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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

Prepared By:

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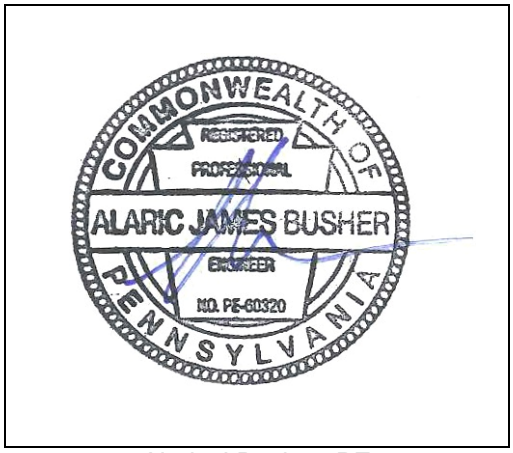

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1.0 GENERAL INFORMATION

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:

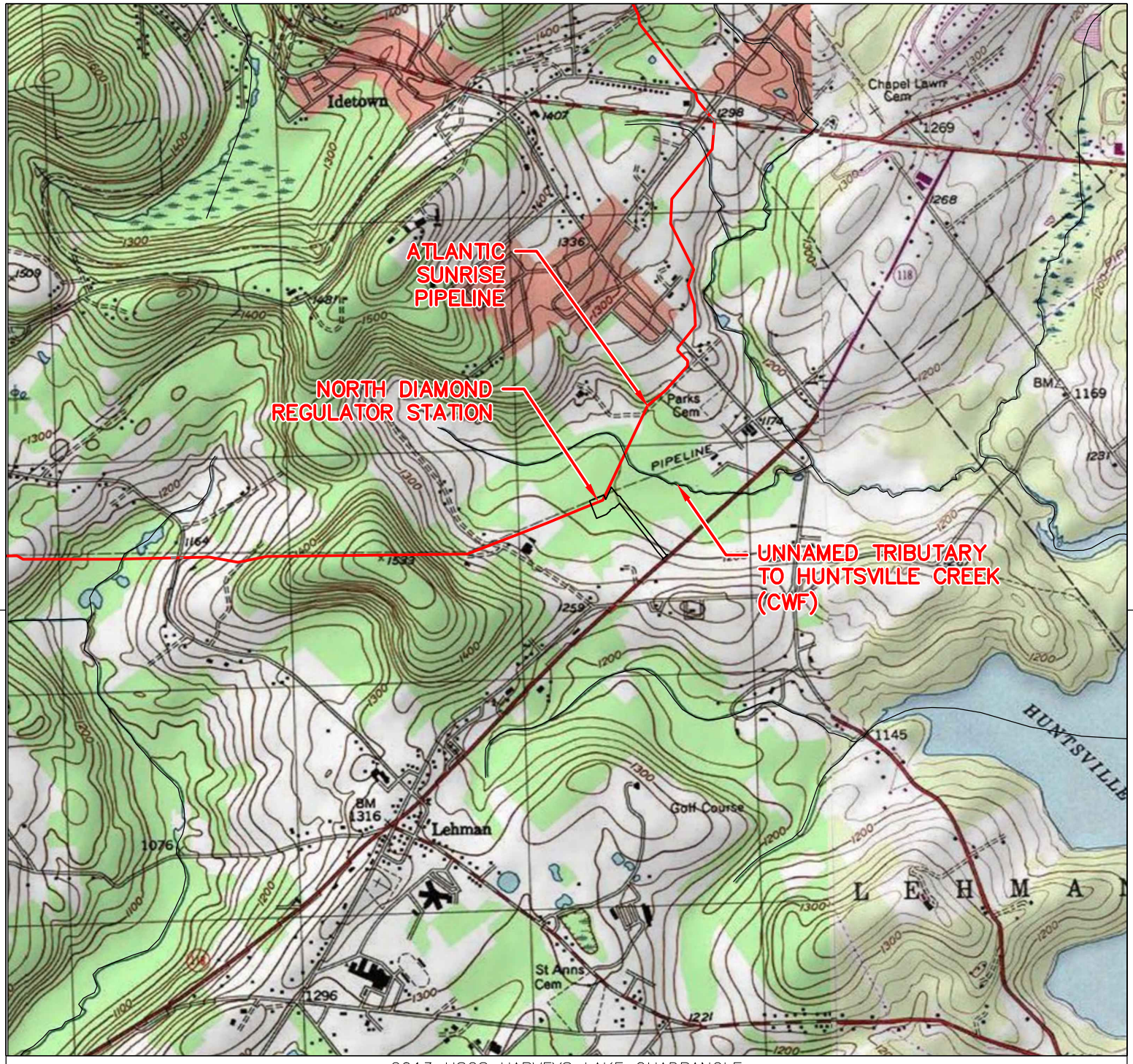
Facility Name	Facility Description	Facility Coordinates
North Diamond Regulator Station	Regulator Station	N41°19'43.07", W76°00'40.81"

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) "Pennsylvania Stormwater Best Management Practices Manual," Technical Guidance No. 363-0300-002, as amended and updated (PCSM 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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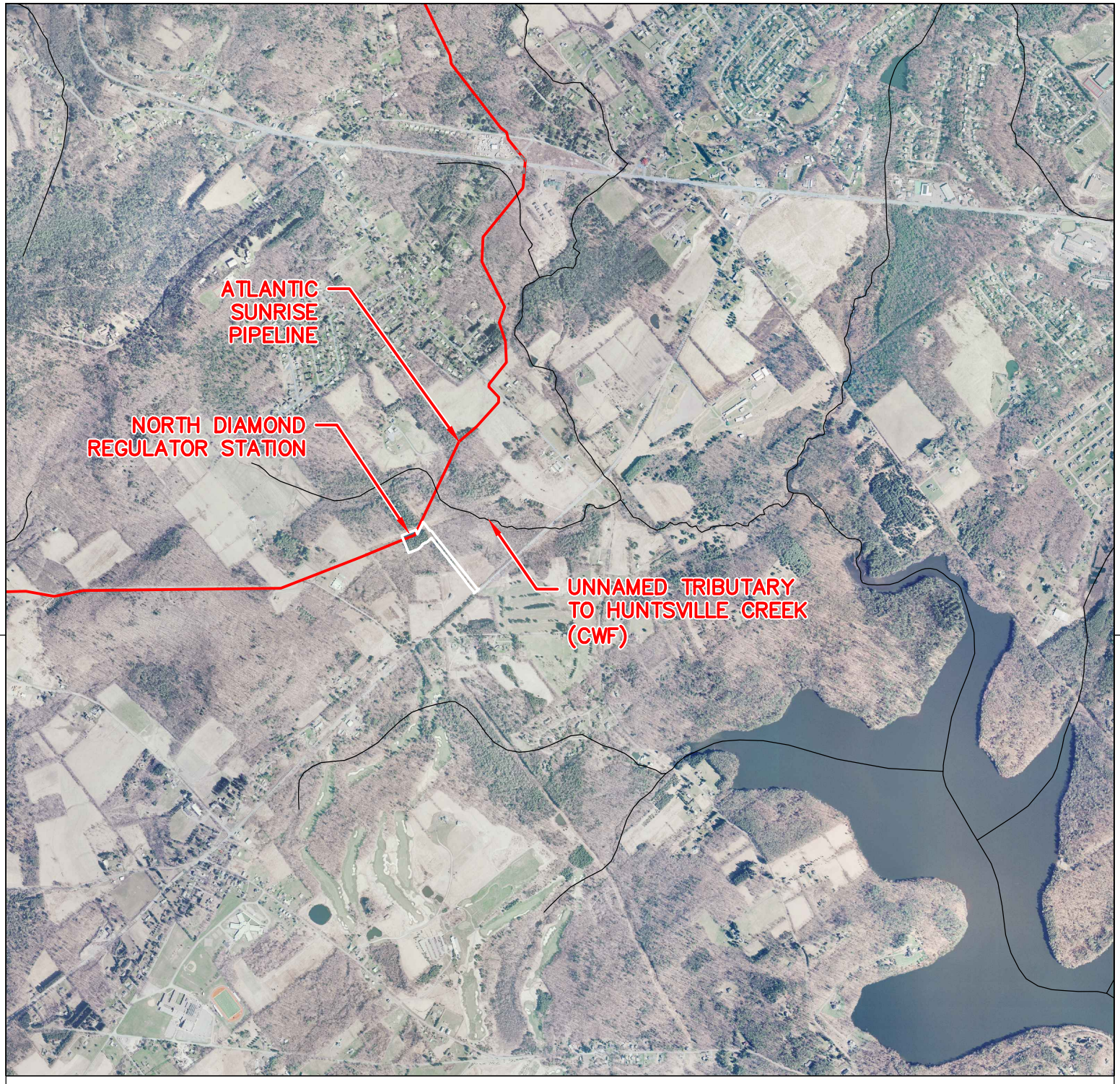

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GRAPHIC SCALE

2000 1000 0 2000

SCALE IN FEET

ATLANTIC SUNRISE PROJECT

NORTH DIAMOND REGULATOR STATION

AERIAL LOCATION MAP

LEHMAN TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

Williams

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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 Worksheets #4 and #5 were 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.

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 PADPE Standards and the 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, but no protected resources are applicable for use as a stormwater BMP. To minimize disturbance, the Site Limit of Disturbance was reduced to the minimum needed to construct the facility and associated pipeline. However, the majority of the right-of-way will be disturbed, making minimized total disturbance applicable for use as a PCSM BMP. Gravel cover was used in lieu of pavement to minimize impervious cover. Additionally, Impervious and gravel areas are disconnected from stormwater conveyance systems. Finally, amended soils are proposed to manage stormwater runoff volume and quality. As a result of these BMP's, some, but not all of the 2 year, 24-hr stormwater volume increase was managed. Therefore, structural BMP's were evaluated 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. Due to this increase in runoff volume, in accordance with 25 Pa. Code §§102.8(g)(3)(iii) and 96.3(c), the applicant is required to demonstrate that the design will maintain and protect existing water quality and existing and designated uses by maintaining the preconstruction site hydrologic impact. This requires a demonstration that the water quality (including increase of stormwater volume) shall be achieved in all surface waters at least 99% of the time. Therefore, to supplement water quality worksheets 12 and 13, the stormwater volume increase was evaluated to verify that the expected volume increase is less than 1% of the volume of the stream at the discharge point to the stream for the 2-yr 24 hour stormwater runoff event. This analysis is provided in Appendix A.5 of this narrative.

POI Summary:

POI: Downslope in existing stream.
Overall Site: Unnamed Tributary to Huntsville Creek

Volume Summary Tables*

Volume Summary to Receiving Water

2- YR PRE (FT^3)	2- YR POST (FT^3)	2- YR VOLUME INCREASE (FT^3)	2- YR NON-STRUCTURAL CREDITS (FT^3)*	STRUCTURAL VOLUME CREDITS (FT^3)*	INCREASE (FT^3)	MAXIMUM ALLOWABLE 2-YEAR STORM INCREASE VOLUME (1%)
169,404	*171,960*	*2,260*	*565***	*1,182*	*513*	*1,694*

*See Appendix A for calculations.
** 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 565 c.f. (2,260*0.25=565) of the available 1,364 c.f. has been credited.

Volume Summary to Point of Interest (POI)

2- YR PRE (FT^3)	2- YR POST (FT^3)	2- YR VOLUME INCREASE (FT^3)	2- YR NON-STRUCTURAL CREDITS (FT^3)*	STRUCTURAL VOLUME CREDITS (FT^3)*	INCREASE (FT^3)
14,329	*16,588*	*2,260*	*565***	*1,182*	*513*

*See Appendix A for calculations.

Runoff Rate Summary Table

STORM EVENT	PRE-DEVELOPMENT * PEAK FLOW (CFS)	POST-DEVELOPMENT* PEAK FLOW (CFS)	REDUCTION (CFS)
1-yr	5.55	4.62	0.93
2-yr	8.75	8.00	0.25
5-yr	13.63	13.11	0.52
10-yr	17.91	17.42	0.49
25-yr	24.45	23.89	0.56
50-yr	29.84	29.25	0.59
100-yr	35.93	35.22	0.71

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

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.

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 Swale 1 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 final 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).

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. Install engineered soil, seed, and stabilize basin.

25. ***Remove accumulated sediments in vegetative swales. Install *Earthen Check Dams* in swales 1 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 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. Disconnection from Storm Sewers

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

4. Soil Amendment and Restoration

   Restrict vehicle access. Monitor water drawdown time in infiltration areas and 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.

5. Reduce Parking Area Imperviousness

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

6. Annual Records of Maintenance Procedures

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

7. 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.

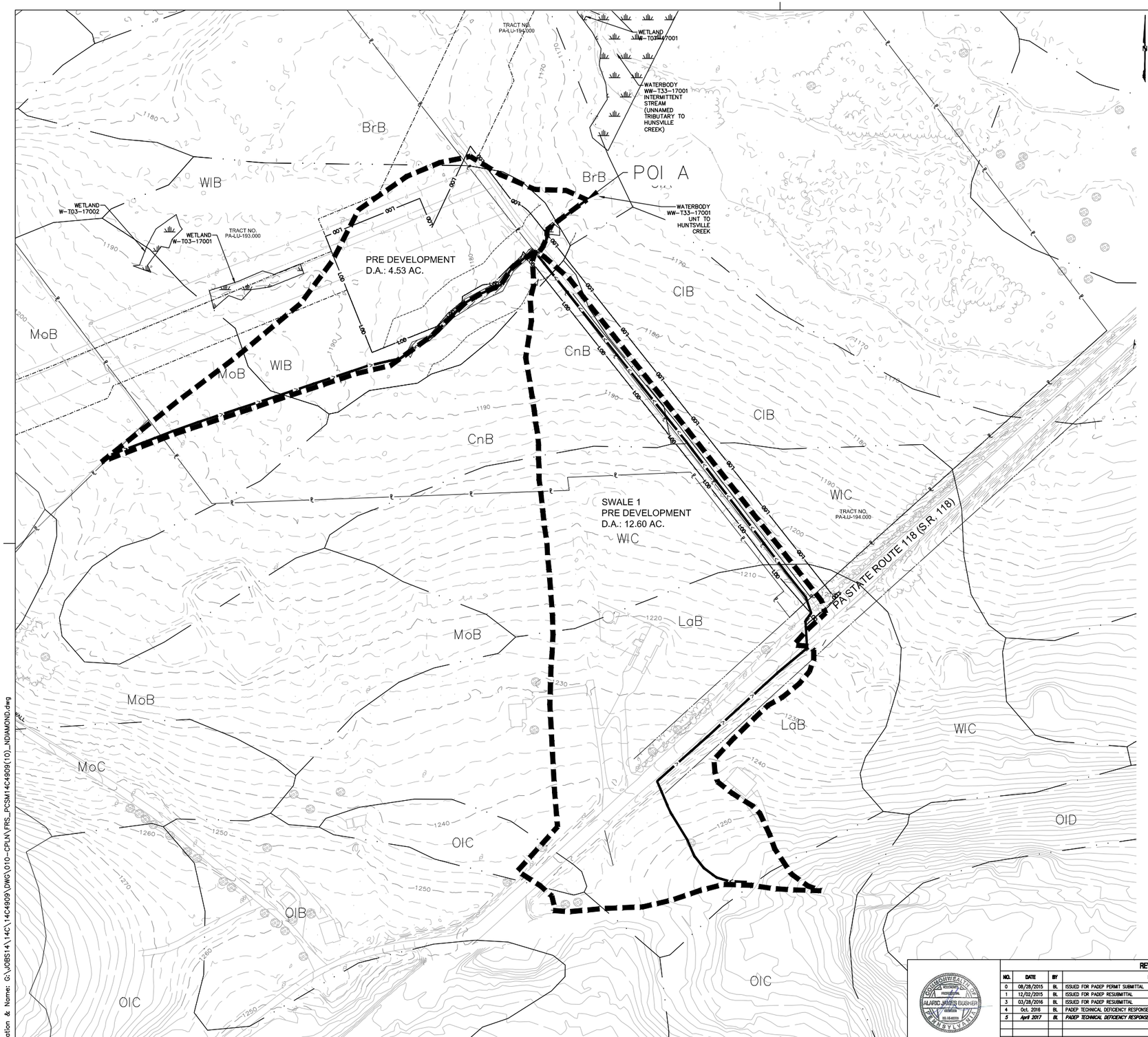
APPENDICES

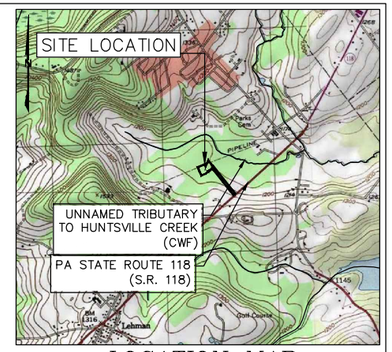
Appendix A	North Diamond Regulator Station Supporting Calculations
	A.1 Pre-Development Calculations A.2 Post Development Calculations A.3 Conveyance Calculations A.4 PCSM BMP Calculations A.5 Water Quality Worksheets A.6 Site Characterization Assessment A.7 Supporting Documentation
Appendix B	Preparer Qualifications
Appendix C	United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Custom Soil Resource Report
Appendix D	Excerpt from Transcontinental Gas Pipe Line Company, LLC PADEP Application No. E40-769 Chapter 105 Water Obstruction and Encroachment Permit Application

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.

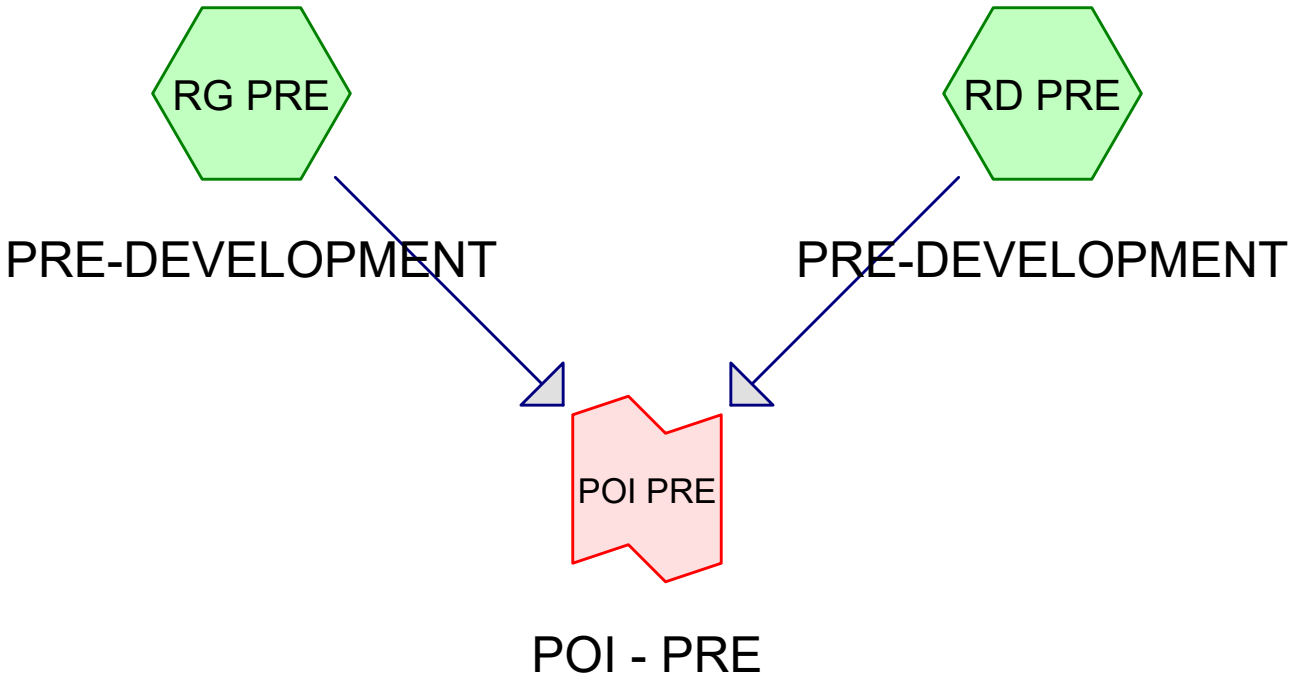
ALARIC J. BUSHER REG NO. PE 60320

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
5	April 2017	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #2	W01161499	AJB	AJB

TRANSCONTINENTAL GAS PIPE LINE 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: 5
APPROVED BY: April 2017	DATE: 07/17/15	DRAWING NUMBER: (36–7935)MF–1A–9	SHEET 1 OF 1
W.O.: 1161499			

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



Subcat Reach Pond Link

Routing Diagram for C-DAT-14C4909-NDIAMOND
Prepared by {enter your company name here}, Printed 4/12/2017

Summary for Subcatchment RD PRE: PRE-DEVELOPMENT

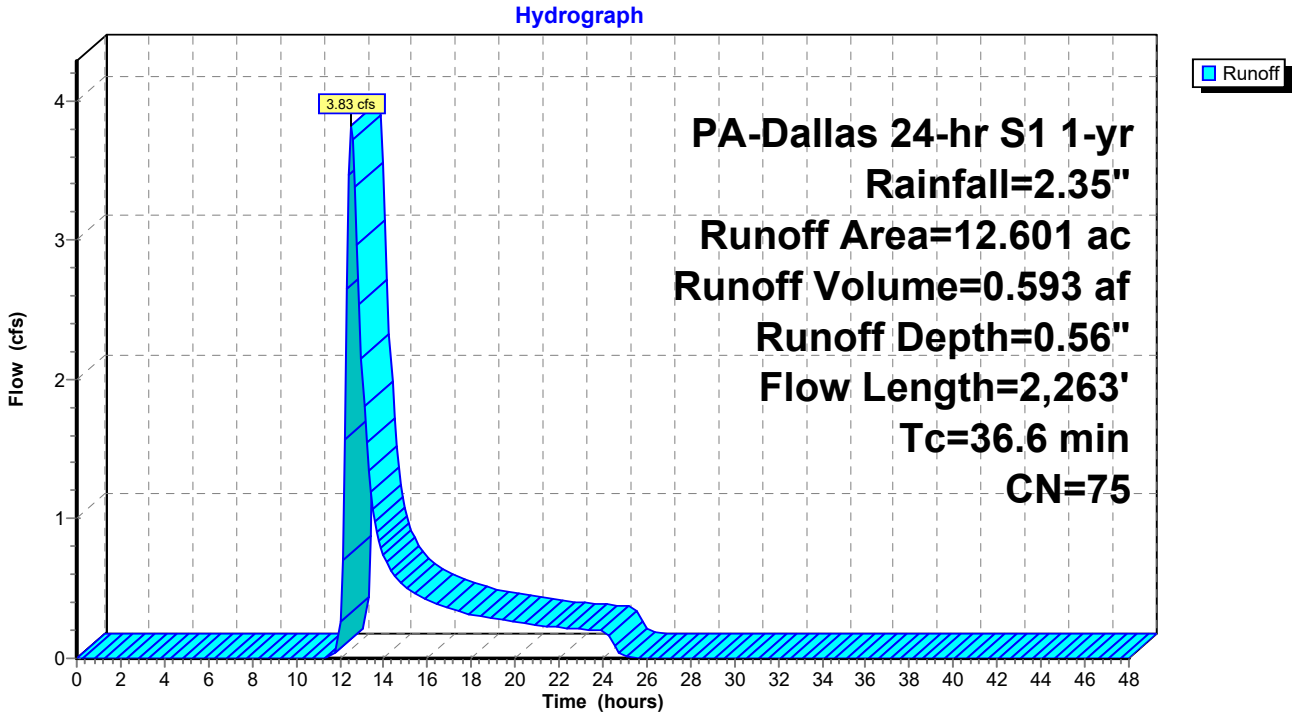
Runoff = 3.83 cfs @ 12.53 hrs, Volume= 0.593 af, Depth= 0.56"

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 1-yr Rainfall=2.35"

	Area (ac)	CN	Description
	2.799	77	Woods, Good, HSG D
	2.424	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.128	70	Woods, Good, HSG C
	5.470	71	Meadow, non-grazed, HSG C
	12.601	75	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

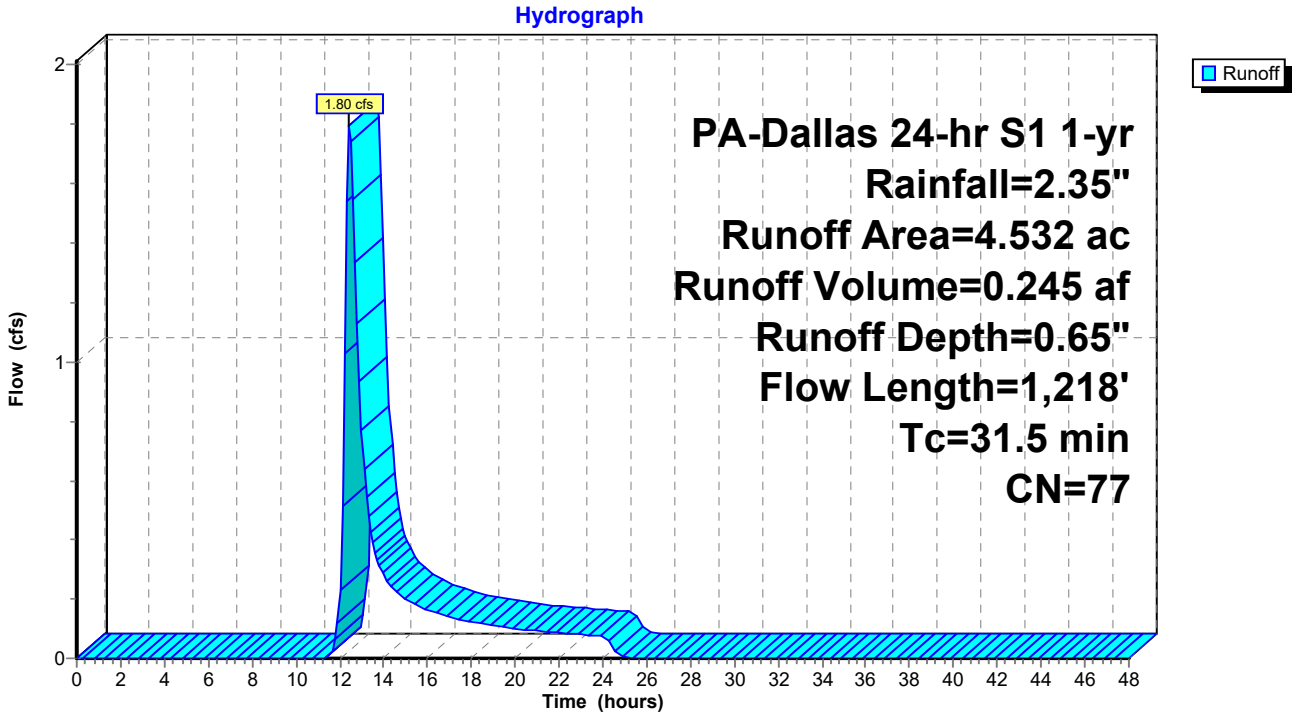
Runoff = 1.80 cfs @ 12.44 hrs, Volume= 0.245 af, Depth= 0.65"

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

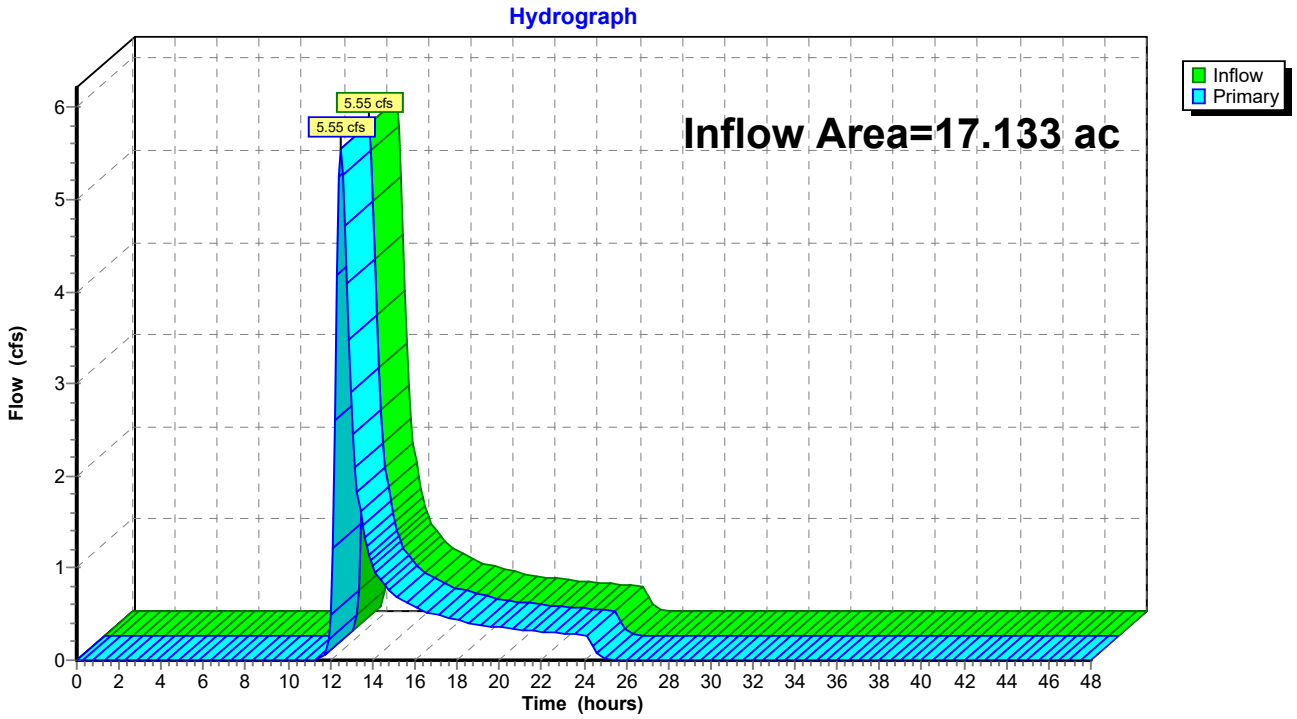


Summary for Link POI PRE: POI - PRE

Inflow Area = 17.133 ac, 4.55% Impervious, Inflow Depth = 0.59" for 1-yr event
Inflow = 5.55 cfs @ 12.50 hrs, Volume= 0.838 af
Primary = 5.55 cfs @ 12.50 hrs, Volume= 0.838 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 Subcatchment RD PRE: PRE-DEVELOPMENT

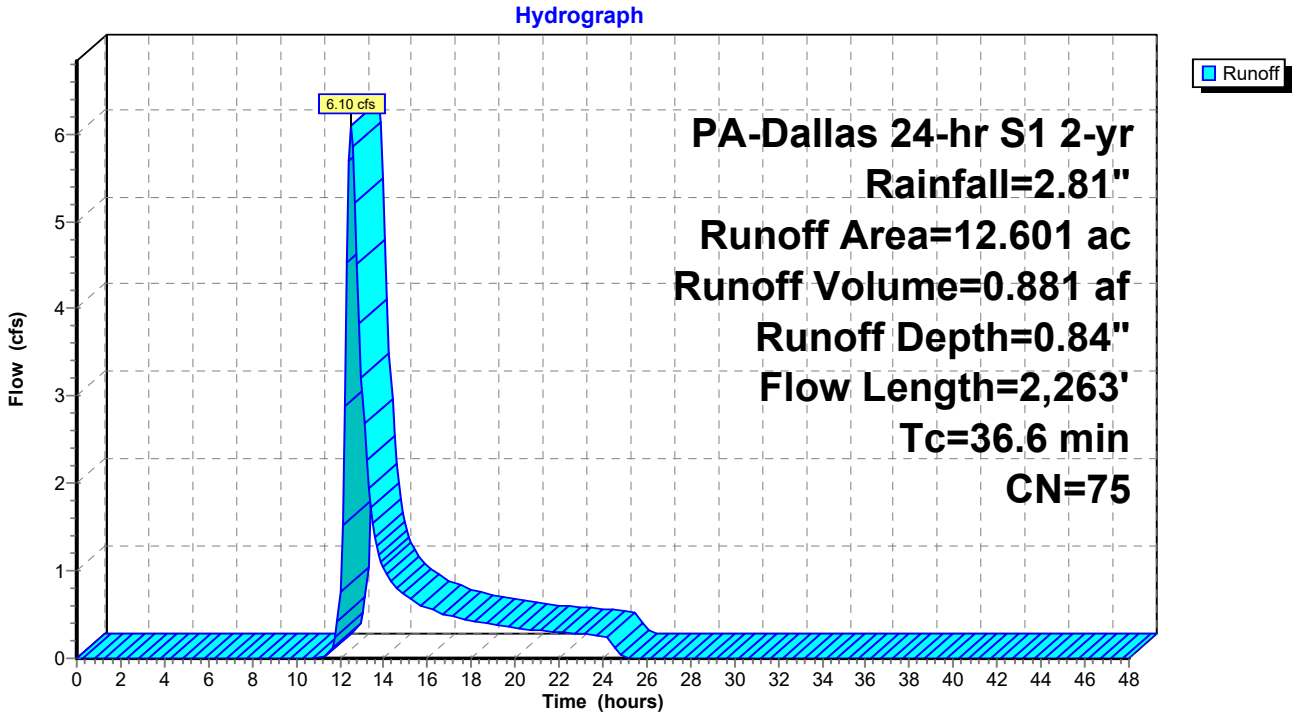
Runoff = 6.10 cfs @ 12.51 hrs, Volume= 0.881 af, Depth= 0.84"

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
	2.799	77	Woods, Good, HSG D
	2.424	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.128	70	Woods, Good, HSG C
	5.470	71	Meadow, non-grazed, HSG C
	12.601	75	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

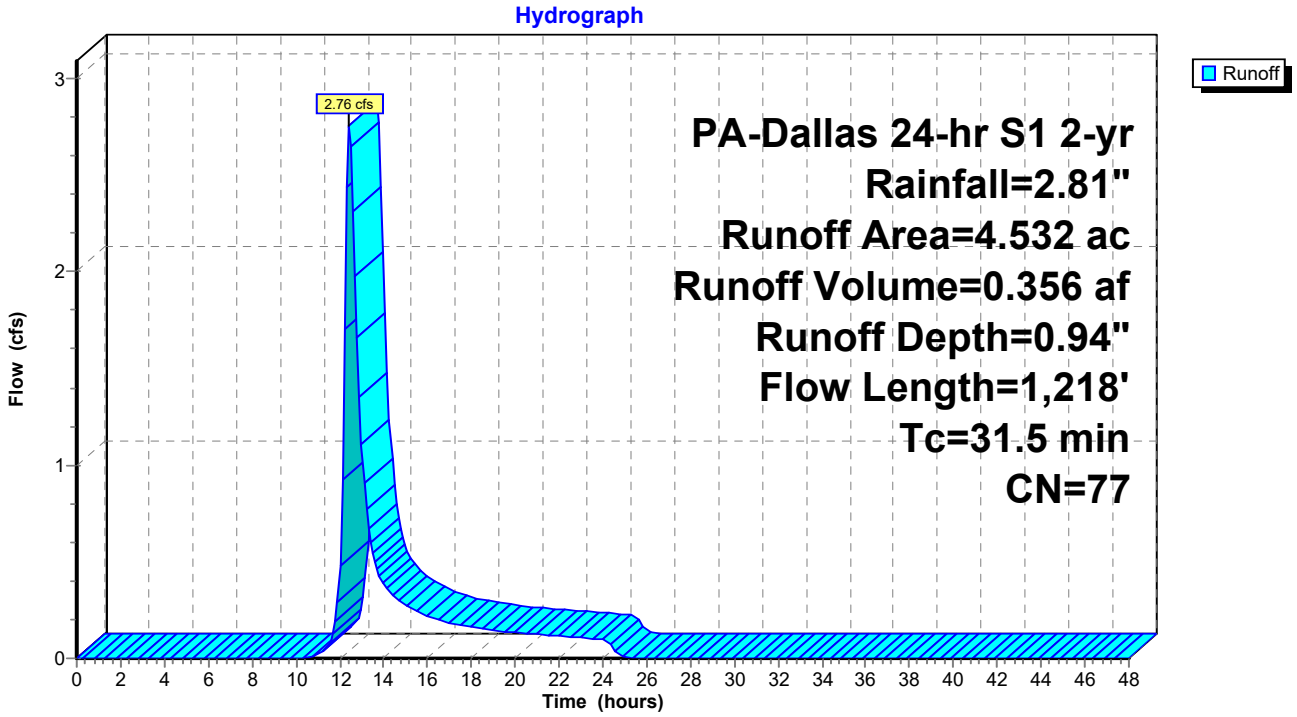
Runoff = 2.76 cfs @ 12.43 hrs, Volume= 0.356 af, Depth= 0.94"

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

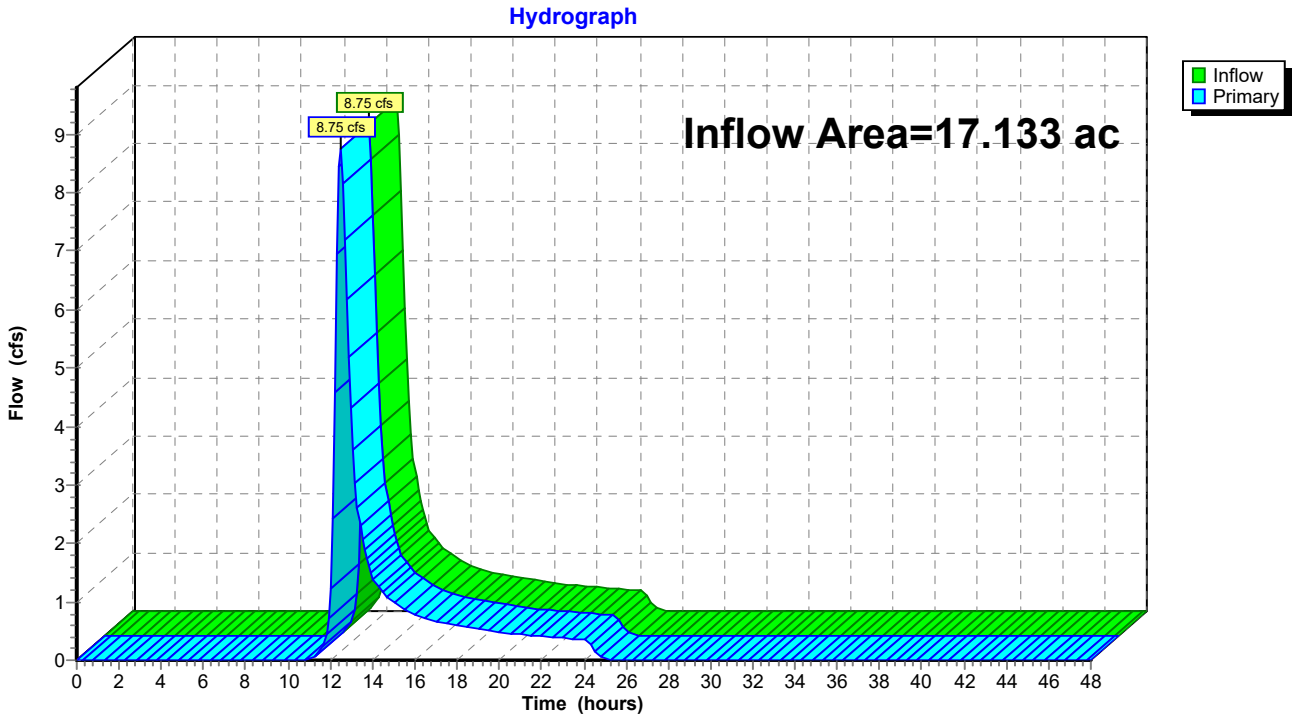


Summary for Link POI PRE: POI - PRE

Inflow Area = 17.133 ac, 4.55% Impervious, Inflow Depth = 0.87" for 2-yr event
Inflow = 8.75 cfs @ 12.48 hrs, Volume= 1.236 af
Primary = 8.75 cfs @ 12.48 hrs, Volume= 1.236 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 Subcatchment RD PRE: PRE-DEVELOPMENT

Runoff = 9.60 cfs @ 12.50 hrs, Volume= 1.352 af, Depth= 1.29"

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
	2.799	77	Woods, Good, HSG D
	2.424	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.128	70	Woods, Good, HSG C
	5.470	71	Meadow, non-grazed, HSG C
	12.601	75	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
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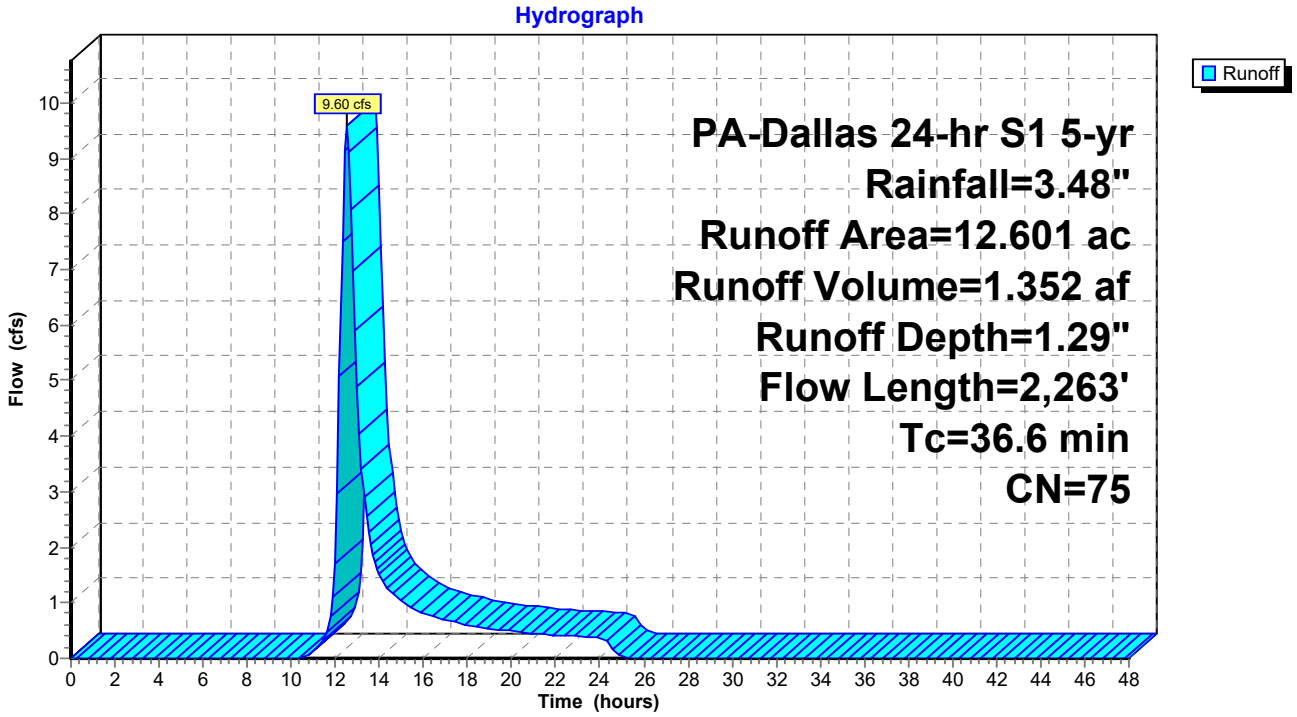
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

