ATTACHMENT M: STORMWATER MANAGEMENT REPORTS

Exhibit M-1:	Stormwater Management System- Merrill Road Converter Station (1/16/2019)
Exhibit M-2:	Stormwater Management System- Fickett Road Substation (5/29/2018)
Exhibit M-3:	Stormwater Management Report for the Kennebec River Crossing Termination Stations (10/19/2018)

Exhibit M-1: Stormwater Management System-Merrill Road Converter Station (1/16/2019)

STORMWATER MANAGEMENT SYSTEM

Prepared for the

CENTRAL MAINE POWER COMPANY
MERRILL ROAD CONVERTER SUBSTATION

CENTRAL MAINE POWER

Location

Merrill Road
Lewiston, ME 04240

Owner

Central Maine Power Company
83 Edison Drive
Augusta, Maine 04336

STATE OF MAINE
KENNETH R. VOLOCK
No. 11062
LICENSED PROFESSIONAL ENGINEER
01-16-2019
REV. E

Prepared by

POWER ENGINEERS

11733 Chesterdale Road
Cincinnati, OH 45246
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September 2017
REVISED January 2019

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INTRODUCTION

Central Maine Power Company (CMP) is proposing to construct a new electrical substation as part of the New England Clean Energy Connect (NECEC) Project. The new station will be built on Merrill Road in the town of Lewiston in Androscoggin County, Maine and will be named the Merrill Road Converter Substation.

The proposed electrical substation is located within the Lower Androscoggin Watershed. Site runoff flows north to Stetson Brook, and then heads south into the Androscoggin River. The river then flows downstream to Merrymeeting Bay, then southeast to the Kennebec River and discharges into the Atlantic Ocean.

Merrill Road Converter Substation

The existing conditions and proposed grading plans for the proposed Merrill Road Converter Substation are included with this submission as sheets 1076-003-001 SH 001 General Site Plan Existing Conditions and 1076-003-001 SH 002 General Site Plan Proposed Conditions, respectively. The layout of proposed equipment within the yard is shown on SK-MER-GL Conceptual General Location Plan.

The proposed substation will sit on a 54.2 acre parcel of mostly wooded land that is a mix of somewhat steep terrain and low lying wetlands and includes an existing electric transmission line corridor. The western portion of the site is relatively flat with steeply ascending sloped terrain heading from west to east along the site. The existing transmission line corridor will be the site for a proposed access road to the station. The proposed station pad footprint will be approximately 7.10 acres and will consist of roof top, concrete foundations and pavement impervious and evenly graded 3/4” to 1.5” stone for the remainder of the station pad. The access road will consist of gravel. The station pad site will consist of a total developed area of 10.71 acres, of which, 7.15 acres will be impervious. The access road will include an additional total developed area of 2.71 acres, of which, 0.96 acres will be impervious. The site will be sloped to drain to the north, honoring the existing drainage patterns to the extent practicable. Site and road stormwater runoff will be treated with grassed underdrain soil filters, gravel wetlands and stormwater detention, while the stoned yard areas are considered to be treated in place.

Permitting Requirements

The Merrill Road Converter Substation is part of the larger NECEC Project currently being undertaken by CMP. The project is submitted as a whole to the Maine Department of Environmental Protection (MeDEP) for permitting purposes.

The project will require a Stormwater Management Permit and a Site Location of Development Permit because more than 3 acres will be stripped or graded and not revegetated within one year, and because the project will occupy more than 20 acres of land. The project will also be required to meet the Basic, General and Flooding Standards as described in MeDEP Chapter 500. The standards will be met using several erosion and sedimentation control and permanent stormwater management Best Management Practices (BMPs).

BASIC STANDARDS

The proposed project will disturb more than one acre of land, requiring compliance with the Basic Standards as described in MeDEP Chapter 500 Section 4B. In order to meet the Basic Standards, the proposed project will be required to address the following:

- Erosion and Sedimentation Control
- Inspection and Maintenance
- Housekeeping

Erosion and Sedimentation Control

Exhibit 14-1 of the Site Law application contains the manual "Central Maine Power Company Environmental Guidelines for Construction and Maintenance Activities on Transmission Line and Substation Projects". This manual addresses general erosion and sedimentation control measures used in many previous transmission and substation projects and has been reviewed and approved by MeDEP. The manual was developed to be consistent with the Maine Erosion and Sediment Control Practices Field Guide for Contractors, 2015, and MeDEP's Chapter 500.

Specific erosion and sedimentation control BMPs for the Merrill Road Converter Substation project are indicated on sheet 1076-003-003 SH 001 & SH 002 Erosion and Sediment Control Plan 1 and 2. Details of the measures proposed are shown on sheet 1076-003-005 SH 004 Site Details 4 and sheet 1076-003-005 SH 005 Site Details 5. Sheet 1076-003-005 SH 006 Site Details 6 presents a plan for implementing these measures at the site.

Inspection and Maintenance

CMP will ensure that a qualified design engineer inspects the construction site periodically to verify that the stormwater BMPs are constructed in accordance with the plans and specifications shown on the design drawings, and, as needed, during any period when construction activity affecting the stormwater management system occurs, until the site is permanently stabilized.

Inspection and Maintenance procedures for the proposed substation are described below. BMP Inspection & Maintenance Checklists and BMP Inspection & Maintenance Logs for each site have been enclosed in Appendix A. The BMP Inspection & Maintenance Checklists outline the required inspection frequency/requirements and maintenance/cleanout thresholds for each BMP measure. The enclosed BMP Inspection & Maintenance Logs include specific inspection guidelines for each BMP measure and are the documentation portion of this Plan.

Scheduled Inspections

Prior to completion of construction, CMP shall designate a CMP Supervisor and personnel or a contractor as the Site Inspector. Inspection requirements for each individual BMP measure are specified on the Inspection & Maintenance Checklists in Appendix A.

- QUARTERLY: Inspections of stormwater conveyance, control and treatment measures at each Site are to be performed on a quarterly basis throughout the year. Inspections during

winter months may encounter snow and ice cover, frozen ground, snow embankments, dormant vegetation, etc. In these cases, the inspector must use his/her best judgment interpreting these inspection and maintenance requirements, in order to meet both the stated objectives and the intent of the Plan. The inspection should prevent problems and plan for maintenance in advance of the spring thaw (removing snow piles if they obstruct drainage paths, repairing any damage from snow plows, frost heaves, etc.).

- FOLLOW-UP: Additional follow-up inspections will be performed, as needed, depending on the results of routine inspections and site conditions, under the direction of the CMP Supervisor.

As-Needed Maintenance

Maintenance is to be performed on an as-needed basis, in accordance with recommendations made by the Site Inspector. Routine maintenance will include the immediate repair of eroded channels or gullies; reseeding or sodding of bare ground; removal of trash, leaves and sediment; and control of vegetation. Maintenance issues associated with specific areas and stormwater facilities at each Site are identified on the Inspection & Maintenance Checklists in Appendix A. Disposal of all sediment, debris, and waste shall be in accordance with Maine Solid Waste Management Rules, Chapter 400.

5-Year Re-Certification

CMP will certify the following to the Maine DEP within three months of the expiration of each five-year interval from the date of issuance of the permit:

- All areas of the project site have been inspected for areas of erosion, and appropriate steps have been taken to permanently stabilize these areas.

- All aspects of the stormwater control system have been inspected for damage, wear, and malfunction, and appropriate steps have been taken to repair or replace the facilities.

- The erosion and stormwater maintenance plan for the site is being implemented as written, or modifications of the plan have been submitted to and approved by the department, and the maintenance log is being maintained.

Housekeeping Plan

Housekeeping entails the control or elimination of pollution not specifically related to soil erosion such as spill prevention, dust control, litter removal and groundwater dewatering. Housekeeping is addressed within this narrative and on sheet 1076-003-005 SH 005 Site Details 6 for the Merrill Road Converter Substation.

GENERAL STANDARDS

The proposed project will result in more than one acre of new impervious area, requiring compliance with the General Standards as described in MeDEP Chapter 500 Section 4C. For the purposes of determining the level of permitting and treatment required, the substation yard is treated as impervious area.

Stormwater Treatment BMPs

At the Merrill Road Converter Substation, stormwater treatment will be accomplished using three separate treatment measures.

The approach to the station within the existing transmission line right of way will be a gravel access road and will be drained using open conveyance channels. Runoff from the road, up to within 50 feet of the substation, will be treated to meet the requirements under ***Section 4.C (5) (C) - Exceptions from the general standards for Linear portion of a project***. The majority of the gravel access road, vegetated developed areas and the drainage ditch running east and west on the north side of the road, will be treated using gravel wetlands with grassed swale and forebay pre-treatment. Gravel access roads and vegetated developed areas sited on wetland areas meet the requirements of ***Section 4.C(5) (E) – Exemption from the general standards for Wetland Road Crossing*** – portions of the road crossing the wetland will include permeable base and are not required to meet the general standards.

The substation yard will be treated in-place via filtration through an 18”-thick layer of gravel below the stone surface. This ***Crushed Stone Substation Surface*** is approved by MeDEP as an adequate treatment for the yard surface for compliance with the General Standards and water quality treatment requirement. Additional paved and rooftop surfaces and additional developed areas around the yard will also be treated in the ***Crushed Stone Substation Surface***. Developed areas outside the substation pad will discharge to open drainage channels around the station pad which will flow to a single ***Underdrained Soil Filter*** where additional detention will be provided. The soil filter/detention basin will discharge through a level spreader to the north of the station. Runoff from the station pad does not require detention and will bypass the soil filter and detention by sheet flowing to the proposed catch basin outside of the soil filter area to the north of the pad. The catch basin will also discharge through a level spreader to the north of the substation. The stormwater treatment measures, and the areas that are treated by each, are depicted on sheet 1076-003-002 SH 004 Post-Development Stormwater Plan.

Crushed Stone Substation Surface

MeDEP has provided yard construction requirements that allow the General Standards requirements to be met for the substation pad, and no further water quality treatment of stormwater from the pad itself is required. The MeDEP letter describing the construction requirements is included with this submission as Appendix B.

The substation surface for each yard is comprised of crushed stone. The crushed stone is supported by 18” of gravel base which acts to filter stormwater runoff as it passes through and into the soil subgrade below. The typical crushed stone surface section is shown in the Substation Yard Sections on sheet 1076-003-005 SH 001 Site Details 1 for the Merrill Road Converter Substation.

In each yard, an additional 2” of crushed stone above the 4” requirement will be provided, creating a 6” layer. The additional storage in the crushed stone layer down slope of the buildings, paved areas and various concrete foundations throughout the yard will allow the crushed stone surface to treat each of these non-soil areas. Calculations for treatment of runoff from the pad have been provided on sheet 1076-003-002 SH 004 Post-Development Stormwater Plan for the Merrill Road Converter Substation. Groundwater dewatering has been addressed with a system of perforated piping, which runs below the frost line in the excavated region of the station pad and around the foundation of the equipment enclosure. The groundwater dewatering system is designed to prevent the migration of groundwater into the 6” station crushed stone and 18” gravel base.

Grassed Underdrain Soil Filter

Runoff from the vegetated developed areas as well as partial sections of the gravel access road will be treated in Grassed Underdrain Soil Filter. Pretreatment will be accomplished by flowing runoff through a vegetated swale and into pre-treatment forebays before entering the filter area.

The Grassed Underdrain Soil Filter is comprised of an 18”-thick layer of a silty sand and organic material mix. The underdrain system consists of 4” perforated pipe within a 12”-thick layer of underdrain material. A detail of the underdrained soil filter is shown on sheet 1076-003-002 SH 002 Stormwater Treatment Plan. Included with soil filters are orifices which discharge the treatment volume from a single outlet with a release time between 24 and 48 hours. Underdrained soil filter sizing and orifice calculations are shown in Appendix C.

Gravel Wetlands

Runoff from the vegetated developed areas as well as partial sections of the gravel access road will be treated in Gravel Wetlands. Pretreatment will be accomplished by flowing runoff through a vegetated swale and into a pre-treatment forebay before entering the gravel wetland treatment cell area.

The Gravel Wetland is comprised of an 8” thick layer of a wetland soil mix, 6” transitional gravel layer and 24” crushed stone layer. The underdrain system consists of 6” perpendicular perforated pipe within the crushed stone layer of the gravel wetland. Details of the gravel wetland are shown on sheets 1076-003-002 SH 005 and SH 006 of the Stormwater Treatment Plans. Included with gravel wetlands are orifices which discharge the treatment volume from a single outlet with a release time between 24 and 48 hours. Gravel wetland sizing and orifice calculations are shown in Appendix C.

The hydraulic modeling report for the entire project site, including station and access road, is included with this submission in Appendix C. The report was developed based on USDA TR-55 methodology. The report illustrates how the site drainage and stormwater management infrastructure will function during the 2 -, 10 - and 25 - year storms. The report also contains the hydrologic calculations for the project. The modeling results were used to confirm that adequate water quality volume (WQV) will be provided below the primary outlet in both the Grassed Underdrain Soil Filter and the Gravel Wetlands.

Permeable Road Base

The gravel access road is proposed through existing wetlands. Where it is possible, the road will be built on a rock sandwich road base which will allow water to freely pass beneath the road to be

discharged downgradient of the road. The rock sandwich will consist of a 12” think (minimum) layer of 3” – 6” diameter stone sandwiched between layers of permeable filter fabric. The roads with rock sandwich base will be used to cross the existing low-laying wetlands to maintain sheet flow through the wetland areas. The rock sandwich will be constructed to adhere to CH 8.4 of the *BMP Technical Design Manual* (Permeable Base Material).

Per Chapter 500 (Section 4.C(5)(e), Page 12); wetland road crossings that provide a passage for flows are exempt from the requirement to meet the General Standards. Approximately 440 linear feet of access road is exempt from the requirement to meet the General Standards.

Stormwater Treatment Calculations

In order to meet the General Standards, the proposed project must use MeDEP approved treatment measures to treat no less than 95% of the proposed impervious area and 80% of the proposed developed area at the substation site. At the Merrill Road Converter Substation, 99.33% of impervious area is treated, and 83.75% of the developed area is treated. For the linear portion of the project treatment has been reduced to not less than 75% of impervious access road and no less than 50% of the developed area surrounding the road to within 50’ of the substation. At the linear portion of the Merrill Road Converter Substation, 78.70% of impervious area is treated, and 54.90% of developed area is treated. Stormwater treatment calculations for the Merrill Road Converter Substation are shown on sheet 1076-003-002 SH 004 Post-Development Stormwater Plan.

FLOODING STANDARD

The project is required to meet the MeDEP Chapter 500 Flooding Standard; an increase of over 3 acres of impervious area requires a decrease in peak stormwater runoff as a result of the proposed development. Additionally, management of stormwater to prevent site and road inundation during a 25-year storm event is provided. The site is situated on HSG Type A, Type C and Type D soils. Pre-developed and post-developed Curve Numbers for the project can be found in Appendix C and on the project drainage area maps (Sheets 1076-003-002 SH 003 and SH 004). The MeDEP letter describing the construction requirements that allow the General Standards requirements to be met for the pad within the ***Crushed Stone Substation Surface*** also prescribes Curve Numbers for use when calculating runoff from the stone section. Pre-Developed Curve Numbers for the project site range from 72 to 77. MeDEP prescribes developed Curve Numbers for the stone station surface of 55 and 60 over HSG Type C and Type D soils respectively. As existing drainage patterns have been maintained to the extent practicable, the sizes and times of concentration have not been significantly altered with this project. Due to the decreased Curve Numbers across the stone station pad (CN decreased to 55 and 60 for these areas), post-development peak flows were calculated to be less than or relatively equal to the pre-development peak flows from the substation pad without the need for on-site stormwater attenuation. In order to maintain a post-development peak runoff rate at or below the pre-development peak runoff rate for developed landscaped areas outside the pad however, some level of stormwater detention is required. Additional stormwater storage is provided in the grassed underdrain soil filter and gravel wetlands. A maximum of 18” of flooding storage depth above the required water quality volume elevations in the grassed underdrain soil filter and gravel wetlands is proposed. The proposed on-site stormwater detention will provide sufficient capacity to meet the MeDEP Flooding Standard Requirements in Chapter 500 at each analysis point, located at the property line. At each analysis point, stormwater detention or the ***Crushed Stone Substation Surface*** provides enough treatment to decrease post-development 2 -, 10 – and 25 – year design storm peak

flows to be lower than pre-development peak flows. See the table below for the pre- and post-development peak flows at each analysis point.

Pre-Developed Peak Flow Rates

Analysis Point	2-Year Flow Rate (CFS)	10-Year Flow Rate (CFS)	25-Year Flow Rate (CFS)
A	11.75	26.46	36.58
B	5.09	11.09	15.17
C	5.88	14.62	20.83
D	0.74	1.55	2.09
E	3.31	7.00	9.47

Post-Developed Peak Flow Rates

Analysis Point	2-Year Flow Rate (CFS)	10-Year Flow Rate (CFS)	25-Year Flow Rate (CFS)	Peak 2-Year Flow Rate at Outfall (If Subsheds Present)	Peak 10-Year Flow Rate at Outfall (If Subsheds Present)	Peak 25-Year Flow Rate at Outfall (If Subsheds Present)
A1	5.33	12.43	17.35	11.73	23.66	31.35
A2	7.96	15.32	20.10			
A3	2.99	7.15	10.03			
B	3.66	8.01	10.95	N/A		
C1	0.81	1.70	2.30	5.81	14.08	20.07
C2	0.74	1.40	1.82			
C3	5.79	14.12	19.95			
D	0.68	1.43	1.93	N/A		
E	2.85	6.01	8.13	N/A		

CONCLUSION

The NECEC Project will require a Stormwater Management Permit, and will be required to meet the Basic and General Standards and the Flooding Standard as described in MeDEP Chapter 500. The Basic Standards shall be met at the Merrill Road Converter Substation through Erosion and Sedimentation Control, Inspection and Maintenance, and Housekeeping, as described in this narrative and the attached checklists, logs and plans. The General Standards shall be met at the Merrill Road Converter Substation by using Grassed Underdrain Soil Filters, Gravel Wetlands and the MeDEP approved crushed stone substation yard section, as illustrated on the attached stormwater treatment plans. The Flooding Standard shall be met using storage above the water quality volume within the proposed Grassed Underdrain Soil Filter and Gravel Wetlands.

APPENDIX A – BMP INSPECTION & MAINTENANCE CHECKLISTS AND LOGS

APPENDIX A-1: BMP INSPECTION & MAINTENANCE CHECKLIST

Central Maine Power Company – Merrill Road Converter Substation
Lewiston, Maine

BMP MEASURE	INSPECTION REQUIREMENTS*	MAINTENANCE/CLEANOUT THRESHOLDS
Vegetated Swales	Inspect swale for accumulated sediment, debris and other obstructions. Inspect swales for evidence of erosion, gullies, or slumping of the side slopes. Inspect swales for bare ground/sparse vegetation. Monitor vegetative growth.	Clean as needed and dispose of properly. Repair and re-seed as necessary. Consult engineer if problem persists. Areas of persistent erosion may need to be armored. Re-seed as necessary. Soil may need to be scarified if compacted soils are present. Mow vegetation in swales to roughly six inches at least once and no more than two times a year. To be performed between June 15th and August 30th.
Check Dams	Inspect check dams to ensure the center is lower than the edges. Inspect check dams for stone displacement, erosion, concentrated flow or channelization. Inspect check dams for accumulated sediment, debris or other obstructions.	Repair as necessary. Repair any damaged areas. Consult engineer if problem persists. Clean as needed and dispose of properly. Sediment must be removed before it exceeds one half the original height of the check dam.
Revegetated Areas	Inspect revegetated areas for evidence of erosion, concentrated flow, or channelization. Inspect revegetated areas for bare ground/sparse vegetation.	Repair and re-seed as necessary. Consult engineer if problem persists. Areas of concentrated flow where rills and gullies are present may need to be armored Re-seed as necessary. Soil may need to be scarified if compacted soils are present.
Gravel Access Roads	Inspect access road shoulder for accumulated sand/sediment. Inspect grade on access road and shoulder to ensure stormwater is not impeded by accumulation of materials or false ditches. Inspect access road to ensure that there is no rutting, wash-boarding, frost heaves, potholes, or ponding occurring.	Remove sand/sediment as necessary. Repair grade as necessary. Repair by replacing gravel and re-grading as necessary.

*Inspections are to be performed on a monthly basis with additional follow-up inspections and maintenance as needed.

APPENDIX A-1: BMP INSPECTION & MAINTENANCE CHECKLIST

Central Maine Power Company – Merrill Road Substation
Lewiston, Maine

BMP MEASURE	INSPECTION REQUIREMENTS*	MAINTENANCE/CLEANOUT THRESHOLDS
Grassed Underdrained Soil Filter	Inspect entering swale, basin and outlet structure for accumulated sediment, debris and other obstructions. Inspect filter for evidence of erosion, gullies, or slumping of the side slopes. Inspect filter for bare ground/sparse vegetation. Monitor vegetative growth.	Clean as needed and dispose of properly. Repair and re-seed as necessary. Consult engineer if problem persists. Areas of persistent erosion may need to be armored. Re-seed as necessary. Soil may need to be scarified if filter media becomes compacted. Mow vegetation in impoundment to roughly six inches at least once and no more than two times a year. To be performed between June 15th and August 30th.
Crushed Stone Substation Surface	Inspect crushed stone areas for accumulated sand/sediment. Inspect substation surface to ensure that there is no ponding occurring.	Remove sand/sediment as necessary. Repair by re-grading as necessary.

*Inspections are to be performed on a monthly basis with additional follow-up inspections and maintenance as needed.

APPENDIX A-2: BMP INSPECTION & MAINTENANCE LOG

Central Maine Power Company – Merrill Road Converter Substation

Lewiston, Maine

BMP MEASURE (Refer to Appendix B-1 & the O&M Plan)	**Inspector(s):**			**Inspection Type:** Monthly [ ] Follow-up [ ]	**Photos Taken:** Yes [ ] No [ ]	**Date:**
VEGETATED SWALES	**YES***	**NO**	**INITIALS**	**OBSERVATIONS**	**CORRECTIVE ACTIONS/REPAIR ACTIVITY**	**DATE COMPLETED & BY WHOM** (Refer to any contractor service logs)
Swale along Gravel Access Road						
1. Is there an accumulation of sediment, debris and/or other obstructions?						
2. Is there any evidence of erosion, gullies or slumping of the side slopes?						
3. Are there areas of bare ground or sparse vegetation?						
4. Has vegetation been mowed to a length roughly 6" this year?						
Swale along Northwesterly side of yard						
1. Is there an accumulation of sediment, debris and/or other obstructions?						
2. Is there any evidence of erosion, gullies or slumping of the side slopes?						
3. Are there areas of bare ground or sparse vegetation?						
4. Has vegetation been mowed to a length roughly 6" this year?						
CHECK DAMS						
Check Dams in Swale along Gravel Access Road						
1. Are the edges of the check dams higher than the center?						
2. Is there any evidence of stone displacement, erosion, concentrated flow or channelization?						
3. Is there an accumulation of sediment, debris and/or other obstructions?						

APPENDIX A-2: BMP INSPECTION & MAINTENANCE LOG
Central Maine Power Company – Merrill Road Converter Substation
Lewiston, Maine

BMP MEASURE (Refer to Appendix B-1 & the O&M Plan)	**Inspector(s):**			**Inspection Type:** Monthly [ ] Follow-up [ ]	**Photos Taken:** Yes [ ] No [ ]	**Date:**
CHECK DAMS (cont.)	**YES***	**NO**	**INITIALS**	**OBSERVATIONS**	**CORRECTIVE ACTIONS/REPAIR ACTIVITY**	**DATE COMPLETED & BY WHOM** (Refer to any contractor service logs)
Check Dams in Swale along North, South and East sides of the yard						
1. Are the edges of the check dams higher than the center?						
2. Is there any evidence of stone displacement, erosion, concentrated flow or channelization?						
3. Is there an accumulation of sediment, debris and/or other obstructions?						
REVEGETATED AREAS						
Revegetated Areas along Access Road						
1. Is there any evidence of erosion, concentrated flow or channelization?						
2. Are there areas of bare ground or sparse vegetation?						
Revegetated Areas on all sides of the station						
1. Is there any evidence of erosion, concentrated flow or channelization?						
2. Are there areas of bare ground or sparse vegetation?						
GRAVEL ACCESS ROADS						
Access Road to Entrance						
1. Is there an accumulation of sand and/or sediment in the road shoulder?						
2. Does the grade across the road section allow stormwater to drain off the roadway?						
3. Are there any signs of rutting, wash-boarding, frost heaves, potholes or ponding?						

APPENDIX A-2: BMP INSPECTION & MAINTENANCE LOG

Central Maine Power Company – Merrill Road Converter Substation

Lewiston, Maine

BMP MEASURE (Refer to Appendix B-1 & the O&M Plan)	**Inspector(s):**			**Inspection Type:** Monthly [ ] Follow-up [ ]	**Photos Taken:** Yes [ ] No [ ]	**Date:**
GRASSED UNDERDRAINED SOIL FILTER						
West side of station yard and north of Access Road	**YES***	**NO**	**INITIALS**	**OBSERVATIONS**	**CORRECTIVE ACTIONS/REPAIR ACTIVITY**	**DATE COMPLETED & BY WHOM** (Refer to any contractor service logs)
1. Is there an accumulation of sand and/or sediment in the swale or basin?						
2. Is there any evidence of erosion, gullies or slumping of the side slopes?						
3. Are there areas of bare ground or sparse vegetation?						
CRUSHED STONE SUBSTATION SURFACE						
Fenced-in area of the Substation and aprons						
1. Is there an accumulation of sand/sediment in crushed stone areas?						

APPENDIX B – LETTER FROM MEDEP TO CMP

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

JUN 11 2008

JOHN ELIAS BALDACCI
GOVERNOR

DAVID P. LITTELL
COMMISSIONER

June 5, 2008

Roy Koster
Central Maine Power
83 Edison Drive
Augusta, ME 04336

RE: DEP Stormwater Management Regulations and how they apply to Central Maine Power Company Substations and Switchyards

Dear Mr. Koster:

I am writing to provide clarification on how substations and switchyards designed by Central Maine Power Company (CMP) can meet DEP Stormwater Management rules, Chapter 500 and the Site Location of Development Law. This letter supersedes a previous DEP letter on this subject dated February 29, 2008 and is a follow-up to further discussions between CMP and DEP staff.

Based on the report prepared by John Simon of Balance Engineering, dated March 8, 2008, regarding the stormwater runoff coefficient at CMP substations and switchyards, the required gravel fill and surface nature of these structures performs differently than most common construction practices and a modeling variance will be allowed for CMP substations and switchyards as follows:

When Flooding Standard requirements apply to a CMP project, modeling must demonstrate that peak runoff from the substation structure does not exceed predevelopment flow rates at the property line. Because of the permeability plus storage within the gravel fill and roughness of the crushed rock surface, the curve number (CN) specified in John Simon's report (March 2008) may be used for the substation area. As reported, a CN of 55 may be used for substations and switchyards that are built on areas that are mapped as HSG "A", "B", and "C", and a CN of 60 must be used when the area is mapped as HSG "D" for the HydroCAD model. However, all impervious surfaces will have to be added for an averaged curve number.

The General Standards of Chapter 500 (water quality) will be considered as met by the CMP substation/switchyard design specifications as long as the structure includes the typical CMP substation profile overlaying the natural ground surface. The soil layers within the CMP substation profile consist of 4 inches of crushed stone, 50:50 mix of 1.5"

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web site: www.maine.gov/dep

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and 0.75" diameter stone overlaying 18 inches or more of gravel fill, MDOT 703.06 Type A. Saturation within the granular fill will detain and provide treatment for the one-inch design standard under that requirement. Groundwater can never be any higher than 18 inches below the top of the gravel fill. Other treatment considerations will need to be provided for all impervious structures anticipated on the substation and switchyard and for the roadway.

The Basic Standards of Chapter 500 (erosion and sedimentation control, inspection and maintenance, and housekeeping) will be met by the standard CMP substation and switchyard design specification and erosion control/construction plan as developed by CMP for each Stormwater Management application. These are minimum erosion control measures that will need to be maintained until the site is fully stabilized. However, based on site and weather conditions during construction, additional erosion control measures may be needed.

While there are several ways to approach the design standards discussed above, these must be considered the minimum requirements in meeting the Stormwater Management and Site Location of Development Laws. However, in some situations where the local hydrology and site conditions warrant more resource protection, additional BMPs may be required. Also, the access drive and associated roadside swales are included in the disturbed area for permitting purposes and the treatment of these areas must be addressed separately from the substation or switchyard and be treated with standard practices. The natural hydrology of these areas will need to be maintained and will have to meet all applicable standards as established in Chapter 500 (page 11, Section 5).

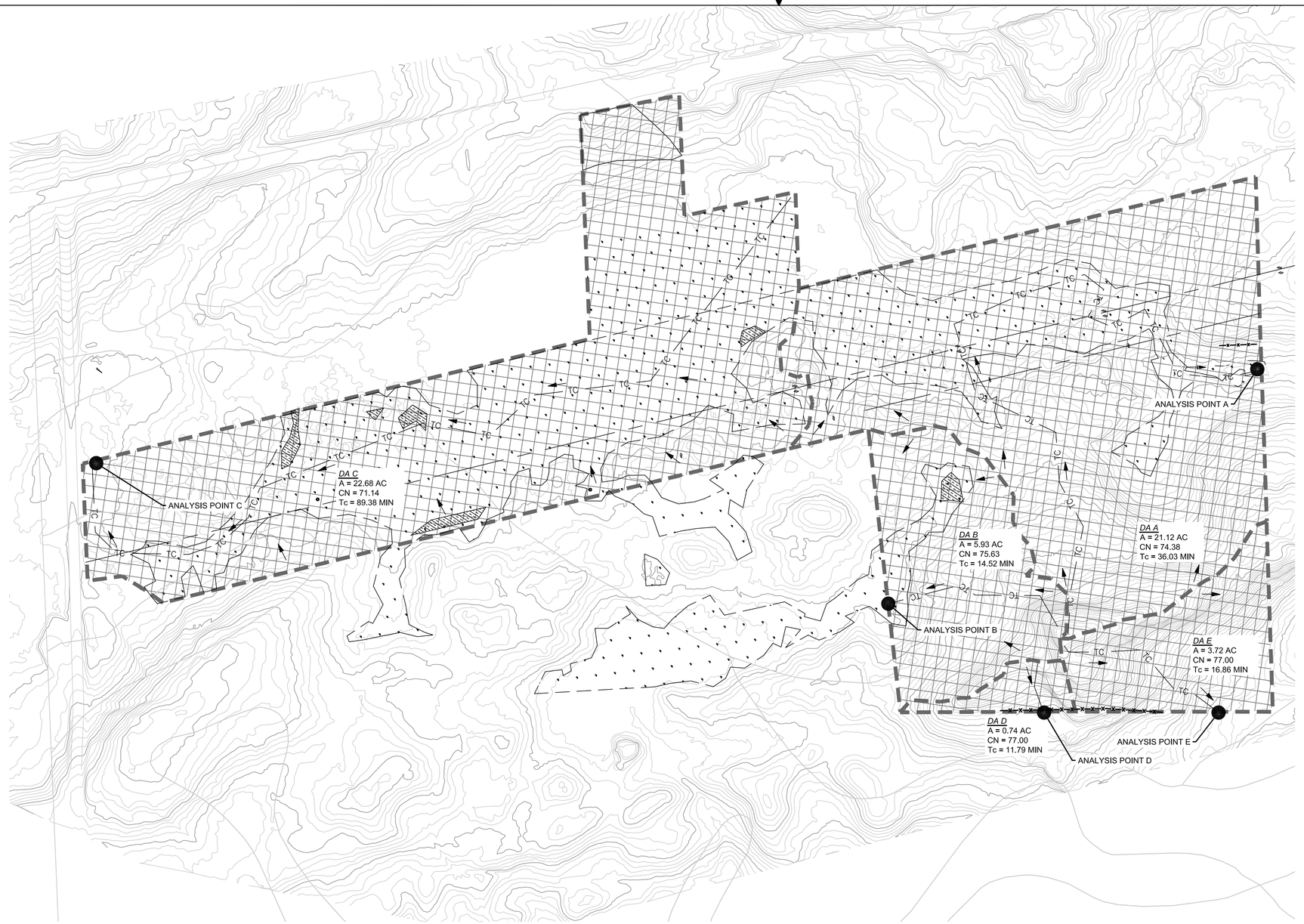
I hope this addresses your request and will make the DEP permitting process more straight forward. If you have further questions, please contact Marianne Hubert at (207) 287-4140.

Sincerely,

Don Witherill, Director
Watershed Management Division
Bureau of Land and Water Quality

Cc: Marianne Hubert, PE, DEP program manager
Andy Fisk, DEP L&W Bureau Director
Dan Butler, PE, TRC
Gerry Mirabile, CMP

APPENDIX C – STORMWATER CALCULATIONS



LEGEND

- 750 — EX. MAJOR CONTOUR
- 744 — EX. MINOR CONTOUR
- TC — EX. TIME OF CONCENTRATION
- HrD (D Soils) / HrC (C Soils) — EX. SOIL BOUNDARY
- EX. OVERHEAD UTILITY
- EX. FLOW DIRECTION ARROW
- EX. DRAINAGE BOUNDARY
- EX. PROPERTY BOUNDARY
- EX. WETLAND
- EX. VERNAL POOL
- ANALYSIS POINT
- EX. WOODS

EXISTING CONDITIONS HYDRAULIC SUMMARY			
DRAINAGE AREA	2 - YEAR FLOW RATE (CFS)	10 - YEAR FLOW RATE (CFS)	25 - YEAR FLOW RATE (CFS)
A	11.75	26.46	36.58
B	5.09	11.09	15.17
C	5.88	14.62	20.83
D	0.74	1.55	2.09
E	3.31	7.00	9.47

0 300 600 Feet

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION
08/09/18

REV.	DESCRIPTION	DATE	BY	CK	APP
B	ACCESS ROAD ALIGNMENT REVISIONS	07/12/18	TJG	KRV	
C	STORMWATER MANAGEMENT REVISIONS	08/09/18	TJG	KRV	

OWNER ENGINEER:

APPROVAL STAMP:

PE Stamp

DRAWING PREPARED BY:

ACCEPTED BY OE:

IUSA ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of Iberdrola, USA

CMP IBERDROLA - USA

REV.	DATE	BY	DESCRIPTION	APP.

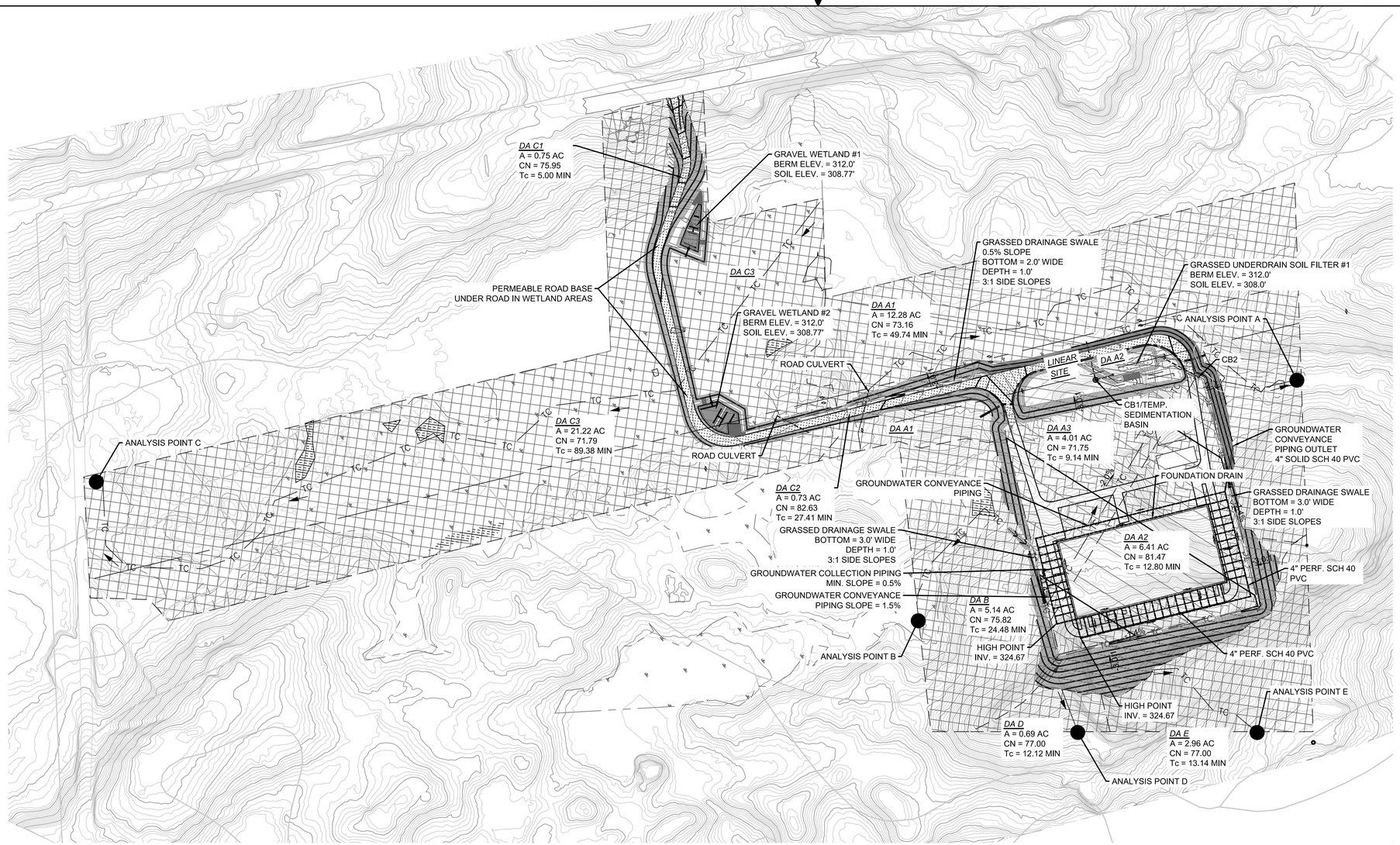
PRE-DEVELOPMENT STORMWATER PLAN

SH 3 OF 6

MERRILL ROAD/1076 LEWISTON, ME

DR. TJG | SCALE: 1" = 150' | FILE: 1076-003-002SH003.DWG
CK. KRV | NO. 1076-003-002 | REV. C
APP.
DATE:

ANSI D CADD Drawing, DO NOT REVISE MANUALLY.



LEGEND

- 750 — EX. MAJOR CONTOUR
- 744 — EX. MINOR CONTOUR
- HrD (D Soils) / HrC (C Soils) — EX. SOIL BOUNDARY
- EX. OVERHEAD UTILITY
- EX. PROPERTY BOUNDARY
- EX. WETLAND
- EX. VERNAL POOL
- 750 — PROP. MAJOR CONTOUR
- 744 — PROP. MINOR CONTOUR
- TC — PROP. TIME OF CONCENTRATION
- PROP. FLOW DIRECTION ARROW
- PROP. DRAINAGE BOUNDARY
- ANALYSIS POINT
- PROP. CULVERT/PIPING
- PROP. SITE/LINEAR DEMARCATION
- PROP. IMPERVIOUS PAVING/ROOF
- EX. WOODS
- PROP. STONE PAD
- PROP. DEVELOPED GRASS
- PROP. GRAVEL ROAD
- PROP. UNDERDRAIN SOIL FILTER/GRAVEL WETLAND

PROPOSED CONDITIONS HYDRAULIC SUMMARY

DRAINAGE AREA	2 - YEAR FLOW RATE (CFS)	10 - YEAR FLOW RATE (CFS)	25 - YEAR FLOW RATE (CFS)	PEAK 2 - YEAR FLOW RATE AT ANALYSIS POINT (IF SUBSHEDS PRESENT)	PEAK 10 - YEAR FLOW RATE AT ANALYSIS POINT (IF SUBSHEDS PRESENT)	PEAK 25 - YEAR FLOW RATE AT ANALYSIS POINT (IF SUBSHEDS PRESENT)
A1	5.33	12.43	17.35	11.73	23.66	31.35
A2	7.96	15.32	20.10			
A3	2.99	7.15	10.03			
B	3.66	8.01	10.95	N/A	N/A	N/A
C1	0.81	1.70	2.30	5.81	14.08	20.07
C2	0.74	1.40	1.82			
C3	5.79	14.12	19.95			
D	0.68	1.43	1.93	N/A	N/A	N/A
E	2.85	6.01	8.13	N/A	N/A	N/A

STORMWATER TREATMENT REQUIREMENTS (% OF TREATED AREA)

LAND TYPE	STATION	STATION % TREATED	LINEAR	LINEAR % TREATED
IMPERVIOUS TOTAL[1]	7.15 AC	99.33%	0.96 AC	78.70%
IMPERVIOUS TREATED	7.10 AC		0.76 AC	
DEVELOPED TOTAL[2,3]	10.71 AC	83.75%	2.71 AC	54.90%
DEVELOPED TREATED	8.97 AC		1.49 AC	

[1]IMPERVIOUS TOTAL DOES NOT INCLUDE 0.20 ACRES OF EXEMPTED WETLAND ROAD CROSSING AREA WITH PERMEABLE ROAD BASE

[2]DEVELOPED TOTAL DOES NOT INCLUDE 0.47 ACRES OF EXEMPTED WETLAND ROAD CROSSING AREA WITH PERMEABLE ROAD BASE

[3]DEVELOPED AREA INCLUDES BOTH IMPERVIOUS AND LANDSCAPED SURFACES

0 300 600 Feet

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION
08/09/18

REV.	DESCRIPTION	DATE	BY	CK	APP
B	MEDEP PERMIT SET COMMENT REVISIONS	05/29/18	TJG	KRV	
C	ACCESS ROAD ALIGNMENT REVISIONS	07/12/18	TJG	KRV	
D	STORMWATER MANAGEMENT REVISIONS	08/09/18	TJG	KRV	
E	STORMWATER MANAGEMENT REVISIONS	01/15/19	AJW	KRV	

OWNER ENGINEER:
APPROVAL STAMP:
PE Stamp
DRAWING PREPARED BY:
ACCEPTED BY OE:

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CMP IBERDROLA - USA

REV.	DATE	BY	DESCRIPTION	APP.

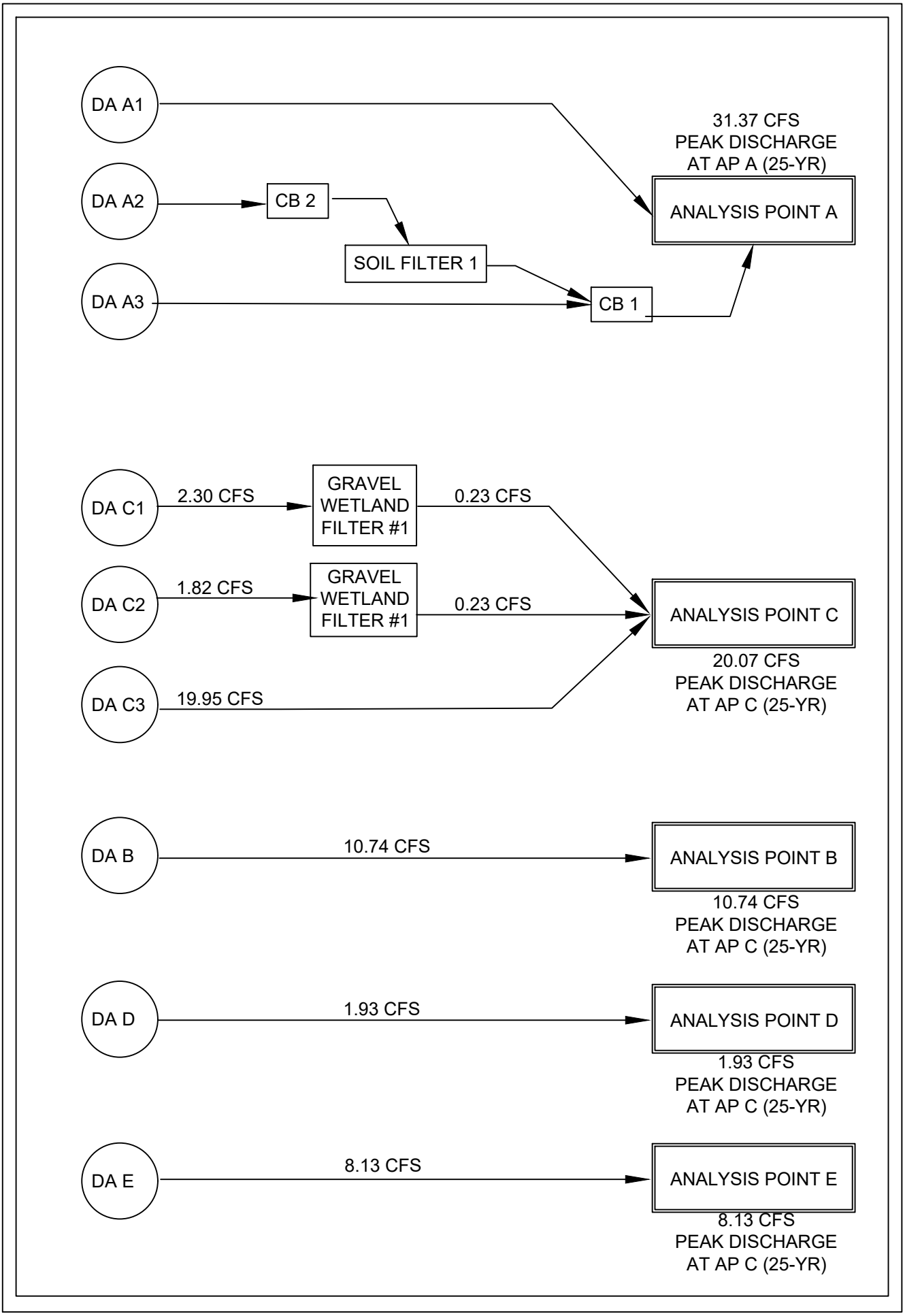
POST-DEVELOPMENT STORMWATER PLAN

SH 4 OF 6

MERRILL ROAD/1076 LEWISTON, ME

DR. TJG | SCALE: 1" = 150' | FILE: 1076-003-002SH004.DWG
CK. KRV | NO. 1076-003-002 | REV. E
APP.
DATE:

ANSI D CADD Drawing, DO NOT REVISE MANUALLY


DA A1
DA A2
CB 2
SOIL FILTER 1
DA A3
CB 1
31.37 CFS
PEAK DISCHARGE
AT AP A (25-YR)
ANALYSIS POINT A
DA C1
2.30 CFS
GRAVEL
WETLAND
FILTER #1
0.23 CFS
DA C2
1.82 CFS
GRAVEL
WETLAND
FILTER #1
0.23 CFS
DA C3
19.95 CFS
ANALYSIS POINT C
20.07 CFS
PEAK DISCHARGE
AT AP C (25-YR)
DA B
10.74 CFS
ANALYSIS POINT B
10.74 CFS
PEAK DISCHARGE
AT AP C (25-YR)
DA D
1.93 CFS
ANALYSIS POINT D
1.93 CFS
PEAK DISCHARGE
AT AP C (25-YR)
DA E
8.13 CFS
ANALYSIS POINT E
8.13 CFS
PEAK DISCHARGE
AT AP C (25-YR)

Project Description

File Name ..... Existing Conditions.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Jul 13, 2017 00:00:00
End Analysis On ..... Jul 14, 2017 00:00:00
Start Reporting On ..... Jul 13, 2017 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	5
Nodes	5
Junctions	0
Outfalls	5
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-02	Cumulative	inches	Maine	Androscoggin	2	3.04	SCS Type III 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
A	21.12	74.38	3.04	0.95	20.15	11.75	0 00:36:01
B	5.93	75.63	3.04	1.02	6.05	5.09	0 00:14:31
C	22.68	71.14	3.04	0.79	17.92	5.88	0 01:29:22
D	0.74	77.00	3.04	1.10	0.81	0.74	0 00:11:47
E	3.72	77.00	3.04	1.10	4.09	3.31	0 00:16:51

Node Summary

Element ID	Element Type	Invert Elevation (ft)
OUT-A	Outfall	298.00
OUT-B	Outfall	310.00
OUT-C	Outfall	298.00
OUT-D	Outfall	338.00
OUT-E	Outfall	298.00

Subbasin Hydrology

Subbasin : A

Input Data

Area (ac) 21.12
Weighted Curve Number 74.38
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	7.92	C	70.00
Woods, Good	13.20	D	77.00
Composite Area & Weighted CN	21.12		74.38

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	32.75	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.17	0.00	0.00
Computed Flow Time (min) :	10.03	0.00	0.00

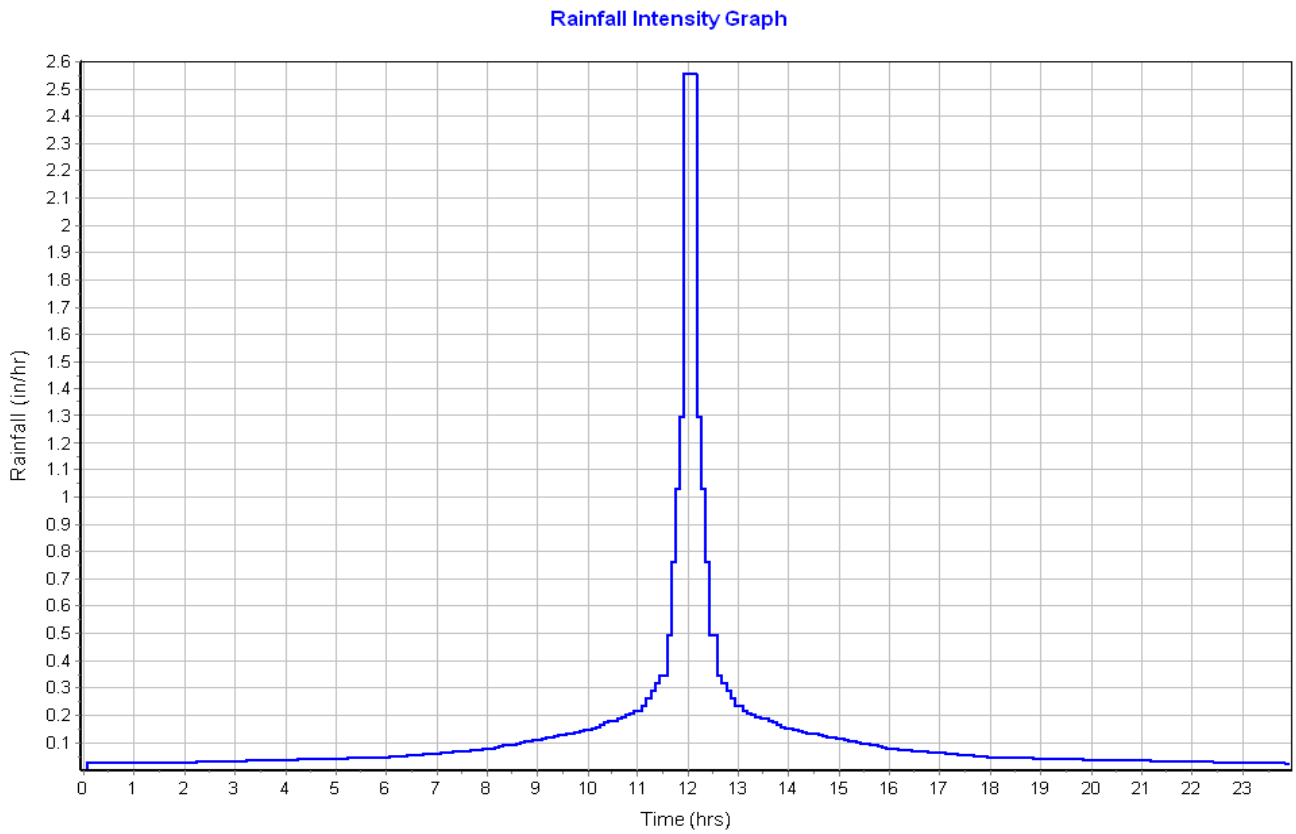
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	870	1086	0.00
Slope (%) :	5.65	.76	0.00
Surface Type :	Woodland		Unpaved
Velocity (ft/sec) :	1.19	1.31	0.00
Computed Flow Time (min) :	12.18	13.82	0.00

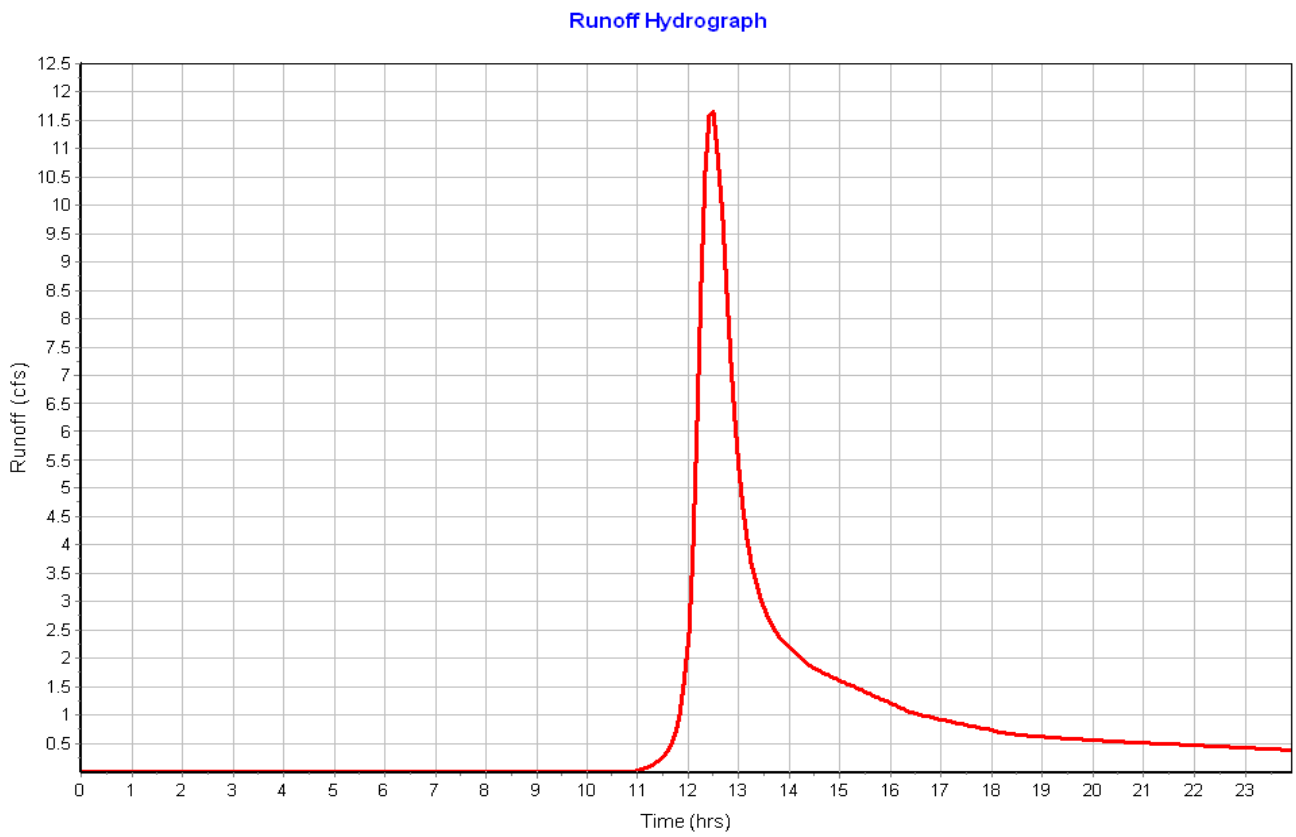
Total TOC (min) 36.03

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 0.95
Peak Runoff (cfs) 11.75
Weighted Curve Number 74.38
Time of Concentration (days hh:mm:ss) 0 00:36:02

Subbasin : A


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B

Input Data

Area (ac) 5.93
Weighted Curve Number 75.63
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	1.16	C	70.00
Woods, Good	4.77	D	77.00
Composite Area & Weighted CN	5.93		75.63

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	34	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.17	0.00	0.00
Computed Flow Time (min) :	9.88	0.00	0.00

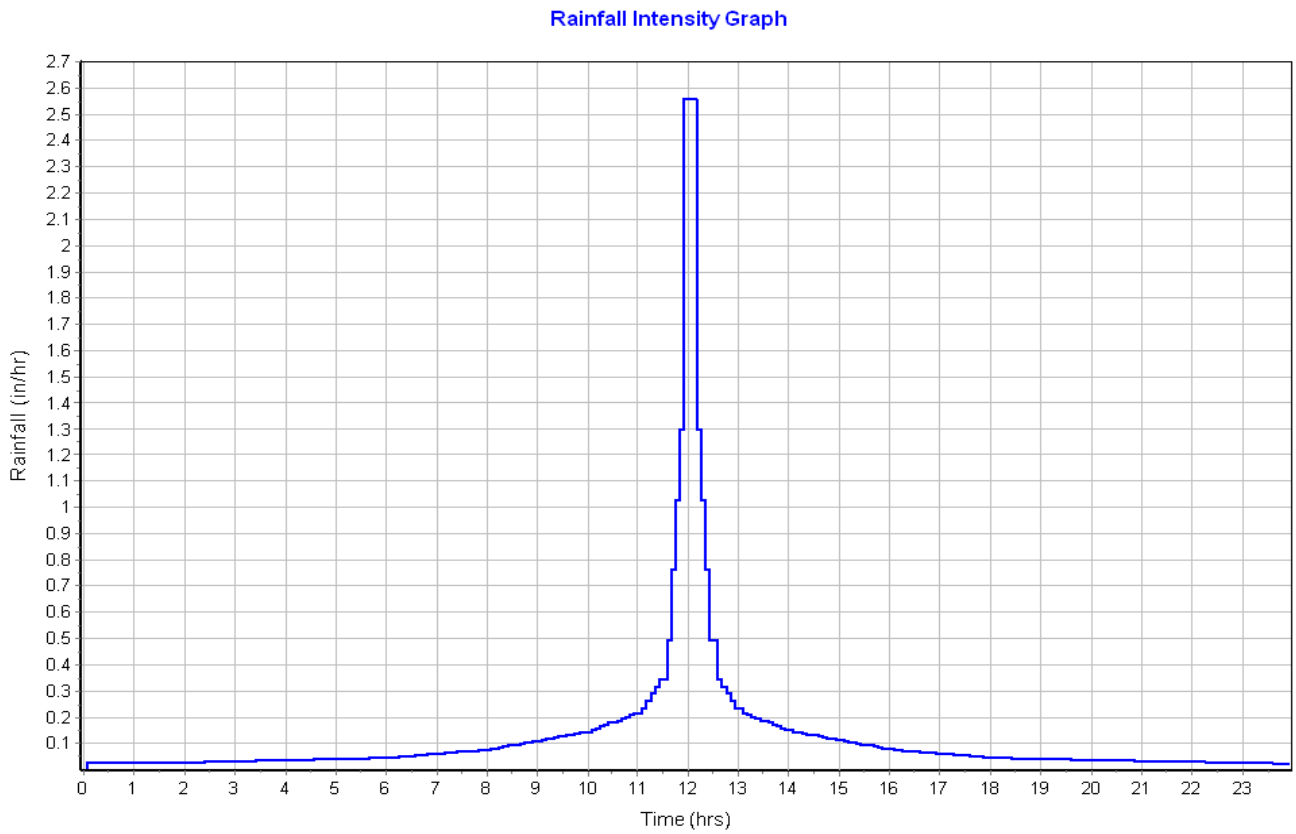
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	440	0.00	0.00
Slope (%) :	10	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.58	0.00	0.00
Computed Flow Time (min) :	4.64	0.00	0.00

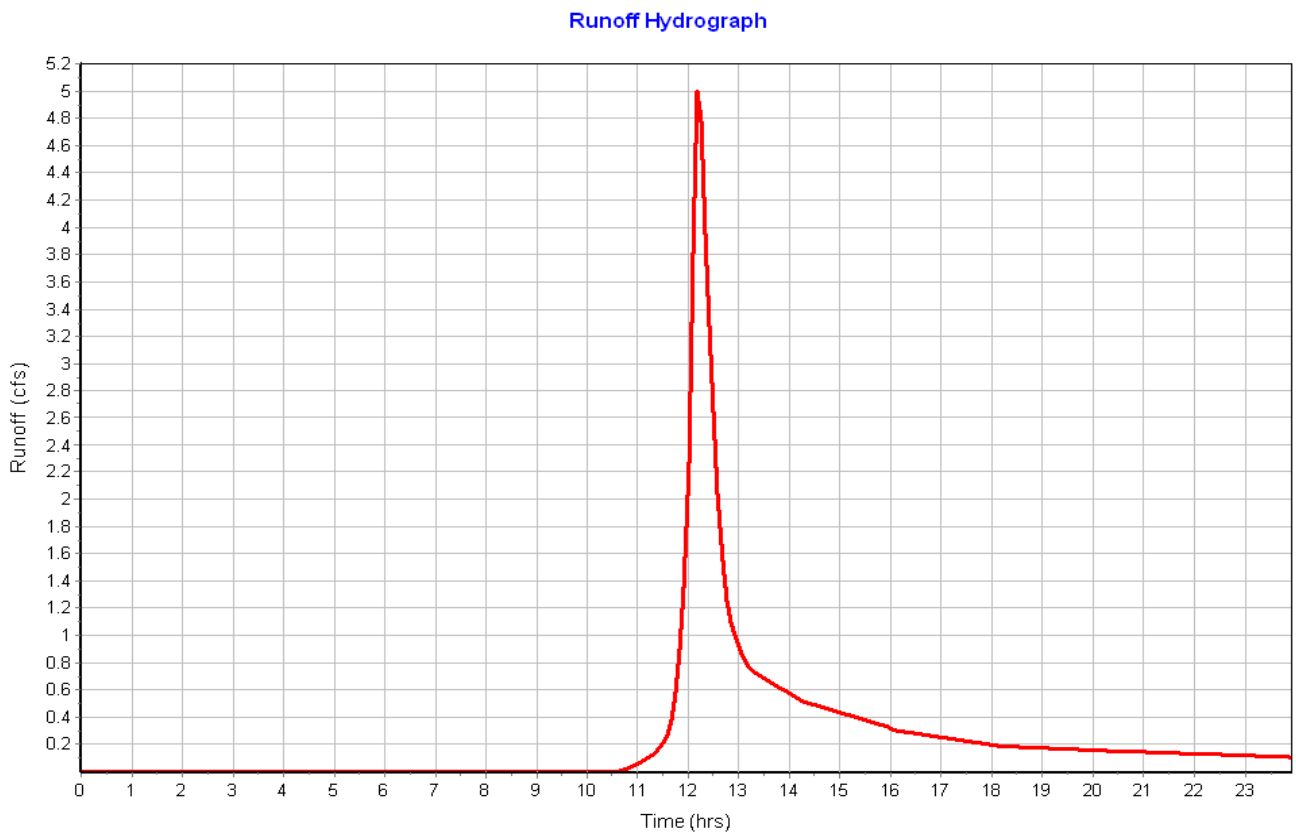
Total TOC (min) 14.52

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 1.02
Peak Runoff (cfs) 5.09
Weighted Curve Number 75.63
Time of Concentration (days hh:mm:ss) 0 00:14:31

Subbasin : B


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C

Input Data

Area (ac) 22.68
Weighted Curve Number 71.14
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	14.42	C	70.00
Woods, Good	7.58	D	77.00
Woods, Good	0.68	A	30.00
Composite Area & Weighted CN	22.68		71.14

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	.47	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.03	0.00	0.00
Computed Flow Time (min) :	54.75	0.00	0.00

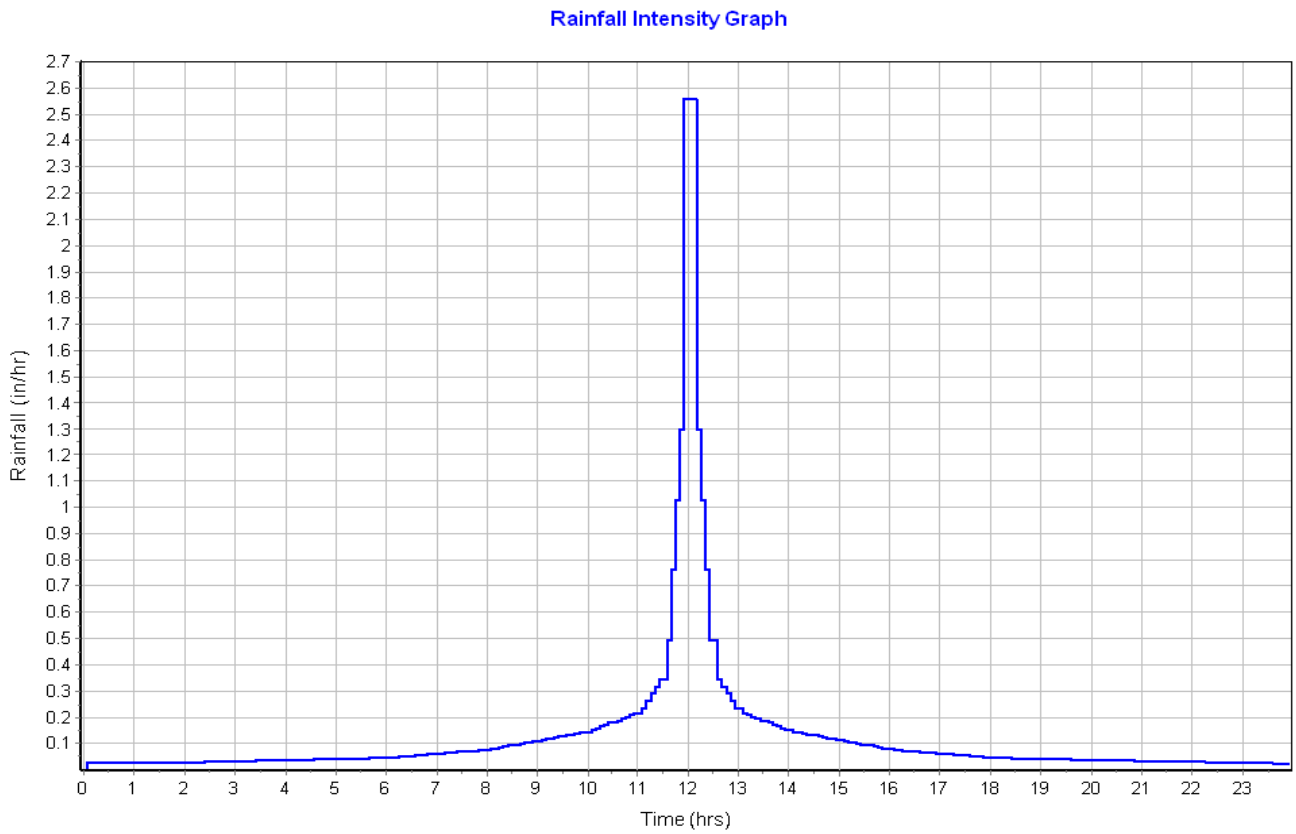
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2140	0.00	0.00
Slope (%) :	.47	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	1.03	0.00	0.00
Computed Flow Time (min) :	34.63	0.00	0.00

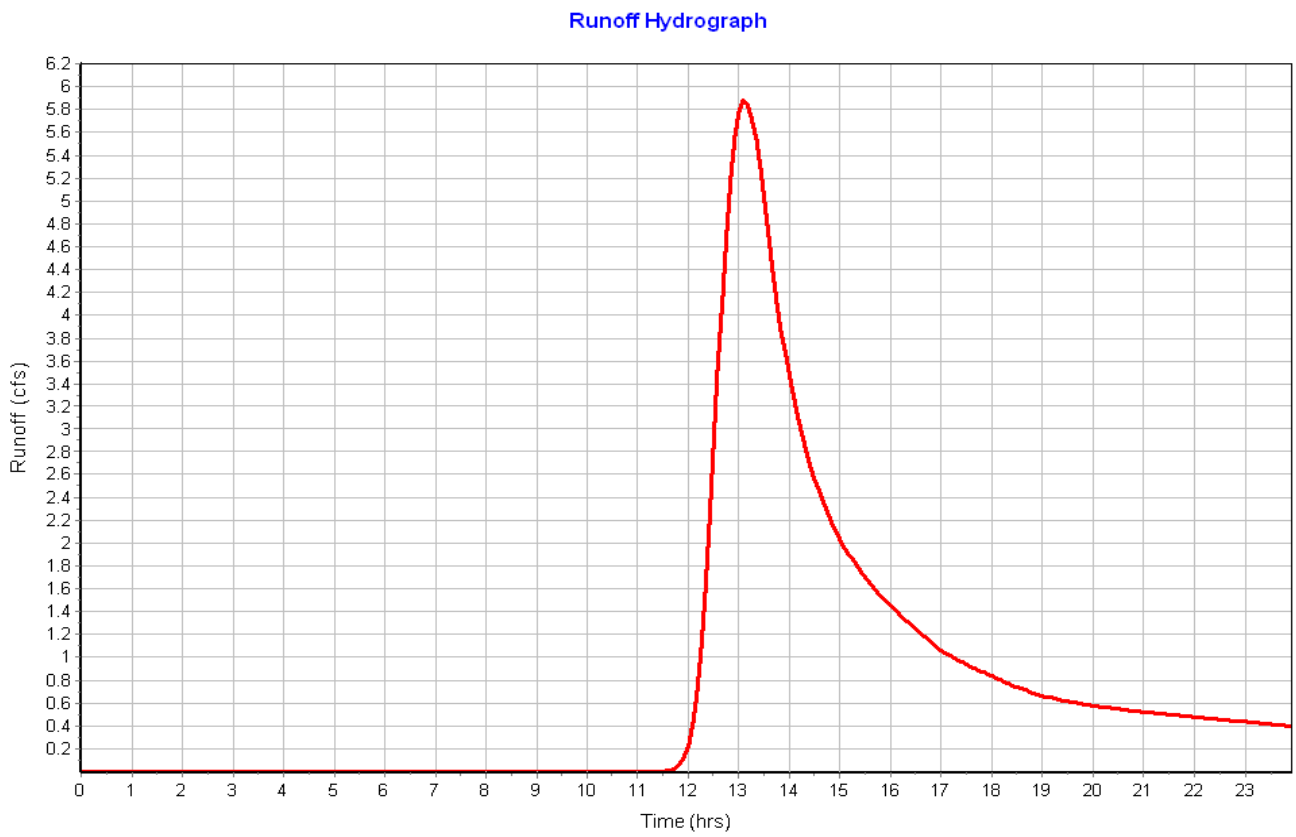
Total TOC (min) 89.38

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 0.79
Peak Runoff (cfs) 5.88
Weighted Curve Number 71.14
Time of Concentration (days hh:mm:ss) 0 01:29:23

Subbasin : C


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : D

Input Data

Area (ac) 0.74
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.74	D	77.00
Composite Area & Weighted CN	0.74		77.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	23.2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.14	0.00	0.00
Computed Flow Time (min) :	11.51	0.00	0.00

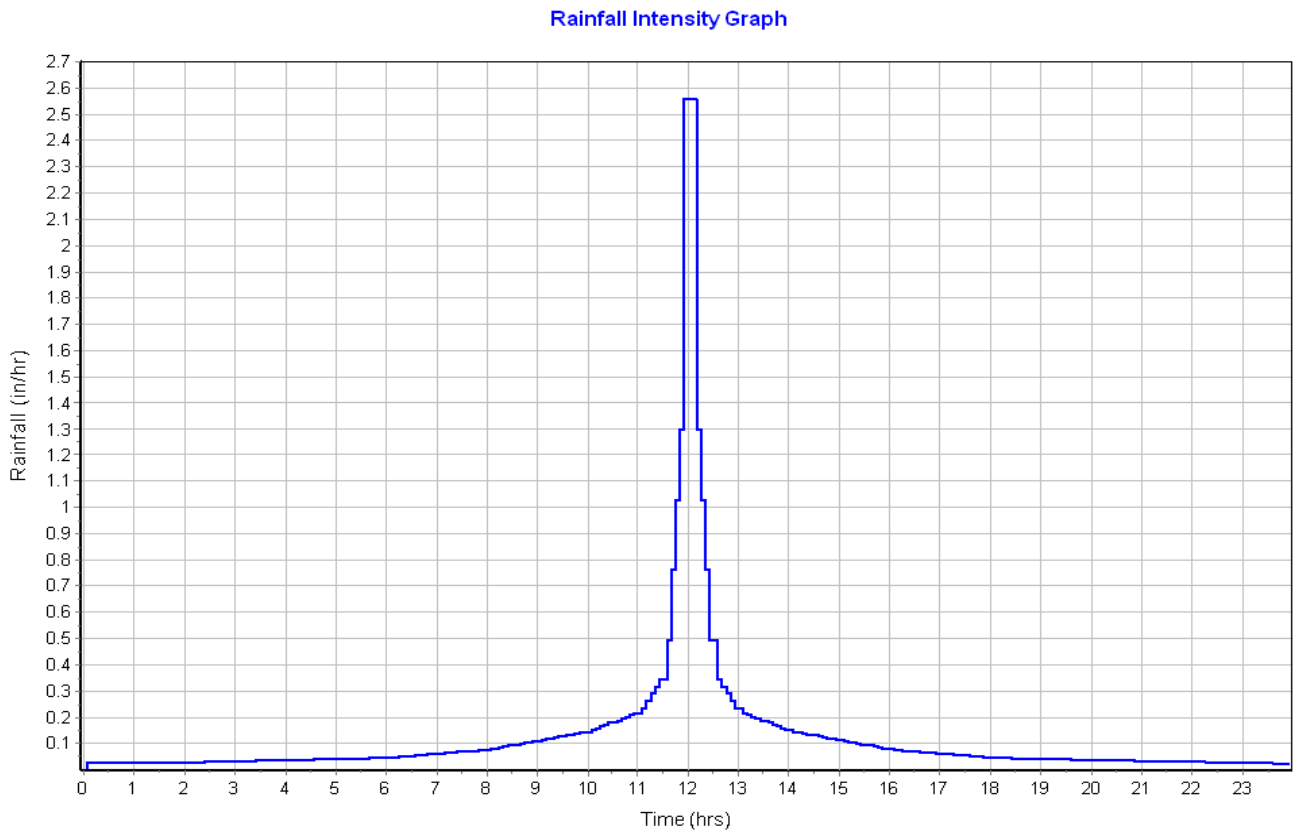
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	33	0.00	0.00
Slope (%) :	14.75	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.92	0.00	0.00
Computed Flow Time (min) :	0.29	0.00	0.00

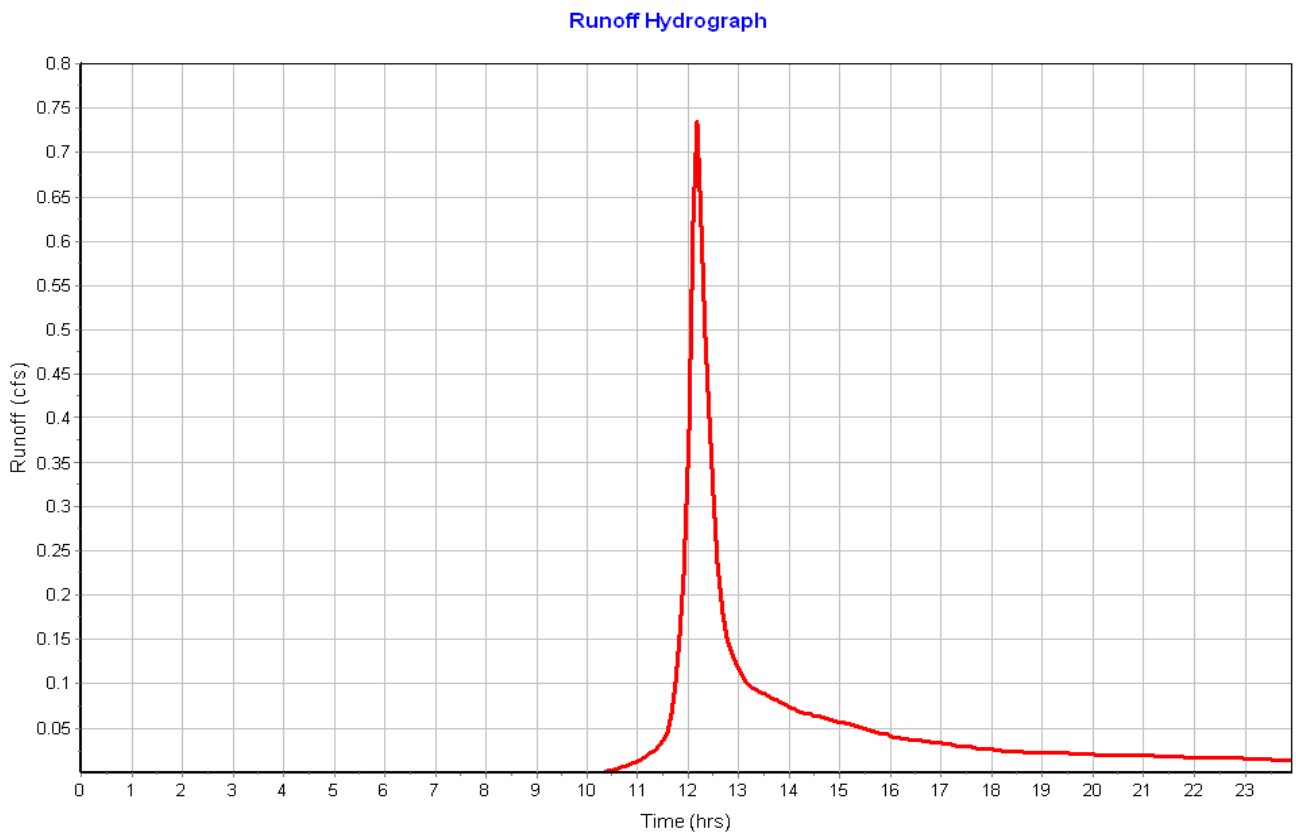
Total TOC (min) 11.79

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 1.10
Peak Runoff (cfs) 0.74
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:11:47

Subbasin : D


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : E

Input Data

Area (ac) 3.72
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	3.72	D	77.00
Composite Area & Weighted CN	3.72		77.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	14	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	14.09	0.00	0.00

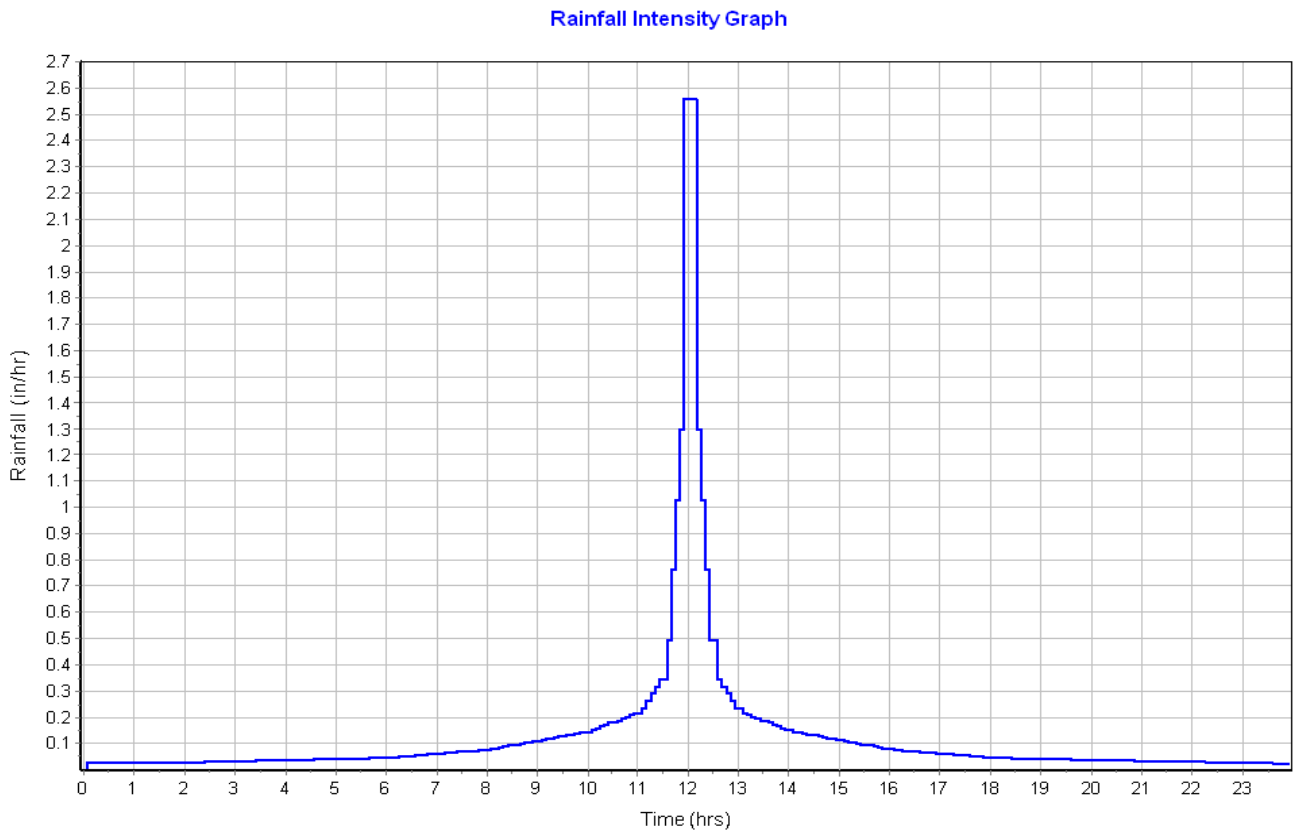
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	375	0.00	0.00
Slope (%) :	20.25	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.25	0.00	0.00
Computed Flow Time (min) :	2.78	0.00	0.00

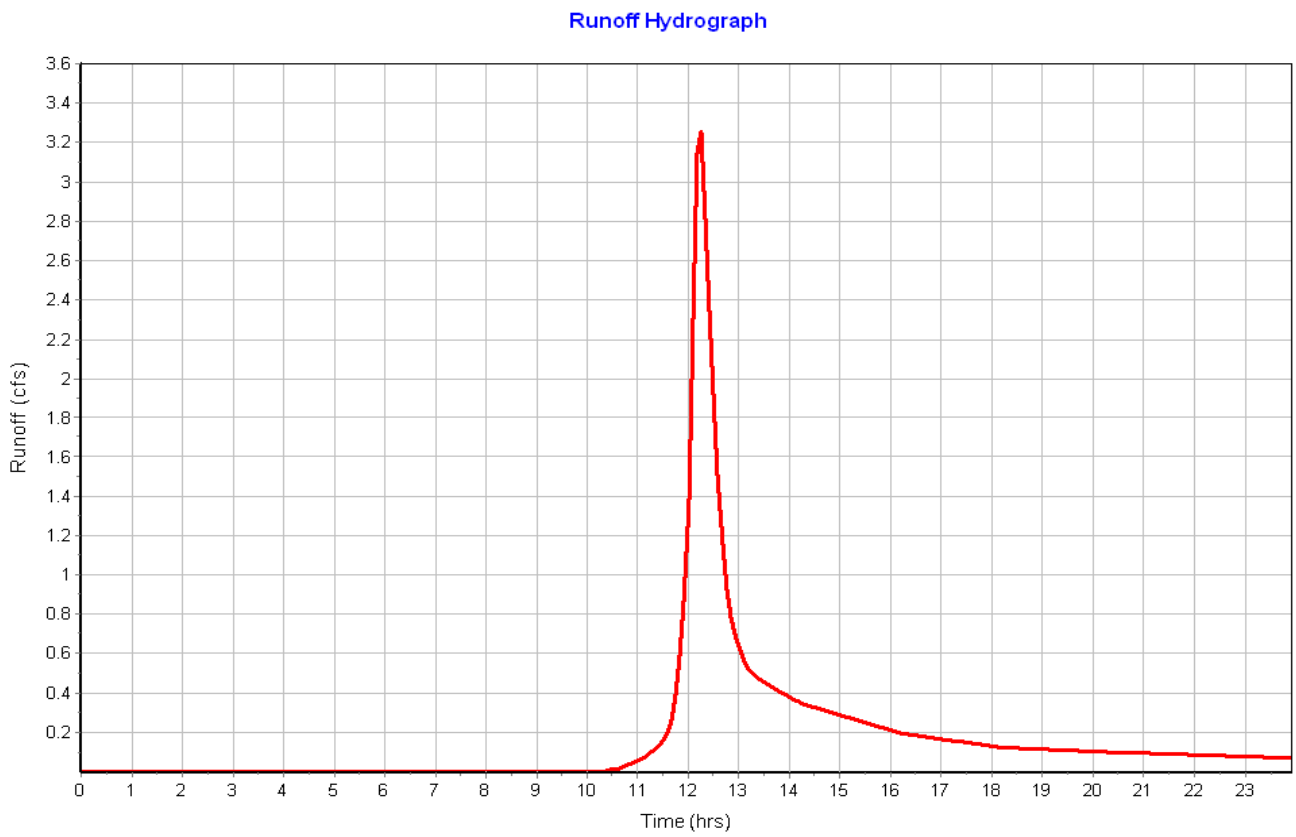
Total TOC (min) 16.86

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 1.10
Peak Runoff (cfs) 3.31
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:16:52

Subbasin : E


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Project Description

File Name ..... Existing Conditions.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Jul 13, 2017 00:00:00
End Analysis On ..... Jul 14, 2017 00:00:00
Start Reporting On ..... Jul 13, 2017 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	5
Nodes	5
Junctions	0
Outfalls	5
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-10	Cumulative	inches	Maine	Androscoggin	10	4.55	SCS Type III 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
A	21.12	74.38	4.55	2.04	43.11	26.46	0 00:36:01
B	5.93	75.63	4.55	2.14	12.69	11.09	0 00:14:31
C	22.68	71.14	4.55	1.79	40.67	14.62	0 01:29:22
D	0.74	77.00	4.55	2.25	1.67	1.55	0 00:11:47
E	3.72	77.00	4.55	2.25	8.37	7.00	0 00:16:51

Node Summary

Element ID	Element Type	Invert Elevation (ft)
OUT-A	Outfall	298.00
OUT-B	Outfall	310.00
OUT-C	Outfall	298.00
OUT-D	Outfall	338.00
OUT-E	Outfall	298.00

Subbasin Hydrology

Subbasin : A

Input Data

Area (ac) 21.12
Weighted Curve Number 74.38
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	7.92	C	70.00
Woods, Good	13.20	D	77.00
Composite Area & Weighted CN	21.12		74.38

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	32.75	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.17	0.00	0.00
Computed Flow Time (min) :	10.03	0.00	0.00

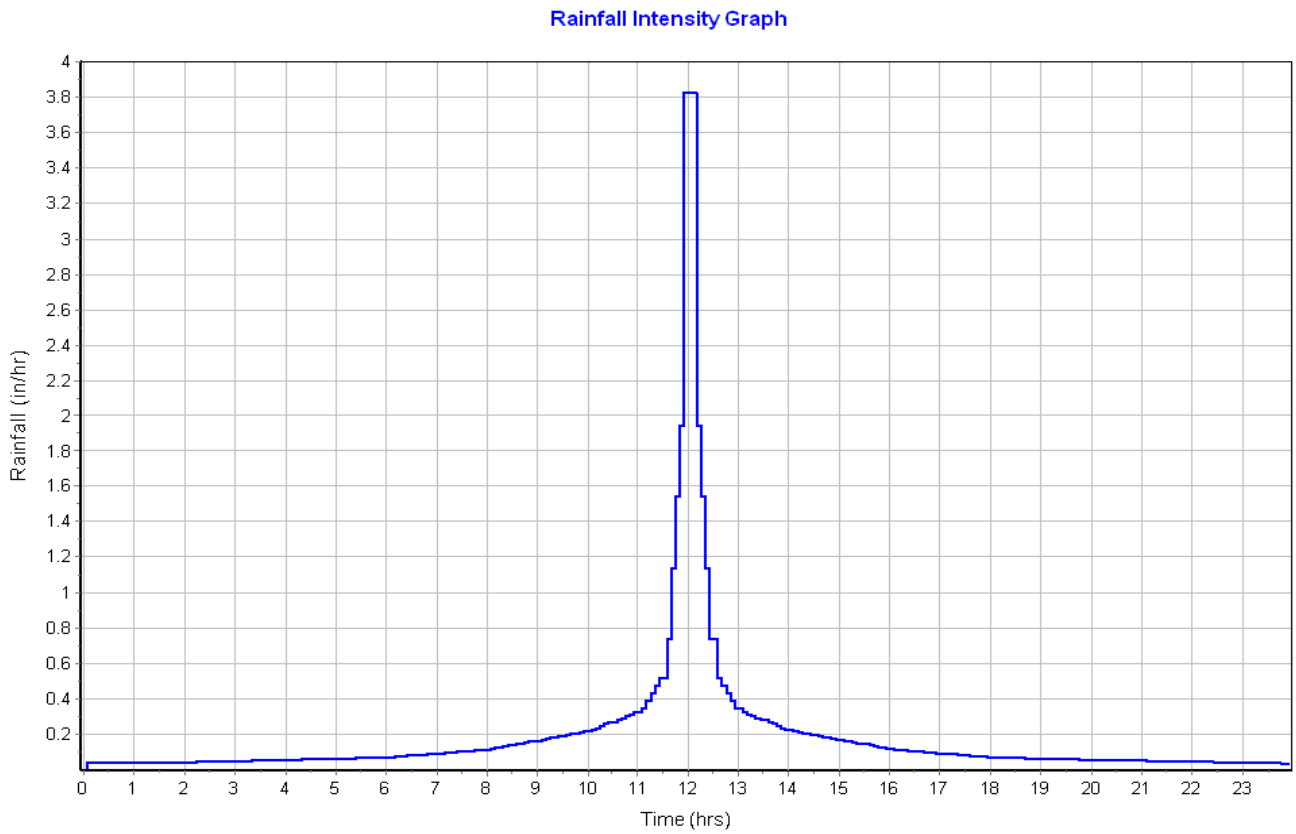
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	870	1086	0.00
Slope (%) :	5.65	.76	0.00
Surface Type :	Woodland		Unpaved
Velocity (ft/sec) :	1.19	1.31	0.00
Computed Flow Time (min) :	12.18	13.82	0.00

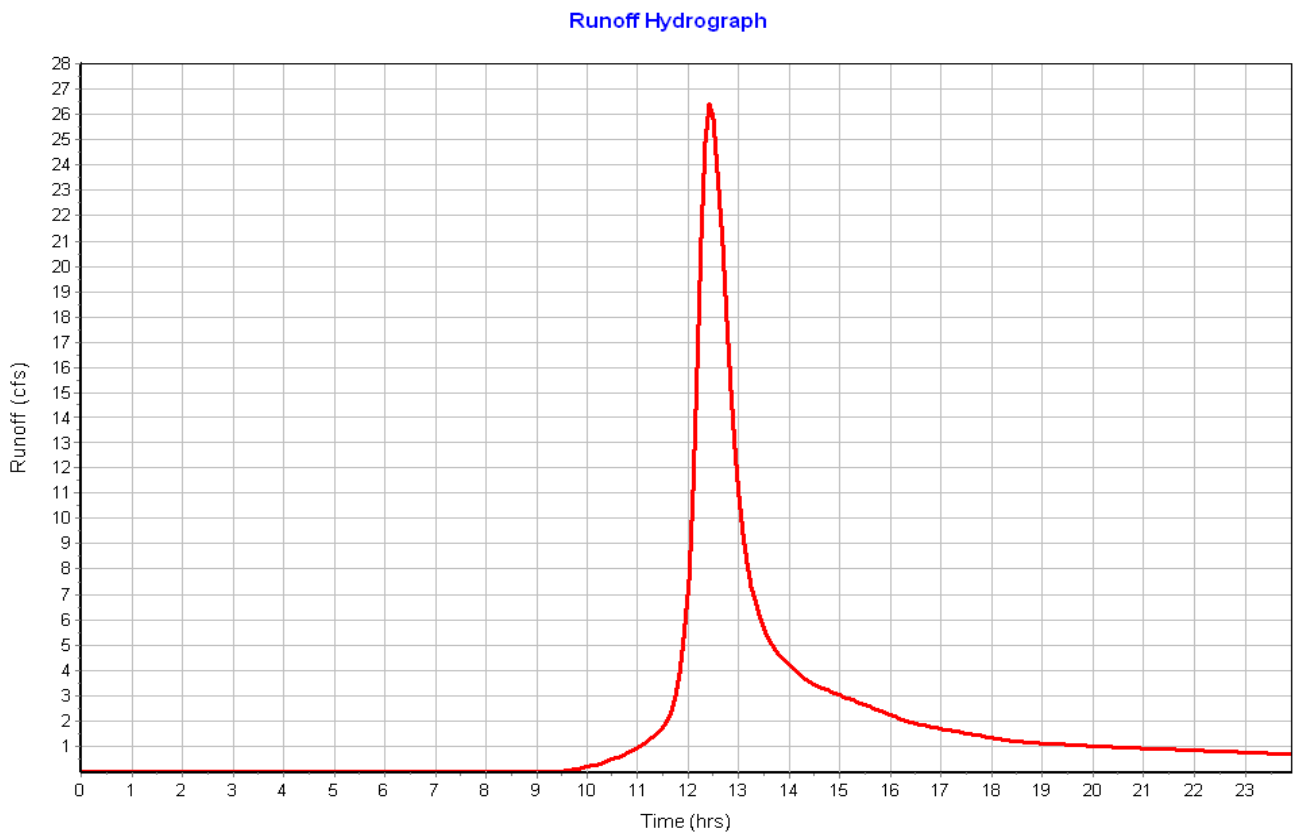
Total TOC (min) 36.03

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 2.04
Peak Runoff (cfs) 26.46
Weighted Curve Number 74.38
Time of Concentration (days hh:mm:ss) 0 00:36:02

Subbasin : A


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B

Input Data

Area (ac) 5.93
Weighted Curve Number 75.63
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	1.16	C	70.00
Woods, Good	4.77	D	77.00
Composite Area & Weighted CN	5.93		75.63

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	34	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.17	0.00	0.00
Computed Flow Time (min) :	9.88	0.00	0.00

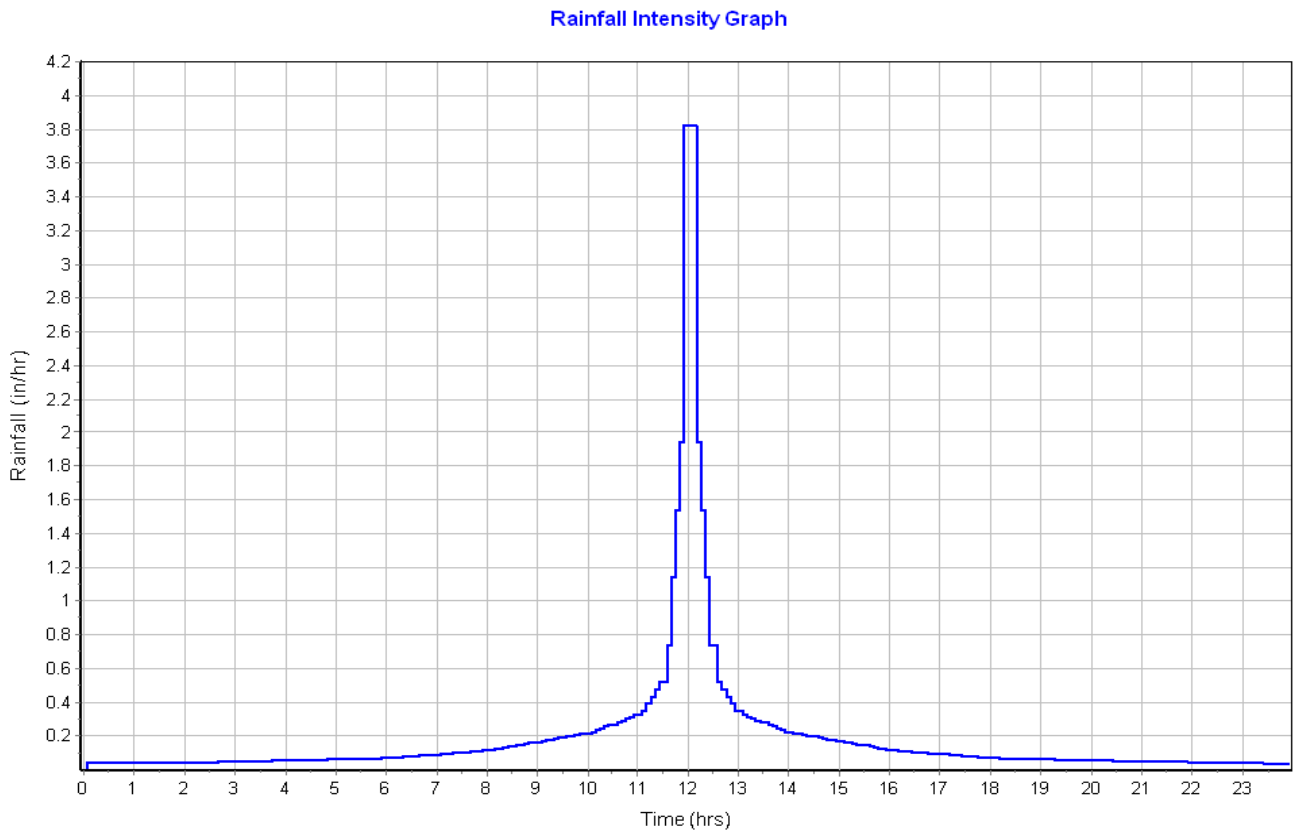
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	440	0.00	0.00
Slope (%) :	10	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.58	0.00	0.00
Computed Flow Time (min) :	4.64	0.00	0.00

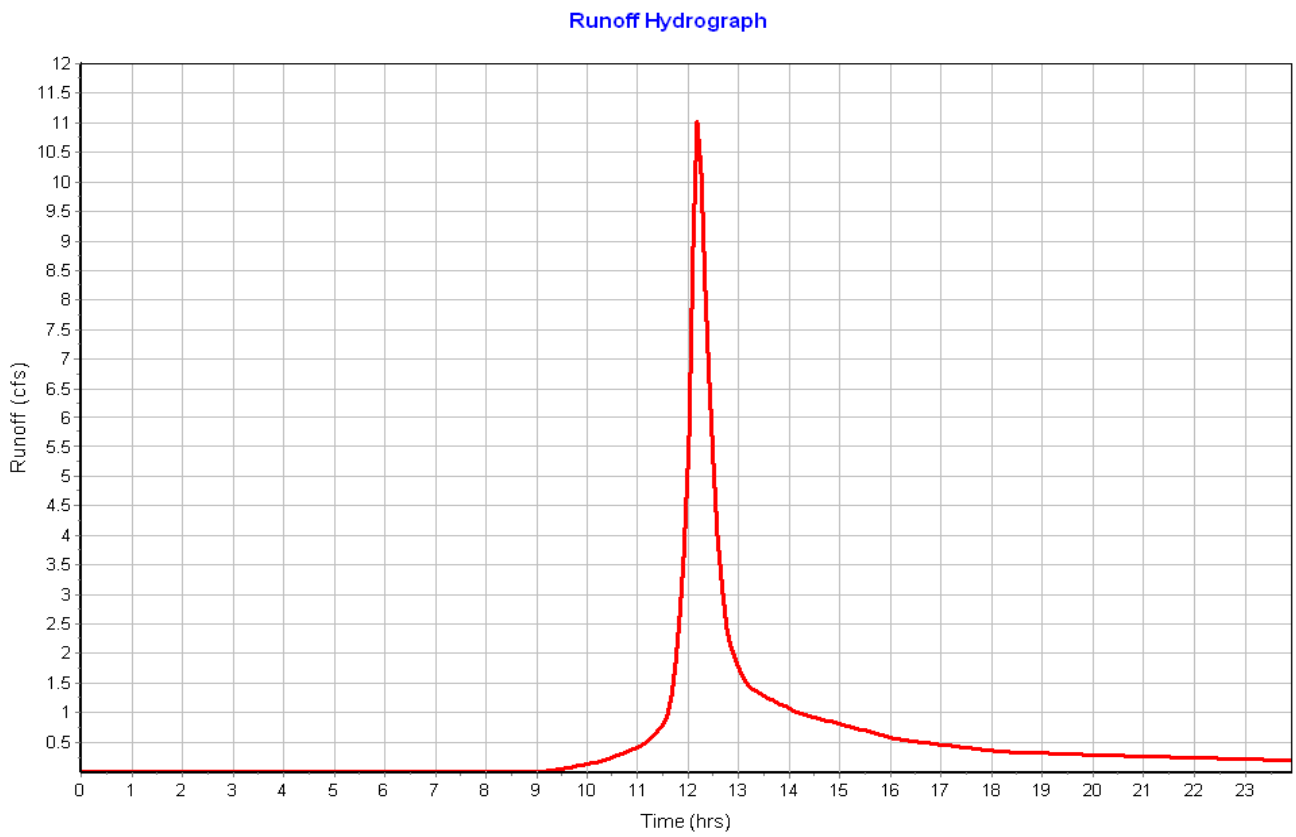
Total TOC (min) 14.52

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 2.14
Peak Runoff (cfs) 11.09
Weighted Curve Number 75.63
Time of Concentration (days hh:mm:ss) 0 00:14:31

Subbasin : B


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C

Input Data

Area (ac) 22.68
Weighted Curve Number 71.14
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	14.42	C	70.00
Woods, Good	7.58	D	77.00
Woods, Good	0.68	A	30.00
Composite Area & Weighted CN	22.68		71.14

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	.47	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.03	0.00	0.00
Computed Flow Time (min) :	54.75	0.00	0.00

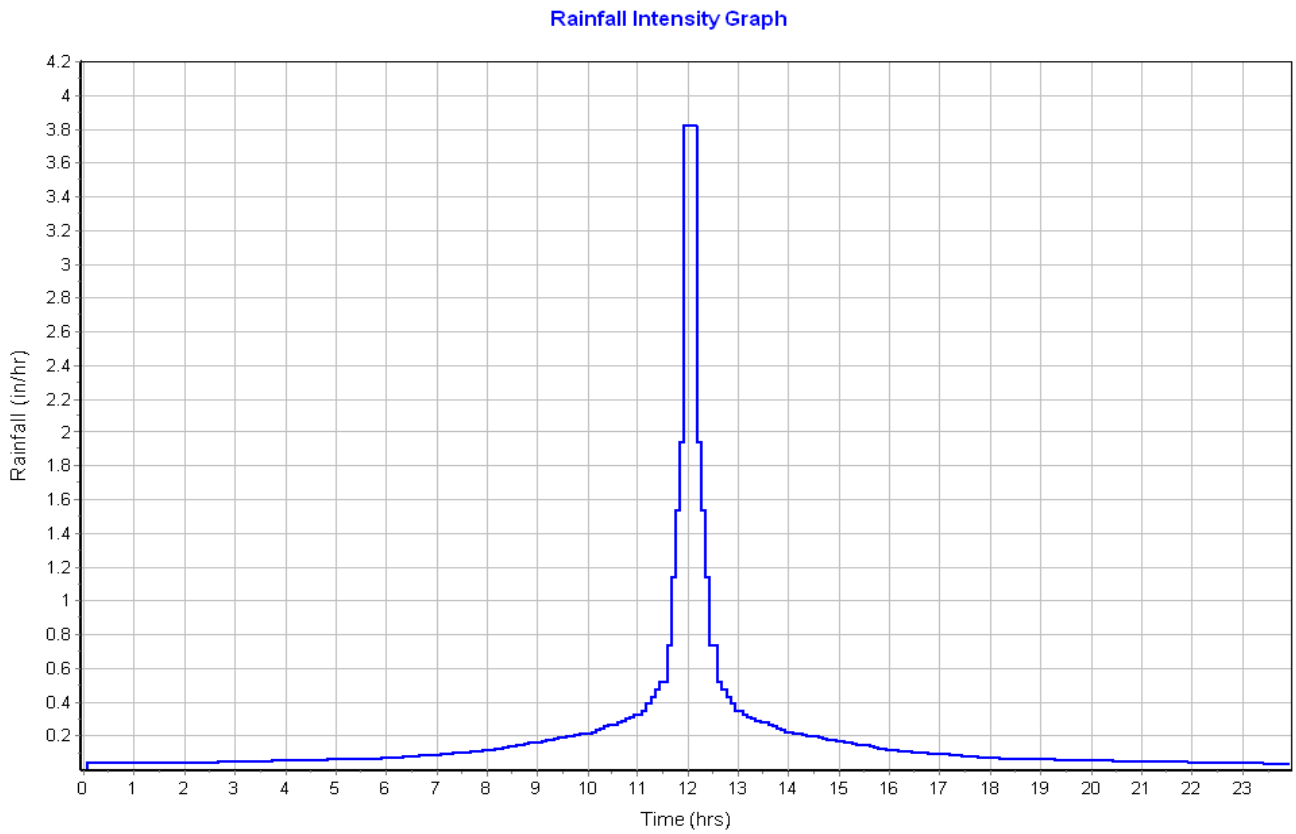
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2140	0.00	0.00
Slope (%) :	.47	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	1.03	0.00	0.00
Computed Flow Time (min) :	34.63	0.00	0.00

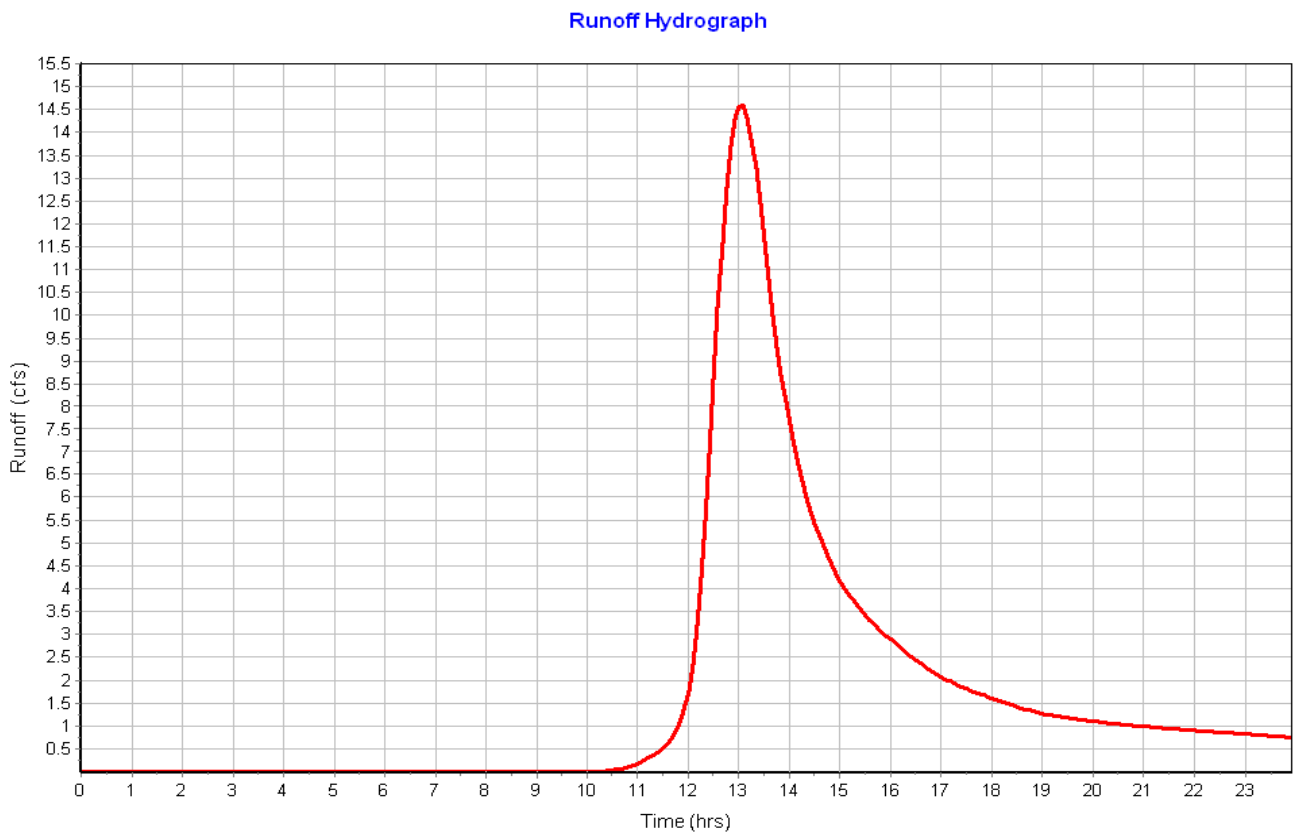
Total TOC (min) 89.38

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 1.79
Peak Runoff (cfs) 14.62
Weighted Curve Number 71.14
Time of Concentration (days hh:mm:ss) 0 01:29:23

Subbasin : C


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : D

Input Data

Area (ac) 0.74
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.74	D	77.00
Composite Area & Weighted CN	0.74		77.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	23.2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.14	0.00	0.00
Computed Flow Time (min) :	11.51	0.00	0.00

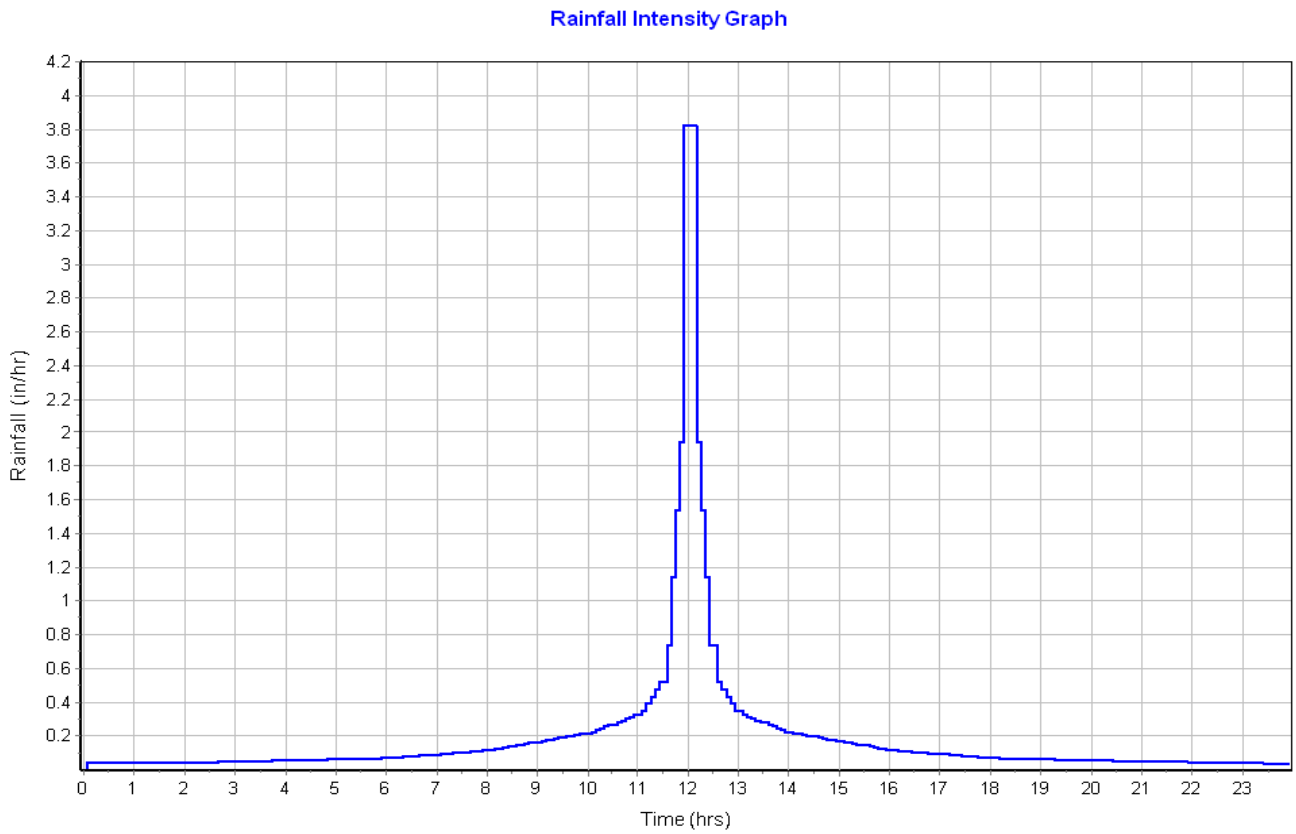
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	33	0.00	0.00
Slope (%) :	14.75	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.92	0.00	0.00
Computed Flow Time (min) :	0.29	0.00	0.00

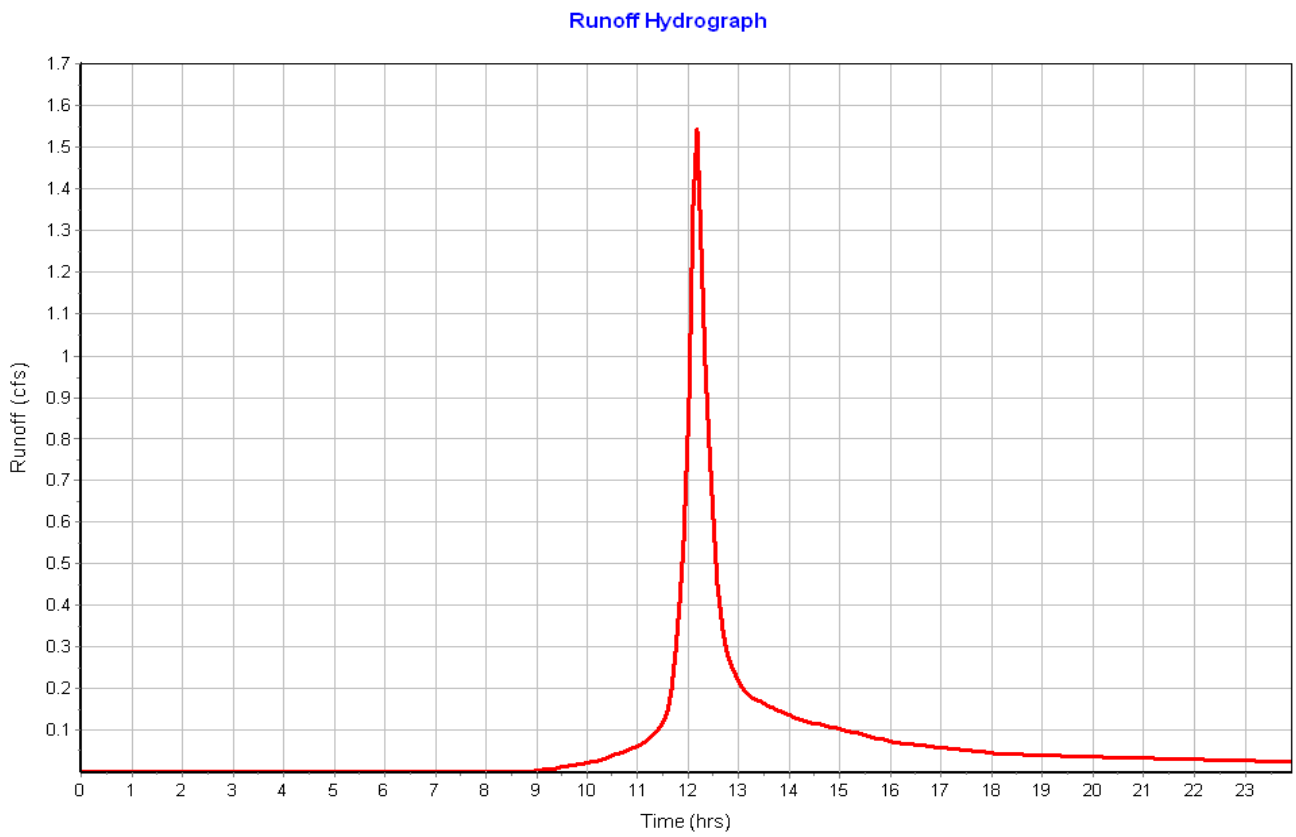
Total TOC (min) 11.79

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 2.25
Peak Runoff (cfs) 1.55
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:11:47

Subbasin : D


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : E

Input Data

Area (ac) 3.72
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	3.72	D	77.00
Composite Area & Weighted CN	3.72		77.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	14	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	14.09	0.00	0.00

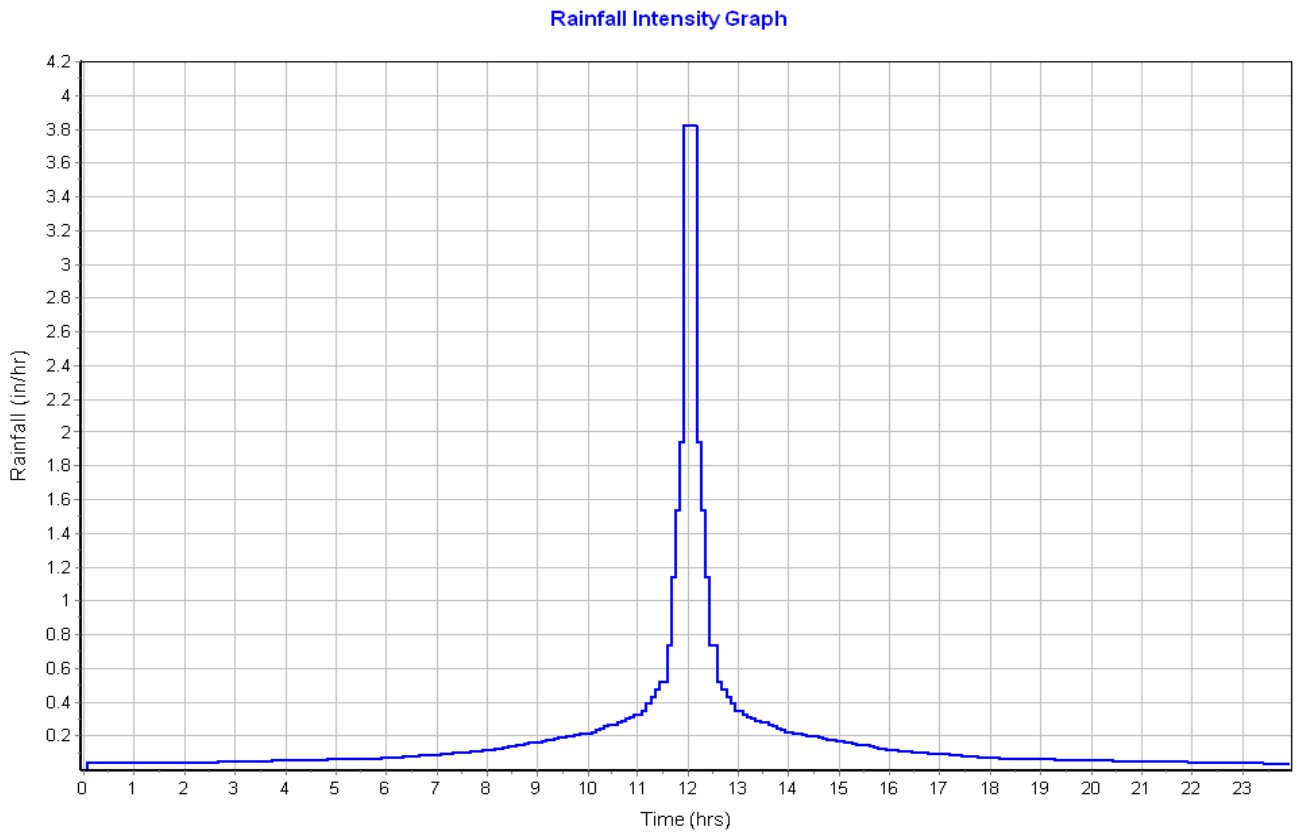
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	375	0.00	0.00
Slope (%) :	20.25	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.25	0.00	0.00
Computed Flow Time (min) :	2.78	0.00	0.00

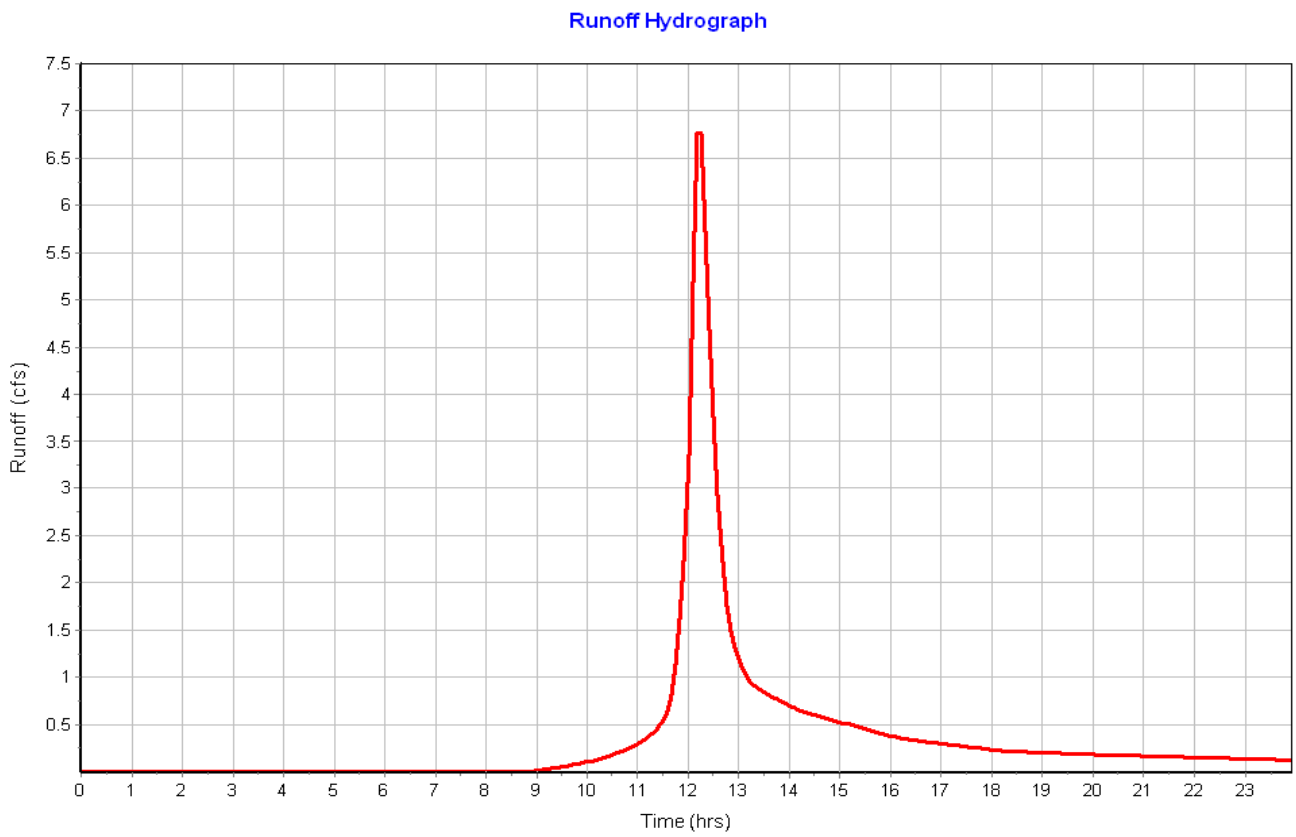
Total TOC (min) 16.86

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 2.25
Peak Runoff (cfs) 7.00
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:16:52

Subbasin : E


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Project Description

File Name ..... Existing Conditions.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Jul 13, 2017 00:00:00
End Analysis On ..... Jul 14, 2017 00:00:00
Start Reporting On ..... Jul 13, 2017 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	5
Nodes	5
Junctions	0
Outfalls	5
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-25	Cumulative	inches	Maine	Androscoggin	25	5.49	SCS Type III 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
A	21.12	74.38	5.49	2.80	59.03	36.58	0 00:36:01
B	5.93	75.63	5.49	2.91	17.26	15.17	0 00:14:31
C	22.68	71.14	5.49	2.51	56.84	20.83	0 01:29:22
D	0.74	77.00	5.49	3.04	2.25	2.09	0 00:11:47
E	3.72	77.00	5.49	3.04	11.30	9.47	0 00:16:51

Node Summary

Element ID	Element Type	Invert Elevation (ft)
OUT-A	Outfall	298.00
OUT-B	Outfall	310.00
OUT-C	Outfall	298.00
OUT-D	Outfall	338.00
OUT-E	Outfall	298.00

Subbasin Hydrology

Subbasin : A

Input Data

Area (ac) 21.12
Weighted Curve Number 74.38
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	7.92	C	70.00
Woods, Good	13.20	D	77.00
Composite Area & Weighted CN	21.12		74.38

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	32.75	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.17	0.00	0.00
Computed Flow Time (min) :	10.03	0.00	0.00

