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Plymouth Mill
PO Box 747
Highway 149 North
Plymouth, NC 27962
T 252-793-8111
www.domtar.com

Fac/Perm/Co 9401 | Date 12-3-12 | Doc ID# 17784

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SOLID WASTE SECTION
ASHEVILLE REGIONAL OFFICE

APPROVED DOCUMENT
Division of Waste Management
Solid Waste Section
Date **October 4, 2013** By **LY Frost**

November 15, 2012

Mr. Larry Frost
Environmental Engineer
North Carolina Division of Waste Management
Solid Waste Division
Permitting Branch
2090 US Highway 70
Swannanoa, NC 28778

Certified Mail
Return Receipts Requested

Subject: Permit Renewal Request for Industrial Solid Waste Landfill Facility Permit No. 9401
Domtar Paper Company, LLC – Plymouth, NC

Dear Larry:

We are submitting this Permit Modification request in conjunction with the Five Year Permit Renewal for the On-site Industrial Waste Landfill No. 3. The final cap design for the final build-out of the landfill has been revised for Phases 2 through 18 to incorporate the use of slope drains instead of articulated block channels, reduce the number of drainage terraces, remove the geosynthetic clay liner from the cap, and increase the protective cover soil to 18 inches. The Permit Modification request includes updated Operations Plan, Closure/Post-Closure Plan, stability analysis, and erosion and sediment calculations directly related to these changes. In efforts to be consistent with the original approved design; the background and site specific data used in Joyce Engineering's current calculations, model analysis, and landfill design were obtained from the approved permit application *[Phase 3 And Phase 4 Construction Plan Application, On-Site Industrial Waste Landfill No. 3 Domtar Paper Company, LLC (Formerly Weyerhaeuser Company), Plymouth North Carolina, June 2008, Revised August 2009, August 2010, And November 2010)].*

We would also like to request a revision of the language in Attachment 3, Condition 4: We are permitted to receive solid waste generated by Domtar and Weyerhaeuser Plymouth Lumber Technology Facility. In addition to updating Attachment 3, Condition 4, we would like to have Attachment 3, Condition 19b(ii) and Condition 19b(iii) removed from the permit. It was previously approved by NCDENR to omit listing the amount of waste by specific waste type and disposal location within the facility in the annual reports.

If you have any questions or require any additional information pertaining to this report, please contact me by phone, (252) 793-8163 or by email, kari.cahoon@domtar.com.

Sincerely,

Kari Cahoon

Kari Cahoon
Environmental Engineer

xc: Department files
Enclosure: (2) Domtar Paper Company, LLC. On site Industrial Waste Landfill No.3 Revised Cap Design

FINANCIAL RESPONSIBILITY/OWNERSHIP FORM
SEDIMENTATION POLLUTION CONTROL ACT

No person may initiate any land-disturbing activity on one or more acres as covered by the Act before this form and an acceptable erosion and sedimentation control plan have been completed and approved by the Land Quality Section, N.C. Department of Environment and Natural Resources. (Please type or print and, if the question is not applicable or the e-mail and/or fax information unavailable, place N/A in the blank.)

Part A.

1. Project Name Domtar Paper Company, LLC

2. Location of land-disturbing activity: County Washington & Martin City or Township Plymouth

   Highway/Street NC Hwy 149 North Latitude 35 50'20" Longitude 76 46'42

3. Approximate date land-disturbing activity will commence: Not Applicable

4. Purpose of development (residential, commercial, industrial, institutional, etc.): Industrial

5. Total acreage disturbed or uncovered (including off-site borrow and waste areas): 0

6. Amount of fee enclosed: $ 0 . The application fee of $65.00 per acre (rounded up to the next acre) is assessed without a ceiling amount (Example: a 9-acre application fee is $585).

7. Has an erosion and sediment control plan been filed? Yes X No _____ Enclosed X

8. Person to contact should erosion and sediment control issues arise during land-disturbing activity:

   Name Kari Cahoon E-mail Address Kari.Cahoon@domtar.com

   Telephone (252) 793-8163 Cell # _____ Fax # (252) 793-8871

9. Landowner(s) of Record (attach accompanied page to list additional owners):

   Domtar Paper Company, LLC. (252) 793-8111 (252)793-8871
   Name Telephone Fax Number

   PO Box 747 NC Highway 149 North
   Current Mailing Address Current Street Address

   Plymouth NC 27962 Plymouth NC 27962
   City State Zip City State Zip

10. Deed Book No. 443 Page No. 592 Provide a copy of the most current deed.

Part B.

1. Person(s) or firm(s) who are financially responsible for the land-disturbing activity (Provide a comprehensive list of all responsible parties on an attached sheet):

   Dennis Askew Dennis.Askew@domtar.com
   Name E-mail Address

   PO Box 747 NC Highway 149 North
   Current Mailing Address Current Street Address

   Plymouth NC 27962 Plymouth NC 27962
   City State Zip City State Zip

   Telephone (252) 793-8100 Fax Number (252) 793-8871

2. (a) If the Financially Responsible Party is not a resident of North Carolina, give name and street address of the designated North Carolina Agent:

Name	E-mail Address
Current Mailing Address	Current Street Address
City State Zip	City State Zip
Telephone	Fax Number

(b) If the Financially Responsible Party is a Partnership or other person engaging in business under an assumed name, **attach a copy of the Certificate of Assumed Name.** If the Financially Responsible Party is a Corporation, give name and street address of the Registered Agent:

Name of Registered Agent	E-mail Address
Current Mailing Address	Current Street Address
City State Zip	City State Zip
Telephone	Fax Number

The above information is true and correct to the best of my knowledge and belief and was provided by me under oath (This form must be signed by the Financially Responsible Person if an individual or his attorney-in-fact, or if not an individual, by an officer, director, partner, or registered agent with the authority to execute instruments for the Financially Responsible Person). I agree to provide corrected information should there be any change in the information provided herein.

Dennis Askew	Mill Manager
Type or print name	Title or Authority
Dennis Askew PJ	11/14/2012
Signature	Date

I, Shirley V. Davenport, a Notary Public of the County of Washington State of North Carolina, hereby certify that Dennis Askew appeared personally before me this day and being duly sworn acknowledged that the above form was executed by him.

Witness my hand and notarial seal, this 14 day of November, 2012

Shirley V. Davenport
Notary

Seal

My commission expires 01-30-2015

JOYCE ENGINEERING

2211 W. Meadowview Rd., #101
Greensboro, NC 27407
tel: 336/323-0092
fax: 336/323-0093
www.JoyceEngineering.com

November 16, 2012

Mr. Larry Frost
Environmental Engineer
NCDENR Division of Waste Management
Solid Waste Section – Permitting Branch
2090 U.S. Highway 70
Swannanoa, North Carolina 28778

RE: Permit Renewal/ Modification
Domtar Paper Company, LLC.
On-site Industrial Waste Landfill No. 3, Permit No. 9401
Plymouth, North Carolina
JEI Project No. 853.1201.11 Task 01

Dear Mr. Frost:

On behalf of the Domtar Paper Company, LLC. (Domtar), Joyce Engineering (JOYCE) is submitting this Permit Modification request in conjunction with the Five Year Permit Renewal for the On-site Industrial Waste Landfill No. 3. The final cap design for the final build-out of the landfill has been revised for Phases 2 through 18 to incorporate the use of slope drains instead of articulated block channels, reduce the number of drainage terraces, remove the geosynthetic clay liner from the cap, and increase the protective cover soil to 18 inches. The Permit Modification request includes updated Operations Plan, Closure/Post-Closure Plan, stability analysis, and erosion and sediment calculations directly related to these changes. In efforts to be consistent with the original approved design; the background and site specific data used in JOYCE's current calculations, model analysis, and landfill design were obtained from the approved permit application *[Phase 3 And Phase 4 Construction Plan Application, On-Site Industrial Waste Landfill No. 3 Domtar Paper Company, LLC (Formerly Weyerhaeuser Company), Plymouth North Carolina, June 2008, Revised August 2009, August 2010, And November 2010)]*.

At this time, Domtar would also like to request a revision of the language in Attachment 3, Condition 4: The facility is permitted to receive solid waste generated by Domtar and Weyerhaeuser Plymouth Lumber Technology Facility. In addition to updating Attachment 3, Condition 4, Domtar would like to have Attachment 3, Condition 19b(ii) and Condition 19b(iii) removed from the permit. It was previously approved by NCDENR to omit listing the amount of waste by specific waste type and disposal location within the facility in the annual reports.

If you have any questions regarding these documents, please do not hesitate to contact me at (336) 790-0038 or cmitchell@joyceengineering.com.

Sincerely,
JOYCE ENGINEERING, INC.

Carrie T. Mitchell, P.E.
Project Consultant

Enclosures

C: Kari Cahoon, Domtar Paper Company, LLC. (w/o enclosure)

***PREPARED FOR*:**

DOMTAR PAPER COMPANY, LLC
HIGHWAY 149 NORTH
PLYMOUTH, NC 27962

DOMTAR PAPER COMPANY, LLC
ON-SITE INDUSTRIAL WASTE LANDFILL NO. 3
PLYMOUTH, NORTH CAROLINA
PERMIT NO. 94-01

2012 PERMIT RENEWAL
REVISED CAP DESIGN REPORT

NOVEMBER 2012

***PREPARE BY*:**

JOYCE ENGINEERING

2211 WEST MEADOWVIEW ROAD, SUITE 101
GREENSBORO, NORTH CAROLINA
NC LICENSE NUMBER C-0782
PHONE: (336) 323-0092
FAX: (336) 323-0093

JOYCE PROJECT NO. 853.1201.11.01

NORTH CAROLINA PROFESSIONAL SEAL 037933 11/14/12 ENGINEER CARRIE T. MITCHELL

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INTRODUCTION

The purpose of this document is to outline sections of the original permit documents submitted by RMT North Carolina, Inc. [Phase 3 And Phase 4 Construction Plan Application, On-Site Industrial Waste Landfill No. 3 Domtar Paper Company, LLC (Formerly Weyerhaeuser Company), Plymouth North Carolina, June 2008, Revised August 2009, August 2010, And November 2010)] that have been modified by Joyce Engineering (JOYCE) for the Landfill No. 3 revised cap design. This facility is located in Plymouth, North Carolina off Highway 149. Waste generated by Domtar and Weyerhaeuser Plymouth Lumber Technology Facility is placed in the active on-site landfill. RMT North Carolina, Inc. (RMT) prepared the original landfill design. At the request of Domtar, JOYCE has revised the cap design for phases 2 through 18. The following sections highlight changes made to the original design.

SUMMARY OF REVISIONS

The following revisions w made to the landfill cap design:

- Removal of the geosynthetic clay liner (GCL) layer from the cap;
- Increasing the vegetative support layer from 12 inches to 18 inches;
- Require the use of geocomposite material with a minimum transmissivity of 4×10^{-4} m^2/sec;
- Replace the drainage terrace system and articulated block drainage channels with slope drains and a single drainage bench to control runoff from the cap; and
- Final elevation change from 156 ft. to 176 ft. due to removal of drainage terraces.

In efforts to be consistent with the original approved design, the background and site-specific data used in JOYCE's current calculations, model analysis, and landfill design were obtained from the original permit application. The documents included in the Revised Cap Design report should be used in conjunction with the approved permit application. It should be noted that the original design for Landfill No. 3 was to overlap Landfill No. 2. The capacity for the larger landfill is the permitted capacity. Therefore, with these modifications, the landfill is still within the permitted waste capacity. Documents supporting these revisions can be found in the appendices of this report. In addition to the supporting documents, the following information should supplement and amend sections of the original report plan.

Section 4 Engineering Design

Section 4.1 Design Variances – Final Grade Slopes

The portion of this section that is affected by the revised cap design is the statement "15-foot wide intermediate drainage terraces for every 20-foot rise in elevation" and Joyce recommends:

- **Final grade slopes**: Domtar proposes final landfill grades constructed at 3 (horizontal): 1 (vertical), with a 15-foot wide drainage bench at the 100 elevation. Revised calculations indicate that this design change result in an acceptable factor of safety against slope failure (see Section 4.2.2 for additional information).

Section 4.2.2, Liner and Cap Stability

This section should omit reference to Landfill No. 3 overlapping Landfill No. 2. The two landfills will not be conjoined. As previously mentioned, the original permit design enveloped a much larger footprint than the most recently approved design. The stability of the revised cap system was evaluated by examining potential for veneer, global circular and block type failures. Calculations for these analyses are found in Appendix E. The analyses indicate that the proposed cap system will be stable. The factors of safety are as listed: veneer 1.52, global circular 2.01, and block 2.21. The physical properties were assumed and/or based on previous permitting documents. Laboratory testing of actual materials proposed for use in constructing the cap will be completed prior to use to verify that the materials meet the specified parameters for stability.

Section 4.5, Cover System

References to the geosynthetic clay liner, grass swales, and articulated block drainage channels in this section are no longer valid.

JOYCE recommends that the final cover system be constructed after the waste has reached final grades. Domtar proposes a final cover system that includes the following elements from bottom to top:

- 12-inch select ash foundation layer
- 40-mil linear low-density polyethylene (LLDPE) textured geomembrane liner
- Geocomposite drainage layer
- 18 inches general fill (vegetation support layer)
- 6 inches top soil

Suitable vegetation will be placed on the top layer to protect the final cover system against erosion and to enhance evapotranspiration. In order to promote surface runoff, the final cover will be sloped a minimum of 5 percent at the top and a maximum of 33 percent at the sideslopes.

A portion of the precipitation falling on the closed landfill will be lost to runoff and evapotranspiration. Of the original permit document, Appendix G Water and Mass Balance Calculations, demonstrates that this amount could be as much as 15 percent. The remainder will be intercepted by the geocomposite drainage layer and diverted to the drainage bench. The drainage bench will convey this precipitation to slope drains located on the exterior face of the landfill and ultimately into a sediment basin.

Section 4.7, Erosion Control Plan

References to a "terrace system" are no longer valid.

JOYCE recommends to preserve the integrity of the final cover, a suitable stand of grass be planted over the majority of the landfill. In addition, surface water will be controlled by the use of diversion berms, slope drains, benches and conveyance channels. The bench will be placed at an elevation of 100 feet on the sideslopes. The bench will collect the stormwater and will route the runoff to slope drains which will convey the runoff in to the storm water conveyance channel network and ultimately into a sediment basin/detention pond. The calculations for the design of the revised drainage system are included in Appendix L, Stormwater/Erosion and Sedimentation Calculations. These calculations show that the revised system will be able to use the channels and basins that were approved in the previous permit as the drainage areas have not increased.

As in the original design, temporary measures will be implemented during construction to reduce erosion. These measures include silt fences at the perimeter of the cell, hay bales in the bench before the cap is placed, and sediment traps at borrow areas.

These measures, both permanent and temporary, have been designed by JOYCE and RMT to reduce the amount of erosion on the landfill. Detention basins have been designed to attenuate the runoff from the finished landfill to the peak runoff rate of the existing terrain. The calculations for the design of these basins are included in Appendix L, Stormwater/Erosion and Sedimentation Calculations.

Finally, the area will be fertilized, seeded, and mulched in accordance with North Carolina Department of Transportation specifications. Completed areas will be revegetated in a timely manner so as to minimize erosion of the finished surface.

Section 7: Closure/ Post-closure

Section 7.1, Closure Method

Any reference to the geosynthetic clay layer (GCL) is no longer valid.

JOYCE recommends waste continue to be placed as discussed in the approved permit application (Section 5, Operating Procedures) until final grades are reached. Once the surface is at the appropriate elevation, a 12-inch intermediate layer of select waste will then be placed, compacted, and graded. This layer will serve as a smooth support layer for the textured 40-mil LLPDE geomembrane. A geocomposite drainage layer will be placed over the textured geomembrane. The textured geomembrane will provide greater friction at the interface with the geotextile component of the geocomposite than a smooth geomembrane would. This enhanced interface friction provides additional stability to the cover system on the 3 (horizontal): 1 (vertical) sideslopes.

The final component of the cover system is the 24-inch thick vegetative layer. This layer will consist of 18 inches of general fill soil and 6 inches of topsoil capable of supporting vegetative growth. In addition, the sedimentation basins will be cleaned of sediment build-up within the basin as necessary, and this sediment, which will consist of the material eroded from the cover, will be blended into the vegetative layer.

JOYCE's 2012 Permit Renewal Revised Cap Design (Drawing No. P-02 Final Cap Design) shows the final grades for the landfill. The sideslopes are designed to be no steeper than 3 (horizontal): 1 (vertical). The top of the final cover is sloped at 5 percent minimum. Detailed information regarding the landfill closure is provided in Appendix N.

Appendix E: Slope Stability Analysis

This section has been revised to include the slope stability analyses results based on the revised cap design. The XSTABL program was used to analyze the slope stability. The analyses results were all above the industry accepted standard of 1.5 in the following factors of safety: veneer, global circular and blocking.

Appendix L: Stormwater/Erosion and Sedimentation Calculations

The post development stormwater calculations have been revised for the northwest, east, and west areas of Landfill No. 3 to reflect the change in the cap design. The HydroCAD stormwater model was used to determine the peak flows from the drainage area. The calculated peak flows do not exceed the designed ponds flow rates. Since the slope drains and diversion berms are incorporated into the revised final cap design, Attachment L8 and L9 are no longer valid since the articulated block drainage channel will no longer be used. The post-development design calculations are included as Appendix 2 of the Revised Cap Design Erosion and Sediment Control Plan.

Appendix M: Operations Plan

The Operations Plan was updated to provide efficient operations at the on-site landfill. It reflects the general facility operations, site operations management, erosion and sediment control, vegetation management as well as the potential for Domtar to incorporate agricultural utilization and/or other beneficial reuse applications into its operations.

Appendix N: Closure/Post-closure Plan

The Closure/Post-closure Plan outlines the closing sequence of Phases 2, 3 and 4 of Landfill No. 3. The Plan has been updated to address the potential of closing Landfill No. 3 at the current phases. The revisions also reflect the changes in the final cover system design and updated closure and post-closure care cost estimates.

Appendix P: Construction Quality Assurance Plan Phases 3 and 4 Construction – Landfill No. 3

The sections of this plan affected by JOYCE's revised final cap design are as follow:

Section 10 Geosynthetic Clay Liner

Section 10.1, Introduction

References to GCL in the final cover system are no longer

This section of the CQA plan applies to the geosynthetic clay liner used in the landfill base composite liner. This section is divided into three major subheadings, which cover the quality assurance requirements for pre-installation (includes the GCL manufacturer), installation, and post-installation (includes the final examination of GCL prior to the placement of the geomembrane). The terms pre-installation, installation, and post-installation are applicable only to the GCL installation and do not apply to the overall construction of the landfill facility.

Section 11 Geocomposites

*Table 11-1, Geocomposite Acceptance Specifications***,** the table has been revised for the final cover geocomposite transmissivity which should be a minimum of 4.0×10^{-4} m^2/sec to satisfy the revised cap design requirements.

APPENDIX E

SLOPE STABILITY ANALYSIS

E1 – SLOPE STABILITY FINDINGS

FINAL COVER VENEER FAILURE ANALYSIS

OBJECTIVE

Calculate the shear strength that will provide an unsaturated veneer slope stability factor of safety (FS) ≥ 1.5 with respect to the geocomposite drainage layer / soil protective cover layer failing along the final cover 3H:1V sideslopes. The calculation will also consider the presence of heavy equipment placing and spreading the protective cover material across the sideslope.

METHODOLOGY

The analytical method used to calculate the veneer slope stability FS is taken from a report prepared by the Geosynthetic Research Institute (GRI), Drexel University:

1) "*Cover Soil Slope Stability Involving Geosynthetic Interfaces*", (GRI REPORT #18), by Te-Yang Soong and Robert M. Koerner, December 9, 1996 and

GRI Report #18 is used to consider the presence of equipment on top of the protective cover layer and provides a FS based on the most critical interface shear strength of final cover components. The spreadsheet calculates a FS by dividing the protective cover material along the 3H:1V sideslope into two blocks:

1) an active wedge of protective cover material along the length of the sideslope; and
2) a passive wedge of protective cover material at the toe of the sideslope.

A freebody diagram is then drawn identifying the forces on each wedge and static equilibrium equations are resolved in terms of vertical and horizontal components. Expressions are derived that quantify the magnitude of both the passive and active interwedge forces. Subsequently, the interwedge force equations are set equal to each other and are arranged in the form of a quadratic equation that can be solved to calculate a FS.

This calculation analyzes the longest length of the 3H:1V final cover sideslope between benches. Figure 1 illustrates the proposed geometry of the final cover sideslope and the freebody of the forces acting along the sideslope.

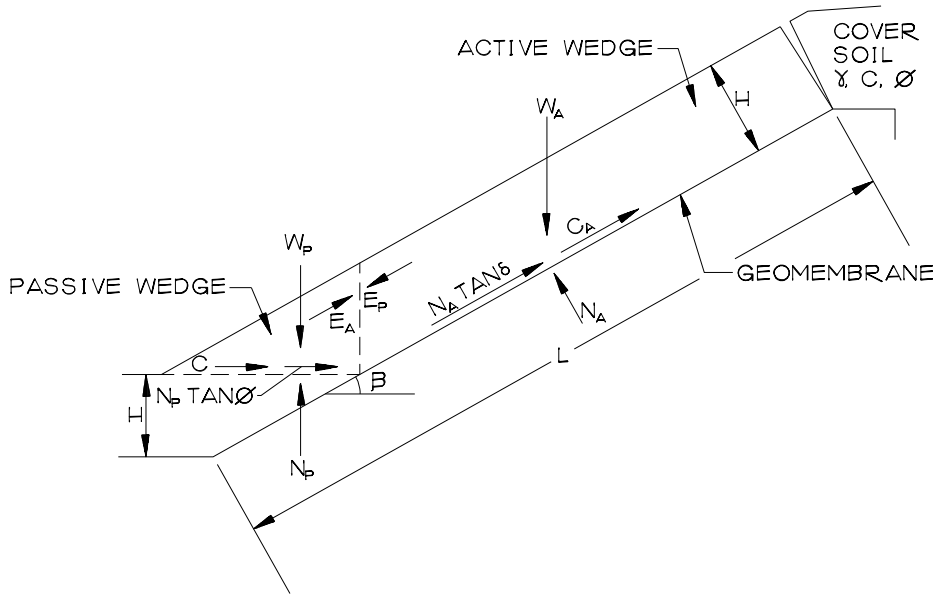


Figure 1, Slope Geometry & Free Body Diagram

Slope Dimensions	
Maximum Length of Sideslope (along the length of the geomembrane)	230 feet
Sideslope Orientation	3H:1V or 18.43 degrees

This veneer slope stability FS calculation is prepared proposing the following assumptions:

- The presence of moving equipment (dynamic loading) along the 3H:1V protective cover sideslope is analyzed within GRI Report #18.
- The shear strength component of adhesion developed between geosynthetic material layers is ignored.
- Tensile strength of the geosynthetic materials contributing to the veneer slope stability FS is ignored.
- The protective cover material provides a buttress at the toe of the slope, i.e. the passive soil wedge.
- For conservatism, the cohesive strength of the proposed protective cover material was ignored.
- Weights of the geosynthetic components are negligible compared to the weight of protective cover material and therefore are not considered in the calculations.
- All calculations will utilize a 1-foot unit width of sideslope.

PROPOSED FINAL COVER

The proposed Final Cover System is outlined below, from top to bottom:

- 6 inches of Vegetative Soil;
- 18 inches of Protective Soil
- Geocomposite Drainage Layer (geotextile heat bonded to both sides of a geonet);
- Textured 40-mil LLDPE Flexible Membrane Liner (FML); and
- 1-foot thick Selected Waste Layer.

PROTECTIVE COVER MATERIAL PARAMETERS

Unit weight: γ_{Total} = 130 pcf;

Cohesion: c = 0 psf; and
Internal angle of friction: ϕ_i = 28.0 degrees

REQUIRED SHEAR STRENGTH PARAMETERS

The calculation spreadsheet presented within GRI Report #18 will be used to determine the shear strength parameter (contact interface friction angle, $\delta_{interface\ friction}$) that corresponds to a FS ≥ 1.5 under drained conditions for all geosynthetic interfaces. The input variables of final cover sideslope length, protective cover, and LGP equipment will be held constant within the spreadsheet while the contact interface friction angle, $\delta_{interface\ friction,}$ is varied until a FS of ≥ 1.5 is achieved. To be conservative, cohesion values of 0 psf will be entered.

The calculated $\delta_{interface\ friction}$ that corresponds to the FS ≥ 1.5 represents laboratory data where a straight line is drawn from the origin through the first data point (i.e. c = 0 psf) that corresponds to the lowest normal load within the given data set. The lowest normal load models the shear strength of protective cover material under relatively light normal loads that are anticipated to be initially encountered in the field during placement of the material. With respect to the protective cover, normal loads representative of 18 inches of protective cover are appropriate. The proposed critical contact interface will undergo ASTM D-5321-92 Direct Shear Testing and will be required to meet the minimum calculated contact interface friction angle corresponding to the first normal load.

The resulting contact interface friction angles will be included with other minimum shear strength parameters specified within the Construction Quality Assurance (CQA) Plan and/or specifications.

VARIABLES DEFINED

W_A = Total weight of the active wedge;
W_P = Total weight of the passive wedge;
N_A = Effective force normal to the failure plane of the active wedge;
N_P = Effective force normal to the failure plane of the passive wedge;
γ = Unit weight of the leachate collection/protective cover material;
h = Thickness of the leachate collection/protective cover material;
L = Length of slope measured along the geomembrane;
β = Soil slope angle beneath the geomembrane;
ϕ = Internal angle of friction within the protective cover soil;
δ = Interface friction angle between the most critical geosynthetic interface;
C_a = Adhesive force between the components lying along the most critical geosynthetic interface of the active wedge;
c_a = The adhesion developed between the components lying along the most critical geosynthetic interface of the active wedge;
C = Cohesive force along the failure plane of the passive wedge;
c = cohesion of the protective cover soil;
E_A = Interwedge force acting on the active wedge from the passive wedge;
E_P = Interwedge force acting on the passive wedge from the active wedge; and
FS = Factor of safety against protective cover soil sliding down the slope.

CALCULATIONS

It is proposed that a Low Ground Pressure (LGP) bulldozer will be used to place protective cover material across the sideslope. The pressure exerted upon the top of the geosynthetic layers by a bulldozer is modeled as illustrated in Figure 2 thus the bulldozer will not operate over the geosynthetic layers until the 18-inch thick protective cover material layer is placed.

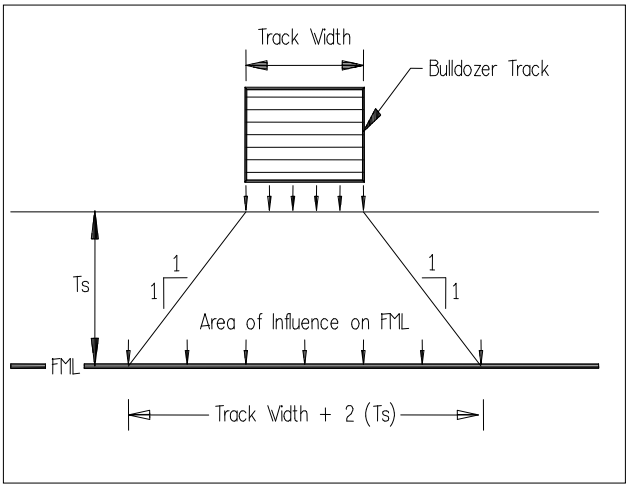


Figure 2, Stress Distribution of the LGP Bulldozer upon the Geosynthetic Layers

The following typical LGP Bulldozer equipment specifications are used within the GRI Report #18.

- 2 tracks
- Track length = 9.4 feet
- Track width = 3.0 feet
- Operating weight = 38,300 lbs
- One Track Contact area = 28.2 ft^2
- One Track Contact pressure = 19,150 lbs / 28.2 ft^2 = 679.1 psf

Subsequently, the forces illustrated in Figure 1 are resolved below to produce a veneer slope stability FS. The equations presented are taken from pages 13 and 14 of GRI Report #18.

$$W_a = \gamma h^2 \left[\frac{L}{h} - \frac{1}{\sin\beta} - \frac{\tan\beta}{2} \right]$$

$$N_a = W_a \cos\beta$$

$$C_a = c_a \left[L - \frac{h}{\sin\beta} \right]$$

Balancing the forces in the vertical direction, the following formulation results:

$$E_A \sin\beta = W_A - N_A \cos\beta - \frac{N_A \tan\delta + C_a}{FS} \sin\beta$$

The interwedge force acting on the active wedge is:

$$E_A = \frac{FS \cdot (W_A - N_A \cos\beta) - (N_A \tan\delta + C_a)\sin\beta}{\sin\beta \, FS}$$

The passive wedge can be considered in a similar manner:

$$W_p = \frac{\gamma h^2}{\sin 2\beta}$$

$$N_p = W_p + E_p \sin\beta$$

$$C = \frac{c\,h}{\sin\beta}$$

Balancing the forces in the horizontal direction produces:

$$E_p \cos\beta = \frac{C + N_p \tan\phi}{FS}$$

The interwedge force acting on the passive wedge is:

$$E_p = \frac{C + W_p \tan\phi}{\cos\beta\,(FS) - \sin\beta \tan\phi}$$

Setting $E_A = E_p$ the equation can be arranged in the form of the quadratic equation:

$$a(FS)^2 + b(FS) + c = 0$$

Where the coefficients a, b and c are equal to the following expressions:

$$a = (W_A - N_A \cos\beta)\cos\beta$$

$$b = -\left[(W_A - N_A \cos\beta)\sin\beta \tan\phi + (N_A \tan\delta + C_a)\sin\beta \cos\beta + \sin\beta(C + W_p \tan\phi)\right]$$

$$c = (N_A \tan\delta + C_a)\sin^2\beta \tan\phi$$

The quadratic equation is then used to calculate the FS:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

For the ease of calculations the above quadratic equation was input into a spreadsheet format to produce a FS corresponding to a given set of input parameters. A copy of the spreadsheet calculations displaying the results is included in Attachment A.