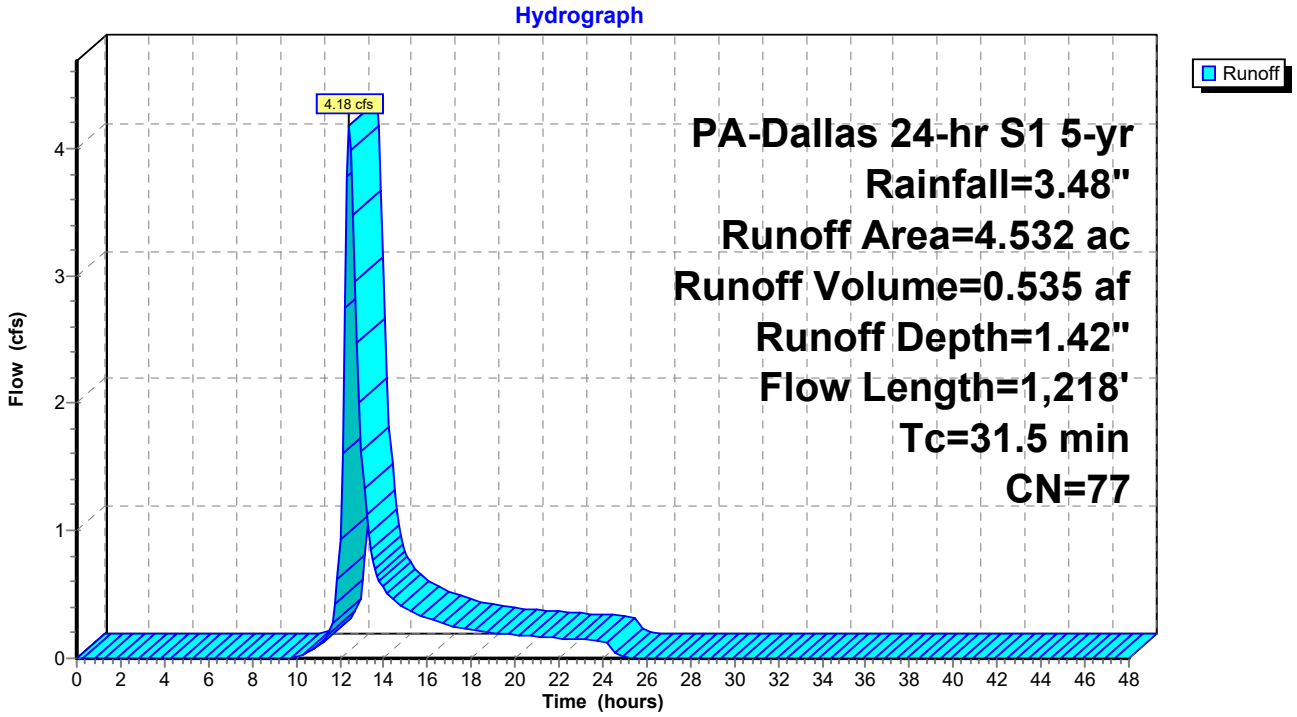
Runoff = 4.18 cfs @ 12.42 hrs, Volume= 0.535 af, Depth= 1.42"

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

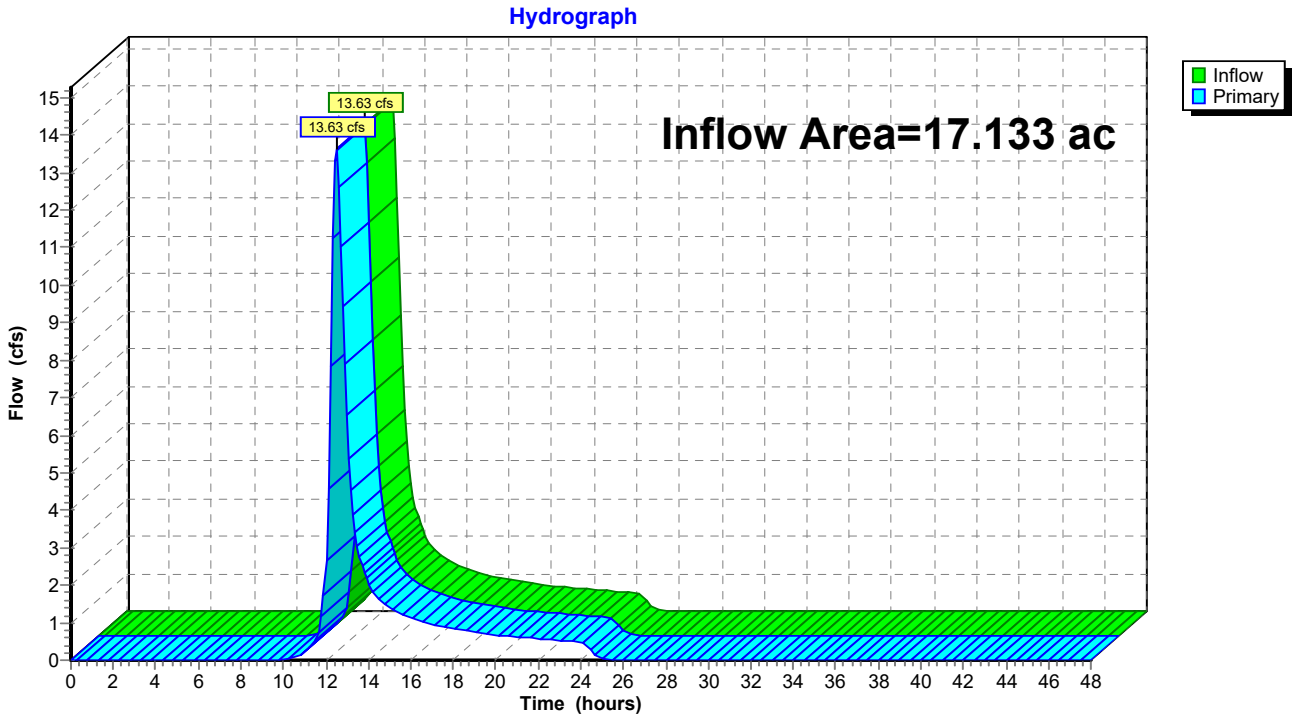


Summary for Link POI PRE: POI - PRE

Inflow Area = 17.133 ac, 4.55% Impervious, Inflow Depth = 1.32" for 5-yr event
Inflow = 13.63 cfs @ 12.47 hrs, Volume= 1.887 af
Primary = 13.63 cfs @ 12.47 hrs, Volume= 1.887 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 Subcatchment RD PRE: PRE-DEVELOPMENT

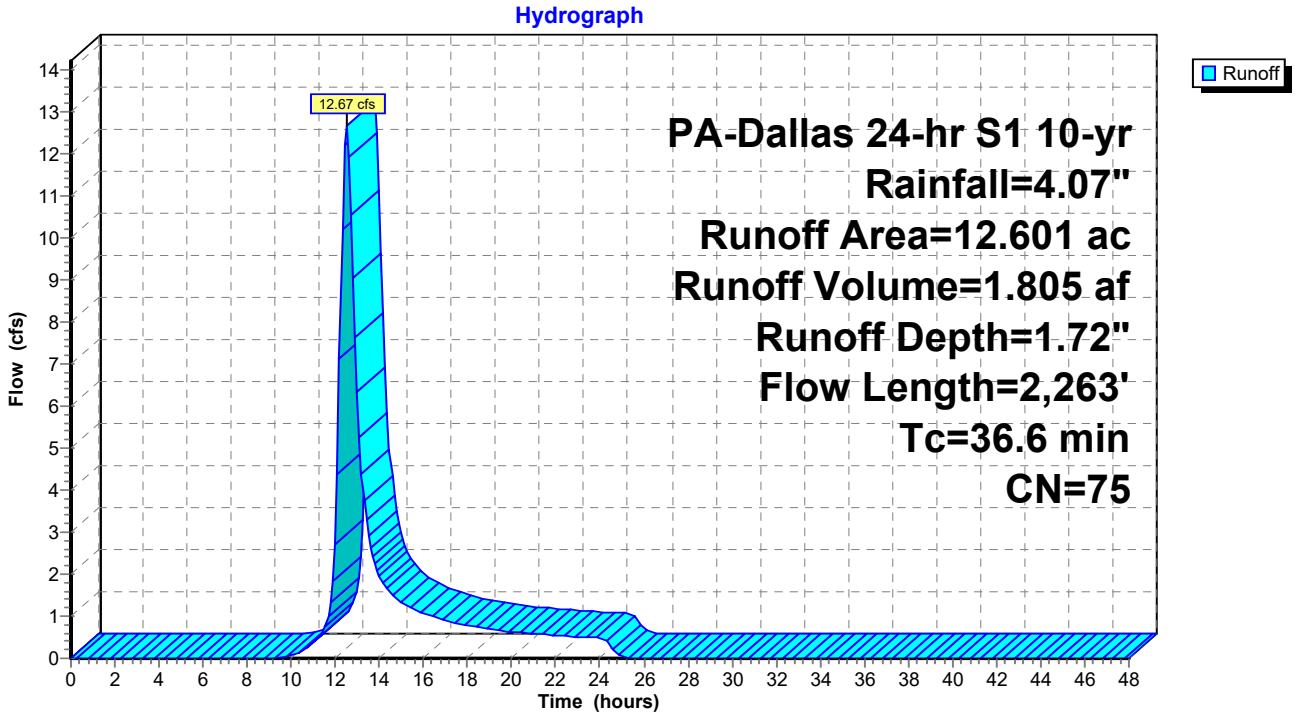
Runoff = 12.67 cfs @ 12.49 hrs, Volume= 1.805 af, Depth= 1.72"

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
	2.799	77	Woods, Good, HSG D
	2.424	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.128	70	Woods, Good, HSG C
	5.470	71	Meadow, non-grazed, HSG C
	12.601	75	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

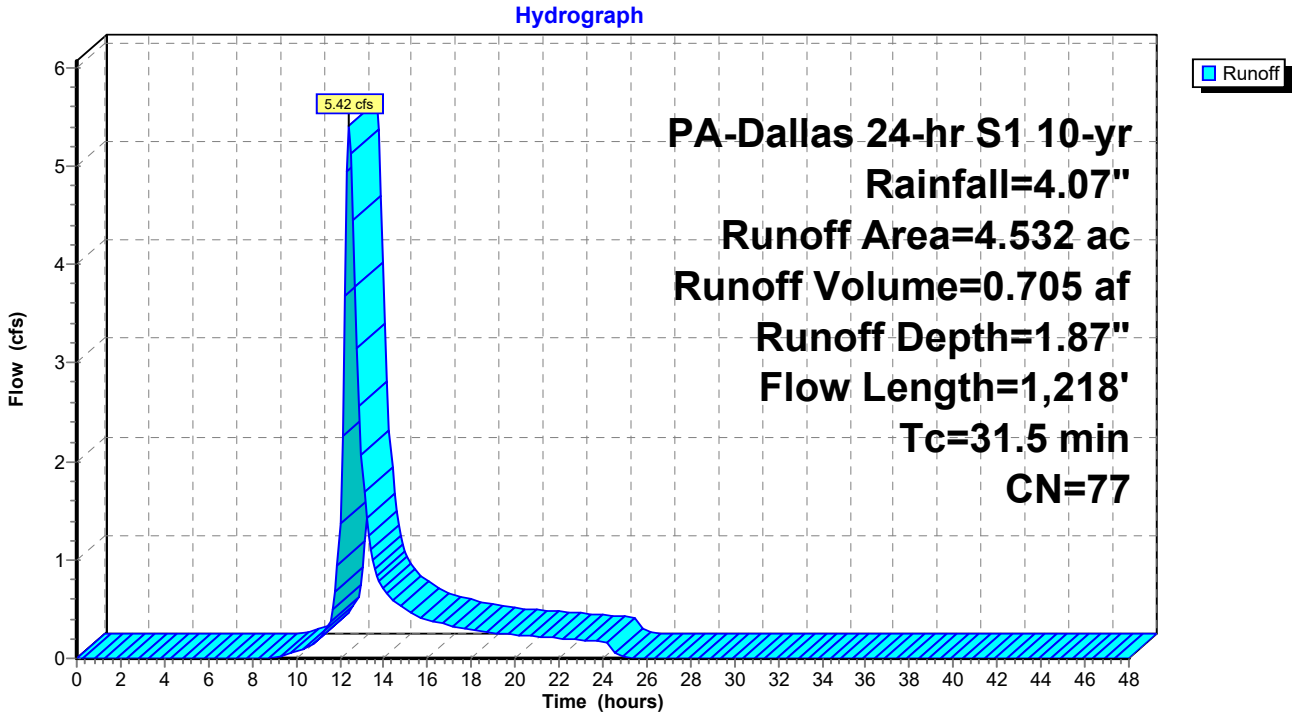
Runoff = 5.42 cfs @ 12.41 hrs, Volume= 0.705 af, Depth= 1.87"

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

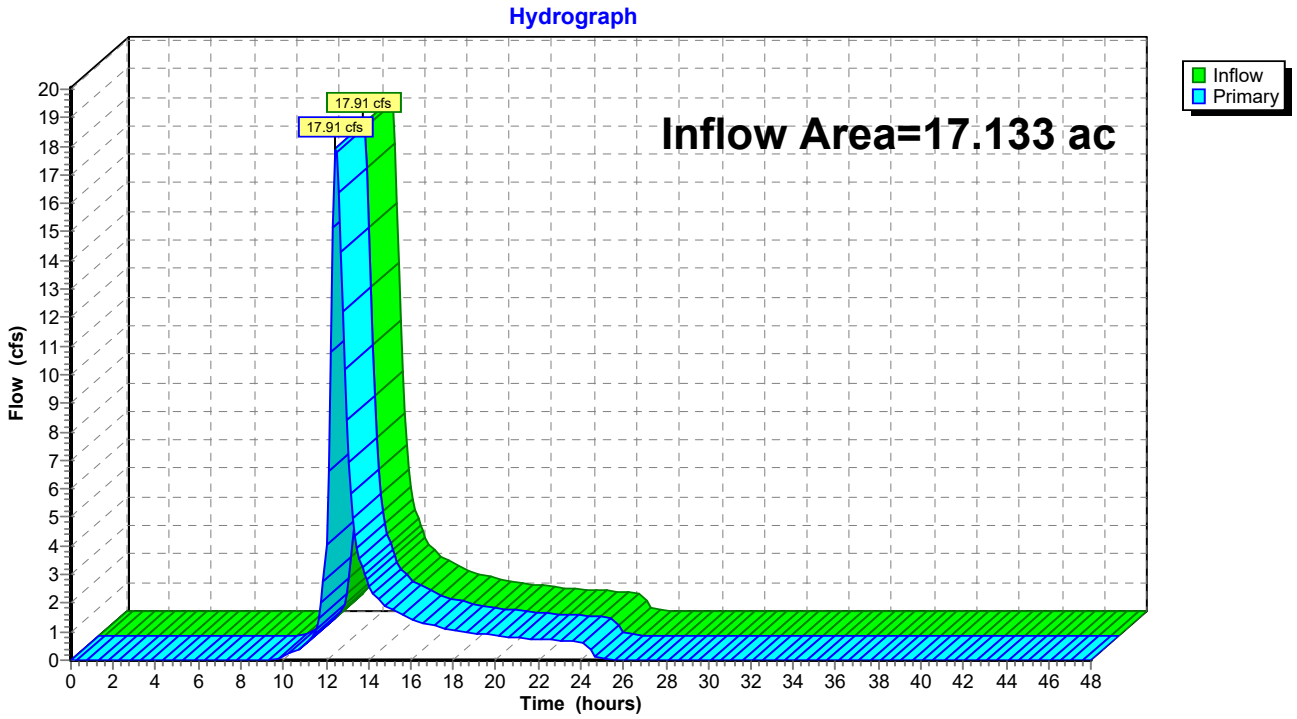


Summary for Link POI PRE: POI - PRE

Inflow Area = 17.133 ac, 4.55% Impervious, Inflow Depth = 1.76" for 10-yr event
Inflow = 17.91 cfs @ 12.46 hrs, Volume= 2.510 af
Primary = 17.91 cfs @ 12.46 hrs, Volume= 2.510 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 Subcatchment RD PRE: PRE-DEVELOPMENT

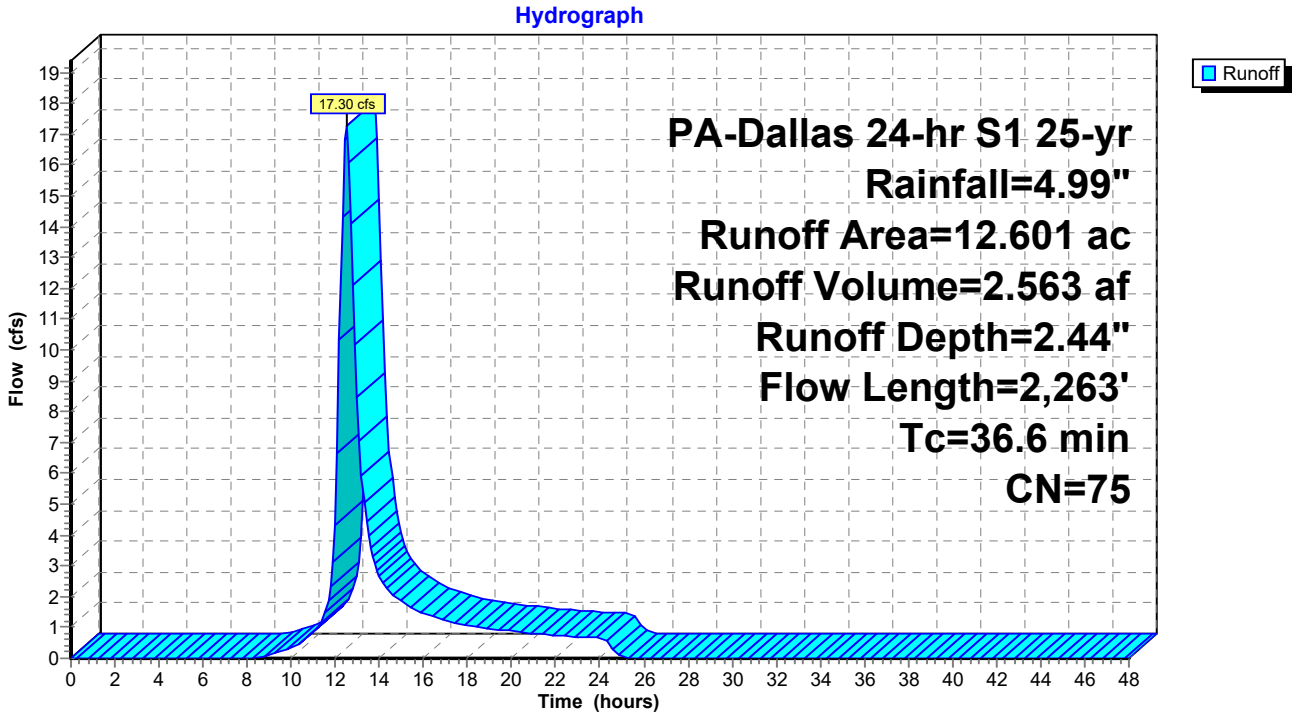
Runoff = 17.30 cfs @ 12.48 hrs, Volume= 2.563 af, Depth= 2.44"

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
	2.799	77	Woods, Good, HSG D
	2.424	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.128	70	Woods, Good, HSG C
	5.470	71	Meadow, non-grazed, HSG C
	12.601	75	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

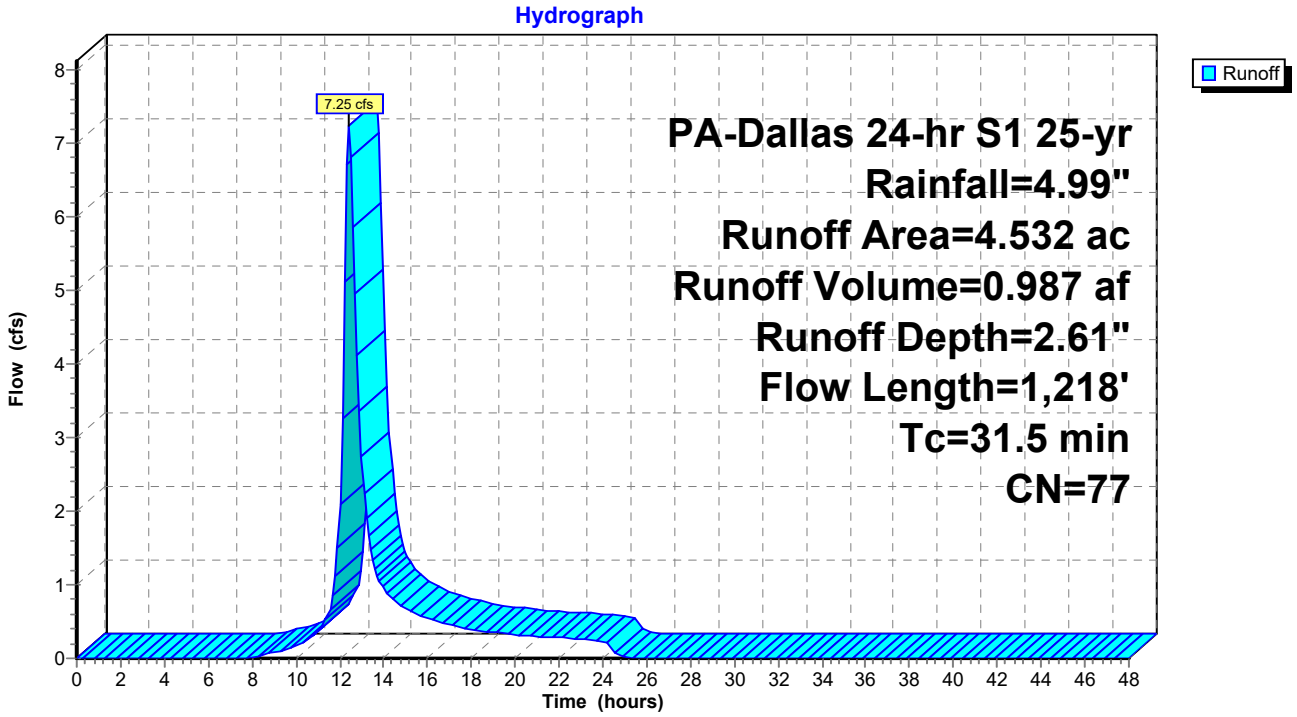
Runoff = 7.25 cfs @ 12.40 hrs, Volume= 0.987 af, Depth= 2.61"

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

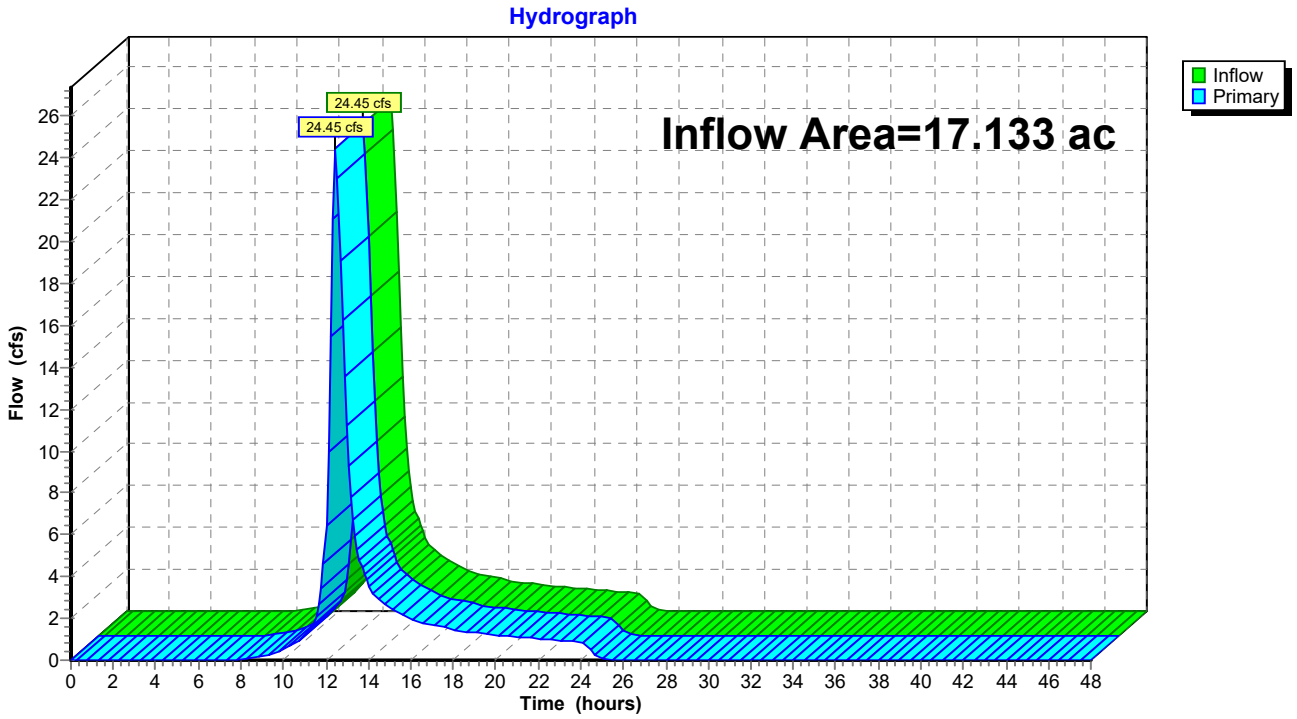


Summary for Link POI PRE: POI - PRE

Inflow Area = 17.133 ac, 4.55% Impervious, Inflow Depth = 2.49" for 25-yr event
Inflow = 24.45 cfs @ 12.45 hrs, Volume= 3.551 af
Primary = 24.45 cfs @ 12.45 hrs, Volume= 3.551 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 Subcatchment RD PRE: PRE-DEVELOPMENT

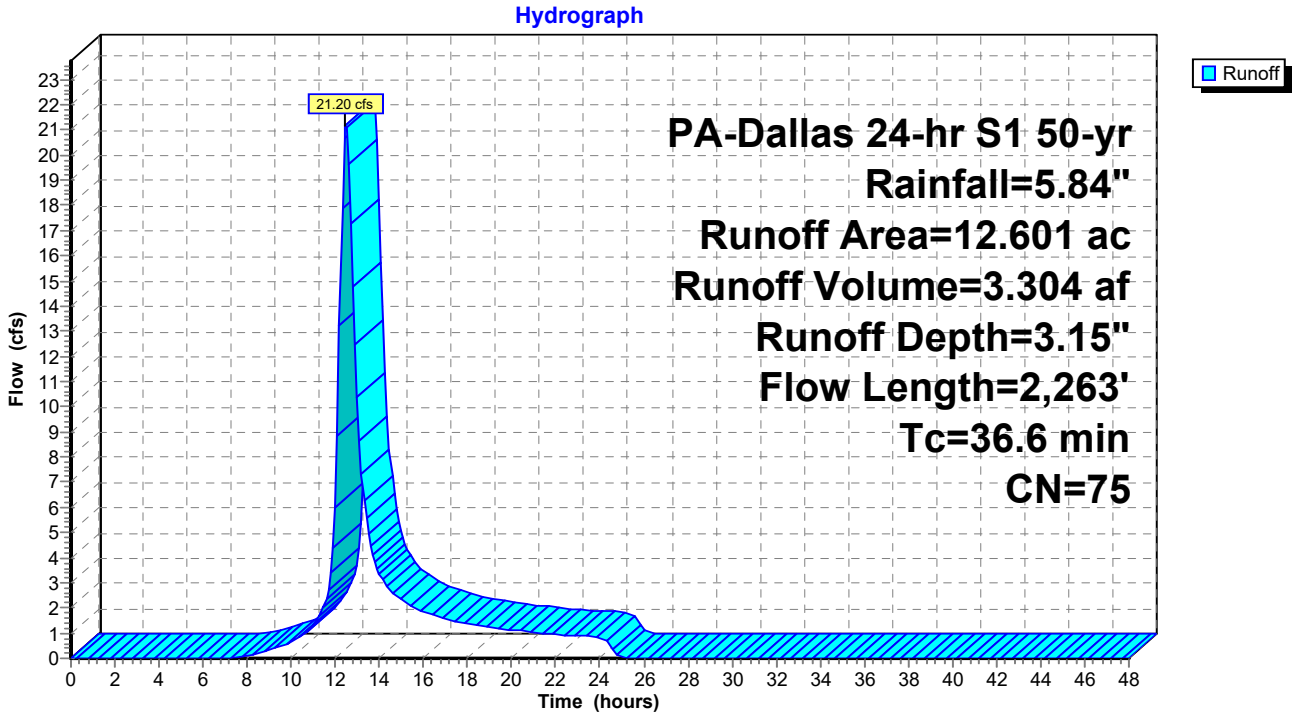
Runoff = 21.20 cfs @ 12.47 hrs, Volume= 3.304 af, Depth= 3.15"

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
	2.799	77	Woods, Good, HSG D
	2.424	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.128	70	Woods, Good, HSG C
	5.470	71	Meadow, non-grazed, HSG C
	12.601	75	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

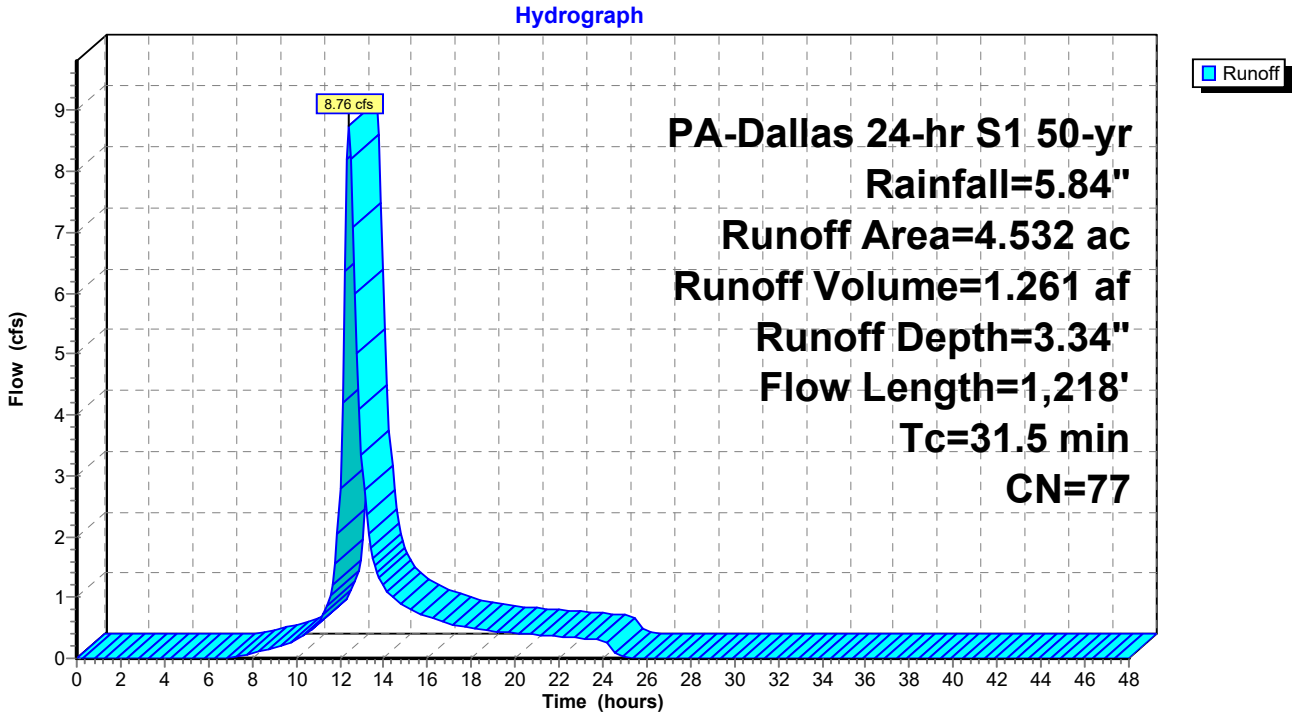
Runoff = 8.76 cfs @ 12.40 hrs, Volume= 1.261 af, Depth= 3.34"

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

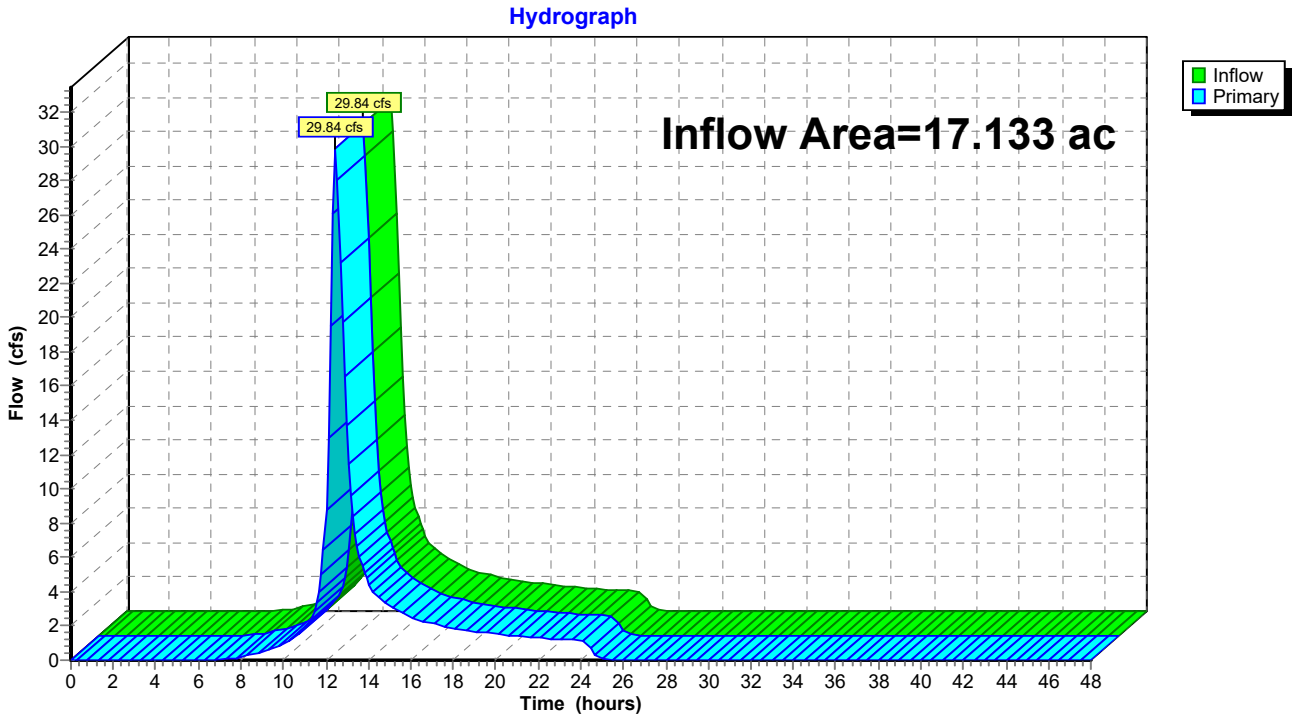


Summary for Link POI PRE: POI - PRE

Inflow Area = 17.133 ac, 4.55% Impervious, Inflow Depth = 3.20" for 50-yr event
Inflow = 29.84 cfs @ 12.45 hrs, Volume= 4.565 af
Primary = 29.84 cfs @ 12.45 hrs, Volume= 4.565 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 Subcatchment RD PRE: PRE-DEVELOPMENT

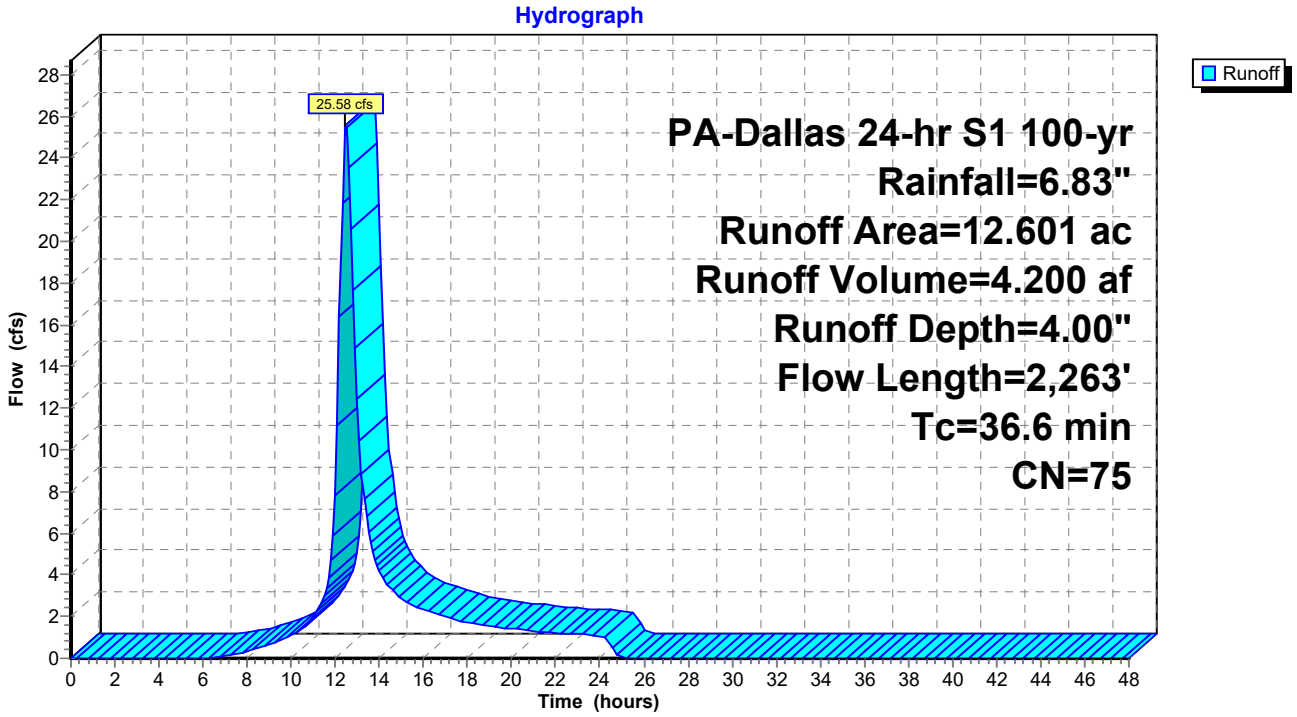
Runoff = 25.58 cfs @ 12.46 hrs, Volume= 4.200 af, Depth= 4.00"

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
	2.799	77	Woods, Good, HSG D
	2.424	78	Meadow, non-grazed, HSG D
*	0.000	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.128	70	Woods, Good, HSG C
	5.470	71	Meadow, non-grazed, HSG C
	12.601	75	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD PRE: PRE-DEVELOPMENT



Summary for Subcatchment RG PRE: PRE-DEVELOPMENT

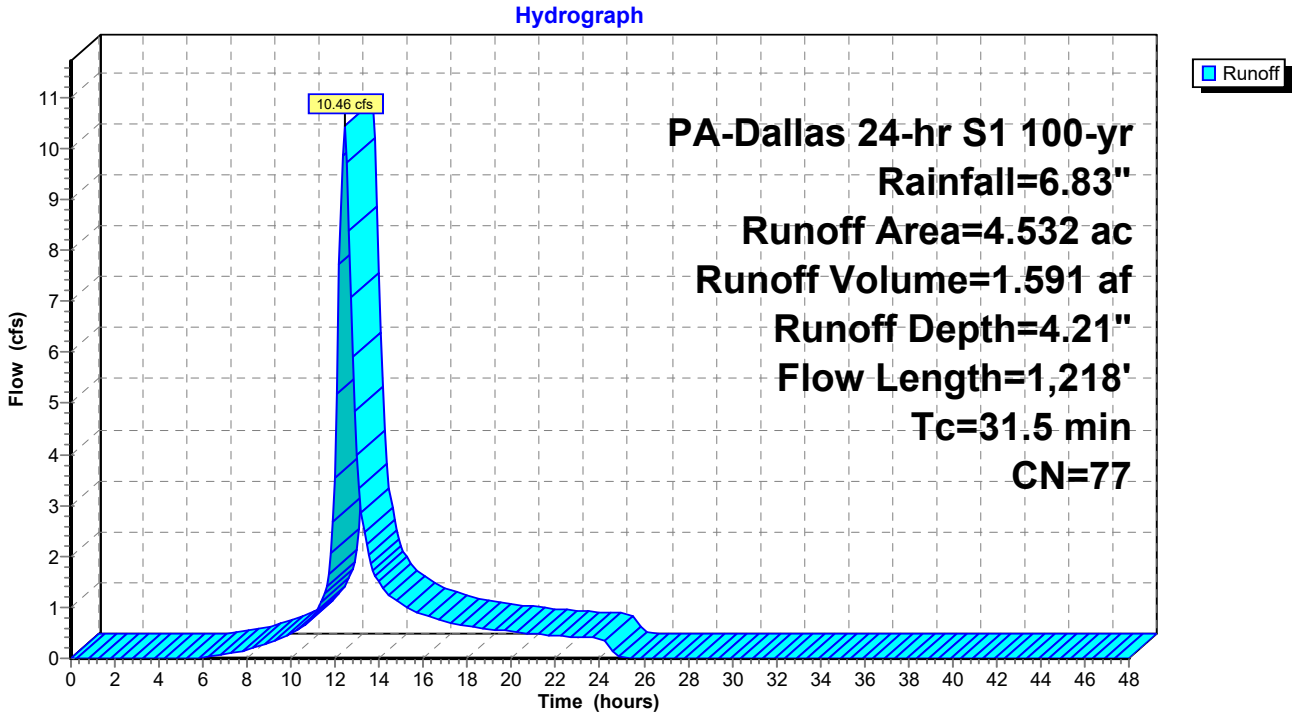
Runoff = 10.46 cfs @ 12.40 hrs, Volume= 1.591 af, Depth= 4.21"

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

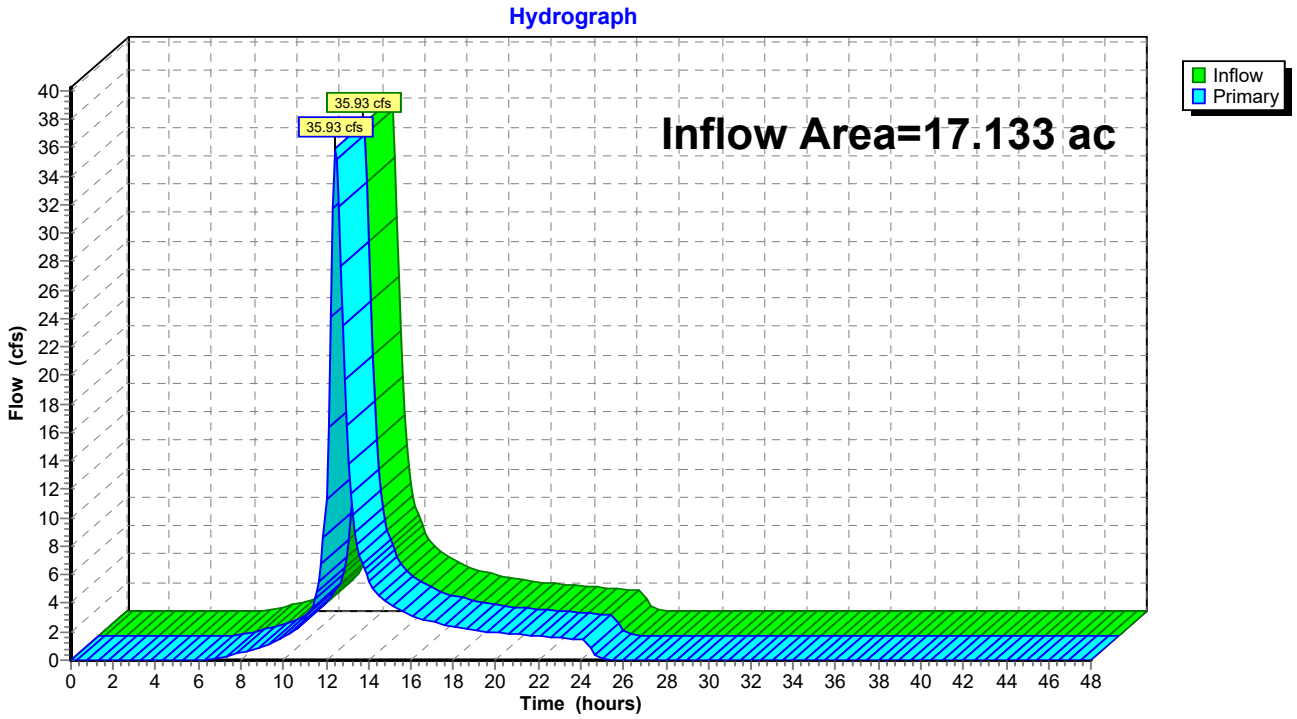


Summary for Link POI PRE: POI - PRE

Inflow Area = 17.133 ac, 4.55% Impervious, Inflow Depth = 4.06" for 100-yr event
Inflow = 35.93 cfs @ 12.44 hrs, Volume= 5.792 af
Primary = 35.93 cfs @ 12.44 hrs, Volume= 5.792 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

WATER QUALITY WORKSHEET 3
GRAVEL PAD DISCONNECTED
FROM STORM SEWERS
AREA = 0.56 AC.

