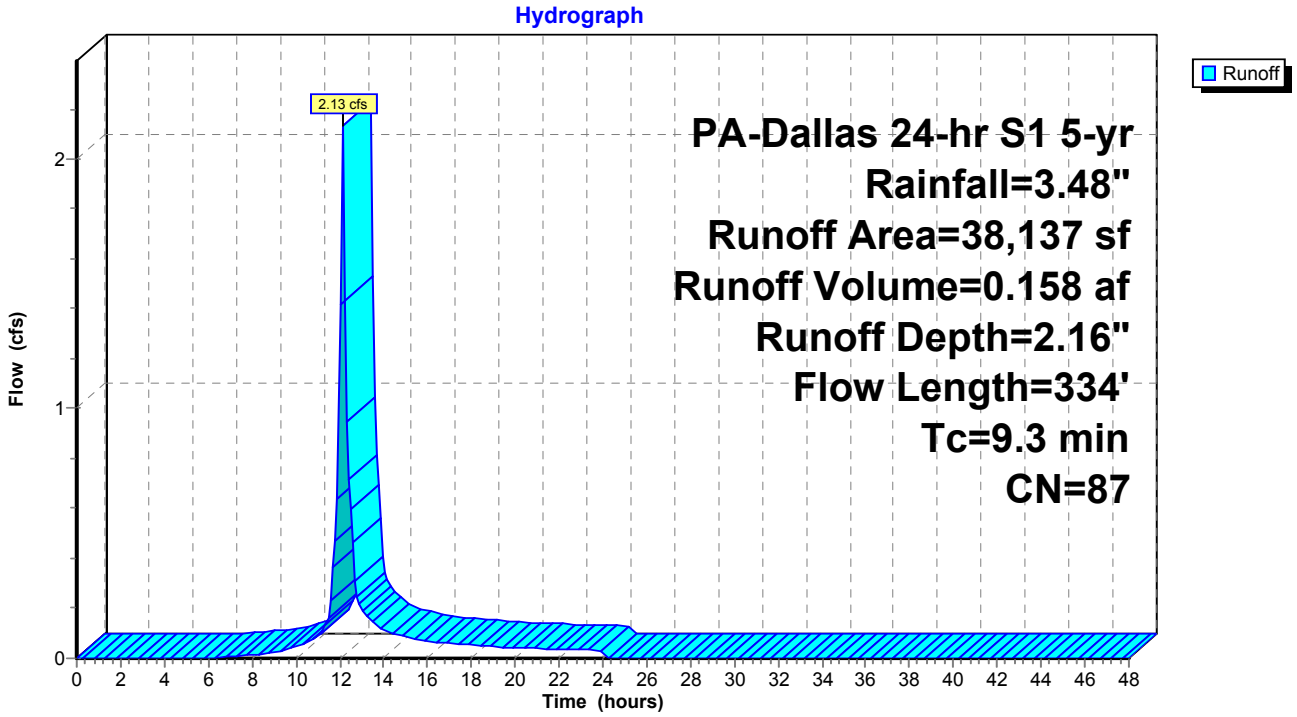
Runoff = 2.13 cfs @ 12.10 hrs, Volume= 0.158 af, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 5-yr Rainfall=3.48"

	Area (sf)	CN	Description
	0	77	Woods, Good, HSG D
	10,973	78	Meadow, non-grazed, HSG D
*	26,790	91	Gravel areas, HSG D
*	374	98	Impervious areas, HSG D
	38,137	87	Weighted Average
	37,763		99.02% Pervious Area
	374		0.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0400	0.24		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.81"
0.8	50	0.0200	0.99		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.3	169	0.0178	2.15		**Shallow Concentrated Flow, SCF 2** Unpaved Kv= 16.1 fps
0.1	15	0.2667	3.62		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
9.3	334	Total			

Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

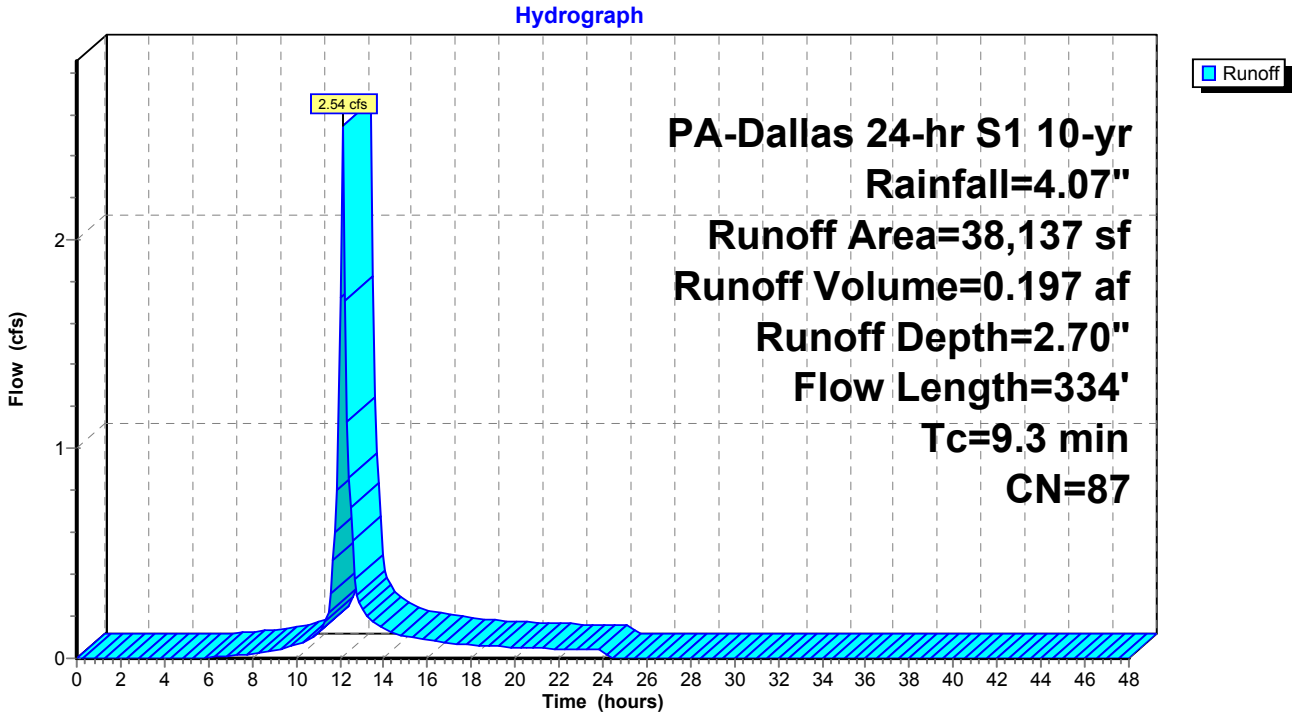
Runoff = 2.54 cfs @ 12.10 hrs, Volume= 0.197 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 10-yr Rainfall=4.07"

	Area (sf)	CN	Description
	0	77	Woods, Good, HSG D
	10,973	78	Meadow, non-grazed, HSG D
*	26,790	91	Gravel areas, HSG D
*	374	98	Impervious areas, HSG D
	38,137	87	Weighted Average
	37,763		99.02% Pervious Area
	374		0.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0400	0.24		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.81"
0.8	50	0.0200	0.99		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.3	169	0.0178	2.15		**Shallow Concentrated Flow, SCF 2** Unpaved Kv= 16.1 fps
0.1	15	0.2667	3.62		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
9.3	334	Total			

Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

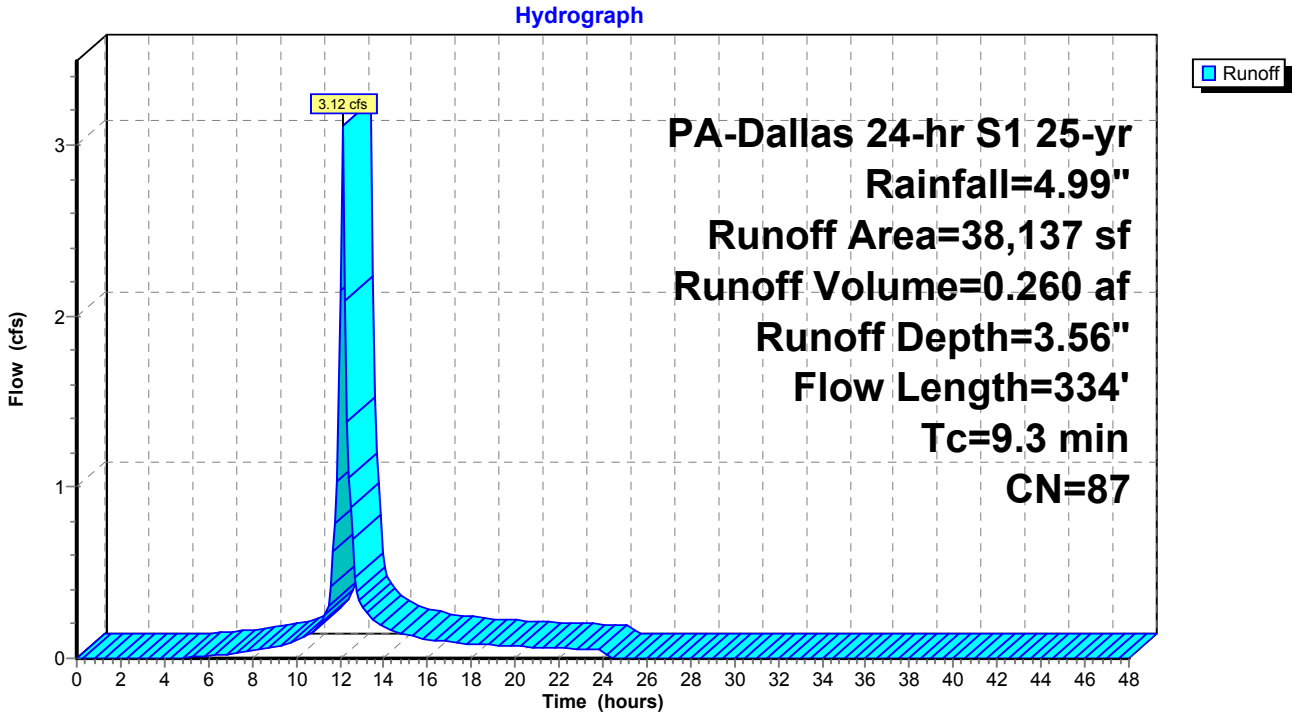
Runoff = 3.12 cfs @ 12.10 hrs, Volume= 0.260 af, Depth= 3.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 25-yr Rainfall=4.99"

	Area (sf)	CN	Description
	0	77	Woods, Good, HSG D
	10,973	78	Meadow, non-grazed, HSG D
*	26,790	91	Gravel areas, HSG D
*	374	98	Impervious areas, HSG D
	38,137	87	Weighted Average
	37,763		99.02% Pervious Area
	374		0.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0400	0.24		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.81"
0.8	50	0.0200	0.99		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.3	169	0.0178	2.15		**Shallow Concentrated Flow, SCF 2** Unpaved Kv= 16.1 fps
0.1	15	0.2667	3.62		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
9.3	334	Total			

Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

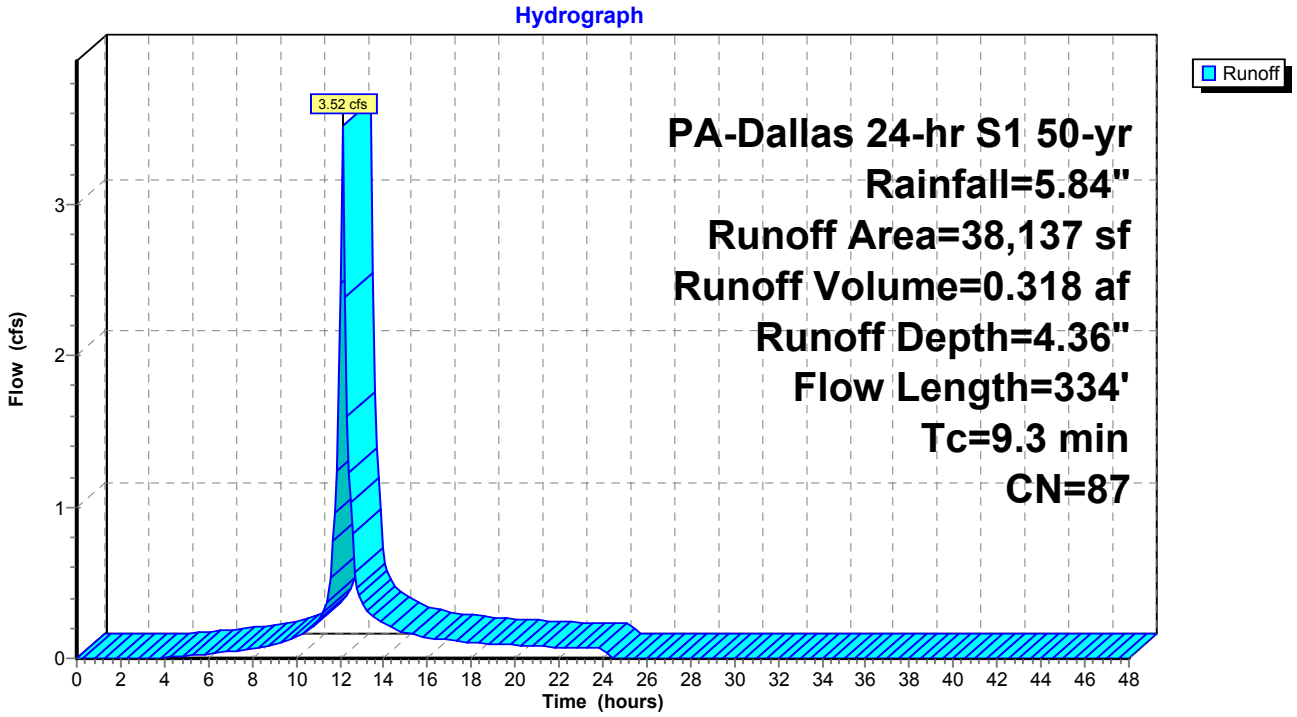
Runoff = 3.52 cfs @ 12.10 hrs, Volume= 0.318 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 50-yr Rainfall=5.84"

	Area (sf)	CN	Description
	0	77	Woods, Good, HSG D
	10,973	78	Meadow, non-grazed, HSG D
*	26,790	91	Gravel areas, HSG D
*	374	98	Impervious areas, HSG D
	38,137	87	Weighted Average
	37,763		99.02% Pervious Area
	374		0.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0400	0.24		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.81"
0.8	50	0.0200	0.99		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.3	169	0.0178	2.15		**Shallow Concentrated Flow, SCF 2** Unpaved Kv= 16.1 fps
0.1	15	0.2667	3.62		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
9.3	334	Total			

Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

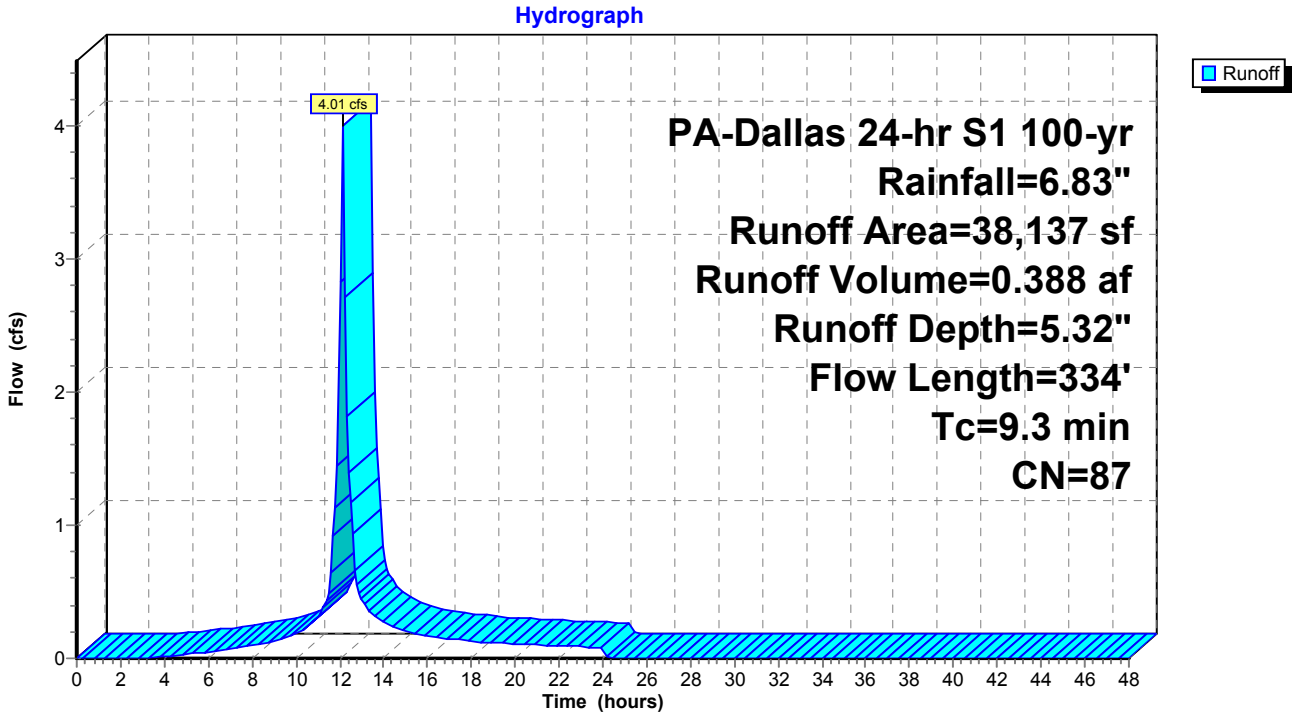
Runoff = 4.01 cfs @ 12.10 hrs, Volume= 0.388 af, Depth= 5.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 100-yr Rainfall=6.83"

	Area (sf)	CN	Description
	0	77	Woods, Good, HSG D
	10,973	78	Meadow, non-grazed, HSG D
*	26,790	91	Gravel areas, HSG D
*	374	98	Impervious areas, HSG D
	38,137	87	Weighted Average
	37,763		99.02% Pervious Area
	374		0.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0400	0.24		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.81"
0.8	50	0.0200	0.99		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.3	169	0.0178	2.15		**Shallow Concentrated Flow, SCF 2** Unpaved Kv= 16.1 fps
0.1	15	0.2667	3.62		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
9.3	334	Total			

Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN



Summary for Pond RG 1: RAIN GARDEN

Inflow Area = 0.876 ac, 0.98% Impervious, Inflow Depth = 1.19" for 1-yr event
Inflow = 1.23 cfs @ 12.10 hrs, Volume= 0.087 af
Outflow = 0.61 cfs @ 12.29 hrs, Volume= 0.087 af, Atten= 50%, Lag= 11.2 min
Primary = 0.61 cfs @ 12.29 hrs, Volume= 0.087 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.39' @ 12.29 hrs Surf.Area= 2,638 sf Storage= 973 cf

Plug-Flow detention time= 68.7 min calculated for 0.087 af (100% of inflow)
Center-of-Mass det. time= 68.1 min (912.0 - 843.9)

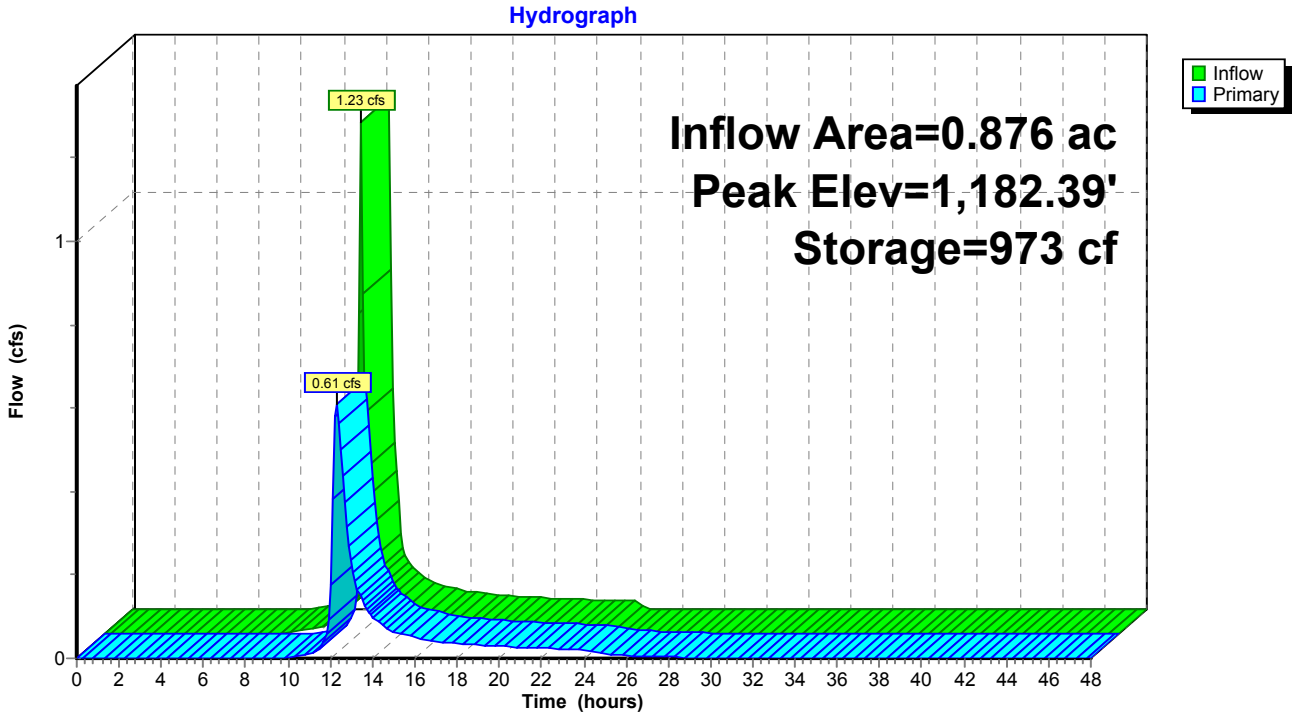
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,182.00	2,318	0	0
1,183.00	3,134	2,726	2,726
1,184.00	4,048	3,591	6,317

Device	Routing	Invert	Outlet Devices
#1	Primary	1,182.00'	**12.0" Round Culvert** L= 80.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,182.00' / 1,176.00' S= 0.0750 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Primary	1,183.00'	**30.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.61 cfs @ 12.29 hrs HW=1,182.39' (Free Discharge)
1=Culvert (Inlet Controls 0.61 cfs @ 2.13 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Stage-Discharge for Pond RG 1: RAIN GARDEN

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,182.00	0.00	1,182.52	1.01	1,183.04	3.42	1,183.56	37.84
1,182.01	0.00	1,182.53	1.05	1,183.05	3.70	1,183.57	38.77
1,182.02	0.00	1,182.54	1.08	1,183.06	4.01	1,183.58	39.71
1,182.03	0.00	1,182.55	1.12	1,183.07	4.34	1,183.59	40.66
1,182.04	0.01	1,182.56	1.15	1,183.08	4.70	1,183.60	41.61
1,182.05	0.01	1,182.57	1.19	1,183.09	5.08	1,183.61	42.53
1,182.06	0.02	1,182.58	1.22	1,183.10	5.47	1,183.62	43.46
1,182.07	0.02	1,182.59	1.26	1,183.11	5.89	1,183.63	44.39
1,182.08	0.03	1,182.60	1.30	1,183.12	6.32	1,183.64	45.33
1,182.09	0.04	1,182.61	1.33	1,183.13	6.77	1,183.65	46.27
1,182.10	0.04	1,182.62	1.37	1,183.14	7.24	1,183.66	47.21
1,182.11	0.05	1,182.63	1.41	1,183.15	7.72	1,183.67	48.17
1,182.12	0.06	1,182.64	1.45	1,183.16	8.22	1,183.68	49.12
1,182.13	0.07	1,182.65	1.48	1,183.17	8.73	1,183.69	50.09
1,182.14	0.09	1,182.66	1.52	1,183.18	9.26	1,183.70	51.05
1,182.15	0.10	1,182.67	1.56	1,183.19	9.80	1,183.71	52.03
1,182.16	0.11	1,182.68	1.60	1,183.20	10.36	1,183.72	53.00
1,182.17	0.12	1,182.69	1.63	1,183.21	10.93	1,183.73	53.99
1,182.18	0.14	1,182.70	1.67	1,183.22	11.51	1,183.74	54.97
1,182.19	0.15	1,182.71	1.71	1,183.23	12.11	1,183.75	55.96
1,182.20	0.17	1,182.72	1.75	1,183.24	12.72	1,183.76	56.96
1,182.21	0.19	1,182.73	1.79	1,183.25	13.34	1,183.77	57.96
1,182.22	0.20	1,182.74	1.83	1,183.26	13.98	1,183.78	58.96
1,182.23	0.22	1,182.75	1.86	1,183.27	14.63	1,183.79	59.97
1,182.24	0.24	1,182.76	1.90	1,183.28	15.29	1,183.80	60.98
1,182.25	0.26	1,182.77	1.94	1,183.29	15.96	1,183.81	62.05
1,182.26	0.28	1,182.78	1.98	1,183.30	16.64	1,183.82	63.13
1,182.27	0.30	1,182.79	2.01	1,183.31	17.34	1,183.83	64.22
1,182.28	0.32	1,182.80	2.05	1,183.32	18.04	1,183.84	65.31
1,182.29	0.35	1,182.81	2.09	1,183.33	18.76	1,183.85	66.40
1,182.30	0.37	1,182.82	2.13	1,183.34	19.49	1,183.86	67.50
1,182.31	0.39	1,182.83	2.16	1,183.35	20.23	1,183.87	68.61
1,182.32	0.42	1,182.84	2.20	1,183.36	20.98	1,183.88	69.72
1,182.33	0.44	1,182.85	2.23	1,183.37	21.74	1,183.89	70.84
1,182.34	0.47	1,182.86	2.27	1,183.38	22.51	1,183.90	71.97
1,182.35	0.49	1,182.87	2.30	1,183.39	23.29	1,183.91	73.10
1,182.36	0.52	1,182.88	2.34	1,183.40	24.08	1,183.92	74.24
1,182.37	0.55	1,182.89	2.37	1,183.41	24.87	1,183.93	75.38
1,182.38	0.57	1,182.90	2.40	1,183.42	25.67	1,183.94	76.53
1,182.39	0.60	1,182.91	2.44	1,183.43	26.49	1,183.95	77.68
1,182.40	0.63	1,182.92	2.47	1,183.44	27.31	1,183.96	78.84
1,182.41	0.66	1,182.93	2.50	1,183.45	28.14	1,183.97	80.00
1,182.42	0.69	1,182.94	2.53	1,183.46	28.98	1,183.98	81.17
1,182.43	0.72	1,182.95	2.56	1,183.47	29.82	1,183.99	82.35
1,182.44	0.75	1,182.96	2.58	1,183.48	30.68	1,184.00	**83.53**
1,182.45	0.78	1,182.97	2.61	1,183.49	31.55		
1,182.46	0.81	1,182.98	2.63	1,183.50	32.42		
1,182.47	0.85	1,182.99	2.66	1,183.51	33.30		
1,182.48	0.88	1,183.00	2.67	1,183.52	34.19		
1,182.49	0.91	1,183.01	2.78	1,183.53	35.09		
1,182.50	0.95	1,183.02	2.95	1,183.54	36.00		
1,182.51	0.98	1,183.03	3.17	1,183.55	36.91		

Stage-Area-Storage for Pond RG 1: RAIN GARDEN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
1,182.00	2,318	0
1,182.02	2,334	47
1,182.04	2,351	93
1,182.06	2,367	141
1,182.08	2,383	188
1,182.10	2,400	236
1,182.12	2,416	284
1,182.14	2,432	333
1,182.16	2,449	381
1,182.18	2,465	430
1,182.20	2,481	480
1,182.22	2,498	530
1,182.24	2,514	580
1,182.26	2,530	630
1,182.28	2,546	681
1,182.30	2,563	732
1,182.32	2,579	784
1,182.34	2,595	835
1,182.36	2,612	887
1,182.38	2,628	940
1,182.40	2,644	992
1,182.42	2,661	1,046
1,182.44	2,677	1,099
1,182.46	2,693	1,153
1,182.48	2,710	1,207
1,182.50	2,726	1,261
1,182.52	2,742	1,316
1,182.54	2,759	1,371
1,182.56	2,775	1,426
1,182.58	2,791	1,482
1,182.60	2,808	1,538
1,182.62	2,824	1,594
1,182.64	2,840	1,651
1,182.66	2,857	1,708
1,182.68	2,873	1,765
1,182.70	2,889	1,823
1,182.72	2,906	1,880
1,182.74	2,922	1,939
1,182.76	2,938	1,997
1,182.78	2,954	2,056
1,182.80	2,971	2,116
1,182.82	2,987	2,175
1,182.84	3,003	2,235
1,182.86	3,020	2,295
1,182.88	3,036	2,356
1,182.90	3,052	2,417
1,182.92	3,069	2,478
1,182.94	3,085	2,539
1,182.96	3,101	2,601
1,182.98	3,118	2,663
1,183.00	3,134	2,726
1,183.02	3,152	2,789
1,183.04	3,171	2,852
1,183.06	3,189	2,916
1,183.08	3,207	2,980
1,183.10	3,225	3,044
1,183.12	3,244	3,109
1,183.14	3,262	3,174
1,183.16	3,280	3,239
1,183.18	3,299	3,305
1,183.20	3,317	3,371
1,183.22	3,335	3,438
1,183.24	3,353	3,504
1,183.26	3,372	3,572
1,183.28	3,390	3,639
1,183.30	3,408	3,707
1,183.32	3,426	3,776
1,183.34	3,445	3,844
1,183.36	3,463	3,913
1,183.38	3,481	3,983
1,183.40	3,500	4,053
1,183.42	3,518	4,123
1,183.44	3,536	4,193
1,183.46	3,554	4,264
1,183.48	3,573	4,336
1,183.50	3,591	4,407
1,183.52	3,609	4,479
1,183.54	3,628	4,552
1,183.56	3,646	4,624
1,183.58	3,664	4,697
1,183.60	3,682	4,771
1,183.62	3,701	4,845
1,183.64	3,719	4,919
1,183.66	3,737	4,994
1,183.68	3,756	5,068
1,183.70	3,774	5,144
1,183.72	3,792	5,219
1,183.74	3,810	5,295
1,183.76	3,829	5,372
1,183.78	3,847	5,449
1,183.80	3,865	5,526
1,183.82	3,883	5,603
1,183.84	3,902	5,681
1,183.86	3,920	5,759
1,183.88	3,938	5,838
1,183.90	3,957	5,917
1,183.92	3,975	5,996
1,183.94	3,993	6,076
1,183.96	4,011	6,156
1,183.98	4,030	6,236
1,184.00	**4,048**	**6,317**

Summary for Pond RG 1: RAIN GARDEN

Inflow Area = 0.876 ac, 0.98% Impervious, Inflow Depth = 1.57" for 2-yr event
Inflow = 1.63 cfs @ 12.10 hrs, Volume= 0.115 af
Outflow = 0.88 cfs @ 12.26 hrs, Volume= 0.115 af, Atten= 46%, Lag= 9.5 min
Primary = 0.88 cfs @ 12.26 hrs, Volume= 0.115 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.48' @ 12.26 hrs Surf.Area= 2,710 sf Storage= 1,208 cf

Plug-Flow detention time= 60.1 min calculated for 0.115 af (100% of inflow)
Center-of-Mass det. time= 59.6 min (894.1 - 834.5)