CONCLUSIONS

Utilizing a contact interface shear strength friction angle of 26.4 degrees resulted in a veneer slope stability FS equal to 1.517 while the equipment is static. While the equipment is placing the protective cover, a veneer slope stability FS equal to 1.434 was calculated. Additional assumptions include:

- The presence of an equipment load along the final cover sideslope, equipment pushes material from toe towards the crest;
- The shear strength component of adhesion/cohesion between the protective cover material and nonwoven geotextile cushion does not exist;

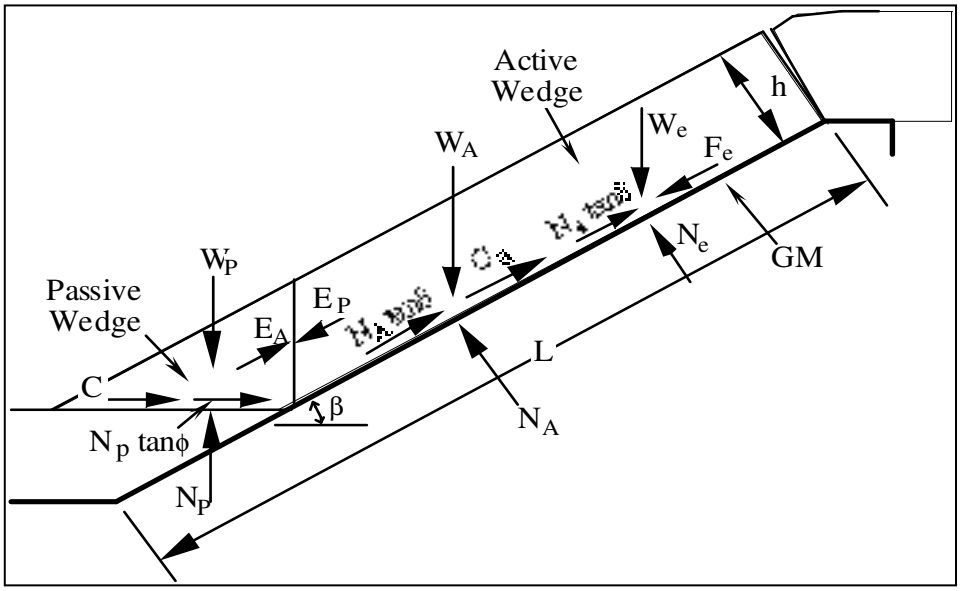
- Geosynthetic materials are not in tension;
- Cohesion does not exist within the cover soil.

ATTACHMENT

SPREADSHEET CALCULATION

Domtar Paper Company - On-Site Industrial Waste Landfill No. 3

Placement of the 2 feet Thick Protective/Vegetative Cover Material Layer
Across the Final Cover Sideslopes with the Incorporation of Static Equipment Loads



Calculation of FS

Active Wedge:

Wa=	*58068.5*	*lb*
Na=	*55090.3*	*lb*

Passive Wedge:

Wp=	*866.9*	*lb*

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

a=	*19273.7*
b=	*-32587*
c=	*5087.2*

FS= 1.517

thickness of protective cover soil = h =	2.00	ft				
pro. cov. mat. slope angle beneath the geomembrane = β =	18.43	°	*= 0.32*	*(rad.)*		
finished protective cover material slope angle = ω =	18.43	°	*= 0.32*	*(rad.)*		
length of slope measured along the geomembrane = L =	230.0	ft				
unit weight of the protective cover soil = γ =	130.0	lb/ft^3				
friction angle of the protective cover soil = ϕ =	28.0	°	*= 0.49*	*(rad.)*		
cohesion of the protective cover soil = c =	0.0	lb/ft^2			*C= 0*	*lb*
critical interface friction angle = δ =	26.40	°	*= 0.46*	*(rad.)*		
adhesion = ca =	0.0	lb/ft^2			*Ca= 0*	*lb*

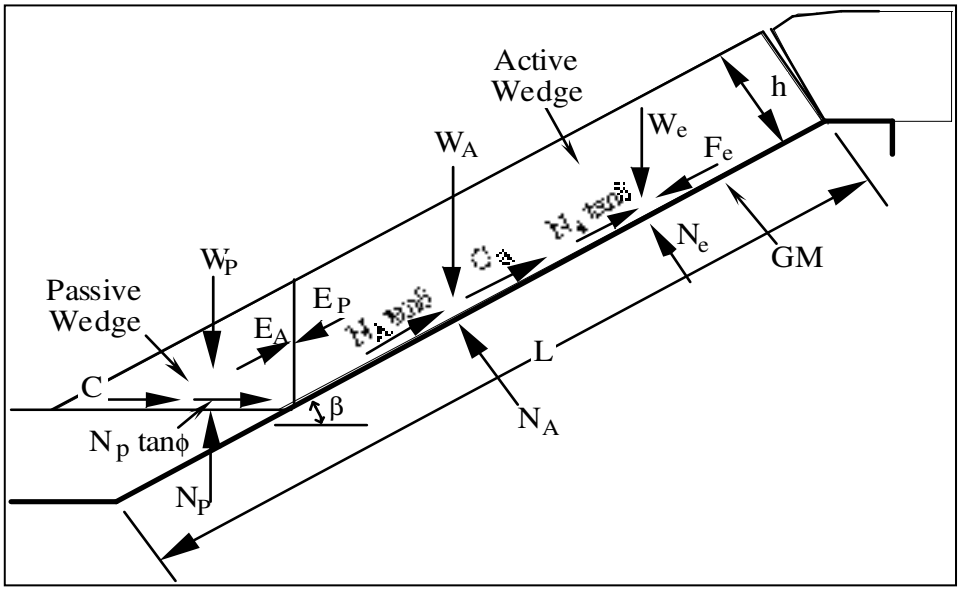
thickness of the protective cover soil = h =	2.00	ft	*b/h=*	*1.5*
equipment ground pressure (= wt. of equipment/(2wb)) = q =	679.1	lb/ft^2	*We=qwI=*	*6192.0*
length of each equipment track = w =	9.4	ft	*Ne=Wecos β=*	*5874.4*
width of each equipment track = b =	3.0	ft	*Fe=We(a/g)=*	*0.0*
influence factor* at geomembrane interface = I =	0.97			
acceleration/deceleration of the bulldozer = a =	0.00	g		

Note: numbers in boxes are input values

numbers in Italics are calculated values

Domtar Paper Company - On-Site Industrial Waste Landfill No. 3

Placement of the 2 Feet Thick Protective/Vegetative Cover Material Layer across the Final Cover Sideslopes with the Incorporation of Moving Equipment Loads



Calculation of FS

Active Wedge:

Wa=	*58068.5*	*lb*
Na=	*55090.3*	*lb*

Passive Wedge:

Wp=	*866.9*	*lb*

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

a=	*20389.9*
b=	*-32785*
c=	*5087.2*

FS= 1.434

thickness of protective cover soil = h =	2.00	ft				
pro. cov. mat. slope angle beneath the geomembrane = β =	18.43	°	*= 0.32*	*(rad.)*		
finished protective cover material slope angle = ω =	18.43	°	*= 0.32*	*(rad.)*		
length of slope measured along the geomembrane = L =	230.0	ft				
unit weight of the protective cover soil = γ =	130.0	lb/ft^3				
friction angle of the protective cover soil = ϕ =	28.0	°	*= 0.49*	*(rad.)*		
cohesion of the protective cover soil = c =	0.0	lb/ft^2			*C= 0*	*lb*
critical interface friction angle = δ =	26.40	°	*= 0.46*	*(rad.)*		
adhesion = ca =	0.0	lb/ft^2			*Ca= 0*	*lb*

thickness of the protective cover soil = h =	2.00	ft	*b/h=*	*1.5*
equipment ground pressure (= wt. of equipment/(2wb)) = q =	679.1	lb/ft^2	*We=qwI=*	*6192.0*
length of each equipment track = w =	9.4	ft	*Ne=Wecos β=*	*5874.4*
width of each equipment track = b =	3.0	ft	*Fe=We(a/g)=*	*1176.5*
influence factor* at geomembrane interface = I =	0.97			
acceleration/deceleration of the bulldozer = a =	0.19	g		

Note: numbers in boxes are input values

numbers in Italics are calculated values

GLOBAL SLOPE STABILITY

OBJECTIVE

The objective of this calculation is to analyze the stability of the Domtar On-Site Landfill No. 3 at final build-out. This analysis will determine the lowest acceptable internal friction angle of the soil liner, and interface friction angles of the soil to geosynthetic or geosynthetic to geosynthetic interfaces that will result in a factor of safety (FS) against deep-seated translational and rotational failures exceeding 1.5 for static conditions and 1.0 for seismic conditions.

METHODOLOGY

Cross Sections A-A Final Grade Slopes

The final grade scenario was considered by preparing a cross-section through the proposed landfill final condition configuration that included the maximum crest height and a sloping landfill basegrade.

CROSS-SECTION GEOMETRY

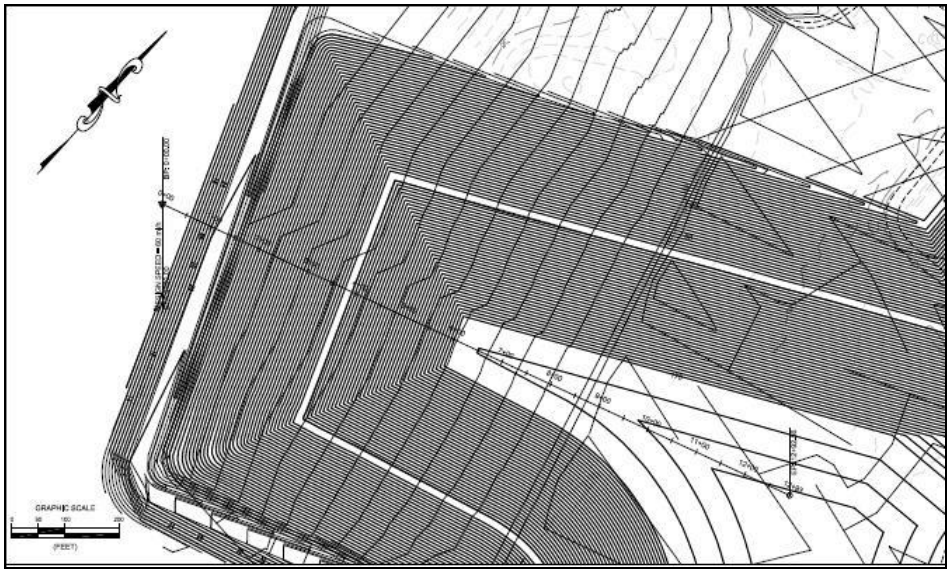
Cross Section A-A – Post Closure Slopes

Cross-section A-A depicts a maximum waste elevation and thickness through the western portion of the landfill. The baseliner is generally sloping in at a minimum of .5 percent.

Since global stability is being analyzed, the final cover system was modeled as one soil unit.

A plan view drawing of the cross section location is provided in Figure 1.

Figure 1



STATIC STABILITY ANALYSIS

The software program used to calculate slope stability FS within this analysis is entitled, "XSTABL" version 5.206, compiled by Interactive Software Designs, Inc. of Moscow, Idaho. It is a version of "PC STABL 5M" written by Purdue University for the Indiana Department of Highways.

The program uses limit equilibrium techniques to determine a FS for each given input cross-section and corresponding data file. XSTABL will calculate FS for both rotational and translational failure surfaces within each cross-section in terms of both static and seismic conditions based upon slope geometry, phreatic surfaces and the shear strength parameters of MSW, soils and the most critical contact interface within the proposed baseliner system. The software is used to analyze both static and seismic conditions.

<u>Bishop's Simplified Method</u>
Bishop's simplified method is a limit equilibrium technique initially used within this analysis by XSTABL to locate the most critical rotational failure surface within the cross-section.

Characteristics of Bishop's Method include:

- Dividing failure mass into a number of slices;
- Satisfies vertical force equilibrium for each slice and overall moment equilibrium about the center of the rotational failure surface;
- Specifically applicable to rotational failure surfaces;
- Considers all interslice shear forces to be horizontal (no interslice shear forces); and
- Produces a conservative FS.

Rankine Method

The Rankine method is a technique used within XSTABL to locate the most critical translational failure surface within the cross-section.

Characteristics of the Rankine Method include:

- The ability to single out a confined zone that may represent a potentially weak layer.
- Generating passive and active portions of the failure surface at angles dependent on the shear strength of the surrounding soil unit;
- Satisfies both vertical force and moment equilibrium for each slice and overall horizontal force equilibrium for the entire wedge;
- Applicable to any shape of failure surface;
- Considers all interslice shear forces to be horizontal (no interslice shear force); and
- Produces a FS that is considerably lower than methods that satisfies all conditions of equilibrium for each slice.

SEISMIC STABILITY ANALYSIS

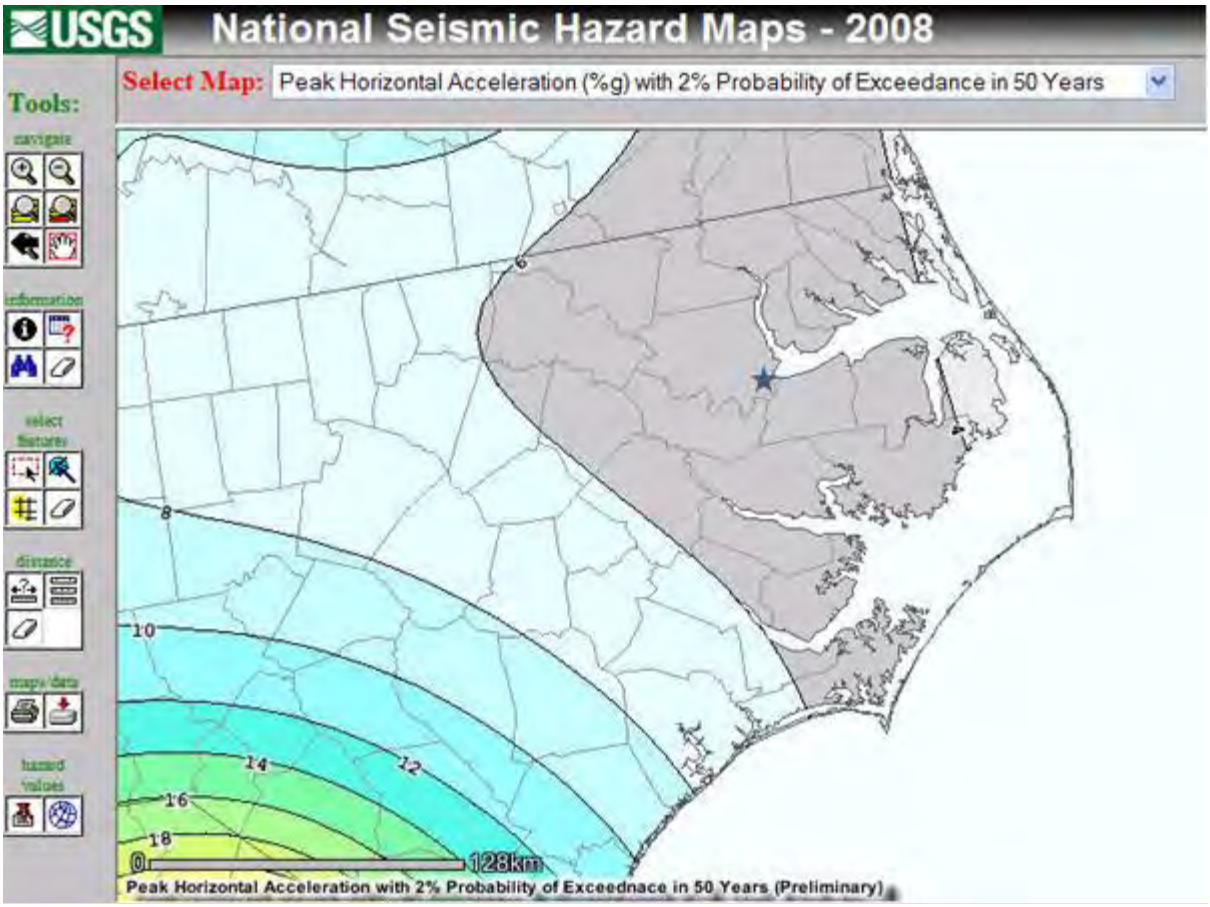
According to 15A NCAC 13B.1622(5)(b)(i), stability evaluation under seismic conditions is required if and only if the landfill is located in a seismic impact zone. A seismic impact zone is defined as follows: "Seismic impact zone" means an area with a ten percent or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 250 years.

The USGS publishes Seismic Hazard Maps based on a 50 year return period. A probability of exceedance of 2% in 50 years is approximately equal to that of 10% in 250. This equivalency is demonstrated by comparing the return periods for each, as shown below.

Return Period(year)=1/(1-(1-Encounter Probability(%)/100)^(1/Period(year))).

Encounter Probability (%)	10	2
Period (year)	250	50
Return Period (year)	2,373	2,475

For the Domtar location, the maximum horizontal acceleration due to seismic activity expected to occur with a likelihood of 2% in 50 years is 5% of gravitational acceleration, or .05g, as shown below. Since this value is considerably less than .1g, the site is not in a seismic impact zone, and seismic analysis is not required.



LANDFILL DESIGN

The landfill layers and assumed parameters used for the global stability modeling are as follows:

			Modeled Parameters			
Component	Depth	Description	Unit Wt. Moist (pcf)	Unit Wt. Satd. (pcf)	Friction Angle (Ø)	Layer #
Cover	6"	Vegetative Soil	130	135	28	3
Cover	18"	Protective Soil				
Cover	na	Geocomposite				
Cover	na	40 mil LLDPE				
Cover	12"	Selected Waste				
Waste	134'	approx. max waste depth	70	70	41	4
Bottom Liner	18"	Drainage Layer	125	135	30	5
Bottom Liner	na	Geotextile	60	60	20	6
Bottom Liner	na	60 mil HDPE FML				
Bottom Liner	na	GCL				
Bottom Liner	12"	Compacted Clay Soil	130	135	20	7
Structural Fill	15'	depth varies	125	130	25	2
Existing Ground	varies		130	135	28	1
Base Grade	na	Upper 5 feet below subgrade	130	135	15	8
Subsurface Soil	na	Below upper 5 feet	140	145	35	9

Modeling of Geosynthetic Layers

The flexible membrane liner and geosynthetic clay liner materials were modeled using a single 6" layer with assumed parameters intended to represent the worst case of the internal and interface frictions of the synthetic materials used in the liner. During construction, testing will be required to demonstrate that the geosynthetic materials meet the minimum assumed parameters of the stability modeling.

SLOPE STABILITY RESULTS

Factors of safety (FS) were calculated for the final slope condition for the final build-out of the new landfill phase. The XSTABL software package calculated FS, expressing the ratio of

resisting to driving forces. Calculated factors of safety are provided below, with XSTABL output following.

SECTION A-A FINAL CONDITION SCENARIO

File	Failure Type	Static/Seismic	FS
SXNA_BL	Translational	Static	2.21
SXNA_C	Rotational	Static	2.01
SXNA_C2	Rotational	Static	2.26

SXNA-BL evaluated the likelihood of a translational, sliding block type failure through the geosynthetic liner material.

SXNA-C evaluated the likelihood of a deep, rotational failure through either the waste or underlying soil layers from the landfill bench.

SXNA-C2 evaluated the likelihood of a deep, rotational failure through either the waste or underlying soil layers from the top of the landfill.

In conclusion, the factors of safety achieved for the scenarios above indicate a high degree of stability for the worst case cross section of the landfill. From a global stability perspective, construction of the landfill with the grades and materials analyzed is acceptable.

See Appendix E-2 for XSTABL output.

E2 – XSTABL OUTPUT

XSTABL File: SXNA_C2 10-18-12 14:22

```
*****************************************
*              X S T A B L              *
*                                       *
*        Slope Stability Analysis       *
*               using the               *
*            Method of Slices           *
*                                       *
*        Copyright (C) 1992 - 2002      *
*   Interactive Software Designs, Inc.  *
*        Moscow, ID 83843, U.S.A.       *
*                                       *
*          All Rights Reserved          *
*                                       *
*  Ver. 5.206                 96 - 1932 *
*****************************************
```

Problem Description : Domtar

SEGMENT BOUNDARY COORDINATES
---

13 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	2.0	7.3	54.3	8.1	1
2	54.3	8.1	110.2	26.0	2
3	110.2	26.0	135.7	26.0	2
4	135.7	26.0	147.2	25.1	3
5	147.2	25.1	376.5	100.0	3
6	376.5	100.0	391.5	100.0	3
7	391.5	100.0	601.7	170.0	3
8	601.7	170.0	651.8	172.0	3
9	651.8	172.0	916.2	172.1	3
10	916.2	172.1	1005.3	174.0	3
11	1005.3	174.0	1075.1	174.2	3
12	1075.1	174.2	1223.9	175.9	3
13	1223.9	175.9	1286.5	176.0	3

34 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment

1	147.2	25.1	376.5	97.5	4
2	376.5	97.5	391.5	97.5	4
3	391.5	97.5	601.7	167.5	4
4	601.7	167.5	651.8	169.5	4
5	651.8	169.5	916.2	169.6	4
6	916.2	169.6	1005.3	171.5	4
7	1005.3	171.5	1075.1	171.7	4
8	1075.1	171.7	1223.9	173.4	4
9	1223.9	173.4	1286.5	173.5	4
10	135.7	26.0	166.2	19.0	5
11	166.2	19.0	859.0	41.0	5
12	859.0	41.0	898.6	45.0	5
13	898.6	45.0	1060.1	45.0	5
14	1060.1	45.0	1292.6	42.3	5
15	135.7	26.0	166.2	17.5	6
16	166.2	17.5	859.0	39.5	6
17	859.0	39.5	898.6	43.5	6
18	898.6	43.5	1060.1	43.5	6
19	1060.1	43.5	1292.6	40.8	6
20	135.7	26.0	166.2	17.0	7
21	166.2	17.0	859.0	39.0	7
22	859.0	39.0	898.6	43.0	7
23	898.6	43.0	1060.1	43.0	7
24	1060.1	43.0	1292.6	40.3	7
25	135.7	26.0	166.2	16.0	8
26	166.2	16.0	859.0	38.0	8
27	859.0	38.0	898.6	42.0	8
28	898.6	42.0	1060.1	42.0	8
29	1060.1	42.0	1292.6	39.3	8
30	135.7	26.0	166.2	11.0	9
31	166.2	11.0	859.0	33.0	9
32	859.0	33.0	898.6	37.0	9
33	898.6	37.0	1060.1	37.0	9
34	1060.1	37.0	1292.6	39.3	9

ISOTROPIC Soil Parameters
---

9 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	130.0	135.0	.0	28.00	.000	.0	1
2	130.0	135.0	.0	28.00	.000	.0	0

```
  3   130.0   135.0        .0    28.00      .000         .0
0
  4    70.0    70.0        .0    41.00      .000         .0
0
  5   125.0   135.0        .0    30.00      .000         .0
2
  6    60.0    60.0        .0    20.00      .000         .0
0
  7   130.0   135.0        .0    20.00      .000         .0
0
  8   130.0   135.0        .0    15.00      .000         .0
1
  9   140.0   145.0        .0    35.00      .000         .0
0


A critical failure surface searching method, using a random
technique for generating CIRCULAR surfaces has been specified.


 2500 trial surfaces will be generated and analyzed.


  50 Surfaces initiate from each of  50 points equally spaced
along the ground surface between  x =    125.0 ft
                              and  x =    135.0 ft


Each surface terminates between   x =    590.0 ft
                            and   x =    610.0 ft


Unless further limitations were imposed, the minimum elevation
at which a surface extends is  y =       .0 ft


* * * * *  DEFAULT SEGMENT LENGTH SELECTED BY XSTABL  * * * * *

   15.0 ft line segments define each trial failure surface.


---------------------
ANGULAR RESTRICTIONS
---------------------

  The first segment of each failure surface will be inclined
  within the angular range defined by :

          Lower angular limit :=   -45.0 degrees
          Upper angular limit :=  (slope angle - 5.0) degrees
```

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface
is specified by 36 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	128.67	26.00
2	143.34	22.87
3	158.10	20.18
4	172.93	17.95
5	187.83	16.17
6	202.77	14.85
7	217.74	13.98
8	232.74	13.57
9	247.74	13.62
10	262.73	14.12
11	277.70	15.08
12	292.63	16.50
13	307.51	18.37
14	322.33	20.70
15	337.07	23.47
16	351.72	26.70
17	366.27	30.37
18	380.69	34.48
19	394.99	39.03
20	409.13	44.01
21	423.12	49.43
22	436.94	55.26
23	450.57	61.52
24	464.01	68.19
25	477.24	75.26
26	490.24	82.74
27	503.01	90.61
28	515.53	98.86
29	527.80	107.50
30	539.80	116.50
31	551.52	125.87
32	562.94	135.58
33	574.07	145.65
34	584.88	156.04
35	595.37	166.76
36	596.87	168.39

**** Simplified BISHOP FOS = 2.261 ****

The following is a summary of the TEN most critical surfaces

Problem Description : Domtar

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	2.261	238.70	505.25	491.72	128.67	596.87	4.499E+08
2.	2.264	238.88	510.37	496.79	128.47	600.21	4.607E+08
3.	2.265	236.12	507.09	493.62	125.61	594.37	4.467E+08
4.	2.266	237.69	511.52	497.97	127.04	599.25	4.598E+08
5.	2.266	241.46	511.67	498.05	131.12	603.83	4.715E+08
6.	2.267	237.22	500.69	487.03	128.27	591.57	4.361E+08
7.	2.268	240.85	494.05	480.32	132.96	592.48	4.342E+08
8.	2.271	235.20	506.82	493.24	125.20	592.68	4.432E+08
9.	2.272	241.52	498.11	484.34	133.37	595.97	4.443E+08
10.	2.274	244.06	517.02	503.30	133.57	608.79	4.909E+08

* * * END OF FILE * * *

XSTABL File: SXNA_C 10-18-12 14:21

```
*****************************************
*              X S T A B L              *
*                                       *
*        Slope Stability Analysis       *
*               using the               *
*            Method of Slices           *
*                                       *
*        Copyright (C) 1992 - 2002      *
*   Interactive Software Designs, Inc.  *
*        Moscow, ID 83843, U.S.A.       *
*                                       *
*          All Rights Reserved          *
*                                       *
*  Ver. 5.206                 96 - 1932 *
*****************************************
```

Problem Description : Domtar

SEGMENT BOUNDARY COORDINATES
---

13 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
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5	147.2	25.1	376.5	100.0	3
6	376.5	100.0	391.5	100.0	3
7	391.5	100.0	601.7	170.0	3
8	601.7	170.0	651.8	172.0	3
9	651.8	172.0	916.2	172.1	3
10	916.2	172.1	1005.3	174.0	3
11	1005.3	174.0	1075.1	174.2	3
12	1075.1	174.2	1223.9	175.9	3
13	1223.9	175.9	1286.5	176.0	3

34 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment

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5	651.8	169.5	916.2	169.6	4
6	916.2	169.6	1005.3	171.5	4
7	1005.3	171.5	1075.1	171.7	4
8	1075.1	171.7	1223.9	173.4	4
9	1223.9	173.4	1286.5	173.5	4
10	135.7	26.0	166.2	19.0	5
11	166.2	19.0	859.0	41.0	5
12	859.0	41.0	898.6	45.0	5
13	898.6	45.0	1060.1	45.0	5
14	1060.1	45.0	1292.6	42.3	5
15	135.7	26.0	166.2	17.5	6
16	166.2	17.5	859.0	39.5	6
17	859.0	39.5	898.6	43.5	6
18	898.6	43.5	1060.1	43.5	6
19	1060.1	43.5	1292.6	40.8	6
20	135.7	26.0	166.2	17.0	7
21	166.2	17.0	859.0	39.0	7
22	859.0	39.0	898.6	43.0	7
23	898.6	43.0	1060.1	43.0	7
24	1060.1	43.0	1292.6	40.3	7
25	135.7	26.0	166.2	16.0	8
26	166.2	16.0	859.0	38.0	8
27	859.0	38.0	898.6	42.0	8
28	898.6	42.0	1060.1	42.0	8
29	1060.1	42.0	1292.6	39.3	8
30	135.7	26.0	166.2	11.0	9
31	166.2	11.0	859.0	33.0	9
32	859.0	33.0	898.6	37.0	9
33	898.6	37.0	1060.1	37.0	9
34	1060.1	37.0	1292.6	39.3	9