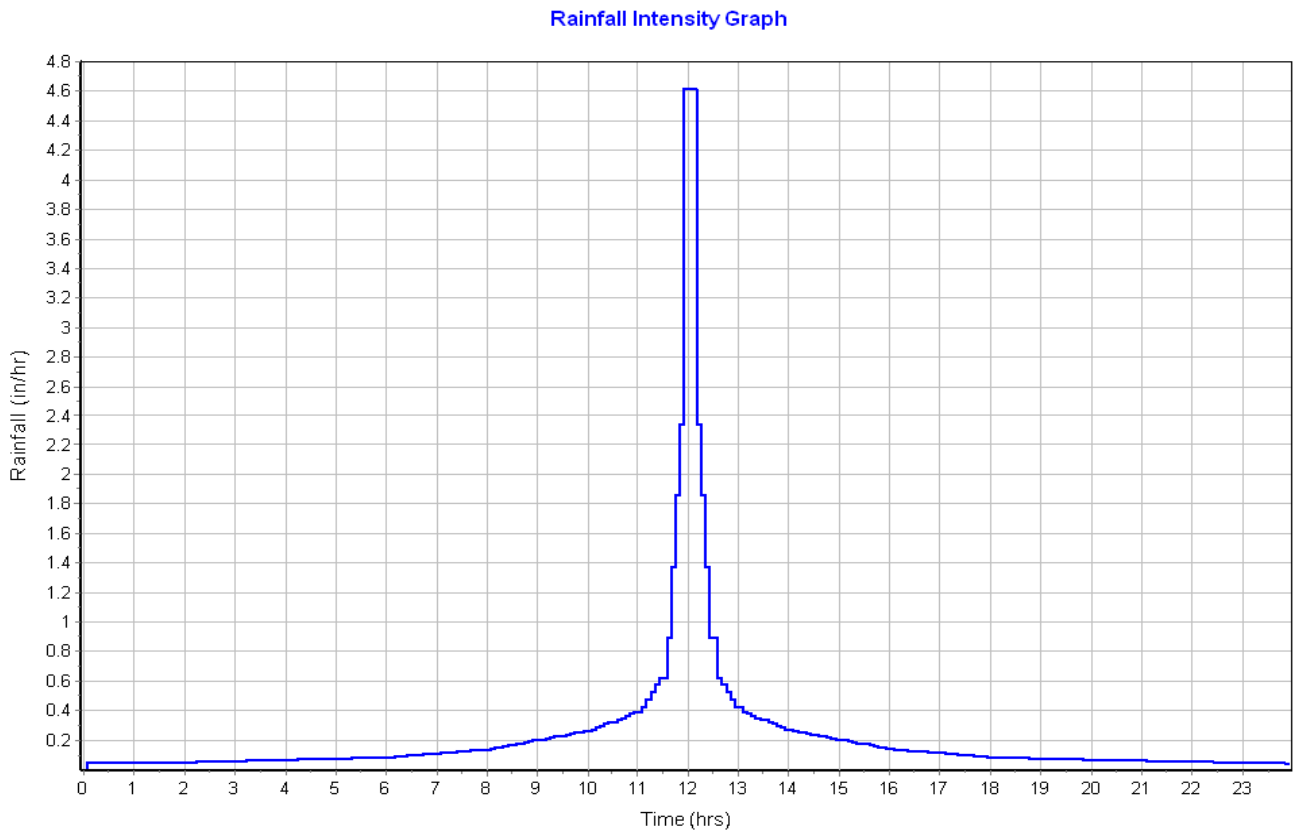
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	870	1086	0.00
Slope (%) :	5.65	.76	0.00
Surface Type :	Woodland		Unpaved
Velocity (ft/sec) :	1.19	1.31	0.00
Computed Flow Time (min) :	12.18	13.82	0.00

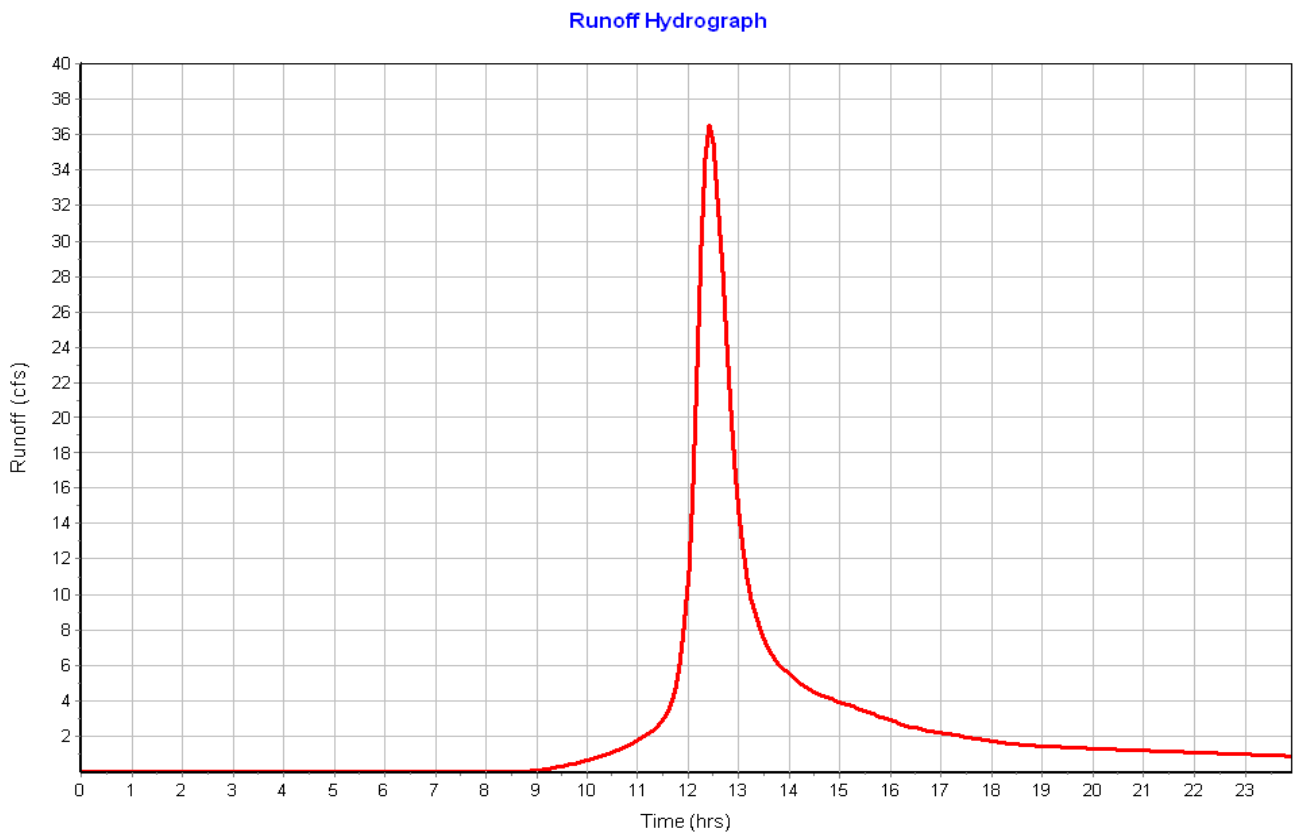
Total TOC (min) 36.03

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 2.80
Peak Runoff (cfs) 36.58
Weighted Curve Number 74.38
Time of Concentration (days hh:mm:ss) 0 00:36:02

Subbasin : A


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B

Input Data

Area (ac) 5.93
Weighted Curve Number 75.63
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	1.16	C	70.00
Woods, Good	4.77	D	77.00
Composite Area & Weighted CN	5.93		75.63

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	34	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.17	0.00	0.00
Computed Flow Time (min) :	9.88	0.00	0.00

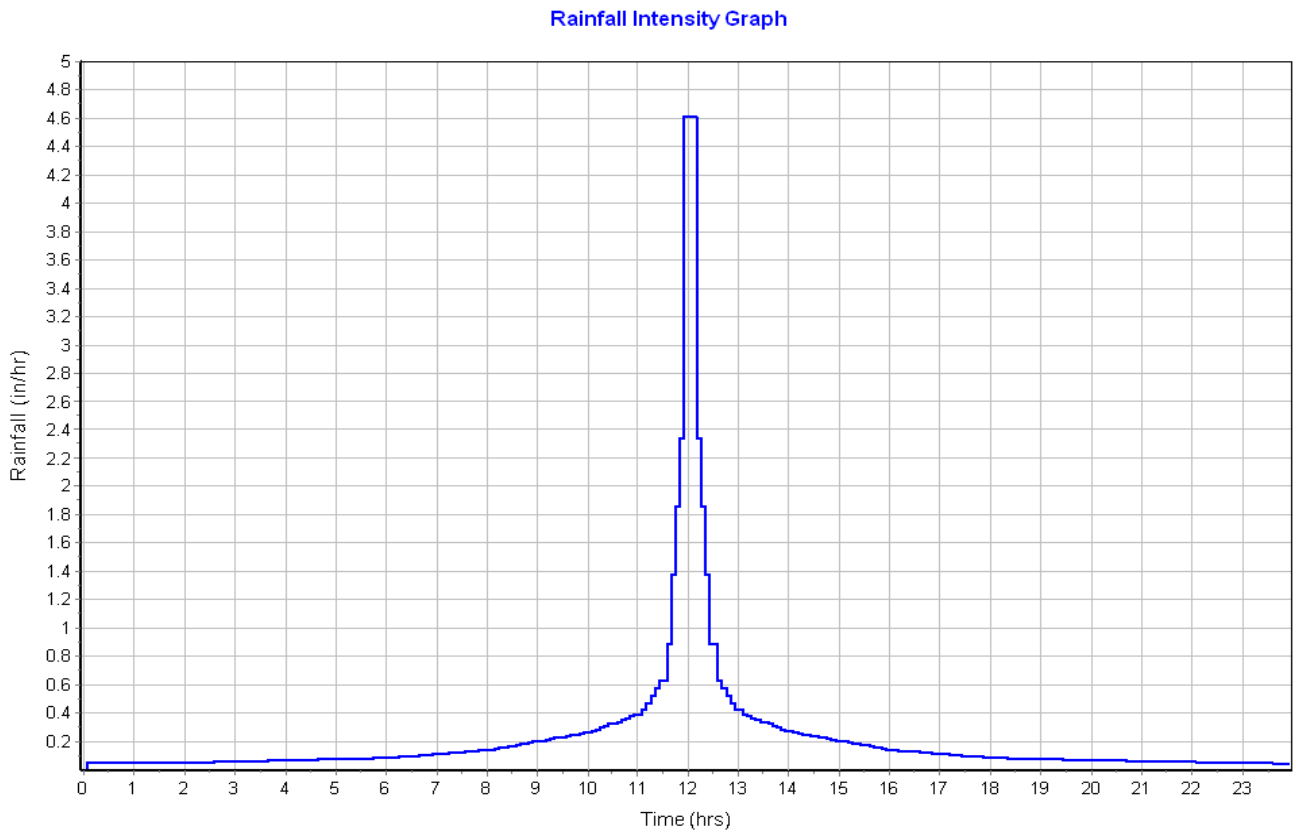
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	440	0.00	0.00
Slope (%) :	10	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.58	0.00	0.00
Computed Flow Time (min) :	4.64	0.00	0.00

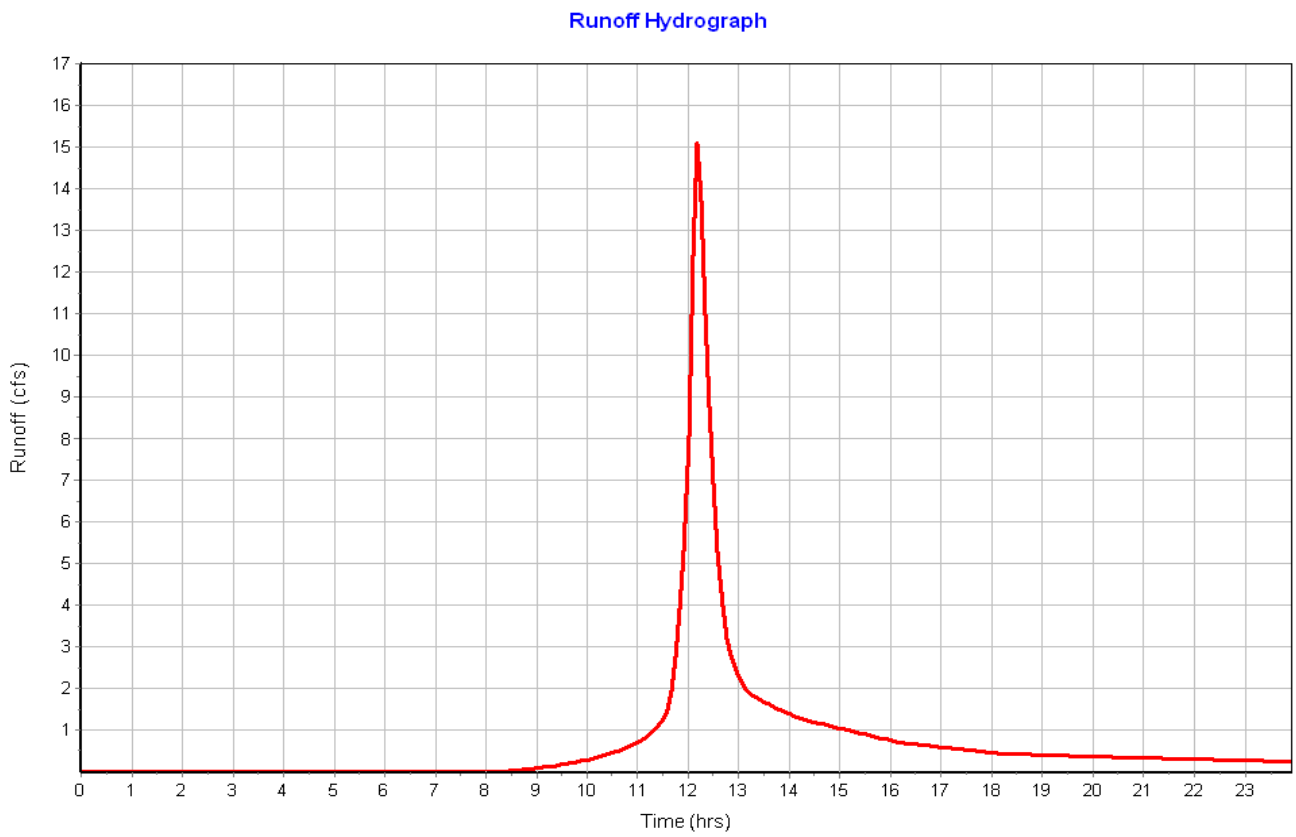
Total TOC (min) 14.52

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 2.91
Peak Runoff (cfs) 15.17
Weighted Curve Number 75.63
Time of Concentration (days hh:mm:ss) 0 00:14:31

Subbasin : B


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C

Input Data

Area (ac) 22.68
Weighted Curve Number 71.14
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	14.42	C	70.00
Woods, Good	7.58	D	77.00
Woods, Good	0.68	A	30.00
Composite Area & Weighted CN	22.68		71.14

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	.47	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.03	0.00	0.00
Computed Flow Time (min) :	54.75	0.00	0.00

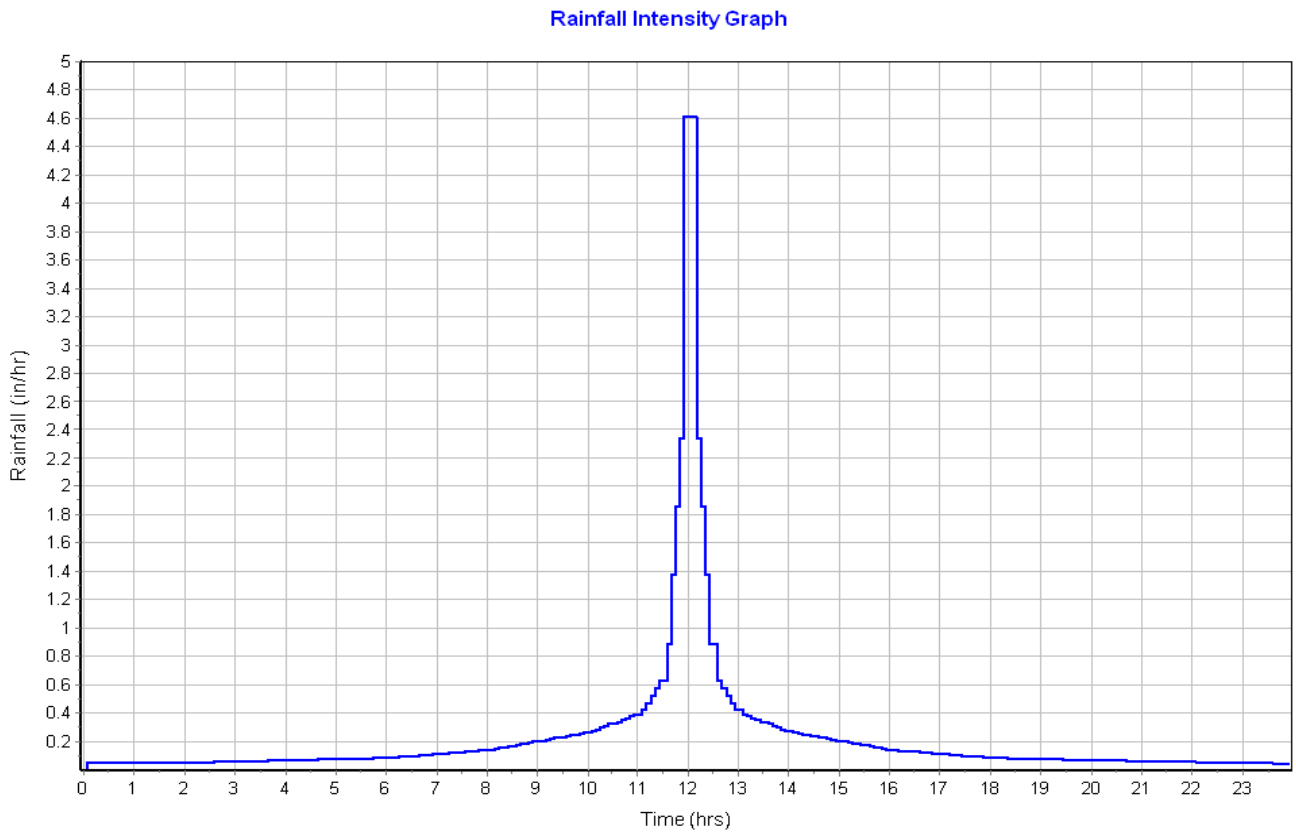
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2140	0.00	0.00
Slope (%) :	.47	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	1.03	0.00	0.00
Computed Flow Time (min) :	34.63	0.00	0.00

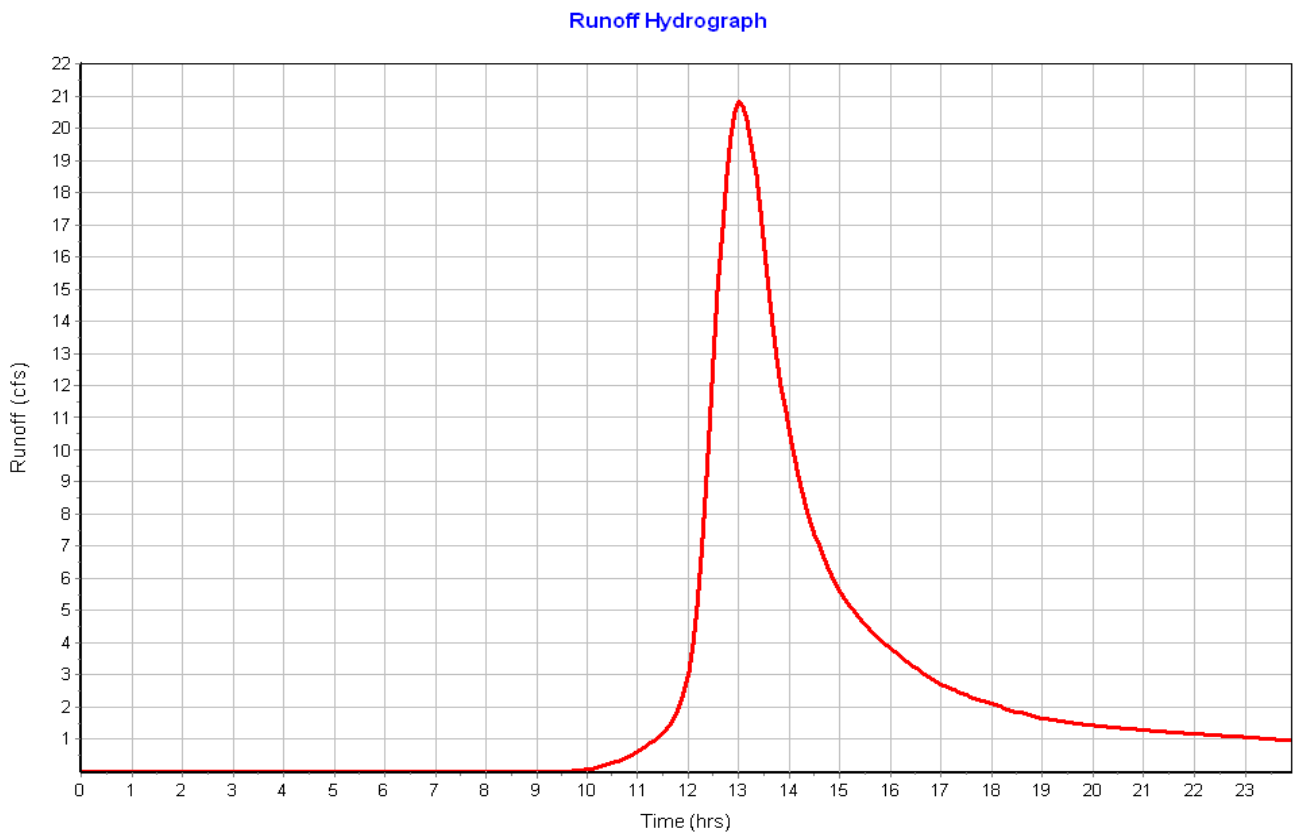
Total TOC (min) 89.38

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 2.51
Peak Runoff (cfs) 20.83
Weighted Curve Number 71.14
Time of Concentration (days hh:mm:ss) 0 01:29:23

Subbasin : C


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : D

Input Data

Area (ac) 0.74
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.74	D	77.00
Composite Area & Weighted CN	0.74		77.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	23.2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.14	0.00	0.00
Computed Flow Time (min) :	11.51	0.00	0.00

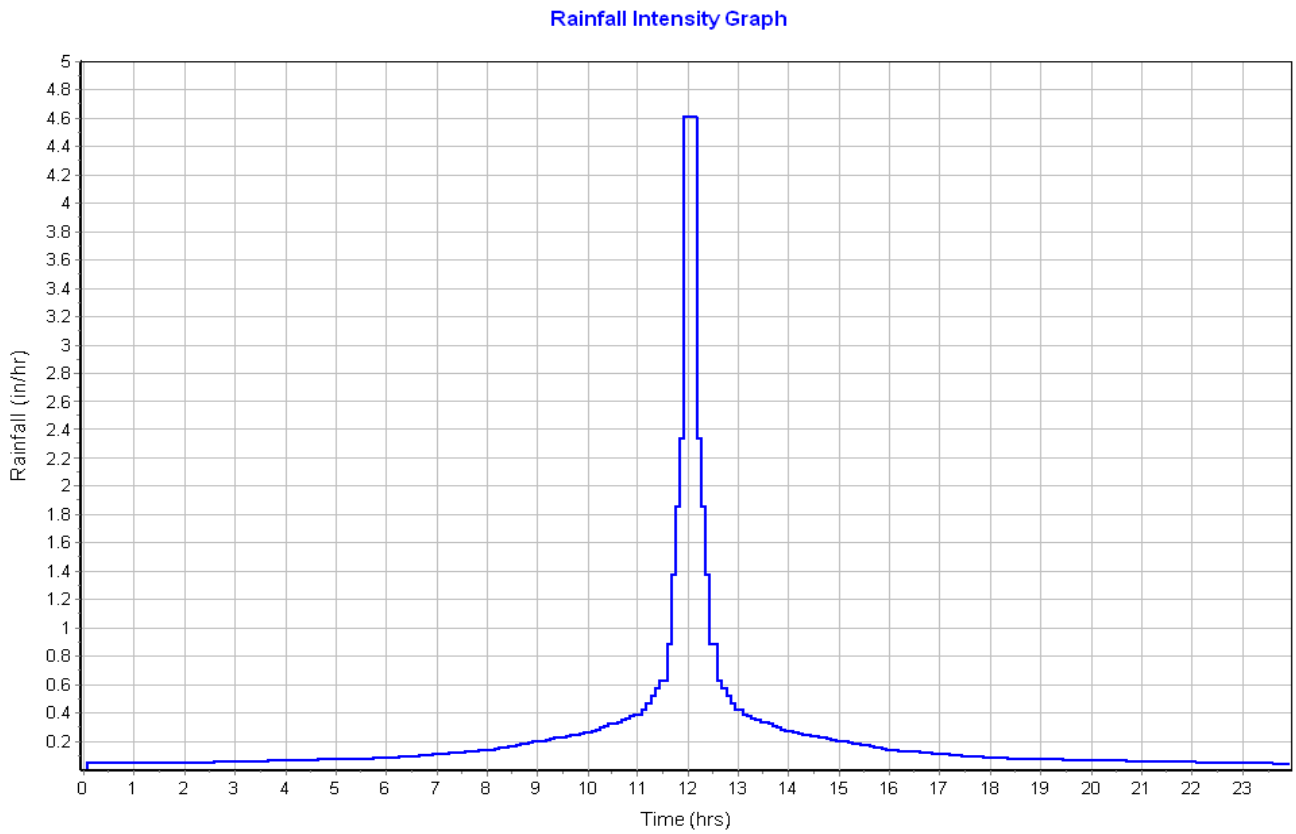
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	33	0.00	0.00
Slope (%) :	14.75	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.92	0.00	0.00
Computed Flow Time (min) :	0.29	0.00	0.00

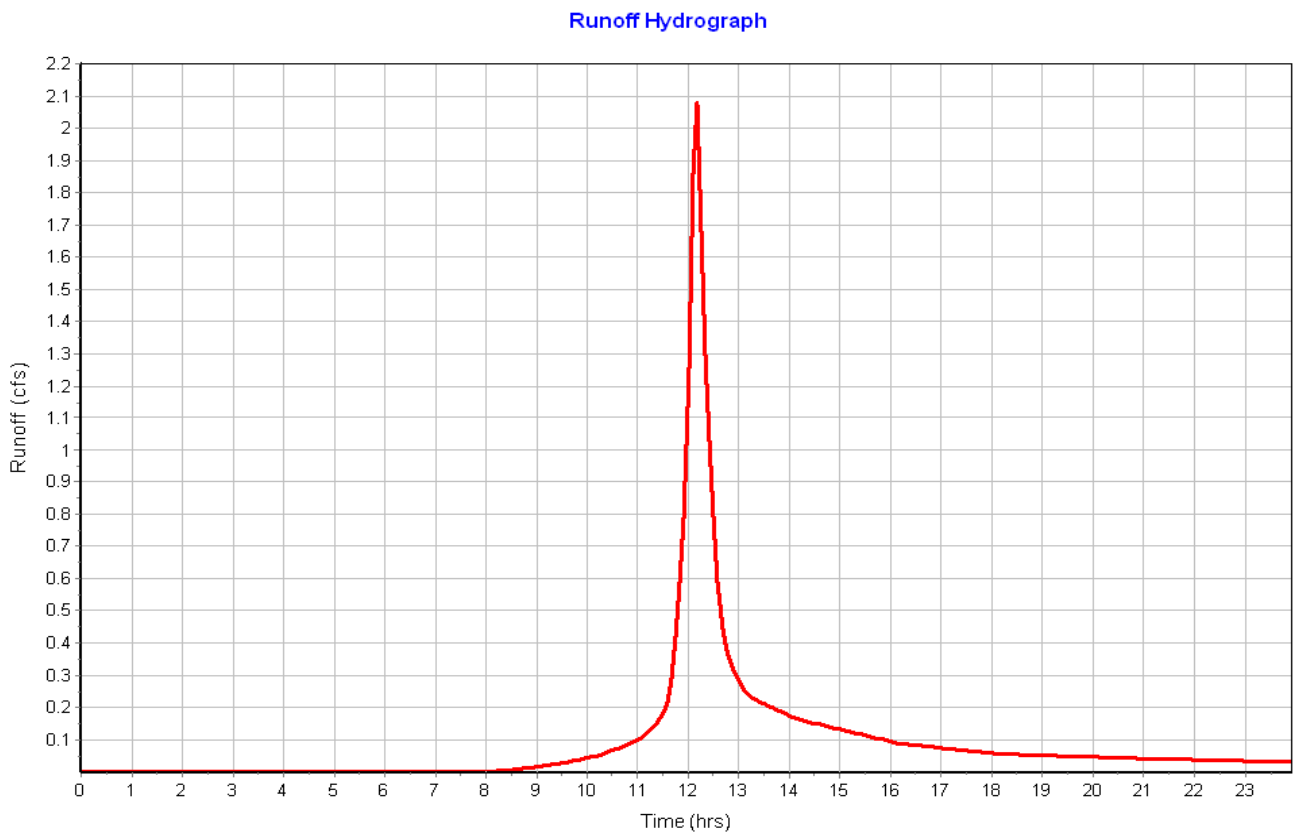
Total TOC (min) 11.79

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 3.04
Peak Runoff (cfs) 2.09
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:11:47

Subbasin : D


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : E

Input Data

Area (ac) 3.72
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	3.72	D	77.00
Composite Area & Weighted CN	3.72		77.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	14	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	14.09	0.00	0.00

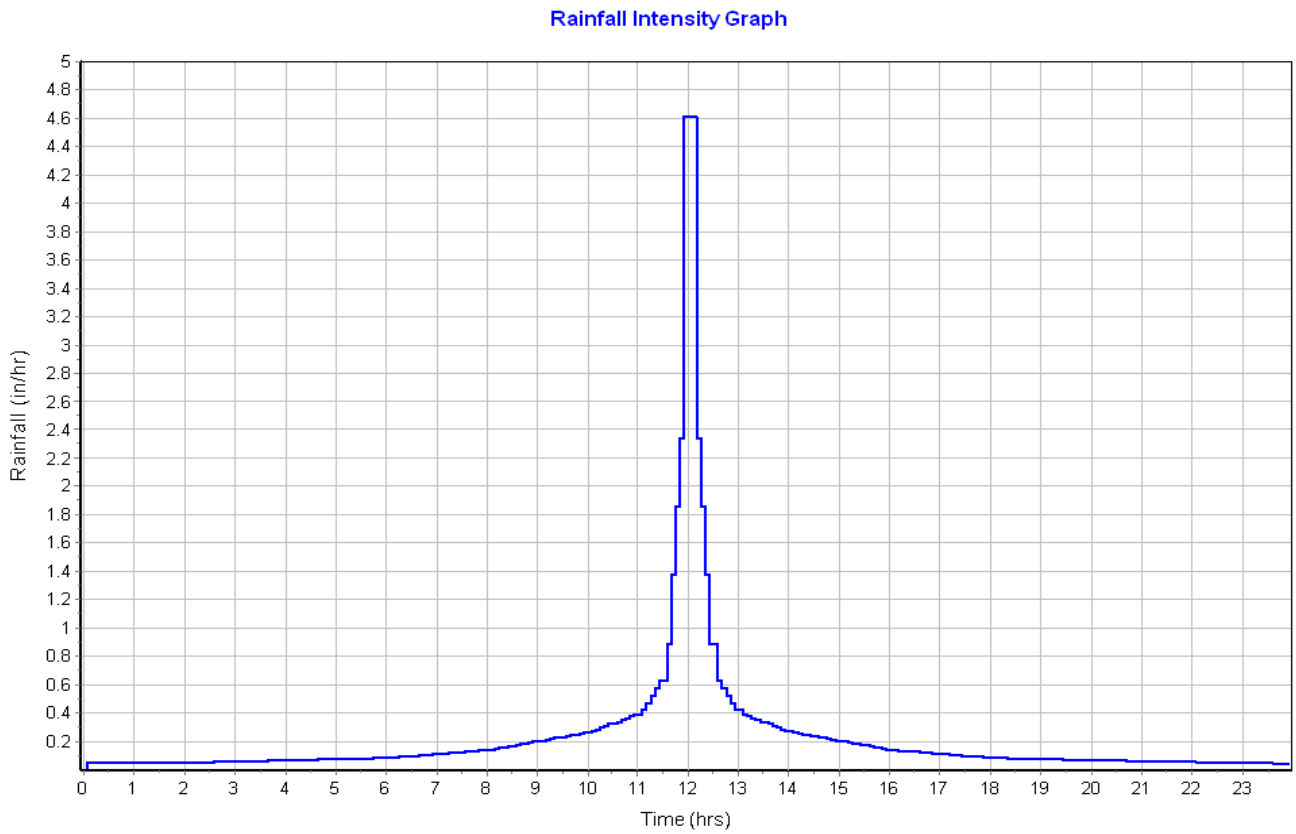
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	375	0.00	0.00
Slope (%) :	20.25	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.25	0.00	0.00
Computed Flow Time (min) :	2.78	0.00	0.00

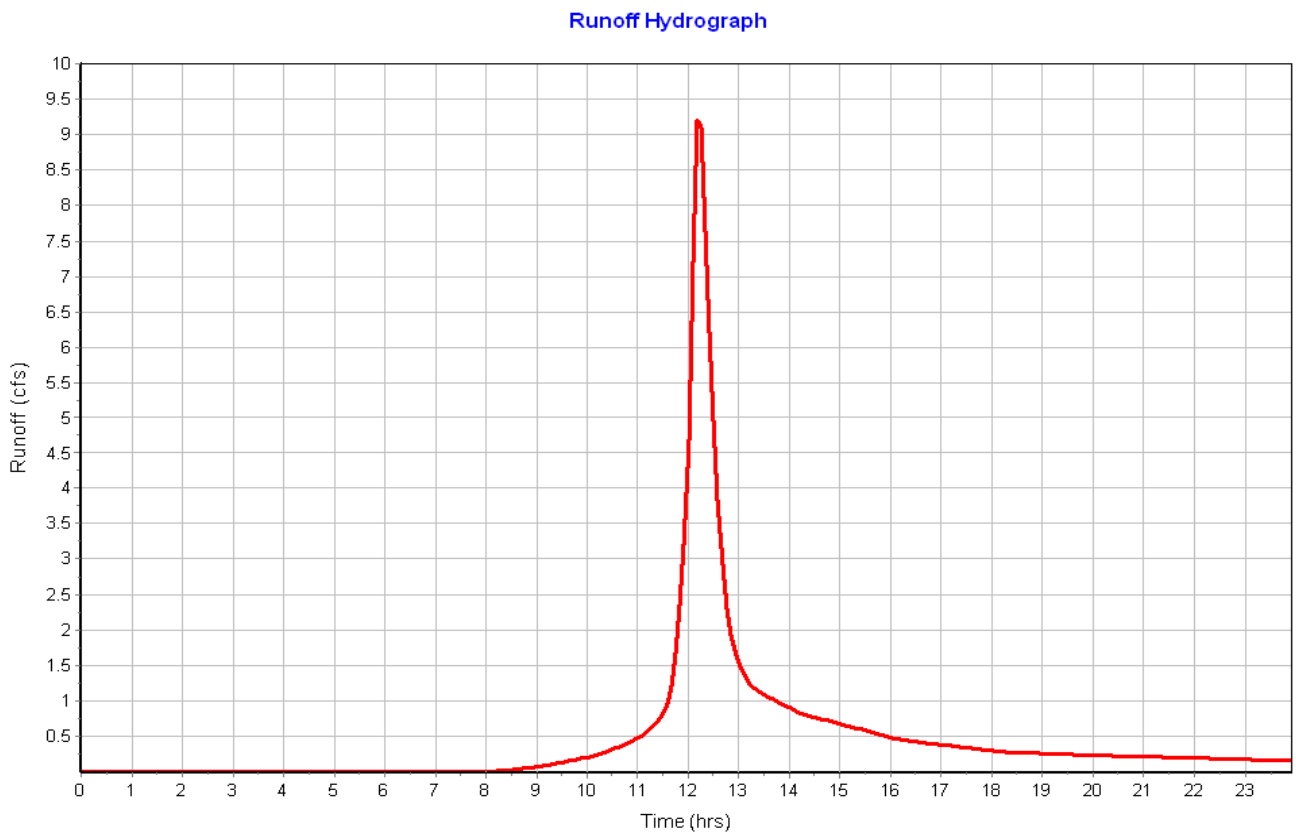
Total TOC (min) 16.86

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 3.04
Peak Runoff (cfs) 9.47
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:16:52

Subbasin : E


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Project Description

File Name ..... Proposed Conditions 1-15-19.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Jul 13, 2017 00:00:00
End Analysis On ..... Jul 14, 2017 00:00:00
Start Reporting On ..... Jul 13, 2017 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	9
Nodes	16
Junctions	7
Outfalls	5
Flow Diversions	0
Inlets	0
Storage Nodes	4
Links	17
Channels	2
Pipes	5
Pumps	0
Orifices	7
Weirs	3
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-002	Cumulative	inches	Maine	Androscoggin	2	3.04	SCS Type III 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
A1	12.28	73.16	3.04	0.89	10.93	5.33	0 00:49:44
A2	6.41	81.47	3.04	1.38	8.81	7.96	0 00:12:48
A3	4.01	71.75	3.04	0.82	3.29	2.99	0 00:09:08
B	5.14	75.65	3.04	1.02	5.26	3.66	0 00:24:28
C1-WETLAND	0.75	75.95	3.04	1.04	0.78	0.81	0 00:05:00
C2-WETLAND	0.73	82.63	3.04	1.45	1.06	0.74	0 00:27:24
C3-BYPASS	21.22	71.79	3.04	0.82	17.44	5.79	0 01:29:22
D	0.69	77.00	3.04	1.10	0.76	0.68	0 00:12:07
E	2.96	77.00	3.04	1.10	3.25	2.85	0 00:13:08

Node Summary

Element ID	Element Type	Invert Elevation (ft)
CB1	Junction	305.30
CB2	Junction	312.00
END-SECTION-C1	Junction	308.00
END-SECTION-C2	Junction	308.00
OUTLET-STR-A2	Junction	305.60
OUTLET-STR-C1	Junction	308.10
OUTLET-STR-C2	Junction	308.10
OUT-A	Outfall	298.00
OUT-B	Outfall	310.00
OUT-C	Outfall	298.00
OUT-D	Outfall	338.00
OUT-E	Outfall	298.00
DETENTION-A	Storage Node	309.50
FILTER-1	Storage Node	308.00
WETLAND-C1	Storage Node	308.77
WETLAND-C2	Storage Node	308.77

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)	(ft/sec)	(ft)
CULV-A	Pipe	CB1	OUT-A	98.00	305.30	305.12	0.1800	36.000	0.0150	7.24	24.77	3.04	1.11
CULV-A2-1	Pipe	CB2	FILTER-1	104.00	312.00	310.00	1.9200	24.000	0.0150	7.91	27.19	7.52	0.74
CULV-A2-2	Pipe	OUTLET-STR-A2	CB1	43.00	305.60	305.30	0.7000	24.000	0.0150	5.36	16.38	4.66	0.79
CULV-C1	Pipe	OUTLET-STR-C1	END-SECTION-C1	30.00	308.10	308.00	0.3300	12.000	0.0130	0.02	2.06	0.84	0.07
CULV-C2	Pipe	OUTLET-STR-C2	END-SECTION-C2	30.00	308.10	308.00	0.3300	12.000	0.0130	0.02	2.06	0.85	0.07
WETLAND-CHANNEL-C1	Channel	END-SECTION-C1	OUT-C	2050.00	308.00	298.00	0.4900	6.000	0.0320	0.02	101.48	0.00	0.00
WETLAND-CHANNEL-C2	Channel	END-SECTION-C2	OUT-C	1712.00	308.00	298.00	0.5800	6.000	0.0320	0.02	111.05	0.00	0.00
BEEHIVE-GRATE	Orifice	DETENTION-A	CB1		309.50	305.30		18.167		0.00			
ORIF-A2	Orifice	FILTER-1	OUTLET-STR-A2		308.00	305.60		6.000		5.36			
ORIF-C1	Orifice	WETLAND-C1	OUTLET-STR-C1		308.77	308.10		0.880		0.02			
ORIF-C2A	Orifice	WETLAND-C2	OUTLET-STR-C2		308.77	308.10		0.880		0.02			
ORIF-DET-A	Orifice	DETENTION-A	CB1		309.50	305.30		4.000		1.88			
Wetland-1-BEEHIVE	Orifice	WETLAND-C1	OUTLET-STR-C1		308.77	308.10		18.170		0.00			
Wetland-2-BEEHIVE	Orifice	WETLAND-C2	OUTLET-STR-C2		308.77	308.10		18.170		0.00			
SPILLWAY-A2	Weir	FILTER-1	DETENTION-A		308.00	309.50				0.00			
SPILLWAY-C1	Weir	WETLAND-C1	END-SECTION-C1		308.77	308.00				0.00			
SPILLWAY-C2	Weir	WETLAND-C2	END-SECTION-C2		308.77	308.00				0.00			

Subbasin Hydrology

Subbasin : A1

Input Data

Area (ac) 12.28
Weighted Curve Number 73.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	4.58	D	77.00
> 75% grass cover, Good	0.68	C	74.00
Woods, Good	6.62	C	70.00
> 75% grass cover, Good	0.40	D	80.00
Composite Area & Weighted CN	12.28		73.16

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.05	0.00	0.00
Computed Flow Time (min) :	30.68	0.00	0.00

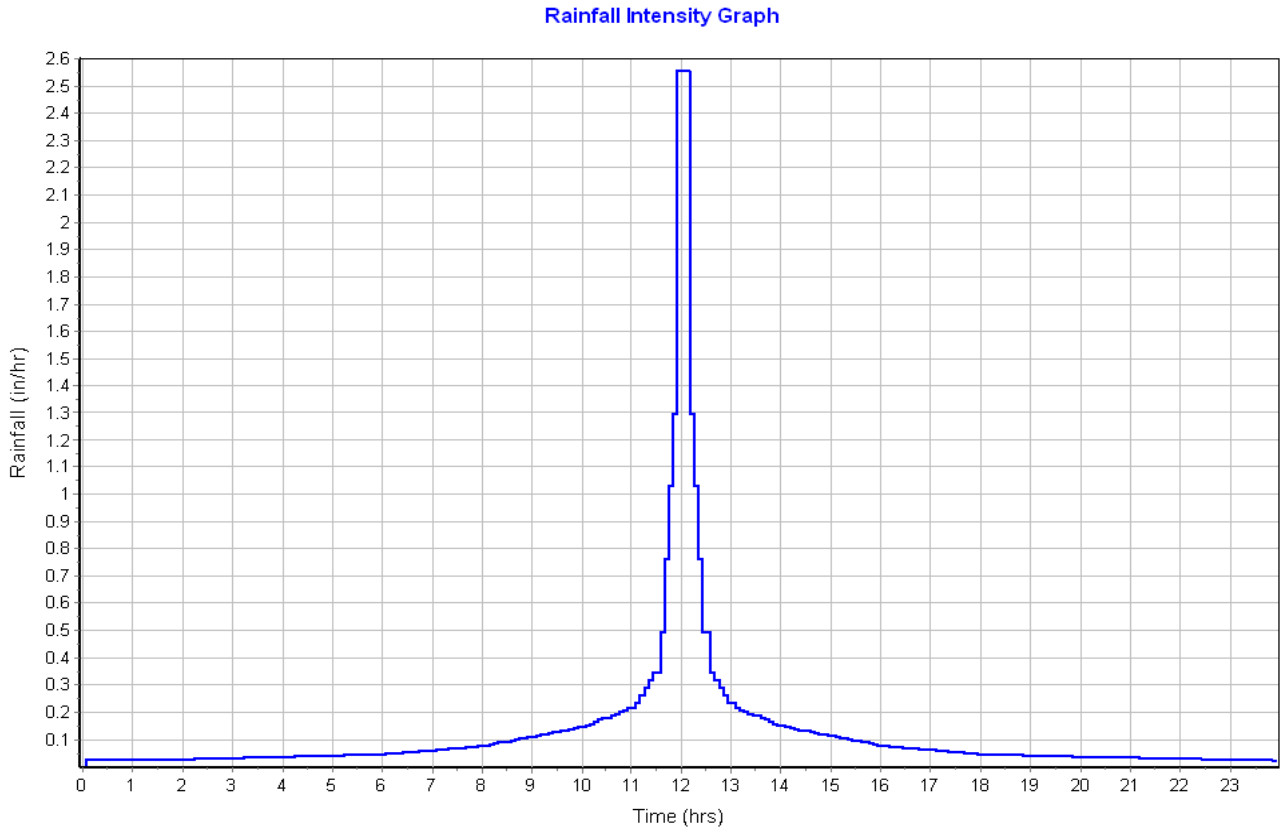
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1510	0.00	0.00
Slope (%) :	.78	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	1.32	0.00	0.00
Computed Flow Time (min) :	19.07	0.00	0.00

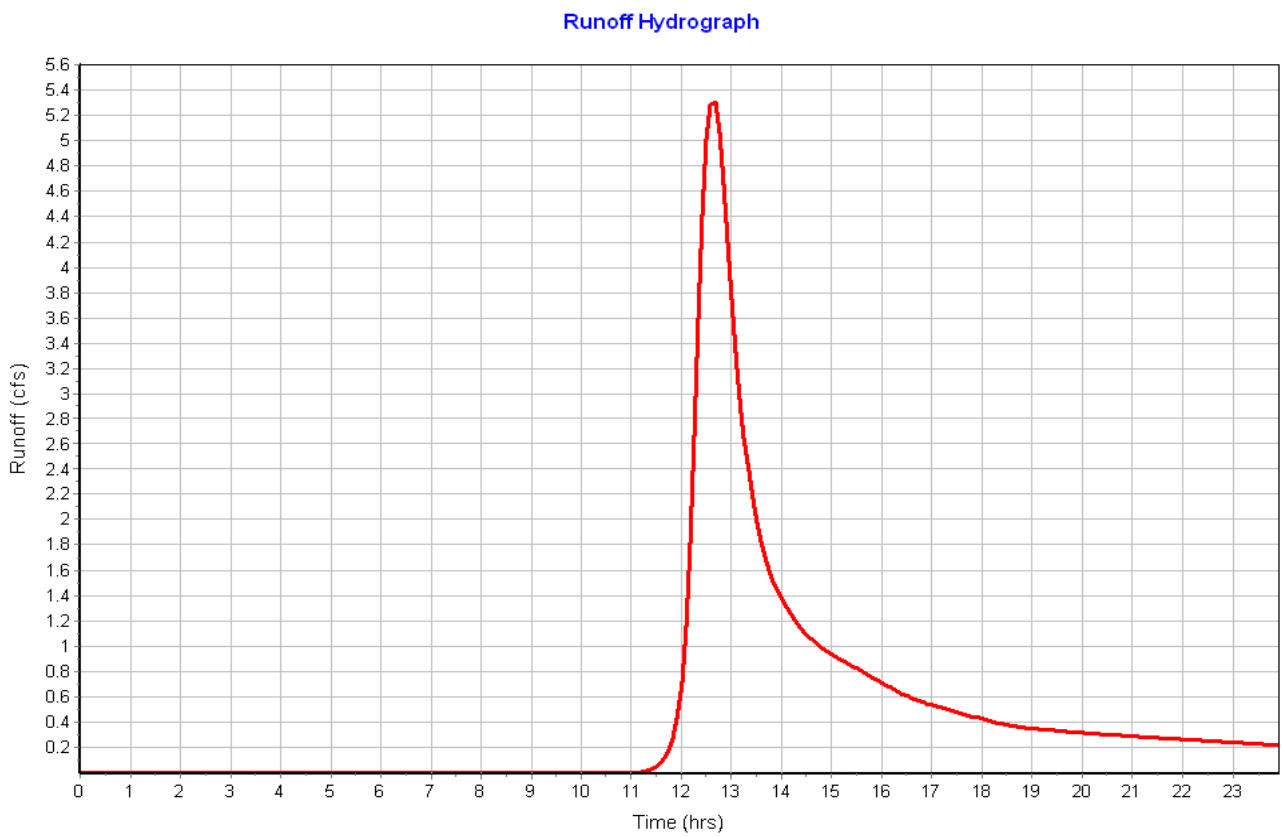
Total TOC (min) 49.74

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 0.89
Peak Runoff (cfs) 5.33
Weighted Curve Number 73.16
Time of Concentration (days hh:mm:ss) 0 00:49:44

Subbasin : A1


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : A2

Input Data

Area (ac) 6.41
Weighted Curve Number 81.47
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.13	D	77.00
Roofs	1.77	D	98.00
> 75% grass cover, Good	1.87	D	80.00
Stone_Pad	1.80	D	60.00
Gravel roads	0.17	D	91.00
Pavement	0.67	D	98.00
Composite Area & Weighted CN	6.41		81.47

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	85	0.00	0.00
Slope (%) :	33.33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	6.32	0.00	0.00

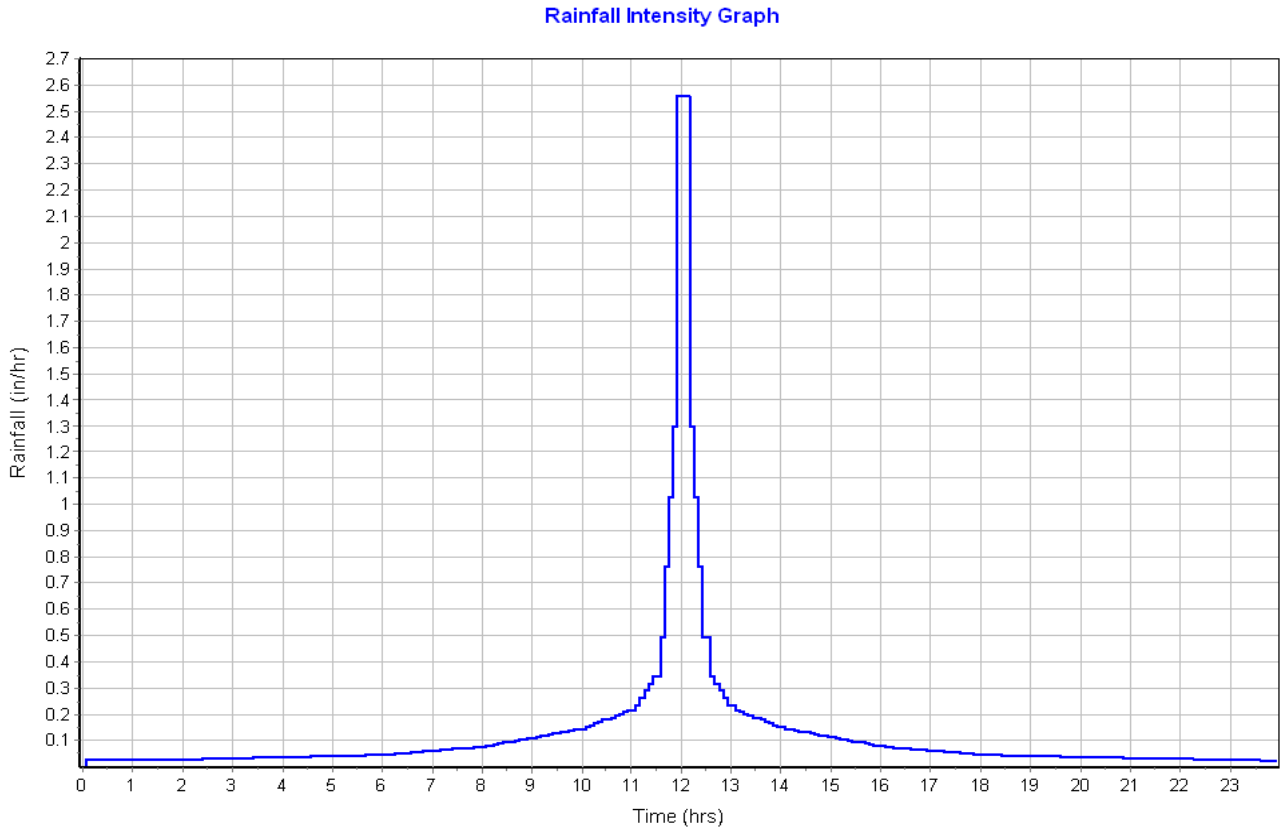
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1138	0.00	0.00
Channel Slope (%) :	1.4	0.00	0.00
Cross Section Area (ft^2) :	4.398	0.00	0.00
Wetted Perimeter (ft) :	8.12	0.00	0.00
Velocity (ft/sec) :	2.93	0.00	0.00
Computed Flow Time (min) :	6.48	0.00	0.00

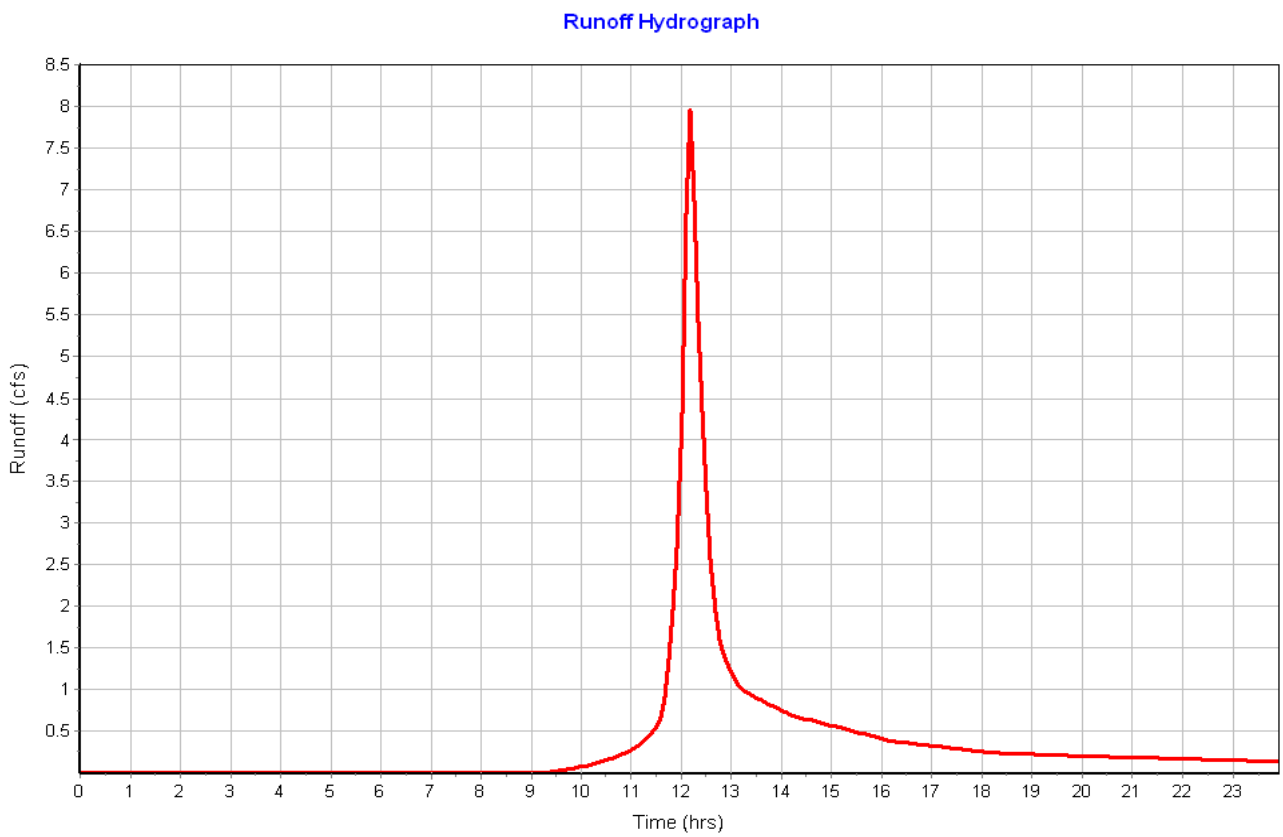
Total TOC (min) 12.80

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 1.38
Peak Runoff (cfs) 7.96
Weighted Curve Number 81.47
Time of Concentration (days hh:mm:ss) 0 00:12:48

Subbasin : A2


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : A3

Input Data

Area (ac) 4.01
Weighted Curve Number 71.75
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.75	D	80.00
> 75% grass cover, Good	0.14	C	74.00
Stone_Pad	2.28	D	60.00
Roofs	0.19	D	98.00
Gravel roads	0.25	D	91.00
Pavement	0.35	D	98.00
Foundations	0.05	D	98.00
Composite Area & Weighted CN	4.01		71.75

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.01	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	1.44	0.00	0.00
Computed Flow Time (min) :	1.16	0.00	0.00

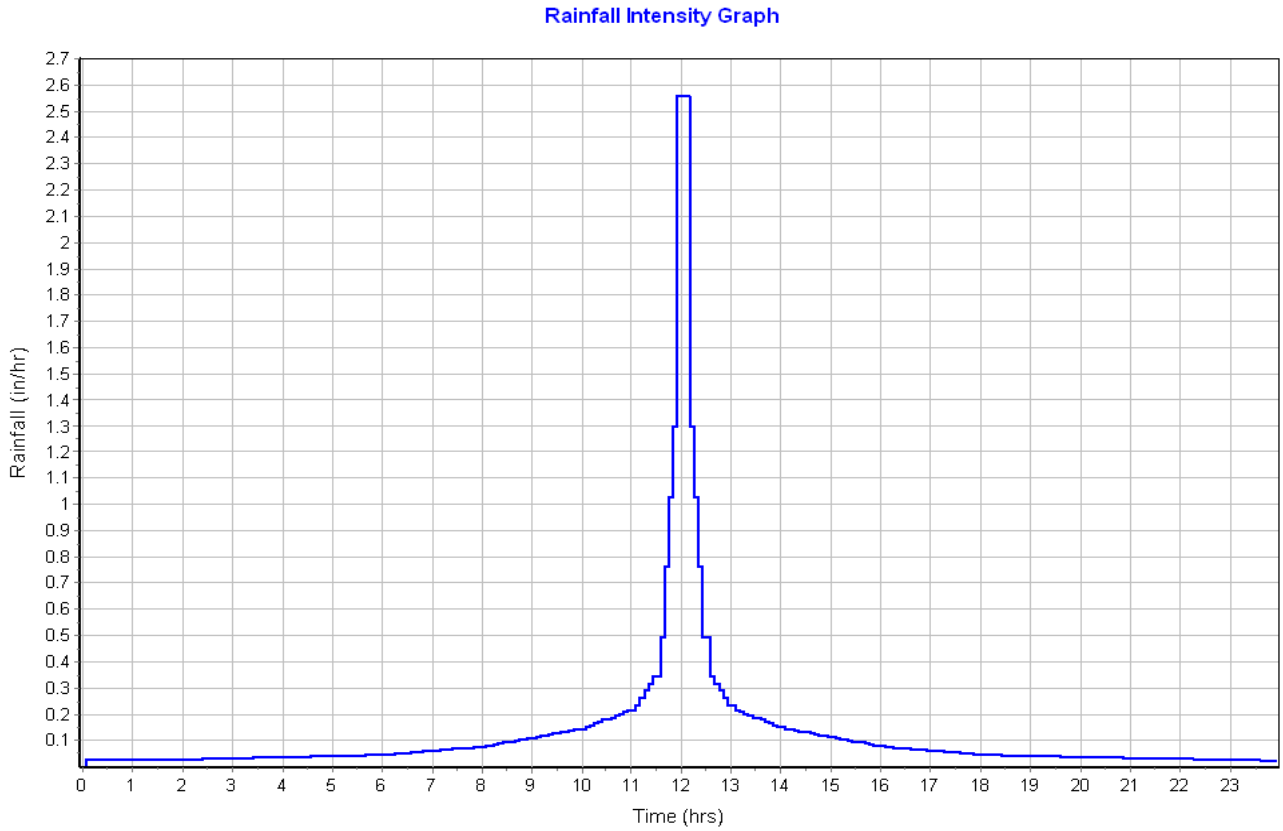
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	548	25	200
Slope (%) :	2	33.33	1.5
Surface Type :	Unpaved	rass pastu	rass pasture
Velocity (ft/sec) :	2.28	4.04	0.86
Computed Flow Time (min) :	4.01	0.10	3.88

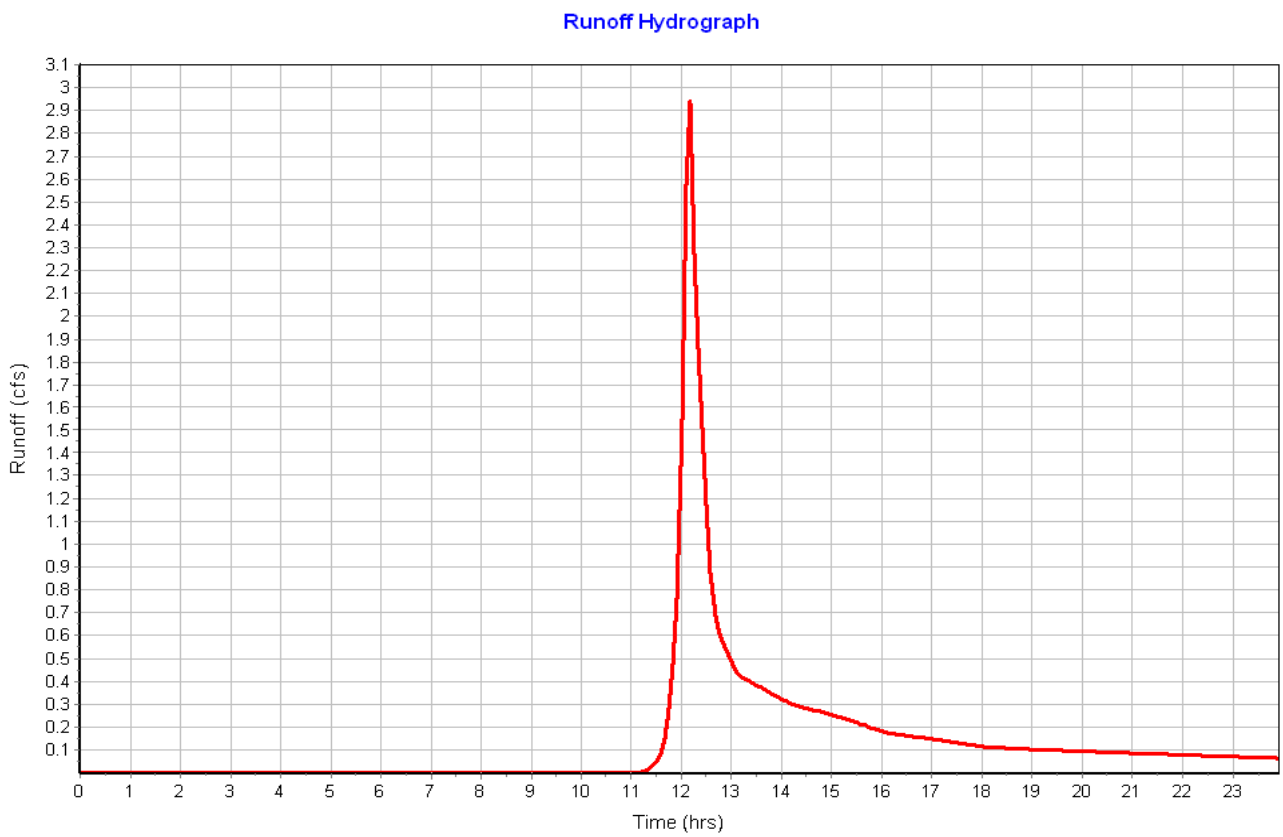
Total TOC (min) 9.14

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 0.82
Peak Runoff (cfs) 2.99
Weighted Curve Number 71.75
Time of Concentration (days hh:mm:ss) 0 00:09:08

Subbasin : A3


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B

Input Data

Area (ac) 5.14
Weighted Curve Number 75.65
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	1.20	C	70.00
Woods, Good	3.45	D	77.00
> 75% grass cover, Good	0.49	D	80.00
Composite Area & Weighted CN	5.14		75.65

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	90	0.00	0.00
Slope (%) :	33.33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.23	0.00	0.00
Computed Flow Time (min) :	6.62	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	368	0.00	0.00
Slope (%) :	1.63	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	1.92	0.00	0.00
Computed Flow Time (min) :	3.19	0.00	0.00

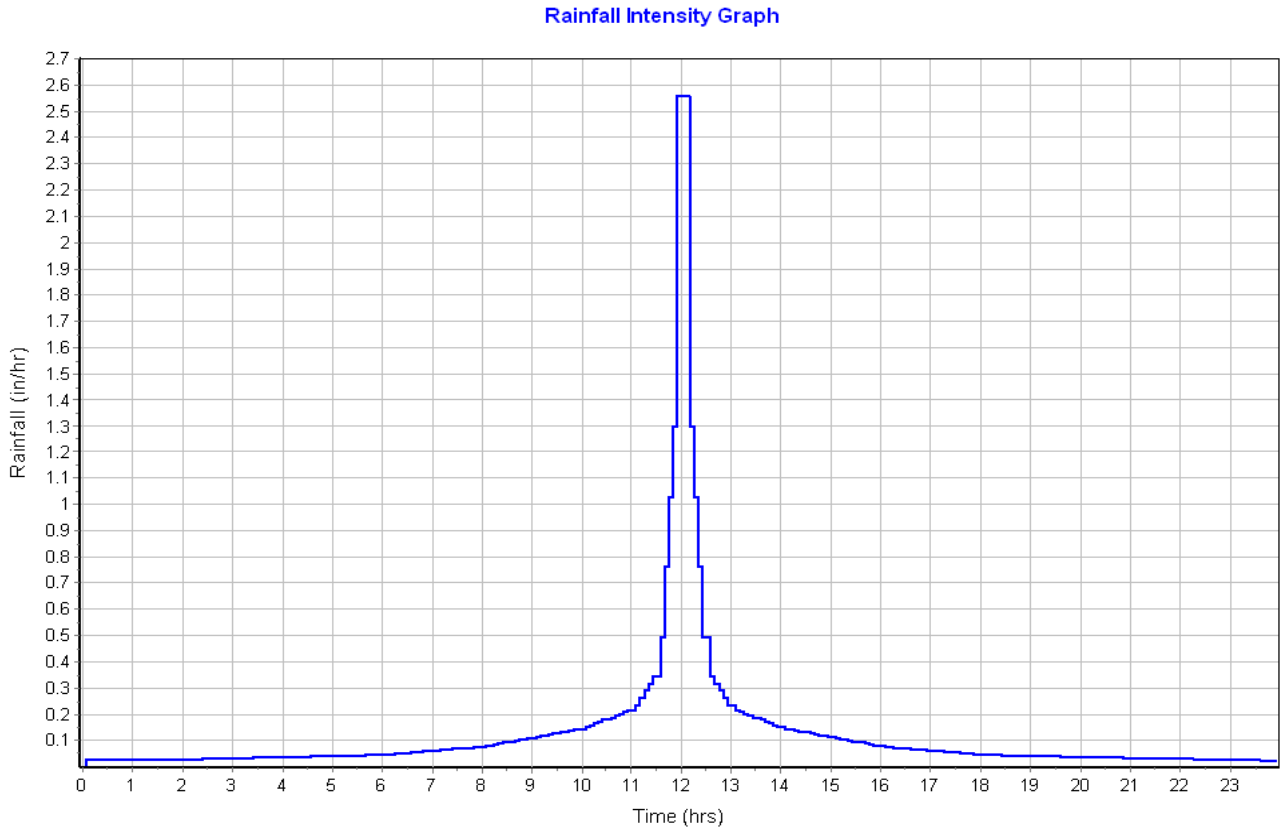
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.3	.3	0.00
Flow Length (ft) :	272	85	0.00
Channel Slope (%) :	1.4	16.7	0.00
Cross Section Area (ft²) :	3.287	1.367	0.00
Wetted Perimeter (ft) :	7.17	5.15	0.00
Velocity (ft/sec) :	0.35	0.84	0.00
Computed Flow Time (min) :	12.97	1.69	0.00

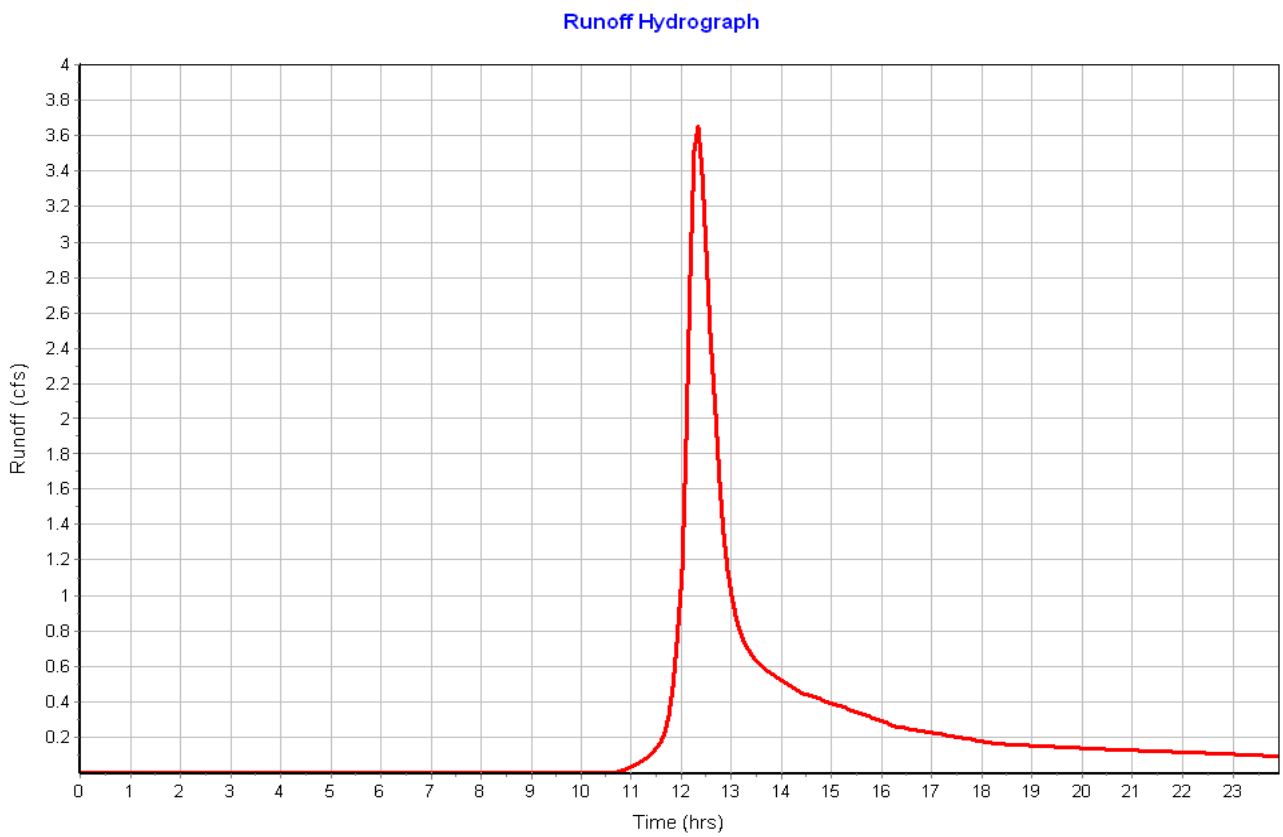
Total TOC (min) 24.48

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 1.02
Peak Runoff (cfs) 3.66
Weighted Curve Number 75.65
Time of Concentration (days hh:mm:ss) 0 00:24:29

Subbasin : B


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C1-WETLAND

Input Data

Area (ac) 0.75
Weighted Curve Number 75.95
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.12	D	77.00
> 75% grass cover, Good	0.04	A	39.00
> 75% grass cover, Good	0.05	D	80.00
> 75% grass cover, Good	0.34	C	74.00
Woods, Good	0.02	C	70.00
Gravel roads	0.04	A	76.00
Gravel roads	0.09	C	89.00
Gravel roads	0.05	D	91.00
Composite Area & Weighted CN	0.75		75.95

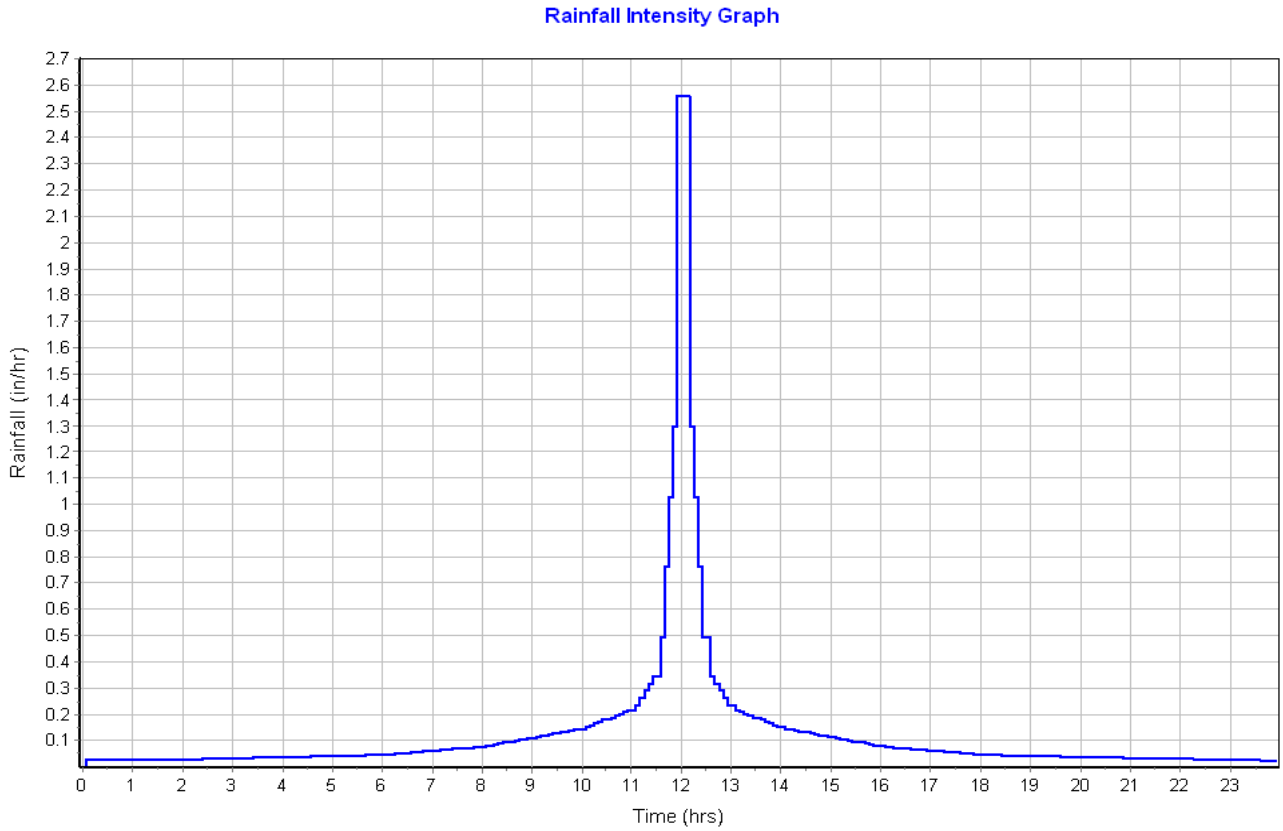
Time of Concentration

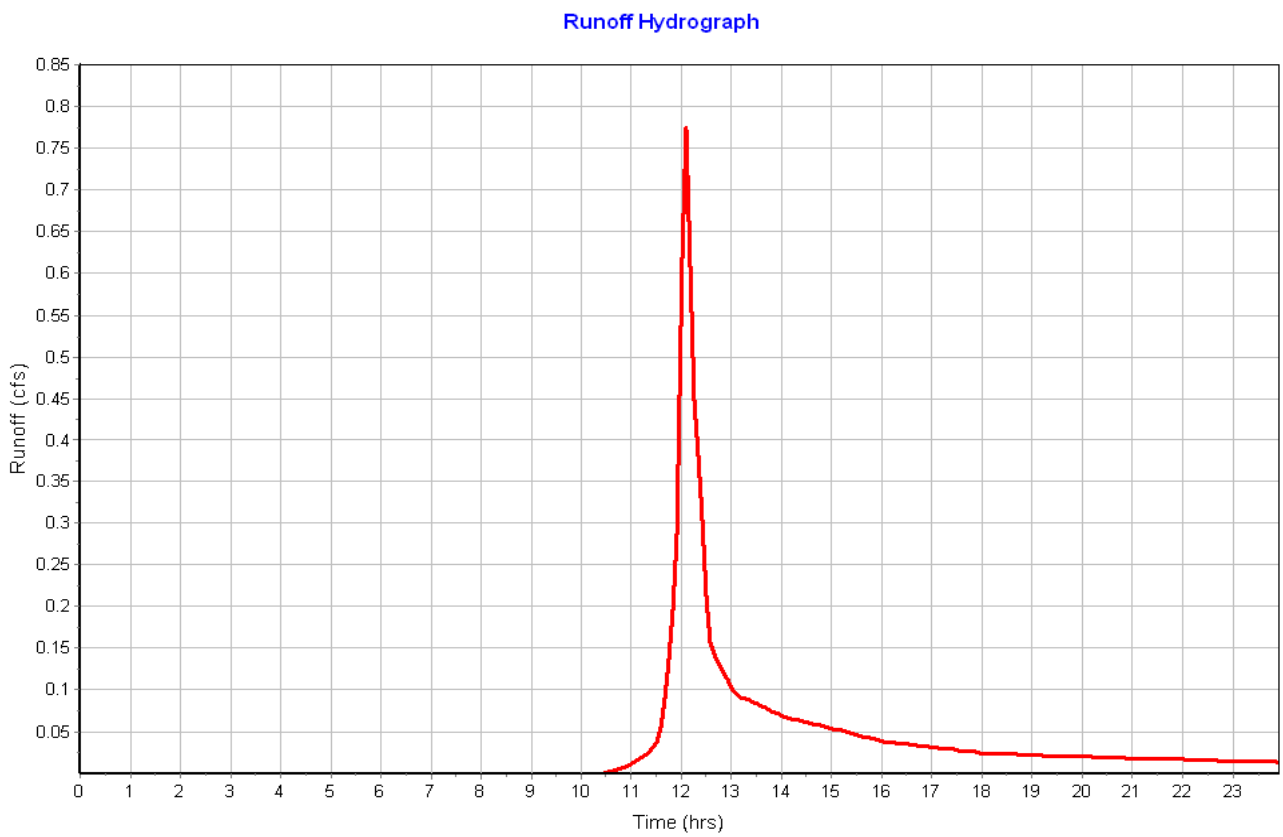
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 1.04
Peak Runoff (cfs) 0.81
Weighted Curve Number 75.95
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : C1-WETLAND





Subbasin : C2-WETLAND

Input Data

Area (ac) 0.73
Weighted Curve Number 82.63
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.31	C	74.00
Gravel roads	0.42	C	89.00
Composite Area & Weighted CN	0.73		82.63

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.01	0.00	0.00
Flow Length (ft) :	44	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	1.22	0.00	0.00
Computed Flow Time (min) :	0.60	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	636	0.00	0.00
Slope (%) :	1.6	0.00	0.00
Surface Type :		Unpaved	Unpaved
Velocity (ft/sec) :	1.90	0.00	0.00
Computed Flow Time (min) :	5.58	0.00	0.00

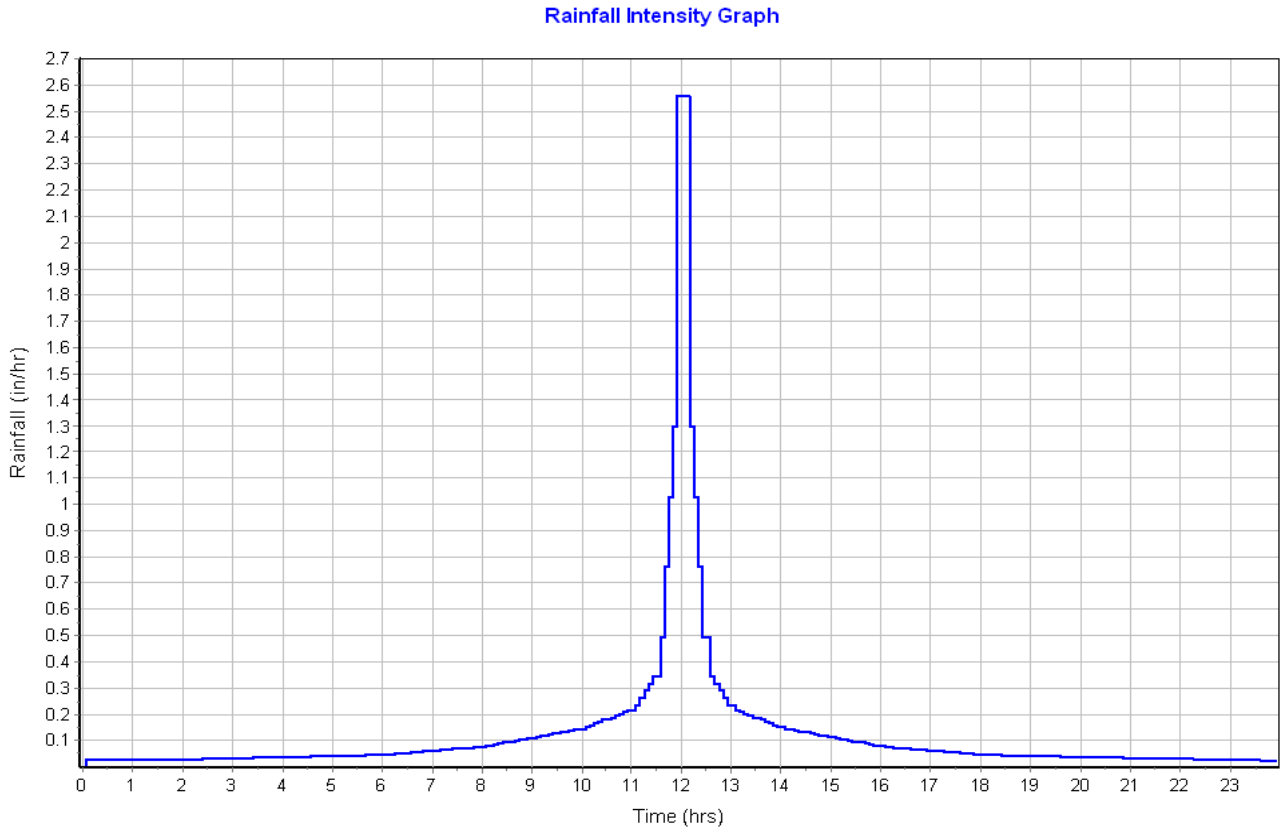
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.03	0.00	0.00
Flow Length (ft) :	2256	0.00	0.00
Channel Slope (%) :	.5	0.00	0.00
Cross Section Area (ft^2) :	2.475	0.00	0.00
Wetted Perimeter (ft) :	6.91	0.00	0.00
Velocity (ft/sec) :	1.77	0.00	0.00
Computed Flow Time (min) :	21.23	0.00	0.00

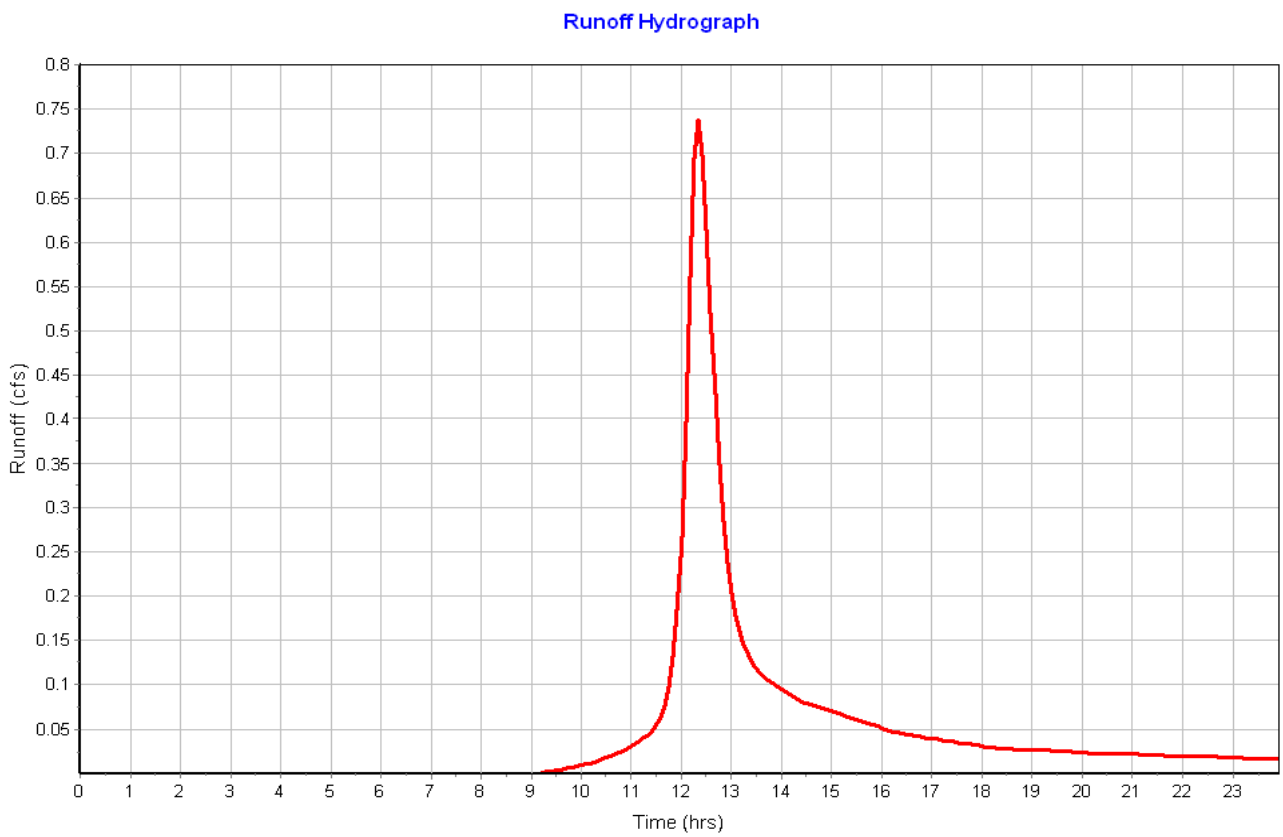
Total TOC (min) 27.41

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 1.45
Peak Runoff (cfs) 0.74
Weighted Curve Number 82.63
Time of Concentration (days hh:mm:ss) 0 00:27:25

Subbasin : C2-WETLAND





Subbasin : C3-BYPASS

Input Data

Area (ac) 21.22
Weighted Curve Number 71.79
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.01	D	80.00
Woods, Good	12.33	C	70.00
Woods, Good	7.45	D	77.00
> 75% grass cover, Good	0.66	A	39.00
> 75% grass cover, Good	0.57	C	74.00
Gravel roads	0.20	C	89.00
Composite Area & Weighted CN	21.22		71.79

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	.47	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.03	0.00	0.00
Computed Flow Time (min) :	54.75	0.00	0.00

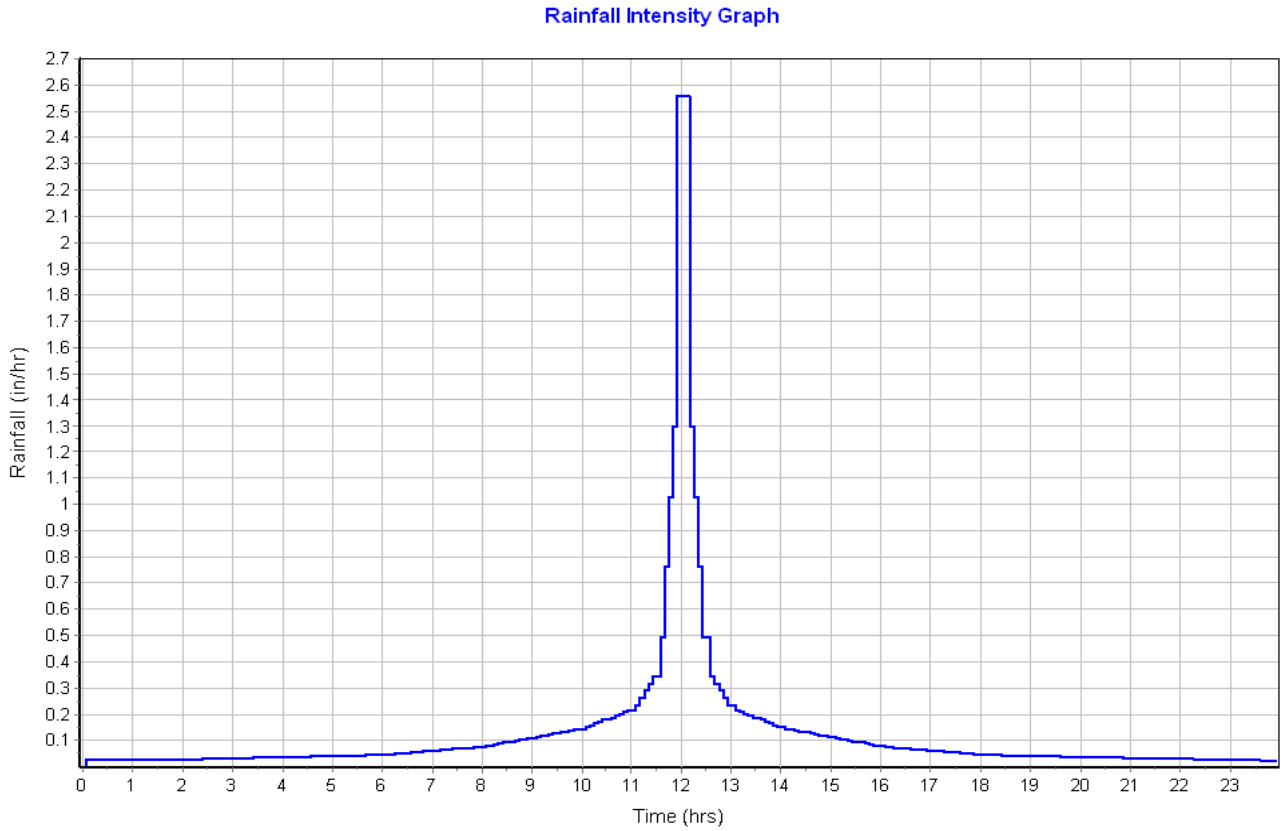
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2140	0.00	0.00
Slope (%) :	.47	0.00	0.00
Surface Type :		Unpaved	Unpaved
Velocity (ft/sec) :	1.03	0.00	0.00
Computed Flow Time (min) :	34.63	0.00	0.00

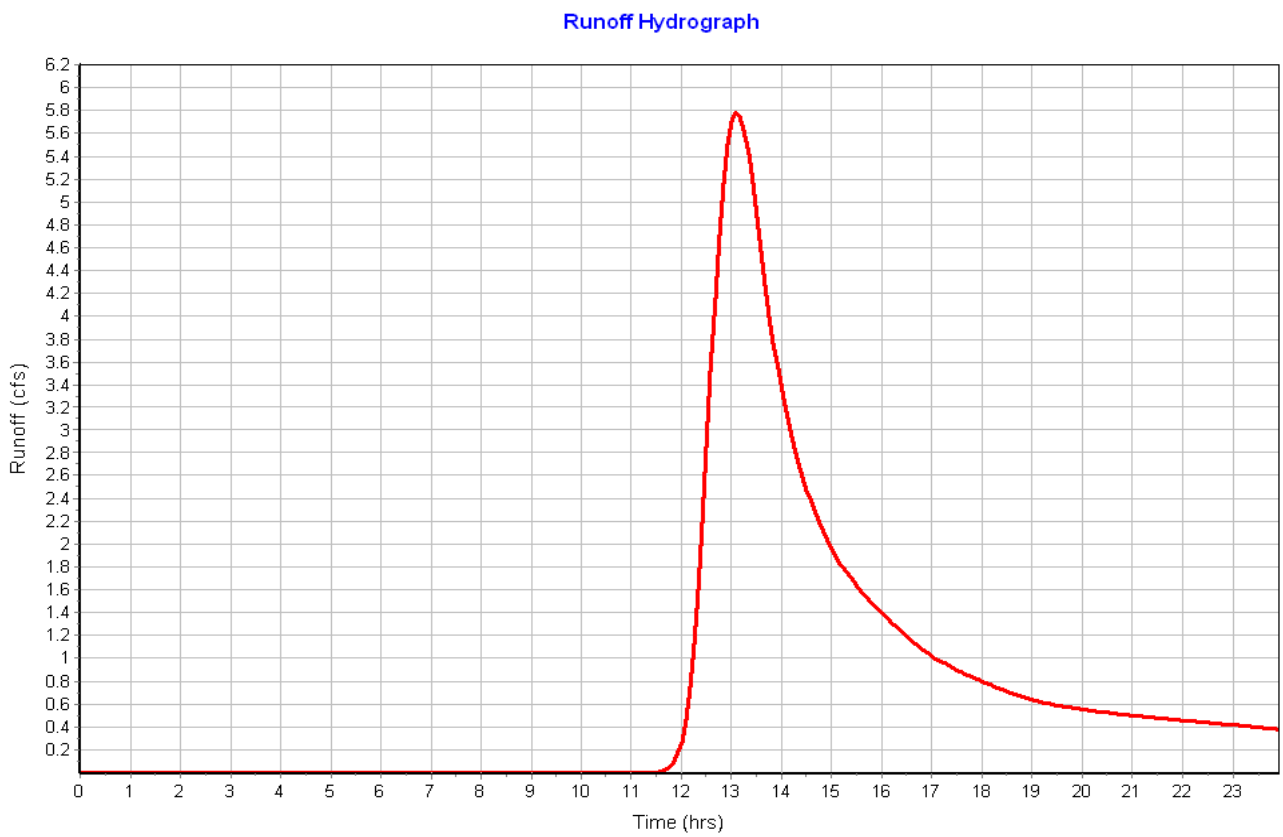
Total TOC (min) 89.38

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 0.82
Peak Runoff (cfs) 5.79
Weighted Curve Number 71.79
Time of Concentration (days hh:mm:ss) 0 01:29:23

Subbasin : C3-BYPASS





Subbasin : D

Input Data

Area (ac) 0.69
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.74	D	77.00
Composite Area & Weighted CN	0.74		77.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	21	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.14	0.00	0.00
Computed Flow Time (min) :	11.98	0.00	0.00

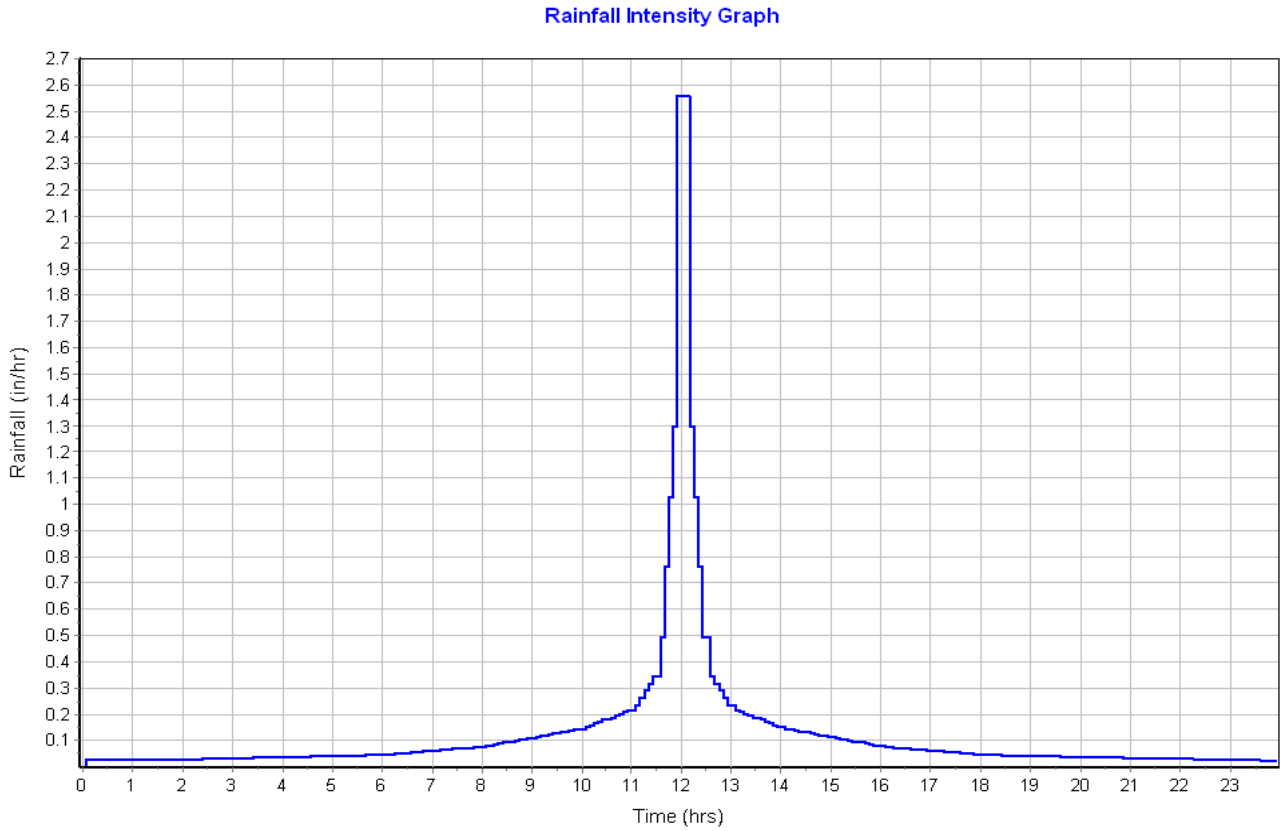
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	16	0.00	0.00
Slope (%) :	14.5	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.90	0.00	0.00
Computed Flow Time (min) :	0.14	0.00	0.00

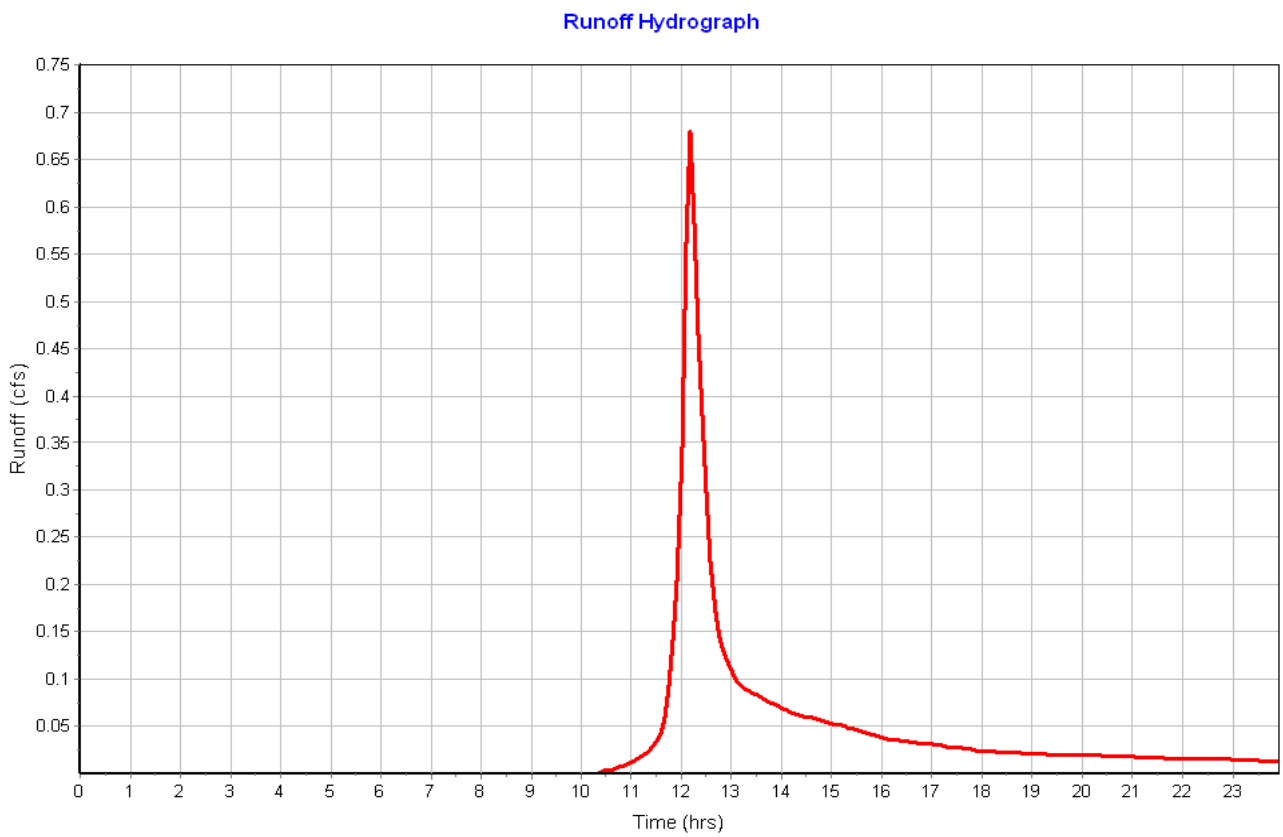
Total TOC (min) 12.12

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 1.10
Peak Runoff (cfs) 0.68
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:12:07

Subbasin : D


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : E

Input Data

Area (ac) 2.96
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	2.96	D	77.00
Composite Area & Weighted CN	2.96		77.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	24	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.15	0.00	0.00
Computed Flow Time (min) :	11.35	0.00	0.00

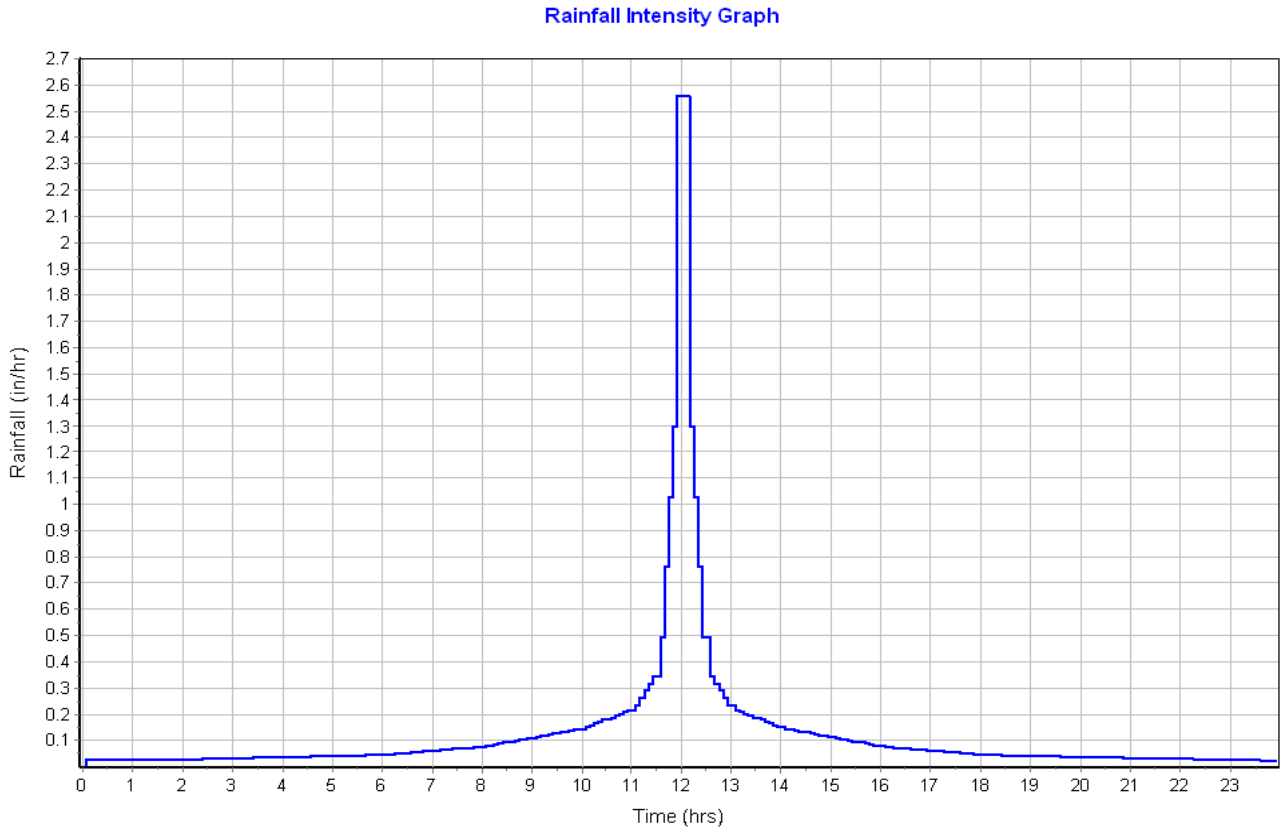
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	227	0.00	0.00
Slope (%) :	18	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.12	0.00	0.00
Computed Flow Time (min) :	1.78	0.00	0.00

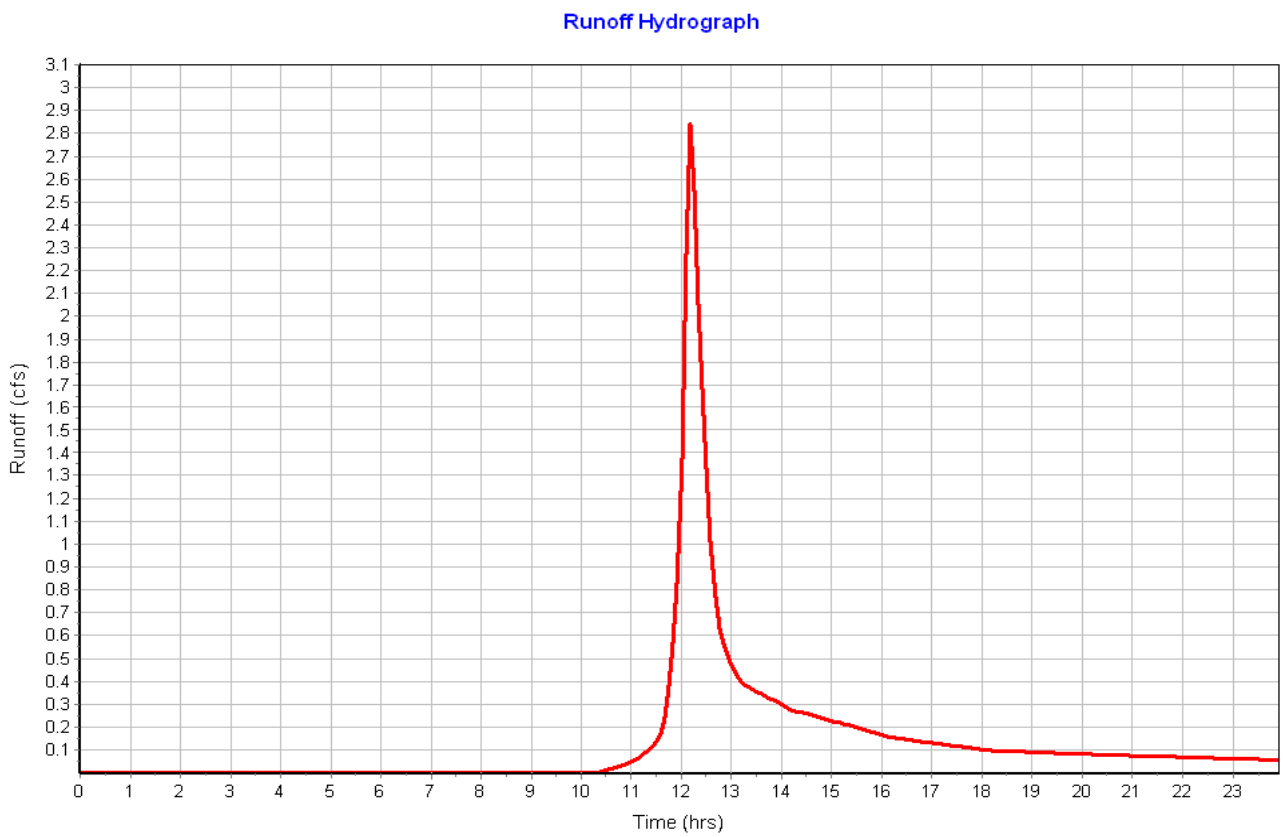
Total TOC (min) 13.14

Subbasin Runoff Results

Total Rainfall (in) 3.04
Total Runoff (in) 1.10
Peak Runoff (cfs) 2.85
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:13:08

Subbasin : E


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Junction Input

Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)
CB1	305.30	310.33
CB2	312.00	316.00
END-SECTION-C1	308.00	6.00
END-SECTION-C2	308.00	310.00
OUTLET-STR-A2	305.60	312.00
OUTLET-STR-C1	308.10	312.00
OUTLET-STR-C2	308.10	310.27

Junction Results

Element ID	Peak Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Time of Max HGL Occurrence
	(cfs)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)
CB1	7.24	306.41	1.11	3.92	305.49	0 12:26
CB2	7.95	312.74	0.74	3.26	312.11	0 12:15
END-SECTION-C1	0.02	308.07	0.07	3.16	308.06	0 19:47
END-SECTION-C2	0.02	308.07	0.07	3.16	308.07	0 21:13
OUTLET-STR-A2	5.36	306.39	0.79	5.61	305.73	0 12:26
OUTLET-STR-C1	0.02	308.17	0.07	3.83	308.16	0 19:46
OUTLET-STR-C2	0.02	308.17	0.07	2.10	308.17	0 21:12

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness
CULV-A	98.00	305.30	305.12	0.1800	CIRCULAR	36.000	36.000	0.0150
CULV-A2-1	104.00	312.00	310.00	1.9200	CIRCULAR	24.000	24.000	0.0150
CULV-A2-2	43.00	305.60	305.30	0.7000	CIRCULAR	24.000	24.000	0.0150
CULV-C1	30.00	308.10	308.00	0.3300	CIRCULAR	12.000	12.000	0.0130
CULV-C2	30.00	308.10	308.00	0.3300	CIRCULAR	12.000	12.000	0.0130

Pipe Results

Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth
	(cfs)	(days hh:mm)	(cfs)	(ft/sec)	(ft)
CULV-A	7.24	0 12:26	24.77	3.04	1.11
CULV-A2-1	7.91	0 12:15	27.19	7.52	0.74
CULV-A2-2	5.36	0 12:26	16.38	4.66	0.79
CULV-C1	0.02	0 19:47	2.06	0.84	0.07
CULV-C2	0.02	0 21:13	2.06	0.85	0.07

Storage Nodes

Storage Node : DETENTION-A

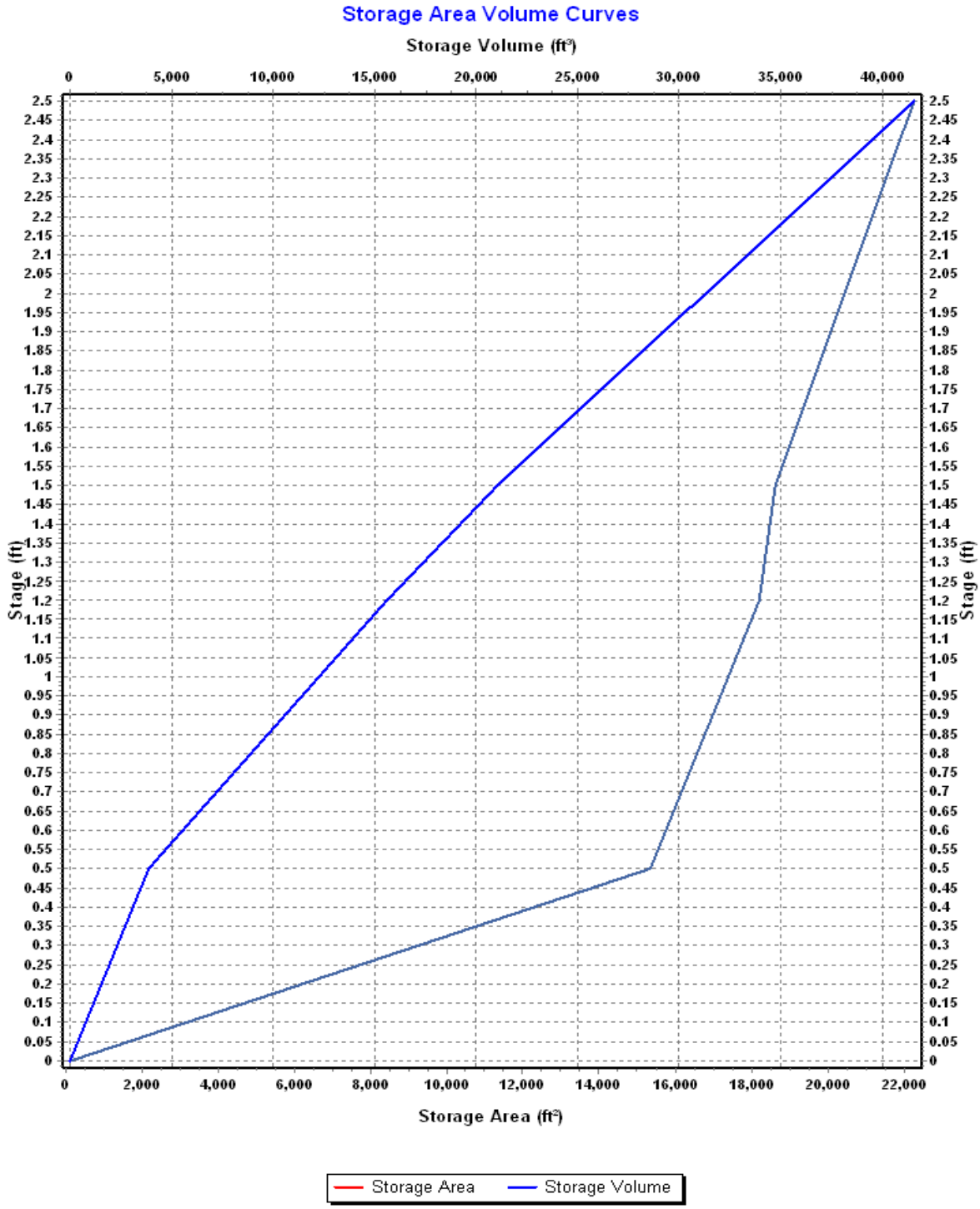
Input Data

Invert Elevation (ft) 309.50
Max (Rim) Elevation (ft) 312.00
Max (Rim) Offset (ft) 2.50
Initial Water Elevation (ft) 309.50
Initial Water Depth (ft) 0.00
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Storage-08

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	113	0.000
.5	15327	3860.00
1.2	18183.	15588.50
1.5	18635	21111.20
2.5	22257	41557.20


Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
Stage (ft)
2.5
2.45
2.4
2.35
2.3
2.25
2.2
2.15
2.1
2.05
2
1.95
1.9
1.85
1.8
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : DETENTION-A (continued)

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
BEEHIVE-GRATE	Bottom	CIRCULAR	18.17			310.33	0.61
ORIF-DET-A	Side	Rectangular		4.00	36.00	309.50	0.63

Output Summary Results

Peak Inflow (cfs) 2.94
Peak Lateral Inflow (cfs) 2.94
Peak Outflow (cfs) 1.88
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 309.81
Max HGL Depth Attained (ft) 0.31
Average HGL Elevation Attained (ft) 309.54
Average HGL Depth Attained (ft) 0.04
Time of Max HGL Occurrence (days hh:mm) 0 12:25
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Storage Node : FILTER-1

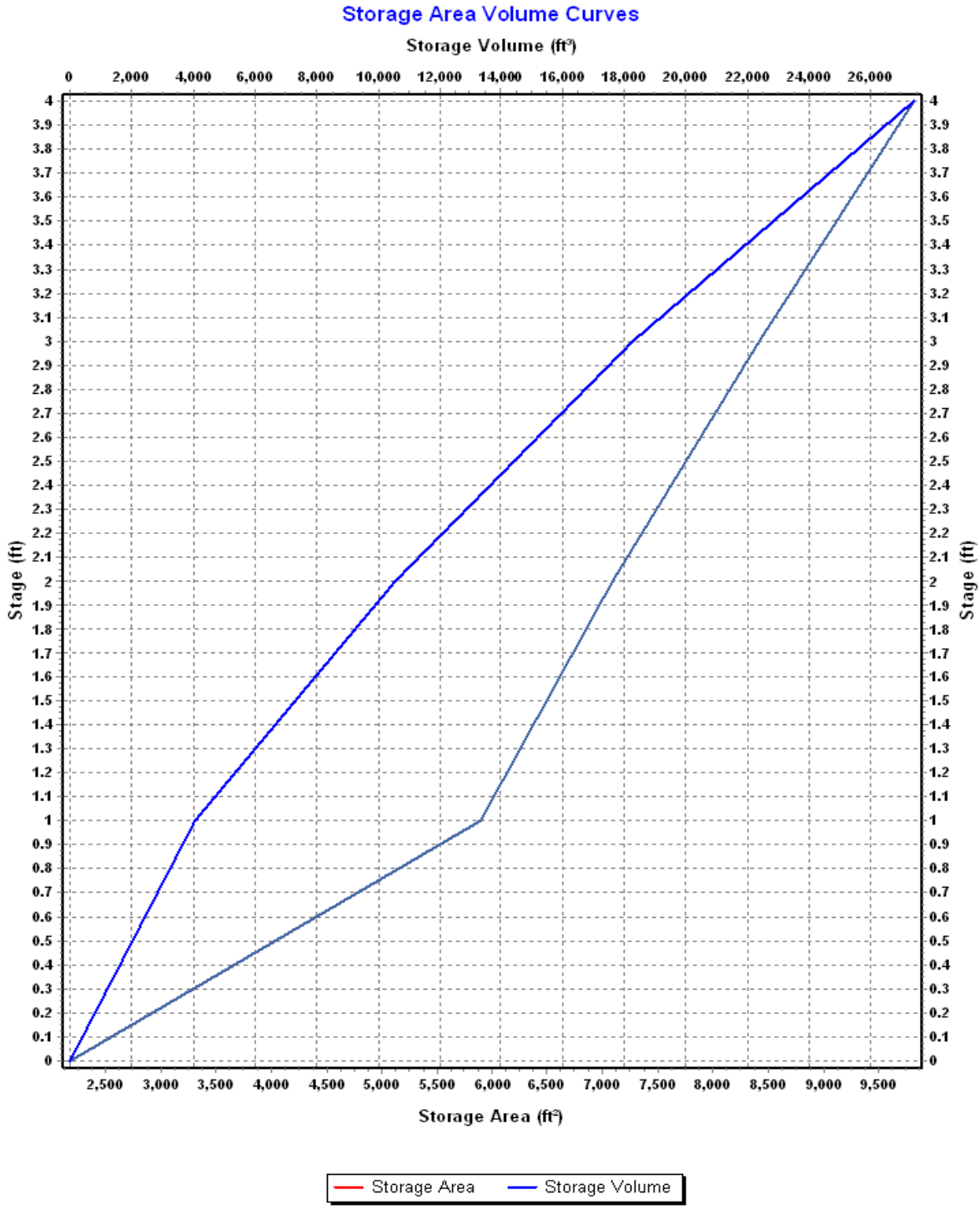
Input Data

Invert Elevation (ft)	308.00
Max (Rim) Elevation (ft)	312.00
Max (Rim) Offset (ft)	4.00
Initial Water Elevation (ft)	309.00
Initial Water Depth (ft)	1.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Storage-05

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	2178	0.000
1	5898	4038.00
2	7084	10529.00
3	8421	18281.50
4	9818	27401.00


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
26,000
Stage (ft)
Storage Area (ft²)
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
8,000
8,500
9,000
9,500
Storage Area
Storage Volume

Storage Node : FILTER-1 (continued)

Outflow Weirs

Element ID	Weir Type	Crest Elevation (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
SPILLWAY-A2	Trapezoidal	310.70	55.00	1.30	3.10

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
ORIF-A2	Side	Rectangular		6.00	35.00	309.00	0.63

Output Summary Results

Peak Inflow (cfs) 7.91
Peak Lateral Inflow (cfs) 0.00
Peak Outflow (cfs) 5.36
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 309.78
Max HGL Depth Attained (ft) 1.78
Average HGL Elevation Attained (ft) 309.08
Average HGL Depth Attained (ft) 1.08
Time of Max HGL Occurrence (days hh:mm) 0 12:26
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Storage Node : WETLAND-C1

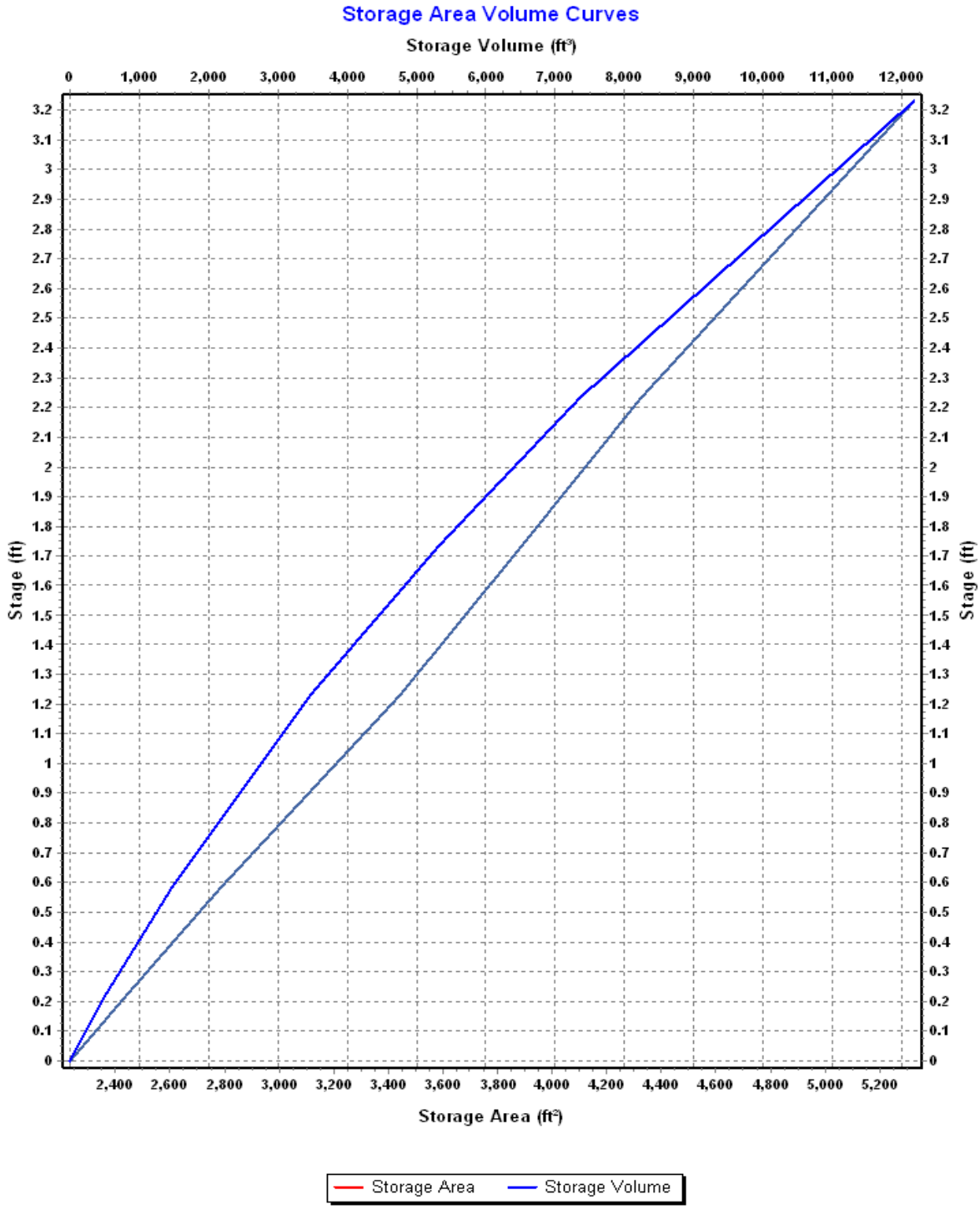
Input Data

Invert Elevation (ft) 308.77
Max (Rim) Elevation (ft) 312.00
Max (Rim) Offset (ft) 3.23
Initial Water Elevation (ft) 309.33
Initial Water Depth (ft) 0.56
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Storage-09

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	2234.3266	0.000
0.23	2446.5288	538.30
0.583	2787.6137	1462.13
1.23	3441.1460	3477.13
1.73	3884.8913	5308.64
2.23	4323.3307	7360.70
3.23	5324	12184.37