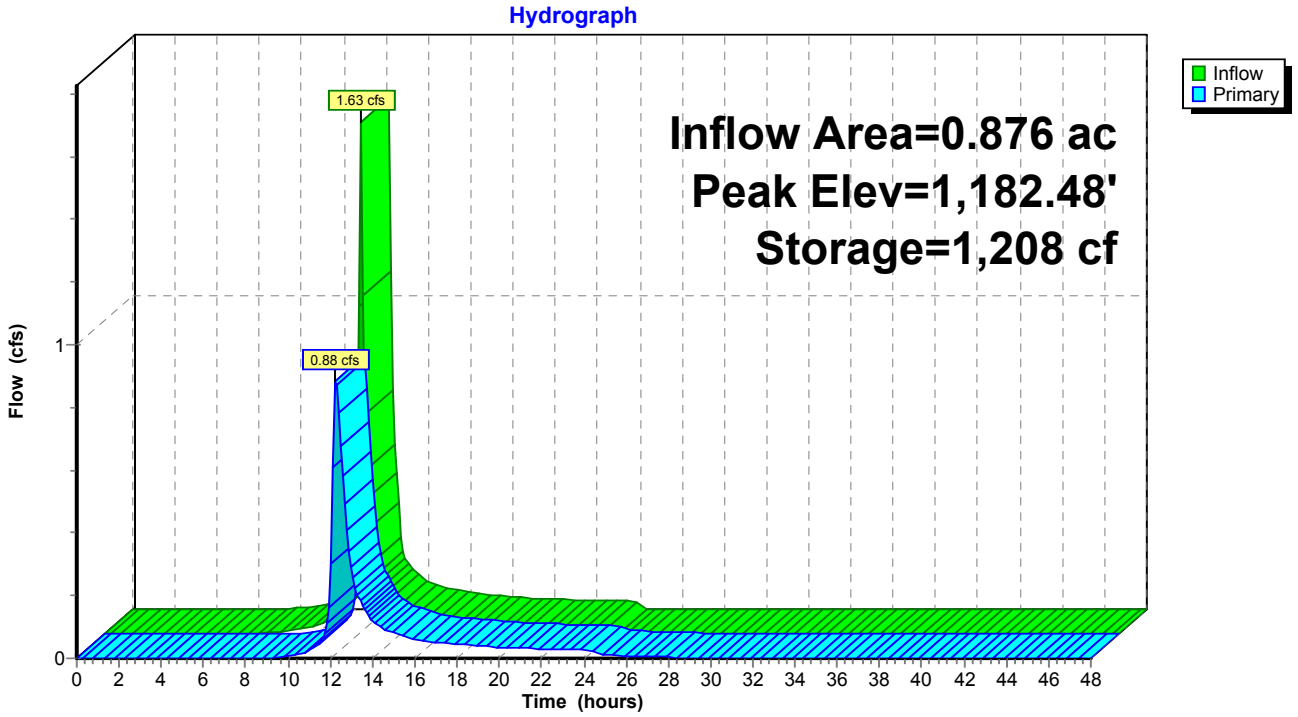
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,182.00	2,318	0	0
1,183.00	3,134	2,726	2,726
1,184.00	4,048	3,591	6,317

Device	Routing	Invert	Outlet Devices
#1	Primary	1,182.00'	**12.0" Round Culvert** L= 80.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,182.00' / 1,176.00' S= 0.0750 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Primary	1,183.00'	**30.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.87 cfs @ 12.26 hrs HW=1,182.48' (Free Discharge)
1=Culvert (Inlet Controls 0.87 cfs @ 2.35 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Pond RG 1: RAIN GARDEN

Inflow Area = 0.876 ac, 0.98% Impervious, Inflow Depth = 2.16" for 5-yr event
Inflow = 2.13 cfs @ 12.10 hrs, Volume= 0.158 af
Outflow = 1.28 cfs @ 12.24 hrs, Volume= 0.158 af, Atten= 40%, Lag= 8.6 min
Primary = 1.28 cfs @ 12.24 hrs, Volume= 0.158 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.60' @ 12.24 hrs Surf.Area= 2,804 sf Storage= 1,525 cf

Plug-Flow detention time= 52.4 min calculated for 0.158 af (100% of inflow)
Center-of-Mass det. time= 51.9 min (877.1 - 825.2)

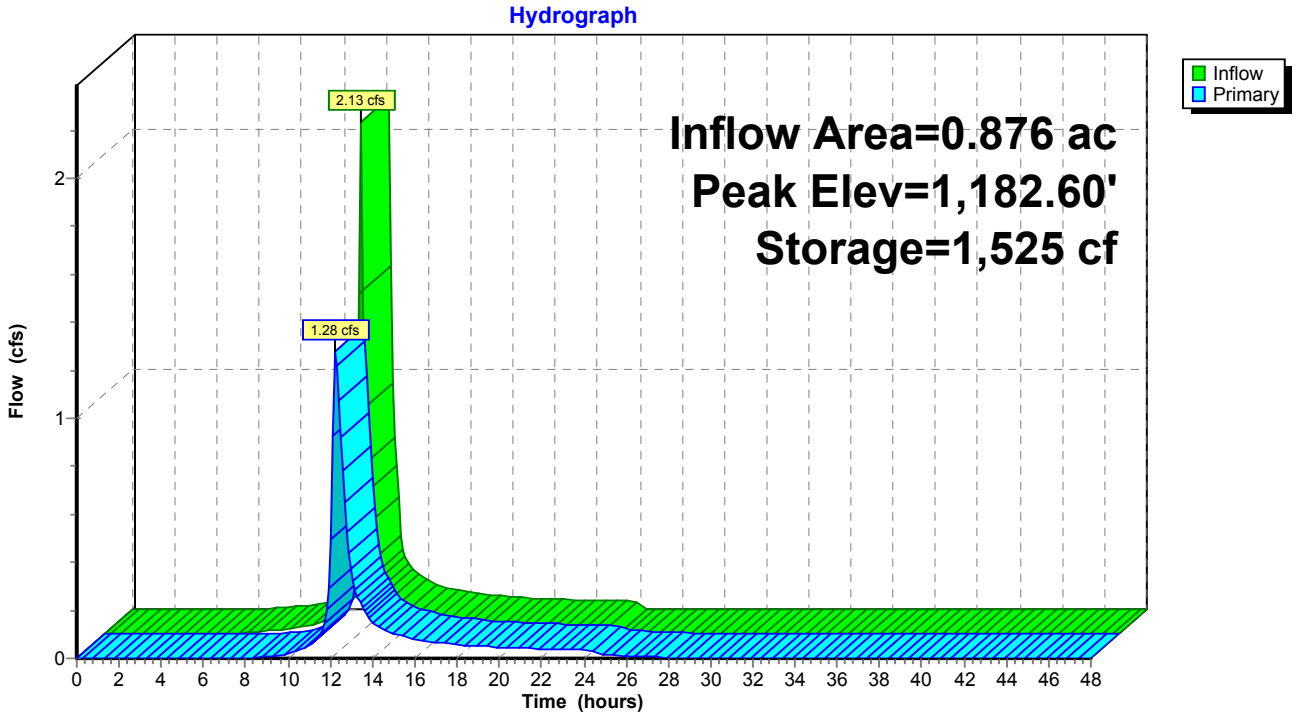
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,182.00	2,318	0	0
1,183.00	3,134	2,726	2,726
1,184.00	4,048	3,591	6,317

Device	Routing	Invert	Outlet Devices
#1	Primary	1,182.00'	**12.0" Round Culvert** L= 80.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,182.00' / 1,176.00' S= 0.0750 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Primary	1,183.00'	**30.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.24 cfs @ 12.24 hrs HW=1,182.58' (Free Discharge)
1=Culvert (Inlet Controls 1.24 cfs @ 2.60 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Pond RG 1: RAIN GARDEN

Inflow Area = 0.876 ac, 0.98% Impervious, Inflow Depth = 2.70" for 10-yr event
Inflow = 2.54 cfs @ 12.10 hrs, Volume= 0.197 af
Outflow = 1.58 cfs @ 12.24 hrs, Volume= 0.197 af, Atten= 38%, Lag= 8.3 min
Primary = 1.58 cfs @ 12.24 hrs, Volume= 0.197 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.68' @ 12.24 hrs Surf.Area= 2,870 sf Storage= 1,753 cf

Plug-Flow detention time= 46.0 min calculated for 0.197 af (100% of inflow)
Center-of-Mass det. time= 47.6 min (867.6 - 820.0)

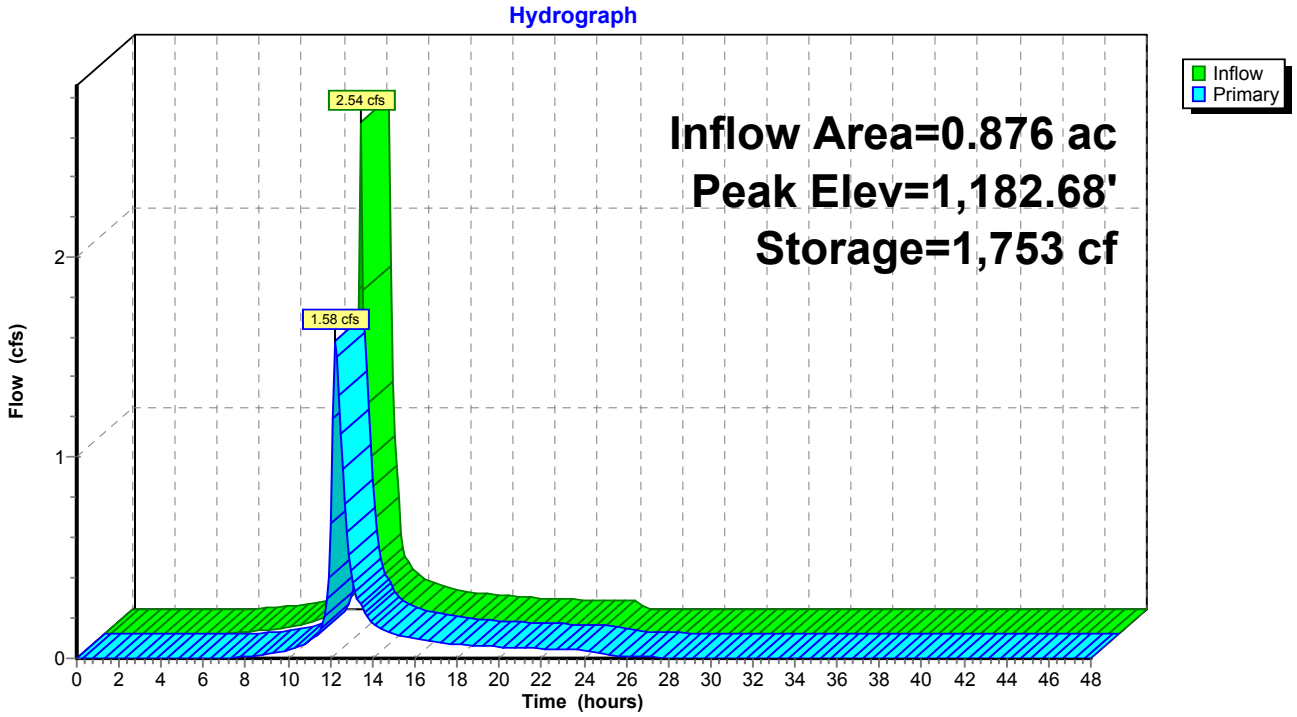
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,182.00	2,318	0	0
1,183.00	3,134	2,726	2,726
1,184.00	4,048	3,591	6,317

Device	Routing	Invert	Outlet Devices
#1	Primary	1,182.00'	**12.0" Round Culvert** L= 80.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,182.00' / 1,176.00' S= 0.0750 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Primary	1,183.00'	**30.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.53 cfs @ 12.24 hrs HW=1,182.66' (Free Discharge)
1=Culvert (Inlet Controls 1.53 cfs @ 2.77 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Pond RG 1: RAIN GARDEN

Inflow Area = 0.876 ac, 0.98% Impervious, Inflow Depth = 3.56" for 25-yr event
Inflow = 3.12 cfs @ 12.10 hrs, Volume= 0.260 af
Outflow = 1.99 cfs @ 12.23 hrs, Volume= 0.259 af, Atten= 36%, Lag= 8.0 min
Primary = 1.99 cfs @ 12.23 hrs, Volume= 0.259 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.78' @ 12.23 hrs Surf.Area= 2,957 sf Storage= 2,065 cf

Plug-Flow detention time= 43.6 min calculated for 0.259 af (100% of inflow)
Center-of-Mass det. time= 43.2 min (857.0 - 813.8)

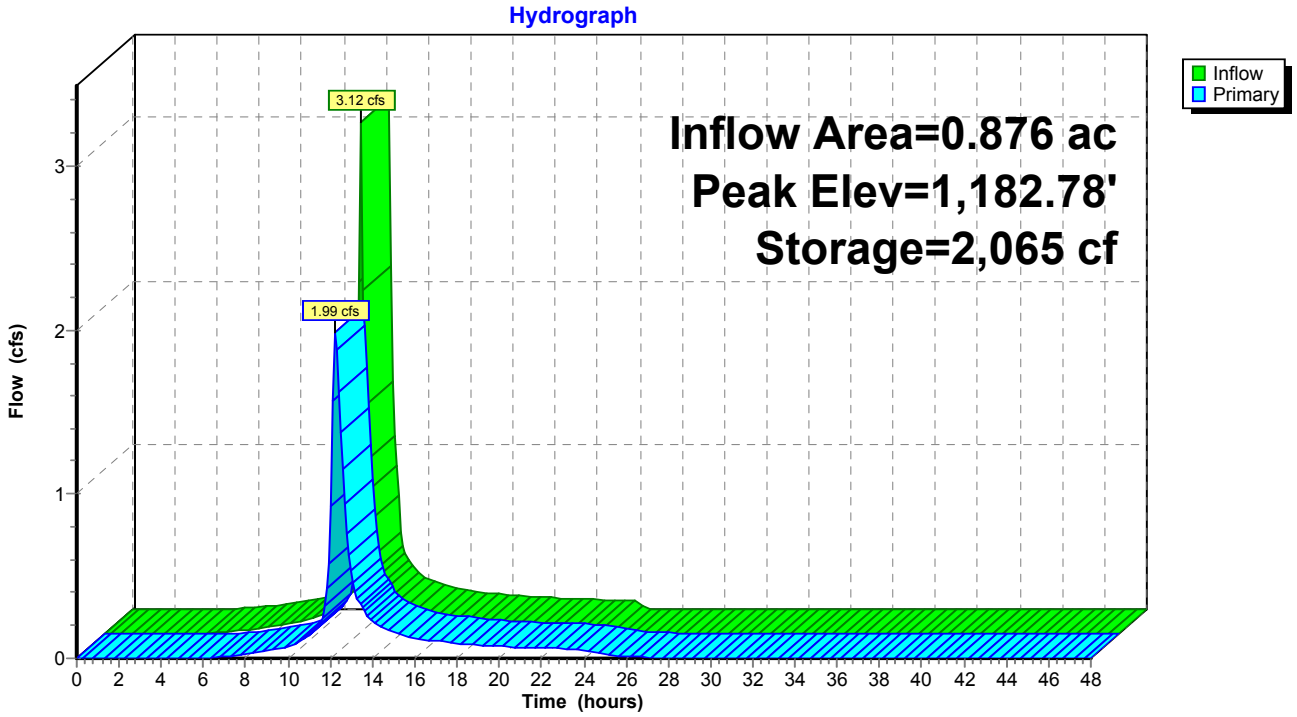
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,182.00	2,318	0	0
1,183.00	3,134	2,726	2,726
1,184.00	4,048	3,591	6,317

Device	Routing	Invert	Outlet Devices
#1	Primary	1,182.00'	**12.0" Round Culvert** L= 80.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,182.00' / 1,176.00' S= 0.0750 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Primary	1,183.00'	**30.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.94 cfs @ 12.23 hrs HW=1,182.77' (Free Discharge)
1=Culvert (Inlet Controls 1.94 cfs @ 2.99 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Pond RG 1: RAIN GARDEN

Inflow Area = 0.876 ac, 0.98% Impervious, Inflow Depth = 4.36" for 50-yr event
Inflow = 3.52 cfs @ 12.10 hrs, Volume= 0.318 af
Outflow = 2.28 cfs @ 12.23 hrs, Volume= 0.318 af, Atten= 35%, Lag= 8.0 min
Primary = 2.28 cfs @ 12.23 hrs, Volume= 0.318 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.86' @ 12.23 hrs Surf.Area= 3,022 sf Storage= 2,302 cf

Plug-Flow detention time= 38.8 min calculated for 0.318 af (100% of inflow)
Center-of-Mass det. time= 40.3 min (849.3 - 809.1)

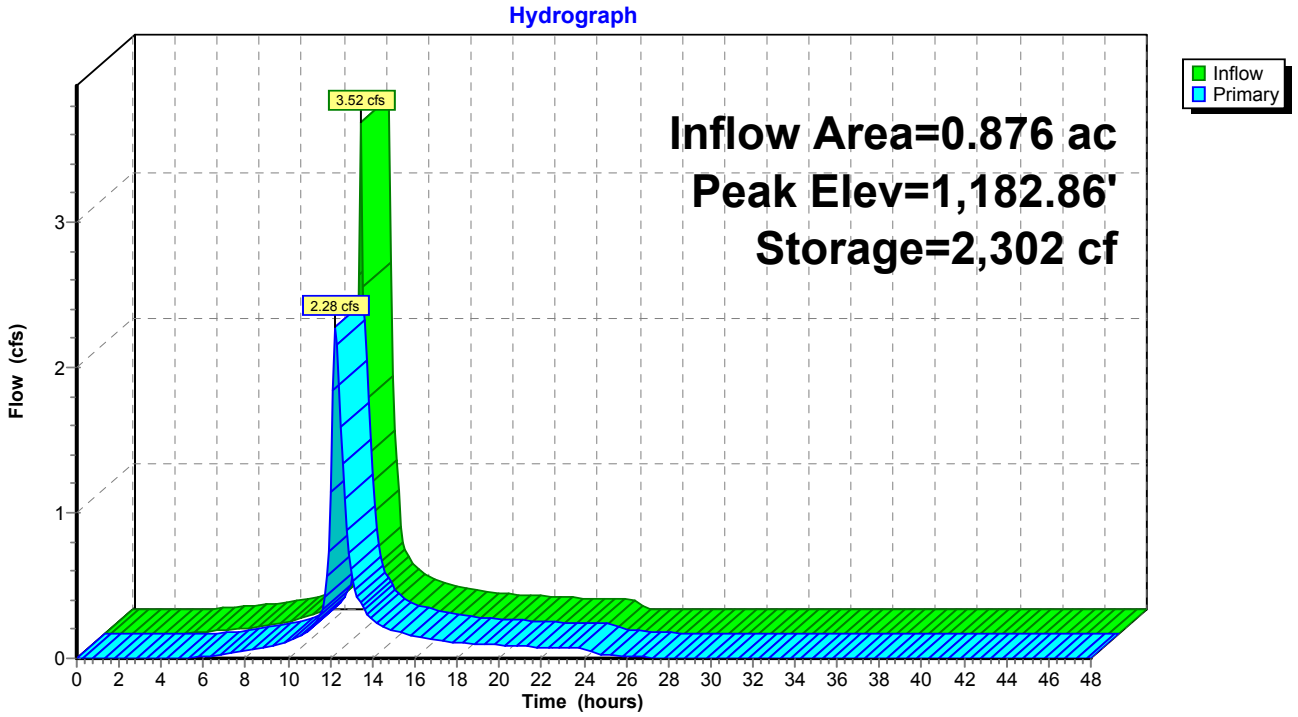
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,182.00	2,318	0	0
1,183.00	3,134	2,726	2,726
1,184.00	4,048	3,591	6,317

Device	Routing	Invert	Outlet Devices
#1	Primary	1,182.00'	**12.0" Round Culvert** L= 80.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,182.00' / 1,176.00' S= 0.0750 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Primary	1,183.00'	**30.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=2.23 cfs @ 12.23 hrs HW=1,182.85' (Free Discharge)
1=Culvert (Inlet Controls 2.23 cfs @ 3.13 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Pond RG 1: RAIN GARDEN

Inflow Area = 0.876 ac, 0.98% Impervious, Inflow Depth = 5.32" for 100-yr event
Inflow = 4.01 cfs @ 12.10 hrs, Volume= 0.388 af
Outflow = 2.57 cfs @ 12.23 hrs, Volume= 0.388 af, Atten= 36%, Lag= 8.1 min
Primary = 2.57 cfs @ 12.23 hrs, Volume= 0.388 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.95' @ 12.23 hrs Surf.Area= 3,095 sf Storage= 2,577 cf

Plug-Flow detention time= 36.4 min calculated for 0.387 af (100% of inflow)
Center-of-Mass det. time= 37.8 min (842.0 - 804.3)

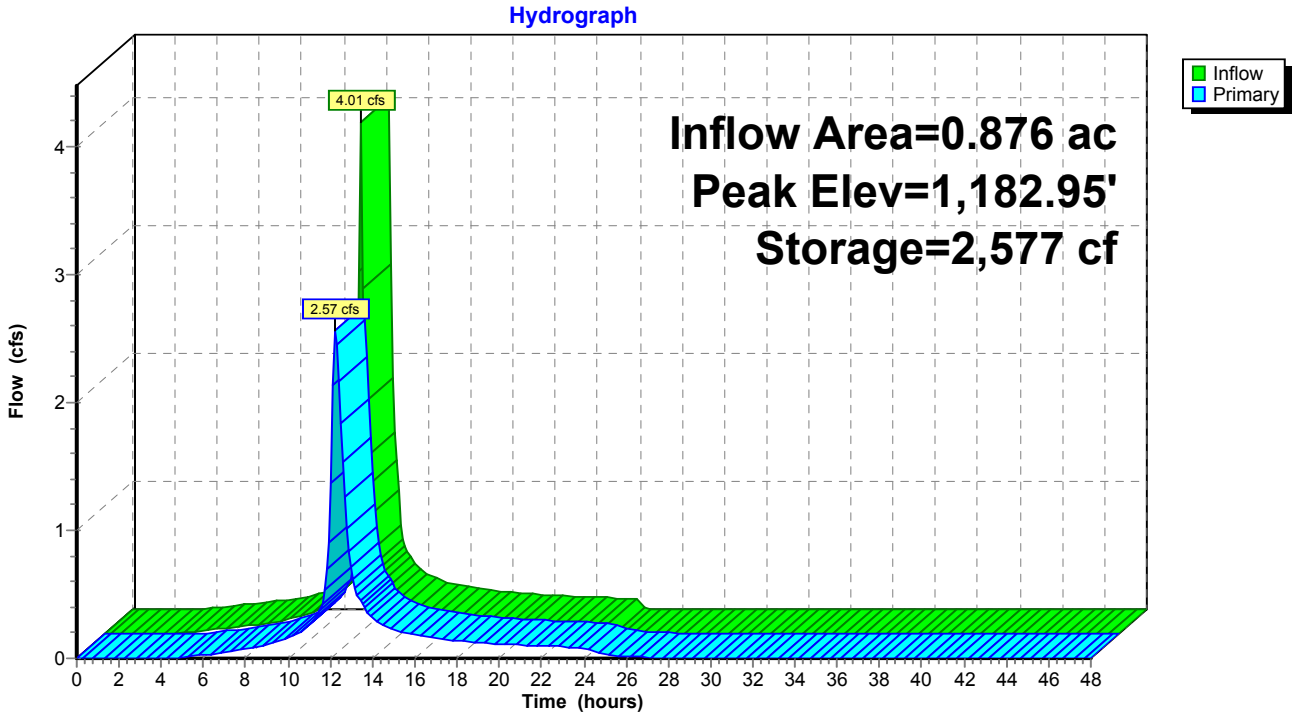
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,182.00	2,318	0	0
1,183.00	3,134	2,726	2,726
1,184.00	4,048	3,591	6,317

Device	Routing	Invert	Outlet Devices
#1	Primary	1,182.00'	**12.0" Round Culvert** L= 80.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,182.00' / 1,176.00' S= 0.0750 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Primary	1,183.00'	**30.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=2.52 cfs @ 12.23 hrs HW=1,182.94' (Free Discharge)
1=Culvert (Inlet Controls 2.52 cfs @ 3.29 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1

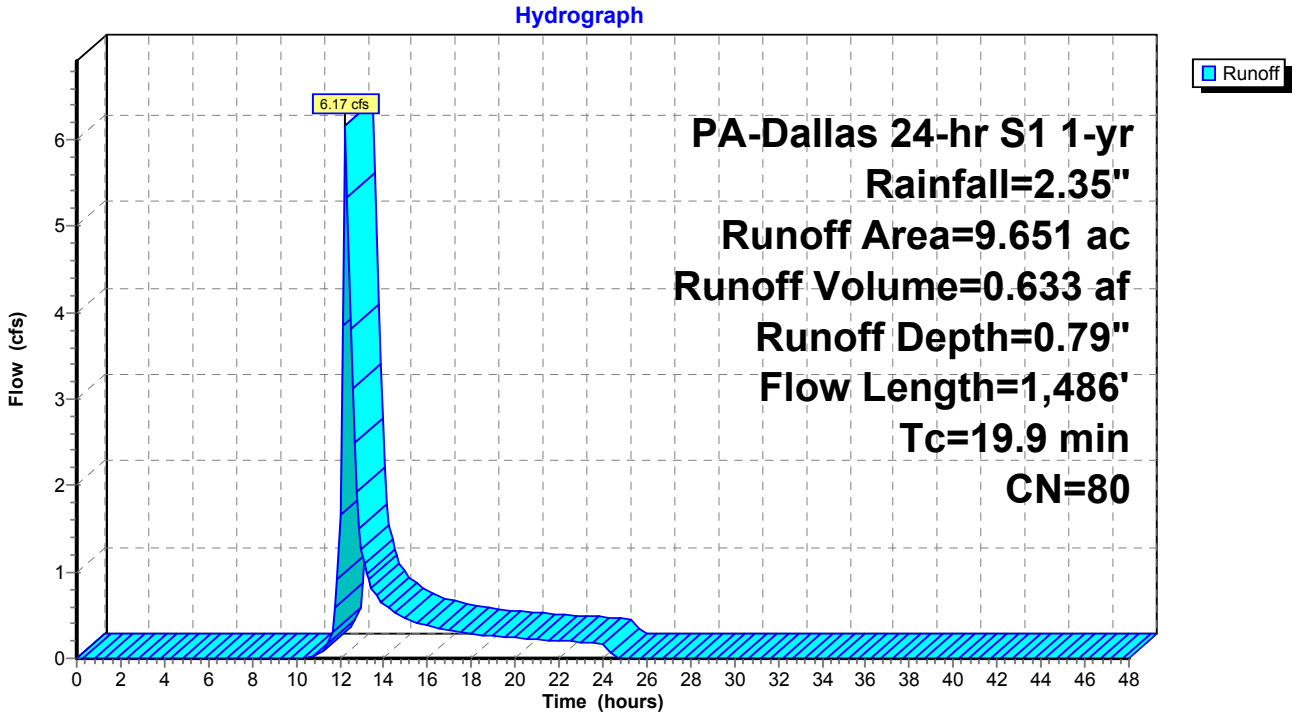
Runoff = 6.17 cfs @ 12.25 hrs, Volume= 0.633 af, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 1-yr Rainfall=2.35"

	Area (ac)	CN	Description
	2.596	77	Woods, Good, HSG D
	6.059	78	Meadow, non-grazed, HSG D
*	0.287	91	Gravel areas, HSG D
*	0.709	98	Impervious areas, HSG D
	9.651	80	Weighted Average
	8.942		92.65% Pervious Area
	0.709		7.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	44	0.0277	1.25		**Sheet Flow, SHT 1** Smooth surfaces n= 0.011 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
19.9	1,486	Total			

Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1

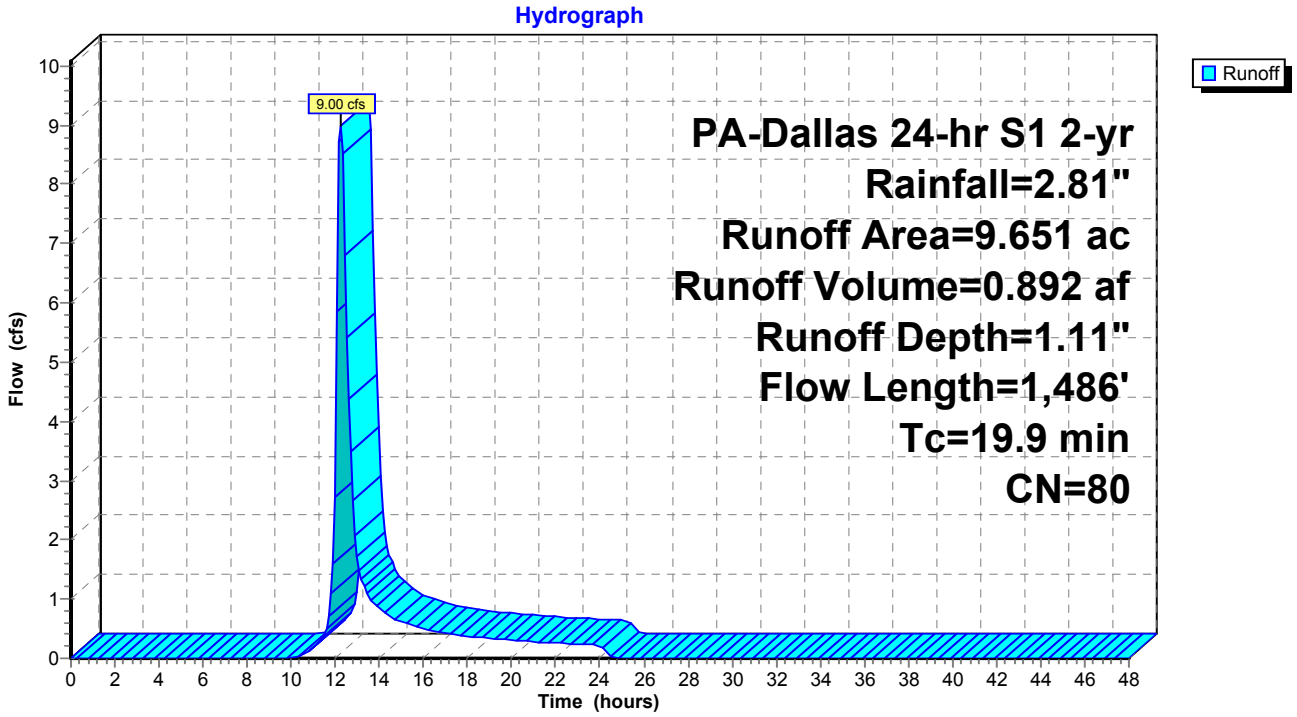
Runoff = 9.00 cfs @ 12.24 hrs, Volume= 0.892 af, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 2-yr Rainfall=2.81"

	Area (ac)	CN	Description
	2.596	77	Woods, Good, HSG D
	6.059	78	Meadow, non-grazed, HSG D
*	0.287	91	Gravel areas, HSG D
*	0.709	98	Impervious areas, HSG D
	9.651	80	Weighted Average
	8.942		92.65% Pervious Area
	0.709		7.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	44	0.0277	1.25		**Sheet Flow, SHT 1** Smooth surfaces n= 0.011 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
19.9	1,486	Total			

Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1

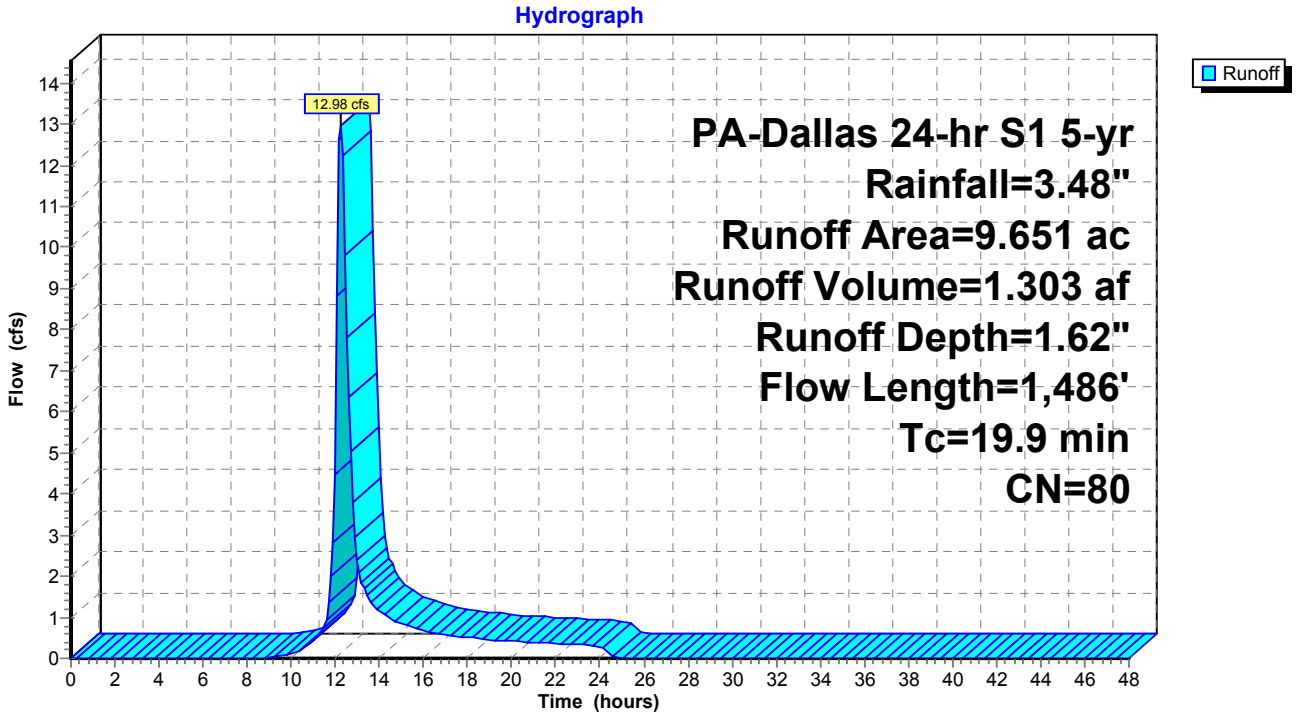
Runoff = 12.98 cfs @ 12.24 hrs, Volume= 1.303 af, Depth= 1.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 5-yr Rainfall=3.48"

	Area (ac)	CN	Description
	2.596	77	Woods, Good, HSG D
	6.059	78	Meadow, non-grazed, HSG D
*	0.287	91	Gravel areas, HSG D
*	0.709	98	Impervious areas, HSG D
	9.651	80	Weighted Average
	8.942		92.65% Pervious Area
	0.709		7.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	44	0.0277	1.25		**Sheet Flow, SHT 1** Smooth surfaces n= 0.011 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
19.9	1,486	Total			

Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1

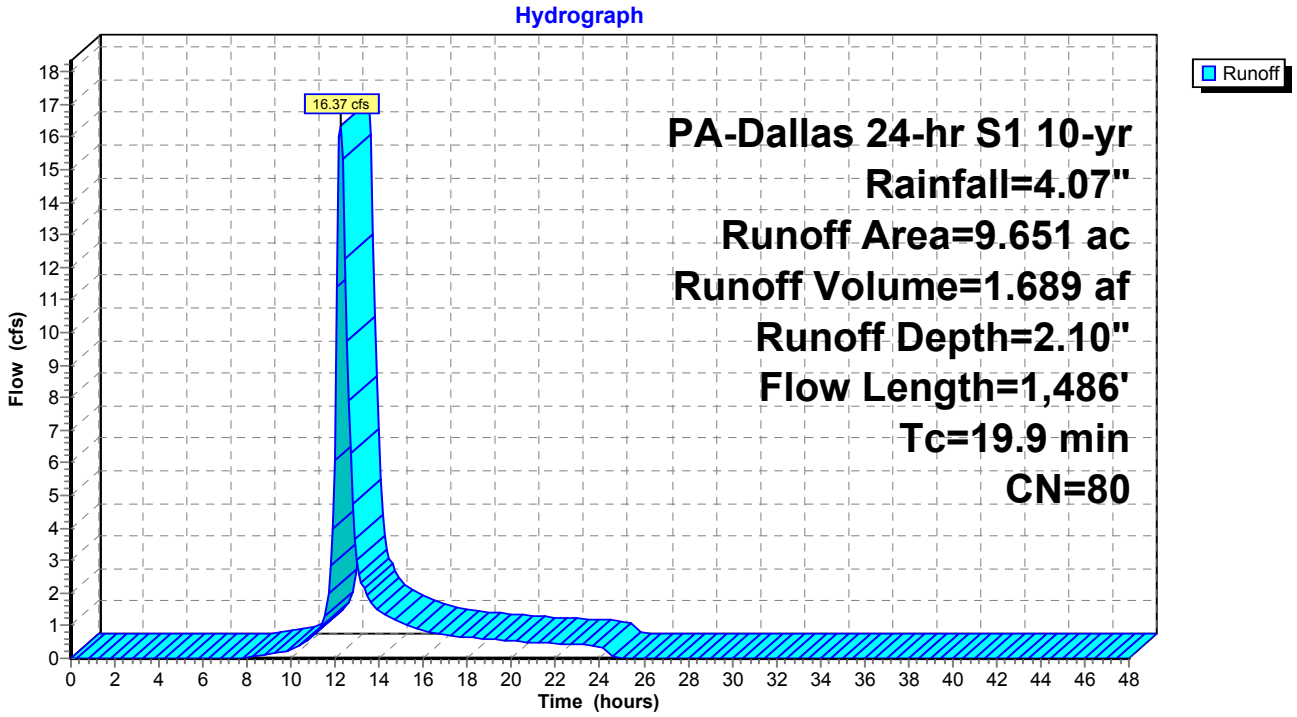
Runoff = 16.37 cfs @ 12.24 hrs, Volume= 1.689 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 10-yr Rainfall=4.07"

	Area (ac)	CN	Description
	2.596	77	Woods, Good, HSG D
	6.059	78	Meadow, non-grazed, HSG D
*	0.287	91	Gravel areas, HSG D
*	0.709	98	Impervious areas, HSG D
	9.651	80	Weighted Average
	8.942		92.65% Pervious Area
	0.709		7.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	44	0.0277	1.25		**Sheet Flow, SHT 1** Smooth surfaces n= 0.011 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
19.9	1,486	Total			

Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1

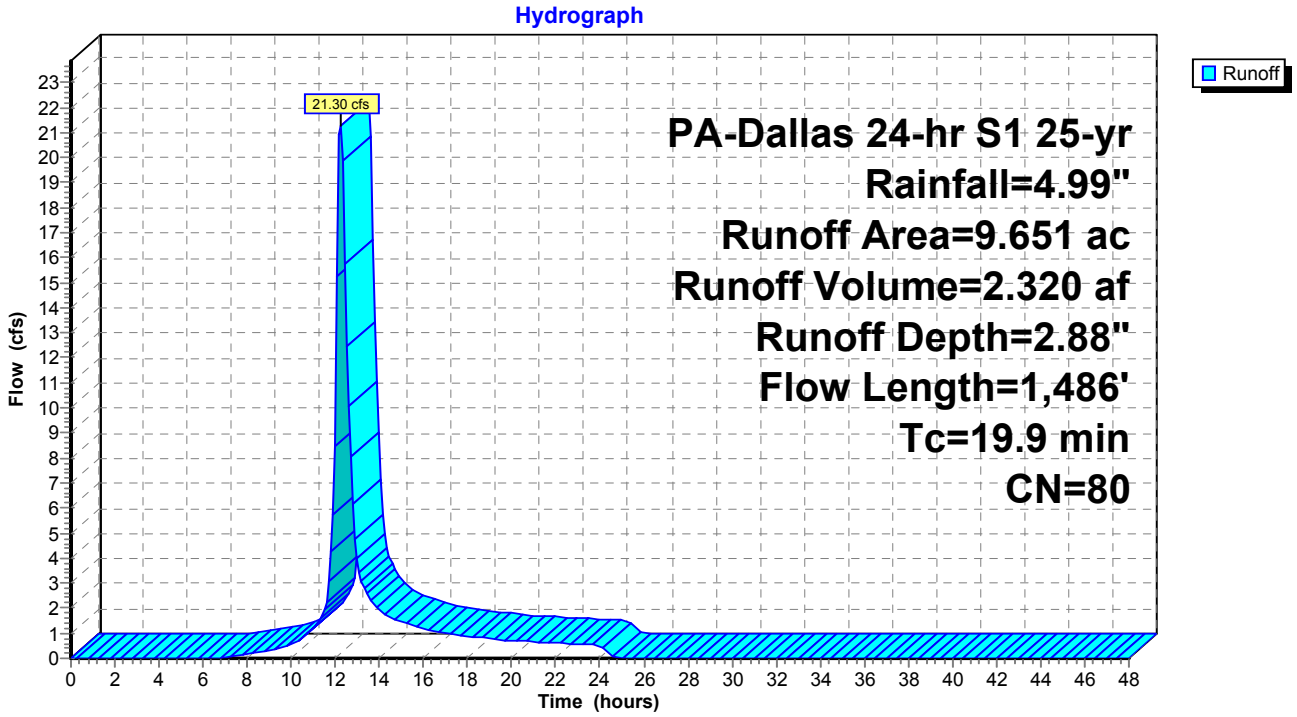
Runoff = 21.30 cfs @ 12.23 hrs, Volume= 2.320 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 25-yr Rainfall=4.99"

	Area (ac)	CN	Description
	2.596	77	Woods, Good, HSG D
	6.059	78	Meadow, non-grazed, HSG D
*	0.287	91	Gravel areas, HSG D
*	0.709	98	Impervious areas, HSG D
	9.651	80	Weighted Average
	8.942		92.65% Pervious Area
	0.709		7.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	44	0.0277	1.25		**Sheet Flow, SHT 1** Smooth surfaces n= 0.011 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
19.9	1,486	Total			

Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1

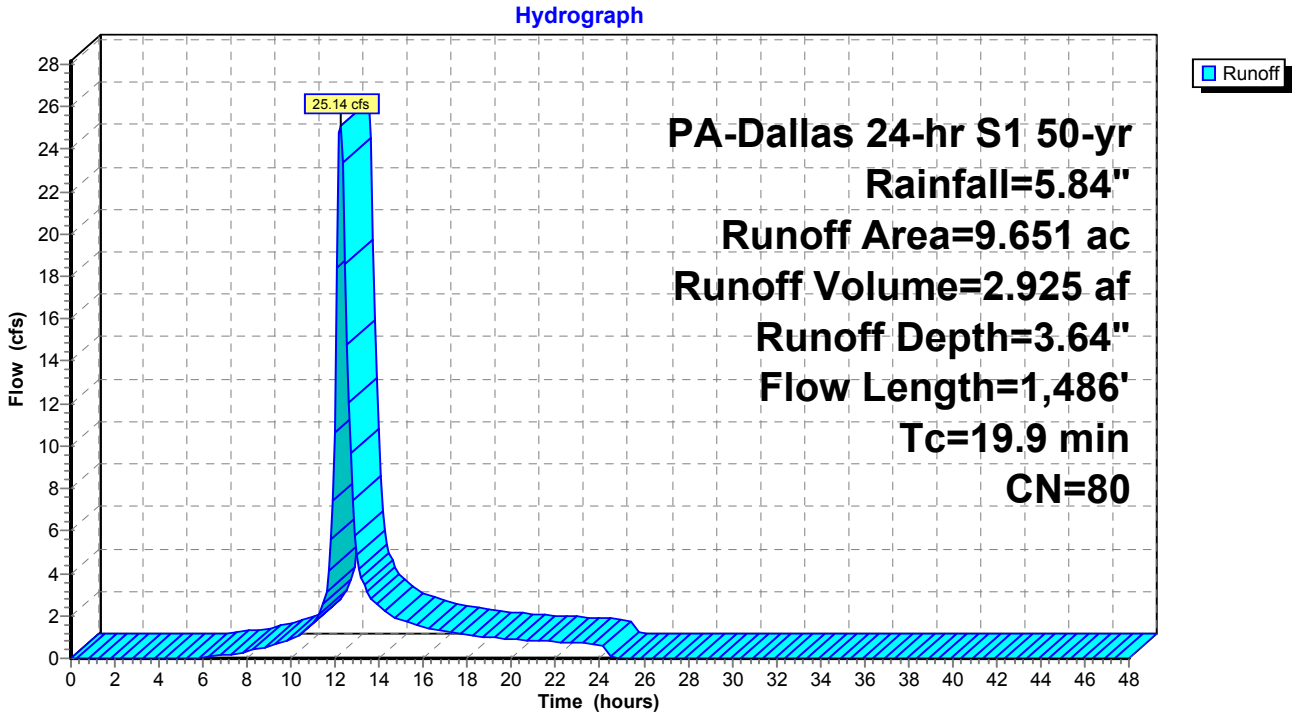
Runoff = 25.14 cfs @ 12.23 hrs, Volume= 2.925 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 50-yr Rainfall=5.84"

	Area (ac)	CN	Description
	2.596	77	Woods, Good, HSG D
	6.059	78	Meadow, non-grazed, HSG D
*	0.287	91	Gravel areas, HSG D
*	0.709	98	Impervious areas, HSG D
	9.651	80	Weighted Average
	8.942		92.65% Pervious Area
	0.709		7.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	44	0.0277	1.25		**Sheet Flow, SHT 1** Smooth surfaces n= 0.011 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
19.9	1,486	Total			

Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1

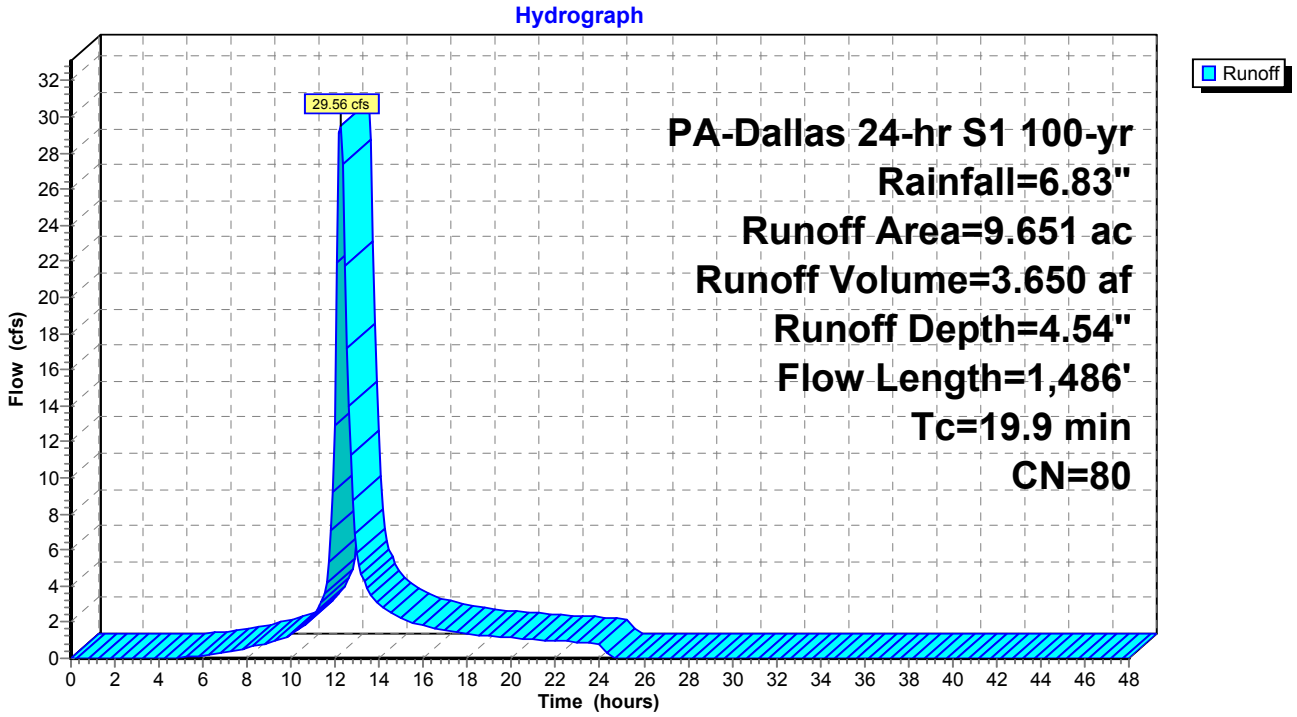
Runoff = 29.56 cfs @ 12.23 hrs, Volume= 3.650 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 100-yr Rainfall=6.83"

	Area (ac)	CN	Description
	2.596	77	Woods, Good, HSG D
	6.059	78	Meadow, non-grazed, HSG D
*	0.287	91	Gravel areas, HSG D
*	0.709	98	Impervious areas, HSG D
	9.651	80	Weighted Average
	8.942		92.65% Pervious Area
	0.709		7.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	44	0.0277	1.25		**Sheet Flow, SHT 1** Smooth surfaces n= 0.011 P2= 2.81"
4.0	56	0.0536	0.24		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
2.9	251	0.0438	1.46		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0385	3.98		**Shallow Concentrated Flow, SCF 2** Paved Kv= 20.3 fps
4.0	408	0.0588	1.70		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
7.4	542	0.0590	1.21		**Shallow Concentrated Flow, SCF 4** Woodland Kv= 5.0 fps
0.9	172	0.0407	3.03		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
19.9	1,486	Total			

Subcatchment RD POST: POST DEVELOPMENT VEG SWALE 1



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 9.651 ac, 7.35% Impervious, Inflow Depth = 0.79" for 1-yr event
Inflow = 6.17 cfs @ 12.25 hrs, Volume= 0.633 af
Outflow = 3.30 cfs @ 12.59 hrs, Volume= 0.567 af, Atten= 47%, Lag= 20.2 min
Primary = 3.30 cfs @ 12.59 hrs, Volume= 0.567 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,175.26' @ 12.58 hrs Surf.Area= 0 sf Storage= 7,450 cf

Plug-Flow detention time= 112.3 min calculated for 0.567 af (90% of inflow)
Center-of-Mass det. time= 58.8 min (942.1 - 883.3)

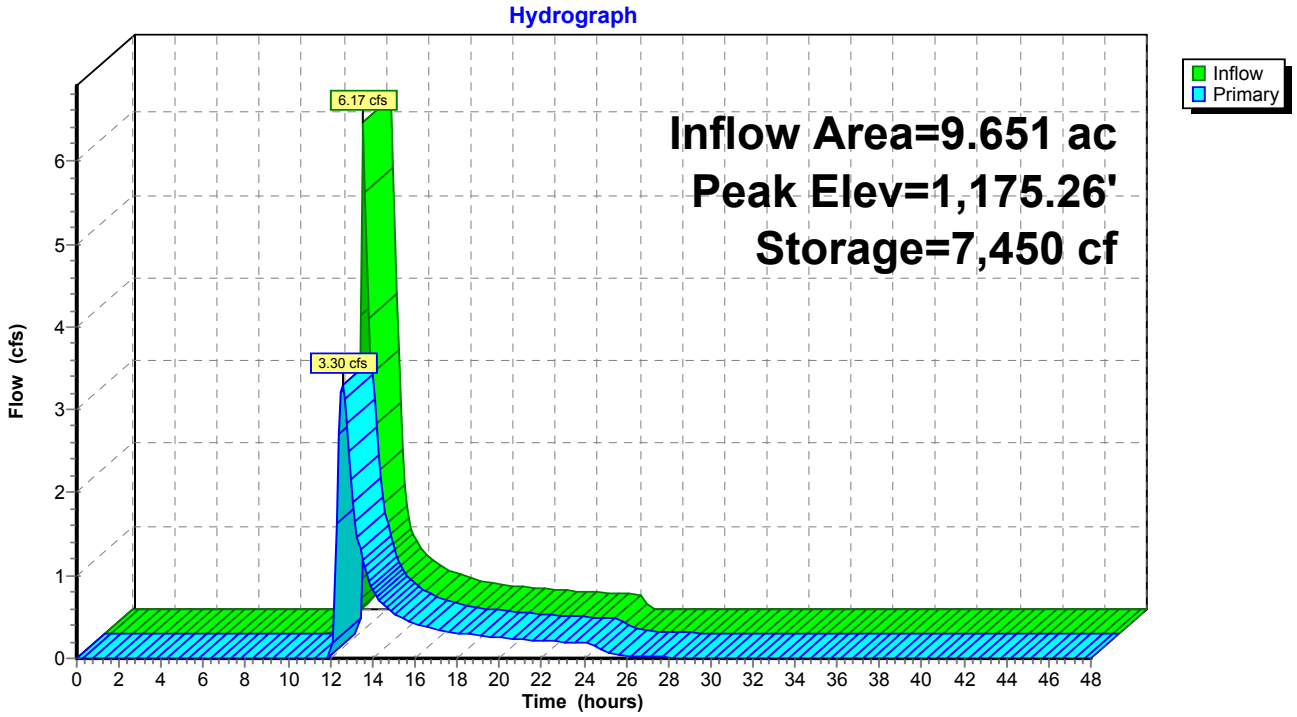
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	20,182 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,883	2,883
1,176.00	17,299	20,182

Device	Routing	Invert	Outlet Devices
#1	Primary	1,175.00'	**9.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=3.28 cfs @ 12.59 hrs HW=1,175.26' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 3.28 cfs @ 1.38 fps)

Pond VS 1: VEG SWALE 1



Stage-Discharge for Pond VS 1: VEG SWALE 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,174.00	0.00	1,174.52	0.00	1,175.04	0.19	1,175.56	10.35
1,174.01	0.00	1,174.53	0.00	1,175.05	0.27	1,175.57	10.63
1,174.02	0.00	1,174.54	0.00	1,175.06	0.36	1,175.58	10.92
1,174.03	0.00	1,174.55	0.00	1,175.07	0.45	1,175.59	11.21
1,174.04	0.00	1,174.56	0.00	1,175.08	0.55	1,175.60	11.50
1,174.05	0.00	1,174.57	0.00	1,175.09	0.65	1,175.61	11.81
1,174.06	0.00	1,174.58	0.00	1,175.10	0.77	1,175.62	12.13
1,174.07	0.00	1,174.59	0.00	1,175.11	0.88	1,175.63	12.44
1,174.08	0.00	1,174.60	0.00	1,175.12	1.01	1,175.64	12.76
1,174.09	0.00	1,174.61	0.00	1,175.13	1.13	1,175.65	13.09
1,174.10	0.00	1,174.62	0.00	1,175.14	1.27	1,175.66	13.42
1,174.11	0.00	1,174.63	0.00	1,175.15	1.41	1,175.67	13.75
1,174.12	0.00	1,174.64	0.00	1,175.16	1.55	1,175.68	14.08
1,174.13	0.00	1,174.65	0.00	1,175.17	1.70	1,175.69	14.42
1,174.14	0.00	1,174.66	0.00	1,175.18	1.85	1,175.70	14.76
1,174.15	0.00	1,174.67	0.00	1,175.19	2.01	1,175.71	15.10
1,174.16	0.00	1,174.68	0.00	1,175.20	2.17	1,175.72	15.45
1,174.17	0.00	1,174.69	0.00	1,175.21	2.33	1,175.73	15.80
1,174.18	0.00	1,174.70	0.00	1,175.22	2.50	1,175.74	16.16
1,174.19	0.00	1,174.71	0.00	1,175.23	2.67	1,175.75	16.51
1,174.20	0.00	1,174.72	0.00	1,175.24	2.85	1,175.76	16.88
1,174.21	0.00	1,174.73	0.00	1,175.25	3.03	1,175.77	17.24
1,174.22	0.00	1,174.74	0.00	1,175.26	3.22	1,175.78	17.61
1,174.23	0.00	1,174.75	0.00	1,175.27	3.41	1,175.79	17.98
1,174.24	0.00	1,174.76	0.00	1,175.28	3.60	1,175.80	18.35
1,174.25	0.00	1,174.77	0.00	1,175.29	3.80	1,175.81	18.74
1,174.26	0.00	1,174.78	0.00	1,175.30	4.00	1,175.82	19.13
1,174.27	0.00	1,174.79	0.00	1,175.31	4.20	1,175.83	19.53
1,174.28	0.00	1,174.80	0.00	1,175.32	4.41	1,175.84	19.93
1,174.29	0.00	1,174.81	0.00	1,175.33	4.62	1,175.85	20.33
1,174.30	0.00	1,174.82	0.00	1,175.34	4.84	1,175.86	20.74
1,174.31	0.00	1,174.83	0.00	1,175.35	5.05	1,175.87	21.15
1,174.32	0.00	1,174.84	0.00	1,175.36	5.28	1,175.88	21.56
1,174.33	0.00	1,174.85	0.00	1,175.37	5.50	1,175.89	21.98
1,174.34	0.00	1,174.86	0.00	1,175.38	5.73	1,175.90	22.40
1,174.35	0.00	1,174.87	0.00	1,175.39	5.96	1,175.91	22.82
1,174.36	0.00	1,174.88	0.00	1,175.40	6.19	1,175.92	23.25
1,174.37	0.00	1,174.89	0.00	1,175.41	6.43	1,175.93	23.69
1,174.38	0.00	1,174.90	0.00	1,175.42	6.67	1,175.94	24.12
1,174.39	0.00	1,174.91	0.00	1,175.43	6.91	1,175.95	24.56
1,174.40	0.00	1,174.92	0.00	1,175.44	7.16	1,175.96	25.01
1,174.41	0.00	1,174.93	0.00	1,175.45	7.41	1,175.97	25.45
1,174.42	0.00	1,174.94	0.00	1,175.46	7.66	1,175.98	25.91
1,174.43	0.00	1,174.95	0.00	1,175.47	7.92	1,175.99	26.36
1,174.44	0.00	1,174.96	0.00	1,175.48	8.18	1,176.00	**26.82**
1,174.45	0.00	1,174.97	0.00	1,175.49	8.44		
1,174.46	0.00	1,174.98	0.00	1,175.50	8.70		
1,174.47	0.00	1,174.99	0.00	1,175.51	8.97		
1,174.48	0.00	1,175.00	0.00	1,175.52	9.24		
1,174.49	0.00	1,175.01	0.02	1,175.53	9.51		
1,174.50	0.00	1,175.02	0.07	1,175.54	9.79		
1,174.51	0.00	1,175.03	0.13	1,175.55	10.07		

Stage-Area-Storage for Pond VS 1: VEG SWALE 1

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
1,174.00	0	1,175.04	3,575
1,174.02	58	1,175.06	3,921
1,174.04	115	1,175.08	4,267
1,174.06	173	1,175.10	4,613
1,174.08	231	1,175.12	4,959
1,174.10	288	1,175.14	5,305
1,174.12	346	1,175.16	5,651
1,174.14	404	1,175.18	5,997
1,174.16	461	1,175.20	6,343
1,174.18	519	1,175.22	6,689
1,174.20	577	1,175.24	7,035
1,174.22	634	1,175.26	7,381
1,174.24	692	1,175.28	7,727
1,174.26	750	1,175.30	8,073
1,174.28	807	1,175.32	8,419
1,174.30	865	1,175.34	8,765
1,174.32	923	1,175.36	9,111
1,174.34	980	1,175.38	9,457
1,174.36	1,038	1,175.40	9,803
1,174.38	1,096	1,175.42	10,149
1,174.40	1,153	1,175.44	10,495
1,174.42	1,211	1,175.46	10,841
1,174.44	1,269	1,175.48	11,187
1,174.46	1,326	1,175.50	11,533
1,174.48	1,384	1,175.52	11,878
1,174.50	1,442	1,175.54	12,224
1,174.52	1,499	1,175.56	12,570
1,174.54	1,557	1,175.58	12,916
1,174.56	1,614	1,175.60	13,262
1,174.58	1,672	1,175.62	13,608
1,174.60	1,730	1,175.64	13,954
1,174.62	1,787	1,175.66	14,300
1,174.64	1,845	1,175.68	14,646
1,174.66	1,903	1,175.70	14,992
1,174.68	1,960	1,175.72	15,338
1,174.70	2,018	1,175.74	15,684
1,174.72	2,076	1,175.76	16,030
1,174.74	2,133	1,175.78	16,376
1,174.76	2,191	1,175.80	16,722
1,174.78	2,249	1,175.82	17,068
1,174.80	2,306	1,175.84	17,414
1,174.82	2,364	1,175.86	17,760
1,174.84	2,422	1,175.88	18,106
1,174.86	2,479	1,175.90	18,452
1,174.88	2,537	1,175.92	18,798
1,174.90	2,595	1,175.94	19,144
1,174.92	2,652	1,175.96	19,490
1,174.94	2,710	1,175.98	19,836
1,174.96	2,768	1,176.00	**20,182**
1,174.98	2,825		
1,175.00	2,883		
1,175.02	3,229		

Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 9.651 ac, 7.35% Impervious, Inflow Depth = 1.11" for 2-yr event
Inflow = 9.00 cfs @ 12.24 hrs, Volume= 0.892 af
Outflow = 5.72 cfs @ 12.49 hrs, Volume= 0.826 af, Atten= 36%, Lag= 14.9 min
Primary = 5.72 cfs @ 12.49 hrs, Volume= 0.826 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,175.38' @ 12.49 hrs Surf.Area= 0 sf Storage= 9,454 cf

Plug-Flow detention time= 85.9 min calculated for 0.824 af (92% of inflow)
Center-of-Mass det. time= 47.7 min (919.1 - 871.4)