ISOTROPIC Soil Parameters
---

9 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	130.0	135.0	.0	28.00	.000	.0	1
2	130.0	135.0	.0	28.00	.000	.0	0

```
  3   130.0   135.0        .0    28.00      .000         .0
0
  4    70.0    70.0        .0    41.00      .000         .0
0
  5   125.0   135.0        .0    30.00      .000         .0
2
  6    60.0    60.0        .0    20.00      .000         .0
0
  7   130.0   135.0        .0    20.00      .000         .0
0
  8   130.0   135.0        .0    15.00      .000         .0
1
  9   140.0   145.0        .0    35.00      .000         .0
0


A critical failure surface searching method, using a random
technique for generating CIRCULAR surfaces has been specified.


 2500 trial surfaces will be generated and analyzed.


  50 Surfaces initiate from each of  50 points equally spaced
along the ground surface between  x =    130.0 ft
                              and  x =    140.0 ft


Each surface terminates between   x =    350.0 ft
                            and   x =    385.0 ft


Unless further limitations were imposed, the minimum elevation
at which a surface extends is  y =       .0 ft


* * * * *  DEFAULT SEGMENT LENGTH SELECTED BY XSTABL  * * * * *

    8.0 ft line segments define each trial failure surface.


---------------------
ANGULAR RESTRICTIONS
---------------------

  The first segment of each failure surface will be inclined
  within the angular range defined by :

          Lower angular limit :=   -45.0 degrees
          Upper angular limit :=  (slope angle - 5.0) degrees
```

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface
is specified by 32 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	139.39	25.71
2	146.85	22.84
3	154.44	20.30
4	162.14	18.11
5	169.92	16.27
6	177.78	14.79
7	185.70	13.66
8	193.67	12.89
9	201.66	12.48
10	209.66	12.44
11	217.65	12.75
12	225.62	13.43
13	233.55	14.47
14	241.43	15.86
15	249.24	17.61
16	256.96	19.71
17	264.57	22.16
18	272.07	24.95
19	279.44	28.07
20	286.65	31.53
21	293.70	35.30
22	300.58	39.40
23	307.26	43.80
24	313.73	48.49
25	319.99	53.48
26	326.02	58.74
27	331.80	64.27
28	337.32	70.06
29	342.58	76.09
30	347.56	82.35
31	352.25	88.83
32	354.97	92.97

**** Simplified BISHOP FOS = 2.006 ****

The following is a summary of the TEN most critical surfaces

Problem Description : Domtar

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	2.006	206.67	189.29	176.87	139.39	354.97	4.216E+07
2.	2.007	203.81	190.08	177.65	135.71	351.85	4.108E+07
3.	2.014	207.63	199.17	186.64	138.57	362.82	4.742E+07
4.	2.018	205.60	188.86	176.13	139.18	352.83	4.116E+07
5.	2.020	205.12	204.69	192.22	134.29	363.43	4.898E+07
6.	2.020	205.16	199.34	186.67	135.92	359.54	4.603E+07
7.	2.022	210.90	218.34	205.82	138.16	379.28	5.978E+07
8.	2.024	208.13	207.66	194.97	137.76	368.98	5.196E+07
9.	2.025	202.38	192.49	179.80	134.49	351.26	4.137E+07
10.	2.026	207.33	216.25	203.72	134.49	374.01	5.643E+07

* * * END OF FILE * * *

XSTABL File: SXNA_BL 10-18-12 14:20

```
*****************************************
*              X S T A B L              *
*                                       *
*        Slope Stability Analysis       *
*               using the               *
*            Method of Slices           *
*                                       *
*        Copyright (C) 1992 - 2002      *
*   Interactive Software Designs, Inc.  *
*        Moscow, ID 83843, U.S.A.       *
*                                       *
*          All Rights Reserved          *
*                                       *
*  Ver. 5.206                 96 - 1932 *
*****************************************
```

Problem Description : Domtar

SEGMENT BOUNDARY COORDINATES
---

13 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	2.0	7.3	54.3	8.1	1
2	54.3	8.1	110.2	26.0	2
3	110.2	26.0	135.7	26.0	2
4	135.7	26.0	147.2	25.1	3
5	147.2	25.1	376.5	100.0	3
6	376.5	100.0	391.5	100.0	3
7	391.5	100.0	601.7	170.0	3
8	601.7	170.0	651.8	172.0	3
9	651.8	172.0	916.2	172.1	3
10	916.2	172.1	1005.3	174.0	3
11	1005.3	174.0	1075.1	174.2	3
12	1075.1	174.2	1223.9	175.9	3
13	1223.9	175.9	1286.5	176.0	3

34 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment

1	147.2	25.1	376.5	97.5	4
2	376.5	97.5	391.5	97.5	4
3	391.5	97.5	601.7	167.5	4
4	601.7	167.5	651.8	169.5	4
5	651.8	169.5	916.2	169.6	4
6	916.2	169.6	1005.3	171.5	4
7	1005.3	171.5	1075.1	171.7	4
8	1075.1	171.7	1223.9	173.4	4
9	1223.9	173.4	1286.5	173.5	4
10	135.7	26.0	166.2	19.0	5
11	166.2	19.0	859.0	41.0	5
12	859.0	41.0	898.6	45.0	5
13	898.6	45.0	1060.1	45.0	5
14	1060.1	45.0	1292.6	42.3	5
15	135.7	26.0	166.2	17.5	6
16	166.2	17.5	859.0	39.5	6
17	859.0	39.5	898.6	43.5	6
18	898.6	43.5	1060.1	43.5	6
19	1060.1	43.5	1292.6	40.8	6
20	135.7	26.0	166.2	17.0	7
21	166.2	17.0	859.0	39.0	7
22	859.0	39.0	898.6	43.0	7
23	898.6	43.0	1060.1	43.0	7
24	1060.1	43.0	1292.6	40.3	7
25	135.7	26.0	166.2	16.0	8
26	166.2	16.0	859.0	38.0	8
27	859.0	38.0	898.6	42.0	8
28	898.6	42.0	1060.1	42.0	8
29	1060.1	42.0	1292.6	39.3	8
30	135.7	26.0	166.2	11.0	9
31	166.2	11.0	859.0	33.0	9
32	859.0	33.0	898.6	37.0	9
33	898.6	37.0	1060.1	37.0	9
34	1060.1	37.0	1292.6	39.3	9

ISOTROPIC Soil Parameters
---

9 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	130.0	135.0	.0	28.00	.000	.0	1
2	130.0	135.0	.0	28.00	.000	.0	0

3	130.0	135.0	.0	28.00	.000	.0
0						
4	70.0	70.0	.0	41.00	.000	.0
0						
5	125.0	135.0	.0	30.00	.000	.0
2						
6	60.0	60.0	.0	20.00	.000	.0
0						
7	130.0	135.0	.0	20.00	.000	.0
0						
8	130.0	135.0	.0	15.00	.000	.0
1						
9	140.0	145.0	.0	35.00	.000	.0
0						

2 Water surface(s) have been specified

Unit weight of water = 62.40 (pcf)

Water Surface No. 1 specified by 7 coordinate points

****
PHREATIC SURFACE,
****

Point No.	x-water (ft)	y-water (ft)
1	2.00	2.00
2	135.70	4.00
3	166.20	6.00
4	859.00	26.00
5	898.60	26.00
6	1060.10	28.00
7	1292.60	30.00

Water Surface No. 2 specified by 5 coordinate points

****
PHREATIC SURFACE,
****

Point No.	x-water (ft)	y-water (ft)
1	166.20	18.50
2	859.00	40.50
3	898.60	44.50
4	1060.10	44.50
5	1292.60	41.80

A critical failure surface searching method, using a random technique for generating sliding BLOCK surfaces, has been specified.

The active and passive portions of the sliding surfaces are generated according to the Rankine theory.

1600 trial surfaces will be generated and analyzed.

4 boxes specified for generation of central block base

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

Length of line segments for active and passive portions of sliding block is 34.0 ft

Box no.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Width (ft)
1	136.0	25.5	136.5	25.0	.5
2	170.0	17.3	175.0	17.3	.5
3	275.0	20.8	280.0	20.9	.5
4	510.0	28.2	530.0	28.8	.5

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED JANBU METHOD * * * * *

The 10 most critical of all the failure surfaces examined are displayed below - the most critical first

Failure surface No. 1 specified by 13 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	134.89	26.00
2	136.37	25.23
3	170.92	17.10
4	275.98	20.58
5	529.84	28.71

6	530.07	29.05
7	530.96	30.58
8	545.06	61.52
9	559.16	92.46
10	573.26	123.40
11	587.35	154.34
12	591.86	164.22
13	593.74	167.35

** Corrected JANBU FOS = 2.209 ** (Fo factor = 1.049)

Failure surface No. 2 specified by 13 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	135.34	26.00
2	136.01	25.65
3	170.24	17.18
4	279.26	20.67
5	529.93	28.81
6	530.10	29.06
7	530.98	30.58
8	545.08	61.52
9	559.18	92.46
10	573.28	123.40
11	587.38	154.34
12	591.89	164.23
13	593.77	167.36

** Corrected JANBU FOS = 2.209 ** (Fo factor = 1.049)

Failure surface No. 3 specified by 13 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	135.33	26.00
2	136.02	25.64
3	170.16	17.16
4	279.01	20.64
5	528.26	28.71
6	528.47	29.00
7	529.36	30.53
8	543.45	61.47
9	557.55	92.41
10	571.65	123.35
11	585.75	154.29
12	590.00	163.60
13	591.88	166.73

** Corrected JANBU FOS = 2.209 ** (Fo factor = 1.049)

Failure surface No. 4 specified by 13 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	135.01	26.00
2	136.01	25.48
3	170.10	17.16
4	277.34	20.60
5	528.48	28.55
6	528.81	29.01
7	529.69	30.54
8	543.79	61.48
9	557.89	92.42
10	571.99	123.36
11	586.09	154.30
12	590.39	163.73
13	592.27	166.86

** Corrected JANBU FOS = 2.209 ** (Fo factor = 1.049)

Failure surface No. 5 specified by 13 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	135.26	26.00
2	136.05	25.59
3	173.80	17.19
4	277.12	20.63
5	529.67	28.90
6	529.78	29.05
7	530.66	30.57
8	544.76	61.51
9	558.86	92.45
10	572.96	123.39
11	587.06	154.33
12	591.51	164.11
13	593.39	167.23

** Corrected JANBU FOS = 2.209 ** (Fo factor = 1.049)

Failure surface No. 6 specified by 13 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	135.36	26.00
2	136.06	25.63
3	170.41	17.18

4	279.10	20.64
5	527.94	28.68
6	528.16	28.99
7	529.04	30.52
8	543.14	61.46
9	557.24	92.40
10	571.34	123.34
11	585.44	154.28
12	589.63	163.48
13	591.51	166.61

** Corrected JANBU FOS = 2.209 ** (Fo factor = 1.049)

Failure surface No. 7 specified by 13 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	134.73	26.00
2	136.45	25.10
3	173.14	17.14
4	276.79	20.61
5	529.66	28.91
6	529.75	29.04
7	530.64	30.57
8	544.74	61.51
9	558.83	92.45
10	572.93	123.39
11	587.03	154.33
12	591.49	164.10
13	593.36	167.22

** Corrected JANBU FOS = 2.209 ** (Fo factor = 1.049)

Failure surface No. 8 specified by 13 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	135.05	26.00
2	136.45	25.27
3	173.11	17.14
4	278.37	20.63
5	529.11	28.54
6	529.45	29.04
7	530.33	30.56
8	544.43	61.50
9	558.53	92.44
10	572.63	123.38
11	586.73	154.32
12	591.13	163.98
13	593.01	167.11

** Corrected JANBU FOS = 2.210 ** (Fo factor = 1.049)

Failure surface No. 9 specified by 13 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	135.21	26.00
2	136.16	25.51
3	172.71	17.23
4	279.99	20.67
5	528.09	28.90
6	528.16	28.99
7	529.05	30.52
8	543.15	61.46
9	557.24	92.40
10	571.34	123.34
11	585.44	154.28
12	589.64	163.48
13	591.52	166.61

** Corrected JANBU FOS = 2.210 ** (Fo factor = 1.049)

Failure surface No.10 specified by 13 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	134.77	26.00
2	136.12	25.30
3	170.88	17.22
4	276.18	20.62
5	529.38	28.92
6	529.46	29.04
7	530.34	30.56
8	544.44	61.50
9	558.54	92.44
10	572.64	123.38
11	586.74	154.32
12	591.15	163.99
13	593.03	167.11

** Corrected JANBU FOS = 2.210 ** (Fo factor = 1.049)

The following is a summary of the TEN most critical surfaces

Problem Description : Domtar

	Modified JANBU FOS	Correction Factor	Initial x-coord (ft)	Terminal x-coord (ft)	Available Strength (lb)
1.	2.209	1.049	134.89	593.74	9.379E+05
2.	2.209	1.049	135.34	593.77	9.376E+05
3.	2.209	1.049	135.33	591.88	9.306E+05
4.	2.209	1.049	135.01	592.27	9.325E+05
5.	2.209	1.049	135.26	593.39	9.357E+05
6.	2.209	1.049	135.36	591.51	9.292E+05
7.	2.209	1.049	134.73	593.36	9.359E+05
8.	2.210	1.049	135.05	593.01	9.359E+05
9.	2.210	1.049	135.21	591.52	9.284E+05
10.	2.210	1.049	134.77	593.03	9.341E+05

* * * END OF FILE * * *

APPENDIX L

STORMWATER/EROSION AND SEDIMENTATION CALCULATIONS

L1 – STORMWATER/EROSION CONTROL DESIGN

***PREPARED FOR*:**

DOMTAR PAPER COMPANY, LLC.
HIGHWAY 149 NORTH
PLYMOUTH, NC 27962

DOMTAR PAPER COMPANY, LLC
ON-SITE INDUSTRIAL WASTE LANDFILL NO. 3
PLYMOUTH, NORTH CAROLINA
PERMIT NO. 94-01

REVISED CAP DESIGN
EROSION AND SEDIMENT CONTROL PLAN

NOVEMBER 2012

***PREPARED BY*:**

JOYCE ENGINEERING

2211 WEST MEADOWVIEW ROAD, SUITE 101
GREENSBORO, NORTH CAROLINA
NC LICENSE NUMBER C-0782
PHONE: (336) 323-0092
FAX: (336) 323-0093
JOYCE PROJECT NO. 853.1201.11.01

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4.0 SOIL 2
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Appendices

Appendix No. 1 – Slope Drain Summary

Appendix No. 2 – HydroCAD Reports

Appendix No. 3 – Drainage Exhibit

Drawings

See Sheets P-03 and P-04 of the Revised Cap Design drawings dated November 2012 for revised E&S features and associated details. These drawings were prepared by Joyce Engineering and submitted as part of the 2012 Permit Renewal for Domtar Paper, Landfill No. 3.

1.0 PROJECT DESCRIPTION

Domtar Paper Company, LLC (Domtar), formerly the Weyerhaeuser Company, is located in Plymouth, North Carolina, and contains a kraft process pulp mill. Waste generated by Domtar and Weyerhaeuser Plymouth Lumber Technology Facility is placed in the active on-site landfill. The active landfill (Landfill No. 3) is located to the east of the asbestos landfill and secondary sludge facility. Domtar is currently operating in Phases 2, 3 and 4. Phases 1A and 1B have been closed and entered into post closure care in 2011. The landfill will be served by existing sediment basin SB-3 (north of the Landfill No. 3), and proposed sediment basins SB-4 (east of the secondary sludge building), SB-5 (east of Landfill No. 3) and SB-6 (west of Landfill No. 3) as originally designed. Sediment basin SB3 was installed in 2000 and basins SB-4 and SB-5 will be installed as the filling of landfill phases 2, 3, and 4 progresses.

The landfill area is covered under the provisions of previously approved Erosion and Sediment Control permits granted in 2000, 2002, and 2010. As part of the 2012 Permit Renewal, Joyce Engineering (JOYCE) revised the final cap design by reducing the number of drainage terraces that were previously proposed by RMT North Carolina, Inc. (RMT) for Phases 3 and beyond. Also, the articulated block drainage channels proposed by RMT have been replaced with a network of HDPE slope drains as the method of conveying storm water from Landfill No. 3 once it has been capped and closed. This Plan provides erosion and sediment control design calculations specifically for the changes made by JOYCE and should be used as a supplement with the existing, approved E&S plans. The supporting calculations for the design of the slope drains are included in this report. Since the landfill footprint/drainage area has not increased from the previously approved E&S plans, the roadside storm water channels, box culverts and sediment ponds were not revised. Therefore, calculations for these features are not included as part of this report. JOYCE ensured that the post-developed design specifications such as runoff method (SCS 25 yr-24 hr storm), rainfall event (Plymouth , NC 7.25”), soil classification (B), and Curve Number (69) coincided with the previously approved E&S design calculations prepared by RMT, dated June 2008. The current peak flow rates into the ponds do not exceed the previously designed values and the discharge from the ponds does not exceed pre-developed flow rates as determined by RMT.

The Contractor will be required to conduct his operations in accordance with the approved permit(s).

2.0 EXISTING SITE CONDITIONS

The site contains an active landfill, an asbestos landfill, two closed landfills, secondary sludge facility, borrow area, sediment control features, and other supporting structures. Welch Creek and Little Mill Creek are at the permitted landfill boundaries on the north and west sides. Property lines and stream locations are shown on Drawing No. P-01 existing conditions of the 2012 Permit Renewal Revised Cap Design dated November 2012 submitted by JOYCE.

3.0 ADJACENT AREAS

The site is bordered by creeks on the north and west sides. The areas east and south of the site are covered with dense woods.

4.0 SOIL

The predominant soils at the site are characterized as sandy loam and loamy sand as previously reported.

5.0 CRITICAL EROSION AREAS

Due to relatively steep slopes at the existing landfill, the entire footprint is considered as a critical erosion area. The potential for the release of sediment in any area were earthwork occurs will be minimized by controlling the surface runoff with diversion berms, slope drains, sediment basins, and by promptly re-vegetating these areas when grading activities are completed.

6.0 EROSION AND SEDIMENT CONTROL MEASURES

All vegetative practices and erosion and sediment control features shall be constructed and maintained in accordance with the North Carolina Erosion and Sediment Control Planning and Design Manual (NCESCPDM). A plan-view drawing, Drawing No. P-03, and details, Drawing No. P-04, are provided to show the revisions to the final cap as proposed by JOYCE in the 2012 Permit Renewal Revised Cap Design and consequent erosion and sediment control features. Supporting calculations are attached in appendices, along with a drainage exhibit drawing. Erosion and sediment control features utilized during construction should follow the design plans as submitted by RMT and approved by the State on November 2011. Items listed below are North Carolina standard erosion and sediment control features. Features listed in **bold** font apply to the Revised Cap Design drawings dated November 2012 designed by JOYCE. Other features may be reflected in the original RMT design.

A. Temporary Diversions (Reference NCESCPDM 6.20) - Temporary diversion berms to direct sediment laden flow into a series of storm water conveyance channels which drain into sediment basins. Diversions will also be used to prevent flow from entering disturbed areas in the borrow site or during construction.

B. **Permanent Diversions (Reference NCESCPDM 6.21) - A system of diversion berms and benches to direct storm water flow into either slope drains or storm water conveyance channels will be installed across the landfill cap. All diversion features will be stabilized as discussed below, vegetated, and maintained as permanent structures.**

C. Sediment Fence (Reference NCESCPDM 6.62) - Sediment fences should be installed as shown on the Erosion and Sediment Control Plan to filter sediment laden runoff from sheet flow.

D. Grass-Lined Channels (Reference NCESCPDM 6.30) - Grass-lined channels with temporary lining (straw with net, or synthetic mat) should be constructed to collect and convey stormwater to the sediment basins.

E. Sediment Trap (Reference NCESCPD 6.60) - Sediment traps are usually utilized during construction to trap sediment from runoff. These features are normally abandoned once the site is fully constructed and vegetation established.

F. Sediment Basins (Reference NCESCPDM 6.61) - There are currently three (3) sediment basin located on the site. Sediment Basin SB-1 is located in northeastern of the Landfill No. 2 and collects stormwater runoff from the northern portion of Landfill No. 2. Sediment Basin SB-2 is located south of Landfill No. 2; this basin currently collects stormwater runoff from the southern portion of the closed landfill. Sediment Basin SB-3 is located in north of Landfill No. 3 and currently collects stormwater runoff from the active landfill. Additional basins will be constructed adjacent to the Landfill No. 3 as the landfill phases outward. Each basin has been designed with flow routing for the 25 year 24 hour storm event.

G. Outlet Protection (Reference NCESCPDM 6.41) - Riprap will be placed at the outlet of all slope drain pipes to dissipate flow velocity.

H. Slope Drains (Reference NCESCPDM 6.32) - Slope drains will be used to convey storm water from the landfill cap and benches down to roadside channels that transport the water to the sediment basins.

7.0 VEGETATIVE STABILIZATION

Vegetative cover shall be re-established immediately after land-disturbing activities are completed or when construction activities are delayed for 21 or more working days. Temporary and permanent seeding specifications are attached.

8.0 TEMPORARY STABILIZATION

Disturbed areas will be vegetated as described in paragraph 7.0 and the seeding specifications. All temporary control features will remain in place and maintained until stabilization with vegetative cover is achieved. Accumulated sediment will be removed from the sediment traps and basins as needed to maintain the storage capacity required for this site.

9.0 MAINTENANCE

All erosion and sediment control measures will be inspected regularly during construction and after each significant rainfall. The following items will be part of routine maintenance during construction, operations, closure construction and post closure care of the landfill.

A. The sediment basins will be cleaned out when the level of sediment buildup reaches the cleanout point indicated on the riser pipe.

B. Silt fences will be checked regularly for overtopping, undermining, structural failure, and deterioration of the fabric. Sediment shall be removed when the level of sediment deposition reaches halfway to the top of the barrier.

C. The seeded areas will be inspected regularly to ensure that a good stand of vegetation is maintained. Areas without established vegetation should be fertilized and reseeded annually.

D. All stormwater conveyance channels will be inspected regularly and accumulated sediment will be removed.

10.0 CONSTRUCTION SEQUENCE

A. Obtain plan approval and other applicable permits;

B. Flag the limits of construction;

C. Clear and grub the area as needed, stockpile topsoil, stabilize disturbed areas;

D. Install temporary diversions and sediment fencing;

E. Construct and stabilize all stormwater conveyance channels;

F. Proceed with rough grading of the proposed landfill closure grades;

G. Seed and stabilize denuded areas immediately after grading is completed;

H. Inspect all erosion and control features weekly and following each significant rainfall. Make repairs immediately; and

I. After the site is stabilized, remove all temporary measures and establish permanent vegetation on the disturbed areas.

END

APPENDIX NO. 1

SLOPE DRAIN SUMMARY

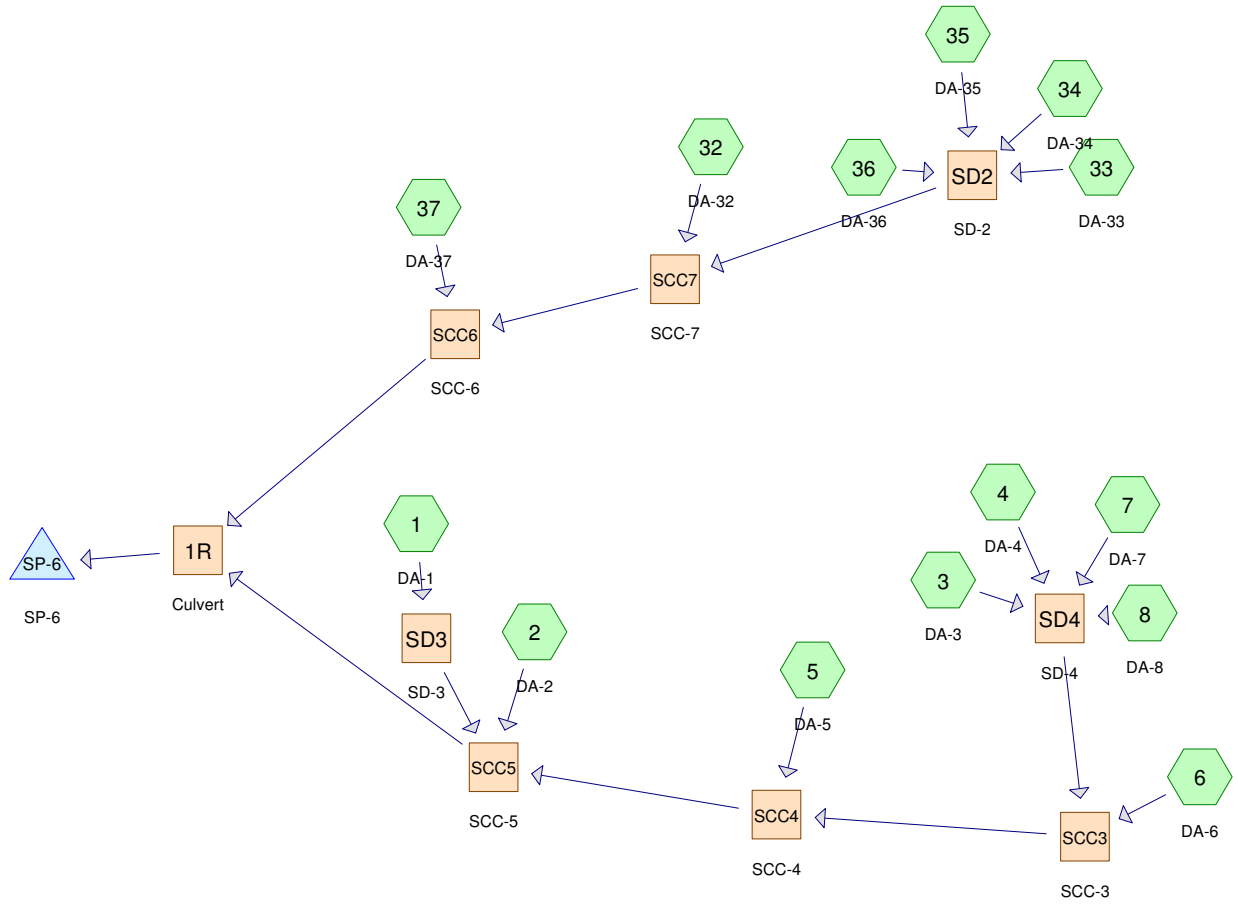
Job:	Domtar Paper Company		
Job Number:	853.1201.11.01		
Calculated By:	CTM	Date:	10/17/2012
Checked By:		Date:	
Subject:	Landfill No. 3 - Revised Cap Design		
	Slope Drain Summary		

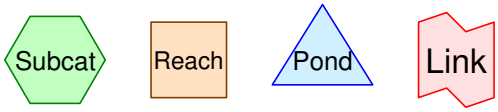
HydroCAD stormwater modeling software was utilized for pipe sizing. See attached reports for pipe flow specifications.
See drainage exhibit for drainage area locations.