Storage Area Volume Curves
Storage Volume (ft³)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
Stage (ft)
3.2
3.1
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2,400
2,600
2,800
3,000
3,200
3,400
3,600
3,800
4,000
4,200
4,400
4,600
4,800
5,000
5,200
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : WETLAND-C1 (continued)

Outflow Weirs

Element ID	Weir Type	Crest Elevation (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
SPILLWAY-C1	Trapezoidal	310.70	10.00	1.30	3.33

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
ORIF-C1	Side	CIRCULAR	0.88			308.10	0.61
Wetland-1-BEEHIV	Bottom	CIRCULAR	18.17			310.27	0.61

Output Summary Results

Peak Inflow (cfs)	0.77
Peak Lateral Inflow (cfs)	0.77
Peak Outflow (cfs)	0.02
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	309.80
Max HGL Depth Attained (ft)	1.03
Average HGL Elevation Attained (ft)	309.48
Average HGL Depth Attained (ft)	0.71
Time of Max HGL Occurrence (days hh:mm)	0 19:46
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : WETLAND-C2

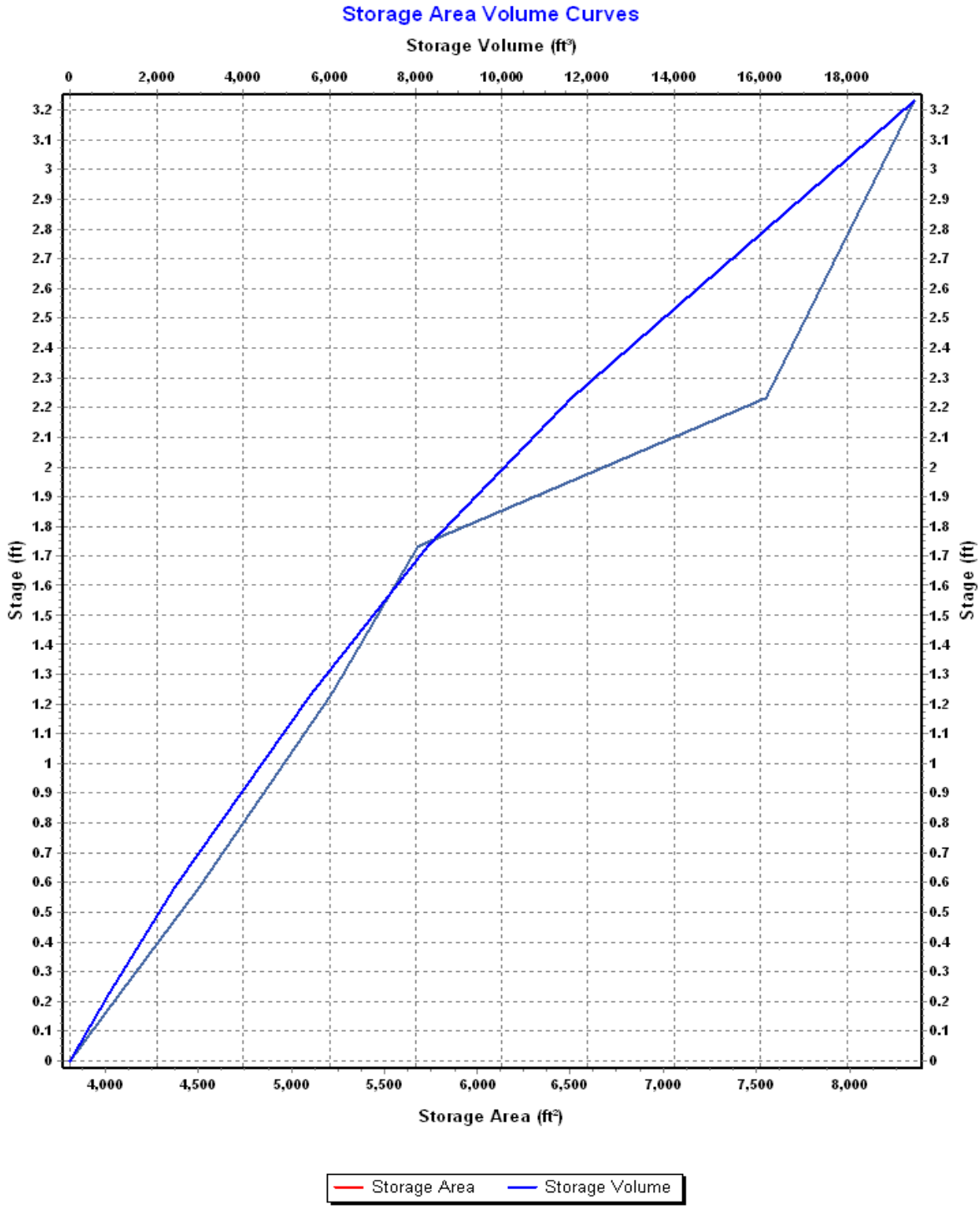
Input Data

Invert Elevation (ft)	308.77
Max (Rim) Elevation (ft)	312.00
Max (Rim) Offset (ft)	3.23
Initial Water Elevation (ft)	309.42
Initial Water Depth (ft)	0.65
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Storage-07

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	3813.8233	0.000
0.23	4081.9612	908.02
0.583	4508.5002	2424.24
1.23	5212.0439	5568.84
1.73	5680.7080	8292.03
2.23	7549	11599.46
3.23	8345	19546.46


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
8,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : WETLAND-C2 (continued)

Outflow Weirs

Element ID	Weir Type	Crest Elevation (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
SPILLWAY-C2	Trapezoidal	310.80	10.00	1.20	3.10

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
ORIF-C2A	Side	CIRCULAR	0.88			308.10	0.61
Wetland-2-BEEHIV	Bottom	CIRCULAR	18.17			310.27	0.61

Output Summary Results

Peak Inflow (cfs)	0.74
Peak Lateral Inflow (cfs)	0.74
Peak Outflow (cfs)	0.02
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	309.89
Max HGL Depth Attained (ft)	1.12
Average HGL Elevation Attained (ft)	309.59
Average HGL Depth Attained (ft)	0.82
Time of Max HGL Occurrence (days hh:mm)	0 21:12
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Project Description

File Name ..... Proposed Conditions 1-15-19.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Jul 13, 2017 00:00:00
End Analysis On ..... Jul 14, 2017 00:00:00
Start Reporting On ..... Jul 13, 2017 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	9
Nodes	16
Junctions	7
Outfalls	5
Flow Diversions	0
Inlets	0
Storage Nodes	4
Links	17
Channels	2
Pipes	5
Pumps	0
Orifices	7
Weirs	3
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-010	Cumulative	inches	Maine	Androscoggin	10	4.55	SCS Type III 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
A1	12.28	73.16	4.55	1.95	23.90	12.43	0 00:49:44
A2	6.41	81.47	4.55	2.63	16.88	15.32	0 00:12:48
A3	4.01	71.75	4.55	1.84	7.37	7.15	0 00:09:08
B	5.14	75.65	4.55	2.14	11.01	8.01	0 00:24:28
C1-WETLAND	0.75	75.95	4.55	2.17	1.62	1.70	0 00:05:00
C2-WETLAND	0.73	82.63	4.55	2.74	2.00	1.40	0 00:27:24
C3-BYPASS	21.22	71.79	4.55	1.84	39.09	14.12	0 01:29:22
D	0.69	77.00	4.55	2.25	1.55	1.43	0 00:12:07
E	2.96	77.00	4.55	2.25	6.66	6.01	0 00:13:08

Node Summary

Element ID	Element Type	Invert Elevation (ft)
CB1	Junction	305.30
CB2	Junction	312.00
END-SECTION-C1	Junction	308.00
END-SECTION-C2	Junction	308.00
OUTLET-STR-A2	Junction	305.60
OUTLET-STR-C1	Junction	308.10
OUTLET-STR-C2	Junction	308.10
OUT-A	Outfall	298.00
OUT-B	Outfall	310.00
OUT-C	Outfall	298.00
OUT-D	Outfall	338.00
OUT-E	Outfall	298.00
DETENTION-A	Storage Node	309.50
FILTER-1	Storage Node	308.00
WETLAND-C1	Storage Node	308.77
WETLAND-C2	Storage Node	308.77

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)	(ft/sec)	(ft)
CULV-A	Pipe	CB1	OUT-A	98.00	305.30	305.12	0.1800	36.000	0.0150	11.79	24.77	3.46	1.46
CULV-A2-1	Pipe	CB2	FILTER-1	104.00	312.00	310.00	1.9200	24.000	0.0150	15.24	27.19	8.91	1.07
CULV-A2-2	Pipe	OUTLET-STR-A2	CB1	43.00	305.60	305.30	0.7000	24.000	0.0150	8.55	16.38	5.27	1.03
CULV-C1	Pipe	OUTLET-STR-C1	END-SECTION-C1	30.00	308.10	308.00	0.3300	12.000	0.0130	0.12	2.06	1.44	0.17
CULV-C2	Pipe	OUTLET-STR-C2	END-SECTION-C2	30.00	308.10	308.00	0.3300	12.000	0.0130	0.12	2.06	1.41	0.16
WETLAND-CHANNEL-C1	Channel	END-SECTION-C1	OUT-C	2050.00	308.00	298.00	0.4900	6.000	0.0320	0.07	101.48	0.00	0.01
WETLAND-CHANNEL-C2	Channel	END-SECTION-C2	OUT-C	1712.00	308.00	298.00	0.5800	6.000	0.0320	0.08	111.05	0.00	0.01
BEEHIVE-GRATE	Orifice	DETENTION-A	CB1		309.50	305.30		18.167		0.00			
ORIF-A2	Orifice	FILTER-1	OUTLET-STR-A2		308.00	305.60		6.000		8.55			
ORIF-C1	Orifice	WETLAND-C1	OUTLET-STR-C1		308.77	308.10		0.880		0.03			
ORIF-C2A	Orifice	WETLAND-C2	OUTLET-STR-C2		308.77	308.10		0.880		0.03			
ORIF-DET-A	Orifice	DETENTION-A	CB1		309.50	305.30		4.000		3.25			
Wetland-1-BEEHIVE	Orifice	WETLAND-C1	OUTLET-STR-C1		308.77	308.10		18.170		0.10			
Wetland-2-BEEHIVE	Orifice	WETLAND-C2	OUTLET-STR-C2		308.77	308.10		18.170		0.09			
SPILLWAY-A2	Weir	FILTER-1	DETENTION-A		308.00	309.50				0.00			
SPILLWAY-C1	Weir	WETLAND-C1	END-SECTION-C1		308.77	308.00				0.00			
SPILLWAY-C2	Weir	WETLAND-C2	END-SECTION-C2		308.77	308.00				0.00			

Subbasin Hydrology

Subbasin : A1

Input Data

Area (ac) 12.28
Weighted Curve Number 73.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	4.58	D	77.00
> 75% grass cover, Good	0.68	C	74.00
Woods, Good	6.62	C	70.00
> 75% grass cover, Good	0.40	D	80.00
Composite Area & Weighted CN	12.28		73.16

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.05	0.00	0.00
Computed Flow Time (min) :	30.68	0.00	0.00

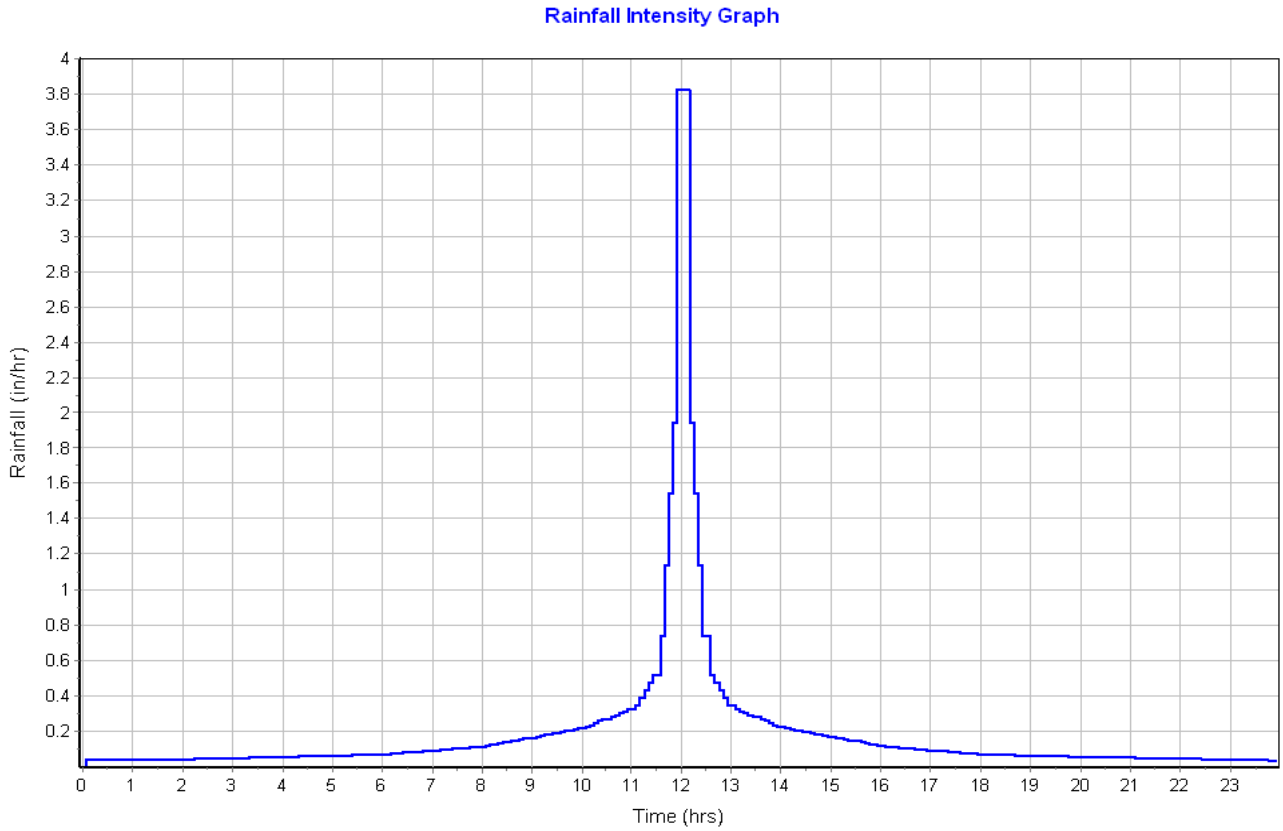
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1510	0.00	0.00
Slope (%) :	.78	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	1.32	0.00	0.00
Computed Flow Time (min) :	19.07	0.00	0.00

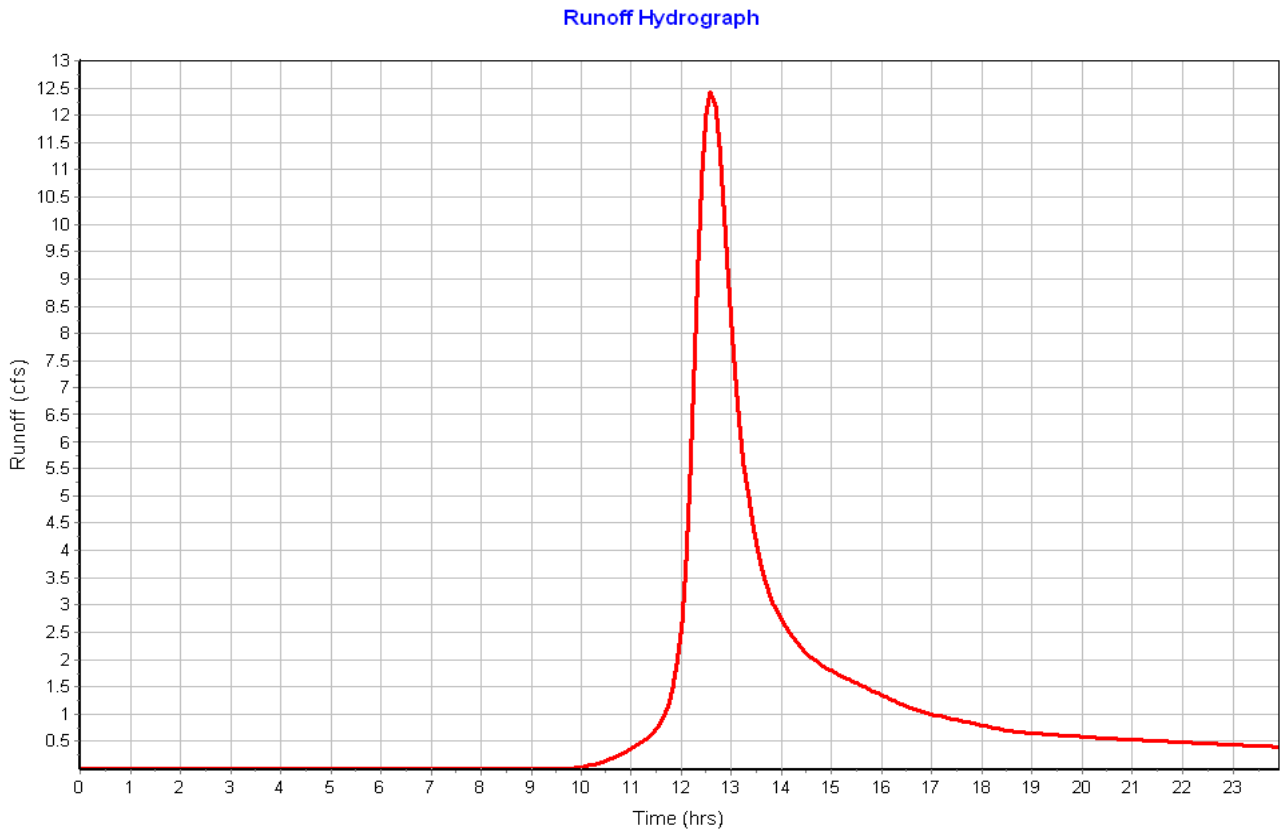
Total TOC (min) 49.74

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 1.95
Peak Runoff (cfs) 12.43
Weighted Curve Number 73.16
Time of Concentration (days hh:mm:ss) 0 00:49:44

Subbasin : A1


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : A2

Input Data

Area (ac) 6.41
Weighted Curve Number 81.47
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.13	D	77.00
Roofs	1.77	D	98.00
> 75% grass cover, Good	1.87	D	80.00
Stone_Pad	1.80	D	60.00
Gravel roads	0.17	D	91.00
Pavement	0.67	D	98.00
Composite Area & Weighted CN	6.41		81.47

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	85	0.00	0.00
Slope (%) :	33.33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	6.32	0.00	0.00

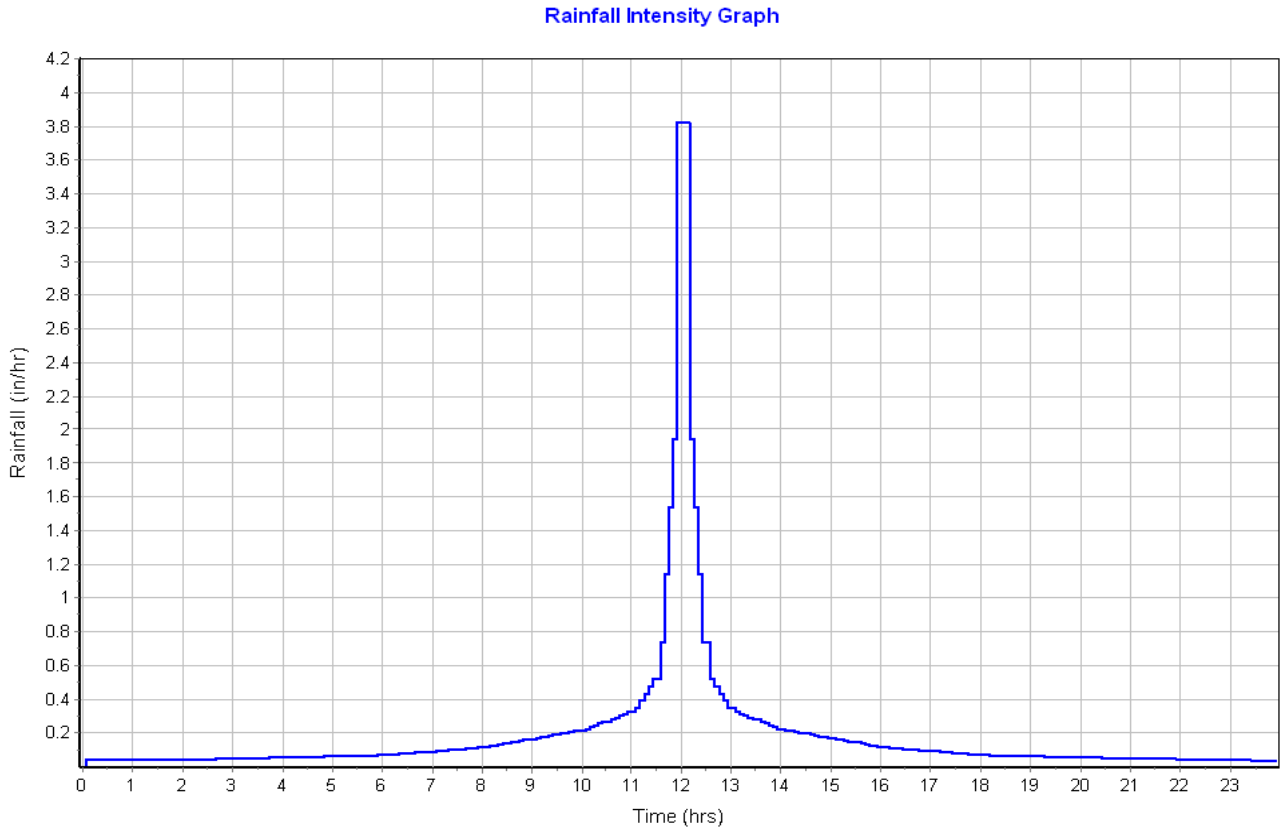
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1138	0.00	0.00
Channel Slope (%) :	1.4	0.00	0.00
Cross Section Area (ft^2) :	4.398	0.00	0.00
Wetted Perimeter (ft) :	8.12	0.00	0.00
Velocity (ft/sec) :	2.93	0.00	0.00
Computed Flow Time (min) :	6.48	0.00	0.00

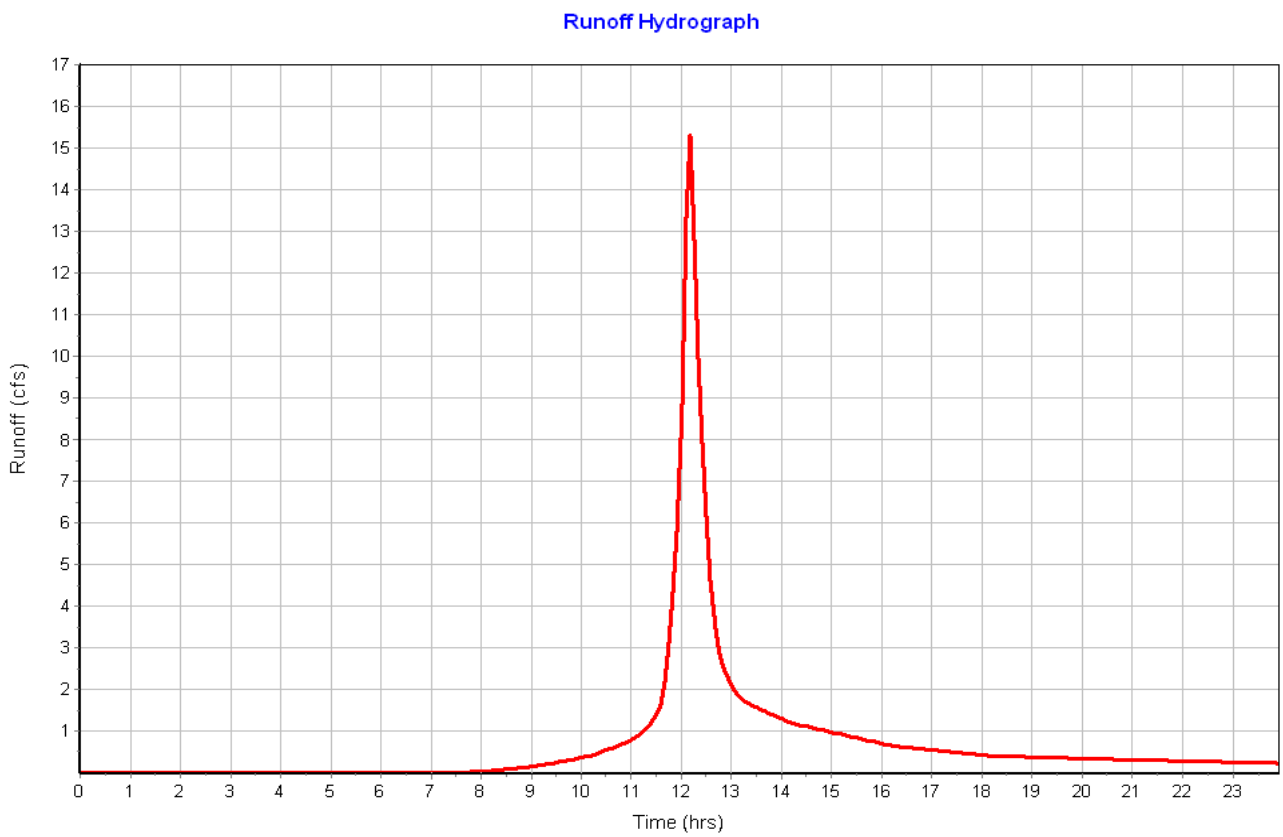
Total TOC (min) 12.80

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 2.63
Peak Runoff (cfs) 15.32
Weighted Curve Number 81.47
Time of Concentration (days hh:mm:ss) 0 00:12:48

Subbasin : A2


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : A3

Input Data

Area (ac) 4.01
Weighted Curve Number 71.75
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.75	D	80.00
> 75% grass cover, Good	0.14	C	74.00
Stone_Pad	2.28	D	60.00
Roofs	0.19	D	98.00
Gravel roads	0.25	D	91.00
Pavement	0.35	D	98.00
Foundations	0.05	D	98.00
Composite Area & Weighted CN	4.01		71.75

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.01	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	1.44	0.00	0.00
Computed Flow Time (min) :	1.16	0.00	0.00

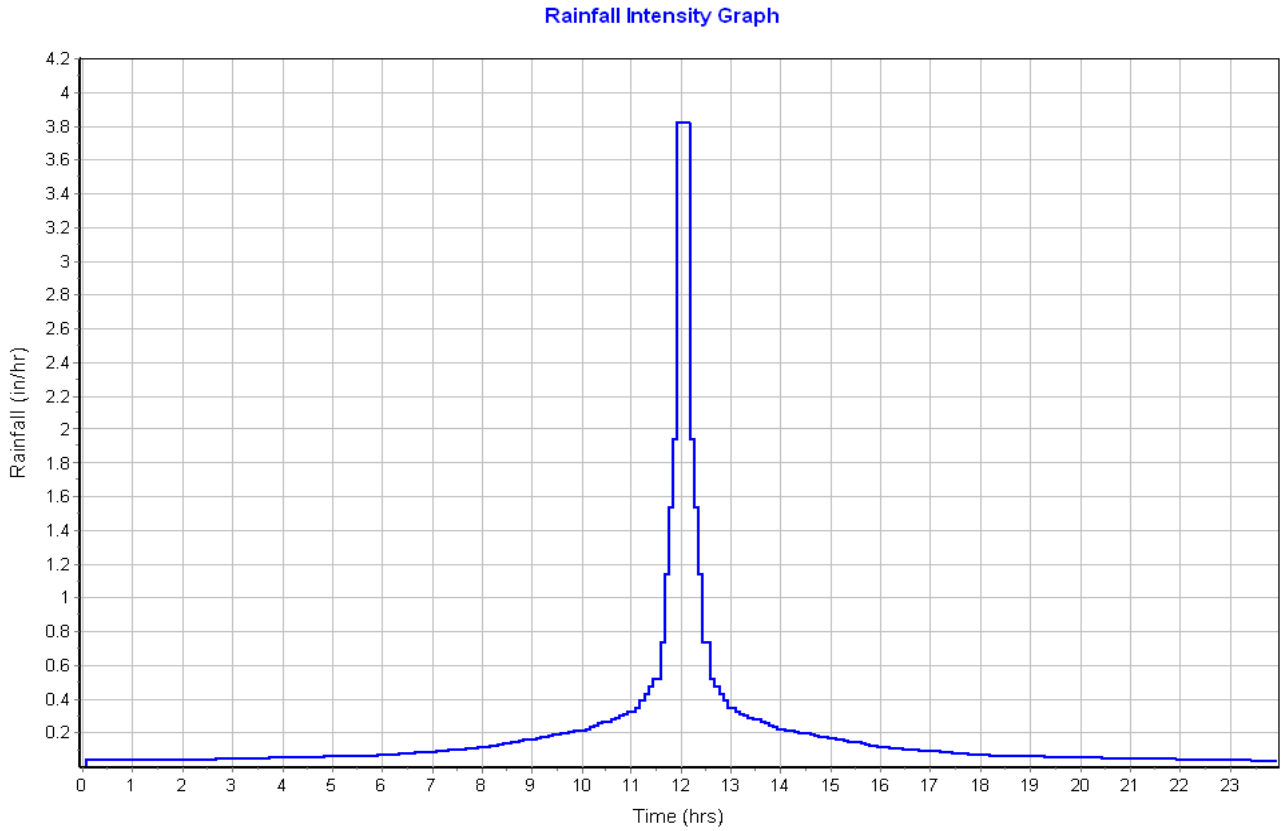
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	548	25	200
Slope (%) :	2	33.33	1.5
Surface Type :	Unpaved	rass pastu	rass pasture
Velocity (ft/sec) :	2.28	4.04	0.86
Computed Flow Time (min) :	4.01	0.10	3.88

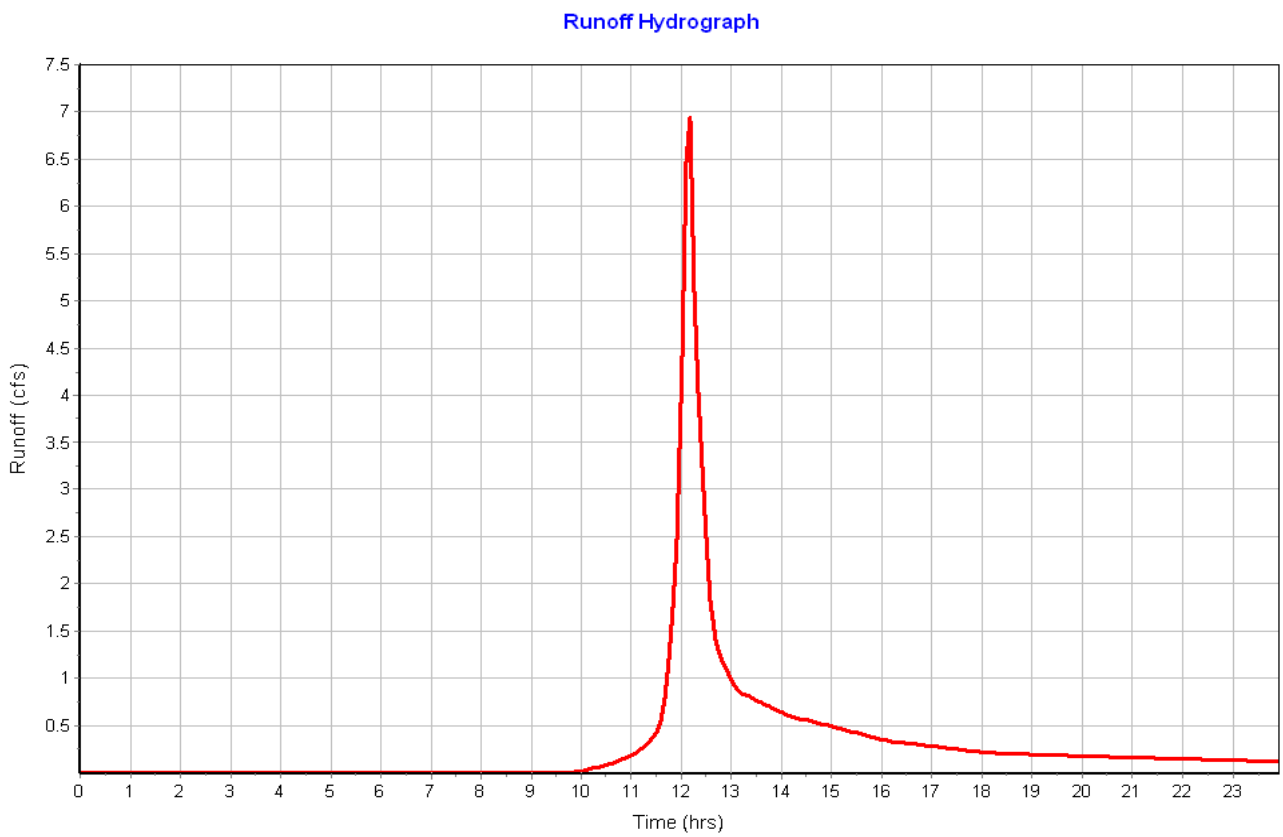
Total TOC (min) 9.14

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 1.84
Peak Runoff (cfs) 7.15
Weighted Curve Number 71.75
Time of Concentration (days hh:mm:ss) 0 00:09:08

Subbasin : A3


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B

Input Data

Area (ac) 5.14
Weighted Curve Number 75.65
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	1.20	C	70.00
Woods, Good	3.45	D	77.00
> 75% grass cover, Good	0.49	D	80.00
Composite Area & Weighted CN	5.14		75.65

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	90	0.00	0.00
Slope (%) :	33.33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.23	0.00	0.00
Computed Flow Time (min) :	6.62	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	368	0.00	0.00
Slope (%) :	1.63	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	1.92	0.00	0.00
Computed Flow Time (min) :	3.19	0.00	0.00

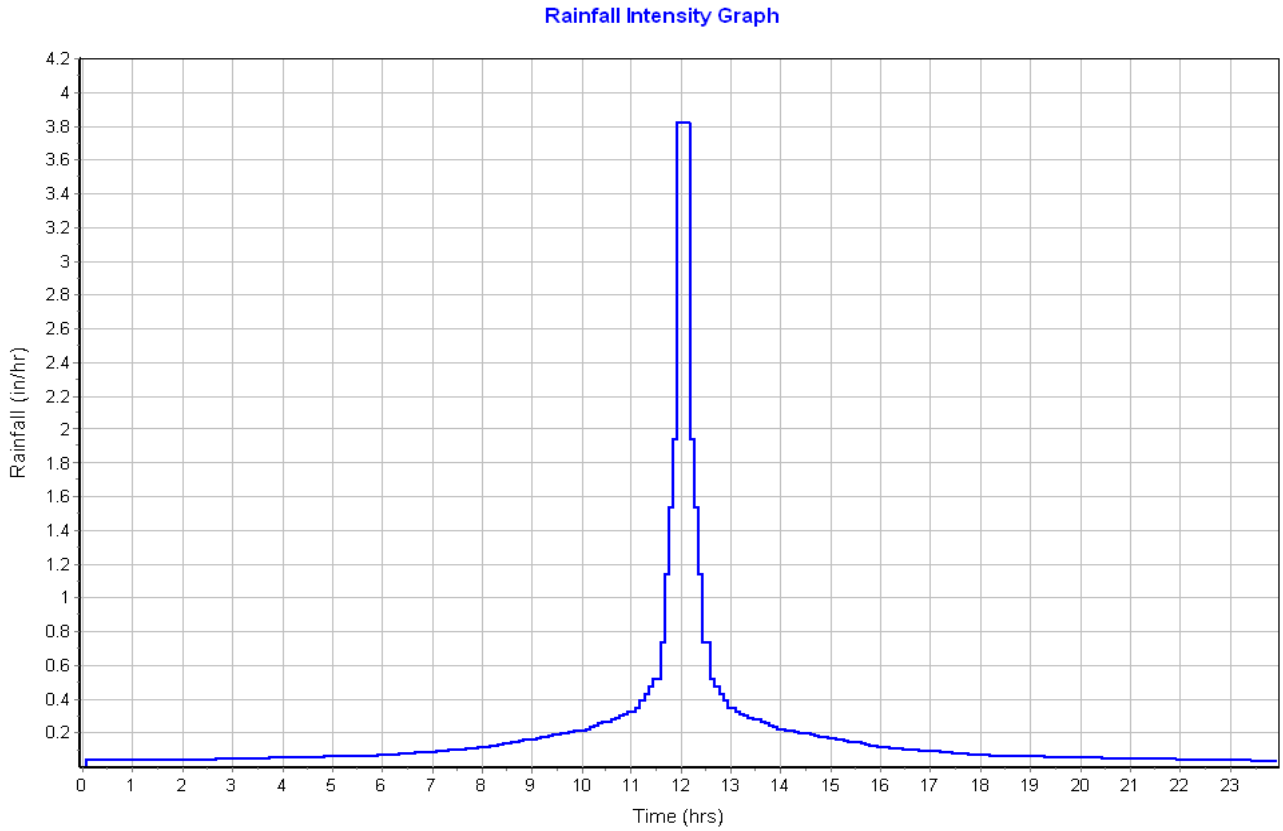
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.3	.3	0.00
Flow Length (ft) :	272	85	0.00
Channel Slope (%) :	1.4	16.7	0.00
Cross Section Area (ft²) :	3.287	1.367	0.00
Wetted Perimeter (ft) :	7.17	5.15	0.00
Velocity (ft/sec) :	0.35	0.84	0.00
Computed Flow Time (min) :	12.97	1.69	0.00

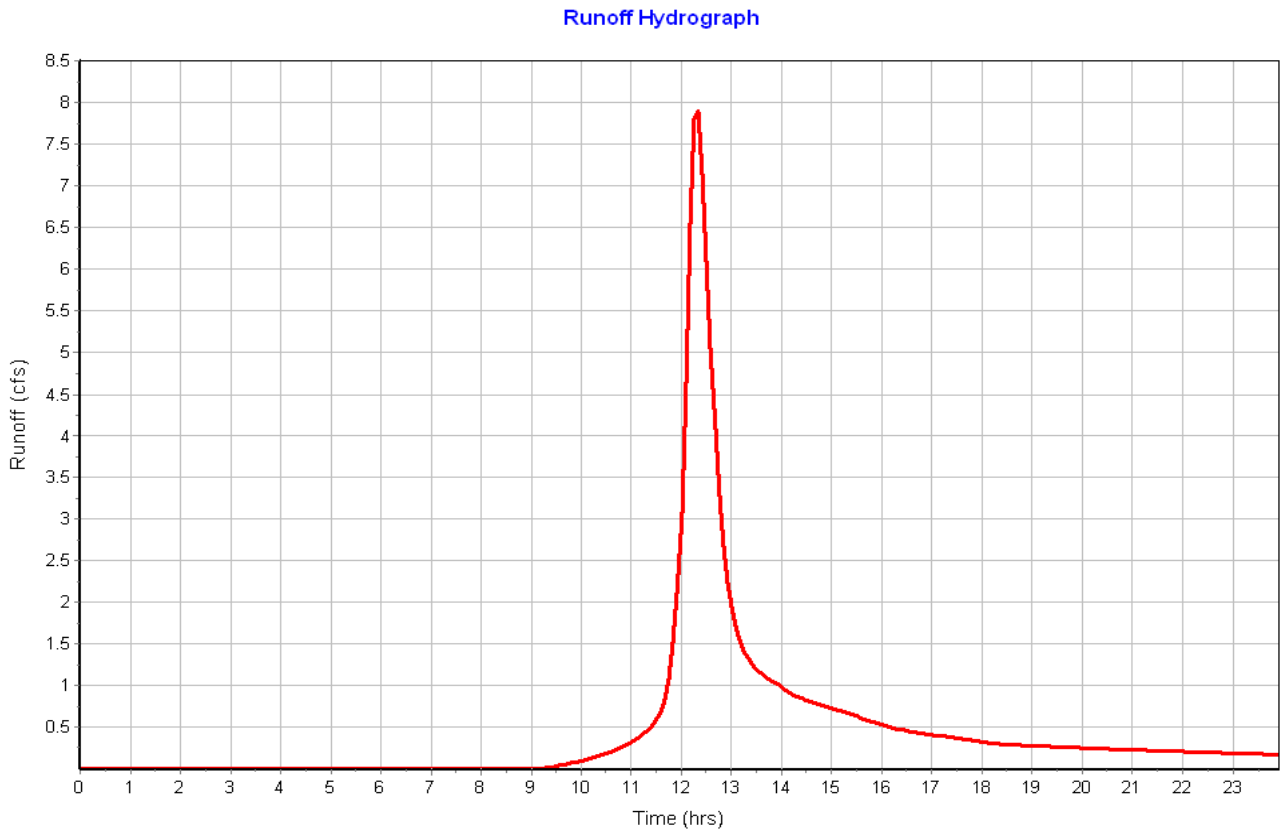
Total TOC (min) 24.48

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 2.14
Peak Runoff (cfs) 8.01
Weighted Curve Number 75.65
Time of Concentration (days hh:mm:ss) 0 00:24:29

Subbasin : B


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C1-WETLAND

Input Data

Area (ac) 0.75
Weighted Curve Number 75.95
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.12	D	77.00
> 75% grass cover, Good	0.04	A	39.00
> 75% grass cover, Good	0.05	D	80.00
> 75% grass cover, Good	0.34	C	74.00
Woods, Good	0.02	C	70.00
Gravel roads	0.04	A	76.00
Gravel roads	0.09	C	89.00
Gravel roads	0.05	D	91.00
Composite Area & Weighted CN	0.75		75.95

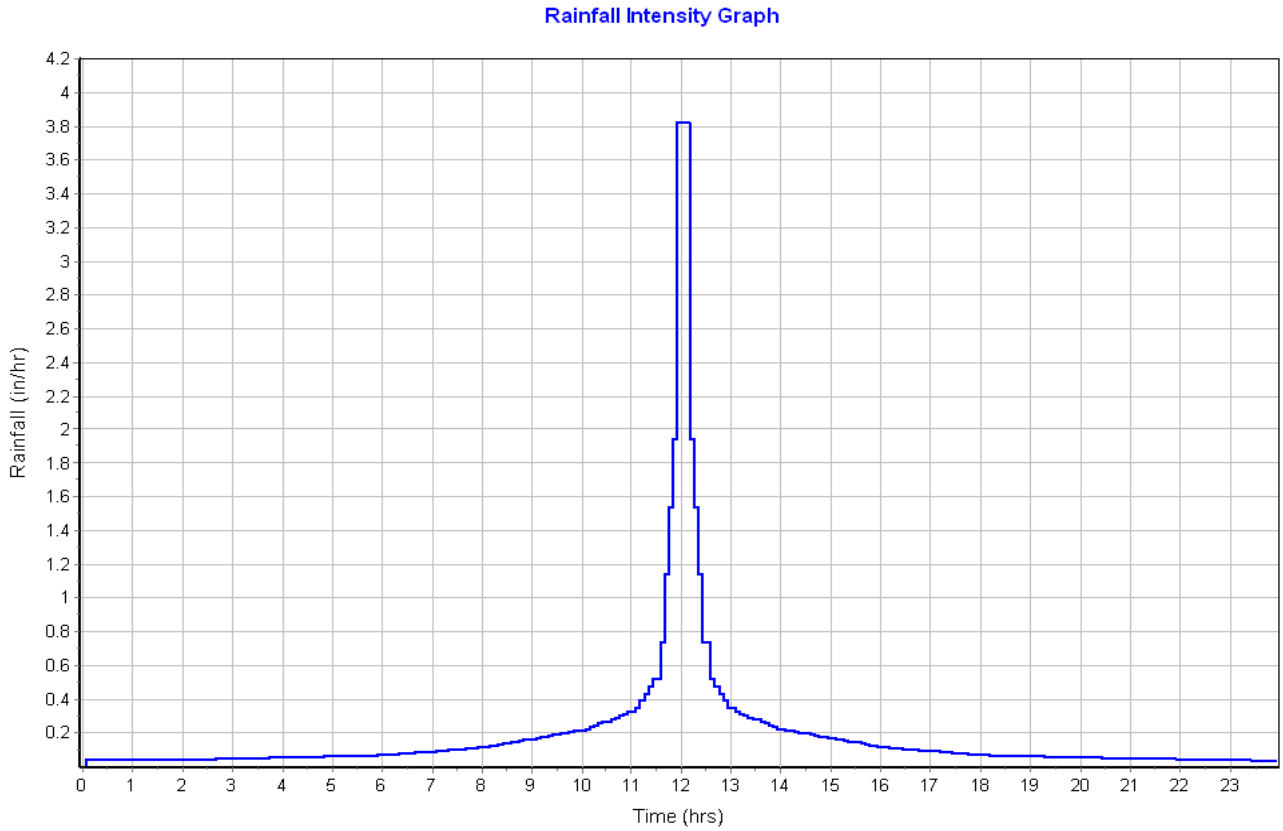
Time of Concentration

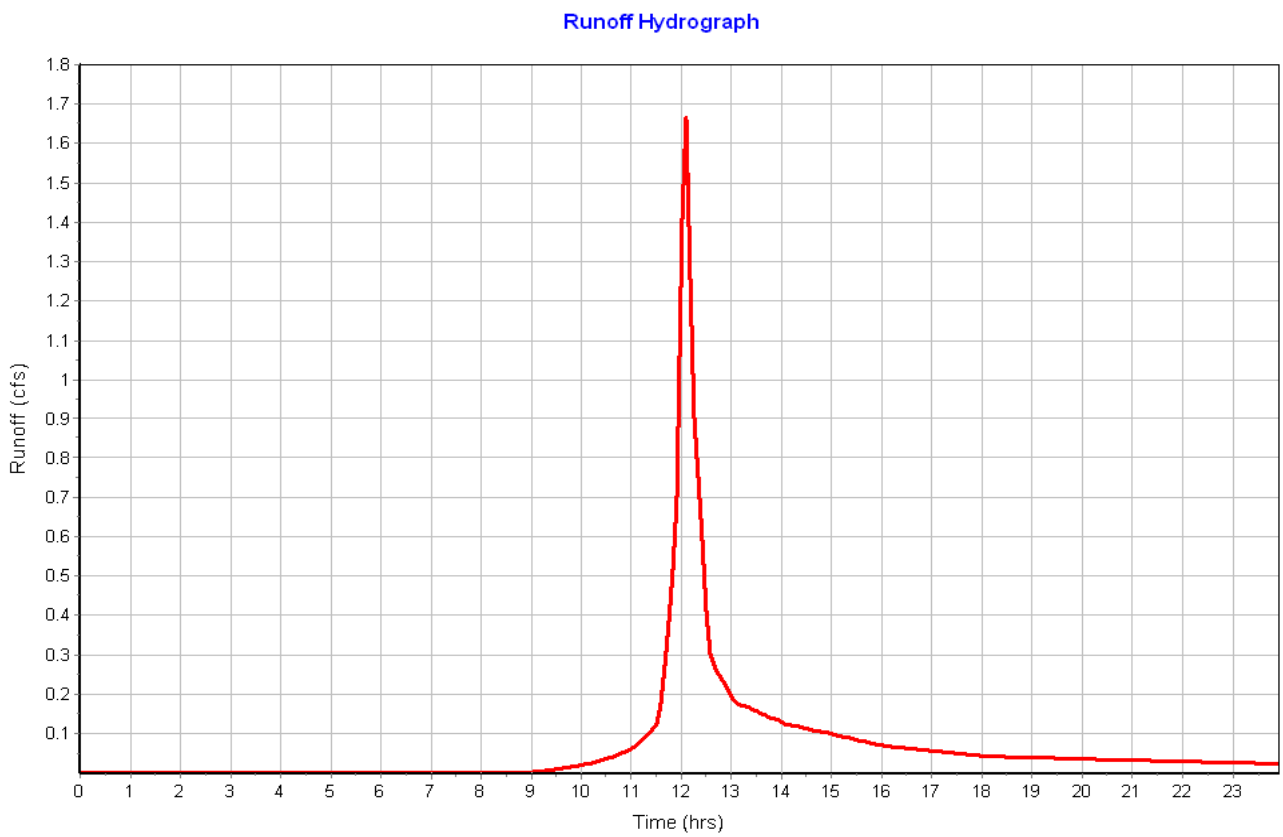
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 2.17
Peak Runoff (cfs) 1.70
Weighted Curve Number 75.95
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : C1-WETLAND





Subbasin : C2-WETLAND

Input Data

Area (ac) 0.73
Weighted Curve Number 82.63
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.31	C	74.00
Gravel roads	0.42	C	89.00
Composite Area & Weighted CN	0.73		82.63

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.01	0.00	0.00
Flow Length (ft) :	44	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	1.22	0.00	0.00
Computed Flow Time (min) :	0.60	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	636	0.00	0.00
Slope (%) :	1.6	0.00	0.00
Surface Type :		Unpaved	Unpaved
Velocity (ft/sec) :	1.90	0.00	0.00
Computed Flow Time (min) :	5.58	0.00	0.00

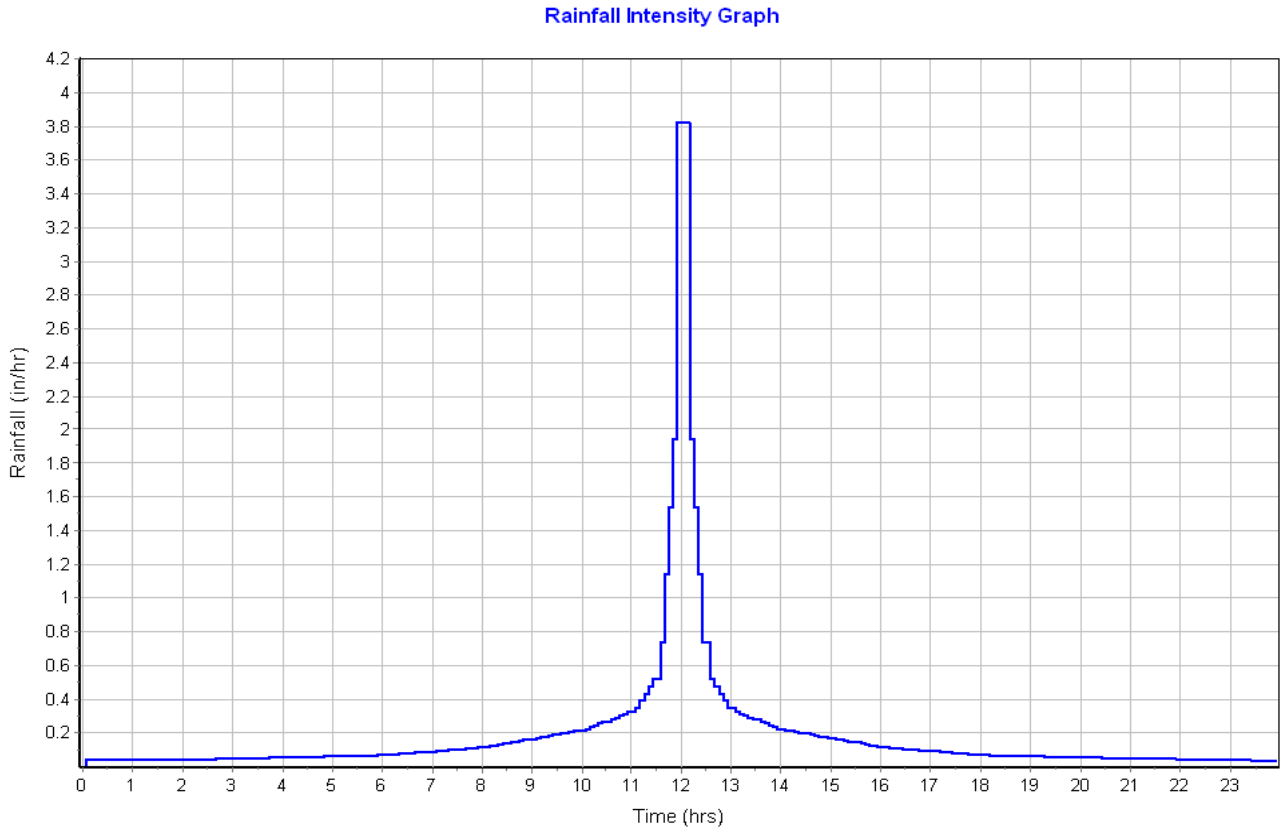
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.03	0.00	0.00
Flow Length (ft) :	2256	0.00	0.00
Channel Slope (%) :	.5	0.00	0.00
Cross Section Area (ft^2) :	2.475	0.00	0.00
Wetted Perimeter (ft) :	6.91	0.00	0.00
Velocity (ft/sec) :	1.77	0.00	0.00
Computed Flow Time (min) :	21.23	0.00	0.00

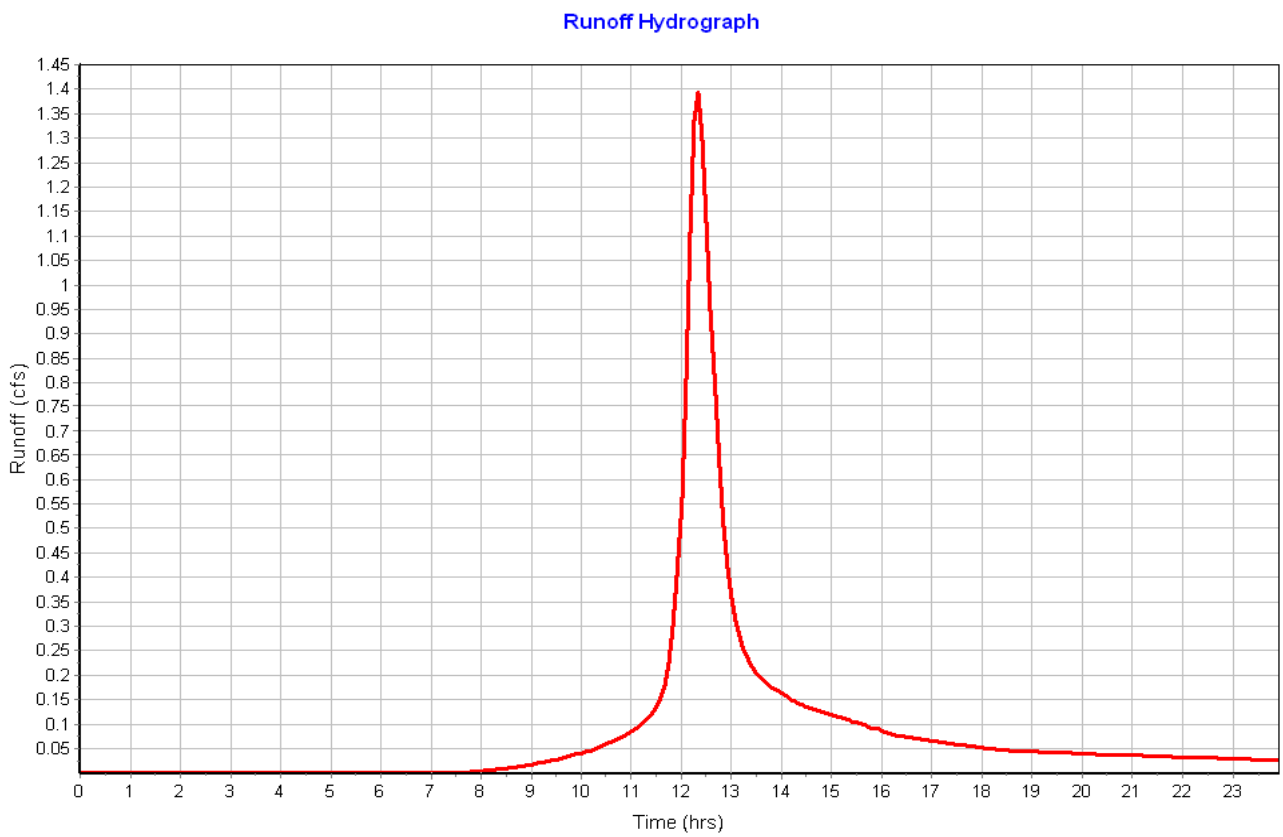
Total TOC (min) 27.41

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 2.74
Peak Runoff (cfs) 1.40
Weighted Curve Number 82.63
Time of Concentration (days hh:mm:ss) 0 00:27:25

Subbasin : C2-WETLAND





Subbasin : C3-BYPASS

Input Data

Area (ac) 21.22
Weighted Curve Number 71.79
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.01	D	80.00
Woods, Good	12.33	C	70.00
Woods, Good	7.45	D	77.00
> 75% grass cover, Good	0.66	A	39.00
> 75% grass cover, Good	0.57	C	74.00
Gravel roads	0.20	C	89.00
Composite Area & Weighted CN	21.22		71.79

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	.47	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.03	0.00	0.00
Computed Flow Time (min) :	54.75	0.00	0.00

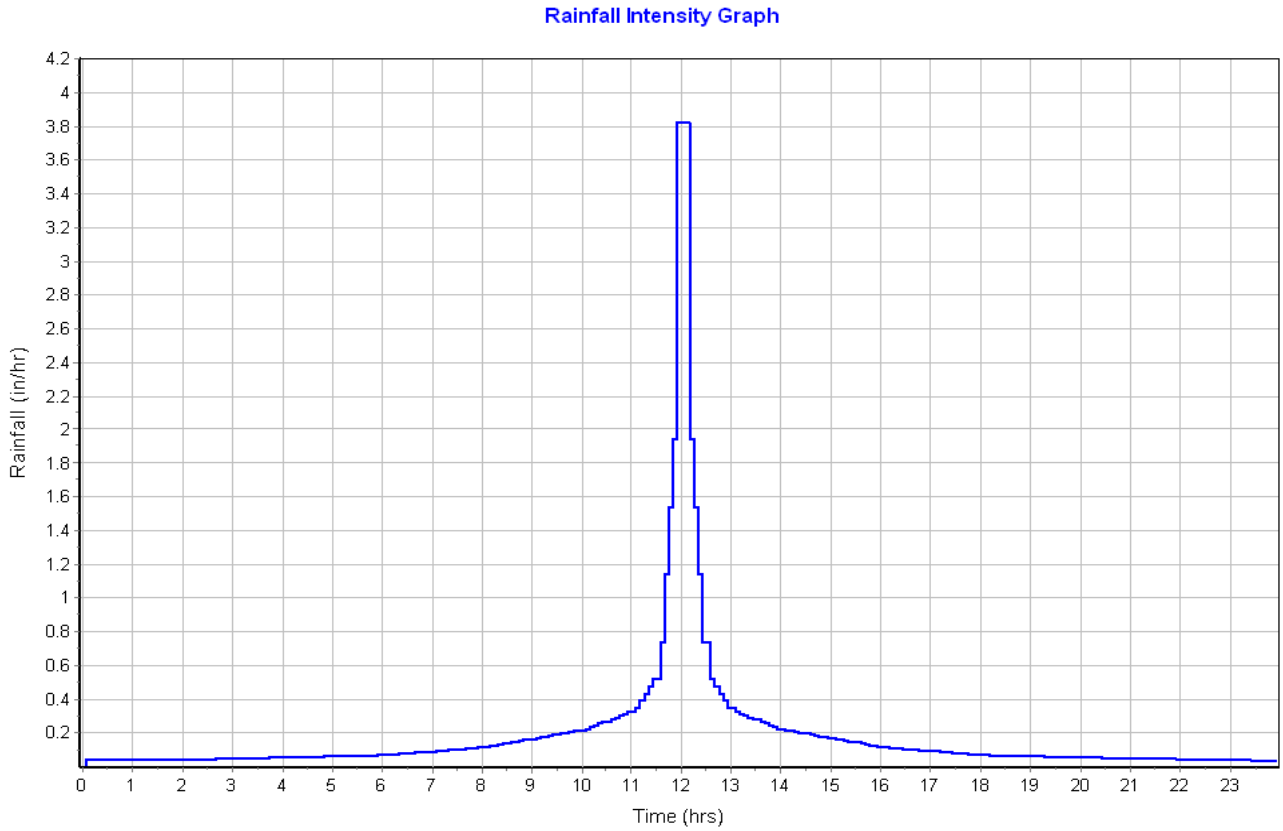
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2140	0.00	0.00
Slope (%) :	.47	0.00	0.00
Surface Type :		Unpaved	Unpaved
Velocity (ft/sec) :	1.03	0.00	0.00
Computed Flow Time (min) :	34.63	0.00	0.00

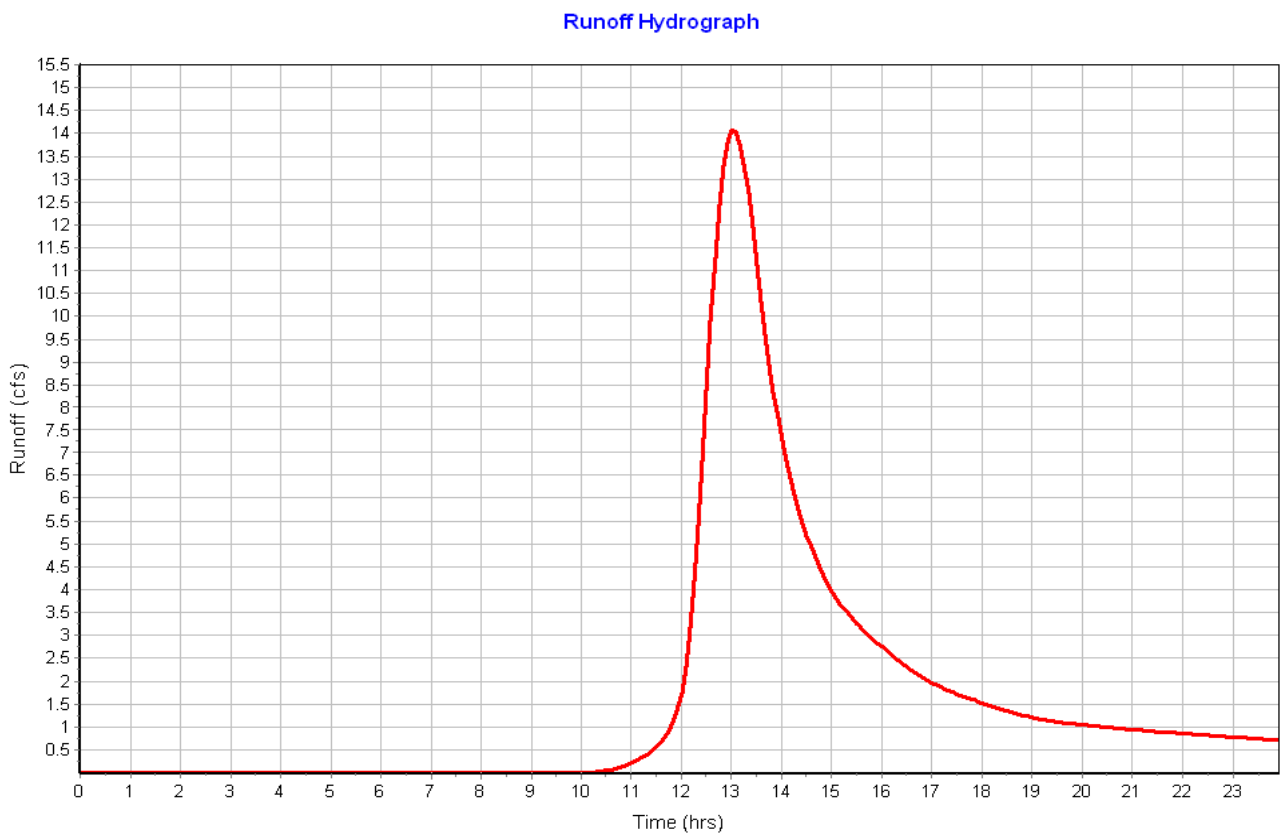
Total TOC (min) 89.38

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 1.84
Peak Runoff (cfs) 14.12
Weighted Curve Number 71.79
Time of Concentration (days hh:mm:ss) 0 01:29:23

Subbasin : C3-BYPASS





Subbasin : D

Input Data

Area (ac) 0.69
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.74	D	77.00
Composite Area & Weighted CN	0.74		77.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	21	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.14	0.00	0.00
Computed Flow Time (min) :	11.98	0.00	0.00

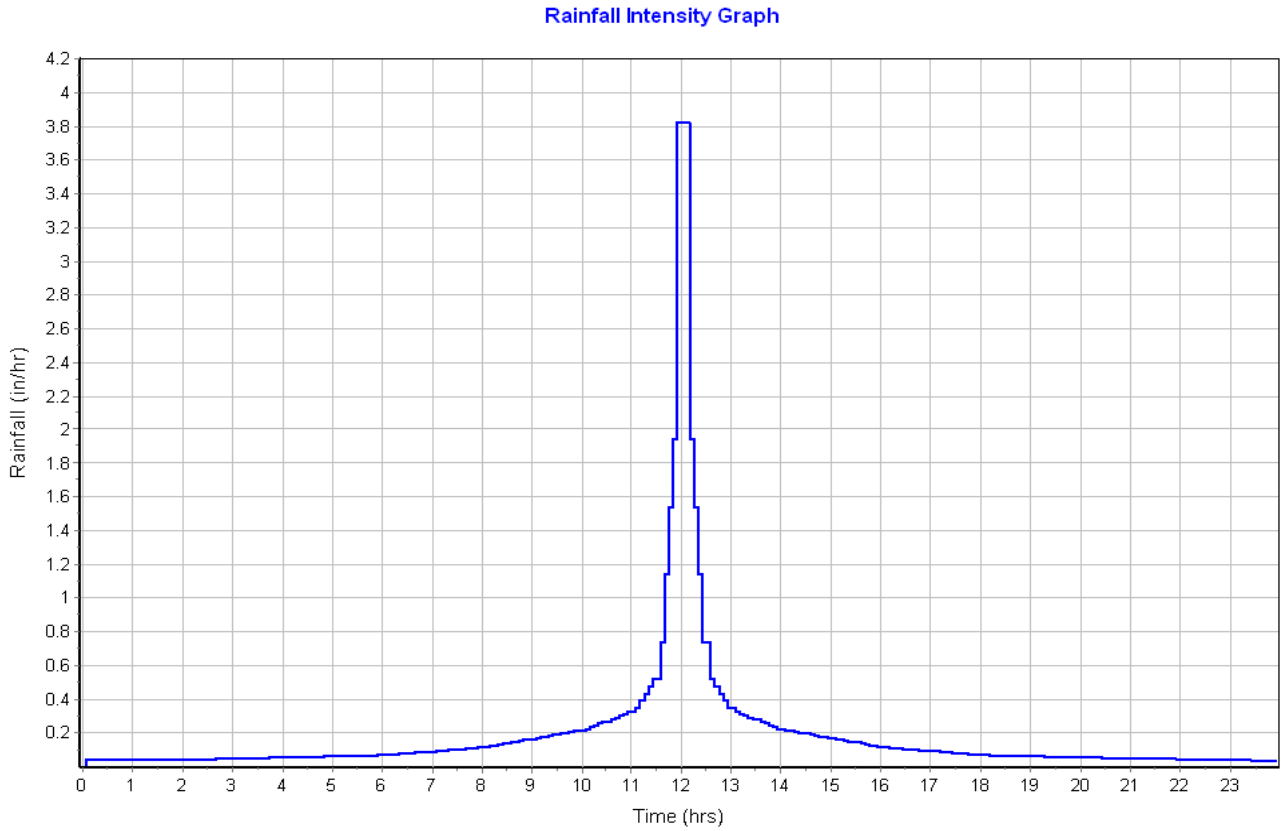
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	16	0.00	0.00
Slope (%) :	14.5	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.90	0.00	0.00
Computed Flow Time (min) :	0.14	0.00	0.00

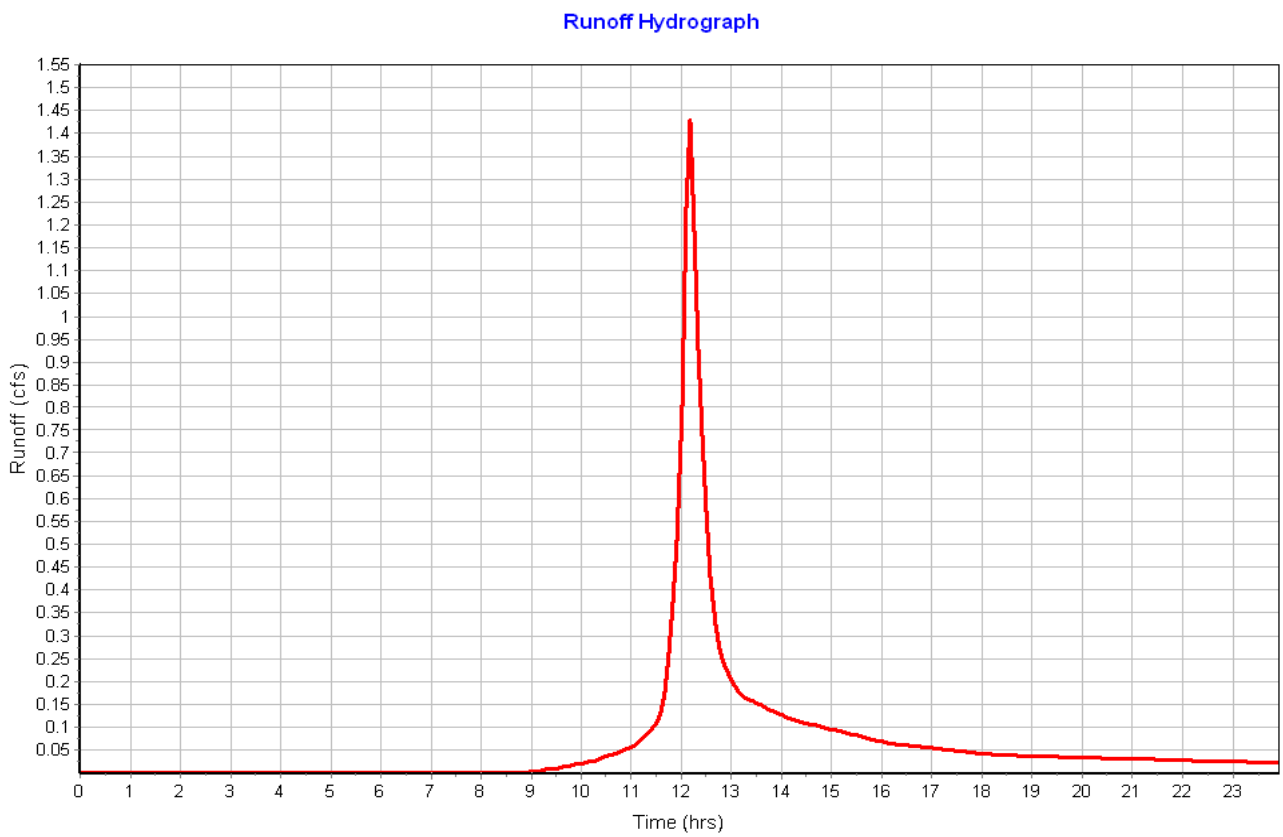
Total TOC (min) 12.12

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 2.25
Peak Runoff (cfs) 1.43
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:12:07

Subbasin : D


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : E

Input Data

Area (ac) 2.96
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	2.96	D	77.00
Composite Area & Weighted CN	2.96		77.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	24	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.15	0.00	0.00
Computed Flow Time (min) :	11.35	0.00	0.00

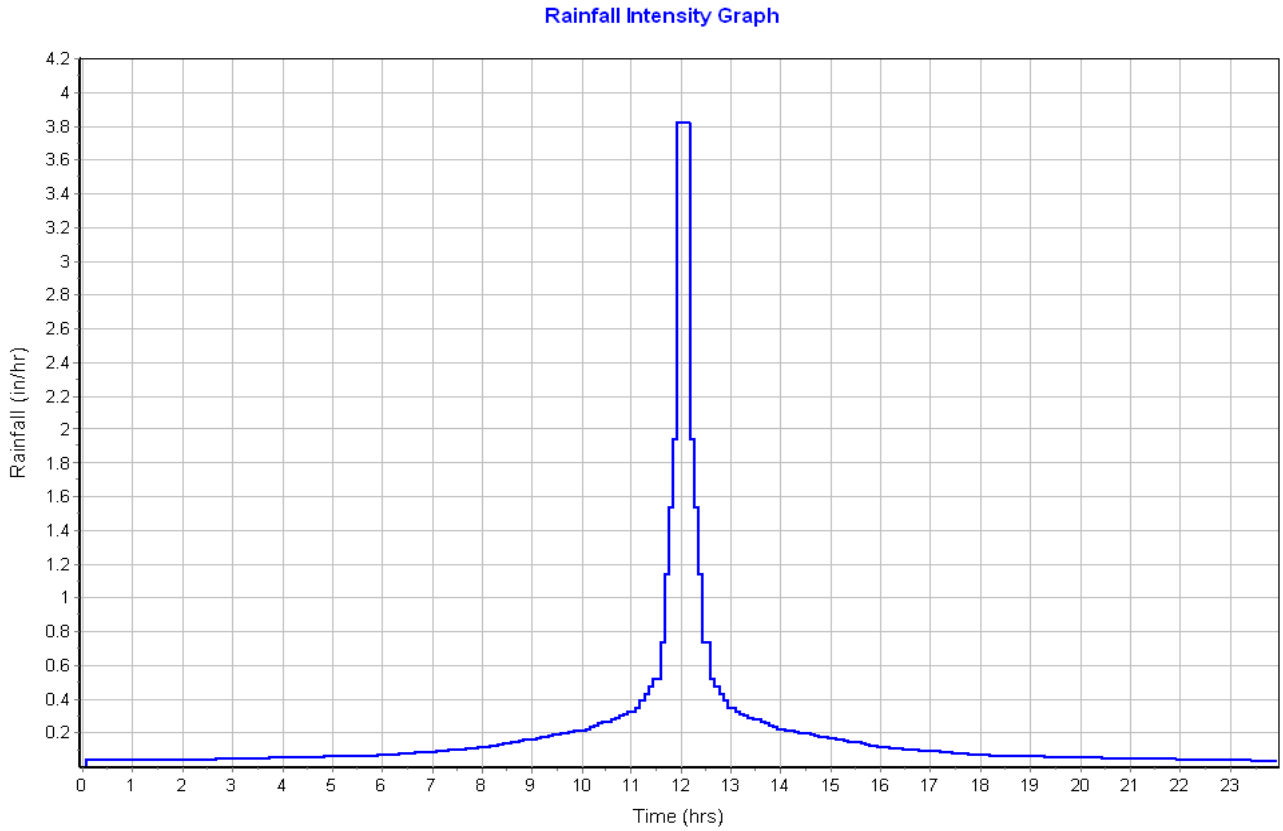
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	227	0.00	0.00
Slope (%) :	18	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.12	0.00	0.00
Computed Flow Time (min) :	1.78	0.00	0.00

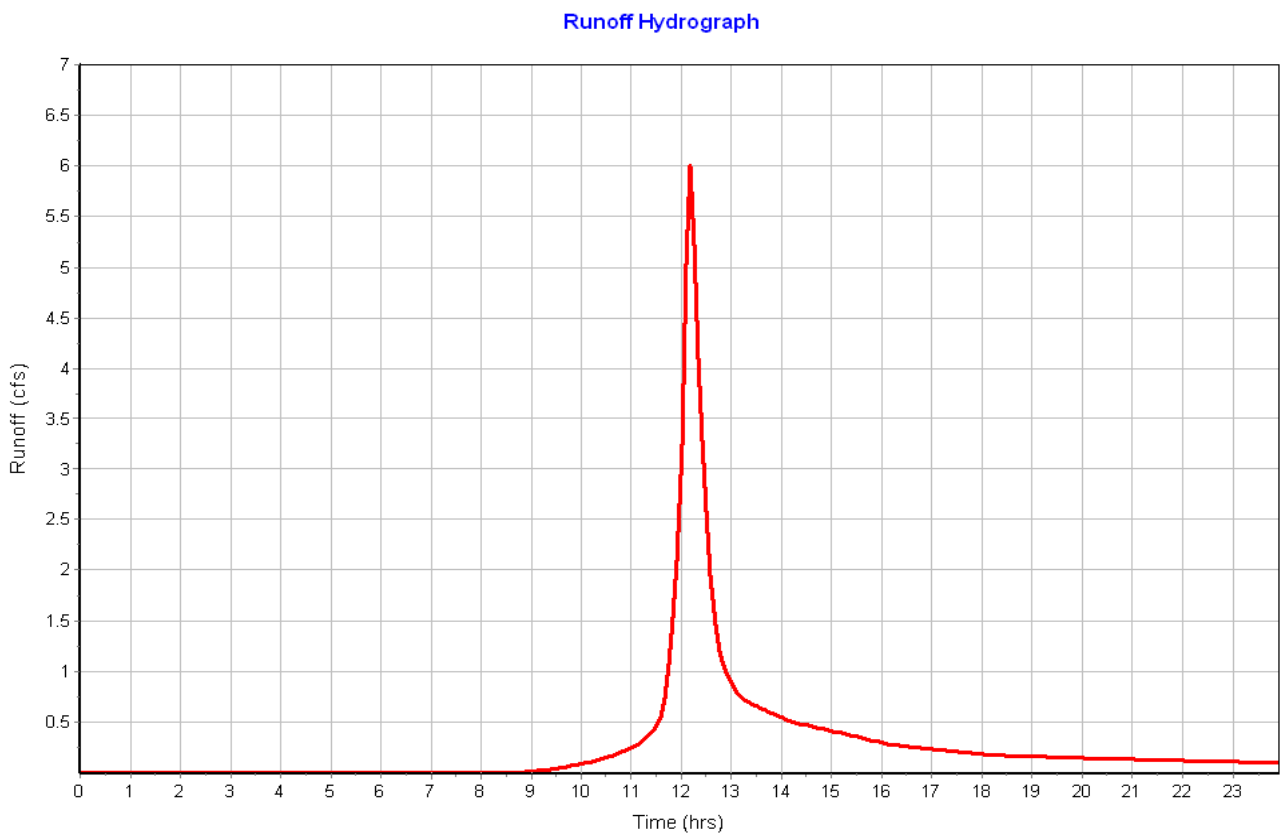
Total TOC (min) 13.14

Subbasin Runoff Results

Total Rainfall (in) 4.55
Total Runoff (in) 2.25
Peak Runoff (cfs) 6.01
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:13:08

Subbasin : E


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Junction Input

Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)
CB1	305.30	310.33
CB2	312.00	316.00
END-SECTION-C1	308.00	6.00
END-SECTION-C2	308.00	310.00
OUTLET-STR-A2	305.60	312.00
OUTLET-STR-C1	308.10	312.00
OUTLET-STR-C2	308.10	310.27

Junction Results

Element ID	Peak Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Time of Max HGL Occurrence
	(cfs)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)
CB1	11.79	306.76	1.46	3.57	305.58	0 12:29
CB2	15.30	313.07	1.07	2.93	312.15	0 12:15
END-SECTION-C1	0.12	308.17	0.17	3.06	308.08	0 14:13
END-SECTION-C2	0.12	308.16	0.16	3.07	308.08	0 15:12
OUTLET-STR-A2	8.55	306.63	1.03	5.37	305.79	0 12:29
OUTLET-STR-C1	0.12	308.27	0.17	3.73	308.18	0 14:13
OUTLET-STR-C2	0.12	308.26	0.16	2.01	308.18	0 15:12

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness
CULV-A	98.00	305.30	305.12	0.1800	CIRCULAR	36.000	36.000	0.0150
CULV-A2-1	104.00	312.00	310.00	1.9200	CIRCULAR	24.000	24.000	0.0150
CULV-A2-2	43.00	305.60	305.30	0.7000	CIRCULAR	24.000	24.000	0.0150
CULV-C1	30.00	308.10	308.00	0.3300	CIRCULAR	12.000	12.000	0.0130
CULV-C2	30.00	308.10	308.00	0.3300	CIRCULAR	12.000	12.000	0.0130

Pipe Results

Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth
	(cfs)	(days hh:mm)	(cfs)	(ft/sec)	(ft)
CULV-A	11.79	0 12:30	24.77	3.46	1.46
CULV-A2-1	15.24	0 12:15	27.19	8.91	1.07
CULV-A2-2	8.55	0 12:29	16.38	5.27	1.03
CULV-C1	0.12	0 14:13	2.06	1.44	0.17
CULV-C2	0.12	0 15:12	2.06	1.41	0.16

Storage Nodes

Storage Node : DETENTION-A

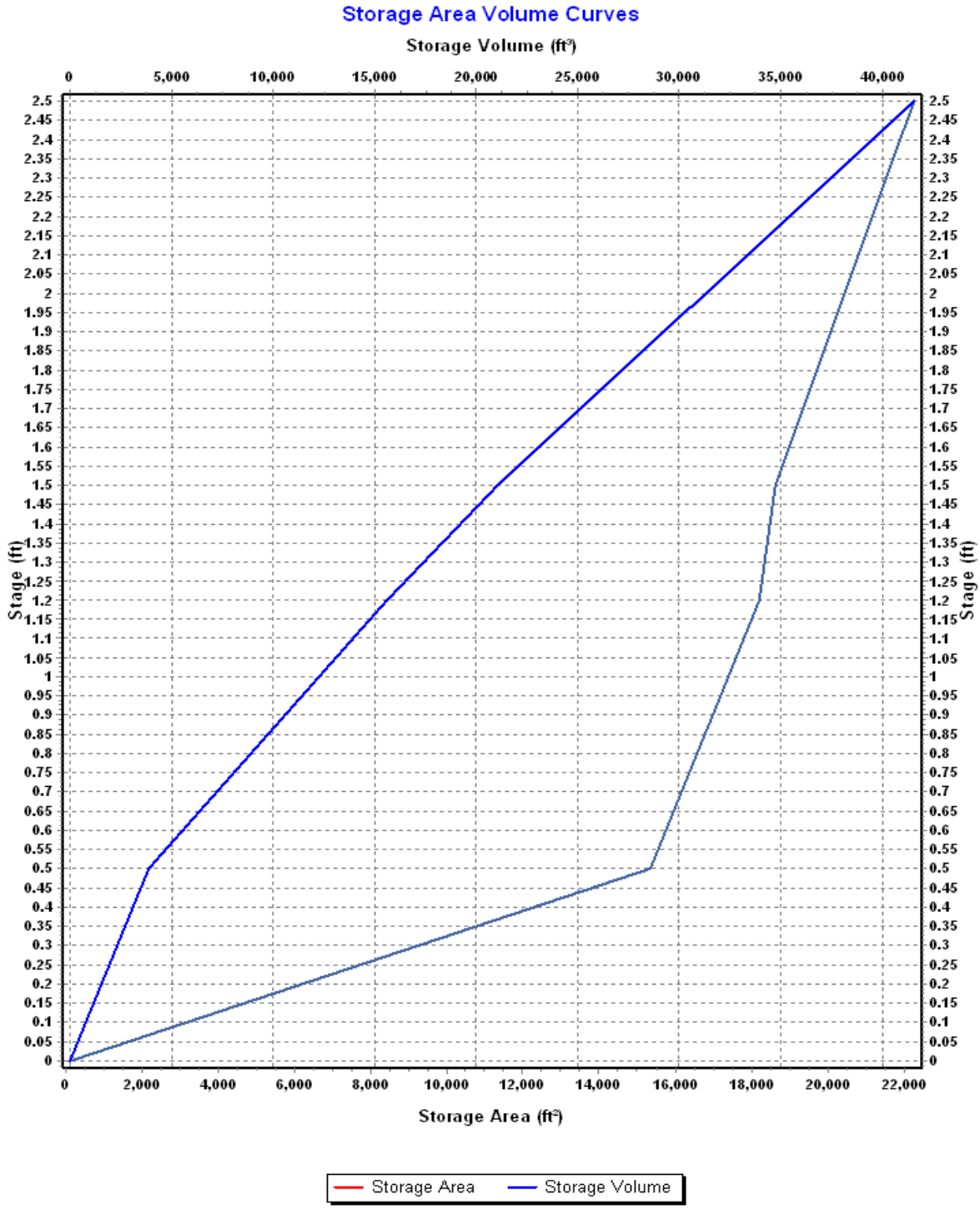
Input Data

Invert Elevation (ft) 309.50
Max (Rim) Elevation (ft) 312.00
Max (Rim) Offset (ft) 2.50
Initial Water Elevation (ft) 309.50
Initial Water Depth (ft) 0.00
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Storage-08

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	113	0.000
.5	15327	3860.00
1.2	18183.	15588.50
1.5	18635	21111.20
2.5	22257	41557.20


Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
Stage (ft)
2.5
2.45
2.4
2.35
2.3
2.25
2.2
2.15
2.1
2.05
2
1.95
1.9
1.85
1.8
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : DETENTION-A (continued)

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
BEEHIVE-GRATE	Bottom	CIRCULAR	18.17			310.33	0.61
ORIF-DET-A	Side	Rectangular		4.00	36.00	309.50	0.63

Output Summary Results

Peak Inflow (cfs)	6.94
Peak Lateral Inflow (cfs)	6.94
Peak Outflow (cfs)	3.25
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	310.08
Max HGL Depth Attained (ft)	0.58
Average HGL Elevation Attained (ft)	309.57
Average HGL Depth Attained (ft)	0.07
Time of Max HGL Occurrence (days hh:mm)	0 12:30
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : FILTER-1

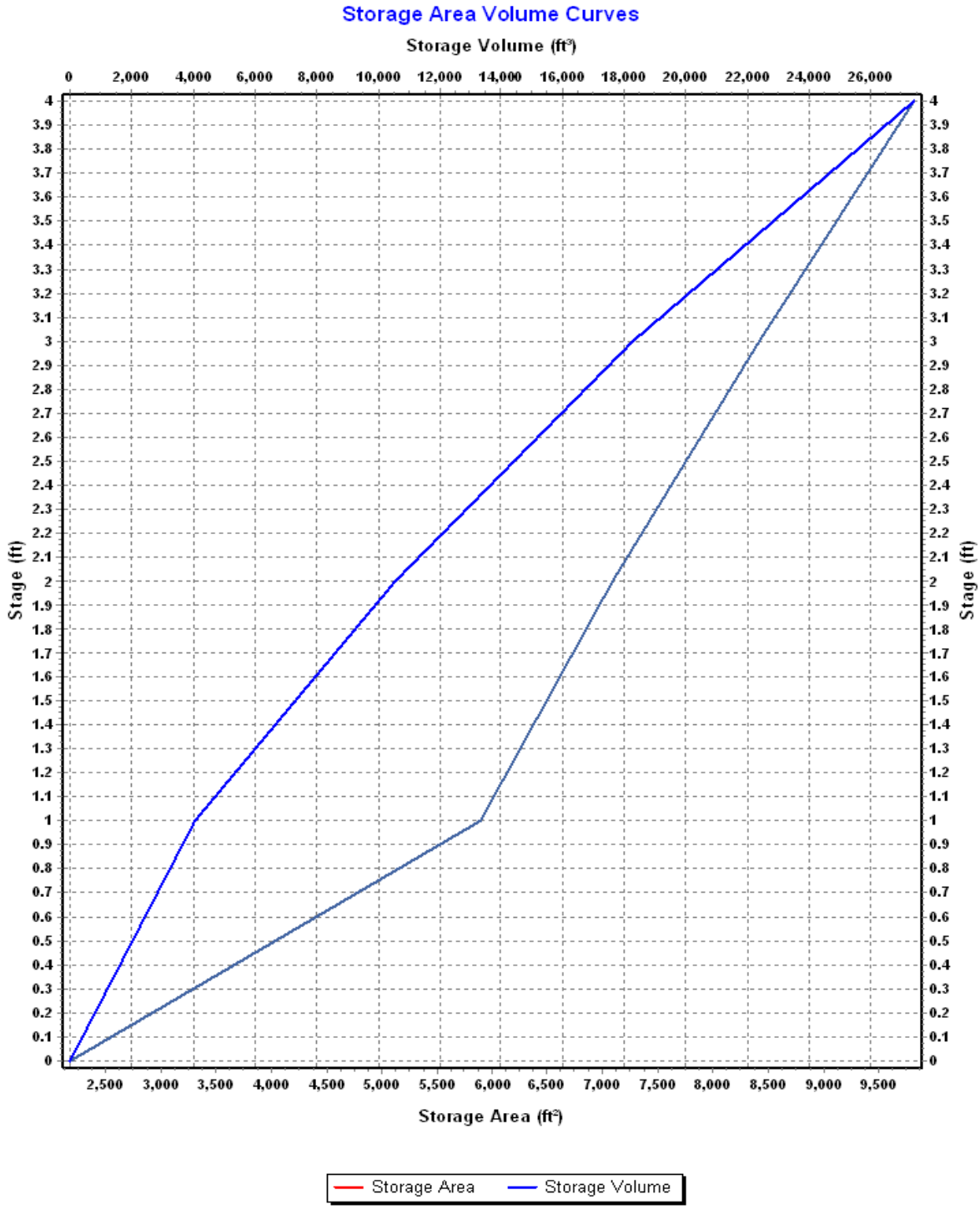
Input Data

Invert Elevation (ft) 308.00
Max (Rim) Elevation (ft) 312.00
Max (Rim) Offset (ft) 4.00
Initial Water Elevation (ft) 309.00
Initial Water Depth (ft) 1.00
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Storage-05

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	2178	0.000
1	5898	4038.00
2	7084	10529.00
3	8421	18281.50
4	9818	27401.00


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
26,000
Stage (ft)
Storage Area (ft²)
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
8,000
8,500
9,000
9,500
Storage Area
Storage Volume

Storage Node : FILTER-1 (continued)

Outflow Weirs

Element ID	Weir Type	Crest Elevation (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
SPILLWAY-A2	Trapezoidal	310.70	55.00	1.30	3.10

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
ORIF-A2	Side	Rectangular		6.00	35.00	309.00	0.63

Output Summary Results

Peak Inflow (cfs) 15.24
Peak Lateral Inflow (cfs) 0.00
Peak Outflow (cfs) 8.55
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 310.61
Max HGL Depth Attained (ft) 2.61
Average HGL Elevation Attained (ft) 309.14
Average HGL Depth Attained (ft) 1.14
Time of Max HGL Occurrence (days hh:mm) 0 12:29
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Storage Node : WETLAND-C1

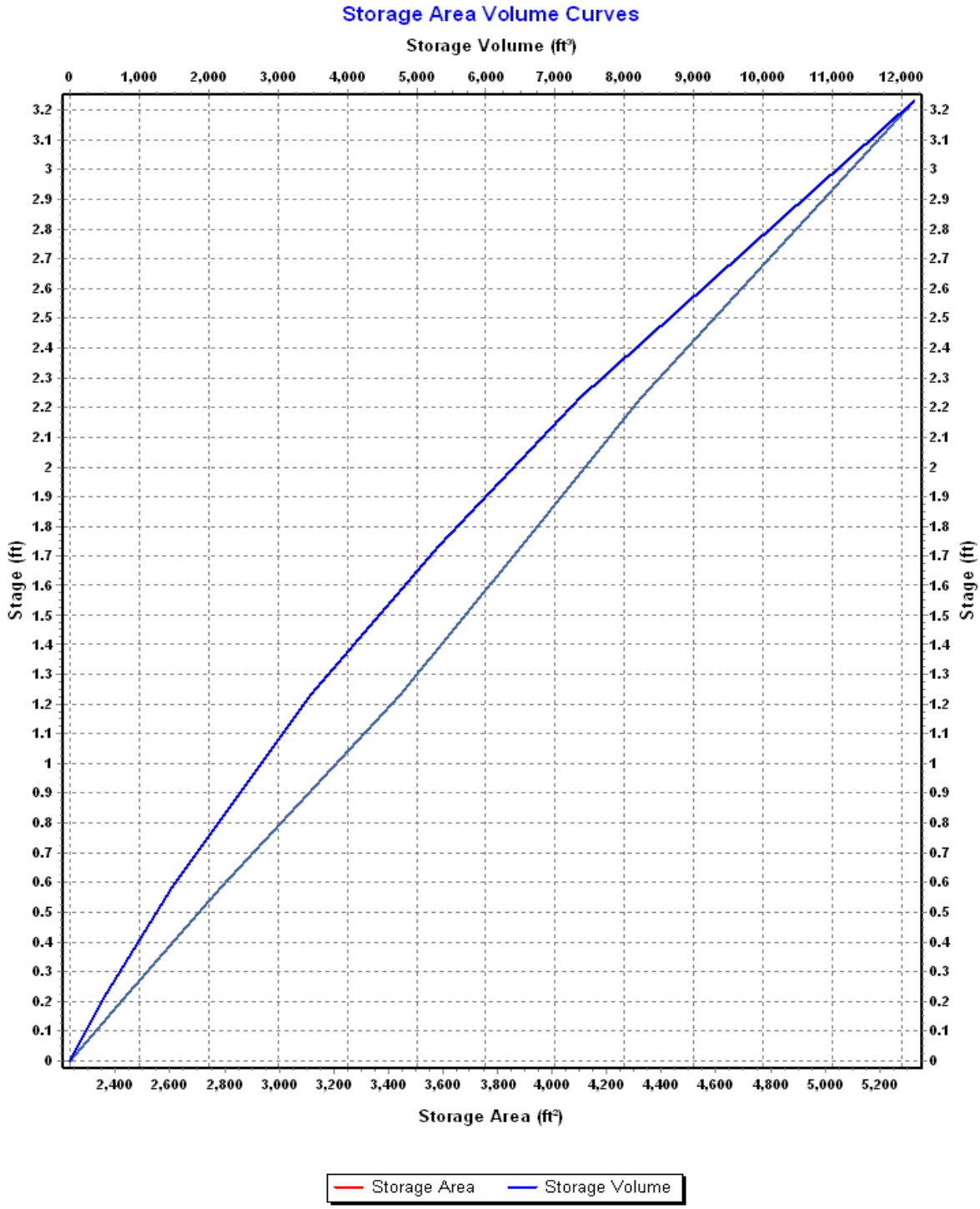
Input Data

Invert Elevation (ft)	308.77
Max (Rim) Elevation (ft)	312.00
Max (Rim) Offset (ft)	3.23
Initial Water Elevation (ft)	309.33
Initial Water Depth (ft)	0.56
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Storage-09

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	2234.3266	0.000
0.23	2446.5288	538.30
0.583	2787.6137	1462.13
1.23	3441.1460	3477.13
1.73	3884.8913	5308.64
2.23	4323.3307	7360.70
3.23	5324	12184.37


Storage Area Volume Curves
Storage Volume (ft³)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
Stage (ft)
3.2
3.1
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2,400
2,600
2,800
3,000
3,200
3,400
3,600
3,800
4,000
4,200
4,400
4,600
4,800
5,000
5,200
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : WETLAND-C1 (continued)

Outflow Weirs

Element ID	Weir Type	Crest Elevation (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
SPILLWAY-C1	Trapezoidal	310.70	10.00	1.30	3.33

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
ORIF-C1	Side	CIRCULAR	0.88			308.10	0.61
Wetland-1-BEEHIV	Bottom	CIRCULAR	18.17			310.27	0.61

Output Summary Results

Peak Inflow (cfs) 1.66
Peak Lateral Inflow (cfs) 1.66
Peak Outflow (cfs) 0.12
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 310.30
Max HGL Depth Attained (ft) 1.53
Average HGL Elevation Attained (ft) 309.74
Average HGL Depth Attained (ft) 0.97
Time of Max HGL Occurrence (days hh:mm) 0 14:13
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Storage Node : WETLAND-C2

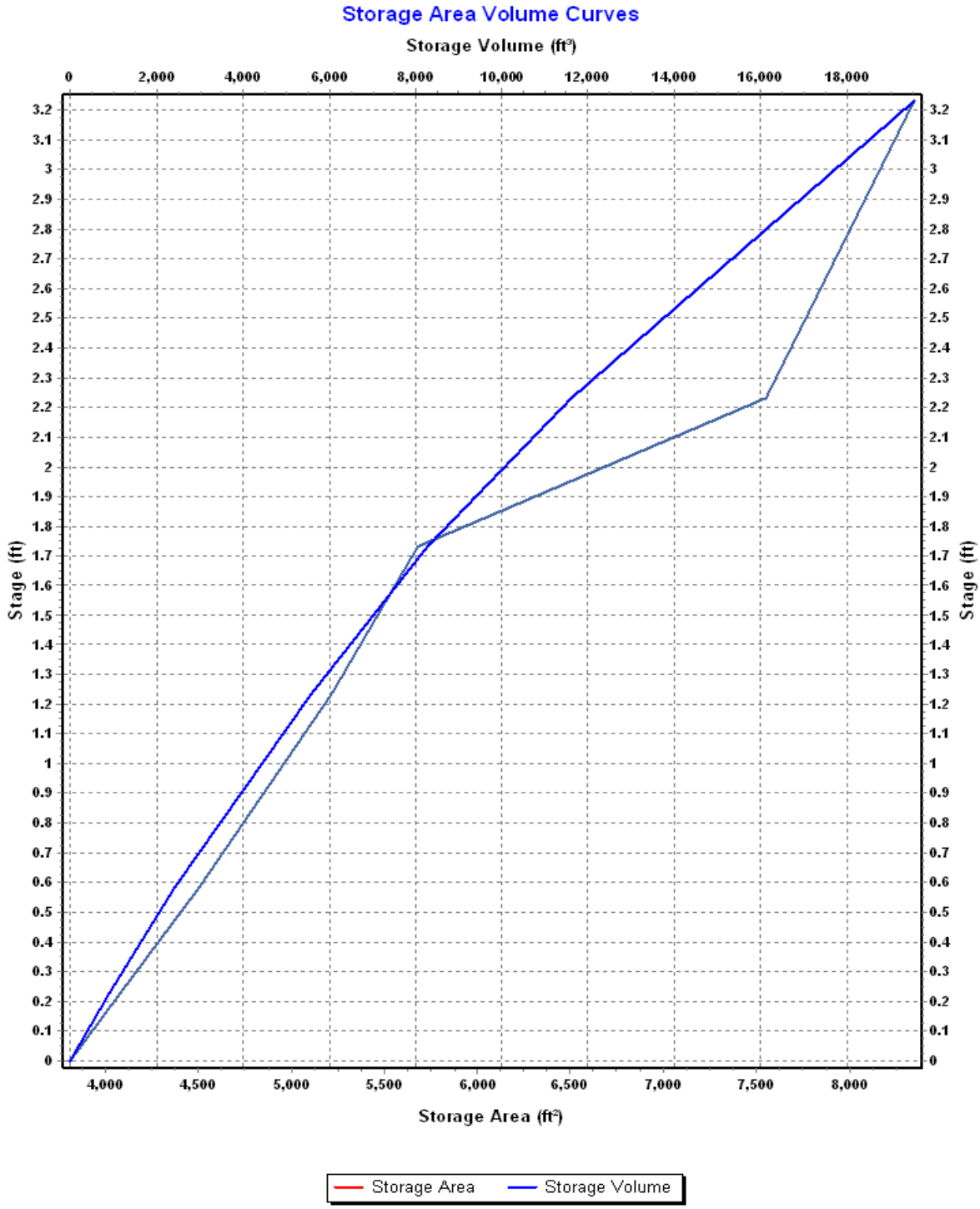
Input Data

Invert Elevation (ft)	308.77
Max (Rim) Elevation (ft)	312.00
Max (Rim) Offset (ft)	3.23
Initial Water Elevation (ft)	309.42
Initial Water Depth (ft)	0.65
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Storage-07

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	3813.8233	0.000
0.23	4081.9612	908.02
0.583	4508.5002	2424.24
1.23	5212.0439	5568.84
1.73	5680.7080	8292.03
2.23	7549	11599.46
3.23	8345	19546.46


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
Stage (ft)
3.2
3.1
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
8,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : WETLAND-C2 (continued)

Outflow Weirs

Element ID	Weir Type	Crest Elevation (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
SPILLWAY-C2	Trapezoidal	310.80	10.00	1.20	3.10

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
ORIF-C2A	Side	CIRCULAR	0.88			308.10	0.61
Wetland-2-BEEHIV	Bottom	CIRCULAR	18.17			310.27	0.61

Output Summary Results

Peak Inflow (cfs)	1.39
Peak Lateral Inflow (cfs)	1.39
Peak Outflow (cfs)	0.12
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	310.30
Max HGL Depth Attained (ft)	1.53
Average HGL Elevation Attained (ft)	309.80
Average HGL Depth Attained (ft)	1.03
Time of Max HGL Occurrence (days hh:mm)	0 15:12
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Project Description

File Name ..... Proposed Conditions 1-15-19.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Jul 13, 2017 00:00:00
End Analysis On ..... Jul 14, 2017 00:00:00
Start Reporting On ..... Jul 13, 2017 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	9
Nodes	16
Junctions	7
Outfalls	5
Flow Diversions	0
Inlets	0
Storage Nodes	4
Links	17
Channels	2
Pipes	5
Pumps	0
Orifices	7
Weirs	3
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-025	Cumulative	inches	Maine	Androscoggin	25	5.49	SCS Type III 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
A1	12.28	73.16	5.49	2.69	32.97	17.35	0 00:49:44
A2	6.41	81.47	5.49	3.47	22.23	20.10	0 00:12:48
A3	4.01	71.75	5.49	2.56	10.27	10.03	0 00:09:08
B	5.14	75.65	5.49	2.91	14.97	10.95	0 00:24:28
C1-WETLAND	0.75	75.95	5.49	2.94	2.21	2.30	0 00:05:00
C2-WETLAND	0.73	82.63	5.49	3.58	2.62	1.82	0 00:27:24
C3-BYPASS	21.22	71.79	5.49	2.56	54.39	19.95	0 01:29:22
D	0.69	77.00	5.49	3.04	2.10	1.93	0 00:12:07
E	2.96	77.00	5.49	3.04	8.99	8.13	0 00:13:08

Node Summary

Element ID	Element Type	Invert Elevation (ft)
CB1	Junction	305.30
CB2	Junction	312.00
END-SECTION-C1	Junction	308.00
END-SECTION-C2	Junction	308.00
OUTLET-STR-A2	Junction	305.60
OUTLET-STR-C1	Junction	308.10
OUTLET-STR-C2	Junction	308.10
OUT-A	Outfall	298.00
OUT-B	Outfall	310.00
OUT-C	Outfall	298.00
OUT-D	Outfall	338.00
OUT-E	Outfall	298.00
DETENTION-A	Storage Node	309.50
FILTER-1	Storage Node	308.00
WETLAND-C1	Storage Node	308.77
WETLAND-C2	Storage Node	308.77

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)	(ft/sec)	(ft)
CULV-A	Pipe	CB1	OUT-A	98.00	305.30	305.12	0.1800	36.000	0.0150	14.64	24.77	3.65	1.66
CULV-A2-1	Pipe	CB2	FILTER-1	104.00	312.00	310.00	1.9200	24.000	0.0150	20.01	27.19	9.48	1.28
CULV-A2-2	Pipe	OUTLET-STR-A2	CB1	43.00	305.60	305.30	0.7000	24.000	0.0150	9.20	16.38	5.36	1.07
CULV-C1	Pipe	OUTLET-STR-C1	END-SECTION-C1	30.00	308.10	308.00	0.3300	12.000	0.0130	0.53	2.06	2.20	0.35
CULV-C2	Pipe	OUTLET-STR-C2	END-SECTION-C2	30.00	308.10	308.00	0.3300	12.000	0.0130	0.42	2.06	2.05	0.31
WETLAND-CHANNEL-C1	Channel	END-SECTION-C1	OUT-C	2050.00	308.00	298.00	0.4900	6.000	0.0320	0.23	101.48	0.19	0.01
WETLAND-CHANNEL-C2	Channel	END-SECTION-C2	OUT-C	1712.00	308.00	298.00	0.5800	6.000	0.0320	0.23	111.05	0.20	0.01
BEEHIVE-GRATE	Orifice	DETENTION-A	CB1		309.50	305.30		18.167		1.10			
ORIF-A2	Orifice	FILTER-1	OUTLET-STR-A2		308.00	305.60		6.000		9.20			
ORIF-C1	Orifice	WETLAND-C1	OUTLET-STR-C1		308.77	308.10		0.880		0.03			
ORIF-C2A	Orifice	WETLAND-C2	OUTLET-STR-C2		308.77	308.10		0.880		0.03			
ORIF-DET-A	Orifice	DETENTION-A	CB1		309.50	305.30		4.000		4.58			
Wetland-1-BEEHIVE	Orifice	WETLAND-C1	OUTLET-STR-C1		308.77	308.10		18.170		0.51			
Wetland-2-BEEHIVE	Orifice	WETLAND-C2	OUTLET-STR-C2		308.77	308.10		18.170		0.39			
SPILLWAY-A2	Weir	FILTER-1	DETENTION-A		308.00	309.50				7.77			
SPILLWAY-C1	Weir	WETLAND-C1	END-SECTION-C1		308.77	308.00				0.00			
SPILLWAY-C2	Weir	WETLAND-C2	END-SECTION-C2		308.77	308.00				0.00			

Subbasin Hydrology

Subbasin : A1

Input Data

Area (ac) 12.28
Weighted Curve Number 73.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	4.58	D	77.00
> 75% grass cover, Good	0.68	C	74.00
Woods, Good	6.62	C	70.00
> 75% grass cover, Good	0.40	D	80.00
Composite Area & Weighted CN	12.28		73.16

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.05	0.00	0.00
Computed Flow Time (min) :	30.68	0.00	0.00

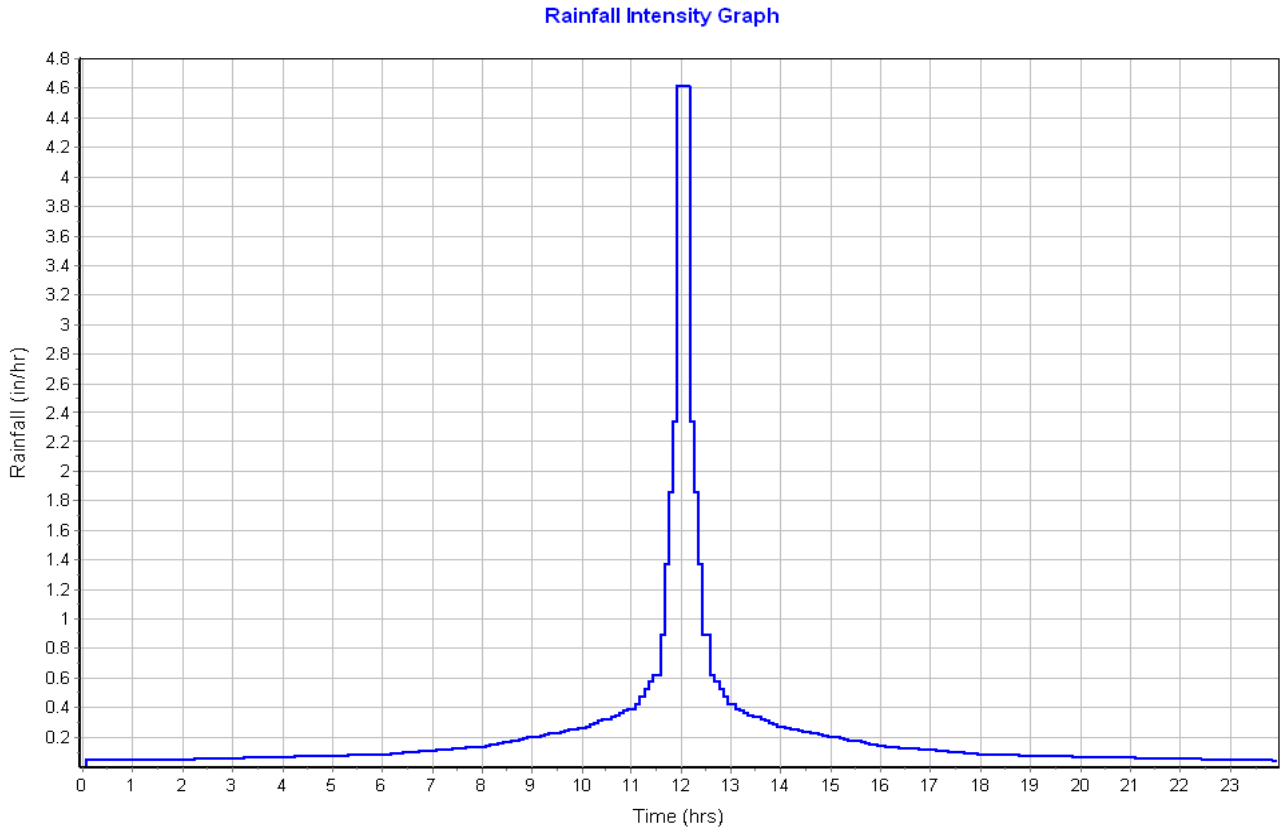
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1510	0.00	0.00
Slope (%) :	.78	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	1.32	0.00	0.00
Computed Flow Time (min) :	19.07	0.00	0.00

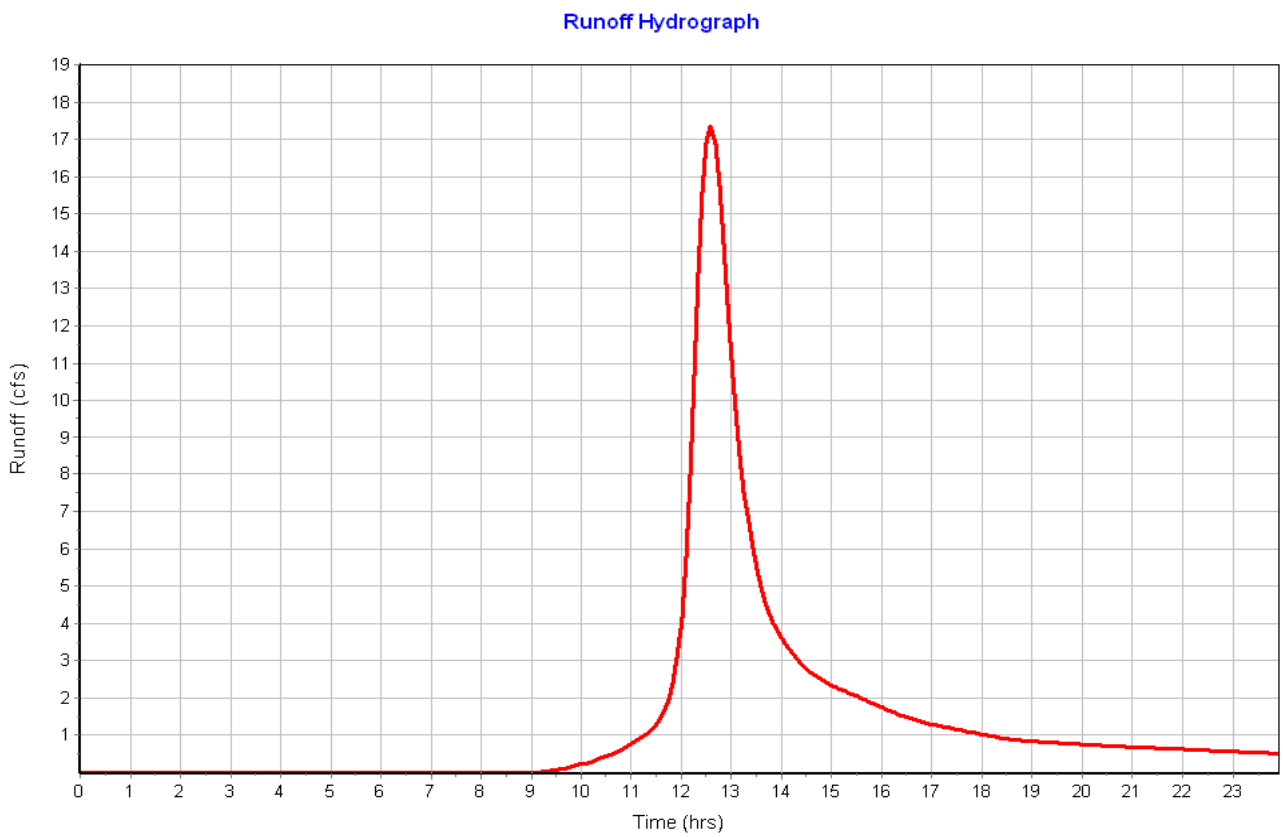
Total TOC (min) 49.74

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 2.69
Peak Runoff (cfs) 17.35
Weighted Curve Number 73.16
Time of Concentration (days hh:mm:ss) 0 00:49:44

Subbasin : A1


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : A2

Input Data

Area (ac) 6.41
Weighted Curve Number 81.47
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.13	D	77.00
Roofs	1.77	D	98.00
> 75% grass cover, Good	1.87	D	80.00
Stone_Pad	1.80	D	60.00
Gravel roads	0.17	D	91.00
Pavement	0.67	D	98.00
Composite Area & Weighted CN	6.41		81.47

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	85	0.00	0.00
Slope (%) :	33.33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	6.32	0.00	0.00

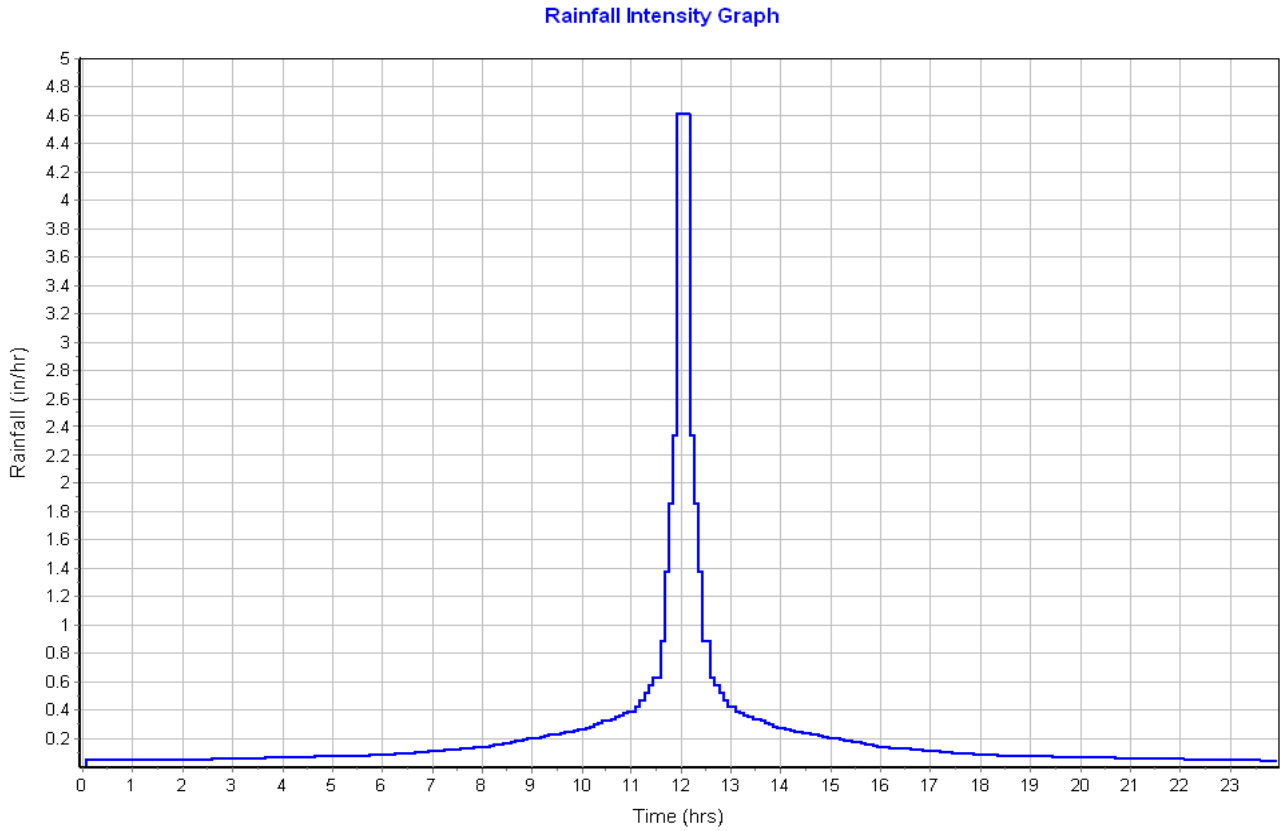
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1138	0.00	0.00
Channel Slope (%) :	1.4	0.00	0.00
Cross Section Area (ft^2) :	4.398	0.00	0.00
Wetted Perimeter (ft) :	8.12	0.00	0.00
Velocity (ft/sec) :	2.93	0.00	0.00
Computed Flow Time (min) :	6.48	0.00	0.00

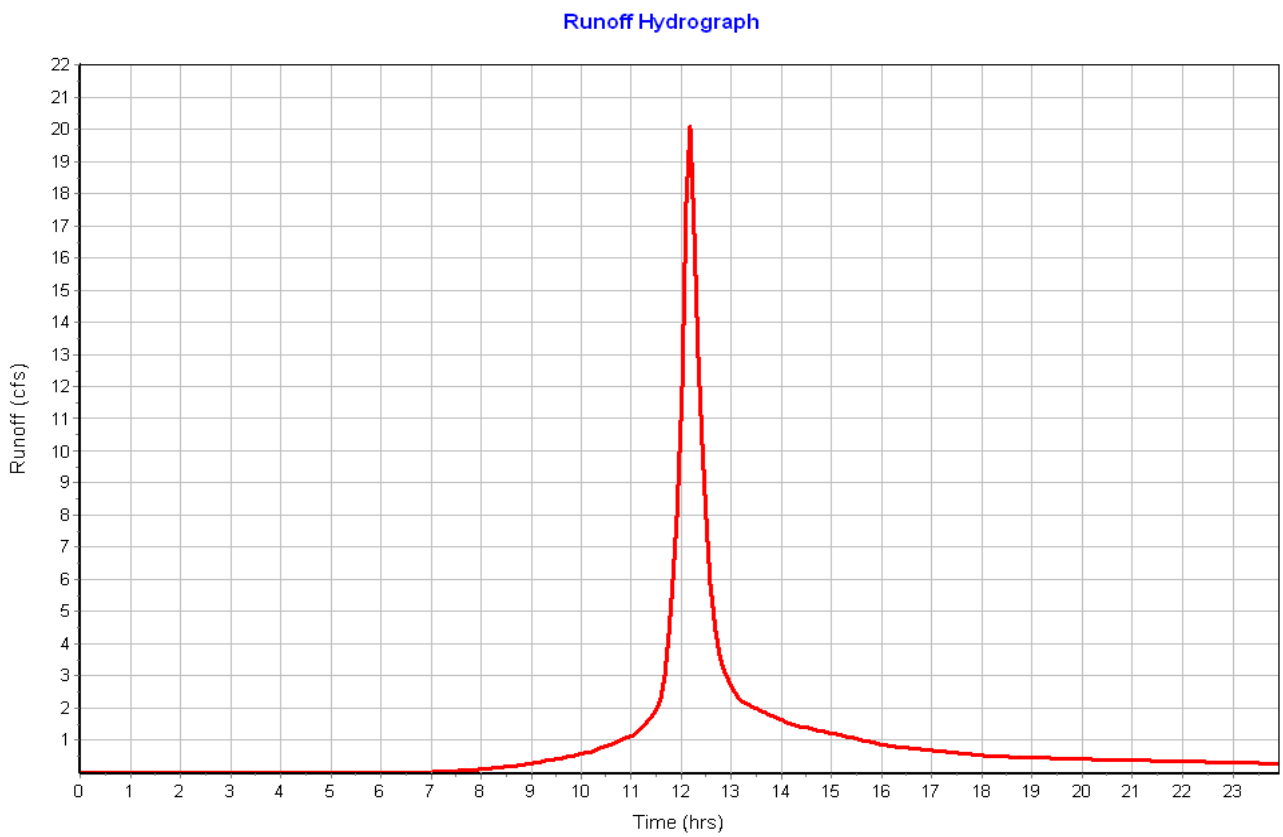
Total TOC (min) 12.80

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 3.47
Peak Runoff (cfs) 20.10
Weighted Curve Number 81.47
Time of Concentration (days hh:mm:ss) 0 00:12:48

Subbasin : A2


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : A3

Input Data

Area (ac) 4.01
Weighted Curve Number 71.75
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.75	D	80.00
> 75% grass cover, Good	0.14	C	74.00
Stone_Pad	2.28	D	60.00
Roofs	0.19	D	98.00
Gravel roads	0.25	D	91.00
Pavement	0.35	D	98.00
Foundations	0.05	D	98.00
Composite Area & Weighted CN	4.01		71.75

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.01	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	1.44	0.00	0.00
Computed Flow Time (min) :	1.16	0.00	0.00

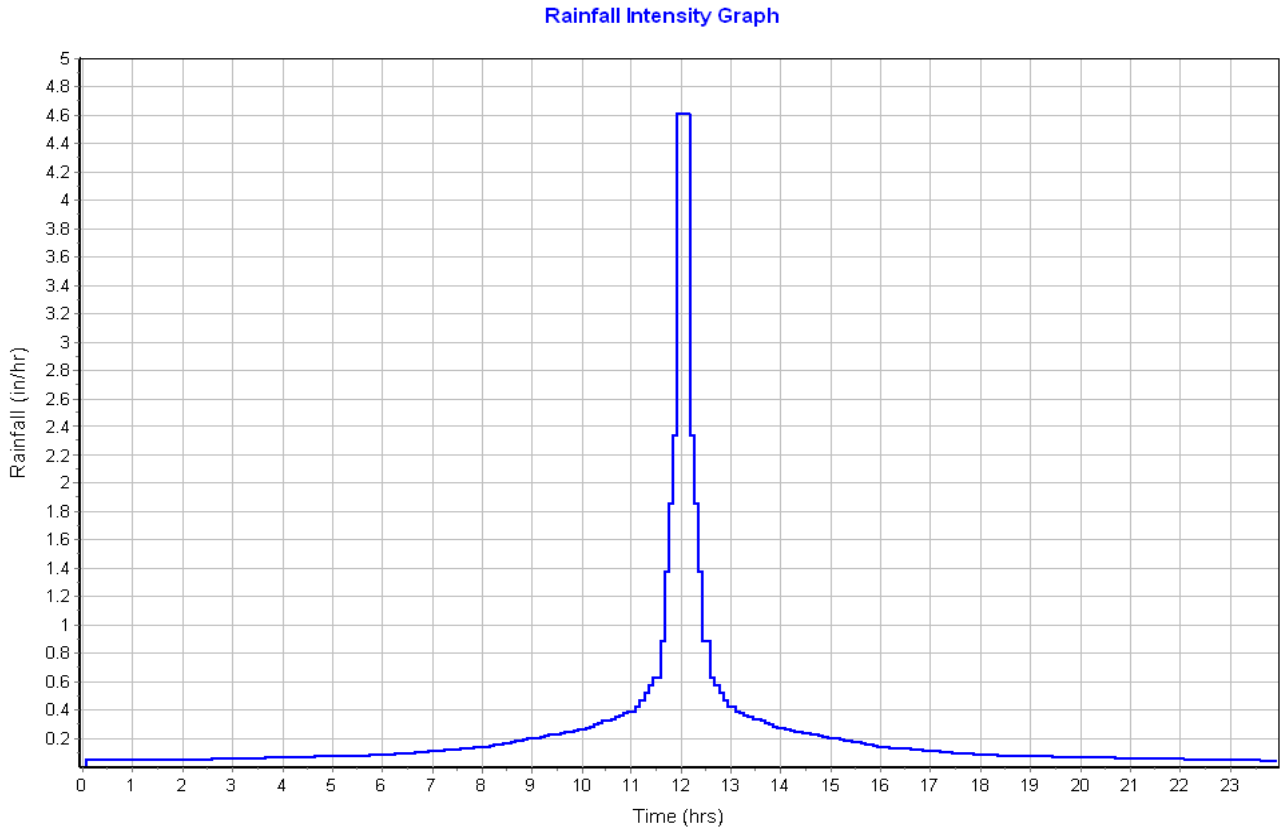
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	548	25	200
Slope (%) :	2	33.33	1.5
Surface Type :	Unpaved	rass pastu	rass pasture
Velocity (ft/sec) :	2.28	4.04	0.86
Computed Flow Time (min) :	4.01	0.10	3.88