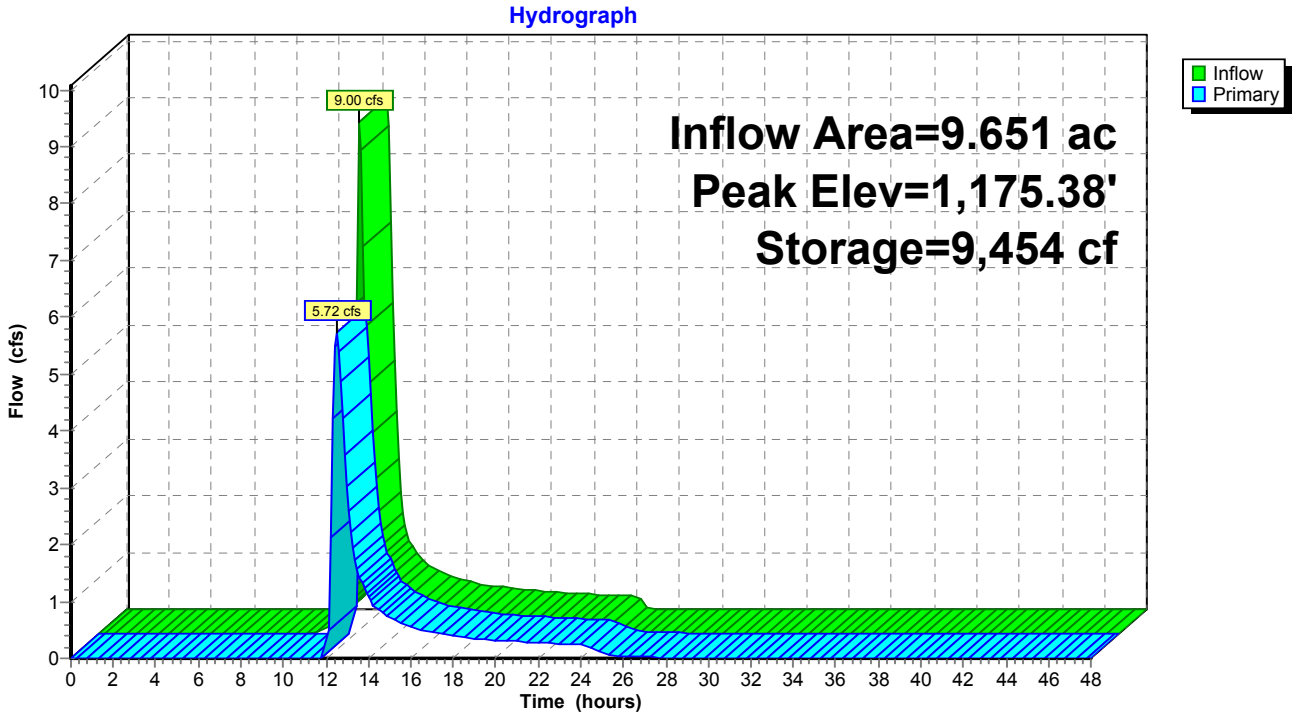
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	20,182 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,883	2,883
1,176.00	17,299	20,182

Device	Routing	Invert	Outlet Devices
#1	Primary	1,175.00'	**9.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=5.70 cfs @ 12.49 hrs HW=1,175.38' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 5.70 cfs @ 1.67 fps)

Pond VS 1: VEG SWALE 1



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 9.651 ac, 7.35% Impervious, Inflow Depth = 1.62" for 5-yr event
Inflow = 12.98 cfs @ 12.24 hrs, Volume= 1.303 af
Outflow = 9.55 cfs @ 12.43 hrs, Volume= 1.237 af, Atten= 26%, Lag= 11.3 min
Primary = 9.55 cfs @ 12.43 hrs, Volume= 1.237 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,175.53' @ 12.43 hrs Surf.Area= 0 sf Storage= 12,075 cf

Plug-Flow detention time= 68.9 min calculated for 1.237 af (95% of inflow)
Center-of-Mass det. time= 39.9 min (900.2 - 860.3)

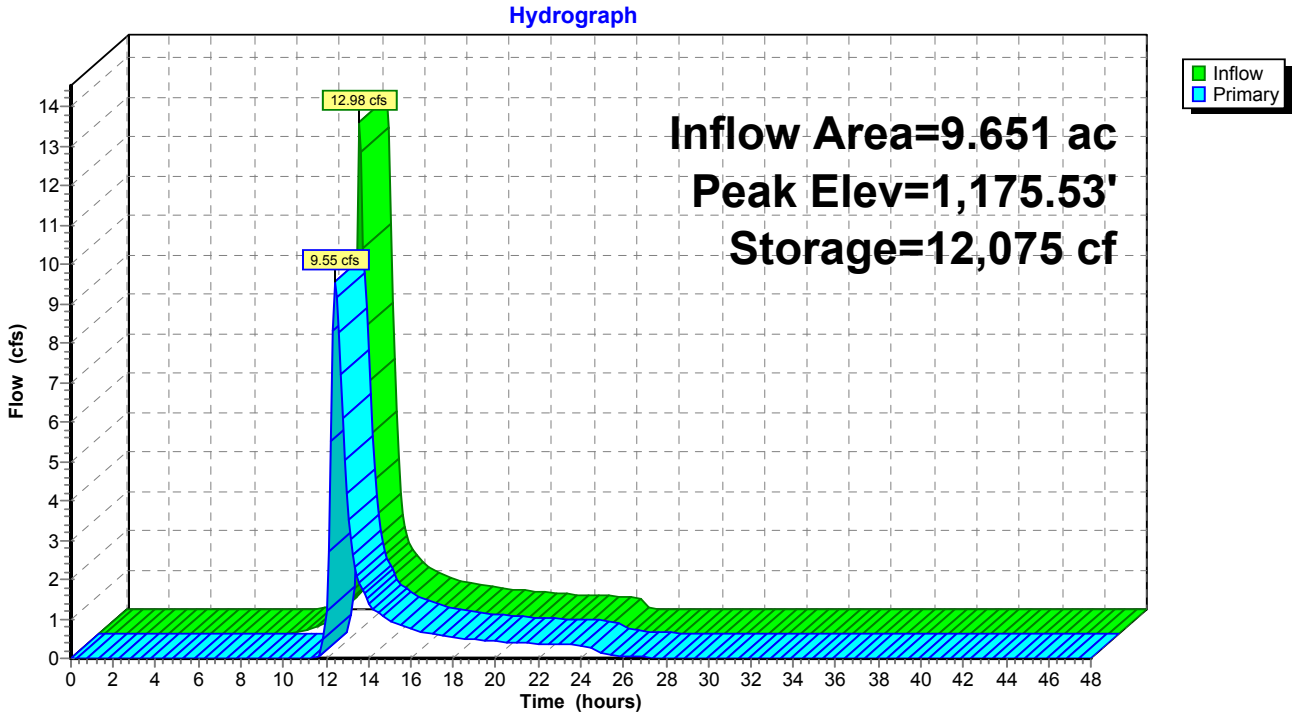
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	20,182 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,883	2,883
1,176.00	17,299	20,182

Device	Routing	Invert	Outlet Devices
#1	Primary	1,175.00'	**9.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=9.39 cfs @ 12.43 hrs HW=1,175.53' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 9.39 cfs @ 1.99 fps)

Pond VS 1: VEG SWALE 1



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 9.651 ac, 7.35% Impervious, Inflow Depth = 2.10" for 10-yr event
Inflow = 16.37 cfs @ 12.24 hrs, Volume= 1.689 af
Outflow = 12.69 cfs @ 12.41 hrs, Volume= 1.622 af, Atten= 22%, Lag= 10.1 min
Primary = 12.69 cfs @ 12.41 hrs, Volume= 1.622 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,175.64' @ 12.41 hrs Surf.Area= 0 sf Storage= 13,914 cf

Plug-Flow detention time= 58.0 min calculated for 1.619 af (96% of inflow)
Center-of-Mass det. time= 36.6 min (891.1 - 854.5)

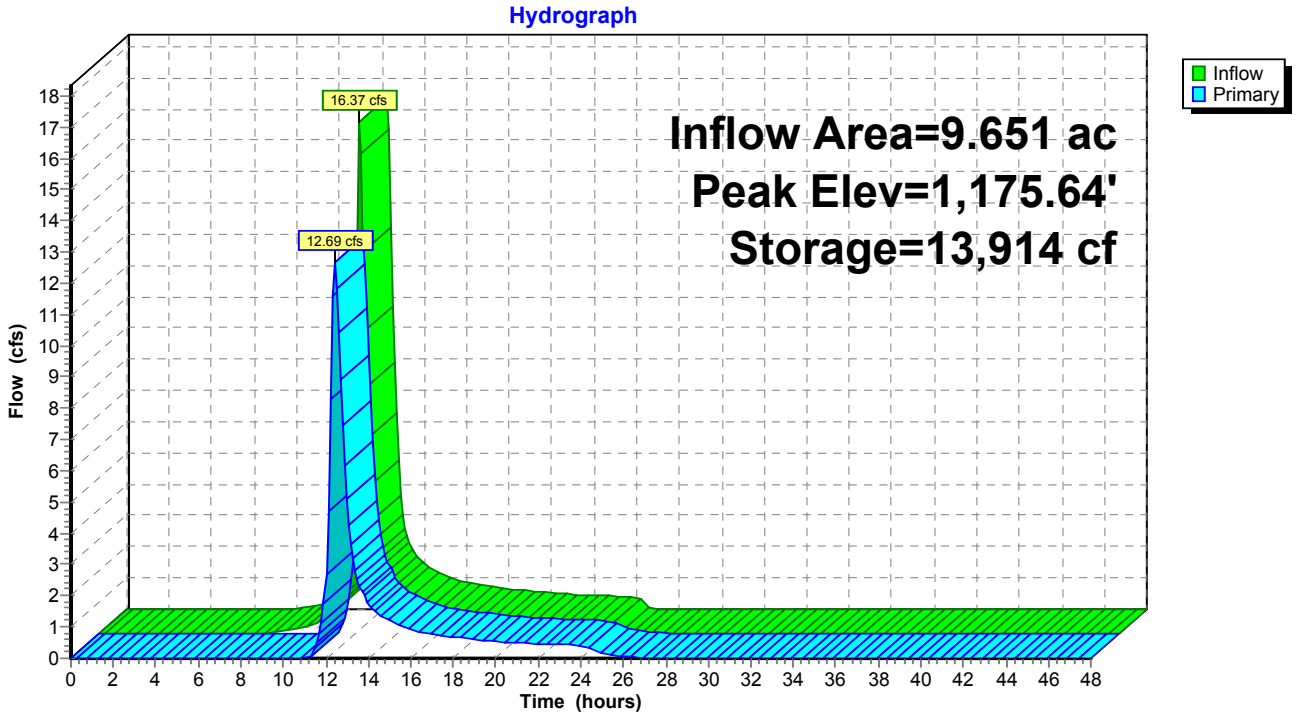
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	20,182 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,883	2,883
1,176.00	17,299	20,182

Device	Routing	Invert	Outlet Devices
#1	Primary	1,175.00'	**9.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=12.63 cfs @ 12.41 hrs HW=1,175.64' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 12.63 cfs @ 2.21 fps)

Pond VS 1: VEG SWALE 1



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 9.651 ac, 7.35% Impervious, Inflow Depth = 2.88" for 25-yr event
Inflow = 21.30 cfs @ 12.23 hrs, Volume= 2.320 af
Outflow = 17.22 cfs @ 12.38 hrs, Volume= 2.253 af, Atten= 19%, Lag= 8.8 min
Primary = 17.22 cfs @ 12.38 hrs, Volume= 2.253 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,175.77' @ 12.38 hrs Surf.Area= 0 sf Storage= 16,194 cf

Plug-Flow detention time= 51.2 min calculated for 2.253 af (97% of inflow)
Center-of-Mass det. time= 33.6 min (881.6 - 848.1)

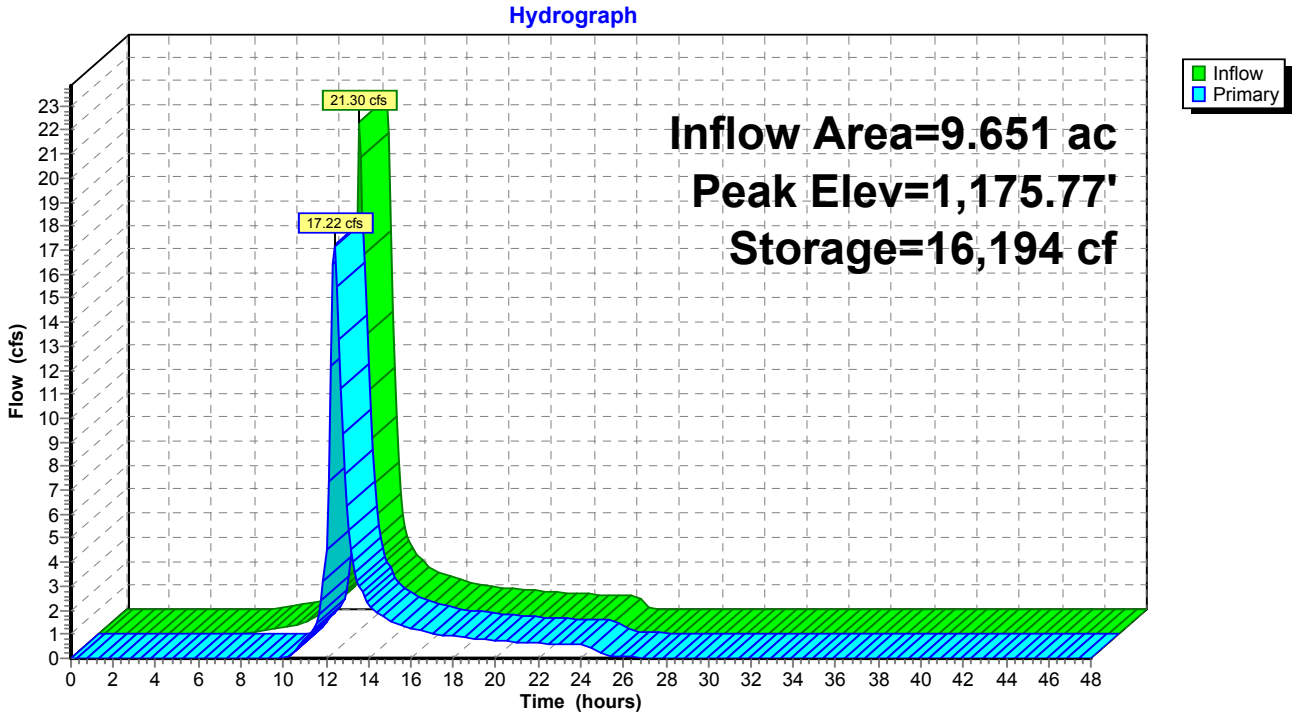
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	20,182 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,883	2,883
1,176.00	17,299	20,182

Device	Routing	Invert	Outlet Devices
#1	Primary	1,175.00'	**9.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=17.03 cfs @ 12.38 hrs HW=1,175.76' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 17.03 cfs @ 2.48 fps)

Pond VS 1: VEG SWALE 1



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 9.651 ac, 7.35% Impervious, Inflow Depth = 3.64" for 50-yr event
Inflow = 25.14 cfs @ 12.23 hrs, Volume= 2.925 af
Outflow = 20.91 cfs @ 12.36 hrs, Volume= 2.859 af, Atten= 17%, Lag= 7.9 min
Primary = 20.91 cfs @ 12.36 hrs, Volume= 2.859 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,175.86' @ 12.36 hrs Surf.Area= 0 sf Storage= 17,836 cf

Plug-Flow detention time= 46.1 min calculated for 2.859 af (98% of inflow)
Center-of-Mass det. time= 31.6 min (874.9 - 843.2)

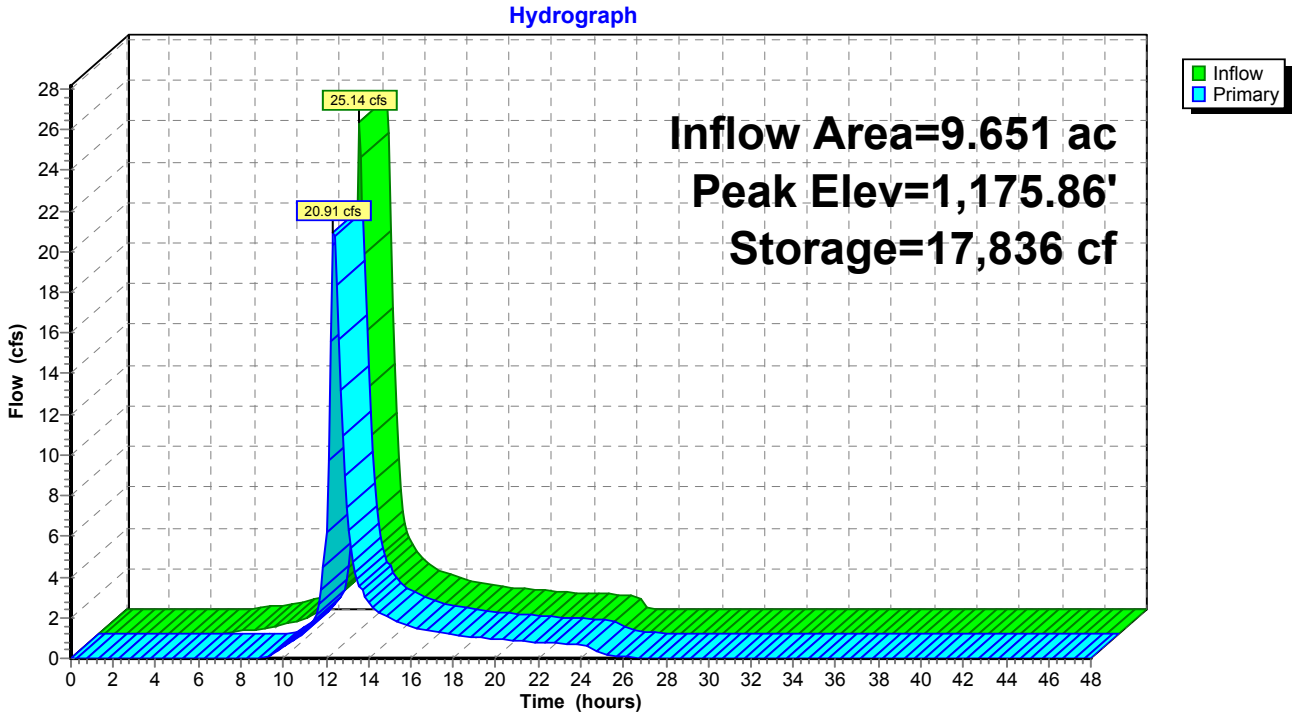
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	20,182 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,883	2,883
1,176.00	17,299	20,182

Device	Routing	Invert	Outlet Devices
#1	Primary	1,175.00'	**9.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=20.59 cfs @ 12.36 hrs HW=1,175.86' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 20.59 cfs @ 2.67 fps)

Pond VS 1: VEG SWALE 1



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 9.651 ac, 7.35% Impervious, Inflow Depth = 4.54" for 100-yr event
Inflow = 29.56 cfs @ 12.23 hrs, Volume= 3.650 af
Outflow = 25.41 cfs @ 12.35 hrs, Volume= 3.583 af, Atten= 14%, Lag= 7.0 min
Primary = 25.41 cfs @ 12.35 hrs, Volume= 3.583 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,175.97' @ 12.35 hrs Surf.Area= 0 sf Storage= 19,661 cf

Plug-Flow detention time= 41.8 min calculated for 3.583 af (98% of inflow)
Center-of-Mass det. time= 29.8 min (868.1 - 838.3)

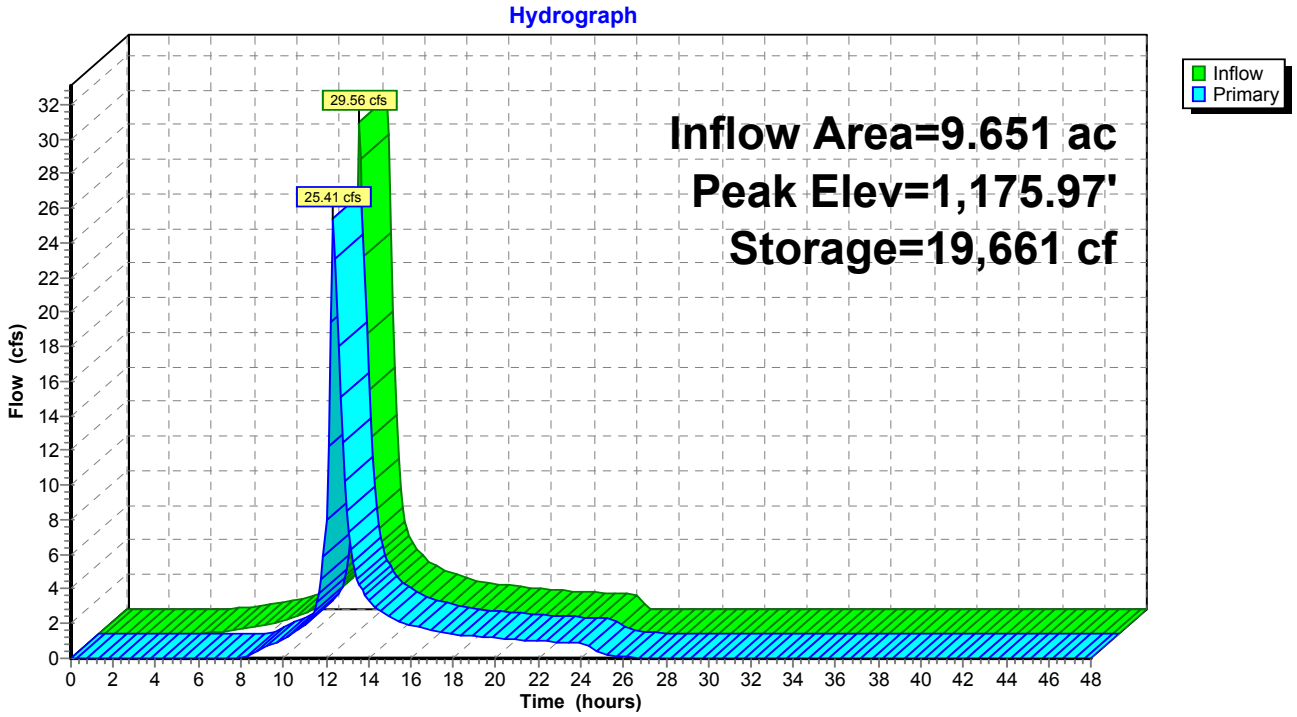
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	20,182 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,883	2,883
1,176.00	17,299	20,182

Device	Routing	Invert	Outlet Devices
#1	Primary	1,175.00'	**9.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=24.72 cfs @ 12.35 hrs HW=1,175.95' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 24.72 cfs @ 2.88 fps)

Pond VS 1: VEG SWALE 1

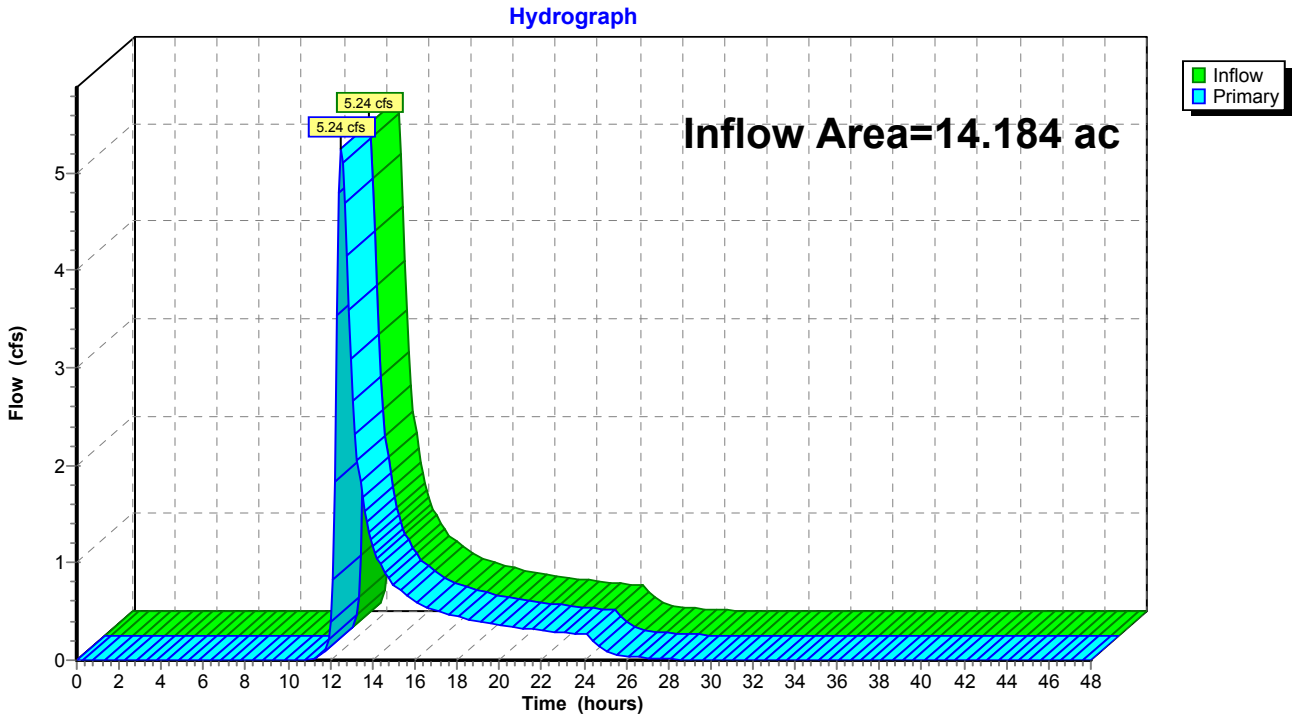


Summary for Link POI POST: POI - POST

Inflow Area = 14.184 ac, 5.06% Impervious, Inflow Depth = 0.73" for 1-yr event
Inflow = 5.24 cfs @ 12.53 hrs, Volume= 0.864 af
Primary = 5.24 cfs @ 12.53 hrs, Volume= 0.864 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI POST: POI - POST

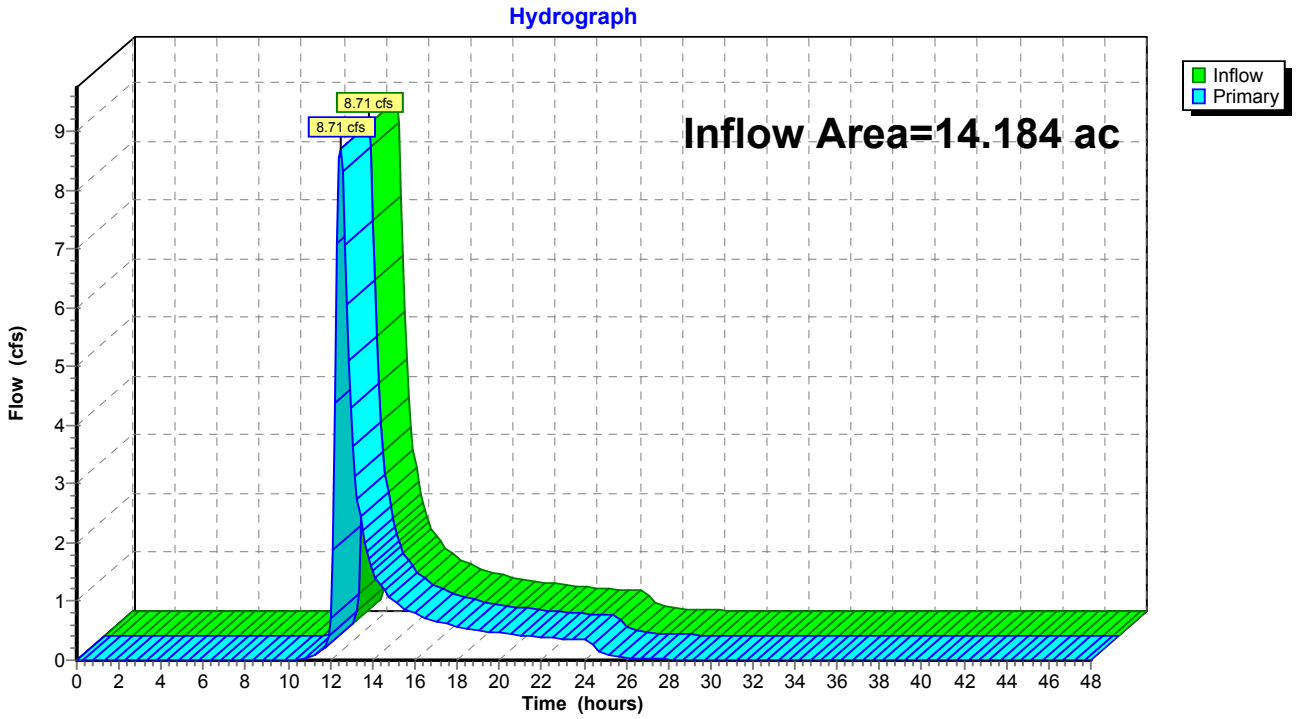


Summary for Link POI POST: POI - POST

Inflow Area = 14.184 ac, 5.06% Impervious, Inflow Depth = 1.05" for 2-yr event
Inflow = 8.71 cfs @ 12.46 hrs, Volume= 1.244 af
Primary = 8.71 cfs @ 12.46 hrs, Volume= 1.244 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI POST: POI - POST

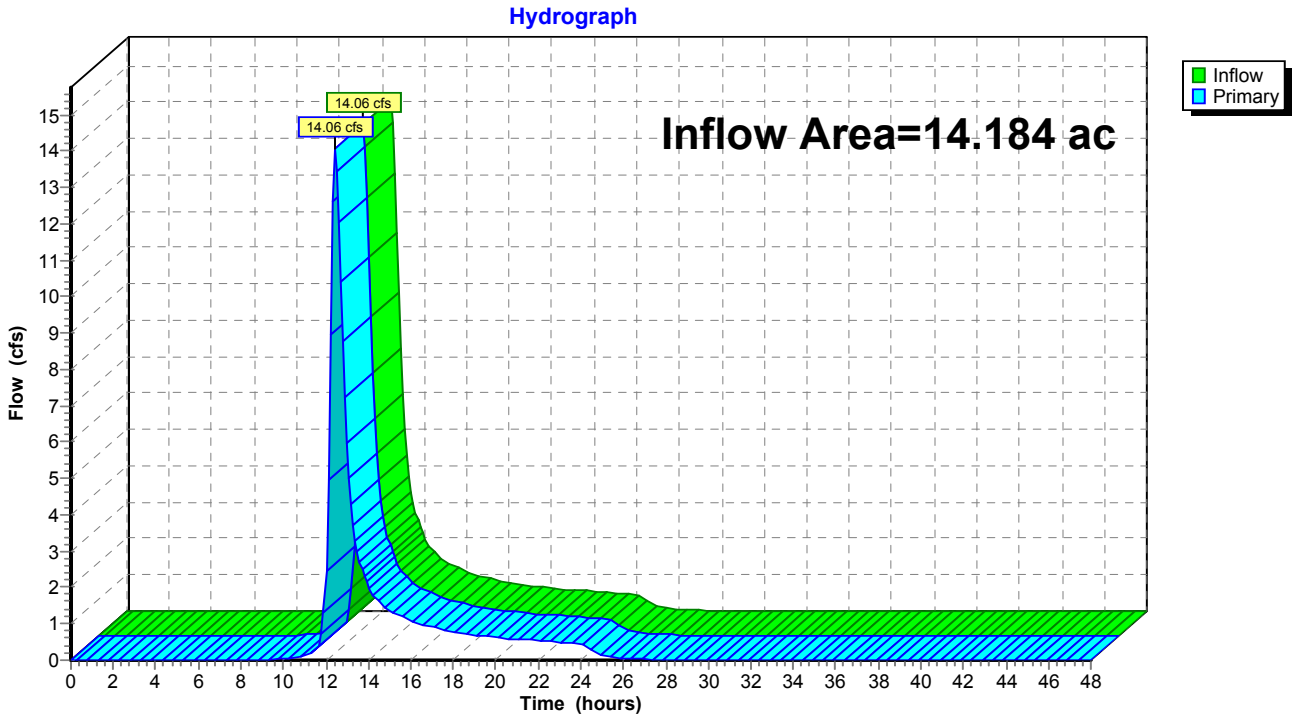


Summary for Link POI POST: POI - POST

Inflow Area = 14.184 ac, 5.06% Impervious, Inflow Depth = 1.56" for 5-yr event
Inflow = 14.06 cfs @ 12.42 hrs, Volume= 1.847 af
Primary = 14.06 cfs @ 12.42 hrs, Volume= 1.847 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI POST: POI - POST