POST DEVELOPMENT
RAIN GARDEN
D.A.: 0.82 AC.

WATER QUALITY WORKSHEET 3
GRAVEL PAD DISCONNECTED
FROM STORM SEWERS
AREA = 0.55 AC.

POST DEVELOPMENT
BYPASS
D.A.: 3.71 AC.

POI A
POST DEVELOPMENT
D.A.: 4.53 AC.

WATER QUALITY WORKSHEET 3
BUILDING ROOF DISCONNECTED
FROM STORM SEWERS
AREA = 0.01 AC.

POST DEVELOPMENT
SWALE 2
D.A.: 0.35 AC.

SWALE 1
POST DEVELOPMENT
D.A.: 12.60 AC.

WETLAND
W-T03-17002

WETLAND
W-T03-17001

WATERBODY
WW-T33-17001
INTERMITTENT
STREAM
(UNNAMED
TRIBUTARY TO
HUNSVILLE
CREEK)

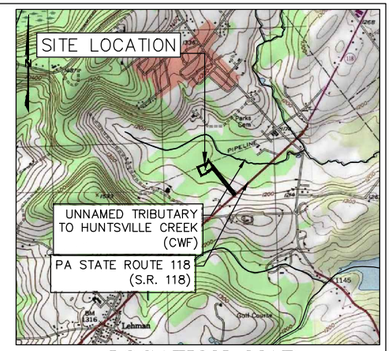
WATERBODY
WW-T33-17001
UNT TO
HUNTSVILLE
CREEK

TRACT NO.
PA-LU-194.000

PA STATE ROUTE 118 (S.R. 118)

WALL

BrB, WlB, MoB, CnB, CIB, WlC, LaB, MoC, OIC, OIB



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.

COMMONWEALTH OF PENNSYLVANIA
ALARIC JAMES BUSHER
E-PENNSYLVANIA

ALARIC J. BUSHER REG NO. PE 60320

BLE Companies — ARCHITECTURE, ENGINEERING, ENVIRONMENTAL, LAND SURVEYING

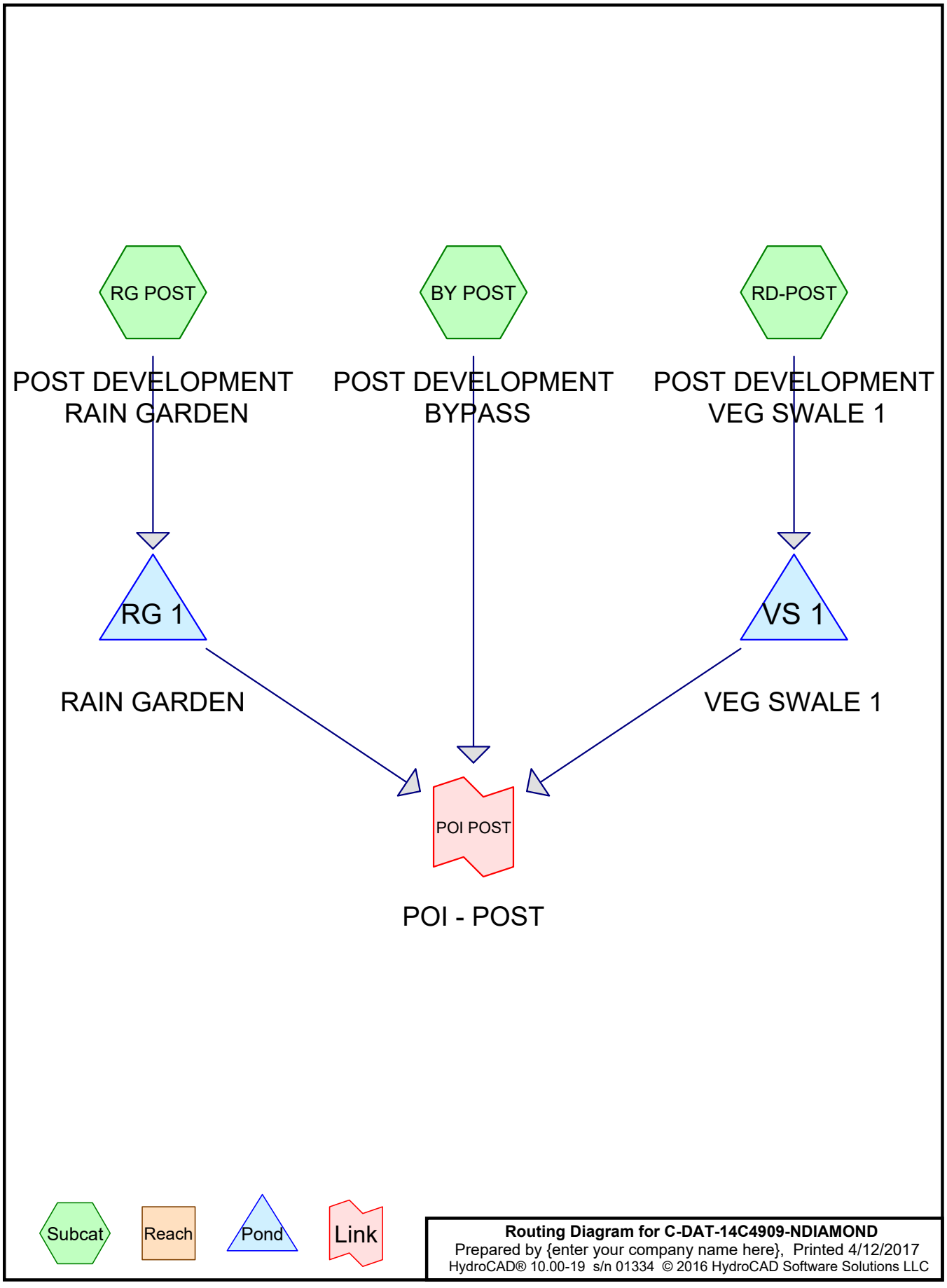
NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
0	08/28/2015	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	W01161499	DAK	AJB
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL	W01161499	DAK	AJB
3	03/28/2016	BL	ISSUED FOR PADEP RESUBMITTAL	W01161499	AJB	AJB
4	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	W01161499	AJB	AJB
5	April 2017	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #2	W01161499	AJB	AJB

TRANSCONTINENTAL GAS PIPE LINE 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: 5
APPROVED BY:	April 2017	DATE:	07/17/15	DRAWING NUMBER: (36–7935)MF–1A–9	SHEET 1 OF 1
W.O.	1161499				

Drawing Location & Name: G:\JOBS\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 4/12/2017

Summary for Subcatchment BY POST: POST DEVELOPMENT BYPASS

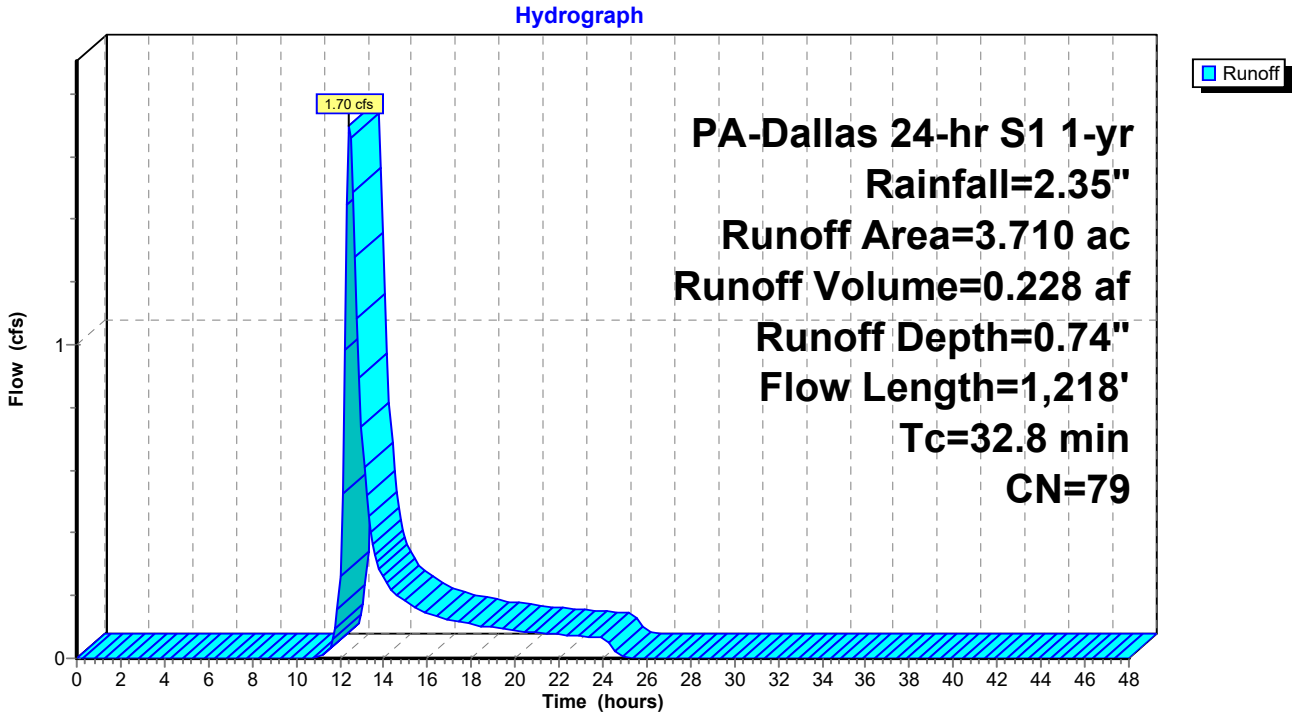
Runoff = 1.70 cfs @ 12.44 hrs, Volume= 0.228 af, Depth= 0.74"

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
	1.709	77	Woods, Good, HSG D
	1.716	78	Meadow, non-grazed, HSG D
*	0.285	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	3.710	79	Weighted Average
	3.710		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
10.9	476	0.0211	0.73		**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
32.8	1,218	Total			

Subcatchment BY POST: POST DEVELOPMENT BYPASS



Summary for Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1

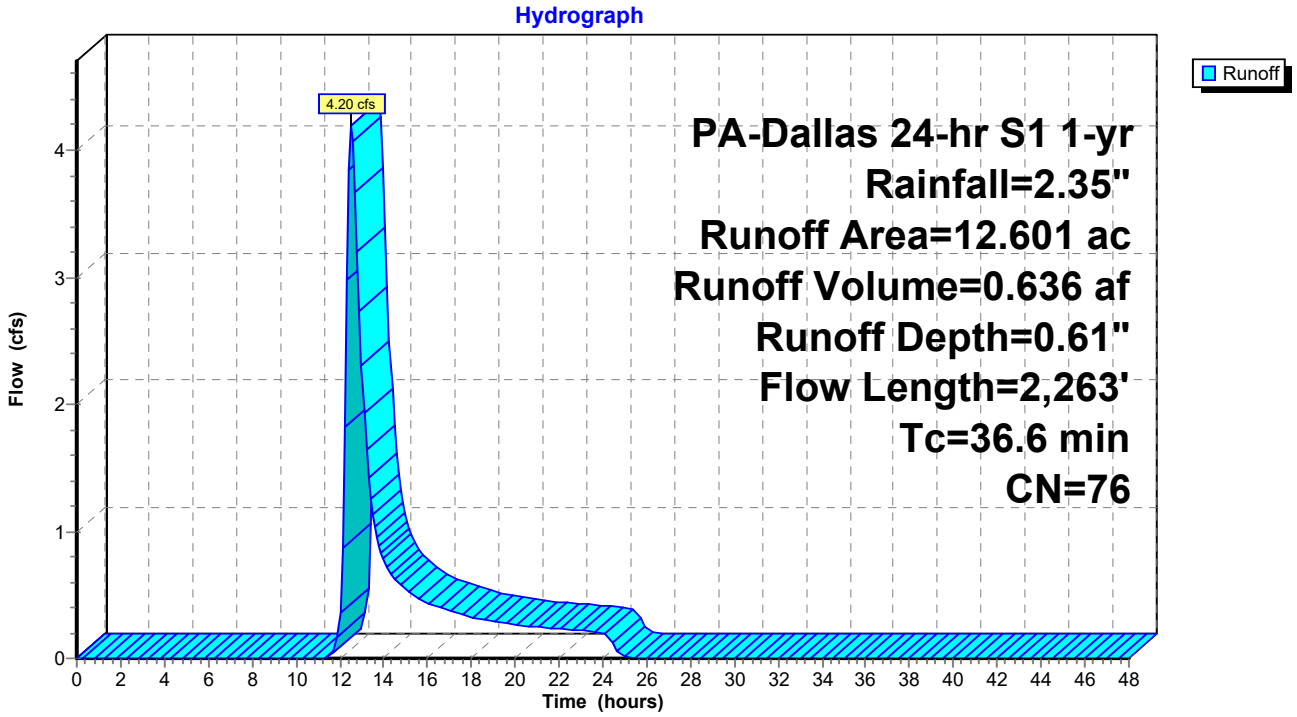
Runoff = 4.20 cfs @ 12.52 hrs, Volume= 0.636 af, Depth= 0.61"

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 1-yr Rainfall=2.35"

	Area (ac)	CN	Description
	2.454	77	Woods, Good, HSG D
	2.534	78	Meadow, non-grazed, HSG D
*	0.236	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.088	70	Woods, Good, HSG C
	5.458	71	Meadow, non-grazed, HSG C
*	0.051	89	Gravel areas, HSG C
	12.601	76	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

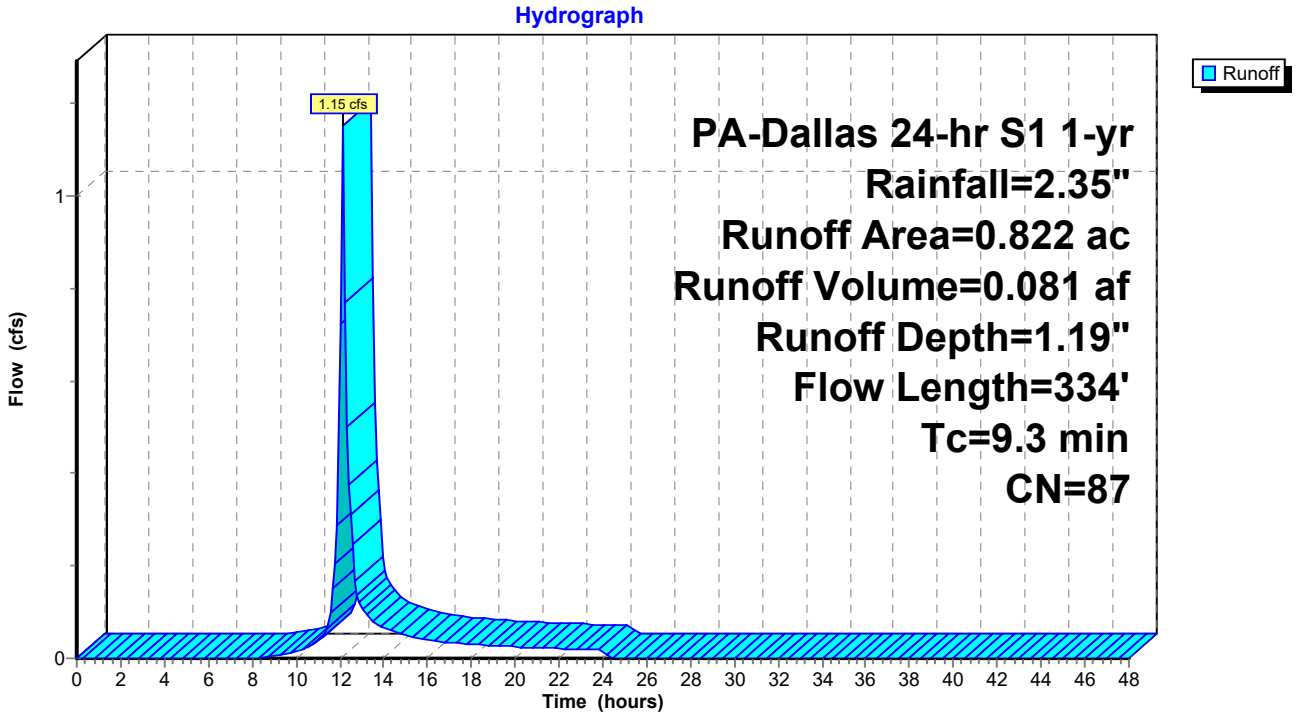
Runoff = 1.15 cfs @ 12.10 hrs, Volume= 0.081 af, Depth= 1.19"

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 (ac)	CN	Description
	0.000	77	Woods, Good, HSG D
	0.272	78	Meadow, non-grazed, HSG D
*	0.541	91	Gravel areas, HSG D
*	0.009	98	Impervious areas, HSG D
	0.822	87	Weighted Average
	0.813		98.91% Pervious Area
	0.009		1.09% 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 = 0.822 ac, 1.09% Impervious, Inflow Depth = 1.19" for 1-yr event
Inflow = 1.15 cfs @ 12.10 hrs, Volume= 0.081 af
Outflow = 0.56 cfs @ 12.29 hrs, Volume= 0.081 af, Atten= 51%, Lag= 11.5 min
Primary = 0.56 cfs @ 12.29 hrs, Volume= 0.081 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.38' @ 12.29 hrs Surf.Area= 2,625 sf Storage= 929 cf

Plug-Flow detention time= 70.9 min calculated for 0.081 af (100% of inflow)
Center-of-Mass det. time= 70.3 min (914.2 - 843.9)

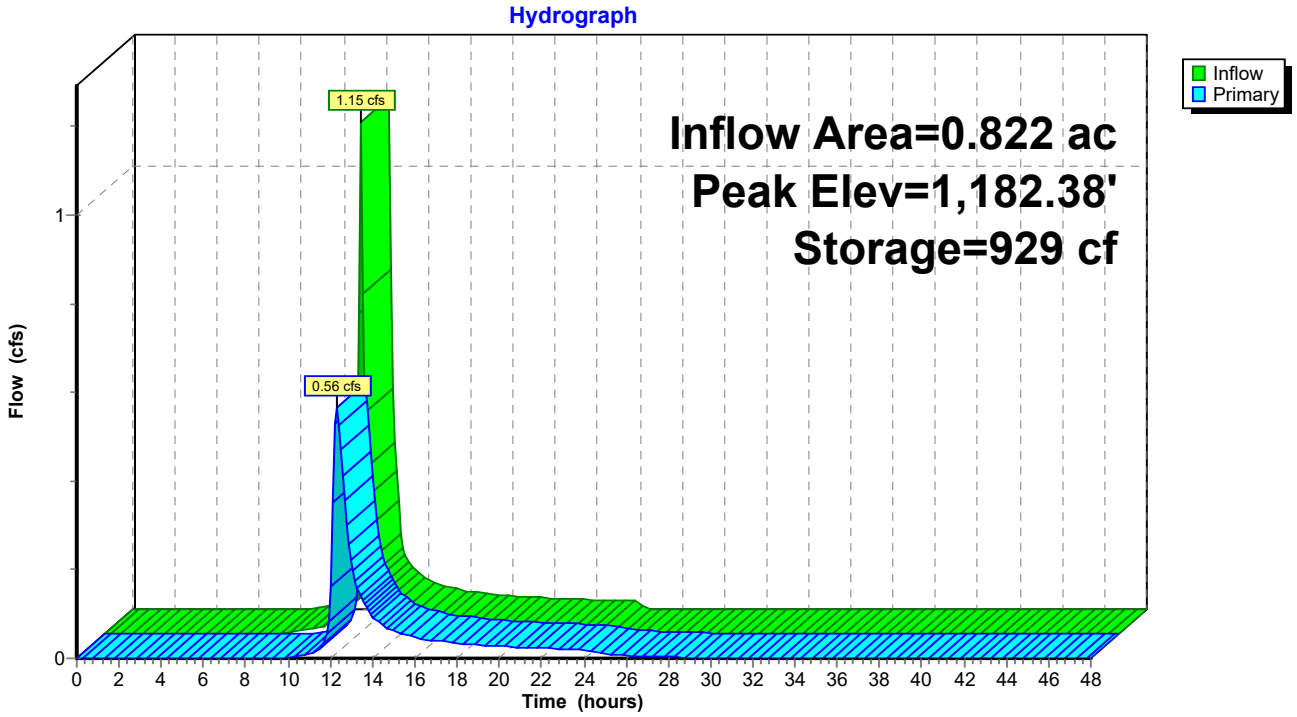
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

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=0.56 cfs @ 12.29 hrs HW=1,182.38' (Free Discharge)
1=Culvert (Inlet Controls 0.56 cfs @ 2.09 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 12.601 ac, 6.19% Impervious, Inflow Depth = 0.61" for 1-yr event
Inflow = 4.20 cfs @ 12.52 hrs, Volume= 0.636 af
Outflow = 3.17 cfs @ 12.82 hrs, Volume= 0.575 af, Atten= 25%, Lag= 17.7 min
Primary = 3.17 cfs @ 12.82 hrs, Volume= 0.575 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs / 2
Peak Elev= 1,175.26' @ 12.82 hrs Surf.Area= 0 sf Storage= 5,602 cf

Plug-Flow detention time= 92.8 min calculated for 0.574 af (90% of inflow)
Center-of-Mass det. time= 45.3 min (961.1 - 915.9)

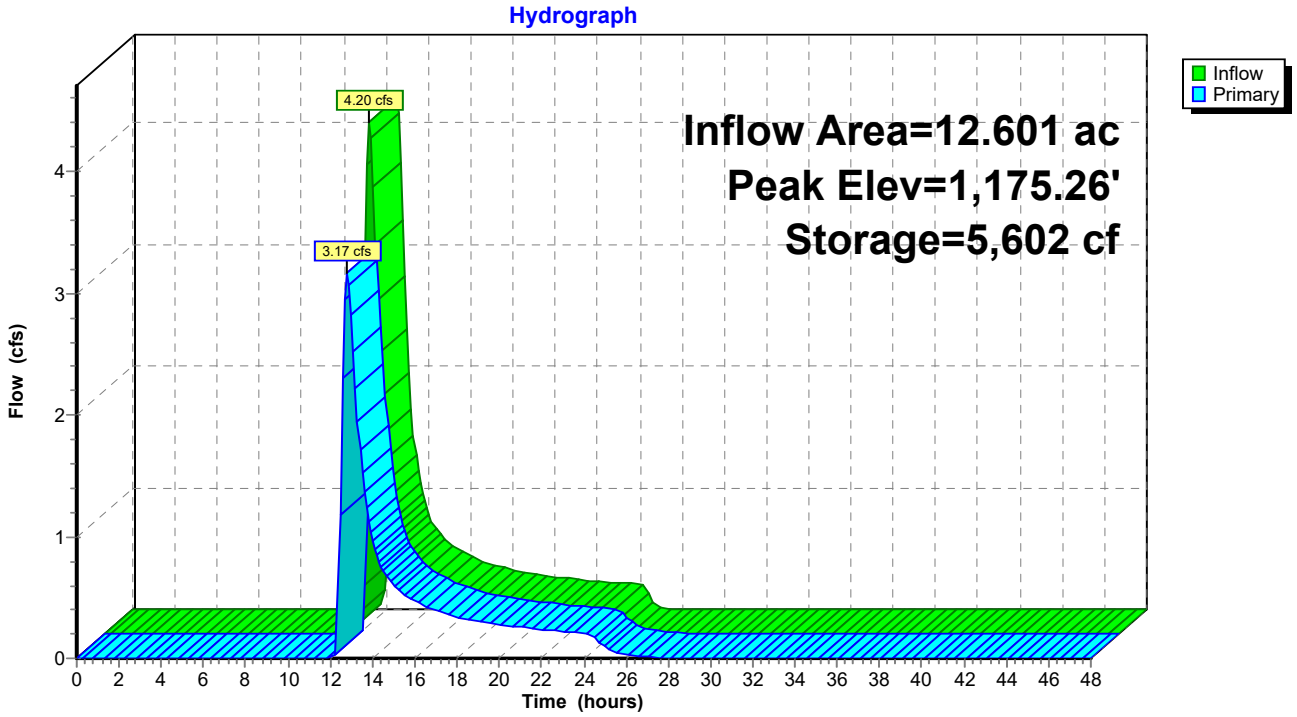
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	14,139 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,649	2,649
1,176.00	11,490	14,139

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=3.14 cfs @ 12.82 hrs HW=1,175.26' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 3.14 cfs @ 1.36 fps)

Pond VS 1: VEG SWALE 1

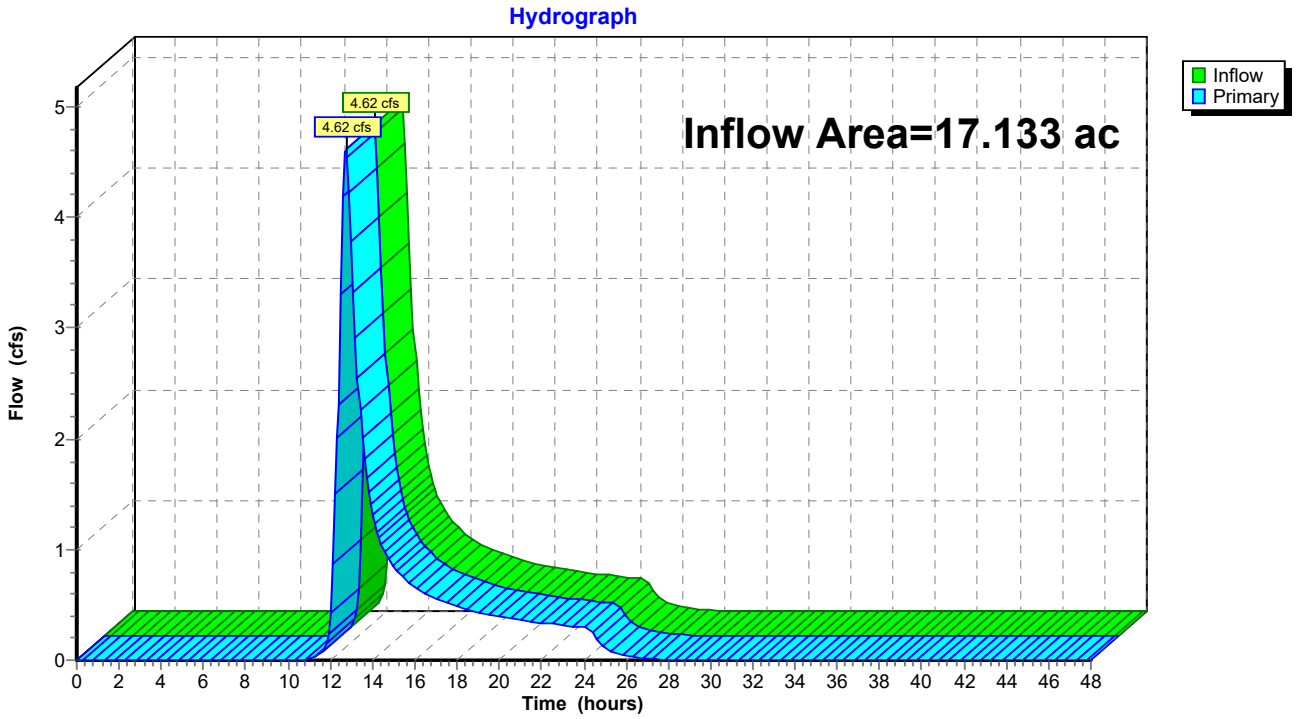


Summary for Link POI POST: POI - POST

Inflow Area = 17.133 ac, 4.61% Impervious, Inflow Depth = 0.62" for 1-yr event
Inflow = 4.62 cfs @ 12.74 hrs, Volume= 0.884 af
Primary = 4.62 cfs @ 12.74 hrs, Volume= 0.884 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 Subcatchment BY POST: POST DEVELOPMENT BYPASS

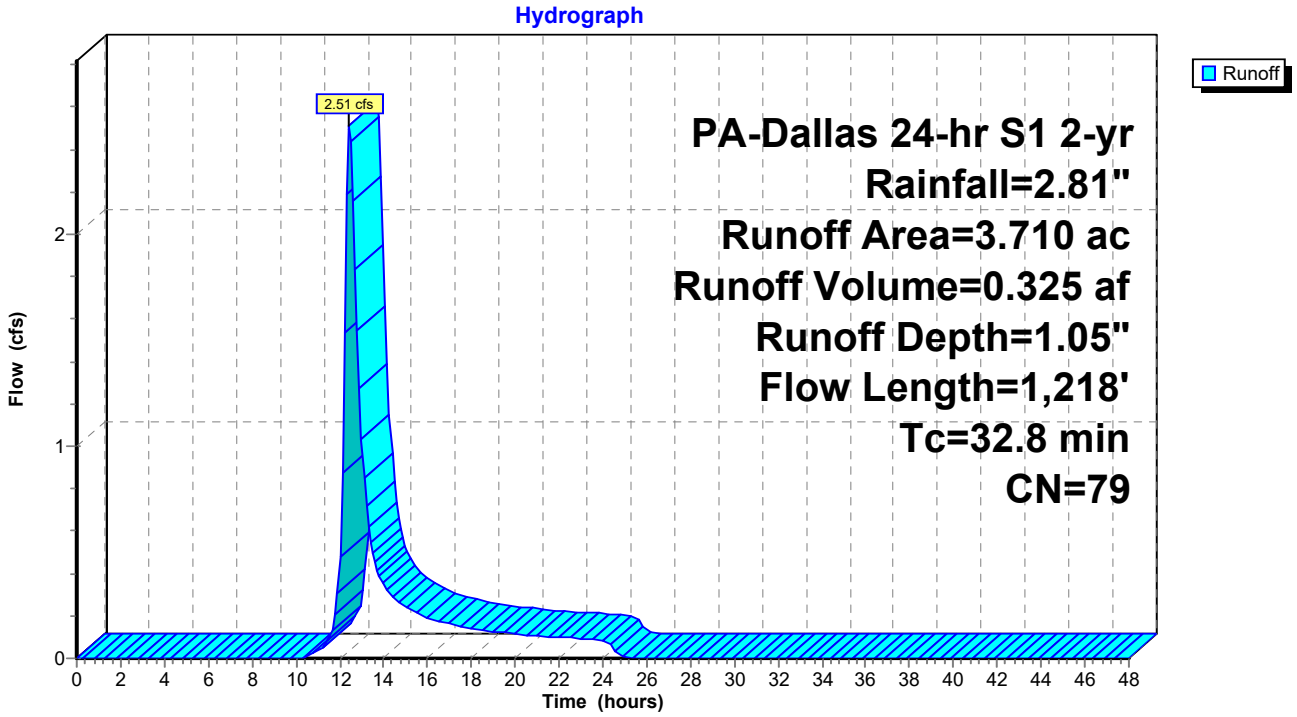
Runoff = 2.51 cfs @ 12.43 hrs, Volume= 0.325 af, Depth= 1.05"

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
	1.709	77	Woods, Good, HSG D
	1.716	78	Meadow, non-grazed, HSG D
*	0.285	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	3.710	79	Weighted Average
	3.710		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
10.9	476	0.0211	0.73		**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
32.8	1,218	Total			

Subcatchment BY POST: POST DEVELOPMENT BYPASS



Summary for Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1

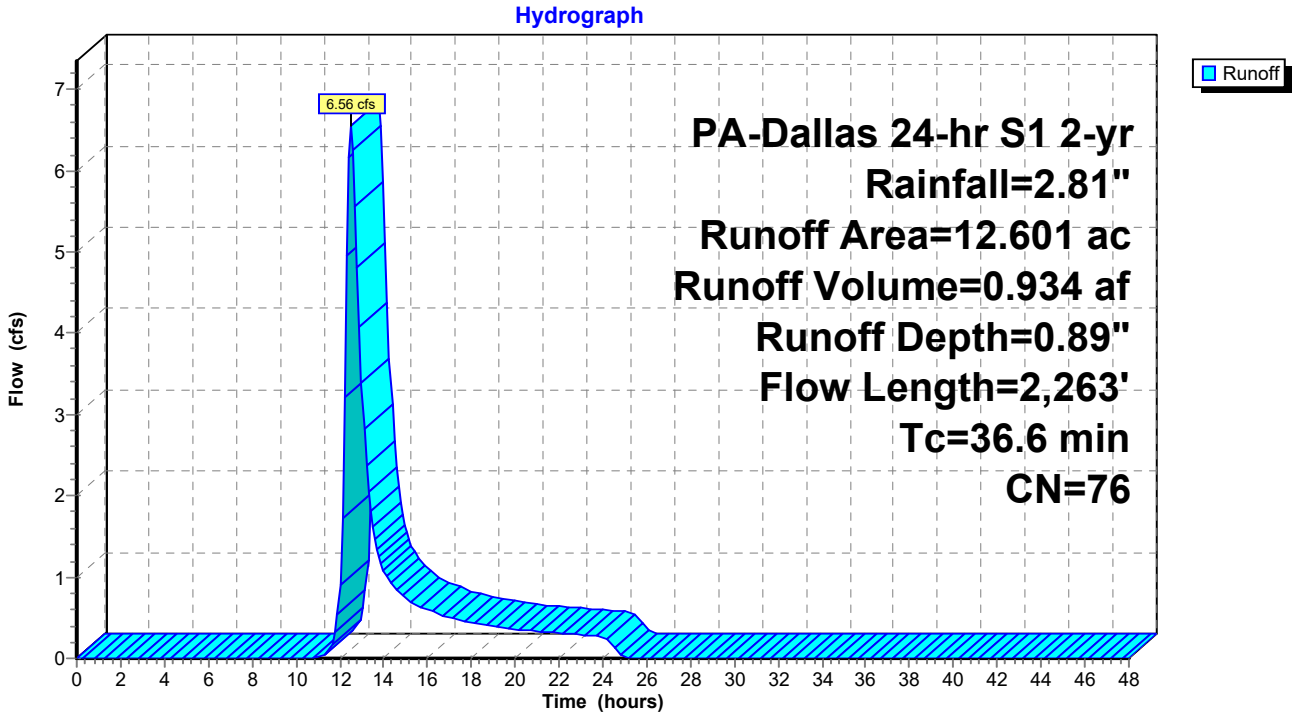
Runoff = 6.56 cfs @ 12.51 hrs, Volume= 0.934 af, Depth= 0.89"

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
	2.454	77	Woods, Good, HSG D
	2.534	78	Meadow, non-grazed, HSG D
*	0.236	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.088	70	Woods, Good, HSG C
	5.458	71	Meadow, non-grazed, HSG C
*	0.051	89	Gravel areas, HSG C
	12.601	76	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

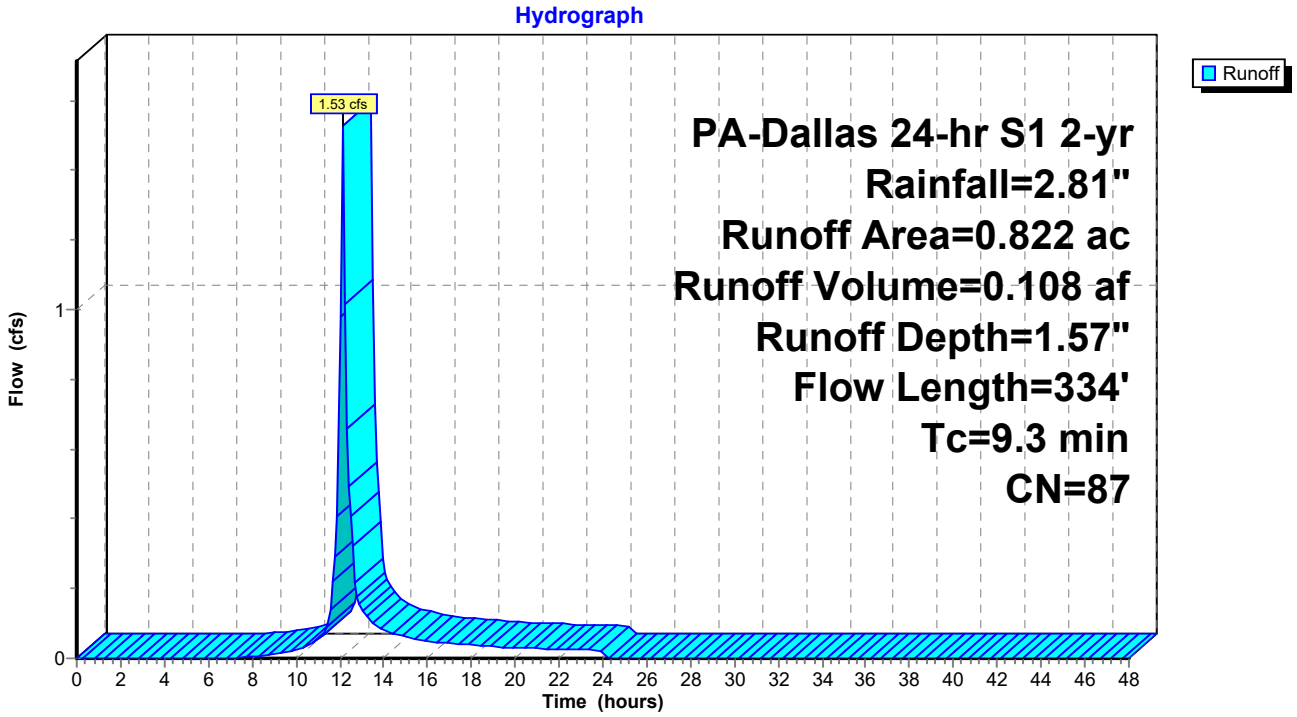
Runoff = 1.53 cfs @ 12.10 hrs, Volume= 0.108 af, Depth= 1.57"

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 (ac)	CN	Description
	0.000	77	Woods, Good, HSG D
	0.272	78	Meadow, non-grazed, HSG D
*	0.541	91	Gravel areas, HSG D
*	0.009	98	Impervious areas, HSG D
	0.822	87	Weighted Average
	0.813		98.91% Pervious Area
	0.009		1.09% 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 = 0.822 ac, 1.09% Impervious, Inflow Depth = 1.57" for 2-yr event
Inflow = 1.53 cfs @ 12.10 hrs, Volume= 0.108 af
Outflow = 0.82 cfs @ 12.26 hrs, Volume= 0.108 af, Atten= 47%, Lag= 9.8 min
Primary = 0.82 cfs @ 12.26 hrs, Volume= 0.108 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.46' @ 12.26 hrs Surf.Area= 2,694 sf Storage= 1,154 cf

Plug-Flow detention time= 62.0 min calculated for 0.108 af (100% of inflow)
Center-of-Mass det. time= 61.5 min (896.0 - 834.5)

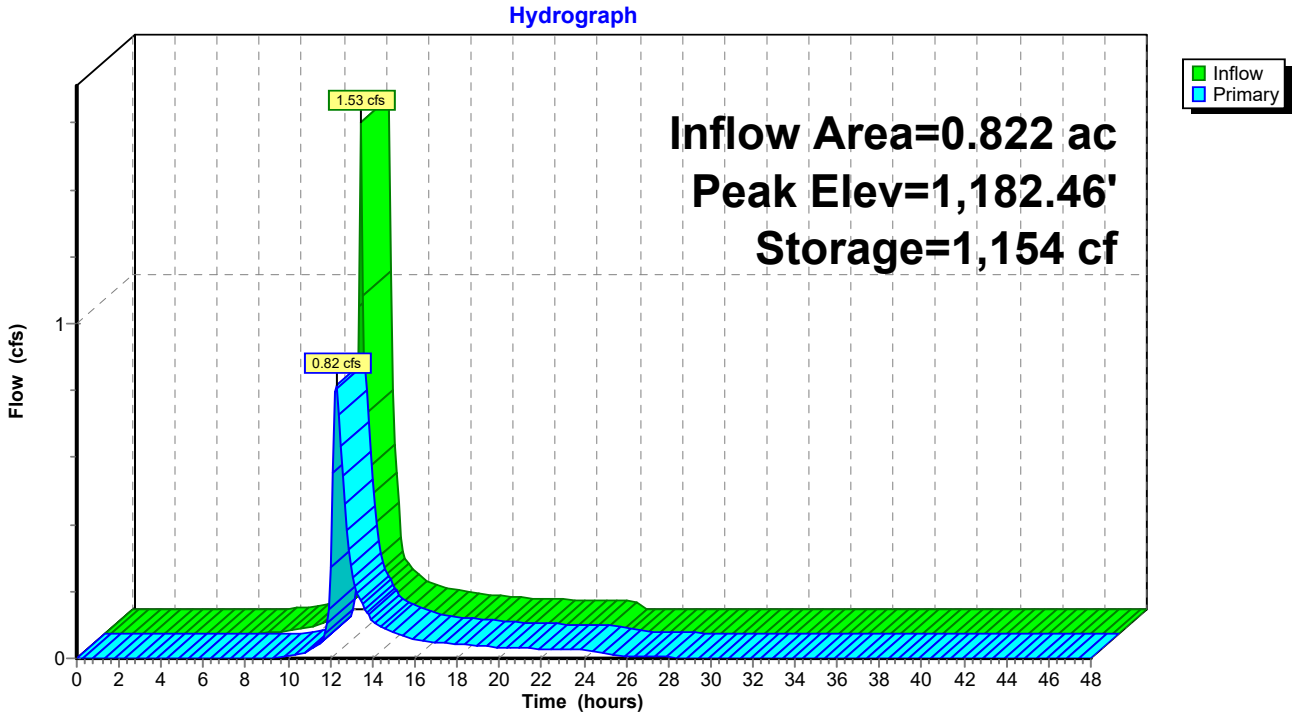
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

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=0.81 cfs @ 12.26 hrs HW=1,182.46' (Free Discharge)
1=Culvert (Inlet Controls 0.81 cfs @ 2.30 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 12.601 ac, 6.19% Impervious, Inflow Depth = 0.89" for 2-yr event
Inflow = 6.56 cfs @ 12.51 hrs, Volume= 0.934 af
Outflow = 5.56 cfs @ 12.71 hrs, Volume= 0.873 af, Atten= 15%, Lag= 12.3 min
Primary = 5.56 cfs @ 12.71 hrs, Volume= 0.873 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs / 2
Peak Elev= 1,175.37' @ 12.71 hrs Surf.Area= 0 sf Storage= 6,931 cf

Plug-Flow detention time= 70.0 min calculated for 0.873 af (94% of inflow)
Center-of-Mass det. time= 34.5 min (936.2 - 901.7)

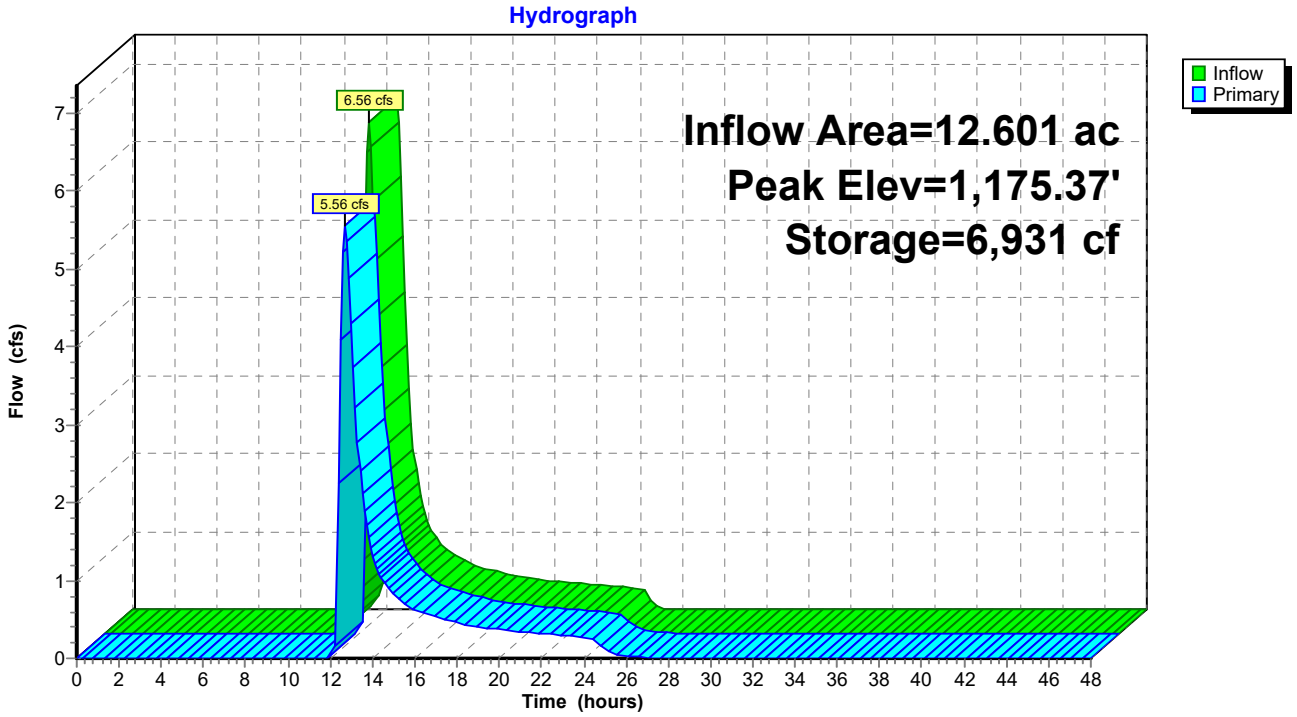
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	14,139 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,649	2,649
1,176.00	11,490	14,139