Slope Drain	Q25 Outflow (cfs)	Pipe Slope (ft/ft)	Max. Velocity (fps)	Avg. Depth (in)	Approximate Length (ft)	Pipe Diameter (in)	Drainage Areas
SD-1	29.14	0.2146	20.34	13.8	410	18	25, 26, 28, 29, 31
SD-2	33.67	0.3171	24.57	13.2	410	18	33, 34, 35, 36
SD-3	6.57	0.3273	16.48	5.04	220	18	1
SD-4	27.22	0.3077	23.38	11.40	390	18	3, 4, 7, 8
SD-5	21.27	0.2988	21.8	9.84	415	18	9, 10, 13, 14
SD-6	16.78	0.3467	21.80	8.16	375	18	15, 16, 19
SD-7	28.28	0.2143	20.25	13.44	280	18	20, 22, 23, 24

APPENDIX NO. 2

HYDROCAD REPORTS





Drainage Diagram for Domtar E&S - West
Prepared by {enter your company name here} 11/1/2012
HydroCAD® 8.00 s/n 004761 © 2006 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcats)
29.400	69	Pasture/grassland/range, Fair, HSG B (1,2,3,4,5,6,7,8,32,33,34,35,36,37)
29.400		

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: DA-1 Runoff Area=1.550 ac Runoff Depth>3.72"
Flow Length=225' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=6.62 cfs 0.480 af

Subcatchment 2: DA-2 Runoff Area=3.860 ac Runoff Depth>3.72"
Flow Length=222' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=16.50 cfs 1.195 af

Subcatchment 3: DA-3 Runoff Area=0.550 ac Runoff Depth>3.72"
Flow Length=258' Slope=0.0500 '/' Tc=6.0 min CN=69 Runoff=2.35 cfs 0.170 af

Subcatchment 4: DA-4 Runoff Area=2.080 ac Runoff Depth>3.72"
Flow Length=213' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=8.89 cfs 0.644 af

Subcatchment 5: DA-5 Runoff Area=2.480 ac Runoff Depth>3.72"
Flow Length=183' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=10.60 cfs 0.768 af

Subcatchment 6: DA-6 Runoff Area=1.470 ac Runoff Depth>3.72"
Flow Length=212' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=6.28 cfs 0.455 af

Subcatchment 7: DA-7 Runoff Area=2.070 ac Runoff Depth>3.72"
Flow Length=229' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=8.85 cfs 0.641 af

Subcatchment 8: DA-8 Runoff Area=1.740 ac Runoff Depth>3.72"
Flow Length=340' Slope=0.0500 '/' Tc=6.0 min CN=69 Runoff=7.44 cfs 0.539 af

Subcatchment 32: DA-32 Runoff Area=1.590 ac Runoff Depth>3.72"
Flow Length=174' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=6.80 cfs 0.492 af

Subcatchment 33: DA-33 Runoff Area=2.260 ac Runoff Depth>3.72"
Flow Length=227' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=9.66 cfs 0.700 af

Subcatchment 34: DA-34 Runoff Area=1.590 ac Runoff Depth>3.72"
Flow Length=263' Slope=0.0500 '/' Tc=6.0 min CN=69 Runoff=6.80 cfs 0.492 af

Subcatchment 35: DA-35 Runoff Area=1.050 ac Runoff Depth>3.72"
Flow Length=385' Slope=0.0500 '/' Tc=6.0 min CN=69 Runoff=4.49 cfs 0.325 af

Subcatchment 36: DA-36 Runoff Area=3.070 ac Runoff Depth>3.72"
Flow Length=228' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=13.12 cfs 0.951 af

Subcatchment 37: DA-37 Runoff Area=4.040 ac Runoff Depth>3.72"
Flow Length=200' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=17.27 cfs 1.251 af

Reach 1R: Culvert Avg. Depth=0.53' Max Vel=18.00 fps Inflow=95.80 cfs 9.049 af
n=0.012 L=250.0' S=0.0560 '/' Capacity=1,029.84 cfs Outflow=95.53 cfs 9.047 af

Reach SCC3: SCC-3 Avg. Depth=1.15' Max Vel=3.81 fps Inflow=33.49 cfs 2.449 af
n=0.035 L=340.0' S=0.0118 '/' Capacity=1,305.35 cfs Outflow=31.44 cfs 2.445 af

Reach SCC4: SCC-4 Avg. Depth=1.04' Max Vel=5.35 fps Inflow=40.47 cfs 3.213 af
n=0.035 L=627.0' S=0.0255 '/' Capacity=1,922.49 cfs Outflow=38.73 cfs 3.206 af

Reach SCC5: SCC-5 Avg. Depth=1.80' Max Vel=3.02 fps Inflow=55.23 cfs 4.881 af
n=0.035 L=895.0' S=0.0045 '/' Capacity=804.56 cfs Outflow=50.64 cfs 4.856 af

Reach SCC6: SCC-6 Avg. Depth=1.33' Max Vel=4.82 fps Inflow=54.22 cfs 4.207 af
n=0.035 L=877.0' S=0.0160 '/' Capacity=1,520.55 cfs Outflow=51.00 cfs 4.193 af

Reach SCC7: SCC-7 Avg. Depth=1.13' Max Vel=4.74 fps Inflow=40.45 cfs 2.960 af
n=0.035 L=327.0' S=0.0183 '/' Capacity=1,630.19 cfs Outflow=38.17 cfs 2.956 af

Reach SD2: SD-2 Avg. Depth=1.10' Max Vel=24.57 fps Inflow=34.06 cfs 2.468 af
D=18.0" n=0.020 L=410.0' S=0.3171 '/' Capacity=38.45 cfs Outflow=33.67 cfs 2.468 af

Reach SD3: SD-3 Avg. Depth=0.42' Max Vel=16.48 fps Inflow=6.62 cfs 0.480 af
D=18.0" n=0.020 L=220.0' S=0.3273 '/' Capacity=39.06 cfs Outflow=6.57 cfs 0.480 af

Reach SD4: SD-4 Avg. Depth=0.95' Max Vel=23.38 fps Inflow=27.52 cfs 1.995 af
D=18.0" n=0.020 L=390.0' S=0.3077 '/' Capacity=37.87 cfs Outflow=27.22 cfs 1.994 af

Pond SP-6: SP-6 Peak Elev=13.04' Storage=179,418 cf Inflow=95.53 cfs 9.047 af
24.0" x 70.0' Culvert Outflow=15.44 cfs 8.106 af

Total Runoff Area = 29.400 ac Runoff Volume = 9.106 af Average Runoff Depth = 3.72"
100.00% Pervious Area = 29.400 ac 0.00% Impervious Area = 0.000 ac

Subcatchment 1: DA-1

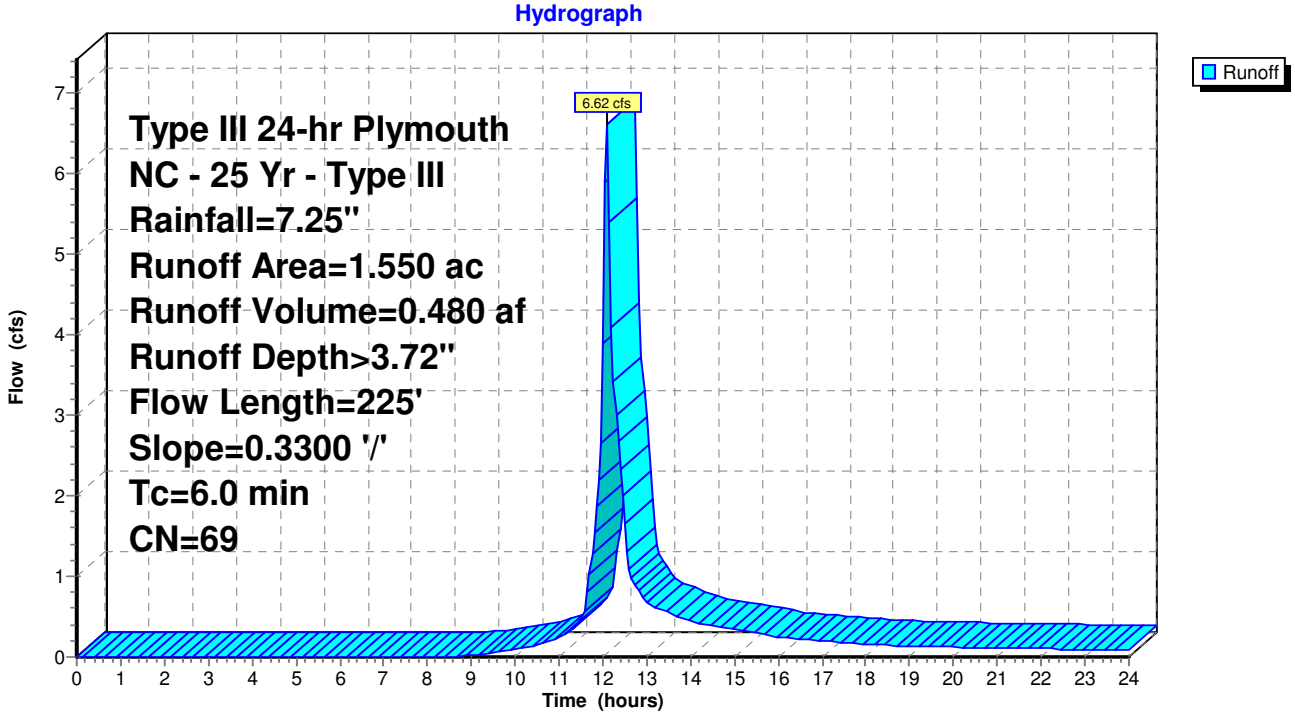
Runoff = 6.62 cfs @ 12.09 hrs, Volume= 0.480 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
1.550	69	Pasture/grassland/range, Fair, HSG B
1.550		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	225	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.9	225	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1: DA-1



Subcatchment 2: DA-2

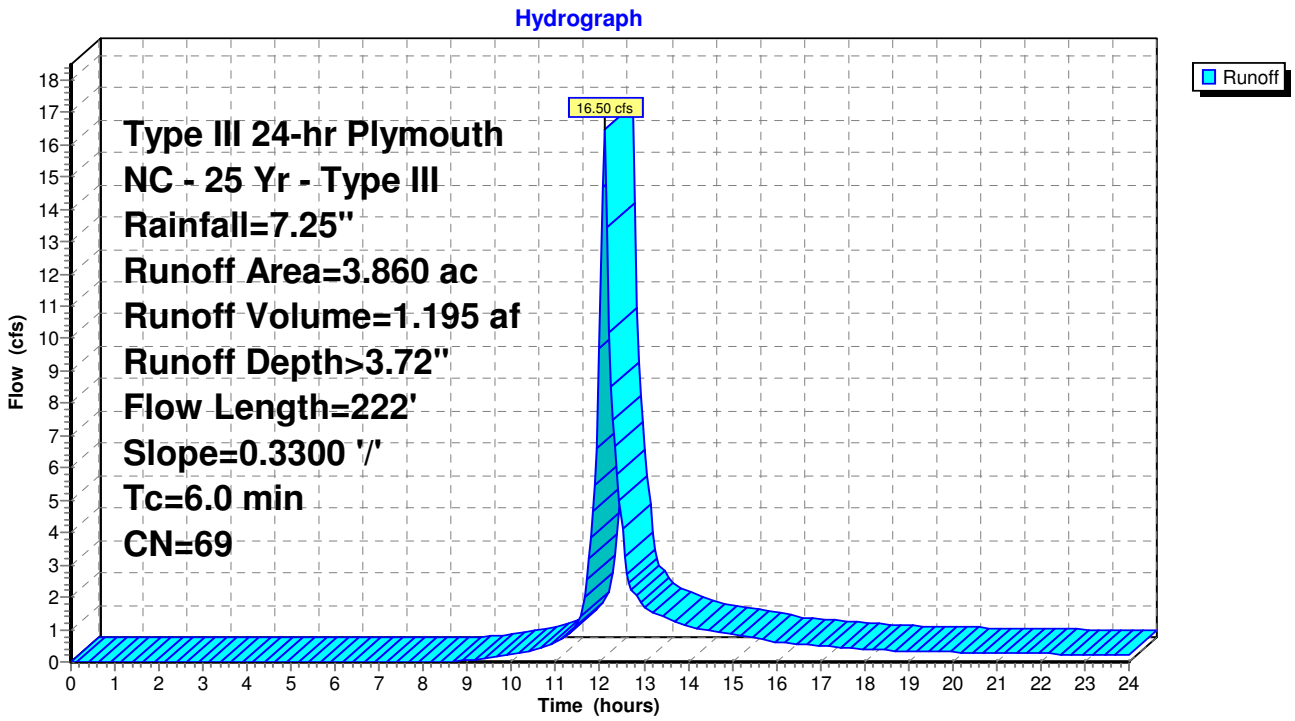
Runoff = 16.50 cfs @ 12.09 hrs, Volume= 1.195 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
3.860	69	Pasture/grassland/range, Fair, HSG B
3.860		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	222	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.9	222	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2: DA-2



Subcatchment 3: DA-3

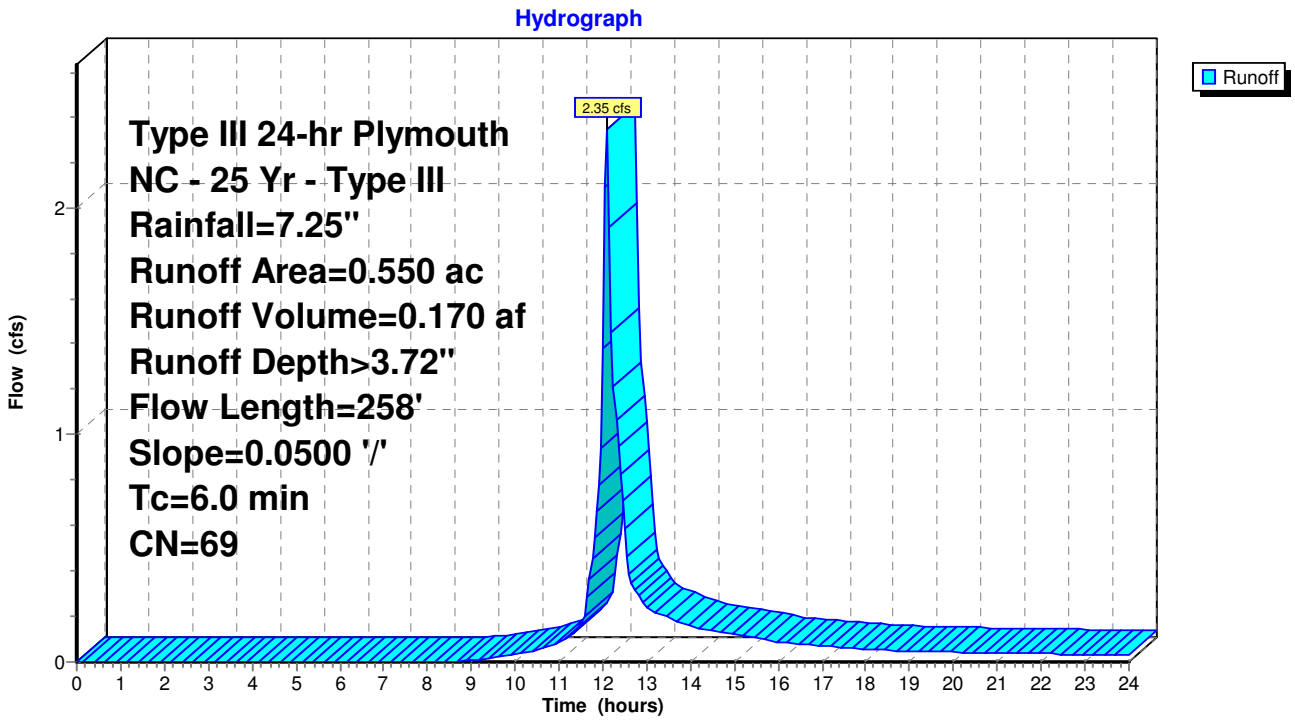
Runoff = 2.35 cfs @ 12.09 hrs, Volume= 0.170 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
0.550	69	Pasture/grassland/range, Fair, HSG B
0.550		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	258	0.0500	1.57		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
2.7	258	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 3: DA-3



Subcatchment 4: DA-4

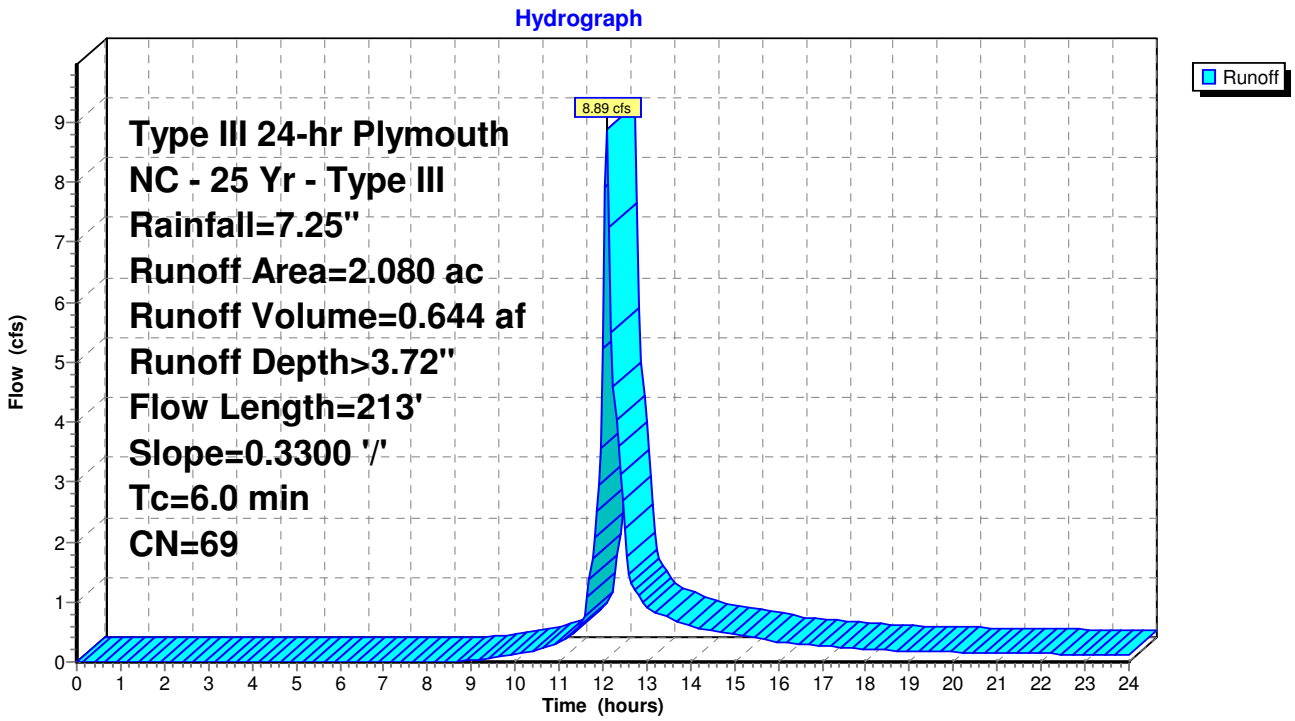
Runoff = 8.89 cfs @ 12.09 hrs, Volume= 0.644 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
2.080	69	Pasture/grassland/range, Fair, HSG B
2.080		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	213	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.9	213	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 4: DA-4



Subcatchment 5: DA-5

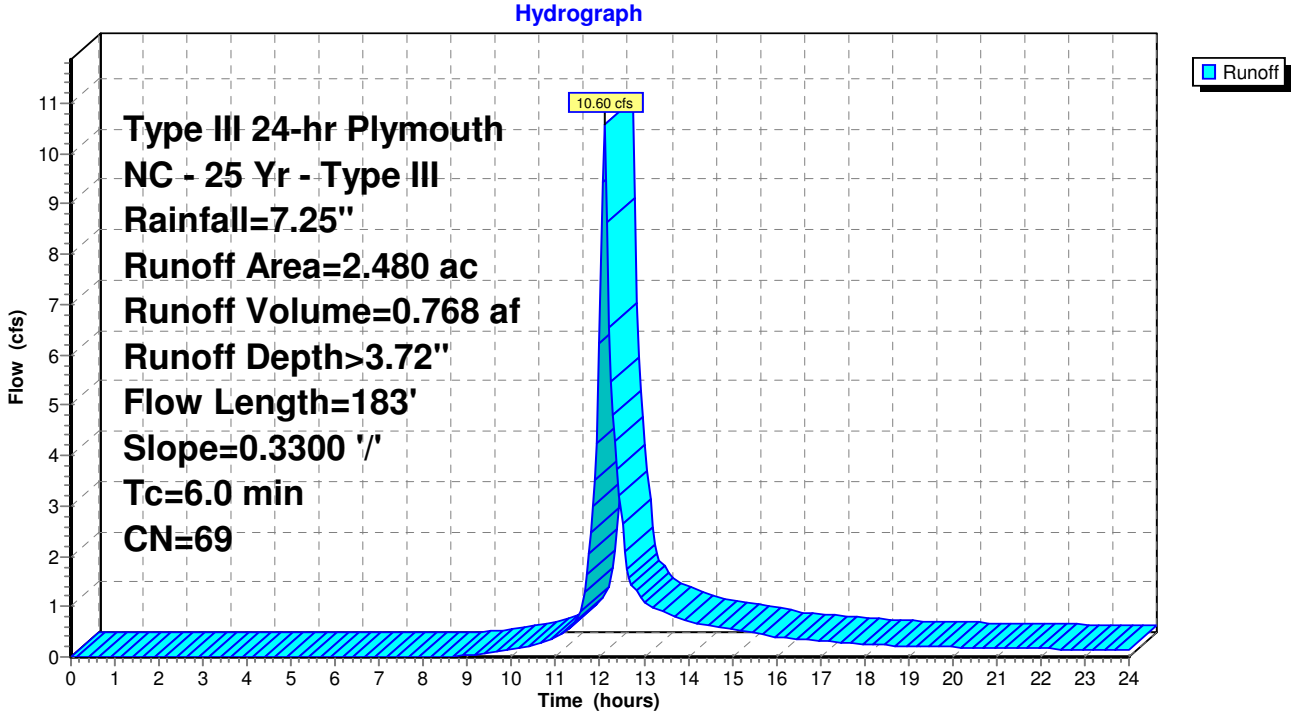
Runoff = 10.60 cfs @ 12.09 hrs, Volume= 0.768 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
2.480	69	Pasture/grassland/range, Fair, HSG B
2.480		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	183	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.8	183	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 5: DA-5



Subcatchment 6: DA-6

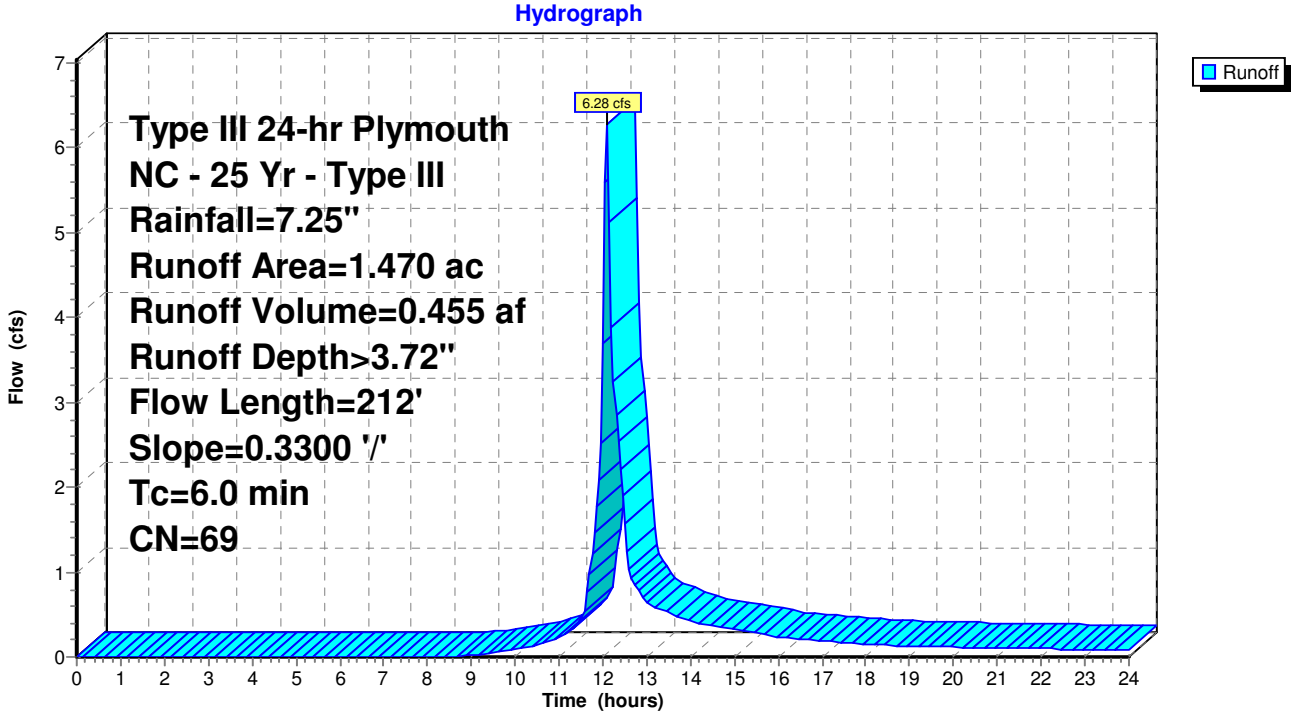
Runoff = 6.28 cfs @ 12.09 hrs, Volume= 0.455 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
1.470	69	Pasture/grassland/range, Fair, HSG B
1.470		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	212	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.9	212	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 6: DA-6



Subcatchment 7: DA-7

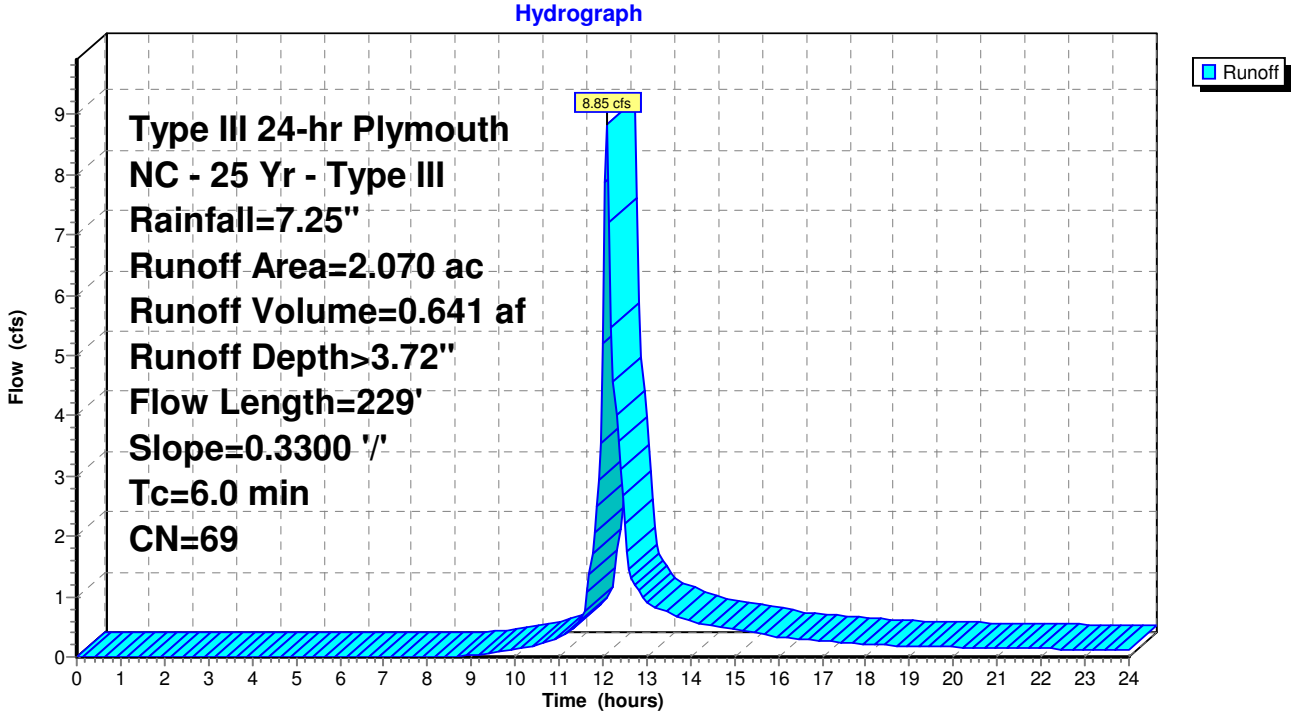
Runoff = 8.85 cfs @ 12.09 hrs, Volume= 0.641 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
2.070	69	Pasture/grassland/range, Fair, HSG B
2.070		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	229	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.9	229	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 7: DA-7



Subcatchment 8: DA-8

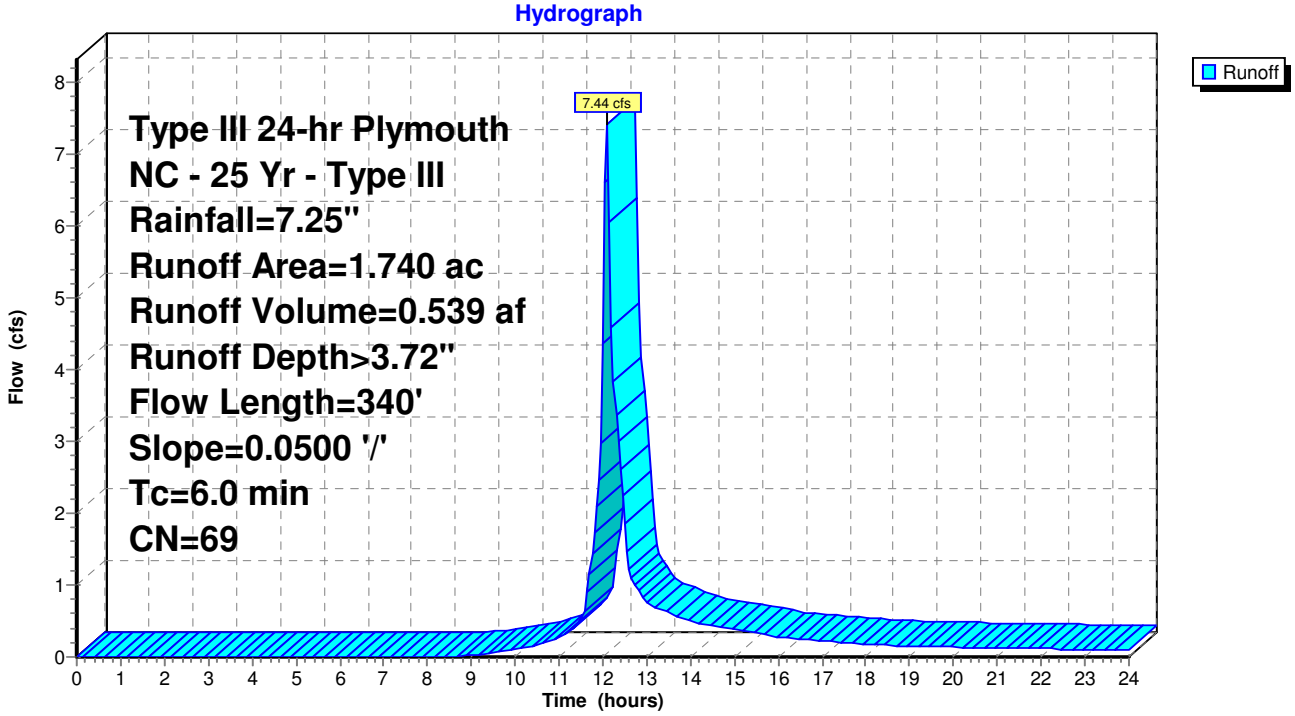
Runoff = 7.44 cfs @ 12.09 hrs, Volume= 0.539 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
1.740	69	Pasture/grassland/range, Fair, HSG B
1.740		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	340	0.0500	1.57		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
3.6	340	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 8: DA-8