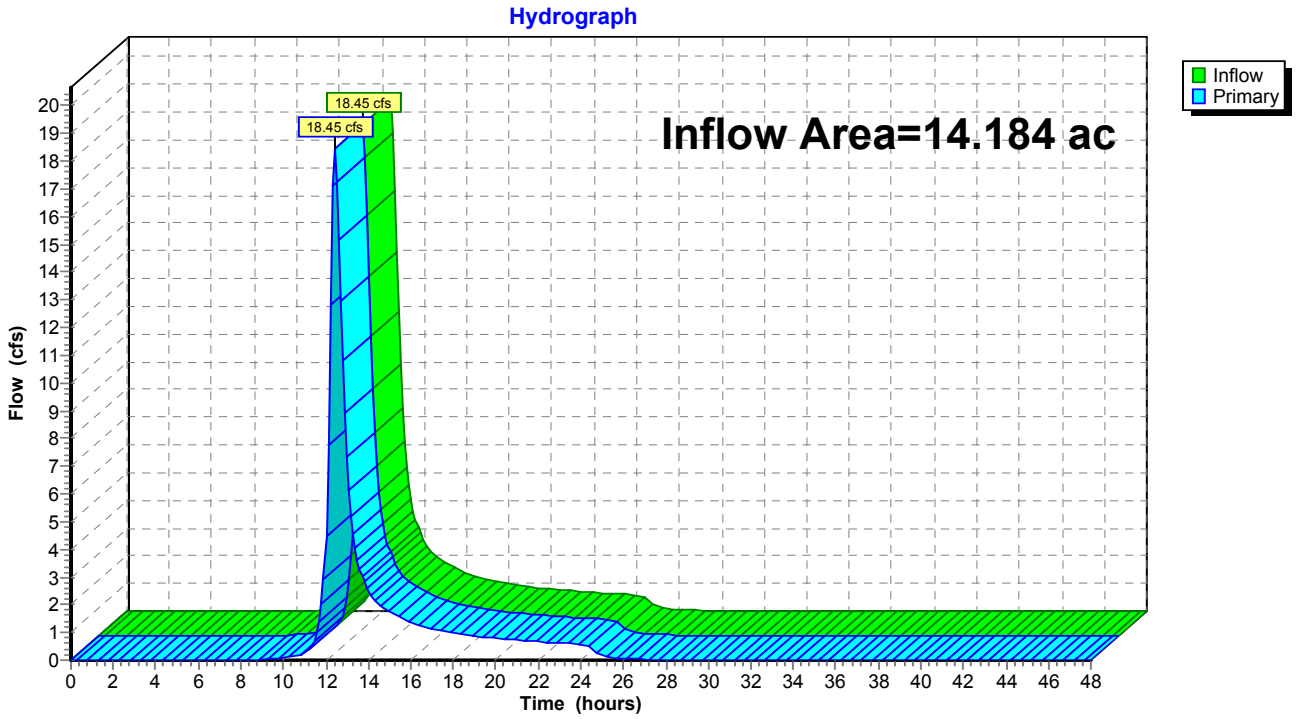


Summary for Link POI POST: POI - POST

Inflow Area = 14.184 ac, 5.06% Impervious, Inflow Depth = 2.04" for 10-yr event
Inflow = 18.45 cfs @ 12.40 hrs, Volume= 2.412 af
Primary = 18.45 cfs @ 12.40 hrs, Volume= 2.412 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI POST: POI - POST

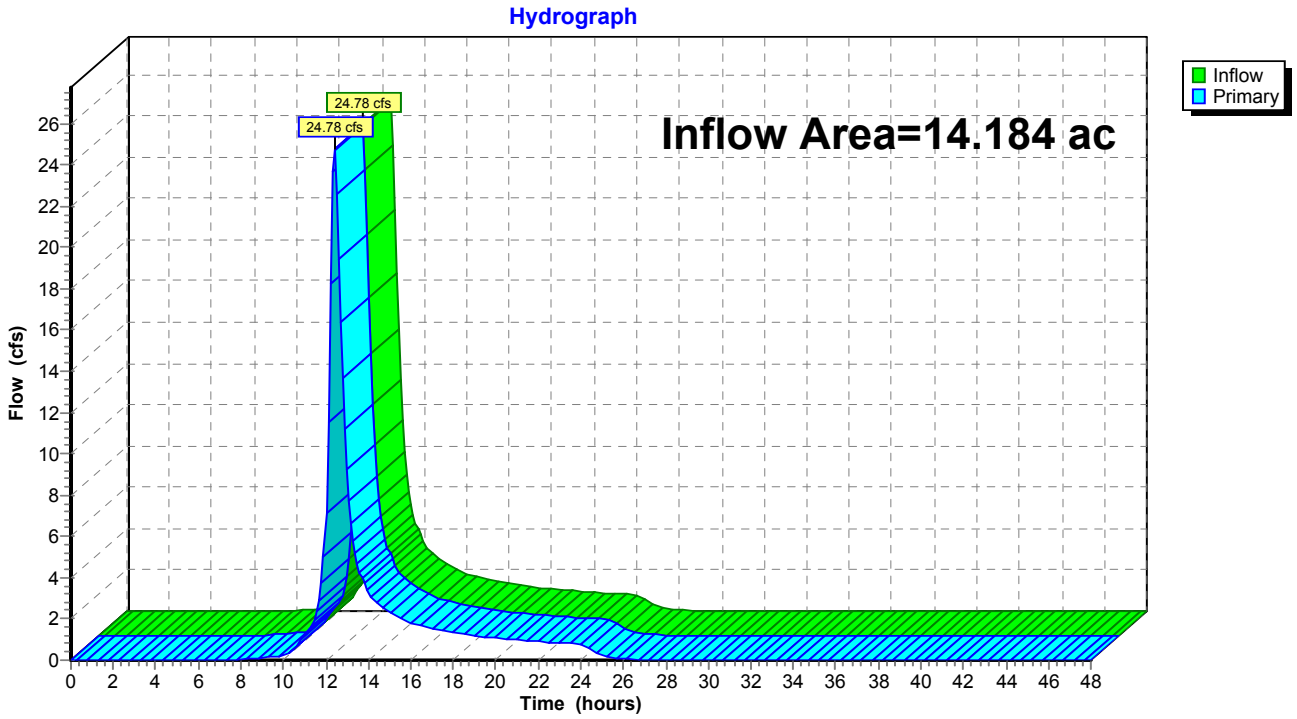


Summary for Link POI POST: POI - POST

Inflow Area = 14.184 ac, 5.06% Impervious, Inflow Depth = 2.82" for 25-yr event
Inflow = 24.78 cfs @ 12.38 hrs, Volume= 3.337 af
Primary = 24.78 cfs @ 12.38 hrs, Volume= 3.337 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI POST: POI - POST

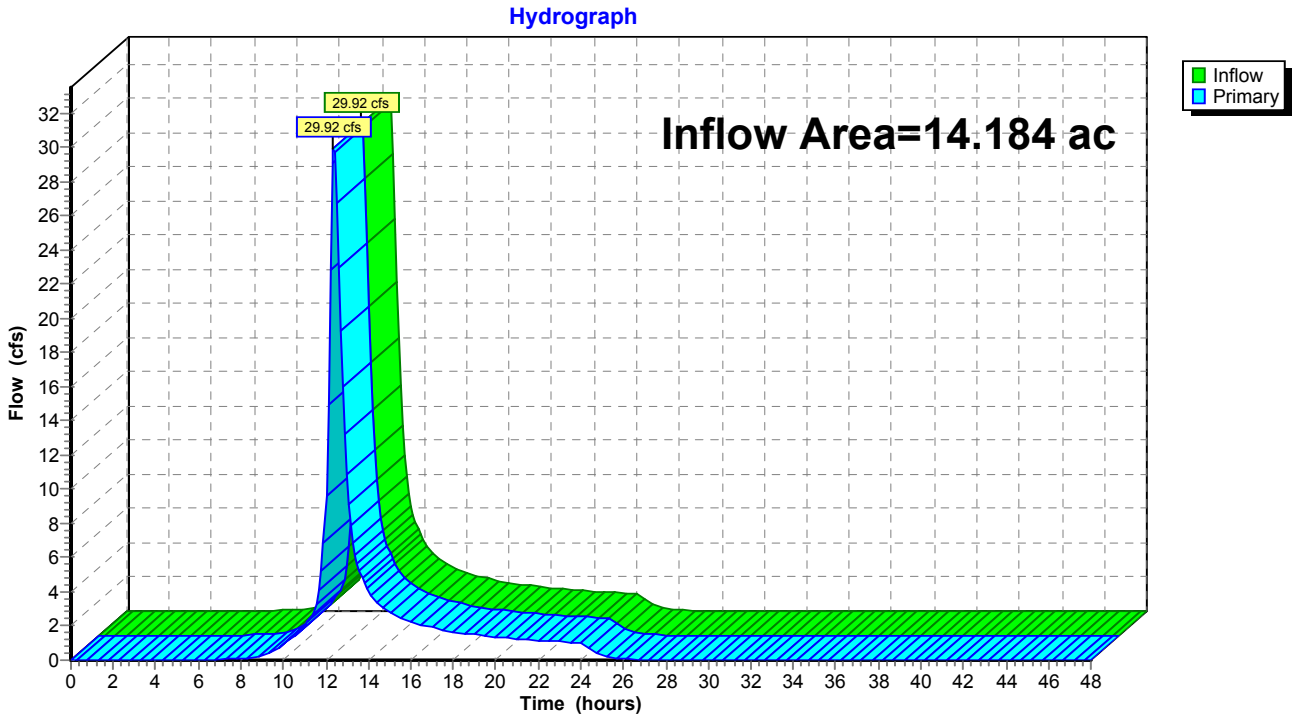


Summary for Link POI POST: POI - POST

Inflow Area = 14.184 ac, 5.06% Impervious, Inflow Depth = 3.57" for 50-yr event
Inflow = 29.92 cfs @ 12.37 hrs, Volume= 4.225 af
Primary = 29.92 cfs @ 12.37 hrs, Volume= 4.225 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI POST: POI - POST

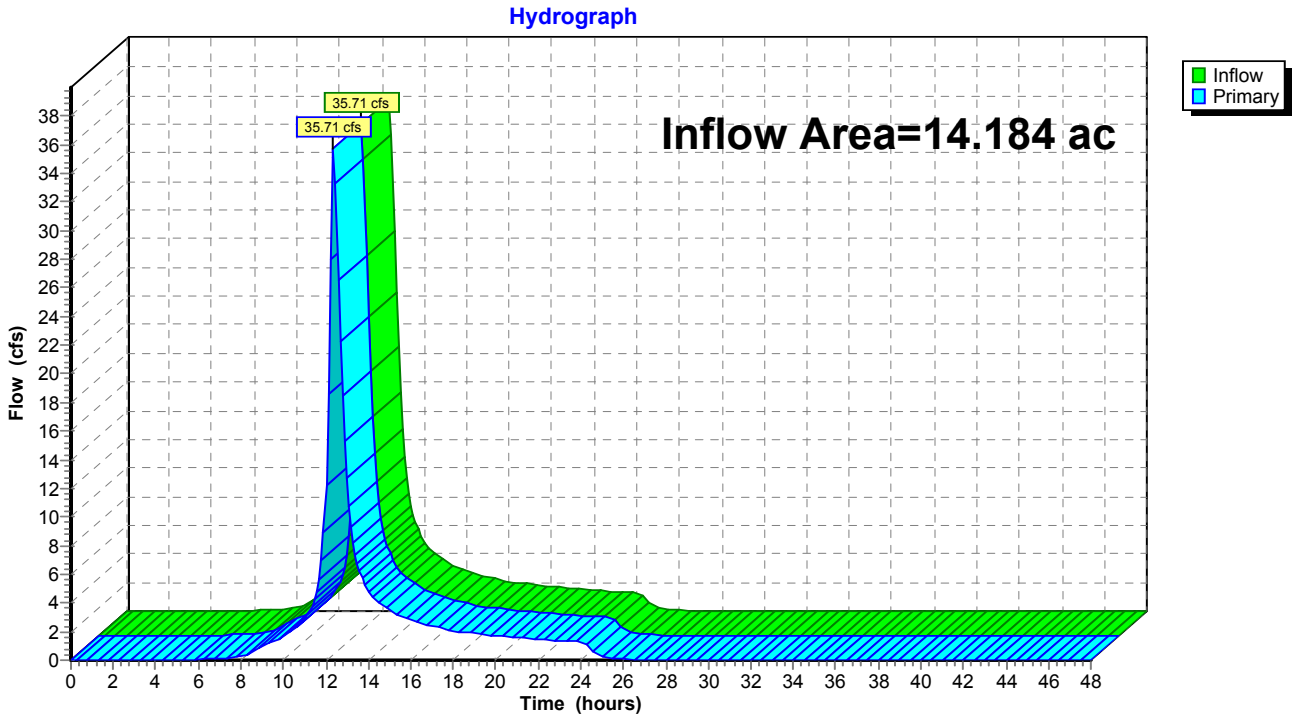


Summary for Link POI POST: POI - POST

Inflow Area = 14.184 ac, 5.06% Impervious, Inflow Depth = 4.47" for 100-yr event
Inflow = 35.71 cfs @ 12.35 hrs, Volume= 5.288 af
Primary = 35.71 cfs @ 12.35 hrs, Volume= 5.288 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs

Link POI POST: POI - POST



A.3 Conveyance Calculations

E&S WORKSHEET # 11

Channel Design Data

PROJECT NAME: ATLANTIC SUNRISE PROJECT - NORTH DIAMOND REGULATOR STATION

LOCATION: LEHMAN TOWNSHIP, LUZERNE COUNTY, PENNSYLVANIA

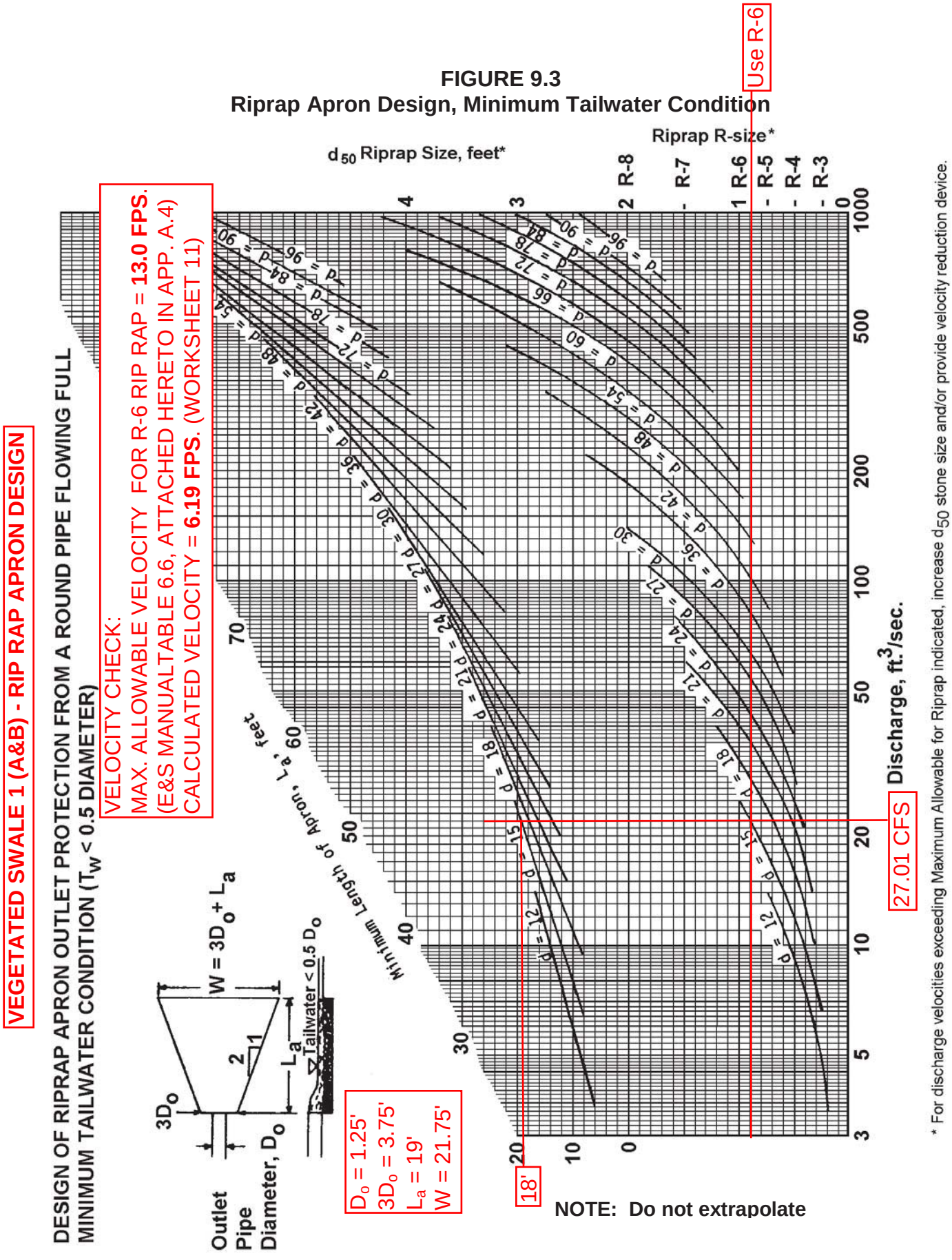
PREPARED BY: JEC DATE: 04/03/2015

CHECKED BY: AJB DATE: 04/03/2015

CHANNEL OR CHANNEL SECTION		VEGETATED SWALE 1A LINING	VEGETATED SWALE 1A GRASS	VEGETATED SWALE 1B LINING	VEGETATED SWALE 1B GRASS
TEMPORARY OR PERMANENT?	(T OR P)	P	P	P	P
DESIGN STORM	(2, 5, OR 10 YR)	10	10	10	10
ACRES	(AC)	9.82	9.82	1.30	1.30
MULTIPLIER[1]	(1.6, 2.25, or 2.75)[1]	2.75	2.75	2.75	2.75
Qr (REQUIRED CAPACITY)	(CFS)	27.01	27.01	3.58	3.58
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	27.05	27.05	3.58	3.58
PROTECTIVE LINING[2]		SC250	GRASS/ SC250	SC250	GRASS/ SC250
n (MANNING'S COEFFICIENT)[2]		***0.034***	0.055	0.040	0.110
Va (ALLOWABLE VELOCITY)	(FPS)	N/A	N/A	N/A	N/A
V (CALCULATED AT FLOW DEPTH d)	(FPS)	***5.84***	***4.11***	2.87	1.38
τa (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	2.50	8.00	2.50	8.00
τd (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	***2.04***	***2.59***	0.81	1.35
CHANNEL BOTTOM WIDTH	(FT)	***3***	***3***	2	2
CHANNEL SIDE SLOPES	(H:V)	3	3	3	3
D (TOTAL DEPTH)	(FT)	2.0	2.0	2.0	2.0
CHANNEL TOP WIDTH @ D	(FT)	15	15	14	14
d (CALCULATED FLOW DEPTH)	(FT)	***0.84***	***1.06***	0.39	0.65
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	***8.03***	***9.38***	4.35	5.92
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	***3.58***	***2.82***	5.10	3.06
d50 STONE SIZE	(IN)	N/A	N/A	N/A	N/A
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	***4.63***	***6.58***	1.24	2.59
R (HYDRAULIC RADIUS)		***0.56***	***0.68***	0.28	0.42
S (BED SLOPE)[3]	(FT/FT)	0.039	0.039	0.033	0.033
Sc (CRITICAL SLOPE)	(FT/FT)	***0.021***	0.052	0.037	0.243
.7Sc	(FT/FT)	***0.015***	0.036	0.026	0.170
1.3Sc	(FT/FT)	***0.027***	0.068	0.048	0.316
STABLE FLOW?	(Y/N)	Y	N	N	Y
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	***0.37***	***0.33***	0.08	0.07
FREEBOARD BASED ON STABLE FLOW	(FT)	0.50	0.50	0.50	0.50
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.50	0.50	0.50	0.50
DESIGN METHOD FOR PROTECTIVE LINING [5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS	(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.

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



Adapted from USDA - NRCS

Not to be used for Box Culverts

E&S WORKSHEET # 11
Channel Design Data

PROJECT NAME: ATLANTIC SUNRISE PROJECT - NORTH DIAMOND REGULATOR STATION

LOCATION: LEHMAN TOWNSHIP, LUZERNE COUNTY, PENNSYLVANIA

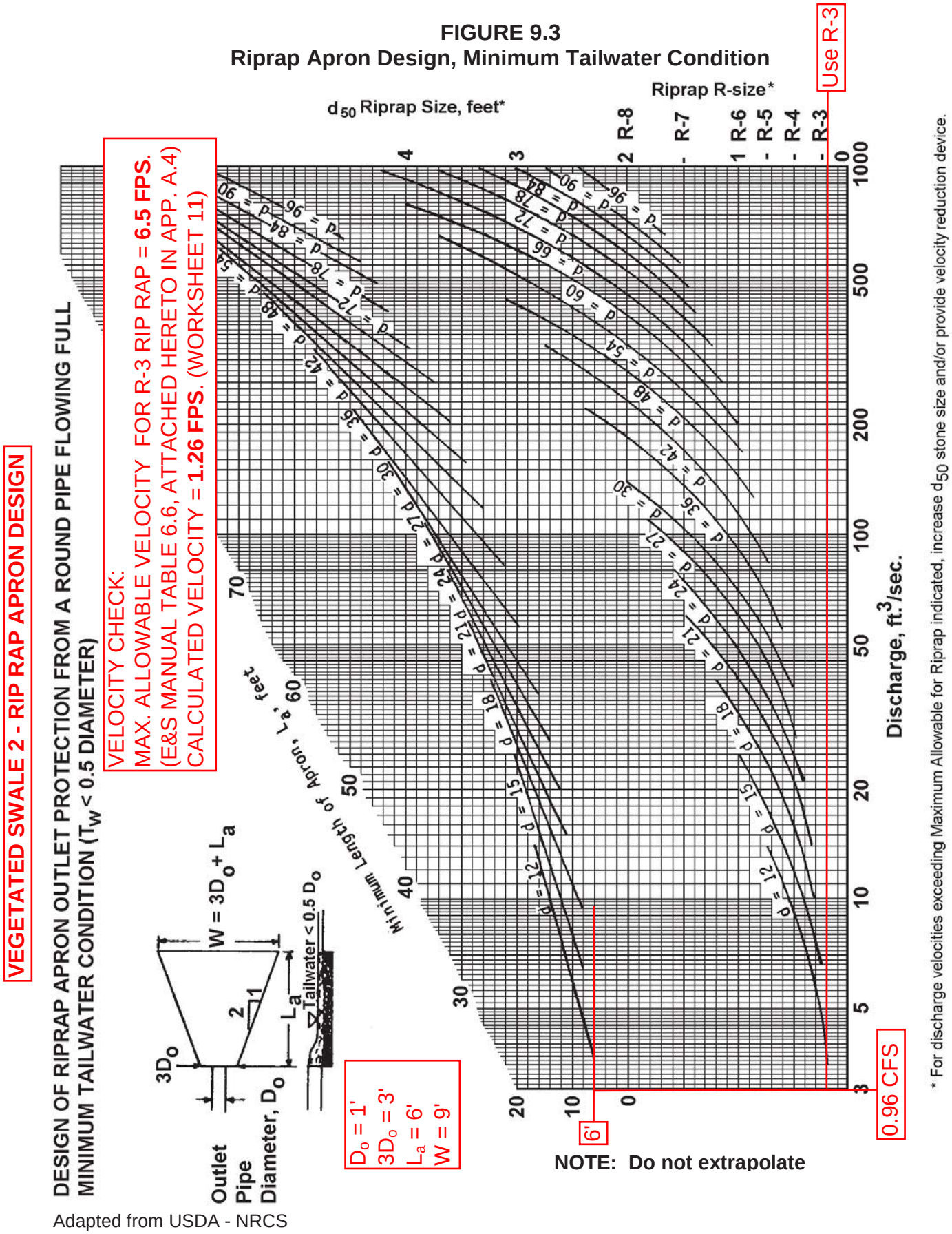
PREPARED BY: JEC DATE: 04/03/2015

CHECKED BY: AJB DATE: 04/03/2015

CHANNEL OR CHANNEL SECTION		VEGETATED SWALE 2 LINING	VEGETATED SWALE 2 GRASS		
TEMPORARY OR PERMANENT?	(T OR P)	P	P		
DESIGN STORM	(2, 5, OR 10 YR)	10	10		
ACRES	(AC)	0.35	0.35		
MULTIPLIER[1]	(1.6, 2.25, or 2.75)[1]	2.75	2.75		
Qr (REQUIRED CAPACITY)	(CFS)	0.96	0.96		
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	0.96	0.97		
PROTECTIVE LINING[2]		S75	GRASS		
n (MANNING'S COEFFICIENT)[2]		0.055	0.070		
Va (ALLOWABLE VELOCITY)	(FPS)	N/A	N/A		
V (CALCULATED AT FLOW DEPTH d)	(FPS)	1.26	1.07		
τa (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	1.55	1.00		
τd (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	0.30	0.35		
CHANNEL BOTTOM WIDTH	(FT)	2	2		
CHANNEL SIDE SLOPES	(H:V)	3	3		
D (TOTAL DEPTH)	(FT)	1.0	1.0		
CHANNEL TOP WIDTH @ D	(FT)	8	8		
d (CALCULATED FLOW DEPTH)	(FT)	0.27	0.31		
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	3.62	3.86		
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	7.41	6.45		
d50 STONE SIZE	(IN)	N/A	N/A		
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	0.76	0.91		
R (HYDRAULIC RADIUS)		0.20	0.23		
S (BED SLOPE)[3]	(FT/FT)	0.018	0.018		
Sc (CRITICAL SLOPE)	(FT/FT)	0.077	0.120		
.7Sc	(FT/FT)	0.054	0.084		
1.3Sc	(FT/FT)	0.100	0.155		
STABLE FLOW?	(Y/N)	Y	Y		
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	0.03	0.0		
FREEBOARD BASED ON STABLE FLOW	(FT)	0.50	0.5		
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.50	0.5		
DESIGN METHOD FOR PROTECTIVE LINING [5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS	(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.

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



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

Adapted from USDA - NRCS

Not to be used for Box Culverts

Summary for Subcatchment DA1: DITCH RELIEF CULVERT 1

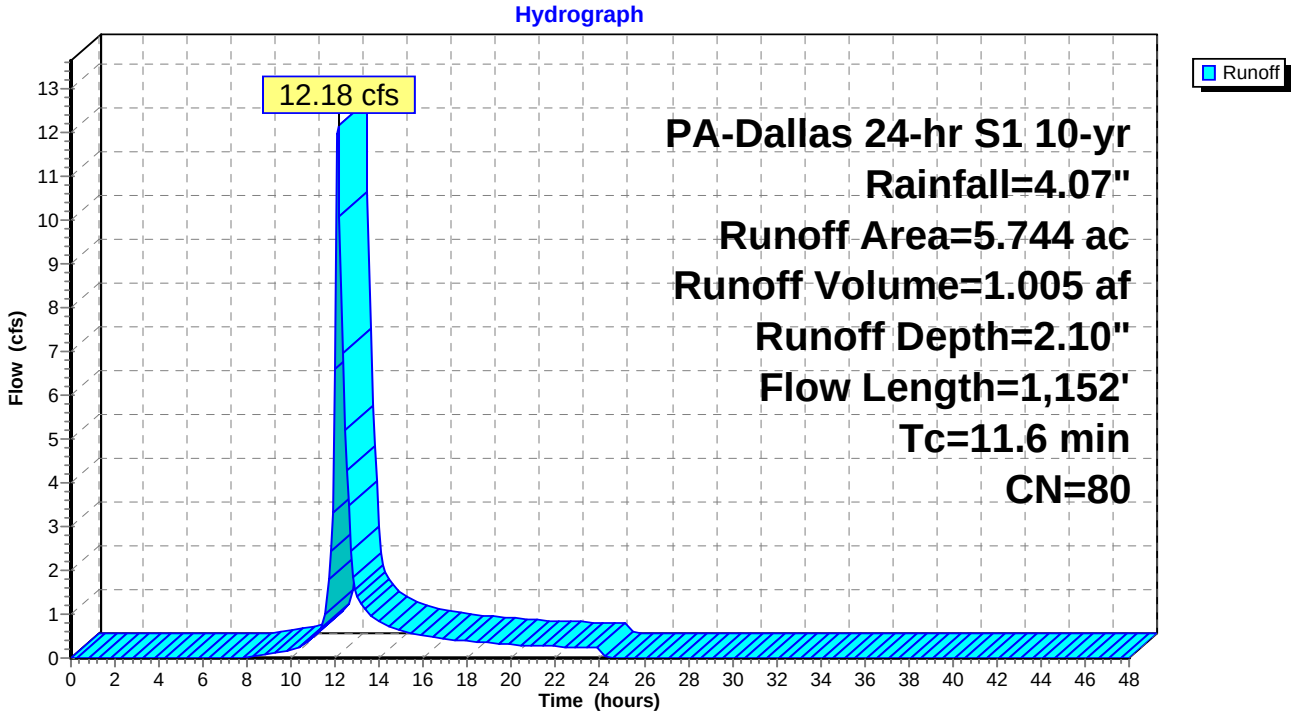
Runoff = 12.18 cfs @ 12.12 hrs, Volume= 1.005 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 10-yr Rainfall=4.07"

	Area (ac)	CN	Description
	0.888	77	Woods, Good, HSG D
	4.145	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.711	98	Impervious areas, HSG D
	5.744	80	Weighted Average
	5.033		87.62% Pervious Area
	0.711		12.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0277	1.47		**Sheet Flow, SHT 1** Smooth surfaces n= 0.011 P2= 2.81"
1.0	189	0.0265	3.30		**Shallow Concentrated Flow, SCF 1** Paved Kv= 20.3 fps
5.1	527	0.0607	1.72		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
4.4	336	0.0655	1.28		**Shallow Concentrated Flow, SCF 3** Woodland Kv= 5.0 fps
11.6	1,152	Total			

Subcatchment DA1: DITCH RELIEF CULVERT 1



Culvert Report

Circular Culvert

Invert Elev Dn (ft)	=	1177.50
Pipe Length (ft)	=	100.00
Slope (%)	=	0.50
Invert Elev Up (ft)	=	1178.00
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

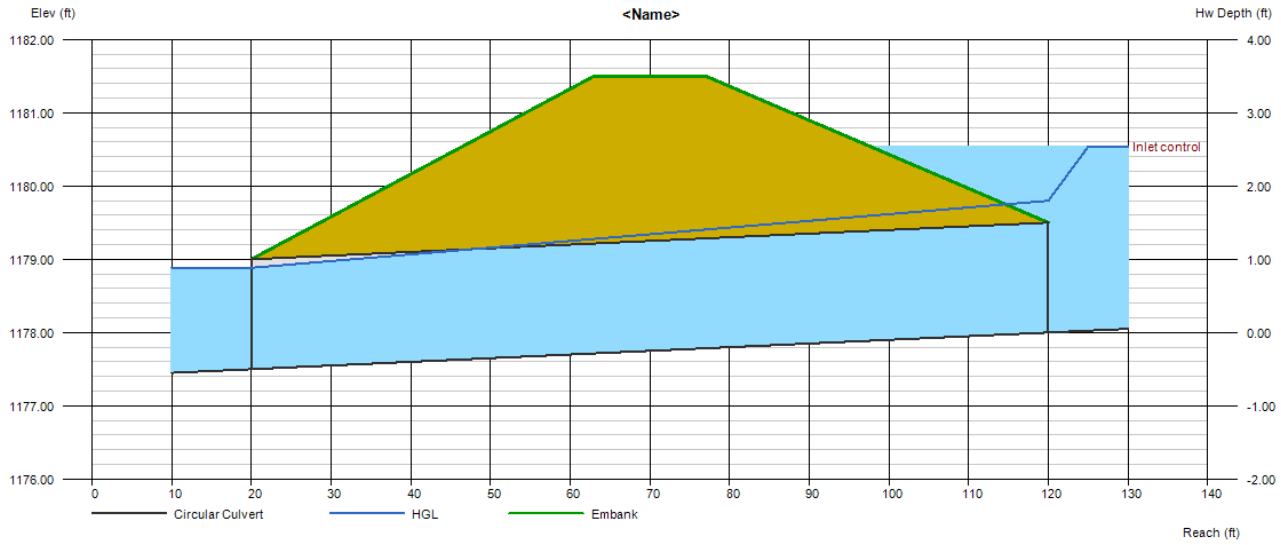
Top Elevation (ft)	=	1181.50
Top Width (ft)	=	14.00
Crest Width (ft)	=	14.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	12.18
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	10.98
Qpipe (cfs)	=	10.98
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.44
Veloc Up (ft/s)	=	6.21
HGL Dn (ft)	=	1178.88
HGL Up (ft)	=	1179.80
Hw Elev (ft)	=	1180.54
Hw/D (ft)	=	1.69
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 28 2015