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=5.53 cfs @ 12.71 hrs HW=1,175.37' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 5.53 cfs @ 1.66 fps)

Pond VS 1: VEG SWALE 1

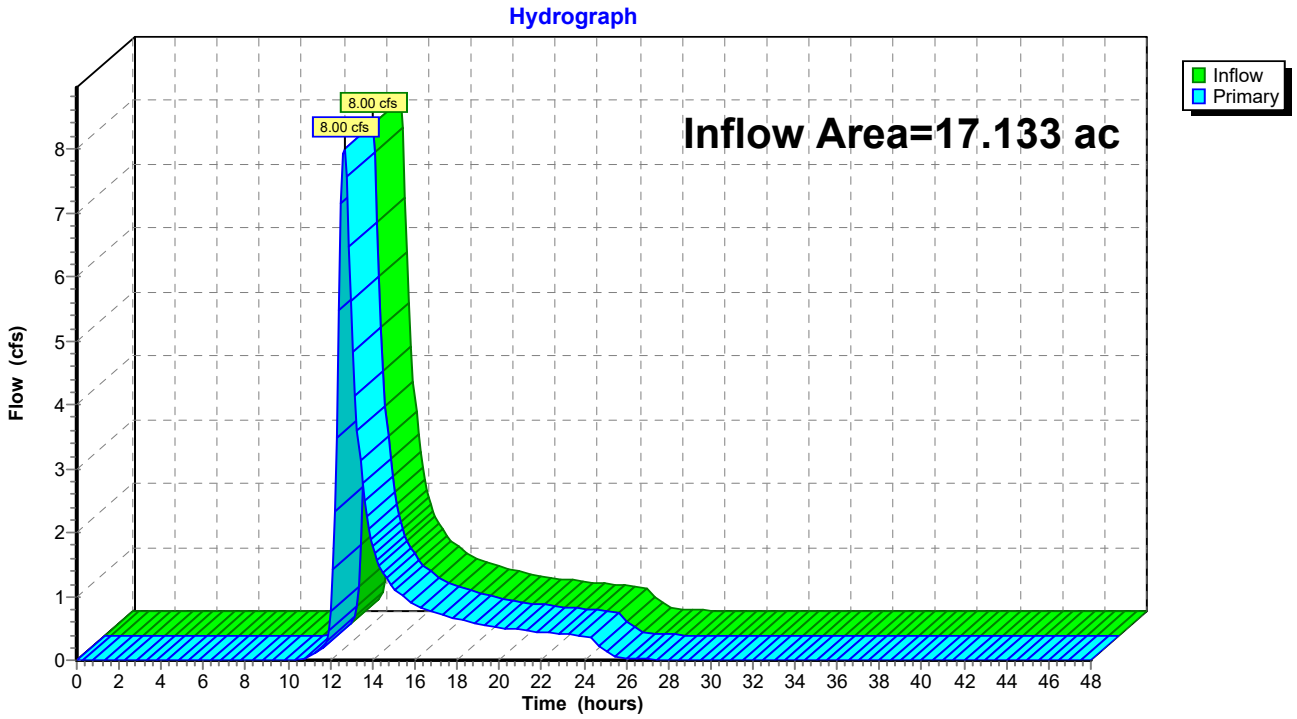


Summary for Link POI POST: POI - POST

Inflow Area = 17.133 ac, 4.61% Impervious, Inflow Depth = 0.91" for 2-yr event
Inflow = 8.00 cfs @ 12.64 hrs, Volume= 1.306 af
Primary = 8.00 cfs @ 12.64 hrs, Volume= 1.306 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 Subcatchment BY POST: POST DEVELOPMENT BYPASS

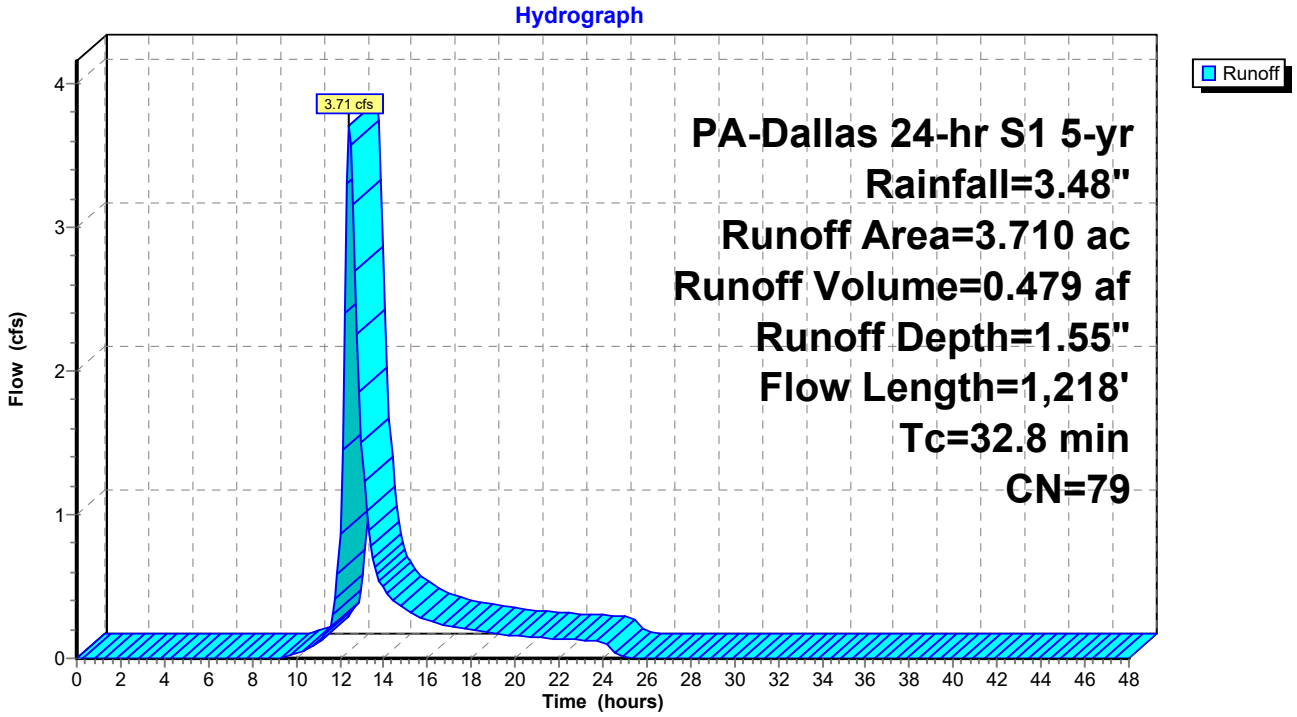
Runoff = 3.71 cfs @ 12.43 hrs, Volume= 0.479 af, Depth= 1.55"

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
	1.709	77	Woods, Good, HSG D
	1.716	78	Meadow, non-grazed, HSG D
*	0.285	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	3.710	79	Weighted Average
	3.710		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
10.9	476	0.0211	0.73		**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
32.8	1,218	Total			

Subcatchment BY POST: POST DEVELOPMENT BYPASS



Summary for Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1

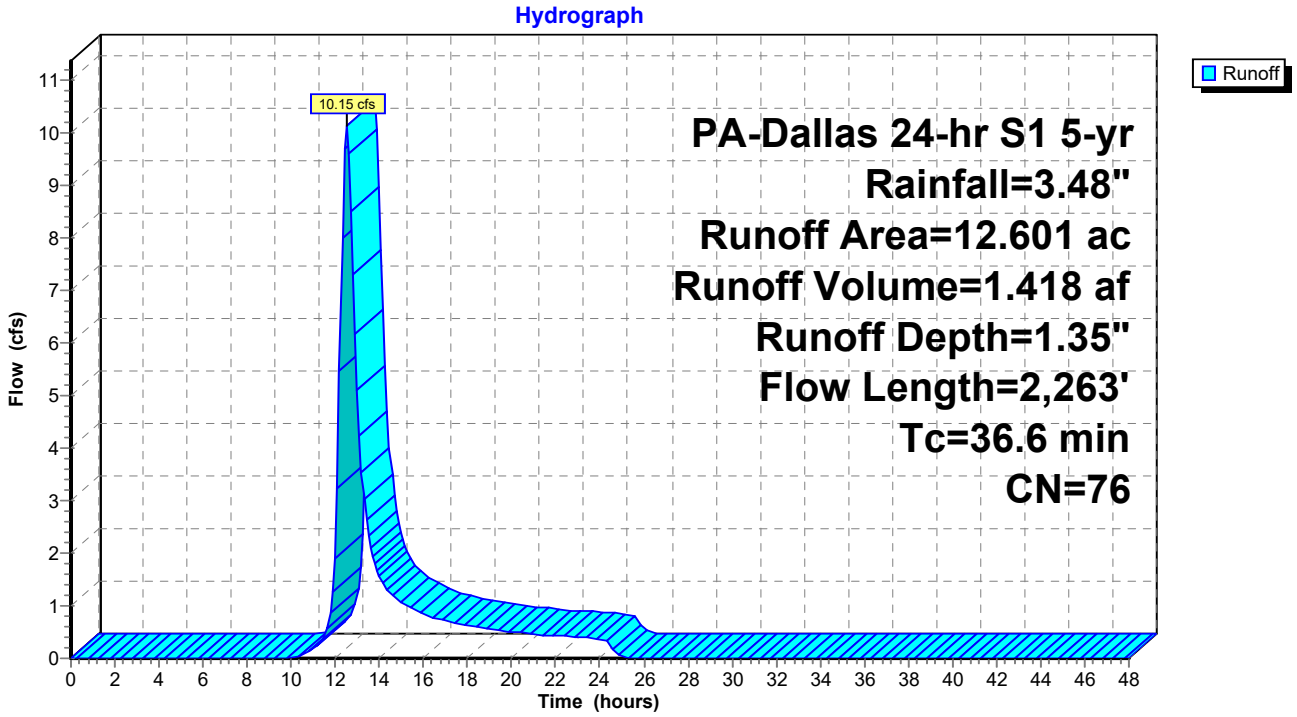
Runoff = 10.15 cfs @ 12.50 hrs, Volume= 1.418 af, Depth= 1.35"

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
	2.454	77	Woods, Good, HSG D
	2.534	78	Meadow, non-grazed, HSG D
*	0.236	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.088	70	Woods, Good, HSG C
	5.458	71	Meadow, non-grazed, HSG C
*	0.051	89	Gravel areas, HSG C
	12.601	76	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

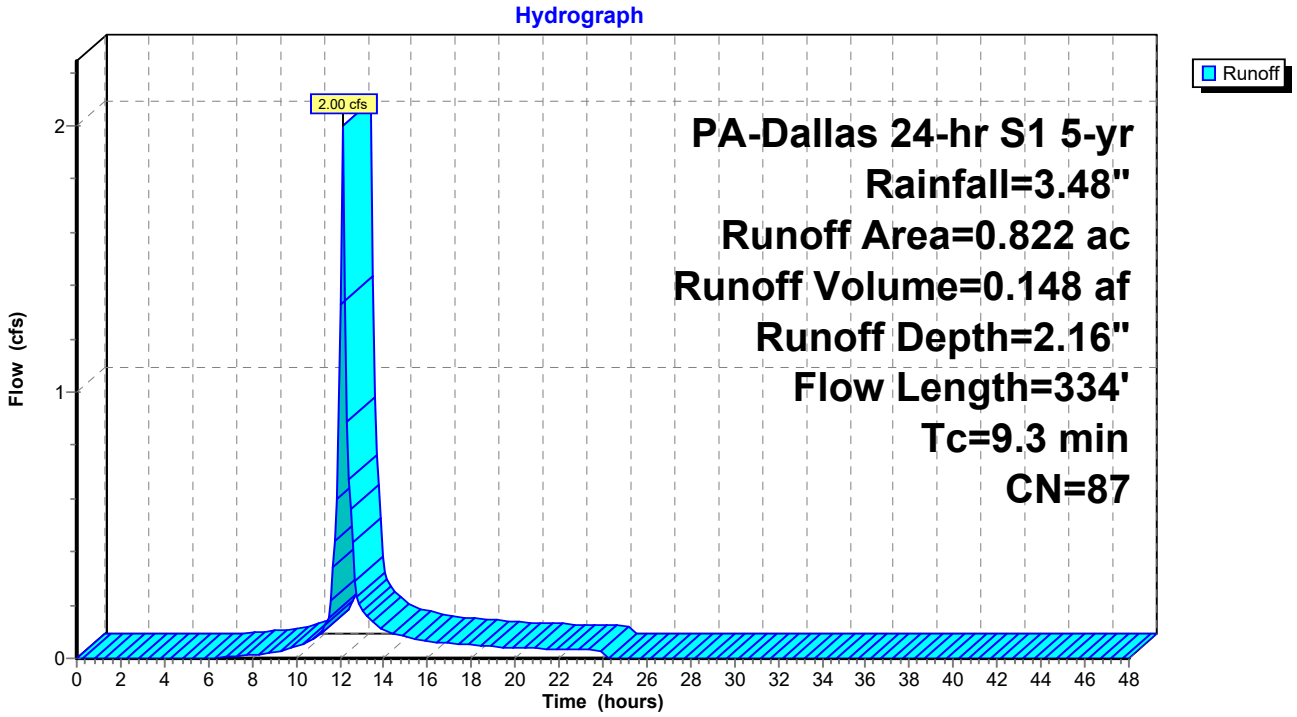
Runoff = 2.00 cfs @ 12.10 hrs, Volume= 0.148 af, Depth= 2.16"

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 (ac)	CN	Description
	0.000	77	Woods, Good, HSG D
	0.272	78	Meadow, non-grazed, HSG D
*	0.541	91	Gravel areas, HSG D
*	0.009	98	Impervious areas, HSG D
	0.822	87	Weighted Average
	0.813		98.91% Pervious Area
	0.009		1.09% 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 = 0.822 ac, 1.09% Impervious, Inflow Depth = 2.16" for 5-yr event
Inflow = 2.00 cfs @ 12.10 hrs, Volume= 0.148 af
Outflow = 1.19 cfs @ 12.24 hrs, Volume= 0.148 af, Atten= 41%, Lag= 8.7 min
Primary = 1.19 cfs @ 12.24 hrs, Volume= 0.148 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.57' @ 12.25 hrs Surf.Area= 2,784 sf Storage= 1,456 cf

Plug-Flow detention time= 51.8 min calculated for 0.148 af (100% of inflow)
Center-of-Mass det. time= 53.5 min (878.7 - 825.2)

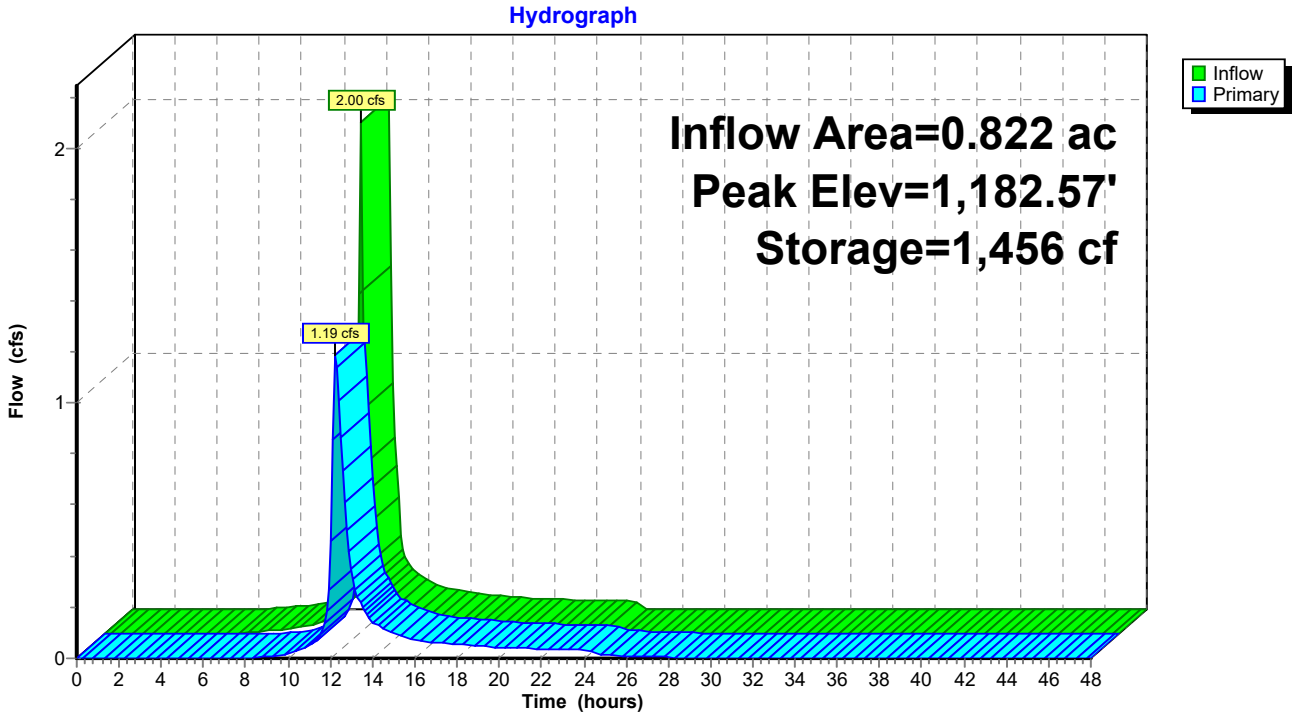
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

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=1.15 cfs @ 12.24 hrs HW=1,182.56' (Free Discharge)
1=Culvert (Inlet Controls 1.15 cfs @ 2.55 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 12.601 ac, 6.19% Impervious, Inflow Depth = 1.35" for 5-yr event
Inflow = 10.15 cfs @ 12.50 hrs, Volume= 1.418 af
Outflow = 9.27 cfs @ 12.64 hrs, Volume= 1.358 af, Atten= 9%, Lag= 8.6 min
Primary = 9.27 cfs @ 12.64 hrs, Volume= 1.358 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs / 2
Peak Elev= 1,175.52' @ 12.64 hrs Surf.Area= 0 sf Storage= 8,635 cf

Plug-Flow detention time= 50.4 min calculated for 1.355 af (96% of inflow)
Center-of-Mass det. time= 27.3 min (916.3 - 889.0)

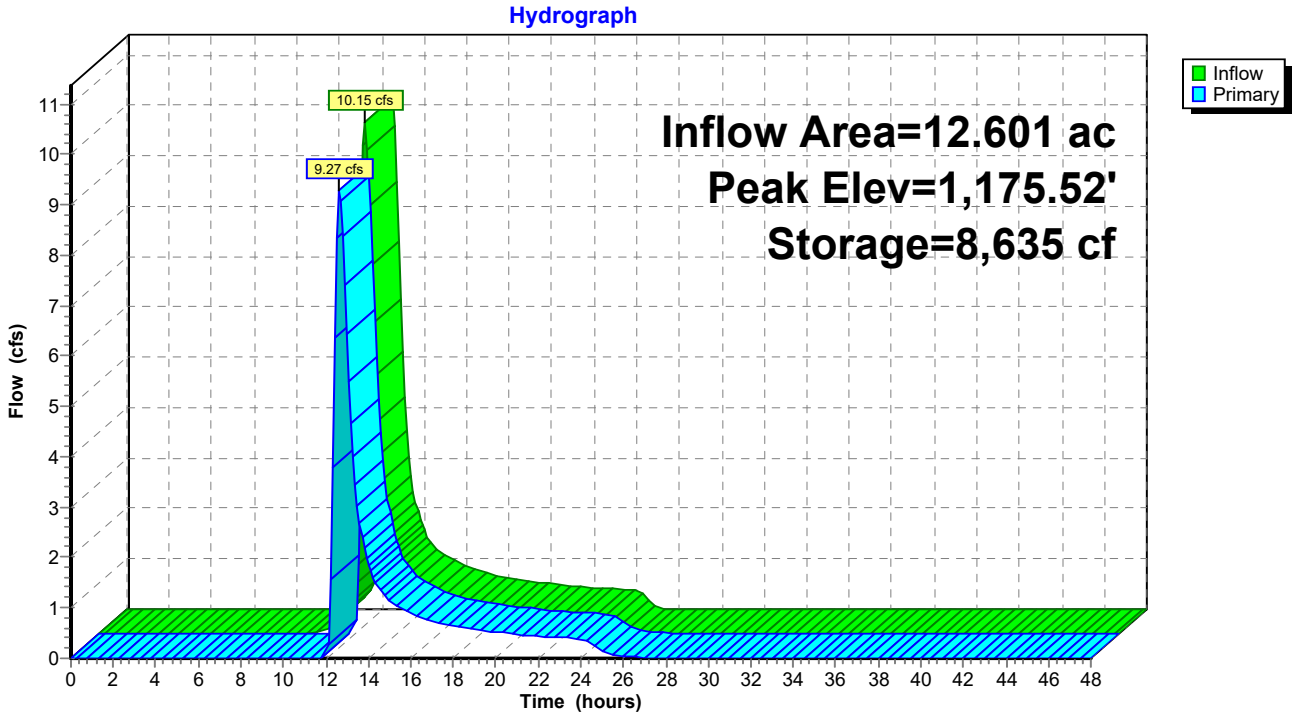
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	14,139 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,649	2,649
1,176.00	11,490	14,139

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=9.15 cfs @ 12.64 hrs HW=1,175.52' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 9.15 cfs @ 1.97 fps)

Pond VS 1: VEG SWALE 1

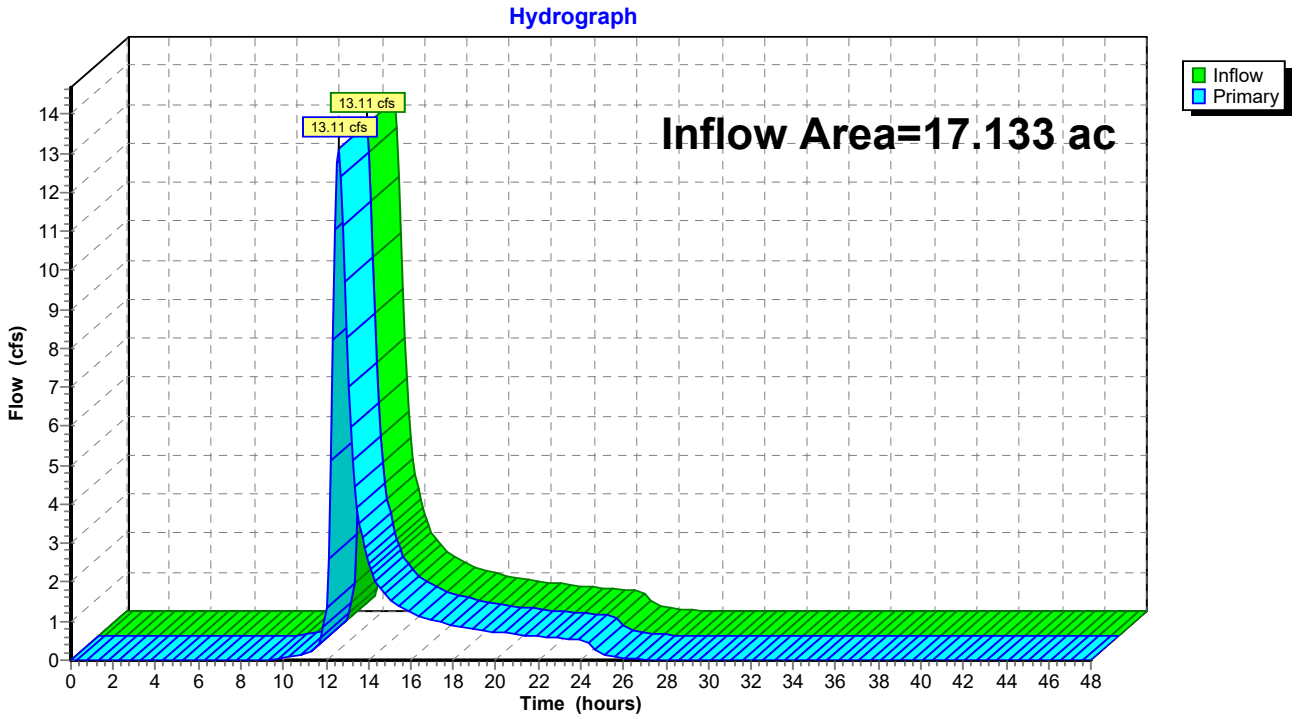


Summary for Link POI POST: POI - POST

Inflow Area = 17.133 ac, 4.61% Impervious, Inflow Depth = 1.39" for 5-yr event
Inflow = 13.11 cfs @ 12.58 hrs, Volume= 1.985 af
Primary = 13.11 cfs @ 12.58 hrs, Volume= 1.985 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 Subcatchment BY POST: POST DEVELOPMENT BYPASS

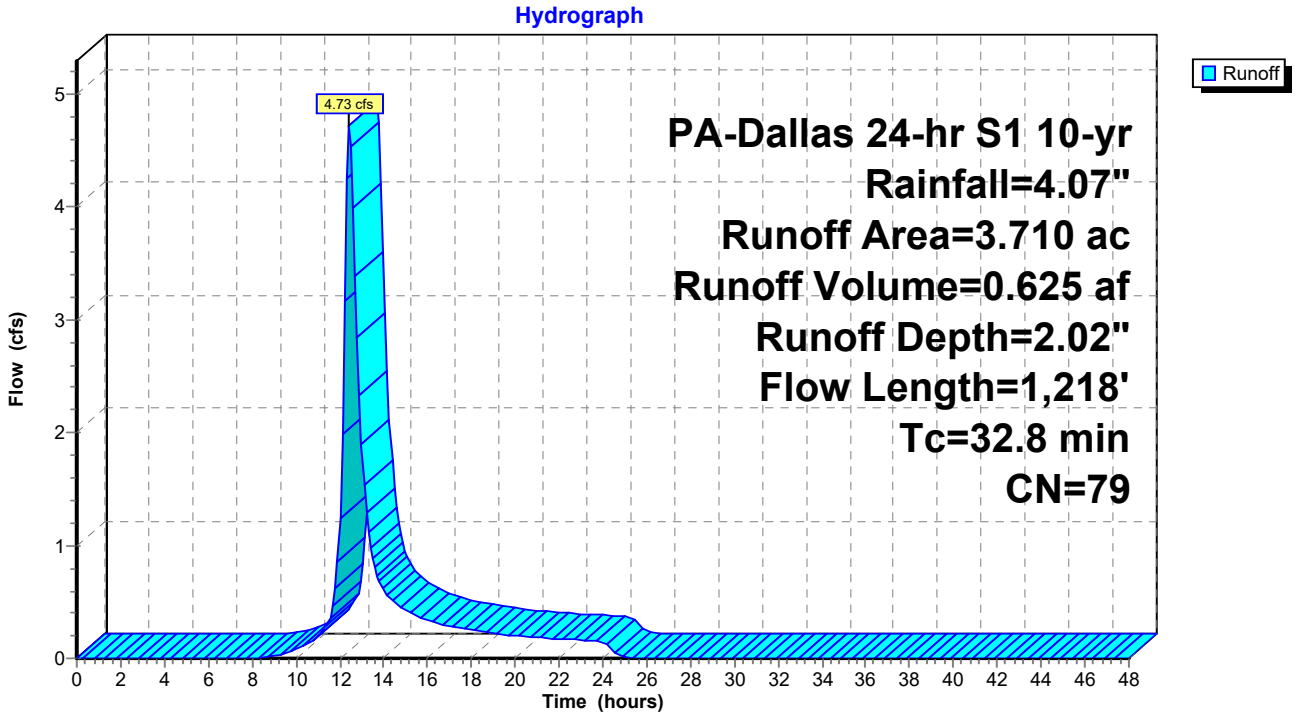
Runoff = 4.73 cfs @ 12.42 hrs, Volume= 0.625 af, Depth= 2.02"

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
	1.709	77	Woods, Good, HSG D
	1.716	78	Meadow, non-grazed, HSG D
*	0.285	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	3.710	79	Weighted Average
	3.710		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
10.9	476	0.0211	0.73		**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
32.8	1,218	Total			

Subcatchment BY POST: POST DEVELOPMENT BYPASS



Summary for Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1

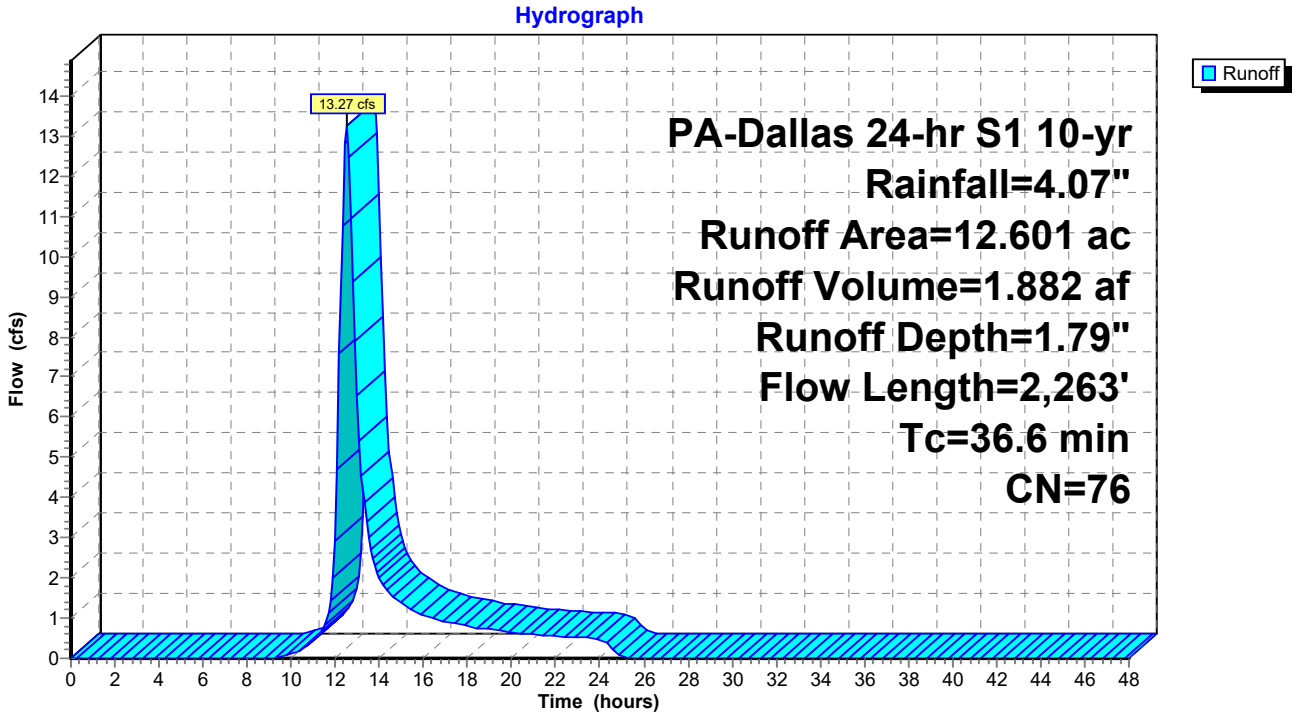
Runoff = 13.27 cfs @ 12.49 hrs, Volume= 1.882 af, Depth= 1.79"

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 10-yr Rainfall=4.07"

	Area (ac)	CN	Description
	2.454	77	Woods, Good, HSG D
	2.534	78	Meadow, non-grazed, HSG D
*	0.236	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.088	70	Woods, Good, HSG C
	5.458	71	Meadow, non-grazed, HSG C
*	0.051	89	Gravel areas, HSG C
	12.601	76	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

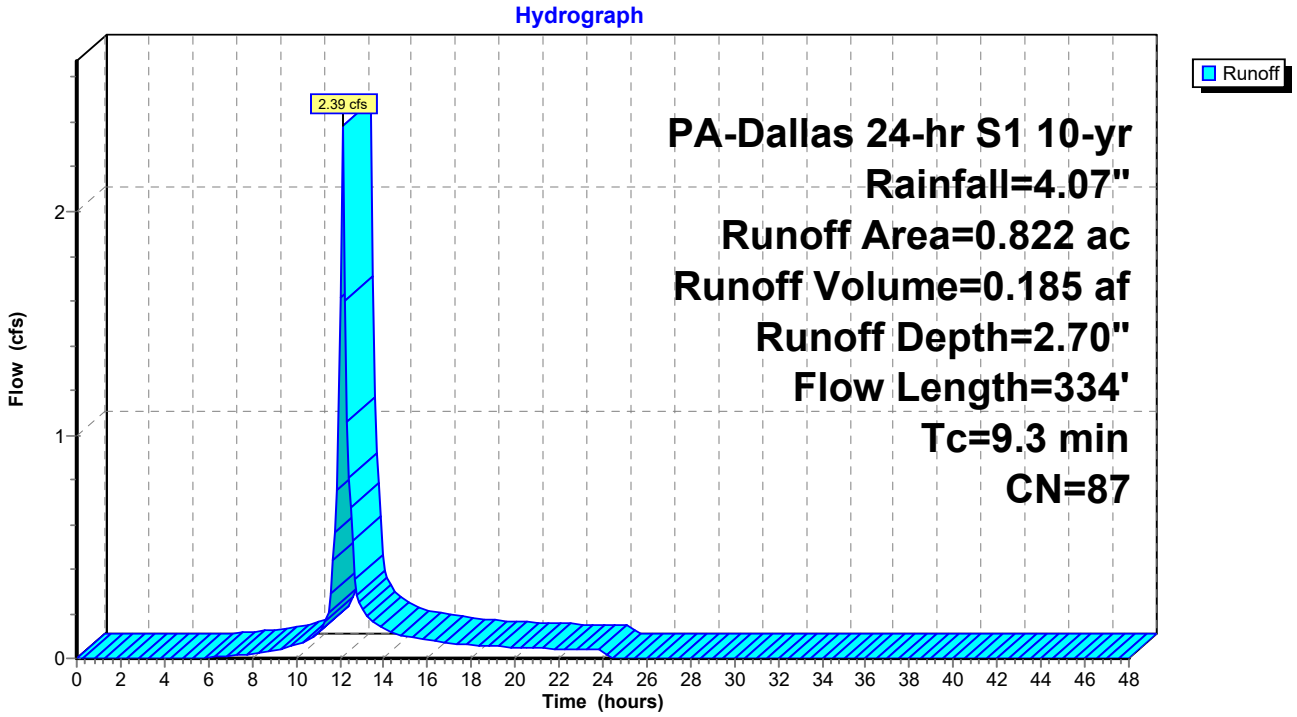
Runoff = 2.39 cfs @ 12.10 hrs, Volume= 0.185 af, Depth= 2.70"

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 (ac)	CN	Description
	0.000	77	Woods, Good, HSG D
	0.272	78	Meadow, non-grazed, HSG D
*	0.541	91	Gravel areas, HSG D
*	0.009	98	Impervious areas, HSG D
	0.822	87	Weighted Average
	0.813		98.91% Pervious Area
	0.009		1.09% 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 = 0.822 ac, 1.09% Impervious, Inflow Depth = 2.70" for 10-yr event
Inflow = 2.39 cfs @ 12.10 hrs, Volume= 0.185 af
Outflow = 1.47 cfs @ 12.24 hrs, Volume= 0.185 af, Atten= 38%, Lag= 8.3 min
Primary = 1.47 cfs @ 12.24 hrs, Volume= 0.185 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.65' @ 12.24 hrs Surf.Area= 2,847 sf Storage= 1,673 cf

Plug-Flow detention time= 47.4 min calculated for 0.185 af (100% of inflow)
Center-of-Mass det. time= 49.1 min (869.1 - 820.0)

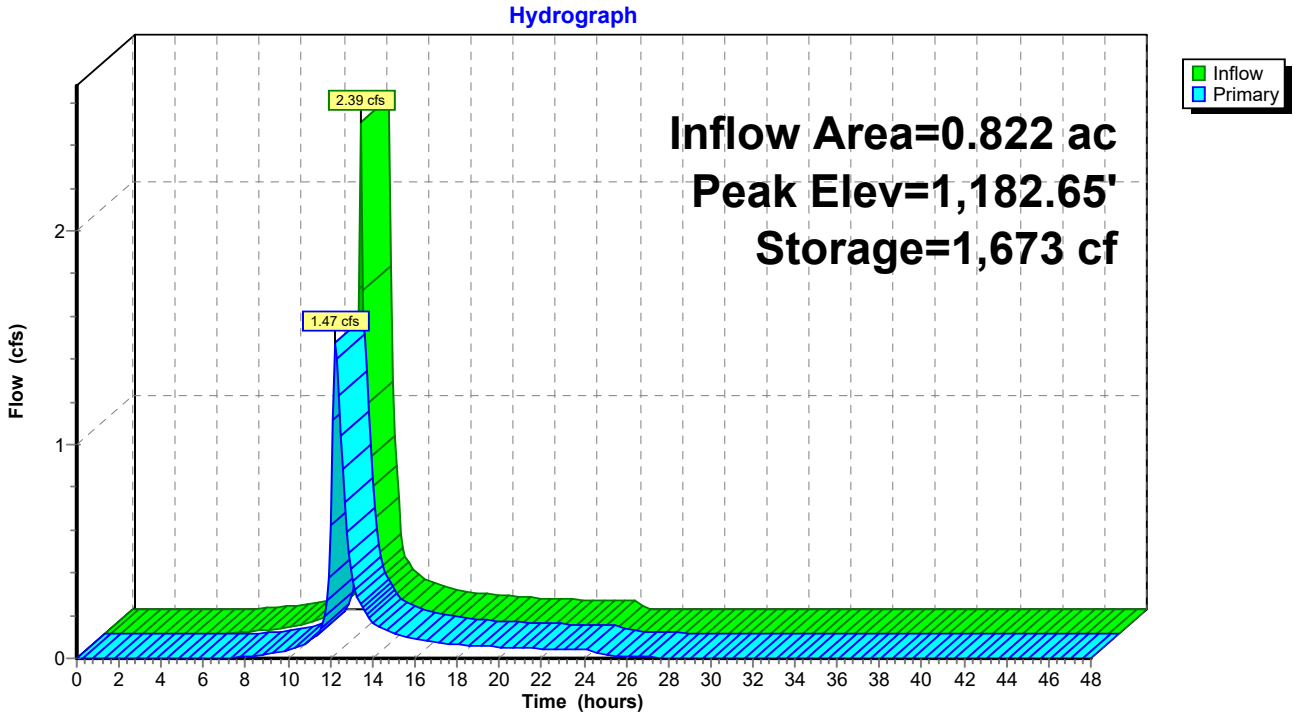
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

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=1.43 cfs @ 12.24 hrs HW=1,182.64' (Free Discharge)
1=Culvert (Inlet Controls 1.43 cfs @ 2.71 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 12.601 ac, 6.19% Impervious, Inflow Depth = 1.79" for 10-yr event
Inflow = 13.27 cfs @ 12.49 hrs, Volume= 1.882 af
Outflow = 12.40 cfs @ 12.61 hrs, Volume= 1.821 af, Atten= 7%, Lag= 7.4 min
Primary = 12.40 cfs @ 12.61 hrs, Volume= 1.821 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs / 2
Peak Elev= 1,175.63' @ 12.61 hrs Surf.Area= 0 sf Storage= 9,872 cf

Plug-Flow detention time= 42.2 min calculated for 1.817 af (97% of inflow)
Center-of-Mass det. time= 24.4 min (907.1 - 882.7)

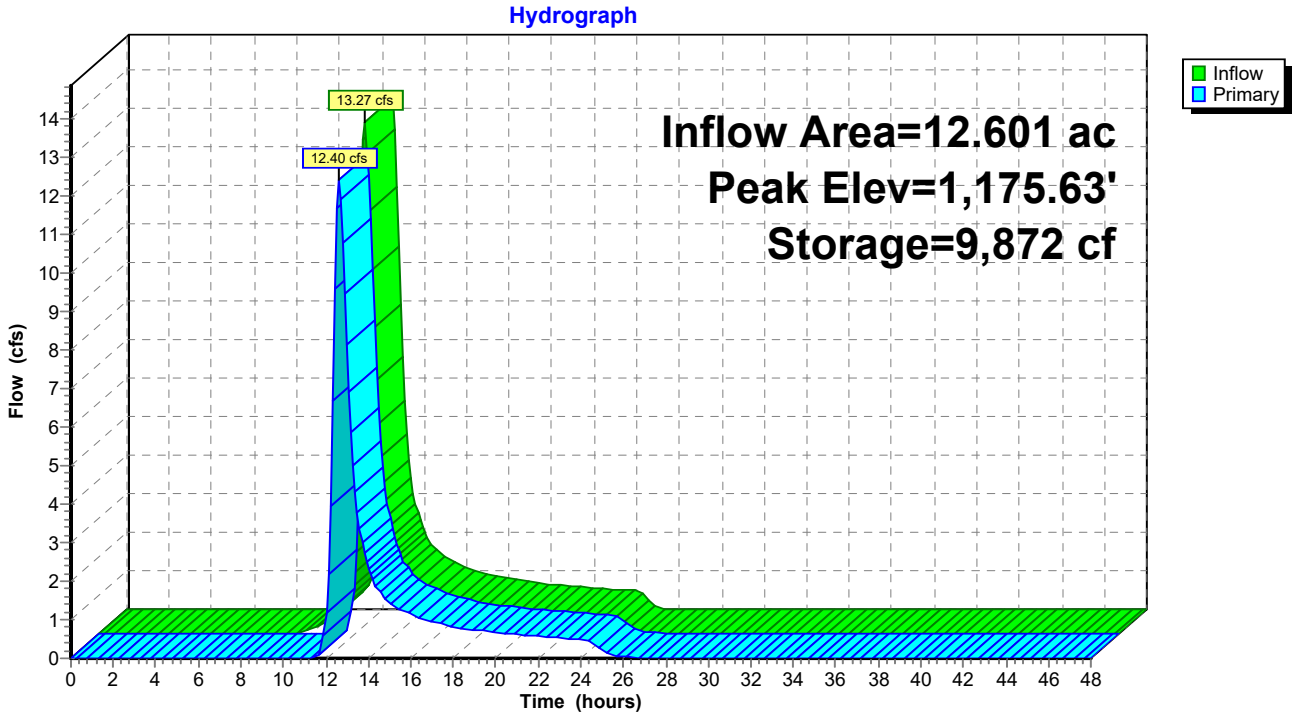
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	14,139 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,649	2,649
1,176.00	11,490	14,139

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=12.35 cfs @ 12.61 hrs HW=1,175.63' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 12.35 cfs @ 2.19 fps)