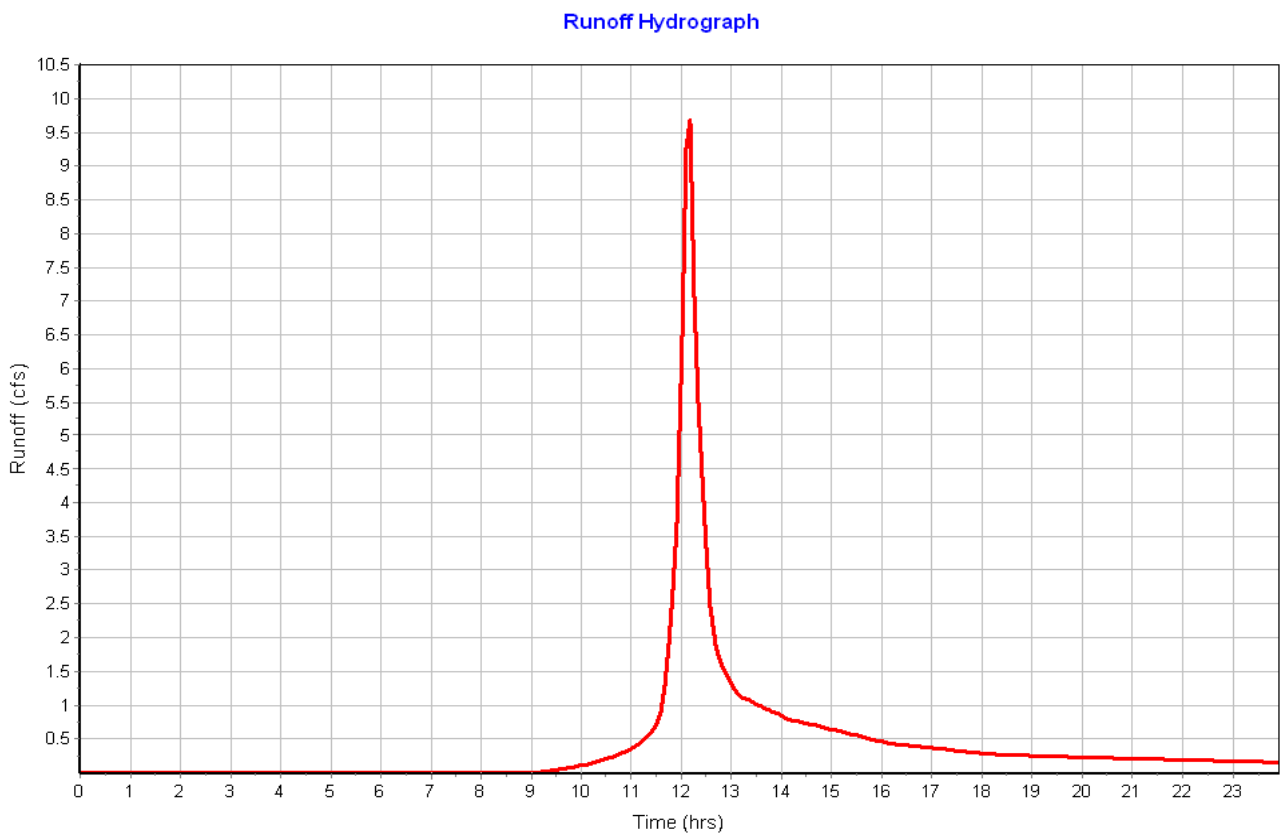
Total TOC (min) 9.14

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 2.56
Peak Runoff (cfs) 10.03
Weighted Curve Number 71.75
Time of Concentration (days hh:mm:ss) 0 00:09:08

Subbasin : A3


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B

Input Data

Area (ac) 5.14
Weighted Curve Number 75.65
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	1.20	C	70.00
Woods, Good	3.45	D	77.00
> 75% grass cover, Good	0.49	D	80.00
Composite Area & Weighted CN	5.14		75.65

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	90	0.00	0.00
Slope (%) :	33.33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.23	0.00	0.00
Computed Flow Time (min) :	6.62	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	368	0.00	0.00
Slope (%) :	1.63	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	1.92	0.00	0.00
Computed Flow Time (min) :	3.19	0.00	0.00

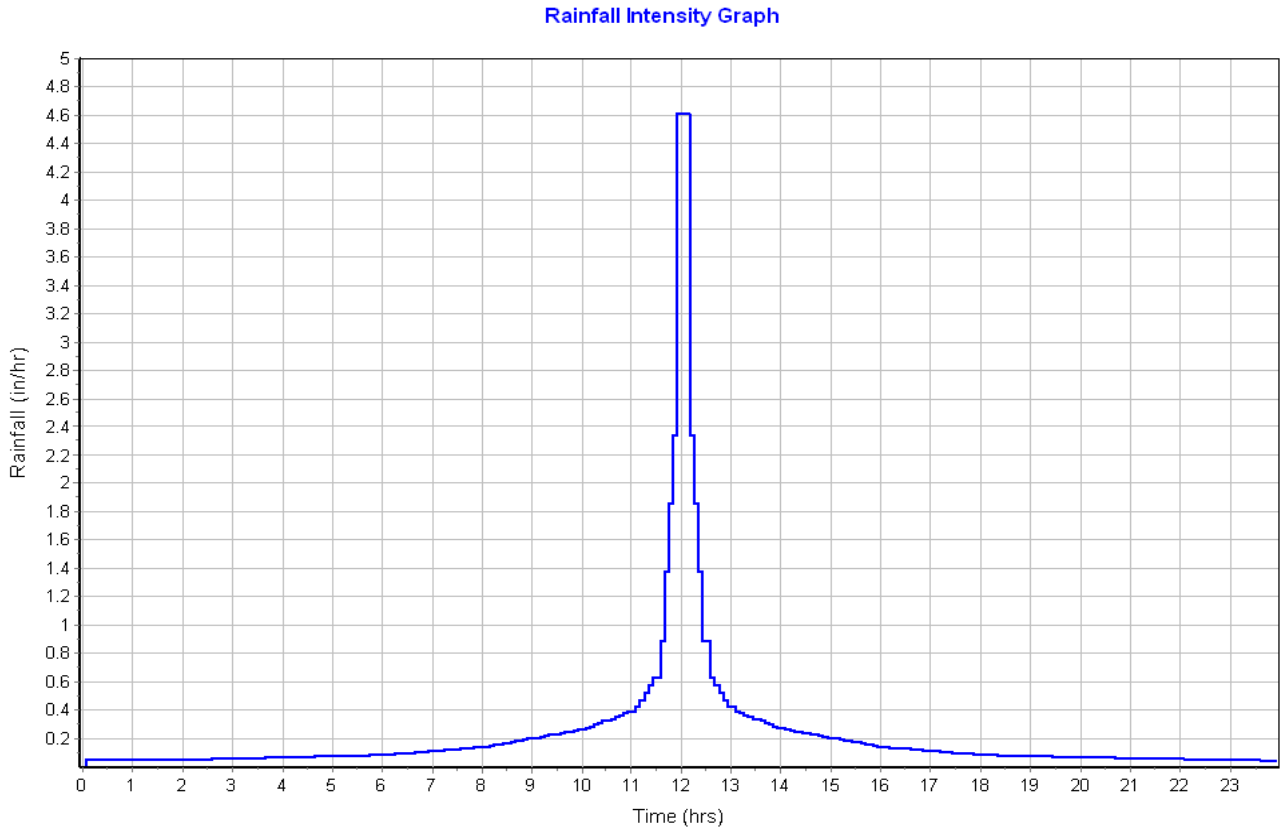
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.3	.3	0.00
Flow Length (ft) :	272	85	0.00
Channel Slope (%) :	1.4	16.7	0.00
Cross Section Area (ft²) :	3.287	1.367	0.00
Wetted Perimeter (ft) :	7.17	5.15	0.00
Velocity (ft/sec) :	0.35	0.84	0.00
Computed Flow Time (min) :	12.97	1.69	0.00

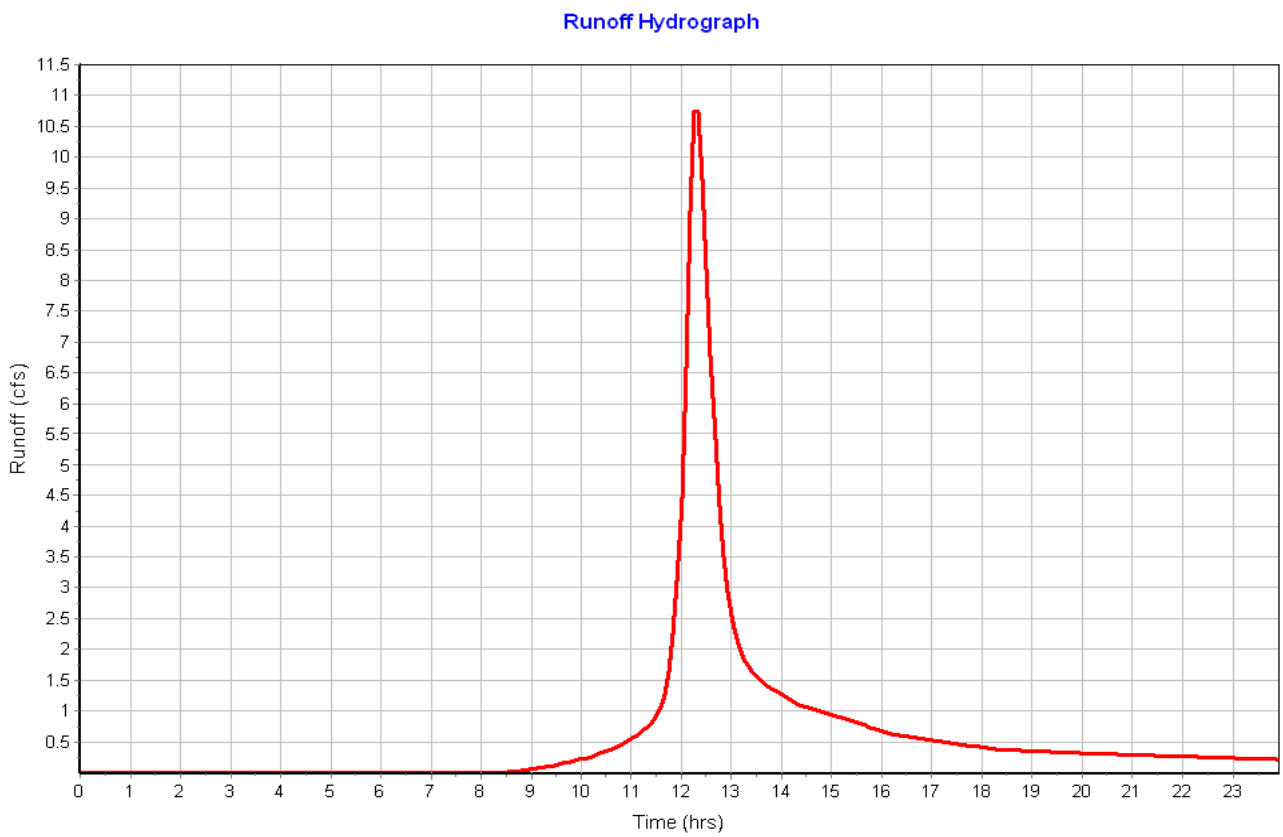
Total TOC (min) 24.48

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 2.91
Peak Runoff (cfs) 10.95
Weighted Curve Number 75.65
Time of Concentration (days hh:mm:ss) 0 00:24:29

Subbasin : B


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C1-WETLAND

Input Data

Area (ac) 0.75
Weighted Curve Number 75.95
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.12	D	77.00
> 75% grass cover, Good	0.04	A	39.00
> 75% grass cover, Good	0.05	D	80.00
> 75% grass cover, Good	0.34	C	74.00
Woods, Good	0.02	C	70.00
Gravel roads	0.04	A	76.00
Gravel roads	0.09	C	89.00
Gravel roads	0.05	D	91.00
Composite Area & Weighted CN	0.75		75.95

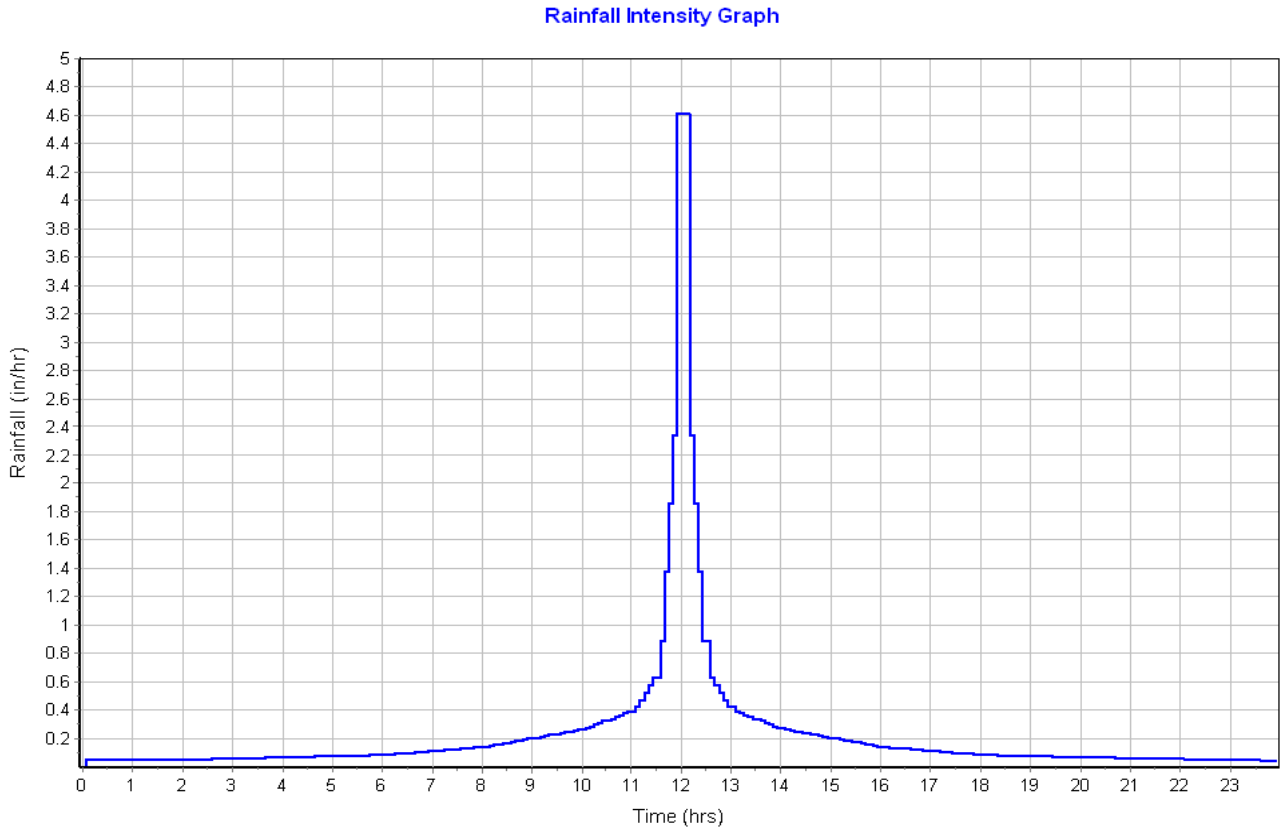
Time of Concentration

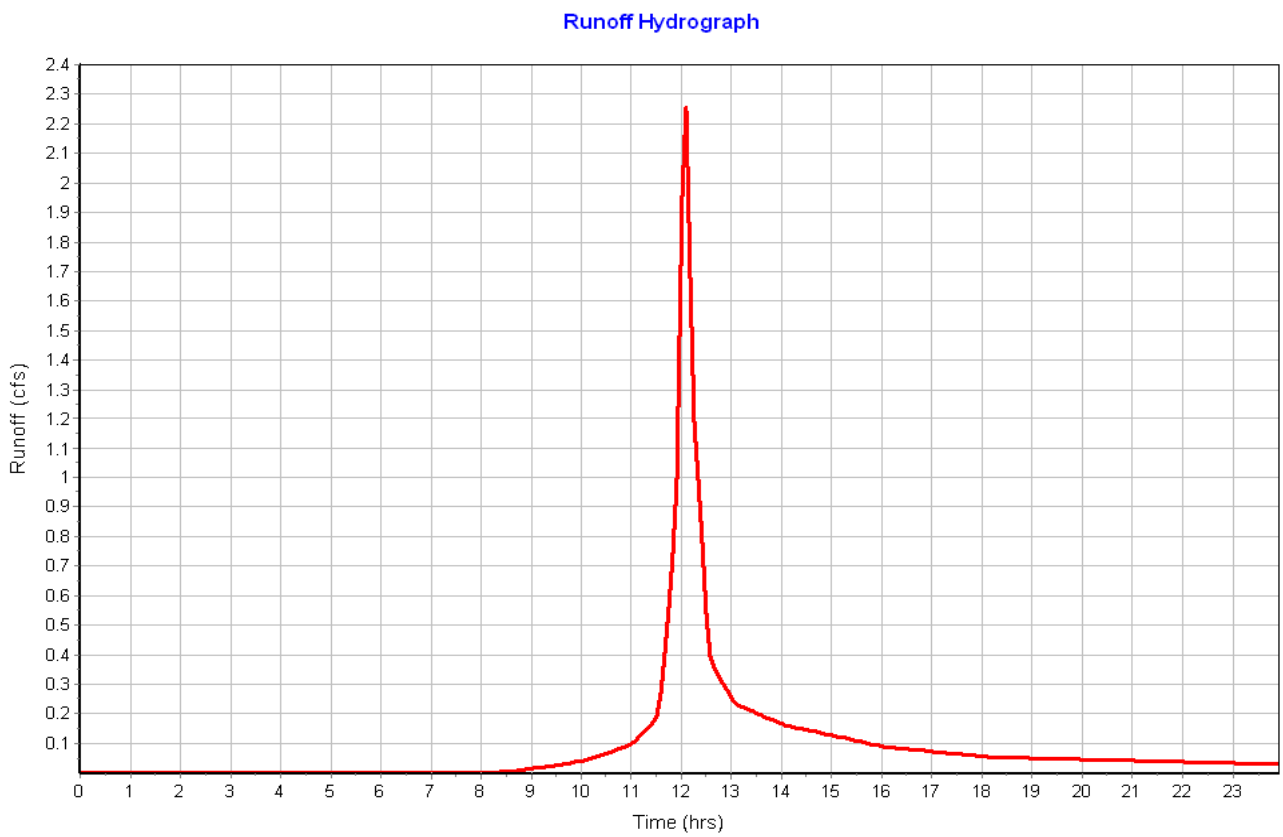
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 2.94
Peak Runoff (cfs) 2.30
Weighted Curve Number 75.95
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : C1-WETLAND





Subbasin : C2-WETLAND

Input Data

Area (ac) 0.73
Weighted Curve Number 82.63
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.31	C	74.00
Gravel roads	0.42	C	89.00
Composite Area & Weighted CN	0.73		82.63

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.01	0.00	0.00
Flow Length (ft) :	44	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	1.22	0.00	0.00
Computed Flow Time (min) :	0.60	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	636	0.00	0.00
Slope (%) :	1.6	0.00	0.00
Surface Type :		Unpaved	Unpaved
Velocity (ft/sec) :	1.90	0.00	0.00
Computed Flow Time (min) :	5.58	0.00	0.00

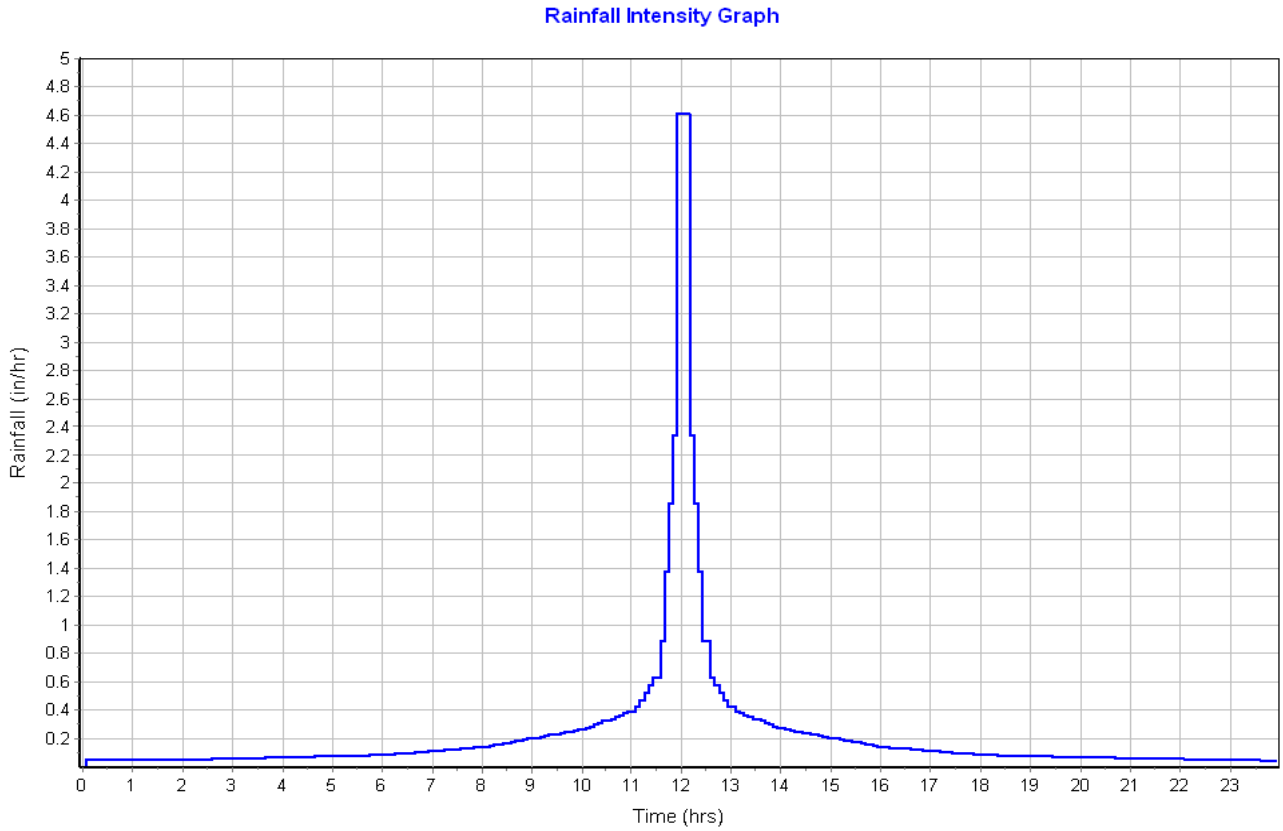
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.03	0.00	0.00
Flow Length (ft) :	2256	0.00	0.00
Channel Slope (%) :	.5	0.00	0.00
Cross Section Area (ft^2) :	2.475	0.00	0.00
Wetted Perimeter (ft) :	6.91	0.00	0.00
Velocity (ft/sec) :	1.77	0.00	0.00
Computed Flow Time (min) :	21.23	0.00	0.00

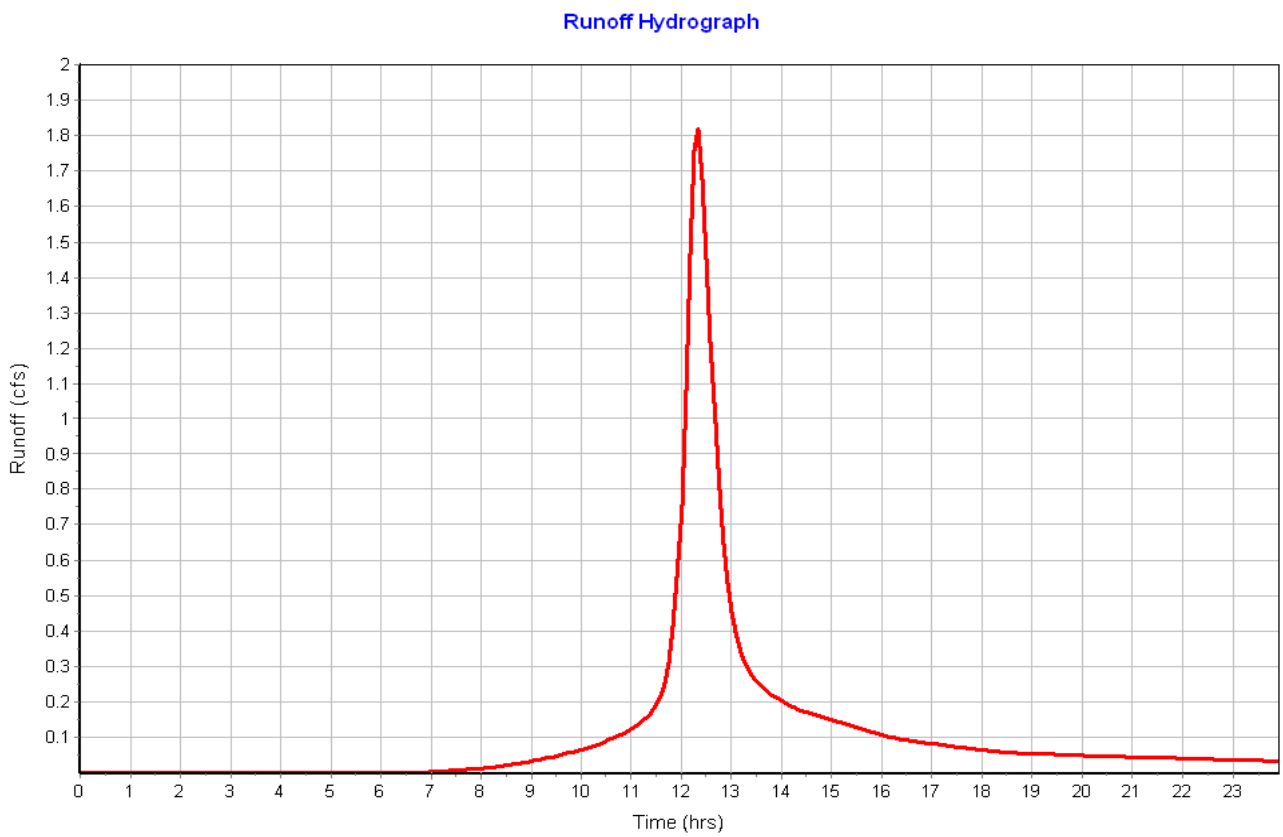
Total TOC (min) 27.41

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 3.58
Peak Runoff (cfs) 1.82
Weighted Curve Number 82.63
Time of Concentration (days hh:mm:ss) 0 00:27:25

Subbasin : C2-WETLAND





Subbasin : C3-BYPASS

Input Data

Area (ac) 21.22
Weighted Curve Number 71.79
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.01	D	80.00
Woods, Good	12.33	C	70.00
Woods, Good	7.45	D	77.00
> 75% grass cover, Good	0.66	A	39.00
> 75% grass cover, Good	0.57	C	74.00
Gravel roads	0.20	C	89.00
Composite Area & Weighted CN	21.22		71.79

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	.47	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.03	0.00	0.00
Computed Flow Time (min) :	54.75	0.00	0.00

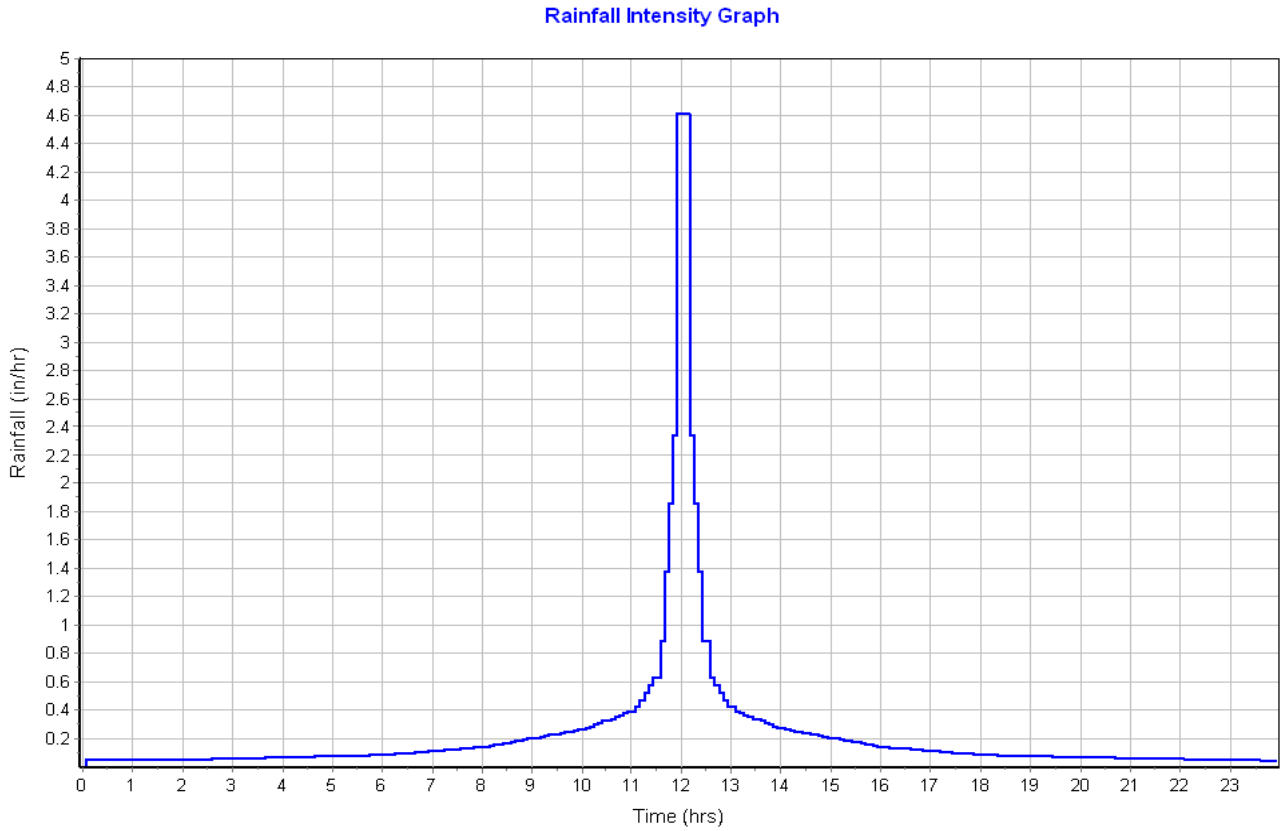
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2140	0.00	0.00
Slope (%) :	.47	0.00	0.00
Surface Type :		Unpaved	Unpaved
Velocity (ft/sec) :	1.03	0.00	0.00
Computed Flow Time (min) :	34.63	0.00	0.00

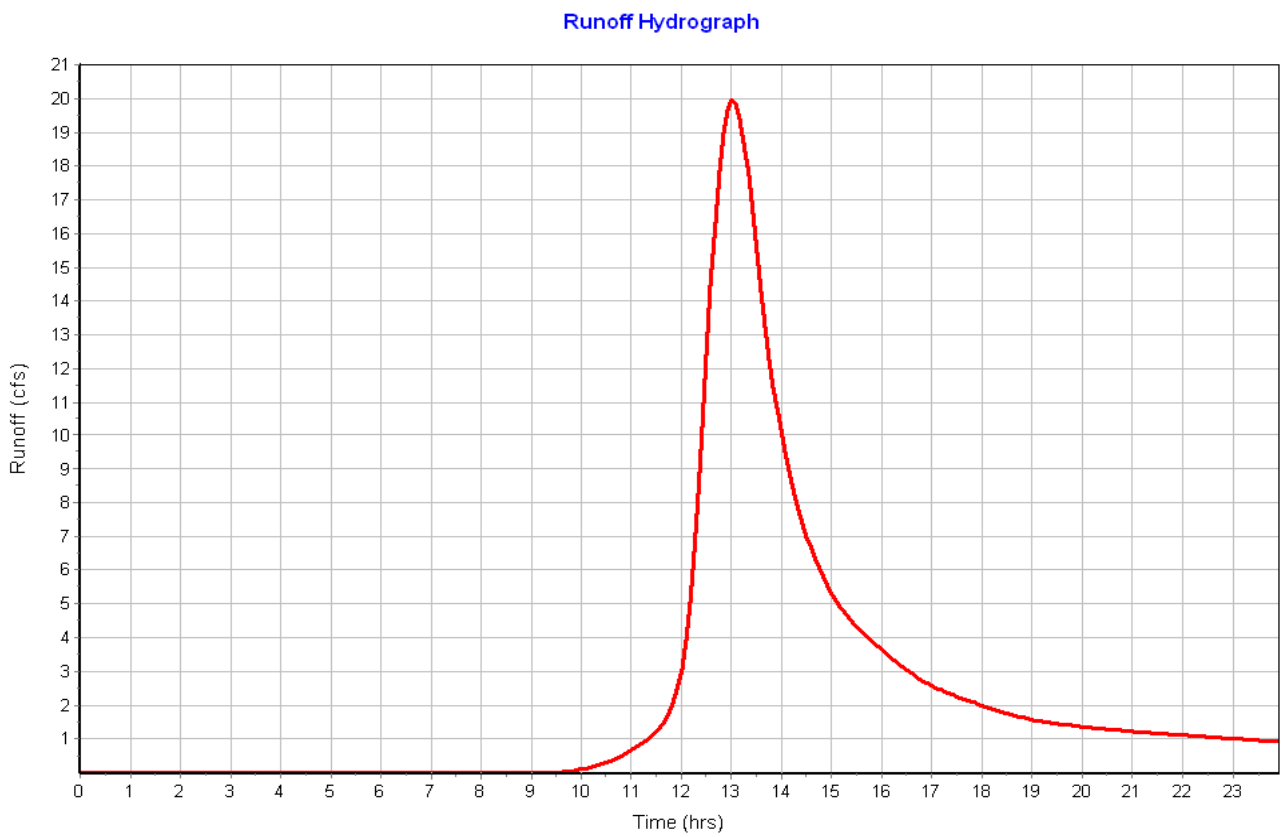
Total TOC (min) 89.38

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 2.56
Peak Runoff (cfs) 19.95
Weighted Curve Number 71.79
Time of Concentration (days hh:mm:ss) 0 01:29:23

Subbasin : C3-BYPASS





Subbasin : D

Input Data

Area (ac) 0.69
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.74	D	77.00
Composite Area & Weighted CN	0.74		77.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	21	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.14	0.00	0.00
Computed Flow Time (min) :	11.98	0.00	0.00

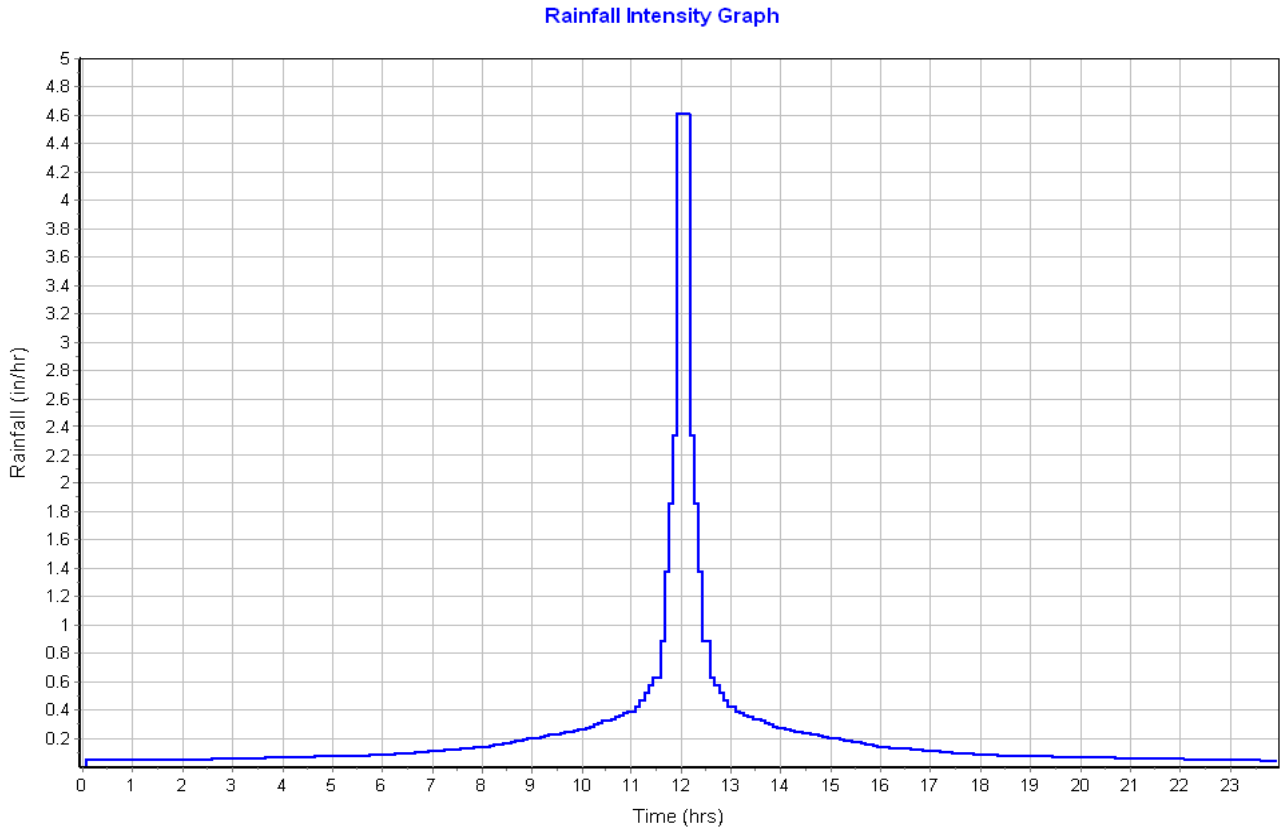
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	16	0.00	0.00
Slope (%) :	14.5	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.90	0.00	0.00
Computed Flow Time (min) :	0.14	0.00	0.00

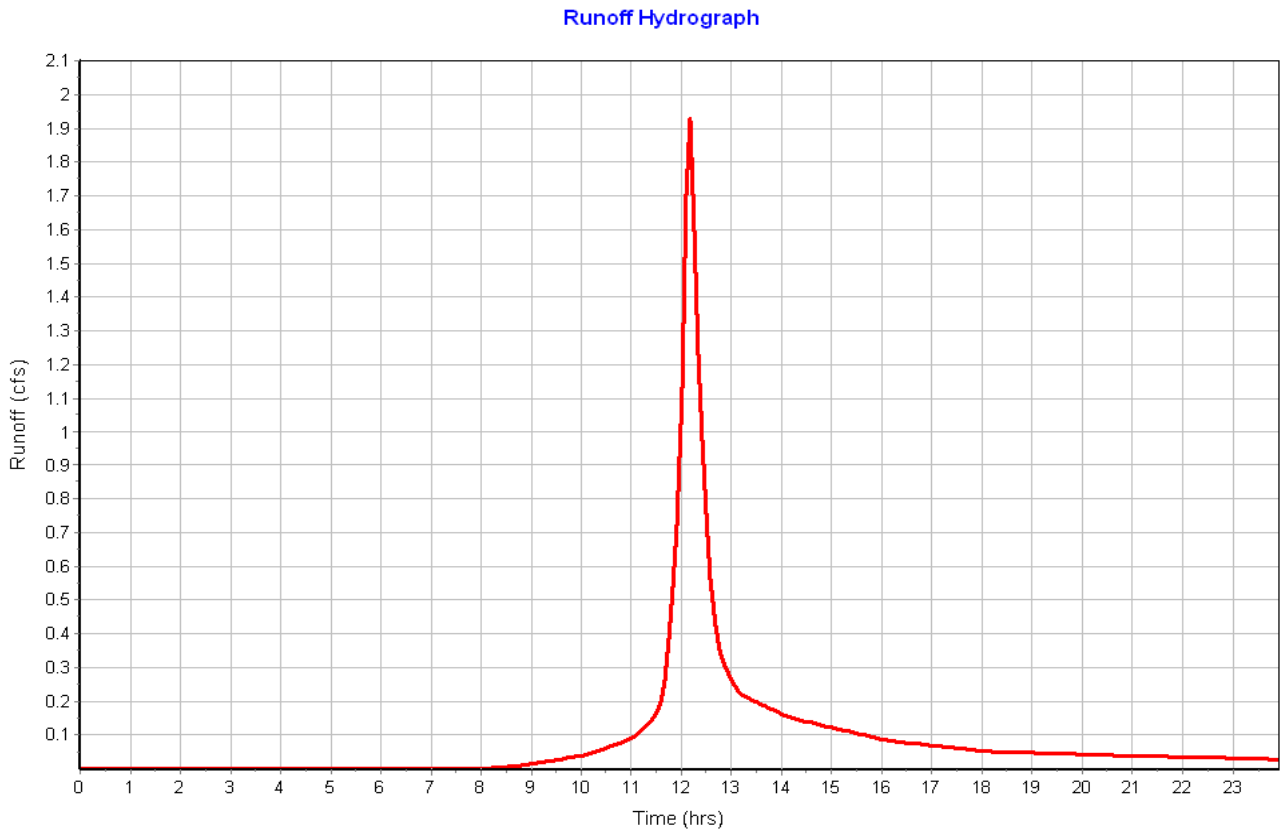
Total TOC (min) 12.12

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 3.04
Peak Runoff (cfs) 1.93
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:12:07

Subbasin : D


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : E

Input Data

Area (ac) 2.96
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	2.96	D	77.00
Composite Area & Weighted CN	2.96		77.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	24	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.15	0.00	0.00
Computed Flow Time (min) :	11.35	0.00	0.00

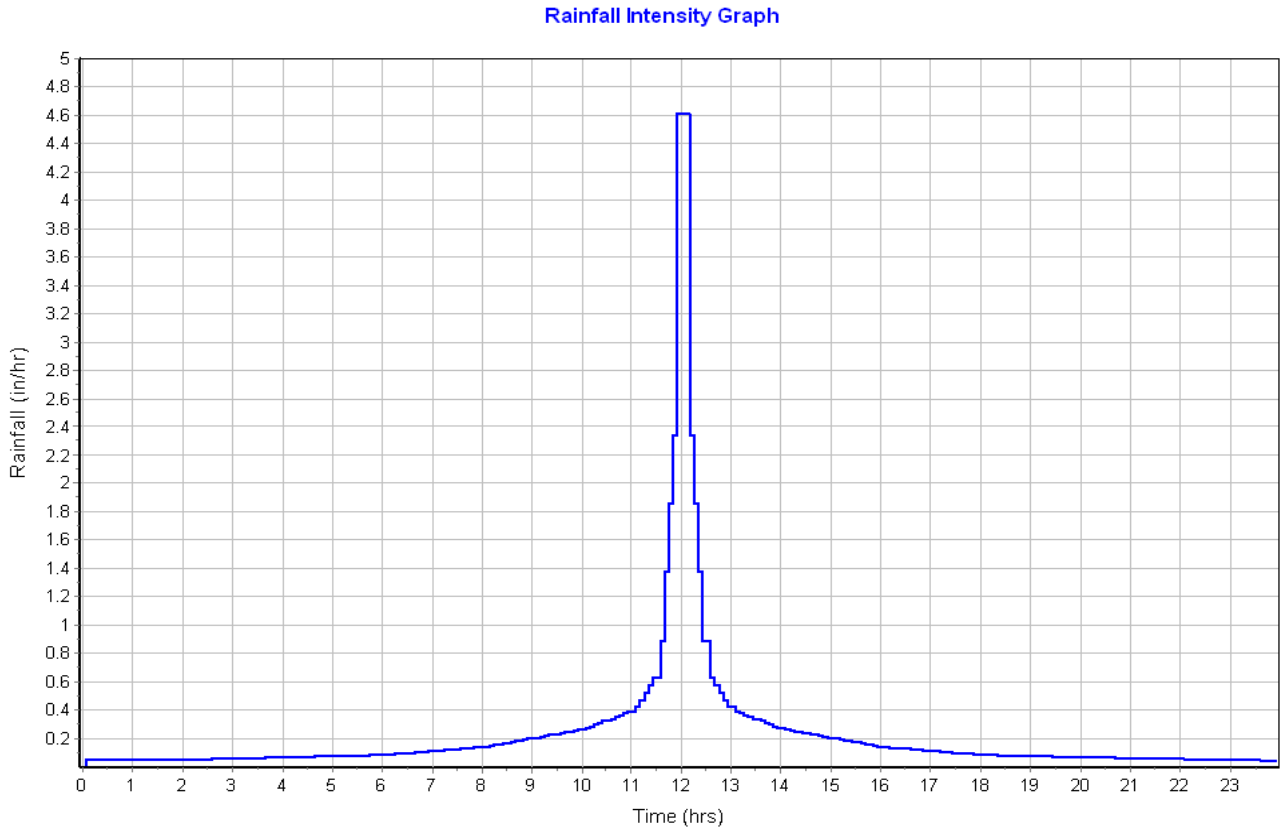
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	227	0.00	0.00
Slope (%) :	18	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.12	0.00	0.00
Computed Flow Time (min) :	1.78	0.00	0.00

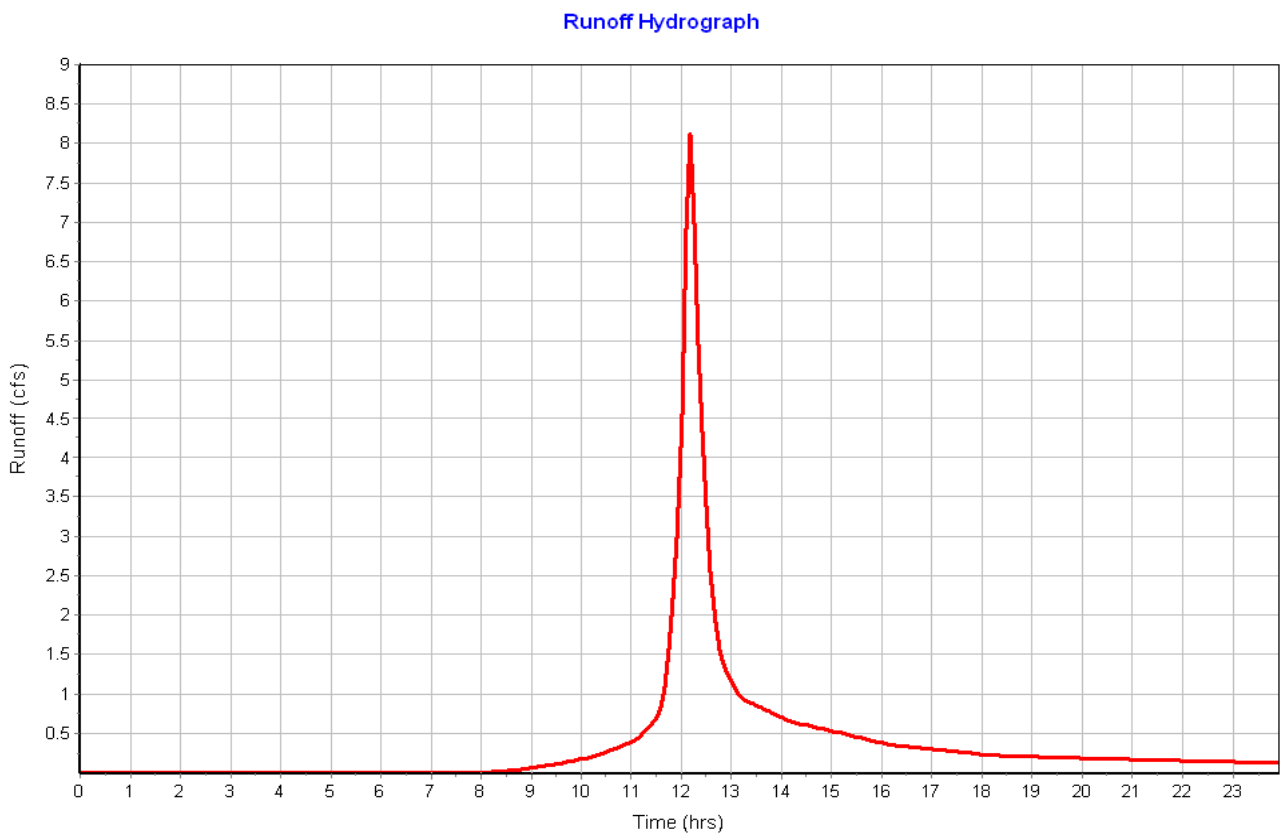
Total TOC (min) 13.14

Subbasin Runoff Results

Total Rainfall (in) 5.49
Total Runoff (in) 3.04
Peak Runoff (cfs) 8.13
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:13:08

Subbasin : E


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Junction Input

Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)
CB1	305.30	310.33
CB2	312.00	316.00
END-SECTION-C1	308.00	6.00
END-SECTION-C2	308.00	310.00
OUTLET-STR-A2	305.60	312.00
OUTLET-STR-C1	308.10	312.00
OUTLET-STR-C2	308.10	310.27

Junction Results

Element ID	Peak Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Time of Max HGL Occurrence
	(cfs)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)
CB1	14.64	306.96	1.66	3.37	305.63	0 12:31
CB2	20.08	313.28	1.28	2.72	312.18	0 12:15
END-SECTION-C1	0.53	308.35	0.35	2.88	308.10	0 12:36
END-SECTION-C2	0.42	308.31	0.31	2.92	308.10	0 13:09
OUTLET-STR-A2	9.20	306.67	1.07	5.33	305.82	0 12:20
OUTLET-STR-C1	0.53	308.45	0.35	3.55	308.20	0 12:36
OUTLET-STR-C2	0.42	308.41	0.31	1.86	308.20	0 13:08

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness
CULV-A	98.00	305.30	305.12	0.1800	CIRCULAR	36.000	36.000	0.0150
CULV-A2-1	104.00	312.00	310.00	1.9200	CIRCULAR	24.000	24.000	0.0150
CULV-A2-2	43.00	305.60	305.30	0.7000	CIRCULAR	24.000	24.000	0.0150
CULV-C1	30.00	308.10	308.00	0.3300	CIRCULAR	12.000	12.000	0.0130
CULV-C2	30.00	308.10	308.00	0.3300	CIRCULAR	12.000	12.000	0.0130

Pipe Results

Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth
	(cfs)	(days hh:mm)	(cfs)	(ft/sec)	(ft)
CULV-A	14.64	0 12:31	24.77	3.65	1.66
CULV-A2-1	20.01	0 12:15	27.19	9.48	1.28
CULV-A2-2	9.20	0 12:20	16.38	5.36	1.07
CULV-C1	0.53	0 12:36	2.06	2.20	0.35
CULV-C2	0.42	0 13:09	2.06	2.05	0.31

Storage Nodes

Storage Node : DETENTION-A

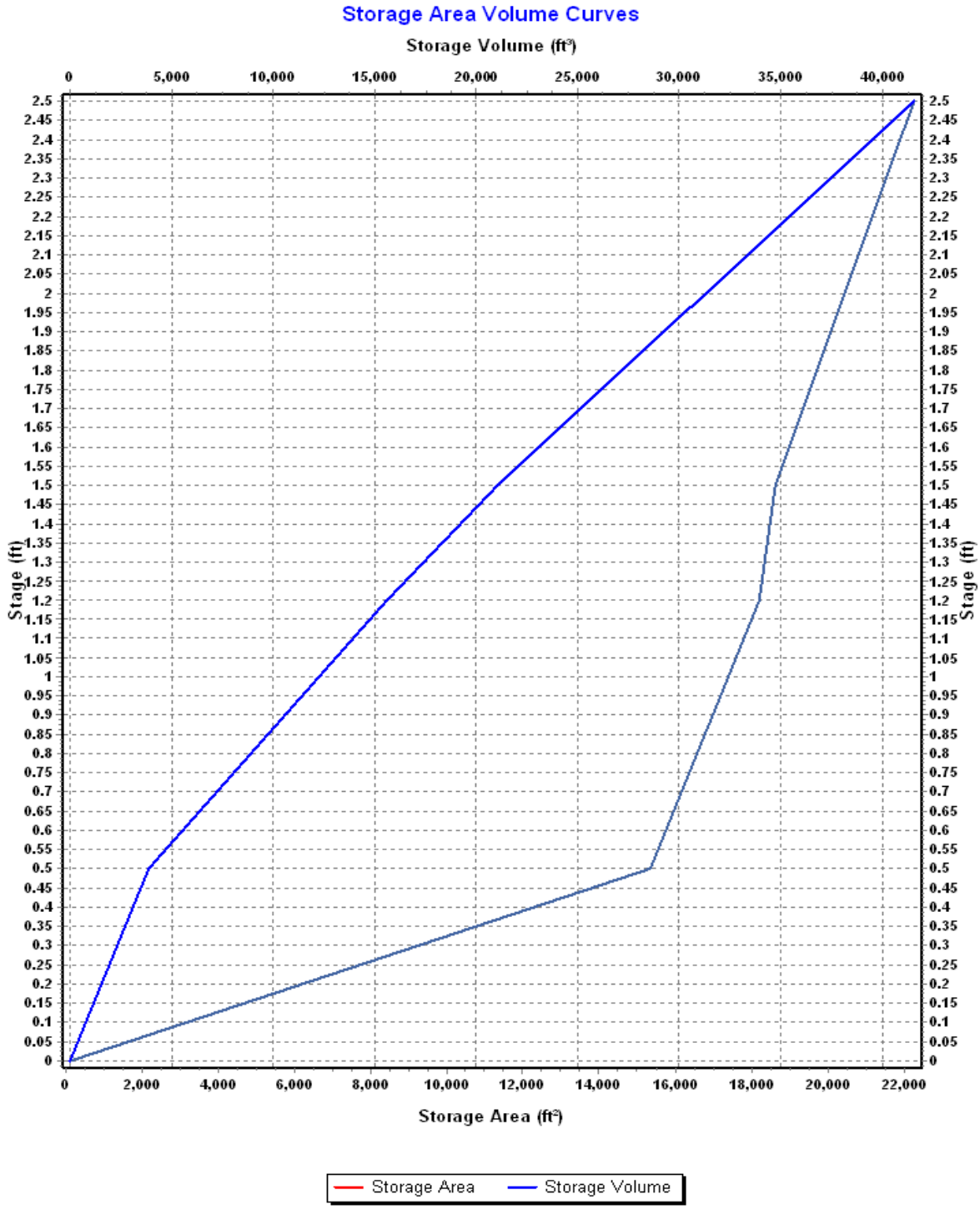
Input Data

Invert Elevation (ft) 309.50
Max (Rim) Elevation (ft) 312.00
Max (Rim) Offset (ft) 2.50
Initial Water Elevation (ft) 309.50
Initial Water Depth (ft) 0.00
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Storage-08

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	113	0.000
.5	15327	3860.00
1.2	18183.	15588.50
1.5	18635	21111.20
2.5	22257	41557.20


Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
Stage (ft)
2.5
2.45
2.4
2.35
2.3
2.25
2.2
2.15
2.1
2.05
2
1.95
1.9
1.85
1.8
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : DETENTION-A (continued)

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
BEEHIVE-GRATE	Bottom	CIRCULAR	18.17			310.33	0.61
ORIF-DET-A	Side	Rectangular		4.00	36.00	309.50	0.63

Output Summary Results

Peak Inflow (cfs)	14.91
Peak Lateral Inflow (cfs)	9.67
Peak Outflow (cfs)	5.69
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	310.50
Max HGL Depth Attained (ft)	1
Average HGL Elevation Attained (ft)	309.61
Average HGL Depth Attained (ft)	0.11
Time of Max HGL Occurrence (days hh:mm)	0 12:32
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : FILTER-1

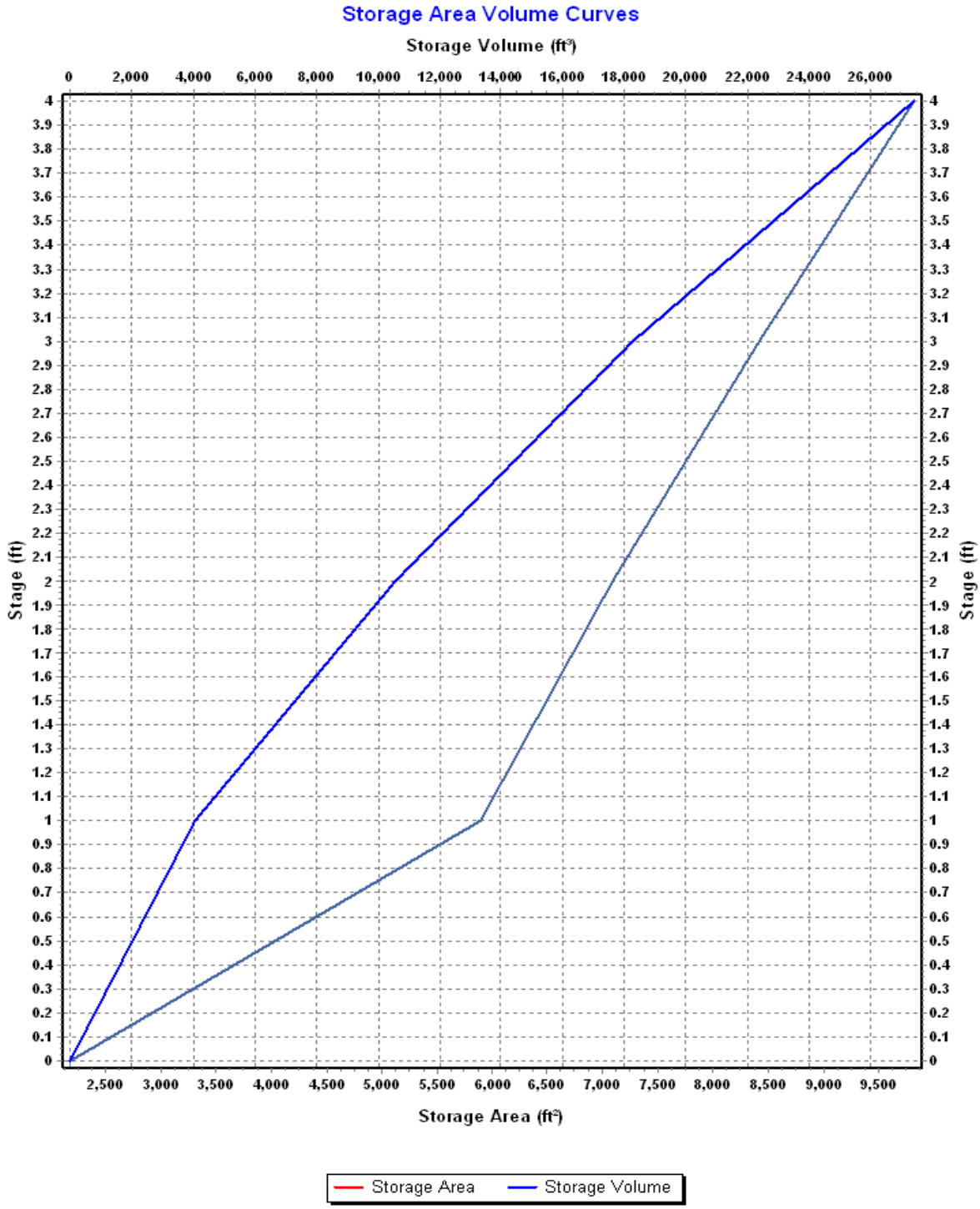
Input Data

Invert Elevation (ft) 308.00
Max (Rim) Elevation (ft) 312.00
Max (Rim) Offset (ft) 4.00
Initial Water Elevation (ft) 309.00
Initial Water Depth (ft) 1.00
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Storage-05

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	2178	0.000
1	5898	4038.00
2	7084	10529.00
3	8421	18281.50
4	9818	27401.00


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
26,000
Stage (ft)
Storage Area (ft²)
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
8,000
8,500
9,000
9,500
Storage Area
Storage Volume

Storage Node : FILTER-1 (continued)

Outflow Weirs

Element ID	Weir Type	Crest Elevation (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
SPILLWAY-A2	Trapezoidal	310.70	55.00	1.30	3.10

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
ORIF-A2	Side	Rectangular		6.00	35.00	309.00	0.63

Output Summary Results

Peak Inflow (cfs)	20.01
Peak Lateral Inflow (cfs)	0.00
Peak Outflow (cfs)	16.97
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	310.83
Max HGL Depth Attained (ft)	2.83
Average HGL Elevation Attained (ft)	309.17
Average HGL Depth Attained (ft)	1.17
Time of Max HGL Occurrence (days hh:mm)	0 12:20
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : WETLAND-C1

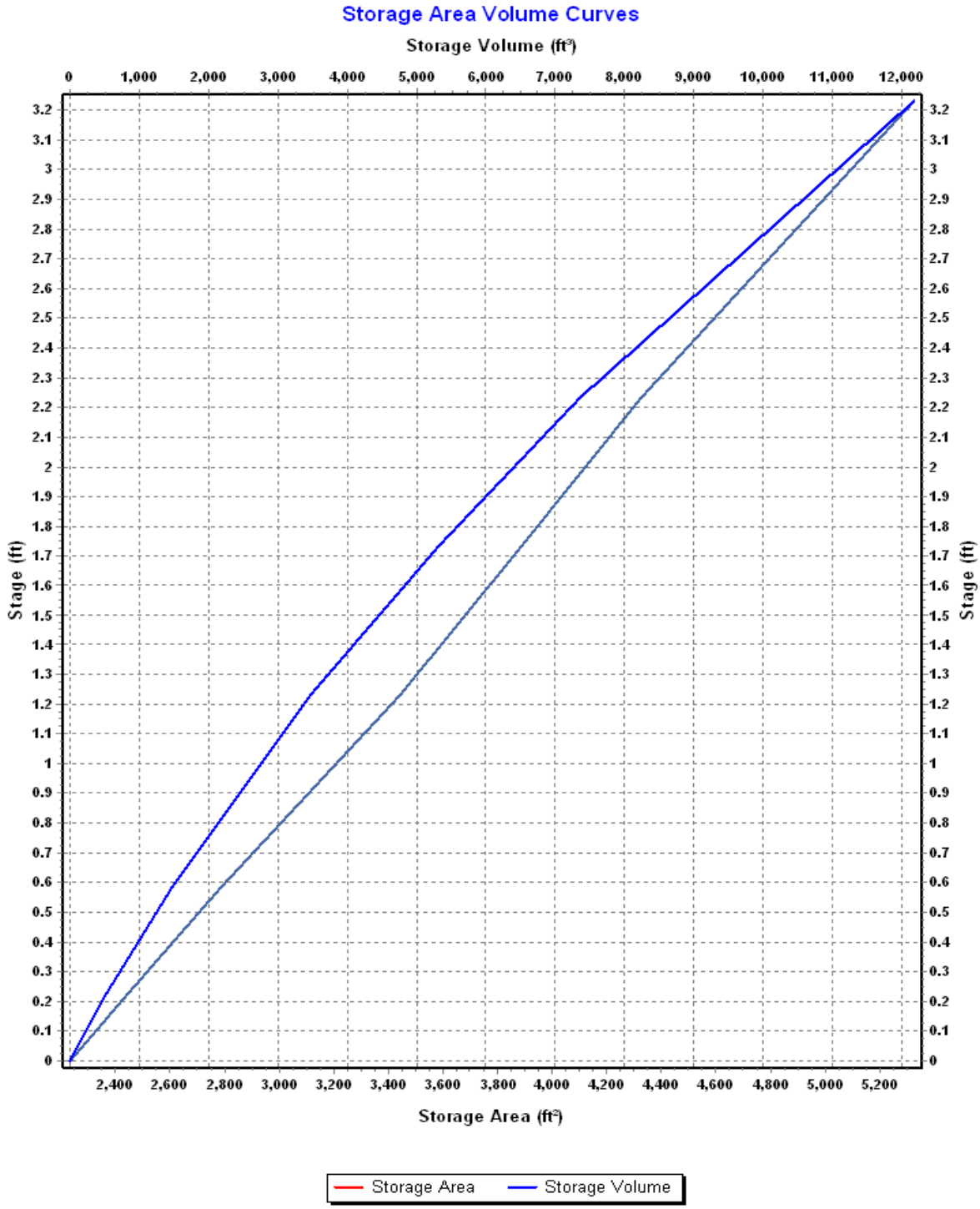
Input Data

Invert Elevation (ft) 308.77
Max (Rim) Elevation (ft) 312.00
Max (Rim) Offset (ft) 3.23
Initial Water Elevation (ft) 309.33
Initial Water Depth (ft) 0.56
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Storage-09

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	2234.3266	0.000
0.23	2446.5288	538.30
0.583	2787.6137	1462.13
1.23	3441.1460	3477.13
1.73	3884.8913	5308.64
2.23	4323.3307	7360.70
3.23	5324	12184.37


Storage Area Volume Curves
Storage Volume (ft³)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
2,400
2,600
2,800
3,000
3,200
3,400
3,600
3,800
4,000
4,200
4,400
4,600
4,800
5,000
5,200
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : WETLAND-C1 (continued)

Outflow Weirs

Element ID	Weir Type	Crest Elevation (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
SPILLWAY-C1	Trapezoidal	310.70	10.00	1.30	3.33

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
ORIF-C1	Side	CIRCULAR	0.88			308.10	0.61
Wetland-1-BEEHIV	Bottom	CIRCULAR	18.17			310.27	0.61

Output Summary Results

Peak Inflow (cfs) 2.26
Peak Lateral Inflow (cfs) 2.26
Peak Outflow (cfs) 0.53
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 310.37
Max HGL Depth Attained (ft) 1.6
Average HGL Elevation Attained (ft) 309.77
Average HGL Depth Attained (ft) 1
Time of Max HGL Occurrence (days hh:mm) 0 12:36
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Storage Node : WETLAND-C2

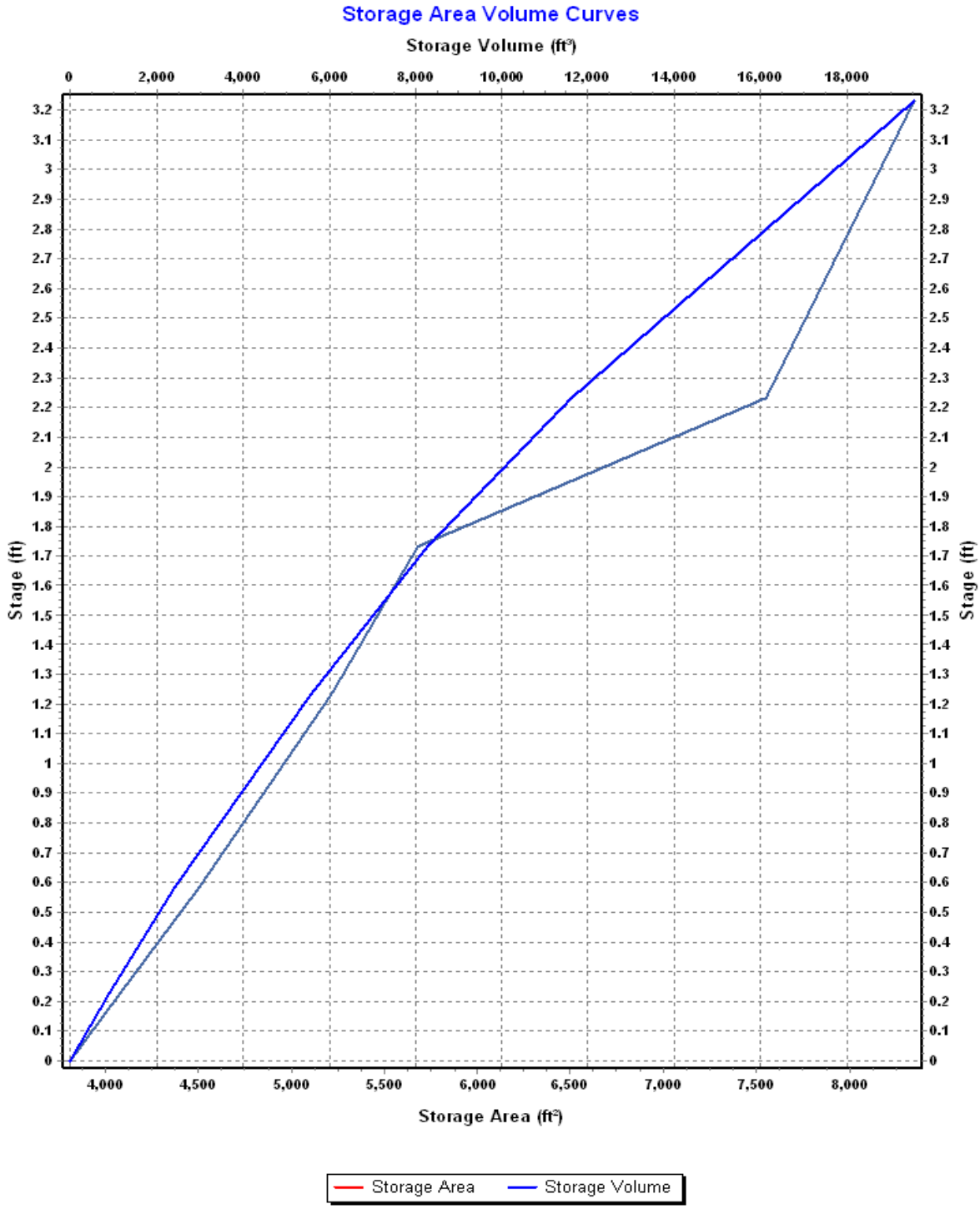
Input Data

Invert Elevation (ft) 308.77
Max (Rim) Elevation (ft) 312.00
Max (Rim) Offset (ft) 3.23
Initial Water Elevation (ft) 309.42
Initial Water Depth (ft) 0.65
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Storage-07

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	3813.8233	0.000
0.23	4081.9612	908.02
0.583	4508.5002	2424.24
1.23	5212.0439	5568.84
1.73	5680.7080	8292.03
2.23	7549	11599.46
3.23	8345	19546.46


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
Stage (ft)
3.2
3.1
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
8,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : WETLAND-C2 (continued)

Outflow Weirs

Element ID	Weir Type	Crest Elevation (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
SPILLWAY-C2	Trapezoidal	310.80	10.00	1.20	3.10

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
ORIF-C2A	Side	CIRCULAR	0.88			308.10	0.61
Wetland-2-BEEHIV	Bottom	CIRCULAR	18.17			310.27	0.61

Output Summary Results

Peak Inflow (cfs) 1.82
Peak Lateral Inflow (cfs) 1.82
Peak Outflow (cfs) 0.42
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 310.36
Max HGL Depth Attained (ft) 1.59
Average HGL Elevation Attained (ft) 309.82
Average HGL Depth Attained (ft) 1.05
Time of Max HGL Occurrence (days hh:mm) 0 13:08
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Exhibit M-2: Stormwater Management System-Fickett Road Substation (5/29/2018)

STORMWATER MANAGEMENT SYSTEM

Prepared for the

CENTRAL MAINE POWER COMPANY
FICKETT ROAD SUBSTATION

Location

Fickett Road
Pownal, ME

Owner

Central Maine Power Company
83 Edison Drive
Augusta, Maine 04336

STATE OF MAINE
KENNETH R. VOLOCK
No. 11062
LICENSED
PROFESSIONAL ENGINEER
05-29-18
REV. B

Prepared by

11733 Chesterdale Road
Cincinnati, OH 45246
(513) 326-1500
September 2017
REVISED MAY 2018

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APPENDIX A – BMP INSPECTION & MAINTENANCE CHECKLISTS AND LOGS

APPENDIX B – CORRESPONDENCE FROM MEDEP TO CMP

APPENDIX C – STORMWATER COMPUTATIONS

INTRODUCTION

Central Maine Power Company (CMP) is proposing to construct a new electrical substation as part of the New England Clean Energy Connect (NECEC) Project. The new station will be built on Fickett Road in the town of Pownal in Cumberland County, Maine and will be named the Fickett Road Substation.

Runoff from the proposed electrical substation flows south to Runaround Brook, and then heads north into Runaround Pond. Runaround Pond is listed as a Lake Most at Risk from New Development in Maine Department of Environmental Protection (MeDEP) Chapter 502. The pond then discharges to Runaround Brook, then Chandler Brook, heading downstream to Royal River, then southeast where it discharges into the Atlantic Ocean.

Fickett Road Substation

The existing conditions and proposed grading plans for the proposed Fickett Road Substation are included with this submission as sheets 1077-003-001 SH 001 General Site Plan Existing Conditions and 1077-003-001 SH 002 General Site Plan Proposed Conditions, respectively. The layout of proposed equipment within the yard is shown on SK-FICK-GL Conceptual General Location Plan.

The proposed substation will sit on a 19.61 acre parcel of land that is a mix of flat terrain, steep hills, forest, shrubs and low lying wetlands and includes an existing electric transmission line corridor. The proposed station footprint will be approximately 3.75 acres and will consist of roof top and concrete foundation impervious and evenly graded 3/4” to 1.5” stone for the remainder of the station pad. The access roads leading to the station from the north and east will consist of gravel. The project will consist of a total developed area of 4.87 acres, of which, 3.90 acres will be impervious. The site will be sloped to drain to the south, honoring the existing drainage patterns to the extent practicable. Site stormwater runoff will be treated with a grassed underdrain soil filter, while the stoned yard areas are considered to be treated in place.

Permitting Requirements

The Fickett Road Substation is part of the larger NECEC Project currently being undertaken by CMP. The project is submitted as a whole to the MeDEP for permitting purposes.

The project will require a Stormwater Management Permit and a Site Location of Development Permit because more than 3 acres will be stripped or graded and not revegetated within one year, and because the project will occupy more than 20 acres of land. The project will be required to meet the Basic, General, and Flooding Standards as described in MeDEP Chapter 500. As a result of the Fickett Road Substation discharging to Runaround Brook the project is also required to meet the Chapter 500 Phosphorous Standard. The standards will be met using several erosion and sedimentation control and permanent stormwater management Best Management Practices (BMPs).

BASIC STANDARD

The proposed project will disturb more than one acre of land, requiring compliance with the Basic Standard as described in MeDEP Chapter 500 Section 4B. In order to meet the Basic Standard, the proposed project will be required to address the following:

- Erosion and Sedimentation Control
- Inspection and Maintenance
- Housekeeping

Erosion and Sedimentation Control

Exhibit 14-1 of the Site Law Application contains the manual "Central Maine Power Company - Environmental Guidelines for Construction and Maintenance Activities on Transmission Line and Substation Projects". This manual addresses general erosion and sedimentation control measures used in many previous transmission and substation projects and has been reviewed and approved by MeDEP. The manual was developed to be consistent with the Maine Erosion and Sediment Control Practices Field Guide for Contractors, 2015, and MeDEP's Chapter 500.

Specific erosion and sedimentation control BMPs for the Fickett Road Substation project are indicated on sheet 1077-003-004 SH 001 Erosion and Sediment Control Plan. Details of the measures proposed are shown on sheet 1077-003-005 SH 003 Site Details 3 and sheet 1077-003-005 SH 004 Site Details 4. Sheet 1077-003-005 SH 005 Site Details 5 presents a plan for implementing these measures at the site.

Inspection and Maintenance

CMP will ensure that a qualified design engineer inspects the construction site periodically to verify that the stormwater BMPs are constructed in accordance with the plans and specifications shown on the design drawings, and, as needed, during any period when construction activity affecting the stormwater management system occurs, until the site is permanently stabilized. Inspection and Maintenance procedures for the proposed substation are described below. BMP Inspection & Maintenance Checklists and BMP Inspection & Maintenance Logs for each site have been enclosed in Appendix A. The BMP Inspection & Maintenance Checklists outline the inspection frequency/requirements and maintenance/cleanout thresholds for each BMP measure. The enclosed BMP Inspection & Maintenance Logs include specific inspection guidelines for each BMP measure and are the documentation portion of this Plan.

Scheduled Inspections

Prior to completion of construction, CMP shall designate a CMP Supervisor and personnel or a contractor as the Site Inspector for each substation. Inspection requirements for each individual BMP measure are specified on the Inspection & Maintenance Checklists in Appendix A.

- QUARTERLY: Inspections of stormwater conveyance, control and treatment measures at each Site are to be performed on a quarterly basis throughout the year. Inspections during winter months may encounter snow and ice cover, frozen ground, snow embankments, dormant vegetation, etc. In these cases, the inspector must use his/her best judgment

interpreting these inspection and maintenance requirements, in order to meet both the stated objectives and the intent of the Plan. The inspection should prevent problems and plan for maintenance in advance of the spring thaw (removing snow piles if they obstruct drainage paths, repairing any damage from snow plows, frost heaves, etc.).

- FOLLOW-UP: Additional follow-up inspections will be performed, as needed, depending on the results of routine inspections and site conditions, under the direction of the CMP Supervisor.

As-Needed Maintenance

Maintenance is to be performed on an as-needed basis, in accordance with recommendations made by the Site Inspector. Routine maintenance will include the immediate repair of eroded channels or gullies; reseeding or sodding of bare ground; removal of trash, leaves and sediment; and control of vegetation. Maintenance issues associated with specific areas and stormwater facilities at each Site are identified on the Inspection & Maintenance Checklists in Appendix A. Disposal of all sediment, debris, and waste shall be in accordance with Maine Solid Waste Management Rules, Chapter 400.

5-Year Re-Certification

CMP will certify the following to the MeDEP within three months of the expiration of each five-year interval from the date of issuance of the permit:

- All areas of the project site have been inspected for areas of erosion, and appropriate steps have been taken to permanently stabilize these areas.

- All aspects of the stormwater control system have been inspected for damage, wear, and malfunction, and appropriate steps have been taken to repair or replace the facilities.

- The erosion and stormwater maintenance plan for the site is being implemented as written, or modifications of the plan have been submitted to and approved by the department, and the maintenance log is being maintained.

Housekeeping

Housekeeping entails the control or elimination of pollution not specifically related to soil erosion such as spill prevention, dust control, litter removal and dewatering. Housekeeping is addressed within the narrative and on sheet 1077-003-005 SH 004 Site Details 4 for the Fickett Road Substation.

PHOSPHORUS STANDARD

The Fickett Road substation discharges to Runaround Pond and will add more than 20,000 square feet of impervious surface within the watershed of a Lake Most at Risk. For this reason the project is required to meet the MeDEP Chapter 500 Phosphorus Standard. In order to meet the Phosphorus Standard, the project needs to reduce the amount of phosphorus released from the site to calculated allowable levels for the parcel. Phosphorus Worksheet 1 was used to calculate the allowable phosphorus load from the parcel, also known as the phosphorous Budget. Following establishment of

the phosphorous Budget, pre-treatment phosphorous loading from the site and loading from the site following implementation of on site BMPs is calculated using Worksheet 2. For the proposed condition, phosphorous Worksheet 2 was used to calculate post-developed phosphorous export loads from the site. Worksheets 1 and 2 can be found in Appendix C.

Stormwater Treatment BMPs

Crushed Stone Substation Surface

MeDEP has provided yard construction requirements that allow for reduced *Export Coefficients* and *Treatment Factors* to be applied to the substation's stone surface for treatment related to meeting the Phosphorous Standard. In email correspondence following MeDEP's 2008 letter MeDEP has indicated that phosphorous loading and phosphorous removal associated with the station pad may be calculating using an *Export Coefficient* of 0.30 and a *Treatment Factor* of 0.10 for the ***Crushed Stone Substation Surface***. The email correspondence can be found in Appendix B.

Grassed Underdrain Soil Filter

Runoff from the vegetated developed area along the west side of the station pad will be treated in a Grassed Underdrain Soil Filter. Pretreatment will be accomplished by flowing runoff through a vegetated swale and into a pre-treatment forebay before entering the filter area. Additionally, areas of the station pad and the rooftop surfaces within the pad will be treated within the Soil Filter following treatment within the crushed stone.

The Grassed Underdrain Soil Filter is comprised of an 18"-thick layer of a silty sand and organic material mix. The underdrain system consists of 6" perforated pipe within a 12"-thick layer of underdrain material. The filter is proposed partially within an existing wetland and within areas believed to have elevated groundwater conditions. An impermeable liner has been incorporated into the filter to allow for proper dewatering and prevent oversaturation of the filter media by groundwater prior to rain events. A detail of the underdrained soil filter is shown on sheet 1077-003-003 SH 001 Stormwater Treatment Plan. Underdrained soil filter sizing calculations are provided in Appendix C.

Stormwater Treatment Calculations

In addition to using the station stone as a BMP, a downstream Soil Filter is proposed to further reduce post developed phosphorous exports from the site by providing primary treatment for developed areas surrounding the pad and by further treating runoff from the stone pad as part of a two-tier treatment train utilizing the ***Crushed Stone Substation Surface*** treatment with a downstream soil filter. For parts of the site (pad, rooftops) utilizing the two-tier treatment train, a calculated Treatment Factor of 0.1 was used.

Export Coefficients for the proposed surfaces were used to calculate pre-treatment loading and *Treatment Factors* for the proposed BMPs were used to calculate load reductions and subsequent post-developed phosphorous export loads. As shown in Worksheet 1, the Budget for the parcel was calculated to be 0.51 pounds per year and as seen in Worksheet 2, a post developed, post treatment phosphorous export load of 0.45 is achieved.

Typical sizing of Soil Filters for adherence to the Phosphorous Standard requires that the filter have capacity to contain the standard water quality volume (BMP_{ST}) which is the volume required for adherence to the General Standard, plus additional volume calculated using a prescribed Treatment Factor. The BMP_{ST} volume plus the additional phosphorous treatment volume requirement constitute the total volume capacity required for BMPs used to meet the Phosphorous Standard and is known as BMP_{TF}. The Fickett Road substation yard is self-treating and does not require additional BMPs for adherence to the General Standard, therefore the soil filter was sized to have capacity for the difference between the BMP_{ST} and BMP_{TF} for areas of the yard plus the full BMP_{TF} for developed landscaped areas outside the yard that are not treated for the general standard within the yard stone. Appendix C contains calculations for sizing the soil filter based on these parameters.

The hydraulic modeling report for the entire project site is also included with this submission in Appendix C. The calculations were developed using USDA TR-55 methodology. The model results in Appendix C illustrate how the site drainage and stormwater management infrastructure will function during the 2 -, 10 - and 25 - year storms. The report also contains the hydrologic calculations for the project. The modeling results were used to confirm that adequate water quality volume (WQV) will be provided below the required 18" depth for the Grassed Underdrain Soil Filter.

FLOODING STANDARD

The project is required to meet the MeDEP Chapter 500 Flooding Standard; the addition of over 3 acres of impervious area requires a decrease in peak stormwater runoff as a result of the proposed development. The site is situated entirely within existing HSG Type D soils. Pre-developed and post-developed Curve Numbers for the project can be found in Appendix C and on the project drainage area maps (Sheets 1077-003-003 SH 002 and SH 003). The MeDEP letter describing the construction requirements that allow the General Standard requirements to be met for the yards within the ***Crushed Stone Substation Surface*** also prescribes allotted Curve Numbers for use when calculating runoff from the stone section. Pre-Developed Curve Numbers for the project site depicted on the drainage area maps indicate existing Curve Numbers ranging from 73 to 77. MeDEP prescribes a developed Curve Number for the stone station surface over HSG Type D soils of 60. As existing drainage patterns have been maintained to the extent practicable, the sizes and times of concentration have not been significantly altered with this project. Due to the decreased Curve Numbers across the stone station pad (CN decreased to 60 for these areas), post-development peak flows were calculated to be less than or relatively equal to the pre-development peak flows without the need for on-site stormwater attenuation. Tables 1 and 2 show the pre- and post-development peak flows at each analysis point. Tables 3 through 5 show the comparisons between the pre-developed and post-developed peak flow rates

Table 1 - Pre-Developed Peak Flow Rates

Analysis Point	2-Year Flow Rate (CFS)	10-Year Flow Rate (CFS)	25-Year Flow Rate (CFS)
A	2.25	5.70	7.51
B	3.98	10.12	13.36
C	0.27	0.66	0.86
D	0.13	0.30	0.38

Table 2 - Post-Developed Peak Flow Rates

Analysis Point	2-Year Flow Rate (CFS)	10-Year Flow Rate (CFS)	25-Year Flow Rate (CFS)	Peak 2-Year Flow Rate at Outfall (If Subsheds Present)	Peak 10-Year Flow Rate at Outfall (If Subsheds Present)	Peak 25-Year Flow Rate at Outfall (If Subsheds Present)
A	2.33	5.71	7.47	N/A	N/A	N/A
B1	1.30	4.05	5.55	2.06	5.73	7.71
B2	1.84	5.14	6.91			
C	0.15	0.37	0.48	N/A	N/A	N/A
D	0.13	0.30	0.38	N/A	N/A	N/A

Table 3 – Flow Rate Comparison, 2-Year

Analysis Point	PRE 2-Year Flow Rate (CFS)	POST 2-Year Flow Rate (CFS)	Change in Peak Flow Rate (CFS)
A	2.25	2.33	0.08
B	3.98	2.06	(1.92)
C	0.27	0.15	(0.12)
D	0.13	0.13	0.00

Table 4 – Flow Rate Comparison, 10-Year

Analysis Point	PRE 10-Year Flow Rate (CFS)	POST 10-Year Flow Rate (CFS)	Change in Peak Flow Rate (CFS)
A	5.70	5.71	0.01
B	10.12	5.73	(4.39)
C	0.66	0.37	(0.29)
D	0.30	0.30	0.00

Table 5 – Flow Rate Comparison, 25-Year

Analysis Point	PRE 25-Year Flow Rate (CFS)	POST 25-Year Flow Rate (CFS)	Change in Peak Flow Rate (CFS)
A	7.51	7.47	(1.04)
B	13.36	7.71	(5.65)
C	0.86	0.48	(0.38)
D	0.38	0.38	0.00

Access Road Culvert Sizing

An approximately 200’ long gravel access drive is proposed extending from Fickett Road to the proposed substation pad. The road will be graded to slope longitudinally downward to a low point between the station pad and Fickett Road and will be graded to have a 2% minimum cross slope to carry stormwater runoff from the road surface. Surface runoff from areas upstream of the new access

drive currently flow within a poorly defined ditch along Fickett Road and will be required to pass beneath the road via a proposed 15” reinforced concrete culvert.

The culvert is expected to serve a drainage area of approximately 0.68 acres having a runoff Curve Number of 75 and with a time of concentration of 5 minutes. The drainage area hydrology was modeled in AutoDesk’s Storm and Sanitary Analysis program to develop post-developed peak flow rates to the culvert in the 2-, 10- and 25-year storm events. Hydraulic analysis of the culvert was completed using AutoDesk’s Hydraflow Express analysis tool to confirm flow capacity and check for flooding. Hydrologic model outputs including peak flow rates can be found in Appendix C in the *Proposed Conditions Hydraulic/Hydrologic Report*. The *Culvert Report* in Appendix C demonstrates the anticipated performance of the culvert during a 25-year event including flow regime and hydraulic grade line elevations at both upstream and downstream ends.

CONCLUSION

The NECEC Project will require a Stormwater Management Permit, and will be required to meet the Basic, Phosphorous and Flooding Standards as described in MeDEP Chapter 500. The Basic Standard shall be met at the Fickett Road Substation through Erosion and Sedimentation Control, Inspection and Maintenance, and Housekeeping, as described in this narrative and the attached checklists, logs and plans. The Flooding Standards shall be met at the Fickett Road Substation by using the MeDEP approved substation yard stone section, as illustrated on the attached stormwater treatment plans. The proposed culvert beneath the new access drive has been sized to prevent flooding of the road during the 25-year storm event. The Phosphorus Standard shall be met using the MeDEP approved substation yard section and a Grassed Underdrain Soil Filter.

APPENDIX A – BMP INSPECTION & MAINTENANCE CHECKLISTS AND LOGS

APPENDIX A-1: BMP INSPECTION & MAINTENANCE CHECKLIST

Central Maine Power Company – Fickett Road Substation
Pownal, Maine

BMP MEASURE	INSPECTION REQUIREMENTS*	MAINTENANCE/CLEANOUT THRESHOLDS
Vegetated Swales	Inspect swale for accumulated sediment, debris and other obstructions. Inspect swales for evidence of erosion, gullies, or slumping of the side slopes. Inspect swales for bare ground/sparse vegetation. Monitor vegetative growth.	Clean as needed and dispose of properly. Repair and re-seed as necessary. Consult engineer if problem persists. Areas of persistent erosion may need to be armored. Re-seed as necessary. Soil may need to be scarified if compacted soils are present. Mow vegetation in swales to roughly six inches at least once and no more than two times a year. To be performed between June 15th and August 30th. Fertilizer containing phosphorus is prohibited, except when establishing new turf or vegetation on bare soil.
Check Dams	Inspect check dams to ensure the center is lower than the edges. Inspect check dams for stone displacement, erosion, concentrated flow or channelization. Inspect check dams for accumulated sediment, debris or other obstructions.	Repair as necessary. Repair any damaged areas. Consult engineer if problem persists. Clean as needed and dispose of properly. Sediment must be removed before it exceeds one half the original height of the check dam.
Revegetated Areas	Inspect revegetated areas for evidence of erosion, concentrated flow, or channelization. Inspect revegetated areas for bare ground/sparse vegetation.	Repair and re-seed as necessary. Consult engineer if problem persists. Areas of concentrated flow where rills and gullies are present may need to be armored Re-seed as necessary. Soil may need to be scarified if compacted soils are present. Fertilizer containing phosphorus is prohibited, except when establishing new turf or vegetation on bare soil.
Gravel Access Roads	Inspect access road shoulder for accumulated sand/sediment. Inspect grade on access road and shoulder to ensure stormwater is not impeded by accumulation of materials or false ditches. Inspect access road to ensure that there is no rutting, wash-boarding, frost heaves, potholes, or ponding occurring.	Remove sand/sediment as necessary. Repair grade as necessary. Repair by replacing gravel and re-grading as necessary.

*Inspections are to be performed on a monthly basis with additional follow-up inspections and maintenance as needed.

APPENDIX A-1: BMP INSPECTION & MAINTENANCE CHECKLIST

Central Maine Power Company – Fickett Road Substation
Pownal, Maine

BMP MEASURE	INSPECTION REQUIREMENTS*	MAINTENANCE/CLEANOUT THRESHOLDS
Grassed Underdrained Soil Filter	Inspect entering swale, basin and outlet structure for accumulated sediment, debris and other obstructions.	Clean as needed and dispose of properly.
	Inspect filter for evidence of erosion, gullies, or slumping of the side slopes.	Repair and re-seed as necessary. Consult engineer if problem persists. Areas of persistent erosion may need to be armored.
	Inspect filter for bare ground/sparse vegetation.	Re-seed as necessary. Soil may need to be scarified if filter media becomes compacted.
	Monitor vegetative growth.	Mow vegetation in impoundment to roughly six inches at least once and no more than two times a year. To be performed between June 15th and August 30th. Fertilizer containing phosphorus is prohibited, except when establishing new turf or vegetation on bare soil.
	Test Ball Valve operating nuts and open and close for operability.	Replace ball valve if not in good operating condition.
Crushed Stone Substation Surface	Inspect crushed stone areas for accumulated sand/sediment.	Remove sand/sediment as necessary.
	Inspect substation surface to ensure that there is no ponding occurring.	Repair by re-grading as necessary.

*Inspections are to be performed on a monthly basis with additional follow-up inspections and maintenance as needed.

APPENDIX A-2: BMP INSPECTION & MAINTENANCE LOG

Central Maine Power Company – Fickett Road Substation

Pownal, Maine

BMP MEASURE (Refer to Appendix B-1 & the O&M Plan)	**Inspector(s):**			**Inspection Type:** Monthly [ ] Follow-up [ ]	**Photos Taken:** Yes [ ] No [ ]	**Date:**
VEGETATED SWALES	**YES***	**NO**	**INITIALS**	**OBSERVATIONS**	**CORRECTIVE ACTIONS/REPAIR ACTIVITY**	**DATE COMPLETED & BY WHOM** (Refer to any contractor service logs)
Swale along Northwesterly side of yard						
1. Is there an accumulation of sediment, debris and/or other obstructions?						
2. Is there any evidence of erosion, gullies or slumping of the side slopes?						
3. Are there areas of bare ground or sparse vegetation?						
4. Has vegetation been mowed to a length roughly 6" this year?						
CHECK DAMS						
Check Dams in Swales						
1. Are the edges of the check dams higher than the center?						
2. Is there any evidence of stone displacement, erosion, concentrated flow or channelization?						
3. Is there an accumulation of sediment, debris and/or other obstructions?						

APPENDIX A-2: BMP INSPECTION & MAINTENANCE LOG
Central Maine Power Company – Fickett Road Substation
Pownal, Maine

BMP MEASURE (Refer to Appendix B-1 & the O&M Plan)	**Inspector(s):**			**Inspection Type:** Monthly [ ] Follow-up [ ]	**Photos Taken:** Yes [ ] No [ ]	**Date:**
	YES*	**NO**	**INITIALS**	**OBSERVATIONS**	**CORRECTIVE ACTIONS/REPAIR ACTIVITY**	**DATE COMPLETED & BY WHOM** (Refer to any contractor service logs)
REVEGETATED AREAS						
Revegetated Areas along Access Road						
1. Is there any evidence of erosion, concentrated flow or channelization?						
2. Are there areas of bare ground or sparse vegetation?						
Revegetated Areas on all sides of the station						
1. Is there any evidence of erosion, concentrated flow or channelization?						
2. Are there areas of bare ground or sparse vegetation?						
GRAVEL ACCESS ROADS						
Access Road to Entrance						
1. Is there an accumulation of sand and/or sediment in the road shoulder?						
2. Does the grade across the road section allow stormwater to drain off the roadway?						
3. Are there any signs of rutting, wash-boarding, frost heaves, potholes or ponding?						

APPENDIX A-2: BMP INSPECTION & MAINTENANCE LOG
Central Maine Power Company – Fickett Road Substation
Pownal, Maine

BMP MEASURE (Refer to Appendix B-1 & the O&M Plan)	**Inspector(s):**			**Inspection Type:** Monthly [ ] Follow-up [ ]	**Photos Taken:** Yes [ ] No [ ]	**Date:**
GRASSED UNDERDRAINED SOIL FILTER **West side of station yard and north of Access Road**	**YES***	**NO**	**INITIALS**	**OBSERVATIONS**	**CORRECTIVE ACTIONS/REPAIR ACTIVITY**	**DATE COMPLETED & BY WHOM** (Refer to any contractor service logs)
1. Is there an accumulation of sand and/or sediment in the swale or basin?						
2. Is there any evidence of erosion, gullies or slumping of the side slopes?						
3. Are there areas of bare ground or sparse vegetation?						
4. Is the ball valve clean and operable?						
CRUSHED STONE SUBSTATION SURFACE **Fenced-in area of the Substation and aprons**						
1. Is there an accumulation of sand/sediment in crushed stone areas?						

APPENDIX B – CORRESPONDENCE FROM MEDEP TO CMP

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

JUN 11 2008

JOHN ELIAS BALDACCI
GOVERNOR

DAVID P. LITTELL
COMMISSIONER

June 5, 2008

Roy Koster
Central Maine Power
83 Edison Drive
Augusta, ME 04336

RE: DEP Stormwater Management Regulations and how they apply to Central Maine Power Company Substations and Switchyards

Dear Mr. Koster:

I am writing to provide clarification on how substations and switchyards designed by Central Maine Power Company (CMP) can meet DEP Stormwater Management rules, Chapter 500 and the Site Location of Development Law. This letter supersedes a previous DEP letter on this subject dated February 29, 2008 and is a follow-up to further discussions between CMP and DEP staff.

Based on the report prepared by John Simon of Balance Engineering, dated March 8, 2008, regarding the stormwater runoff coefficient at CMP substations and switchyards, the required gravel fill and surface nature of these structures performs differently than most common construction practices and a modeling variance will be allowed for CMP substations and switchyards as follows:

When Flooding Standard requirements apply to a CMP project, modeling must demonstrate that peak runoff from the substation structure does not exceed predevelopment flow rates at the property line. Because of the permeability plus storage within the gravel fill and roughness of the crushed rock surface, the curve number (CN) specified in John Simon's report (March 2008) may be used for the substation area. As reported, a CN of 55 may be used for substations and switchyards that are built on areas that are mapped as HSG "A", "B", and "C", and a CN of 60 must be used when the area is mapped as HSG "D" for the HydroCAD model. However, all impervious surfaces will have to be added for an averaged curve number.

The General Standards of Chapter 500 (water quality) will be considered as met by the CMP substation/switchyard design specifications as long as the structure includes the typical CMP substation profile overlaying the natural ground surface. The soil layers within the CMP substation profile consist of 4 inches of crushed stone, 50:50 mix of 1.5"

AUGUSTA
17 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0017
(207) 287-7688 FAX: (207) 287-7826
RAY BLDG., HOSPITAL ST.

BANGOR
106 HOGAN ROAD
BANGOR, MAINE 04401
(207) 941-4570 FAX: (207) 941-4584

PORTLAND
312 CANCO ROAD
PORTLAND, MAINE 04103
(207) 822-6300 FAX: (207) 822-6303

PRESQUE ISLE
1235 CENTRAL DRIVE, SKYWAY PARK
PRESQUE ISLE, MAINE 04769-2094
(207) 764-0477 FAX: (207) 760-3143

web site: www.maine.gov/dep

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and 0.75" diameter stone overlaying 18 inches or more of gravel fill, MDOT 703.06 Type A. Saturation within the granular fill will detain and provide treatment for the one-inch design standard under that requirement. Groundwater can never be any higher than 18 inches below the top of the gravel fill. Other treatment considerations will need to be provided for all impervious structures anticipated on the substation and switchyard and for the roadway.

The Basic Standards of Chapter 500 (erosion and sedimentation control, inspection and maintenance, and housekeeping) will be met by the standard CMP substation and switchyard design specification and erosion control/construction plan as developed by CMP for each Stormwater Management application. These are minimum erosion control measures that will need to be maintained until the site is fully stabilized. However, based on site and weather conditions during construction, additional erosion control measures may be needed.

While there are several ways to approach the design standards discussed above, these must be considered the minimum requirements in meeting the Stormwater Management and Site Location of Development Laws. However, in some situations where the local hydrology and site conditions warrant more resource protection, additional BMPs may be required. Also, the access drive and associated roadside swales are included in the disturbed area for permitting purposes and the treatment of these areas must be addressed separately from the substation or switchyard and be treated with standard practices. The natural hydrology of these areas will need to be maintained and will have to meet all applicable standards as established in Chapter 500 (page 11, Section 5).

I hope this addresses your request and will make the DEP permitting process more straight forward. If you have further questions, please contact Marianne Hubert at (207) 287-4140.

Sincerely,

Don Witherill, Director
Watershed Management Division
Bureau of Land and Water Quality

Cc: Marianne Hubert, PE, DEP program manager
Andy Fisk, DEP L&W Bureau Director
Dan Butler, PE, TRC
Gerry Mirabile, CMP

From: Gungor, Kerem [mailto:Kerem.Gungor@maine.gov]
Sent: Wednesday, August 23, 2017 1:57 PM
To: Volock, Kenny
Subject: RE: CMP Substation Yard Treatment Clarifications

Hi Kenny,

Here are my answers:

Is there a point at which we can no longer consider the concrete and roof area within a substation to be treated through the 4" stone and 18" MDOT Type "A" gravel station yard section?

I took into account the storage volume provided by the underlying 18" gravel layer for Coopers Mill substation minor revision I reviewed. Same approach can be followed for NECEC:

Storage Volume Provided for Treatment (cf) = (Substation Yard Area excluding the impervious surfaces (sf)) x 2 ft x 0.3 (assumed porosity for the substation yard profile)

Storage Volume Required for the Treatment of the Impervious Surfaces (cf) = Impervious surface (i.e. concrete, roof) (sf) x (1/12) (ft) (one-inch storage requirement for the impervious surfaces)

Therefore, one unit area of stone yard can treat up to 7 unit areas of impervious area (I would recommend staying on the conservative side, not going this far). You do not need to provide additional treatment for the roof at Merrill Road substation.

How is the station yard section considered when it comes to phosphorous treatment?
Considering the storage volume and structure of the station yard, I would use the minimum treatment factor, **0.1** as given for the infiltration measures in **Table 4.1** of the Phosphorus Control Manual. For the concrete surfaces and roof, you can use the export factor of **0.5 lb/ac/yr**. For the substation yard, the export factor of **0.3 lb/ac/yr** can be used.
Please let me know if you have any more questions.
Best,

Kerem Gungor, Ph.D., P.E.
Environmental Engineer, Central Maine Region
Bureau of Land Resources | Land Division
Maine Department of Environmental Protection
(207) 446-3915 | kerem.gungor@maine.gov

From: kenny.volock@powereng.com [mailto:kenny.volock@powereng.com]
Sent: Wednesday, August 23, 2017 12:03 PM
To: Gungor, Kerem
Subject: CMP Substation Yard Treatment Clarifications

Kerem,

Thank you for your input regarding stormwater management and erosion control during the NECEC Pre-Application last Thursday. I do have a couple follow-up questions that I would like some clarification on:

Is there a point at which we can no longer consider the concrete and roof area within a substation to be treated through the 4" stone and 18" MDOT Type "A" gravel station yard section?

Since we typically call for 6" of stone, I've always assumed the extra 2" of stone is what provided the additional water quality volume for the roof and concrete areas. Depending on what you use for porosity of the stone (0.3 to 0.4), you would have 0.6" to 0.8" available, enough for 0.6 acres to 0.8 acres of roof/concrete per acre of stone yard. This equates to 37.5% to 44.4% roof/concrete area.

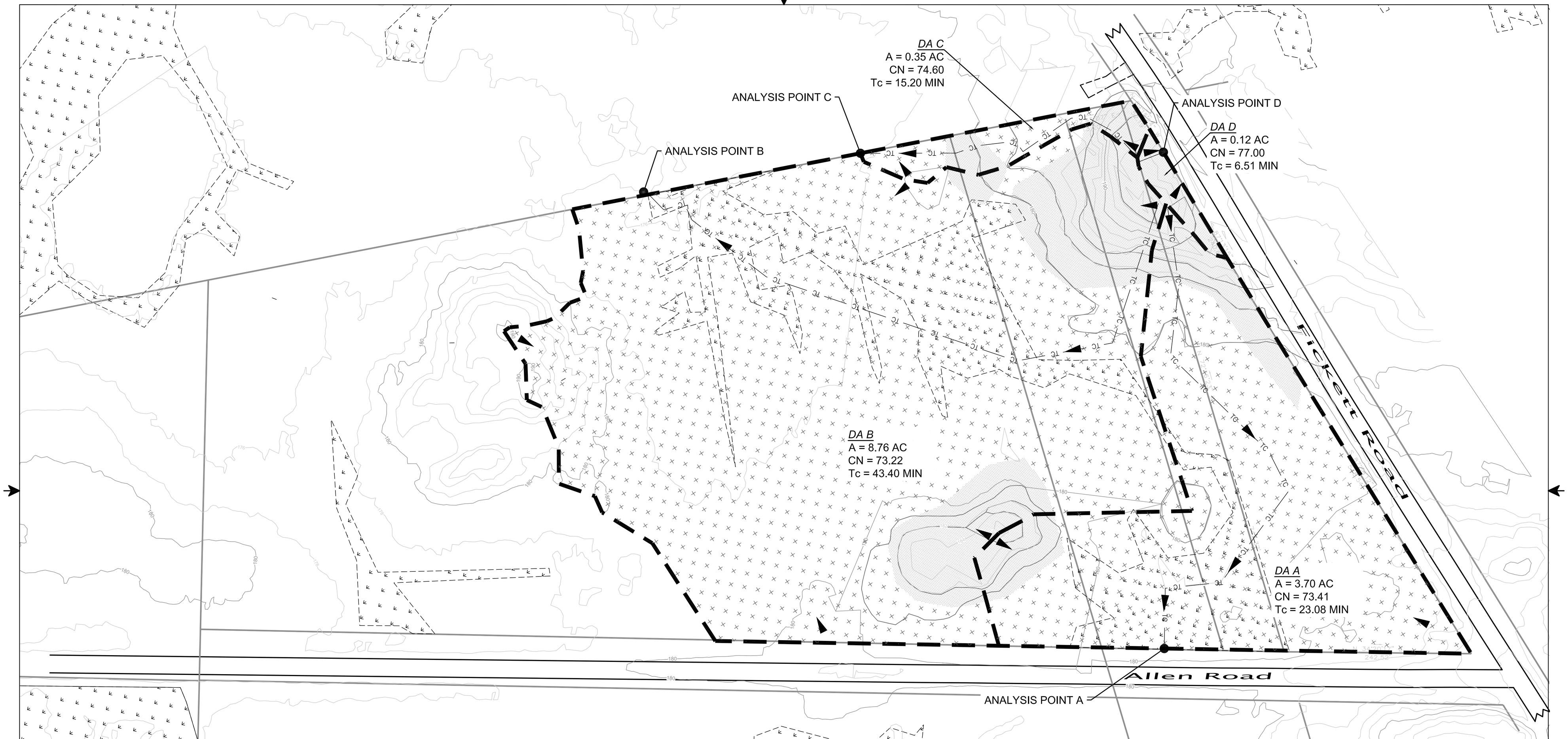
A typical substation yard has only around 2% to 5% roof/concrete area, so it is negligible. However, at Merrill Road, with a very large building, that percentage could approach 30%. I would like to know, prior to submission, if we will be able to consider the runoff from the building roof as treated by the yard, or if we will need to make separate provisions.

How is the station yard section considered when it comes to phosphorous treatment?

The 2008 letter from MeDEP to CMP discusses the Flooding and General Standards, but does not discuss the Phosphorous Standard. Can we assume the yard to have the same base treatment factor of 0.4 as the other BMPs? Or is there some other base treatment factor we should be using?

Any input you could provide in resolving these two outstanding issues would be greatly appreciated.

APPENDIX C – STORMWATER COMPUTATIONS



LEGEND

- 750 — EX. MAJOR CONTOUR
- 744 — EX. MINOR CONTOUR
- TC — EX. TIME OF CONCENTRATION
- EX. SOIL BOUNDARY *
- EX. OVERHEAD UTILITY
- EX. FLOW DIRECTION ARROW
- EX. DRAINAGE BOUNDARY
- EX. PROPERTY BOUNDARY
- EX. WETLAND
- ANALYSIS POINT

* SITE IS ENTIRELY HSG TYPE D SOILS

- EX. BRUSH
- EX. WOODS

EXISTING CONDITIONS HYDRAULIC SUMMARY			
DRAINAGE AREA	2 - YEAR FLOW RATE (CFS)	10 - YEAR FLOW RATE (CFS)	25 - YEAR FLOW RATE (CFS)
A	2.25	5.70	7.51
B	3.98	10.12	13.36
C	0.27	0.66	0.86
D	0.13	0.30	0.38

0 60 120 Feet

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION 05/29/18

REV.	DESCRIPTION	DATE	BY	CK	APP

OWNER ENGINEER:
APPROVAL STAMP:
PE Stamp
DRAWING PREPARED BY:
ACCEPTED BY OE:

IUSA ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of Iberdrola, USA

CMP IBERDROLA - USA

REV.	DATE	BY	DESCRIPTION	APP.

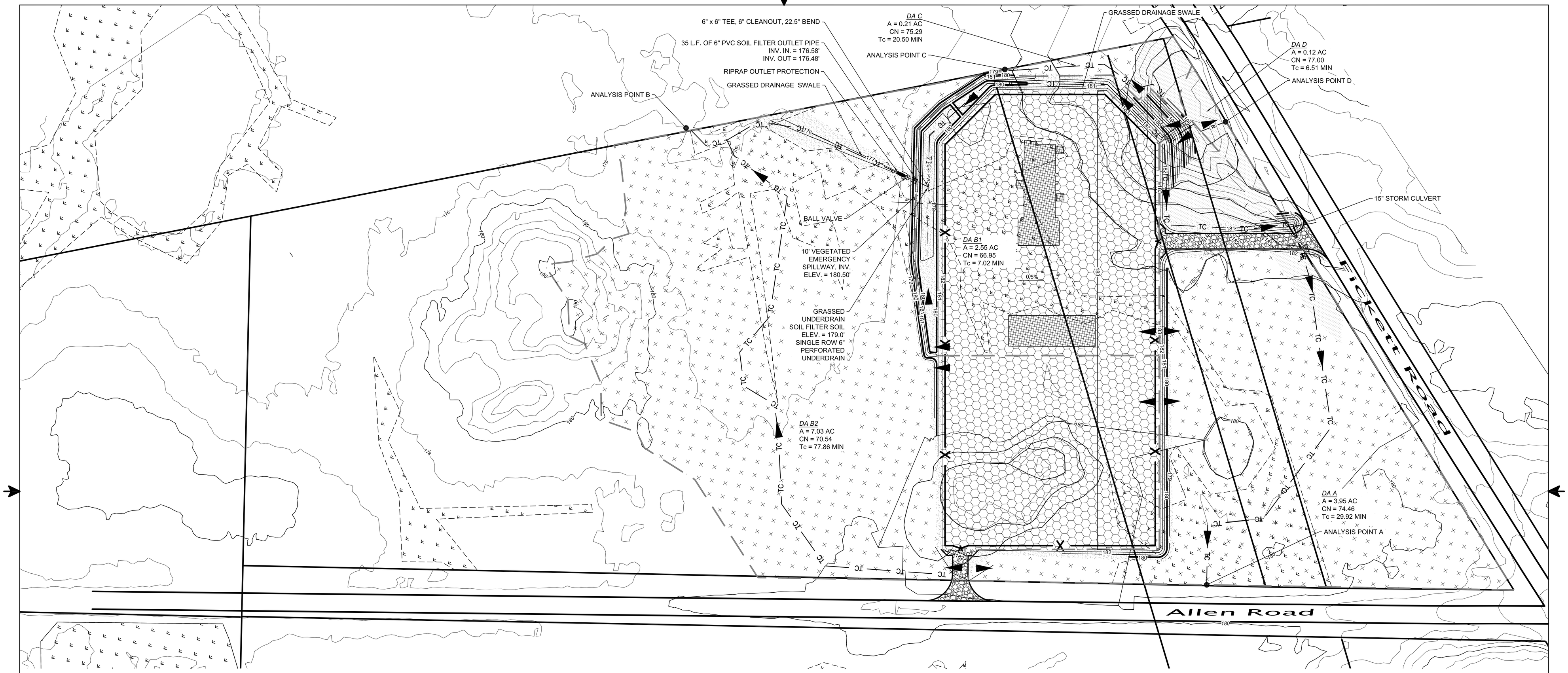
PRE-DEVELOPMENT STORMWATER PLAN

SH 2 OF 3

FICKETT ROAD/1077 POWNAL, ME

DR.	TJG	SCALE: 1" = 60'	FILE: 1077-003-003SH002.DWG
CK.	KRV	NO.	REV.
APP.		1077-003-003	A
DATE:			

ANSI D CADD Drawing, DO NOT REVISE MANUALLY.



LEGEND

- 750 — EX. MAJOR CONTOUR
- 744 — EX. MINOR CONTOUR
- EX. SOIL BOUNDARY *
- EX. OVERHEAD UTILITY
- EX. PROPERTY BOUNDARY
- EX. WETLAND
- 750 — PROP. MAJOR CONTOUR
- 744 — PROP. MINOR CONTOUR
- TC — PROP. TIME OF CONCENTRATION
- PROP. FLOW DIRECTION ARROW
- PROP. DRAINAGE BOUNDARY
- ANALYSIS POINT
- PROP. CULVERT/PIPING

* SITE IS ENTIRELY HSG TYPE D SOILS

- EX. WOODS
- EX. BRUSH
- PROP. DEVELOPED GRASS/LANDSCAPE
- PROP. IMPERVIOUS SURFACE/ROOF
- PROP. STONE PAD
- PROP. GRAVEL ACCESS ROAD

PROPOSED CONDITIONS HYDRAULIC SUMMARY

DRAINAGE AREA	2 - YEAR FLOW RATE (CFS)	10 - YEAR FLOW RATE (CFS)	25 - YEAR FLOW RATE (CFS)	PEAK 2 - YEAR FLOW RATE AT OUTFALL (IF SUBSHEDS PRESENT)	PEAK 10 - YEAR FLOW RATE AT OUTFALL (IF SUBSHEDS PRESENT)	PEAK 25 - YEAR FLOW RATE AT OUTFALL (IF SUBSHEDS PRESENT)
A	2.33	5.71	7.47	N/A	N/A	N/A
B1	1.30	4.05	5.55	2.06	5.73	7.71
B2	1.84	5.14	6.91			
C	0.15	0.37	0.48	N/A	N/A	N/A
D	0.13	0.30	0.38	N/A	N/A	N/A

STORMWATER TREATMENT REQUIREMENTS (% OF TREATED AREA)

LAND TYPE	STATION	STATION % TREATED
IMPERVIOUS TOTAL	3.90 AC	96.15%
IMPERVIOUS TREATED	3.75 AC	
DEVELOPED TOTAL*	4.87 AC	85.83%
DEVELOPED TREATED	4.18 AC	

*DEVELOPED AREA INCLUDES BOTH IMPERVIOUS AND LANDSCAPED SURFACES

STORMWATER TREATMENT FOR PHOSPHOROUS STANDARD

CONDITION	PHOSPHOROUS EXPORT LOAD (LBS P/YEAR)
PROJECT PHOSPHOROUS BUDGET	0.51
PRE-TREATMENT ALGAL AV. P EXPORT	1.65
POST-TREATMENT ALGAL AV. P EXPORT	0.45

0 120 240 Feet

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION 05/29/18

REV.	DESCRIPTION	DATE	BY	CK	APP
B	MEDEP PERMIT SET COMMENT REVISIONS	05/29/18	TJG	KRV	

OWNER ENGINEER:
APPROVAL STAMP:
PE Stamp
DRAWING PREPARED BY:
ACCEPTED BY OE:

IUSA ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of Iberdrola, USA

CMP IBERDROLA - USA

REV.	DATE	BY	DESCRIPTION	APP.

POST-DEVELOPMENT STORMWATER PLAN

SH 3 OF 3

FICKETT ROAD/1077 POWNAL, ME

DR. TJG | SCALE: 1" = 60' | FILE: 1077-003-003SH003.DWG
CK. KRV | NO. 1077-003-003 | REV. B
APP.
DATE:

ANSI D CADD Drawing, DO NOT REVISE MANUALLY.

Worksheet 1 - PPB calculations

Project Name:	**Fickett Road Substation**			
Lake Watershed:	**Runaround Pond**			
Town: Durham				
Standard Calculations				
Watershed per acre phosphorus budget (Appendix C)		**PAPB**	0.03	lbs P/acre/year
Total acreage of development parcel:		**TA**	19.61	acres
NWI wetland acreage:		**WA**	2.41	acres
Steep slope acreage:		**SA**	0.17	acres
Project acreage: A = TA - (WA+ SA)		**A**	17.03	acres
Project Phosphorus Budget: PPB = P x A		**PPB**	0.51	**lbs P/year**
Small Watershed Adjustment				
If Project Acreage (A) is greater than the threshold acreage for the small watershed threshold (SWT, from pertinent lake and town info in the table in Appendix C), calculate an alternative PPB using the analysis below and use this value if it is less than the the Standard Calculation PPB.				
Small Watershed Threshold (Appendix C):		**SWT**	N/A	acres
Project acreage:		**A**	N/A	acres
Allowable increase in town's share of annual phosphorus load to lake (Appendix C):		**FC**	N/A	lbs P/year
Area available for development (Appendix C):		**AAD**	N/A	acres
Ratio of A to AAD (R=A/AAD)		**R**	N/A	
Project Phosphorus Budget				
If R < 0.5,	PPB = [(FC x R)/2] + [FC/4]	**PPB**	N/A	**lbs P/year**
If R> 0.5,	PPB = FC x R	**PPB**	N/A	**lbs P/year**

Worksheet 2
Pre-PPE and Post-PPE Calculations

Calculate phosphorus export from development for before and after treatment
Use as many sheets as needed for each development type (commercial, roads, residential lots, etc.)

Project name: Fickett Substation **Development type**: ___Commercial_____ Sheet # _____

Land Surface Type or Lot #(s) with description	Acres or # of lots	Export Coefficient from Table 3.1 Table 3.2	Pre-treatment Algal Av. P Export (lbs P/year)	Treatment Factor for BMP(s) from Chapter 6	Post-treatment Algal Av. P Export (lbs P/year)	Description of BMPs
Impervious Roofs	0.24	0.5	0.12	0.1	0.01	Stone yard to Soil Filter
Stone Station Pad	1.58	0.3	0.47	0.1	0.05	Stone Yard
Concrete Foundations	0.05	0.5	0.03	0.1	0.00	Stone Yard
Stone Station Pad to Soil Filter	1.88	0.3	0.56	0.1	0.06	Stone yard to Soil Filter
Gravel Road Outside Station	0.15	0.5	0.08	1	0.08	N/A
Landscaped Treated	0.43	0.4	0.17	0.25	0.04	Soil Filter
Landscaped Untreated	0.54	0.4	0.22	1	0.22	N/A
		Total Pre-PPE (lbs P/year)	1.65	**Total PostPPE (lbs P/year)**	0.45	

WORKSHEET 4 - PROJECT PHOSPHORUS EXPORT SUMMARY

Summarizing the project's algal available phosphorus export (PPE)

Project Name: Fickett Road Substation

Project Phosphorus Budget - Worksheet 1	**PPB**	0.51	lbs P/year
Total Pre-Treatment Phosphorus Export - Worksheet 2	**Pre-PPE**	1.65	lbs P/year
Total Post-Treatment Phosphorus Export - Worksheet 2	**Post-PPE**	0.45	lbs P/year
Total Phosphorus Mitigation Credit - Worksheet 3	**TMC**	0.00	lbs P/year
Project Phosphorus Export (Post-PPE - TMC)	**PPE**	0.45	lbs P/year

Is the Project Phosphorus Export ≤ the Project Phosphorus Budget? (PPE≤PPB)

*If **YES**, PPE is less than or equal to PPB and the project meets its phosphorus budget .* *If **NO,** PPE is greater than PPB, more reduction in phosphorus export is required or the payment of a compensation fee may be an option*	YES
The amount of phosphorus that needs further treatment or compensation	lbs P/year

Has Project Phosphorus Export been sufficiently reduced?
Is (Pre-PPE - Post-PPE)/Pre-PPE greater than 0.60?

*If **YES**, in some watersheds the compensation fee is an available option.* *If **NO**, more treatment must be provided. PPE must be further reduced.*	
*The post-treatment phosphorus export must be less than 40% of the pre-treatment export (Post-PPE < 0.4*Pre-PPE)*	%

If the project is located in a watershed that is eligible for a compensation fee (or is a residential subdivision with buffers), a compensation fee may be appropriate as follows:

If Project Export has been reduced by greater than 60% and less than 75%, $25,000 per pound minus $833 per 1% Percent Export	
If Project Export has been reduced by greater than 75%, $12,500 per pound minus $500 per 1% Project Export	

Calculations for Grassed Underdrain Soil Filter							
*Based upon MeDEP Stormwater BMPs Chapter 7.1 - Grassed Underdrain Soil Filters and Phosphorus Control Manual							
Land Type	Area (AC.)	BMP_{ST} = WQv Required, General Standard[1], (CU.FT.)	Treatment Factor (TF)[2]	BMP_{TF} = WQv Required, Phosphorus Standard + General Standard[3], (CU.FT.)	WQv Required[4], BMP_{TF} - BMP_{ST}, (CU.FT.)	Total WQv Required (Impervious and Pervious) (CU.FT.)	WQv Provided[5] @ 18" Depth, (CU.FT.)
Impervious Catchment	2.07	7,514.10	0.25	12,022.56	4,508.46	5,507.44	8,354.00
Pervious Developed Catchment	0.43	624.36	0.25	998.98	998.98		

[1] The General Standard has been met by providing the required BMP_{ST} Water Quality volume within the MeDEP approved station pad stone section.

[2] The Treatment Factor used to upsize the required Stanard Treatment volume in order to meet the Phosphorous Standard.

[3] The Water Quality volume required to meet the General and Phosphorous Standards, calculated using the Maine Storm Water Management Design Manual - Phosphorus Control Manual, Section 4.3: BMP_{TF}=0.4*(BMP_{ST}/TF)

[4] The Water Quality volume required to meet the Phosphorouse Standard for areas where the General Standard has already been met within the MeDEP approved station pad stone section.

[5] Flow rate for ball valve to detain WQv over 36 hour period = 8,354CF * 7.48GAL/CF / (36HR*60MIN/HR) = 29 GPM. Flow rate ranges between 22 - 43 GPM for detention times between 24 - 48 HR.