Subcatchment 32: DA-32

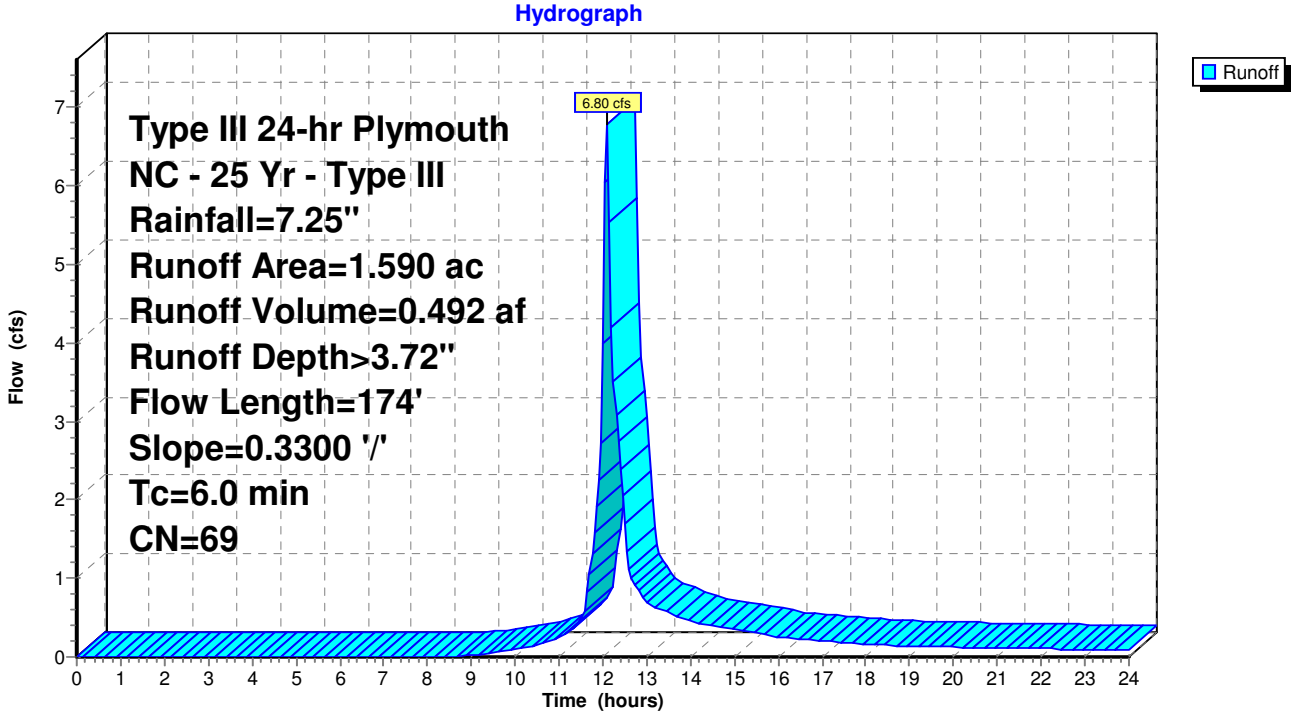
Runoff = 6.80 cfs @ 12.09 hrs, Volume= 0.492 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
1.590	69	Pasture/grassland/range, Fair, HSG B
1.590		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	174	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.7	174	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 32: DA-32



Subcatchment 33: DA-33

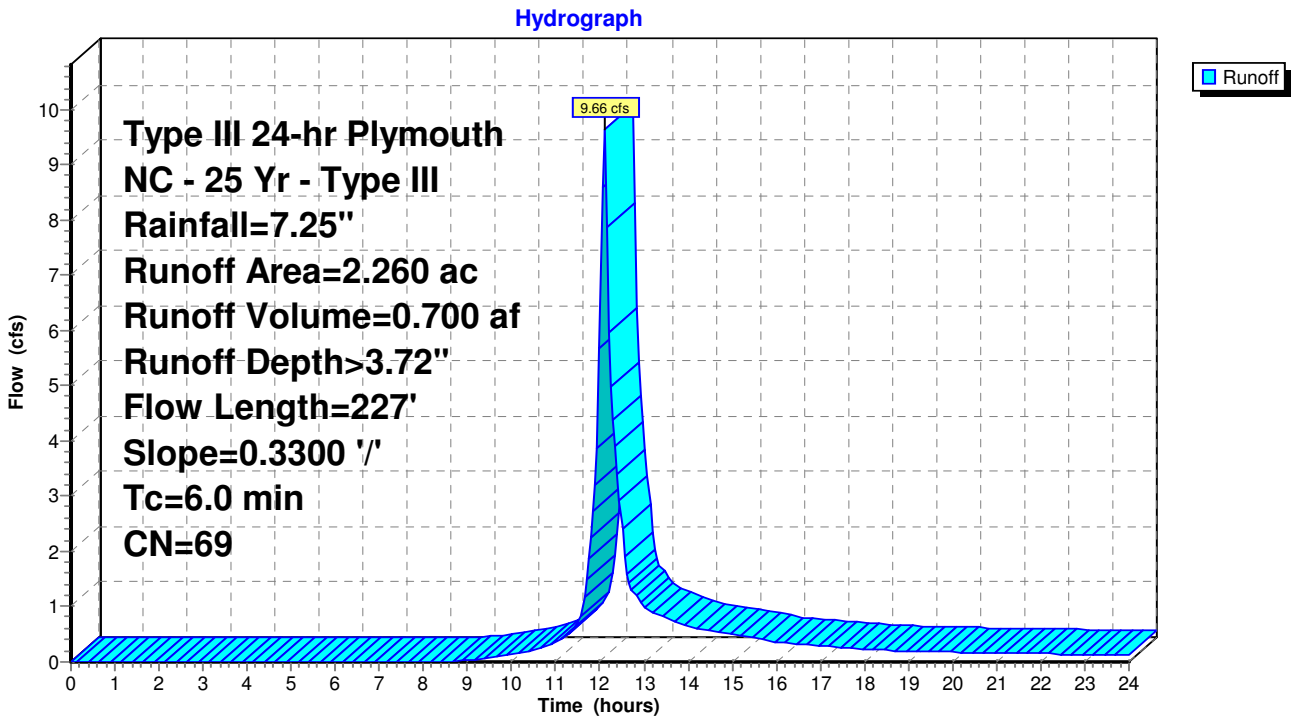
Runoff = 9.66 cfs @ 12.09 hrs, Volume= 0.700 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
2.260	69	Pasture/grassland/range, Fair, HSG B
2.260		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	227	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.9	227	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 33: DA-33



Subcatchment 34: DA-34

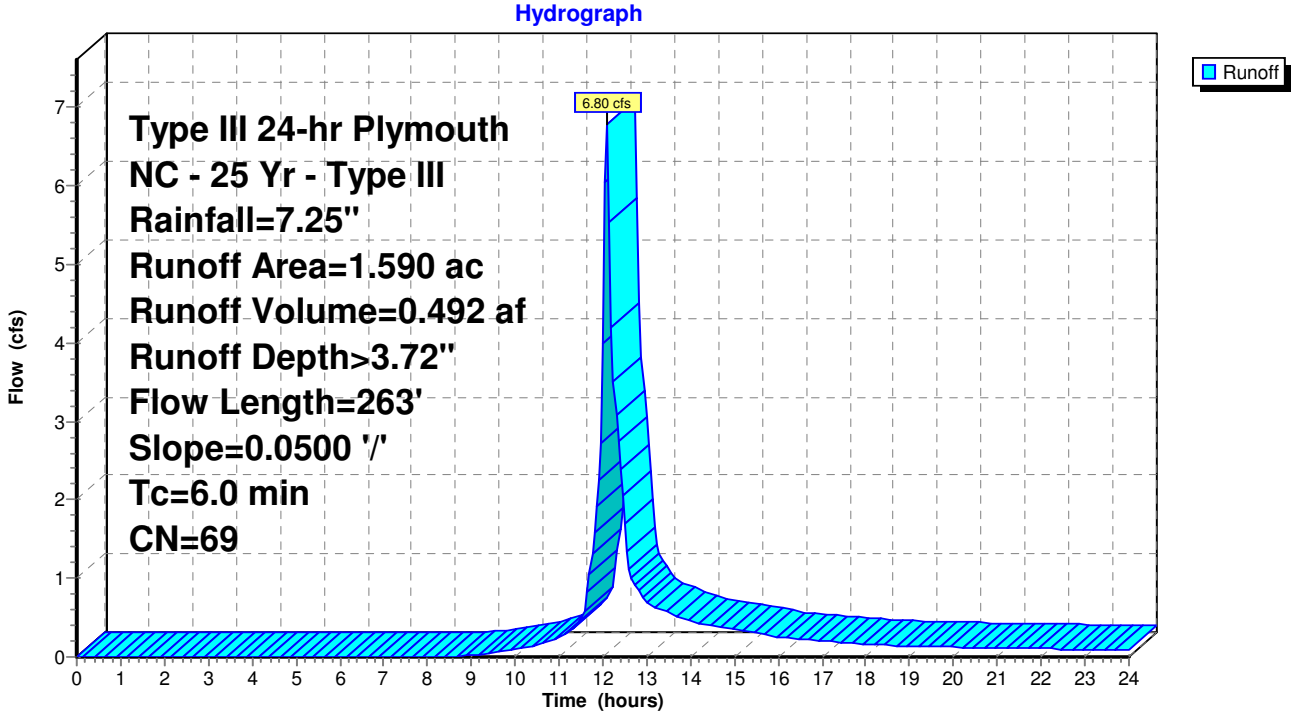
Runoff = 6.80 cfs @ 12.09 hrs, Volume= 0.492 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
1.590	69	Pasture/grassland/range, Fair, HSG B
1.590		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	263	0.0500	1.57		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
2.8	263	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 34: DA-34



Subcatchment 35: DA-35

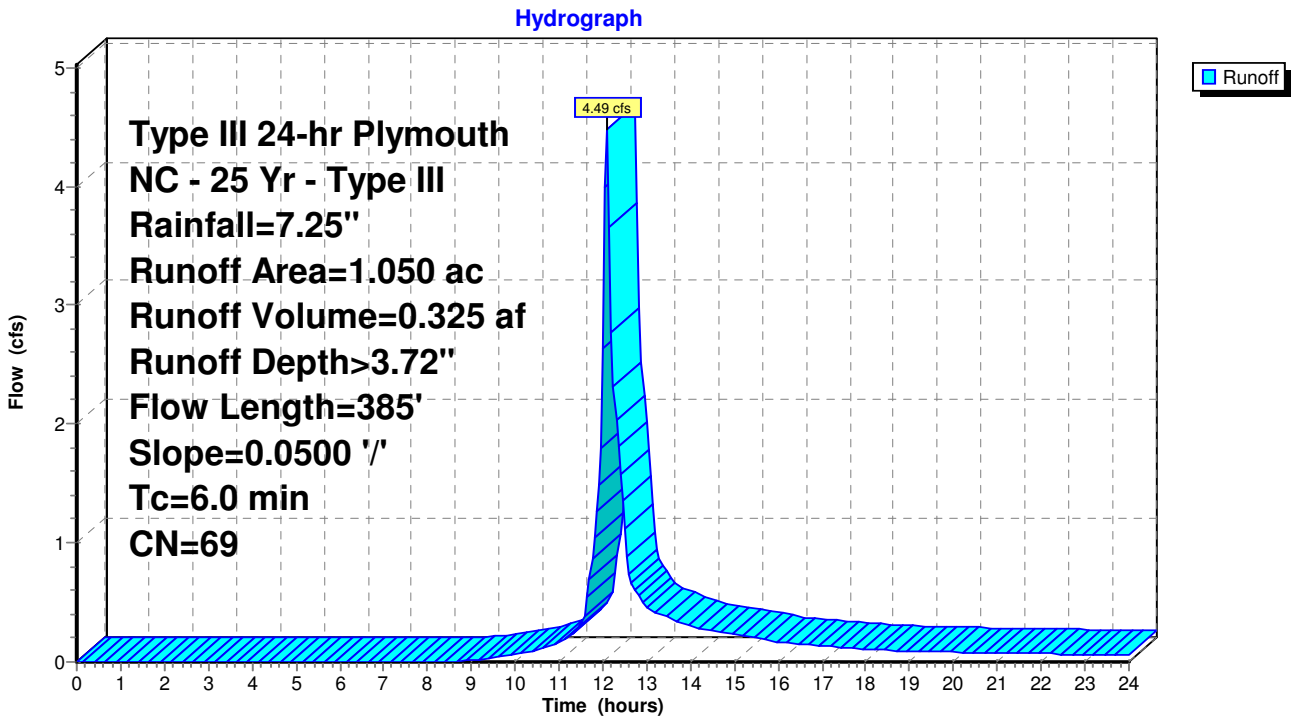
Runoff = 4.49 cfs @ 12.09 hrs, Volume= 0.325 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
1.050	69	Pasture/grassland/range, Fair, HSG B
1.050		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	385	0.0500	1.57		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
4.1	385	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 35: DA-35



Subcatchment 36: DA-36

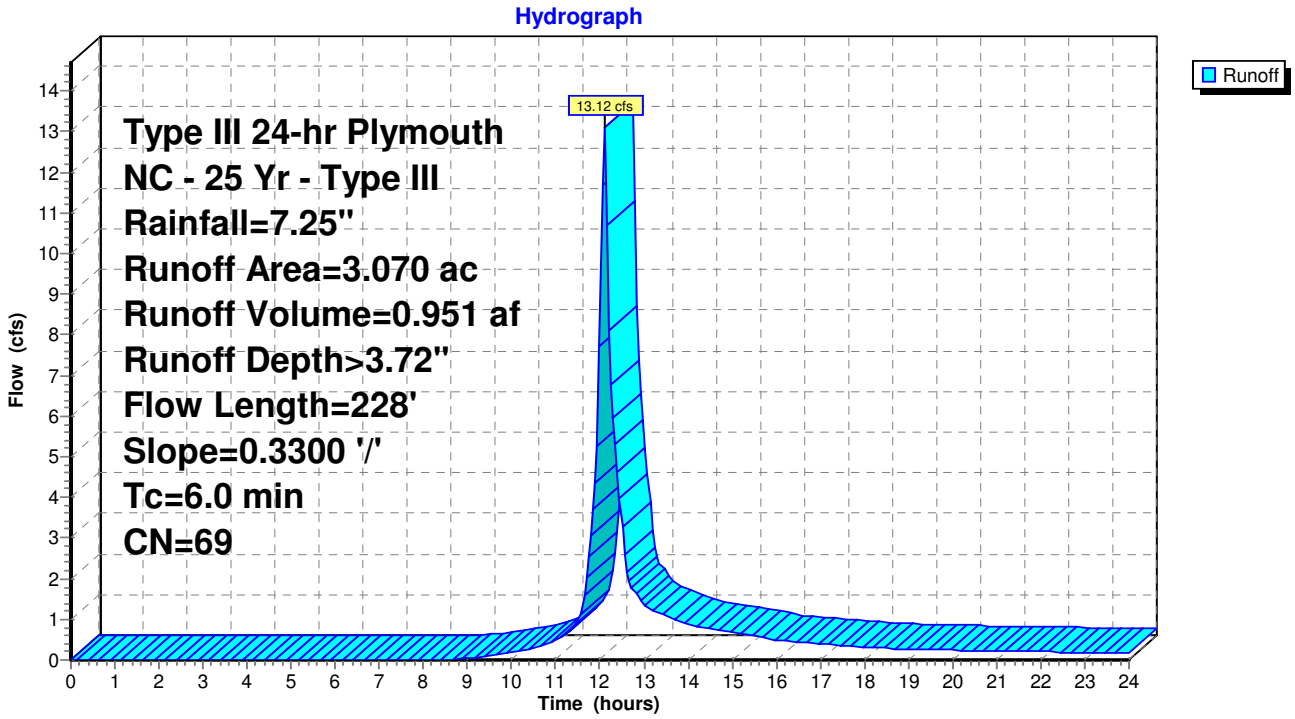
Runoff = 13.12 cfs @ 12.09 hrs, Volume= 0.951 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
3.070	69	Pasture/grassland/range, Fair, HSG B
3.070		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	228	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.9	228	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 36: DA-36



Subcatchment 37: DA-37

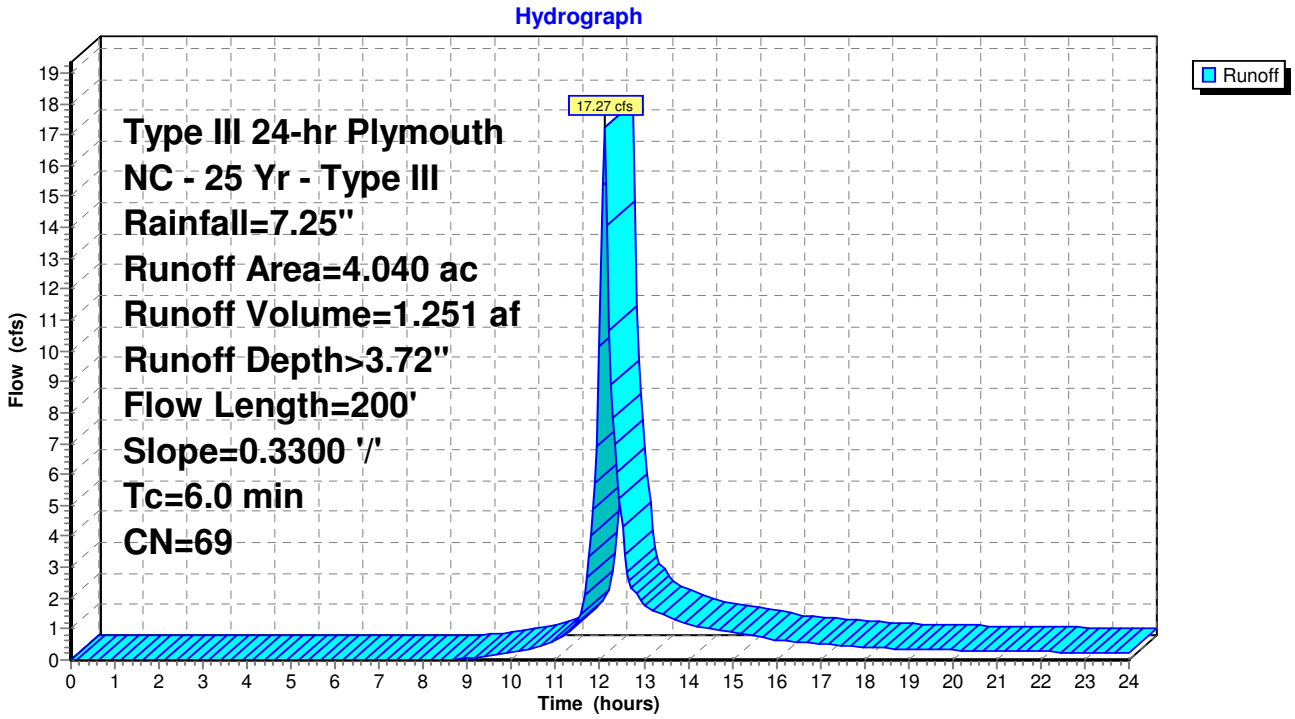
Runoff = 17.27 cfs @ 12.09 hrs, Volume= 1.251 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr - Type III Rainfall=7.25"

Area (ac)	CN	Description
4.040	69	Pasture/grassland/range, Fair, HSG B
4.040		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	200	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.8	200	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 37: DA-37



Reach 1R: Culvert

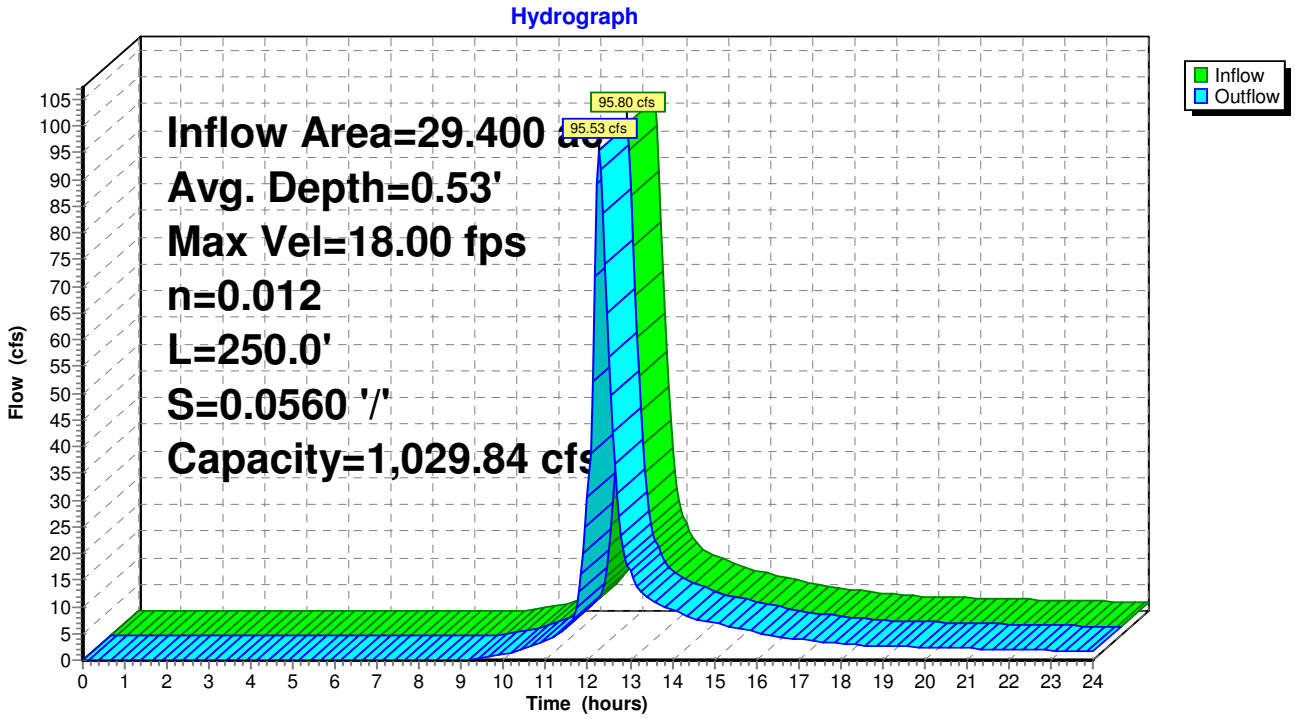
Inflow Area = 29.400 ac, Inflow Depth > 3.69" for Plymouth, NC - 25 Yr - Type III event
Inflow = 95.80 cfs @ 12.25 hrs, Volume= 9.049 af
Outflow = 95.53 cfs @ 12.26 hrs, Volume= 9.047 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 18.00 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 5.49 fps, Avg. Travel Time= 0.8 min

Peak Storage= 1,331 cf @ 12.25 hrs, Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 2.50', Capacity at Bank-Full= 1,029.84 cfs

10.00' x 2.50' deep channel, n= 0.012 Concrete pipe, finished
Length= 250.0' Slope= 0.0560 '/'
Inlet Invert= 24.00', Outlet Invert= 10.00'

Reach 1R: Culvert



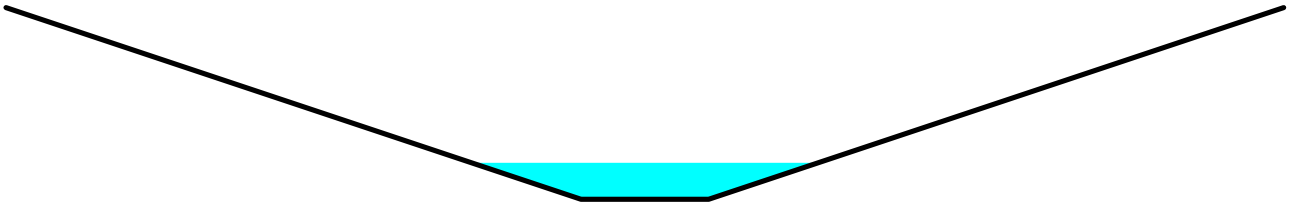
Reach SCC3: SCC-3

Inflow Area = 7.910 ac, Inflow Depth > 3.72" for Plymouth, NC - 25 Yr - Type III event
Inflow = 33.49 cfs @ 12.10 hrs, Volume= 2.449 af
Outflow = 31.44 cfs @ 12.15 hrs, Volume= 2.445 af, Atten= 6%, Lag= 2.9 min

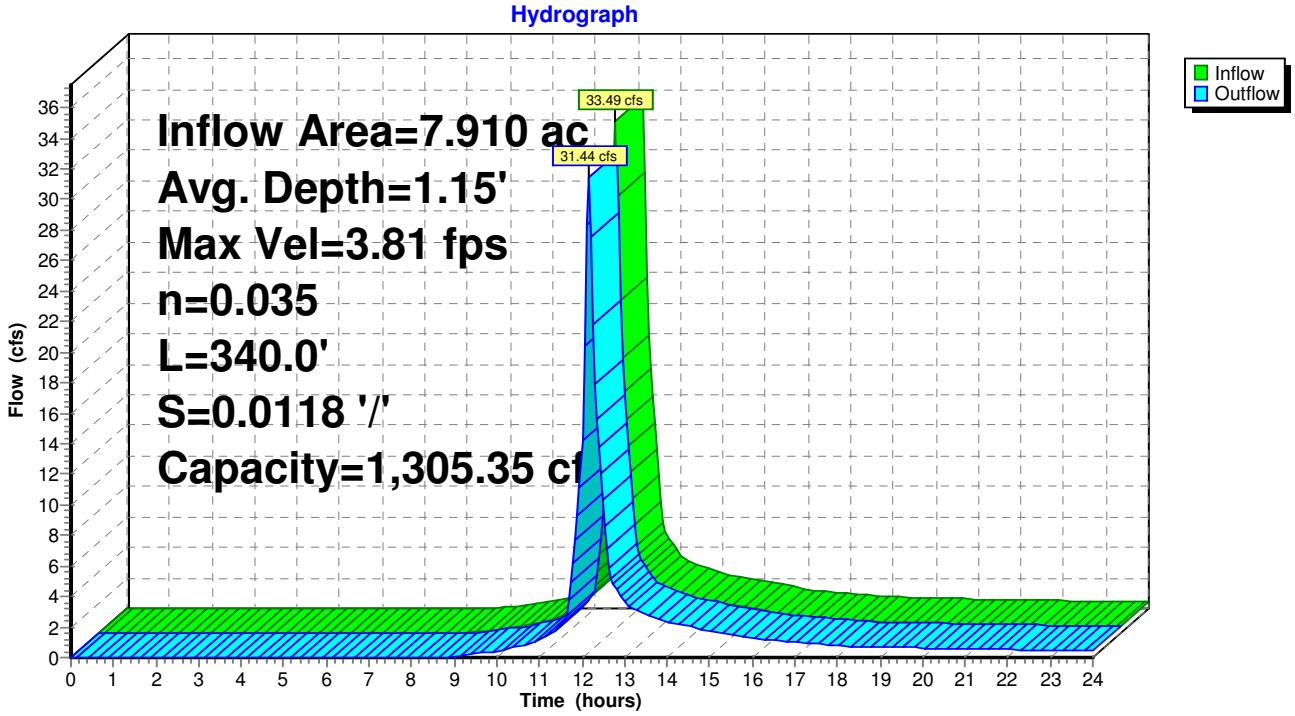
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.81 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.36 fps, Avg. Travel Time= 4.2 min

Peak Storage= 2,897 cf @ 12.12 hrs, Average Depth at Peak Storage= 1.15'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 1,305.35 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 340.0' Slope= 0.0118 '/'
Inlet Invert= 48.00', Outlet Invert= 44.00'



Reach SCC3: SCC-3



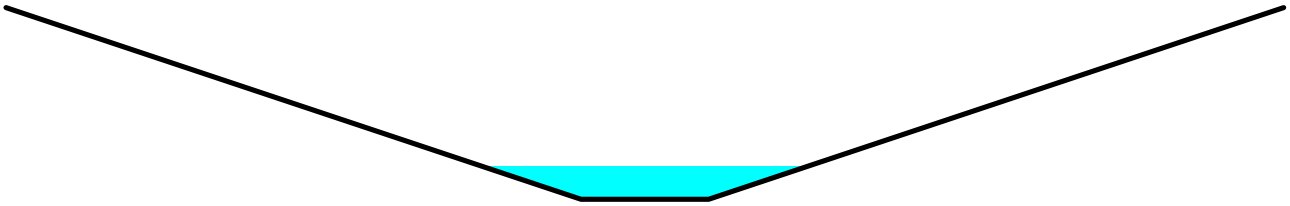
Reach SCC4: SCC-4

Inflow Area = 10.390 ac, Inflow Depth > 3.71" for Plymouth, NC - 25 Yr - Type III event
Inflow = 40.47 cfs @ 12.13 hrs, Volume= 3.213 af
Outflow = 38.73 cfs @ 12.20 hrs, Volume= 3.206 af, Atten= 4%, Lag= 3.7 min