DITCH RELIEF CULVERT 1

Circular

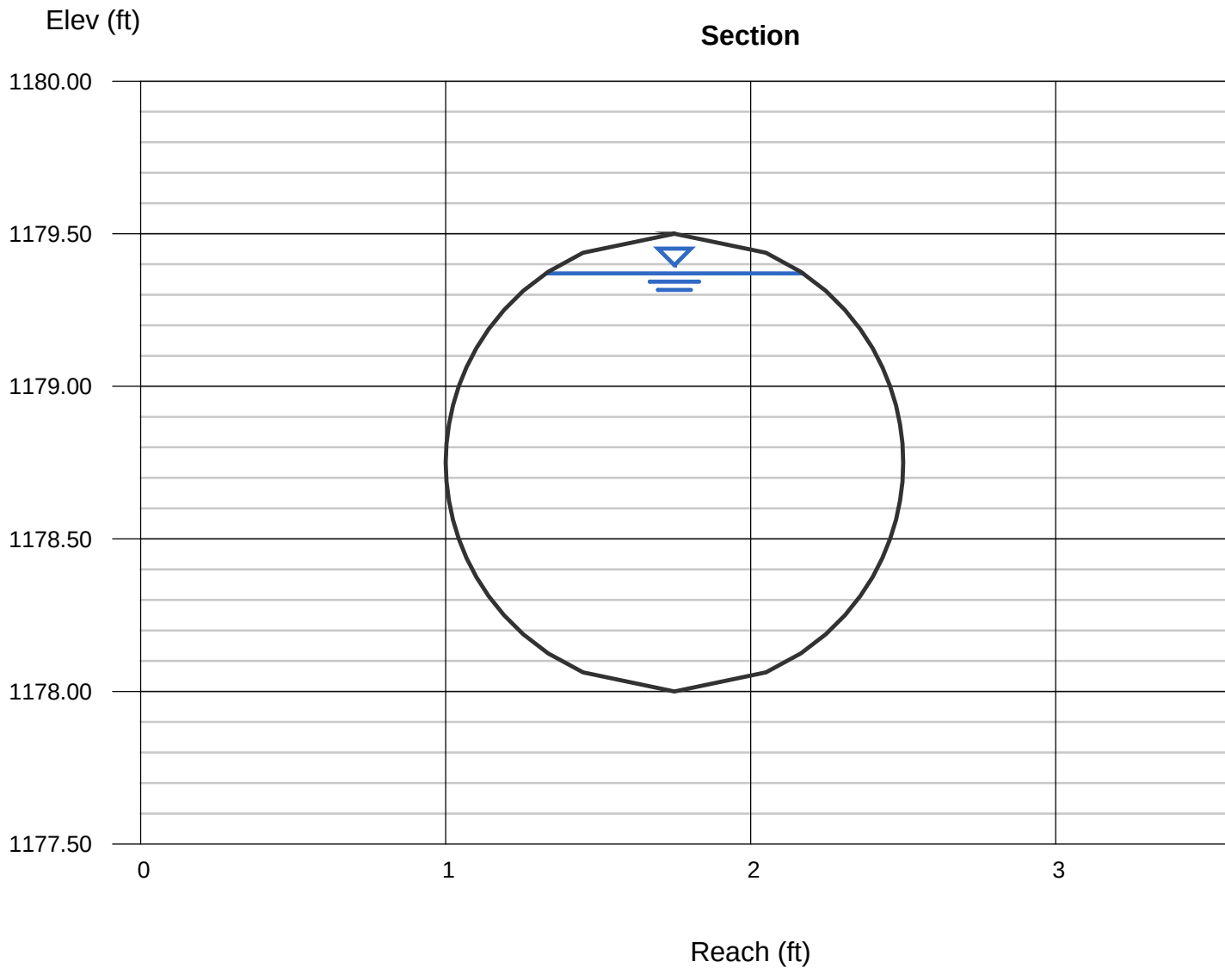
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1178.00
Slope (%)	= 1.00
N-Value	= 0.012

Calculations

Compute by:	Known Q
Known Q (cfs)	= 12.18

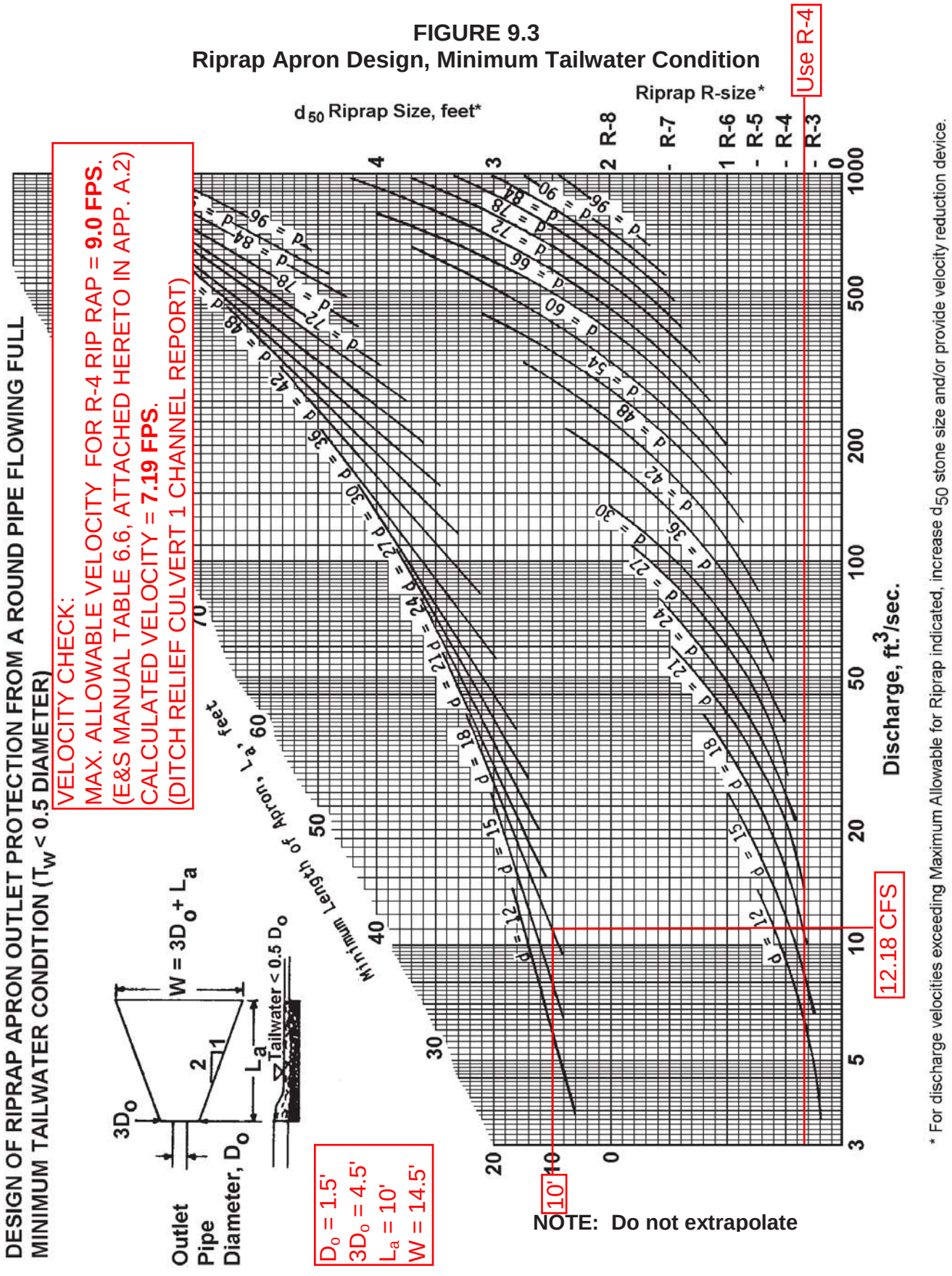
Highlighted

Depth (ft)	= 1.37
Q (cfs)	= 12.18
Area (sqft)	= 1.69
Velocity (ft/s)	= 7.19
Wetted Perim (ft)	= 3.82
Crit Depth, Yc (ft)	= 1.33
Top Width (ft)	= 0.84
EGL (ft)	= 2.17



DITCH RELIEF CULVERT 1 - RIP RAP APRON DESIGN

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



Adapted from USDA - NRCS

Not to be used for Box Culverts

Summary for Subcatchment DA2: DITCH RELIEF CULVERT 2

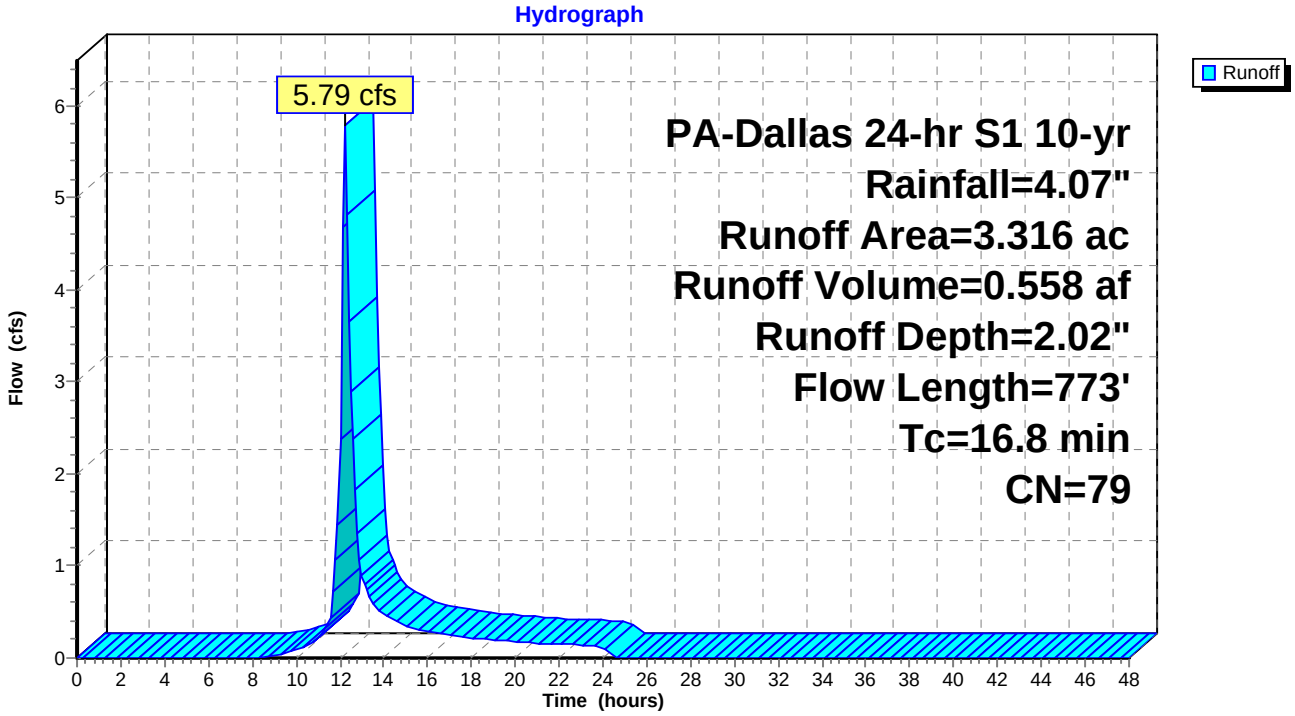
Runoff = 5.79 cfs @ 12.20 hrs, Volume= 0.558 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 10-yr Rainfall=4.07"

	Area (ac)	CN	Description
	0.209	77	Woods, Good, HSG D
	2.914	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.193	98	Impervious areas, HSG D
	3.316	79	Weighted Average
	3.123		94.18% Pervious Area
	0.193		5.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	24	0.0277	1.10		**Sheet Flow, SHT 1** Smooth surfaces n= 0.011 P2= 2.81"
6.7	76	0.0265	0.19		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
8.8	603	0.0265	1.14		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.9	70	0.0607	1.23		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
16.8	773	Total			

Subcatchment DA2: DITCH RELIEF CULVERT 2



Culvert Report

DITCH RELIEF CULVERT 2

Invert Elev Dn (ft)	=	1187.00
Pipe Length (ft)	=	50.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	1187.50
Rise (in)	=	15.0
Shape	=	Circular
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

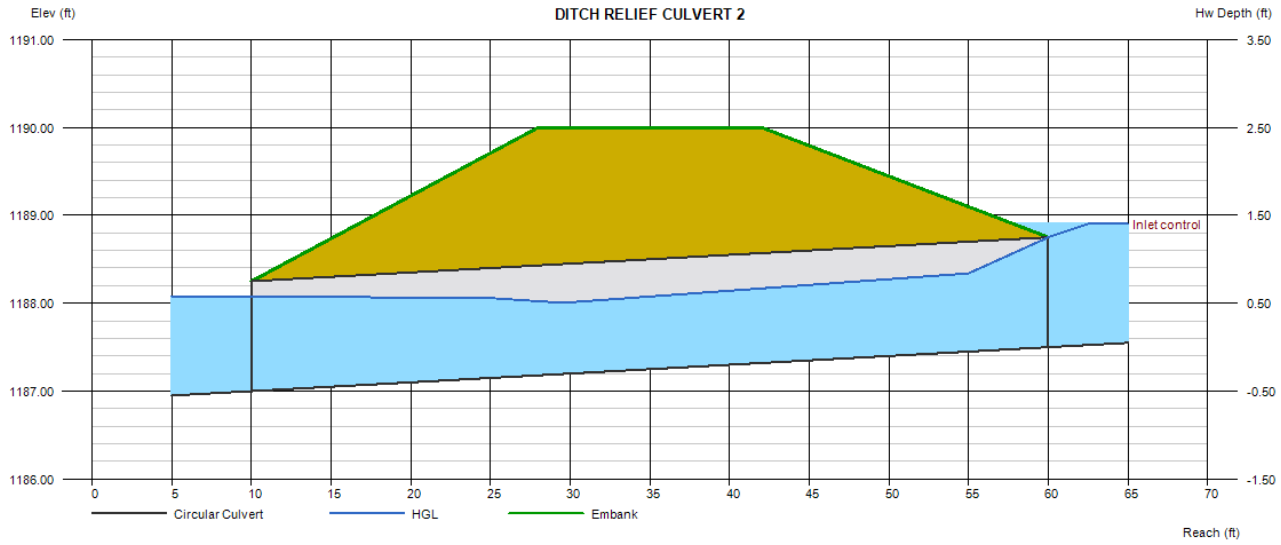
Top Elevation (ft)	=	1190.00
Top Width (ft)	=	14.00
Crest Width (ft)	=	14.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	5.79
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	5.00
Qpipe (cfs)	=	5.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.44
Veloc Up (ft/s)	=	5.25
HGL Dn (ft)	=	1188.08
HGL Up (ft)	=	1188.41
Hw Elev (ft)	=	1188.90
Hw/D (ft)	=	1.12
Flow Regime	=	Inlet Control



Channel Report

DITCH RELIEF CULVERT 2

Circular

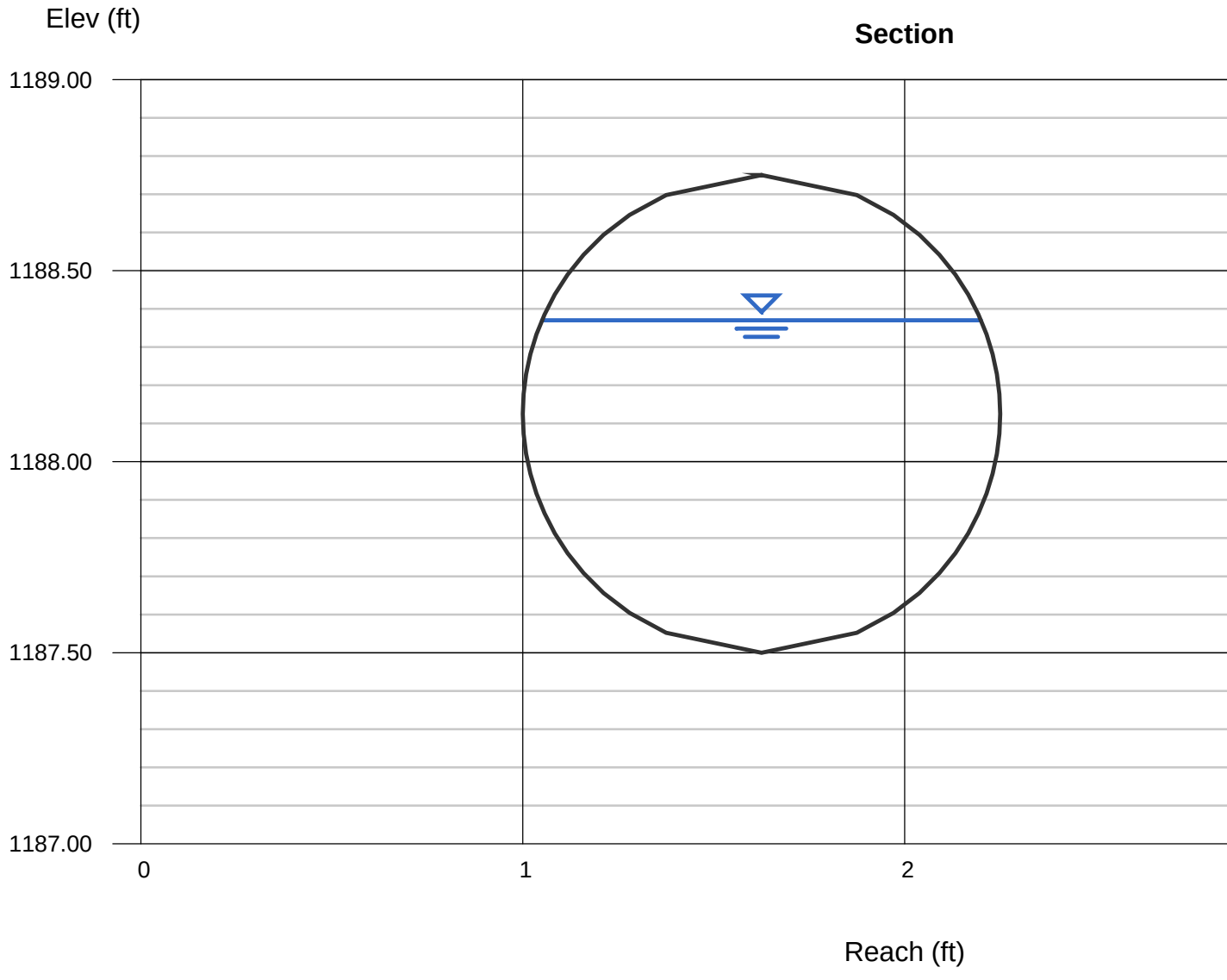
Diameter (ft)	= 1.25
Invert Elev (ft)	= 1187.50
Slope (%)	= 1.00
N-Value	= 0.012

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.79

Highlighted

Depth (ft)	= 0.87
Q (cfs)	= 5.790
Area (sqft)	= 0.91
Velocity (ft/s)	= 6.34
Wetted Perim (ft)	= 2.47
Crit Depth, Yc (ft)	= 0.98
Top Width (ft)	= 1.15
EGL (ft)	= 1.50

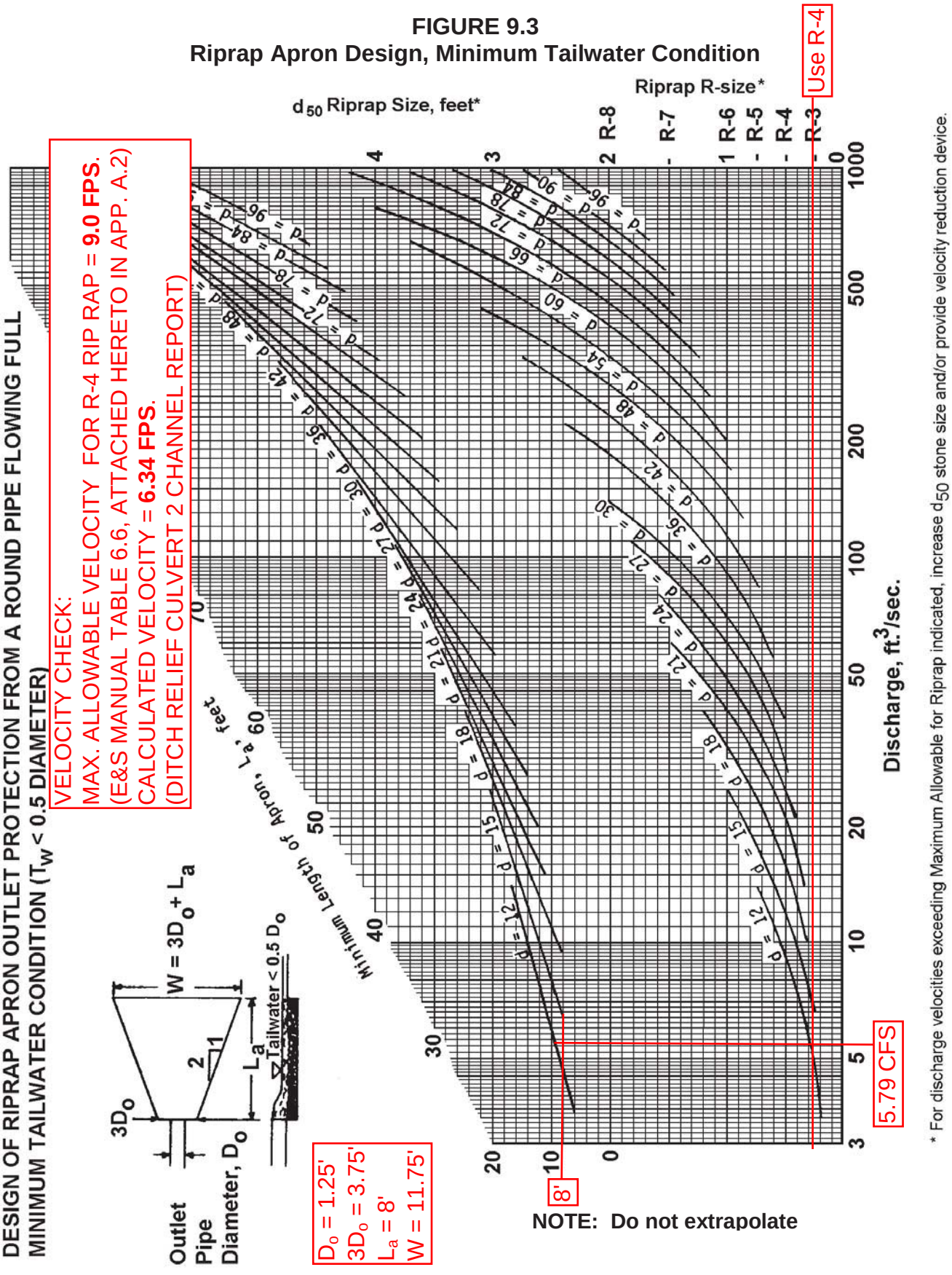


DITCH RELIEF CULVERT 2 - RIP RAP APRON DESIGN

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)

VELOCITY CHECK:
MAX. ALLOWABLE VELOCITY FOR R-4 RIP RAP = **9.0 FPS**.
(E&S MANUAL TABLE 6.6, ATTACHED HERETO IN APP. A.2)
CALCULATED VELOCITY = **6.34 FPS**.
(DITCH RELIEF CULVERT 2 CHANNEL REPORT)



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

Adapted from USDA - NRCS

Not to be used for Box Culverts

Summary for Subcatchment DA3: DITCH RELIEF CULVERT 3

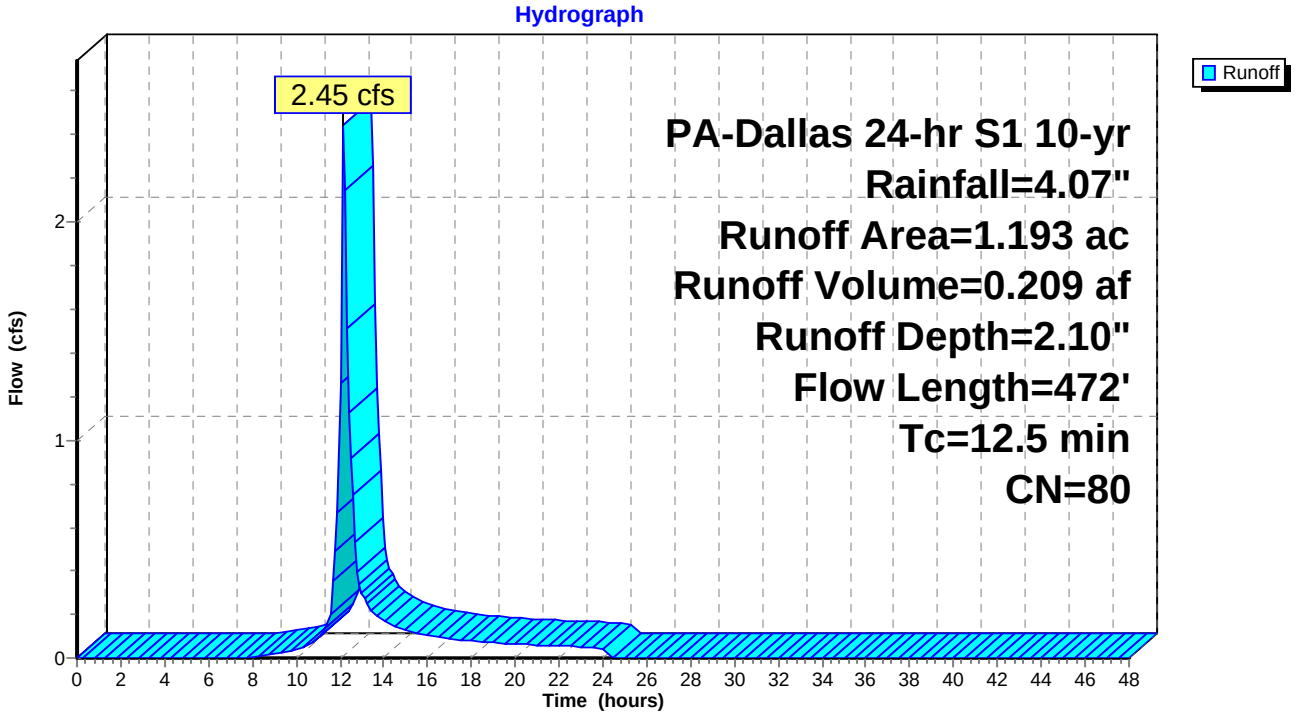
Runoff = 2.45 cfs @ 12.13 hrs, Volume= 0.209 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
PA-Dallas 24-hr S1 10-yr Rainfall=4.07"

	Area (ac)	CN	Description
	0.058	77	Woods, Good, HSG D
	1.021	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.114	98	Impervious areas, HSG D
	1.193	80	Weighted Average
	1.079		90.44% Pervious Area
	0.114		9.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	24	0.0277	1.10		**Sheet Flow, SHT 1** Smooth surfaces n= 0.011 P2= 2.81"
6.7	76	0.0265	0.19		**Sheet Flow, SHT 2** Range n= 0.130 P2= 2.81"
5.1	352	0.0265	1.14		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.3	20	0.0607	1.23		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
12.5	472	Total			

Subcatchment DA3: DITCH RELIEF CULVERT 3



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 28 2015

DITCH RELIEF CULVERT 3

Invert Elev Dn (ft)	=	1197.00
Pipe Length (ft)	=	50.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	1197.50
Rise (in)	=	15.0
Shape	=	Circular
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

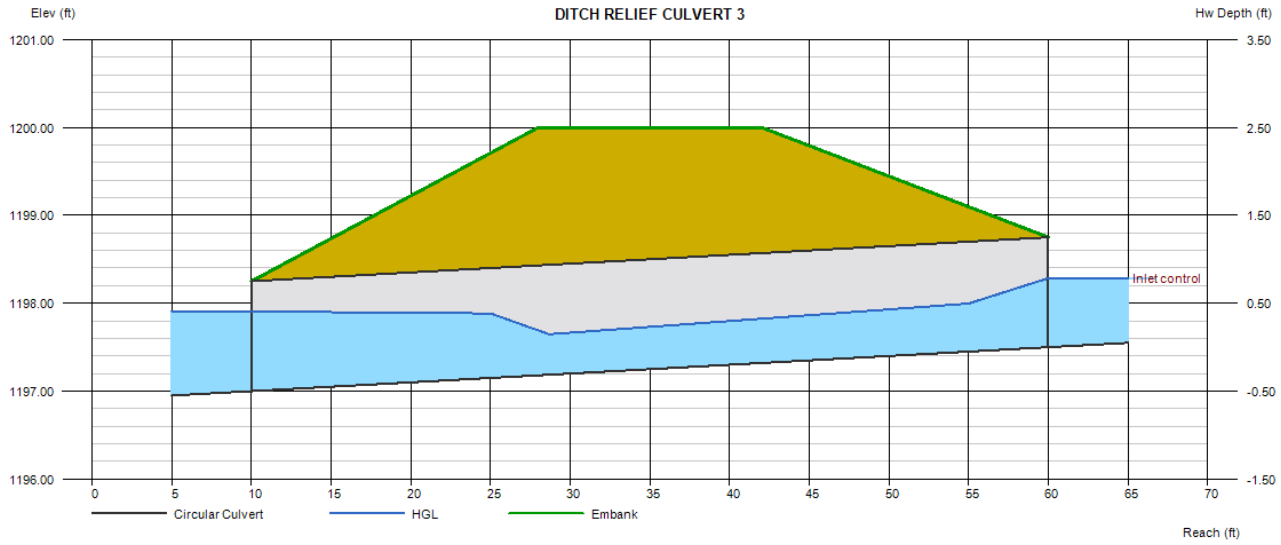
Top Elevation (ft)	=	1200.00
Top Width (ft)	=	14.00
Crest Width (ft)	=	14.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	2.45
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	2.00
Qpipe (cfs)	=	2.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.10
Veloc Up (ft/s)	=	3.73
HGL Dn (ft)	=	1197.91
HGL Up (ft)	=	1198.06
Hw Elev (ft)	=	1198.29
Hw/D (ft)	=	0.63
Flow Regime	=	Inlet Control