Pond VS 1: VEG SWALE 1

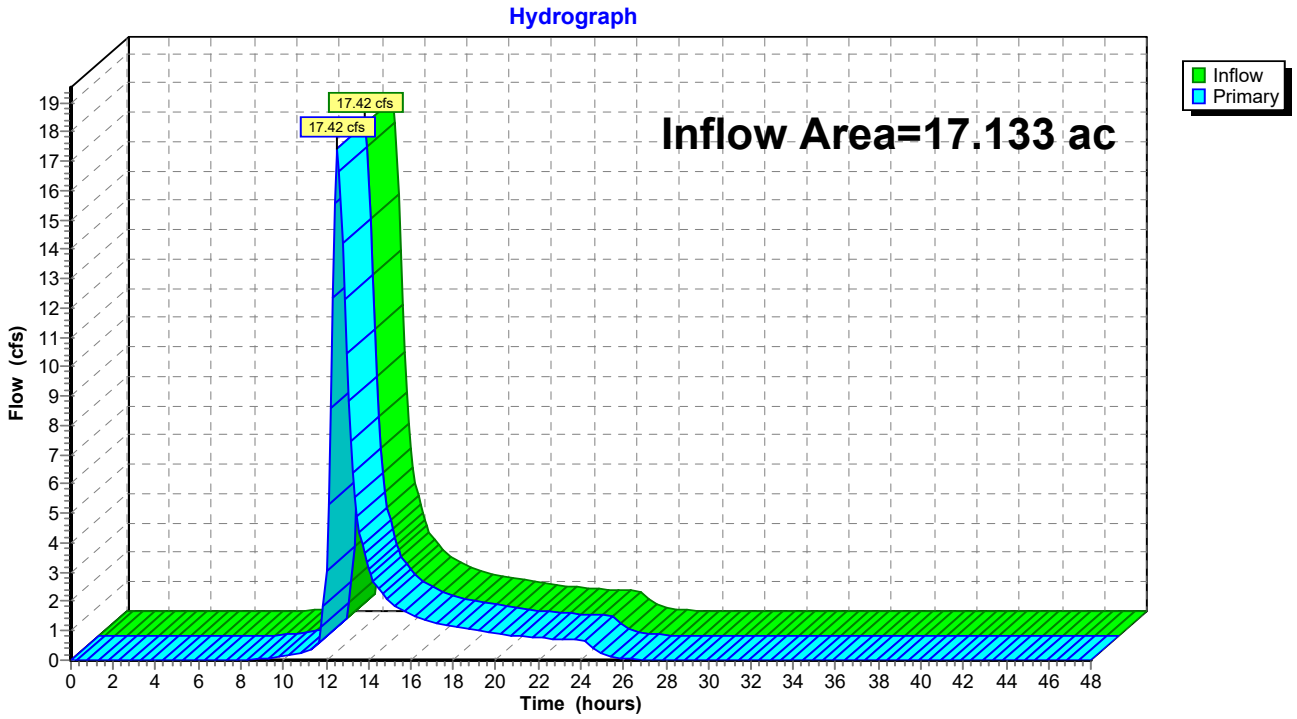


Summary for Link POI POST: POI - POST

Inflow Area = 17.133 ac, 4.61% Impervious, Inflow Depth = 1.84" for 10-yr event
Inflow = 17.42 cfs @ 12.55 hrs, Volume= 2.631 af
Primary = 17.42 cfs @ 12.55 hrs, Volume= 2.631 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 Subcatchment BY POST: POST DEVELOPMENT BYPASS

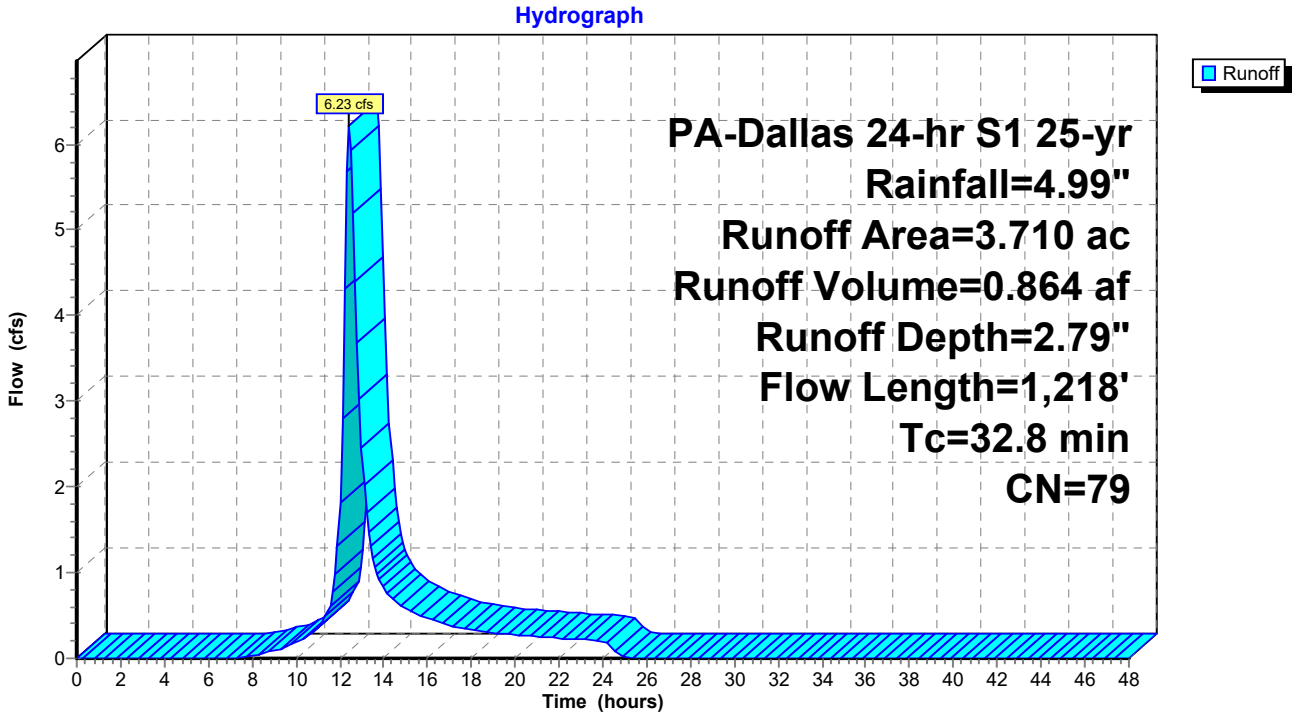
Runoff = 6.23 cfs @ 12.42 hrs, Volume= 0.864 af, Depth= 2.79"

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
	1.709	77	Woods, Good, HSG D
	1.716	78	Meadow, non-grazed, HSG D
*	0.285	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	3.710	79	Weighted Average
	3.710		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
10.9	476	0.0211	0.73		**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
32.8	1,218	Total			

Subcatchment BY POST: POST DEVELOPMENT BYPASS



Summary for Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1

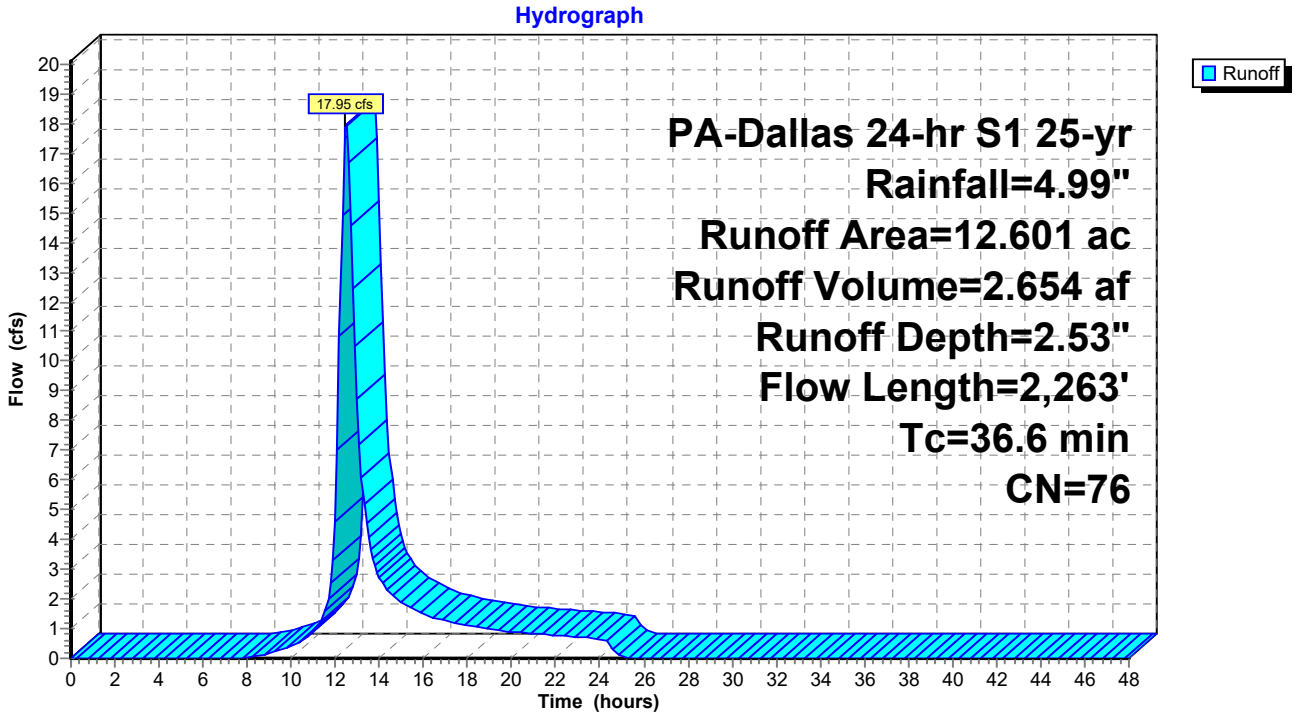
Runoff = 17.95 cfs @ 12.48 hrs, Volume= 2.654 af, Depth= 2.53"

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
	2.454	77	Woods, Good, HSG D
	2.534	78	Meadow, non-grazed, HSG D
*	0.236	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.088	70	Woods, Good, HSG C
	5.458	71	Meadow, non-grazed, HSG C
*	0.051	89	Gravel areas, HSG C
	12.601	76	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

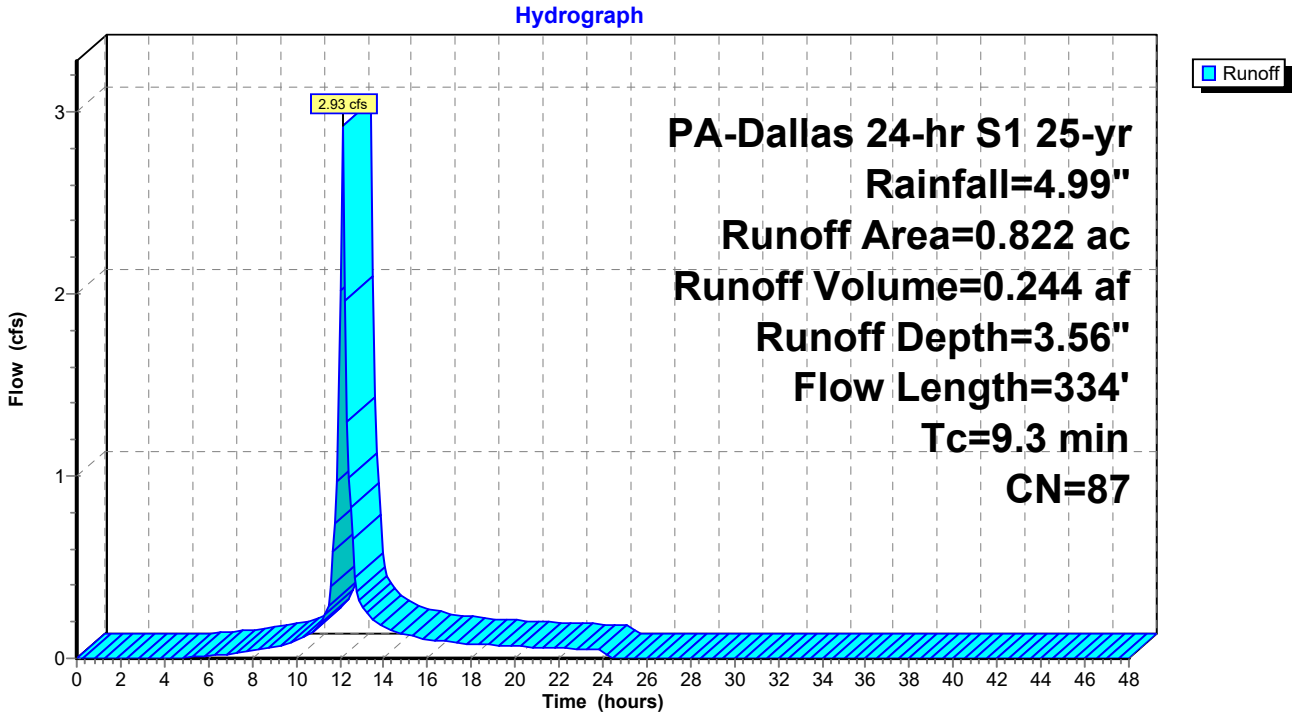
Runoff = 2.93 cfs @ 12.10 hrs, Volume= 0.244 af, Depth= 3.56"

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 (ac)	CN	Description
	0.000	77	Woods, Good, HSG D
	0.272	78	Meadow, non-grazed, HSG D
*	0.541	91	Gravel areas, HSG D
*	0.009	98	Impervious areas, HSG D
	0.822	87	Weighted Average
	0.813		98.91% Pervious Area
	0.009		1.09% 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 = 0.822 ac, 1.09% Impervious, Inflow Depth = 3.56" for 25-yr event
Inflow = 2.93 cfs @ 12.10 hrs, Volume= 0.244 af
Outflow = 1.86 cfs @ 12.23 hrs, Volume= 0.244 af, Atten= 36%, Lag= 8.0 min
Primary = 1.86 cfs @ 12.23 hrs, Volume= 0.244 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.75' @ 12.23 hrs Surf.Area= 2,930 sf Storage= 1,967 cf

Plug-Flow detention time= 42.9 min calculated for 0.243 af (100% of inflow)
Center-of-Mass det. time= 44.4 min (858.2 - 813.8)

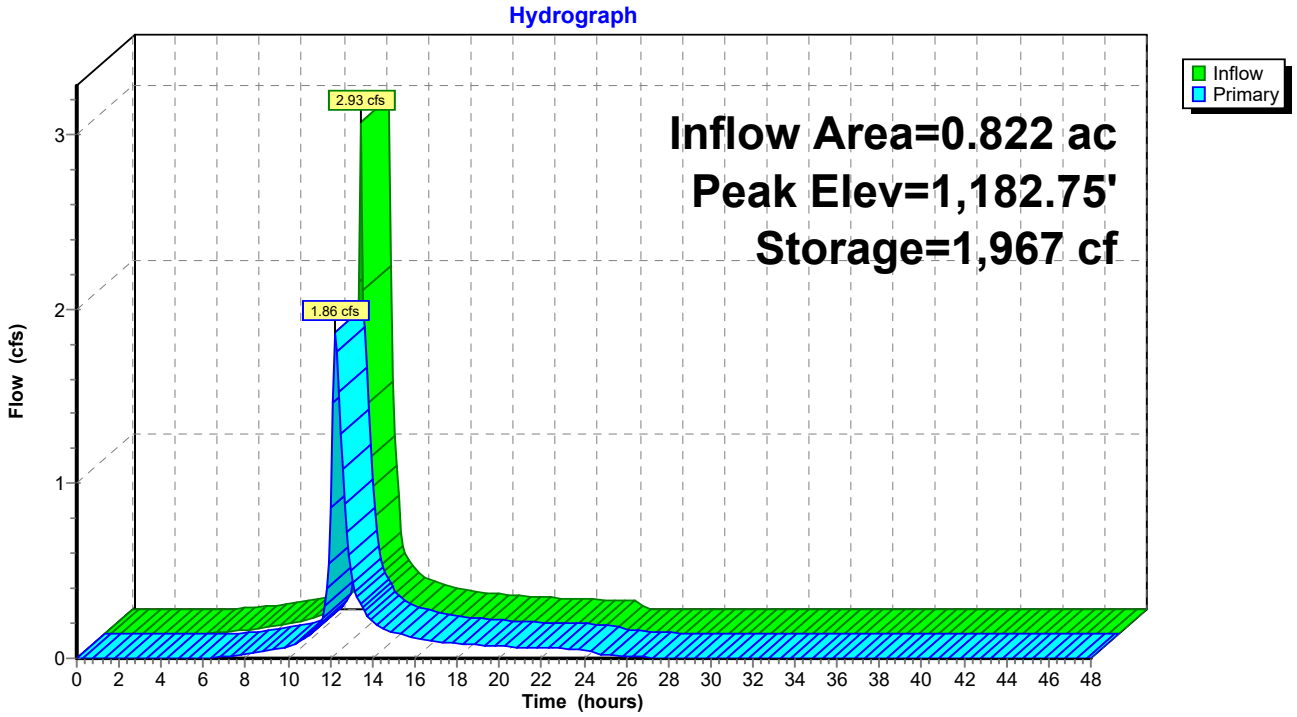
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

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=1.81 cfs @ 12.23 hrs HW=1,182.74' (Free Discharge)
1=Culvert (Inlet Controls 1.81 cfs @ 2.92 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 12.601 ac, 6.19% Impervious, Inflow Depth = 2.53" for 25-yr event
Inflow = 17.95 cfs @ 12.48 hrs, Volume= 2.654 af
Outflow = 17.04 cfs @ 12.58 hrs, Volume= 2.593 af, Atten= 5%, Lag= 6.2 min
Primary = 17.04 cfs @ 12.58 hrs, Volume= 2.593 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs / 2
Peak Elev= 1,175.76' @ 12.58 hrs Surf.Area= 0 sf Storage= 11,432 cf

Plug-Flow detention time= 36.5 min calculated for 2.593 af (98% of inflow)
Center-of-Mass det. time= 22.1 min (898.0 - 875.9)

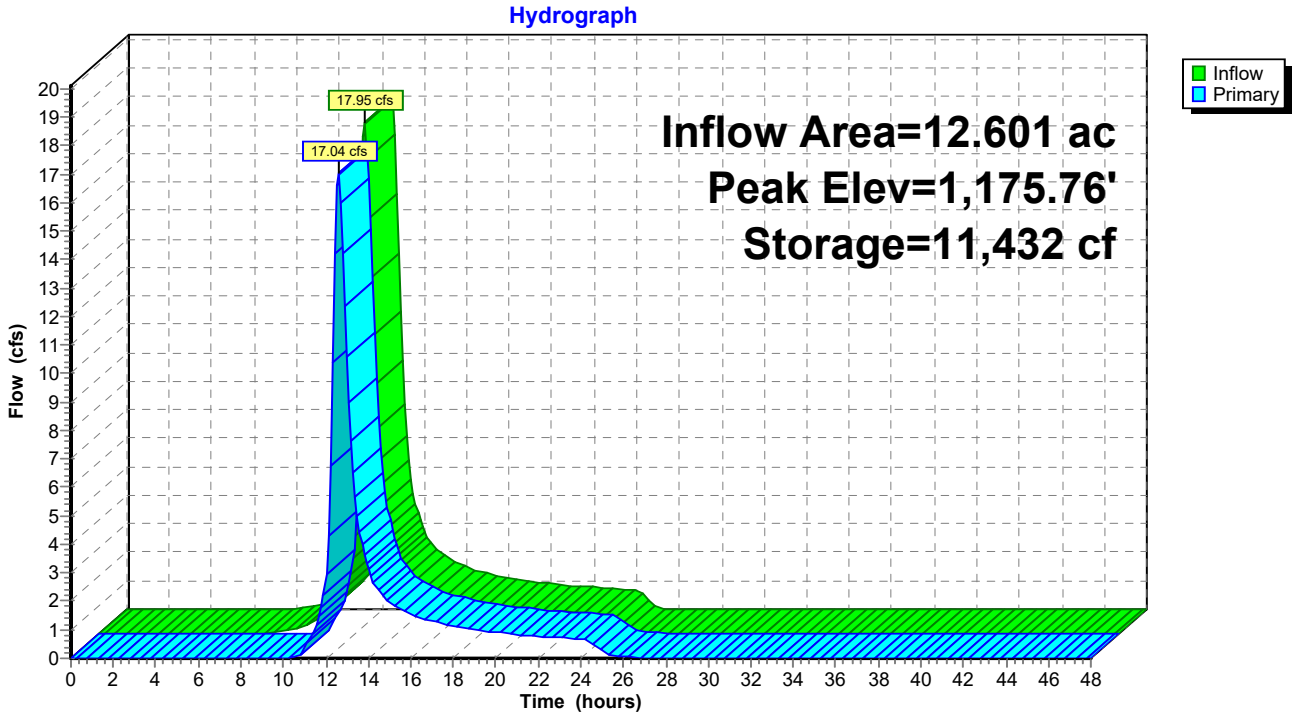
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	14,139 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,649	2,649
1,176.00	11,490	14,139

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=16.91 cfs @ 12.58 hrs HW=1,175.76' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 16.91 cfs @ 2.47 fps)

Pond VS 1: VEG SWALE 1

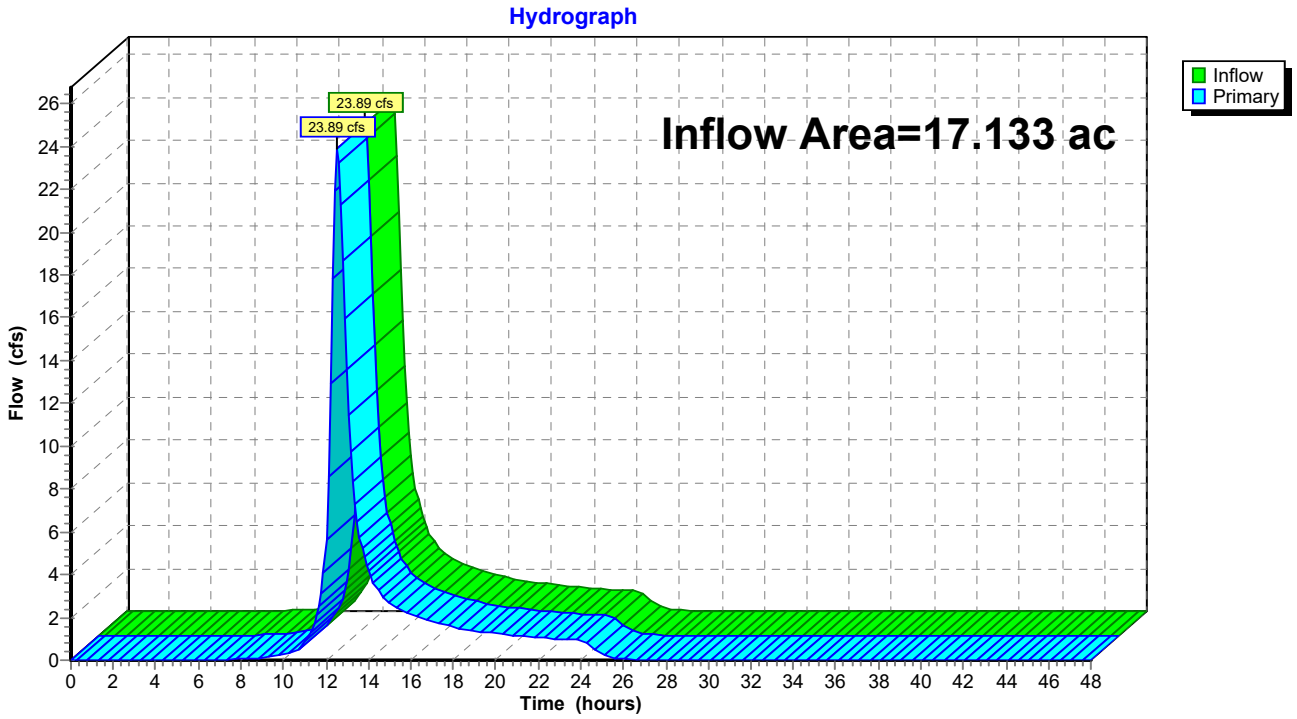


Summary for Link POI POST: POI - POST

Inflow Area = 17.133 ac, 4.61% Impervious, Inflow Depth = 2.59" for 25-yr event
Inflow = 23.89 cfs @ 12.53 hrs, Volume= 3.700 af
Primary = 23.89 cfs @ 12.53 hrs, Volume= 3.700 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 Subcatchment BY POST: POST DEVELOPMENT BYPASS

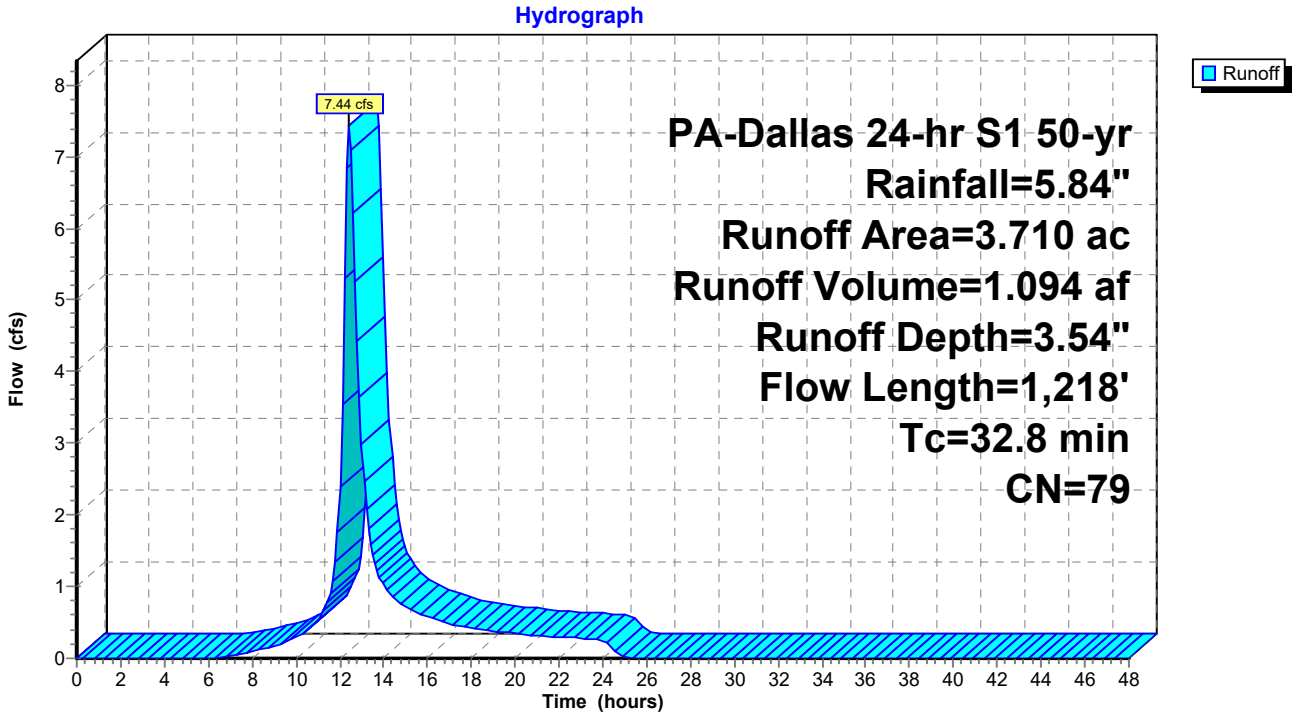
Runoff = 7.44 cfs @ 12.41 hrs, Volume= 1.094 af, Depth= 3.54"

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
	1.709	77	Woods, Good, HSG D
	1.716	78	Meadow, non-grazed, HSG D
*	0.285	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	3.710	79	Weighted Average
	3.710		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
10.9	476	0.0211	0.73		**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
32.8	1,218	Total			

Subcatchment BY POST: POST DEVELOPMENT BYPASS



Summary for Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1

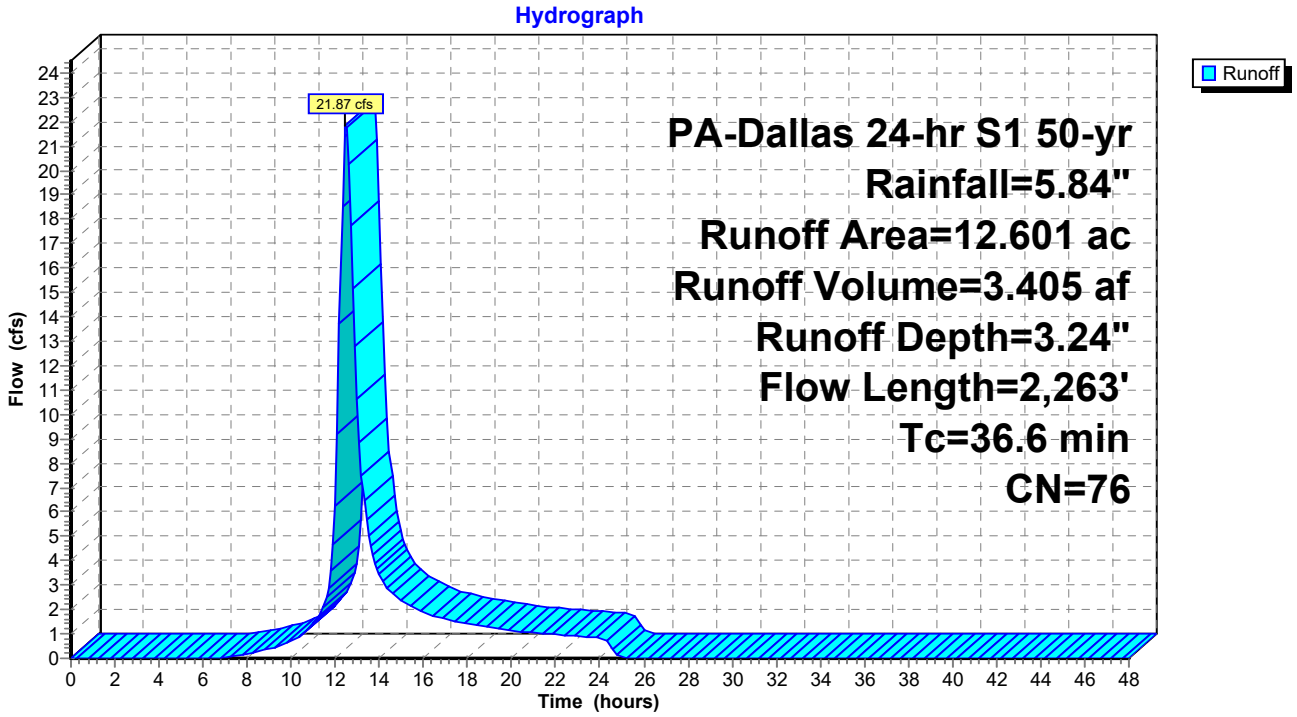
Runoff = 21.87 cfs @ 12.47 hrs, Volume= 3.405 af, Depth= 3.24"

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
	2.454	77	Woods, Good, HSG D
	2.534	78	Meadow, non-grazed, HSG D
*	0.236	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.088	70	Woods, Good, HSG C
	5.458	71	Meadow, non-grazed, HSG C
*	0.051	89	Gravel areas, HSG C
	12.601	76	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

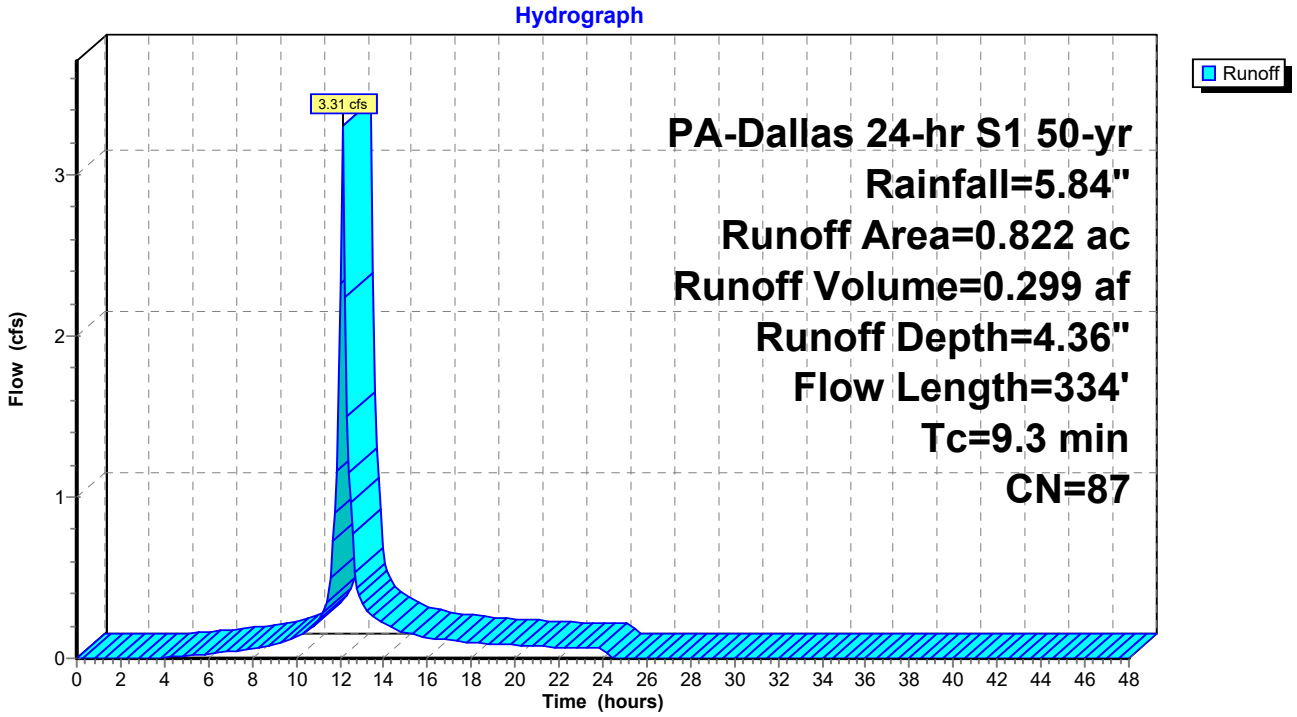
Runoff = 3.31 cfs @ 12.10 hrs, Volume= 0.299 af, Depth= 4.36"

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 (ac)	CN	Description
	0.000	77	Woods, Good, HSG D
	0.272	78	Meadow, non-grazed, HSG D
*	0.541	91	Gravel areas, HSG D
*	0.009	98	Impervious areas, HSG D
	0.822	87	Weighted Average
	0.813		98.91% Pervious Area
	0.009		1.09% 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 = 0.822 ac, 1.09% Impervious, Inflow Depth = 4.36" for 50-yr event
Inflow = 3.31 cfs @ 12.10 hrs, Volume= 0.299 af
Outflow = 2.14 cfs @ 12.23 hrs, Volume= 0.299 af, Atten= 35%, Lag= 8.0 min
Primary = 2.14 cfs @ 12.23 hrs, Volume= 0.299 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.82' @ 12.23 hrs Surf.Area= 2,991 sf Storage= 2,189 cf

Plug-Flow detention time= 40.0 min calculated for 0.298 af (100% of inflow)
Center-of-Mass det. time= 41.5 min (850.5 - 809.1)

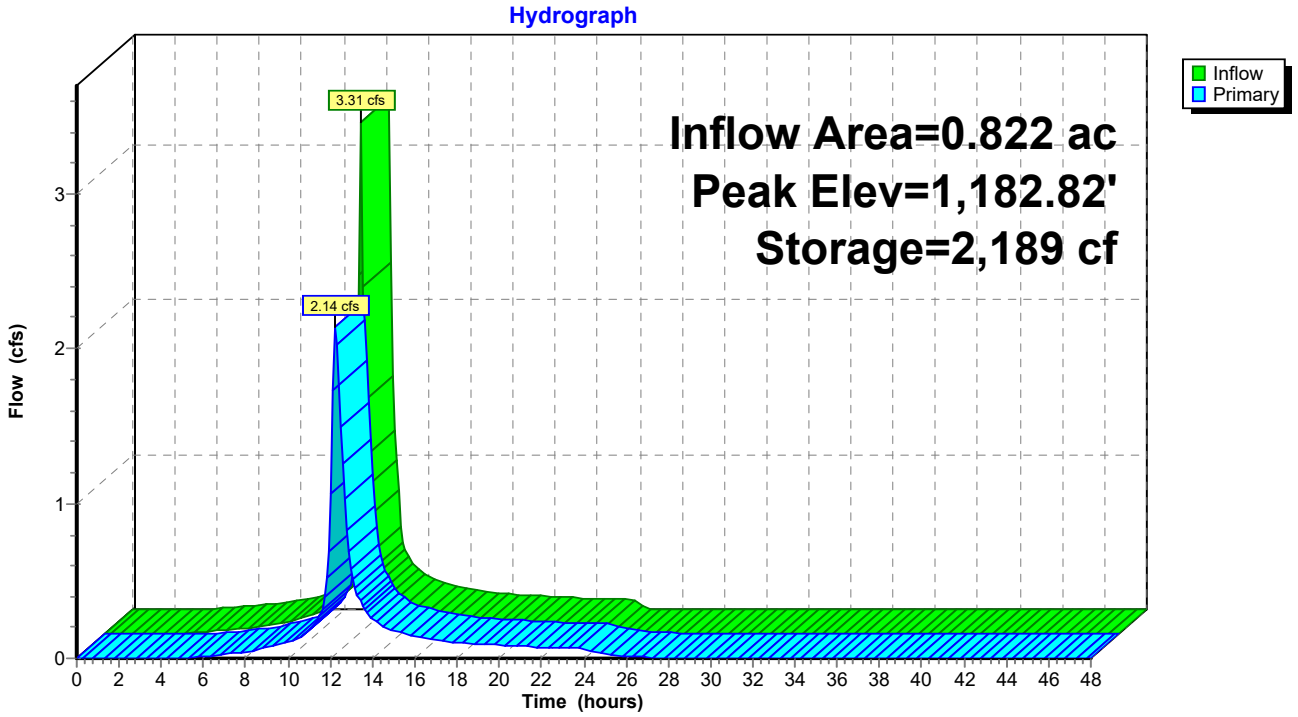
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

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=2.09 cfs @ 12.23 hrs HW=1,182.81' (Free Discharge)
1=Culvert (Inlet Controls 2.09 cfs @ 3.07 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 12.601 ac, 6.19% Impervious, Inflow Depth = 3.24" for 50-yr event
Inflow = 21.87 cfs @ 12.47 hrs, Volume= 3.405 af
Outflow = 20.94 cfs @ 12.56 hrs, Volume= 3.344 af, Atten= 4%, Lag= 5.4 min
Primary = 20.94 cfs @ 12.56 hrs, Volume= 3.344 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs / 2
Peak Elev= 1,175.87' @ 12.56 hrs Surf.Area= 0 sf Storage= 12,590 cf

Plug-Flow detention time= 32.3 min calculated for 3.344 af (98% of inflow)
Center-of-Mass det. time= 20.7 min (891.7 - 871.1)

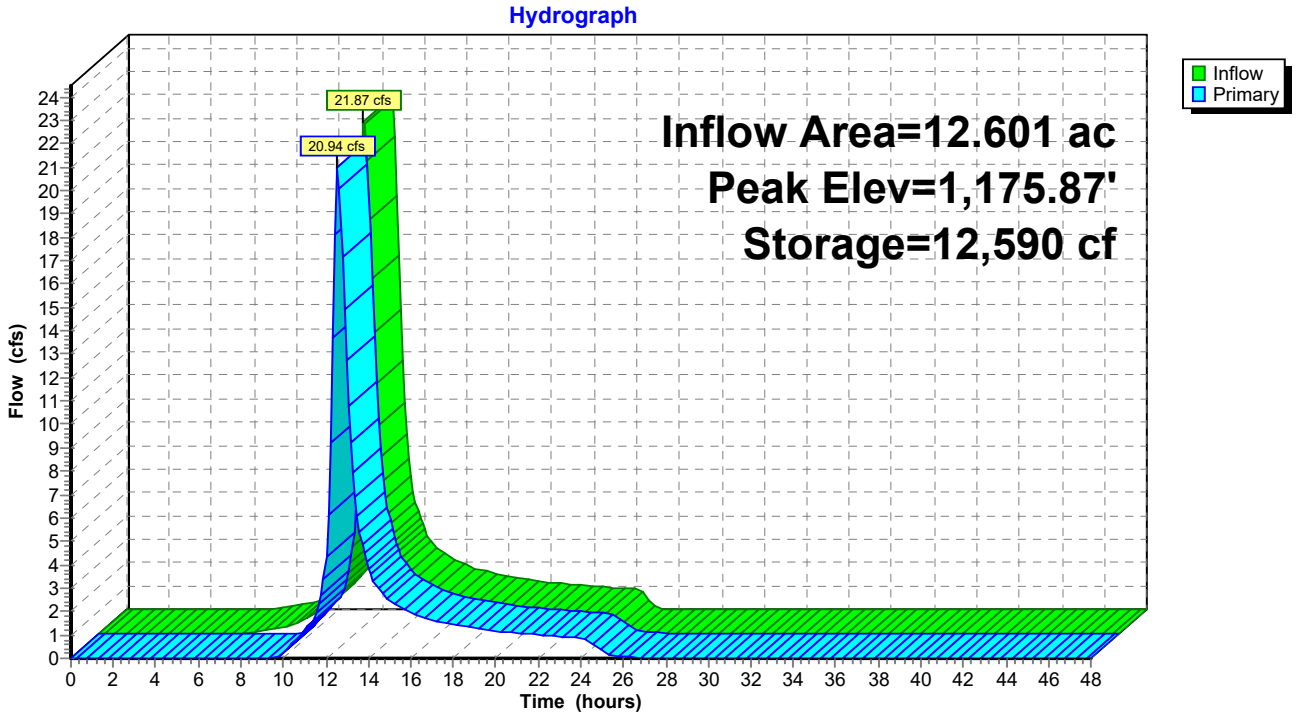
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	14,139 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,649	2,649
1,176.00	11,490	14,139

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=20.75 cfs @ 12.56 hrs HW=1,175.86' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 20.75 cfs @ 2.68 fps)

Pond VS 1: VEG SWALE 1

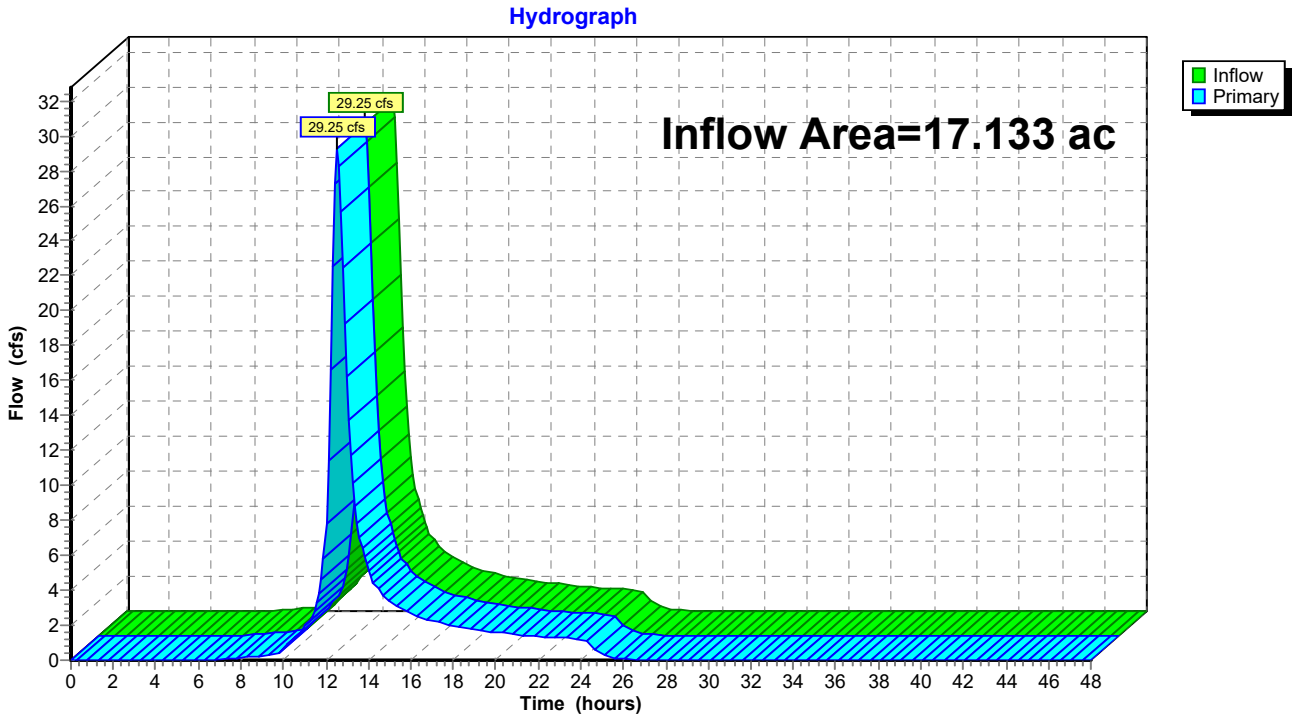


Summary for Link POI POST: POI - POST

Inflow Area = 17.133 ac, 4.61% Impervious, Inflow Depth = 3.32" for 50-yr event
Inflow = 29.25 cfs @ 12.52 hrs, Volume= 4.736 af
Primary = 29.25 cfs @ 12.52 hrs, Volume= 4.736 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 Subcatchment BY POST: POST DEVELOPMENT BYPASS