Orifice Sizing, Ball Valve						
WQv Required (CF)	Detention Time (HR)	Flow Rate (CFS)	Average Head (FT)	Orifice Coefficient	Orifice Area (SF)	Orifice Diameter (IN)[3]
8354	36	0.064459877	1.96	0.614	0.009344372	1.308914774

[3] Equivalent Ball Valve Opening = 1/4 Turn

Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Sep 13 2017

Circular Culvert

Invert Elev Dn (ft)	=	180.55
Pipe Length (ft)	=	45.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	181.00
Rise (in)	=	15.0
Shape	=	Circular
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
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

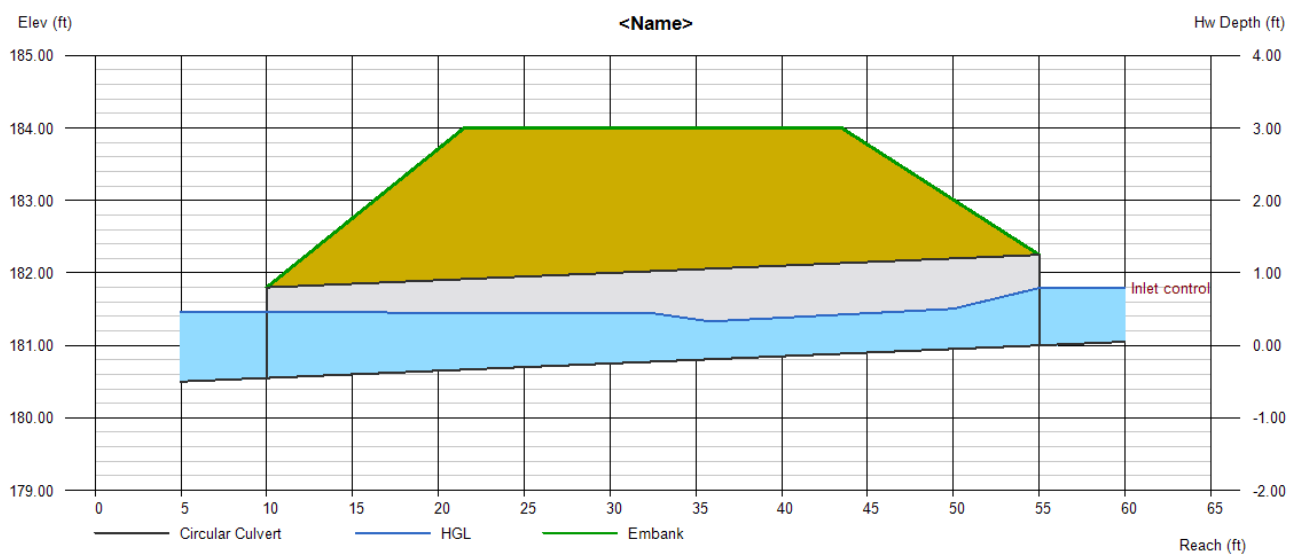
Top Elevation (ft)	=	184.00
Top Width (ft)	=	22.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	2.03
Qmax (cfs)	=	2.03
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	2.03
Qpipe (cfs)	=	2.03
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.12
Veloc Up (ft/s)	=	3.75
HGL Dn (ft)	=	181.46
HGL Up (ft)	=	181.57
Hw Elev (ft)	=	181.79
Hw/D (ft)	=	0.63
Flow Regime	=	Inlet Control



Project Description

File Name ..... Existing Conditions.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Aug 10, 2017 00:00:00
End Analysis On ..... Aug 11, 2017 00:00:00
Start Reporting On ..... Aug 10, 2017 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	4
Nodes	4
Junctions	0
Outfalls	4
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-02	Cumulative	inches	Maine	Cumberland (Southeast)	2	3.00	SCS Type III 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
A	3.70	73.41	3.00	0.88	3.25	2.25	0 00:23:04
B	8.76	73.22	3.00	0.87	7.61	3.98	0 00:43:24
C	0.35	74.60	3.00	0.94	0.33	0.27	0 00:15:12
D	0.12	77.00	3.00	1.07	0.13	0.13	0 00:06:30

Subbasin Hydrology

Subbasin : A

Input Data

Area (ac) 3.70
Weighted Curve Number 73.41
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.38	D	77.00
Brush, Good	3.32	D	73.00
Composite Area & Weighted CN	3.70		73.41

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	14.36	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	13.94	0.00	0.00

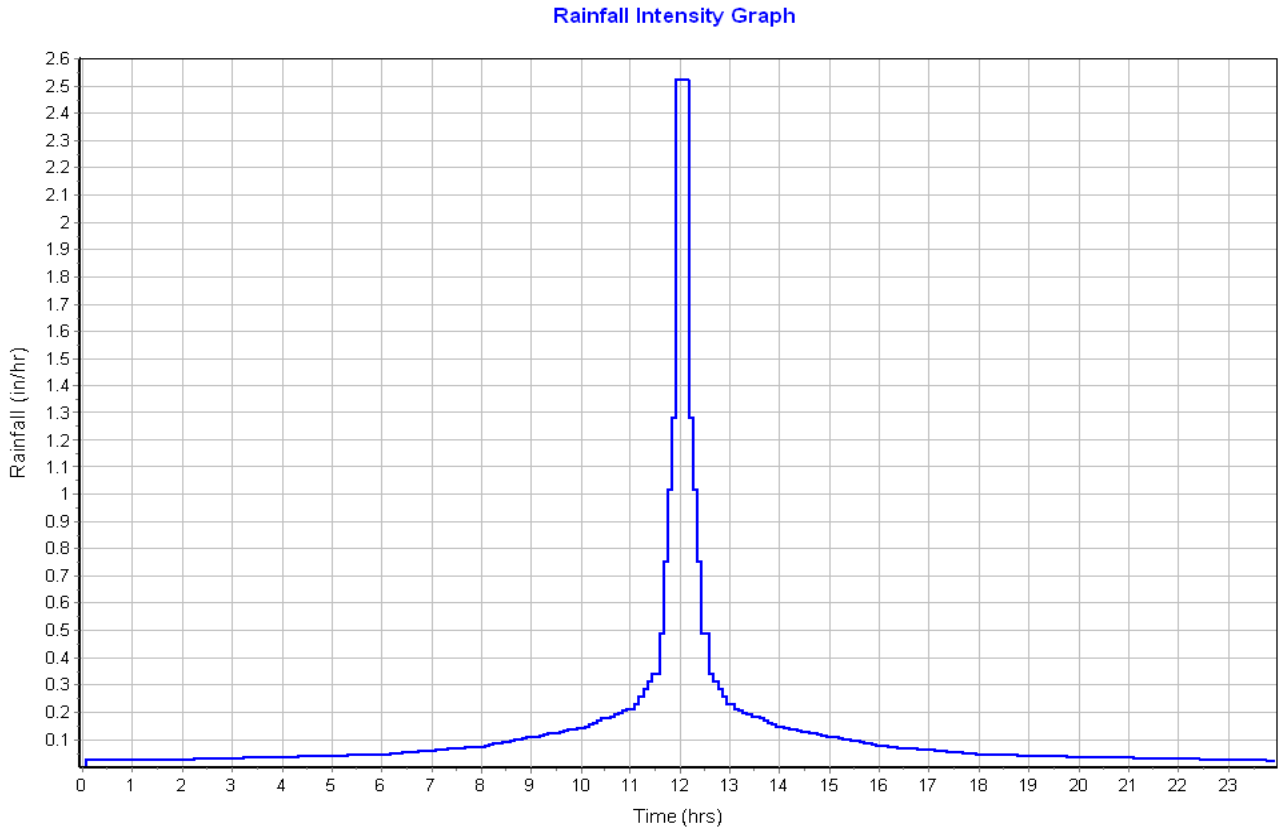
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	625	0.00	0.00
Slope (%) :	.582	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	1.14	0.00	0.00
Computed Flow Time (min) :	9.14	0.00	0.00

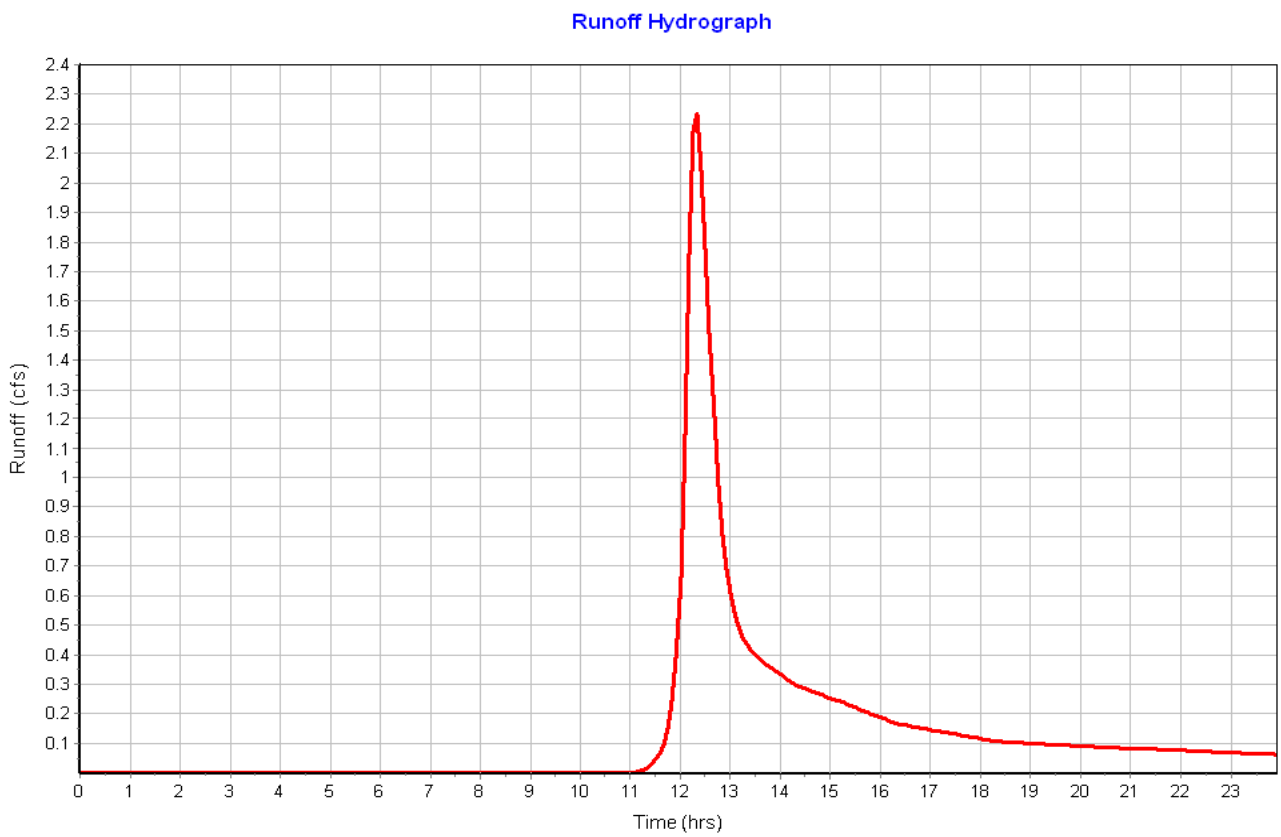
Total TOC (min) 23.08

Subbasin Runoff Results

Total Rainfall (in) 3.00
Total Runoff (in) 0.88
Peak Runoff (cfs) 2.25
Weighted Curve Number 73.41
Time of Concentration (days hh:mm:ss) 0 00:23:05

Subbasin : A


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B

Input Data

Area (ac) 8.76
Weighted Curve Number 73.22
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Brush, Good	8.27	D	73.00
Woods, Good	0.49	D	77.00
Composite Area & Weighted CN	8.76		73.22

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	4.25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	22.69	0.00	0.00

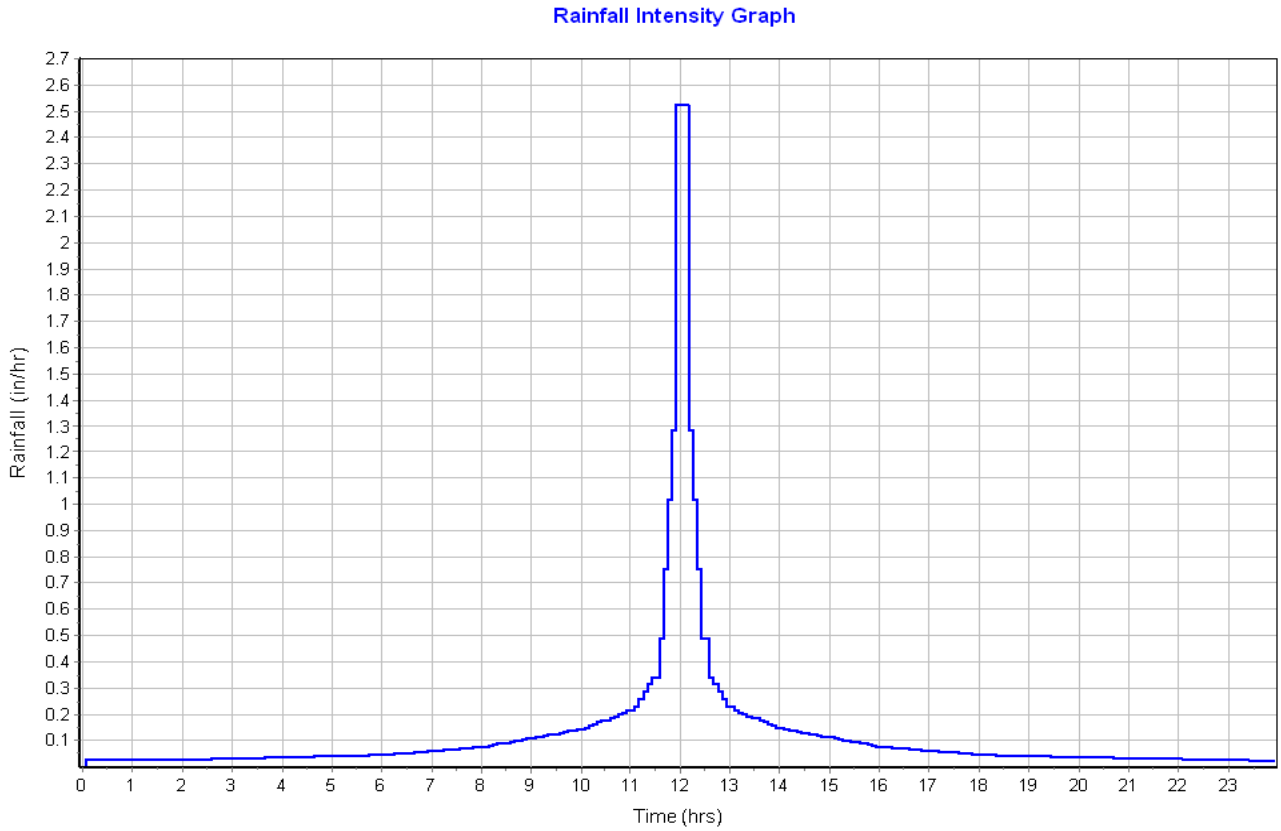
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	758	0.00	0.00
Slope (%) :	.758	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	0.61	0.00	0.00
Computed Flow Time (min) :	20.71	0.00	0.00

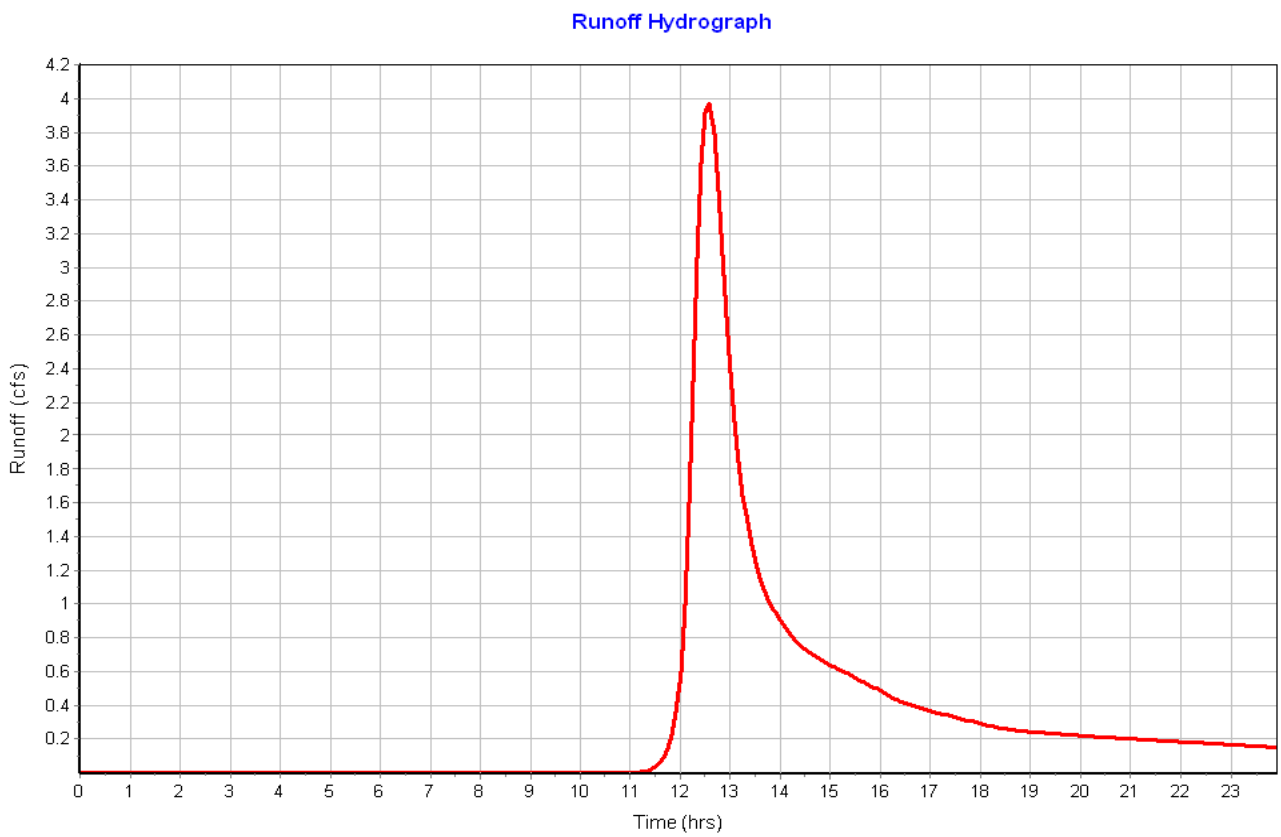
Total TOC (min) 43.40

Subbasin Runoff Results

Total Rainfall (in) 3.00
Total Runoff (in) 0.87
Peak Runoff (cfs) 3.98
Weighted Curve Number 73.22
Time of Concentration (days hh:mm:ss) 0 00:43:24

Subbasin : B


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C

Input Data

Area (ac) 0.35
Weighted Curve Number 74.60
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.03	D	77.00
Woods, Good	0.04	D	77.00
Brush, Good	0.08	D	73.00
Brush, Good	0.13	D	73.00
Woods, Good	0.07	D	77.00
Composite Area & Weighted CN	0.35		74.60

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	87	0.00	0.00
Slope (%) :	10.35	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.14	0.00	0.00
Computed Flow Time (min) :	10.28	0.00	0.00

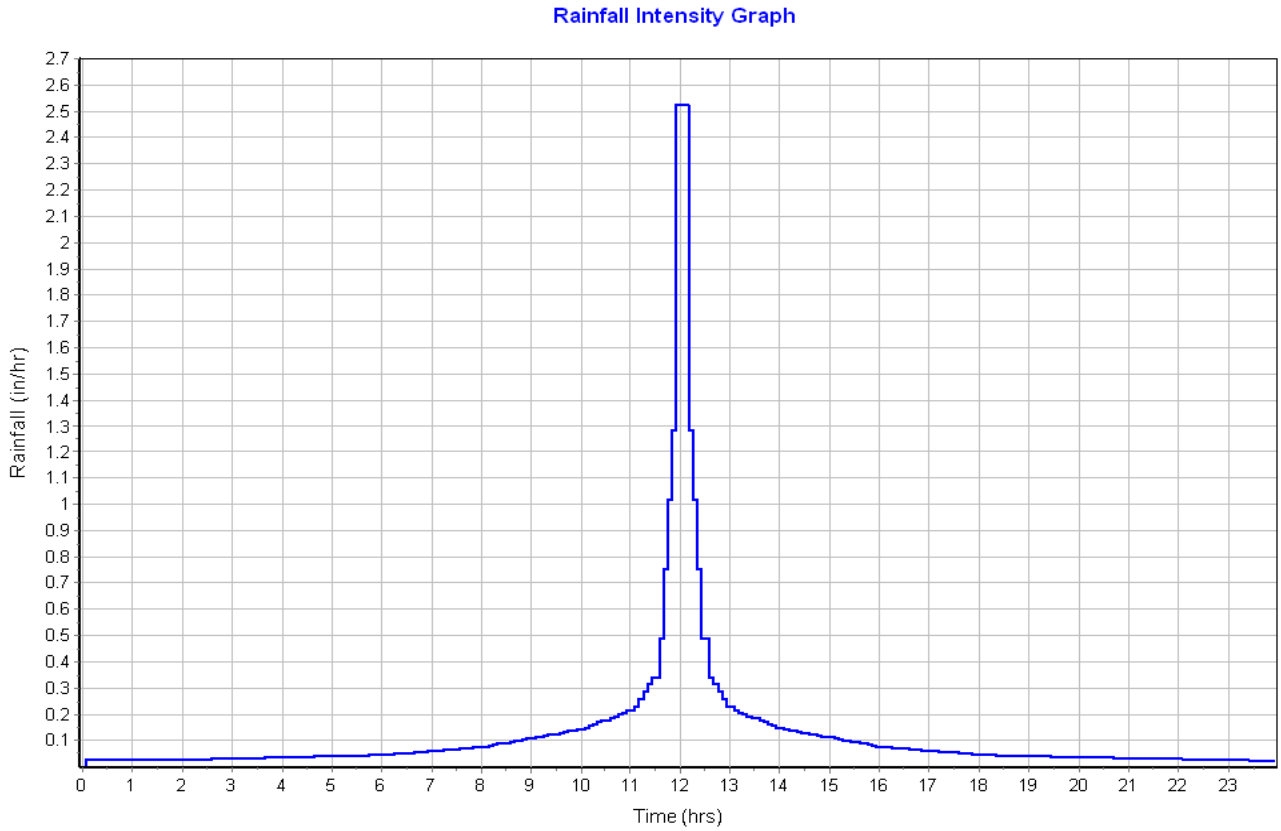
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	313	0.00	0.00
Slope (%) :	2.3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.06	0.00	0.00
Computed Flow Time (min) :	4.92	0.00	0.00

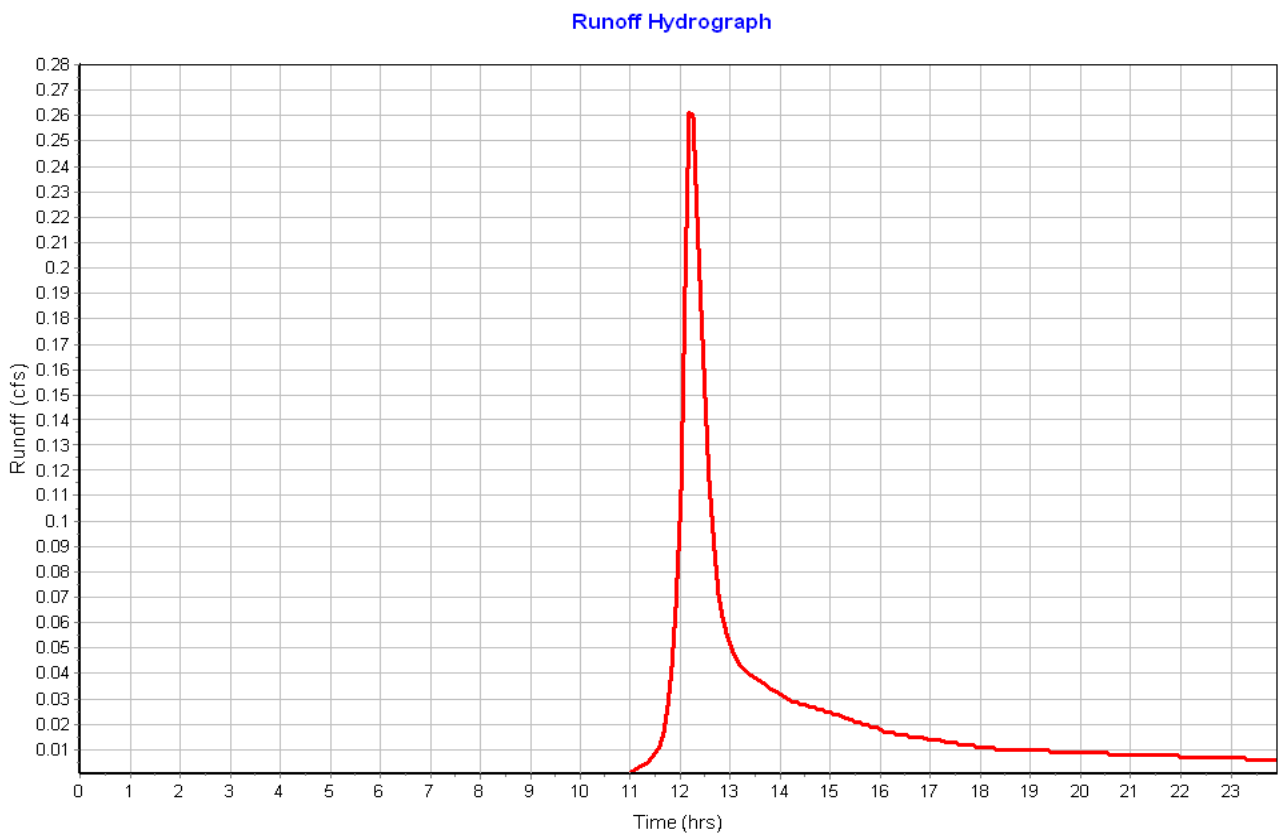
Total TOC (min) 15.20

Subbasin Runoff Results

Total Rainfall (in) 3.00
Total Runoff (in) 0.94
Peak Runoff (cfs) 0.27
Weighted Curve Number 74.60
Time of Concentration (days hh:mm:ss) 0 00:15:12

Subbasin : C


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : D

Input Data

Area (ac) 0.12
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.12	D	77.00
Composite Area & Weighted CN	0.12		77.00

Time of Concentration

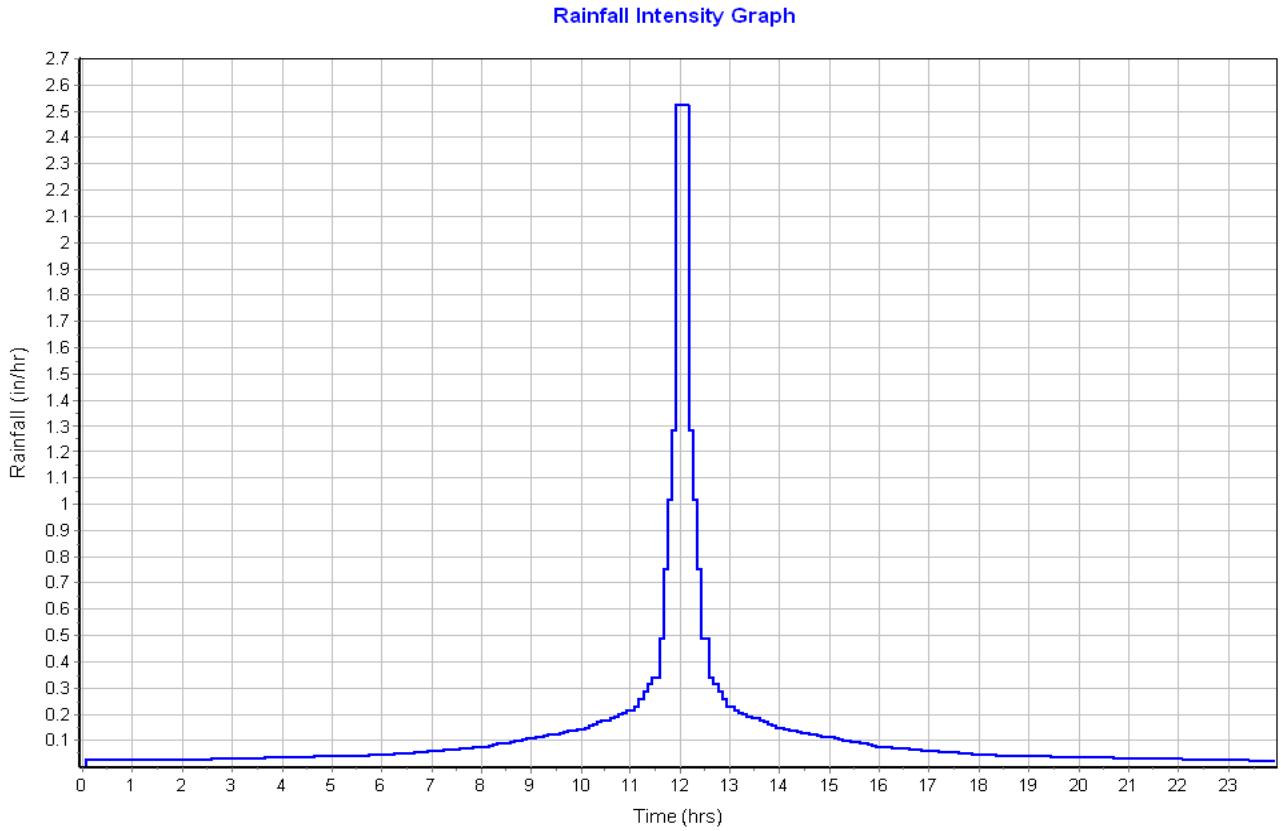
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	36	0.00	0.00
Slope (%) :	5.55	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.09	0.00	0.00
Computed Flow Time (min) :	6.51	0.00	0.00

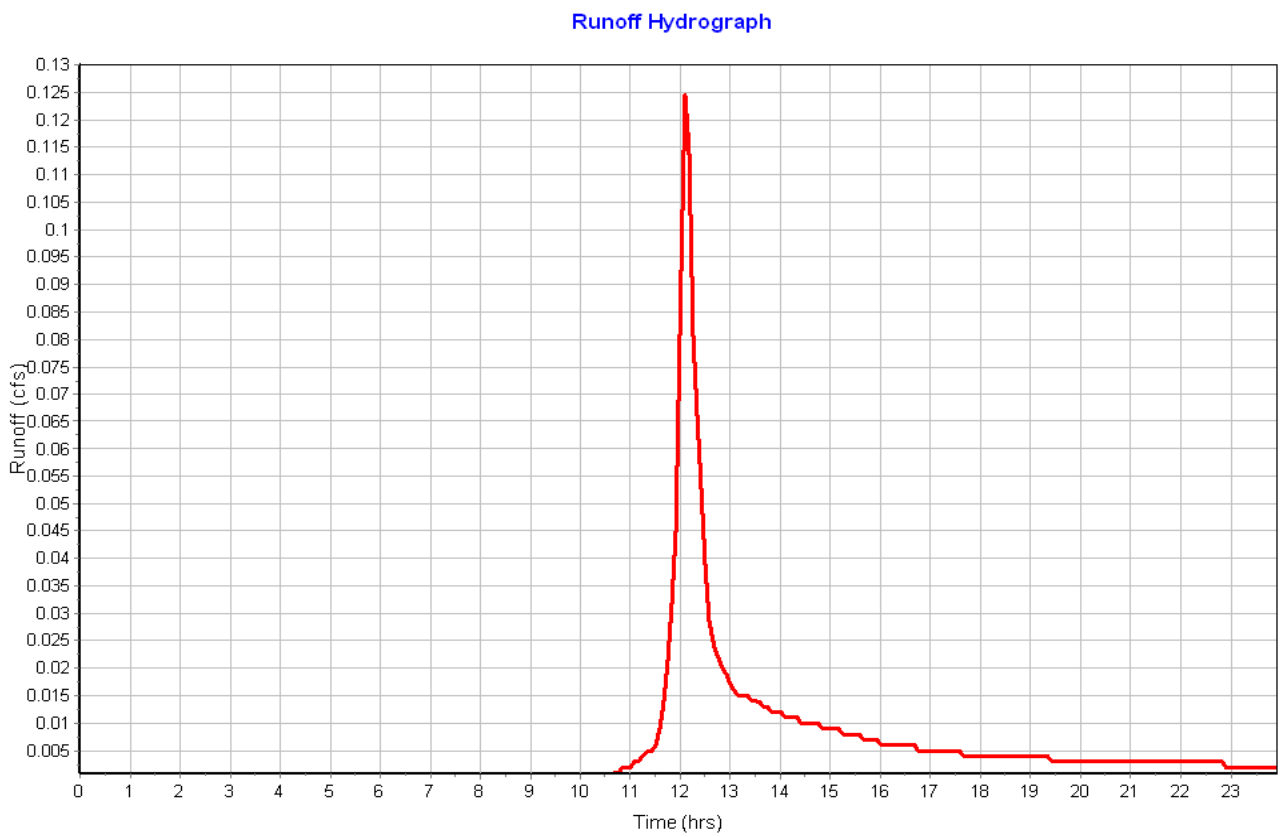
Total TOC (min) 6.51

Subbasin Runoff Results

Total Rainfall (in) 3.00
Total Runoff (in) 1.07
Peak Runoff (cfs) 0.13
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:06:31

Subbasin : D


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Project Description

File Name ..... Existing Conditions.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Aug 10, 2017 00:00:00
End Analysis On ..... Aug 11, 2017 00:00:00
Start Reporting On ..... Aug 10, 2017 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	4
Nodes	4
Junctions	0
Outfalls	4
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-10	Cumulative	inches	Maine	Cumberland (Southeast)	10	4.70	SCS Type III 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
A	3.70	73.41	4.70	2.08	7.70	5.70	0 00:23:04
B	8.76	73.22	4.70	2.07	18.10	10.12	0 00:43:24
C	0.35	74.60	4.70	2.18	0.76	0.66	0 00:15:12
D	0.12	77.00	4.70	2.37	0.28	0.30	0 00:06:30

Subbasin Hydrology

Subbasin : A

Input Data

Area (ac) 3.70
Weighted Curve Number 73.41
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.38	D	77.00
Brush, Good	3.32	D	73.00
Composite Area & Weighted CN	3.70		73.41

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	14.36	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	13.94	0.00	0.00

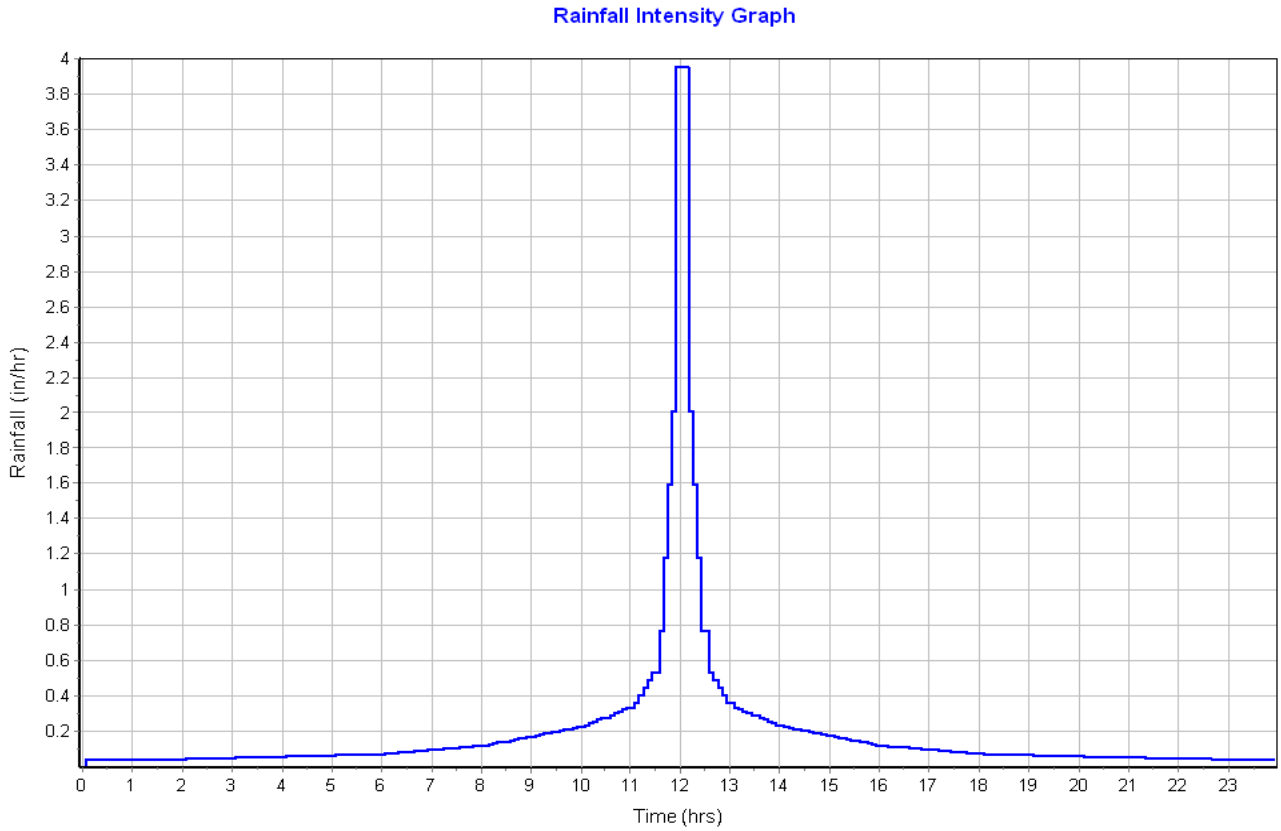
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	625	0.00	0.00
Slope (%) :	.582	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	1.14	0.00	0.00
Computed Flow Time (min) :	9.14	0.00	0.00

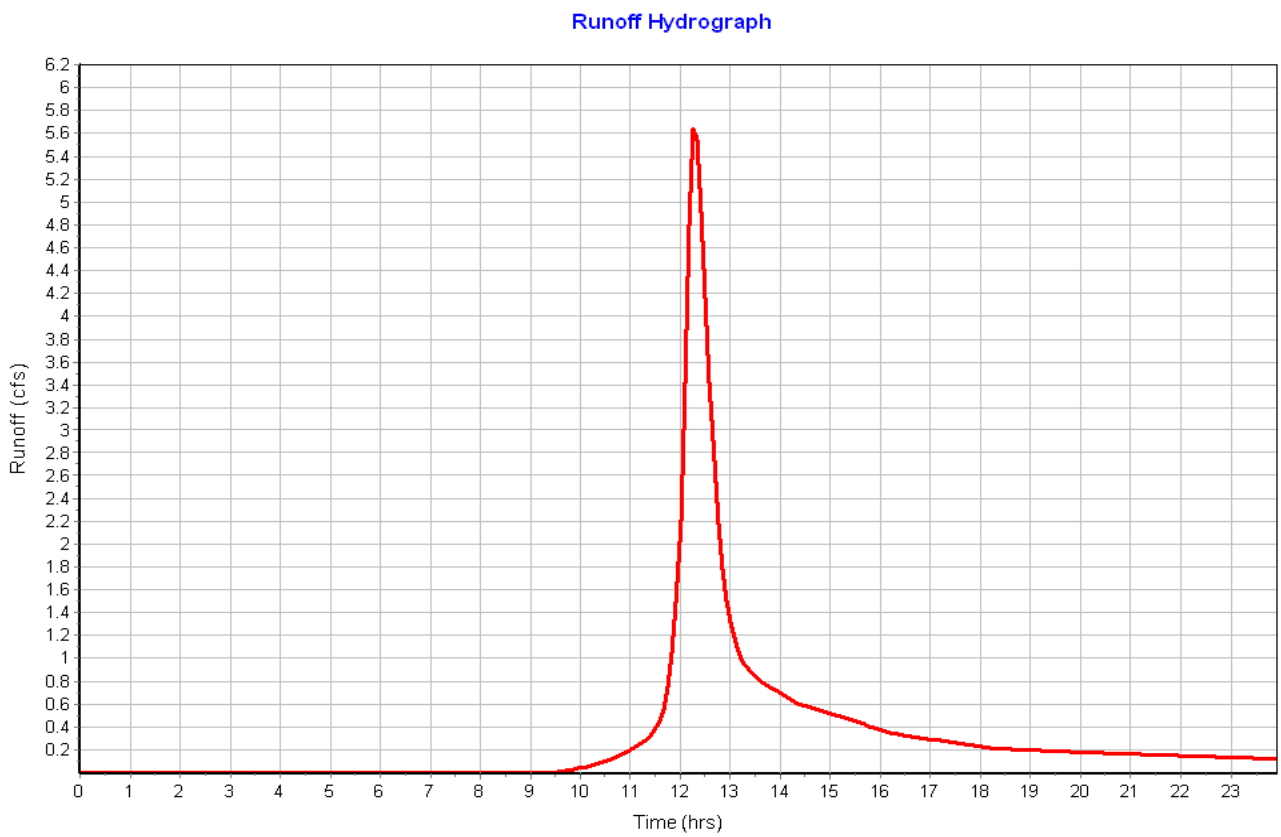
Total TOC (min) 23.08

Subbasin Runoff Results

Total Rainfall (in) 4.70
Total Runoff (in) 2.08
Peak Runoff (cfs) 5.70
Weighted Curve Number 73.41
Time of Concentration (days hh:mm:ss) 0 00:23:05

Subbasin : A


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B

Input Data

Area (ac) 8.76
Weighted Curve Number 73.22
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Brush, Good	8.27	D	73.00
Woods, Good	0.49	D	77.00
Composite Area & Weighted CN	8.76		73.22

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	4.25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	22.69	0.00	0.00

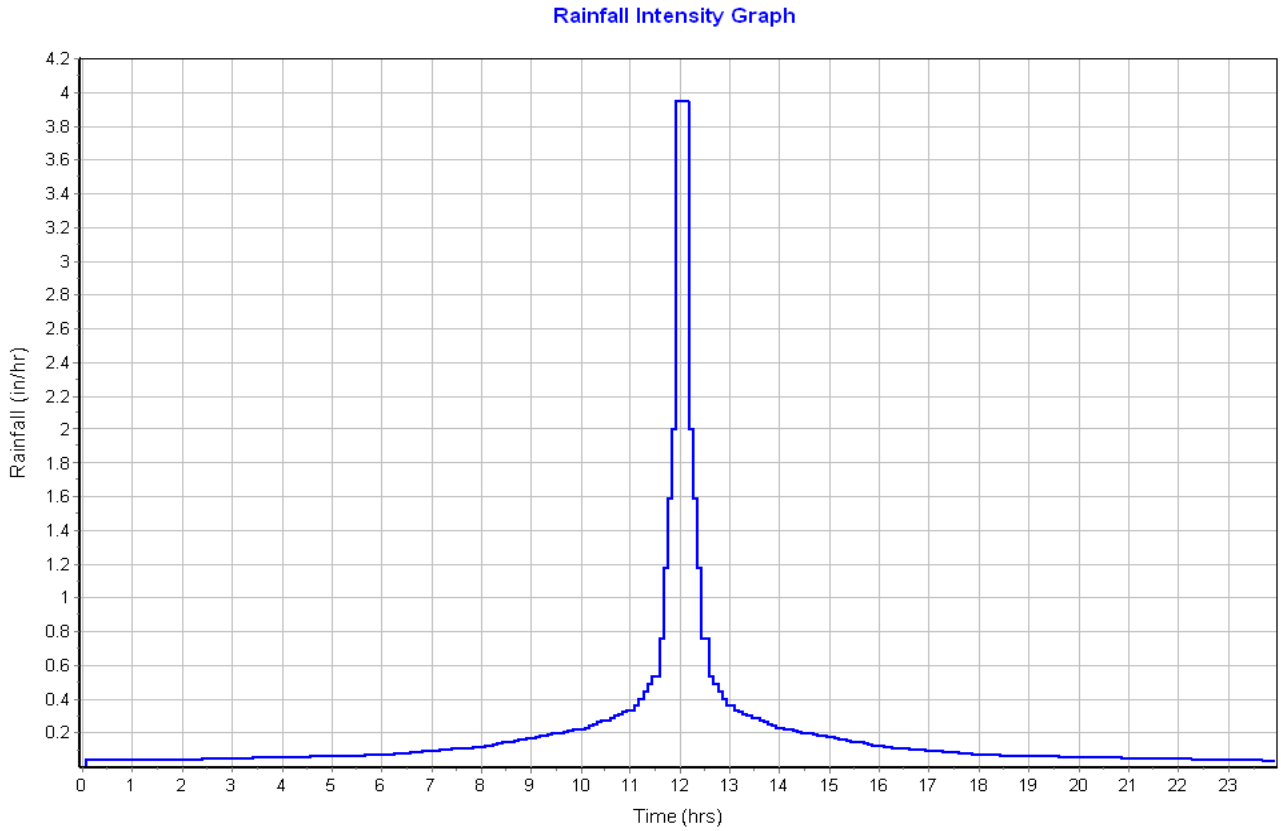
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	758	0.00	0.00
Slope (%) :	.758	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	0.61	0.00	0.00
Computed Flow Time (min) :	20.71	0.00	0.00

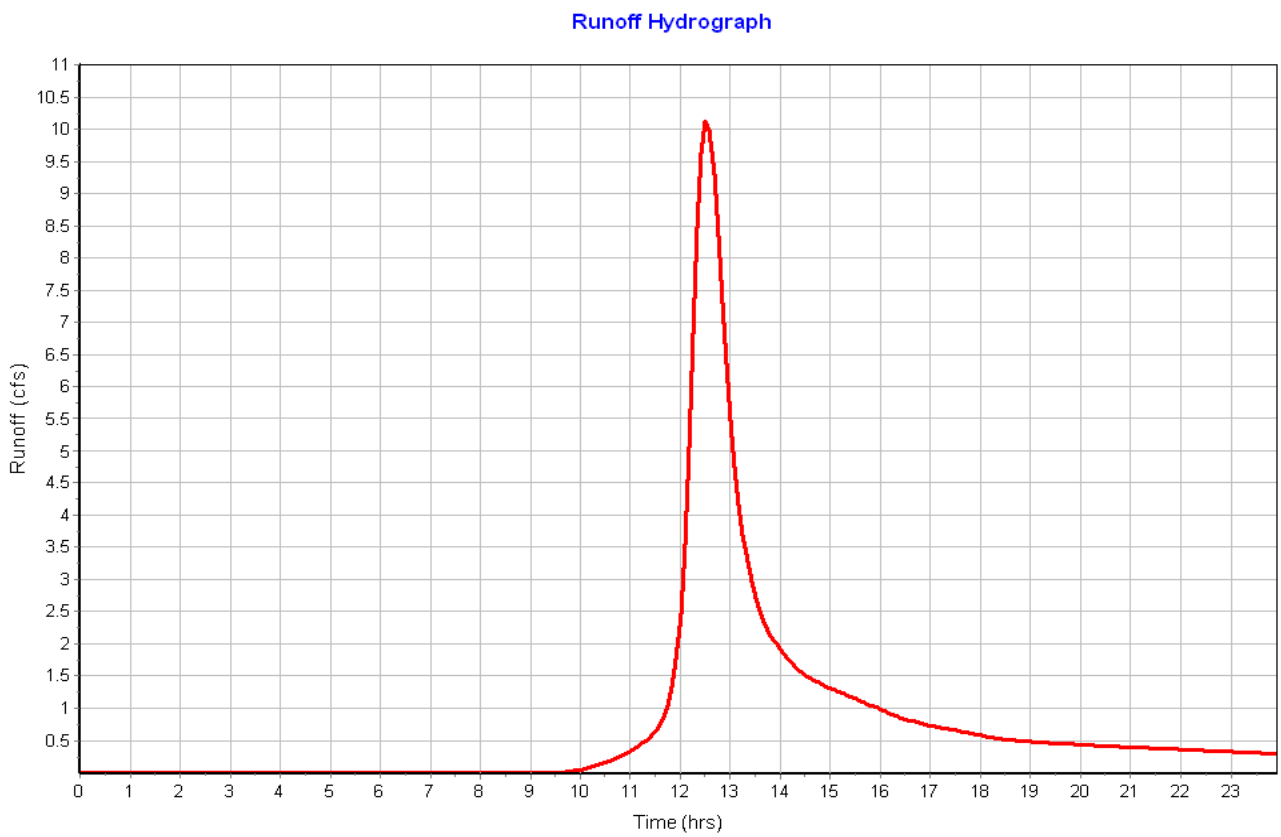
Total TOC (min) 43.40

Subbasin Runoff Results

Total Rainfall (in) 4.70
Total Runoff (in) 2.07
Peak Runoff (cfs) 10.12
Weighted Curve Number 73.22
Time of Concentration (days hh:mm:ss) 0 00:43:24

Subbasin : B


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C

Input Data

Area (ac) 0.35
Weighted Curve Number 74.60
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.03	D	77.00
Woods, Good	0.04	D	77.00
Brush, Good	0.08	D	73.00
Brush, Good	0.13	D	73.00
Woods, Good	0.07	D	77.00
Composite Area & Weighted CN	0.35		74.60

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	87	0.00	0.00
Slope (%) :	10.35	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.14	0.00	0.00
Computed Flow Time (min) :	10.28	0.00	0.00

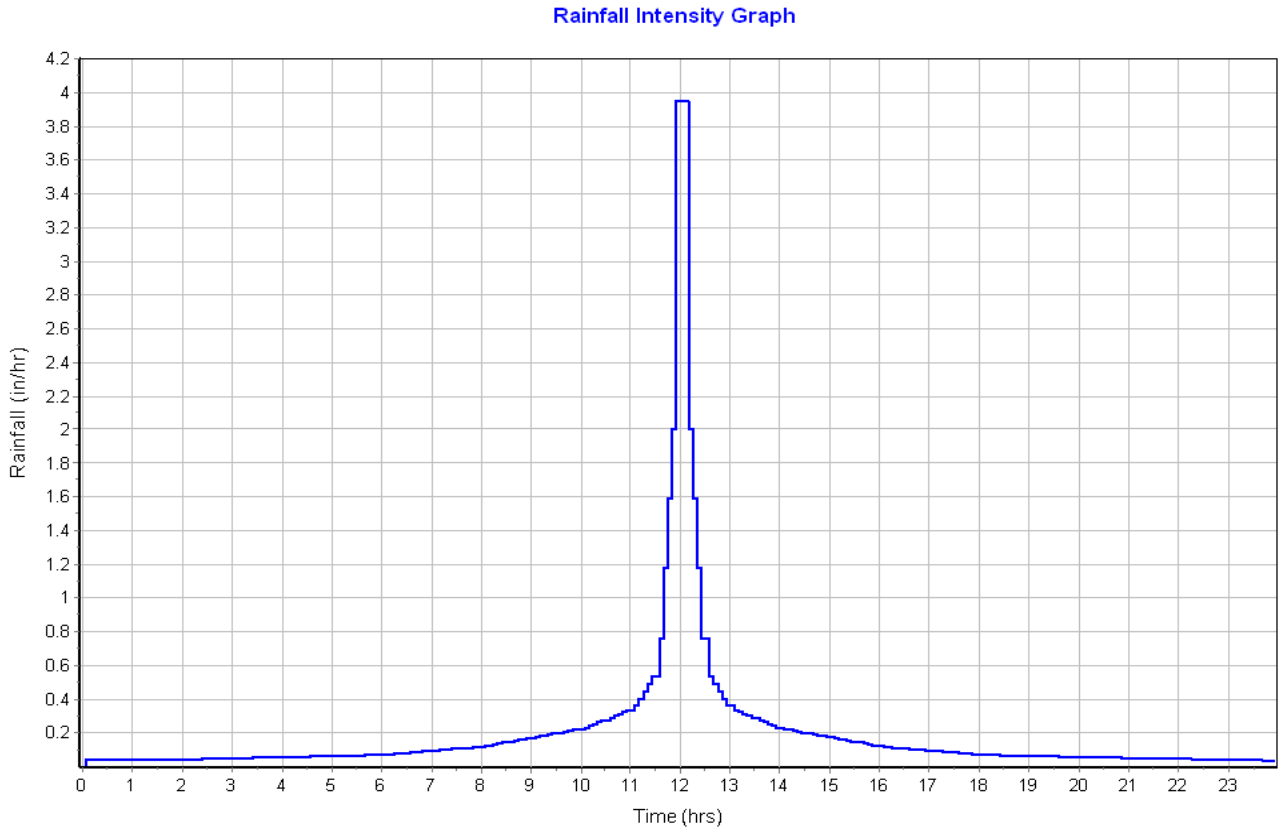
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	313	0.00	0.00
Slope (%) :	2.3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.06	0.00	0.00
Computed Flow Time (min) :	4.92	0.00	0.00

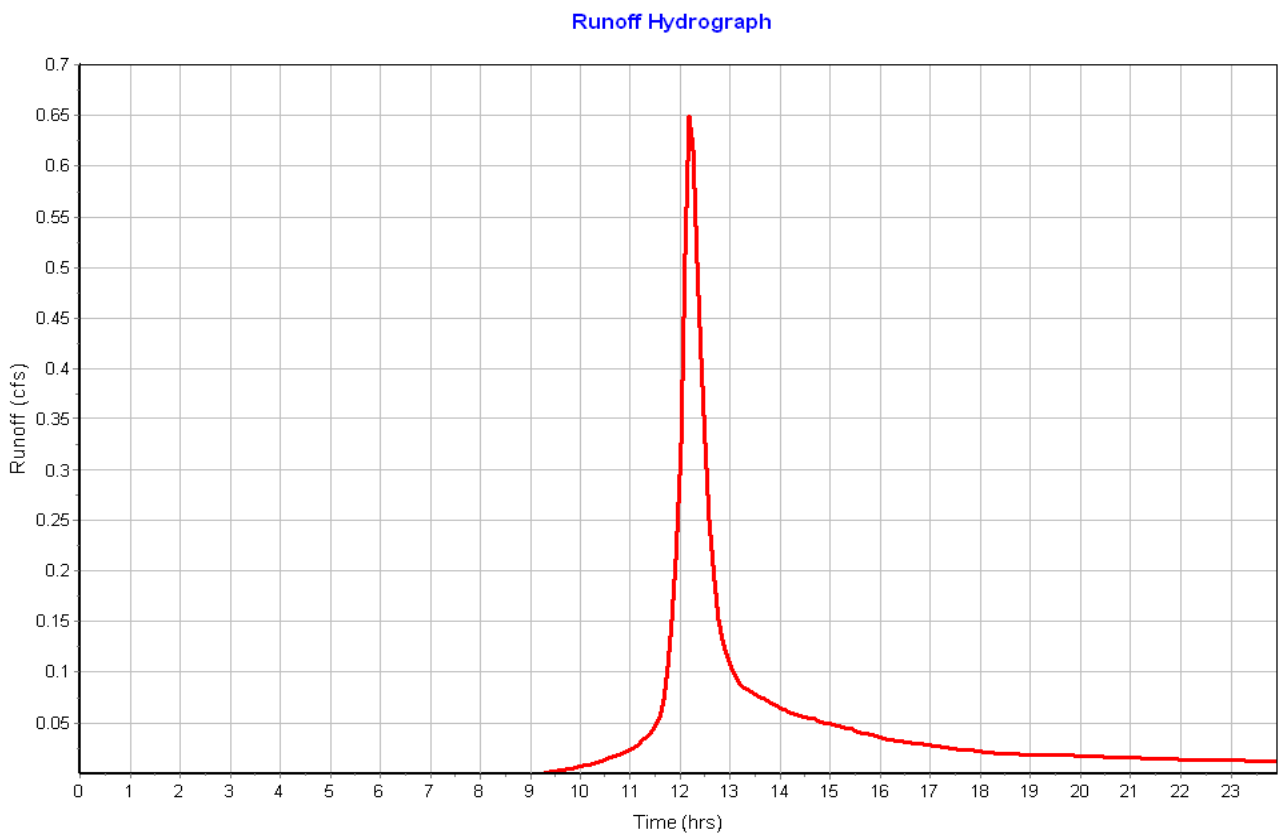
Total TOC (min) 15.20

Subbasin Runoff Results

Total Rainfall (in) 4.70
Total Runoff (in) 2.18
Peak Runoff (cfs) 0.66
Weighted Curve Number 74.60
Time of Concentration (days hh:mm:ss) 0 00:15:12

Subbasin : C


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : D

Input Data

Area (ac) 0.12
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.12	D	77.00
Composite Area & Weighted CN	0.12		77.00

Time of Concentration

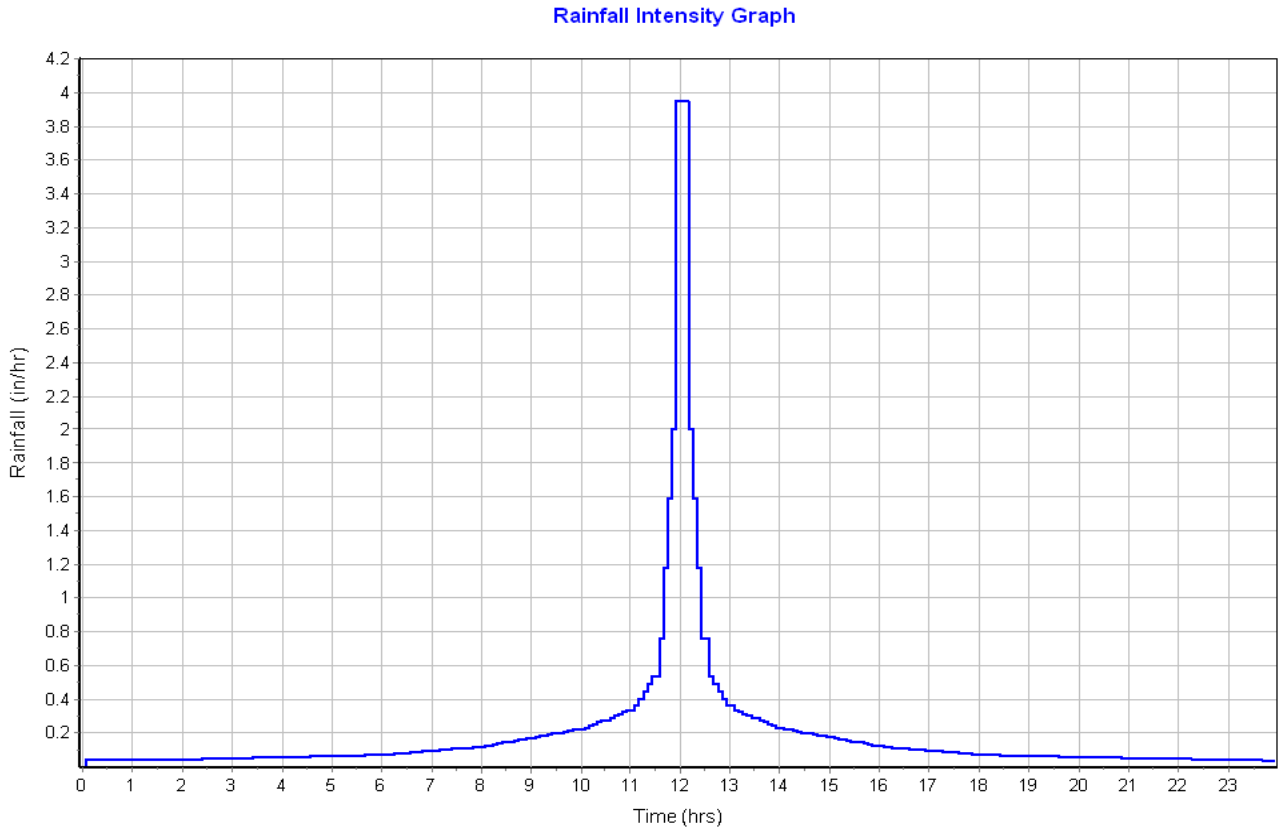
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	36	0.00	0.00
Slope (%) :	5.55	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.09	0.00	0.00
Computed Flow Time (min) :	6.51	0.00	0.00

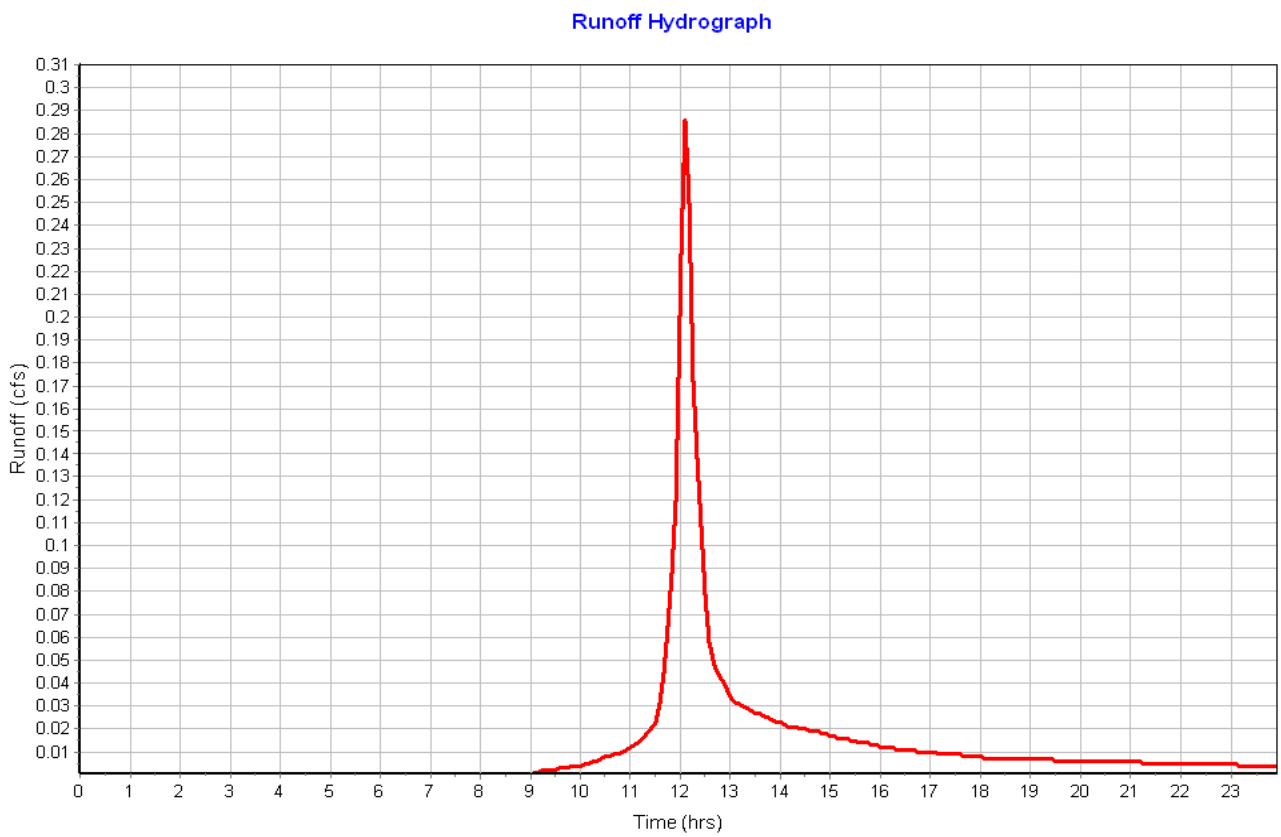
Total TOC (min) 6.51

Subbasin Runoff Results

Total Rainfall (in) 4.70
Total Runoff (in) 2.37
Peak Runoff (cfs) 0.30
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:06:31

Subbasin : D


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Project Description

File Name ..... Existing Conditions.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Aug 10, 2017 00:00:00
End Analysis On ..... Aug 11, 2017 00:00:00
Start Reporting On ..... Aug 10, 2017 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	4
Nodes	4
Junctions	0
Outfalls	4
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-25	Cumulative	inches	Maine	Cumberland (Southeast)	25	5.50	SCS Type III 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
A	3.70	73.41	5.50	2.72	10.05	7.51	0 00:23:04
B	8.76	73.22	5.50	2.70	23.65	13.36	0 00:43:24
C	0.35	74.60	5.50	2.82	0.99	0.86	0 00:15:12
D	0.12	77.00	5.50	3.04	0.37	0.38	0 00:06:30

Subbasin Hydrology

Subbasin : A

Input Data

Area (ac) 3.70
Weighted Curve Number 73.41
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.38	D	77.00
Brush, Good	3.32	D	73.00
Composite Area & Weighted CN	3.70		73.41

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	14.36	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	13.94	0.00	0.00

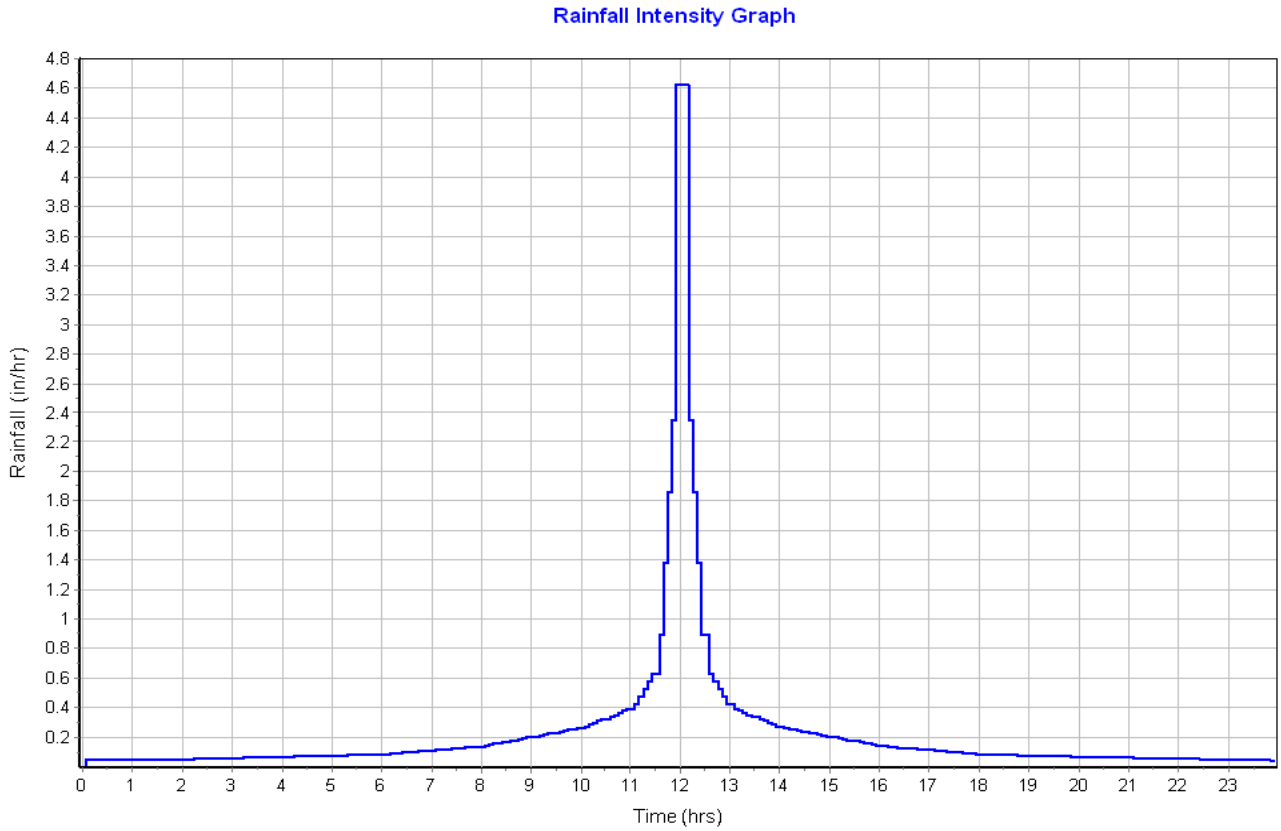
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	625	0.00	0.00
Slope (%) :	.582	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	1.14	0.00	0.00
Computed Flow Time (min) :	9.14	0.00	0.00

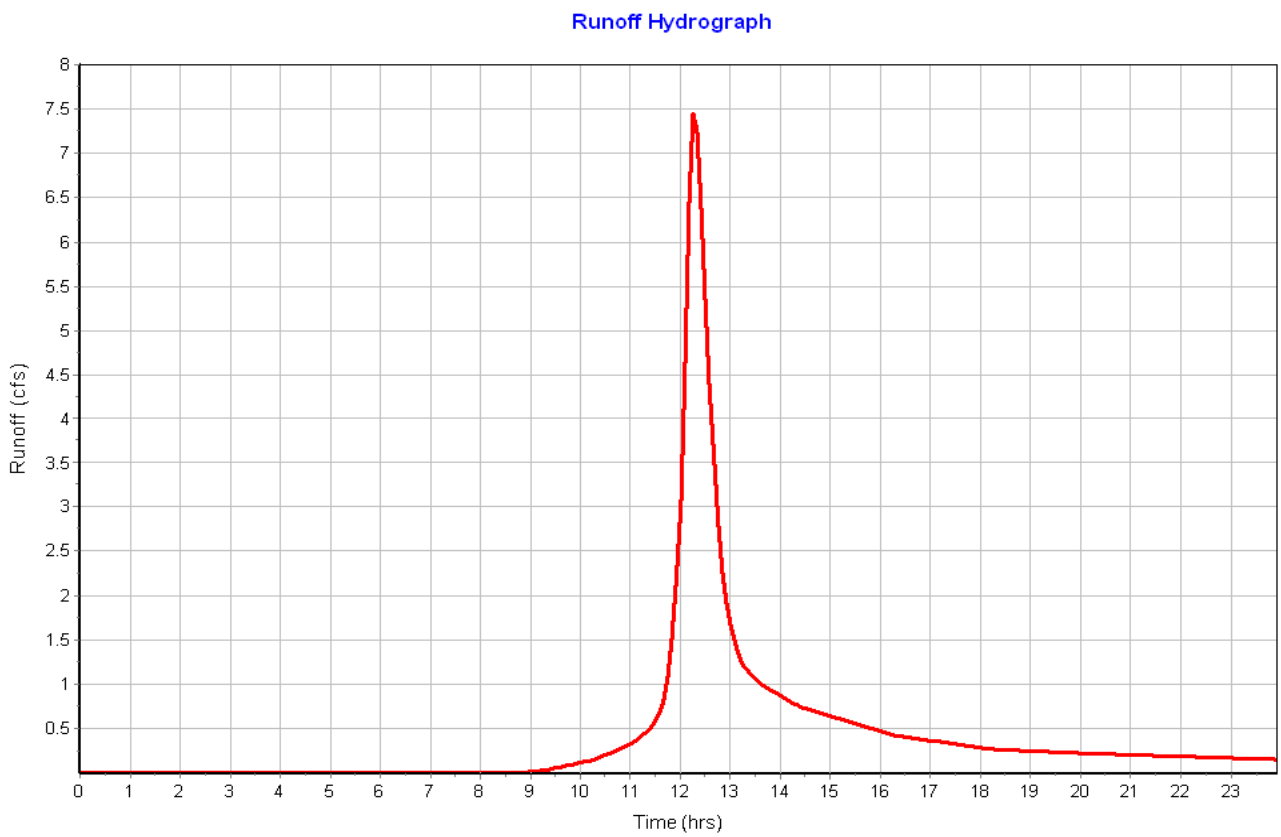
Total TOC (min) 23.08

Subbasin Runoff Results

Total Rainfall (in) 5.50
Total Runoff (in) 2.72
Peak Runoff (cfs) 7.51
Weighted Curve Number 73.41
Time of Concentration (days hh:mm:ss) 0 00:23:05

Subbasin : A


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B

Input Data

Area (ac) 8.76
Weighted Curve Number 73.22
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Brush, Good	8.27	D	73.00
Woods, Good	0.49	D	77.00
Composite Area & Weighted CN	8.76		73.22

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	4.25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	22.69	0.00	0.00

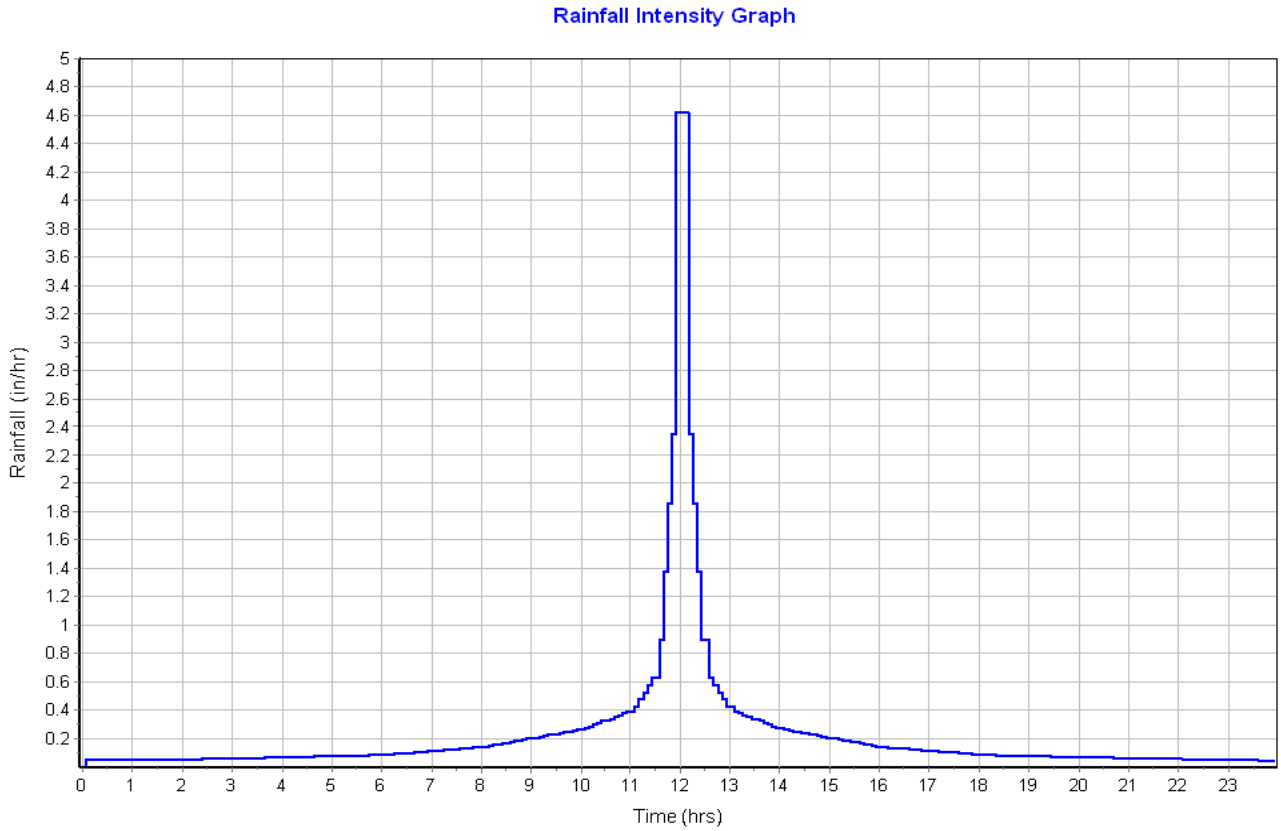
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	758	0.00	0.00
Slope (%) :	.758	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	0.61	0.00	0.00
Computed Flow Time (min) :	20.71	0.00	0.00

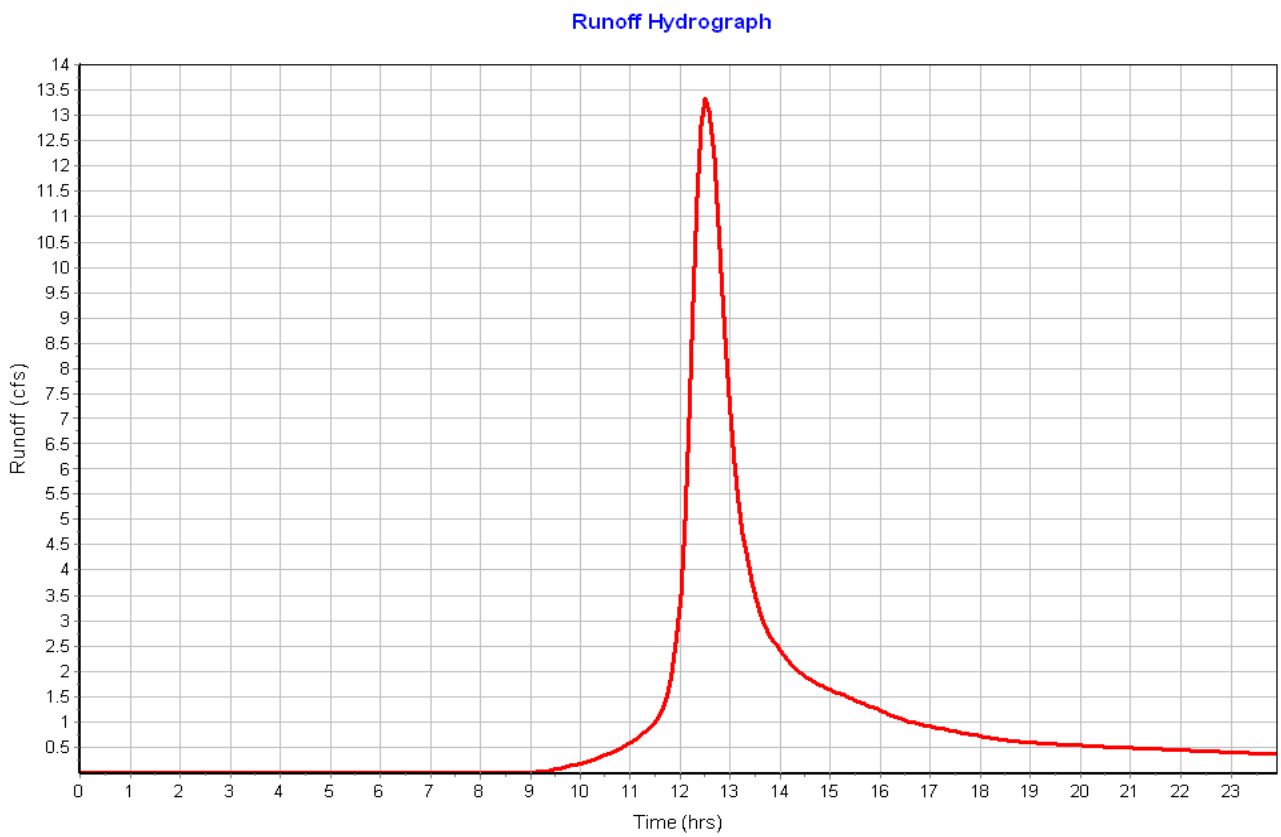
Total TOC (min) 43.40

Subbasin Runoff Results

Total Rainfall (in) 5.50
Total Runoff (in) 2.70
Peak Runoff (cfs) 13.36
Weighted Curve Number 73.22
Time of Concentration (days hh:mm:ss) 0 00:43:24

Subbasin : B


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C

Input Data

Area (ac) 0.35
Weighted Curve Number 74.60
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.03	D	77.00
Woods, Good	0.04	D	77.00
Brush, Good	0.08	D	73.00
Brush, Good	0.13	D	73.00
Woods, Good	0.07	D	77.00
Composite Area & Weighted CN	0.35		74.60

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	87	0.00	0.00
Slope (%) :	10.35	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.14	0.00	0.00
Computed Flow Time (min) :	10.28	0.00	0.00

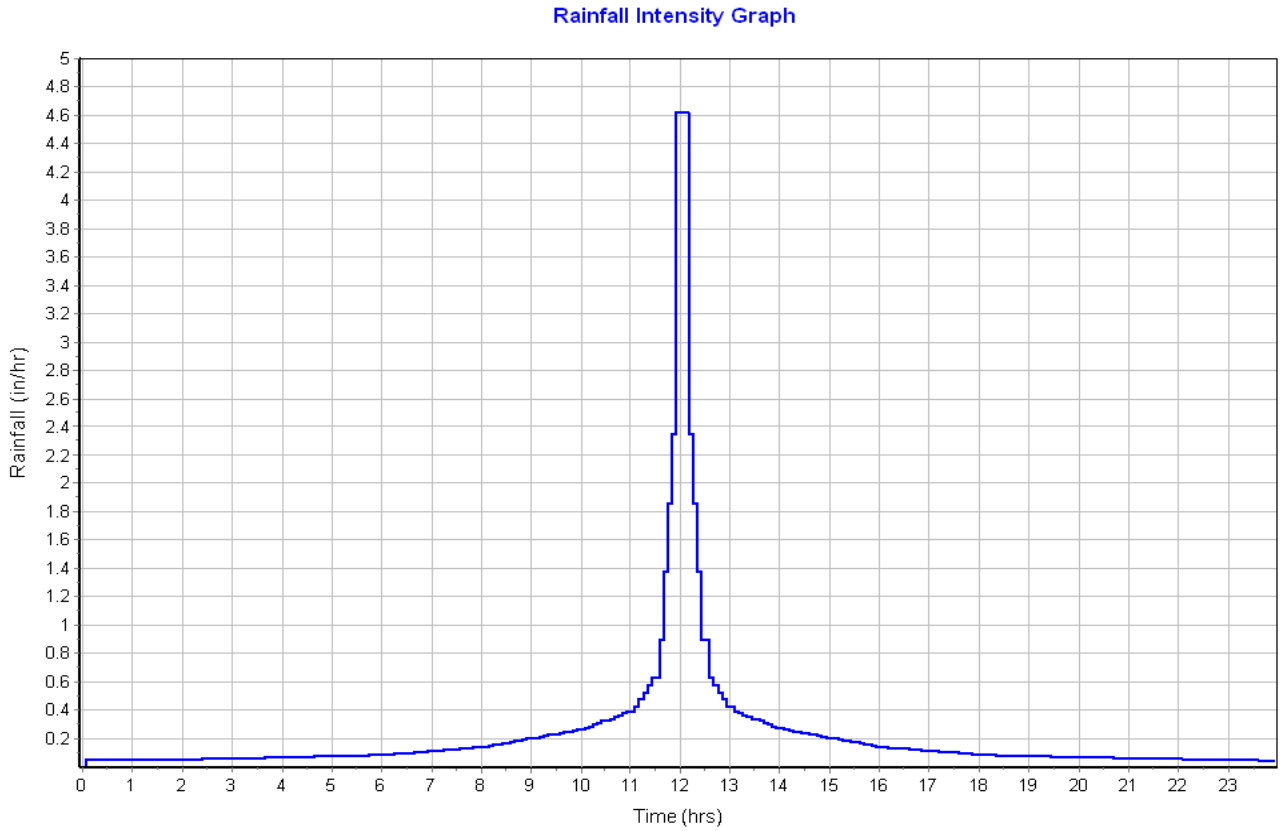
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	313	0.00	0.00
Slope (%) :	2.3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.06	0.00	0.00
Computed Flow Time (min) :	4.92	0.00	0.00

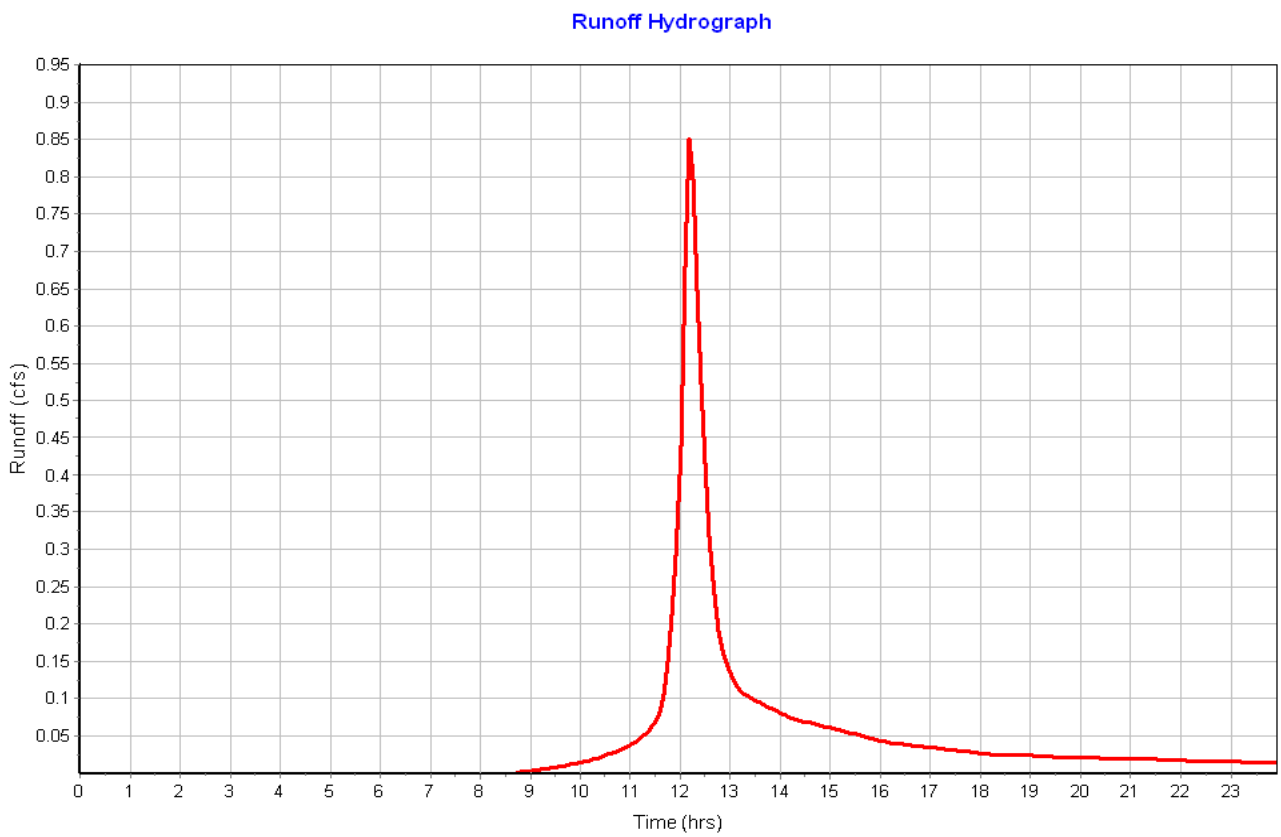
Total TOC (min) 15.20

Subbasin Runoff Results

Total Rainfall (in) 5.50
Total Runoff (in) 2.82
Peak Runoff (cfs) 0.86
Weighted Curve Number 74.60
Time of Concentration (days hh:mm:ss) 0 00:15:12

Subbasin : C


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : D

Input Data

Area (ac) 0.12
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.12	D	77.00
Composite Area & Weighted CN	0.12		77.00

Time of Concentration

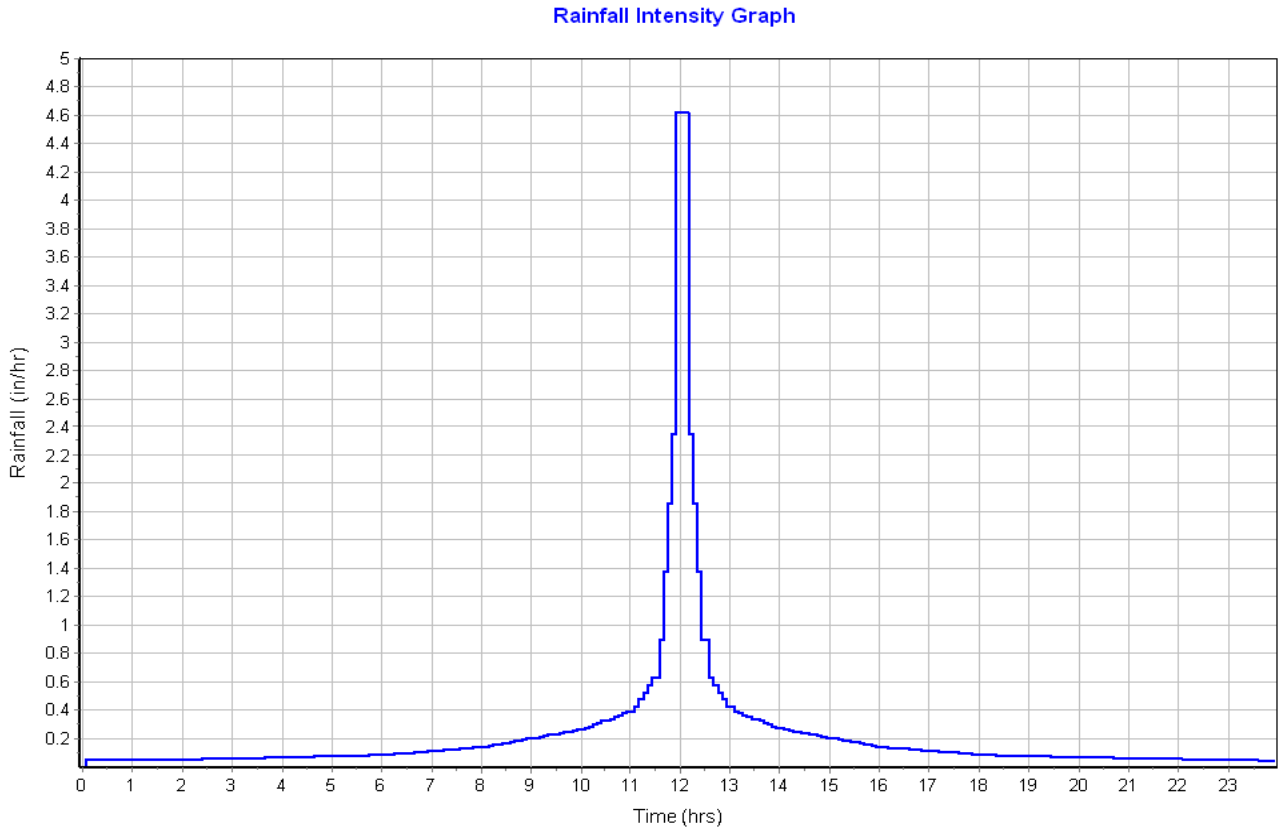
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	36	0.00	0.00
Slope (%) :	5.55	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.09	0.00	0.00
Computed Flow Time (min) :	6.51	0.00	0.00

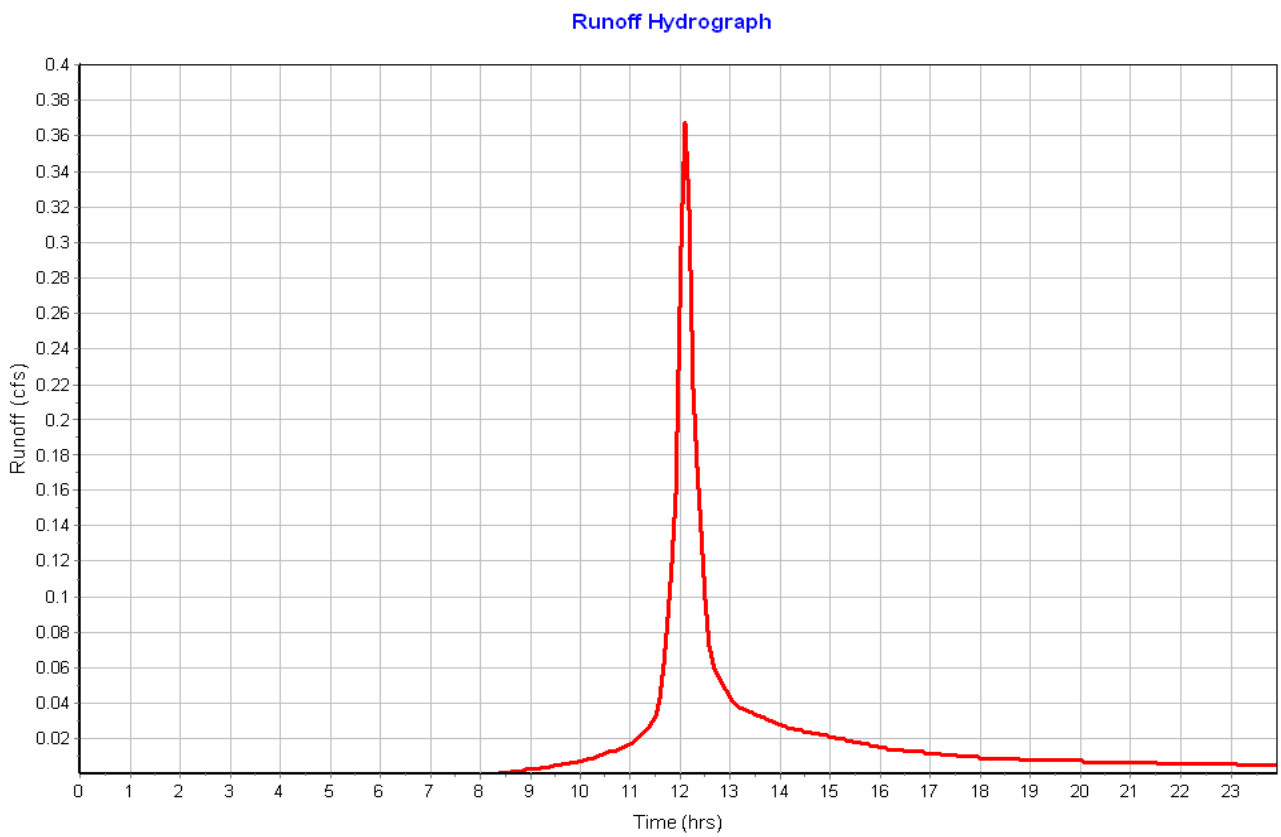
Total TOC (min) 6.51

Subbasin Runoff Results

Total Rainfall (in) 5.50
Total Runoff (in) 3.04
Peak Runoff (cfs) 0.38
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:06:31

Subbasin : D


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Project Description

File Name ..... Proposed Conditions_SMT.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Aug 15, 2017 00:00:00
End Analysis On ..... Aug 17, 2017 00:00:00
Start Reporting On ..... Aug 15, 2017 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	6
Nodes	7
Junctions	2
Outfalls	5
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	2
Channels	0
Pipes	2
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-02	Cumulative	inches	Maine	Cumberland (Southeast)	2	3.00	SCS Type III 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
A	3.95	74.46	3.00	0.93	3.68	2.33	0 00:29:55
B-1	2.55	66.95	3.00	0.58	1.49	1.30	0 00:07:01
B-2	7.03	70.54	3.00	0.74	5.20	1.84	0 01:17:51
C	0.21	75.29	3.00	0.98	0.20	0.15	0 00:20:30
CulvertDrainageArea	0.68	75.00	3.00	0.96	0.65	0.67	0 00:05:00
D	0.12	77.00	3.00	1.07	0.13	0.13	0 00:06:30

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Peak Inflow (cfs)
CulvertInlet	Junction	181.00	0.64
Out_B1andB2	Junction	176.00	2.06
CulvertOutlet	Outfall	180.35	0.64
OUT-A	Outfall	180.00	2.31
OUT-B	Outfall	176.00	2.06
OUT-C	Outfall	178.00	0.15
OUT-D	Outfall	190.82	0.12

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)	(ft/sec)	(ft)
Direct_to_OutB	Pipe	Out_B1andB2	OUT-B	1715.96	0.00	0.00	0.0000	0.000	0.0150	2.06	0.00	0.00	0.00
Link-03	Pipe	CulvertInlet	CulvertOutlet	45.00	181.00	180.55	1.0000	15.000	0.0150	0.64	5.60	3.04	0.29

Subbasin Hydrology

Subbasin : A

Input Data

Area (ac) 3.95
Weighted Curve Number 74.46
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.33	D	77.00
Gravel roads	0.10	D	91.00
> 75% grass cover, Good	0.38	D	80.00
Brush, Good	3.14	D	73.00
Composite Area & Weighted CN	3.95		74.46

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	45	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.23	0.00	0.00
Computed Flow Time (min) :	3.23	0.00	0.00

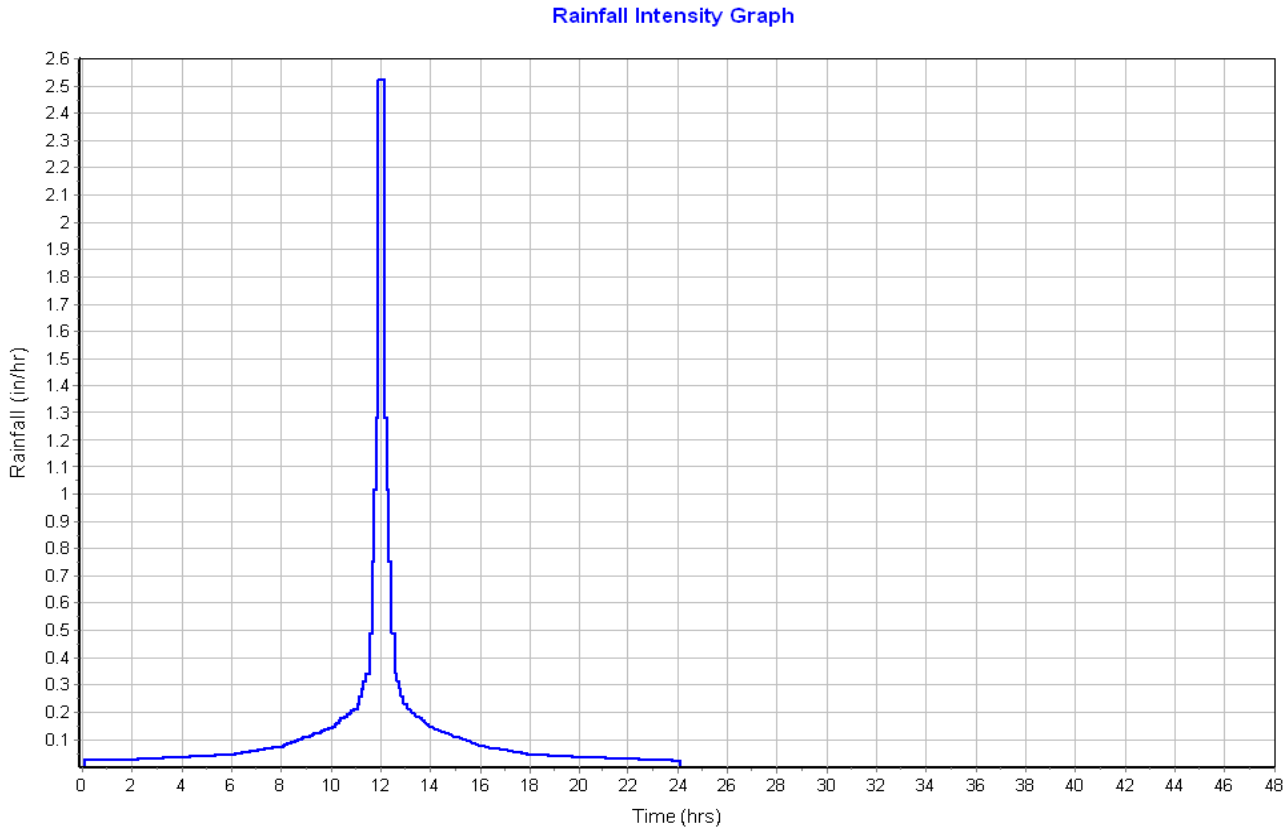
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	264	574	0.00
Slope (%) :	.76	.35	0.00
Surface Type :	Grassed waterway	Grass pasture	Unpaved
Velocity (ft/sec) :	1.31	0.41	0.00
Computed Flow Time (min) :	3.36	23.33	0.00

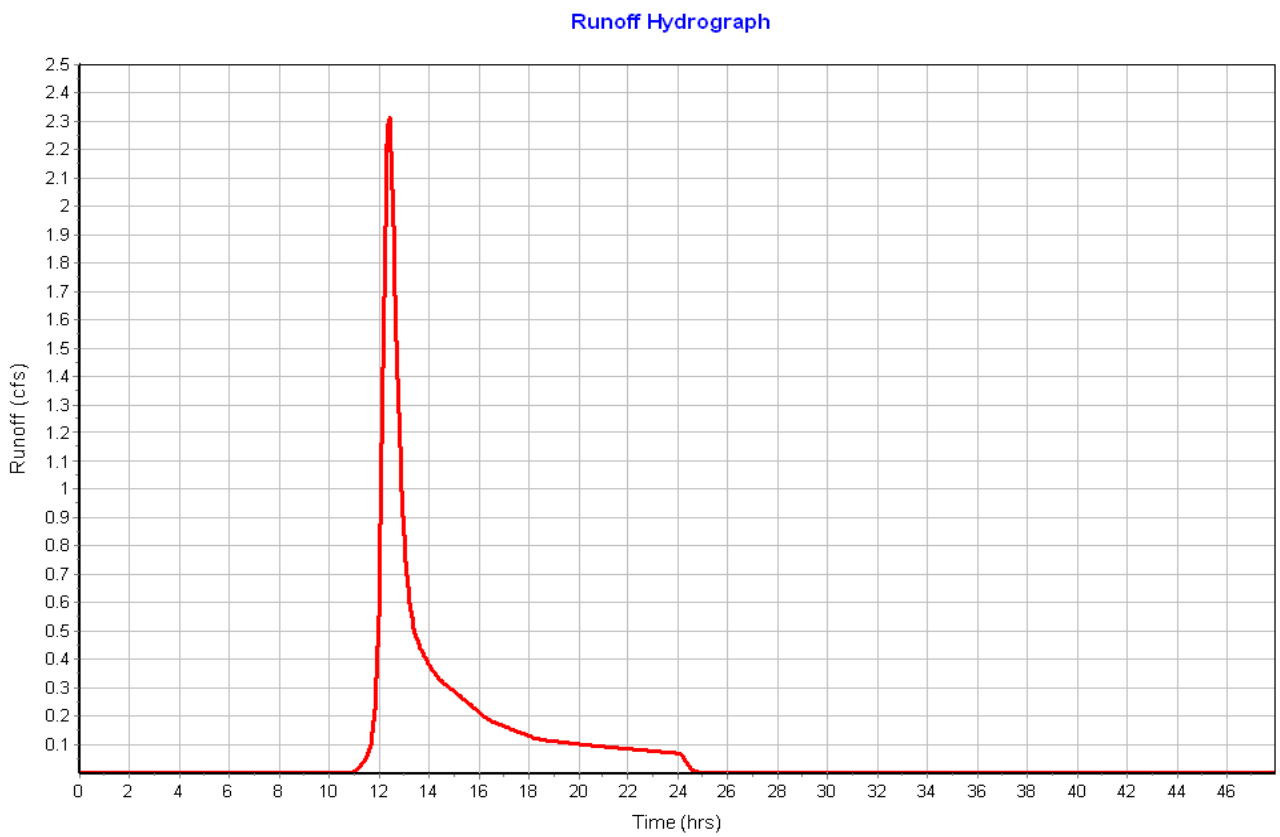
Total TOC (min) 29.92

Subbasin Runoff Results

Total Rainfall (in) 3.00
Total Runoff (in) 0.93
Peak Runoff (cfs) 2.33
Weighted Curve Number 74.46
Time of Concentration (days hh:mm:ss) 0 00:29:55

Subbasin : A


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B-1

Input Data

Area (ac) 2.55
Weighted Curve Number 66.95
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel-Pad	1.88	D	60.00
Rooftops	0.24	D	98.00
> 75% grass cover, Good	0.43	D	80.00
Composite Area & Weighted CN	2.55		66.95

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	38	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	2.82	0.00	0.00

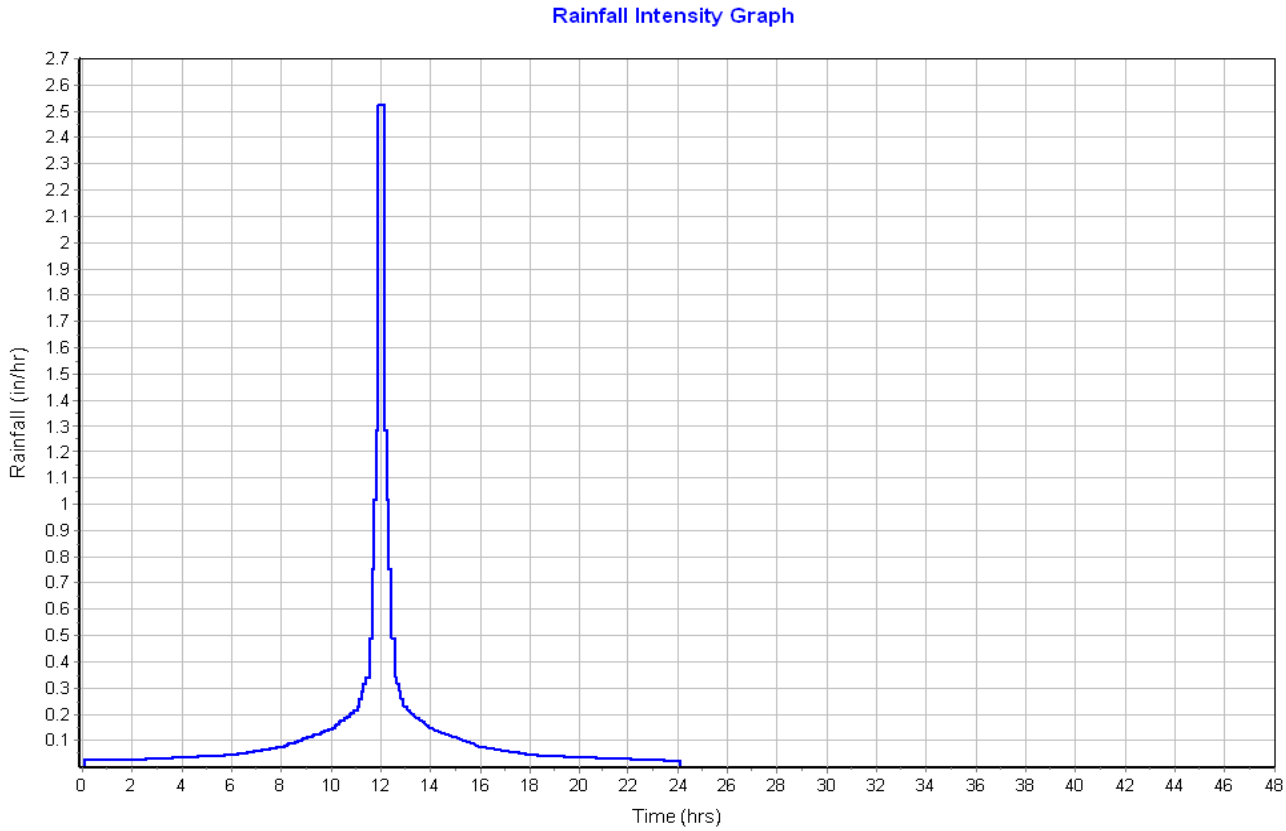
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	385	0.00	0.00
Slope (%) :	1.04	0.00	0.00
Surface Type :	Grassed waterway	Grass pasture	rass pasture
Velocity (ft/sec) :	1.53	0.00	0.00
Computed Flow Time (min) :	4.19	0.00	0.00

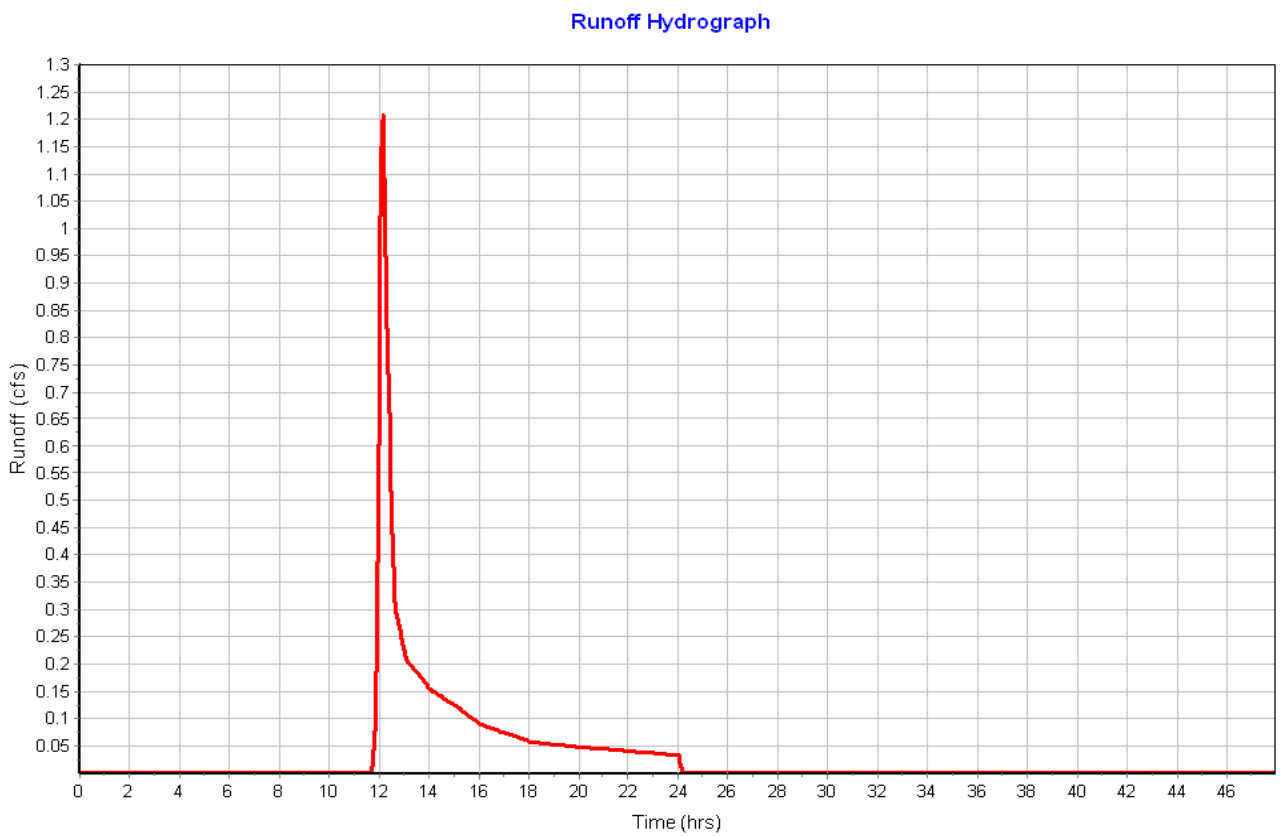
Total TOC (min) 7.02

Subbasin Runoff Results

Total Rainfall (in) 3.00
Total Runoff (in) 0.58
Peak Runoff (cfs) 1.30
Weighted Curve Number 66.95
Time of Concentration (days hh:mm:ss) 0 00:07:01

Subbasin : B-1


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B-2

Input Data

Area (ac) 7.03
Weighted Curve Number 70.54
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Brush, Good	5.19	D	73.00
Gravel roads	0.05	D	91.00
> 75% grass cover, Good	0.16	D	80.00
Gravel_Pad	1.58	D	60.00
ConcreteFoundations	0.05	D	98.00
Composite Area & Weighted CN	7.03		70.54

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	.25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.03	0.00	0.00
Computed Flow Time (min) :	50.95	0.00	0.00

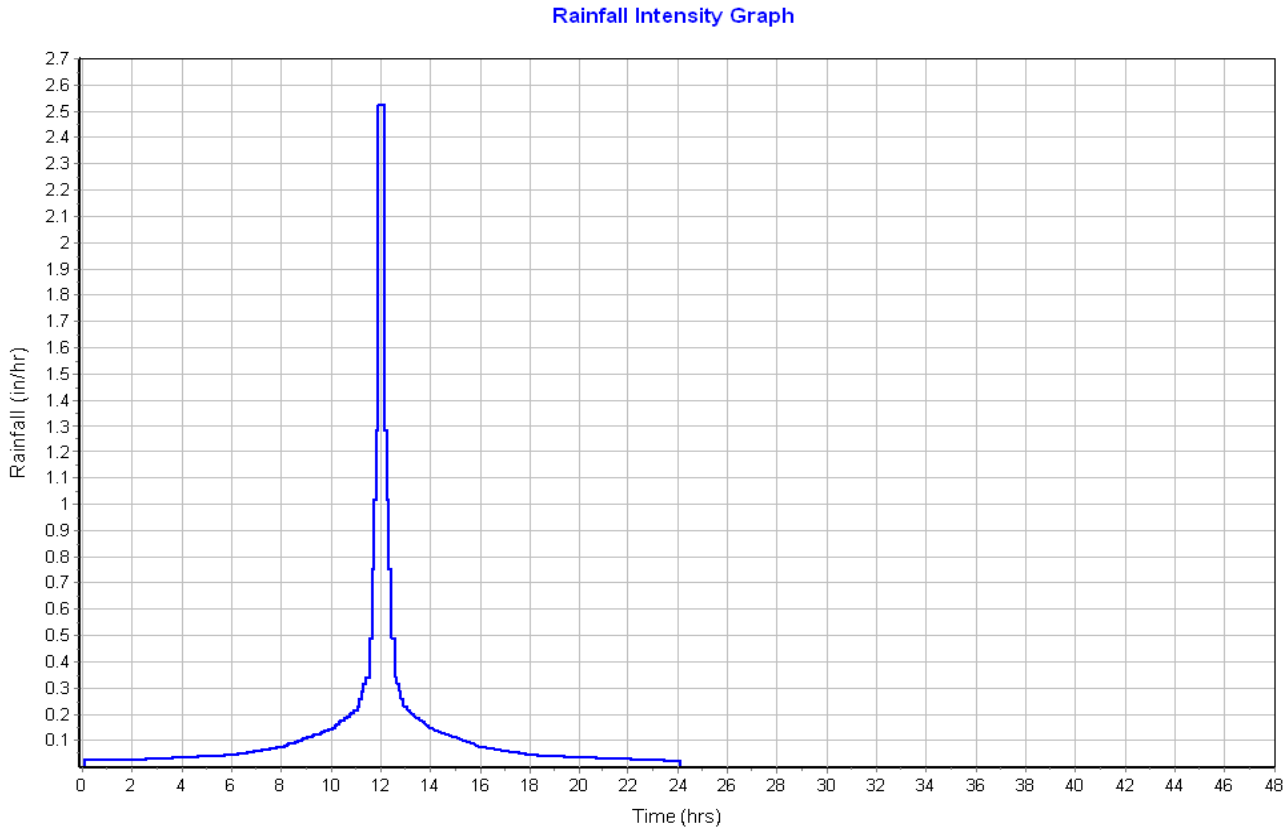
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	791	0.00	0.00
Slope (%) :	.5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	0.49	0.00	0.00
Computed Flow Time (min) :	26.90	0.00	0.00

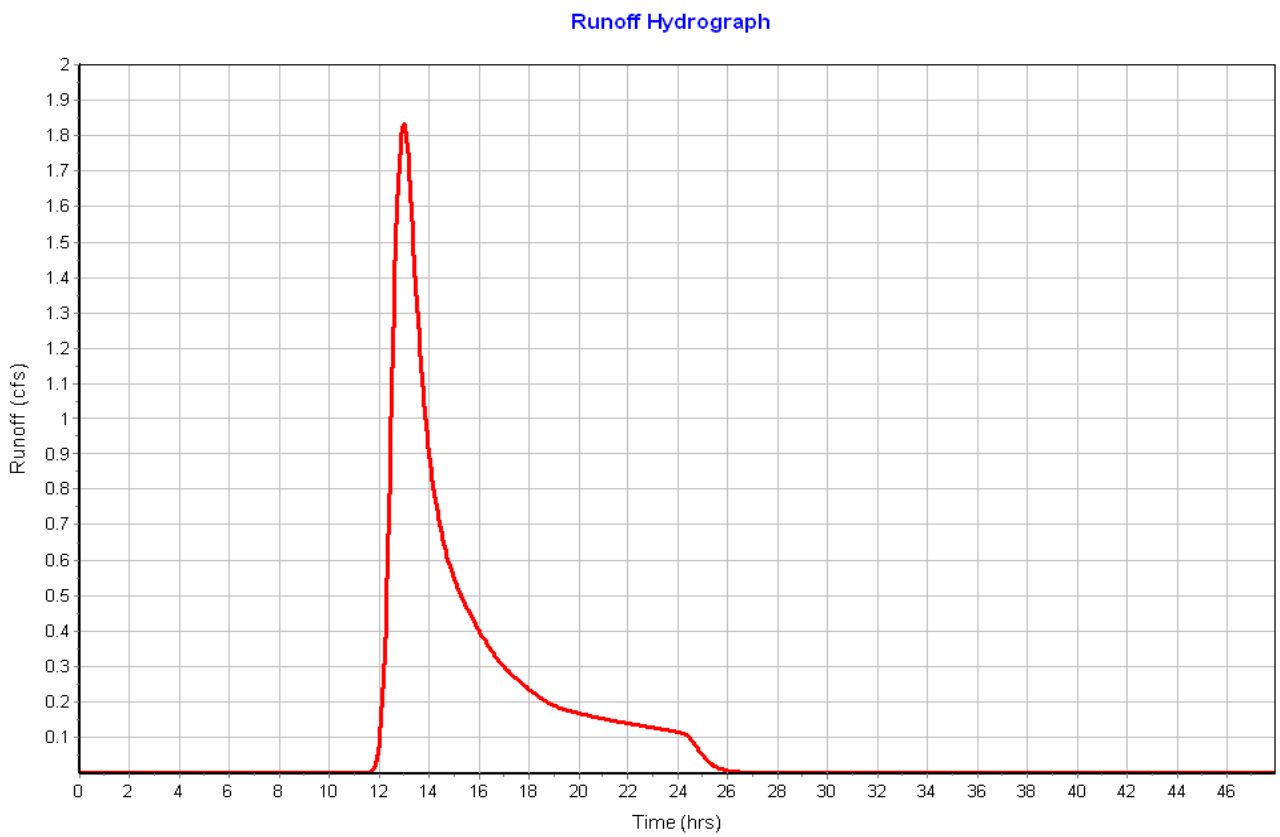
Total TOC (min) 77.86

Subbasin Runoff Results

Total Rainfall (in) 3.00
Total Runoff (in) 0.74
Peak Runoff (cfs) 1.84
Weighted Curve Number 70.54
Time of Concentration (days hh:mm:ss) 0 01:17:52

Subbasin : B-2


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C

Input Data

Area (ac) 0.21
Weighted Curve Number 75.29
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.12	D	77.00
Brush, Good	0.09	D	73.00
Composite Area & Weighted CN	0.21		75.29

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	80	0.00	0.00
Slope (%) :	4.31	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	18.88	0.00	0.00

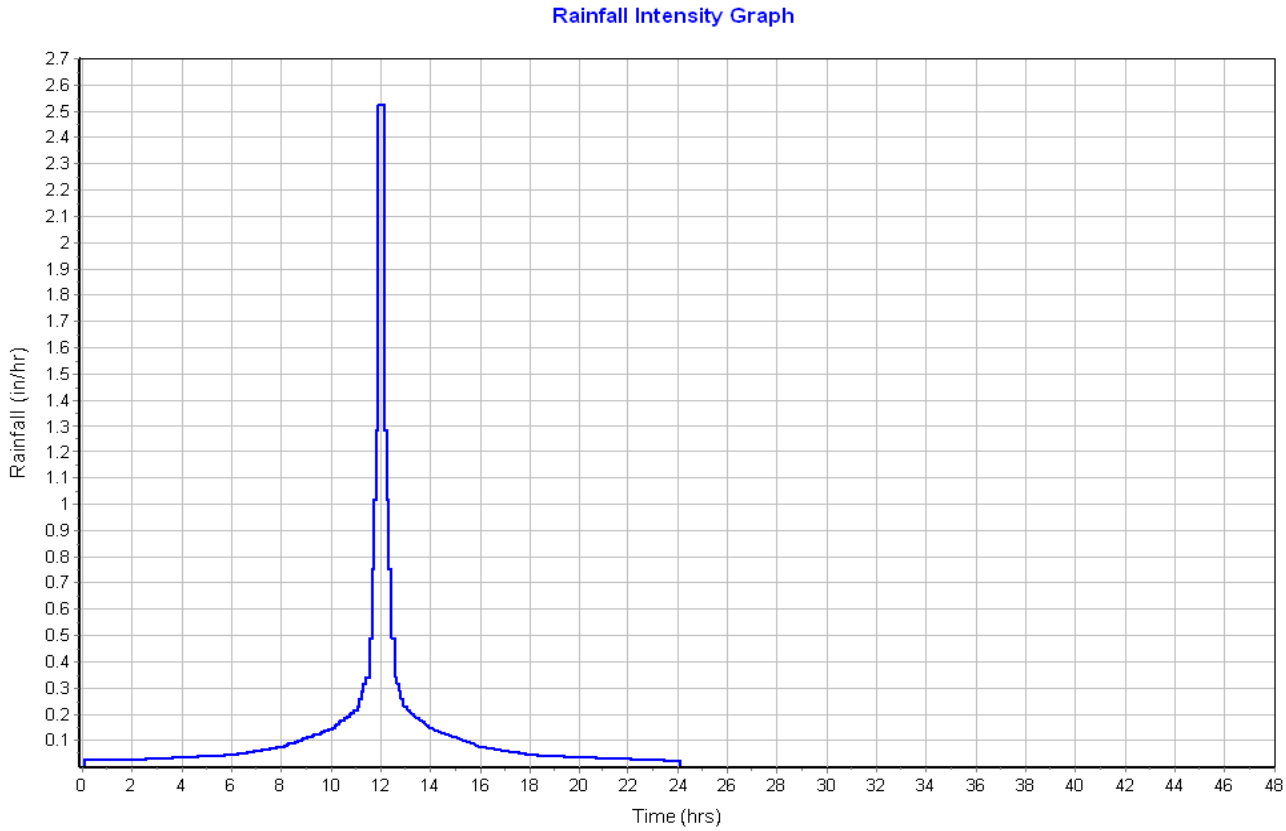
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	182	0.00	0.00
Slope (%) :	7.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.87	0.00	0.00
Computed Flow Time (min) :	1.62	0.00	0.00

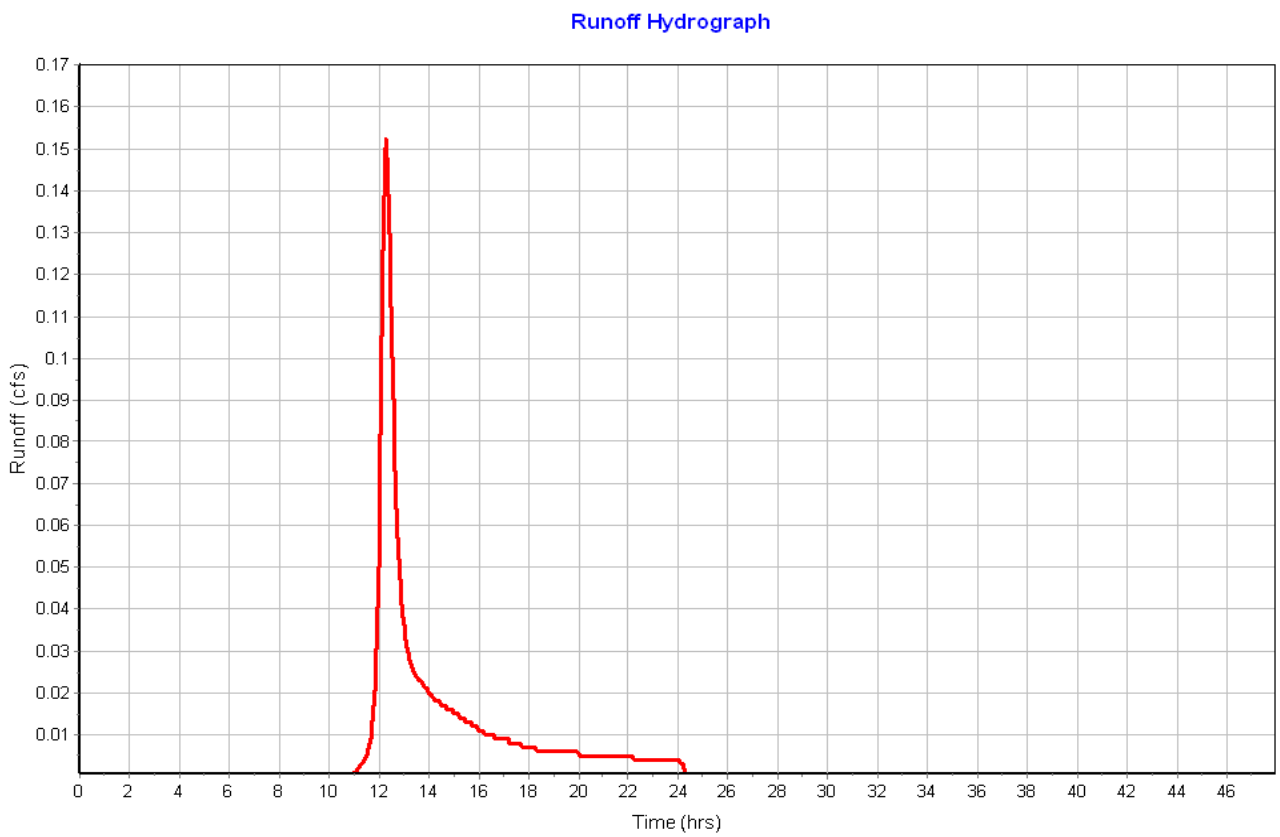
Total TOC (min) 20.50

Subbasin Runoff Results

Total Rainfall (in) 3.00
Total Runoff (in) 0.98
Peak Runoff (cfs) 0.15
Weighted Curve Number 75.29
Time of Concentration (days hh:mm:ss) 0 00:20:30

Subbasin : C


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : CulvertDrainageArea

Input Data

Area (ac) 0.68
Weighted Curve Number 75.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.68	-	75.00
Composite Area & Weighted CN	0.68		75.00

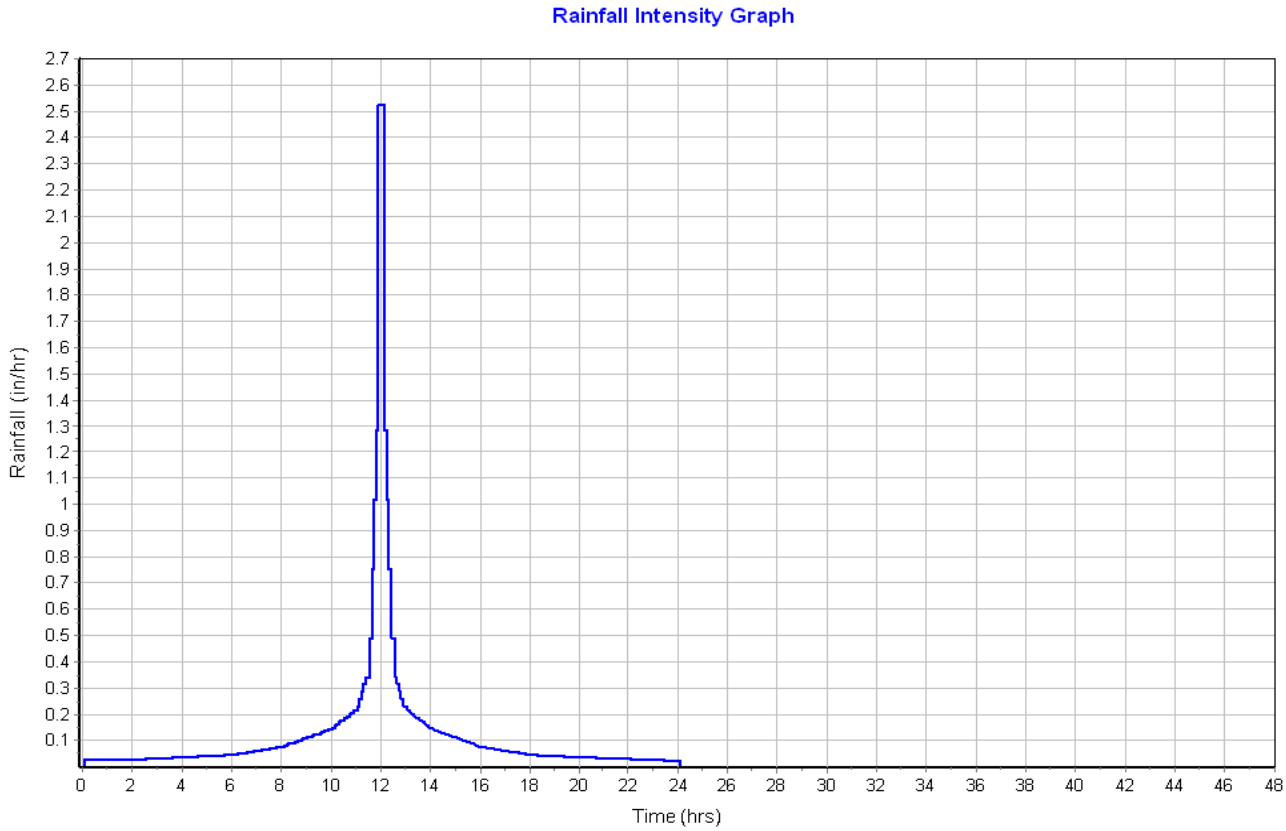
Time of Concentration

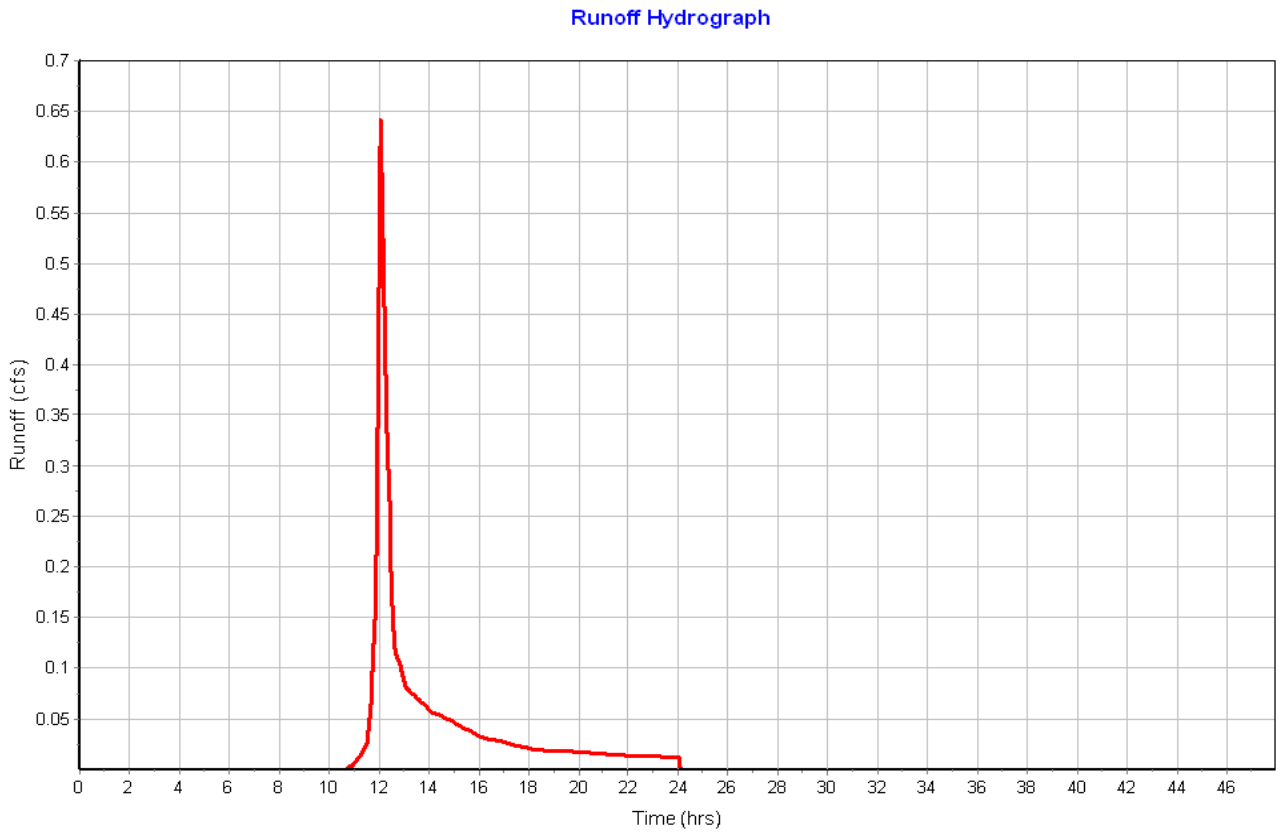
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