Channel Report

DITCH RELIEF CULVERT 3

Circular

Diameter (ft)	= 1.25
Invert Elev (ft)	= 1197.50
Slope (%)	= 1.00
N-Value	= 0.012

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.45

Highlighted

Depth (ft)	= 0.51
Q (cfs)	= 2.450
Area (sqft)	= 0.47
Velocity (ft/s)	= 5.17
Wetted Perim (ft)	= 1.74
Crit Depth, Yc (ft)	= 0.63
Top Width (ft)	= 1.23
EGL (ft)	= 0.93

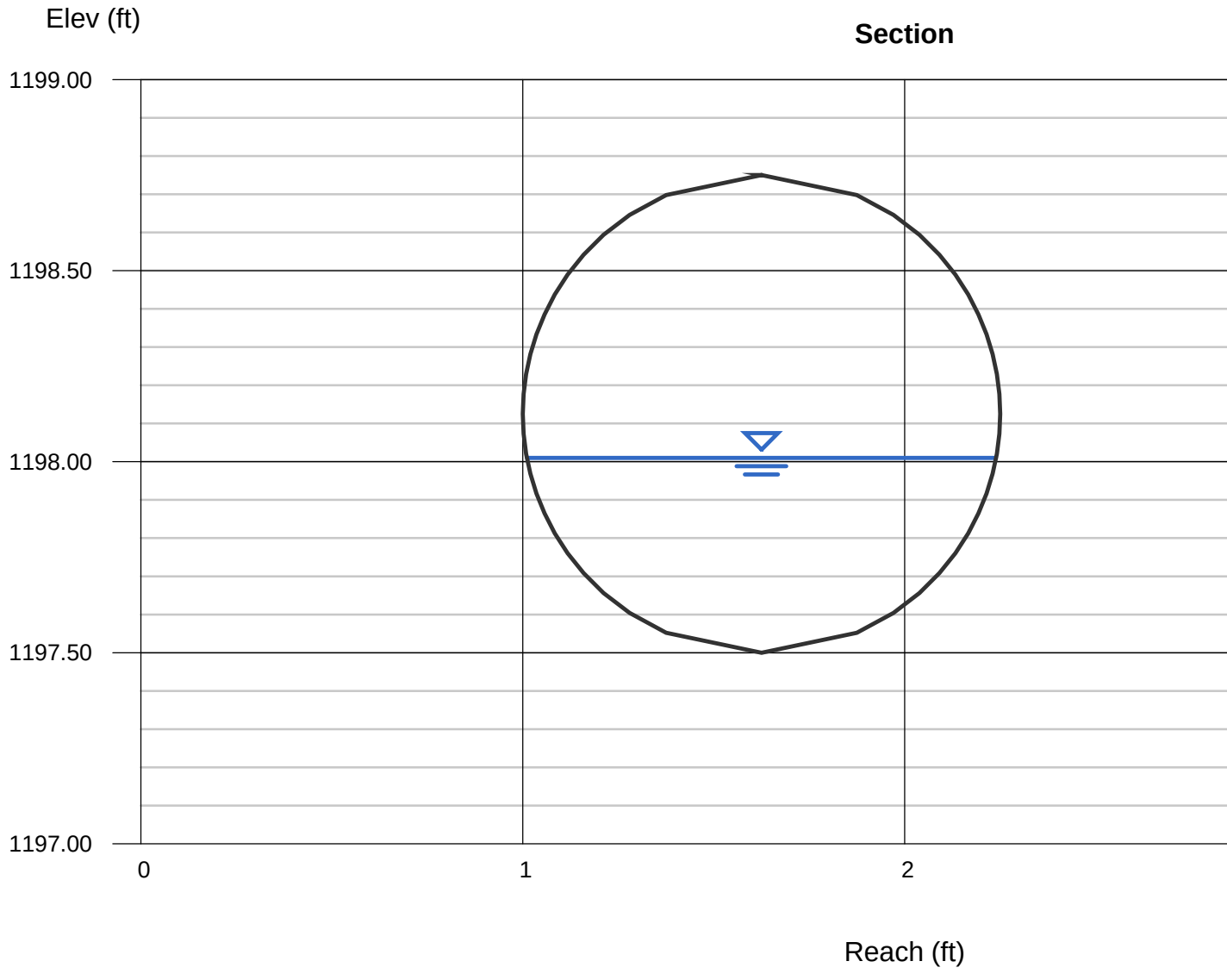
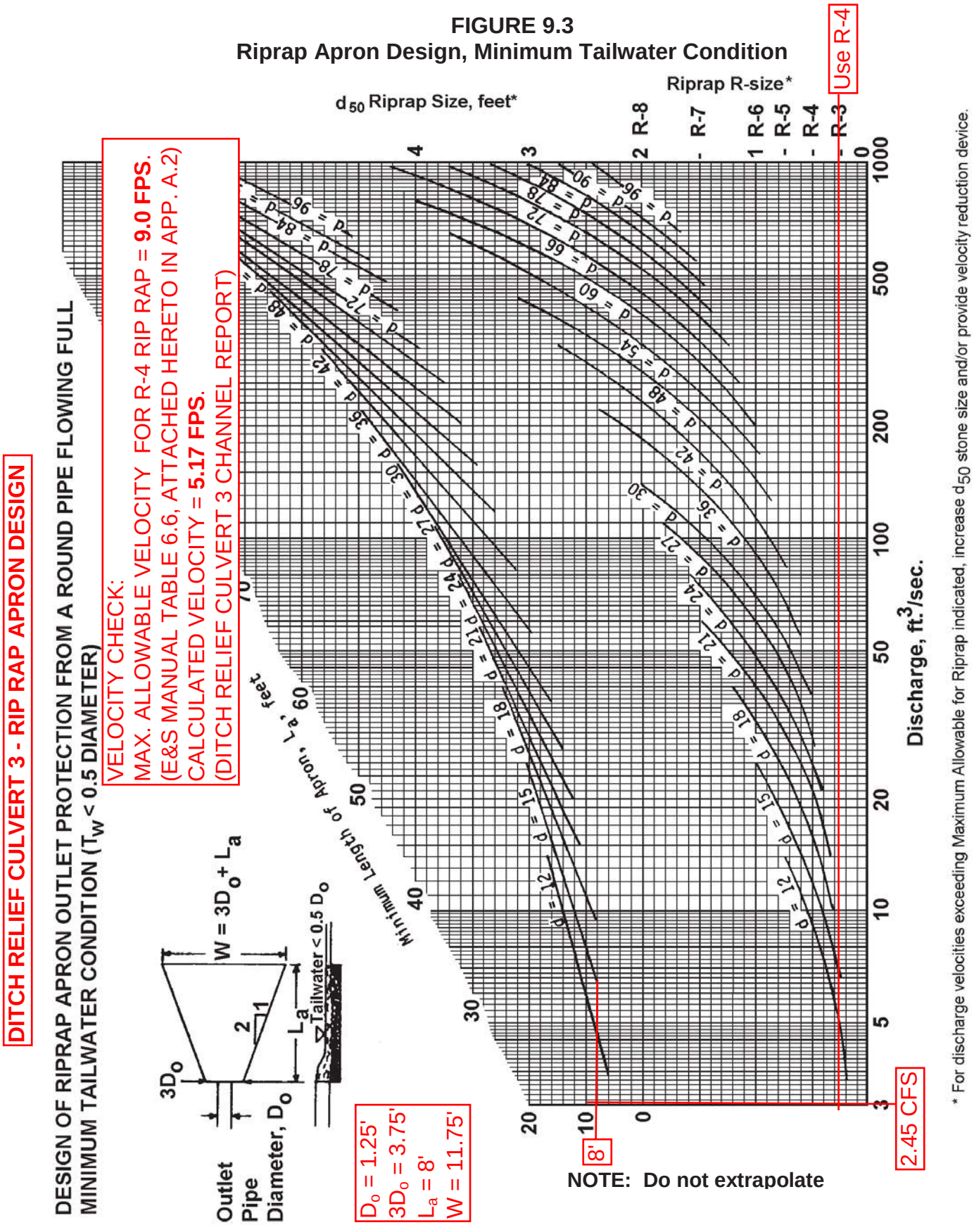


FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition

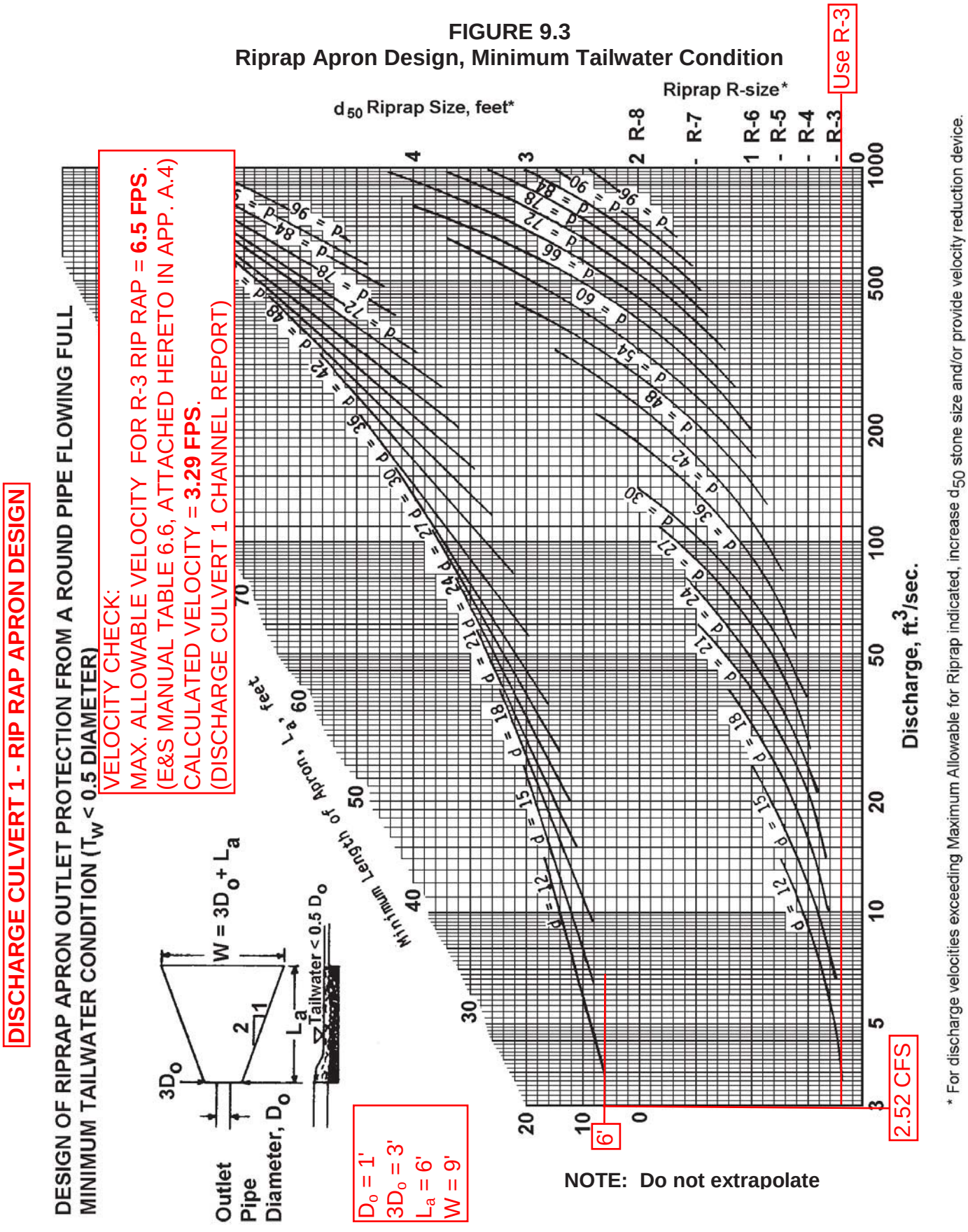


Adapted from USDA - NRCS

Not to be used for Box Culverts

A.4 PCSM BMP Calculations

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition

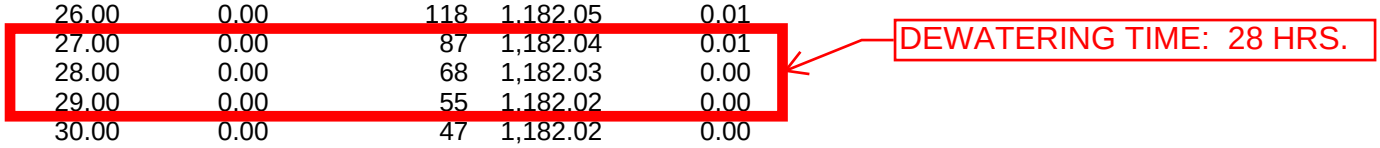


Adapted from USDA - NRCS

Not to be used for Box Culverts

Hydrograph for Pond RG 1: RAIN GARDEN

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	1,182.00	0.00
1.00	0.00	0	1,182.00	0.00
2.00	0.00	0	1,182.00	0.00
3.00	0.00	0	1,182.00	0.00
4.00	0.02	25	1,182.01	0.00
5.00	0.03	96	1,182.04	0.01
6.00	0.05	179	1,182.08	0.03
7.00	0.07	251	1,182.11	0.05
8.00	0.09	313	1,182.13	0.08
9.00	0.13	377	1,182.16	0.11
10.00	0.18	459	1,182.19	0.16
11.00	0.31	597	1,182.25	0.26
12.00	**2.84**	**1,590**	**1,182.62**	**1.37**
13.00	**0.45**	**1,062**	**1,182.43**	**0.71**
14.00	0.27	675	1,182.28	0.32
15.00	0.21	561	1,182.23	0.23
16.00	0.17	499	1,182.21	0.18
17.00	0.15	457	1,182.19	0.16
18.00	0.13	426	1,182.18	0.14
19.00	0.12	402	1,182.17	0.12
20.00	0.11	383	1,182.16	0.11
21.00	0.10	366	1,182.15	0.10
22.00	0.09	352	1,182.15	0.10
23.00	0.09	340	1,182.14	0.09
24.00	0.08	330	1,182.14	0.08
25.00	0.00	183	1,182.08	0.03
26.00	0.00	118	1,182.05	0.01
27.00	0.00	87	1,182.04	0.01
28.00	0.00	68	1,182.03	0.00
29.00	0.00	55	1,182.02	0.00
30.00	0.00	47	1,182.02	0.00
31.00	0.00	41	1,182.02	0.00
32.00	0.00	36	1,182.02	0.00
33.00	0.00	31	1,182.01	0.00
34.00	0.00	27	1,182.01	0.00
35.00	0.00	23	1,182.01	0.00
36.00	0.00	20	1,182.01	0.00
37.00	0.00	18	1,182.01	0.00
38.00	0.00	15	1,182.01	0.00
39.00	0.00	13	1,182.01	0.00
40.00	0.00	12	1,182.01	0.00
41.00	0.00	10	1,182.00	0.00
42.00	0.00	9	1,182.00	0.00
43.00	0.00	8	1,182.00	0.00
44.00	0.00	7	1,182.00	0.00
45.00	0.00	6	1,182.00	0.00
46.00	0.00	5	1,182.00	0.00
47.00	0.00	4	1,182.00	0.00
48.00	0.00	4	1,182.00	0.00



ATLANTIC SUNRISE PROJECT
NORTH DIAMOND REGULATOR STATION VEGETATED SWALE VOLUME

4/3/2015

VEGETATED SWALE 1A

Input data

S =	0.039	ft/ft
Depth (H)=	1	ft
Width (W_B)=	3	
z_1 =	3	
z_2 =	3	

Output data

L =	26	ft
W_T =	9	ft
$W_T + W_B$ =	12	ft
V =	78	cf
No. of check dams =	37	
Volume total =	2883	cf

VEGETATED SWALE 1B

Input data

S =	0.033	ft/ft
Depth (H)=	1	ft
Width (W_B)=	2	
z_1 =	3	
z_2 =	3	

Output data

L =	30	ft
W_T =	8	ft
$W_T + W_B$ =	10	ft
V =	76	cf
No. of check dams =	2	
Volume total =	152	cf

VEGETATED SWALE 2

Input data

S =	0.018	ft/ft
Depth (H)=	1	ft
Width (W_B)=	2	
z_1 =	3	
z_2 =	3	

Output data

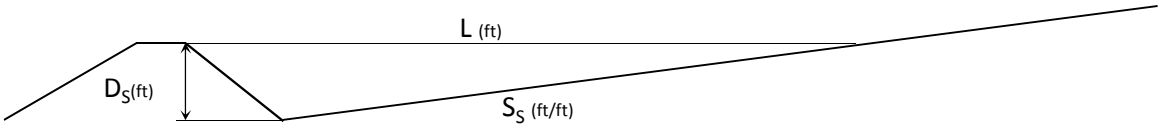
L =	56	ft
W_T =	8	ft
$W_T + W_B$ =	10	ft
V =	140	cf
No. of check dams =	3	
Volume total =	419	cf

Cumulative Volume for pollutant removal = 3035 cf

ATLANTIC SUNRIZE PROJECT
NORTH DIAMOND VEGETATED SWALE INFILTRATION VOLUME
ROCK FILTER VOLUME AND SPACING

10/3/2016

Per the Pennsylvania Stormwater BMP Manual (pg 94), the minimum spacing of rock filter is determined by the length of the storage volume (L). The length of the storage volume is calculated by dividing the height of the rock filter (D_S) by the slope of the channel (S_S):



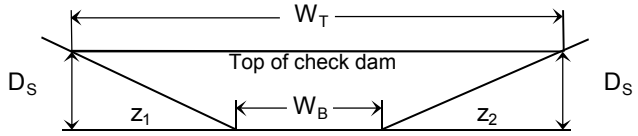
$L = D_S/S_S$

Where: L = Storage Length

S_S = Channel slope

D_S = Height of the rock filter

The volume of runoff that will be stored upstream of a rock filter is dependent on the height of the check dam, the slope of the upstream channel and the dimensions of the upstream channel. The storage volume (V_S) can be calculated with:



$V_S = 0.25 \times L \times D_S \times (W_T + W_B)$

Where:

L = Storage Length

D_S = Height of rock filter

W_T = rock filter top width

W_B = rock filter bottom width

The rock filter top width (W_T) is given by:

$W_T = W_B + z_1 + z_2$

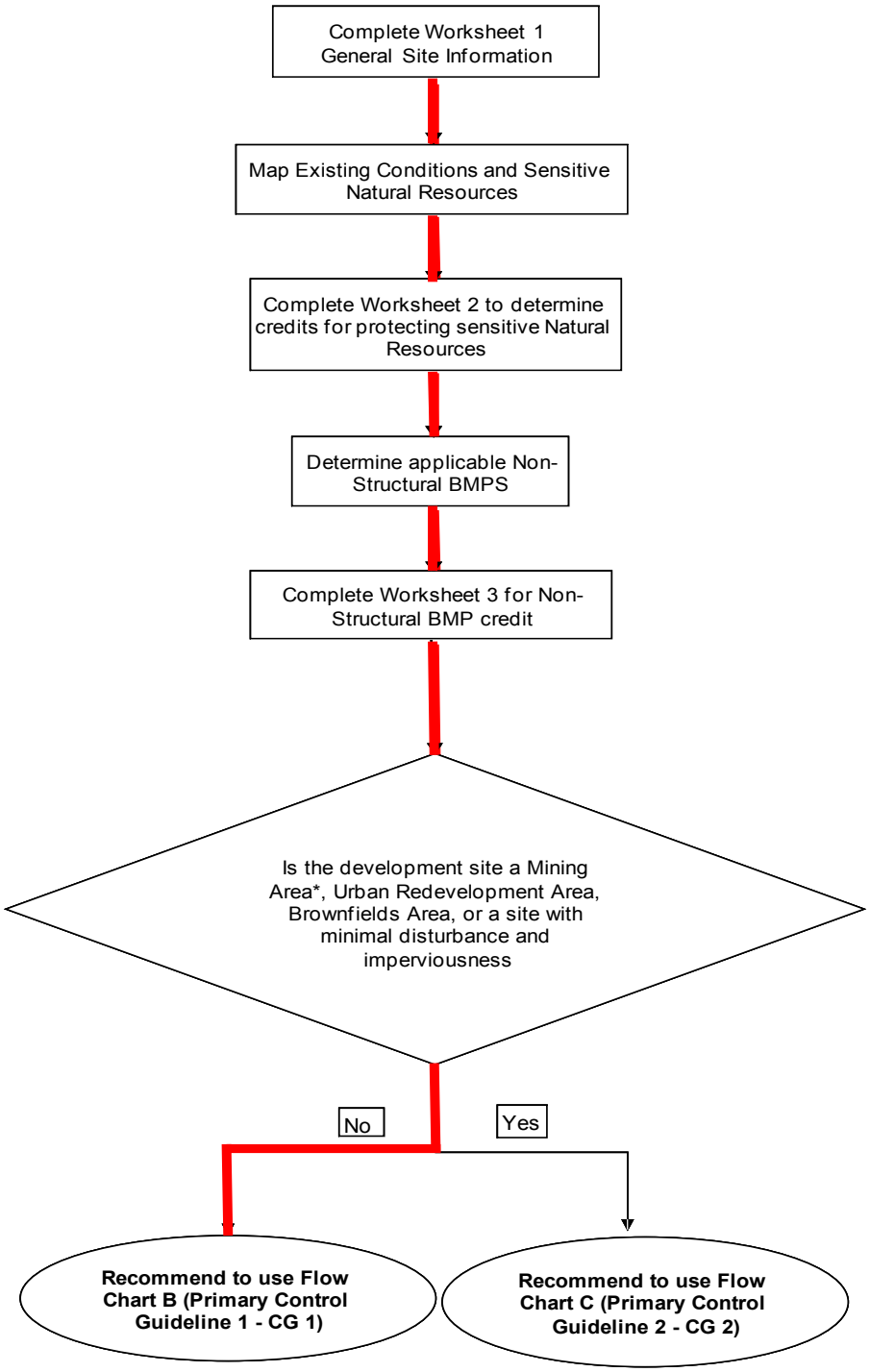
Where: W_B = rock filter bottom width

z_1 = side slope

z_2 = side slope

A.5 Water Quality Worksheets

FLOW CHART A
Stormwater Calculation Process



Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: 19-Oct-15

Project Name: Atlantic Sunrise Project - North Diamond Regulator Station

Municipality: Lehman Township

County: Luzerne County

Total Area (acres): 3.76

Major River Basin: Susquehanna River

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

Watershed: Huntsville Creek

Sub-Basin: UNT to Huntsville Creek

Nearest Surface Water(s) to Receive Runoff: UNT

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	X

List Causes of Impairment:

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/StormwaterManagement/GeneralPermits/default.htm	No	X
Existing or planned drinking water supply?	Yes	
	No	X

If yes, distance from proposed discharge (miles):

Approved Act 167 Plan?	Yes	X
http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html	No	
Existing River Conservation Plan?	Yes	X
http://www.dcnr.state.pa.us/brc/rivers/riversconservation/planningprojects/	No	

Worksheet 2. Sensitive Natural Resources

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	YES	0.01	0.01
Floodplains	YES	***0.38***	***0.00***
Riparian Areas	N/A	0.00	0.00
Wetlands	N/A	0.00	0.00
Woodlands	YES	**3.35**	**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:			
Other:			
TOTAL EXISTING:		***3.74***	***0.01***

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2) ***0.01*** **Ac.**

1.2 Area of Riparian Forest Buffer Protection **-** **Ac.**

3.1 Area of Minimum Disturbance/Reduced Grading **-** **Ac.**

TOTAL ***0.01*** **Ac.**

Site Area	*minus*	Protected Area	=	Stormwater Management Area
3.76	-	***0.01***	=	***3.75***

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction

Lawn ____ ft² x 1/4" x 1/12 = **-** **ft³**

Meadow ____ ft² x 1/3" x 1/12 = **-** **ft³**

3.3 Protect Existing Trees

For Trees within 100 feet of impervious area:

Tree Canopy ____ ft² x 1/2" x 1/12 = **-** **ft³**

For Trees within 20 feet of impervious area:

Tree Canopy ____ x 1/12 = **-** **ft³**

5.1 Disconnect Roof Leaders to Vegetated Areas

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area 374 ft² x 1/12 = **10.39** **ft³**

For all other disconnected roof areas

Roof Area ____ ft² x 1/4" x 1/12 = **-** **ft³**

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 45,121 ft² x 1/3" x 1/12 = **1,253** **ft³**

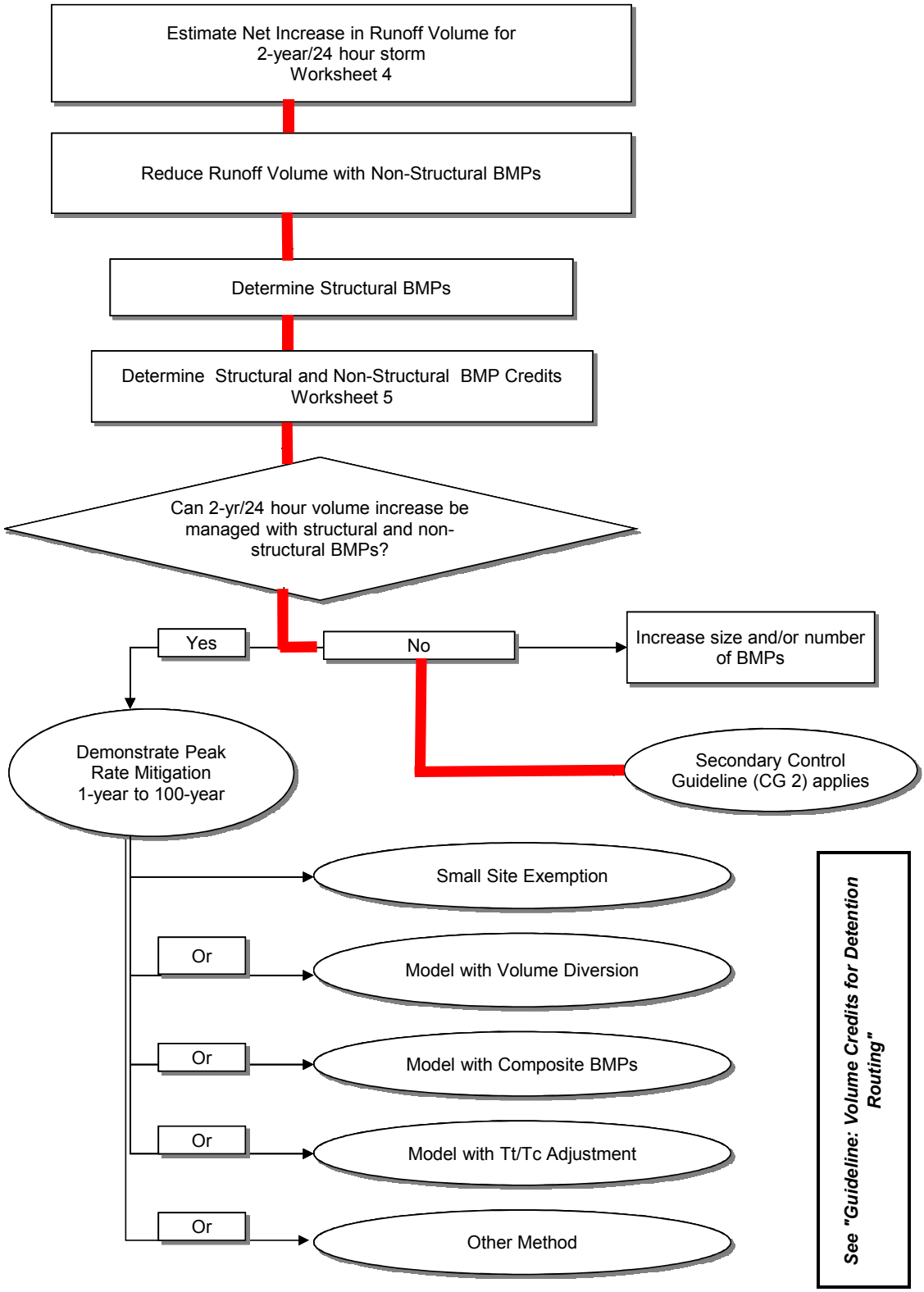
For all other disconnected roof areas

Impervious Area ____ ft² x 1/4" x 1/12 = **-** **ft³**

TOTAL NON-STRUCTURAL VOLUME CREDIT* 1,264 **ft³**

** For use on Worksheet 5*

FLOW CHART B
Control Guideline 1 Process



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

PROJECT: Atlantic Sunrise Project - North Diamond Regulator Station
DA:
2-Year Rainfall: 2.81 in

Total Site Area: 3.76 acres
Protected Site Area: *0.01* acres
Managed Area *3.75* acres

Existing Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff [1] (in)	Runoff Volume[2] (ft^3)
20% Meadow	D	2,172.00	0.05	78	2.82	0.56	1.00	180.20
Woods	D	152,739.00	3.51	77	2.99	0.60	0.94	11,984
Impervious	D	8,691.00	0.20	98	0.20	0.04	2.58	1,867.92
TOTAL:		163,602.00	3.76					14,032

Developed Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff [1] (in)	Runoff Volume[2] (ft^3)
Meadow	D	118,106.00	2.71	78	2.82	0.56	1.00	9,799
Woods	D	-	0.00	77	2.99	0.60	0.94	-
Impervious	D	374.60	0.01	98	0.20	0.04	2.58	81
Gravel	D	45,121.40	1.04	89	1.24	0.25	1.73	6,501
TOTAL:		163,602.00	3.76					16,380

2-Year Volume Increase (ft^3)	**2,348**

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.

WORKSHEET 5. STRUCTURAL BMP VOLUME CREDITS

PROJECT: Atlantic Sunrise Project - North Diamond Regulator Station

SUB-BASIN:

Required Control Volume (ft^3) - *from Worksheet 4*: 2,348

Non-structural Volume Credit (ft^3) - *from Worksheet 3:** - ***580***

Structural Volume Reqmt (ft^3) 1,768

(Required Control Volume minus Non-structural Credit)

	Proposed BMP	Area (ft^2)	Storage Volume (ft^3)
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/Bioretention	2,318	-
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale	2,428	-
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	2,428	-

Total Structural Volume (ft^3): 0

Structural Volume Requirement (ft^3): 1,768

DIFFERENCE -1,768

No more than 25% of Volume Reduction may be met through Non-structural BMP credits (PA BMP Manual Chapter 8, 8.8): 1,264 > (2,322 x .25 = 580), Use 580

WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or the

PRIMARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		
NS BMP 5.5.4 - Cluster Uses at Each Site		
NS BMP 5.6.1 - Minimize Total Disturbed Area		
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native		
NS BMP 5.9.1 - Street Sweeping / Vacuuming		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		

SECONDARY BMPs FOR NITRATE:

NS BMP 5.4.1 - Protect Sensitive / Special Value Features	X	
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features		
NS BMP 5.6.2 - Minimize Soil Compaction		
Structural BMP 6.4.5 - Rain Garden / Bioretention	X	
Structural BMP 6.4.8 - Vegetated Swale	X	
Structural BMP 6.4.9 - Vegetated Filter Strip		
Structural BMP 6.6.1 - Constructed Wetland		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		
Structural BMP 6.7.3 - Soils Amendment/Restoration	X	

WORKSHEET 11. BMPS FOR POLLUTION PREVENTION

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 BMPs are provided across the site. "Provided across the site" is taken to mean that the specifications for that BMP set forward in Chapters 5 and 6 are satisfied.