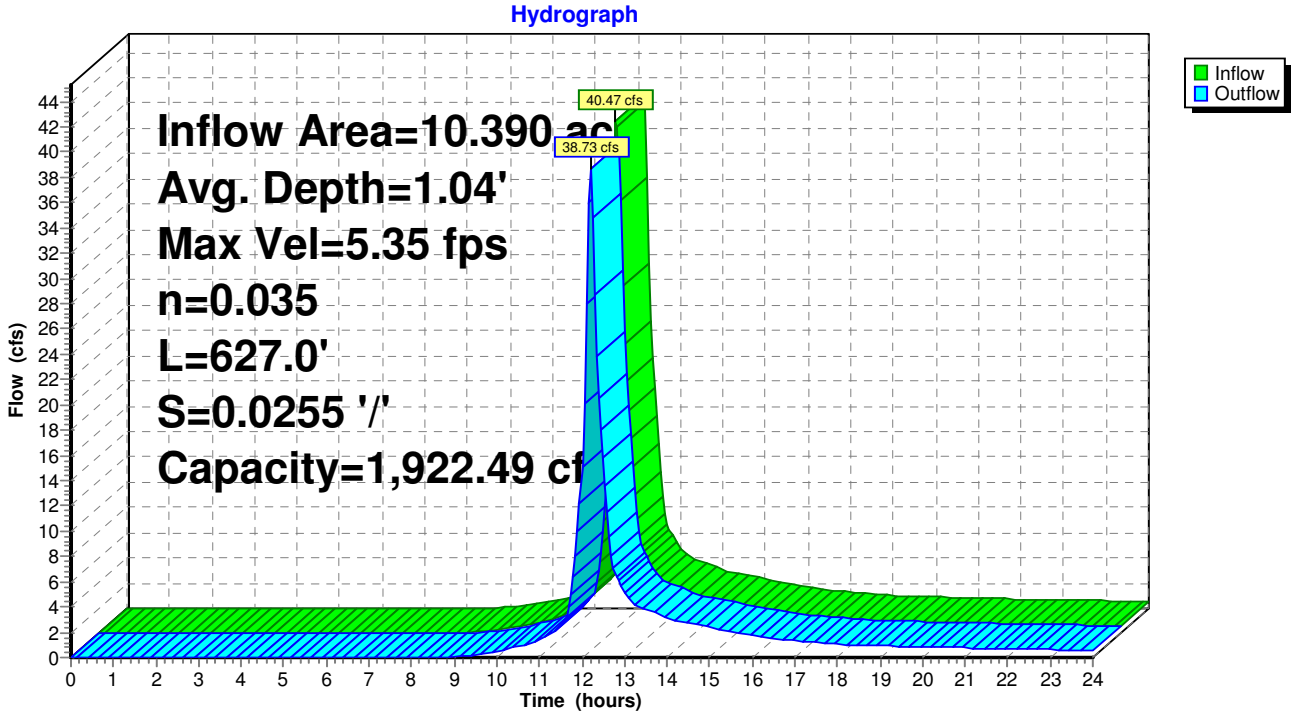
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.35 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 1.93 fps, Avg. Travel Time= 5.4 min

Peak Storage= 4,651 cf @ 12.16 hrs, Average Depth at Peak Storage= 1.04'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 1,922.49 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 627.0' Slope= 0.0255 '/'
Inlet Invert= 44.00', Outlet Invert= 28.00'



Reach SCC4: SCC-4



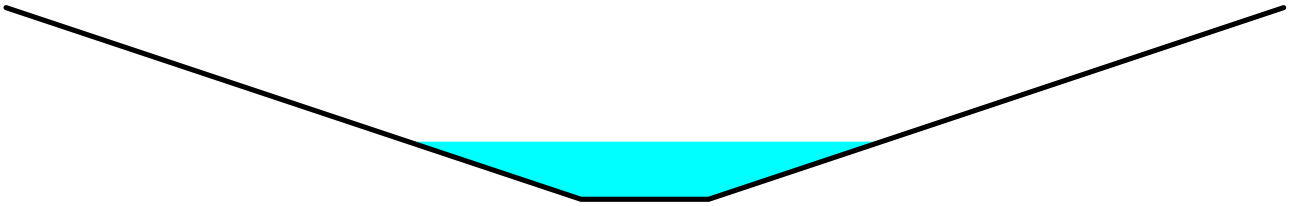
Reach SCC5: SCC-5

Inflow Area = 15.800 ac, Inflow Depth > 3.71" for Plymouth, NC - 25 Yr - Type III event
Inflow = 55.23 cfs @ 12.16 hrs, Volume= 4.881 af
Outflow = 50.64 cfs @ 12.31 hrs, Volume= 4.856 af, Atten= 8%, Lag= 8.8 min

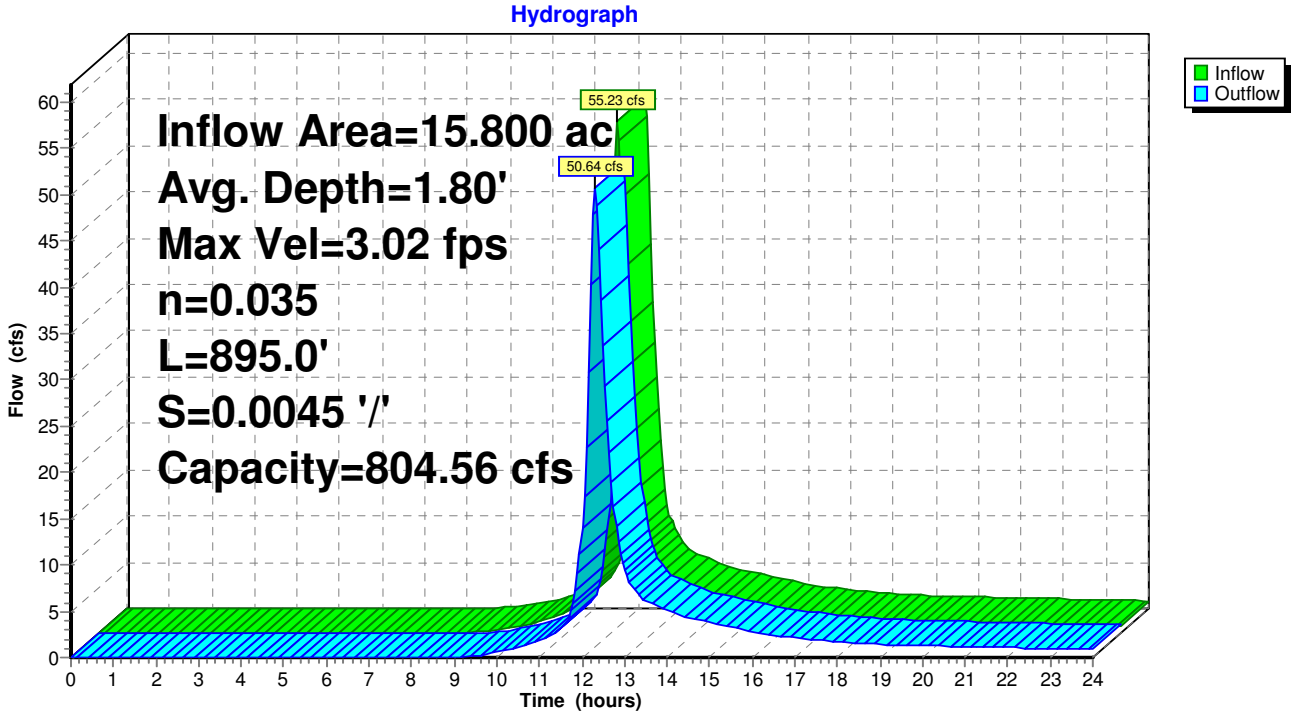
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.02 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 1.21 fps, Avg. Travel Time= 12.3 min

Peak Storage= 15,150 cf @ 12.22 hrs, Average Depth at Peak Storage= 1.80'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 804.56 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 895.0' Slope= 0.0045 '/'
Inlet Invert= 28.00', Outlet Invert= 24.00'



Reach SCC5: SCC-5



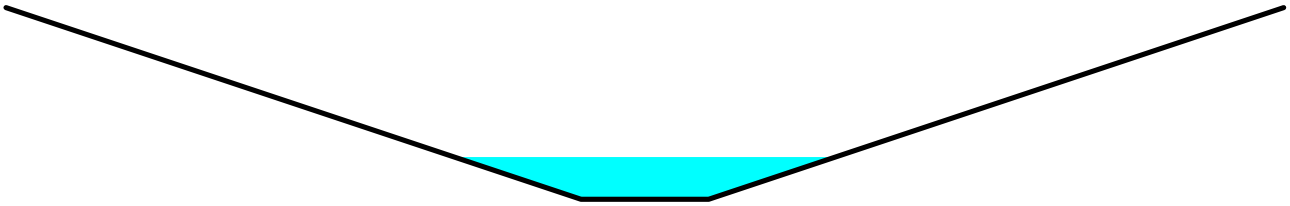
Reach SCC6: SCC-6

Inflow Area = 13.600 ac, Inflow Depth > 3.71" for Plymouth, NC - 25 Yr - Type III event
Inflow = 54.22 cfs @ 12.12 hrs, Volume= 4.207 af
Outflow = 51.00 cfs @ 12.21 hrs, Volume= 4.193 af, Atten= 6%, Lag= 5.4 min

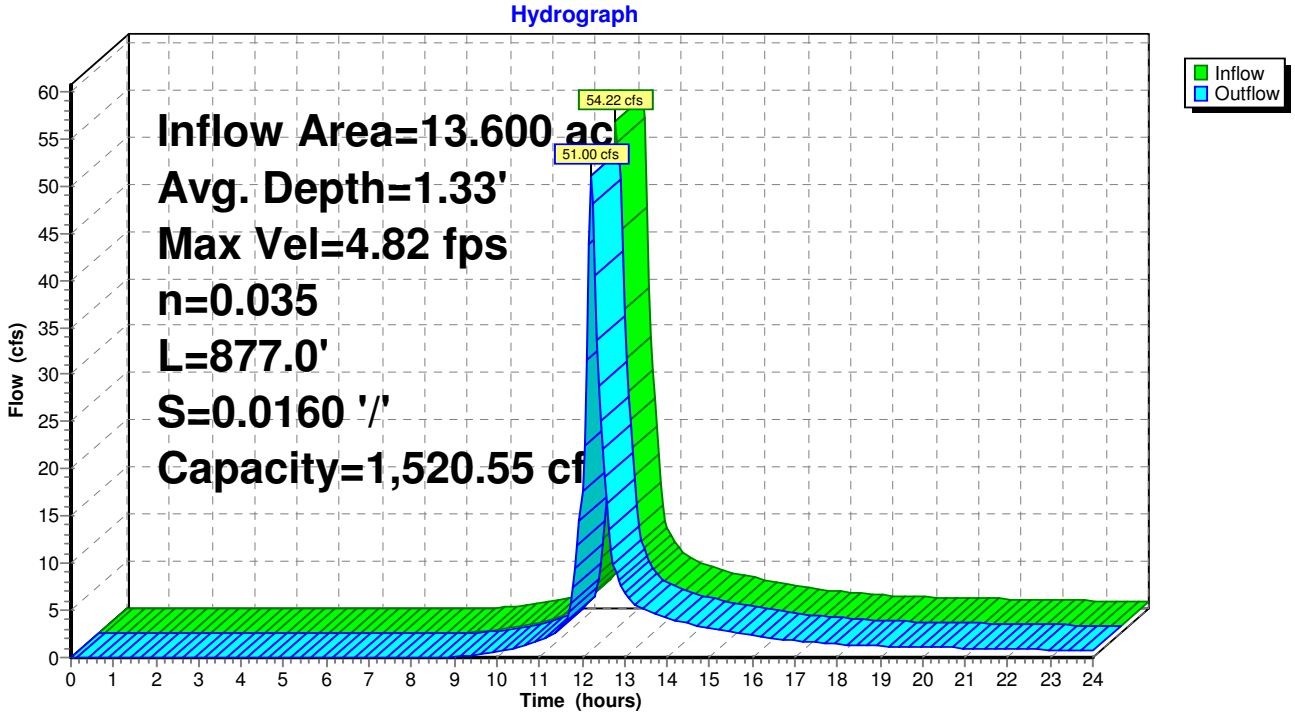
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.82 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 1.80 fps, Avg. Travel Time= 8.1 min

Peak Storage= 9,274 cf @ 12.16 hrs, Average Depth at Peak Storage= 1.33'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 1,520.55 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 877.0' Slope= 0.0160 '/'
Inlet Invert= 38.00', Outlet Invert= 24.00'



Reach SCC6: SCC-6



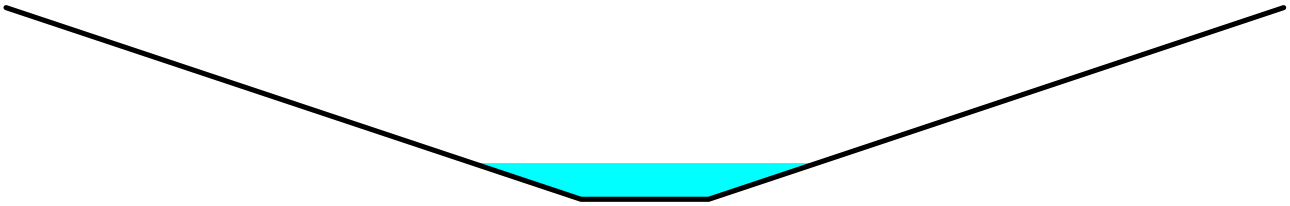
Reach SCC7: SCC-7

Inflow Area = 9.560 ac, Inflow Depth > 3.72" for Plymouth, NC - 25 Yr - Type III event
Inflow = 40.45 cfs @ 12.10 hrs, Volume= 2.960 af
Outflow = 38.17 cfs @ 12.14 hrs, Volume= 2.956 af, Atten= 6%, Lag= 2.2 min

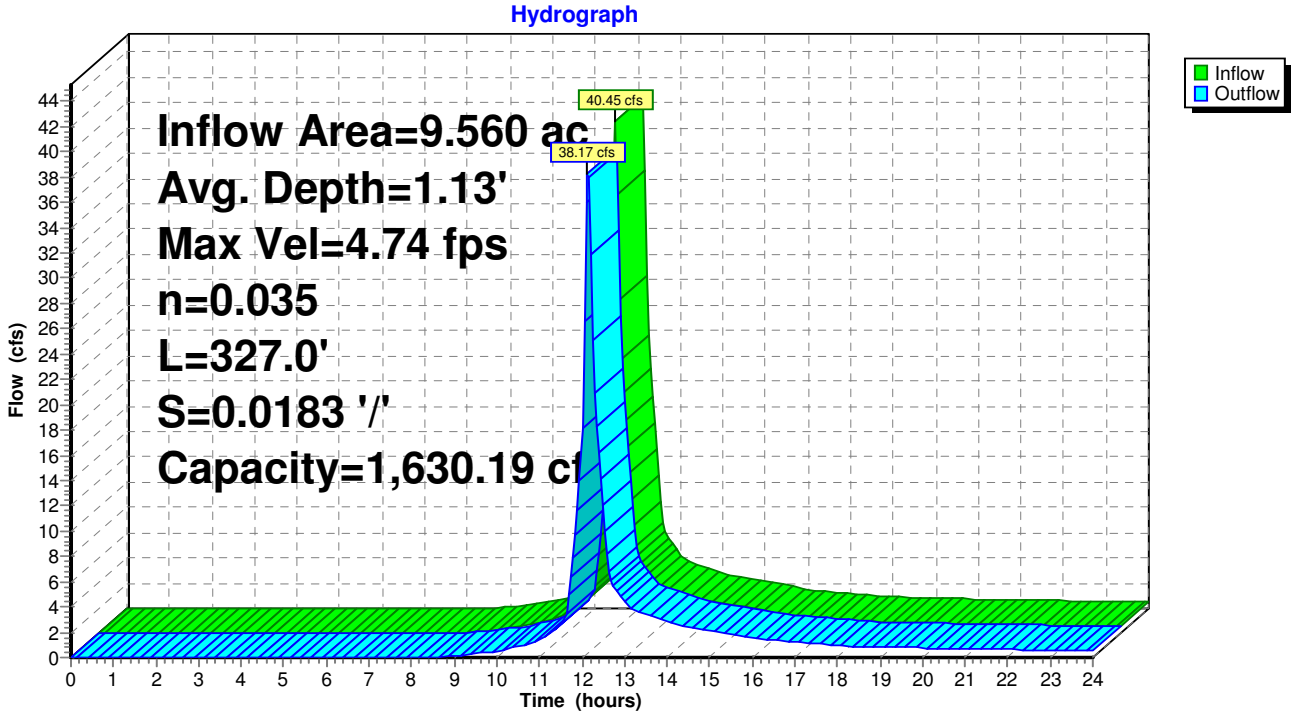
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.74 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 1.69 fps, Avg. Travel Time= 3.2 min

Peak Storage= 2,741 cf @ 12.11 hrs, Average Depth at Peak Storage= 1.13'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 1,630.19 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 327.0' Slope= 0.0183 '/'
Inlet Invert= 44.00', Outlet Invert= 38.00'



Reach SCC7: SCC-7



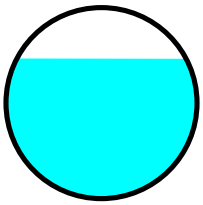
Reach SD2: SD-2

Inflow Area = 7.970 ac, Inflow Depth > 3.72" for Plymouth, NC - 25 Yr - Type III event
Inflow = 34.06 cfs @ 12.09 hrs, Volume= 2.468 af
Outflow = 33.67 cfs @ 12.10 hrs, Volume= 2.468 af, Atten= 1%, Lag= 0.5 min

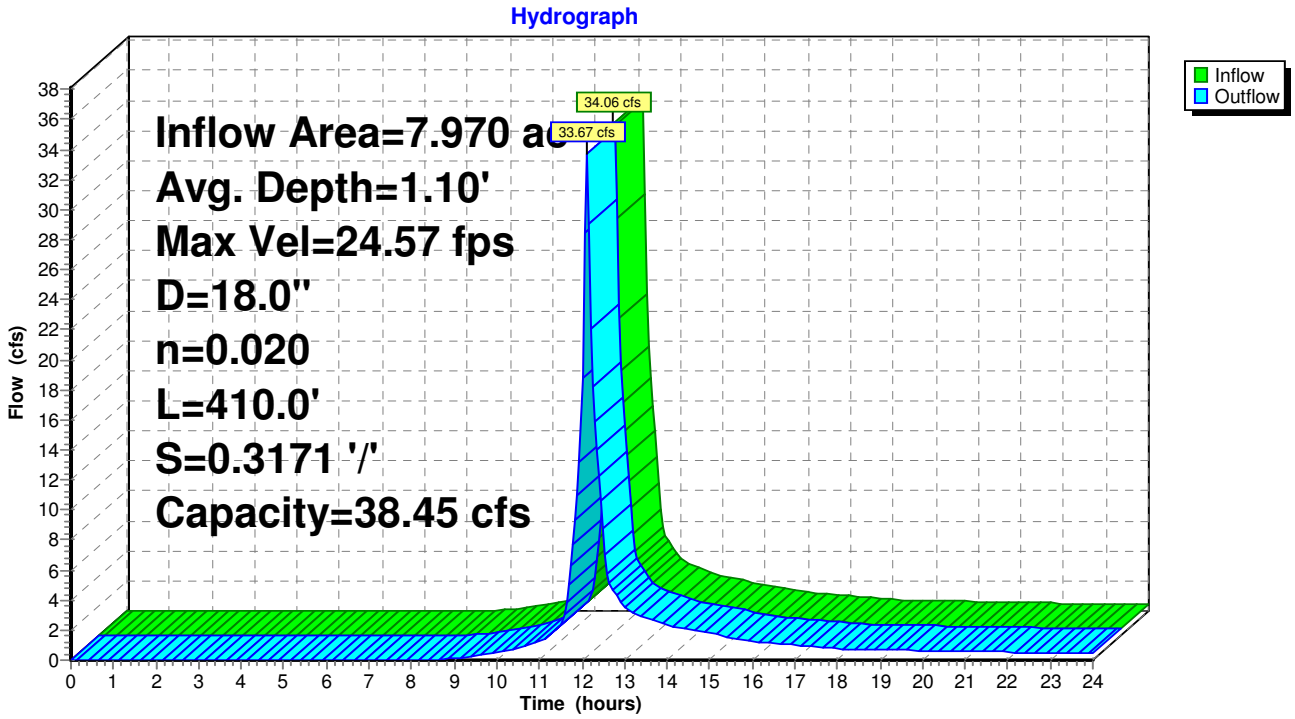
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 24.57 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 9.59 fps, Avg. Travel Time= 0.7 min

Peak Storage= 569 cf @ 12.10 hrs, Average Depth at Peak Storage= 1.10'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 38.45 cfs

18.0" Diameter Pipe, n= 0.020
Length= 410.0' Slope= 0.3171 '/'
Inlet Invert= 170.00', Outlet Invert= 40.00'



Reach SD2: SD-2



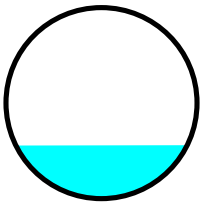
Reach SD3: SD-3

Inflow Area = 1.550 ac, Inflow Depth > 3.72" for Plymouth, NC - 25 Yr - Type III event
Inflow = 6.62 cfs @ 12.09 hrs, Volume= 0.480 af
Outflow = 6.57 cfs @ 12.10 hrs, Volume= 0.480 af, Atten= 1%, Lag= 0.3 min

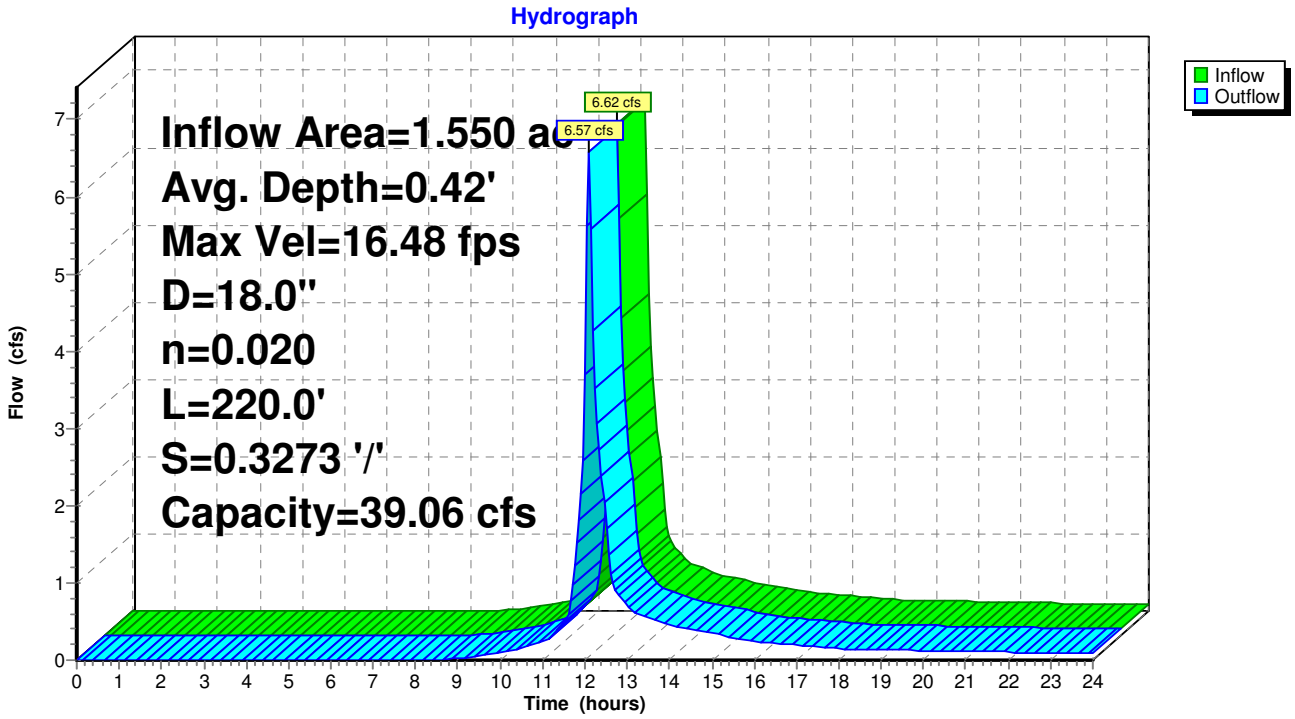
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 16.48 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 5.96 fps, Avg. Travel Time= 0.6 min

Peak Storage= 89 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 39.06 cfs

18.0" Diameter Pipe, n= 0.020
Length= 220.0' Slope= 0.3273 '/'
Inlet Invert= 100.00', Outlet Invert= 28.00'



Reach SD3: SD-3



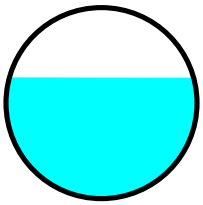
Reach SD4: SD-4

Inflow Area = 6.440 ac, Inflow Depth > 3.72" for Plymouth, NC - 25 Yr - Type III event
Inflow = 27.52 cfs @ 12.09 hrs, Volume= 1.995 af
Outflow = 27.22 cfs @ 12.10 hrs, Volume= 1.994 af, Atten= 1%, Lag= 0.5 min

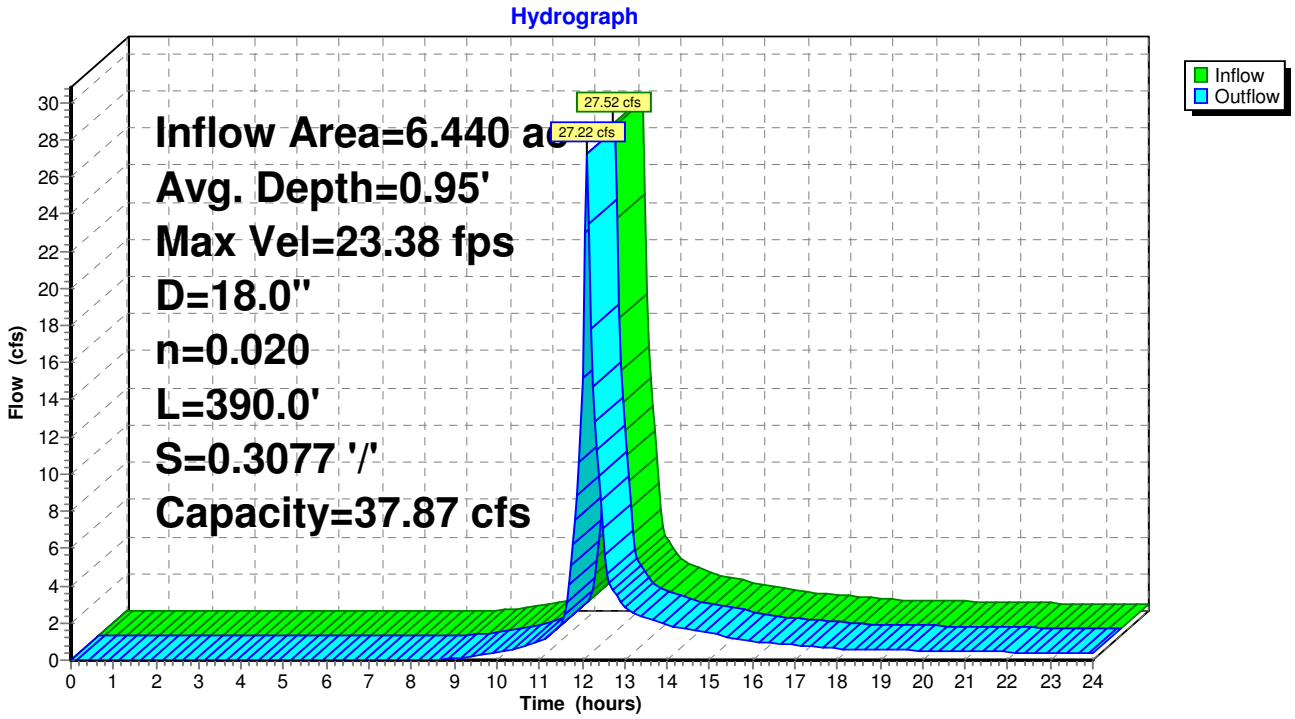
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 23.38 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 8.91 fps, Avg. Travel Time= 0.7 min

Peak Storage= 460 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.95'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 37.87 cfs

18.0" Diameter Pipe, n= 0.020
Length= 390.0' Slope= 0.3077 '/'
Inlet Invert= 170.00', Outlet Invert= 50.00'



Reach SD4: SD-4



Pond SP-6: SP-6

Inflow Area = 29.400 ac, Inflow Depth > 3.69" for Plymouth, NC - 25 Yr - Type III event
Inflow = 95.53 cfs @ 12.26 hrs, Volume= 9.047 af
Outflow = 15.44 cfs @ 13.07 hrs, Volume= 8.106 af, Atten= 84%, Lag= 48.9 min
Primary = 15.44 cfs @ 13.07 hrs, Volume= 8.106 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 13.04' @ 13.07 hrs Surf.Area= 72,877 sf Storage= 179,418 cf

Plug-Flow detention time= 172.3 min calculated for 8.089 af (89% of inflow)
Center-of-Mass det. time= 123.7 min (967.5 - 843.8)