Total Rainfall (in) 3.00
Total Runoff (in) 0.96
Peak Runoff (cfs) 0.67
Weighted Curve Number 75.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : CulvertDrainageArea





Subbasin : D

Input Data

Area (ac) 0.12
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.12	D	77.00
Composite Area & Weighted CN	0.12		77.00

Time of Concentration

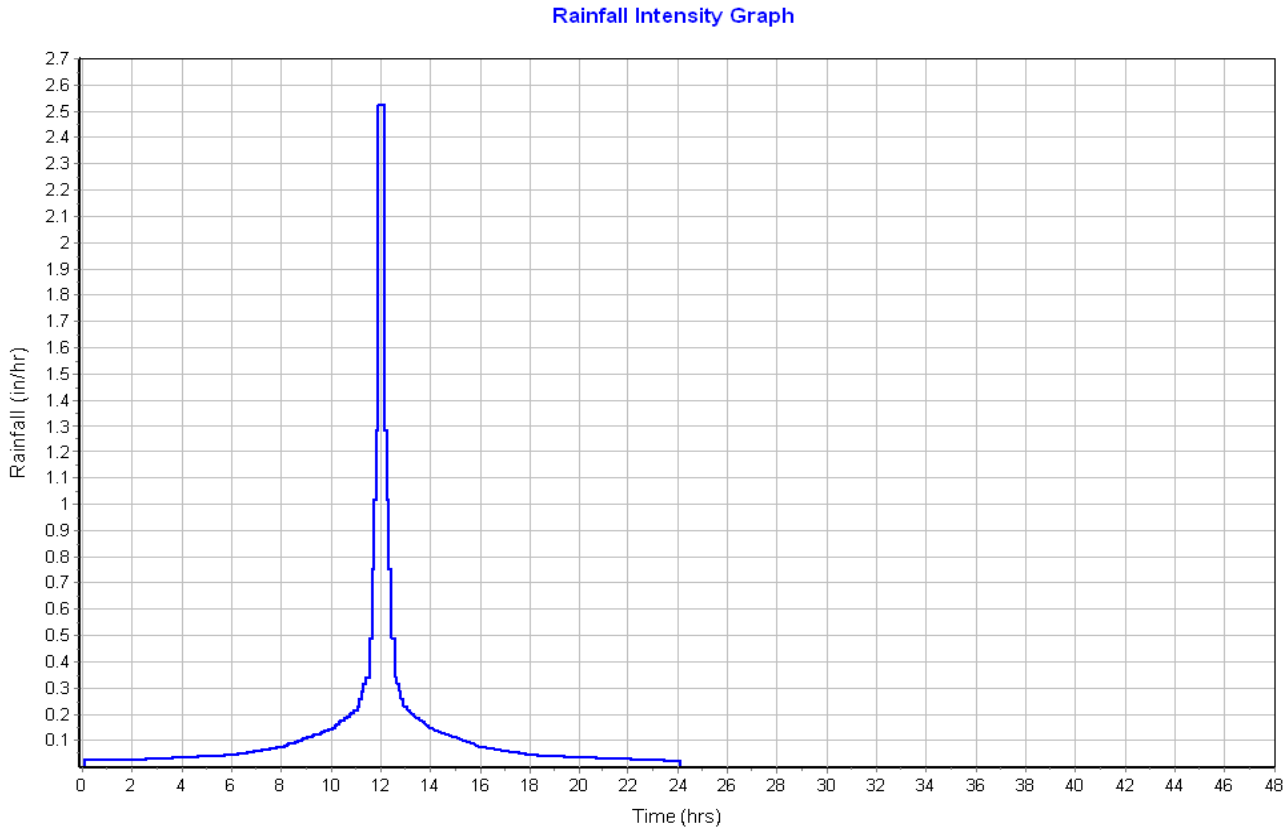
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	36	0.00	0.00
Slope (%) :	5.55	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.09	0.00	0.00
Computed Flow Time (min) :	6.51	0.00	0.00

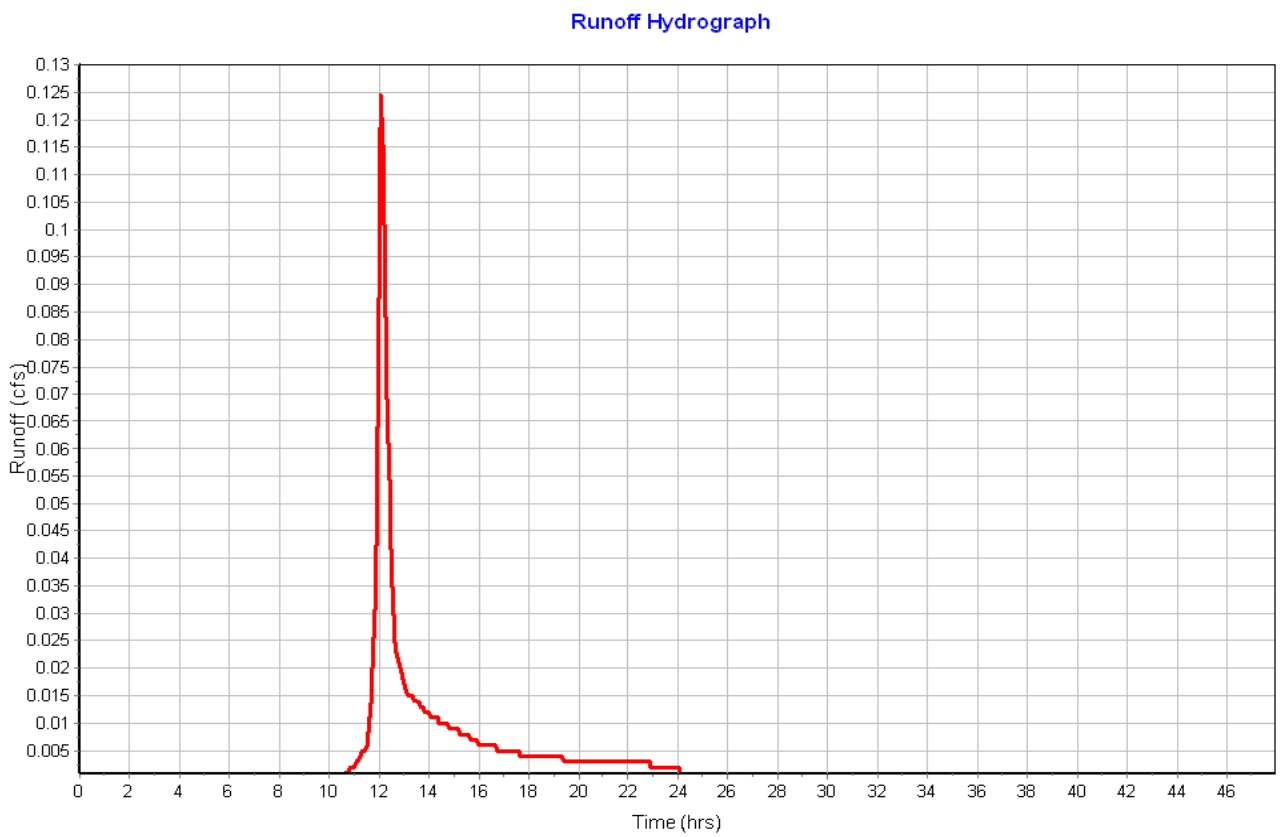
Total TOC (min) 6.51

Subbasin Runoff Results

Total Rainfall (in) 3.00
Total Runoff (in) 1.07
Peak Runoff (cfs) 0.13
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:06:31

Subbasin : D


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Junction Input

Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)
CulvertInlet	181.00	184.00
Out_B1andB2	176.00	6.00

Junction Results

Element ID	Peak Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Time of Max HGL Occurrence
	(cfs)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)
CulvertInlet	0.64	181.29	0.29	2.71	181.02	0 12:10
Out_B1andB2	2.06	176.00	0.00	0.00	176.00	0 00:00

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness
Direct_to_OutB	1715.96	0.00	0.00	0.0000	Dummy	0.000	0.000	0.0150
Link-03	45.00	181.00	180.55	1.0000	CIRCULAR	15.000	15.000	0.0150

Pipe Results

Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth
	(cfs)	(days hh:mm)	(cfs)	(ft/sec)	(ft)
Direct_to_OutB	2.06	0 13:00	0.00	0.00	0.00
Link-03	0.64	0 12:10	5.60	3.04	0.29

Project Description

File Name ..... Proposed Conditions_SMT.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Aug 15, 2017 00:00:00
End Analysis On ..... Aug 17, 2017 00:00:00
Start Reporting On ..... Aug 15, 2017 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	6
Nodes	7
Junctions	2
Outfalls	5
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	2
Channels	0
Pipes	2
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-10	Cumulative	inches	Maine	Cumberland (Southeast)	10	4.70	SCS Type III 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
A	3.95	74.46	4.70	2.16	8.55	5.71	0 00:29:55
B-1	2.55	66.95	4.70	1.59	4.06	4.05	0 00:07:01
B-2	7.03	70.54	4.70	1.86	13.05	5.14	0 01:17:51
C	0.21	75.29	4.70	2.23	0.47	0.37	0 00:20:30
CulvertDrainageArea	0.68	75.00	4.70	2.21	1.50	1.58	0 00:05:00
D	0.12	77.00	4.70	2.37	0.28	0.30	0 00:06:30

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Peak Inflow (cfs)
CulvertInlet	Junction	181.00	1.54
Out_B1andB2	Junction	176.00	5.73
CulvertOutlet	Outfall	180.35	1.53
OUT-A	Outfall	180.00	5.67
OUT-B	Outfall	176.00	5.73
OUT-C	Outfall	178.00	0.37
OUT-D	Outfall	190.82	0.29

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)	(ft/sec)	(ft)
Direct_to_OutB	Pipe	Out_B1andB2	OUT-B	1715.96	0.00	0.00	0.0000	0.000	0.0150	5.73	0.00	0.00	0.00
Link-03	Pipe	CulvertInlet	CulvertOutlet	45.00	181.00	180.55	1.0000	15.000	0.0150	1.53	5.60	3.89	0.45

Subbasin Hydrology

Subbasin : A

Input Data

Area (ac) 3.95
Weighted Curve Number 74.46
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.33	D	77.00
Gravel roads	0.10	D	91.00
> 75% grass cover, Good	0.38	D	80.00
Brush, Good	3.14	D	73.00
Composite Area & Weighted CN	3.95		74.46

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	45	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.23	0.00	0.00
Computed Flow Time (min) :	3.23	0.00	0.00

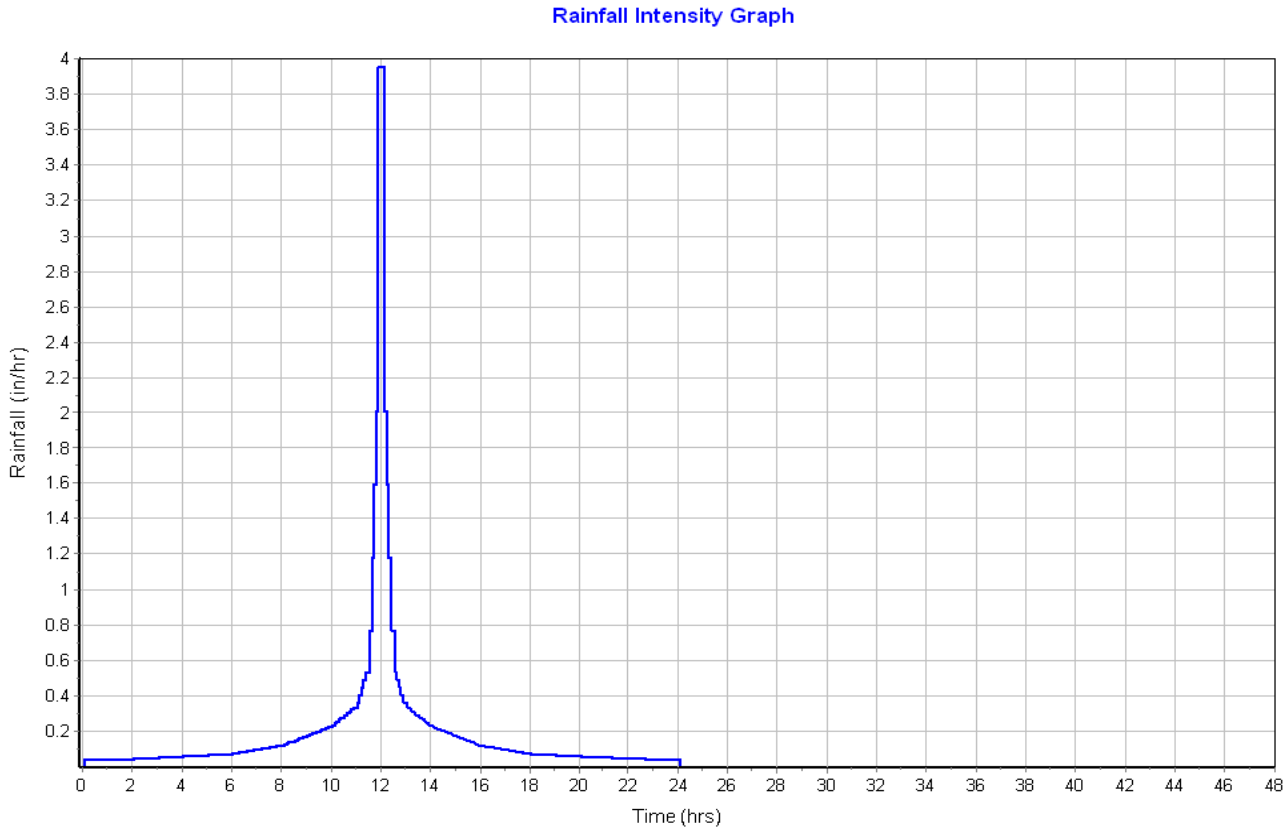
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	264	574	0.00
Slope (%) :	.76	.35	0.00
Surface Type :	Grassed waterway	Grass pasture	Unpaved
Velocity (ft/sec) :	1.31	0.41	0.00
Computed Flow Time (min) :	3.36	23.33	0.00

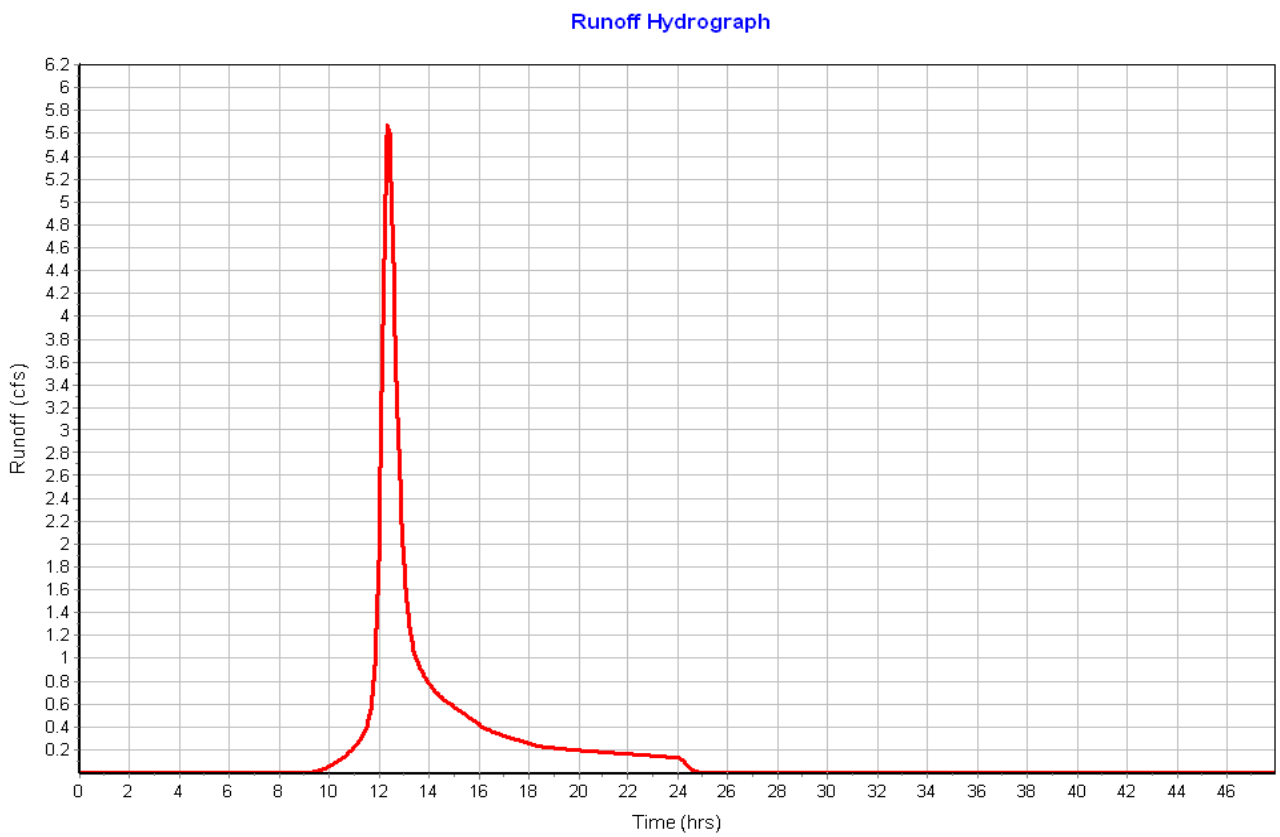
Total TOC (min) 29.92

Subbasin Runoff Results

Total Rainfall (in) 4.70
Total Runoff (in) 2.16
Peak Runoff (cfs) 5.71
Weighted Curve Number 74.46
Time of Concentration (days hh:mm:ss) 0 00:29:55

Subbasin : A


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B-1

Input Data

Area (ac) 2.55
Weighted Curve Number 66.95
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel-Pad	1.88	D	60.00
Rooftops	0.24	D	98.00
> 75% grass cover, Good	0.43	D	80.00
Composite Area & Weighted CN	2.55		66.95

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	38	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	2.82	0.00	0.00

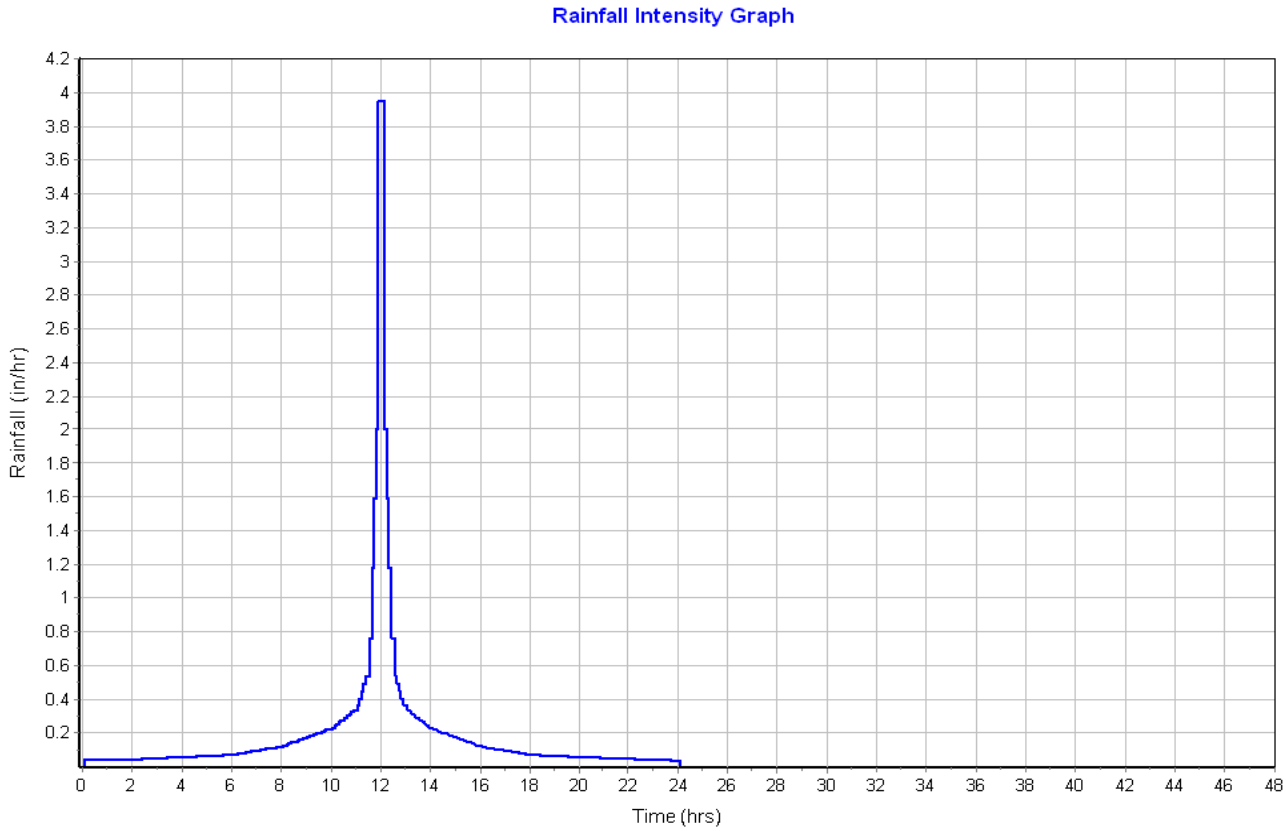
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	385	0.00	0.00
Slope (%) :	1.04	0.00	0.00
Surface Type :	Grassed waterway	Grass pasture	rass pasture
Velocity (ft/sec) :	1.53	0.00	0.00
Computed Flow Time (min) :	4.19	0.00	0.00

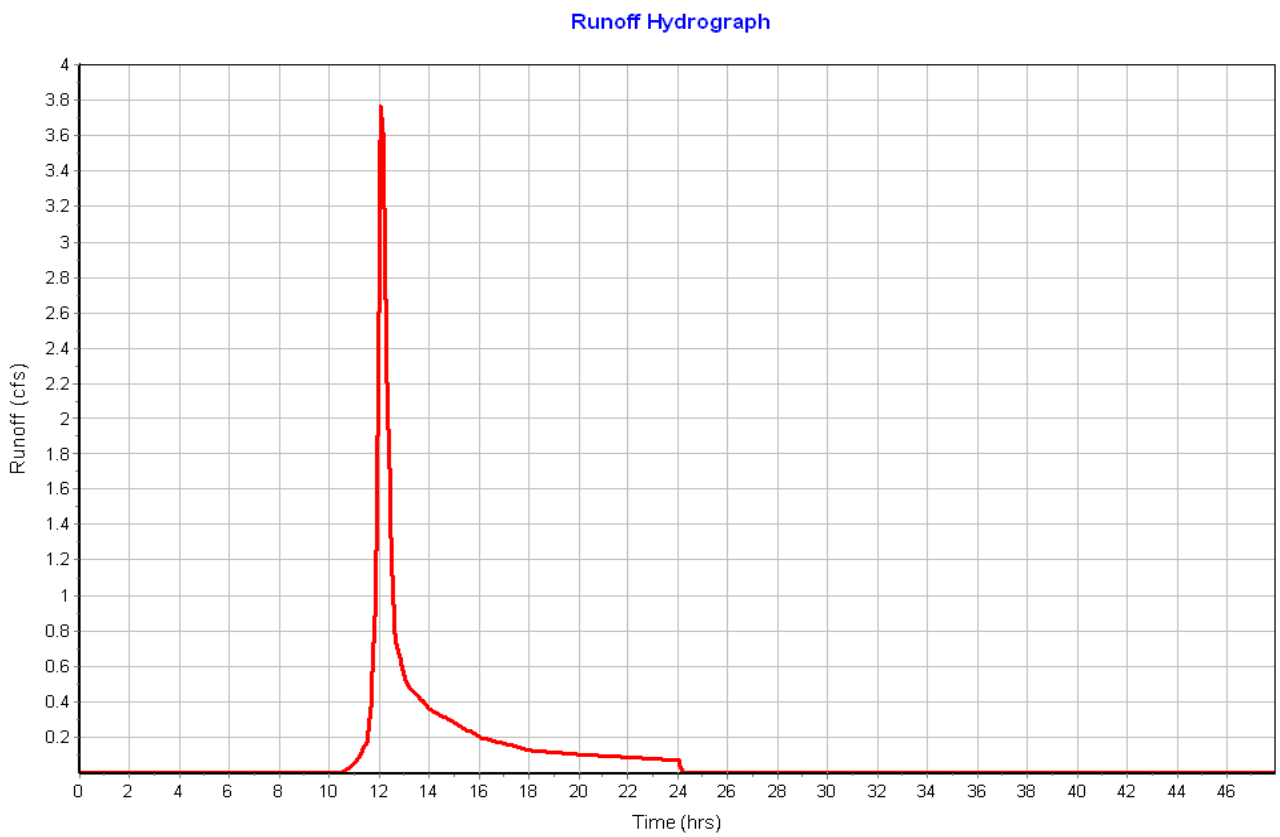
Total TOC (min) 7.02

Subbasin Runoff Results

Total Rainfall (in) 4.70
Total Runoff (in) 1.59
Peak Runoff (cfs) 4.05
Weighted Curve Number 66.95
Time of Concentration (days hh:mm:ss) 0 00:07:01

Subbasin : B-1


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B-2

Input Data

Area (ac) 7.03
Weighted Curve Number 70.54
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Brush, Good	5.19	D	73.00
Gravel roads	0.05	D	91.00
> 75% grass cover, Good	0.16	D	80.00
Gravel_Pad	1.58	D	60.00
ConcreteFoundations	0.05	D	98.00
Composite Area & Weighted CN	7.03		70.54

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	.25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.03	0.00	0.00
Computed Flow Time (min) :	50.95	0.00	0.00

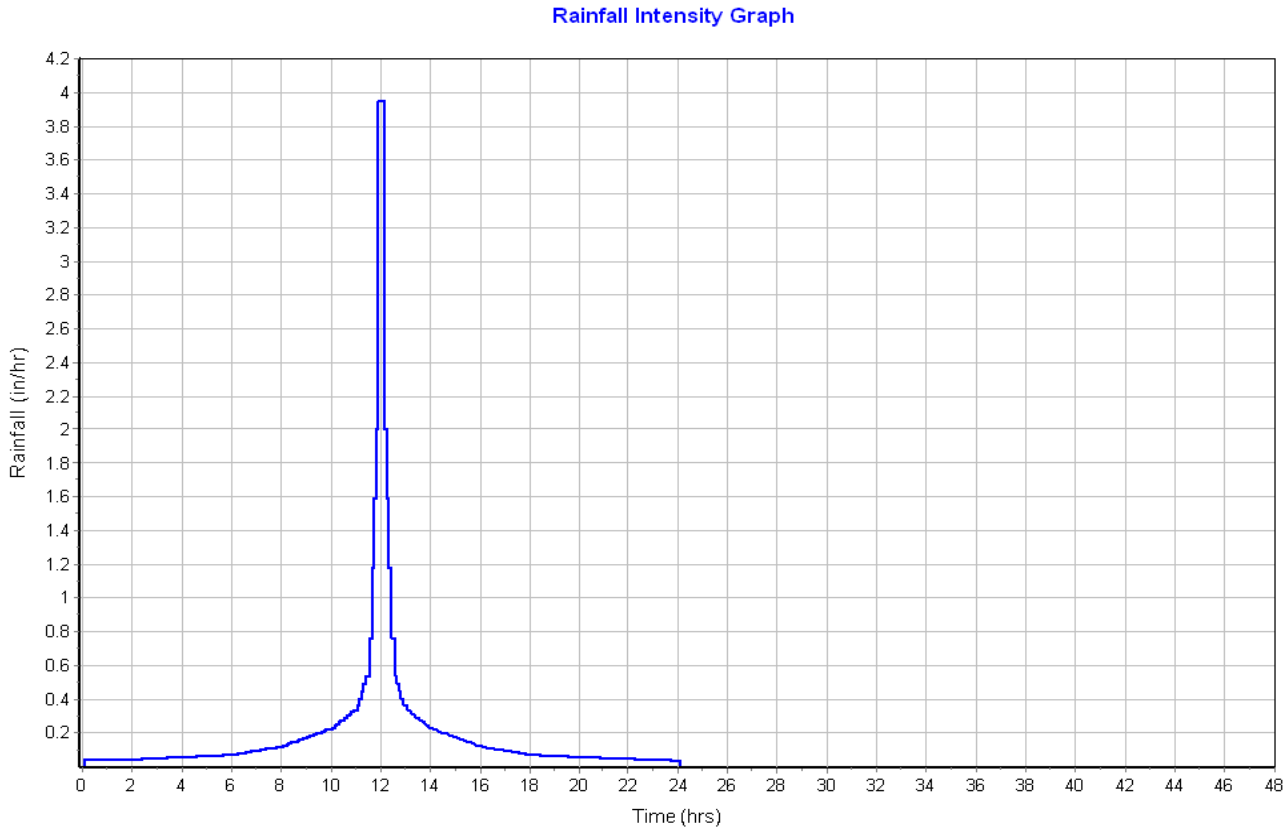
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	791	0.00	0.00
Slope (%) :	.5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	0.49	0.00	0.00
Computed Flow Time (min) :	26.90	0.00	0.00

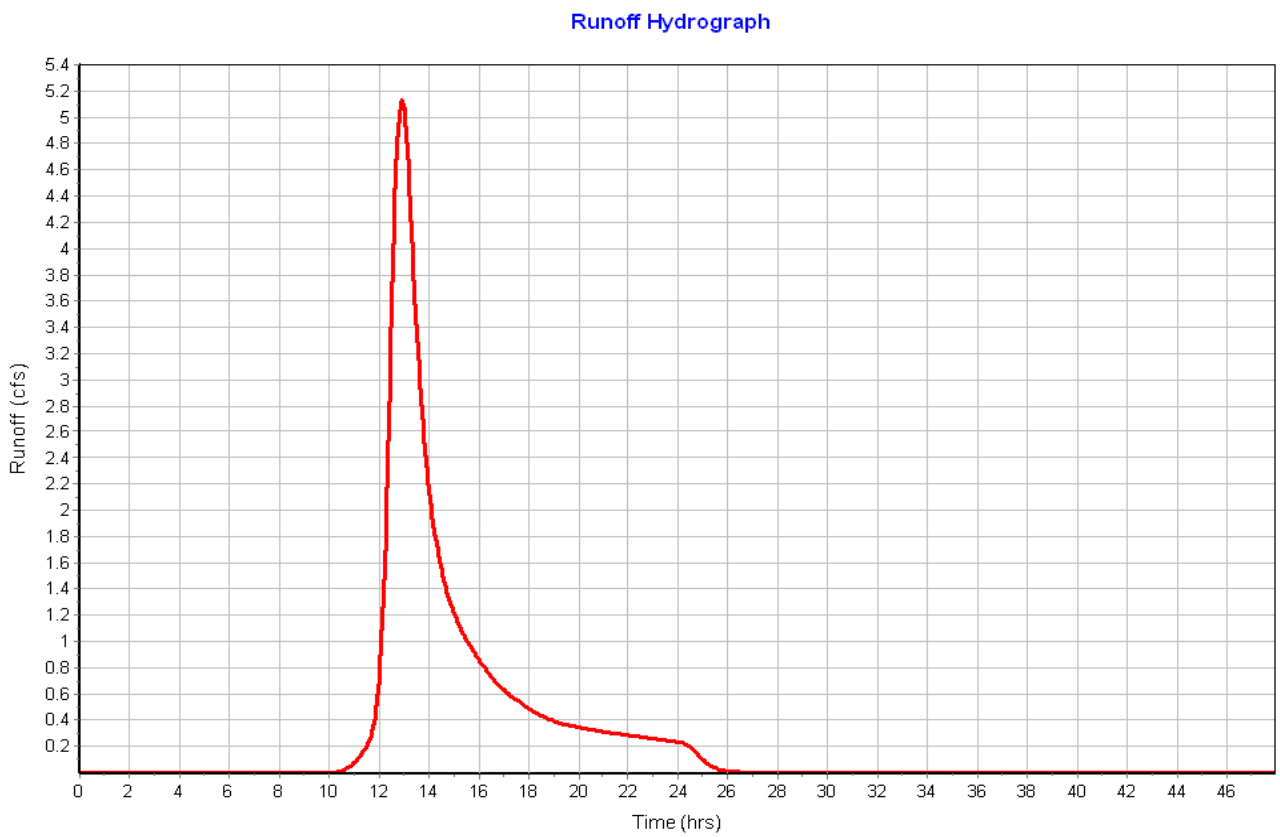
Total TOC (min) 77.86

Subbasin Runoff Results

Total Rainfall (in) 4.70
Total Runoff (in) 1.86
Peak Runoff (cfs) 5.14
Weighted Curve Number 70.54
Time of Concentration (days hh:mm:ss) 0 01:17:52

Subbasin : B-2


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C

Input Data

Area (ac) 0.21
Weighted Curve Number 75.29
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.12	D	77.00
Brush, Good	0.09	D	73.00
Composite Area & Weighted CN	0.21		75.29

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	80	0.00	0.00
Slope (%) :	4.31	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	18.88	0.00	0.00

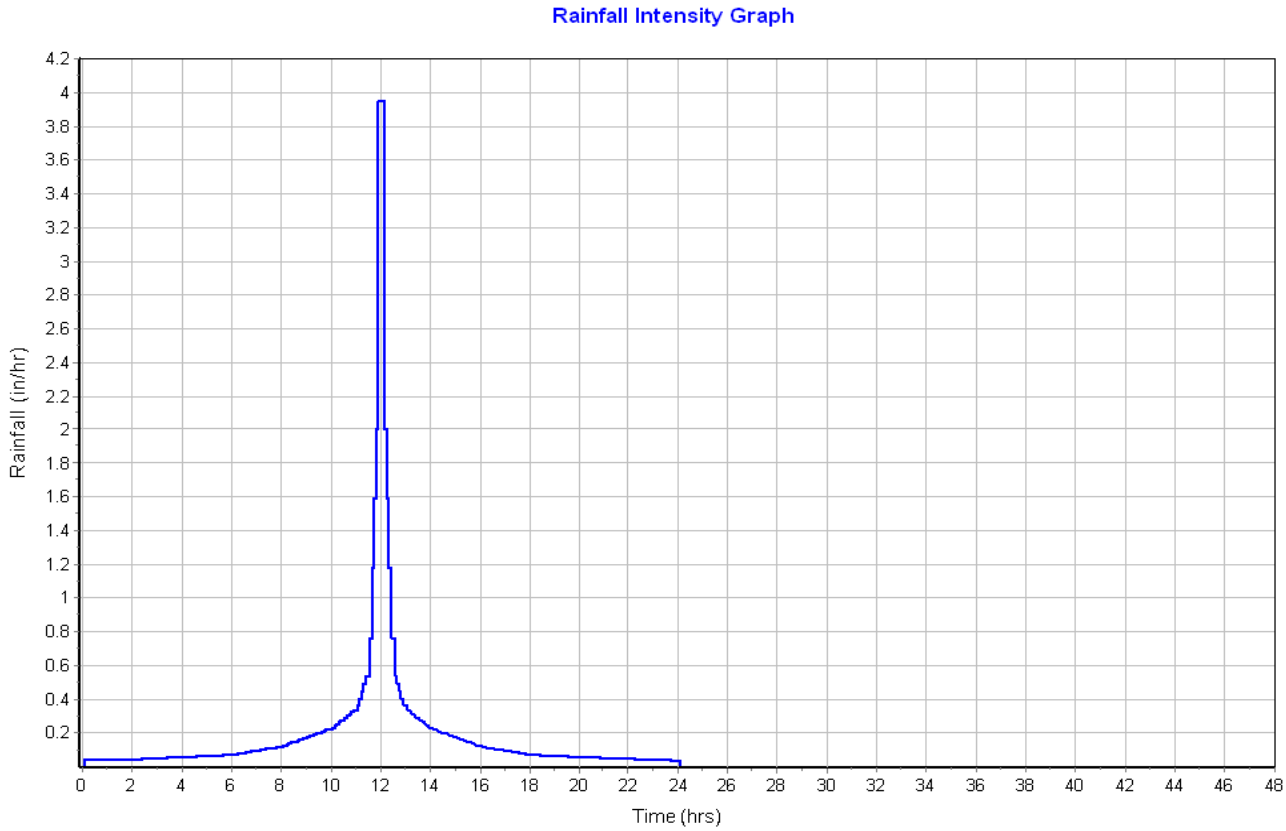
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	182	0.00	0.00
Slope (%) :	7.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.87	0.00	0.00
Computed Flow Time (min) :	1.62	0.00	0.00

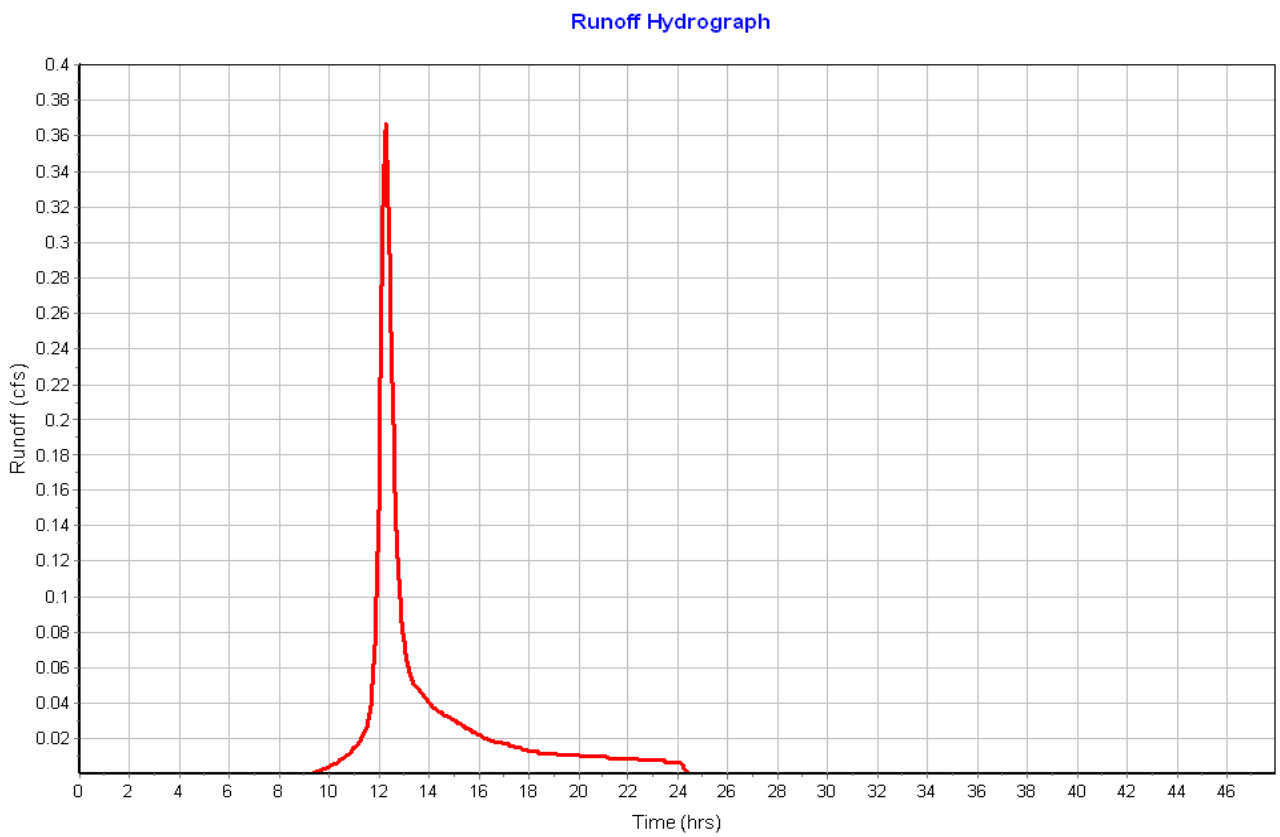
Total TOC (min) 20.50

Subbasin Runoff Results

Total Rainfall (in) 4.70
Total Runoff (in) 2.23
Peak Runoff (cfs) 0.37
Weighted Curve Number 75.29
Time of Concentration (days hh:mm:ss) 0 00:20:30

Subbasin : C


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : CulvertDrainageArea

Input Data

Area (ac) 0.68
Weighted Curve Number 75.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.68	-	75.00
Composite Area & Weighted CN	0.68		75.00

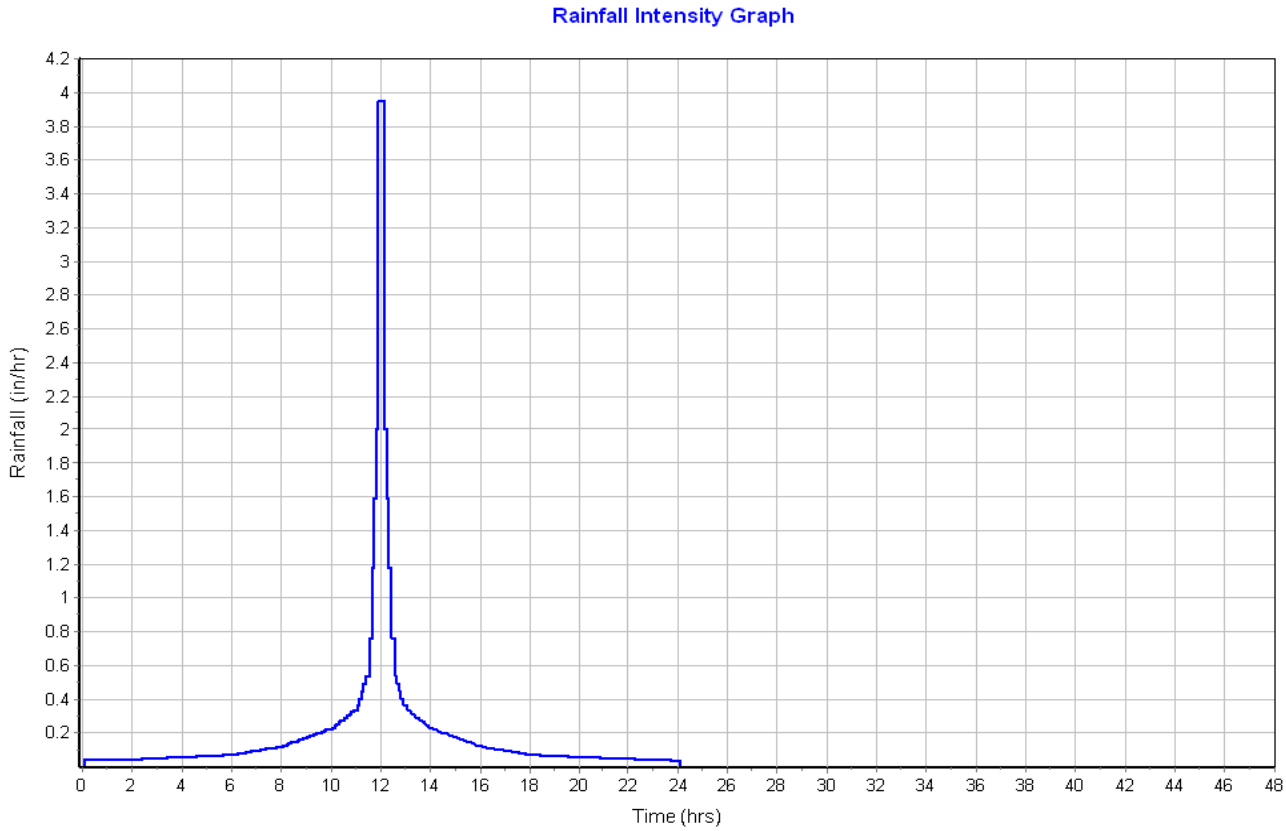
Time of Concentration

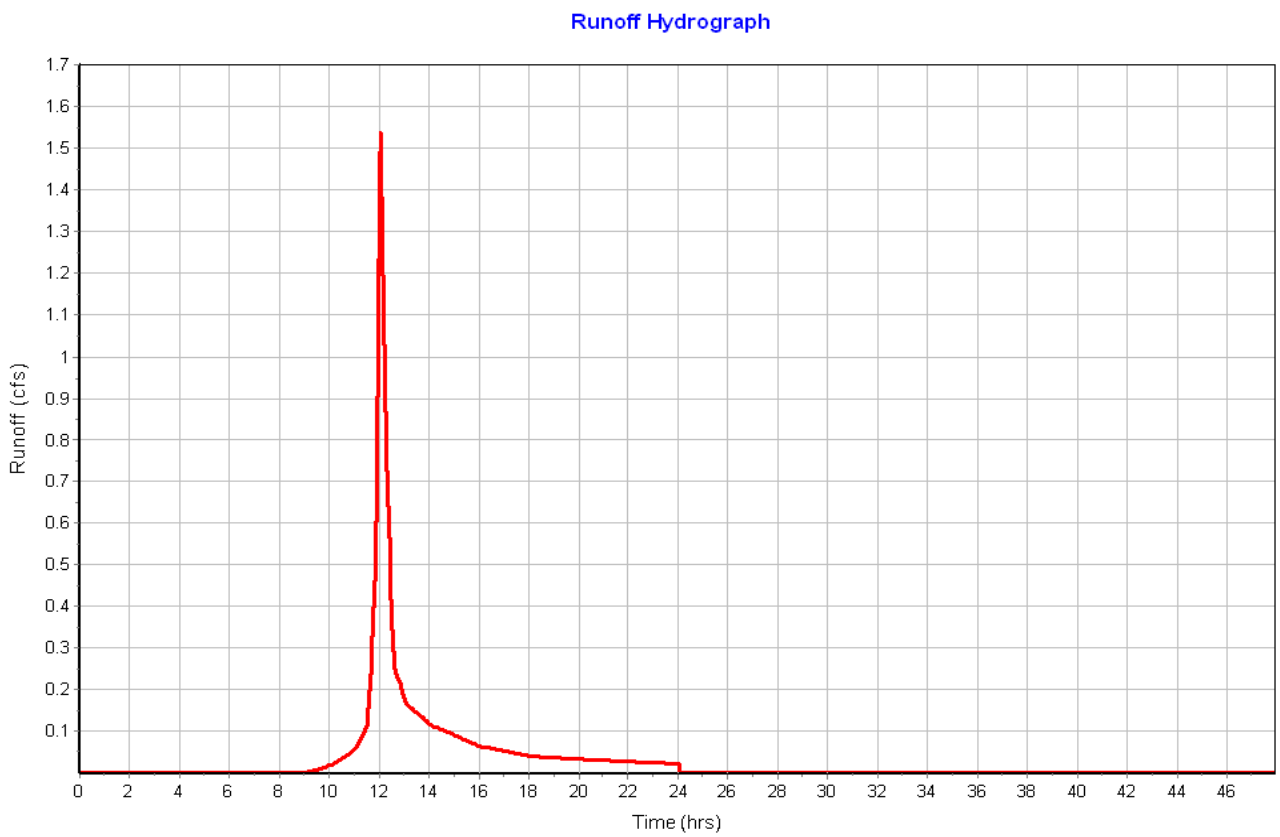
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

Total Rainfall (in) 4.70
Total Runoff (in) 2.21
Peak Runoff (cfs) 1.58
Weighted Curve Number 75.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : CulvertDrainageArea





Subbasin : D

Input Data

Area (ac) 0.12
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.12	D	77.00
Composite Area & Weighted CN	0.12		77.00

Time of Concentration

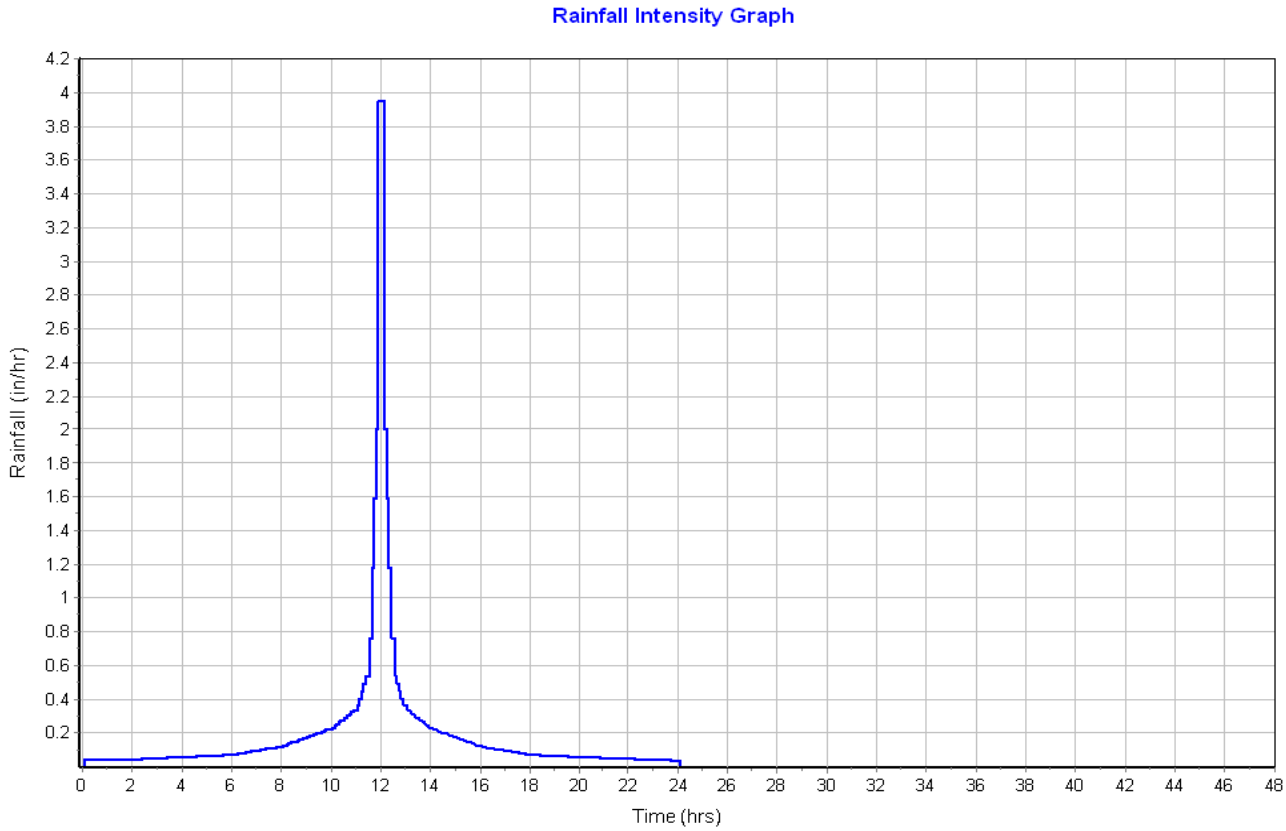
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	36	0.00	0.00
Slope (%) :	5.55	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.09	0.00	0.00
Computed Flow Time (min) :	6.51	0.00	0.00

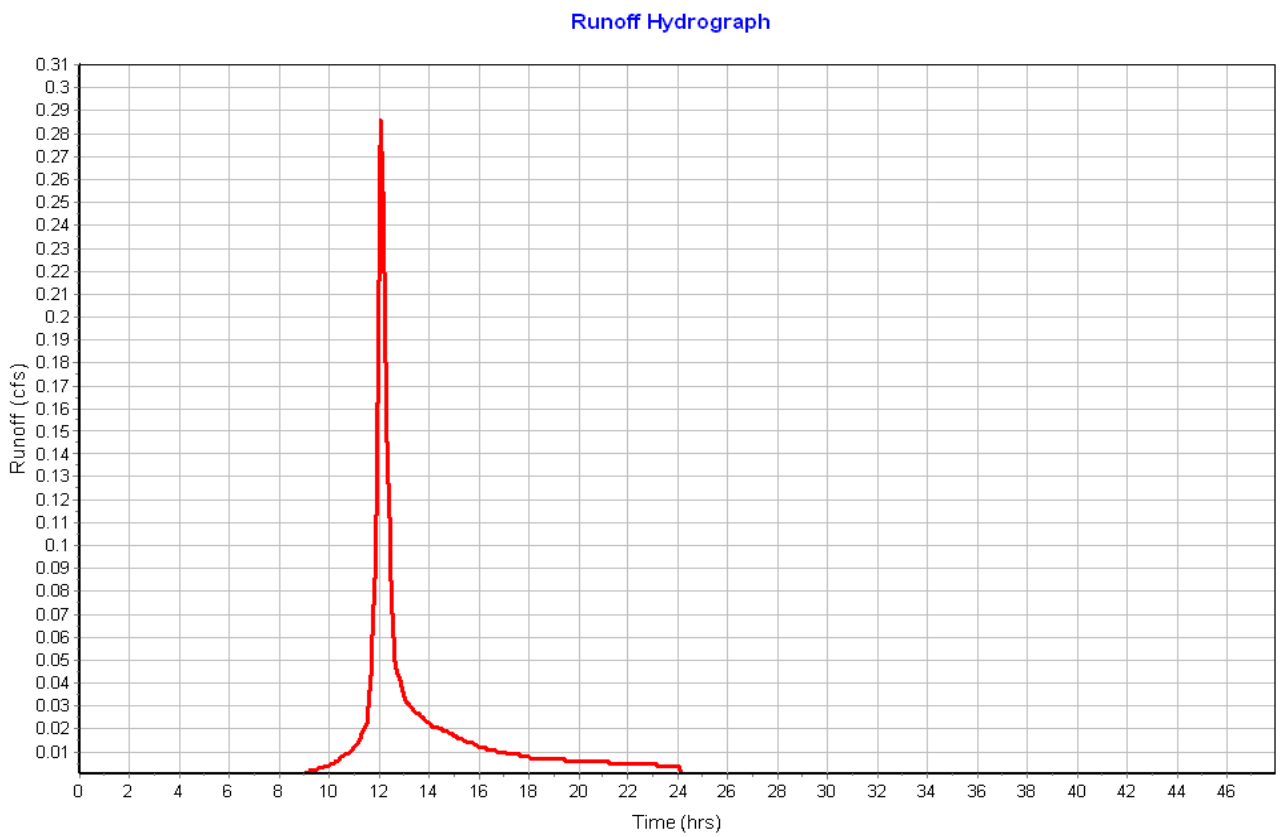
Total TOC (min) 6.51

Subbasin Runoff Results

Total Rainfall (in) 4.70
Total Runoff (in) 2.37
Peak Runoff (cfs) 0.30
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:06:31

Subbasin : D


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Junction Input

Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)
CulvertInlet	181.00	184.00
Out_B1andB2	176.00	6.00

Junction Results

Element ID	Peak Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Time of Max HGL Occurrence
	(cfs)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)
CulvertInlet	1.54	181.45	0.45	2.55	181.03	0 12:10
Out_B1andB2	5.73	176.00	0.00	0.00	176.00	0 00:00

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness
Direct_to_OutB	1715.96	0.00	0.00	0.0000	Dummy	0.000	0.000	0.0150
Link-03	45.00	181.00	180.55	1.0000	CIRCULAR	15.000	15.000	0.0150

Pipe Results

Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth
	(cfs)	(days hh:mm)	(cfs)	(ft/sec)	(ft)
Direct_to_OutB	5.73	0 13:00	0.00	0.00	0.00
Link-03	1.53	0 12:10	5.60	3.89	0.45

Project Description

File Name ..... Proposed Conditions_SMT.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Aug 15, 2017 00:00:00
End Analysis On ..... Aug 17, 2017 00:00:00
Start Reporting On ..... Aug 15, 2017 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	6
Nodes	7
Junctions	2
Outfalls	5
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	2
Channels	0
Pipes	2
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-25	Cumulative	inches	Maine	Cumberland (Southeast)	25	5.50	SCS Type III 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
A	3.95	74.46	5.50	2.81	11.10	7.47	0 00:29:55
B-1	2.55	66.95	5.50	2.16	5.50	5.55	0 00:07:01
B-2	7.03	70.54	5.50	2.46	17.30	6.91	0 01:17:51
C	0.21	75.29	5.50	2.89	0.61	0.48	0 00:20:30
CulvertDrainageArea	0.68	75.00	5.50	2.86	1.94	2.03	0 00:05:00
D	0.12	77.00	5.50	3.04	0.37	0.38	0 00:06:30

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Peak Inflow (cfs)
CulvertInlet	Junction	181.00	1.99
Out_B1andB2	Junction	176.00	7.71
CulvertOutlet	Outfall	180.35	1.98
OUT-A	Outfall	180.00	7.44
OUT-B	Outfall	176.00	7.71
OUT-C	Outfall	178.00	0.48
OUT-D	Outfall	190.82	0.37

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)	(ft/sec)	(ft)
Direct_to_OutB	Pipe	Out_B1andB2	OUT-B	1715.96	0.00	0.00	0.0000	0.000	0.0150	7.71	0.00	0.00	0.00
Link-03	Pipe	CulvertInlet	CulvertOutlet	45.00	181.00	180.55	1.0000	15.000	0.0150	1.98	5.60	4.17	0.51

Subbasin Hydrology

Subbasin : A

Input Data

Area (ac) 3.95
Weighted Curve Number 74.46
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.33	D	77.00
Gravel roads	0.10	D	91.00
> 75% grass cover, Good	0.38	D	80.00
Brush, Good	3.14	D	73.00
Composite Area & Weighted CN	3.95		74.46

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	45	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.23	0.00	0.00
Computed Flow Time (min) :	3.23	0.00	0.00

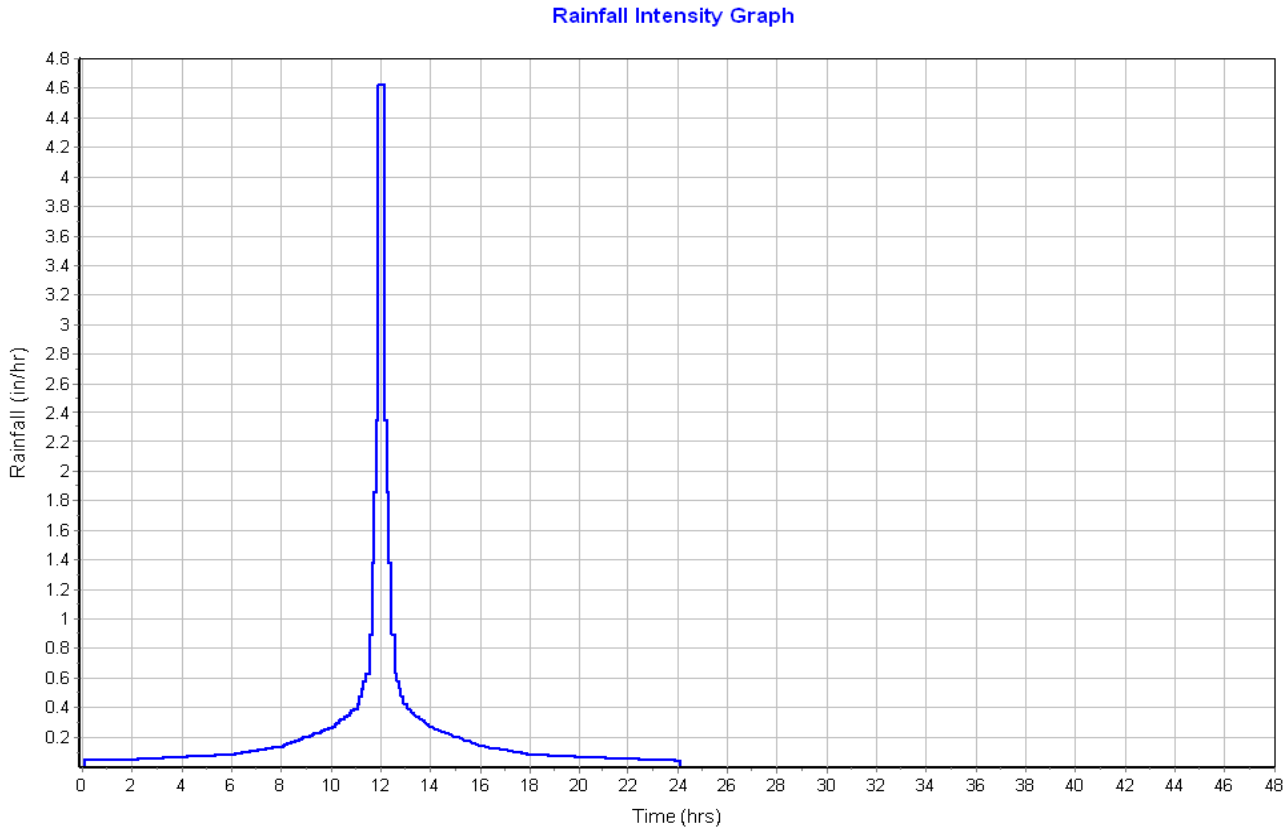
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	264	574	0.00
Slope (%) :	.76	.35	0.00
Surface Type :	Grassed waterway	Grass pasture	Unpaved
Velocity (ft/sec) :	1.31	0.41	0.00
Computed Flow Time (min) :	3.36	23.33	0.00

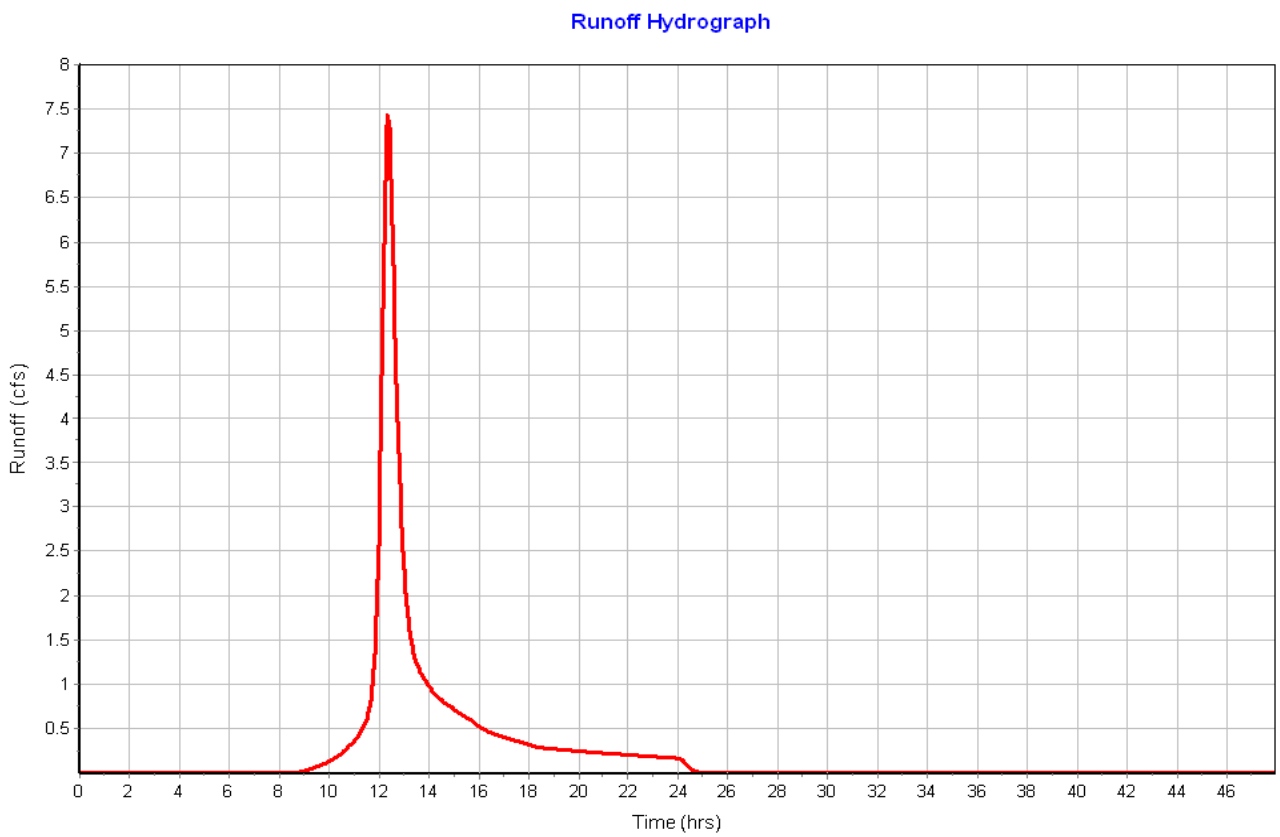
Total TOC (min) 29.92

Subbasin Runoff Results

Total Rainfall (in) 5.50
Total Runoff (in) 2.81
Peak Runoff (cfs) 7.47
Weighted Curve Number 74.46
Time of Concentration (days hh:mm:ss) 0 00:29:55

Subbasin : A


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B-1

Input Data

Area (ac) 2.55
Weighted Curve Number 66.95
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel-Pad	1.88	D	60.00
Rooftops	0.24	D	98.00
> 75% grass cover, Good	0.43	D	80.00
Composite Area & Weighted CN	2.55		66.95

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	38	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	2.82	0.00	0.00

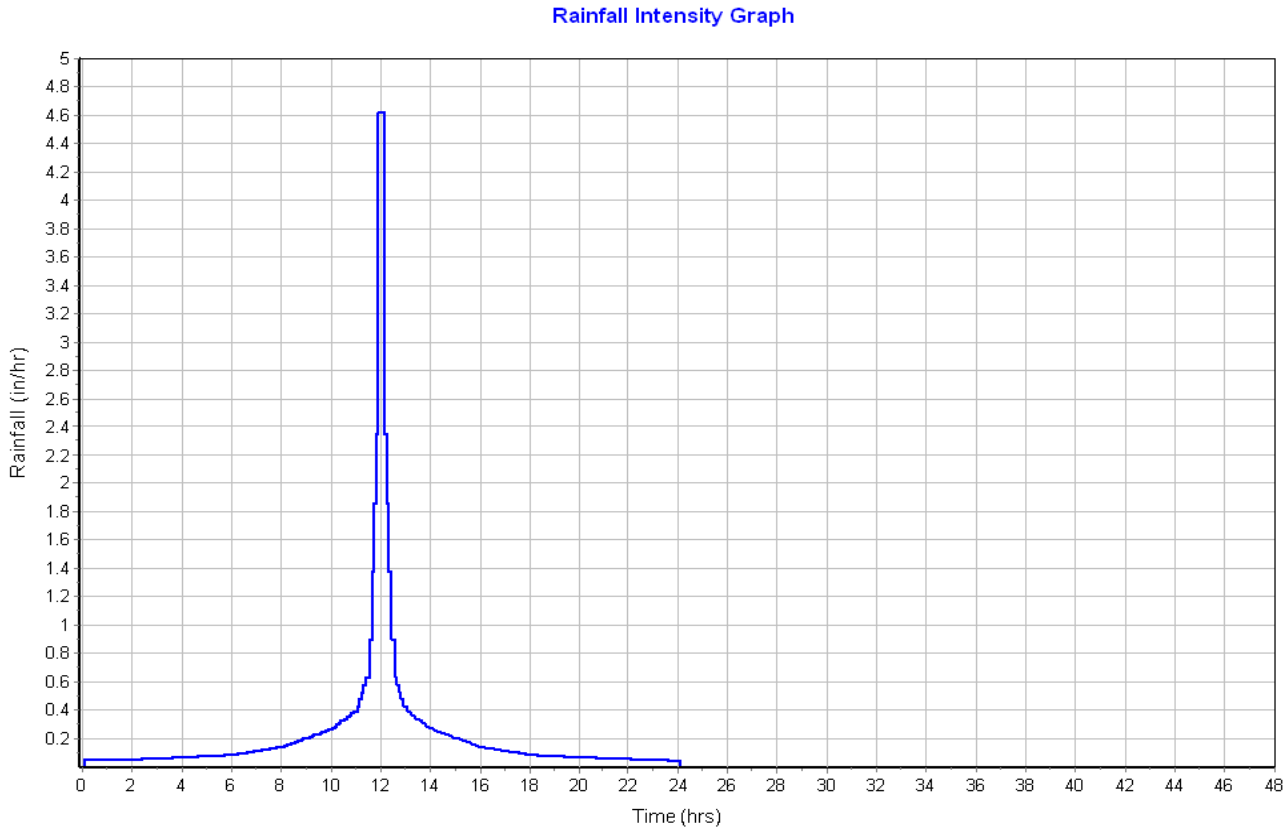
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	385	0.00	0.00
Slope (%) :	1.04	0.00	0.00
Surface Type :	Grassed waterway	Grass pasture	rass pasture
Velocity (ft/sec) :	1.53	0.00	0.00
Computed Flow Time (min) :	4.19	0.00	0.00

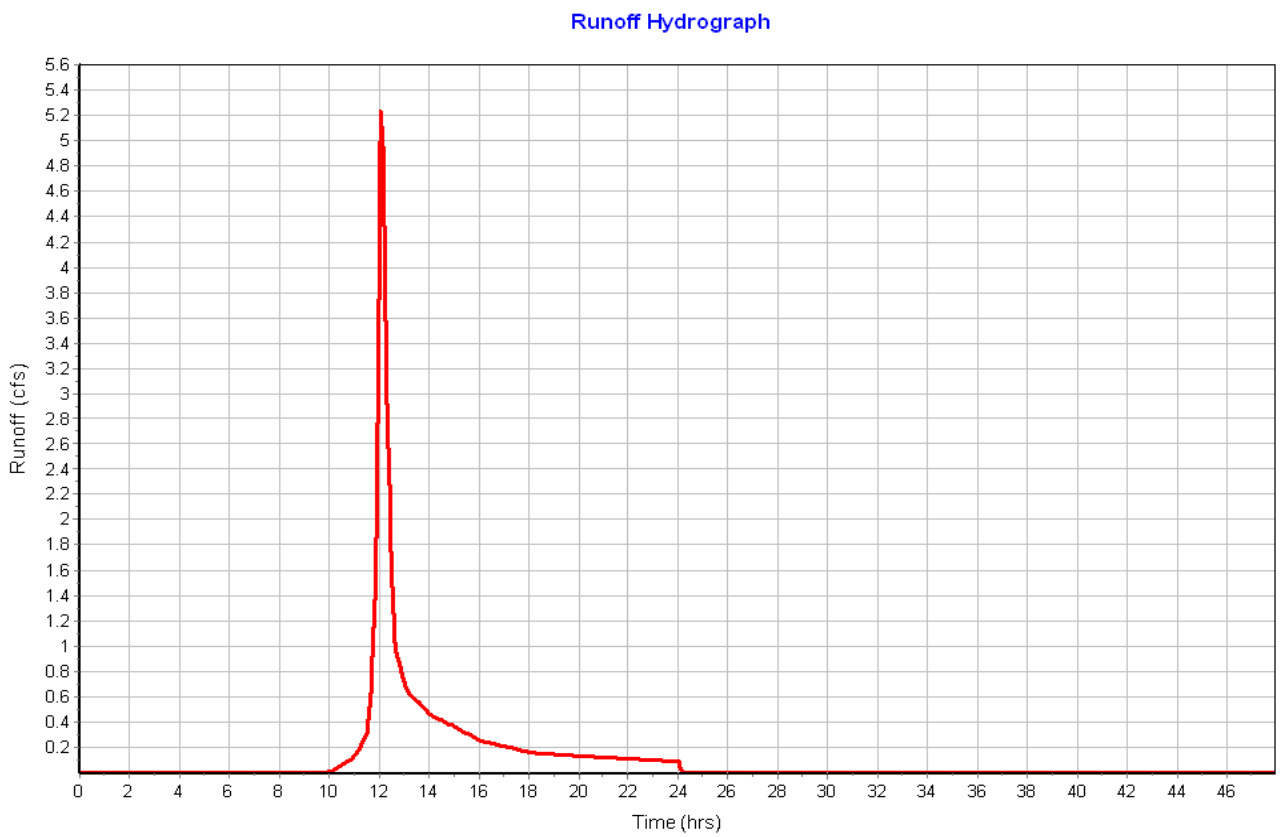
Total TOC (min) 7.02

Subbasin Runoff Results

Total Rainfall (in) 5.50
Total Runoff (in) 2.16
Peak Runoff (cfs) 5.55
Weighted Curve Number 66.95
Time of Concentration (days hh:mm:ss) 0 00:07:01

Subbasin : B-1


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B-2

Input Data

Area (ac) 7.03
Weighted Curve Number 70.54
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Brush, Good	5.19	D	73.00
Gravel roads	0.05	D	91.00
> 75% grass cover, Good	0.16	D	80.00
Gravel_Pad	1.58	D	60.00
ConcreteFoundations	0.05	D	98.00
Composite Area & Weighted CN	7.03		70.54

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	.25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.03	0.00	0.00
Computed Flow Time (min) :	50.95	0.00	0.00

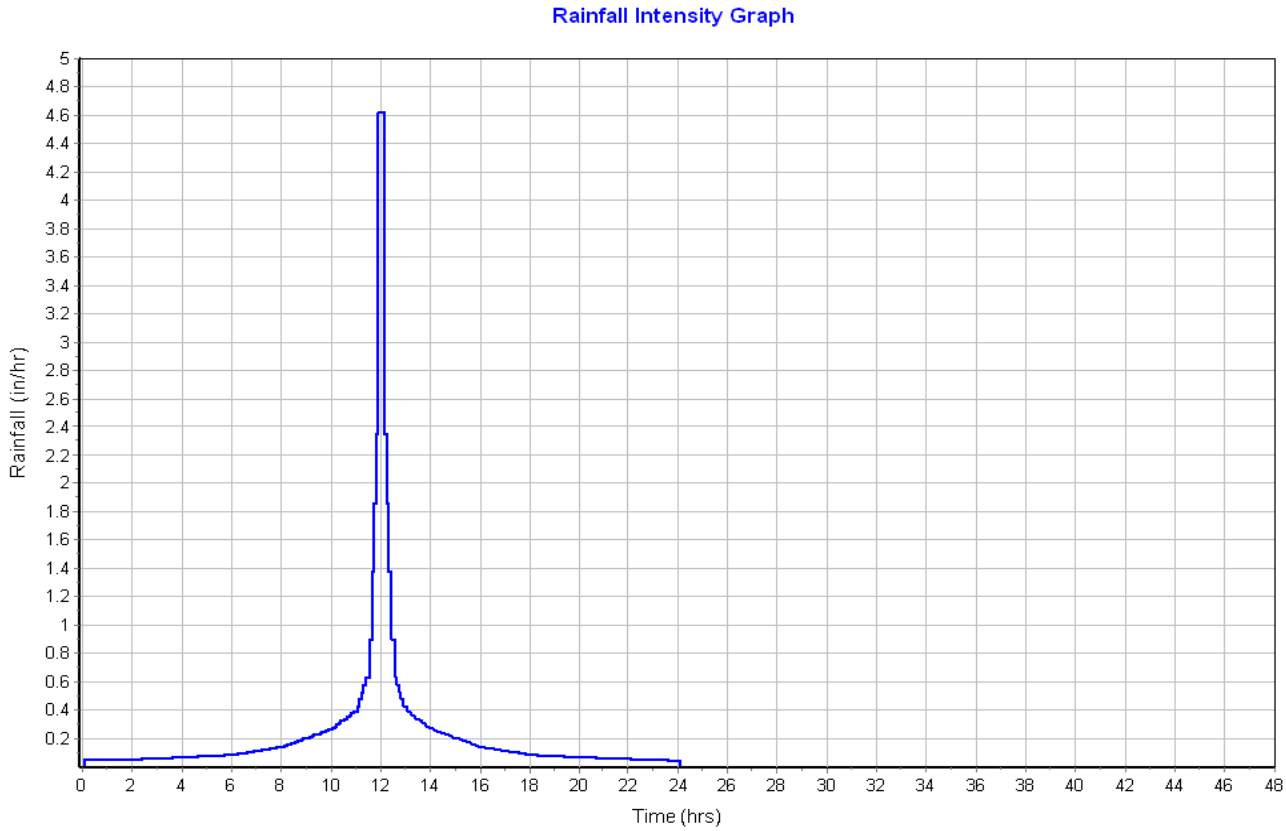
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	791	0.00	0.00
Slope (%) :	.5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	0.49	0.00	0.00
Computed Flow Time (min) :	26.90	0.00	0.00

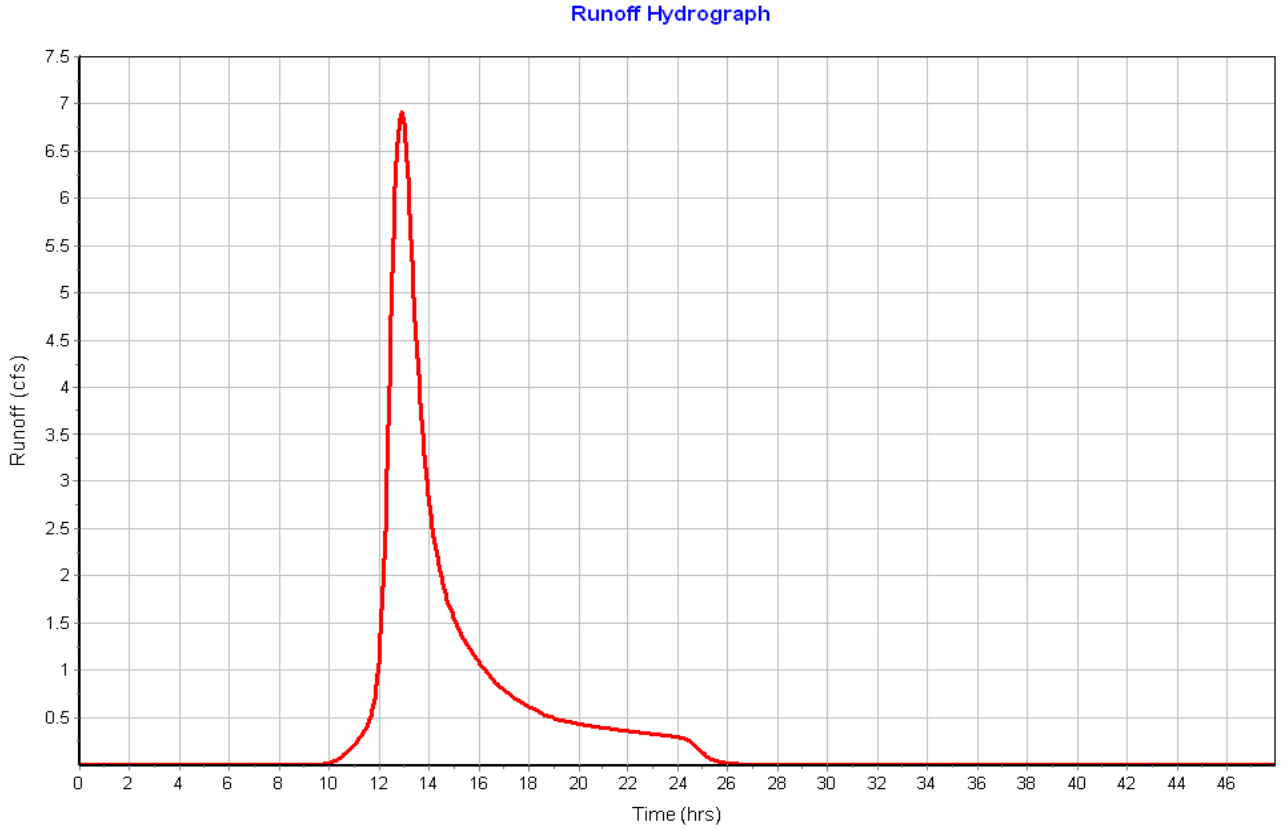
Total TOC (min) 77.86

Subbasin Runoff Results

Total Rainfall (in) 5.50
Total Runoff (in) 2.46
Peak Runoff (cfs) 6.91
Weighted Curve Number 70.54
Time of Concentration (days hh:mm:ss) 0 01:17:52

Subbasin : B-2


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C

Input Data

Area (ac) 0.21
Weighted Curve Number 75.29
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.12	D	77.00
Brush, Good	0.09	D	73.00
Composite Area & Weighted CN	0.21		75.29

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	80	0.00	0.00
Slope (%) :	4.31	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	18.88	0.00	0.00

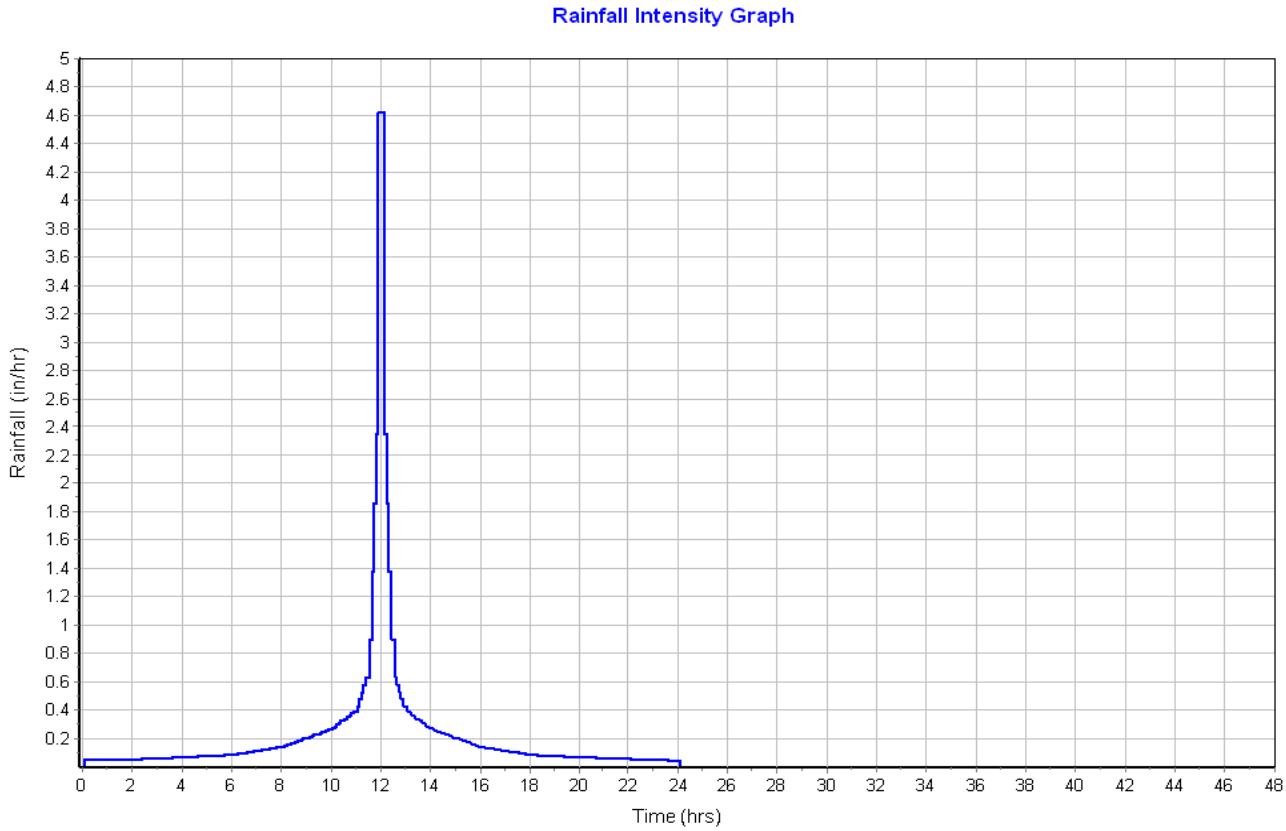
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	182	0.00	0.00
Slope (%) :	7.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.87	0.00	0.00
Computed Flow Time (min) :	1.62	0.00	0.00

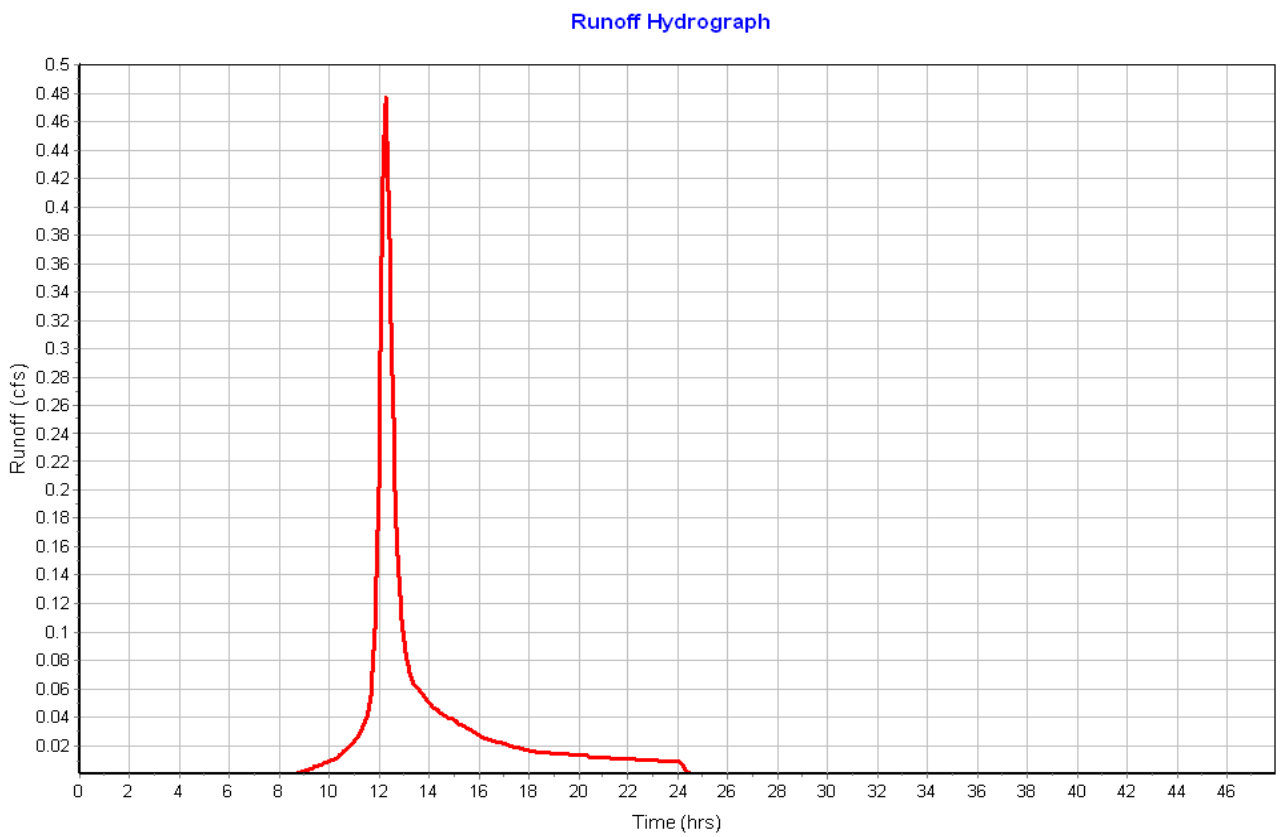
Total TOC (min) 20.50

Subbasin Runoff Results

Total Rainfall (in) 5.50
Total Runoff (in) 2.89
Peak Runoff (cfs) 0.48
Weighted Curve Number 75.29
Time of Concentration (days hh:mm:ss) 0 00:20:30

Subbasin : C


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : CulvertDrainageArea

Input Data

Area (ac) 0.68
Weighted Curve Number 75.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.68	-	75.00
Composite Area & Weighted CN	0.68		75.00

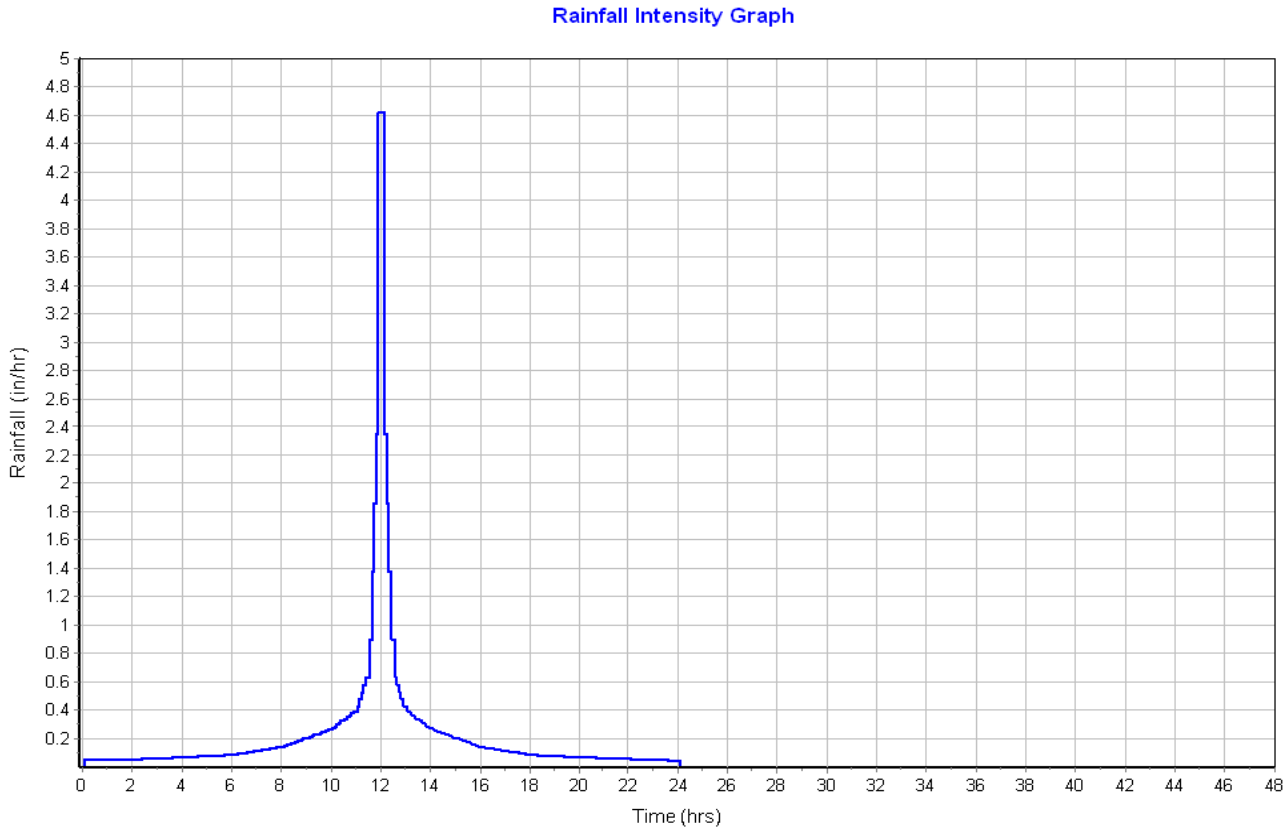
Time of Concentration

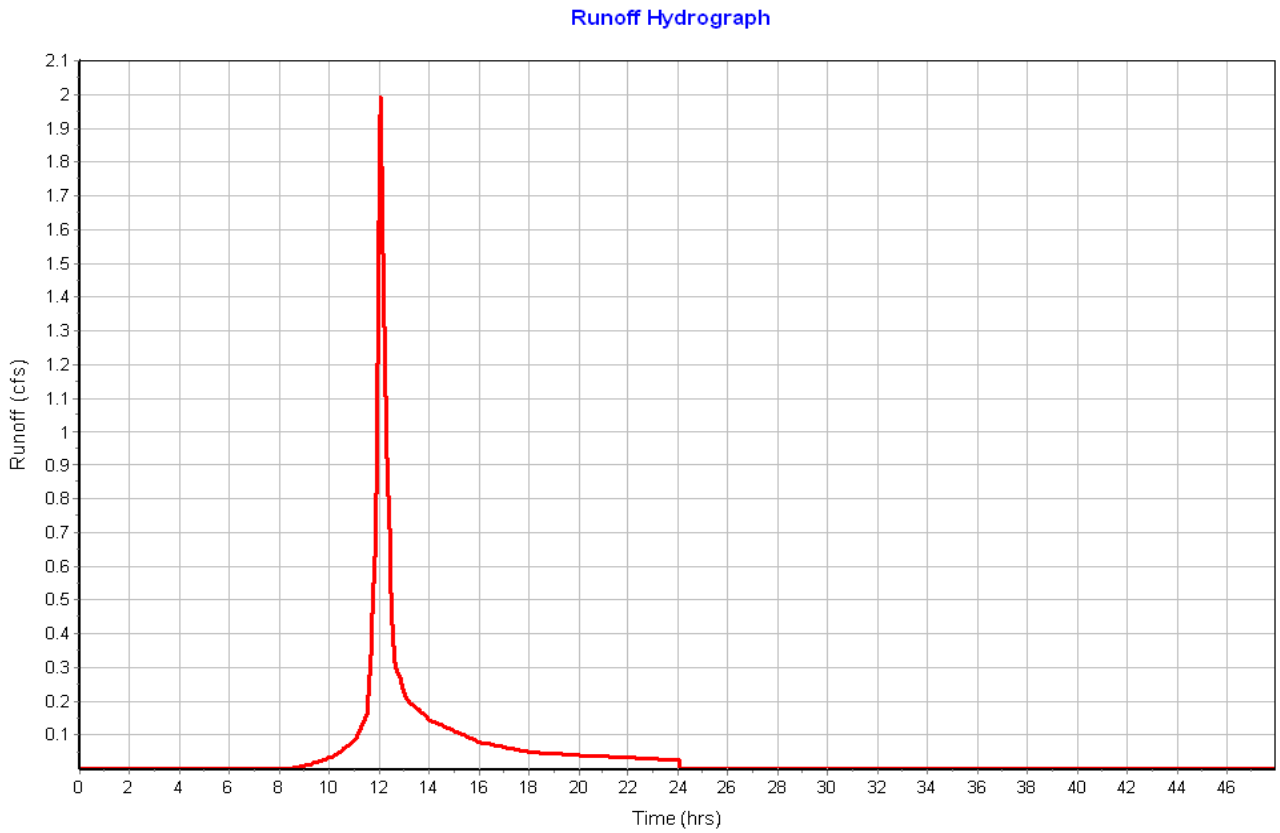
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

Total Rainfall (in) 5.50
Total Runoff (in) 2.86
Peak Runoff (cfs) 2.03
Weighted Curve Number 75.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : CulvertDrainageArea





Subbasin : D

Input Data

Area (ac) 0.12
Weighted Curve Number 77.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.12	D	77.00
Composite Area & Weighted CN	0.12		77.00

Time of Concentration

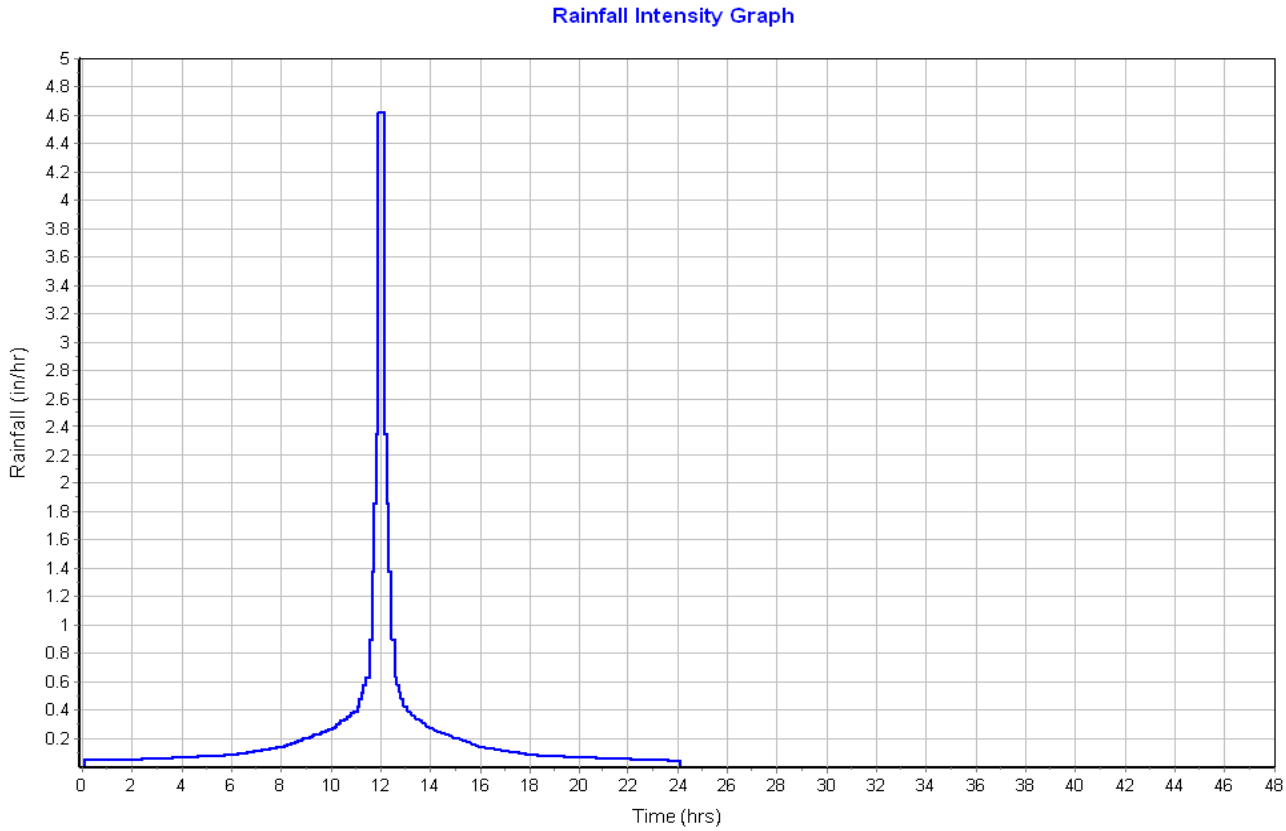
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	36	0.00	0.00
Slope (%) :	5.55	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.00	0.00	0.00
Velocity (ft/sec) :	0.09	0.00	0.00
Computed Flow Time (min) :	6.51	0.00	0.00

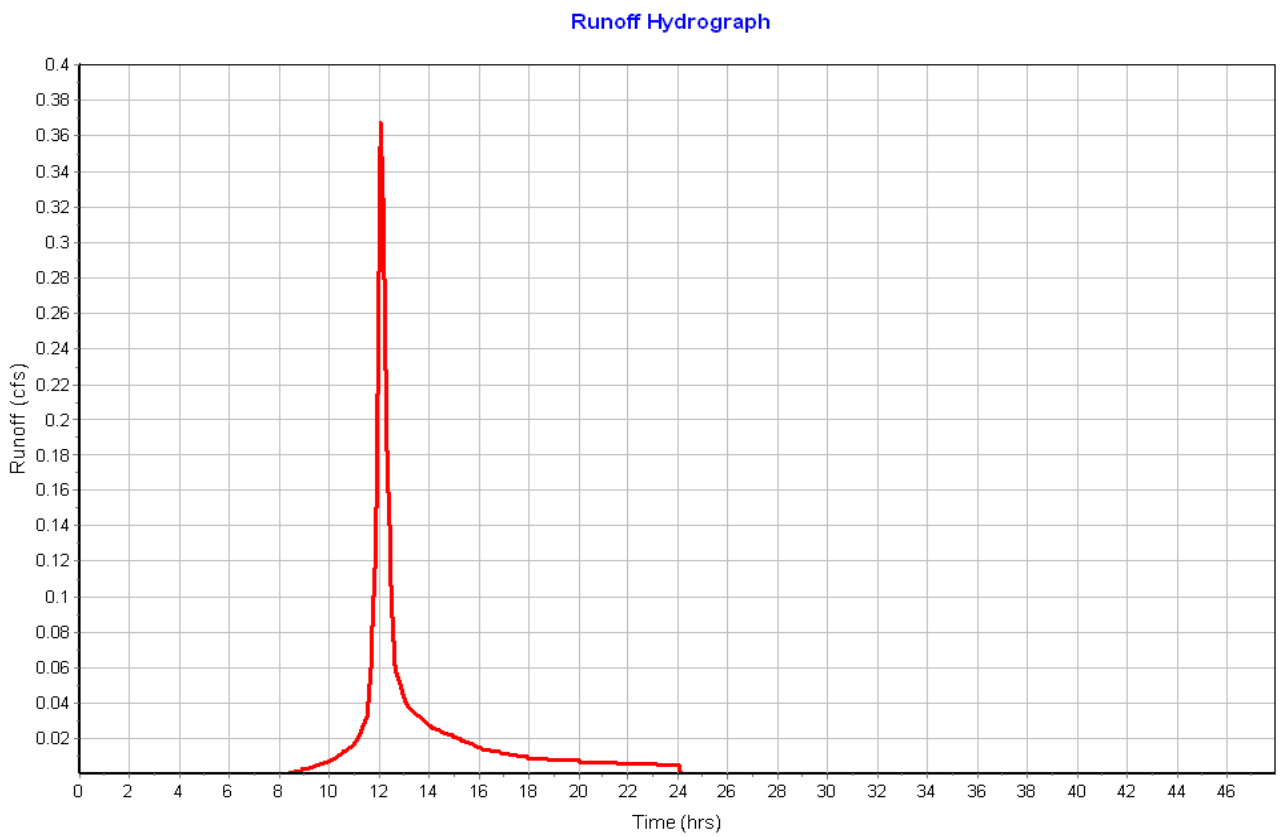
Total TOC (min) 6.51

Subbasin Runoff Results

Total Rainfall (in) 5.50
Total Runoff (in) 3.04
Peak Runoff (cfs) 0.38
Weighted Curve Number 77.00
Time of Concentration (days hh:mm:ss) 0 00:06:31

Subbasin : D


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Junction Input

Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)
CulvertInlet	181.00	184.00
Out_B1andB2	176.00	6.00

Junction Results

Element ID	Peak Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Time of Max HGL Occurrence
	(cfs)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)
CulvertInlet	1.99	181.52	0.52	2.48	181.04	0 12:10
Out_B1andB2	7.71	176.00	0.00	0.00	176.00	0 00:00

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness
Direct_to_OutB	1715.96	0.00	0.00	0.0000	Dummy	0.000	0.000	0.0150
Link-03	45.00	181.00	180.55	1.0000	CIRCULAR	15.000	15.000	0.0150

Pipe Results

Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth
	(cfs)	(days hh:mm)	(cfs)	(ft/sec)	(ft)
Direct_to_OutB	7.71	0 12:55	0.00	0.00	0.00
Link-03	1.98	0 12:10	5.60	4.17	0.51

FILTER NOTES:

1. UNDERDRAIN PIPES SHALL BE SCH. 40 PVC. ENDS OF UNDERDRAIN PIPING SHALL BE PLUGGED WITH PIPE FITTINGS. PIPE JOINTS SHALL BE FULLY GLUED.
2. SOIL FILTER OUTLET PIPE SHALL HAVE 6" DIA. BALL VALVE, WITH 22 - 43 GPM FLOW RATE CAPACITY.
3. COMPACT EMBANKMENT MATERIAL TO 93% OF MAXIMUM DENSITY AS DETERMINED BY ASTM D1557.
4. FILTER BED & SIDE SLOPES SHALL BE SEEDED USING "NEW ENGLAND CONSERVATION/WILDLIFE MIX" FROM NEW ENGLAND WETLAND PLANTS, INC.OF AMHERST, MA. OR APPROVED EQUAL (APPLICATION RATE 25#/ACRE).
5. MDOT 703.22 UNDERDRAIN BACKFILL MATERIAL, TYPE B SPECIFICATIONS.

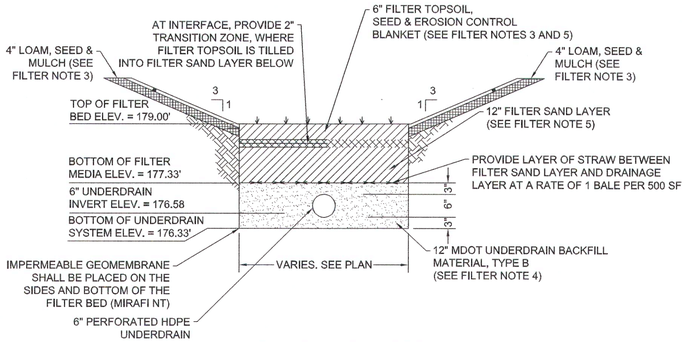
SIEVE	BY WEIGHT
1	90 - 100
1 / 2	75 - 100
#4	50 - 100
#20	15 - 80
#50	0 - 15
#200	0 - 5

6. FILTER MEDIA MATERIALS:
   6.1. FILTER TOPSOIL LAYER: A 6-INCH LAYER OF LOAMY TOPSOIL SUCH AS USDA SANDY LOAM TOPSOIL WITH 5-8% HUMIFIED ORGANIC MATTER. SCREENED TOPSOIL FROM THE SITE MAY BE APPROPRIATE BUT SHALL BE TESTED FOR ORGANIC CONTENT. ORGANIC MATTER (SUCH AS SUPERHUMUS OR EQUIVALENT) MAY BE ADDED IF NECESSARY, PROVIDED THAT THE RESULTING TEXTURE IS SUITABLE. SEE EROSION CONTROL DETAILS FOR EROSION CONTROL BLANKET INSTALLATION REQUIREMENTS.
   6.2. FILTER SAND LAYER: A 12-INCH LAYER OF LOAMY COARSE SAND PER MAINE DEP STORMWATER BEST MANAGEMENT PRACTICES TABLE 7.1.3.

SIEVE	BY WEIGHT
#10	85-100
#20	70-100
#60	15-40
#200	8-15
#200 (CLAY SIZE)	<2.0

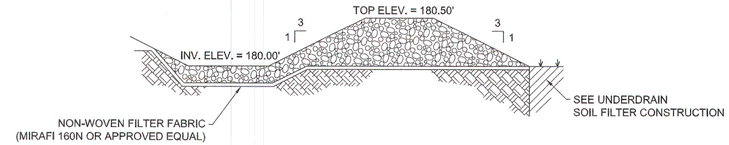
FILTER CONSTRUCTION INSPECTION AND TESTING NOTES:

1. INSPECTION OF THE FILTER BASIN SHALL BE PROVIDED FOR EACH PHASE OF CONSTRUCTION BY THE DESIGN ENGINEER WITH REQUIRED REPORTING TO THE MAINE DEP.
2. AT A MINIMUM INSPECTIONS WILL OCCUR:
   2.1. AFTER PRELIMINARY CONSTRUCTION OF THE FILTER GRADES AND ONCE THE UNDERDRAIN PIPES ARE INSTALLED BUT NOT BACKFILLED;
   2.2. AFTER THE DRAINAGE LAYER IS CONSTRUCTED AND PRIOR TO THE INSTALLATION OF THE FILTER SAND LAYER;
   2.3. AFTER FILTER SAND LAYER IS CONSTRUCTED AND PRIOR TO THE INSTALLATION OF THE FILTER TOPSOIL LAYER;
   2.4. AFTER THE FILTER TOPSOIL LAYER HAS BEEN INSTALLED AND SEEDED; AND
   2.5. AFTER ONE YEAR TO INSPECT HEALTH OF THE VEGETATION AND MAKE CORRECTIONS.
3. THE CONTRACTOR SHALL PROVIDE SUBMITTALS FOR EACH COMPONENT OF THE FILTER MEDIA, IDENTIFYING THE SOURCE.
4. ALL MATERIAL USED FOR THE CONSTRUCTION OF THE FILTER BASIN WILL BE APPROVED BY THE DESIGN ENGINEER, AFTER TESTS BY A CERTIFIED LABORATORY SHOW THAT THEY ARE PASSING MAINE DEP SPECIFICATIONS.
5. THE CONTRACTOR SHALL SUBMIT SAMPLES OF EACH TYPE OF MATERIAL TO BE USED FOR THE MIXED FILTER MEDIA AND SAMPLES OF THE UNDERDRAIN BEDDING MATERIAL. SAMPLES MUST BE A COMPOSITE OF THREE DIFFERENT LOCATIONS (GRABS) FROM THE STOCKPILE OR PIT FACE. SAMPLE SIZE REQUIRED WILL BE DETERMINED BY THE TESTING LABORATORY.
6. THE CONTRACTOR SHALL PERFORM, OR HAVE PERFORMED, A SIEVE ANALYSIS CONFORMING TO ASTM C138 ON EACH TYPE OF THE SAMPLE MATERIAL. ALL MATERIALS SHALL HAVE A CLAY CONTENT OF LESS THAN 2% AS DETERMNED BY HYDROMETER GRAIN SIZE ANALYSIS.
7. THE CONTRACTOR SHALL PERFORM, OR HAVE PERFORMED, A PERMEABILITY TEST ON THE SOIL FILTER MEDIA MATERIALS CONFORMING TO ASTM D2434 WITH THE MIXTURE COMPACTED TO 90 - 92% OF MAXIMUM DRY DENSITY BASED ON ASTM D698.

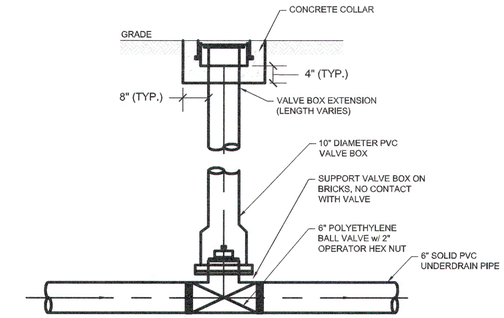


GRASSED UNDERDRAIN SOIL FILTER
CONSTRUCTION DETAILS
NTS

NOTE:
FILTER CROSS SECTION IS SHOWN FOR GRAPHICAL PURPOSES ONLY - NOT TRUE SCALE.



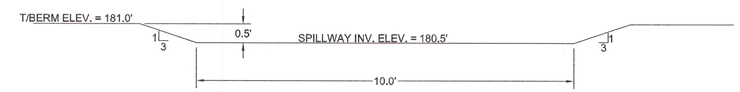
STONE FOREBAY
NTS



NOTES:

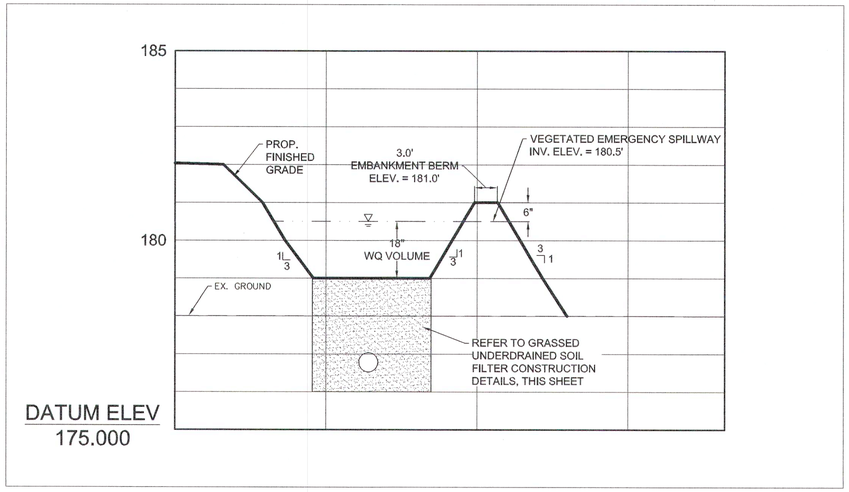
1. INSTALL THE BALL VALVE DURING THE INITIAL PIPE INSTALLATION IN THE FULLY-OPEN POSITION
2. FOLLOWING INITIAL RAIN EVENT THAT PRODUCE OBSERVED OUTFLOW, CLOSE VALVE TO ALLOW AN OUTLFOW OF BETWEEN 22-43 GPM FOR A DEWATERING TIME OF 24-48 HOURS
3. TURN VALVE 1/2 TO 3/4 CLOSED TO ACHIEVE THE REQUIRED MAXIMUM FLOW RATE

6" SOIL FILTER UNDERDRAIN BALL VALVE
NTS



QPEAK, 25-YEAR = 5.55 CFS
VPEAK, 25-YEAR = 1.64 FPS
WEIR LENGTH = 10'
WEIR HEIGHT = 0.5'
FLOW DEPTH, 25-YEAR = 0.31'

UNDERDRAINED SOIL FILTER
EMERGENCY SPILLWAY
NTS



ISSUED FOR REVIEW
NOT FOR CONSTRUCTION 05/29/18

REV.	DESCRIPTION	DATE	BY	CK	APP
B	MEDEP PERMIT SET COMMENT REVISIONS	05/29/18	TJG	KRV	

OWNER ENGINEER:
APPROVAL STAMP:
DRAWING PREPARED BY:
ACCEPTED BY OE:
PE Stamp: STATE OF MAINE, KENNETH R. VOLOCK, NO. 11063, LICENSED PROFESSIONAL ENGINEER, 05-29-18

IUSA ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of Iberdrola, USA

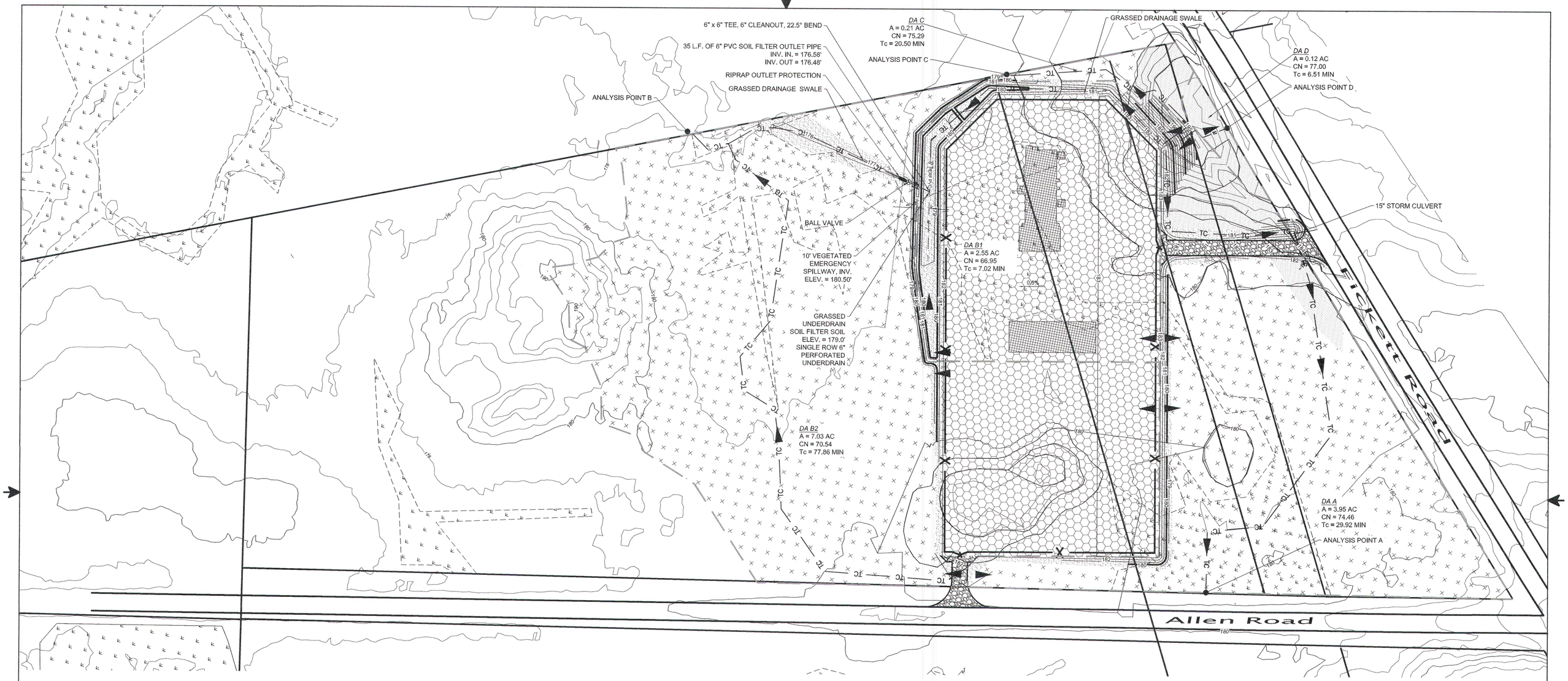
CMP IBERDROLA - USA

REV.	DATE	BY	DESCRIPTION	APP.

STORMWATER TREATMENT PLAN
SH 1 OF 3
FICKETT ROAD/1077 POWNAL, ME

DR.	TJG	SCALE: N/A	FILE: 1077-003-003SH001.DWG
CK.	KRV	NO.	REV.
APP.		1077-003-003	B
DATE:			

ANSI D CADD Drawing, DO NOT REVISE MANUALLY.



LEGEND

- 750 — EX. MAJOR CONTOUR
- 744 — EX. MINOR CONTOUR
- EX. SOIL BOUNDARY *
- EX. OVERHEAD UTILITY
- EX. PROPERTY BOUNDARY
- EX. WETLAND
- 750 — PROP. MAJOR CONTOUR
- 744 — PROP. MINOR CONTOUR
- TC — PROP. TIME OF CONCENTRATION
- PROP. FLOW DIRECTION ARROW
- PROP. DRAINAGE BOUNDARY
- ANALYSIS POINT
- PROP. CULVERT/PIPING

* SITE IS ENTIRELY HSG TYPE D SOILS

- EX. WOODS
- EX. BRUSH
- PROP. DEVELOPED GRASS/LANDSCAPE
- PROP. IMPERVIOUS SURFACE/ROOF
- PROP. STONE PAD
- PROP. GRAVEL ACCESS ROAD

PROPOSED CONDITIONS HYDRAULIC SUMMARY

DRAINAGE AREA	2 - YEAR FLOW RATE (CFS)	10 - YEAR FLOW RATE (CFS)	25 - YEAR FLOW RATE (CFS)	PEAK 2 - YEAR FLOW RATE AT OUTFALL (IF SUBSHEDS PRESENT)	PEAK 10 - YEAR FLOW RATE AT OUTFALL (IF SUBSHEDS PRESENT)	PEAK 25 - YEAR FLOW RATE AT OUTFALL (IF SUBSHEDS PRESENT)
A	2.33	5.71	7.47	N/A	N/A	N/A
B1	1.30	4.05	5.55	2.06	5.73	7.71
B2	1.84	5.14	6.91			
C	0.15	0.37	0.48	N/A	N/A	N/A
D	0.13	0.30	0.38	N/A	N/A	N/A

STORMWATER TREATMENT REQUIREMENTS (% OF TREATED AREA)

LAND TYPE	STATION	STATION % TREATED
IMPERVIOUS TOTAL	3.90 AC	96.15%
IMPERVIOUS TREATED	3.75 AC	
DEVELOPED TOTAL*	4.87 AC	85.83%
DEVELOPED TREATED	4.18 AC	

*DEVELOPED AREA INCLUDES BOTH IMPERVIOUS AND LANDSCAPED SURFACES

STORMWATER TREATMENT FOR PHOSPHOROUS STANDARD

CONDITION	PHOSPHOROUS EXPORT LOAD (LBS P/YEAR)
PROJECT PHOSPHOROUS BUDGET	0.51
PRE-TREATMENT ALGAL AV. P EXPORT	1.65
POST-TREATMENT ALGAL AV. P EXPORT	0.45

0 120 240 Feet

ISSUED FOR REVIEW
NOT FOR CONSTRUCTION 05/29/18

REV.	DESCRIPTION	DATE	BY	CK	APP
B	MEDEP PERMIT SET COMMENT REVISIONS	05/29/18	TJG	KRV	

OWNER ENGINEER:
APPROVAL STAMP:
DRAWING PREPARED BY:
ACCEPTED BY OE:
PE Stamp
STATE OF MAINE KENNETH R. VOLOCK No. 11067 LICENSED PROFESSIONAL ENGINEER 05-29-18 Rev. B

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CMP IBERDROLA - USA

REV.	DATE	BY	DESCRIPTION	APP.

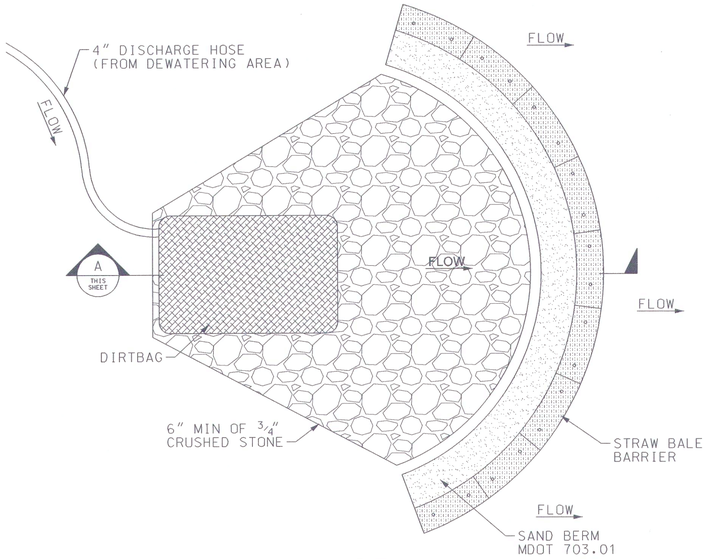
POST-DEVELOPMENT STORMWATER PLAN

SH 3 OF 3

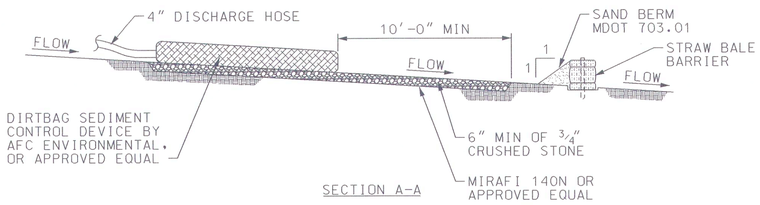
FICKETT ROAD/1077 POWNAL, ME

DR. TJG SCALE: 1" = 60' FILE: 1077-003-003SH003.DWG
CK. KRV NO. 1077-003-003 REV. B
APP.
DATE:

ANSI D CADD Drawing, DO NOT REVISE MANUALLY.

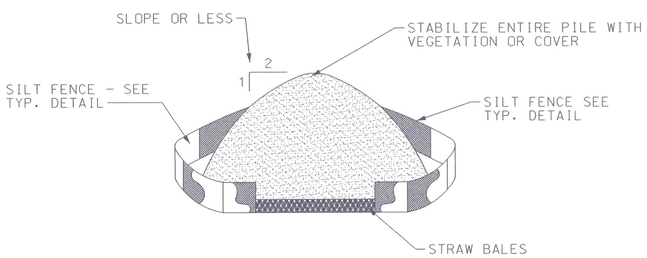


PLAN



SECTION A-A

DEWATERING SYSTEM DETAIL
NTS



INSTALLATION NOTES:

1. AREA CHOSEN FOR STOCKPILING OPERATIONS SHALL BE DRY AND STABLE.
2. MAXIMUM SLOPE OF STOCKPILE SHALL BE 2H:1V.
3. UPON COMPLETION OF SOIL STOCKPILING, EACH PILE SHALL BE SURROUNDED WITH EITHER SILT FENCING OR STRAW BALES, THEN STABILIZED WITH VEGETATION OR COVERED.