BMPs FOR POLLUTANT PREVENTION:

	YES	NO
NS BMP 5.4.1 - Protect Sensitive / Special Value Features	X	
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		
NS BMP 5.4.3 - Protect / Utilize Natural Flow Pathways in Overall		
NS BMP 5.5.1 - Cluster Uses at Each Site; Build on the Smallest Area		
NS BMP 5.6.1 - Minimize Total Disturbed Area - Grading		
NS BMP 5.6.2 - Minimize Soil Compaction in Disturbed Areas		
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native		
NS BMP 5.7.1 - Reduce Street Imperviousness		
NS BMP 5.7.2 - Reduce Parking Imperviousness	X	
NS BMP 5.8.1 - Rooftop Disconnection		
NS BMP 5.8.2 - Disconnection from Storm Sewers	X	
NS BMP 5.9.1 - Street Sweeping		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		
Structural BMP 6.7.3 - Soils Amendment and Restoration	X	

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

TOTAL SITE AREA (AC)	**3.76**
TOTAL DISTURBED AREA (AC)	**3.33**
DISTURBED AREA CONTROLLED BY BMPs (AC)	**3.33**

TOTAL DISTURBED AREAS:

		POLLUTANT					POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	**TSS EMC *(mg/l)***	**TP EMC *(mg/l)***	**Nitrate-Nitrite EMC *(mg/l as N)***	**COVER (Acres)**	**RUNOFF VOLUME (Acre-Feet)**	**TSS** (LBS)**	**TP** (LBS)**	**NO_3 (LBS)**
Pervious Surfaces	Forest	39	0.15	0.17		0.00	0.00	0.00	0.00
	Meadow	47	0.19	0.3	2.28	0.04	4.72	0.02	0.03
	Fertilized Planting Area	55	1.34	0.73		0.00	0.00	0.00	0.00
	Native Planting Area	55	0.40	0.33		0.00	0.00	0.00	0.00
	Lawn, Low-Input	180	0.40	0.44		0.00	0.00	0.00	0.00
	Lawn, High-Input	180	2.22	1.46		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
	Grassed Athletic Field	200	1.07	1.01		0.00	0.00	0.00	0.00
Impervious Surfaces	Rooftop	21	0.13	0.32	0.01	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
	Medium Traffic Street	113	0.33	0.58		0.00	0.00	0.00	0.00
	Low Traffic / Residential Street	86	0.36	0.47		0.00	0.00	0.00	0.00
	Res. Driveway, Play Courts, etc.	60	0.46	0.47		0.00	0.00	0.00	0.00
	High Traffic Parking Lot	120	0.39	0.60		0.00	0.00	0.00	0.00
	Low Traffic Parking Lot	58	0.15	0.39	1.04	0.20	30.82	0.08	0.21
						TOTAL LOAD	35.54	0.10	0.24
						REQUIRED REDUCTION (%)	**85%**	**85%**	**50%**
						REQUIRED REDUCTION (LBS)	30.21	0.08	0.12

* Pollutant Load = [EMC, mg/l] X [Volume, Acre-Feet] 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

WORKSHEET 13 - POLLUTANT REDUCTION THROUGH BMP APPLICATIONS*

** FILL THIS WORKSHEET OUT FOR EACH BMP TYPE WITH DIFFERENT POLLUTANT REMOVAL EFFICIENCIES. SUM POLLUTANT REDUCTION ACHIEVED FOR ALL BMP TYPES ON FINAL SHEET.*

BMP TYPE: **Water Quality - Vegetated Swale 1 (A&B)**

DISTURBED AREA CONTROLLED BY THIS BMP TYPE (AC)	1.87

DISTURBED AREAS CONTROLLED BY THIS BMP TYPE:

		POLLUTANT					POLLUTANT LOAD**		
	LAND COVER CLASSIFICATION	TSS EMC *(mg/l)*	TP EMC *(mg/l)*	Nitrate-Nitrite EMC *(mg/l as N)*	COVER (Acres)	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
	Meadow	47	0.19	0.30	0.82	0.01	1.70	0.01	0.01
	Fertilized Planting Area	55	1.34	0.73		0.00	0.00	0.00	0.00
	Native Planting Area	55	0.40	0.33		0.00	0.00	0.00	0.00
	Lawn, Low-Input	180	0.40	0.44		0.00	0.00	0.00	0.00
	Lawn, High-Input	180	2.22	1.46		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
	Grassed Athletic Field	200	1.07	1.01		0.00	0.00	0.00	0.00
Impervious Surfaces	Rooftop	21	0.13	0.32	0.01	0.00	0.11	0.00	0.00
	High Traffic Street / Highway	261	0.40	0.83		0.00	0.00	0.00	0.00
	Medium Traffic Street	113	0.33	0.58		0.00	0.00	0.00	0.00
	Low Traffic / Residential Street	86	0.36	0.47		0.00	0.00	0.00	0.00
	Res. Driveway, Play Courts, etc.	60	0.46	0.47		0.00	0.00	0.00	0.00
	High Traffic Parking Lot	120	0.39	0.60		0.00	0.00	0.00	0.00
	Low Traffic Parking Lot	58	0.15	0.39	1.04	0.20	30.82	0.08	0.21
	POLUTANT LOAD IN RUNOFF FROM RAIN GARDEN, ENTERING SWALES						2.84	0.01	0.07
	TOTAL LOAD TO THIS BMP TYPE						35.46	0.09	0.29
	POLLUTANT REMOVAL EFFICIENCIES FROM TABLE A-4 (%)						**50%**	**50%**	**20%**
	POLLUTANT REDUCTION ACHIEVED BY THIS BMP TYPE (LBS)						17.73	0.05	0.06

POLLUTANT REDUCTION ACHIEVED BY ALL BMP TYPES (LBS)	*33.80*	*0.09*	*0.12*
REQUIRED REDUCTION FROM WS12 (LBS)	*30.21*	*0.08*	*0.12*

** 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

WORKSHEET 13 - POLLUTANT REDUCTION THROUGH BMP APPLICATIONS*

** FILL THIS WORKSHEET OUT FOR EACH BMP TYPE WITH DIFFERENT POLLUTANT REMOVAL EFFICIENCIES. SUM POLLUTANT REDUCTION ACHIEVED FOR ALL BMP TYPES ON FINAL SHEET.*

BMP TYPE: **Water Quality - Rain Garden**

DISTURBED AREA CONTROLLED BY THIS BMP TYPE (AC)	0.88

DISTURBED AREAS CONTROLLED BY THIS BMP TYPE:

		POLLUTANT					POLLUTANT LOAD**		
	LAND COVER CLASSIFICATION	TSS EMC *(mg/l)*	TP EMC *(mg/l)*	Nitrate-Nitrite EMC *(mg/l as N)*	COVER (Acres)	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
	Meadow	47	0.19	0.30	0.26	0.00	0.54	0.00	0.00
	Fertilized Planting Area	55	1.34	0.73		0.00	0.00	0.00	0.00
	Native Planting Area	55	0.40	0.33		0.00	0.00	0.00	0.00
	Lawn, Low-Input	180	0.40	0.44		0.00	0.00	0.00	0.00
	Lawn, High-Input	180	2.22	1.46		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
	Grassed Athletic Field	200	1.07	1.01		0.00	0.00	0.00	0.00
Impervious Surfaces	Rooftop	21	0.13	0.32		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
	Medium Traffic Street	113	0.33	0.58		0.00	0.00	0.00	0.00
	Low Traffic / Residential Street	86	0.36	0.47		0.00	0.00	0.00	0.00
	Res. Driveway, Play Courts, etc.	60	0.46	0.47		0.00	0.00	0.00	0.00
	High Traffic Parking Lot	120	0.39	0.60		0.00	0.00	0.00	0.00
	Low Traffic Parking Lot	58	0.15	0.39	0.62	0.12	18.37	0.05	0.12
						TOTAL LOAD TO THIS BMP TYPE	18.91	0.05	0.13
						POLLUTANT REMOVAL EFFICIENCIES FROM TABLE A-4 (%)	**85%**	**85%**	**50%**
						POLLUTANT REDUCTION ACHIEVED BY THIS BMP TYPE (LBS)	16.07	0.04	0.06
						POLUTANT LOAD LEAVING BMP (LBS)	2.84	0.01	0.07

POLLUTANT REDUCTION ACHIEVED BY ALL BMP TYPES (LBS)	*33.80*	*0.09*	*0.12*
REQUIRED REDUCTION FROM WS12 (LBS)	*30.21*	*0.08*	*0.12*

** 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

A.6 Site Characterization Assessment

Field Observation Report

Project Number: 14C4909

Project Name: Atlantic Sunrise Project – North Diamond Regulator Station

Date of Field Visit: March 13, 2015

Weather Conditions: Sunny Temperature: Approximately 30-40°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

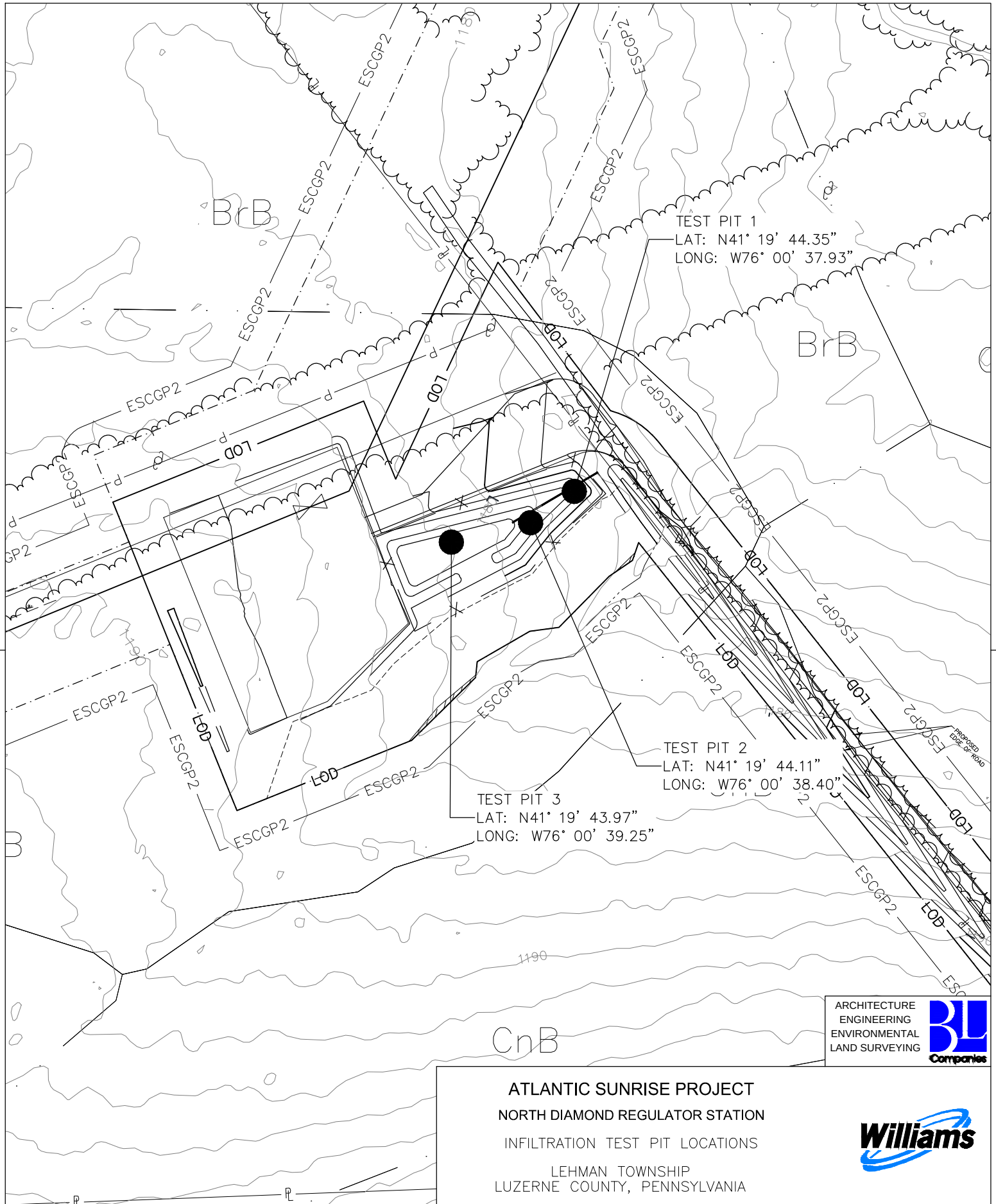
Contractor:
BL Companies
4242 Carlisle Pike, Suite 260
Camp Hill, PA 17011

Three 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 the surface.

Infiltration testing did not appear to be hindered by weather conditions.

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

Pit #1: 40 inches deep, Limiting Layer observed at the surface
Infiltration conducted at the surface, Infiltration Rate = 6.000 inches/hour
Pit #2: 50 inches deep, Limiting Layer observed at the surface
Infiltration conducted at the surface, Infiltration Rate = 0.375 inches/hour
Pit #3: 30 inches deep, Limiting Layer observed at the surface
Infiltration conducted at the surface, Infiltration Rate = 2.813 inches/hour



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ATLANTIC SUNRISE PROJECT

NORTH DIAMOND REGULATOR STATION

INFILTRATION TEST PIT LOCATIONS

LEHMAN TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

Williams

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.

DRAWN BY: AOE	DATE: 3/27/15	ISSUED FOR BID:	SCALE: 1"=100'
CHECKED BY: AJB	DATE: 3/27/15	ISSUED FOR CONSTRUCTION:	
APPROVED BY: AJB	DATE: 3/27/15	DRAWING NUMBER: NORTH DIAMOND RS TEST PITS	SHEET 1 OF 1
WO:			

Soil Profile Log

Project	14C4909-A Atlantic Sunrise Project - North Diamond Regulator St	**Elevation**	1178.00 AMSL
Test Pit #	1	**Soil Type**	Wellsboro channery silt loam, 3-8% slopes
Name	Krystal Bealing, APSS	**Geology**	Catskill Formation
Date	March 13, 2015	**Landscape Position/Slope**	Bench, 0-2%
Weather	30-40°F; Sunny	**Land Use**	Woods
Equipment	Mini Excavator	**Additional Comments**	Approximately 11" snow

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
Oa	1	0	-	-	10YR 2/1	-	Roots present	-	-	-
A	0	10	SiL	-	10YR 4/2	5% 7.5YR 4/6	Roots present, Weak, Granular	-	-	Limiting Layer - Seasonal high water table
Bw1	10	18	SiL	-	10YR 5/1	40% 7.5YR 5/8	Weak, Subangular blocky	-	10	Seep observed; Limiting Layer - Seasonal high water table
Bw2	18	24	SiL	-	2.5Y 6/1	40% 7.5YR 5/8	Weak, Subangular blocky	-	-	Limiting Layer - Seasonal high water table
Bx	24	40+	L	15-35% Channery	7.5YR 4/3	10% 7.5YR 4/6	Weak, Subangular 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 - North Diamond Regulator St	**Elevation**	1180.00 AMSL
Test Pit #	2	**Soil Type**	Wellsboro channery silt loam, 3-8% slopes
Name	Krystal Bealing, APSS	**Geology**	Catskill Formation
Date	March 13, 2015	**Landscape Position/Slope**	Bench, 0-2%
Weather	30-40°F; Sunny	**Land Use**	Woods
Equipment	Mini Excavator	**Additional Comments**	Approximately 11" snow; Approximately 5" 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
Oa	1	0	-	-	10YR 2/1	-	Roots present	-	-	-
A	0	11	SiL	-	10YR 3/2	5% 7.5YR 4/6	Roots present, Weak, Granular	-	-	Limiting Layer - Seasonal high water table
Bw1	11	21	SiL	-	10YR 5/1	35% 7.5YR 5/8	Weak, Subangular blocky	-	14	Seep observed; Limiting Layer - Seasonal high water table
Bw2	21	32	SiL	-	2.5Y 6/1	45% 7.5YR 5/8	Weak, Subangular blocky	-	-	Limiting Layer - Seasonal high water table
Bx	32	50+	L	15-35% Channery	7.5YR 4/3	20% 7.5YR 4/6	Weak, Subangular 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	Atlantic Sunrise Project - North Diamond Regulator Station	**Elevation**	1183.00 AMSL
Test Pit #	3	**Soil Type**	Wellsboro channery silt loam, 3-8% slopes
Name	Krystal Bealing, APSS	**Geology**	Catskill Formation
Date	March 13, 2015	**Landscape Position/Slope**	Bench, 0-2%
Weather	30-40°F; Sunny	**Land Use**	Woods
Equipment	Mini Excavator	**Additional Comments**	Approximately 11" snow; Approximately 5" 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
Oa	1	0	-	-	10YR 2/1	-	Roots present	-	-	-
A	0	7	SiL	-	10YR4/3	10% 7.5YR 4/6	Roots present, Weak, Granular	-	-	Limiting Layer - Seasonal High water table
Bw1	7	25	SiL	-	10YR 5/1	40% 7.5YR 5/8	Weak, Subangular blocky	-	25	Seep observed; Limiting Layer - Seasonal high water table
Bw2	25	30+	SiL	-	2.5Y 6/1	40% 7.5YR 5/8	Weak, Subangular 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 - NORTH DIAMOND REGULATOR STATION													
SOIL INFILTRATION WORKSHEET - DOUBLE RING INFILTROMETER METHOD													
Hole Number	Drop >2 inches after 30 minute presoak?[1]	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[2] (Inches of Drop)	Infiltration Rate[3] (in/hr)	Comments
1	Yes	10	0.938	1.000	1.000	1.063					1.000	6.000	30-40 degrees, sunny, approx. 11" snow cover. Test done at the surface.
2	No	30	0.313	0.188	0.125	0.125					0.188	0.375	30-40 degrees, sunny, approx. 11" snow cover. Approx. 5" frozen soil. Test done at the surface.
3	No	30	1.375	1.500	1.500	1.250					1.406	2.813	30-40 degrees, sunny, approx. 11" snow cover. Test done at the surface.

[1]Inches of drop greater than 2 inches after the 30 minute presoak? Yes, use 10 minute interval; No, use 30 minute interval.

[2]Calculated as the average of the last four stabilized (less than 0.25-inch difference overall) readings.

[3]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.

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Land Surveying
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DIAMOND NORTH REGULATOR STATION
INFILTRATION LOADING RATIO

Total drainage area to potential infiltration area=	458,534	sf.
Impervious area to potential infiltration area =	70,550	sf.
Potential Infiltration area provided =	4,746	sf.
Impervious loading Ratio =	14.9 :	1
Total DA loading Ratio =	96.6 :	1

SUMMARY

Although the above calculation indicates infiltration area is provided on site, no credits for infiltration have been taken for this site. Site constraints such as a shallow limiting layer and high groundwater restrict the suitability for infiltration. Therefore loading ratios for this site are not applicable. It will not be possible for the site to comply with the recommended 5:1 ratio for impervious areas to infiltration areas or the 8:1 ratio for over-all drainage area to infiltration areas as suggested in the PA Stormwater management BMP Manual. This is because there is a large drainage area, including offsite and unimproved areas, that will not be able to bypass the stormwater management system.

It is also worth noting, that the majority of the 'impervious' area is actually gravel, resulting in a greater effective ratio impervious area to infiltration ratio.

A.7 Supporting Documentation

TABLE 6.6
Riprap Gradation, Filter Blanket Requirements, Maximum Velocities

Percent Passing (Square Openings)						
Class, Size NO. / **Rock Size (Inches)**	**R-8**	**R-7**	**R-6**	**R-5**	**R-4**	**R-3**
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[1]	AASHTO #1	AASHTO #1	AASHTO #1	AASHTO #3	AASHTO #3	AASHTO #57
V_{max} (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"**	**3/4 "**	**1/2"**	**3/8"**	**#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: Dallas, Pennsylvania, US*
Latitude: 41.3286°, Longitude: -76.0113°
Elevation: 1185 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_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.317** (0.285-0.352)	**0.376** (0.339-0.418)	**0.442** (0.397-0.492)	**0.492** (0.443-0.546)	**0.555** (0.497-0.615)	**0.605** (0.539-0.672)	**0.656** (0.581-0.729)	**0.710** (0.625-0.790)	**0.787** (0.686-0.880)	**0.849** (0.732-0.952)
10-min	**0.493** (0.443-0.547)	**0.587** (0.529-0.652)	**0.687** (0.618-0.765)	**0.760** (0.683-0.843)	**0.848** (0.759-0.941)	**0.918** (0.817-1.02)	**0.988** (0.875-1.10)	**1.06** (0.933-1.18)	**1.16** (1.01-1.29)	**1.24** (1.07-1.39)
15-min	**0.604** (0.543-0.670)	**0.717** (0.647-0.797)	**0.844** (0.758-0.939)	**0.935** (0.841-1.04)	**1.05** (0.938-1.16)	**1.14** (1.01-1.26)	**1.23** (1.09-1.36)	**1.32** (1.16-1.47)	**1.44** (1.26-1.61)	**1.54** (1.33-1.73)
30-min	**0.799** (0.719-0.887)	**0.960** (0.866-1.07)	**1.16** (1.04-1.29)	**1.30** (1.17-1.44)	**1.48** (1.32-1.64)	**1.62** (1.45-1.80)	**1.77** (1.57-1.97)	**1.92** (1.69-2.14)	**2.14** (1.86-2.39)	**2.31** (2.00-2.60)
60-min	**0.976** (0.878-1.08)	**1.18** (1.06-1.31)	**1.45** (1.30-1.61)	**1.65** (1.49-1.83)	**1.92** (1.72-2.13)	**2.14** (1.91-2.38)	**2.37** (2.10-2.63)	**2.61** (2.30-2.90)	**2.96** (2.58-3.31)	**3.25** (2.80-3.65)
2-hr	**1.14** (1.03-1.27)	**1.37** (1.24-1.53)	**1.70** (1.53-1.90)	**1.96** (1.76-2.19)	**2.35** (2.10-2.63)	**2.69** (2.38-3.00)	**3.07** (2.70-3.43)	**3.49** (3.05-3.91)	**4.14** (3.56-4.66)	**4.71** (4.00-5.33)
3-hr	**1.24** (1.12-1.38)	**1.49** (1.34-1.66)	**1.84** (1.66-2.05)	**2.13** (1.91-2.37)	**2.56** (2.29-2.85)	**2.95** (2.61-3.29)	**3.38** (2.97-3.78)	**3.87** (3.36-4.33)	**4.64** (3.96-5.21)	**5.31** (4.47-6.00)
6-hr	**1.56** (1.41-1.76)	**1.87** (1.68-2.10)	**2.29** (2.06-2.57)	**2.66** (2.38-2.97)	**3.20** (2.84-3.57)	**3.67** (3.24-4.10)	**4.21** (3.68-4.71)	**4.83** (4.18-5.41)	**5.81** (4.93-6.53)	**6.67** (5.59-7.53)
12-hr	**1.93** (1.74-2.17)	**2.31** (2.09-2.59)	**2.84** (2.56-3.19)	**3.30** (2.96-3.69)	**4.00** (3.56-4.47)	**4.62** (4.08-5.16)	**5.34** (4.66-5.96)	**6.16** (5.32-6.90)	**7.46** (6.32-8.39)	**8.62** (7.20-9.75)
24-hr	**2.35** (2.13-2.63)	**2.81** (2.55-3.16)	**3.48** (3.15-3.91)	**4.07** (3.67-4.55)	**4.99** (4.46-5.55)	**5.84** (5.17-6.47)	**6.83** (6.00-7.54)	**8.01** (6.96-8.82)	**9.90** (8.47-10.9)	**11.7** (9.84-12.7)
2-day	**2.76** (2.49-3.10)	**3.31** (2.99-3.72)	**4.09** (3.69-4.59)	**4.77** (4.29-5.34)	**5.85** (5.22-6.52)	**6.84** (6.06-7.59)	**8.01** (7.02-8.86)	**9.38** (8.14-10.4)	**11.6** (9.92-12.8)	**13.7** (11.5-15.0)
3-day	**2.93** (2.67-3.26)	**3.51** (3.20-3.90)	**4.31** (3.93-4.80)	**5.02** (4.55-5.57)	**6.13** (5.52-6.76)	**7.15** (6.40-7.86)	**8.35** (7.40-9.15)	**9.76** (8.57-10.7)	**12.0** (10.4-13.1)	**14.1** (12.1-15.4)
4-day	**3.11** (2.85-3.42)	**3.71** (3.41-4.09)	**4.54** (4.17-5.00)	**5.27** (4.82-5.79)	**6.41** (5.83-7.01)	**7.46** (6.74-8.13)	**8.69** (7.79-9.44)	**10.1** (9.00-11.0)	**12.5** (10.9-13.5)	**14.6** (12.7-15.7)
7-day	**3.67** (3.38-4.03)	**4.38** (4.04-4.80)	**5.31** (4.88-5.82)	**6.12** (5.61-6.69)	**7.38** (6.73-8.04)	**8.53** (7.72-9.27)	**9.86** (8.87-10.7)	**11.4** (10.2-12.3)	**13.9** (12.2-15.0)	**16.1** (14.0-17.4)
10-day	**4.25** (3.92-4.64)	**5.05** (4.66-5.51)	**6.06** (5.59-6.61)	**6.93** (6.37-7.54)	**8.26** (7.56-8.97)	**9.45** (8.60-10.2)	**10.8** (9.78-11.7)	**12.4** (11.1-13.4)	**14.8** (13.1-16.0)	**17.0** (14.9-18.3)
20-day	**5.76** (5.39-6.21)	**6.80** (6.35-7.31)	**7.94** (7.41-8.53)	**8.91** (8.30-9.56)	**10.4** (9.62-11.1)	**11.6** (10.8-12.4)	**13.1** (12.0-13.9)	**14.7** (13.4-15.6)	**17.1** (15.5-18.2)	**19.2** (17.3-20.5)
30-day	**7.18** (6.76-7.68)	**8.42** (7.93-9.00)	**9.69** (9.11-10.3)	**10.7** (10.1-11.5)	**12.3** (11.5-13.1)	**13.7** (12.8-14.5)	**15.1** (14.1-16.1)	**16.7** (15.5-17.8)	**19.2** (17.6-20.4)	**21.2** (19.4-22.6)
45-day	**9.11** (8.60-9.67)	**10.6** (10.0-11.3)	**12.0** (11.3-12.7)	**13.2** (12.4-14.0)	**14.9** (14.0-15.8)	**16.3** (15.3-17.3)	**17.8** (16.7-18.9)	**19.5** (18.2-20.6)	**21.9** (20.3-23.2)	**23.9** (22.1-25.4)
60-day	**11.0** (10.4-11.6)	**12.8** (12.1-13.5)	**14.3** (13.6-15.2)	**15.6** (14.8-16.6)	**17.6** (16.6-18.6)	**19.2** (18.1-20.2)	**20.9** (19.6-22.0)	**22.7** (21.3-23.9)	**25.3** (23.7-26.8)	**27.5** (25.6-29.1)

[1] 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

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:

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

EMPLOYMENT HISTORY:

Current Employer: BL Companies

Telephone: 717-651-9850

Former Employer: N/A

Telephone:

RECENT E&S PLANS PREPARED:

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

APPENDIX C

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

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Luzerne County, Pennsylvania

North Diamond Regulator Station

July 6, 2015

Preface

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).

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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Contents

How Soil Surveys Are Made

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

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

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 LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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: Luzerne County, Pennsylvania
Survey Area Data: Version 6, Sep 19, 2014

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

Date(s) aerial images were photographed: Apr 14, 2011—May 10, 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 Unit Legend

Luzerne County, Pennsylvania (PA079)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BrB	Braceville gravelly loam, 3 to 8 percent slopes	0.0	0.7%
ClB	Chippewa silt loam, 3 to 8 percent slopes	0.4	9.6%
CnB	Chippewa silt loam, 0 to 8 percent slopes, extremely stony	0.3	9.1%
LaB	Lackawanna channery silt loam, 3 to 8 percent slopes	0.2	4.8%
WlB	Wellsboro channery silt loam, 3 to 8 percent slopes	2.4	62.5%
WlC	Wellsboro channery silt loam, 8 to 15 percent slopes	0.5	13.2%
Totals for Area of Interest		**3.8**	**100.0%**

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.

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.

Luzerne County, Pennsylvania

BrB—Braceville gravelly loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9yfv
Mean annual precipitation: 34 to 56 inches
Mean annual air temperature: 40 to 54 degrees F
Frost-free period: 100 to 175 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Braceville and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Braceville

Setting

Landform: Outwash terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy outwash

Typical profile

H1 - 0 to 3 inches: gravelly loam
H2 - 3 to 30 inches: gravelly silt loam
H3 - 30 to 55 inches: very gravelly loam
H4 - 55 to 60 inches: stratified sand and gravel

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 30 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 3.0 inches)

Interpretive groups

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

Minor Components

Rexford, poorly drained

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave

CIB—Chippewa silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2v32s
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Chippewa and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chippewa

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy till dominated by siltstone, sandstone, and shale fragments

Typical profile

Ap - 0 to 7 inches: silt loam
Eg - 7 to 15 inches: channery silt loam
Bgx - 15 to 45 inches: channery silt loam
C - 45 to 72 inches: channery silt loam

Properties and qualities

Slope: 3 to 8 percent
Percent of area covered with surface fragments: 0.0 percent
Depth to restrictive feature: 8 to 20 inches to fragipan
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D

Minor Components

Volusia

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Concave
Across-slope shape: Linear

Chippewa, very poorly drained

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave

CnB—Chippewa silt loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2vcjf
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Chippewa, extremely stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chippewa, Extremely Stony

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy till dominated by siltstone, sandstone, and shale fragments

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 5 inches: silt loam
Eg - 5 to 15 inches: channery silt loam
Bgx - 15 to 45 inches: channery silt loam
C - 45 to 72 inches: channery silt loam

Properties and qualities

Slope: 0 to 8 percent
Percent of area covered with surface fragments: 7.0 percent
Depth to restrictive feature: 8 to 20 inches to fragipan
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D

Minor Components

Volusia, extremely stony

Percent of map unit: 8 percent
Landform: Hills
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Concave
Across-slope shape: Linear

Chippewa, extremely stony, very poorly drained

Percent of map unit: 7 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave

LaB—Lackawanna channery silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9ygl
Elevation: 1,100 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 165 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lackawanna and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lackawanna

Setting

Landform: Hillslopes, ridges
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountaintop, 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 8 inches: channery silt loam
Bw - 8 to 25 inches: channery loam
Bx - 25 to 60 inches: channery silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 21 to 36 inches to fragipan
Natural drainage class: Well drained
Runoff class: 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 21 to 35 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

WlB—Wellsboro channery silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2vck5
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Wellsboro and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wellsboro

Setting

Landform: Till plains
Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bw - 8 to 22 inches: channery silt loam
Bx - 22 to 55 inches: channery loam
C - 55 to 72 inches: very channery loam

Properties and qualities

Slope: 3 to 8 percent
Percent of area covered with surface fragments: 0.0 percent
Depth to restrictive feature: 14 to 30 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 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): 2w
Hydrologic Soil Group: D

Minor Components

Lackawanna

Percent of map unit: 5 percent
Landform: Hillslopes, ridges
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountaintop, side slope
Down-slope shape: Linear
Across-slope shape: Linear

Oquaga

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear

Morris

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex

WlC—Wellsboro channery silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2vck6
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Farmland of statewide importance

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: Till plains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bw - 8 to 22 inches: channery silt loam
Bx - 22 to 55 inches: channery loam
C - 55 to 72 inches: very channery loam

Properties and qualities

Slope: 8 to 15 percent
Percent of area covered with surface fragments: 0.0 percent
Depth to restrictive feature: 14 to 30 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 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): 3e
Hydrologic Soil Group: D

Minor Components

Lackawanna

Percent of map unit: 5 percent
Landform: Hillslopes, ridges
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountaintop, side slope
Down-slope shape: Linear
Across-slope shape: Linear

Morris

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave

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