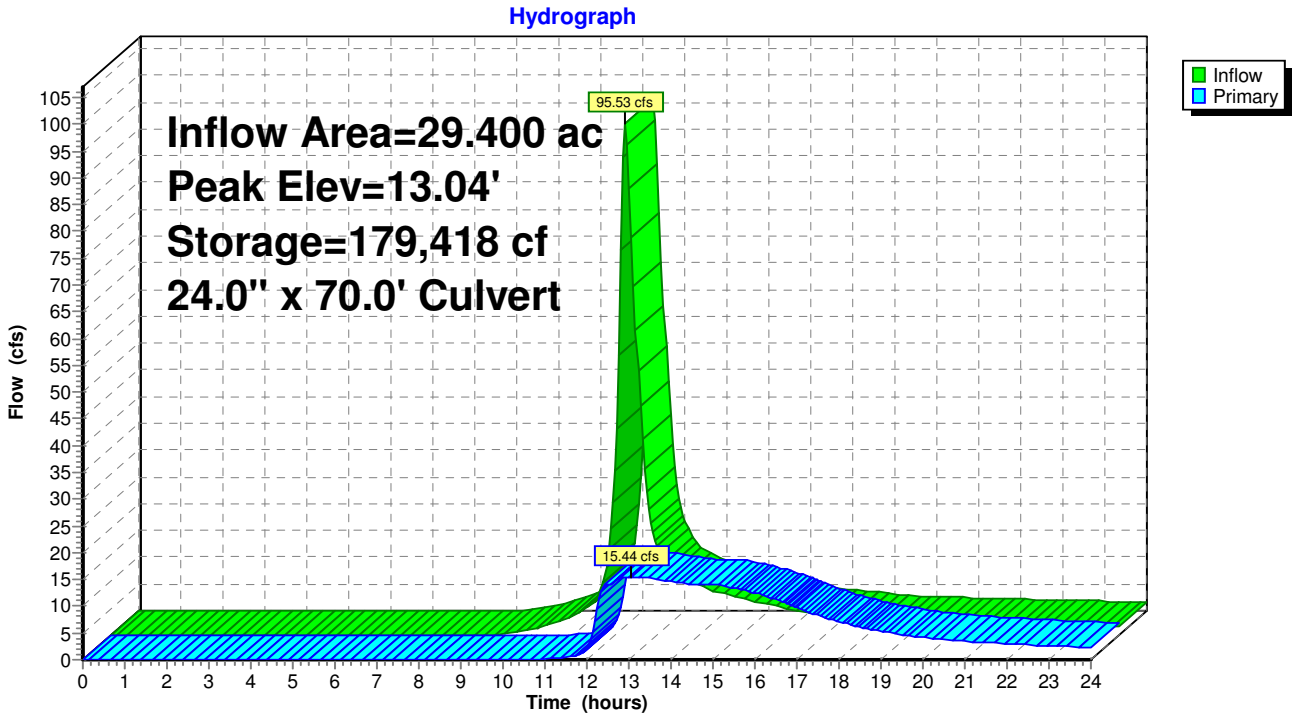
Volume	Invert	Avail.Storage	Storage Description
#1	10.00'	582,331 cf	**Custom Stage Data (Prismatic)** Listed below

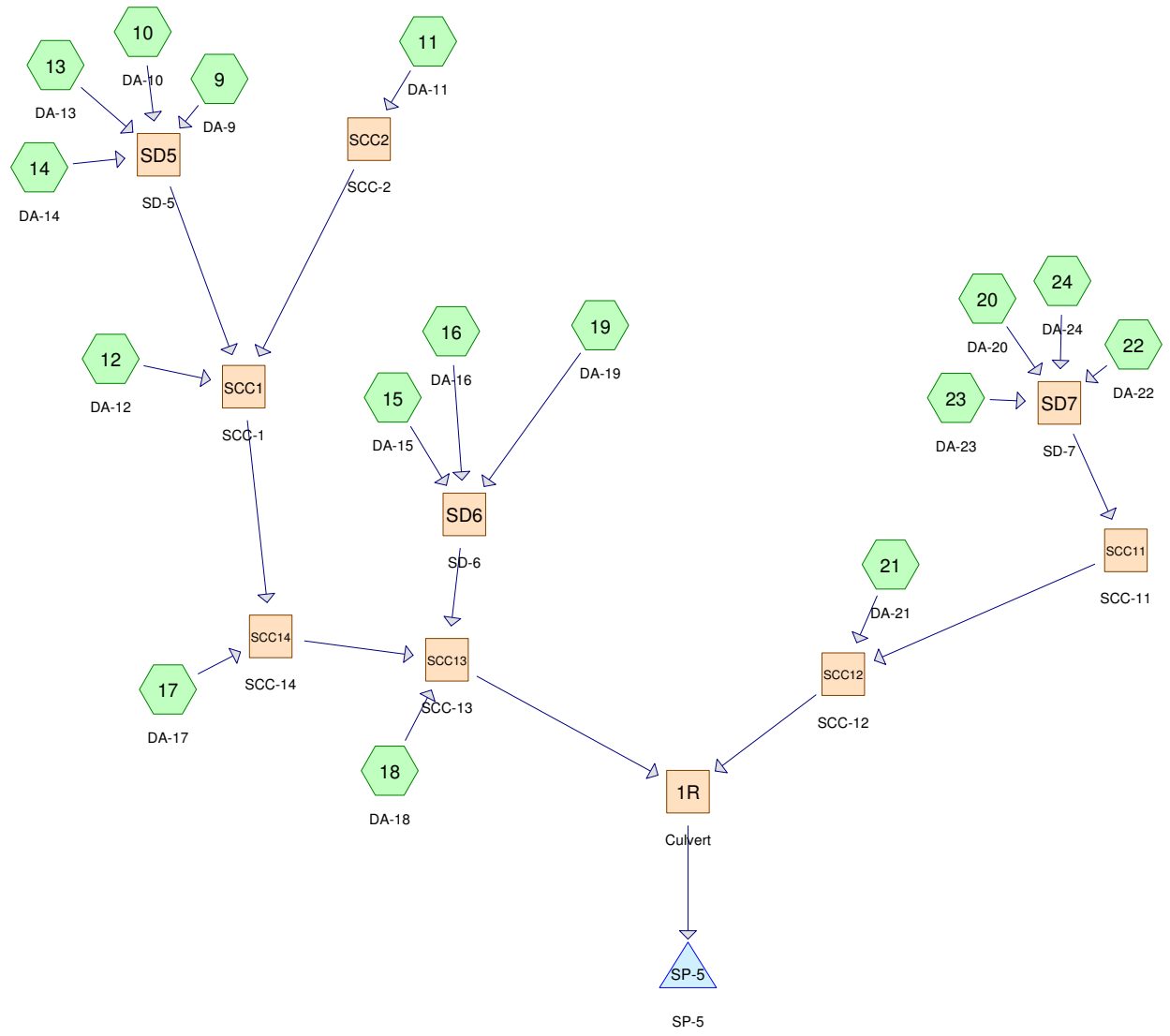
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
10.00	34,605	0	0
12.00	69,396	104,001	104,001
14.00	76,113	145,509	249,510
16.00	83,147	159,260	408,770
18.00	90,414	173,561	582,331

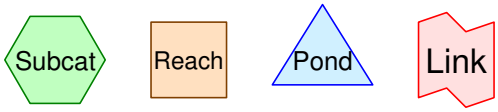
Device	Routing	Invert	Outlet Devices
#1	Primary	10.00'	**24.0" x 70.0' long Culvert** CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 9.30' S= 0.0100 '/' Cc= 0.900 n= 0.023

Primary OutFlow Max=15.44 cfs @ 13.07 hrs HW=13.04' (Free Discharge)
└─**1=Culvert** (Barrel Controls 15.44 cfs @ 4.91 fps)

Pond SP-6: SP-6


Hydrograph
Inflow Area=29.400 ac
Peak Elev=13.04'
Storage=179,418 cf
24.0" x 70.0' Culvert
95.53 cfs
15.44 cfs
Inflow
Primary
Flow (cfs)
Time (hours)





Drainage Diagram for Domtar E&S - East
Prepared by {enter your company name here} 11/1/2012
HydroCAD® 8.00 s/n 004761 © 2006 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcats)
24.900	69	Pasture/grassland/range, Fair, HSG B (9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24)
24.900		

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 9: DA-9 Runoff Area=0.600 ac Runoff Depth>3.72"
Flow Length=212' Slope=0.0500 '/' Tc=6.0 min CN=69 Runoff=2.56 cfs 0.186 af

Subcatchment 10: DA-10 Runoff Area=2.040 ac Runoff Depth>3.72"
Flow Length=229' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=8.72 cfs 0.632 af

Subcatchment 11: DA-11 Runoff Area=2.620 ac Runoff Depth>3.72"
Flow Length=163' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=11.20 cfs 0.811 af

Subcatchment 12: DA-12 Runoff Area=1.940 ac Runoff Depth>3.72"
Flow Length=174' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=8.29 cfs 0.601 af

Subcatchment 13: DA-13 Runoff Area=1.600 ac Runoff Depth>3.72"
Flow Length=226' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=6.84 cfs 0.496 af

Subcatchment 14: DA-14 Runoff Area=0.800 ac Runoff Depth>3.72"
Flow Length=208' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=3.42 cfs 0.248 af

Subcatchment 15: DA-15 Runoff Area=1.060 ac Runoff Depth>3.72"
Flow Length=224' Slope=0.0500 '/' Tc=6.0 min CN=69 Runoff=4.53 cfs 0.328 af

Subcatchment 16: DA-16 Runoff Area=1.610 ac Runoff Depth>3.72"
Flow Length=240' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=6.88 cfs 0.499 af

Subcatchment 17: DA-17 Runoff Area=1.600 ac Runoff Depth>3.72"
Flow Length=191' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=6.84 cfs 0.496 af

Subcatchment 18: DA-18 Runoff Area=1.670 ac Runoff Depth>3.72"
Flow Length=169' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=7.14 cfs 0.517 af

Subcatchment 19: DA-19 Runoff Area=1.300 ac Runoff Depth>3.72"
Flow Length=167' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=5.56 cfs 0.403 af

Subcatchment 20: DA-20 Runoff Area=0.670 ac Runoff Depth>3.72"
Flow Length=100' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=2.86 cfs 0.208 af

Subcatchment 21: DA-21 Runoff Area=1.380 ac Runoff Depth>3.72"
Flow Length=188' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=5.90 cfs 0.427 af

Subcatchment 22: DA-22 Runoff Area=2.810 ac Runoff Depth>3.72"
Flow Length=240' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=12.01 cfs 0.870 af

Subcatchment 23: DA-23 Runoff Area=0.730 ac Runoff Depth>3.72"
Flow Length=96' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=3.12 cfs 0.226 af

Subcatchment 24: DA-24 Runoff Area=2.470 ac Runoff Depth>3.72"
Flow Length=364' Slope=0.0500 '/' Tc=6.0 min CN=69 Runoff=10.56 cfs 0.765 af

Reach 1R: Culvert Avg. Depth=0.61' Max Vel=11.67 fps Inflow=71.63 cfs 7.670 af
n=0.012 L=100.0' S=0.0200 '/' Capacity=615.45 cfs Outflow=71.54 cfs 7.669 af

Reach SCC1: SCC-1 Avg. Depth=1.52' Max Vel=2.33 fps Inflow=33.73 cfs 2.967 af
n=0.035 L=620.0' S=0.0032 '/' Capacity=683.53 cfs Outflow=29.76 cfs 2.953 af

Reach SCC11: SCC-11 Avg. Depth=1.05' Max Vel=3.47 fps Inflow=28.28 cfs 2.068 af
n=0.035 L=564.0' S=0.0106 '/' Capacity=1,241.29 cfs Outflow=26.01 cfs 2.062 af

Reach SCC12: SCC-12 Avg. Depth=1.08' Max Vel=3.85 fps Inflow=30.33 cfs 2.489 af
n=0.035 L=314.0' S=0.0127 '/' Capacity=1,358.32 cfs Outflow=29.33 cfs 2.486 af

Reach SCC13: SCC-13 Avg. Depth=0.93' Max Vel=6.96 fps Inflow=43.98 cfs 5.186 af
n=0.035 L=123.0' S=0.0488 '/' Capacity=2,658.04 cfs Outflow=43.89 cfs 5.185 af

Reach SCC14: SCC-14 Avg. Depth=1.41' Max Vel=2.82 fps Inflow=33.36 cfs 3.448 af
n=0.035 L=392.0' S=0.0051 '/' Capacity=859.63 cfs Outflow=32.73 cfs 3.440 af

Reach SCC2: SCC-2 Avg. Depth=0.73' Max Vel=2.01 fps Inflow=11.20 cfs 0.811 af
n=0.035 L=758.0' S=0.0053 '/' Capacity=874.24 cfs Outflow=9.10 cfs 0.805 af

Reach SD5: SD-5 Avg. Depth=0.82' Max Vel=21.88 fps Inflow=21.54 cfs 1.561 af
D=18.0" n=0.020 L=415.0' S=0.2988 '/' Capacity=37.32 cfs Outflow=21.27 cfs 1.560 af

Reach SD6: SD-6 Avg. Depth=0.68' Max Vel=21.80 fps Inflow=16.97 cfs 1.230 af
D=18.0" n=0.020 L=375.0' S=0.3467 '/' Capacity=40.20 cfs Outflow=16.78 cfs 1.229 af

Reach SD7: SD-7 Avg. Depth=1.12' Max Vel=20.25 fps Inflow=28.55 cfs 2.069 af
D=18.0" n=0.020 L=280.0' S=0.2143 '/' Capacity=31.61 cfs Outflow=28.28 cfs 2.068 af

Pond SP-5: SP-5 Peak Elev=31.85' Storage=131,991 cf Inflow=71.54 cfs 7.669 af
24.0" x 70.0' Culvert Outflow=18.72 cfs 7.206 af

Total Runoff Area = 24.900 ac Runoff Volume = 7.712 af Average Runoff Depth = 3.72"
100.00% Pervious Area = 24.900 ac 0.00% Impervious Area = 0.000 ac

Subcatchment 9: DA-9

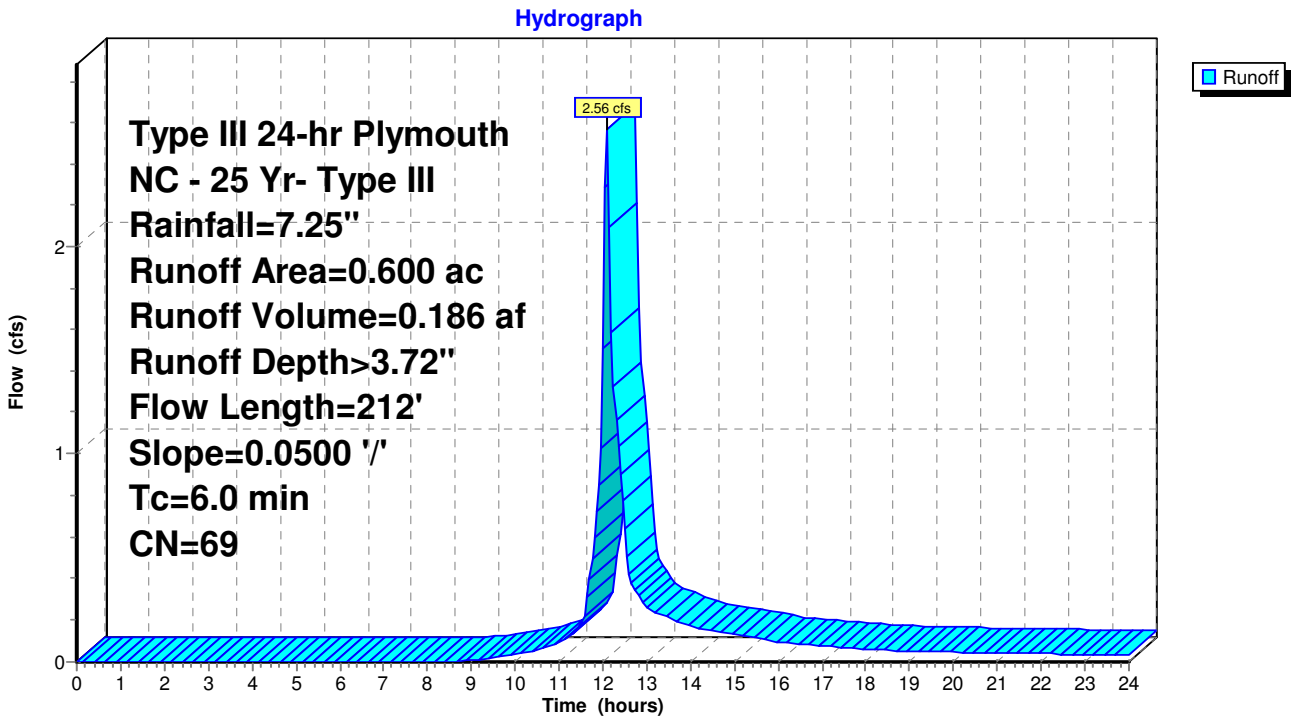
Runoff = 2.56 cfs @ 12.09 hrs, Volume= 0.186 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
0.600	69	Pasture/grassland/range, Fair, HSG B
0.600		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	212	0.0500	1.57		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
2.3	212	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 9: DA-9



Subcatchment 10: DA-10

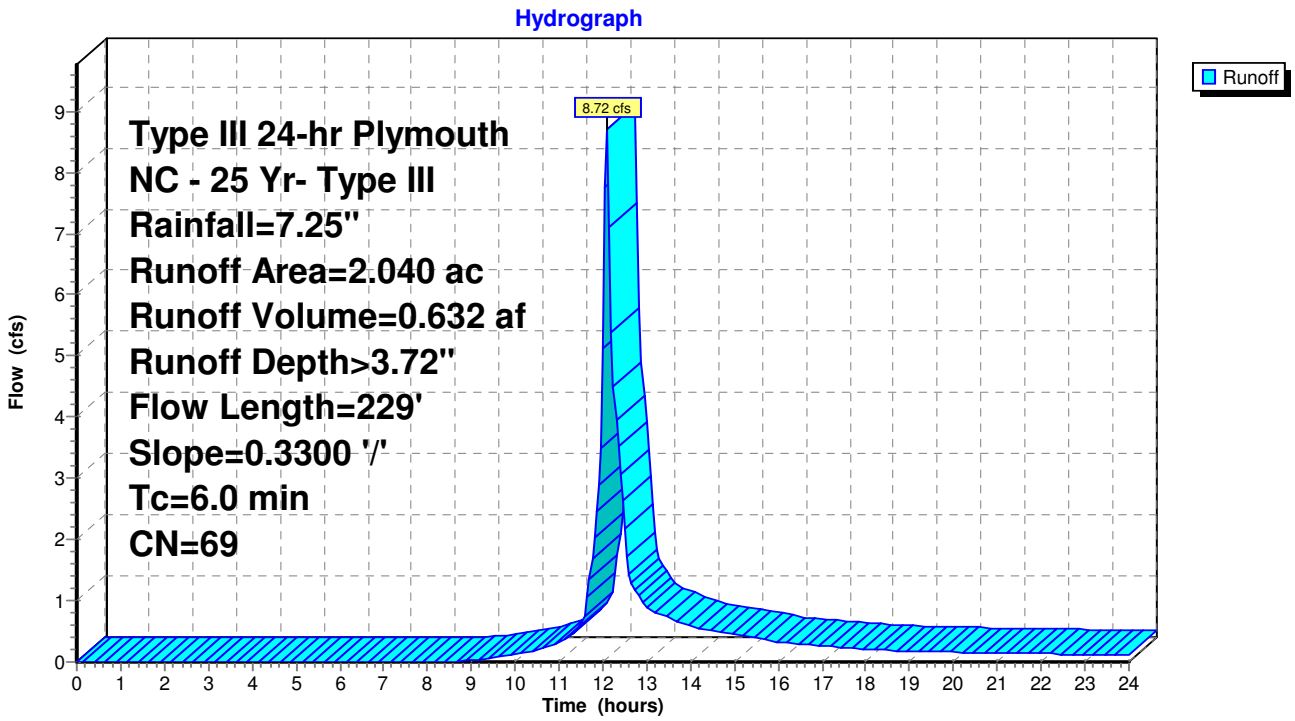
Runoff = 8.72 cfs @ 12.09 hrs, Volume= 0.632 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
2.040	69	Pasture/grassland/range, Fair, HSG B
2.040		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	229	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.9	229	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 10: DA-10



Subcatchment 11: DA-11

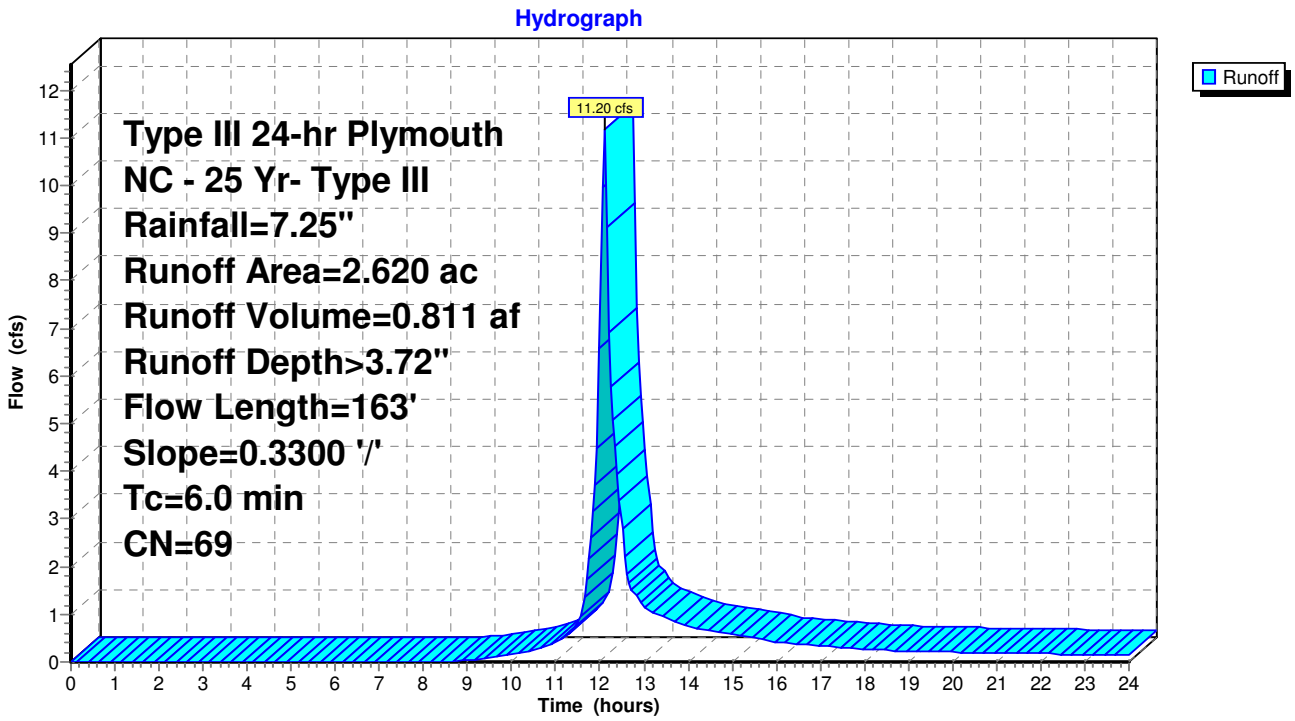
Runoff = 11.20 cfs @ 12.09 hrs, Volume= 0.811 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
2.620	69	Pasture/grassland/range, Fair, HSG B
2.620		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	163	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.7	163	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 11: DA-11



Subcatchment 12: DA-12

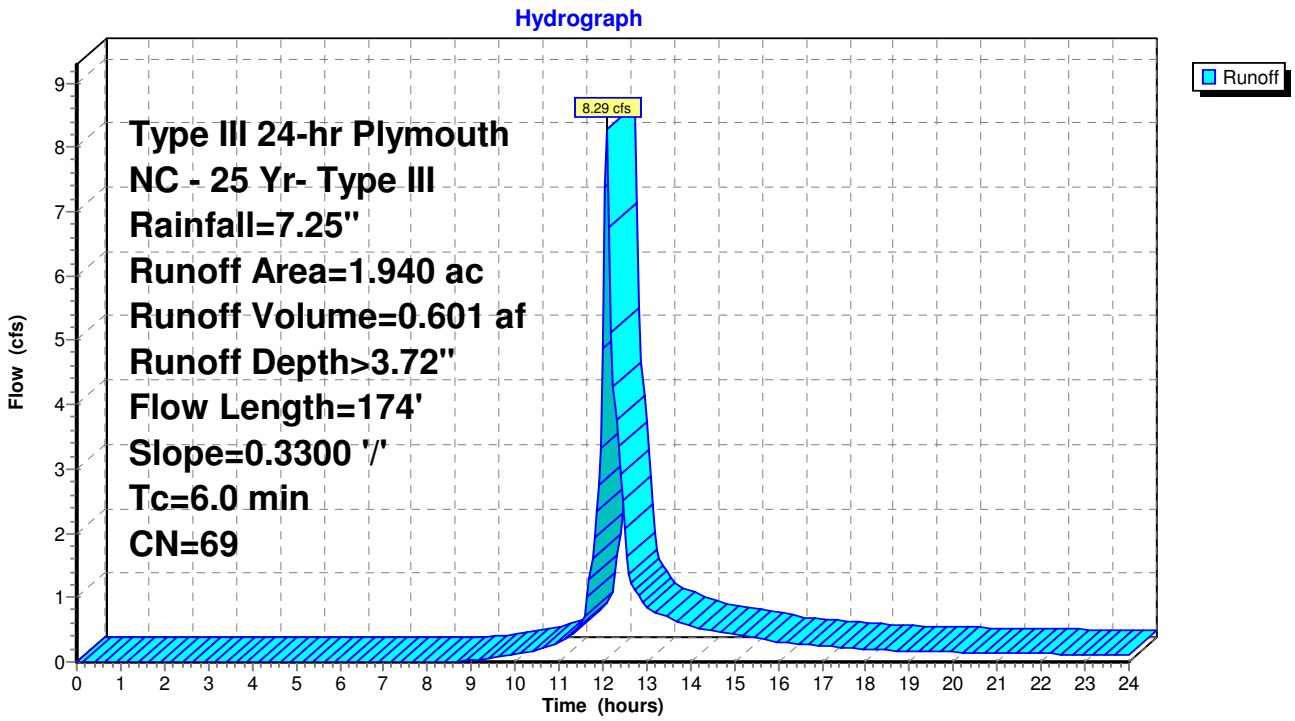
Runoff = 8.29 cfs @ 12.09 hrs, Volume= 0.601 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
1.940	69	Pasture/grassland/range, Fair, HSG B
1.940		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	174	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.7	174	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 12: DA-12



Subcatchment 13: DA-13

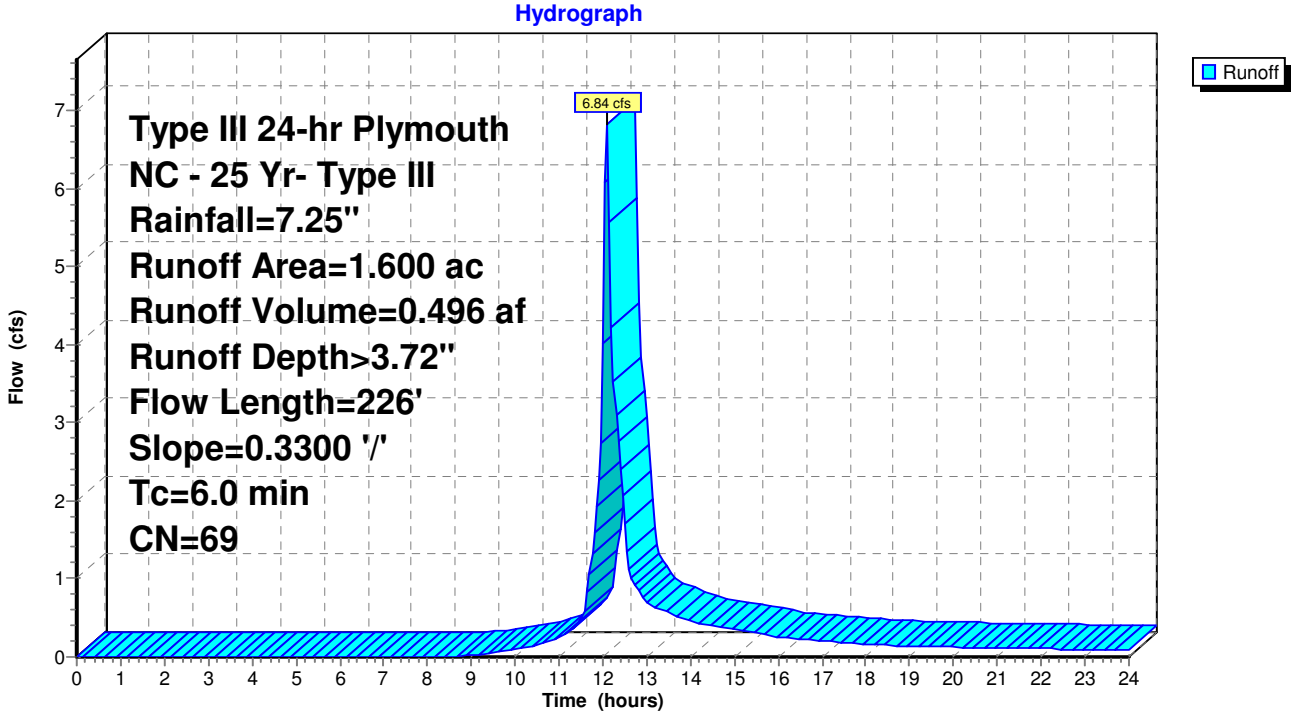
Runoff = 6.84 cfs @ 12.09 hrs, Volume= 0.496 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
1.600	69	Pasture/grassland/range, Fair, HSG B
1.600		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	226	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.9	226	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 13: DA-13