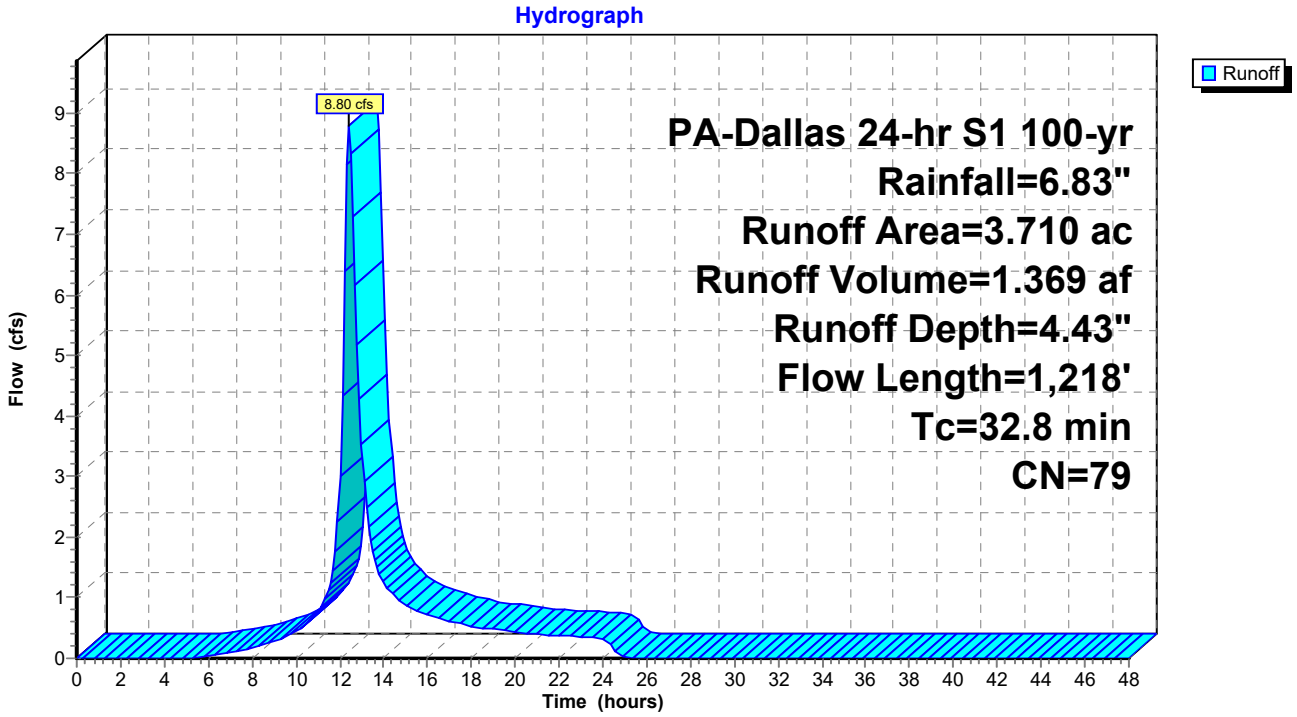
Runoff = 8.80 cfs @ 12.41 hrs, Volume= 1.369 af, Depth= 4.43"

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
	1.709	77	Woods, Good, HSG D
	1.716	78	Meadow, non-grazed, HSG D
*	0.285	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	3.710	79	Weighted Average
	3.710		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
10.9	476	0.0211	0.73		**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
32.8	1,218	Total			

Subcatchment BY POST: POST DEVELOPMENT BYPASS



Summary for Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1

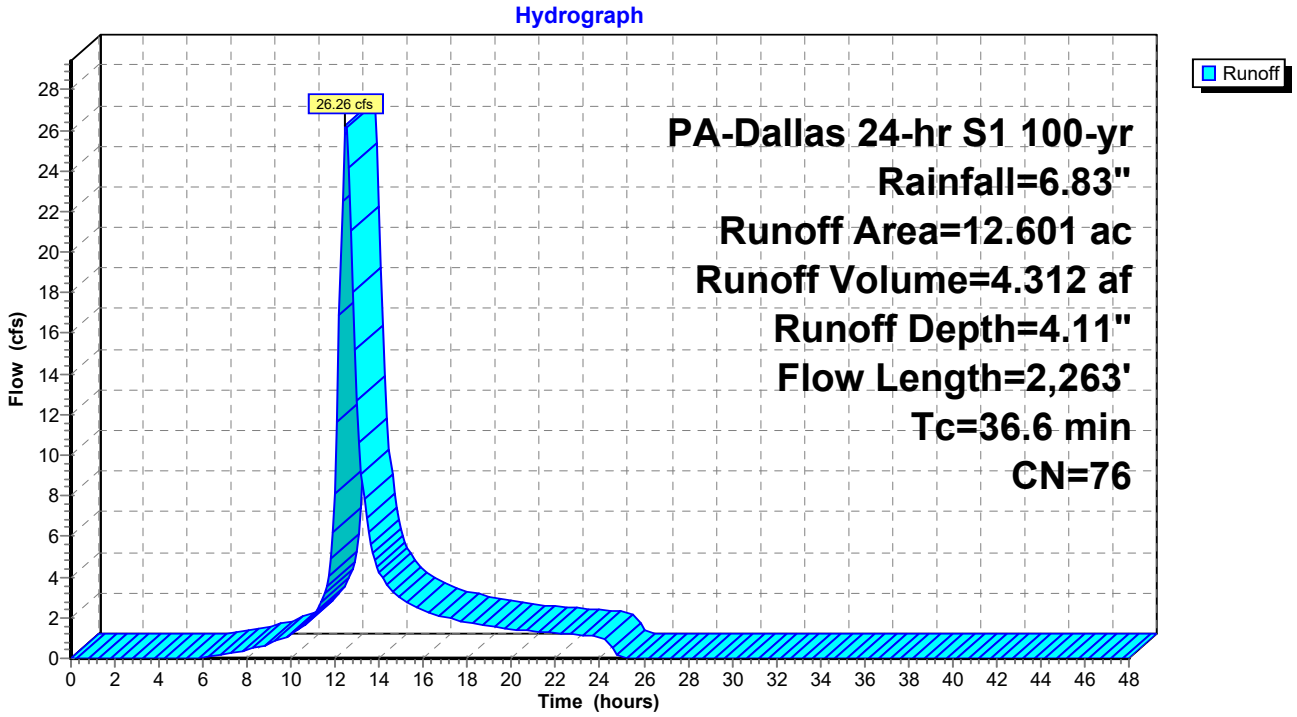
Runoff = 26.26 cfs @ 12.46 hrs, Volume= 4.312 af, Depth= 4.11"

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 100-yr Rainfall=6.83"

	Area (ac)	CN	Description
	2.454	77	Woods, Good, HSG D
	2.534	78	Meadow, non-grazed, HSG D
*	0.236	91	Gravel areas, HSG D
*	0.780	98	Impervious areas, HSG C
	1.088	70	Woods, Good, HSG C
	5.458	71	Meadow, non-grazed, HSG C
*	0.051	89	Gravel areas, HSG C
	12.601	76	Weighted Average
	11.821		93.81% Pervious Area
	0.780		6.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment RD-POST: POST DEVELOPMENT VEG SWALE 1



Summary for Subcatchment RG POST: POST DEVELOPMENT RAIN GARDEN

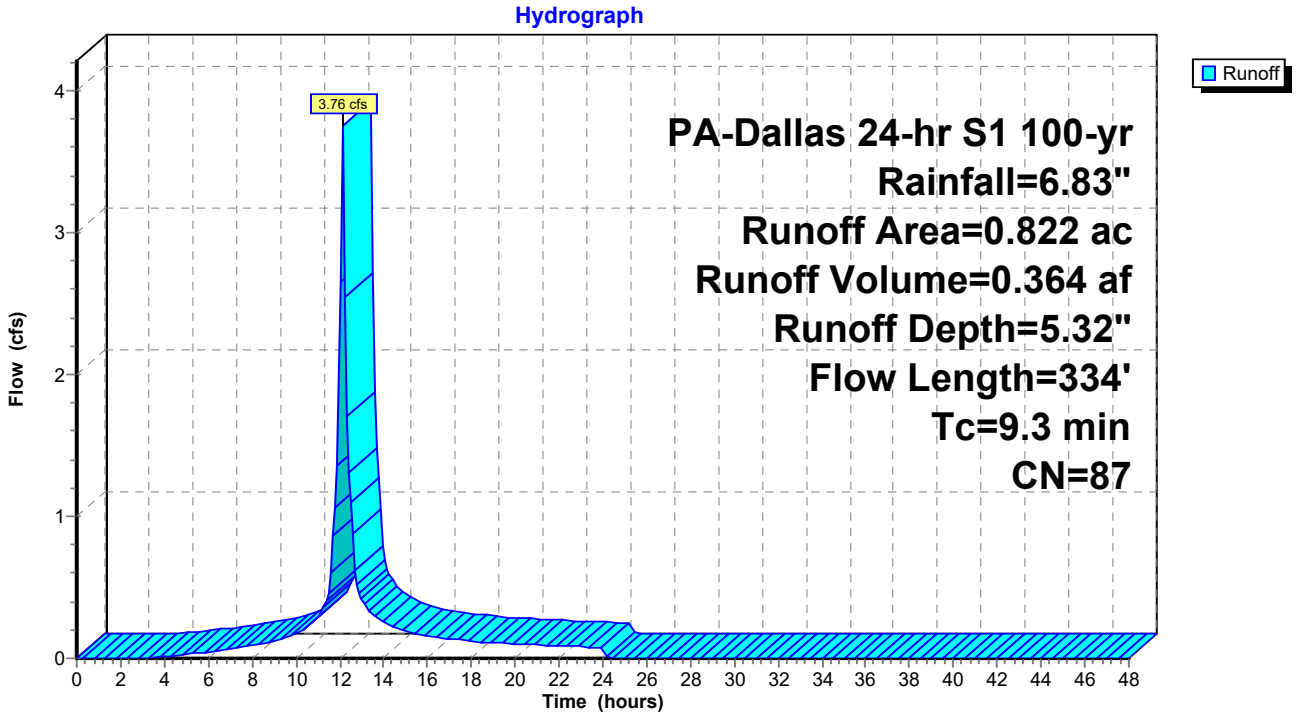
Runoff = 3.76 cfs @ 12.10 hrs, Volume= 0.364 af, Depth= 5.32"

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 (ac)	CN	Description
	0.000	77	Woods, Good, HSG D
	0.272	78	Meadow, non-grazed, HSG D
*	0.541	91	Gravel areas, HSG D
*	0.009	98	Impervious areas, HSG D
	0.822	87	Weighted Average
	0.813		98.91% Pervious Area
	0.009		1.09% 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 = 0.822 ac, 1.09% Impervious, Inflow Depth = 5.32" for 100-yr event
Inflow = 3.76 cfs @ 12.10 hrs, Volume= 0.364 af
Outflow = 2.43 cfs @ 12.23 hrs, Volume= 0.364 af, Atten= 35%, Lag= 8.0 min
Primary = 2.43 cfs @ 12.23 hrs, Volume= 0.364 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 1,182.91' @ 12.23 hrs Surf.Area= 3,059 sf Storage= 2,442 cf

Plug-Flow detention time= 37.4 min calculated for 0.363 af (100% of inflow)
Center-of-Mass det. time= 38.8 min (843.1 - 804.3)

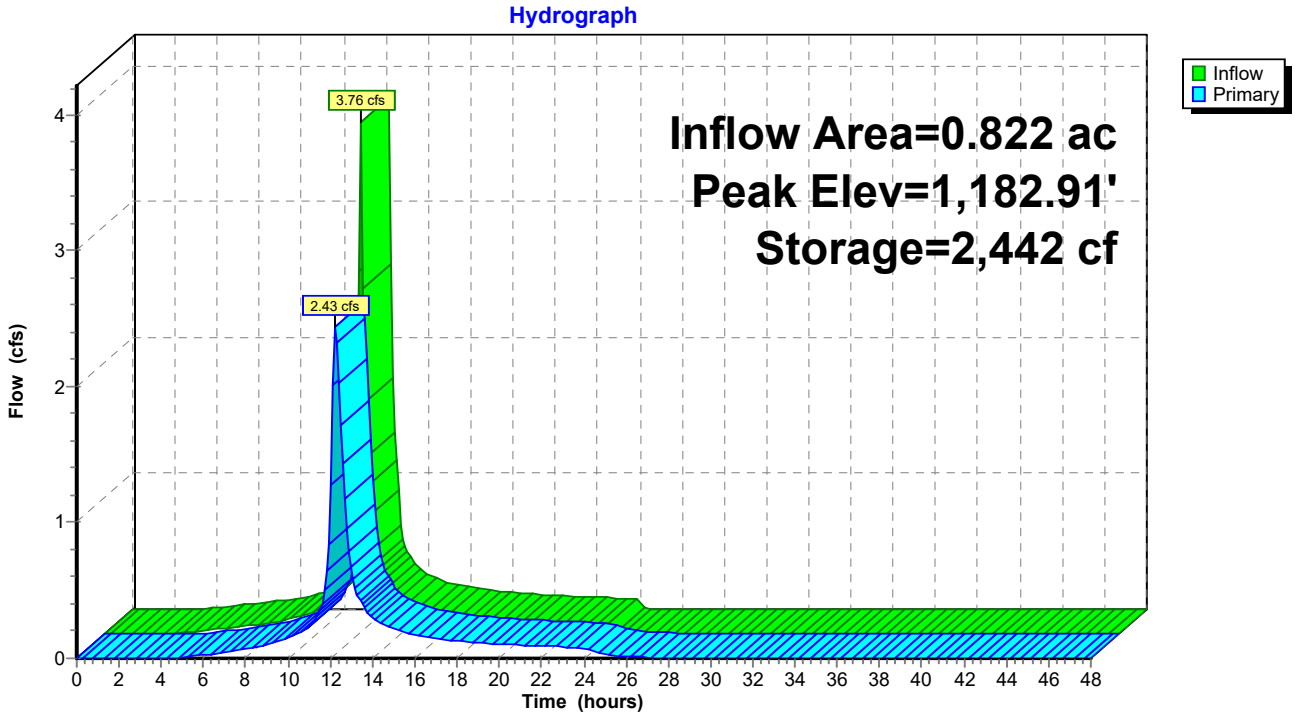
Volume	Invert	Avail.Storage	Storage Description
#1	1,182.00'	6,317 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

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=2.38 cfs @ 12.23 hrs HW=1,182.89' (Free Discharge)
1=Culvert (Inlet Controls 2.38 cfs @ 3.22 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond RG 1: RAIN GARDEN



Summary for Pond VS 1: VEG SWALE 1

Inflow Area = 12.601 ac, 6.19% Impervious, Inflow Depth = 4.11" for 100-yr event
Inflow = 26.26 cfs @ 12.46 hrs, Volume= 4.312 af
Outflow = 25.43 cfs @ 12.54 hrs, Volume= 4.251 af, Atten= 3%, Lag= 4.9 min
Primary = 25.43 cfs @ 12.54 hrs, Volume= 4.251 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs / 2
Peak Elev= 1,175.97' @ 12.54 hrs Surf.Area= 0 sf Storage= 13,789 cf

Plug-Flow detention time= 27.4 min calculated for 4.242 af (98% of inflow)
Center-of-Mass det. time= 19.4 min (885.5 - 866.1)

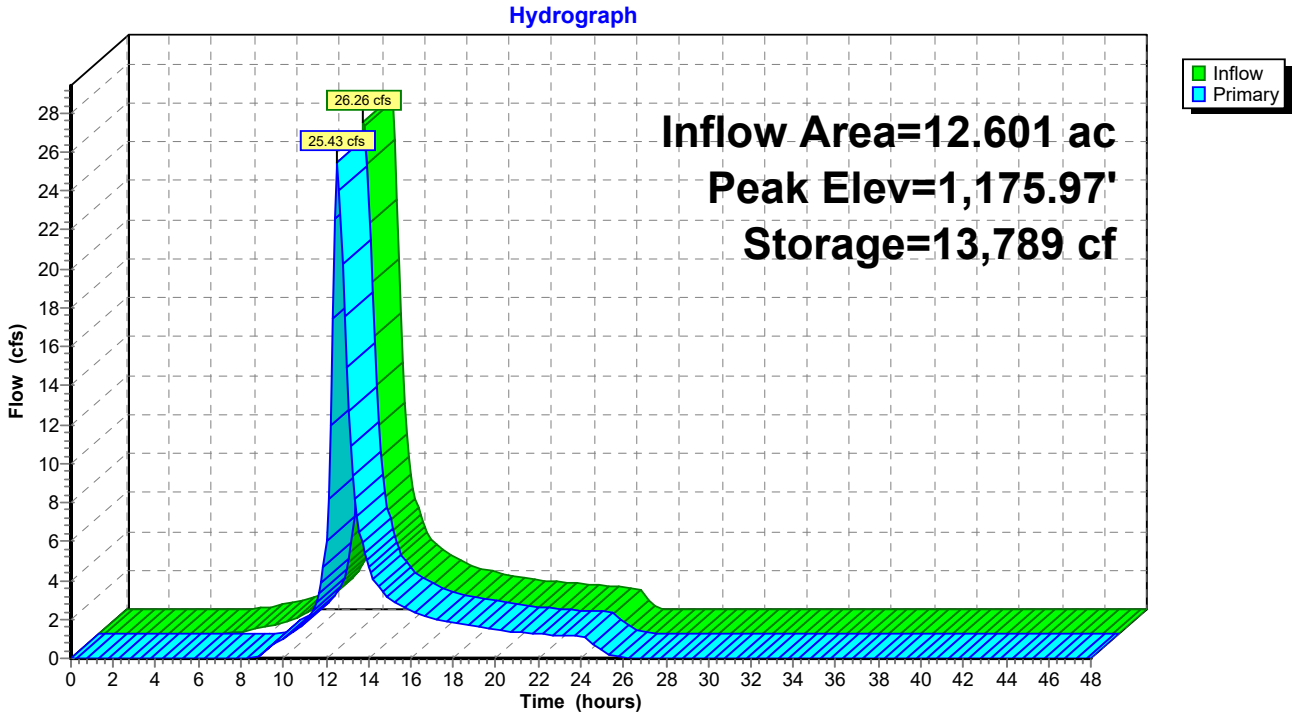
Volume	Invert	Avail.Storage	Storage Description
#1	1,174.00'	14,139 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,174.00	0	0
1,175.00	2,649	2,649
1,176.00	11,490	14,139

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=25.08 cfs @ 12.54 hrs HW=1,175.96' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 25.08 cfs @ 2.90 fps)

Pond VS 1: VEG SWALE 1

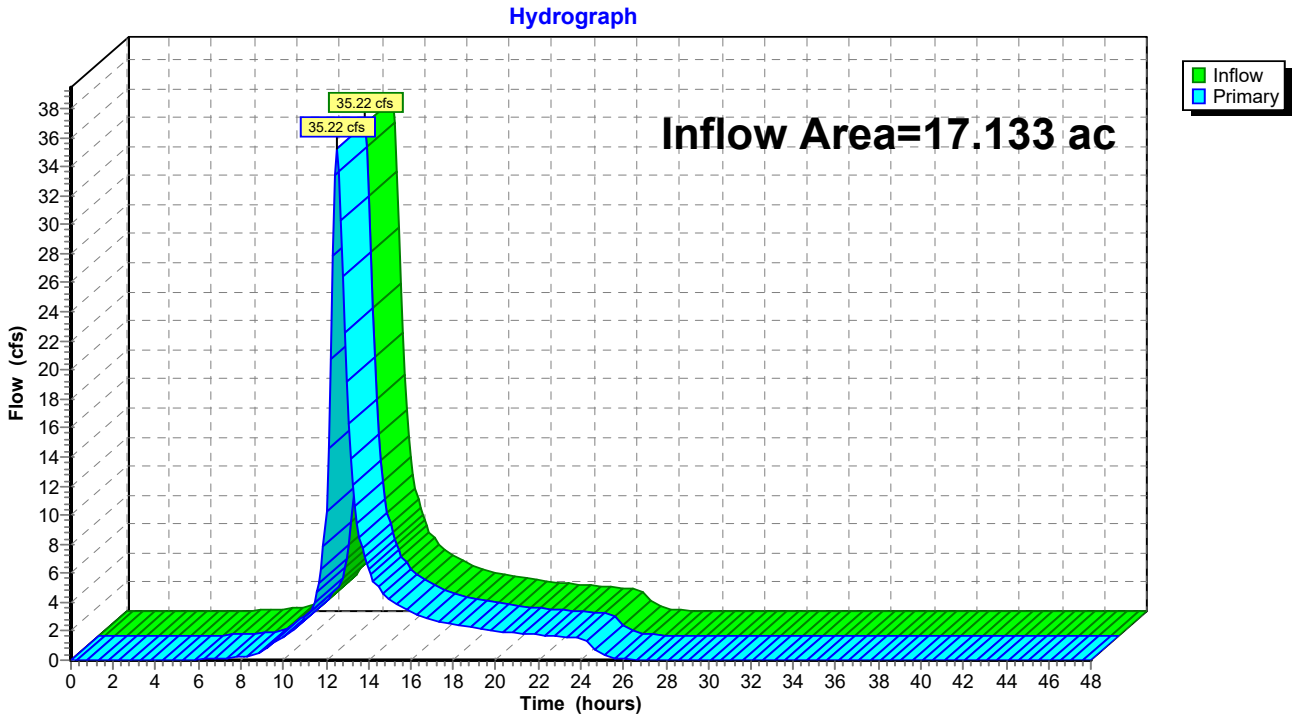


Summary for Link POI POST: POI - POST

Inflow Area = 17.133 ac, 4.61% Impervious, Inflow Depth = 4.19" for 100-yr event
Inflow = 35.22 cfs @ 12.51 hrs, Volume= 5.984 af
Primary = 35.22 cfs @ 12.51 hrs, Volume= 5.984 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: JAB DATE: 04/04/2017

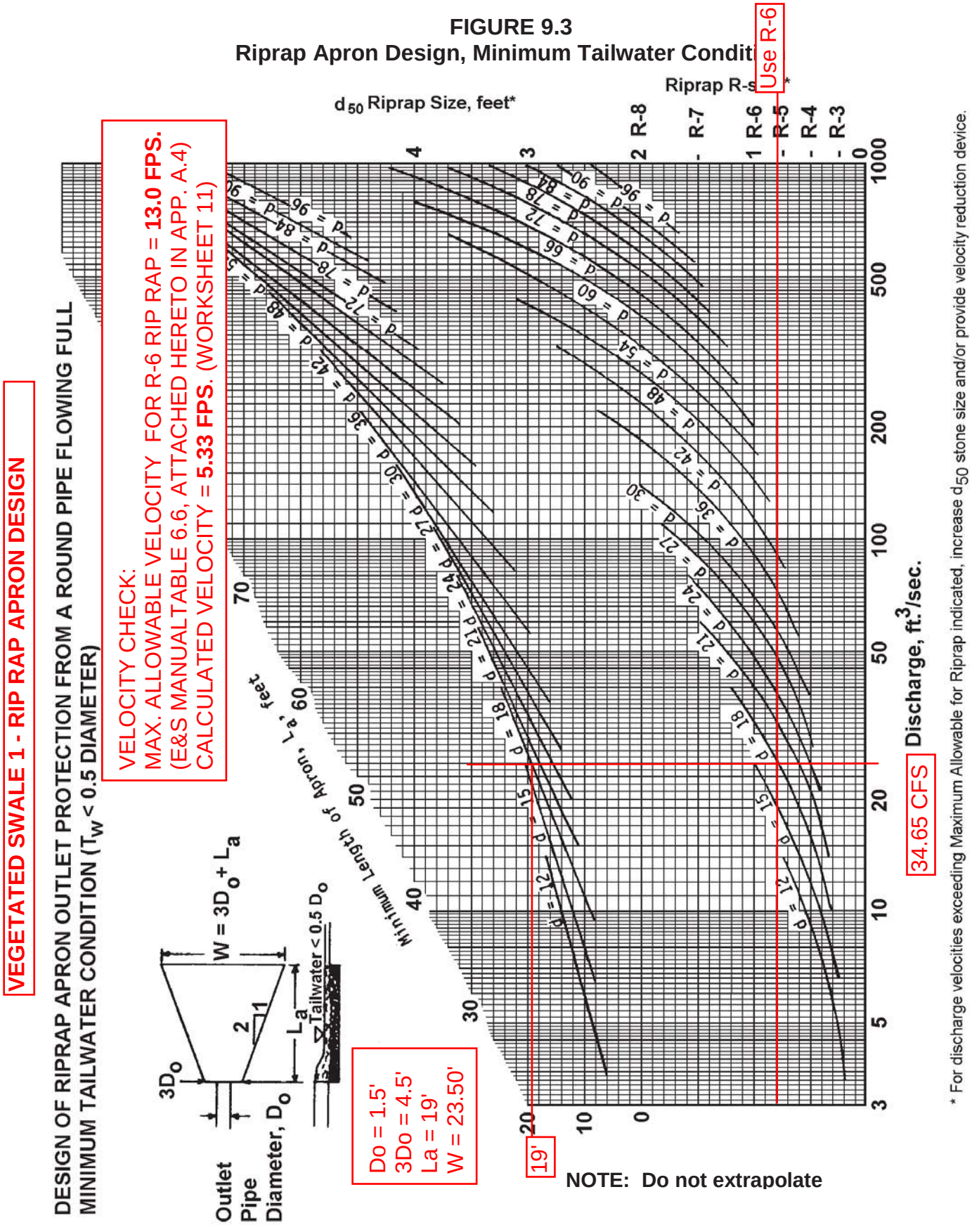
CHECKED BY: AJB DATE: 04/04/2017

CHANNEL OR CHANNEL SECTION		VEGETATED SWALE 1 LINING	VEGETATED SWALE 1 GRASS		
TEMPORARY OR PERMANENT?	(T OR P)	P	P		
DESIGN STORM	(2, 5, OR 10 YR)	10	10		
ACRES	(AC)	12.6	12.6		
MULTIPLIER[1]	(1.6, 2.25, or 2.75)[1]	2.75	2.75		
Qr (REQUIRED CAPACITY)	(CFS)	34.65	34.65		
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	33.95	34.57		
PROTECTIVE LINING[2]		SC250	GRASS/ SC250		
n (MANNING'S COEFFICIENT)[2]		***0.030***	0.055		
Va (ALLOWABLE VELOCITY)	(FPS)	N/A	N/A		
V (CALCULATED AT FLOW DEPTH d)	(FPS)	***5.33***	***3.43***		
τa (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	2.50	8.00		
τd (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	***1.30***	***1.75***		
CHANNEL BOTTOM WIDTH	(FT)	***3***	***3***		
CHANNEL SIDE SLOPES	(H:V)	3	3		
D (TOTAL DEPTH)	(FT)	2.0	2.0		
CHANNEL TOP WIDTH @ D	(FT)	15	15		
d (CALCULATED FLOW DEPTH)	(FT)	***1.04***	***1.40***		
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	***9.24***	***11.40***		
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	***2.88***	***2.14***		
d50 STONE SIZE	(IN)	N/A	N/A		
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	***6.36***	***10.08***		
R (HYDRAULIC RADIUS)		***0.66***	***0.85***		
S (BED SLOPE)[3]	(FT/FT)	0.02	0.02		
Sc (CRITICAL SLOPE)	(FT/FT)	***0.016***	0.048		
.7Sc	(FT/FT)	***0.011***	0.034		
1.3Sc	(FT/FT)	***0.020***	0.063		
STABLE FLOW?	(Y/N)	N	Y		
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	***0.42***	***0.36***		
FREEBOARD BASED ON STABLE FLOW	(FT)	0.50	0.50		
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.50	0.50		
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.

Source: 363-2134-008 / March 31, 2012 / Page 382

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Conditi



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

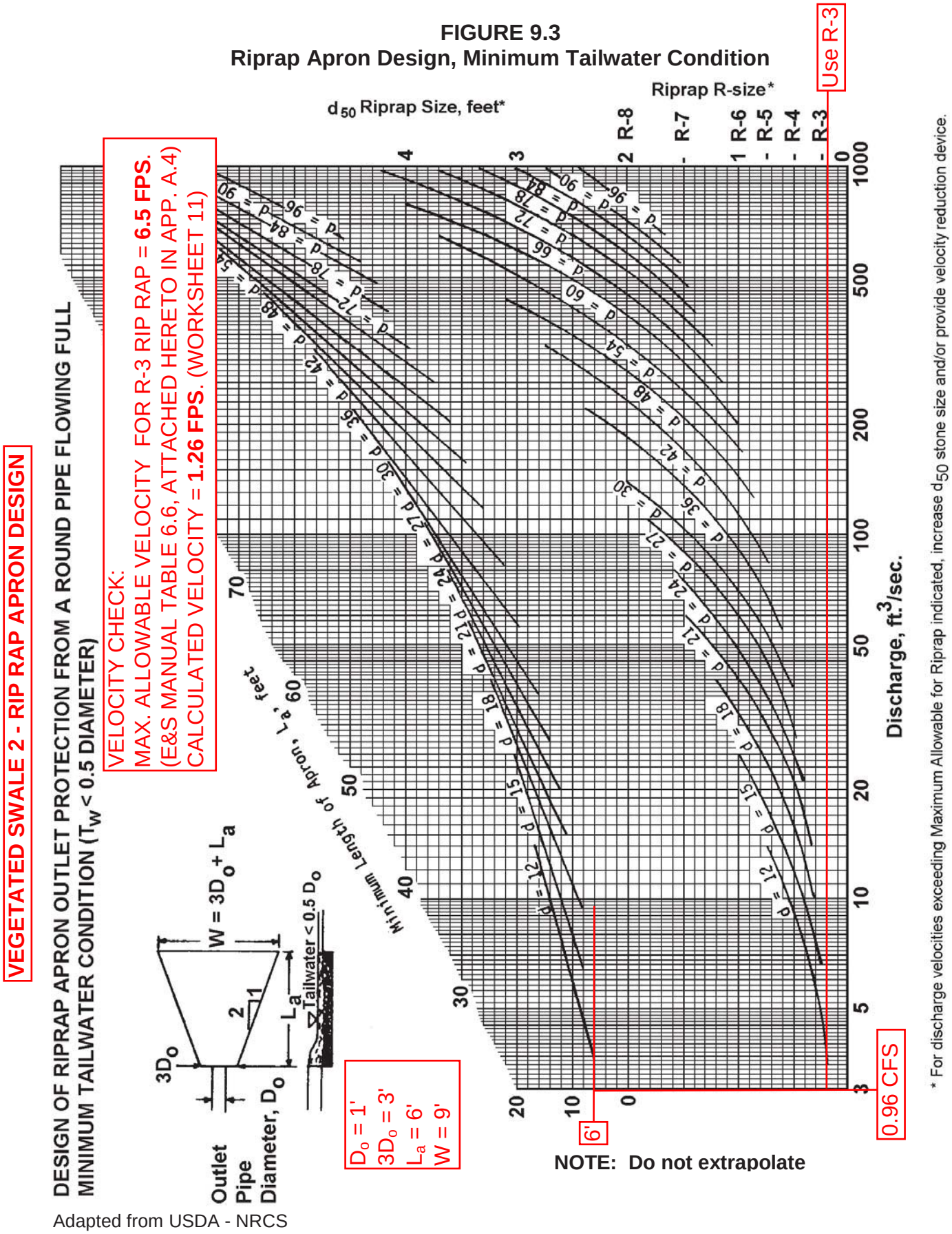
PREPARED BY: JEC DATE: 04/03/2015

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	0.95		
PROTECTIVE LINING[2]		S75	GRASS		
n (MANNING'S COEFFICIENT)[2]		0.055	0.090		
Va (ALLOWABLE VELOCITY)	(FPS)	N/A	N/A		
V (CALCULATED AT FLOW DEPTH d)	(FPS)	1.26	0.89		
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	0.39		
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	0.35		
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	3.62	4.10		
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	7.41	5.71		
d50 STONE SIZE	(IN)	N/A	N/A		
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	0.76	1.07		
R (HYDRAULIC RADIUS)		0.20	0.25		
S (BED SLOPE)[3]	(FT/FT)	0.018	0.018		
Sc (CRITICAL SLOPE)	(FT/FT)	0.077	0.192		
.7Sc	(FT/FT)	0.054	0.134		
1.3Sc	(FT/FT)	0.100	0.249		
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



Adapted from USDA - NRCS

Not to be used for Box Culverts

Summary for Subcatchment DA1: DITCH RELIEF CULVERT 1

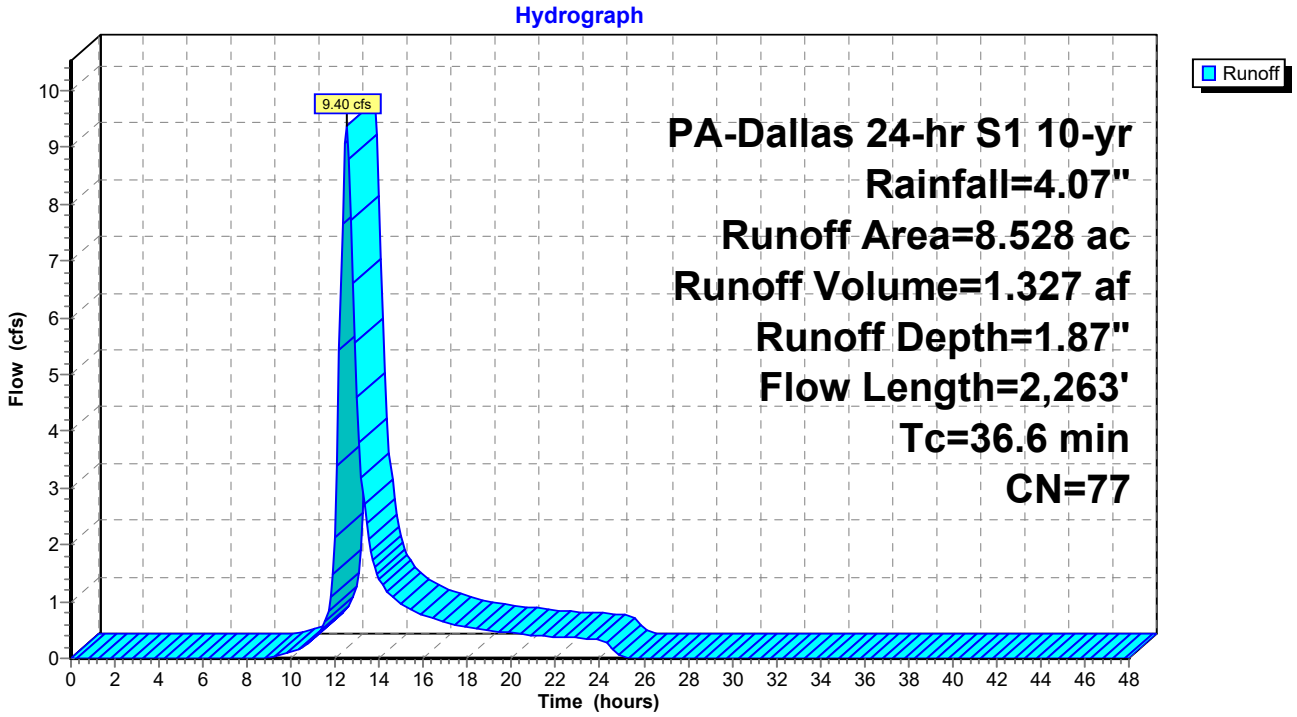
Runoff = 9.40 cfs @ 12.48 hrs, Volume= 1.327 af, Depth= 1.87"

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
	0.000	77	Woods, Good, HSG D
	1.600	78	Meadow, non-grazed, HSG D
*	0.177	91	Gravel areas, HSG D
*	0.802	98	Impervious areas, HSG D
	1.028	70	Woods, Good, HSG C
	4.337	71	Meadow, non-grazed, HSG C
*	0.050	89	Gravel areas, HSG C
*	0.534	98	Impervious areas, HSG C
	8.528	77	Weighted Average
	7.192		84.33% Pervious Area
	1.336		15.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment DA1: DITCH RELIEF CULVERT 1



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Apr 12 2017

Ditch Relief Culvert 1

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

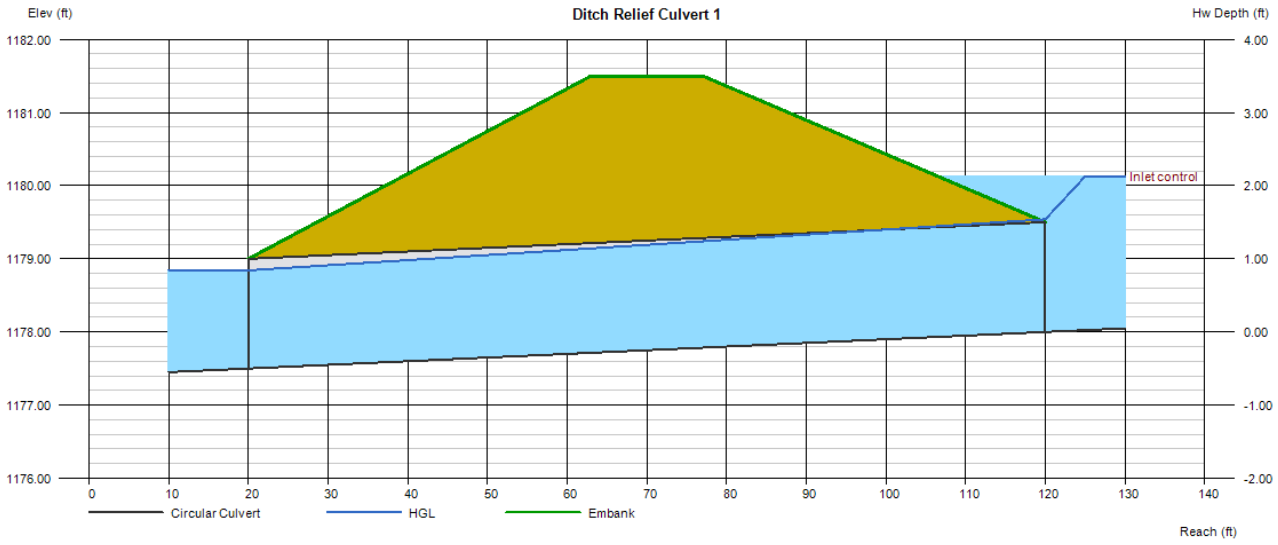
Top Elevation (ft)	=	1181.50
Top Width (ft)	=	14.00
Crest Width (ft)	=	14.00

Calculations

Qmin (cfs)	=	9.40
Qmax (cfs)	=	9.40
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	9.40
Qpipe (cfs)	=	9.40
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.64
Veloc Up (ft/s)	=	5.32
HGL Dn (ft)	=	1178.84
HGL Up (ft)	=	1179.54
Hw Elev (ft)	=	1180.13
Hw/D (ft)	=	1.42
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Apr 12 2017

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)	= 9.40

Highlighted

Depth (ft)	= 1.04
Q (cfs)	= 9.400
Area (sqft)	= 1.31
Velocity (ft/s)	= 7.18
Wetted Perim (ft)	= 2.95
Crit Depth, Yc (ft)	= 1.19
Top Width (ft)	= 1.38
EGL (ft)	= 1.84

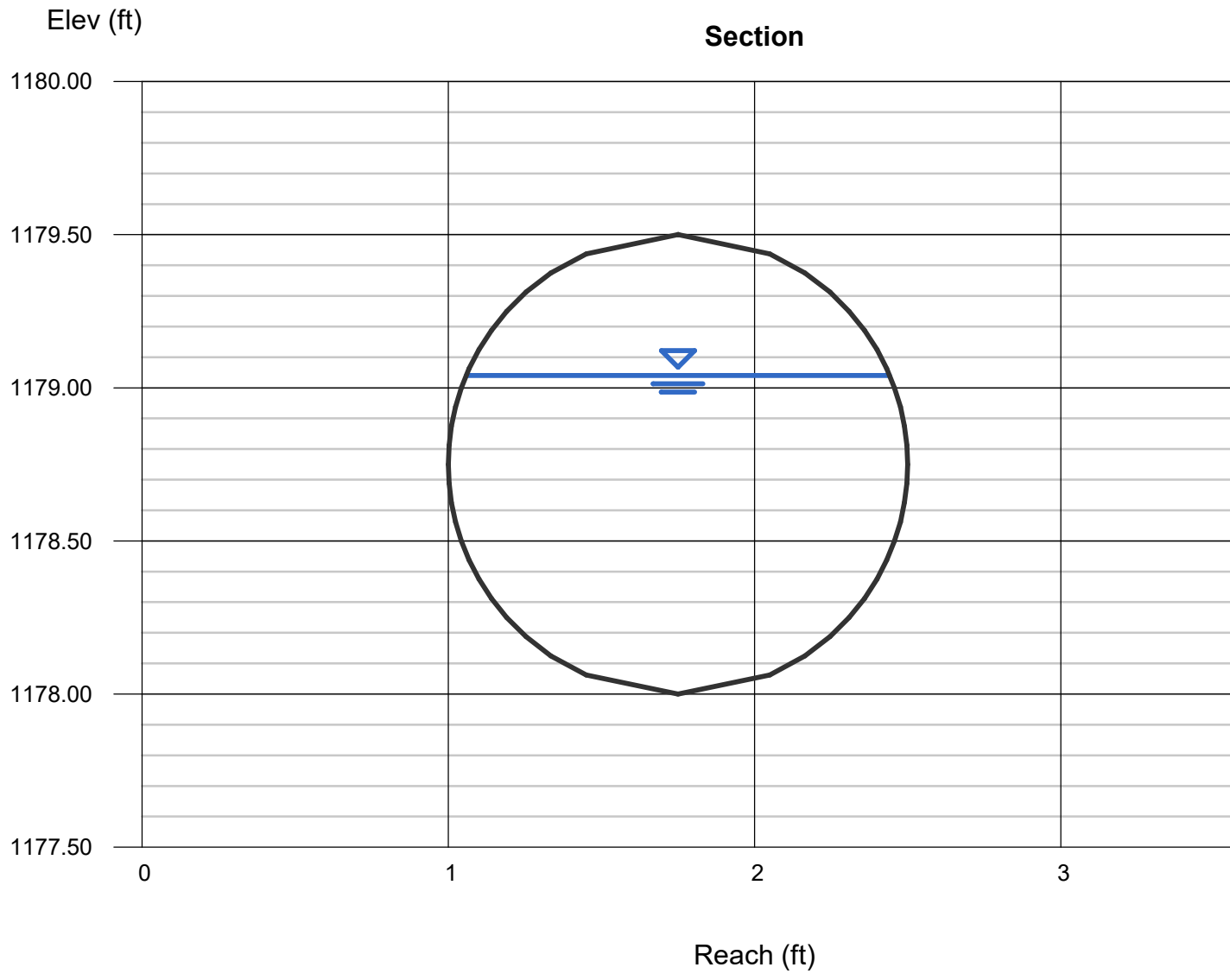
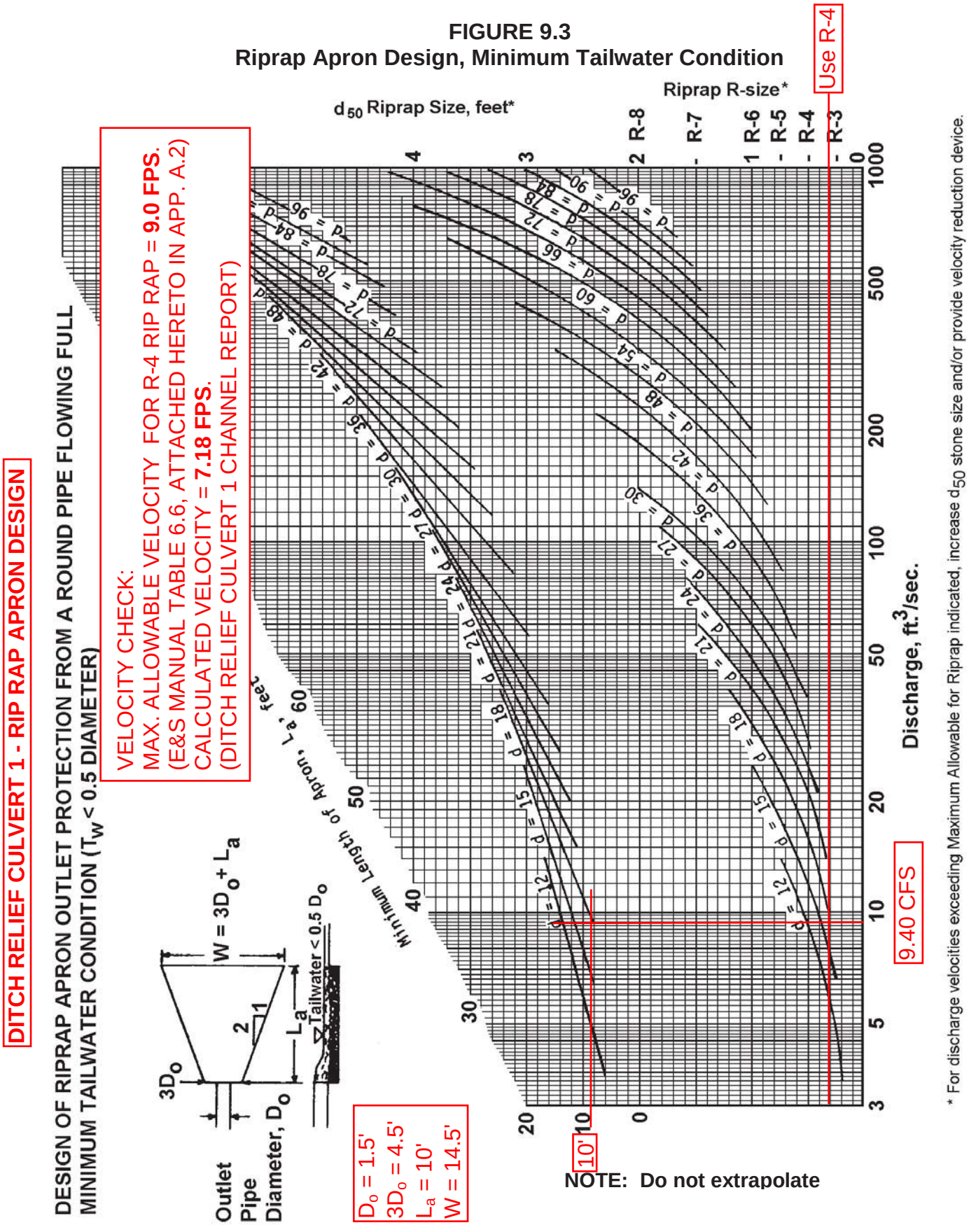


FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



Adapted from USDA - NRCS

Not to be used for Box Culverts

Summary for Subcatchment DA2: DITCH RELIEF CULVERT 2

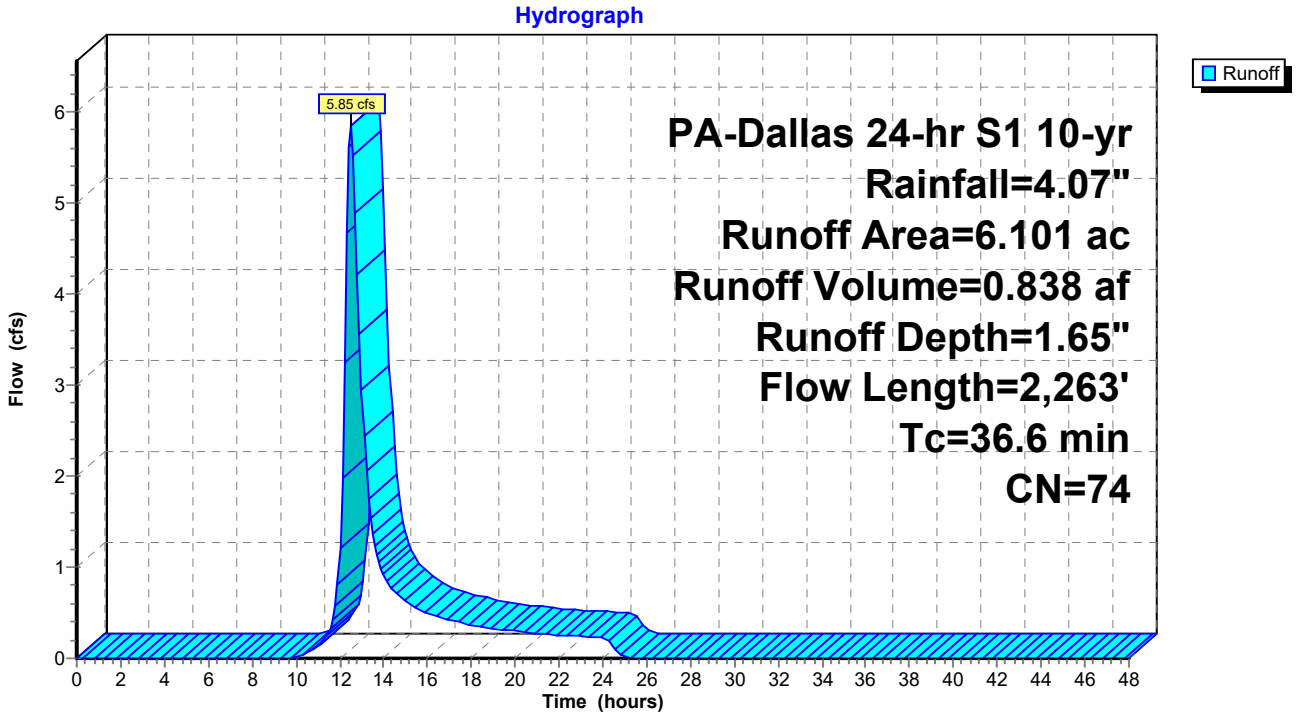
Runoff = 5.85 cfs @ 12.49 hrs, Volume= 0.838 af, Depth= 1.65"

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 10-yr Rainfall=4.07"

	Area (ac)	CN	Description
	0.178	77	Woods, Good, HSG D
	0.833	78	Meadow, non-grazed, HSG D
*	0.116	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	1.028	70	Woods, Good, HSG C
	3.656	71	Meadow, non-grazed, HSG C
*	0.050	89	Gravel areas, HSG C
*	0.240	98	Impervious areas, HSG C
	6.101	74	Weighted Average
	5.861		96.07% Pervious Area
	0.240		3.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment DA2: DITCH RELIEF CULVERT 2



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Apr 12 2017

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

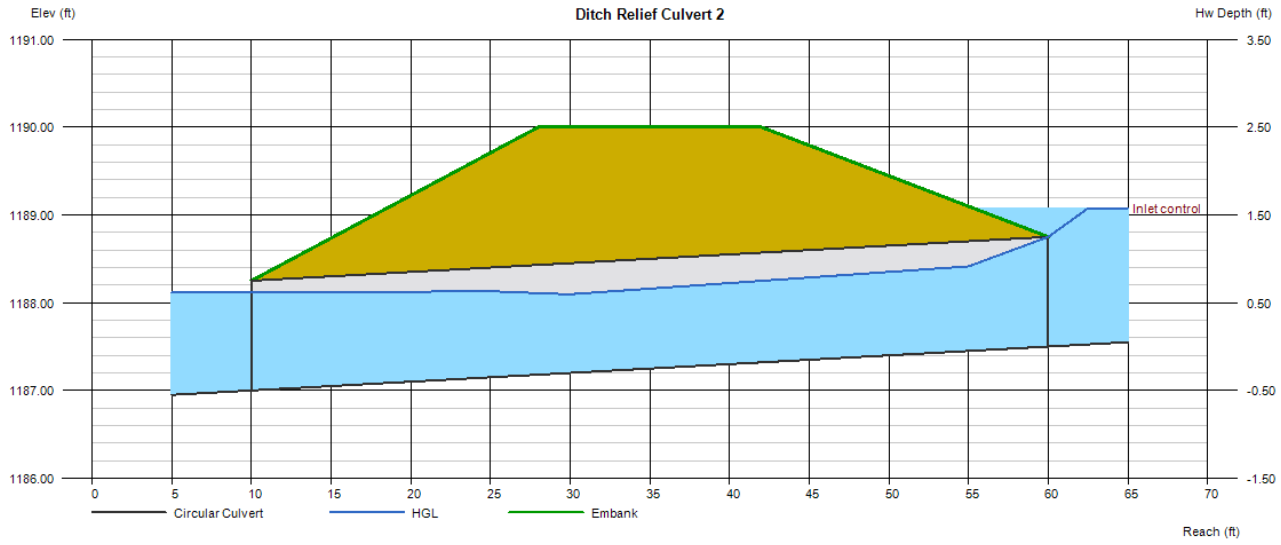
Top Elevation (ft)	=	1190.00
Top Width (ft)	=	14.00
Crest Width (ft)	=	14.00

Calculations

Qmin (cfs)	=	5.85
Qmax (cfs)	=	5.85
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	5.85
Qpipe (cfs)	=	5.85
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.07
Veloc Up (ft/s)	=	5.68
HGL Dn (ft)	=	1188.11
HGL Up (ft)	=	1188.48
Hw Elev (ft)	=	1189.08
Hw/D (ft)	=	1.26
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Apr 12 2017

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)	= 5.85

Highlighted

Depth (ft)	= 0.88
Q (cfs)	= 5.850
Area (sqft)	= 0.93
Velocity (ft/s)	= 6.32
Wetted Perim (ft)	= 2.49
Crit Depth, Yc (ft)	= 0.98
Top Width (ft)	= 1.14
EGL (ft)	= 1.50

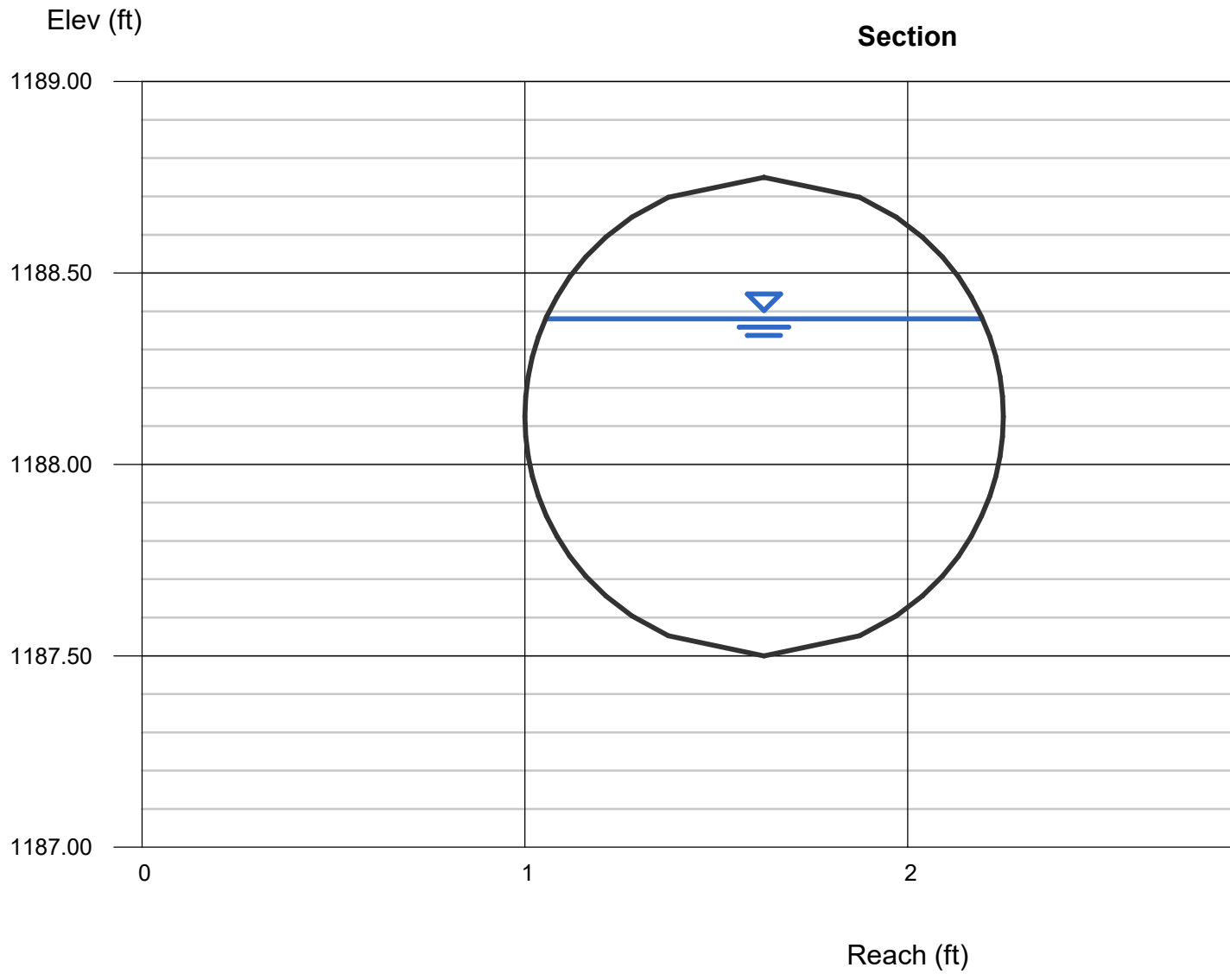
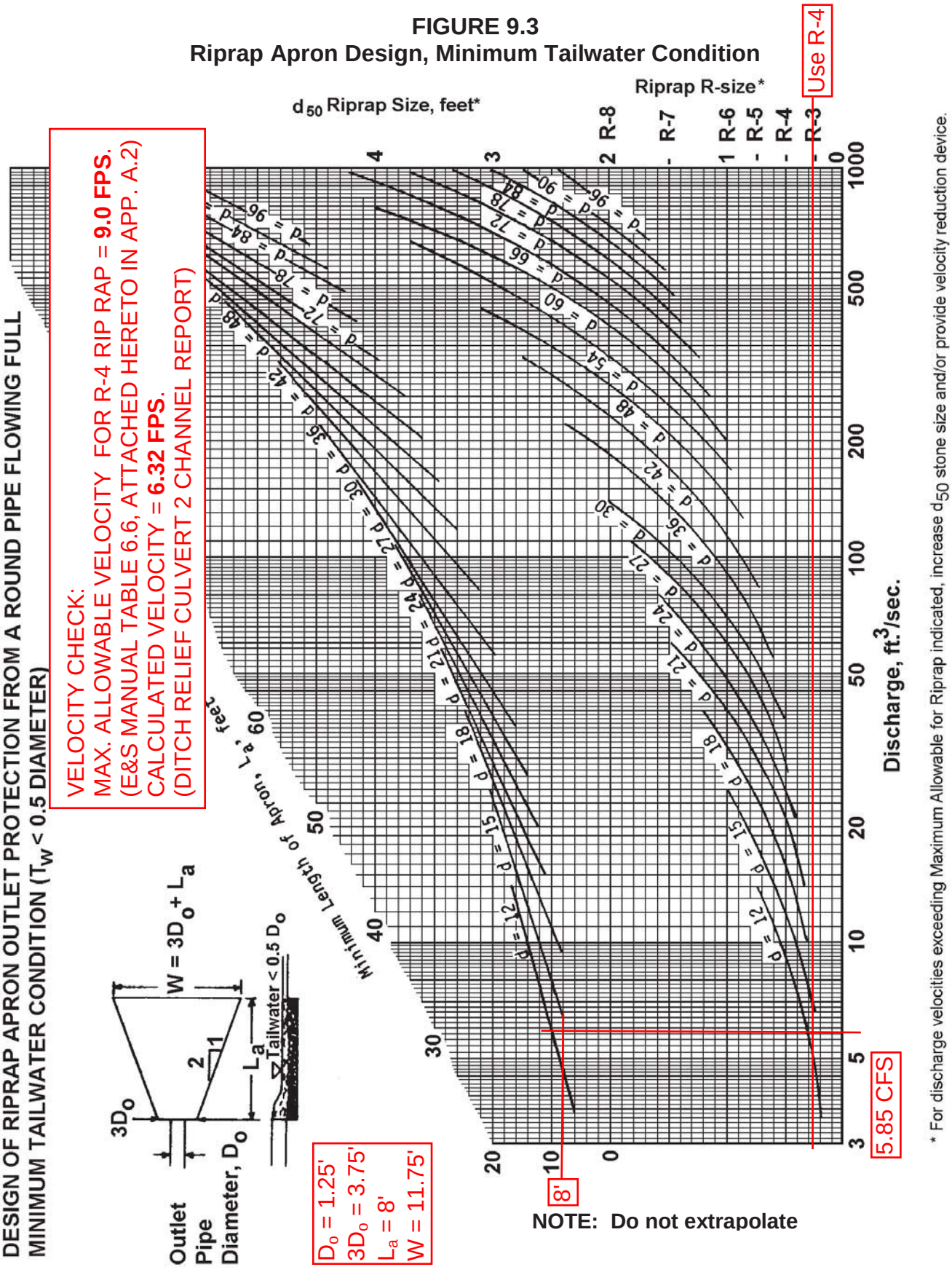


FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition

DITCH RELIEF CULVERT 2 - RIP RAP APRON DESIGN

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 = **6.32 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

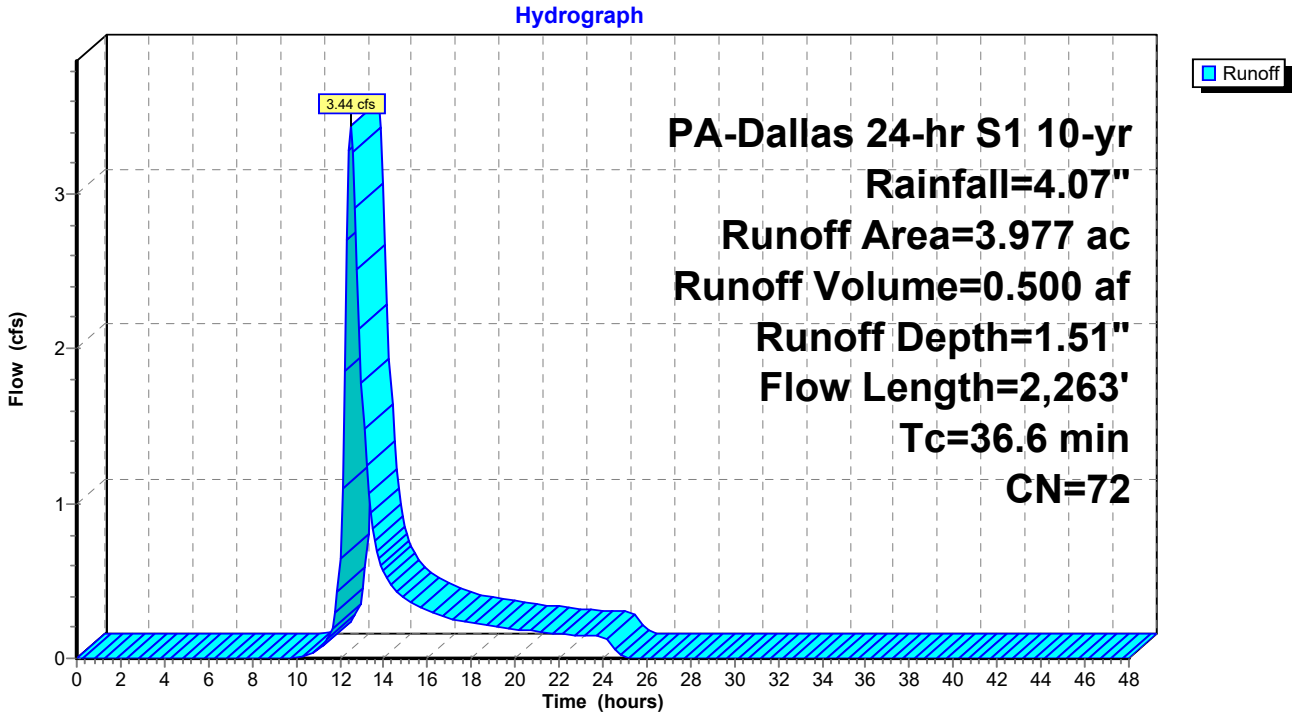
Runoff = 3.44 cfs @ 12.50 hrs, Volume= 0.500 af, Depth= 1.51"

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
	0.027	77	Woods, Good, HSG D
	0.111	78	Meadow, non-grazed, HSG D
*	0.045	91	Gravel areas, HSG D
*	0.000	98	Impervious areas, HSG D
	0.982	70	Woods, Good, HSG C
	2.616	71	Meadow, non-grazed, HSG C
*	0.050	89	Gravel areas, HSG C
*	0.146	98	Impervious areas, HSG C
	3.977	72	Weighted Average
	3.831		96.33% Pervious Area
	0.146		3.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.0250	0.08		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	156	0.0750	1.92		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
0.4	30	0.0760	1.38		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
5.1	435	0.0410	1.42		**Shallow Concentrated Flow, SCF 3** Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0220	3.01		**Shallow Concentrated Flow, SCF 4** Paved Kv= 20.3 fps
8.4	1,480	0.0380	2.92		**Shallow Concentrated Flow, SCF 5** Grassed Waterway Kv= 15.0 fps
36.6	2,263	Total			

Subcatchment DA3: DITCH RELIEF CULVERT 3



Culvert Report

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

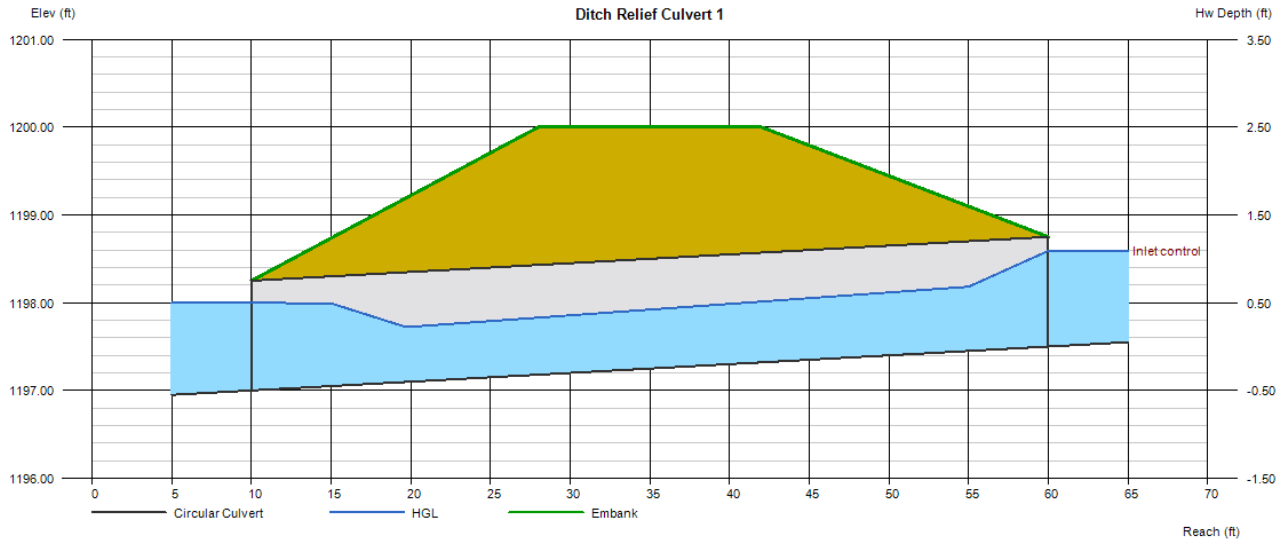
Top Elevation (ft)	=	1200.00
Top Width (ft)	=	14.00
Crest Width (ft)	=	14.00

Calculations

Qmin (cfs)	=	3.44
Qmax (cfs)	=	3.44
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	3.44
Qpipe (cfs)	=	3.44
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.27
Veloc Up (ft/s)	=	4.49
HGL Dn (ft)	=	1198.00
HGL Up (ft)	=	1198.25
Hw Elev (ft)	=	1198.59
Hw/D (ft)	=	0.87
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Apr 12 2017

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)	= 3.44

Highlighted

Depth (ft)	= 0.62
Q (cfs)	= 3.440
Area (sqft)	= 0.61
Velocity (ft/s)	= 5.65
Wetted Perim (ft)	= 1.96
Crit Depth, Yc (ft)	= 0.75
Top Width (ft)	= 1.25
EGL (ft)	= 1.12

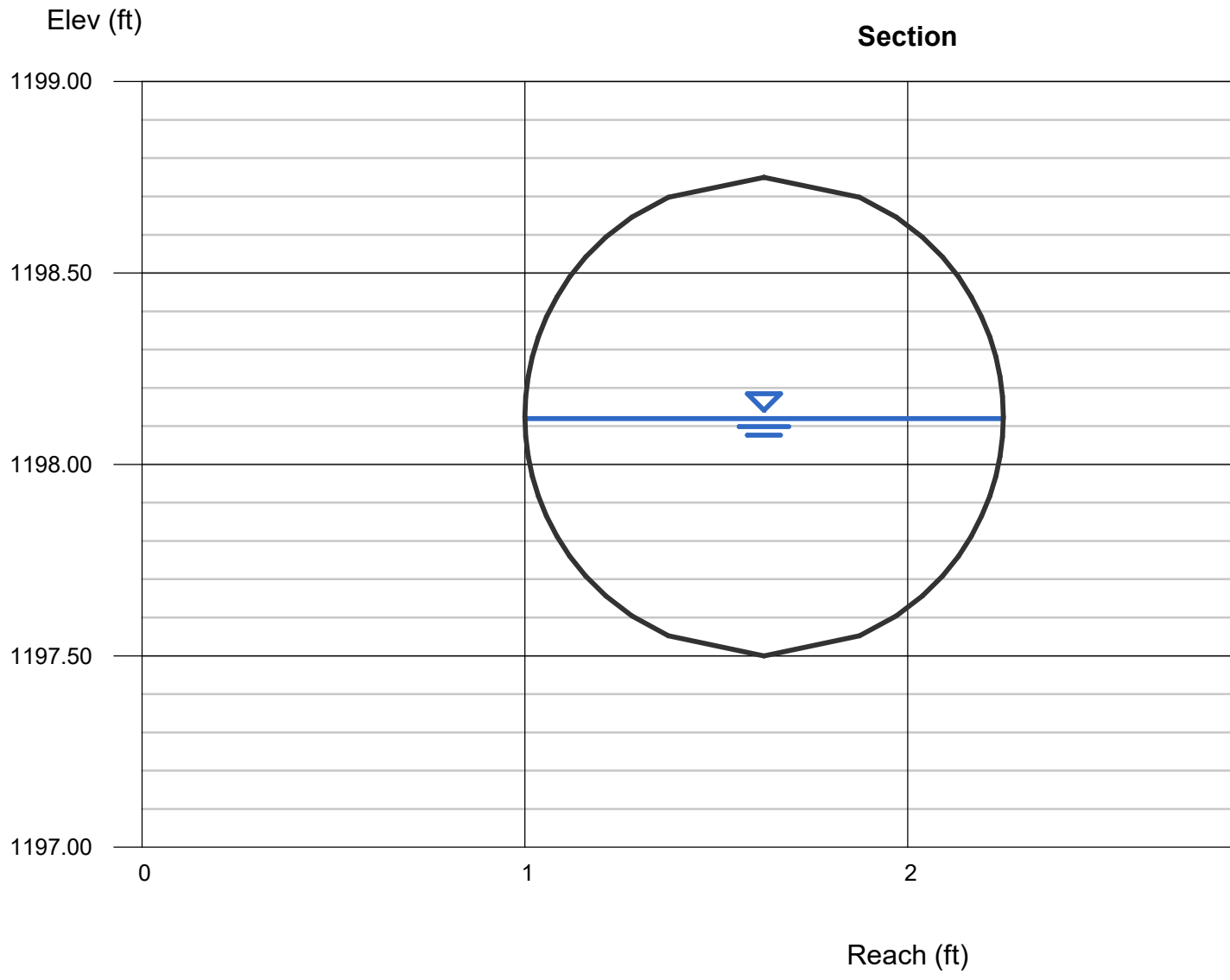
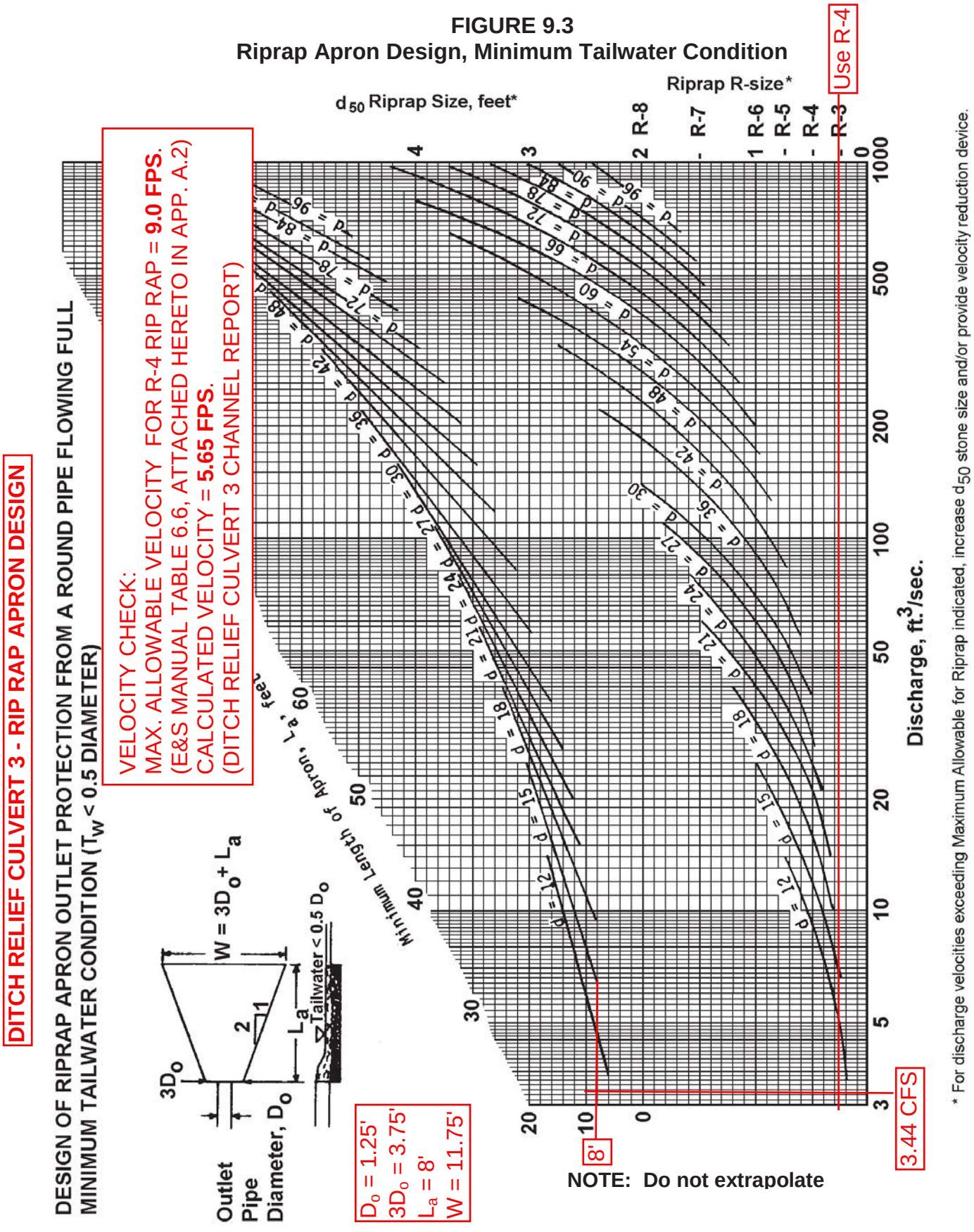


FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition

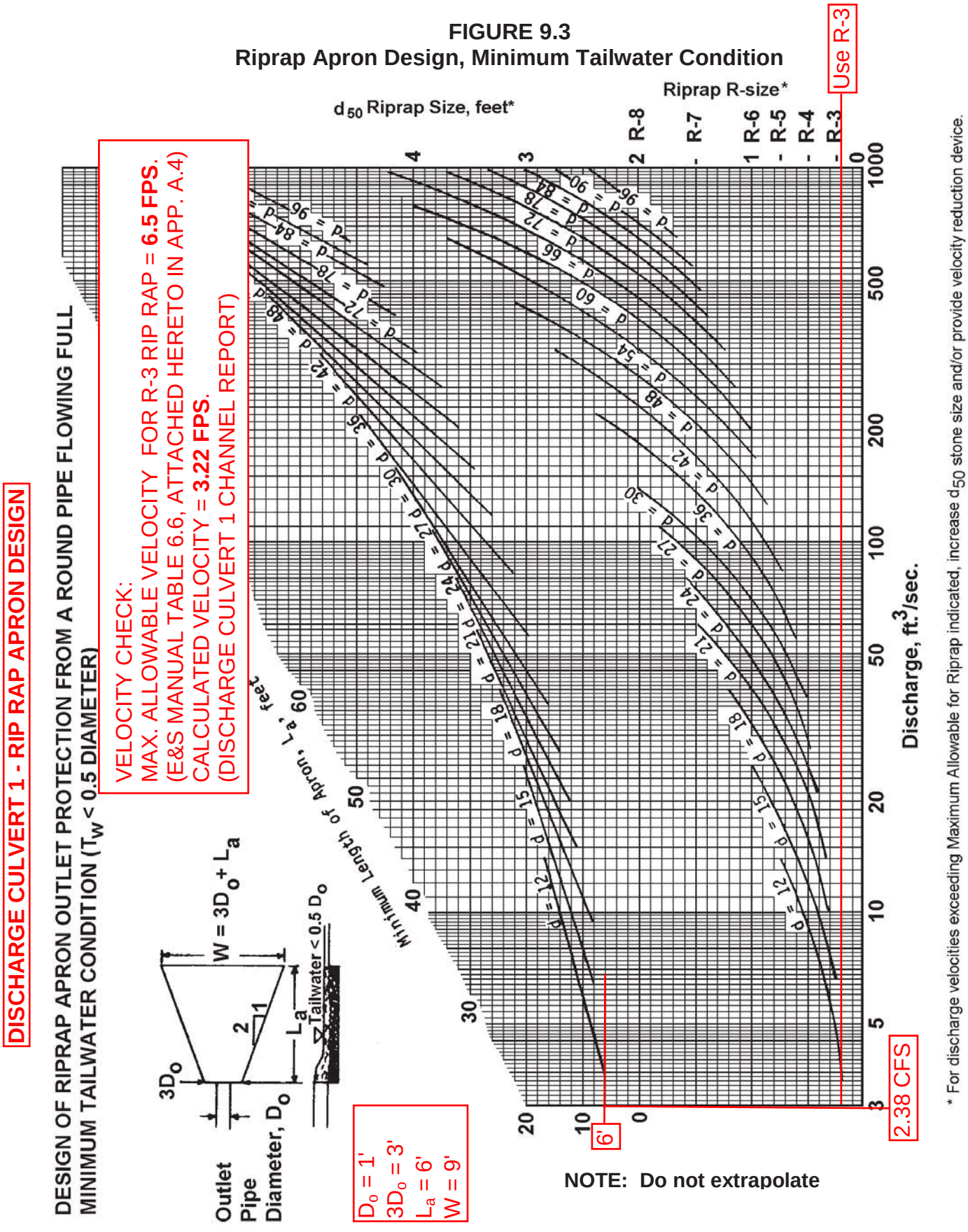


Adapted from USDA - NRCS

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	0.01	24	1,182.01	0.00
5.00	0.03	90	1,182.04	0.01
6.00	0.05	171	1,182.07	0.02
7.00	0.06	241	1,182.10	0.05
8.00	0.09	302	1,182.13	0.07
9.00	0.12	364	1,182.15	0.10
10.00	0.17	443	1,182.18	0.15
11.00	0.29	575	1,182.24	0.24
12.00	**2.66**	**1,519**	**1,182.59**	**1.27**
13.00	**0.42**	**1,026**	**1,182.41**	**0.67**
14.00	0.26	653	1,182.27	0.30
15.00	0.19	543	1,182.23	0.21
16.00	0.16	483	1,182.20	0.17
17.00	0.14	442	1,182.18	0.15
18.00	0.12	412	1,182.17	0.13
19.00	0.11	389	1,182.16	0.11
20.00	0.10	370	1,182.16	0.10
21.00	0.09	354	1,182.15	0.10
22.00	0.09	341	1,182.14	0.09
23.00	0.08	330	1,182.14	0.08
24.00	0.08	319	1,182.13	0.08
25.00	0.00	179	1,182.08	0.03
26.00	0.00	117	1,182.05	0.01
27.00	0.00	86	1,182.04	0.01
28.00	0.00	67	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	35	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	1,182.00	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

DEWATERING TIME: 28 HRS.

ATLANTIC SUNRISE PROJECT
NORTH DIAMOND REGULATOR STATION VEGETATED SWALE VOLUME

4/3/2017

VEGETATED SWALE 1

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 =	34	
Volume total =	2649	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

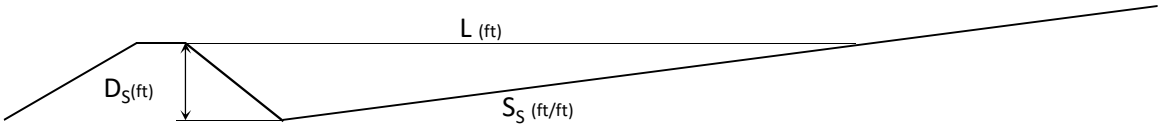
L =	56	ft
W_T =	8	ft
$W_T + W_B$ =	10	ft
V =	140	cf
No. of check dams =	3	
Volume total =	419	cf

Cumulative Volume for pollutant removal = 2649 cf

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

4/3/2017

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):



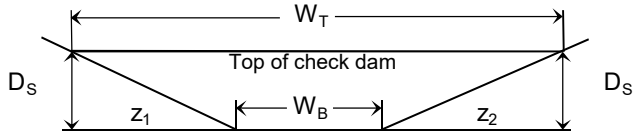
$L = D_S/S_S$

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:

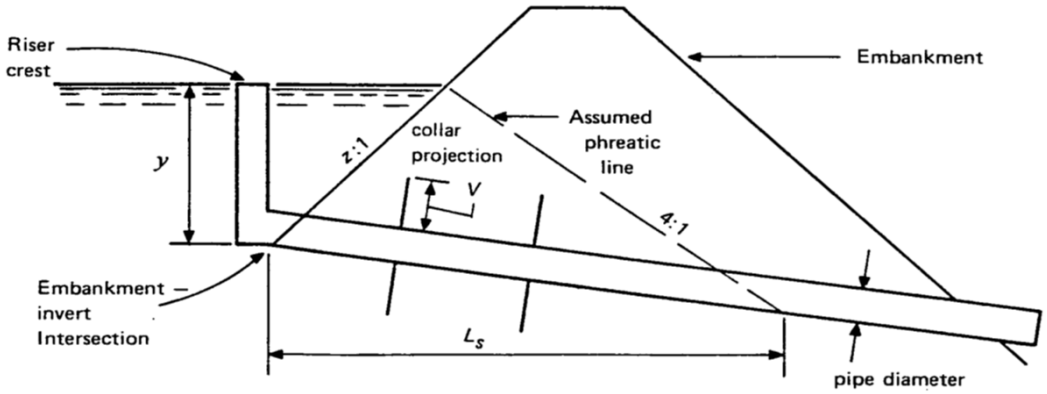
$W_T = W_B + z_1 + z_2$

Where: W_B = rock filter bottom width

z_1 = side slope

z_2 = side slope

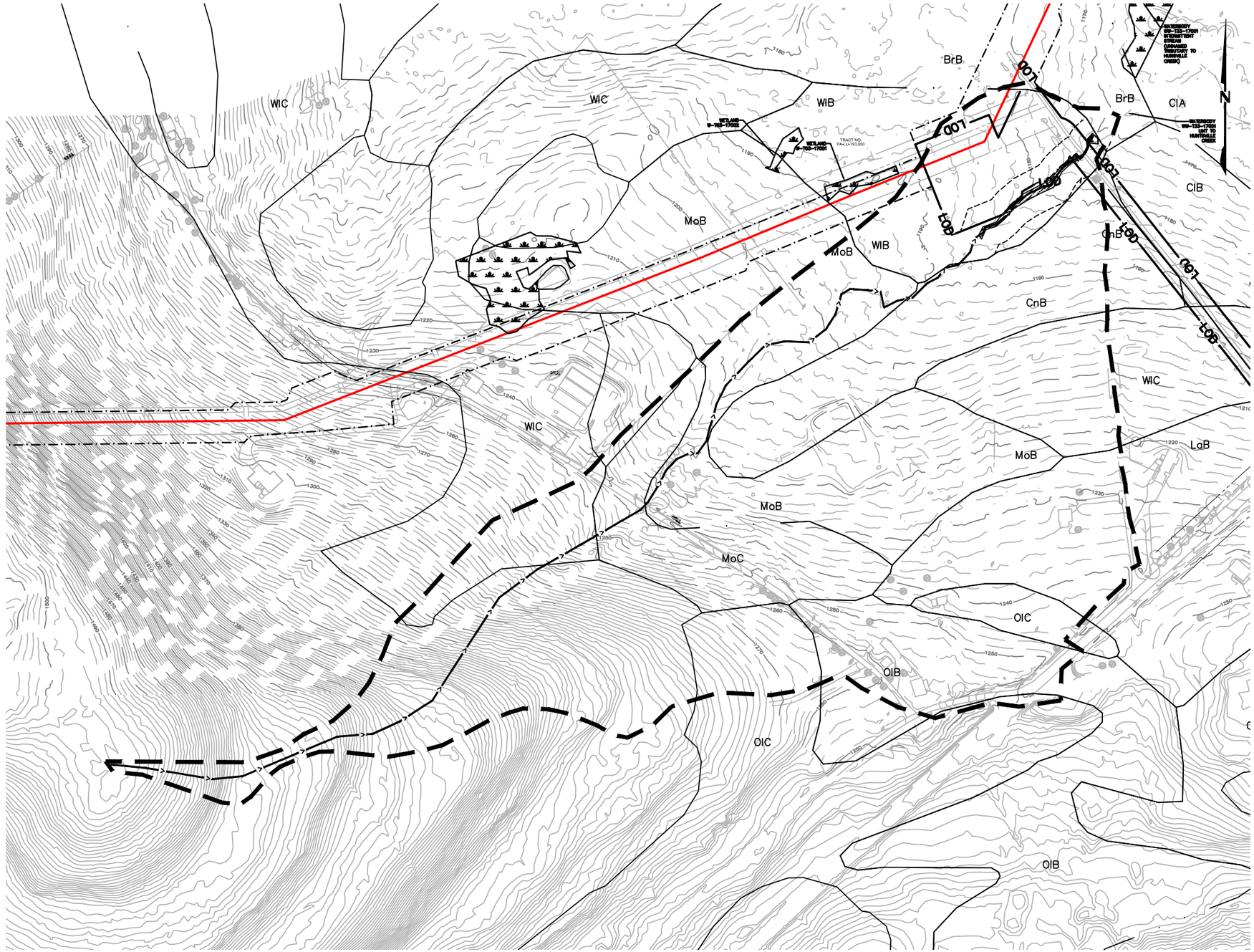
STANDARD WORKSHEET #18
Anti-seep Collar Design



BASIN NO.	TEMP. OR PERM.	Y (FT)	Z	Ls (FT)	Lf (FT)	V (IN)	BARRELL DIA. (IN)	COLLAR SIZE (IN)	NO. COLLARS	COLLAR SPACING (FT)	DISTANCE TO 1ST COLLAR (FT)
1	PERM.	1.00	3	10.00	11.00	9	16	34	1	n/a	10.00

Source: 363-2134-008 / March 31, 2012 / Page 389

A.5 Water Quality Worksheets



LEGEND

- PROPERTY BOUNDARY LINE (APPROXIMATE)
- 1460 — EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' INTERVAL)
- X — FENCE
- STONE ROW
- SOIL BOUNDARY
- TREELINE
- CENTERLINE STREAM/EDGE WATERBODY
- DELINEATED WETLANDS
- WsB — SOIL TYPE DESIGNATION
- EXISTING ROAD
- ROW
- LIMITS OF FLOODWAY/ FLOODPLAN
- 1480 — 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

GRAPHIC SCALE
300 150 0 300
SCALE IN FEET
1 inch = 300 ft.