TYPICAL TOPSOIL STOCKPILE
NTS

DEWATERING NOTES:

1. THE CONTRACTOR SHALL INSTALL, MAINTAIN, AND OPERATE ALL CHANNELS, SUMPS, AND ALL OTHER TEMPORARY DIVERSION AND PROTECTIVE WORKS NEEDED TO DIVERT STREAM FLOW AND OTHER SURFACE WATER THROUGH OR AROUND THE CONSTRUCTION SITE. CONTROL OF SURFACE WATER SHALL BE CONTINUOUS DURING THE PERIOD THAT DAMAGE TO CONSTRUCTION WORK COULD OCCUR.
2. OPEN EXCAVATIONS SHALL BE DEWATERED AND KEPT FREE OF STANDING WATER AND MUDDY CONDITIONS AS NECESSARY FOR THE PROPER EXECUTION OF THE WORK. THE CONTRACTOR SHALL FURNISH, INSTALL, OPERATE, AND MAINTAIN ALL DRAINS, SUMPS AND ALL OTHER EQUIPMENT REQUIRED TO PROPERLY DEWATER THE SITE. DEWATERING SYSTEMS THAT CAUSE A LOSS OF SOIL FINES FROM THE FOUNDATION AREAS WILL NOT BE PERMITTED.
3. INSTALL DIVERSION DITCHES OR BERMS IF NECESSARY TO MINIMIZE THE AMOUNT OF CLEAN STORMWATER RUNOFF ALLOWED INTO THE EXCAVATED AREA.
4. REMOVAL OF WATER FROM THE CONSTRUCTION SITE SHALL BE ACCOMPLISHED SO THAT EROSION AND THE TRANSPORTING OF SEDIMENT AND OTHER POLLUTANTS ARE MINIMIZED.
5. DISCHARGE DEWATERING EFFLUENT TO AREAS AS INDICATED ON THE SITE GRADING PLAN. DISCHARGE SHALL BE IN SHEET FLOW.
6. DEWATERING IN PERIODS OF INTENSE, HEAVY RAIN, WHEN THE INFILTRATIVE CAPACITY OF THE SOIL IS EXCEEDED, SHALL BE AVOIDED.
7. FLOW TO THE SEDIMENT REMOVAL STRUCTURE MAY NOT EXCEED THE STRUCTURE'S CAPACITY TO SETTLE AND FILTER FLOW OR THE STRUCTURE'S VOLUME CAPACITY.
8. WHEN TEMPORARY WORKS ARE NO LONGER NEEDED, THE CONTRACTOR SHALL REMOVE AND RETURN THE AREA TO A CONDITION SIMILAR TO THAT WHICH EXISTED BEFORE CONSTRUCTION. AREAS WHERE TEMPORARY WORKS WERE LOCATED SHALL BE GRADED FOR SIGHTLY APPEARANCE WITH NO OBSTRUCTION TO NATURAL SURFACE WATER FLOWS OR THE PROPER FUNCTIONING AND ACCESS TO THE WORKS OF IMPROVEMENT INSTALLED. THE CONTRACTOR SHALL EXERCISE EXTREME CARE DURING THE REMOVAL STAGES TO MINIMIZE THE LOSS OF SOIL SEDIMENT AND DEBRIS THAT WAS TRAPPED DURING CONSTRUCTION.

HOUSEKEEPING PLAN:

(MAINE DEP CHAPTER 500, APPENDIX C)

1. SPILL PREVENTION. CONTROLS MUST BE USED TO PREVENT POLLUTANTS FROM CONSTRUCTION AND WASTE MATERIALS STORED ON SITE TO ENTER STORMWATER, WHICH INCLUDES STORAGE PRACTICES TO MINIMIZE EXPOSURE OF THE MATERIALS TO STORMWATER. THE SITE CONTRACTOR OR OPERATOR MUST DEVELOP, AND IMPLEMENT AS NECESSARY, APPROPRIATE SPILL PREVENTION, CONTAINMENT, AND RESPONSE PLANNING MEASURES. ANY SPILL OR RELEASE OF TOXIC OR HAZARDOUS SUBSTANCES MUST BE REPORTED TO THE MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION (MDEP). FOR OIL SPILLS, CALL 1-800-482-0777 WHICH IS AVAILABLE 24 HOURS A DAY. FOR SPILLS OF TOXIC OR HAZARDOUS MATERIAL, CALL 1-800-452-4664 WHICH IS AVAILABLE 24 HOURS A DAY. FOR MORE INFORMATION, VISIT THE MDEP'S WEBSITE AT: http://www.maine.gov/dep/spills/emergspillresp/
2. GROUNDWATER PROTECTION. DURING CONSTRUCTION, LIQUID PETROLEUM PRODUCTS AND OTHER HAZARDOUS MATERIALS WITH THE POTENTIAL TO CONTAMINATE GROUNDWATER MAY NOT BE STORED OR HANDLED IN AREAS OF THE SITE DRAINING TO AN INFILTRATION AREA. AN "INFILTRATION AREA" IS ANY AREA OF THE SITE THAT BY DESIGN OR AS A RESULT OF SOILS, TOPOGRAPHY AND OTHER RELEVANT FACTORS ACCUMULATES RUNOFF THAT INFILTRATES INTO THE SOIL. DIKES, BERMS, SUMPS, AND OTHER FORMS OF SECONDARY CONTAINMENT THAT PREVENT DISCHARGE TO GROUNDWATER MAY BE USED TO ISOLATE PORTIONS OF THE SITE FOR THE PURPOSES OF STORAGE AND HANDLING OF THESE MATERIALS. ANY PROJECT PROPOSING INFILTRATION OF STORMWATER MUST PROVIDE ADEQUATE PRE-TREATMENT OF STORMWATER PRIOR TO DISCHARGE OF STORMWATER TO THE INFILTRATION AREA, OR PROVIDE FOR TREATMENT WITHIN THE INFILTRATION AREA, IN ORDER TO PREVENT THE ACCUMULATION OF FINES, REDUCTION IN INFILTRATION RATE, AND CONSEQUENT FLOODING AND DESTABILIZATION.

   LACK OF APPROPRIATE POLLUTANT REMOVAL BEST MANAGEMENT PRACTICES (BMPS) MAY RESULT IN VIOLATIONS OF THE GROUNDWATER QUALITY STANDARD ESTABLISHED BY 38 M.R.S.A. SECTION 465-C(1).
3. FUGITIVE SEDIMENT AND DUST. ACTIONS MUST BE TAKEN TO ENSURE THAT ACTIVITIES DO NOT RESULT IN NOTICEABLE EROSION OF SOILS OR FUGITIVE DUST EMISSIONS DURING OR AFTER CONSTRUCTION. OIL MAY NOT BE USED FOR DUST CONTROL, BUT OTHER WATER ADDITIVES MAY BE CONSIDERED AS NEEDED. A STABILIZED CONSTRUCTION ENTRANCE (SCE) SHOULD BE INCLUDED TO MINIMIZE TRACKING OF MUD AND SEDIMENT. IF OFF-SITE TRACKING OCCURS, PUBLIC ROADS SHOULD BE SWEPT IMMEDIATELY AND NO LESS THAN ONCE A WEEK AND PRIOR TO SIGNIFICANT STORM EVENTS. OPERATIONS DURING DRY MONTHS, THAT EXPERIENCE FUGITIVE DUST PROBLEMS, SHOULD WET DOWN UNPAVED ACCESS ROADS ONCE A WEEK OR MORE FREQUENTLY AS NEEDED WITH A WATER ADDITIVE TO SUPPRESS FUGITIVE SEDIMENT AND DUST.

   DEWATERING A STREAM WITHOUT A PERMIT FROM THE MDEP MAY VIOLATE STATE WATER QUALITY STANDARDS AND THE NATURAL RESOURCES PROTECTION ACT.

HOUSEKEEPING PLAN (CONT):

4. DEBRIS AND OTHER MATERIALS. MINIMIZE THE EXPOSURE OF CONSTRUCTION DEBRIS, BUILDING AND LANDSCAPING MATERIALS, TRASH, FERTILIZERS, PESTICIDES, HERBICIDES, DETERGENTS, SANITARY WASTE AND OTHER MATERIALS TO PRECIPITATION AND STORMWATER RUNOFF. THESE MATERIALS MUST BE PREVENTED FROM BECOMING A POLLUTANT SOURCE.

   TO PREVENT THESE MATERIALS FROM BECOMING A SOURCE OF POLLUTANTS, CONSTRUCTION AND POST-CONSTRUCTION ACTIVITIES RELATED TO A PROJECT MAY BE REQUIRED TO COMPLY WITH APPLICABLE PROVISION OF RULES RELATED TO SOLID, UNIVERSAL, AND HAZARDOUS WASTE, INCLUDING, BUT NOT LIMITED TO, THE MAINE SOLID WASTE AND HAZARDOUS WASTE MANAGEMENT RULES; MAINE HAZARDOUS WASTE MANAGEMENT RULES; MAINE OIL CONVEYANCE AND STORAGE RULES; AND MAINE PESTICIDE REQUIREMENTS.
5. EXCAVATION DE-WATERING. EXCAVATION DE-WATERING IS THE REMOVAL OF WATER FROM TRENCHES, FOUNDATIONS, COFFER DAMS, PONDS, AND OTHER AREAS WITHIN THE CONSTRUCTION AREA THAT RETAIN WATER AFTER EXCAVATION. IN MOST CASES THE COLLECTED WATER IS HEAVILY SILTED AND HINDERS CORRECT AND SAFE CONSTRUCTION PRACTICES. THE COLLECTED WATER REMOVED FROM THE PONDED AREA, EITHER THROUGH GRAVITY OR PUMPING, MUST BE SPREAD THROUGH NATURAL WOODED BUFFERS OR REMOVED TO AREAS THAT ARE SPECIFICALLY DESIGNED TO COLLECT THE MAXIMUM AMOUNT OF SEDIMENT POSSIBLE, LIKE A COFFERDAM SEDIMENTATION BASIN. AVOID ALLOWING THE WATER TO FLOW OVER DISTURBED AREAS OF THE SITE. EQUIVALENT MEASURES MAY BE TAKEN IF APPROVED BY THE MDEP.
6. AUTHORIZED NON-STORMWATER DISCHARGES. IDENTIFY AND PREVENT CONTAMINATION BY NON-STORMWATER DISCHARGES. WHERE ALLOWED NON-STORMWATER DISCHARGES EXIST, THEY MUST BE IDENTIFIED AND STEPS SHOULD BE TAKEN TO ENSURE THE IMPLEMENTATION OF APPROPRIATE POLLUTION PREVENTION MEASURES FOR THE NON-STORMWATER COMPONENT(S) OF THE DISCHARGE. AUTHORIZED NON-STORMWATER DISCHARGES ARE:

   (A)DISCHARGES FROM FIREFIGHTING ACTIVITY;
   (B)FIRE HYDRANT FLUSHINGS;
   (C)VEHICLE WASHWATER IF DETERGENTS ARE NOTUSED AND WASHING IS LIMITED TO THE EXTERIOR OF VEHICLES (ENGINE, UNDERCARRIAGE AND TRANSMISSION WASHING IS PROHIBITED);
   (D)DUST CONTROL RUNOFF IN ACCORDANCE WITH PERMIT CONDITIONS AND PARAGRAPH 3 ABOVE;
   (E)ROUTINE EXTERNAL BUILDING WASHDOWN, NOT INCLUDING SURFACE PAINT REMOVAL, THAT DOES NOT INVOLVE DETERGENTS;
   (F)PAVEMENT WASHWATER (WHERE SPILLS/LEAKS OF TOXIC OR HAZARDOUS MATERIALS HAVE NOT OCCURRED, UNLESS ALL SPILLED MATERIAL HAD BEEN REMOVED) IF DETERGENTS ARE NOT USED;
   (G)UNCONTAMINATED AIR CONDITIONING OR COMPRESSOR CONDENSATE;
   (H)UNCONTAMINATED GROUNDWATER OR SPRING WATER;
   (I)FOUNDATION OR FOOTER DRAIN-WATER WHERE FLOWS ARE NOT CONTAMINATED;
   (J)UNCONTAMINATED EXCAVATION DEWATERING (SEE REQUIREMENTS IN PARAGRAPH 5 ABOVE);
   (K)POTABLE WATER SOURCES INCLUDING WATERLINE FLUSHINGS; AND LANDSCAPE IRRIGATION.
7. UNAUTHORIZED NON-STORMWATER DISCHARGES. THE MDEP'S APPROVAL UNDER THIS CHAPTER DOES NOT AUTHORIZE A DISCHARGE THAT IS MIXED WITH A SOURCE OF NONSTORMWATER, OTHER THAN THOSE DISCHARGES IN COMPLIANCE WITH PARAGRAPH 6 ABOVE. SPECIFICALLY, THE MDEP'S APPROVAL DOES NOT AUTHORIZE DISCHARGES OF THE FOLLOWING:

   (A)WASTEWATER FROM THE WASHOUT OR CLEANOUT OF CONCRETE, STUCCO, PAINT, FORM RELEASE OILS, CURING COMPOUNDS OR OTHER CONSTRUCTION MATERIALS;
   (B)FUELS, OILS OR OTHER POLLUTANTS USED IN VEHICLE AND EQUIPMENT OPERATION AND MAINTENANCE;
   (C)SOAPS, SOLVENTS, OR DETERGENTS USED IN VEHICLE AND EQUIPMENT WASHING; AND
   (D)TOXIC OR HAZARDOUS SUBSTANCES FROM A SPILL OR OTHER RELEASE.

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CONSTRUCTION SEQUENCE:

1. ESTABLISH CONSTRUCTION WORKSPACE LIMITS; IDENTIFY AND MARK SENSITIVE RESOURCES.
2. PERFORM ALL WORK IN ACCORDANCE WITH MAINE EROSION AND SEDIMENT CONTROL PRACTICES FIELD GUIDE FOR CONTRACTORS (2015).
3. PRIOR TO USAGE, CONSTRUCT AND STABILIZE THE CONSTRUCTION ENTRANCE ON THE EXISTING PERMANENT ACCESS ROAD WITH A STONE PAD, MUD RACK, OR OTHER MATERIALS USED TO REDUCE THE TRACKING OR FLOWING OF SEDIMENT OFF THE SITE AND MAINTAIN UNTIL PAVING IS COMPLETED.
4. CLEAR TIMBER AND BRUSH; DO NOT GRUB UNTIL JUST PRIOR TO PRELIMINARY GRADING AND ESTABLISHMENT AND STABILIZATION OF TEMPORARY OR PERMANENT DRAINAGE COURSES.
5. INSTALL AND MAINTAIN SEDIMENT BARRIERS SUCH AS SILT FENCING AND/OR OTHER EROSION CONTROL BARRIERS ALONG THE DOWNHILL LIMIT OF WORK, AS SHOWN ON THE DRAWINGS. SEDIMENT BARRIER LOCATIONS MAY BE ADJUSTED IN THE FIELD BASED ON SITE CONDITIONS AS DETERMINED BY THE ENGINEERING INSPECTOR. WHERE SILT FENCE CANNOT BE TOED-IN PROPERLY DUE TO TREE ROOTS, ROCKS OR FROZEN GROUND, HAY BALES OR AN EROSION CONTROL MIX BERM MAY BE SUBSTITUTED. SILT FENCING WILL BE INSTALLED AFTER CLEARING BUT PRIOR TO GRUBBING AND GRADING ACTIVITIES. ANY EROSION ISSUES DEVELOPED DURING CLEARING WILL BE TEMPORARILY STABILIZED AS NECESSARY.
6. STABILIZE PERMANENT ACCESS ROAD SURFACE, PARKING AREAS AND EQUIPMENT STORAGE AND LAYDOWN AREAS WITH MATTING, CRUSHED STONE OR GRAVEL SUBBASE AS NECESSARY TO MINIMIZE RUTTING AND AVOID PONDING.
7. CONCURRENT WITH INITIATION OF SITE GRADING, CONSTRUCT AND STABILIZE TEMPORARY DRAINAGE SWALES, DIVERSION BERMS, CHECK DAMS, AND CULVERTS WITH TEMPORARY INLET AND OUTLET STRUCTURES TO MINIMIZE SEDIMENT IN SITE RUNOFF DURING THE CONSTRUCTION OF THE ROADWAY. DEWATER IN ACCORDANCE WITH DEWATERING NOTES BELOW.
8. INSTALL PROPERLY SPACED STONE CHECK DAMS IN ANY SECTION OF DITCH WITHIN 24 HOURS OF FORMING, SHAPING OR ROUGH GRADING THAT SECTION OF DITCH.
9. MINIMIZE THE AMOUNT OF DISTURBANCE AT ANY ONE TIME BY STAGING CONSTRUCTION AS MUCH AS PRACTICAL FOR EFFICIENT CONSTRUCTION OF THE FACILITY. NATURAL VEGETATIVE BUFFERS OR STRIPS SHOULD BE LEFT IN PLACE WHERE FEASIBLE TO AID IN SEDIMENT RETENTION AND REDUCE EROSION POTENTIAL.
10. STABILIZE ANY NEWLY GRADED SLOPE GREATER THAN EIGHT PERCENT AND ANY SECTION OF NEWLY CONSTRUCTED DITCH USING ANCHORED EROSION CONTROL BLANKETS OR OTHER APPROVED MULCHING TECHNIQUES WITHIN 24 HOURS. STABILIZE ANY SLOPE EXCEEDING EIGHT PERCENT AND BROUGHT TO FINAL GRADE WITHIN 24 HOURS USING ANCHORED EROSION CONTROL BLANKETS OR EROSION CONTROL MIX APPLIED IN ACCORDANCE WITH MAINE EROSION AND SEDIMENT PRACTICES FIELD GUIDE FOR CONTRACTORS (2015). STABILIZE ANY SECTION OF DITCH BROUGHT TO FINAL GRADE WITHIN 24 HOURS USING THE APPROVED PERMANENT STABILIZATION MEASURES FOR DITCHES.
11. DUST CONTROL METHODS WILL BE EMPLOYED AFTER GRADING AND PRIOR TO FINAL STABILIZATION TO PREVENT THE BLOWING AND MOVEMENT OF DUST THROUGH THE APPLICATION OF WATER AND/OR CALCIUM CHLORIDE TO REDUCE WIND EROSION. REPETITIVE TREATMENT WILL BE APPLIED AS NEEDED TO ACCOMPLISH CONTROL.
12. APPLY TEMPORARY SEED AND MULCH TO ANY EXPOSED AREAS WHERE ACTIVITY IS NOT ANTICIPATED FOR 30 DAYS OR MORE, OR WHERE ACTIVITY HAS NOT OCCURRED WITHIN 30 DAYS. TEMPORARILY MULCH ANY EXPOSED AREAS WHERE ACTIVITY IS NOT ANTICIPATED OR HAS NOT OCCURRED IN 7 DAYS.
13. REMOVE EXCESS SPOILS FROM SITE THAT WILL NOT BE USED FOR THE FINAL DESIGN AND STABILIZATION. STOCKPILED SOILS THAT REMAIN IN PLACE FOR 48 HOURS OR MORE WILL BE CONTAINED WITH SEDIMENT BARRIERS SUCH AS SILT FENCE, HAY BALES OR EQUIVALENT. THE SEDIMENT BARRIERS SHALL BE ADEQUATELY LOCATED AND REINFORCED TO HANDLE A SIGNIFICANT RAIN EVENT AND THE POTENTIAL SLUMPING OF THE PILE. BETWEEN MAY 1 AND OCTOBER 15, APPLY TEMPORARY SEED AND MULCH TO A STOCKPILE THAT IS NOT EXPECTED TO BE DISTURBED WITHIN 30 DAYS. APPLY ANCHORED MULCH DAILY, AS NEEDED, DURING WINTER CONSTRUCTION.
14. INSPECT AND REPAIR EROSION CONTROL MEASURES DAILY IN AREAS OF ACTIVE CONSTRUCTION; OTHERWISE WEEKLY AND AFTER RAINFALL OF 1/2" OR GREATER WITHIN A 24-HOUR PERIOD. REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES 1/3 THE HEIGHT OF THE BARRIER.
15. MONITOR PUBLIC ROADS FOR SIGNS OF TRACKING OR SPILLING OF SPOIL MATERIAL AND CLEAN UP AS NEEDED.
16. COMPLETE FINAL GRADING AND STABILIZATION OF EARTHEN STRUCTURES SUCH AS DIVERSION BERMS, DITCH TURNOUTS AND SWALES THAT WILL CONTROL RUNOFF.
17. FINISH GRADE AND REPLACE TOPSOIL OR LOAM IN DISTURBED AREAS. SEED AND MULCH DISTURBED AREAS WITHIN 6 DAYS OF FINAL GRADING.
18. MAINTAIN ALL TEMPORARY EROSION CONTROLS AND SEDIMENT BARRIERS UNTIL VEGETATION HAS BEEN ESTABLISHED OVER 85-90% OF THE AREA TO BE RE-VEGETATED. RESEED SPARSELY VEGETATED AREAS.
19. REMOVE ALL TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES ONCE THE SITE IS PERMANENTLY STABILIZED.

FERTILIZER AND LIMESTONE REQUIREMENTS:

IN GENERAL, FERTILIZER AND LIME APPLICATION RATES WILL FOLLOW THE GUIDELINES IDENTIFIED BELOW UNLESS SITE SPECIFIC SOIL TESTS IDENTIFY THE NEED FOR ALTERNATIVE FERTILIZER/LIME APPLICATION RATES. FERTILIZER WILL BE APPLIED TO UPLAND AREAS PRIOR TO SEEDING AT A RATE OF 800 POUNDS PER ACRE USING 10-20-20 OR EQUIVALENT. GROUND LIMESTONE (EQUIVALENT TO 50 PERCENT CALCIUM PLUS MAGNESIUM OXIDE) WILL BE APPLIED AT A RATE OF 3 TONS PER ACRE. AN EQUIVALENT MIXTURE OF FERTILIZER AND LIME MAY BE APPLIED USING THE HYDROSEEDING METHOD. NO LIME OR FERTILIZER WILL BE APPLIED TO WETLANDS.

MULCH AND SEEDING SPECIFICATIONS

SUMMARY OF TEMPORARY AND PERMANENT MULCH APPLICATION REQUIREMENTS

CONDITION	TIMING	MULCH TYPE[1,2]	APPLICATION RATES
TEMPORARY			
	IF NO ACTIVITY IN EXPOSED AREAS FOR 7 DAYS, OR PRIOR TO A STORM EVENT	STRAW MULCH OR WOOD FIBER MULCH	2 TONS/ACRES 2000 LB./ACRES
ALL DISTRIBUTED AREAS OF THE CONSTRUCTION WORKSPACE	APPLY MULCH TO ALL EXPOSED AREAS IF NO ACTIVITY OCCURS WITHIN 30 DAYS. APPLY MULCH AND TEMPORARY SEEDING SOONER WHEN IT CAN BE ANTICIPATED THAT ACTIVITY IS NOT GOING TO OCCUR WITHIN 30 DAYS.	STRAW MULCH OR WOOD FIBER MULCH	2 TONS/ACRES 2000 LB./ACRES[3]
ALL WORK AREAS EXPOSED ARE TO BE MULCHED DAILY EACH TIME SOIL IS DISTURBED	OCTOBER 15 - MAY 1	STRAW MULCH OR WOOD FIBER MULCH	3 TONS/ACRES 2000 LB./ACRES
PERMANENT			
ON ALL EXPOSED AREAS AFTER SEEDING TO STABILIZE THE SOIL SURFACE	PERMANENT GRASS AND/OR LEGUME SEEDING COVERED BY HAY OR STRAW MULCH ON ALL AREAS THAT HAVE BEEN RESTORED TO FINAL GRADE. THIS DOES NOT APPLY TO AREAS STABILIZED BY OTHER MEANS SUCH AS JUTE MATTING OR PERMANENT EROSION CONTROL MIX.	CRIMPED STRAW MULCH OR PAPER MULCH OR WOOD FIBER MULCH	2 TONS/ACRES 1500 LB./ACRES[4] 2000 LB./ACRES
WOOD CHIP APPLICATION AREAS	PERMANENT GRASS AND/OR LEGUME SEEDING COVERED BY HAY OR STRAW MULCH ON ALL AREAS THAT HAVE BEEN RESTORED TO FINAL GRADE. THIS DOES NOT APPLY TO AREAS STABILIZED BY OTHER MEANS SUCH AS JUTE MATTING OR PERMANENT EROSION CONTROL MIX.	CRIMPED STRAW MULCH OR PAPER MULCH OR WOOD FIBER MULCH	2 TONS/ACRES 1500 LB./ACRES[4] 2000 LB./ACRES

NOTES:
1. STRAW AND HAY MULCH MAY BE USED INTERCHANGEABLY, EXCEPT IN WETLAND AREAS WHERE STRAW MULCH WILL BE REQUIRED.
2. DOUBLE RATE OF WOOD FIBER MULCH WHEN USED IN CRITICAL AREAS.
3. STRAW, HAY, OR HYDROMULCH (WOOD FIBER OR PAPER MULCH AS APPROPRIATE) WILL PROVIDE 90 PERCENT GROUND COVERAGE
4. PAPER MULCH IS ACCEPTABLE FOR USE DURING THE GROWING SEASON. ON SLOPES GREATER THAN 30 PERCENT AND IN AREAS WHERE VEGETATION HAS NOT ESTABLISHED WELL, ADDITIONAL HAY MULCH WILL BE ADDED AS A WINTERIZING MEASURE.

SEED MIX SPECIFICATIONS

SEED MIX NAME	SEED MIX COMPONENTS	LB./ACRE[1]
TEMPORARY SEED MIX	ANNUAL RYEGRASS	40
PERMANENT UPLAND SEED MIX	REDTOP CREEPING RED FESCUE TALL FESCUE BIRDSFOOT TREFOIL	4 40 40 16
WOOD CHIP APPLICATION SEED MIX	CREEPING RED FESCUE REDTOP TALL FESCUE CROWNVETCH	20 4 30 30
WETLAND SEED MIX	ANNUAL RYEGRASS	40
SUPPLEMENTAL WINTER SEED MIX[2]	WINTER RYEGRASS	120

NOTES:
1. INCREASE SEEDING RATES 10% WHEN HYDROSEEDING
2. WINTER RYE WILL BE ADDED TO PERMANENT UPLAND MIX AT A RATE OF 120 LB./ACRE BETWEEN OCTOBER 15 AND MAY 1

MULCH ANCHORING REQUIREMENTS

ON SLOPES GREATER THAN 3 PER CENT, HAY OR STRAW MULCH WILL BE FIRMLY ANCHORED INTO THE SOIL UTILIZING ONE OF THE FOLLOWING METHODS:
- CRIMPING WITH A STRAIGHT OR NOTCHED MULCH CRIMPING TOOL (FARM DISCS WILL NOT BE ALLOWED);
- TRACK WALKING WITH DEEP-CLEATED EQUIPMENT OPERATING UP AND DOWN THE SLOPE (MULCH CRIMPED PERPENDICULAR TO THE SLOPE) ON SLOPES LESS THAN 25 PERCENT;
- APPLICATION OF MULCH NETTING;
- APPLICATION OF 500 LB./ACRE OF WOOD FIBER MULCH OVER STRAW/HAY MULCH; AND
- COMMERCIALLY AVAILABLE TACKIFIERS (EXCEPT WITHIN 100 FEET OF WATERBODIES OR WETLANDS).

SUMMARY OF SEEDING REQUIREMENTS

CONDITION	TIMING[1,2]	SEED MIX
TEMPORARY SEEDING[3]	TEMPORARY SEED BETWEEN MAY 1 AND OCTOBER 15 ONLY. DISTURBED AREAS OR SPOIL STOCKPILES WILL BE SEEDED IMMEDIATELY IF FURTHER DISTURBANCE IS NOT EXPECTED FOR 30 DAYS OR MORE.	ANNUAL RYEGRASS
PERMANENT SEEDING[3,4]		
UPLAND PORTIONS OF THE CONSTRUCTION AREA	DISTURBED AREA WILL BE SEEDED WITHIN 6 DAYS OF FINAL GRADING.	PERMANENT UPLAND MIX
SLOPES GREATER THAN 3:1	DISTURBED AREA WILL BE SEEDED IMMEDIATELY AFTER SEEDBED PREPARATION.	PERMANENT UPLAND MIX
WETLANDS	DISTURBED WETLANDS WILL BE SEEDED WITHIN 6 DAYS OF FINAL GRADING.	ANNUAL RYEGRASS
WOOD CHIP APPLICATION AREAS	DISTURBED AREA WILL BE SEEDED WITHIN 6 DAYS OF FINAL GRADING.	WOODCHIP APPLICATION SEED MIX
WINTER DORMANT SEEDING	DORMANT SEED BETWEEN OCTOBER 15 AND MAY 1 ONLY. NO SEEDING WILL OCCUR IF SNOW DEPTHS EXCEED 1 INCH.	PERMANENT UPLAND MIX PLUS WINTER RYEGRASS

NOTES:
1. WEATHER CONDITIONS PERMITTING.
2. AREAS THAT DO NOT SUCCESSFULLY REVEGETATE WITHIN APPROPRIATE PERIOD OF TIME WILL BE RESEEDED AS NECESSARY.
3. LOOSEN COMPACTED SOIL TO A MINIMUM DEPTH OF 4 INCHES.
4. TOP DRESS WITH 6 INCHES LOAM, AS NEEDED.

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Exhibit M-3: Stormwater Management Report for the Kennebec River Crossing Termination Stations (10/19/2018)

STORMWATER MANAGEMENT REPORT

Prepared for the

CENTRAL MAINE POWER COMPANY
NEW ENGLAND CLEAN ENERGY CONNECT
KENNEBEC RIVER CROSSING TRANSITION STATIONS

Location

West Forks Plantation &
Moxie Gore,
Maine 04985

Owner

Central Maine Power Company
83 Edison Drive
Augusta, Maine 04336

Prepared by

6 Ashley Drive
Scarborough, ME 04074
(207) 274-2631
October 2018

DRAFT

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12.2.1 *Kennebec River Crossing HDD Transition Stations Project*

The purpose of this section is to describe and quantify the pre- and post-development stormwater characteristics and to demonstrate that construction of the new HDD Transition Stations will comply with the applicable Maine Department of Environmental Protection (MDEP) Chapter 500 stormwater management requirements. The stormwater management system for this development must meet the Basic Standards, General Standards, and Flooding Standards of Chapter 500.

The HDD Transition Stations will be located within the transmission line right of way on both sides of the Kennebec River Gorge. A transition station is required for each side of the crossing to convert the transmission line from overhead to underground. The eastern transition station will be located in Moxie Gore, Somerset County, Maine, as shown on the plans. The western transition station will be located in West Forks Plantation, Somerset County, Maine, as shown on the plans. The transition stations will be identical in size, measuring 135 feet x 135 feet and will be built to substation yard specifications. Each transition station will have a gravel access road constructed which will connect to existing logging roads. The West Forks transition station (West Forks Station) will occupy approximately 0.77 acre of the 300-foot wide right of way owned by Central Maine Power Company (CMP). The Moxie Gore transition station (Moxie Gore Station) will occupy approximately 0.72 acre within the transmission right of way owned by CMP.

The new transition stations will be located on sites that are primarily thickly wooded with some scrub/shrub vegetation.

At the West Forks Station, approximately 2.48 acres of right of way will be disturbed during construction. The land disturbance will be required for the access road, transition station and the temporary working platform/laydown yard for the HDD receiving site.

Following construction, approximately 1.43 acres of the disturbed area will be restored and revegetated. Approximately 1.03 acres will remain as a permanently developed area and will contain the new transition station yard, access road, and associated impervious areas (foundations and steel structures).

For the Moxie Gore Station, approximately 2.30 acres of right of way will be disturbed during construction. The land disturbance will be required for the access road, transition station and the temporary working platform for the HDD drill operations site.

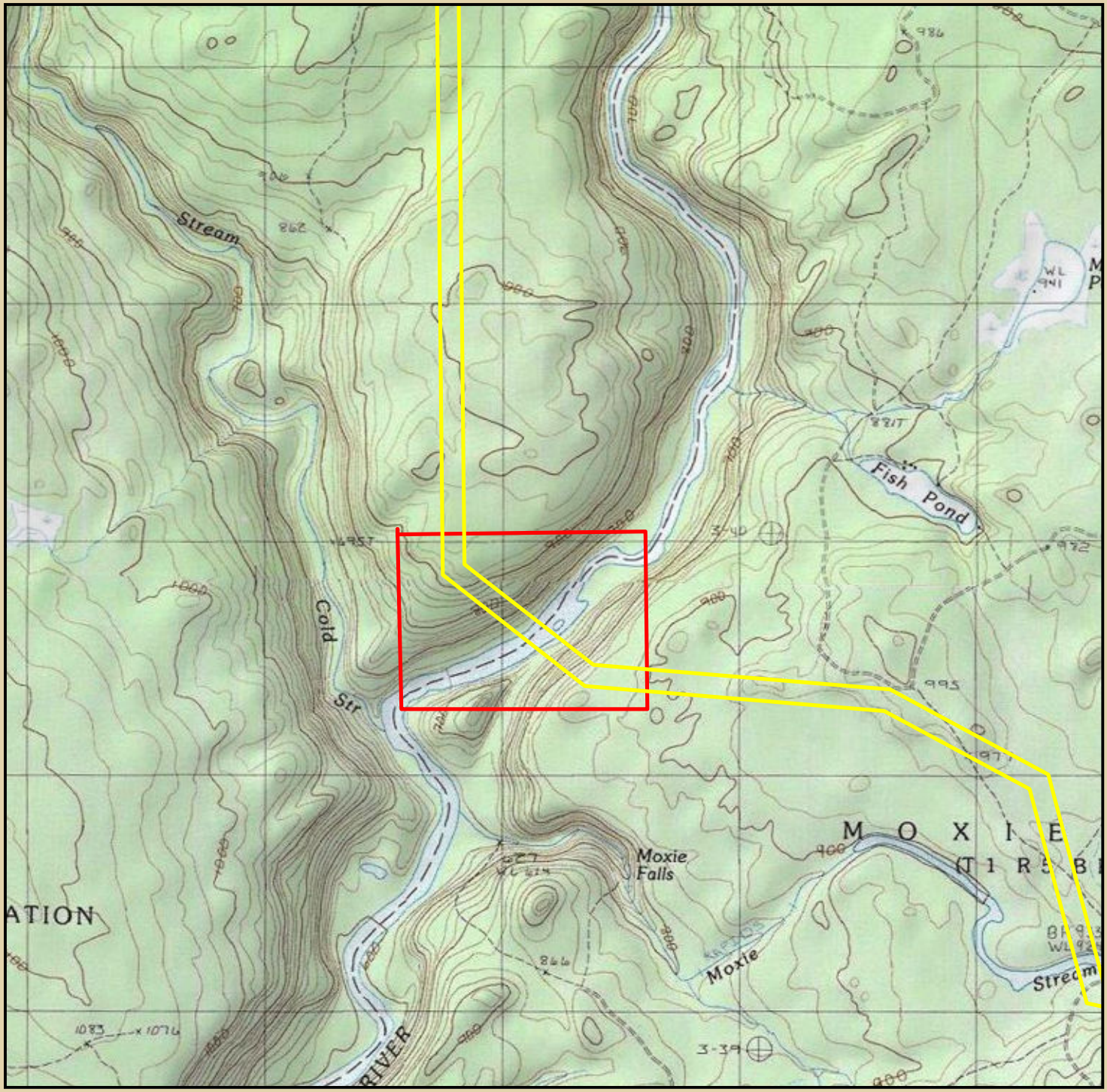
Following construction, approximately 1.44 acres of the disturbed area will be restored and revegetated. Approximately 0.86 acre will remain as a permanently developed area and will contain the new transition station yard, access road, and associated impervious areas (foundations and steel structures).

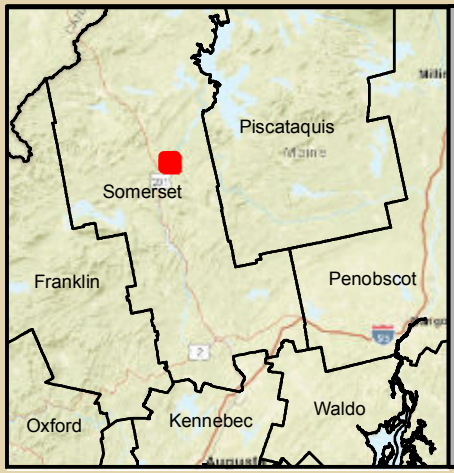
12.2.1.1 Surface Water on or Abutting the Site

There are no water bodies on the project site. The Kennebec River is approximately 1,500 feet from both sites.

Exhibit 12-1

Figure 12-1. Site Location Map





NECEC Project Area

HDD Crossing Location

0 0.25 0.5

Miles

Sources: ESRI, CMP, MEGIS, TRC

Map Coordinate System:
NAD 1983 UTM Zone 19N

CENTRAL MAINE POWER

New England Clean Energy Connect

Location of the Kennebec Gorge HDD Crossing

Created:
10/5/2018

TRC

14 Gabriel Drive
Augusta, ME 04330

12.2.1.2 Downstream Ponds and Lakes

The transition stations are not located in the watershed of a "Lake Most at Risk from Development" or an "Urban Impaired Stream," as defined in Chapter 502. The two sites are located on either side of the Kennebec River as shown on Exhibit 12-1.

12.2.1.3 General Topography

The topography of the land surface for the West Forks Station site ranges from 5 to 28 percent slope, generally draining from northeast to southwest. Elevations across the site range from approximately 972 to 900 feet above mean sea level

The topography of the land surface for the Moxie Gore Station site ranges from 3 to 25 percent slope, generally draining from east to west. Elevations across the area site range from approximately 911 to 872 feet above mean sea level.

Contour information for both sites were obtained from LiDAR data provided by CMP.

12.2.1.4 Flooding

There are no apparent flooding concerns for the two Transition Stations locations. Based on the available FEMA information the stations are located within an unmapped area of Maine.

12.2.1.5 Alterations to Natural Drainage Ways

Alterations to natural drainage ways are not required.

12.2.1.6 Alterations to Land Cover Within the Watershed

The West Forks Station and associated access road will consist of approximately 0.17 acre of new impervious areas (gravel roads, foundations, and concrete pads). The crushed stone switchyard will cover approximately an additional 0.47 acre.

The Moxie Gore Station and associated access road will consist of approximately 0.09 acre of new impervious areas (gravel roads, foundations, and concrete pads). The crushed stone switchyard will cover approximately an additional 0.47 acre.

A summary of the pre- and post-development cover types within the subcatchment analyzed is presented in Table 12-1.

Table 12-1. West Forks Station - Watershed Cover Types

Cover Type	Pre-development Area, acres	Post-development Area, acres	Net Change, acres
Foundations/Pads	0.00	0.01	0.01
Gravel	0.00	0.15	0.15
Yard Surface (crushed stone)	0.00	0.47	0.47
Woods	5.89	4.92	(-)0.97
Brush	0.14	0.48	0.34
Total Area	**6.03**	**6.03**	**0.00**

Table 12-2. Moxie Gore Station - Watershed Cover Types

Cover Type	Pre-development Area, acres	Post-development Area, acres	Net Change, acres
Foundations/Pads	0.00	0.01	0.01
Gravel	0.25	0.38	0.13
Yard Surface (crushed stone)	0.00	0.47	0.47
Woods	11.57	10.71	(-)0.86
Brush	0.58	0.83	0.25
Total Area	**12.40**	**12.40**	**0.00**

12.2.1.7 Modeling Assumptions

The stormwater runoff was estimated using HydroCAD, Version 10.0. HydroCAD is based on methodologies developed by the United States Department of Agriculture Soil Conservation Service (USDA-SCS), namely *Urban Hydrology for Small Watersheds*, Technical Release 55 and Technical Release 20 (TR-55 and TR-20), in combination with other hydraulic and hydrologic calculations. Based on site specific information and rainfall data, the program estimates inflow and outflow hydrographs for a subcatchment. The USDA-SCS is now called the Natural Resources Conservation Service (USDA-NRCS).

The pre- and post-development subcatchment boundaries and hydrologic flow lines used to determine the times of concentration are indicated on the Pre- and Post-Development Drainage Plans located in Appendix 12-2. Within the areas proposed to be developed, the subcatchment boundaries were determined from the surveyed (LiDAR) one-foot contours. Subcatchment boundaries outside areas proposed for development were determined from two-foot contours extrapolated from the USGS topographic quadrangle map. The times of concentration were determined from the surveyed contour information.

The pre- development stormwater analysis for the West Forks Station consists of one subcatchment (1S) totaling approximately 6.03 acres in size. The Post-development consists, of two subcatchments (1S & 1SA) totaling approximately 6.03 acres in size. For the pre-development stormwater analysis for Moxie Gore Station there is one subcatchment (2S) totaling approximately 12.40 acres in size. The Post-development consists, of two subcatchments (2S & 2SA) totaling approximately 12.40 acres in size.

Both sites use study points (SPx) as the boundary node for the subcatchment for the pre- and post-development analysis. Control points are located at the down slope intersection of the Tc hydrologic flow lines and the subcatchment boundaries.

The results of the pre- and post-development site runoff analyses are shown and compared in Tables 12-3 through 12-8, located in Section 12.5: Runoff Analysis.

Storm events modeled for the pre- and post-development analyses assumed precipitation events with a 24-hour duration having a type II distribution and rainfall amounts of 2.44, 3.80, and 4.23 inches, with return frequencies of 2-, 10-, and 25-years, respectively. The storm type and rainfall amounts are based on the NOAA Atlas 14, Volume 10, Version 2, Point Precipitation Frequency Estimates.

Additional assumptions made to complete the pre- and post-development runoff analysis are provided in Section 12.5.

12.3 MAPS

12.3.1 *USGS Quadrangle Map with Site Boundaries (Exhibit 12-1)*

An excerpt from the USGS Quadrangle map (scale 1:24,000) with the site boundaries shown is provided as Exhibit 12-1.

12.3.2 *Watershed Map (Exhibit 12-3)*

A watershed map is provided as Exhibit 12-3.

12.3.3 *NRCS Soils Map*

An excerpt from the USDA-NSCS Soils Survey Map is provided in Appendix 12-1.

12.4 DRAINAGE PLANS

The Pre-Development Watershed Plans and the Post-Development Watershed Plans for the proposed project are provided in Appendix 12-2. The plans include contours, land cover types, soil groups, subcatchment boundaries and analysis points, hydrologic flow lines, time of concentration flow lines, existing features, and drainage ways where applicable. The Post-Development Watershed Plans include the locations of proposed buildings, roads, and stormwater management structures.

12.5 RUNOFF ANALYSIS

The pre- and post-development stormwater analysis calculations are provided in Appendix 12-1. The runoff routing calculations were performed with the use of HydroCAD Version 10.0 software. The analyses include computations for determining the runoff curve numbers (CN values) for the pre- and post-development subcatchments and the HydroCAD output, which includes peak discharge calculations for the 24-hour storms of 2- 10-, and 25-year frequencies and routing calculations.

A summary of the pre- and post-development peak runoff at the control points is provided in Table 12-3 through 12-8.

Exhibit 12-4

Figure 12-4. NRCS Soils Survey Map

Table 12-3. Pre-Development Peak Runoff by Subcatchment

West Forks Station Discharge Rates, cfs		
Storm Frequency	Boundary Node SP1	Total
2-Year	0.85	0.85
10-Year	4.02	4.02
25-Year	5.30	5.30

Table 12-4. Post-Development Peak Runoff by Subcatchment

West Forks Station Discharge Rates, cfs		
Storm Frequency	Boundary Node SP1	Total
2-Year	0.79	0.79
10-Year	3.78	3.78
25-Year	4.99	4.99

Table 12-5. Net Change in Peak Runoff by Subcatchment

West Forks Station Discharge Rates, cfs		
Storm Frequency	Boundary Node SP1	Total
2-Year	(-)0.06	(-)0.06
10-Year	(-)0.24	(-)0.24
25-Year	(-)0.31	(-)0.31

Table 12-6. Pre-Development Peak Runoff by Subcatchment

Moxie Gore Station Discharge Rates, cfs		
Storm Frequency	Boundary Node SP2	Total
2-Year	1.83	1.83
10-Year	7.94	7.94
25-Year	10.38	10.38

Table 12-7. Post-Development Peak Runoff by Subcatchment

Moxie Gore Station Discharge Rates, cfs		
Storm Frequency	Boundary Node SP2	Total
2-Year	1.76	1.76
10-Year	7.70	7.70
25-Year	10.10	10.10

Table 12-8. Net Change in Peak Runoff by Subcatchment

Moxie Gore Station Discharge Rates, cfs		
Storm Frequency	Boundary Node SP2	Total
2-Year	(-)0.07	(-)0.07
10-Year	(-)0.24	(-)0.24
25-Year	(-)0.28	(-)0.28

West Forks Station

The calculations show a net decrease to peak runoff rates in every storm event for the West Forks Station from the pre-development condition to the post developed condition.

Moxie Gore Station

The calculations show a net decrease to peak runoff rates in every storm event for the Moxie Gore Station from the pre-development condition to the post developed condition.

A summary of each node is as follows:

Study Point SP1 (West Forks Station)

Node SP1 is located on the southwest side of the CMP right of way. Node SP1 shows a 6 percent decrease in runoff following a 25-year, 24-hour storm event in the post-development condition. Most of the decrease can be attributed to the runoff curve number being lower because of the increased infiltration of stormwater into the gravel/crushed stone surface of the switchyard placed on top of the existing soils.

Study Point SP2 (Moxie Gore Station)

Node SP2 is located on the South side of the CMP right of way. Node SP2 shows a 3 percent decrease in runoff following a 25-year, 24-hour storm event in the post-development condition. Most of the decrease can be attributed to the runoff curve number being lower because of the increased infiltration of stormwater into the gravel/crushed stone surface of the switchyard placed on top of the existing soils.

Curve Number Computations

A summary of the land cover types, hydrologic soil group (HSG), and curve numbers for the pre- and post-development subcatchments are provided in the stormwater calculation package in Appendix 12-1. Cover types for the impacted area were determined from the topographic field survey and a site visit and are indicated on the Pre- and Post-Development Watershed Plans.

The soils and hydrologic soil group information for the project study area are based on the Web Soil Survey mapping obtained from the USDA-NRCS *Soil Survey of Somerset County Area, Maine dated September 2017*. The soils and hydrologic soil groups within the runoff analysis areas are shown on the Pre- and Post-Development Watershed Plans.

The runoff curve numbers were developed from Appendix A-12: "Runoff Curve Numbers for use in TR-55 and TR-20" of the MDEP *Maine Stormwater Best Management Practices Manual, Volume III* and HydroCAD, based on the observed cover types and hydrologic soil groups. The only curve number that is not referenced directly from TR55 and TR20 is the one used for the switchyard. An engineering study was conducted by TRC Environmental Corporation (TRC), detailing the "typical" cross section and surface materials of a switchyard covered with gravel and crushed stone to calculate its permeability rate. The study was reviewed by John Simon, a USDA-NRCS engineer in Maine. The conclusions of this report were used as the basis of an agreement between CMP and MDEP that a CN value of 55 may be used for switchyards that are mapped as HSG "A", "B", "C", and a CN value of 60 must be used when the area is mapped as HSG "D". A copy of the letter agreement is included at the back of the stormwater calculations (Appendix 12-1).

12.5.1 *Time of Concentration Calculations*

Times of concentration were calculated using USDA-SCS TR-55 methodologies for each subcatchment considering the hydrologic flow lengths, slope, vegetative cover, surface roughness, and each stage-storage relationship. The type and length of each hydrologic flow line for determining time of concentration and travel times in the area to be developed are indicated on the Pre- and Post-Development Drainage Plans. The maximum sheet flow length used for this analysis was 150 feet. For flow lengths beyond 150 feet were assumed to be shallow concentrated flows. Shallow concentrated flow lengths varied for each subcatchment and were extended until they reached the end of the subcatchment or concentrated flow channel. A summary of the input data used to estimate the time of concentration for each subcatchment is provided in the calculation package.

12.5.2 *Travel Time Calculations*

The travel time for each subcatchment was calculated using a spreadsheet based on equations prepared by the USDA-NRCS. These times were then input directly into HydroCAD. The calculation spreadsheets are included in Appendix 12-1.

12.5.3 *Peak Discharge Calculations*

Peak discharge calculations are included in the HydroCAD output. A summary comparison of pre- and post-development peak discharge calculations at each boundary node is presented in Section 12.5, above.

12.5.4 *Reservoir Routing Calculations*

Reservoir routing calculations are included in the HydroCAD output. The "dynamic storage-indication" method was used in the post development analysis. This method recalculates the water surface elevation based on the downstream tailwater condition when performing the routing calculations.

12.6 FLOODING STANDARD

12.6.1 *Variance Submissions*

A variance from the peak flow standard is not necessary for the proposed transition stations. As determined in the pre-application meeting with MDEP staff and documented in the CMP/MDEP agreement letter, water quantity control is not necessary since there is a decrease in runoff, compared to the existing conditions, due to the greater infiltration properties (lower CN value) of the gravel and crushed stone switchyard surface, as compared to the native soils. In addition, the proposed stormwater management system will include several forested treatment buffers adjacent to the level spreaders to retain the pre-development flow regime. As stated previously, the runoff from the developed site will not adversely affect downstream properties.

12.6.2 *Sizing of Storm Drains and Culverts*

The calculations for the sizing of proposed culverts under the access road and other conveyance structures are presented in the stormwater calculation package (Appendix 12-1). The proposed culverts, conveyance swales and level spreader are designed to manage the limited runoff from the access road and switchyard without creating erosive velocities. Detailed drawings for the proposed on-site conveyance structures, including vegetated drainage swales, culverts with inlet and outlet protection, the level spreader and the forested buffers, are shown on the Post-Development Watershed Plan, Site Grading Sections & Details drawings located in Appendix 12-2. Stabilization methods are designed, and will be constructed and maintained in accordance with CMP's *Environmental Guidelines for Construction and Maintenance Activities on Transmission Line and Substation Projects*, dated June 2018 (the CMP's Environmental Guidelines), which is consistent with the *Maine Erosion and Sedimentation Control BMPs*, dated March 2016. Please refer to Section 14: Basic Standards Submissions for a detailed description of the site-specific erosion control measures and practices to be utilized during construction of the switchyard.

12.6.3 *Stormwater Ponds*

Stormwater ponds are not required for runoff treatment or attenuation. As discussed with MDEP staff, facilities (such as substations and termination stations) built to the specifications in the 2008 CMP/MDEP agreement letter will meet the required General Standards and will not necessitate any further treatment of runoff. The use of vegetated swales in conjunction with the level spreaders and forested buffers will be used to collect and treat the runoff from the termination station access roads. The use of on-site vegetated buffers will be maximized to allow for improved natural sheet flow.

12.6.4 *Infiltration Systems*

No infiltration systems are proposed for this project.

12.6.5 *Drainage Easement Declarations*

The proposed stormwater buffers are located entirely on CMP property associated with the Site Location of Development Act (SLODA) permit issued for this project. As a result, any alteration of these buffer areas will require review and approval by the MDEP. No drainage easements are needed. All vegetated buffers shown on the plans will be protected by deed restrictions (Declaration of Restrictions, per MDEP Chapter 500) applied to these areas.

12.7 STORMWATER QUALITY TREATMENT PLAN

12.7.1 *Basic Standards Submissions*

In accordance with the Basic Standards, the proposed switchyard, access road, and associated features will be constructed and stabilized using erosion and sedimentation (E&S) Best Management Practices (BMPs). The site will receive routine maintenance to ensure their continued function and to prevent or correct erosion problems. A level spreader is provided at the northwest corner of the switchyard to return concentrated flows from collector swales along the sides of the yard to non-erosive sheet flows. During and after construction at the Transition Stations, CMP's E&S Plan will be utilized to prevent erosion from occurring, as well as to correct any problems that may develop. The CMP's Environmental Guidelines updated and provided to the MDEP in June 2018, incorporates the applicable procedures of the *Maine Erosion and Sediment Control BMPs*, dated March 2016. The CMP's Environmental Guidelines contains the details and specifications for general stabilization measures to be used during construction and stabilization of the switchyard. These measures will be used to protect exposed soils during construction and during the service life of the project.

The stabilization measures for the site will include temporary and permanent erosion and sedimentation controls; appropriate design of swales, culverts, and erosion protection for earthen cut and fill slopes; and provisions for future maintenance of the site. The vegetated swales, culverts, buffers and level spreader design calculations are included in Appendix 12-3.

12.7.2 *General Standard Submissions*

Since the proposed development is part of a Site Law project compliance with the General Standards is required. Runoff from the gravel access roadway will be treated by the use of level spreaders and vegetated treatment buffers. MDEP staff has stated that as long as the facilities are built to the specifications in the 2008 CMP/MDEP agreement letter, the General Standard requirements will be met for these termination stations and no further water quality treatment of stormwater from the yard itself is required.

12.7.3 *Phosphorus Control Plan*

The transition station are not located in a lake watershed. Therefore, a Phosphorus Control Plan is not required for this application.

12.7.4 *Off-Site Credits*

Off-site credits for total suspended solids (TSS) or phosphorus are not required for the proposed switchyard.

12.7.5 *Runoff Treatment Measures*

The drainage design for this project includes vegetated conveyance swales along the access road that will collect and direct runoff to level spreaders which are adjacent to a forested buffer per the MDEP manual *Design of Stormwater Best Management Practices,* October 2016. The level spreader will convert the channelized flow to sheet flow prior to the runoff leaving the site. The transition stations will provide water quality treatment because they will be built in accordance with the materials and specifications shown on the drawings; *i.e.*, 6 inches of crushed stone on top of 18 inches of the Maine Department of Transportation (MDOT) 703.06 Type A gravel fill. The cross section and materials incorporated in this design exceed the specifications in the CMP/MDEP agreement letter.

12.7.6 *Control Plan for Thermal Impacts to Coldwater Fisheries*

Due to the use of vegetated buffers for treatment of runoff, there will be no thermal impacts.

12.7.7 *Control Plan for Other Pollutants*

A control plan for other pollutants in stormwater runoff is not required.

12.7.8 *Engineering Inspection of Stormwater Management Facilities*

CMP ensures that a qualified engineer will inspect the construction site periodically to verify that the transition stations, stormwater conveyance swales and level spreader are constructed in accordance with the plans and specifications shown on the design drawings, and that these structures are functioning properly. These inspections will commence with the initial earth moving activities on the site and will continue, as needed, during any period when construction activity affecting the stormwater management system occurs, until the site is permanently stabilized.

Additional inspections of the site will be conducted during and after construction to evaluate and maintain the condition and effectiveness of stormwater management structures and erosion and sedimentation control measures. BMPs for erosion control and stormwater pollution prevention during construction will include weekly (minimum) or more frequent inspections and maintenance of items such as temporary and permanent erosion control measures; stabilization of the switchyard site, road ditches, and the ROW; and to correct any erosion or sedimentation that is occurring. The inspection and maintenance of erosion control measures are described in more detailed in CMP's Environmental Guidelines (Update provided to MDEP in June 2018).

12.8 COMPONENTS OF KENNEBEC RIVER GORGE HDD TRANSITION STATIONS POST-CONSTRUCTION STORMWATER MAINTENANCE PLAN

Both of the transition stations will be owned, operated, and maintained by Central Maine Power Company.

12.8.1 *Facilities to be Maintained*

The stormwater management facilities to be maintained at the West Forks and the Moxie Gore Stations include:

- Stormwater conveyance swales and level spreader associated with the access road and transition stations;
- Culverts with inlet and outlet protection;
- Permanent access roads;
- Transition station surface (crushed stone);
- Revegetated areas and embankments; and
- Water quality treatment buffers.

12.8.2 *General Inspection and Maintenance Requirements*

The proposed facility will be operated and maintained in a manner consistent with good utility practices, including monthly on-site substation inspections and maintenance of stormwater management system components, as needed. A post-construction maintenance and inspection log is provided in Appendix 12-3.

Maintenance issues associated with specific areas and facilities at the substation are identified in the following sections.

12.8.2.1 Drainage Conveyance Systems

The vegetated swales, level spreader, and culverts will be inspected on a quarterly basis. Any signs of existing or developing blockage of flow, trash, erosion, channeling or excessive buildup of sediment will be removed/repaired, as needed. Vegetated swales and other vegetated structures will be mowed or otherwise maintained to control the growth of woody vegetation within the channel, but no more than once per year.

12.8.2.2 Roadways

The access roadway will typically require little on-going maintenance, owing to the limited use by heavy vehicles. These areas will be inspected quarterly, and signs of existing or developing erosion, rutting, trash or unwanted vegetation will be removed/repaired as needed.

12.8.2.3 Transition Station Surface

The transition station surfaces will be inspected quarterly. Any signs of existing or developing erosion, rutting, trash, or unwanted vegetation within the switchyard will be removed/repaired as needed.

12.8.2.4 Revegetated Areas and Embankments

Revegetated areas and embankments will be inspected quarterly. Any signs of erosion or inadequate revegetation of these areas will be corrected as needed.

12.8.2.5 Water Quality Treatment Buffers

Quarterly inspections of the water quality treatment buffers will be made to ensure the integrity of the undisturbed, forested buffers. Any signs of developing erosion will be repaired and revegetated as needed.

APPENDIX 12-1

Stormwater Calculation Package

CENTRAL MAINE POWER COMPANY

NECEC

KENNEBEC RIVER GORGE TRANSITION STATIONS

STORMWATER CALCULATIONS

OCTOBER 2018

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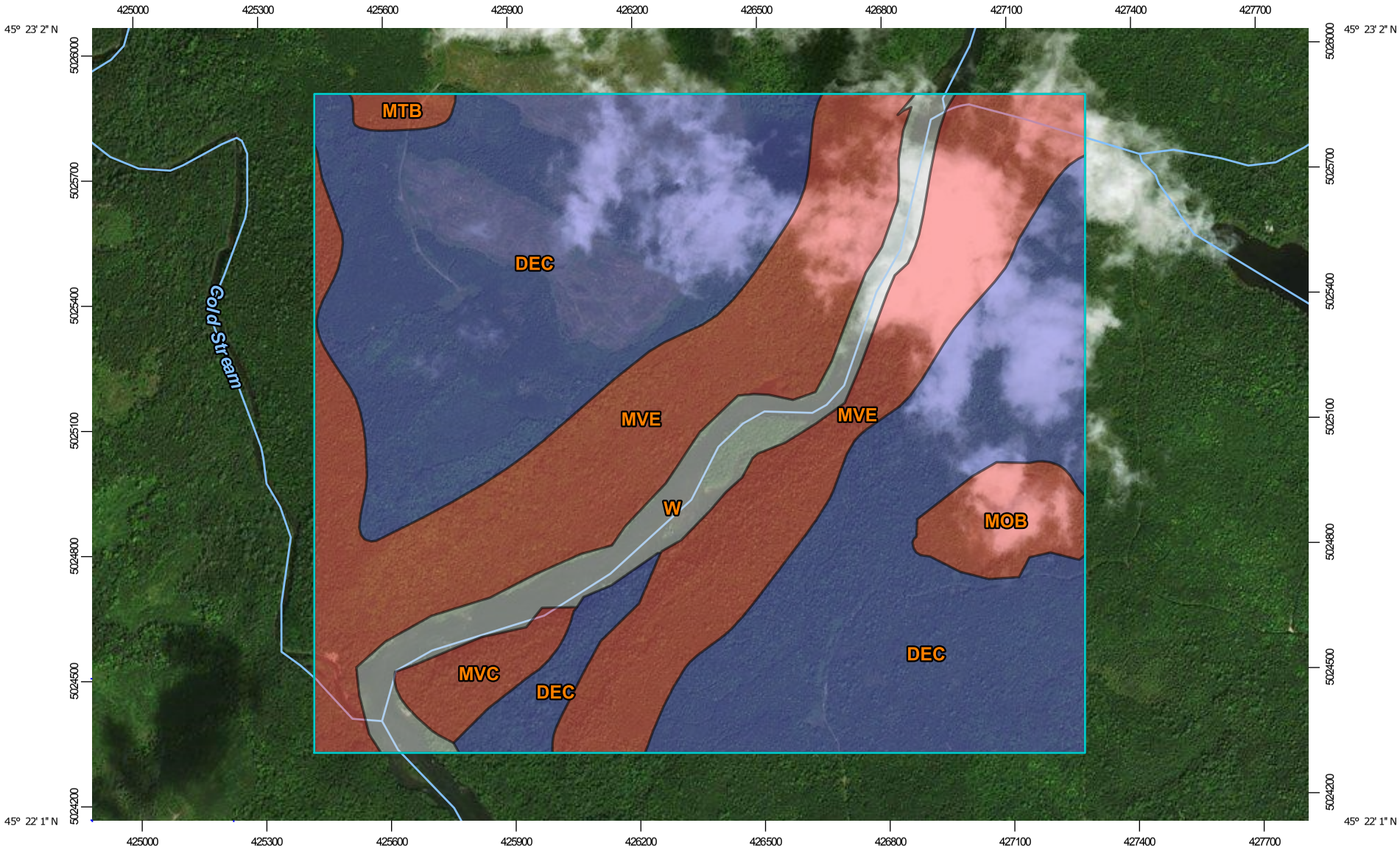
Hydrologic Soil Group—Somerset County Area and Parts of Franklin and Oxford Counties, Maine
(Kennebec Crossing)



Map Scale: 1:13,400 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Somerset County Area and Parts of Franklin and Oxford Counties, Maine
Survey Area Data: Version 22, Sep 11, 2017

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

Date(s) aerial images were photographed: Aug 24, 2014—Sep 21, 2016

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
DEC	Danforth-Elliottsville association, 3 to 15 percent slopes	B	393.6	54.1%
MOB	Monarda-Burnham complex, 0 to 3 percent slopes, very stony	D	21.1	2.9%
MTB	Monarda-Telos complex, 0 to 8 percent slopes, very stony	D	4.9	0.7%
MVC	Monson-Elliottsville-Knob Lock complex, 8 to 30 percent slopes, very rocky	D	15.6	2.1%
MVE	Monson-Elliottsville-Knob Lock complex, 30 to 60 percent slopes, very rocky	D	238.4	32.8%
W	Water bodies		53.4	7.3%
Totals for Area of Interest			**727.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA Atlas 14, Volume 10, Version 2
Location name: Town of Moxie Gore, Maine, USA*
Latitude: 45.3731°, Longitude: -69.9425°
Elevation: 618.28 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

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	0.255 (0.203-0.317)	0.309 (0.245-0.383)	0.396 (0.313-0.493)	0.468 (0.368-0.586)	0.567 (0.430-0.739)	0.644 (0.477-0.856)	0.720 (0.517-0.990)	0.815 (0.552-1.14)	0.941 (0.611-1.36)	1.04 (0.656-1.53)
10-min	0.362 (0.288-0.449)	0.437 (0.347-0.543)	0.560 (0.443-0.698)	0.663 (0.521-0.830)	0.803 (0.609-1.05)	0.912 (0.676-1.21)	1.02 (0.732-1.40)	1.16 (0.782-1.62)	1.33 (0.866-1.93)	1.47 (0.929-2.16)
15-min	0.426 (0.338-0.528)	0.514 (0.408-0.639)	0.659 (0.521-0.822)	0.780 (0.613-0.976)	0.945 (0.717-1.23)	1.07 (0.795-1.43)	1.20 (0.861-1.65)	1.36 (0.920-1.91)	1.57 (1.02-2.27)	1.73 (1.09-2.55)
30-min	0.570 (0.453-0.708)	0.689 (0.547-0.856)	0.883 (0.698-1.10)	1.04 (0.820-1.31)	1.26 (0.959-1.65)	1.44 (1.06-1.91)	1.61 (1.15-2.21)	1.82 (1.23-2.55)	2.10 (1.36-3.03)	2.31 (1.46-3.40)
60-min	0.715 (0.569-0.888)	0.864 (0.686-1.07)	1.11 (0.875-1.38)	1.31 (1.03-1.64)	1.58 (1.20-2.07)	1.80 (1.33-2.39)	2.01 (1.44-2.76)	2.28 (1.54-3.19)	2.62 (1.70-3.80)	2.89 (1.83-4.26)
2-hr	0.947 (0.757-1.17)	1.11 (0.888-1.37)	1.38 (1.10-1.71)	1.60 (1.27-2.00)	1.91 (1.46-2.48)	2.15 (1.61-2.85)	2.38 (1.73-3.28)	2.72 (1.85-3.78)	3.15 (2.06-4.53)	3.49 (2.22-5.10)
3-hr	1.10 (0.886-1.36)	1.28 (1.03-1.58)	1.58 (1.26-1.94)	1.82 (1.45-2.25)	2.15 (1.66-2.79)	2.41 (1.82-3.19)	2.67 (1.95-3.66)	3.05 (2.08-4.22)	3.55 (2.32-5.07)	3.93 (2.50-5.71)
6-hr	1.40 (1.13-1.71)	1.63 (1.31-1.99)	1.99 (1.61-2.44)	2.30 (1.84-2.83)	2.72 (2.10-3.49)	3.05 (2.31-3.99)	3.37 (2.48-4.59)	3.84 (2.64-5.28)	4.47 (2.94-6.33)	4.94 (3.17-7.13)
12-hr	1.73 (1.41-2.09)	2.03 (1.65-2.46)	2.52 (2.04-3.06)	2.93 (2.36-3.58)	3.49 (2.71-4.44)	3.92 (2.98-5.09)	4.36 (3.20-5.85)	4.94 (3.41-6.73)	5.71 (3.77-8.02)	6.29 (4.05-9.00)
24-hr	2.08 (1.70-2.50)	2.44 (2.00-2.94)	3.04 (2.48-3.68)	3.54 (2.87-4.30)	4.23 (3.30-5.33)	4.76 (3.63-6.11)	5.29 (3.89-7.01)	5.94 (4.12-8.03)	6.81 (4.52-9.49)	7.47 (4.83-10.6)
2-day	2.46 (2.03-2.94)	2.86 (2.35-3.41)	3.51 (2.88-4.21)	4.05 (3.30-4.88)	4.79 (3.76-5.98)	5.36 (4.11-6.81)	5.94 (4.38-7.78)	6.61 (4.61-8.85)	7.49 (5.00-10.3)	8.16 (5.30-11.5)
3-day	2.74 (2.27-3.25)	3.15 (2.61-3.76)	3.84 (3.17-4.59)	4.41 (3.61-5.29)	5.19 (4.09-6.44)	5.79 (4.45-7.32)	6.39 (4.73-8.32)	7.08 (4.96-9.44)	7.99 (5.36-11.0)	8.68 (5.65-12.1)
4-day	2.97 (2.47-3.53)	3.41 (2.83-4.05)	4.13 (3.41-4.92)	4.72 (3.88-5.65)	5.54 (4.38-6.85)	6.17 (4.75-7.77)	6.80 (5.04-8.81)	7.51 (5.27-9.97)	8.44 (5.67-11.6)	9.14 (5.97-12.8)
7-day	3.60 (3.01-4.24)	4.08 (3.41-4.82)	4.88 (4.06-5.77)	5.54 (4.57-6.59)	6.44 (5.11-7.91)	7.14 (5.52-8.91)	7.84 (5.82-10.1)	8.57 (6.05-11.3)	9.54 (6.44-13.0)	10.3 (6.73-14.2)
10-day	4.19 (3.52-4.93)	4.71 (3.95-5.55)	5.57 (4.64-6.57)	6.27 (5.20-7.43)	7.24 (5.76-8.85)	7.99 (6.19-9.92)	8.74 (6.50-11.1)	9.48 (6.71-12.4)	10.4 (7.07-14.1)	11.2 (7.34-15.4)
20-day	6.00 (5.07-7.01)	6.61 (5.57-7.72)	7.59 (6.38-8.89)	8.40 (7.02-9.89)	9.53 (7.62-11.5)	10.4 (8.09-12.7)	11.3 (8.38-14.1)	12.0 (8.54-15.6)	12.9 (8.80-17.3)	13.6 (9.00-18.6)
30-day	7.49 (6.35-8.70)	8.16 (6.91-9.49)	9.25 (7.81-10.8)	10.2 (8.52-11.9)	11.4 (9.17-13.7)	12.4 (9.66-15.1)	13.3 (9.95-16.6)	14.1 (10.1-18.2)	15.0 (10.3-20.0)	15.8 (10.4-21.4)
45-day	9.30 (7.92-10.8)	10.1 (8.56-11.7)	11.3 (9.59-13.1)	12.4 (10.4-14.4)	13.8 (11.1-16.5)	14.9 (11.7-18.1)	16.0 (12.0-19.8)	16.8 (12.1-21.6)	17.8 (12.2-23.6)	18.6 (12.3-25.2)
60-day	10.8 (9.22-12.4)	11.6 (9.94-13.4)	13.0 (11.1-15.1)	14.2 (12.0-16.5)	15.8 (12.8-18.8)	17.0 (13.4-20.6)	18.3 (13.7-22.5)	19.1 (13.8-24.6)	20.3 (13.9-26.8)	21.1 (14.1-28.5)

[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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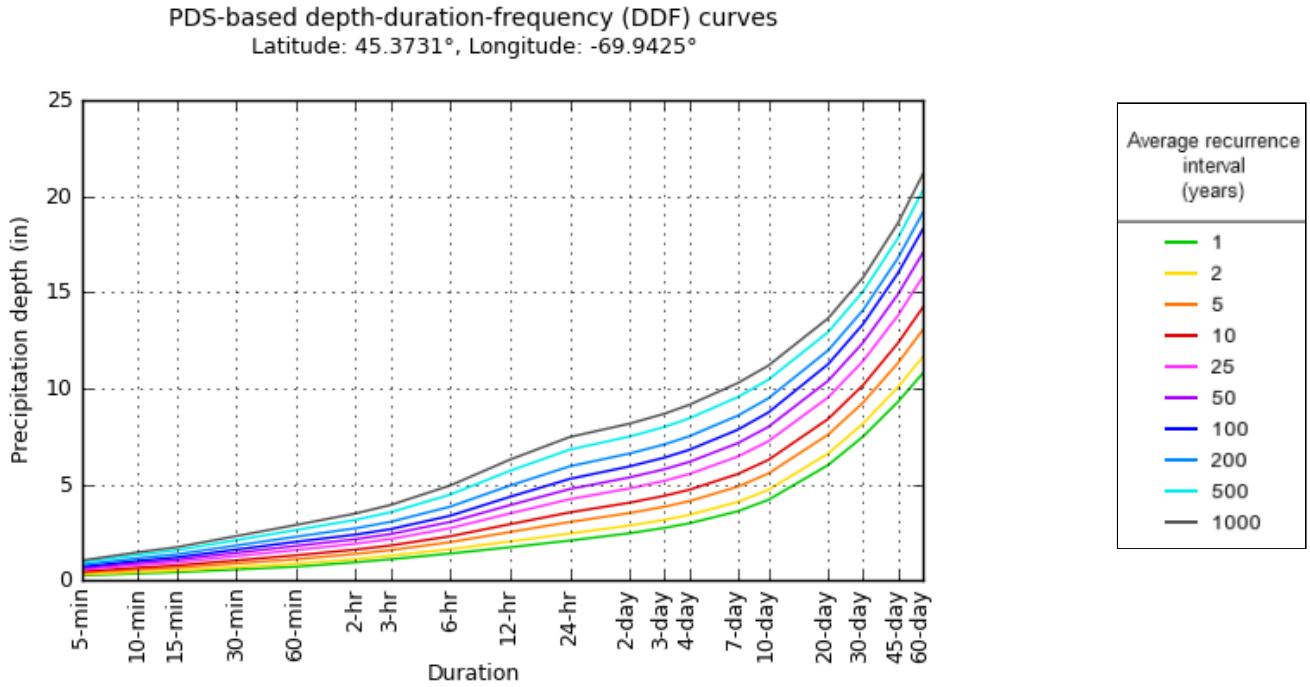
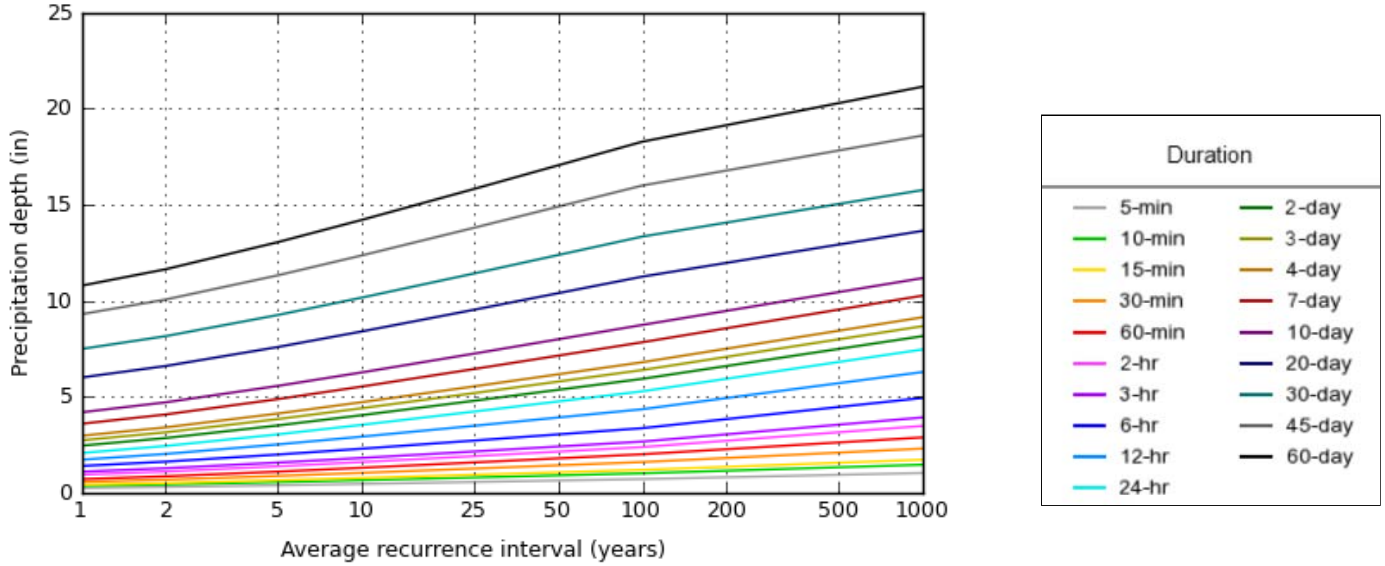
PF graphical





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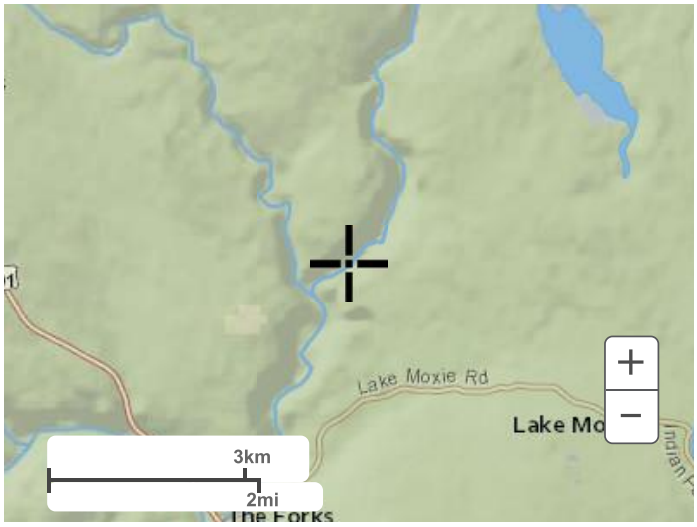
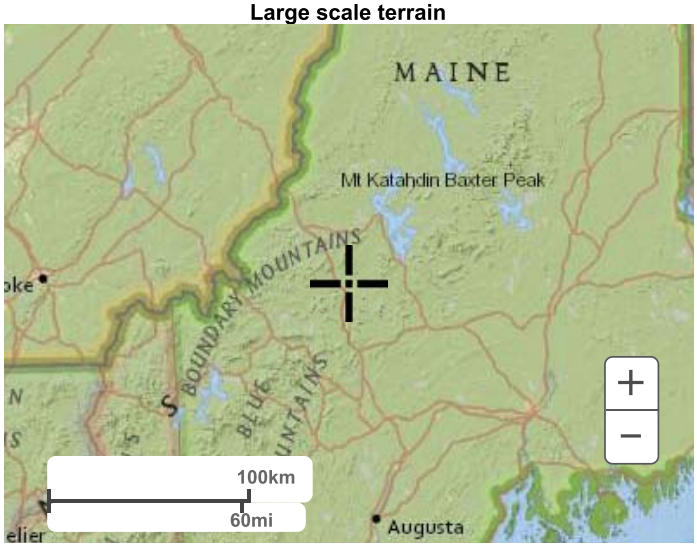
Maps & aerials

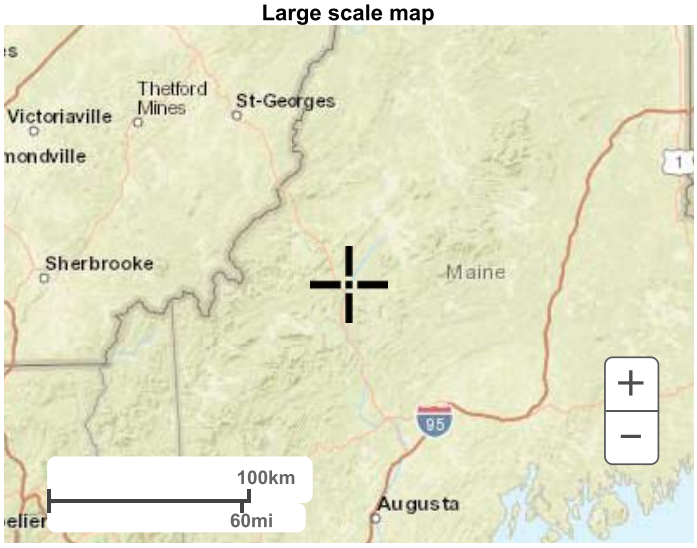
Small scale terrain



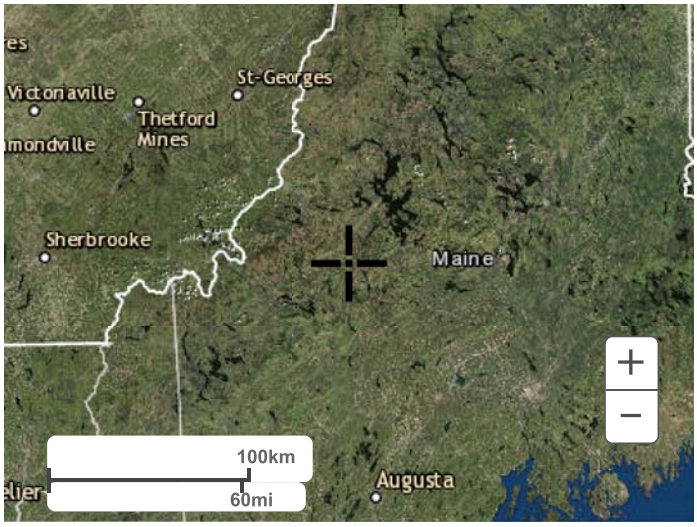
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

PROJECT:	**Avangrid - CMP**	**Calculated By:**	PGT
	Kennebec River Crossing Transition Stations	**Date:**	10/17/2018
TRC Proj. No.:	**306390.0000.00000**	**Checked By:**	DTB
	Time of Concentration Summary	**Date:**	

Time of Concentration Equations:

1. Where $T_t := \frac{0.007 \cdot (N \cdot L)^{0.8}}{P_2^{0.5} \cdot S^{0.4}}$ from SCS TR-55. For Sheet Flow (300 feet or less)

2. Where $V := 20.3282 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Shallow Concentrated Flow (Paved surfaces)

3. Where $T_t := \frac{L}{3600 \cdot V}$ from the SCS Upland Method *Channel Flow Chart* Travel time equation

4. Where $V := 16.1345 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Shallow Concentrated Flow (Unpaved surfaces)

5. Where: $v = 7\sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Shallow Concentrated Flow (Short Grass Pasture)

6. Where: $v = 5\sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Shallow Concentrated Flow (Woodland)

7. Where $V := 12 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Waterways and Swamps, No Channels

8. Where $V := 15 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Grassed Waterways and Roadside Ditches

9. Where $V := 21 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Small Tributary & Swamp w/Channels

10. Where $V := 35 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Large Tributary

11. Where $V := 60 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Main River

12. Where $V := \frac{1.49 \cdot R^{.667} \cdot \sqrt{S}}{N}$ For Channel Flow - Culvert Flow

13. Where P_2 = 2-Year, 24 Hour Rainfall (in) (Somerset, County: P_2= 2.44 inches)

Mannings Roughness Coefficients Table

Surface Description	n - value
Smooth surfaces	0.011
Crush Stone/Substation Yards	0.025
Fallow	0.050
Cultivated: Residue<=20%	0.060
Cultivated: Residue>=20%	0.170
Grass: Short	0.150
Grass: Dense	0.240
Grass: Bermuda	0.410
Range	0.130
Woods: Light underbrush	0.400
Woods: Dense underbrush	0.800

PROJECT:	**Kennebec River Gorge Transition Stations**	**Calculated By:**	PGT
	West Forks Plantation	**Checked By:**	DTB
TRC Proj. No.:	**306390.0000.00000**	**Date:**	10/17/18
Subcatchment:	**PRE & POST DEV 1S**	**Revised:**	

Time of Concentration Determination Worksheet, SCS Methods

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7		
SHEET FLOW									
Manning's No.	0.8	0.4							
Length, ft	117	33							
P2 , in	2.44	2.44							
Slope, ft/ft	0.1227	0.1824							
T_t[1], hr	0.392	0.070							0.4614
SHALLOW CONCENTRATED FLOW									
Paved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Unpaved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Short Grass Pasture									
Length, ft									
Slope, ft/ft									
Velocity[4], ft/sec									
T_t[3], hr									0.0000
Woodland									
Length, ft		551							
Slope, ft/ft		0.081							
Velocity[5], ft/sec		1.4265							
T_t[3], hr		0.107							0.1073
CHANNEL FLOW									
Waterways & Swamps, No Channels									
Length, ft									
Slope, ft/ft									
Velocity[6], ft/sec									
T_t[3], hr									0.0000
Grassed Waterways/Roadside Ditches									
Length, ft									
Slope, ft/ft									
Velocity[7], ft/sec									
T_t, hr									0.0000
Small Tributary & Swamp w/Channels									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Large Tributary									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Culvert									
Diameter, ft									
Area, ft^2									
Wetted Perimeter, ft									
Hydraulic Radius, R, ft									
Slope, ft/ft									
Manning's No.									
Velocity[12], ft/sec									
Length, L, ft									
T_t, hr									0.0000

HR	0.569
Min	**34.12**

PROJECT:	**Kennebec River Gorge Transition Stations**	**Calculated By:**	PGT
	West Forks Plantation	**Checked By:**	DTB
TRC Proj. No.:	**306390.0000.00000**	**Date:**	10/17/18
Subcatchment:	**POST DEV** **T Yard** 1SA	**Revised:**	

Time of Concentration Determination Worksheet, SCS Methods

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7		
SHEET FLOW									
Manning's No.	0.0111								
Length, ft	140								
P2 , in	2.44								
Slope, ft/ft	0.02								
T_t[1], hr	0.030								0.0305
SHALLOW CONCENTRATED FLOW									
Paved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Unpaved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Short Grass Pasture									
Length, ft									
Slope, ft/ft									
Velocity[4], ft/sec									
T_t[3], hr									0.0000
Woodland									
Length, ft									
Slope, ft/ft									
Velocity[5], ft/sec									
T_t[3], hr									0.0000
CHANNEL FLOW									
Waterways & Swamps, No Channels									
Length, ft									
Slope, ft/ft									
Velocity[6], ft/sec									
T_t[3], hr									0.0000
Grassed Waterways/Roadside Ditches									
Length, ft									
Slope, ft/ft									
Velocity[7], ft/sec									
T_t, hr									0.0000
Small Tributary & Swamp w/Channels									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Large Tributary									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Culvert									
Diameter, ft									
Area, ft^2									
Wetted Perimeter, ft									
Hydraulic Radius, R, ft									
Slope, ft/ft									
Manning's No.									
Velocity[12], ft/sec									
Length, L, ft									
T_t, hr									0.0000

HR	0.030
Min	**1.83**

(6 Minutes Minimum)

PROJECT:	**Kennebec River Gorge Transition Stations**	**Calculated By:**	PGT
	Moxie Gore	**Checked By:**	DTB
TRC Proj. No.:	**306390.0000.00000**	**Date:**	10/17/18
Subcatchment:	**PRE & POST DEV 2S**	**Revised:**	

Time of Concentration Determination Worksheet, SCS Methods

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7		
SHEET FLOW									
Manning's No.	0.8								
Length, ft	150								
P2 , in	2.44								
Slope, ft/ft	0.1187								
T_t[1], hr	0.484								0.4841
SHALLOW CONCENTRATED FLOW									
Paved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Unpaved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Short Grass Pasture									
Length, ft									
Slope, ft/ft									
Velocity[4], ft/sec									
T_t[3], hr									0.0000
Woodland									
Length, ft		569							
Slope, ft/ft		0.053							
Velocity[5], ft/sec		1.1500							
T_t[3], hr		0.137							0.1374
CHANNEL FLOW									
Waterways & Swamps, No Channels									
Length, ft			178						
Slope, ft/ft			0.0087						
Velocity[6], ft/sec			1.119						
T_t[3], hr			0.044						0.0442
Grassed Waterways/Roadside Ditches									
Length, ft									
Slope, ft/ft									
Velocity[7], ft/sec									
T_t, hr									0.0000
Small Tributary & Swamp w/Channels									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Large Tributary									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Culvert									
Diameter, ft									
Area, ft^2									
Wetted Perimeter, ft									
Hydraulic Radius, R, ft									
Slope, ft/ft									
Manning's No.									
Velocity[12], ft/sec									
Length, L, ft									
T_t, hr									0.0000

HR	0.666
Min	**39.95**

PROJECT:	**Kennebec River Gorge Transition Stations**	**Calculated By:**	PGT
	Moxie Gore	**Checked By:**	DTB
TRC Proj. No.:	**306390.0000.00000**	**Date:**	10/17/18
Subcatchment:	**POST DEV** **T Yard**	**Revised:**	

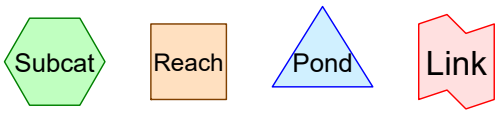
Time of Concentration Determination Worksheet, SCS Methods

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7		
SHEET FLOW									
Manning's No.	0.0111								
Length, ft	140								
P2 , in	2.44								
Slope, ft/ft	0.02								
T_t[1], hr	0.030								0.0305
SHALLOW CONCENTRATED FLOW									
Paved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Unpaved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Short Grass Pasture									
Length, ft									
Slope, ft/ft									
Velocity[4], ft/sec									
T_t[3], hr									0.0000
Woodland									
Length, ft									
Slope, ft/ft									
Velocity[5], ft/sec									
T_t[3], hr									0.0000
CHANNEL FLOW									
Waterways & Swamps, No Channels									
Length, ft									
Slope, ft/ft									
Velocity[6], ft/sec									
T_t[3], hr									0.0000
Grassed Waterways/Roadside Ditches									
Length, ft									
Slope, ft/ft									
Velocity[7], ft/sec									
T_t, hr									0.0000
Small Tributary & Swamp w/Channels									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Large Tributary									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Culvert									
Diameter, ft									
Area, ft^2									
Wetted Perimeter, ft									
Hydraulic Radius, R, ft									
Slope, ft/ft									
Manning's No.									
Velocity[12], ft/sec									
Length, L, ft									
T_t, hr									0.0000

HR	0.030
Min	**1.83**

(6 Minutes Minimum)

PRE-DEVELOPMENT
MODEL



Routing Diagram for 2018-09-20 West Forks PLT Pre-Dev Model
Prepared by TRC, Printed 10/17/2018
HydroCAD® 10.00-20 s/n 01402 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.720	67	Brush, Poor, HSG B (1S, 2S)
0.250	96	Gravel surface, HSG B (2S)
17.460	66	Woods, Poor, HSG B (1S, 2S)
18.430	**66**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
18.430	HSG B	1S, 2S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
18.430		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.720	0.000	0.000	0.000	0.720	Brush, Poor	1S, 2S
0.000	0.250	0.000	0.000	0.000	0.250	Gravel surface	2S
0.000	17.460	0.000	0.000	0.000	17.460	Woods, Poor	1S, 2S
0.000	**18.430**	**0.000**	**0.000**	**0.000**	**18.430**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (WEST FORKS Runoff Area=6.030 ac 0.00% Impervious Runoff Depth=0.30"
Tc=34.1 min CN=66 Runoff=0.85 cfs 0.152 af

Subcatchment 2S: (MOXIE GORE) Runoff Area=12.400 ac 0.00% Impervious Runoff Depth=0.33"
Tc=40.0 min CN=67 Runoff=1.83 cfs 0.343 af

Reach SP1: (SP1) Inflow=0.85 cfs 0.152 af
Outflow=0.85 cfs 0.152 af

Reach SP2: (SP2) Inflow=1.83 cfs 0.343 af
Outflow=1.83 cfs 0.343 af

Total Runoff Area = 18.430 ac Runoff Volume = 0.495 af Average Runoff Depth = 0.32"
100.00% Pervious = 18.430 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: (WEST FORKS PLANTATION)

Runoff = 0.85 cfs @ 12.40 hrs, Volume= 0.152 af, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=2.44"

Area (ac)	CN	Description
5.890	66	Woods, Poor, HSG B
0.140	67	Brush, Poor, HSG B
6.030	66	Weighted Average
6.030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.1					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 2S: (MOXIE GORE)

Runoff = 1.83 cfs @ 12.48 hrs, Volume= 0.343 af, Depth= 0.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=2.44"

Area (ac)	CN	Description
11.570	66	Woods, Poor, HSG B
0.250	96	Gravel surface, HSG B
0.580	67	Brush, Poor, HSG B
12.400	67	Weighted Average
12.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry, See Spreadsheet**

Summary for Reach SP1: (SP1)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.030 ac, 0.00% Impervious, Inflow Depth = 0.30" for 2-Year event
Inflow = 0.85 cfs @ 12.40 hrs, Volume= 0.152 af
Outflow = 0.85 cfs @ 12.40 hrs, Volume= 0.152 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach SP2: (SP2)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	12.400 ac,	0.00% Impervious,	Inflow Depth =	0.33"	for 2-Year event
Inflow =	1.83 cfs @	12.48 hrs,	Volume=	0.343 af	
Outflow =	1.83 cfs @	12.48 hrs,	Volume=	0.343 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (WEST FORKS Runoff Area=6.030 ac 0.00% Impervious Runoff Depth=0.97"
Tc=34.1 min CN=66 Runoff=4.02 cfs 0.487 af

Subcatchment 2S: (MOXIE GORE) Runoff Area=12.400 ac 0.00% Impervious Runoff Depth=1.02"
Tc=40.0 min CN=67 Runoff=7.94 cfs 1.058 af

Reach SP1: (SP1) Inflow=4.02 cfs 0.487 af
Outflow=4.02 cfs 0.487 af

Reach SP2: (SP2) Inflow=7.94 cfs 1.058 af
Outflow=7.94 cfs 1.058 af

Total Runoff Area = 18.430 ac Runoff Volume = 1.544 af Average Runoff Depth = 1.01"
100.00% Pervious = 18.430 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: (WEST FORKS PLANTATION)

Runoff = 4.02 cfs @ 12.33 hrs, Volume= 0.487 af, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=3.80"

Area (ac)	CN	Description
5.890	66	Woods, Poor, HSG B
0.140	67	Brush, Poor, HSG B
6.030	66	Weighted Average
6.030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.1					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 2S: (MOXIE GORE)

Runoff = 7.94 cfs @ 12.40 hrs, Volume= 1.058 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=3.80"

Area (ac)	CN	Description
11.570	66	Woods, Poor, HSG B
0.250	96	Gravel surface, HSG B
0.580	67	Brush, Poor, HSG B
12.400	67	Weighted Average
12.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry, See Spreadsheet**

Summary for Reach SP1: (SP1)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.030 ac, 0.00% Impervious, Inflow Depth = 0.97" for 10-Year event
Inflow = 4.02 cfs @ 12.33 hrs, Volume= 0.487 af
Outflow = 4.02 cfs @ 12.33 hrs, Volume= 0.487 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach SP2: (SP2)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	12.400 ac,	0.00% Impervious,	Inflow Depth =	1.02"	for 10-Year event
Inflow =	7.94 cfs @	12.40 hrs,	Volume=	1.058 af	
Outflow =	7.94 cfs @	12.40 hrs,	Volume=	1.058 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (WEST FORKS Runoff Area=6.030 ac 0.00% Impervious Runoff Depth=1.23"
Tc=34.1 min CN=66 Runoff=5.30 cfs 0.616 af

Subcatchment 2S: (MOXIE GORE) Runoff Area=12.400 ac 0.00% Impervious Runoff Depth=1.29"
Tc=40.0 min CN=67 Runoff=10.38 cfs 1.332 af

Reach SP1: (SP1) Inflow=5.30 cfs 0.616 af
Outflow=5.30 cfs 0.616 af

Reach SP2: (SP2) Inflow=10.38 cfs 1.332 af
Outflow=10.38 cfs 1.332 af

Total Runoff Area = 18.430 ac Runoff Volume = 1.948 af Average Runoff Depth = 1.27"
100.00% Pervious = 18.430 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: (WEST FORKS PLANTATION)

Runoff = 5.30 cfs @ 12.32 hrs, Volume= 0.616 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=4.23"

Area (ac)	CN	Description
5.890	66	Woods, Poor, HSG B
0.140	67	Brush, Poor, HSG B
6.030	66	Weighted Average
6.030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.1					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 2S: (MOXIE GORE)

Runoff = 10.38 cfs @ 12.40 hrs, Volume= 1.332 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=4.23"

Area (ac)	CN	Description
11.570	66	Woods, Poor, HSG B
0.250	96	Gravel surface, HSG B
0.580	67	Brush, Poor, HSG B
12.400	67	Weighted Average
12.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry, See Spreadsheet**

Summary for Reach SP1: (SP1)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.030 ac, 0.00% Impervious, Inflow Depth = 1.23" for 25-Year event
Inflow = 5.30 cfs @ 12.32 hrs, Volume= 0.616 af
Outflow = 5.30 cfs @ 12.32 hrs, Volume= 0.616 af, Atten= 0%, Lag= 0.0 min

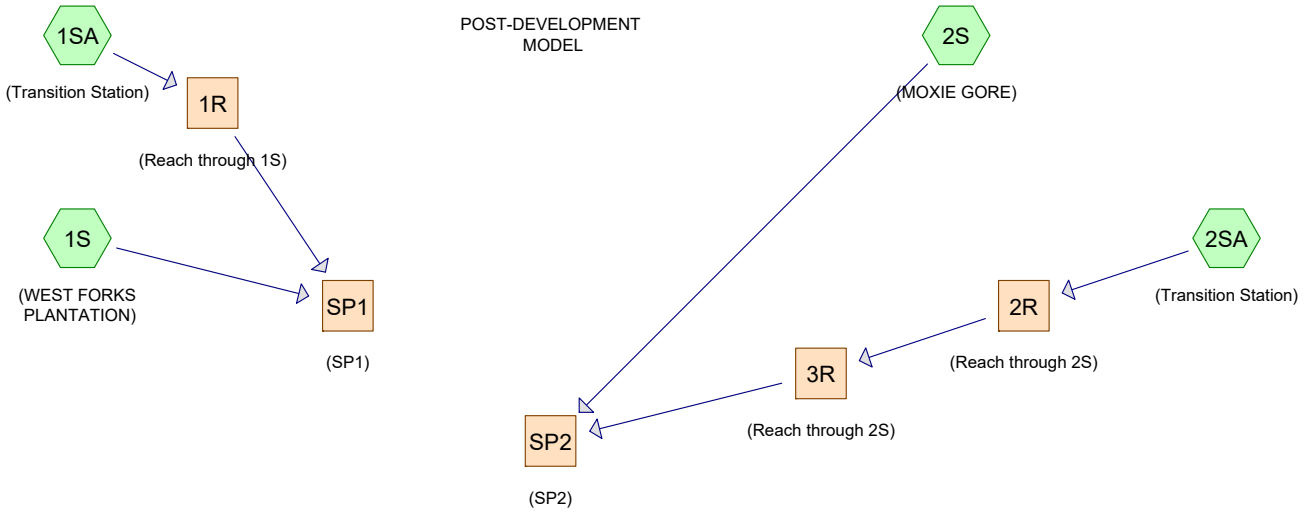
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

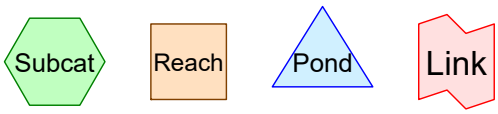
Summary for Reach SP2: (SP2)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 12.400 ac, 0.00% Impervious, Inflow Depth = 1.29" for 25-Year event
Inflow = 10.38 cfs @ 12.40 hrs, Volume= 1.332 af
Outflow = 10.38 cfs @ 12.40 hrs, Volume= 1.332 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs





Routing Diagram for 2018-10-17 West Forks PLT Post-Dev Model
Prepared by TRC, Printed 10/17/2018
HydroCAD® 10.00-20 s/n 01402 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.340	56	Brush, Fair, HSG B (1S)
0.970	67	Brush, Poor, HSG B (1S, 2S)
0.020	98	Foundations, HSG B (1SA, 2SA)
0.530	96	Gravel surface, HSG B (1S, 2S)
0.940	55	Substation Surface (1SA, 2SA)
15.630	66	Woods, Poor, HSG B (1S, 2S)
18.430	**66**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
17.490	HSG B	1S, 1SA, 2S, 2SA
0.000	HSG C	
0.000	HSG D	
0.940	Other	1SA, 2SA
18.430		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.340	0.000	0.000	0.000	0.340	Brush, Fair	1S
0.000	0.970	0.000	0.000	0.000	0.970	Brush, Poor	1S, 2S
0.000	0.020	0.000	0.000	0.000	0.020	Foundations	1SA, 2SA
0.000	0.530	0.000	0.000	0.000	0.530	Gravel surface	1S, 2S
0.000	0.000	0.000	0.000	0.940	0.940	Substation Surface	1SA, 2SA
0.000	15.630	0.000	0.000	0.000	15.630	Woods, Poor	1S, 2S
0.000	**17.490**	**0.000**	**0.000**	**0.940**	**18.430**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (WEST FORKS Runoff Area=5.550 ac 0.00% Impervious Runoff Depth=0.30"
Tc=34.1 min CN=66 Runoff=0.78 cfs 0.140 af

Subcatchment 1SA: (Transition Station) Runoff Area=0.480 ac 2.08% Impervious Runoff Depth=0.09"
Tc=6.0 min CN=56 Runoff=0.01 cfs 0.003 af

Subcatchment 2S: (MOXIE GORE) Runoff Area=11.920 ac 0.00% Impervious Runoff Depth=0.33"
Tc=40.0 min CN=67 Runoff=1.76 cfs 0.330 af

Subcatchment 2SA: (Transition Station) Runoff Area=0.480 ac 2.08% Impervious Runoff Depth=0.09"
Tc=6.0 min CN=56 Runoff=0.01 cfs 0.003 af

Reach 1R: (Reach through 1S) Avg. Flow Depth=0.00' Max Vel=0.47 fps Inflow=0.01 cfs 0.003 af
n=0.030 L=331.0' S=0.1043 '/' Capacity=147.87 cfs Outflow=0.01 cfs 0.003 af

Reach 2R: (Reach through 2S) Avg. Flow Depth=0.01' Max Vel=0.23 fps Inflow=0.01 cfs 0.003 af
n=0.030 L=235.0' S=0.0067 '/' Capacity=11.79 cfs Outflow=0.01 cfs 0.003 af

Reach 3R: (Reach through 2S) Avg. Flow Depth=0.00' Max Vel=0.27 fps Inflow=0.01 cfs 0.003 af
n=0.030 L=747.0' S=0.0358 '/' Capacity=86.69 cfs Outflow=0.00 cfs 0.003 af

Reach SP1: (SP1) Inflow=0.79 cfs 0.144 af
Outflow=0.79 cfs 0.144 af

Reach SP2: (SP2) Inflow=1.76 cfs 0.333 af
Outflow=1.76 cfs 0.333 af

Total Runoff Area = 18.430 ac Runoff Volume = 0.477 af Average Runoff Depth = 0.31"
99.89% Pervious = 18.410 ac 0.11% Impervious = 0.020 ac

Summary for Subcatchment 1S: (WEST FORKS PLANTATION)

Runoff = 0.78 cfs @ 12.40 hrs, Volume= 0.140 af, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=2.44"

Area (ac)	CN	Description
4.920	66	Woods, Poor, HSG B
0.140	67	Brush, Poor, HSG B
0.340	56	Brush, Fair, HSG B
0.150	96	Gravel surface, HSG B
5.550	66	Weighted Average
5.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.1					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 1SA: (Transition Station)

Runoff = 0.01 cfs @ 12.41 hrs, Volume= 0.003 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=2.44"

	Area (ac)	CN	Description
*	0.470	55	Substation Surface
*	0.010	98	Foundations, HSG B
	0.480	56	Weighted Average
	0.470		97.92% Pervious Area
	0.010		2.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 minutes (Minimum)**

Summary for Subcatchment 2S: (MOXIE GORE)

Runoff = 1.76 cfs @ 12.48 hrs, Volume= 0.330 af, Depth= 0.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=2.44"

	Area (ac)	CN	Description
	10.710	66	Woods, Poor, HSG B
	0.380	96	Gravel surface, HSG B
	0.830	67	Brush, Poor, HSG B
	0.000	48	Brush, Good, HSG B
*	0.000	55	Station Surface
	0.000	98	Roofs, HSG B
	11.920	67	Weighted Average
	11.920		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 2SA: (Transition Station)

Runoff = 0.01 cfs @ 12.41 hrs, Volume= 0.003 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=2.44"

	Area (ac)	CN	Description
*	0.470	55	Substation Surface
*	0.010	98	Foundations, HSG B
	0.480	56	Weighted Average
	0.470		97.92% Pervious Area
	0.010		2.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 minutes (Minimum)**

Summary for Reach 1R: (Reach through 1S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.09" for 2-Year event
Inflow = 0.01 cfs @ 12.41 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 12.91 hrs, Volume= 0.003 af, Atten= 12%, Lag= 30.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.47 fps, Min. Travel Time= 11.8 min
Avg. Velocity = 0.47 fps, Avg. Travel Time= 11.8 min

Peak Storage= 4 cf @ 12.91 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.50' Flow Area= 15.0 sf, Capacity= 147.87 cfs

30.00' x 0.50' deep channel, n= 0.030 Short grass
Length= 331.0' Slope= 0.1043 '/'
Inlet Invert= 936.00', Outlet Invert= 901.49'

Summary for Reach 2R: (Reach through 2S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.09" for 2-Year event
Inflow = 0.01 cfs @ 12.41 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 12.96 hrs, Volume= 0.003 af, Atten= 13%, Lag= 32.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.23 fps, Min. Travel Time= 17.3 min
Avg. Velocity = 0.19 fps, Avg. Travel Time= 20.4 min

Peak Storage= 6 cf @ 12.96 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 11.79 cfs

2.00' x 1.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 235.0' Slope= 0.0067 '/'
Inlet Invert= 890.80', Outlet Invert= 889.22'

Summary for Reach 3R: (Reach through 2S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.09" for 2-Year event
Inflow = 0.01 cfs @ 12.96 hrs, Volume= 0.003 af
Outflow = 0.00 cfs @ 14.10 hrs, Volume= 0.003 af, Atten= 18%, Lag= 68.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.27 fps, Min. Travel Time= 45.4 min
Avg. Velocity = 0.27 fps, Avg. Travel Time= 45.4 min

Peak Storage= 13 cf @ 14.10 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.50' Flow Area= 15.0 sf, Capacity= 86.69 cfs

30.00' x 0.50' deep channel, n= 0.030 Short grass
Length= 747.0' Slope= 0.0358 '/'
Inlet Invert= 889.22', Outlet Invert= 862.45'

Summary for Reach SP1: (SP1)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.030 ac, 0.17% Impervious, Inflow Depth = 0.29" for 2-Year event
Inflow = 0.79 cfs @ 12.40 hrs, Volume= 0.144 af
Outflow = 0.79 cfs @ 12.40 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach SP2: (SP2)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 12.400 ac, 0.08% Impervious, Inflow Depth = 0.32" for 2-Year event
Inflow = 1.76 cfs @ 12.48 hrs, Volume= 0.333 af
Outflow = 1.76 cfs @ 12.48 hrs, Volume= 0.333 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (WEST FORKS Runoff Area=5.550 ac 0.00% Impervious Runoff Depth=0.97"
Tc=34.1 min CN=66 Runoff=3.70 cfs 0.448 af

Subcatchment 1SA: (Transition Station) Runoff Area=0.480 ac 2.08% Impervious Runoff Depth=0.49"
Tc=6.0 min CN=56 Runoff=0.32 cfs 0.020 af

Subcatchment 2S: (MOXIE GORE) Runoff Area=11.920 ac 0.00% Impervious Runoff Depth=1.02"
Tc=40.0 min CN=67 Runoff=7.63 cfs 1.017 af

Subcatchment 2SA: (Transition Station) Runoff Area=0.480 ac 2.08% Impervious Runoff Depth=0.49"
Tc=6.0 min CN=56 Runoff=0.32 cfs 0.020 af

Reach 1R: (Reach through 1S) Avg. Flow Depth=0.01' Max Vel=0.72 fps Inflow=0.32 cfs 0.020 af
n=0.030 L=331.0' S=0.1043 '/' Capacity=147.87 cfs Outflow=0.20 cfs 0.020 af

Reach 2R: (Reach through 2S) Avg. Flow Depth=0.12' Max Vel=0.93 fps Inflow=0.32 cfs 0.020 af
n=0.030 L=235.0' S=0.0067 '/' Capacity=11.79 cfs Outflow=0.26 cfs 0.020 af

Reach 3R: (Reach through 2S) Avg. Flow Depth=0.01' Max Vel=0.35 fps Inflow=0.26 cfs 0.020 af
n=0.030 L=747.0' S=0.0358 '/' Capacity=86.69 cfs Outflow=0.07 cfs 0.020 af

Reach SP1: (SP1) Inflow=3.78 cfs 0.468 af
Outflow=3.78 cfs 0.468 af

Reach SP2: (SP2) Inflow=7.70 cfs 1.037 af
Outflow=7.70 cfs 1.037 af

Total Runoff Area = 18.430 ac Runoff Volume = 1.504 af Average Runoff Depth = 0.98"
99.89% Pervious = 18.410 ac 0.11% Impervious = 0.020 ac

Summary for Subcatchment 1S: (WEST FORKS PLANTATION)

Runoff = 3.70 cfs @ 12.33 hrs, Volume= 0.448 af, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=3.80"

Area (ac)	CN	Description
4.920	66	Woods, Poor, HSG B
0.140	67	Brush, Poor, HSG B
0.340	56	Brush, Fair, HSG B
0.150	96	Gravel surface, HSG B
5.550	66	Weighted Average
5.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.1					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 1SA: (Transition Station)

Runoff = 0.32 cfs @ 12.00 hrs, Volume= 0.020 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=3.80"

	Area (ac)	CN	Description
*	0.470	55	Substation Surface
*	0.010	98	Foundations, HSG B
	0.480	56	Weighted Average
	0.470		97.92% Pervious Area
	0.010		2.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 minutes (Minimum)**

Summary for Subcatchment 2S: (MOXIE GORE)

Runoff = 7.63 cfs @ 12.40 hrs, Volume= 1.017 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=3.80"

	Area (ac)	CN	Description
	10.710	66	Woods, Poor, HSG B
	0.380	96	Gravel surface, HSG B
	0.830	67	Brush, Poor, HSG B
	0.000	48	Brush, Good, HSG B
*	0.000	55	Station Surface
	0.000	98	Roofs, HSG B
	11.920	67	Weighted Average
	11.920		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 2SA: (Transition Station)

Runoff = 0.32 cfs @ 12.00 hrs, Volume= 0.020 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=3.80"

	Area (ac)	CN	Description
*	0.470	55	Substation Surface
*	0.010	98	Foundations, HSG B
	0.480	56	Weighted Average
	0.470		97.92% Pervious Area
	0.010		2.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 minutes (Minimum)**

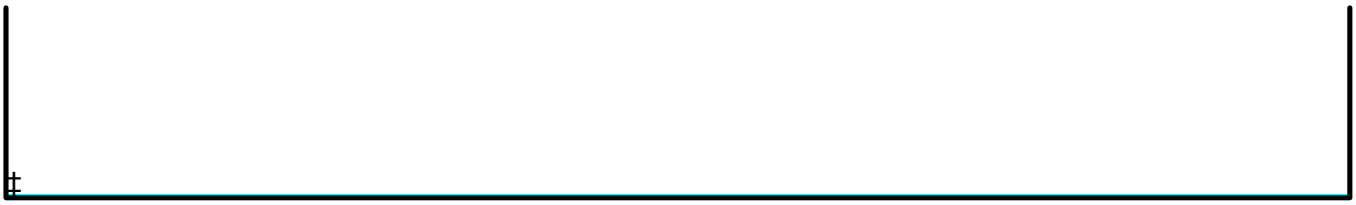
Summary for Reach 1R: (Reach through 1S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.49" for 10-Year event
Inflow = 0.32 cfs @ 12.00 hrs, Volume= 0.020 af
Outflow = 0.20 cfs @ 12.07 hrs, Volume= 0.020 af, Atten= 38%, Lag= 4.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.72 fps, Min. Travel Time= 7.7 min
Avg. Velocity = 0.47 fps, Avg. Travel Time= 11.7 min

Peak Storage= 91 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 0.50' Flow Area= 15.0 sf, Capacity= 147.87 cfs

30.00' x 0.50' deep channel, n= 0.030 Short grass
Length= 331.0' Slope= 0.1043 '/'
Inlet Invert= 936.00', Outlet Invert= 901.49'



Summary for Reach 2R: (Reach through 2S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.49" for 10-Year event
Inflow = 0.32 cfs @ 12.00 hrs, Volume= 0.020 af
Outflow = 0.26 cfs @ 12.04 hrs, Volume= 0.020 af, Atten= 20%, Lag= 2.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.93 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 0.31 fps, Avg. Travel Time= 12.7 min

Peak Storage= 65 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 11.79 cfs

2.00' x 1.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 235.0' Slope= 0.0067 '/'
Inlet Invert= 890.80', Outlet Invert= 889.22'

Summary for Reach 3R: (Reach through 2S)

[61] Hint: Exceeded Reach 2R outlet invert by 0.01' @ 12.34 hrs

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.49" for 10-Year event
Inflow = 0.26 cfs @ 12.04 hrs, Volume= 0.020 af
Outflow = 0.07 cfs @ 12.35 hrs, Volume= 0.020 af, Atten= 73%, Lag= 18.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.35 fps, Min. Travel Time= 35.4 min
Avg. Velocity = 0.28 fps, Avg. Travel Time= 44.9 min

Peak Storage= 147 cf @ 12.35 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 0.50' Flow Area= 15.0 sf, Capacity= 86.69 cfs

30.00' x 0.50' deep channel, n= 0.030 Short grass
Length= 747.0' Slope= 0.0358 '/'
Inlet Invert= 889.22', Outlet Invert= 862.45'

Summary for Reach SP1: (SP1)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	6.030 ac,	0.17% Impervious,	Inflow Depth =	0.93"	for 10-Year event
Inflow =	3.78 cfs @	12.32 hrs,	Volume=	0.468 af	
Outflow =	3.78 cfs @	12.32 hrs,	Volume=	0.468 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach SP2: (SP2)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	12.400 ac,	0.08% Impervious,	Inflow Depth =	1.00"	for 10-Year event
Inflow =	7.70 cfs @	12.40 hrs,	Volume=	1.037 af	
Outflow =	7.70 cfs @	12.40 hrs,	Volume=	1.037 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (WEST FORKS Runoff Area=5.550 ac 0.00% Impervious Runoff Depth=1.23"
Tc=34.1 min CN=66 Runoff=4.88 cfs 0.567 af

Subcatchment 1SA: (Transition Station) Runoff Area=0.480 ac 2.08% Impervious Runoff Depth=0.67"
Tc=6.0 min CN=56 Runoff=0.49 cfs 0.027 af

Subcatchment 2S: (MOXIE GORE) Runoff Area=11.920 ac 0.00% Impervious Runoff Depth=1.29"
Tc=40.0 min CN=67 Runoff=9.98 cfs 1.280 af

Subcatchment 2SA: (Transition Station) Runoff Area=0.480 ac 2.08% Impervious Runoff Depth=0.67"
Tc=6.0 min CN=56 Runoff=0.49 cfs 0.027 af

Reach 1R: (Reach through 1S) Avg. Flow Depth=0.01' Max Vel=0.90 fps Inflow=0.49 cfs 0.027 af
n=0.030 L=331.0' S=0.1043 '/' Capacity=147.87 cfs Outflow=0.35 cfs 0.027 af

Reach 2R: (Reach through 2S) Avg. Flow Depth=0.16' Max Vel=1.09 fps Inflow=0.49 cfs 0.027 af
n=0.030 L=235.0' S=0.0067 '/' Capacity=11.79 cfs Outflow=0.42 cfs 0.027 af

Reach 3R: (Reach through 2S) Avg. Flow Depth=0.01' Max Vel=0.43 fps Inflow=0.42 cfs 0.027 af
n=0.030 L=747.0' S=0.0358 '/' Capacity=86.69 cfs Outflow=0.13 cfs 0.027 af

Reach SP1: (SP1) Inflow=4.99 cfs 0.594 af
Outflow=4.99 cfs 0.594 af

Reach SP2: (SP2) Inflow=10.10 cfs 1.307 af
Outflow=10.10 cfs 1.307 af

Total Runoff Area = 18.430 ac Runoff Volume = 1.901 af Average Runoff Depth = 1.24"
99.89% Pervious = 18.410 ac 0.11% Impervious = 0.020 ac

Summary for Subcatchment 1S: (WEST FORKS PLANTATION)

Runoff = 4.88 cfs @ 12.32 hrs, Volume= 0.567 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=4.23"

Area (ac)	CN	Description
4.920	66	Woods, Poor, HSG B
0.140	67	Brush, Poor, HSG B
0.340	56	Brush, Fair, HSG B
0.150	96	Gravel surface, HSG B
5.550	66	Weighted Average
5.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.1					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 1SA: (Transition Station)

Runoff = 0.49 cfs @ 11.99 hrs, Volume= 0.027 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=4.23"

	Area (ac)	CN	Description
*	0.470	55	Substation Surface
*	0.010	98	Foundations, HSG B
	0.480	56	Weighted Average
	0.470		97.92% Pervious Area
	0.010		2.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 minutes (Minimum)**

Summary for Subcatchment 2S: (MOXIE GORE)

Runoff = 9.98 cfs @ 12.40 hrs, Volume= 1.280 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=4.23"

	Area (ac)	CN	Description
	10.710	66	Woods, Poor, HSG B
	0.380	96	Gravel surface, HSG B
	0.830	67	Brush, Poor, HSG B
	0.000	48	Brush, Good, HSG B
*	0.000	55	Station Surface
	0.000	98	Roofs, HSG B
	11.920	67	Weighted Average
	11.920		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 2SA: (Transition Station)

Runoff = 0.49 cfs @ 11.99 hrs, Volume= 0.027 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=4.23"

	Area (ac)	CN	Description
*	0.470	55	Substation Surface
*	0.010	98	Foundations, HSG B
	0.480	56	Weighted Average
	0.470		97.92% Pervious Area
	0.010		2.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 minutes (Minimum)**

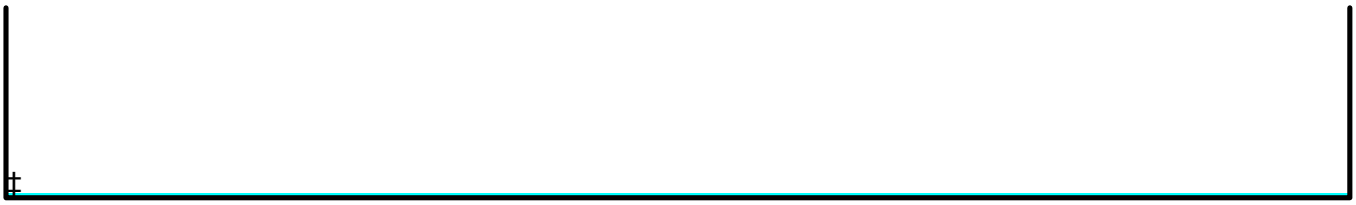
Summary for Reach 1R: (Reach through 1S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.67" for 25-Year event
Inflow = 0.49 cfs @ 11.99 hrs, Volume= 0.027 af
Outflow = 0.35 cfs @ 12.05 hrs, Volume= 0.027 af, Atten= 28%, Lag= 3.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.90 fps, Min. Travel Time= 6.1 min
Avg. Velocity = 0.48 fps, Avg. Travel Time= 11.6 min

Peak Storage= 129 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 0.50' Flow Area= 15.0 sf, Capacity= 147.87 cfs

30.00' x 0.50' deep channel, n= 0.030 Short grass
Length= 331.0' Slope= 0.1043 '/'
Inlet Invert= 936.00', Outlet Invert= 901.49'



Summary for Reach 2R: (Reach through 2S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.67" for 25-Year event
Inflow = 0.49 cfs @ 11.99 hrs, Volume= 0.027 af
Outflow = 0.42 cfs @ 12.03 hrs, Volume= 0.027 af, Atten= 14%, Lag= 2.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 1.09 fps, Min. Travel Time= 3.6 min
Avg. Velocity = 0.34 fps, Avg. Travel Time= 11.6 min

Peak Storage= 90 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 11.79 cfs

2.00' x 1.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 235.0' Slope= 0.0067 '/'
Inlet Invert= 890.80', Outlet Invert= 889.22'

Summary for Reach 3R: (Reach through 2S)

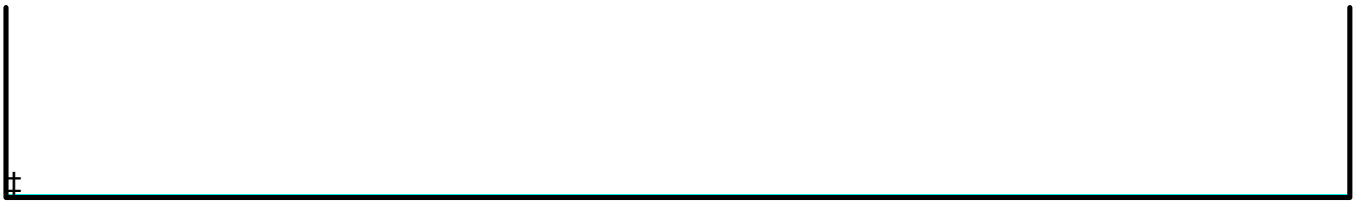
[61] Hint: Exceeded Reach 2R outlet invert by 0.01' @ 12.22 hrs

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.67" for 25-Year event
Inflow = 0.42 cfs @ 12.03 hrs, Volume= 0.027 af
Outflow = 0.13 cfs @ 12.23 hrs, Volume= 0.027 af, Atten= 70%, Lag= 12.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.43 fps, Min. Travel Time= 29.0 min
Avg. Velocity = 0.28 fps, Avg. Travel Time= 44.1 min

Peak Storage= 217 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 0.50' Flow Area= 15.0 sf, Capacity= 86.69 cfs

30.00' x 0.50' deep channel, n= 0.030 Short grass
Length= 747.0' Slope= 0.0358 '/'
Inlet Invert= 889.22', Outlet Invert= 862.45'



Summary for Reach SP1: (SP1)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	6.030 ac,	0.17% Impervious,	Inflow Depth =	1.18"	for 25-Year event
Inflow =	4.99 cfs @	12.32 hrs,	Volume=	0.594 af	
Outflow =	4.99 cfs @	12.32 hrs,	Volume=	0.594 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach SP2: (SP2)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	12.400 ac,	0.08% Impervious,	Inflow Depth =	1.26"	for 25-Year event
Inflow =	10.10 cfs @	12.40 hrs,	Volume=	1.307 af	
Outflow =	10.10 cfs @	12.40 hrs,	Volume=	1.307 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

PROJECT:	**CMP**	**Calculated By:**	PGT
	Kennebec HDD Transition Stations	**Checked By:**	PMM
TRC Proj:		**Date:**	October 17, 2018
		Revised:	

VEGETATED BUFFER AND STONED BERMED LEVEL SPREADER SIZING

Use of stone bermed level lip spreader in lieu of ditch turnout level spreaders.

Design Criteria:

Per BMP manual Volume III chapter 5.2.2 Buffer with Stone Bermed Level Lip Spreader
Reference Tables 5-4, 5-5 and 5-6

The given road section is: 15 ft wide gravel road
12 ft wide ditch section (3 ft bottom including side slopes)

Sub-Watershed 1S - West Forks Station

Vegetated Buffer B-1

Required Length of flow path through a meadow buffer (0-8% slope) = 150 ft
Provided is a 150 ft long meadow buffer. (average slope exceeds 8%)

Treatment for roadway		
Impervious areas		
15 x 65 =	975	0.02 Ac
15 x 368 =	5520	0.13 Ac
Concrete foundations		0.01 Ac
Total Impervious Area		**0.16 Ac**
Pervious area		
12 x 164	1968	0.05 Ac
12 x 307 =	3684	0.08 Ac
Total Landscaped Area		**0.13 Ac**

Level Spreader LS-1

Using Hydrologic Soil group B Soils

Per acre of impervious area =	100	Ft
Per acre of Lawn area =	30	Ft
Length for Impervious area =	16	LF
Length for Lawn area =	4	LF
Total length required =	**20**	**LF**
Provided =	**30**	**LF**

Note: Buffer slope is 16% so additional length of level spreader is provided to compensate for the increased slope.

PROJECT:	**CMP**	**Calculated By:**	PGT
	Kennebec HDD Transition Stations	**Checked By:**	PMM
TRC Proj:		**Date:**	October 17, 2018
		Revised:	

Sub-Watershed 2S - Moxie Gore Station

Vegetated Buffer B-2

Required Length of flow path through a meadow buffer (0-8% slope) = 150 ft
Provided is a 150 ft long meadow buffer.

Treatment for roadway			
Impervious areas			
15 x 88 =	1320	0.03	Ac
15 x150 =	2250	0.05	Ac
Concrete foundations		0.01	Ac
Total Impervious Area		**0.09**	**Ac**
Pervious area			
12 x 65	780	0.02	
12 x 320 =	3840	0.09	Ac
Total Landscaped Area		**0.11**	**Ac**

Level Spreader LS-2

Using Hydrologic Soil group B Soils

Per acre of impervious area =	75	Ft
Per acre of Lawn area =	25	Ft
Length for Impervious area =	7	LF
Length for Lawn area =	3	LF
Total length required =	**10**	**LF**
Provided =	**30**	**LF**

Note: Runoff from transition station yard contributes to level spreader but no water quality treatment is needed.

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

ELIAS BALDACCI
GOVERNOR

DAVID
COM

June 5, 2008

Roy Koster
Central Maine Power
83 Edison Drive
Augusta, ME 04336

RE: DEP Stormwater Management Regulations and how they apply to Central Maine Power Company Substations and Switchyards

Dear Mr. Koster:

I am writing to provide clarification on how substations and switchyards designed by Central Maine Power Company (CMP) can meet DEP Stormwater Management rules, Chapter 500 and the Site Location of Development Law. This letter supersedes a previous DEP letter on this subject dated February 29, 2008 and is a follow-up to further discussions between CMP and DEP staff.

Based on the report prepared by John Simon of Balance Engineering, dated March 8, 2008, regarding the stormwater runoff coefficient at CMP substations and switchyards, the required gravel fill and surface nature of these structures performs differently than most common construction practices and a modeling variance will be allowed for CMP substations and switchyards as follows:

When Flooding Standard requirements apply to a CMP project, modeling must demonstrate that peak runoff from the substation structure does not exceed predevelopment flow rates at the property line. Because of the permeability plus storage within the gravel fill and roughness of the crushed rock surface, the curve number (CN) specified in John Simon's report (March 2008) may be used for the substation area. As reported, a CN of 55 may be used for substations and switchyards that are built on areas that are mapped as HSG "A", "B", and "C", and a CN of 60 must be used when the area is mapped as HSG "D" for the HydroCAD model. However, all impervious surfaces will have to be added for an averaged curve number.

The General Standards of Chapter 500 (water quality) will be considered as met by the CMP substation/switchyard design specifications as long as the structure includes the typical CMP substation profile overlaying the natural ground surface. The soil layers within the CMP substation profile consist of 4 inches of crushed stone, 50:50 mix of 1.5"

USTA
ATE HOUSE STATION
USTA, MAINE 04333-0017
287-7688 FAX: (207) 287-7826
BLDG., HOSPITAL ST.