BL Companies
ARCHITECTURE
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4242 Carlisle Pike, Suite 260
Camp Hill, PA 17011
(717) 651-9850
(717) 651-9858 Fax

NORTH DIAMOND REGULATOR STREAM HYDROLOGY

TRANS CONTINENTAL GAS PIPELINE COMPANY
ATLANTIC SUNRISE PROJECT – PROPOSED 30" NATURAL GAS PIPELINE
LEHMAN TOWNSHIP, LUZERNE COUNTY, PENNSYLVANIA

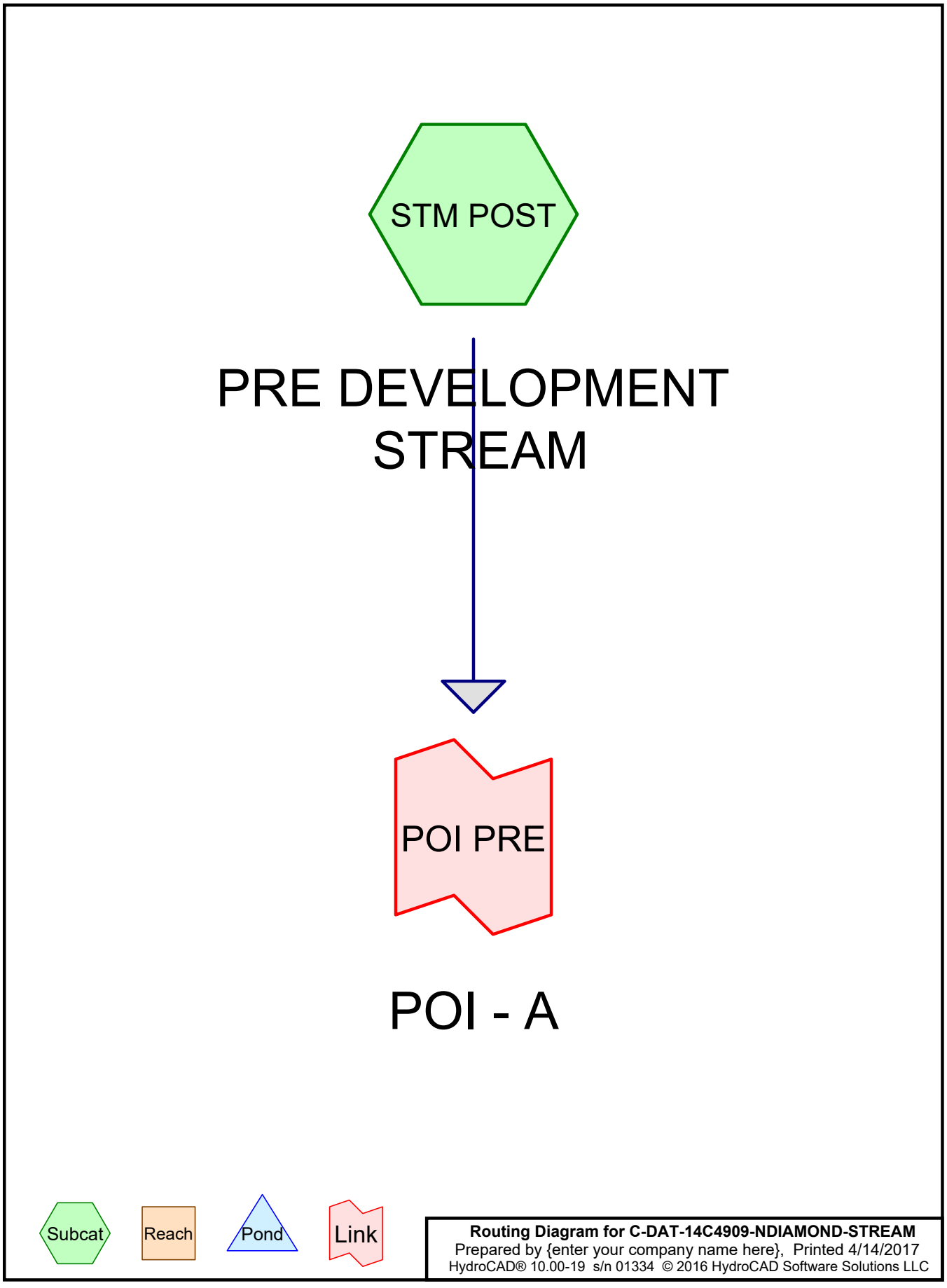
Designed	J.A.B.
Drawn	J.A.B.
Checked	
Approved	
Scale	1"=300'
Project No.	14C4909
Date	03/22/17

CSK-STREAM

CAD File FRS_PCSM14C4909(10)_NDIAMOND

PROJECT:	Atlantic Sunrise Project - North Diamond Regulator Station
SUB-BASIN:	
Municipality:	Lehman Township
County:	Luzerne County

Existing 2-Year Stream Volume Run-off:	3.533	acre-feet
	153,897	Cubic Feet
Volume Increase Per Worksheet 5:	513	Cubic Feet
Percent Increase:	0.33%	



Routing Diagram for C-DAT-14C4909-NDIAMOND-STREAM
Prepared by {enter your company name here}, Printed 4/14/2017

Summary for Subcatchment STM POST: PRE DEVELOPMENT STREAM

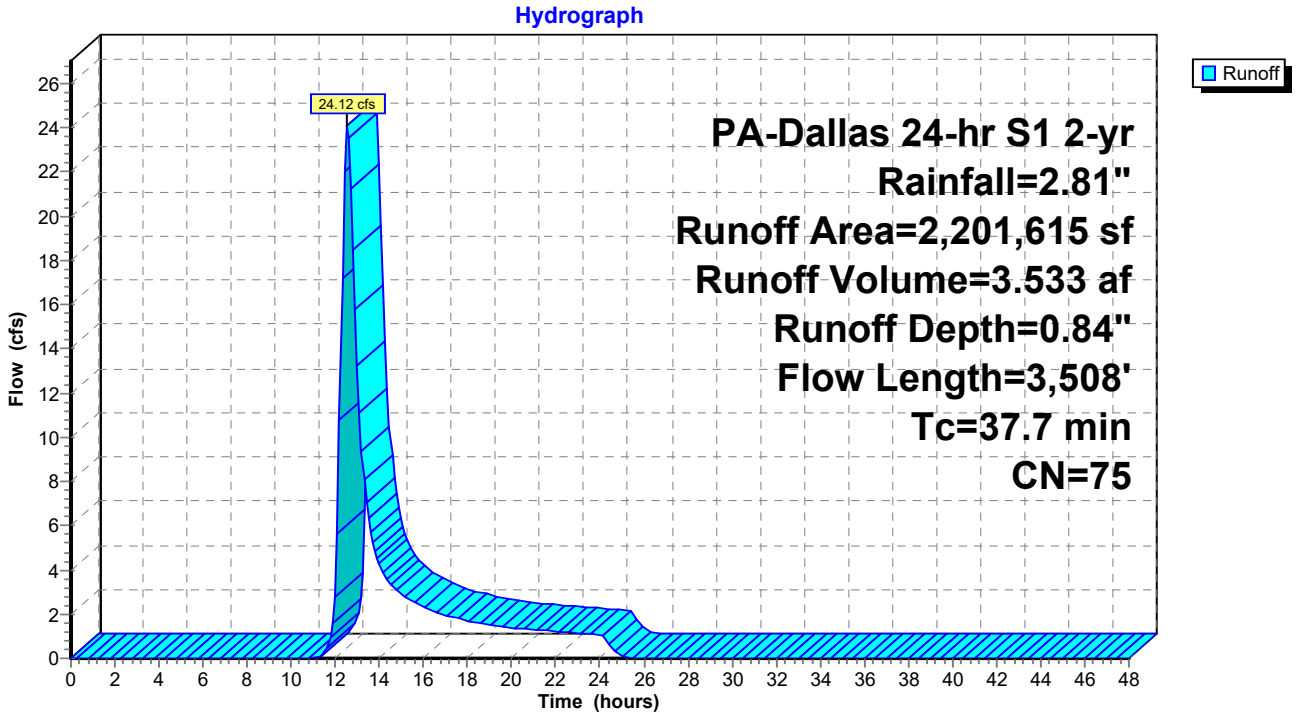
Runoff = 24.12 cfs @ 12.53 hrs, Volume= 3.533 af, Depth= 0.84"

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
	993,415	77	Woods, Good, HSG D
	308,750	78	Meadow, non-grazed, HSG D
*	10,900	91	Gravel areas, HSG D
*	21,565	98	Impervious areas, HSG C
	442,280	70	Woods, Good, HSG C
	412,900	71	Meadow, non-grazed, HSG C
*	11,805	89	Gravel areas, HSG C
	2,201,615	75	Weighted Average
	2,180,050		99.02% Pervious Area
	21,565		0.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	100	0.0600	0.11		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.81"
1.9	268	0.2160	2.32		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
3.6	285	0.0700	1.32		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
8.9	1,085	0.1640	2.02		**Shallow Concentrated Flow, SCF 3** Woodland Kv= 5.0 fps
8.5	1,770	0.0530	3.45		**Shallow Concentrated Flow, SCF 4** Grassed Waterway Kv= 15.0 fps
37.7	3,508	Total			

Subcatchment STM POST: PRE DEVELOPMENT STREAM

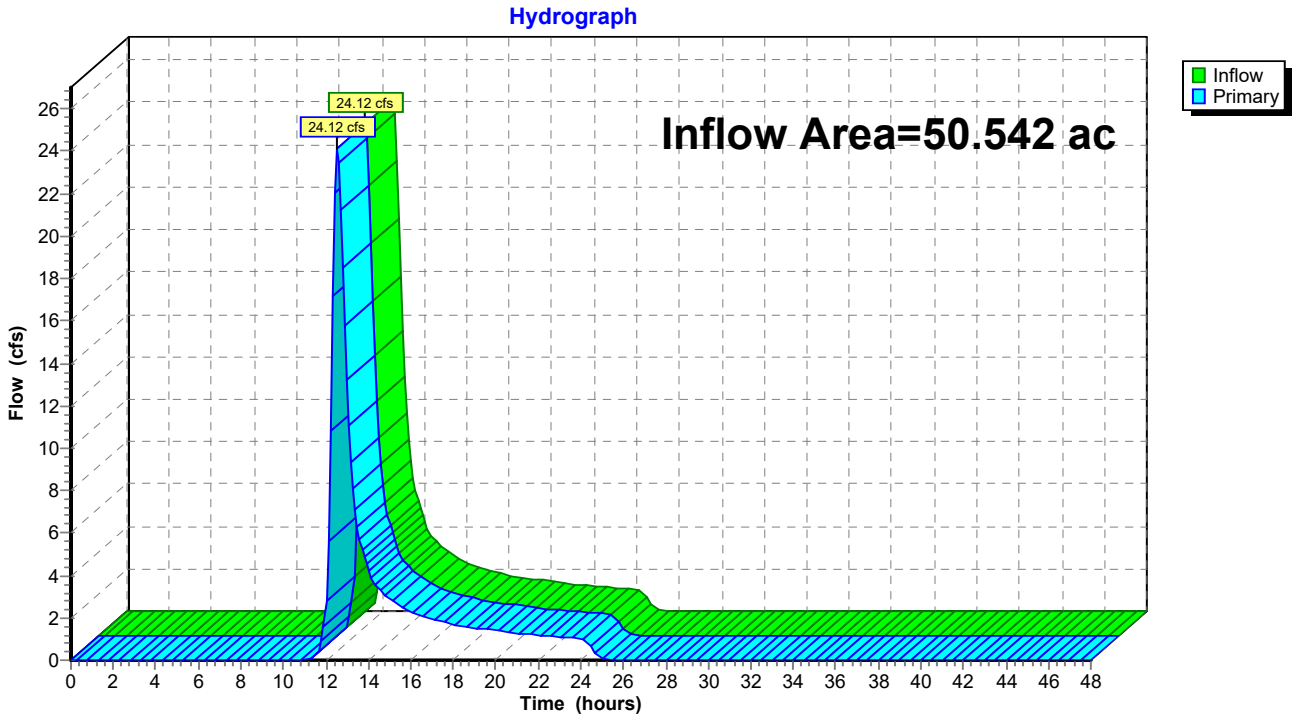


Summary for Link POI PRE: POI - A

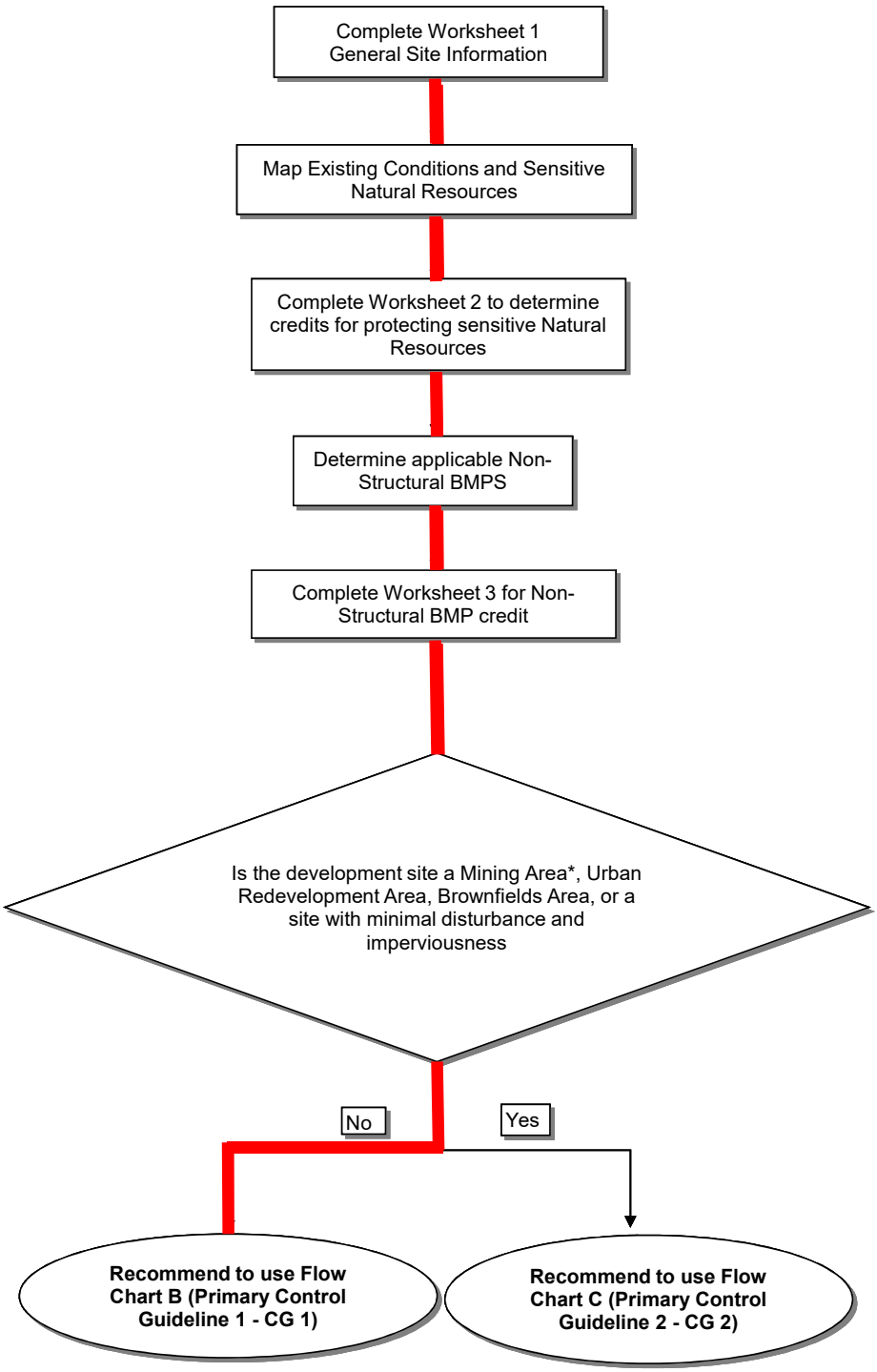
Inflow Area = 50.542 ac, 0.98% Impervious, Inflow Depth = 0.84" for 2-yr event
Inflow = 24.12 cfs @ 12.53 hrs, Volume= 3.533 af
Primary = 24.12 cfs @ 12.53 hrs, Volume= 3.533 af, Atten= 0%, Lag= 0.0 min

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

Link POI PRE: POI - A



FLOW CHART A
Stormwater Calculation Process



Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: 3-Apr-17

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**	**0.00**
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***	***0.00***

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

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

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

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

TOTAL - **Ac.**

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

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction

Lawn ____ ft^2 x 1/4" x 1/12 = - ft^3

Meadow ____ ft^2 x 1/3" x 1/12 = - ft^3

3.3 Protect Existing Trees

For Trees within 100 feet of impervious area:

Tree Canopy ____ ft^2 x 1/2" x 1/12 = - ft^3

For Trees within 20 feet of impervious area:

Tree Canopy ____ x 1/12 = - ft^3

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 ft^2 x 1/12 = **10.39** ft^3

For all other disconnected roof areas

Roof Area ____ ft^2 x 1/4" x 1/12 = - ft^3

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 48,350 ft^2 x 1/3" x 1/12 = **1,343** ft^3

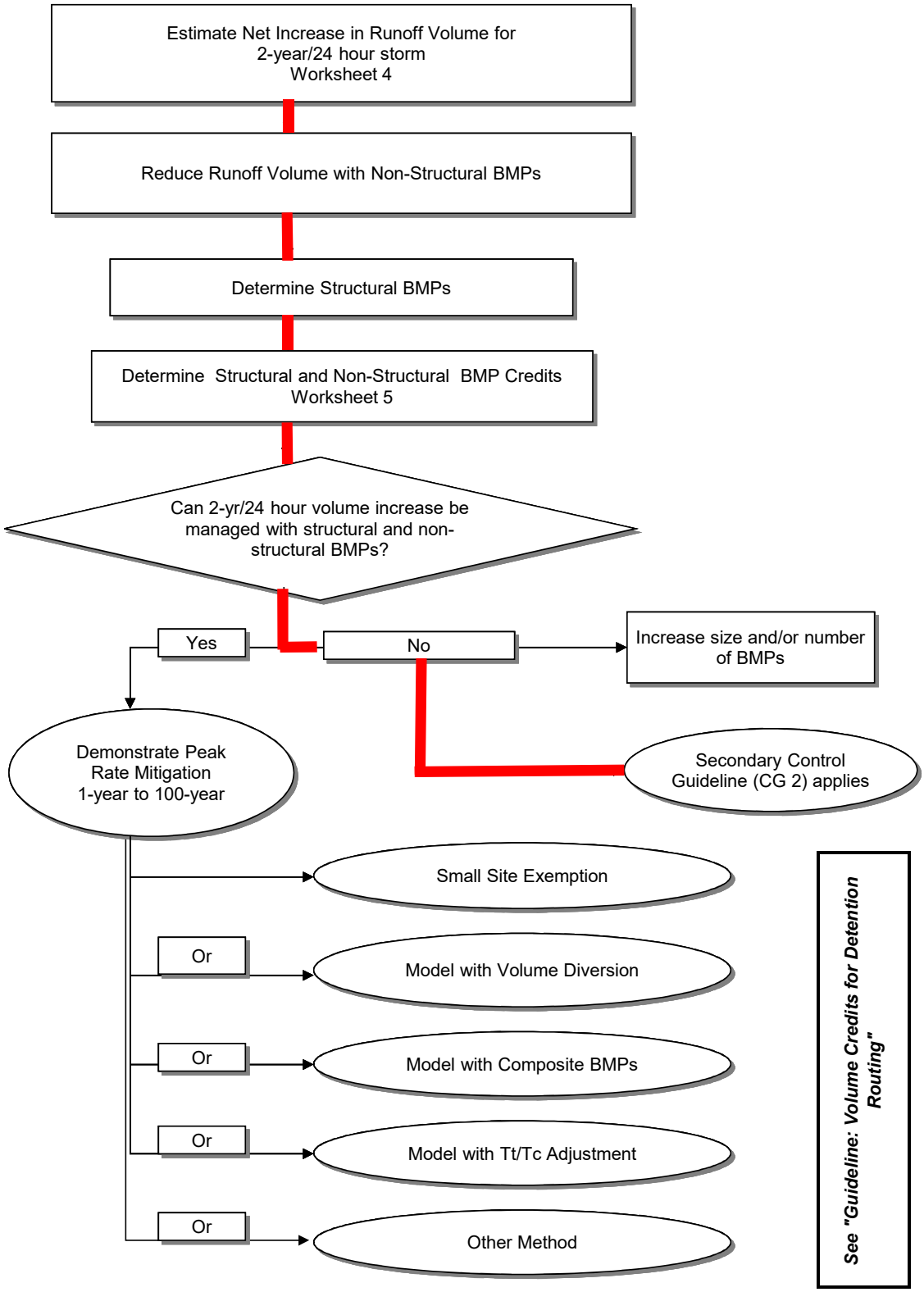
For all other disconnected roof areas

Impervious Area ____ ft^2 x 1/4" x 1/12 = - ft^3

TOTAL NON-STRUCTURAL VOLUME CREDIT* 1,353 ft^3

** 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: *0.00* acres
Managed Area *3.76* 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	150,565.00	3.46	77	2.99	0.60	0.94	11,813
Impervious	D	10,865.00	0.25	98	0.20	0.04	2.58	2,335.17
TOTAL:		163,602.00	3.76					14,329

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	114,702.00	2.63	78	2.82	0.56	1.00	9,516
Woods	D	-	0.00	77	2.99	0.60	0.94	-
Impervious	D	375.00	0.01	98	0.20	0.04	2.58	81
Gravel	D	48,525.00	1.11	89	1.24	0.25	1.73	6,992
TOTAL:		163,602.00	3.76					16,588

2-Year Volume Increase (ft^3)	**2,260**

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*:		2,260
Non-structural Volume Credit (ft^3) - *from Worksheet 3:**	**-**	***565***
Structural Volume Reqmt (ft^3)		1,695
(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		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.7.1	Riparian Buffer/Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment	28,356	1,182
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other	Check Dams in Vegetated Swales		

Total Structural Volume (ft^3): 1,182
Structural Volume Requirement (ft^3): 1,695

DIFFERENCE -513

No more than 25% of Volume Reduction may be met through Non-structural BMP credits (PA BMP Manual Chapter 8, 8.8): 1,364 > (2,260 x .25 = 565), Use 565

WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

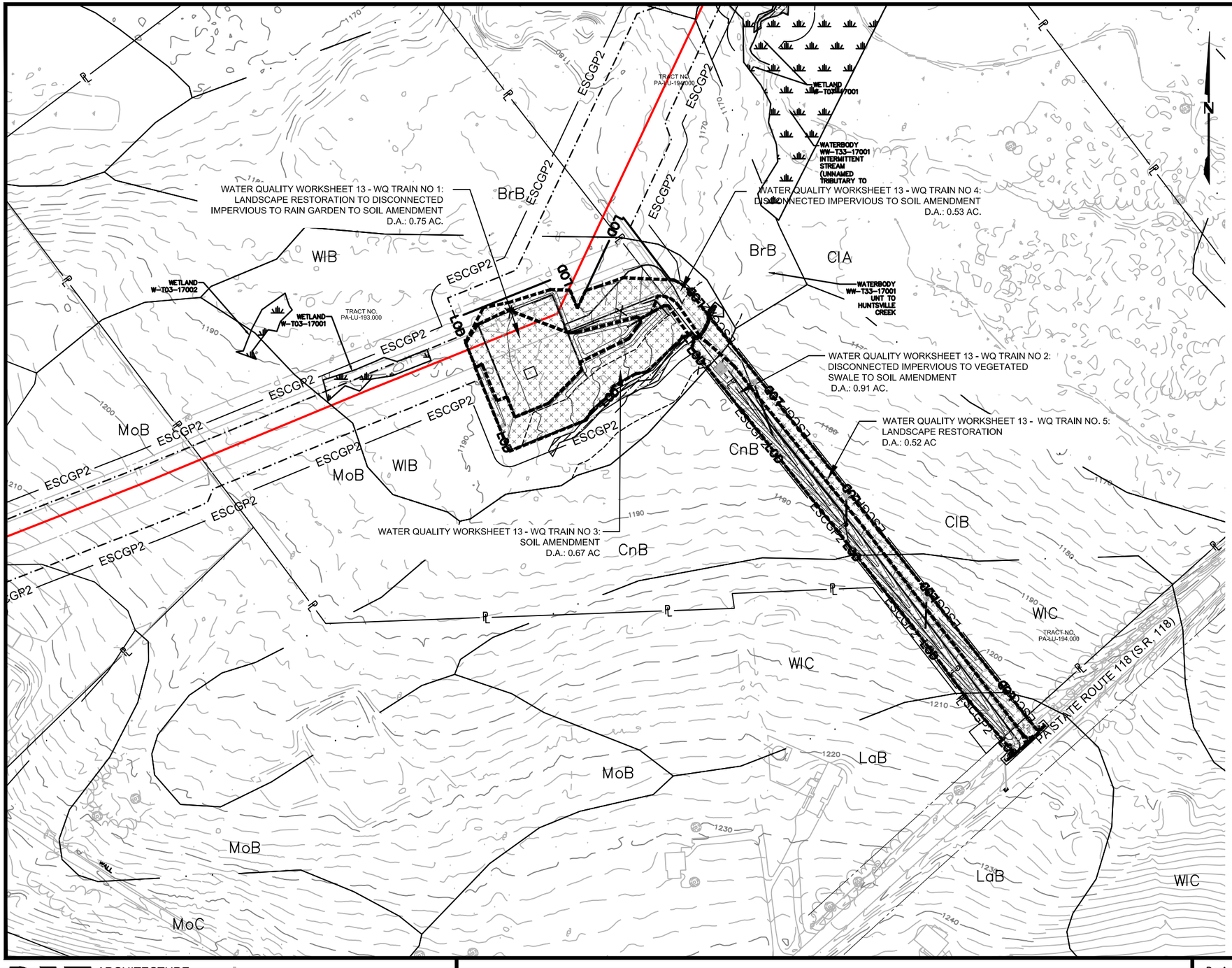
Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or the

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		
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	



LEGEND

- PROPERTY BOUNDARY LINE (APPROXIMATE)
- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' INTERVAL)
- FENCE
- STONE ROW
- SOIL BOUNDARY
- TREELINE
- CENTERLINE STREAM/EDGE WATERBODY
- DELINEATED WETLANDS
- WsB — SOIL TYPE DESIGNATION
- EXISTING ROAD
- ROW
- LIMITS OF FLOODWAY/ FLOODPLAN
- 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
- WATER QUALITY CALCULATION DRAINAGE AREA BOUNDARIES
- DRAINAGE AREAS SPECIFIED ON WATER QUALITY WORKSHEET 13

GRAPHIC SCALE
200 100 0 200
SCALE IN FEET
1 inch = 200 ft.

BL Companies
ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

4242 Carlisle Pike, Suite 260
Camp Hill, PA 17011
(717) 651-9850
(717) 651-9858 Fax

WATER QUALITY CALCULATION DRAINAGE AREA MAP

NORTH DIAMOND STATION – TRANS CONTINENTAL GAS PIPELINE COMPANY
ATLANTIC SUNRISE PROJECT – PROPOSED 30" NATURAL GAS PIPELINE
LEHMAN TOWNSHIP, LUZERNE COUNTY, PENNSYLVANIA

Designed	J.A.B.
Drawn	J.A.B.
Checked	
Approved	
Scale	1"=200'
Project No.	14C4909
Date	03/22/17

BMP DA

CAD File FRS_PCSM14C4909(10)_NDIAMOND

Project Name: North Diamond
Project No.: 14C4909
Date: 4/24/2017

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

Total Site Area (AC)	3.76
Total Disturbed Area (AC)	3.76
Distrubed Area controlled by BMP's (AC)	3.38

Total Disturbed Areas:

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	2.61	0.90	0.20	24.85	0.10	0.16
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.01	2.44	0.00	0.12	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	1.14	1.60	0.15	23.87	0.06	0.16
							TOTAL LOAD (PROPOSED)	48.83	0.16	0.32
							REQUIRED REDUCTION	85%	85%	50%
							REQUIRED REDUCTION (LBS)	41.51	0.14	0.16

*Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]
**TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

Project Name: North Diamond
Project No.: 14C4909
Date: 4/24/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	WQ Train No. 1: Landscape Rest. to Disc. Imper. to Rain Garden #1 to Soil Amendments

DISTURBED AREA CONTROLLED BY BMP	0.75 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.21	0.90	0.02	2.00	0.01	0.01
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.54	1.60	0.07	11.31	0.03	0.08
							TOTAL LOAD	13.31	0.04	0.09
							REMOVAL EFFICIENCIES	99.76%	99.66%	82.50%
							POLLUTANT REDUCTION (LBS)	13.27	0.04	0.07

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.7.2	85%	85%	50%
2	5.8.2	30%	0%	0%
3	6.4.5	85%	85%	30%
4	6.7.3	85%	85%	50%
Equivalent Series Efficiency		99.76%	99.66%	82.50%

Removal Efficiency TSS = 1- (1-.85) * (1-.85)*(1-.85) = 99.66%
Removal Efficiency TP = 1- (1-.85) * (1-.85)*(1-.85)= 99.66%
Removal Efficiency NO3 = 1- (1-.50) * (1-.30)*(1-.3) = 75.5%

Project Name: North Diamond
Project No.: 14C4909
Date: 4/24/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	WQ Train No. 2 Disconnected Impervious to Vegetated Swale to Soil Amendments

DISTURBED AREA CONTROLLED BY BMP	0.91 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.60	0.90	0.05	5.71	0.02	0.04
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.31	1.60	0.04	6.49	0.02	0.04
							TOTAL LOAD	12.20	0.04	0.08
							REMOVAL EFFICIENCIES	94.75%	92.50%	60.00%
							POLLUTANT REDUCTION (LBS)	11.56	0.04	0.05

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	5.8.2	30%	0%	0%
2	6.4.8	50%	50%	20%
3	6.7.3	85%	85%	50%
Equivalent Series Efficiency		94.75%	92.50%	60.00%

Project Name: North Diamond
Project No.: 14C4909
Date: 4/24/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	WQ Train No. 3 Soil Amendments

DISTURBED AREA CONTROLLED BY BMP	0.67 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.67	0.90	0.05	6.38	0.03	0.04
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
							TOTAL LOAD	6.38	0.03	0.04
							REMOVAL EFFICIENCIES	85.00%	85.00%	50.00%
							POLLUTANT REDUCTION (LBS)	5.42	0.02	0.02

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.7.8	85%	85%	50%
Equivalent Series Efficiency		85.00%	85.00%	50.00%

Project Name: North Diamond
Project No.: 14C4909
Date: 4/24/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	WQ Train No. 4 Disconnected Impervious to Soil Amendments

DISTURBED AREA CONTROLLED BY BMP	0.53 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.25	0.90	0.02	2.38	0.01	0.02
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.28	1.60	0.04	5.86	0.02	0.04
							TOTAL LOAD	8.24	0.02	0.05
							REMOVAL EFFICIENCIES	89.50%	85.00%	50.00%
							POLLUTANT REDUCTION (LBS)	7.38	0.02	0.03

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	5.8.2	30%	0%	0%
2	6.7.8	85%	85%	50%
Equivalent Series Efficiency		89.50%	85.00%	50.00%

Project Name: North Diamond
Project No.: 14C4909
Date: 4/24/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	WQ Train No. 5 Landscape Restoration

DISTURBED AREA CONTROLLED BY BMP	0.52 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE	COVER (AC.)	Runoff (in)	RUNOFF VOLUME	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.51	0.90	0.04	4.86	0.02	0.03
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.01	2.44	0.00	0.32	0.00	0.00
							TOTAL LOAD	5.17	0.02	0.03
							REMOVAL EFFICIENCIES	85.00%	85.00%	50.00%
							POLLUTANT REDUCTION (LBS)	4.40	0.02	0.02

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

Project Name: North Diamond
Project No.: 14C4909
Date: 4/24/2017

	TSS (LBS)	TP (LBS)	NO3 (LBS)
TOTAL POLLUTANT REDUCTION PROVIDED (LBS)	42.03	0.14	0.19
TOTAL POLLUTANT REDUCTION REQUIRED (LBS)	41.51	0.14	0.16
Δ	0.52	0.00	0.03

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

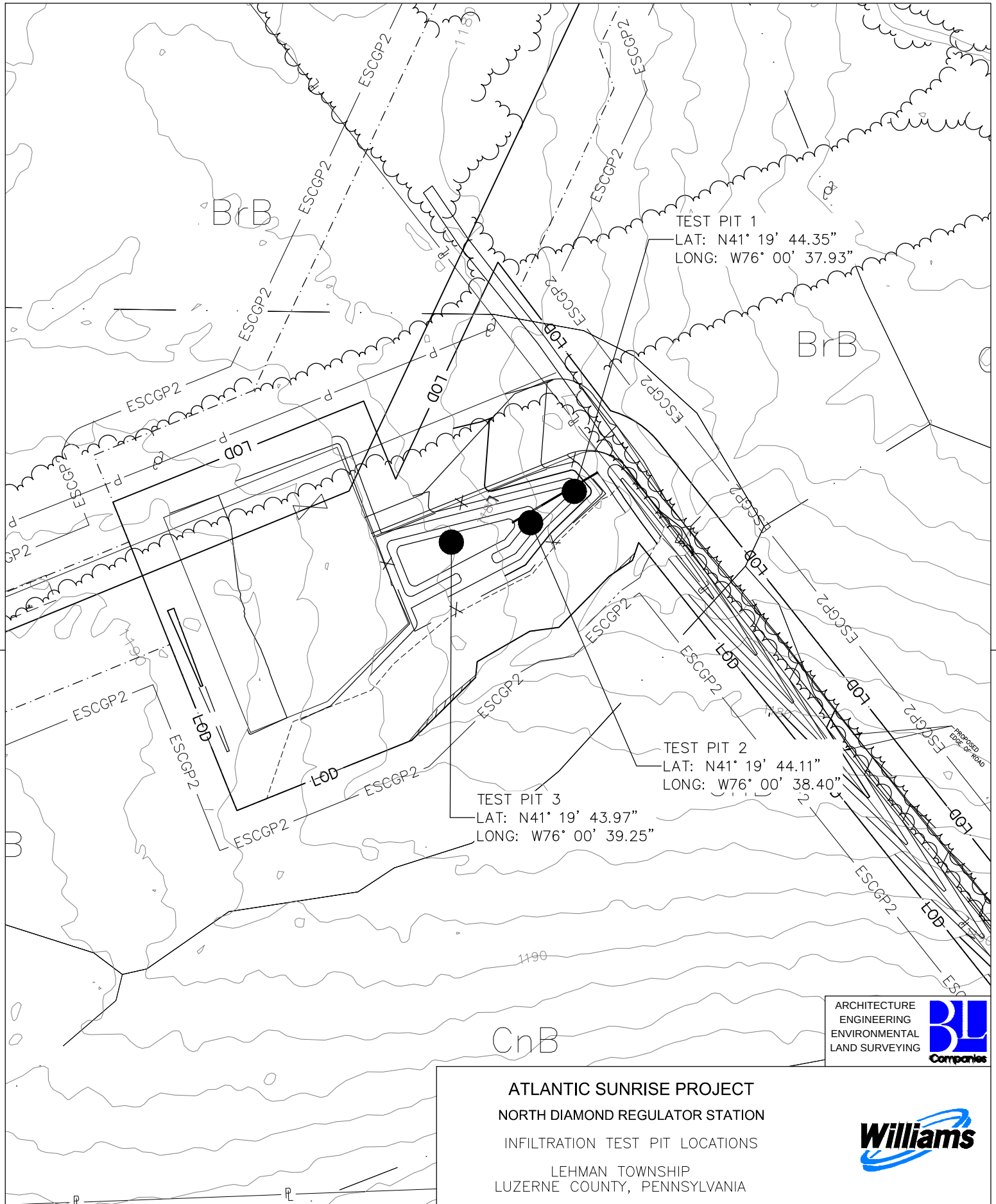
Contractor:
BL Companies
4242 Carlisle Pike, Suite 260
Camp Hill, PA 17011

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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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

APPENDIX B

Preparer Qualifications

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 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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APPENDIX D

Excerpt from Transcontinental Gas Pipe Line Company, LLC
PADEP Application No. E40-769
Chapter 105 Water Obstruction and Encroachment Permit Application

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

and

DEPARTMENT OF ARMY CORPS OF ENGINEERS
(Baltimore, Philadelphia, and Pittsburgh Districts)

JOINT APPLICATION FOR PENNSYLVANIA WATER OBSTRUCTION AND ENCROACHMENT PERMIT AND U.S. ARMY CORPS OF ENGINEERS SECTION 404 PERMIT

Before completing this form, please read the step-by-step instructions and Section F Application Completeness Checklist provided with this Joint Permit package.

	AGENCY USE ONLY	
Application ID# (Assigned by DEP) _____	RECEIVED DATE _____	CHECK NO. _____
Program Application No. _____	REQUIRED APP. FEE _____	AMOUNT $_____

SECTION A. APPLICATION TYPE: STANDARD ☒ SMALL PROJECTS ☐

SECTION B. APPLICANT IDENTIFIER

Applicant Name	Employer ID# (EIN)
Transcontinental Gas Pipe Line Company, LLC (Transco)	74-1079400
Consulting Firm	**Employer ID# (EIN)**
TRC Environmental Corporation	06-0853807

SECTION C. PROJECT LOCATION DATA

Name of stream and/or body of water and Chapter 93 designation.

Please see the Resource Table included as Attachment E-2

Corps District where project will occur.

☐ Pittsburgh (Ohio River Basin) ☒ Baltimore (Susquehanna River Basin) ☐ Philadelphia (Delaware River Basin)

Name of the U.S.G.S. 7 1/2 Minute Quadrangle Map where project is located: Red Rock, Sweet Valley, Harveys Lake, Center Moreland

Indicate location of project: Latitude Start:41.284081, End:41.394672; Longitude Start:-76.313325, End:-75.966182

Project type, purpose and need: The Atlantic Sunrise Project is an expansion of the existing Transco natural gas transmission system that will enable Transco to provide 1.7 million dekatherms per day (MMDth/d) of incremental firm transportation of natural gas from the Marcellus Shale production areas in northern Pennsylvania to its existing market areas, extending to as far south as the Station 85 Pooling Point in Choctaw County, Alabama. The Project includes modifications to the existing Transco Mainline system to reverse the direction of flow, enabling new north-to-south capabilities (bi-directional flow) to transport this new source of natural gas to existing markets. The Luzerne County portion of the Project consists of 22.2 miles of new 30-inch pipeline to be constructed in a 90-foot construction right-of-way. Additionally, there will be two contractor yards totaling 43.5 acres, one staging area totaling 8.2 acres, one new regulator station (North Diamond Regulator Station in Lehman Township), two new mainline valves, two new communication towers, and 11 temporary access roads and 3 permanent access roads used to access the construction right-of-way, mainline valves, and Regulator Station. Total earth disturbance for the Project in Luzerne County is 329.82 acres.

SECTION D. PROJECT STATUS

HAS ANY PORTION OF PROPOSED PROJECT BEEN AUTHORIZED? ☐ yes ☒ no _____ date authorized

If yes, attach description of those portions of the project that have been authorized and identify dates of authorization. Also attach a completed PASPGP-4 Cumulative Impact Project Screening Form.

SECTION E. COMPLIANCE REVIEW

Yes No

☐ ☒ Is the applicant (owner and/or operator) currently in violation of any permits issued by the Department? If yes, please provide:

1. Permit Number: _____
2. Nature of the violation (if any): _____
3. Status of violation (i.e., schedule for compliance, etc.): _____

SECTION F. APPLICATION COMPLETENESS CHECKLIST

Applicant must place an entry - Y = Yes, N = No, N/A = Not Applicable - in each left side column space. See Section 105.13 for additional details. If you are applying under the Small Projects Application format, place an entry in only those comments prefixed by an asterisk (*).

REQUIREMENT	Applicant Entry	DEP Use Only
a. GIF and permit application properly signed, sealed and witnessed	*Y	
b. Application Fee & Worksheet enclosed (see Section G.)	*Y	
c. Copies and proof of receipt - Act 14 notification - Acts 67/68/127	*Y	
d. Cultural Resource Notice (Notice, return receipt and PHMC review letter, as appropriate)	*Y	
e. PASPGP-4 Cumulative Impact Project Screening Form	*Y	
f. Bog Turtle Habitat Screening (copy of "No Effect" determination from the Army Corps of Engineers OR copy of documented clearance from the US Fish and Wildlife Service)	*N/A	
g. Pennsylvania Natural Diversity Inventory (PNDI Project Environmental Review Search Receipt including Avoidance Measures and documentation of agency coordination, as appropriate)	*Y	
h. Plans (site plan including cross sections and profiles for Subsections 151, 191, 231, 261)	*Y	
i. Location map	Y	
j. Project description narrative	*Y	
k. Color photographs with map showing location taken	*Y	
l. Environmental Assessment form	*Y	
m. Erosion and Sediment Control Plan and approval letter	Y	
n. Hydrologic and hydraulic analysis	N/A	
o. Stormwater Management Analysis with consistency letter	Y	
p. Floodplain Management Analysis with consistency letter	Y	
q. Risk Assessment	N/A	
r. Professional engineer's seal and certification	Y (See Attachment H)	
s. Alternative analysis	Y	
t. Mitigation plan	Y	

SECTION G. DETERMINATION OF APPLICATION FEES (DEP FEES ONLY)

The fee required for a project authorized under this permit shall be consistent with 25 PA Code §105.13 (relating to regulated activities – information and fees). To determine the application fee, please complete the Chapter 105 Fee(s) Calculation Worksheet (3150-PM-BWEW0553). Please provide the completed worksheet and a check for the applicable fee(s) made payable to the "Commonwealth of Pennsylvania Clean Water Fund."

SECTION H. ADJOINING PROPERTY OWNERS

Please list the name and address of all property owners whose land adjoins the project property.

NAME	ADDRESS
Please see attached table.	

SECTION I. CERTIFICATION AND SIGNATURE

If Privately Owned, all owners (such as husband and wife) must sign. One or more members authorized to sign on behalf of an entire partnership must sign. For a Corporation, the president, vice president or other responsible official is required to sign. For Political Subdivision, signatures of the chief officer or other responsible official empowered to sign is required with the seal affixed and attested by the clerk. For Commonwealth departments, boards, commissions, receivers, trustees and authorities, a department head, bureau director, executive director, chairman, commissioner or other responsible official is required to sign. Signatures other than above must be accompanied by a power of attorney or other notarized legal documentation indicating authorization to sign on behalf of the applicant.

Application is hereby made for a permit to authorize the activities described herein. I certify I am familiar with the information contained in this application, and to the best of my knowledge and belief, such information is true, complete and accurate. I further certify I possess the authority to undertake the proposed activities.

I certify that the project proposed in this application complies with and will be conducted in a manner that is consistent with the approved Coastal Zone Management program of the Commonwealth of Pennsylvania. (Only portions of Erie, Bucks, Philadelphia and Delaware Counties are in the Coastal Zone).

I grant permission to the agencies responsible for authorization of this work, or their duly authorized representative, to enter the project site for inspection purposes during working hours. I will abide by the conditions of the permit or license if issued and will not begin work without the appropriate authorization.

By: Joseph Dean
(PRINT NAME)

(SIGNATURE) (DATE) SEAL

Manager, Permitting
(TITLE)

WITNESS: _____