BANGOR
106 HOGAN ROAD
BANGOR, MAINE 04401
(207) 941-4570 FAX: (207) 941-4584

PORTLAND
312 CANCO ROAD
PORTLAND, MAINE 04103
(207) 822-6300 FAX: (207) 822-6303

PRESQUE ISLE
1235 CENTRAL DRIVE, SKYW
PRESQUE ISLE, MAINE 0476
(207) 764-0477 FAX: (207) 76

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and 0.75" diameter stone overlaying 18 inches or more of gravel fill, MDOT 703.06 Type A. Saturation within the granular fill will detain and provide treatment for the one-inch design standard under that requirement. Groundwater can never be any higher than 18 inches below the top of the gravel fill. Other treatment considerations will need to be provided for all impervious structures anticipated on the substation and switchyard and for the roadway.

The Basic Standards of Chapter 500 (erosion and sedimentation control, inspection and maintenance, and housekeeping) will be met by the standard CMP substation and switchyard design specification and erosion control/construction plan as developed by CMP for each Stormwater Management application. These are minimum erosion control measures that will need to be maintained until the site is fully stabilized. However, based on site and weather conditions during construction, additional erosion control measures may be needed.

While there are several ways to approach the design standards discussed above, these must be considered the minimum requirements in meeting the Stormwater Management and Site Location of Development Laws. However, in some situations where the local hydrology and site conditions warrant more resource protection, additional BMPs may be required. Also, the access drive and associated roadside swales are included in the disturbed area for permitting purposes and the treatment of these areas must be addressed separately from the substation or switchyard and be treated with standard practices. The natural hydrology of these areas will need to be maintained and will have to meet all applicable standards as established in Chapter 500 (page 11, Section 5).

I hope this addresses your request and will make the DEP permitting process more straight forward. If you have further questions, please contact Marianne Hubert at (207) 287-4140.

Sincerely,

Don Witherill, Director
Watershed Management Division
Bureau of Land and Water Quality

Cc: Marianne Hubert, PE, DEP program manager
Andy Fisk, DEP L&W Bureau Director
Dan Butler, PE, TRC
Gerry Mirabile, CMP

APPENDIX 12-2

315641 SW-1 West Forks Pre-Development Watershed Plan

315641 SW-2 West Forks Post-Development Watershed Plan

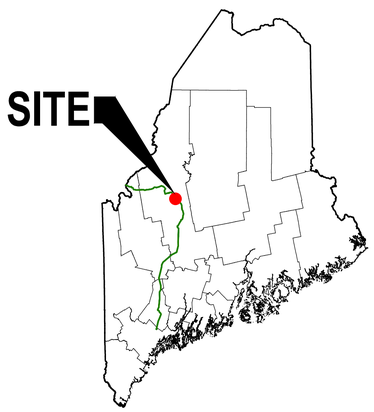
315641 SW-3 Moxie Gore Pre-Development Watershed Plan

315641 SW-4 Moxie Gore Post-Development Watershed Plan

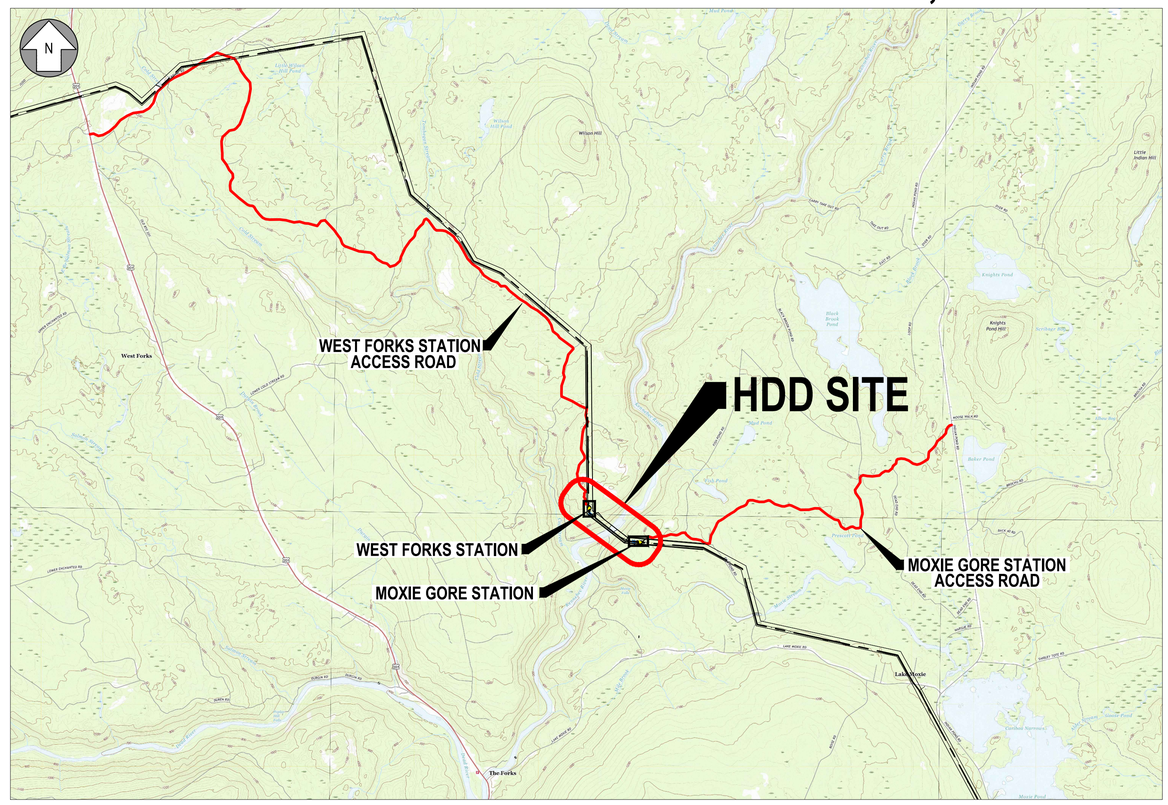
PERMITTING PLAN SET

NECEC KENNEBEC RIVER UNDERGROUND CABLE & HDD

SOMERSET COUNTY
WEST FORKS PLANTATION & MOXIE GORE, MAINE



STATE OF MAINE



LOCATION MAP
SCALE: 1"=4000'

DRAWING INDEX

G-1	COVER SHEET & DRAWING INDEX
G-2	GENERAL NOTES, LEGEND & VICINITY MAP
C-1	HDD CROSSING (STA 0+00 TO 20+50) PLAN & PROFILE
C-2	HDD CROSSING (STA 20+50 TO 36+00) PLAN & PROFILE
C-3	GRADING & RESTORATION PLAN – MOXIE GORE
C-4	GRADING & RESTORATION PLAN – WEST FORKS
C-5	CROSS SECTIONS AND HDD DETAILS 1
C-6	CROSS SECTIONS AND HDD DETAILS 2
C-7	EROSION CONTROL NOTES & DETAILS 1
C-8	EROSION CONTROL NOTES & DETAILS 2
SW-1	PRE-DEVELOPMENT WATERSHED PLAN - WEST FORKS
SW-2	POST-DEVELOPMENT WATERSHED PLAN - WEST FORKS
SW-3	PRE-DEVELOPMENT WATERSHED PLAN - MOXIE GORE
SW-4	POST-DEVELOPMENT WATERSHED PLAN - MOXIE GORE

PREPARED FOR:

AVANGRID

CENTRAL MAINE POWER CO.

83 EDISON DRIVE
AUGUSTA, ME 04336

PREPARED BY:

TRC

249 WESTERN AVENUE
AUGUSTA, ME 04330

811 DigSafe MA·ME·NH·RI·VT

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

IFP - ISSUED FOR PERMITTING
10/17/2018

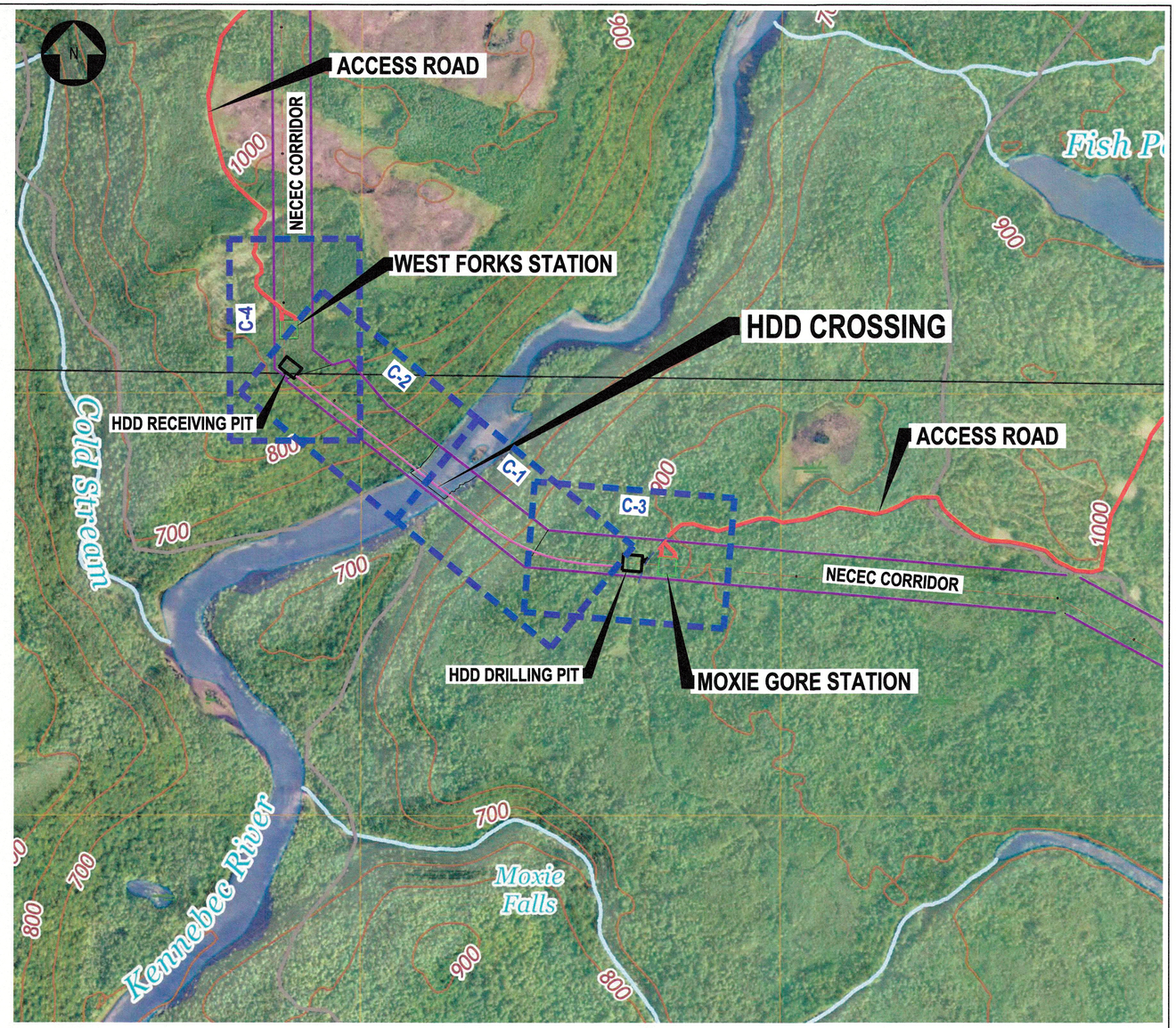
315641-G-1

GENERAL NOTES

1. SURVEY BOUNDARY DATA PROVIDED BY:
   SGC ENGINEERING, INC – "KENNEBEC RIVER GORGE" DATED 9-23-10
   DIRIGO PARTNERS, LTD – "WEYCO SURVEY" DATED 12-06-16
2. TOPOGRAPHIC LIDAR DATA PROVIDED BY CMP DATED SEPTEMBER 2018.
3. PROJECT PROJECTION: NAD83 UTM ZONE – 19 U.S FEET.
4. VERTICAL DATUM: NAVD 88 MEASURED IN U.S. FEET.
5. MEDIUM INTENSITY SOILS INFORMATION OBTAINED FROM WEB SOIL SURVEY OF SOMERSET COUNTY, ME.

LEGEND

EXISTING		PROPOSED
	PROPERTY/ROW LINE	
	SETBACK LINE	
	EASEMENT LINE	
	CENTERLINE	
	EDGE OF PAVEMENT	
	CURBING	
	EDGE OF GRAVEL	
	EDGE OF CONCRETE	
	SUBSTATION YARD	
	SUBSTATION BASELINE	
122	CONTOUR	122
	BUILDING	
	STONEWALL	
	TREELINE	
	CHAIN LINK FENCE	
	STOCKADE FENCE	
	BARB WIRE FENCE	
	RETAINING WALL	
	GUARDRAIL	
S	SEWER	S
FM	SEWER FORCE MAIN	FM
G	GAS	G
W	WATER	W
SD	STORM DRAIN	SD
UD	UNDERDRAIN	UD
12" CMP	CULVERT	12" CMP
UGE	UNDERGROUND ELECTRIC	UGE
	OVERHEAD TRANSMISSION	
	IRON PIPE/REBAR	
	MONUMENT	
	SURVEY CONTROL POINT	
x124.6	SPOT ELEVATION	x122.50
S	SEWER MANHOLE	
D	DRAINAGE MANHOLE	
	CATCH BASIN	
E	ELECTRIC MANHOLE	
	SHUTOFF VALVE	
	HYDRANT	
	UTILITY POLE	
	LIGHT POLE	
	MATCHLINE	
	LIMIT OF WORK	
	SILT FENCE	SF
	RIPRAP	
	EDGE OF WATER	
	STREAM	
	EDGE OF WETLANDS	
	WETLANDS	
	DRAINAGE FLOW	
	DRAINAGE SWALE	
	SIGN	
	SOIL BORING	



VICINITY MAP & SITE PLAN DRAWING INDEX

SCALE: 1"=500'

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	KAV	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

LOGO TRC PROJECT NO.315641

INFO TRC 249 WESTERN AVENUE AUGUSTA, MAINE 04330 207-621-7000

ANSI D 10/17/2018

PE STAMP: STATE OF MAINE, RICKY A. YOUNG, No. 6422, LICENSED PROFESSIONAL ENGINEER, October 10, 2018

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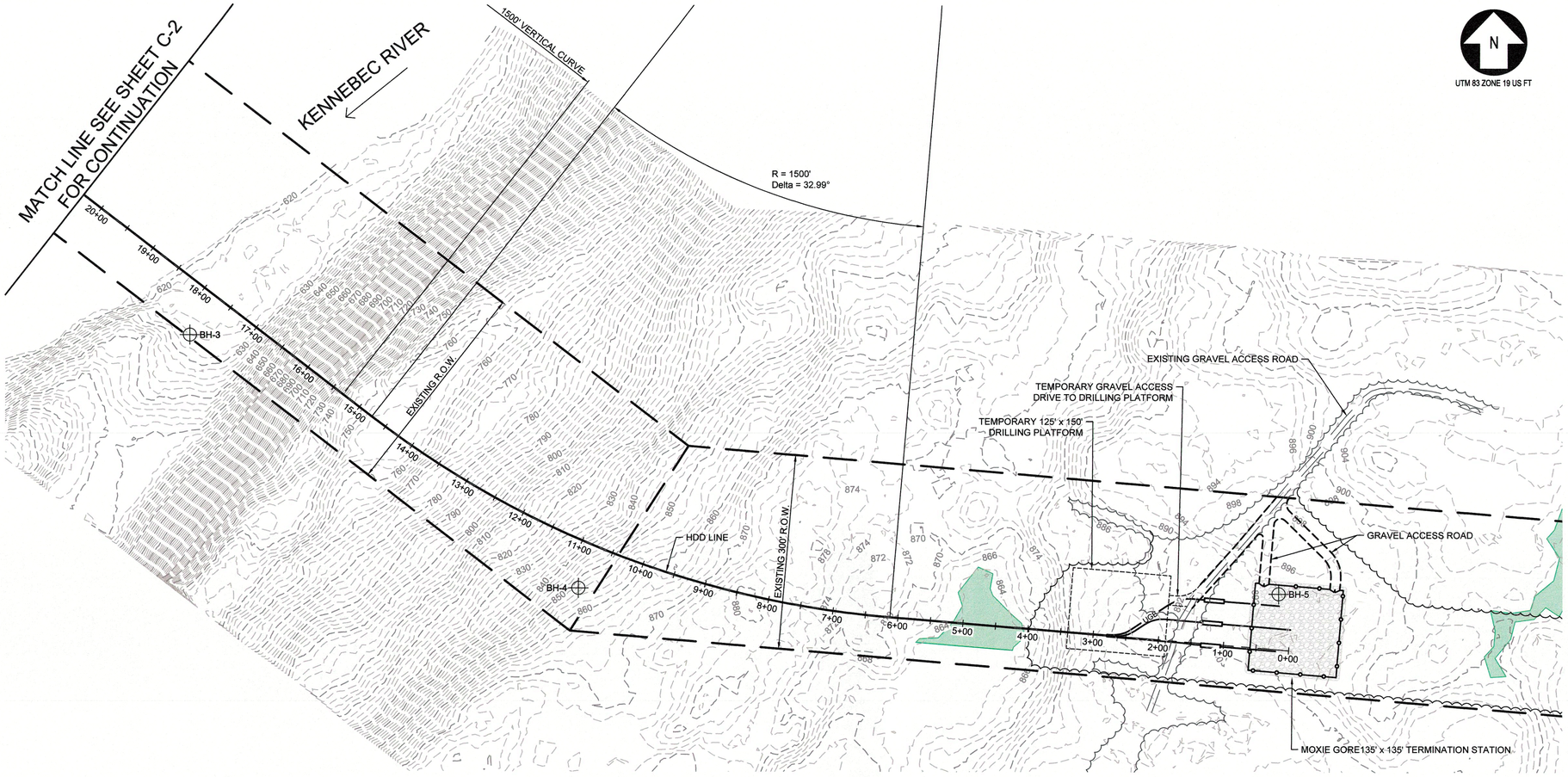
CMP AVANGRID

GENERAL NOTES, LEGEND & VICINITY MAP

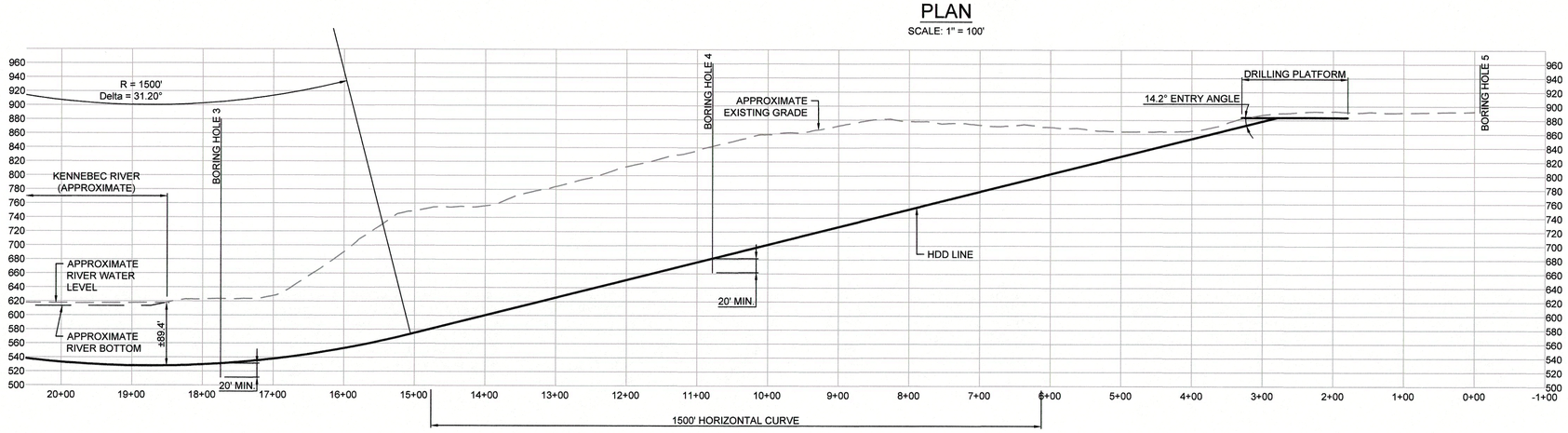
NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	KAV/TRC	SCALE: AS NOTED	FILE: 315641-G-2.dwg	
CK	PGT/TRC	NO.		REV
APP	SGL/TRC	315641-G-2		0-0B
DATE	10/05/2018			



PLAN

SCALE: 1" = 100'



PROFILE

SCALE: HORZ. 1" = 100'
VERT. 1" = 100'

100 0 100 200 FT

SCALE: 1" = 100'

UTM 83 ZONE 19 US FT

SYMBOL LEGEND

SYMBOL	DESCRIPTION
	HDD LINE
UGE	UNDERGROUND ELECTRIC LINE
	TERMINATION STATION FENCE
	ACCESS ROAD
	UNDERGROUND ELECTRIC VAULT
	TEMPORARY WORK PLATFORM
	TEMPORARY ACCESS ROAD
	EXISTING RIGHT OF WAY LINE
	WETLANDS
	STONE PAD
	EXISTING TREE LINE
	LIMIT OF CLEARING
BH-0	PROPOSED BORE HOLE LOCATION

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP: ISSUED FOR PERMITTING	10/17/2018	DED	PGT	SGL
A	IFR: ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

LOGO TRC
PROJECT NO:315641
INFO TRC 249 WESTERN AVENUE AUGUSTA, MAINE 04330 207-621-8000
ANSI D 10/19/2018

ISSUE FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

PE STAMP
STATE OF MAINE
RICKY A. YOUNG
No. 6422
LICENSED
PROFESSIONAL ENGINEER
Oct. 19, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
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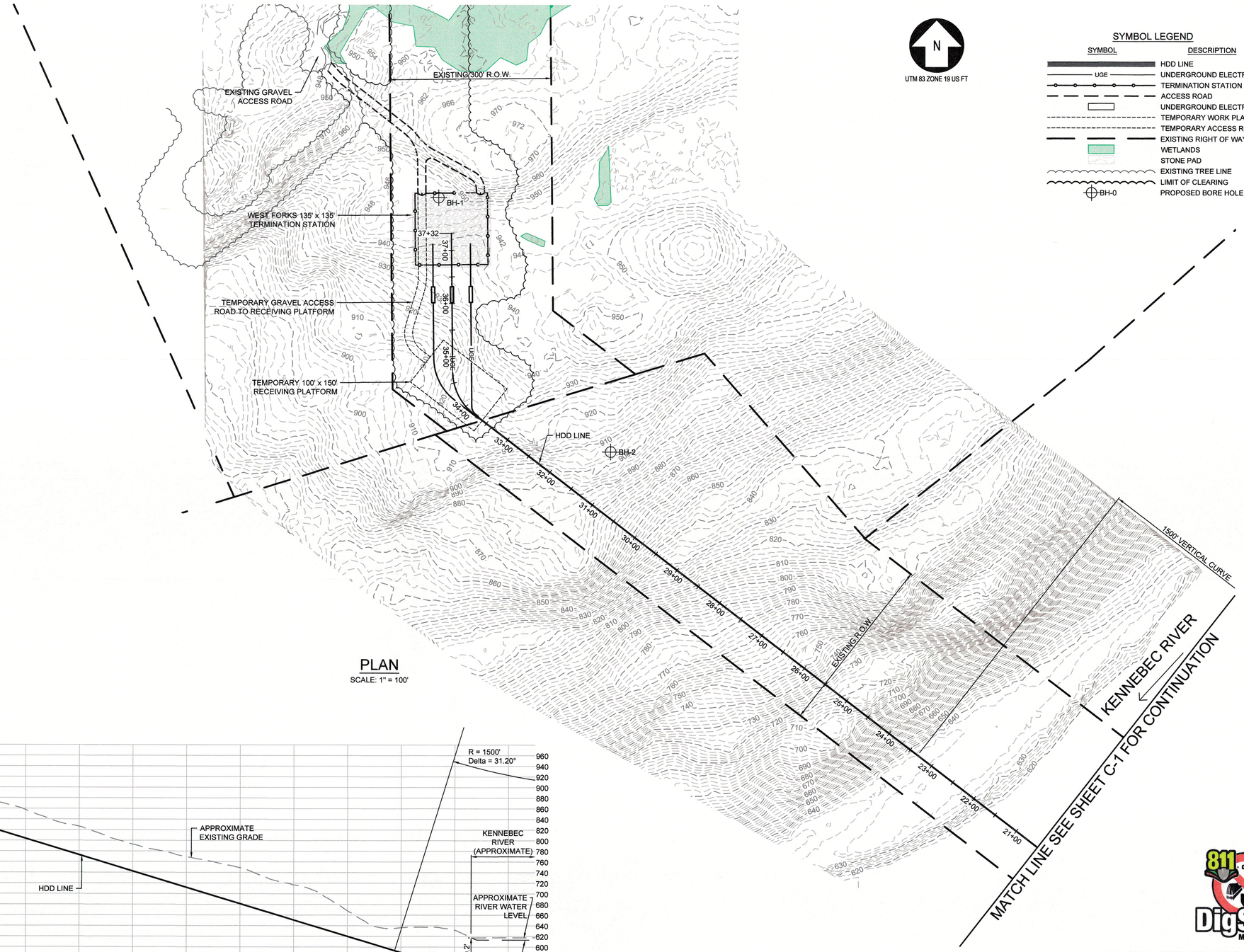
CMP AVANGRID

HDD CROSSING (STA 0+00 TO 20+50) PLAN & PROFILE

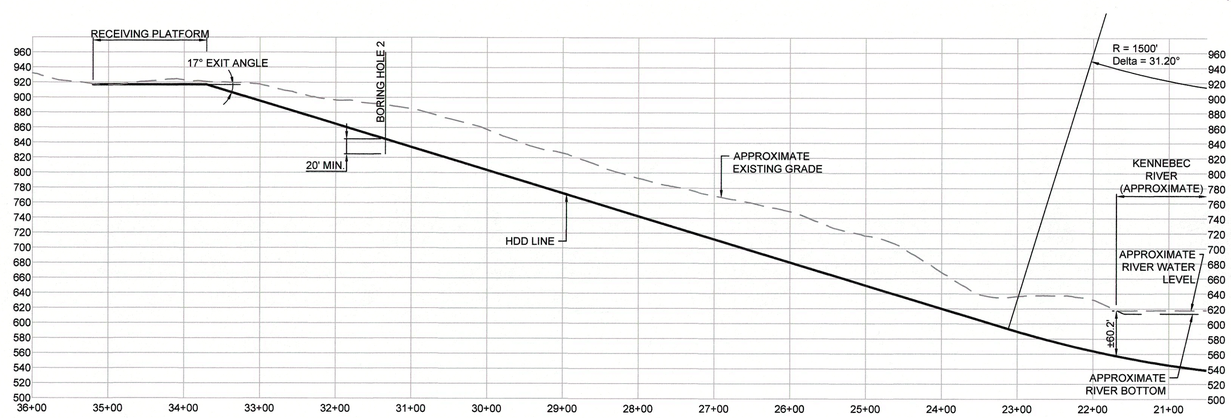
NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	DED/TRC	SCALE: AS NOTED	FILE: 315641 HDD Plan And Profile.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 C-1	0-0B
DATE	10/05/2018		



PLAN

SCALE: 1" = 100'



PROFILE

SCALE: HORZ. 1" = 100'
VERT. 1" = 100'

100 0 100 200 FT

SCALE: 1" = 100'

UTM 83 ZONE 19 US FT

SYMBOL LEGEND

SYMBOL	DESCRIPTION
	HDD LINE
UGE	UNDERGROUND ELECTRIC LINE
	TERMINATION STATION FENCE
	ACCESS ROAD
	UNDERGROUND ELECTRIC VAULT
	TEMPORARY WORK PLATFORM
	TEMPORARY ACCESS ROAD
	EXISTING RIGHT OF WAY LINE
	WETLANDS
	STONE PAD
	EXISTING TREE LINE
	LIMIT OF CLEARING
BH-0	PROPOSED BORE HOLE LOCATION

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2015	DED	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

LOGO TRC

INFO TRC
249 WESTERN AVENUE
AUGUSTA, ME 04330
207-621-7000

PROJECT NO.315641

ANSI D 10/19/2018

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Oct. 19, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
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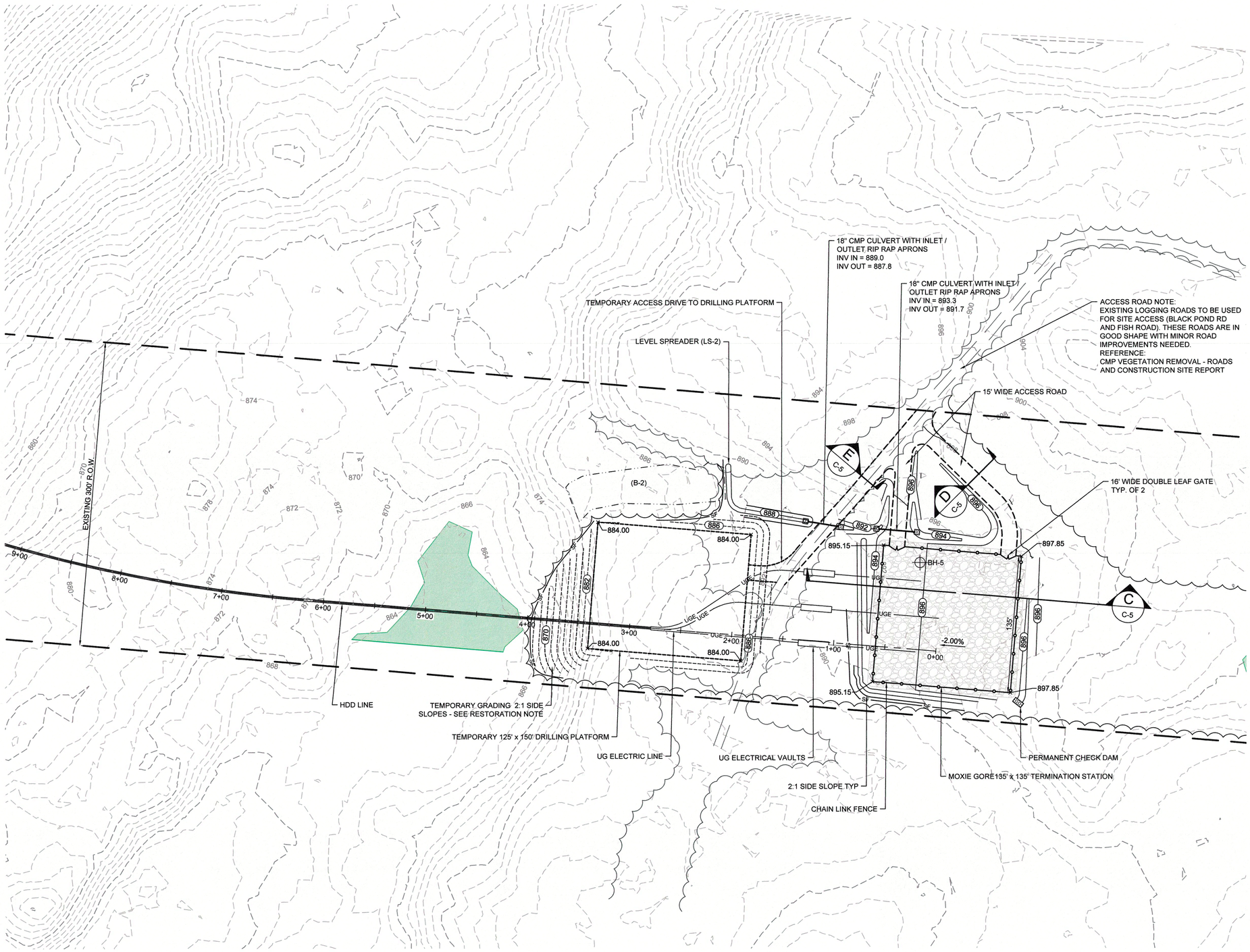
CMP AVANGRID

REV	DESCRIPTION	DATE	BY	CK	APP

HDD CROSSING (STA 20+50 TO 36+00) PLAN & PROFILE

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	DED/TRC	SCALE: AS NOTED	FILE: 315641 HDD Plan And Profile.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 C-2	0-0B
DATE	10/05/2018		



UTM 83 ZONE 19 US FT

SYMBOL LEGEND

SYMBOL	DESCRIPTION
	HDD LINE
UGE	UNDERGROUND ELECTRIC LINE
	TERMINATION STATION FENCE
	ACCESS ROAD
	UNDERGROUND ELECTRIC VAULT
	TEMPORARY WORK PLATFORM
	TEMPORARY ACCESS ROAD
	RIGHT OF WAY LINE
	WETLANDS
	YARD SURFACING
	EXISTING TREE LINE
	LIMIT OF CLEARING
SF	SILT FENCE
850	EXISTING CONTOUR
850	PROPOSED CONTOUR
850	TEMPORARY CONTOUR (SEE RESTORATION NOTE)
BH-0	PROPOSED BORE HOLE LOCATION

RESTORATION NOTE:

PRIOR TO INITIAL SITE GRADING, TOPSOIL WILL BE REMOVED STOCKPILED AND STABILIZED FOR THE DURATION OF CONSTRUCTION. UPON COMPLETION OF CONSTRUCTION THE SITE WILL BE GRADED TO APPROXIMATE PRECONSTRUCTION CONTOURS AND TOPSOIL WILL BE REPLACED. A CONSERVATION SEED MIX (APRIL 16-OCTOBER 31) WILL BE APPLIED AT A RATE SPECIFIED BY THE MANUFACTURER. AN ANNUAL SEED MIXTURE WILL BE APPLIED BASED ON 3X THE MANUFACTURER'S SPECIFIED RATE (NOV 1-APRIL 15). ALL EXPOSED SOIL AND SEEDED AREAS WILL BE COVERED WITH HAY MULCH. MULCH WILL BE APPLIED AT A RATE OF 2 BALES (APRIL 16-OCTOBER 31) AND 5 BALES (NOV 1-APRIL 15) PER 1,000 SQUARE FEET.

50 0 50 100 FT

SCALE: 1" = 50'

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	DED	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

LOGO TRC PROJECT NO: 315641

INFO TRC 249 WESTERN AVENUE AUGUSTA, ME 04330 207-621-7000

ANSI D 10/19/2018

811 DigSafe MA·ME·NH·RI·VT

ISSUE FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

PE STAMP STATE OF MAINE RICKY A. YOUNG No. 6422 LICENSED PROFESSIONAL ENGINEER Oct 19, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

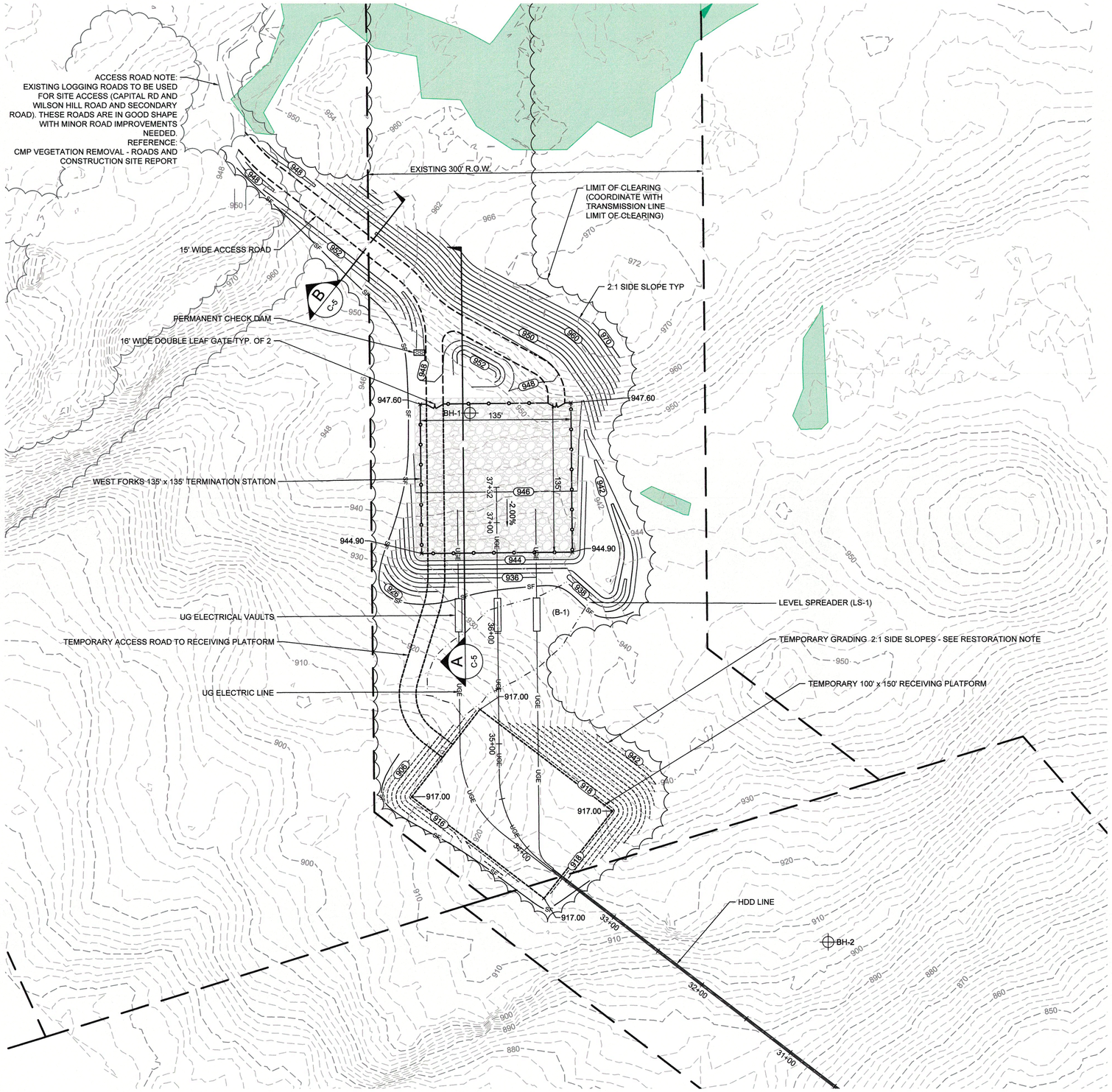
CMP AVANGRID

REV	DESCRIPTION	DATE	BY	CK	APP

GRADING & RESTORATION PLAN
MOXIE GORE

NECEC HDVC LINE — MOXIE GORE & WEST FORKS, ME

BY	DED/TRC	SCALE: AS NOTED	FILE: 315641 Base.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 C-3	0-0B
DATE	10/05/2018		



100 0 100 200 FT

SCALE: 1" = 100'

N

UTM 83 ZONE 19 US FT

SYMBOL LEGEND

SYMBOL	DESCRIPTION
	HDD LINE
UGE	UNDERGROUND ELECTRIC LINE
	TERMINATION STATION FENCE
	ACCESS ROAD
	UNDERGROUND ELECTRIC VAULT
	TEMPORARY WORK PLATFORM
	TEMPORARY ACCESS ROAD
	RIGHT OF WAY LINE
	WETLANDS
	YARD SURFACING
	EXISTING TREE LINE
	LIMIT OF CLEARING
SF	SILT FENCE
850	EXISTING CONTOUR
850	PROPOSED CONTOUR
850	TEMPORARY CONTOUR (SEE RESTORATION NOTE)
BH-0	PROPOSED BORE HOLE LOCATION

RESTORATION NOTE:

PRIOR TO INITIAL SITE GRADING, TOPSOIL WILL BE REMOVED STOCKPILED AND STABILIZED FOR THE DURATION OF CONSTRUCTION. UPON COMPLETION OF CONSTRUCTION THE SITE WILL BE GRADED TO APPROXIMATE PRECONSTRUCTION CONTOURS AND TOPSOIL WILL BE REPLACED. A CONSERVATION SEED MIX (APRIL 16-OCTOBER 31) WILL BE APPLIED AT A RATE SPECIFIED BY THE MANUFACTURER. AN ANNUAL SEED MIXTURE WILL BE APPLIED BASED ON 3X THE MANUFACTURER'S SPECIFIED RATE (NOV 1-APRIL 15). ALL EXPOSED SOIL AND SEEDED AREAS WILL BE COVERED WITH HAY MULCH. MULCH WILL BE APPLIED AT A RATE OF 2 BALES (APRIL 16-OCTOBER 31) AND 5 BALES (NOV 1-APRIL 15) PER 1,000 SQUARE FEET.

811 DigSafe MA-ME-NH-RI-VT

ISSUE FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

PE STAMP: STATE OF MAINE, RICKY A. VINE, LICENSED PROFESSIONAL ENGINEER, October 19, 2018

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Property of AVANGRID

CMP AVANGRID

GRADING & RESTORATION PLAN WEST FORKS

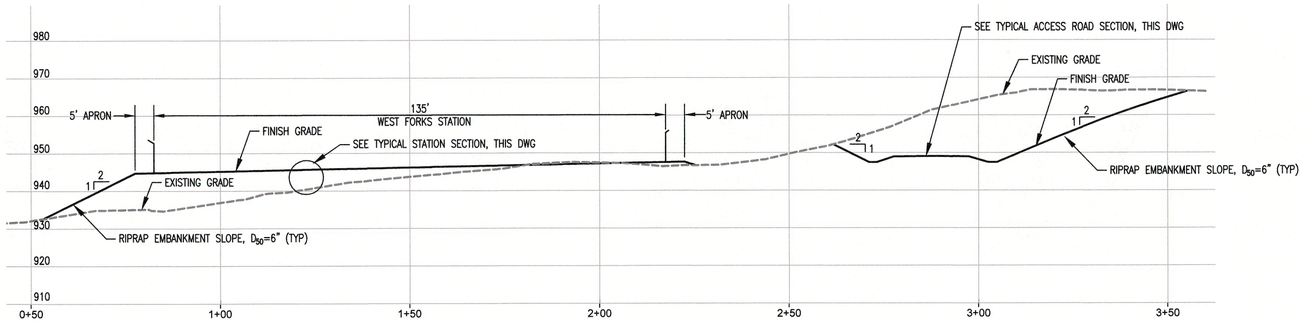
NECEC HDVC LINE — MOXIE GORE & WEST FORKS, ME

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	DED	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KVV	PGT	SGL

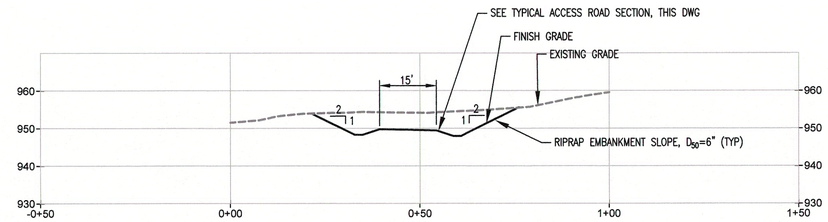
BY	DED/TRC	SCALE: AS NOTED	FILE: 315641 Base.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 C-4	0-0B
DATE	10/05/2018		

LOGO: TRC
PROJECT NO.:315641
INFO: TRC, 249 WESTERN AVENUE, AUGUSTA, ME 04330, 207-621-7000

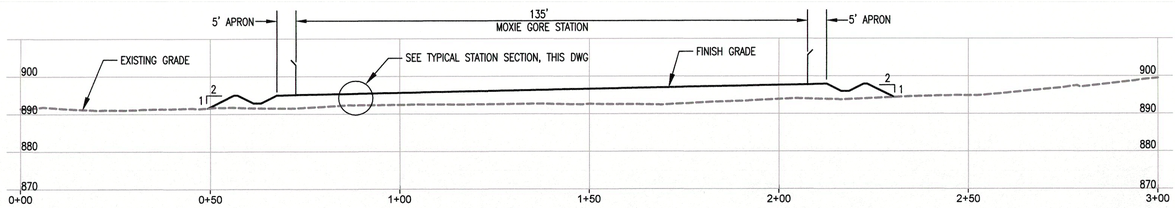
ANSI D 10/19/2018



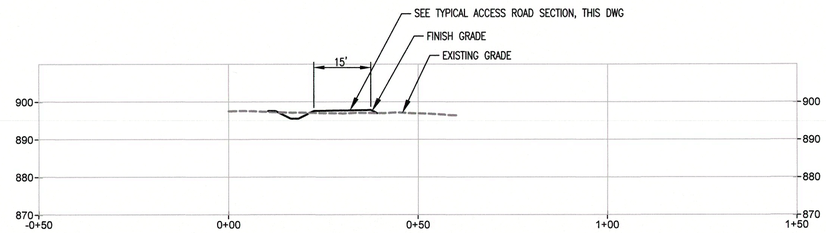
A C-4 WEST FORKS STATION CROSS-SECTION
NOT TO SCALE



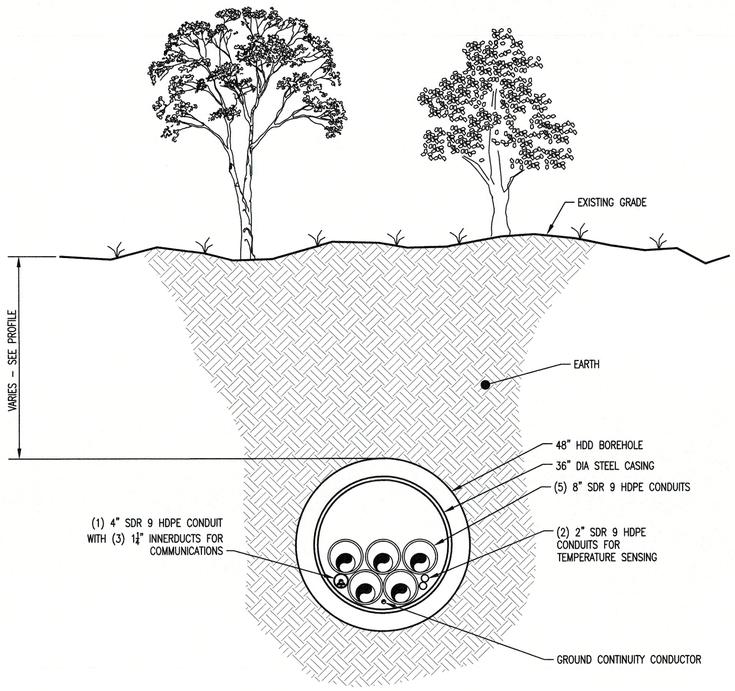
B C-4 WEST FORKS STATION CROSS-SECTION
NOT TO SCALE



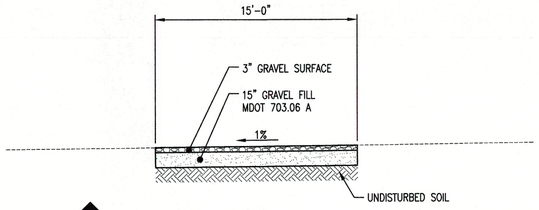
C C-3 MOXIE GORE STATION CROSS-SECTION
NOT TO SCALE



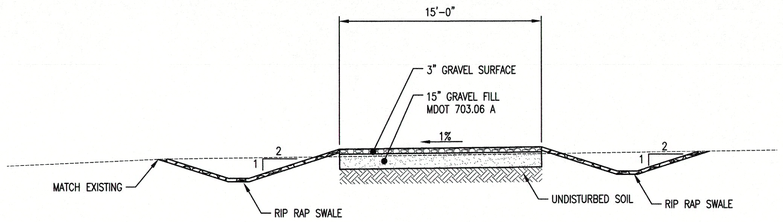
D C-3 MOXIE GORE STATION CROSS-SECTION
NOT TO SCALE



TYPICAL HVDC HDD BORE DETAIL
NOT TO SCALE



E C-3 TYPICAL ACCESS ROAD RESTORATION DETAIL
NOT TO SCALE



TYPICAL ACCESS ROAD SECTION
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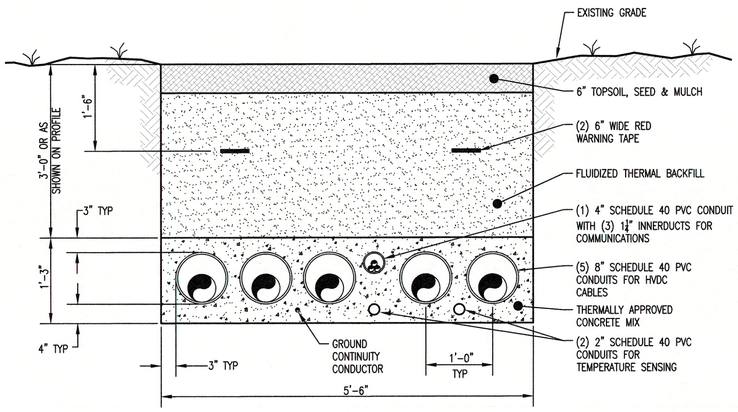
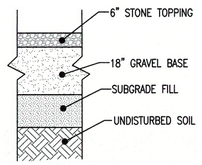


TYPICAL HVDC TRENCH DETAIL
NOT TO SCALE



TYPICAL STATION SECTION
NOT TO SCALE

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

PE STAMP
STATE OF MAINE
RICKY A. YOUNG
No. 8422
LICENSED
PROFESSIONAL ENGINEER
OCTOBER 19, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

CMP AVANGRID

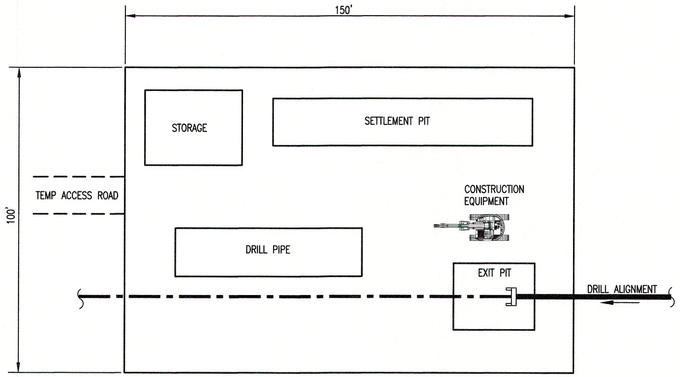
REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	KAV	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

CROSS-SECTIONS & HDD DETAILS 1

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	KAV/TRC	SCALE: AS NOTED	FILE: 315641-C-5.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641-C-5	0-0B
DATE	10/05/2018		

LOGO TRC
INFO TRC 249 WESTERN AVENUE AUGUSTA, MAINE 04330 207-621-7000
PROJECT NO:315641
ANSI D 10/19/2018

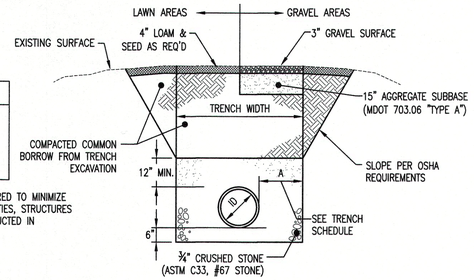


HDD RECEIVING SITE SETUP SCHEMATIC (WEST FORKS)

NOT TO SCALE

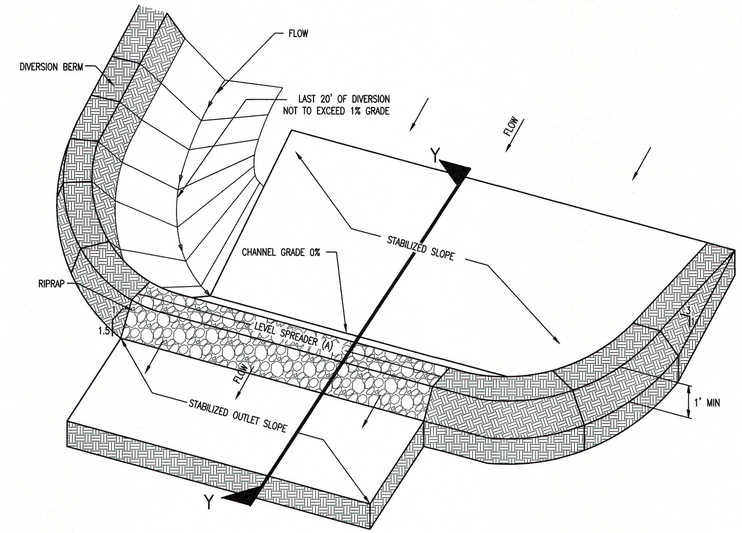
TRENCH SCHEDULE	
ID	A (MIN.)
4"–12"	0'–10"
15"	0'–10"
18"	0'–10"
24"	0'–6"
30"	0'–6"
36"	0'–6"

NOTE: SHORE TRENCH EXCAVATION AS REQUIRED TO MINIMIZE EXCAVATION AND IMPACTS TO ADJACENT UTILITIES, STRUCTURES OR PAVEMENT. TRENCHES SHALL BE CONSTRUCTED IN ACCORDANCE WITH OSHA REQUIREMENTS.

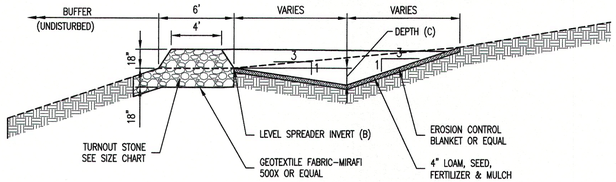


TYPICAL CULVERT TRENCH DETAIL

NOT TO SCALE



TURNOUT STONE SIZE	
SIEVE DESIGNATION	% PASSING BY WEIGHT
12 IN.	100
6 IN.	84–100
3 IN.	68–83
1 IN.	42–55
No. 4	8–12

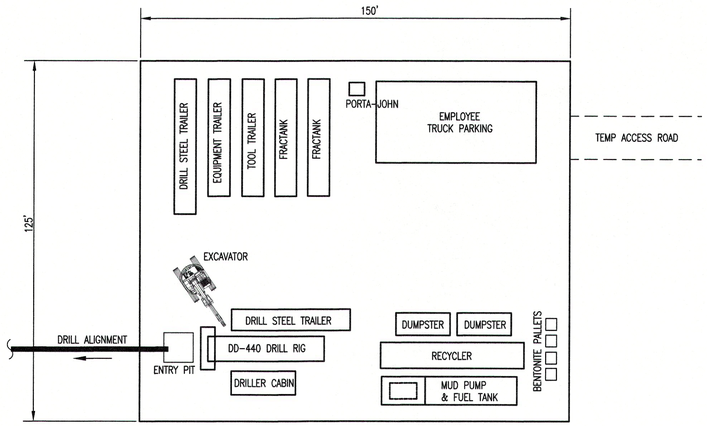


SECTION Y–Y

LEVEL LIP SPREADER DETAIL

NOT TO SCALE

LEVEL SPREADER CHART				
SITE	ID	LENGTH (A)	INVERT (B)	DEPTH (C)
WEST FORKS	LS–1	30'	941.0	2.5'
MOXIE GORE	LS–2	30'	889.0	1.7'



DRILL OPERATION SITE SETUP SCHEMATIC (MOXIE GORE)

NOT TO SCALE

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	KAV	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

ISSUED FOR PERMITTING

NOT FOR CONSTRUCTION

INSTALL

PE STAMP

STATE OF MAINE
RICKY A. YOUNG
No. 5402
LICENSED
PROFESSIONAL ENGINEER
OCTOBER 10, 2018

AVANGRID ENGINEERING CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

CMP AVANGRID

CROSS-SECTIONS & HDD DETAILS 2

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY KAV/TRC | SCALE: AS NOTED | FILE: 315641-C-6.dwg

CK PGT/TRC | NO. 315641-C-6 | REV 0-0B

APP SGL/TRC

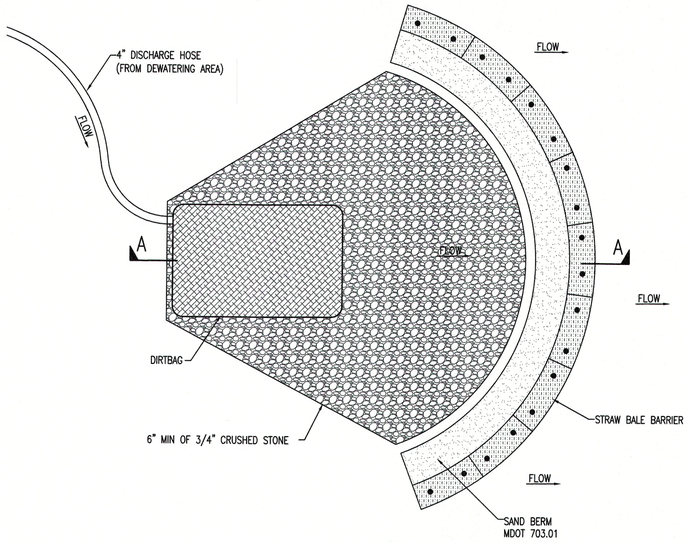
DATE 10/05/2018

LOGO TRC

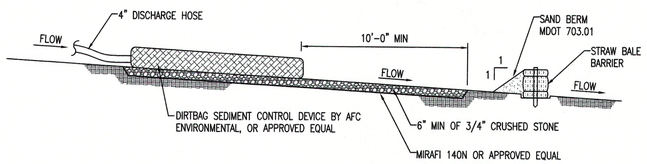
INFO TRC 249 WESTERN AVENUE AUGUSTA, ME 04330 207-621-1000

PROJECT NO: 315641

ANSI D 10/17/2018



PLAN



SECTION A–A

DEWATERING SYSTEM DETAIL

NOT TO SCALE

DEWATERING NOTES

1. THE CONTRACTOR SHALL INSTALL, MAINTAIN, AND OPERATE ALL CHANNELS, SUMPS, AND ALL OTHER TEMPORARY DIVERSION AND PROTECTIVE WORKS NEEDED TO DIVERT STREAM FLOW AND OTHER SURFACE WATER THROUGH OR AROUND THE CONSTRUCTION SITE. CONTROL OF SURFACE WATER SHALL BE CONTINUOUS DURING THE PERIOD THAT DAMAGE TO CONSTRUCTION WORK COULD OCCUR.

2. OPEN EXCAVATIONS SHALL BE DEWATERED AND KEPT FREE OF STANDING WATER AND MUDDY CONDITIONS AS NECESSARY FOR THE PROPER EXECUTION OF THE WORK. THE CONTRACTOR SHALL FURNISH, INSTALL, OPERATE, AND MAINTAIN ALL DRAINS; SUMPS AND ALL OTHER EQUIPMENT REQUIRED TO PROPERLY DEWATER THE SITE. DEWATERING SYSTEMS THAT CAUSE A LOSS OF SOIL FINES FROM THE FOUNDATION AREAS WILL NOT BE PERMITTED.

3. INSTALL DIVERSION DITCHES OR BERMS IF NECESSARY TO MINIMIZE THE AMOUNT OF CLEAN STORMWATER RUNOFF ALLOWED INTO THE EXCAVATED AREA.

4. REMOVAL OF WATER FROM THE CONSTRUCTION SITE SHALL BE ACCOMPLISHED SO THAT EROSION AND THE TRANSPORTING OF SEDIMENT AND OTHER POLLUTANTS ARE MINIMIZED.

5. DISCHARGE DEWATERING EFFLUENT TO AREAS AS INDICATED ON THE SITE GRADING PLAN. DISCHARGE SHALL BE IN SHEET FLOW.

6. DEWATERING IN PERIODS OF INTENSE, HEAVY RAIN, WHEN THE INFILTRATIVE CAPACITY OF THE SOIL IS EXCEEDED, SHALL BE AVOIDED.

7. FLOW TO THE SEDIMENT REMOVAL STRUCTURE MAY NOT EXCEED THE STRUCTURE'S CAPACITY TO SETTLE AND FILTER FLOW OR THE STRUCTURE'S VOLUME CAPACITY.

8. WHEN TEMPORARY WORKS ARE NO LONGER NEEDED, THE CONTRACTOR SHALL REMOVE AND RETURN THE AREA TO A CONDITION SIMILAR TO THAT WHICH EXISTED BEFORE CONSTRUCTION. AREAS WHERE TEMPORARY WORKS WERE LOCATED SHALL BE GRADED FOR SIGHTLY APPEARANCE WITH NO OBSTRUCTION TO NATURAL SURFACE WATER FLOWS OR THE PROPER FUNCTIONING AND ACCESS TO THE WORKS OF IMPROVEMENT INSTALLED. THE CONTRACTOR SHALL EXERCISE EXTREME CARE DURING THE REMOVAL STAGES TO MINIMIZE THE LOSS OF SOIL SEDIMENT AND DEBRIS THAT WAS TRAPPED DURING CONSTRUCTION.

DEWATERING DETAIL NOTES:

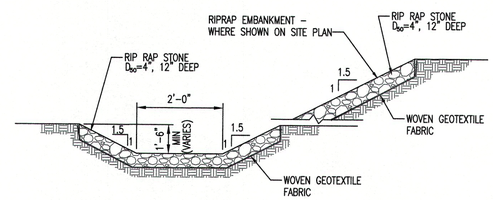
1. DIRT BAG MATERIAL BASED ON PARTICLE SIZE IN DIRTY WATER, I.E. FOR COARSE PARTICLES A WOVEN MATERIAL; FOR SILTS/CLAYS A NON-WOVEN MATERIAL.

2. DO NOT OVER PRESSURIZE DIRT BAG OR USE BEYOND CAPACITY.

3. LOCATE DISCHARGE SITE AS INDICATED ON SITE GRADING PLAN.

4. DOWNGRADIENT RECEIVING AREA MUST BE WELL VEGETATED OR OTHERWISE STABLE FROM EROSION, E.G. FOREST FLOOR OR COARSE GRAVEL/STONE.

5. DISCHARGE NOT PERMITTED WITHIN 100' OF A STREAM OR WETLAND.



RIPRAP SWALE DETAIL (WEST FORKS STATION)

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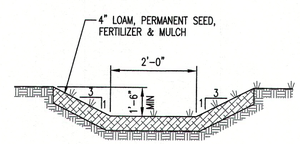
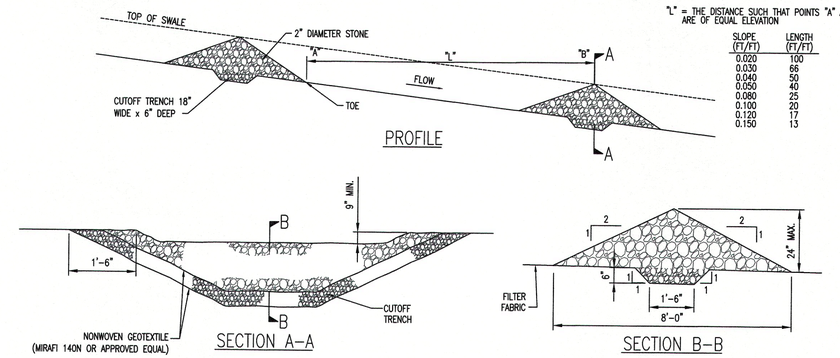


VEGETATED SWALE DETAIL (MOXIE GORE STATION)

NOT TO SCALE



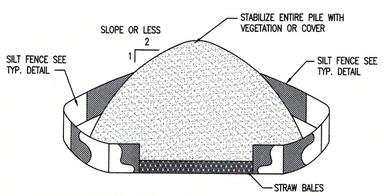
"L" = THE DISTANCE SUCH THAT POINTS "A" AND "B" ARE OF EQUAL ELEVATION

SLOPE (FT/FT)	LENGTH (FT/FT)
0.020	100
0.030	66
0.040	50
0.050	40
0.080	25
0.100	20
0.120	17
0.150	13

NOTE: INSTALL WHERE INDICATED ON SITE GRADING PLAN AND AS NEEDED BY SPACING REQUIREMENTS.

CHECK DAM DETAILS

NOT TO SCALE



INSTALLATION NOTES:

1. AREA CHOSEN FOR STOCKPILING OPERATIONS SHALL BE DRY AND STABLE. STOCKPILES SHALL NOT BE LOCATED:
   A. IN AREAS OF CONCENTRATED FLOW
   B. WITHIN 75' OF A WETLAND OR STREAM
   C. ON A SLOPE GREATER THAN 3%
2. MAXIMUM SLOPE OF STOCKPILE SHALL BE 2H:1V.
3. UPON COMPLETION OF SOIL STOCKPILING, EACH PILE SHALL BE SURROUNDED WITH EITHER SILT FENCING OR STRAW BALES, THEN STABILIZED WITH VEGETATION OR COVERED.

TYPICAL SOIL STOCKPILE

NOT TO SCALE

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	KAV	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

LOGO: TRC
INFO: TRC, 249 WESTERN AVENUE, AUGUSTA, ME 04330, 207-621-8080
PROJECT NO.315641
ANSI D 10/17/2018

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

811 DigSafe MA·ME·NH·RI·VT

INSTALL

PE STAMP: STATE OF MAINE, RICKY A. YOUNG, No. 6422, LICENSED PROFESSIONAL ENGINEER, OCTOBER 17, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

CMP AVANGRID

REV	DESCRIPTION	DATE	BY	CK	APP

EROSION CONTROL NOTES & DETAILS 1

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	KAV/TRC	SCALE: AS NOTED	FILE: 315641-C-7.dwg
CK	PGT/TRC	NO.	
APP	SGL/TRC		
DATE	10/05/2018		

315641-C-7 — REV 0-0B

CONSTRUCTION SEQUENCE

1. ESTABLISH CONSTRUCTION WORKSPACE LIMITS; IDENTIFY AND MARK SENSITIVE RESOURCES.

2. PERFORM ALL WORK IN ACCORDANCE WITH MAINE EROSION CONTROL AND SEDIMENT CONTROL HANDBOOK FOR CONSTRUCTION BEST MANAGEMENT PRACTICES (2003) AND MDEP WINTER CONSTRUCTION GUIDELINES (1999).

3. PRIOR TO USAGE, CONSTRUCT AND STABILIZE THE CONSTRUCTION ENTRANCE ON THE EXISTING PERMANENT ACCESS ROAD WITH A STONE PAD, MUD RACK, OR OTHER MATERIALS USED TO REDUCE THE TRACKING OR FLOWING OF SEDIMENT OFF THE SITE AND MAINTAIN UNTIL PAVING IS COMPLETED.

4. CLEAR TIMBER AND BRUSH; DO NOT GRUB UNTIL JUST PRIOR TO PRELIMINARY GRADING AND ESTABLISHMENT AND STABILIZATION OF TEMPORARY OR PERMANENT DRAINAGE COURSES.

5. INSTALL AND MAINTAIN SEDIMENT BARRIERS SUCH AS SILT FENCING AND/OR OTHER EROSION CONTROL BARRIERS ALONG THE DOWNHILL LIMIT OF WORK, AS SHOWN ON THE DRAWINGS. SEDIMENT BARRIER LOCATIONS MAY BE ADJUSTED IN THE FIELD BASED ON SITE CONDITIONS AS DETERMINED BY THE ENGINEERING INSPECTOR. WHERE SILT FENCE CANNOT BE TOED-IN PROPERLY DUE TO TREE ROOTS, ROCKS OR FROZEN GROUND, HAY BALES OR AN EROSION CONTROL MIX BERM MAY BE SUBSTITUTED. SILT FENCING WILL BE INSTALLED AFTER CLEARING BUT PRIOR TO GRUBBING AND GRADING ACTIVITIES. ANY EROSION ISSUES DEVELOPED DURING CLEARING WILL BE TEMPORARILY STABILIZED AS NECESSARY.

6. STABILIZE PERMANENT ACCESS ROAD SURFACE, PARKING AREAS AND EQUIPMENT STORAGE AND LAYDOWN AREAS WITH MATTING, CRUSHED STONE OR GRAVEL SUBBASE AS NECESSARY TO MINIMIZE RUTTING AND AVOID PONDING.

7. CONCURRENT WITH INITIATION OF SITE GRADING, CONSTRUCT AND STABILIZE TEMPORARY DRAINAGE SWALES, DIVERSION BERMS, CHECK DAMS, AND CULVERTS WITH TEMPORARY INLET AND OUTLET STRUCTURES TO MINIMIZE SEDIMENT IN SITE RUNOFF DURING THE CONSTRUCTION OF THE ROADWAY. DEWATER IN ACCORDANCE WITH DEWATERING NOTES BELOW.

8. INSTALL PROPERLY SPACED STONE CHECK DAMS IN ANY SECTION OF DITCH WITHIN 24 HOURS OF FORMING, SHAPING OR ROUGH GRADING THAT SECTION OF DITCH.

9. MINIMIZE THE AMOUNT OF DISTURBANCE AT ANY ONE TIME BY STAGING CONSTRUCTION AS MUCH AS PRACTICAL FOR EFFICIENT CONSTRUCTION OF THE FACILITY. NATURAL VEGETATIVE BUFFERS OR STRIPS SHOULD BE LEFT IN PLACE WHERE FEASIBLE TO AID IN SEDIMENT RETENTION AND REDUCE EROSION POTENTIAL.

10. STABILIZE ANY NEWLY GRADED SLOPE GREATER THAN EIGHT PERCENT AND ANY SECTION OF NEWLY CONSTRUCTED DITCH USING ANCHORED EROSION CONTROL BLANKETS OR OTHER APPROVED MULCHING TECHNIQUES WITHIN 24 HOURS. STABILIZE ANY SLOPE EXCEEDING EIGHT PERCENT AND BROUGHT TO FINAL GRADE WITHIN 24 HOURS USING THE APPROVED PERMANENT STABILIZATION MEASURES FOR SLOPES. STABILIZE ANY SECTION OF DITCH BROUGHT TO FINAL GRADE WITHIN 24 HOURS USING THE APPROVED PERMANENT STABILIZATION MEASURES FOR DITCHES.

11. DUST CONTROL METHODS WILL BE EMPLOYED AFTER GRADING AND PRIOR TO FINAL STABILIZATION TO PREVENT THE BLOWING AND MOVEMENT OF DUST THROUGH THE APPLICATION OF WATER AND/OR CALCIUM CHLORIDE TO REDUCE WIND EROSION. REPETITIVE TREATMENT WILL BE APPLIED AS NEEDED TO ACCOMPLISH CONTROL.

12. APPLY TEMPORARY SEED AND MULCH TO ANY EXPOSED AREAS WHERE ACTIVITY IS NOT ANTICIPATED FOR 30 DAYS OR MORE, OR WHERE ACTIVITY HAS NOT OCCURRED WITHIN 30 DAYS. TEMPORARILY MULCH ANY EXPOSED AREAS WITHIN 100 FEET OF A WETLAND WHERE ACTIVITY IS NOT ANTICIPATED OR HAS NOT OCCURRED IN 7 DAYS.

13. REMOVE EXCESS SPOILS FROM SITE THAT WILL NOT BE USED FOR THE FINAL DESIGN AND STABILIZATION. STOCKPILED SOILS THAT REMAIN IN PLACE FOR 48 HOURS OR MORE WILL BE CONTAINED WITH SEDIMENT BARRIERS SUCH AS SILT FENCE, HAY BALES OR EQUIVALENT. THE SEDIMENT BARRIERS SHALL BE ADEQUATELY LOCATED AND REINFORCED TO HANDLE A SIGNIFICANT RAIN EVENT AND THE POTENTIAL SLUMPING OF THE PILE. BETWEEN APRIL 15 AND OCTOBER 1, APPLY TEMPORARY SEED AND MULCH TO A STOCKPILE THAT IS NOT EXPECTED TO BE DISTURBED WITHIN 30 DAYS. APPLY ANCHORED MULCH DAILY, AS NEEDED, DURING WINTER CONSTRUCTION.

14. INSPECT AND REPAIR EROSION CONTROL MEASURES DAILY IN AREAS OF ACTIVE CONSTRUCTION; OTHERWISE WEEKLY AND AFTER RAINFALL OF ½ INCH OR GREATER WITHIN A 24-HOUR PERIOD. REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES 1/3 THE HEIGHT OF THE BARRIER.

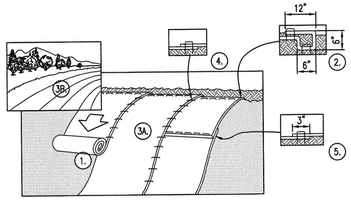
15. MONITOR PUBLIC ROADS FOR SIGNS OF TRACKING OR SPILLING OF SPOIL MATERIAL AND CLEANUP AS NEEDED.

16. COMPLETE FINAL GRADING AND STABILIZATION OF EARTHEN STRUCTURES SUCH AS DIVERSION BERMS, LEVEL SPREADERS AND SWALES THAT WILL CONTROL RUNOFF.

17. FINISH GRADE AND REPLACE TOPSOIL OR LOAM IN DISTURBED AREAS. SEED AND MULCH DISTURBED AREAS WITHIN 6 DAYS OF FINAL GRADING.

18. MAINTAIN ALL TEMPORARY EROSION CONTROLS AND SEDIMENT BARRIERS UNTIL VEGETATION HAS BEEN ESTABLISHED OVER 85-90% OF THE AREA TO BE REVEGETATED. RESEED SPARSELY VEGETATED AREAS.

19. REMOVE ALL TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES ONCE THE SITE IS PERMANENTLY STABILIZED.



1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL-O-SEED DO NOT SEED PREPARED AREA. CELL-O-SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.

2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" DEEP X 6" WIDE TRENCH WITH APPROXIMATELY 12" OF BLANKET EXTEDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE BLANKET.

3. ROLL THE BLANKETS (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. BLANKETS WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING OPTIONAL DOT SYSTEM, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.

4. THE EDGES OF PARALLEL BLANKETS MUST BE STAPLED WITH APPROXIMATELY 2"-5" OVERLAP DEPENDING ON BLANKET TYPE. TO ENSURE PROPER SEAM ALIGNMENT, PLACE THE EDGE OF THE OVERLAPPING BLANKET (BLANKET BEING INSTALLED ON TOP) EVEN WITH THE COLORED SEAM STITCH ON THE PREVIOUSLY INSTALLED BLANKET.

5. CONSECUTIVE BLANKETS SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" APART ACROSS ENTIRE BLANKET WIDTH.

NOTE:
*IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY SECURE THE BLANKETS.

EROSION CONTROL BLANKET INSTALLATION

NOT TO SCALE

MULCH AND SEEDING SPECIFICATIONS

SUMMARY OF TEMPORARY AND PERMANENT MULCH APPLICATION REQUIREMENTS

CONDITION	TIMING	MULCH TYPE[1,2]	APPLICATION RATES
TEMPORARY			
	IF NO ACTIVITY IN EXPOSED AREAS FOR 7 DAYS, OR PRIOR TO A STORM EVENT	STRAW MULCH OR WOOD FIBER MULCH	2 TONS/ACRES 2000 LB./ACRES
ALL DISTRIBUTED AREAS OF THE CONSTRUCTION WORKSPACE	APPLY MULCH TO ALL EXPOSED AREAS IF NO ACTIVITY OCCURS WITHIN 30 DAYS. APPLY MULCH AND TEMPORARY SEEDING SOONER WHEN IT CAN BE ANTICIPATED THAT ACTIVITY IS NOT GOING TO OCCUR WITHIN 30 DAYS.	STRAW MULCH OR WOOD FIBER MULCH	2 TONS/ACRES 2000 LB./ACRES [3]
ALL WORK AREAS EXPOSED ARE TO BE MULCHED DAILY EACH TIME SOIL IS DISTURBED	NOVEMBER 1 – APRIL 15	STRAW MULCH OR WOOD FIBER MULCH	3 TONS/ACRES 2000 LB./ACRES
PERMANENT			
ON ALL EXPOSED AREAS AFTER SEEDING TO STABILIZE THE SOIL SURFACE	PERMANENT GRASS AND/OR LEGUME SEEDING COVERED BY HAY OR STRAW MULCH ON ALL AREAS THAT HAVE BEEN RESTORED TO FINAL GRADE. THIS DOES NOT APPLY TO AREAS STABILIZED BY OTHER MEANS SUCH AS JUTE MATTING OR PERMANENT EROSION CONTROL MIX.	CRIMPED STRAW MULCH OR PAPER MULCH OR WOOD FIBER MULCH	2 TONS/ACRES 1500 LB./ACRES [4] 2000 LB./ACRES
WOOD CHIP APPLICATION AREAS	PERMANENT GRASS AND/OR LEGUME SEEDING COVERED BY HAY OR STRAW MULCH ON ALL AREAS THAT HAVE BEEN RESTORED TO FINAL GRADE. THIS DOES NOT APPLY TO AREAS STABILIZED BY OTHER MEANS SUCH AS JUTE MATTING OR PERMANENT EROSION CONTROL MIX.	CRIMPED STRAW MULCH OR PAPER MULCH OR WOOD FIBER MULCH	2 TONS/ACRES 1500 LB./ACRES [4] 2000 LB./ACRES

NOTES:
1. STRAW AND HAY MULCH MAY BE USED INTERCHANGEABLY, EXCEPT IN WETLAND AREAS WHERE STRAW MULCH WILL BE REQUIRED.
2. DOUBLE RATE OF WOOD FIBER MULCH WHEN USED IN CRITICAL AREAS.
3. STRAW, HAY, OR HYDROMULCH (WOOD FIBER OR PAPER MULCH AS APPROPRIATE) WILL PROVIDE 90 PERCENT GROUND COVERAGE
4. PAPER MULCH IS ACCEPTABLE FOR USE DURING THE GROWING SEASON. ON SLOPES >30 PERCENT AND IN AREAS WHERE VEGETATION HAS NOT ESTABLISHED WELL, ADDITIONAL HAY MULCH WILL BE ADDED AS A WINTERIZING MEASURE.

MULCH ANCHORING REQUIREMENTS

ON SLOPES GREATER THAN 3 PERCENT, HAY OR STRAW MULCH WILL BE FIRMLY ANCHORED INTO THE SOIL UTILIZING ONE OF THE FOLLOWING METHODS:
-CRIMPING WITH A STRAIGHT OR NOTCHED MULCH CRIMPING TOOL (FARM DISCS WILL NOT BE ALLOWED);
-TRACK WALKING WITH DEEP-CLEATED EQUIPMENT OPERATING UP AND DOWN THE SLOPE (MULCH CRIMPED PERPENDICULAR TO THE SLOPE) ON SLOPES <25 PERCENT;
-APPLICATION OF MULCH NETTING;
-APPLICATION OF 500 LB./ACRE OF WOOD FIBER MULCH OVER STRAW/HAY MULCH; AND
-COMMERCIALLY AVAILABLE TACKIFIERS (EXCEPT WITHIN 100 FEET OF WATERBODIES OR WETLANDS).

SEED MIX SPECIFICATIONS

SEED MIX NAME	SEED MIX COMPONENTS	LB./ACRE[1]
TEMPORARY SEED MIX	ANNUAL RYEGRASS	40
PERMANENT UPLAND SEED MIX	REDTOP CREEPING RED FESCUE TALL FESCUE BIRDSFOOT TREFOIL	4 40 40 16
WOODCHIP APPLICATION SEED MIX	CREEPING RED FESCUE REDTOP TALL FESCUE CROWNVETCH	20 4 30 30
WETLAND SEED MIX	ANNUAL RYEGRASS	40
SUPPLEMENTAL WINTER SEED MIX[2]	WINTER RYEGRASS	120

NOTES:
1. INCREASE SEEDING RATES 10% WHEN HYDROSEEDING
2. WINTER RYE WILL BE ADDED TO PERMANENT UPLAND MIX AT A RATE OF 120 LB./ACRE BETWEEN OCTOBER 1 AND APRIL 15

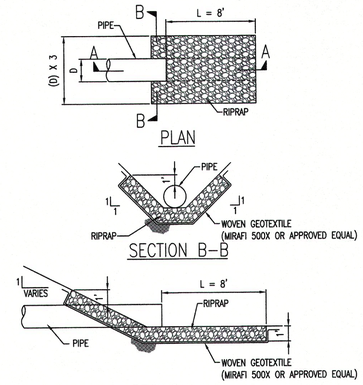
SUMMARY OF SEEDING REQUIREMENTS

CONDITION	TIMING[1,2]	SEED MIX
TEMPORARY SEEDING [3]	TEMPORARY SEED BETWEEN APRIL 15 AND OCTOBER 1 ONLY. DISTURBED AREAS OR SPOIL STOCKPILES WILL BE SEEDED IMMEDIATELY IF FURTHER DISTURBANCE IS NOT EXPECTED FOR 30 DAYS OR MORE.	ANNUAL RYEGRASS
PERMANENT SEEDING [3,4]		
UPLAND PORTIONS OF THE CONSTRUCTION AREA	DISTURBED AREA WILL BE SEEDED WITHIN 6 DAYS OF FINAL GRADING.	PERMANENT UPLAND MIX
SLOPES > 3:1	DISTURBED AREA WILL BE SEEDED IMMEDIATELY AFTER SEEDBED PREPARATION.	PERMANENT UPLAND MIX
WETLANDS	DISTURBED WETLANDS WILL BE SEEDED WITHIN 6 DAYS OF FINAL GRADING.	ANNUAL RYEGRASS
WOODCHIP APPLICATION AREAS	DISTURBED AREA WILL BE SEEDED WITHIN 6 DAYS OF FINAL GRADING.	WOODCHIP APPLICATION SEED MIX
WINTER DORMANT SEEDING	DORMANT SEED BETWEEN OCTOBER 1 AND APRIL 15 ONLY. NO SEEDING WILL OCCUR IF SNOW DEPTHS EXCEED 1 INCH.	PERMANENT UPLAND MIX PLUS WINTER RYEGRASS

NOTES:
1. WEATHER CONDITIONS PERMITTING.
2. AREAS THAT DO NOT SUCCESSFULLY REVEGETATE WITHIN APPROPRIATE PERIOD OF TIME WILL BE RESEEDED AS NECCESSARY.
3. LOOSEN COMPACTED SOIL TO A MINIMUM DEPTH OF 4 INCHES.
4. TOP DRESS WITH 6 INCHES LOAM, AS NEEDED.

FERTILIZER AND LIMESTONE REQUIREMENTS.

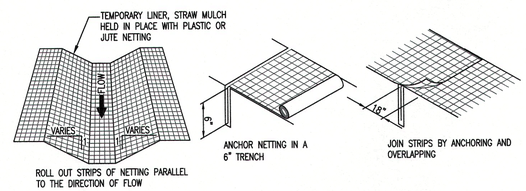
IN GENERAL, FERTILIZER AND LIME APPLICATION RATES WILL FOLLOW THE GUIDELINES IDENTIFIED BELOW UNLESS SITE SPECIFIC SOIL TESTS IDENTIFY THE NEED FOR ALTERNATIVE FERTILIZER/LIME APPLICATION RATES. FERTILIZER WILL BE APPLIED TO UPLAND AREAS PRIOR TO SEEDING AT A RATE OF 800 POUNDS PER ACRE USING 10-20-20 (N-P205-K20) OR EQUIVALENT. GROUND LIMESTONE (EQUIVALENT TO 50 PERCENT CALCIUM PLUS MAGNESIUM OXIDE) WILL BE APPLIED AT A RATE OF 3 TONS PER ACRE. AN EQUIVALENT MIXTURE OF FERTILIZER AND LIME MAY BE APPLIED USING THE HYDROSEEDING METHOD. NO LIME OR FERTILIZER WILL BE APPLIED TO WETLANDS.



NOTES:
- D_{50}=4", D_{MAX}=6"
- THICKNESS=12"
- STONE FOR RIPRAP SHALL CONSIST OF SUB-ANGULAR FIELD STONE OR ROUGH UNHEWN QUARRY STONE OF APPROXIMATELY RECTANGULAR SHAPE. THE STONE SHALL BE HARD AND OF SUCH QUALITY THAT IT WILL NOT DISINTEGRATE ON EXPOSURE TO WATER OR WEATHERING, BE CHEMICALLY STABLE, AND IT SHALL BE SUITABLE IN ALL OTHER RESPECTS FOR THE PURPOSE INTENDED. THE BULK SPECIFIC GRAVITY (SATURATED SURFACE-DRY BASIS) OF THE INDIVIDUAL STONES SHALL BE AT LEAST 2.5.

CULVERT INLET/OUTLET PROTECTION

NOT TO SCALE



1. EXCAVATE THE CHANNEL AND SHAPE IT TO AN EVEN CROSS-SECTION AS SHOWN. WHEN STAKING INDICATE A 0.2' OVERCUT AROUND THE CHANNEL PERIMETER FOR SILTING AND BULKING.
2. GRADE SOIL AWAY FROM CHANNEL SO THAT SURFACE WATER MAY ENTER FREELY.
3. APPLY LIME, FERTILIZER AND SEED TO THE CHANNEL AND ADJOINING AREAS IN ACCORDANCE WITH THE EROSION CONTROL PLAN.
4. SPREAD HAY OR STRAW MULCH AT THE RATE OF 100LB/1000 SF.
5. HOLD MULCH IN PLACE IMMEDIATELY AFTER SPREADING WITH A PLASTIC NETTING INSTALLED AS SHOWN.
6. START LAYING THE NET FROM THE TOP OF THE UPSTREAM END OF THE CHANNEL AND UNROLL IT DOWN GRADE. DO NOT STRETCH THE NETTING.
7. BURY THE UP SLOPE END AND STAPLE THE NET EVERY 12" ACROSS THE TOP END, EVERY 3 FT AROUND THE EDGES AND ACROSS THE NET SO THAT THE STRAW IS HELD CLOSELY AGAINST THE SOIL. HOWEVER, DO NOT STRETCH THE NETTING WHEN STAPLING.
8. NETTING STRIPS SHOULD BE JOINED TOGETHER ALONG THE SIDES WITH A 3" OVERLAP AND STAPLED TOGETHER.
9. TO JOIN ENDS OF STRIPS, INSERT A NEW ROLL OF NET IN A TRENCH AS WITH THE UP SLOPE END AND OVERLAP IT 18" WITH THE PREVIOUSLY LAID UPPER ROLL. TURN UNDER 6" OF THE 18" OVERLAP AND STAPLE EVERY 12" ACROSS THE END.

GRASS LINED CHANNEL

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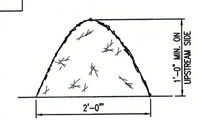
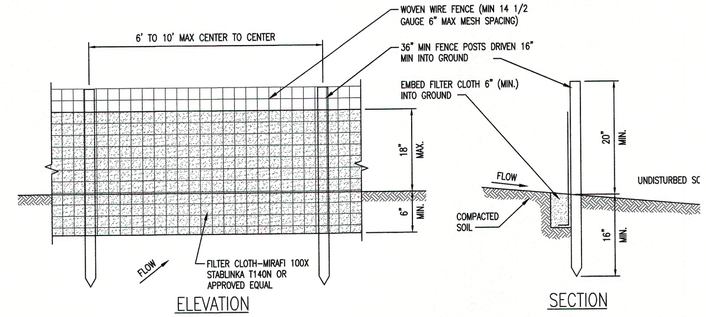


EROSION CONTROL SOIL/BARK MIX: SHALL CONSIST OF SHREDDED BARK, STUMP GRINDINGS, COMPOSTED BARK OR FLUME GRIT AND FRAGMENTED WOOD GENERATED FROM WATER-FLUME LOG HANDLING SYSTEMS. THE MIX SHALL CONFORM TO THE FOLLOWING:
1. pH – 5.0 TO 8.0.
2. SCREEN SIZE: 6" – 100% PASSING
   3/4" – 70% TO 85% PASSING
   MIX SHALL NOT CONTAIN LARGE PORTIONS OF SILTS, CLAYS OR FINE SANDS
3. ORGANIC MATERIAL 20% – 100% (DRY WEIGHT BASIS)
   ORGANIC PORTION MUST BE FIBROUS AND ELONGATED
4. SOLUBLE SALTS SHALL BE < 4.0 mmhos/cm

EROSION CONTROL BERM

NOT TO SCALE

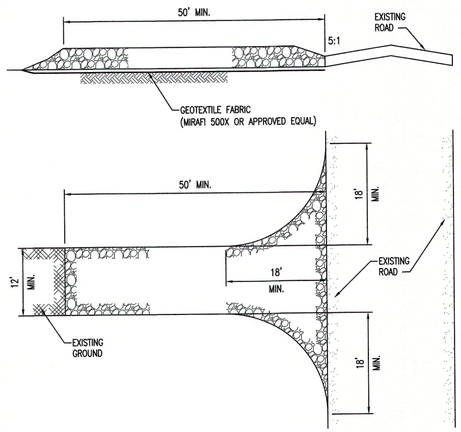


1. WOVEN WIRE FENCE TO BE FASTENED TO FENCE POSTS WITH WIRE TIES OR STAPLES.
2. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MIDSECTION.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY 6" AND FOLDED.
4. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN BUILD-UP REACHES 1/3 THE HEIGHT OF THE FENCE.

POSTS:	STEEL "T" OR "U" TYPE OR 2" HARDWOOD.
FENCE:	WOVEN WIRE. 14 1/2 GA 6" MAX MESH OPENING.
FILTER CLOTH:	FILTER X, MIRAFI 100X. STABLINKA T140N OR APPROVED EQUAL.
PREFABRICATED UNIT:	ENVIROFENCE OR APPROVED EQUAL

SILT FENCE DETAILS

NOT TO SCALE



1. STONE SIZE – USE 2" STONE.
2. LENGTH – NOT LESS THAN 50 FEET.
3. THICKNESS – NOT LESS THAN SIX (6) INCHES.
4. WIDTH – TWELVE (12) FOOT MIN. BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. TWENTY-FOUR (24) FOOT IF SINGLE ENTRANCE TO SITE.
5. GEOTEXTILE FABRIC – WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING THE STONE.
6. SURFACE WATER – ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

STABILIZED CONSTRUCTION ENTRANCE

NOT TO SCALE

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NOT FOR CONSTRUCTION

INSTALL

PE STAMP
STATE OF MAINE
RICKY A. YOUNG
No. 6423
LICENSED
PROFESSIONAL ENGINEER
October 18, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

CMP AVANGRID

REV	DESCRIPTION	DATE	BY	CK	APP

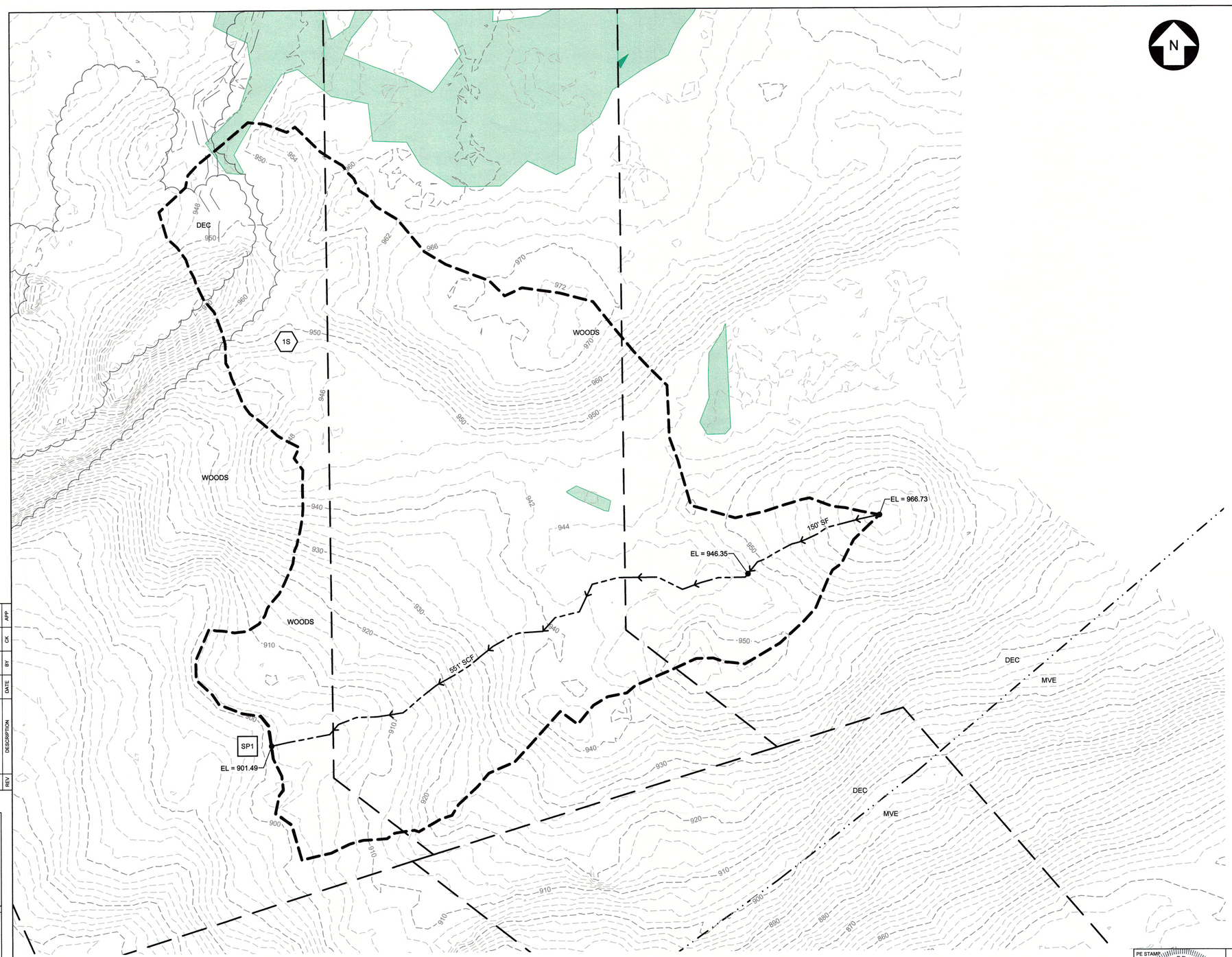
EROSION CONTROL NOTES & DETAILS 2

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	KAV/TRC	SCALE: AS NOTED	FILE: 315641-C-8.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641-C-8	0-0B
DATE	10/05/2018		

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	KAV	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

LOGO TRC
INFO TRC 249 WESTERN AVENUE AUGUSTA, ME 04330 207-621-7000
PROJECT NO-315641
ANSI D 10/17/2018



SOILS LEGEND		
MAP UNIT SYMBOL	MAP UNIT NAME	HSG RATING
DEC	DANFORTH-ELLIOTTSVILLE ASSOCIATION, 3 TO 15 PERCENT SLOPES	B
MOB	MONARDA-BURNHAM COMPLEX, 0 TO 3 PERCENT SLOPES, VERY STONY	D
MTB	MONARDA-TELOS COMPLEX, 0 TO 8 PERCENT SLOPES, VERY STONY	D
MVE	MONSON-ELLIOTTSVILLE-KNOB LOCK COMPLEX, 30 TO 60 PERCENT SLOPES, VERY ROCKY	D

WEST FORKS PRE-DEVELOPMENT LAND COVER COMPARISON SUMMARY (ACRES)		
COVER TYPE	CN	1S
ROOFS & FOUNDATIONS	98	0.00
STONE YARD SURFACE	55	0.00
GRAVEL ROAD, HSG B	96	0.00
BRUSH, HSG B	67	0.14
WOODS, HSG B	66	5.89
TOTAL AREA		6.03

LEGEND

- SUBCATCHMENTBOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- REACH
- 100' SF — SHEET FLOW
- 100' SCF — SHALLOW CONCENTRATED FLOW
- 100' CF — CHANNEL FLOW
- EL. 520.0± — SPOT ELEVATION
- 1R — REACH ID
- 1S — SUBCATCHMENT ID
- 1P — POND ID
- SP1 — STUDY POINT ID
- RIGHT OF WAY
- SOILS
- 100 — CONTOUR
- TREELINE
- WETLAND

50 0 50 100 FT

SCALE: 1" = 50'

ANSI D 10/17/2018

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	CMV	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

LOGO TRC

INFO TRC 249 WESTERN AVENUE AUGUSTA, ME 04330 207-621-7000

PROJECT NO. 315641

ISSUE FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

PE STAMP: STATE OF MAINE RICKY A. JUNGE No. 6422 LICENSED PROFESSIONAL ENGINEER OCT. 19, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

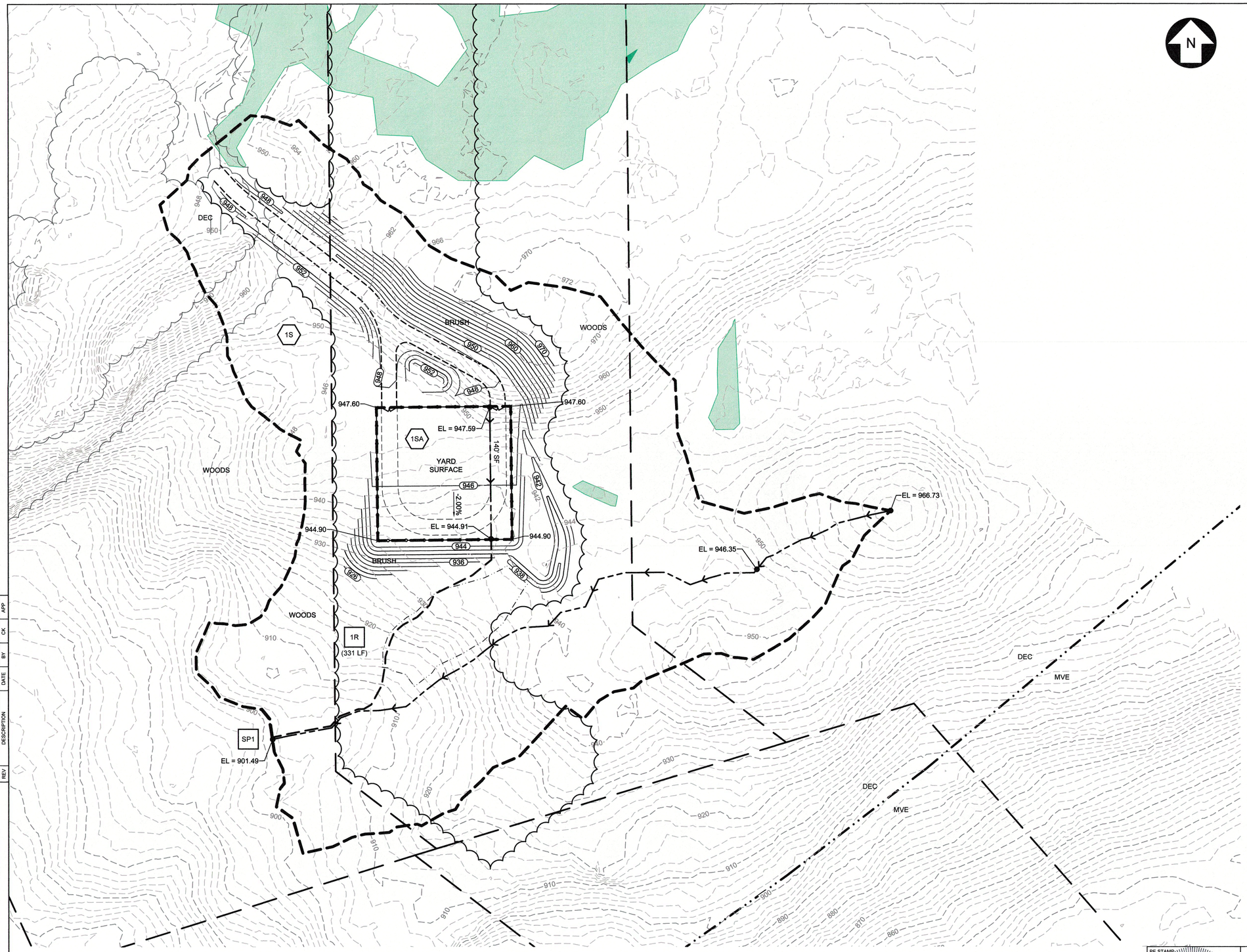
CMP AVANGRID

PRE-DEVELOPMENT WATERSHED PLAN

WEST FORKS STATION

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	PGT/TRC	SCALE: AS NOTED	FILE: 315641 Watershed.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 SW-1	0-0B
DATE	10/05/2018		



SOILS LEGEND		
MAP UNIT SYMBOL	MAP UNIT NAME	HSG RATING
DEC	DANFORTH-ELLIOTTSVILLE ASSOCIATION, 3 TO 15 PERCENT SLOPES	B
MOB	MONARDA-BURNHAM COMPLEX, 0 TO 3 PERCENT SLOPES, VERY STONY	D
MTB	MONARDA-TELOS COMPLEX, 0 TO 8 PERCENT SLOPES, VERY STONY	D
MVE	MONSON-ELLIOTTSVILLE-KNOB LOCK COMPLEX, 30 TO 60 PERCENT SLOPES, VERY ROCKY	D

WEST FORKS POST-DEVELOPMENT LAND COVER COMPARISON SUMMARY (ACRES)			
COVER TYPE	CN	1S	1SA
ROOFS & FOUNDATIONS	98	0.00	0.01
STONE YARD SURFACE	55	0.00	0.47
GRAVEL ROAD, HSG B	96	0.15	0.00
BRUSH, HSG B	67	0.48	0.00
WOODS, HSG B	66	4.92	0.00
TOTAL AREA		5.55	0.48

LEGEND

- SUBCATCHMENTBOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- REACH
- 100' SF — SHEET FLOW
- 100' SCF — SHALLOW CONCENTRATED FLOW
- 100' CF — CHANNEL FLOW
- EL. 520.0± — SPOT ELEVATION
- 1R — REACH ID
- 1S — SUBCATCHMENT ID
- 1P — POND ID
- SP1 — STUDY POINT ID
- RIGHT OF WAY
- SOILS
- 100 — EXISTING CONTOUR
- 100 — PROPOSED CONTOUR
- TREELINE
- WETLAND

50 0 50 100 FT

SCALE: 1" = 50'

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	CMW	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

LOGO TRC PROJECT NO:315641

INFO TRC 249 WESTERN AVENUE AUGUSTA, ME 04330 207-621-7000

ANSI D 10/19/2018

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PE STAMP STATE OF MAINE RICKY A. YOUNG No. 6122 LICENSED PROFESSIONAL ENGINEER Oct. 19, 2018

AVANGRID ENGINEERING CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION Property of AVANGRID

CMP AVANGRID

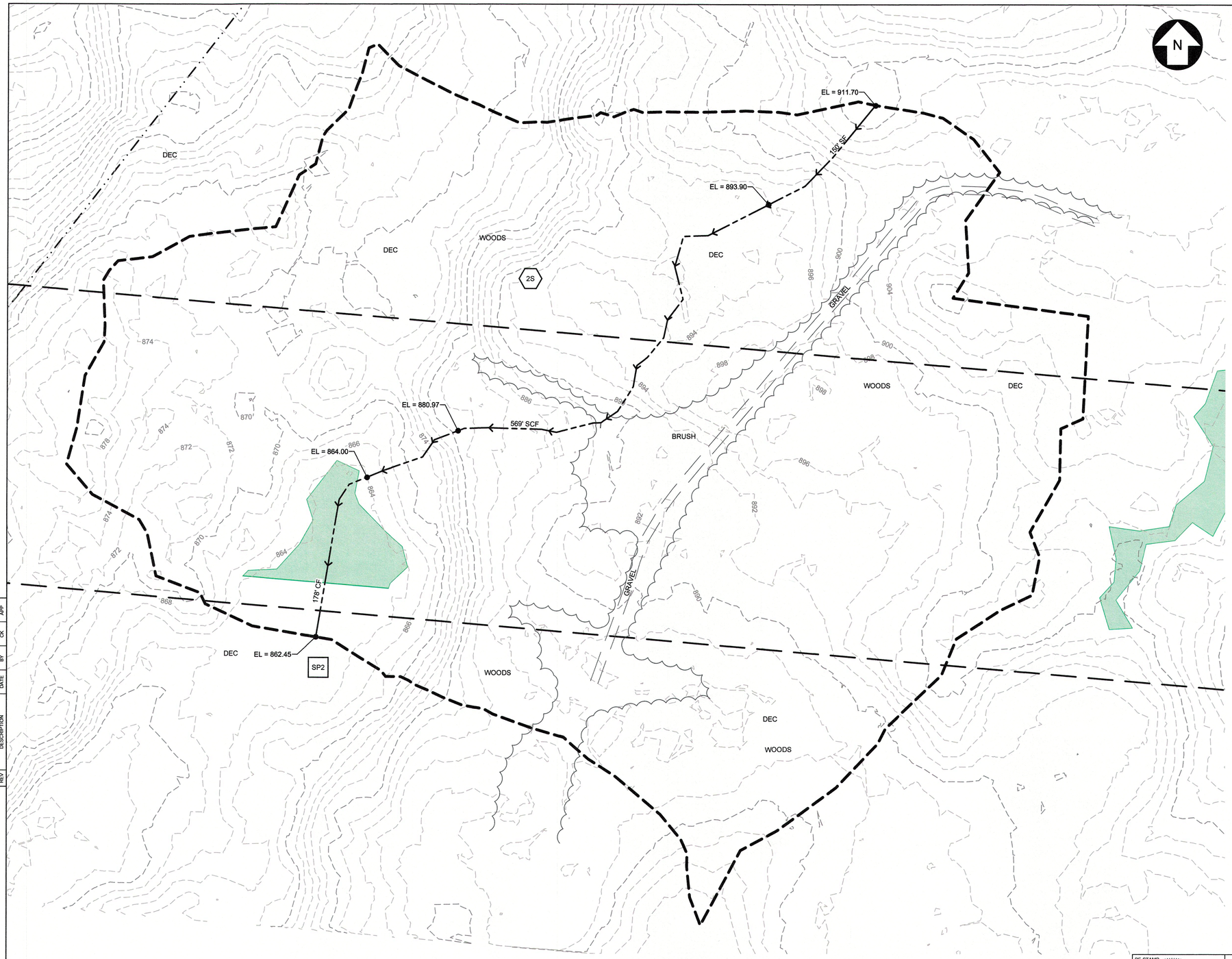
REV	DESCRIPTION	DATE	BY	CK	APP

POST-DEVELOPMENT WATERSHED PLAN

WEST FORKS STATION

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	PGT/TRC	SCALE: AS NOTED	FILE: 315641 Watershed.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 SW-2	0-0B
DATE	10/05/2018		



SOILS LEGEND		
MAP UNIT SYMBOL	MAP UNIT NAME	HSG RATING
DEC	DANFORTH-ELLIOTTSVILLE ASSOCIATION, 3 TO 15 PERCENT SLOPES	B
MOB	MONARDA-BURNHAM COMPLEX, 0 TO 3 PERCENT SLOPES, VERY STONY	D
MTB	MONARDA-TELOS COMPLEX, 0 TO 8 PERCENT SLOPES, VERY STONY	D
MVE	MONSON-ELLIOTTSVILLE-KNOB LOCK COMPLEX, 30 TO 60 PERCENT SLOPES, VERY ROCKY	D

MOXIE GORE PRE-DEVELOPMENT LAND COVER COMPARISON SUMMARY (ACRES)		
COVER TYPE	HSG	2S
ROOFS & FOUNDATIONS	98	0.00
STONE YARD SURFACE	55	0.00
GRAVEL ROAD, HSG B	96	0.25
BRUSH, HSG B	67	0.58
WOODS, HSG B	66	11.57
TOTAL AREA		12.40

LEGEND

- SUBCATCHMENTBOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- REACH
- 100' SF — SHEET FLOW
- 100' SCF — SHALLOW CONCENTRATED FLOW
- 100' CF — CHANNEL FLOW
- EL. 520.0± — SPOT ELEVATION
- 1R — REACH ID
- 1S — SUBCATCHMENT ID
- 1P — POND ID
- SP1 — STUDY POINT ID
- RIGHT OF WAY
- SOILS
- 100 — CONTOUR
- TREELINE
- WETLAND

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	CMW	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

LOGO TRC
PROJECT NO: 315641
INFO TRC 249 WESTERN AVENUE AUGUSTA, MAINE 207-621-7000
ANSI D 10/18/2018

50 0 50 100 FT
SCALE: 1" = 50'

PE STAMP: STATE OF MAINE — RICKY A. YOUNG No. 6422 — LICENSED PROFESSIONAL ENGINEER — OCT. 18, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

CMP AVANGRID

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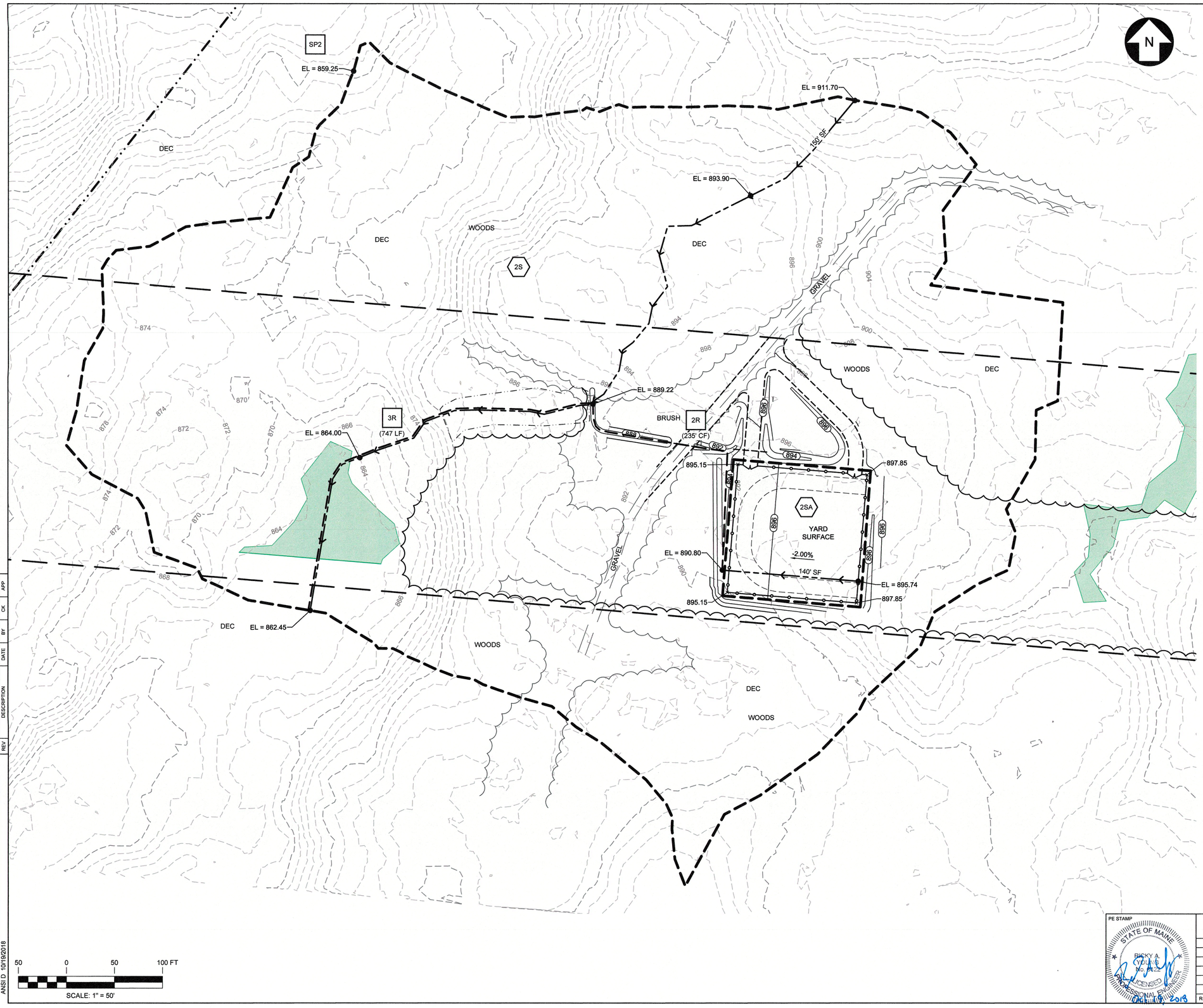
INSTALL

PRE-DEVELOPMENT WATERSHED PLAN

MOXIE GORE STATION

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	PGT/TRC	SCALE: AS NOTED	FILE: 315641 Watershed.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 SW-3	0-0B
DATE	10/05/2018		



SOILS LEGEND		
MAP UNIT SYMBOL	MAP UNIT NAME	HSG RATING
DEC	DANFORTH-ELLIOTTSVILLE ASSOCIATION, 3 TO 15 PERCENT SLOPES	B
MOB	MONARDA-BURNHAM COMPLEX, 0 TO 3 PERCENT SLOPES, VERY STONY	D
MTB	MONARDA-TELOS COMPLEX, 0 TO 8 PERCENT SLOPES, VERY STONY	D
MVE	MONSON-ELLIOTTSVILLE-KNOB LOCK COMPLEX, 30 TO 60 PERCENT SLOPES, VERY ROCKY	D

MOXIE GORE			
POST-DEVELOPMENT LAND COVER COMPARISON SUMMARY (ACRES)			
COVER TYPE	HSG	2S	2SA
ROOFS & FOUNDATIONS	98	0.00	0.01
STONE YARD SURFACE	55	0.00	0.47
GRAVEL ROAD, HSG B	96	0.38	0.00
BRUSH, HSG B	67	0.83	0.00
WOODS, HSG B	66	10.71	0.00
TOTAL AREA		11.92	0.48

LEGEND

- SUBCATCHMENTBOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- REACH
- 100' SF — SHEET FLOW
- 100' SCF — SHALLOW CONCENTRATED FLOW
- 100' CF — CHANNEL FLOW
- EL. 520.0± — SPOT ELEVATION
- 1R — REACH ID
- 1S — SUBCATCHMENT ID
- 1P — POND ID
- SP1 — STUDY POINT ID
- RIGHT OF WAY
- SOILS
- 100 — EXISTING CONTOUR
- 100 — PROPOSED CONTOUR
- TREELINE
- WETLAND

50 0 50 100 FT

SCALE: 1" = 50'

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUE FOR PERMITTING	10/17/2018	CMW	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

LOGO: TRC PROJECT NO:315641

INFO: TRC 249 WESTERN AVENUE AUGUSTA, ME 04330 207-621-7000

ANSI D 10/19/2018

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PE STAMP

STATE OF MAINE — RICKY A. YOUNG — No. 9622 — LICENSED PROFESSIONAL ENGINEER — 10/19/2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

CMP AVANGRID

REV	DESCRIPTION	DATE	BY	CK	APP

POST-DEVELOPMENT WATERSHED PLAN

MOXIE GORE STATION

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	PGT/TRC	SCALE: AS NOTED	FILE: 315641 Watershed.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 SW-4	0-0B
DATE	10/05/2018		

APPENDIX 12-3

Post-Construction Stormwater Inspection and Maintenance Log

CMP West Forks Station				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		**Inspector Initials and Date**	**Inspector Comments**
	Quarterly Inspection	**Maintenance**		
Revegetated Areas and Embankments:				
Inspect all revegetated areas and embankments.	**X**			
Replant bare areas or areas with sparse growth.		**As Required**		
Armor areas with rill erosion with an appropriate lining or divert the erosive flows to on-site areas able to withstand concentrated flows.		**As Required**		
Drainage Conveyance Systems:				
Inspect swales and level spreaders for evidence of erosion, debris, woody growth, and excessive sediment.	**X**			
Remove any obstructions and accumulated sediments or debris.		**As Required**		
Control vegetated growth and woody vegetation.		**As Required**		
Repair any erosion of the swale lining.		**As Required**		
Mow vegetated swales.		**Annually**		
Clean-out any accumulation of sediment within the spreader bays.		**As Required**		
Remove woody vegetation growing through riprap.		**As Required**		
Repair any slumping side slopes.		**As Required**		
Replace riprap where underlying filter fabric is showing or where stones have dislodged.		**As Required**		
Culverts:				
Inspect culvert inlet, outlet, and structure.	**X**			
Remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit.		**As Required**		
Repair any erosion damage at the culvert's inlet and outlet.		**As Required**		

CMP West Forks Station				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		**Inspector Initials and Date**	**Inspector Comments**
	Quarterly Inspection	**Maintenance**		
Roadway Surfaces:				
Inspect access road surfaces and shoulders for erosion, false ditches, and excess accumulation of sand that could impede water flow.	**X**			
Remove excess sand either manually or with a front-end loader.		**As Required**		
Grade gravel roads and shoulders.		**As Required**		
Transition Station Yard:				
Inspect for existing or developing erosion, rutting, trash, and unwanted vegetation.	**X**			
Correct any erosion/rutting and/or remove trash or vegetation.		**As Required**		
Water Quality Treatment Buffers:				
Inspect treatment buffers for evidence of erosion, concentrated flow, or encroachment by development.	**X**			
Manage the buffer's vegetation consistent with the requirements in any deed restrictions.		**As Required**		
Repair any sign of erosion within a buffer.		**As Required**		
Inspect and repair down-slope of all level spreaders and turn-outs for erosion.	**X**			

CMP West Forks Station				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		**Inspector Initials and Date**	**Inspector Comments**
	Quarterly Inspection	**Maintenance**		
Maintenance Needed and When:				

CMP Moxie Gore Station				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		**Inspector Initials and Date**	**Inspector Comments**
	Quarterly Inspection	**Maintenance**		
Revegetated Areas and Embankments:				
Inspect all revegetated areas and embankments.	**X**			
Replant bare areas or areas with sparse growth.		**As Required**		
Armor areas with rill erosion with an appropriate lining or divert the erosive flows to on-site areas able to withstand concentrated flows.		**As Required**		
Drainage Conveyance Systems:				
Inspect swales and level spreaders for evidence of erosion, debris, woody growth, and excessive sediment.	**X**			
Remove any obstructions and accumulated sediments or debris.		**As Required**		
Control vegetated growth and woody vegetation.		**As Required**		
Repair any erosion of the swale lining.		**As Required**		
Mow vegetated swales.		**Annually**		
Clean-out any accumulation of sediment within the spreader bays.		**As Required**		
Remove woody vegetation growing through riprap.		**As Required**		
Repair any slumping side slopes.		**As Required**		
Replace riprap where underlying filter fabric is showing or where stones have dislodged.		**As Required**		
Culverts:				
Inspect culvert inlet, outlet, and structure.	**X**			
Remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit.		**As Required**		
Repair any erosion damage at the culvert's inlet and outlet.		**As Required**		

CMP Moxie Gore Station				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		**Inspector Initials and Date**	**Inspector Comments**
	Quarterly Inspection	**Maintenance**		
Roadway Surfaces:				
Inspect access road surfaces and shoulders for erosion, false ditches, and excess accumulation of sand that could impede water flow.	**X**			
Remove excess sand either manually or with a front-end loader.		**As Required**		
Grade gravel roads and shoulders.		**As Required**		
Transition Station Yard:				
Inspect for existing or developing erosion, rutting, trash, and unwanted vegetation.	**X**			
Correct any erosion/rutting and/or remove trash or vegetation.		**As Required**		
Water Quality Treatment Buffers:				
Inspect treatment buffers for evidence of erosion, concentrated flow, or encroachment by development.	**X**			
Manage the buffer's vegetation consistent with the requirements in any deed restrictions.		**As Required**		
Repair any sign of erosion within a buffer.		**As Required**		
Inspect and repair down-slope of all level spreaders and turn-outs for erosion.	**X**			

CMP Moxie Gore Station				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		**Inspector Initials and Date**	**Inspector Comments**
	Quarterly Inspection	**Maintenance**		
Maintenance Needed and When:				

APPENDIX 12-4

Buffer Declaration of Restrictions

3. Meadow buffer

DECLARATION OF RESTRICTIONS (Non-Wooded Meadow Buffer)

THIS DECLARATION OF RESTRICTIONS is made this _____day of _____, 20___, by
_____, _____
(name) (street address)
_____, _____County, Maine,_____, (herein referred to as the
(city or town) (county) (zip code)
"Declarant"), pursuant to a permit received from the Maine Department of Environmental Protection under the Stormwater Management Law, to preserve a buffer area on a parcel of land near
_____, _____ .
(road name) (known feature and/or town)

WHEREAS, the Declarant holds title to certain real property situated in _____, Maine
(town)
described in a deed from _____ to _____, dated
(name) (name of Declarant)
_____, 20____, and recorded in Book ____ Page ____ at the _____County Registry of Deeds, herein referred to as the "property"; and

WHEREAS, Declarant desires to place certain restrictions, under the terms and conditions herein, over a portion of said real property (hereinafter referred to as the "Restricted Buffer") described as follows: (Note: Insert description of restricted buffer location here)

WHEREAS, pursuant to the Stormwater Management Law, 38 M.R.S. Section 420-D and Chapter 500 of rules promulgated by the Maine Board of Environmental Protection ("Stormwater Management Rules"), Declarant has agreed to impose certain restrictions on the Restricted Buffer Area as more particularly set forth herein and has agreed that these restrictions may be enforced by the Maine Department of Environmental Protection or any successor (hereinafter the "MDEP"),

NOW, THEREFORE, the Declarant hereby declares that the Restricted Buffer Area is and shall forever be held, transferred, sold, conveyed, occupied and maintained subject to the conditions and restrictions set forth herein. The Restrictions shall run with the Restricted Buffer Area and shall be binding on all parties having any right, title or interest in and to the Restricted Buffer Area, or any portion thereof, and their heirs, personal representatives, successors, and assigns. Any present or future owner or occupant of the Restricted Buffer Area or any portion thereof, by the acceptance of a deed of conveyance of all or part of the Covenant Area or an instrument conveying any interest therein, whether or not the deed or instrument shall so express, shall be deemed to have accepted the Restricted Buffer Area subject to the Restrictions and shall agree to be bound by, to comply with and to be subject to each and every one of the Restrictions hereinafter set forth.

1. **Restrictions on Restricted Buffer Area**. Unless the owner of the Restricted Buffer Area, or any successors or assigns, obtains the prior written approval of the MDEP, the Restricted Buffer Area must remain undeveloped in perpetuity. To maintain the ability of the Restricted Buffer Area to filter and absorb stormwater, and to maintain compliance with the Stormwater Management Law and the permit issued thereunder to the Declarant, the use of the Restricted Buffer Area is hereinafter limited as follows.

   a. No soil, loam, peat, sand, gravel, concrete, rock or other mineral substance, refuse, trash, vehicle bodies or parts, rubbish, debris, junk waste, pollutants or other fill material will be placed, stored or dumped on the Restricted Buffer Area, nor may the topography or the natural mineral soil of the area be altered or manipulated in any way;

   b. A dense cover of grassy vegetation must be maintained over the Restricted Buffer Area, except that shrubs, trees and other woody vegetation may also be planted or allowed to grow in the area. The Restricted Buffer Area may not be maintained as a lawn or used as a pasture. If vegetation in the Restricted Buffer Area is mowed, it may be mown no more than two times per year.

   c. No building or other temporary or permanent structure may be constructed, placed or permitted to remain on the Restricted Buffer Area, except for a sign, utility pole or fence (whether constructed of wood, steel or other materials) and appurtenant equipment such as guys and guy anchors;

   d. No trucks, cars, dirt bikes, ATVs, bulldozers, backhoes, or other motorized vehicles or mechanical equipment may be permitted on the Restricted Buffer Area, except for vehicles used in mowing;

   e. Any level lip spreader directing flow to the Restricted Buffer Area must be regularly inspected and adequately maintained to preserve the function of the level spreader.

   Any activity on or use of the Restricted Buffer Area inconsistent with the purpose of these Restrictions is prohibited. Any future alterations or changes in use of the Restricted Buffer Area must receive prior approval in writing from the MDEP. The MDEP may approve such alterations and changes in use if such alterations and uses do not impede the stormwater control and treatment capability of the Restricted Buffer Area or if adequate and appropriate alternative means of stormwater control and treatment are provided.

2. **Enforcement**. The MDEP may enforce any of the Restrictions set forth in Section 1 above.

3. **Binding Effect**. The restrictions set forth herein shall be binding on any present or future owner of the Restricted Buffer Area. If the Restricted Buffer Area is at any time owned by more than one owner, each owner shall be bound by the foregoing restrictions to the extent that any of the Restricted Buffer Area is included within such owner's property.

4. **Amendment**. Any provision contained in this Declaration may be amended or revoked only by the recording of a written instrument or instruments specifying the amendment or the revocation signed by the owner or owners of the Restricted Buffer Area and by the MDEP.

5. **Effective Provisions of Declaration**. Each provision of this Declaration, and any agreement, promise, covenant and undertaking to comply with each provision of this Declaration, shall be deemed a land use restriction running with the land as a burden and upon the title to the Restricted Buffer Area.

6. **Severability**. Invalidity or unenforceability of any provision of this Declaration in whole or in part shall not affect the validity or enforceability of any other provision or any valid and enforceable part of a provision of this Declaration.

7. **Governing Law**. This Declaration shall be governed by and interpreted in accordance with the laws of the State of Maine.

_____
(NAME)

STATE OF MAINE, _____, County, dated _____, 20__ .
(County)

Personally appeared before me the above named _____, who swore to the truth of the foregoing to the best of (his/her) knowledge, information and belief and acknowledged the foregoing instrument to be (his/her) free act and deed.

_____
Notary Public

_____