Subcatchment 14: DA-14

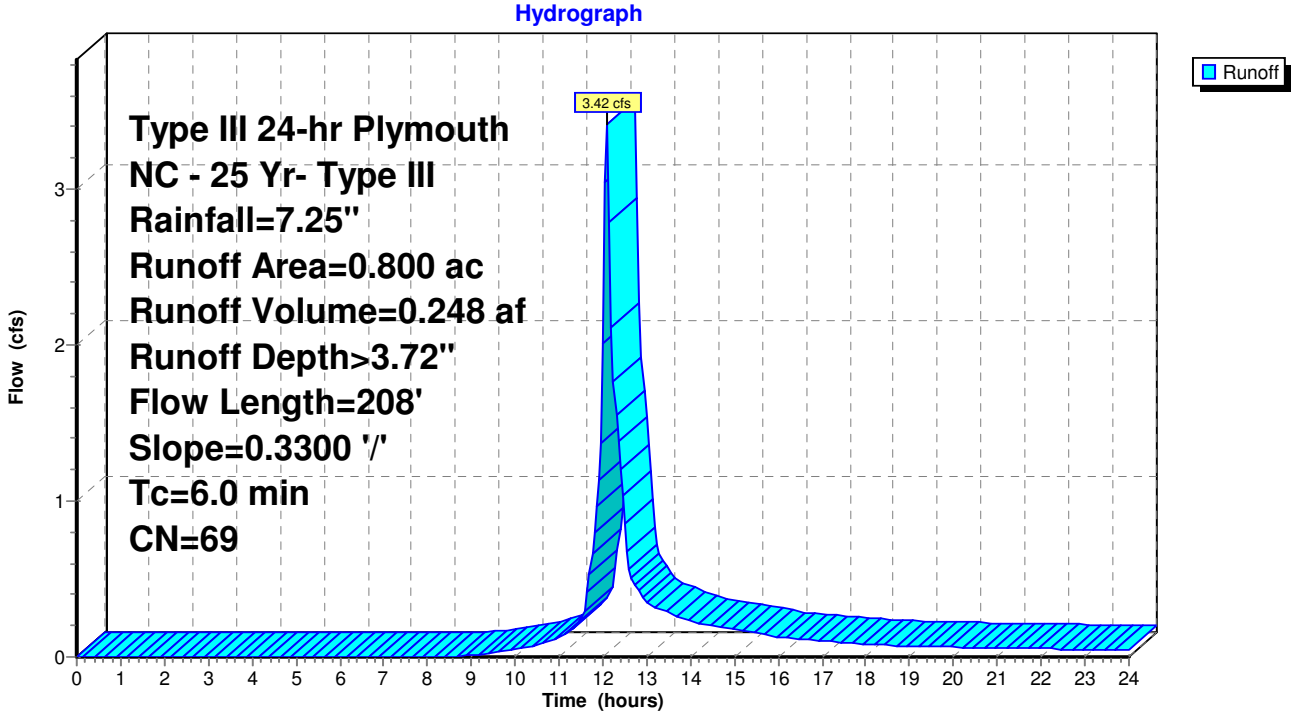
Runoff = 3.42 cfs @ 12.09 hrs, Volume= 0.248 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
0.800	69	Pasture/grassland/range, Fair, HSG B
0.800		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	208	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.9	208	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 14: DA-14



Subcatchment 15: DA-15

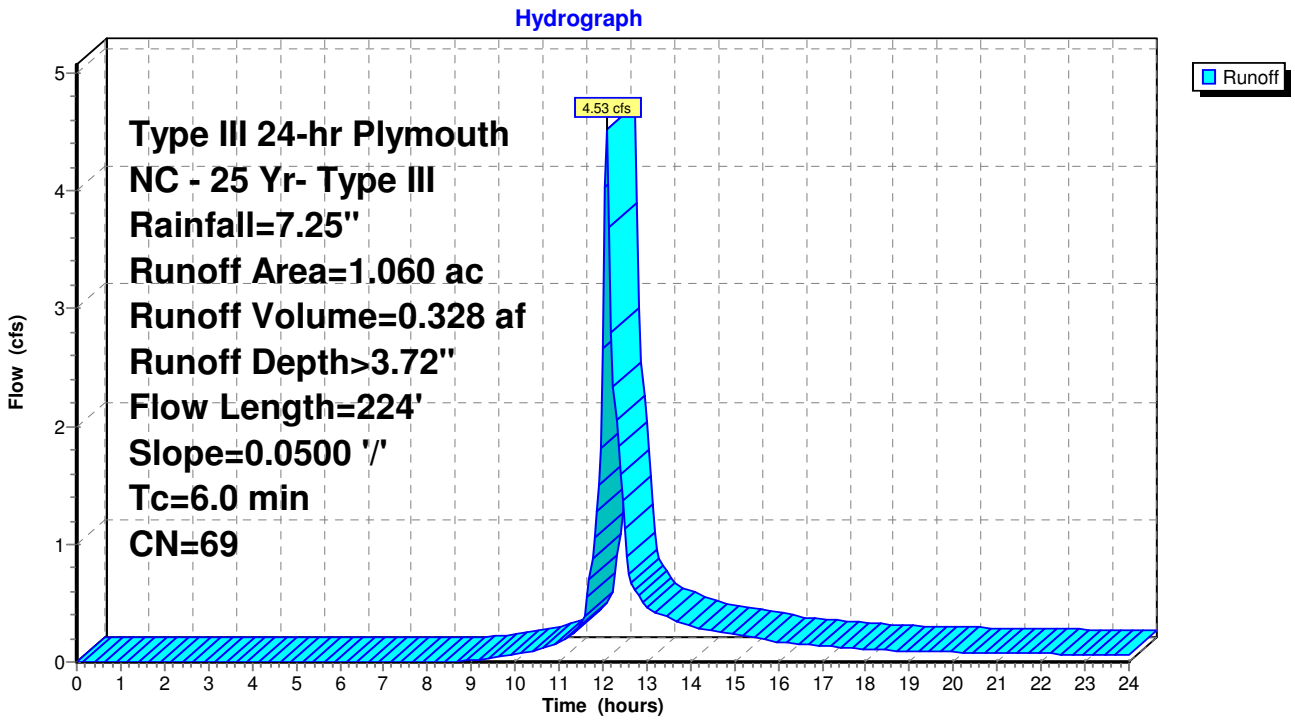
Runoff = 4.53 cfs @ 12.09 hrs, Volume= 0.328 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
1.060	69	Pasture/grassland/range, Fair, HSG B
1.060		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	224	0.0500	1.57		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
2.4	224	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 15: DA-15



Subcatchment 16: DA-16

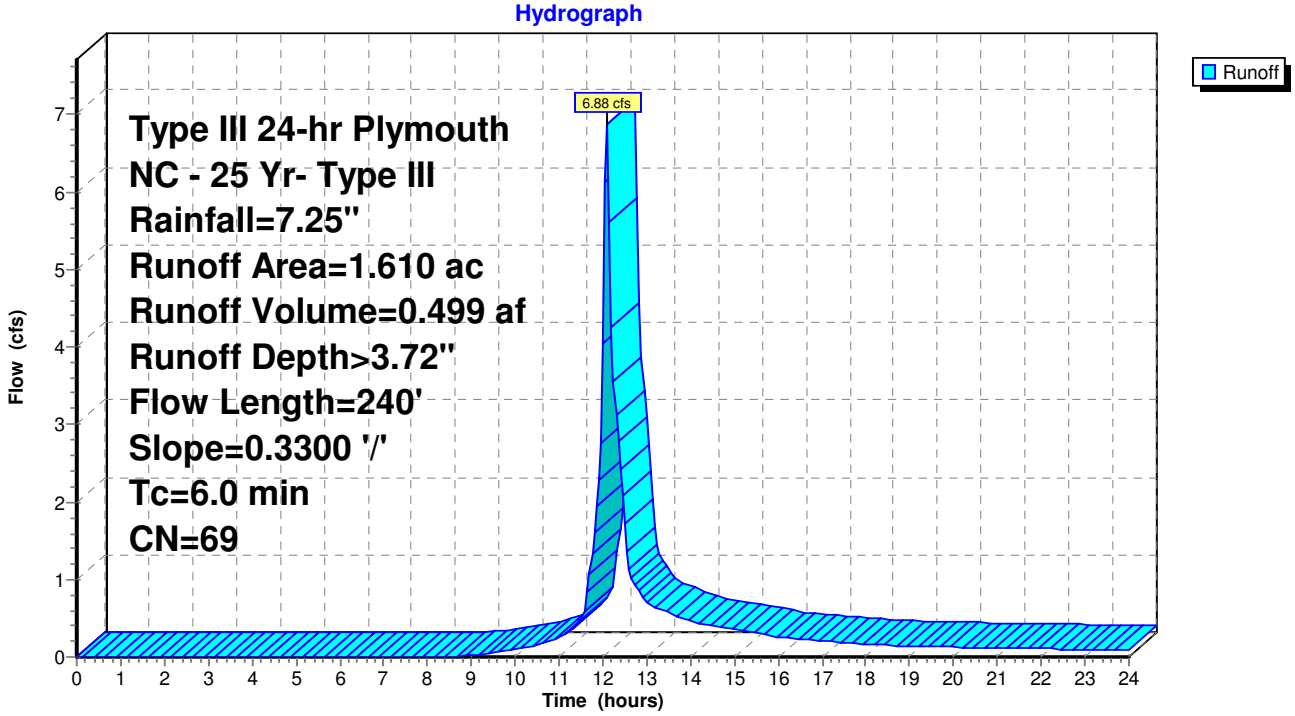
Runoff = 6.88 cfs @ 12.09 hrs, Volume= 0.499 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
1.610	69	Pasture/grassland/range, Fair, HSG B
1.610		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	240	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
1.0	240	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 16: DA-16



Subcatchment 17: DA-17

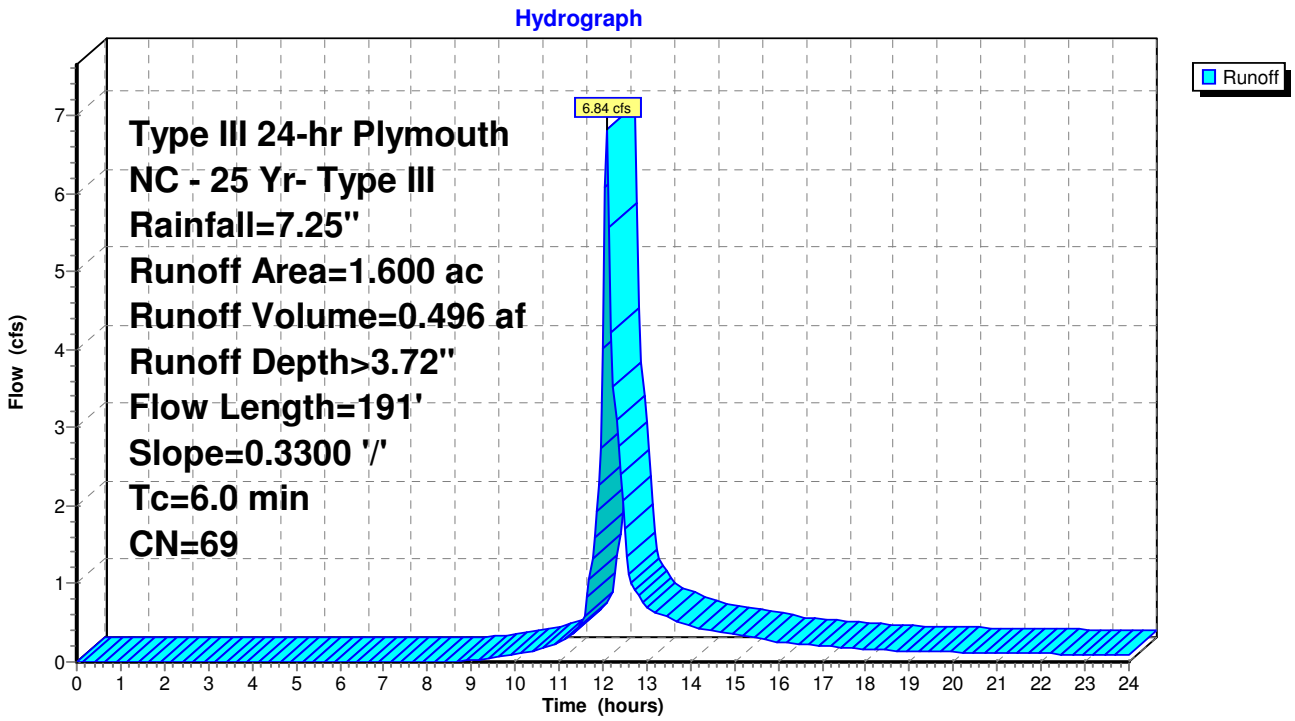
Runoff = 6.84 cfs @ 12.09 hrs, Volume= 0.496 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
1.600	69	Pasture/grassland/range, Fair, HSG B
1.600		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	191	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.8	191	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 17: DA-17



Subcatchment 18: DA-18

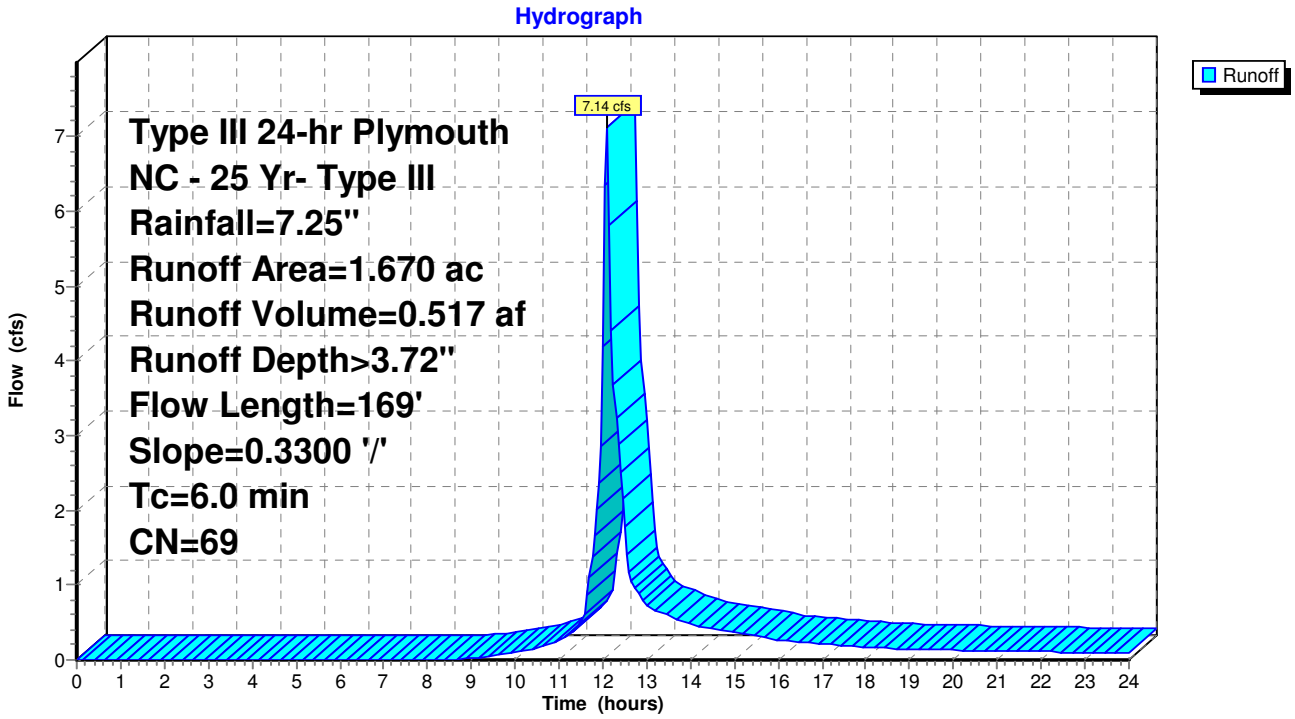
Runoff = 7.14 cfs @ 12.09 hrs, Volume= 0.517 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
1.670	69	Pasture/grassland/range, Fair, HSG B
1.670		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	169	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.7	169	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 18: DA-18



Subcatchment 19: DA-19

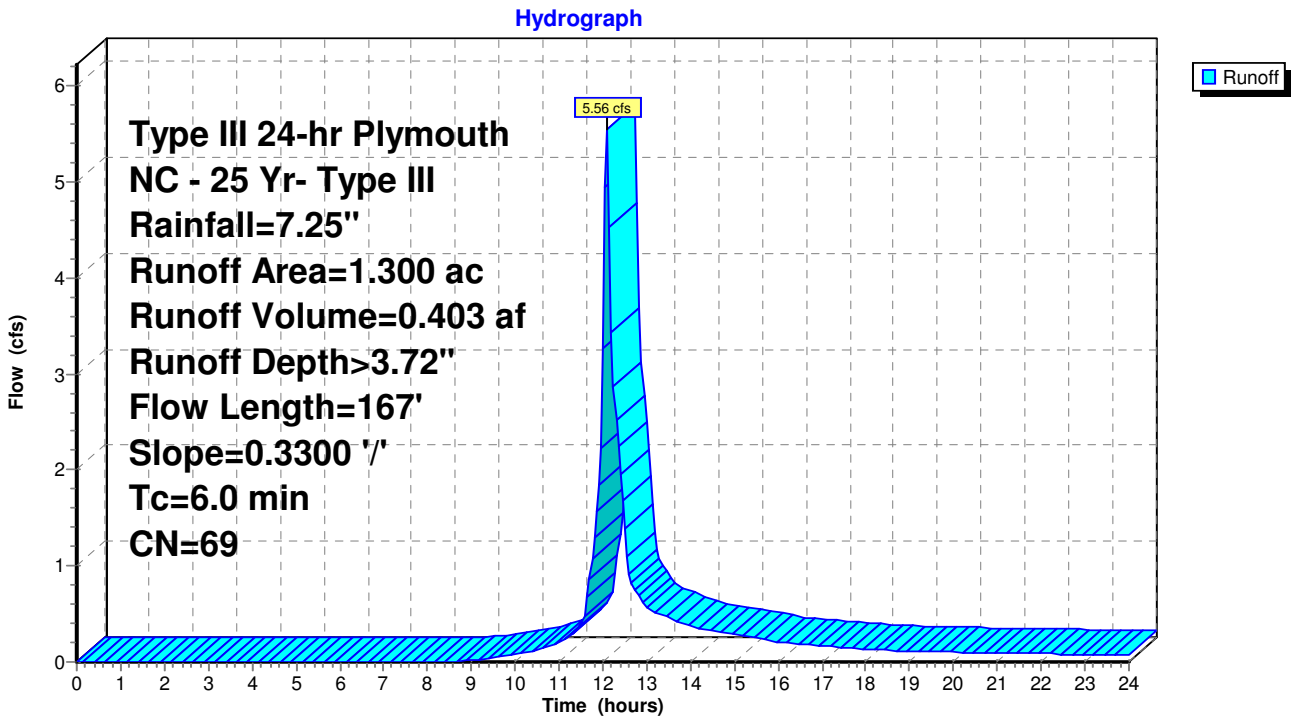
Runoff = 5.56 cfs @ 12.09 hrs, Volume= 0.403 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
1.300	69	Pasture/grassland/range, Fair, HSG B
1.300		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	167	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.7	167	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 19: DA-19



Subcatchment 20: DA-20

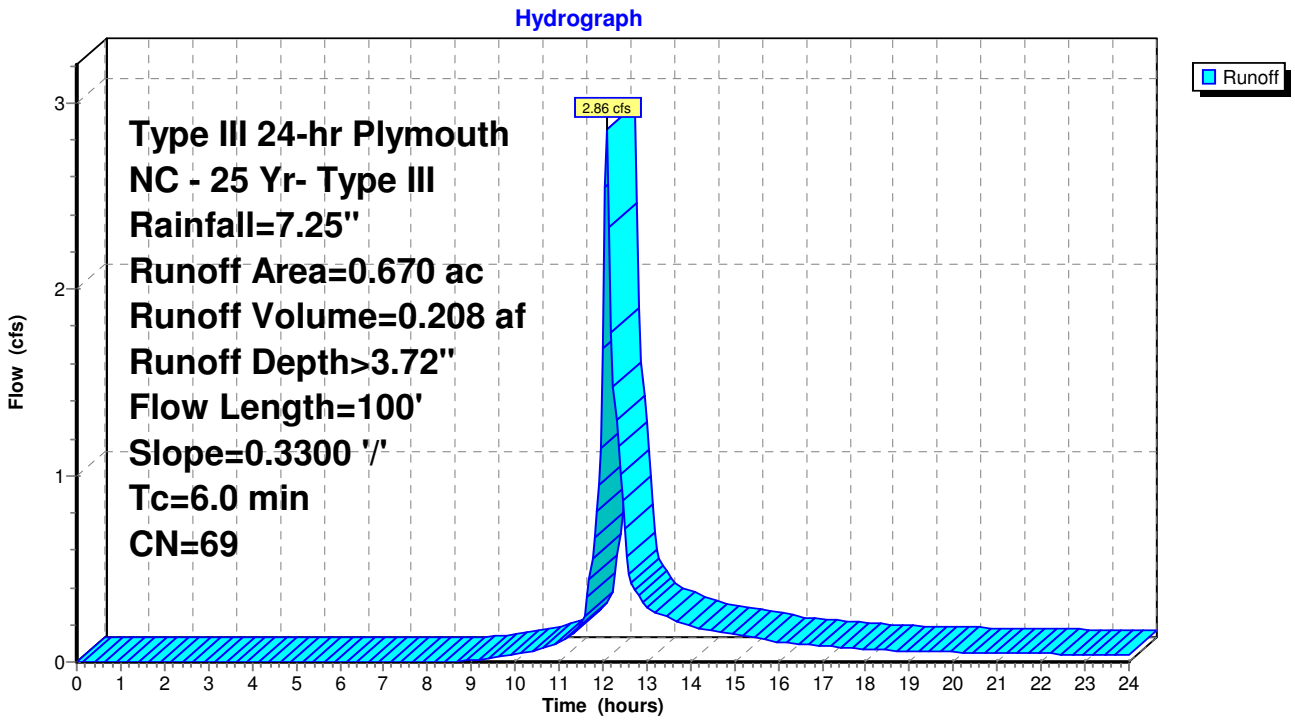
Runoff = 2.86 cfs @ 12.09 hrs, Volume= 0.208 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
0.670	69	Pasture/grassland/range, Fair, HSG B
0.670		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	100	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.4	100	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 20: DA-20



Subcatchment 21: DA-21

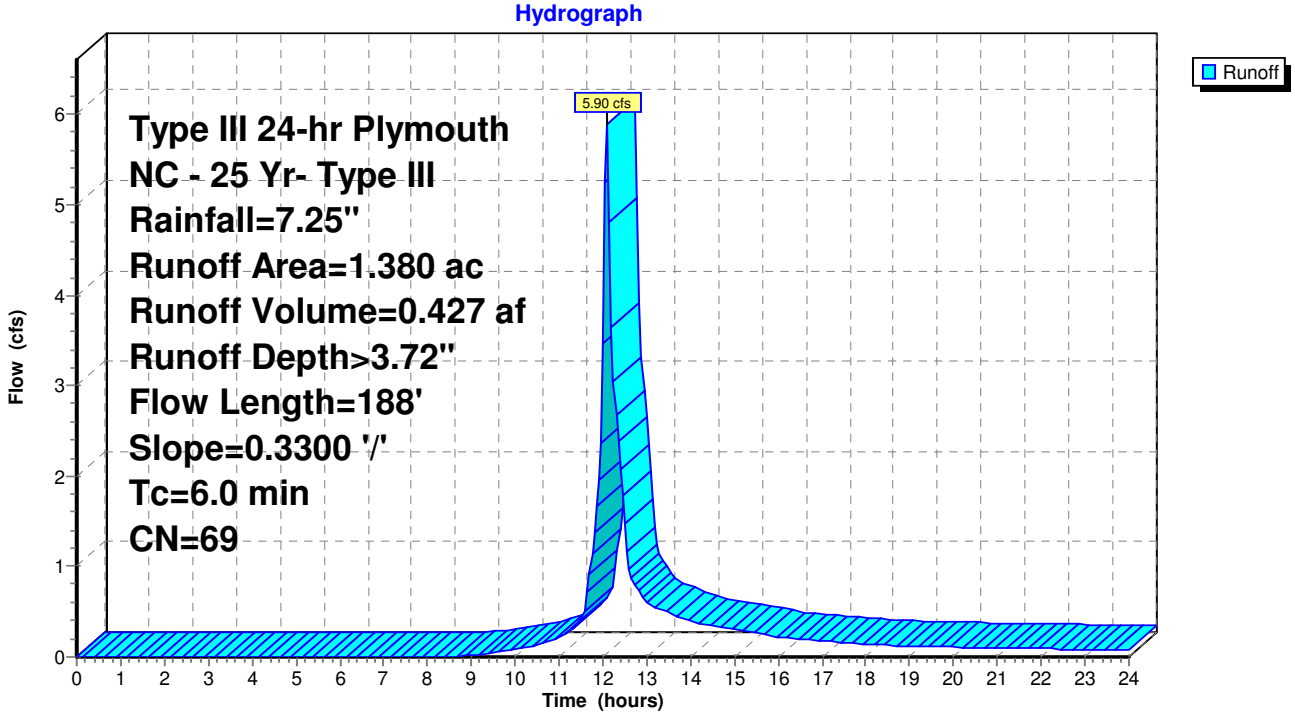
Runoff = 5.90 cfs @ 12.09 hrs, Volume= 0.427 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
1.380	69	Pasture/grassland/range, Fair, HSG B
1.380		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	188	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.8	188	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 21: DA-21



Subcatchment 22: DA-22

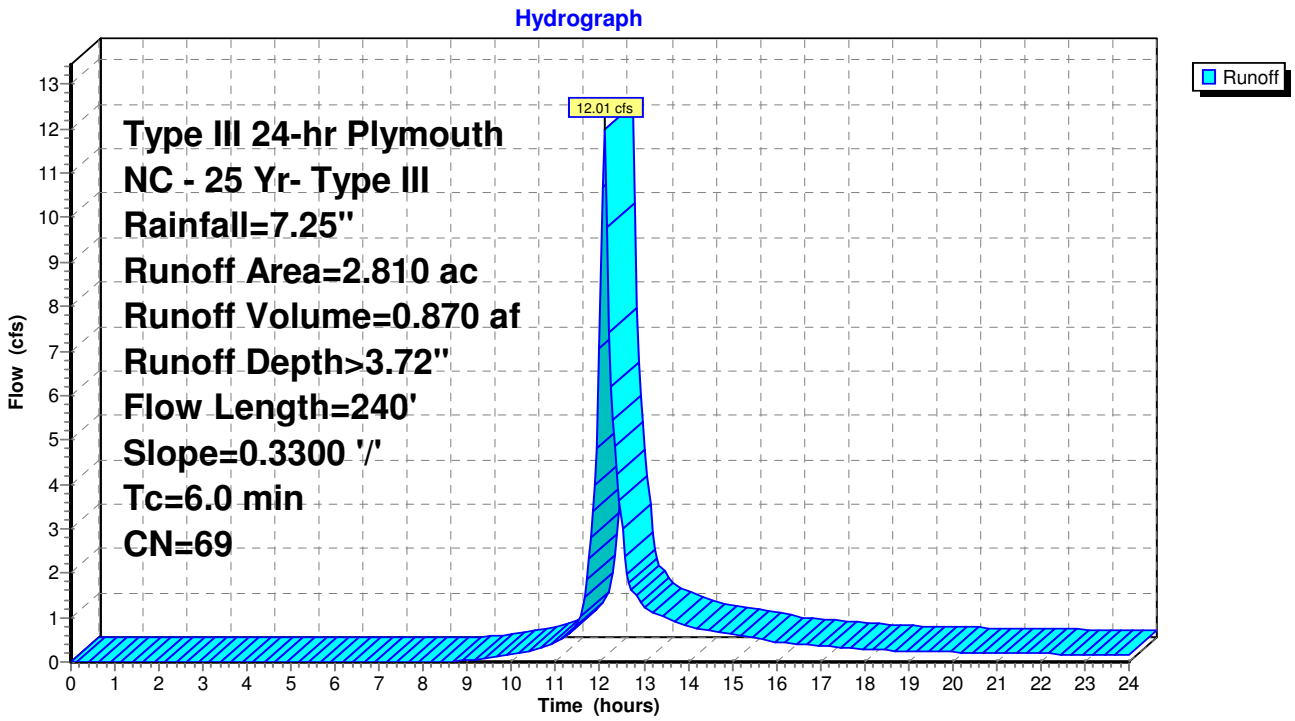
Runoff = 12.01 cfs @ 12.09 hrs, Volume= 0.870 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
2.810	69	Pasture/grassland/range, Fair, HSG B
2.810		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	240	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
1.0	240	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 22: DA-22



Subcatchment 23: DA-23

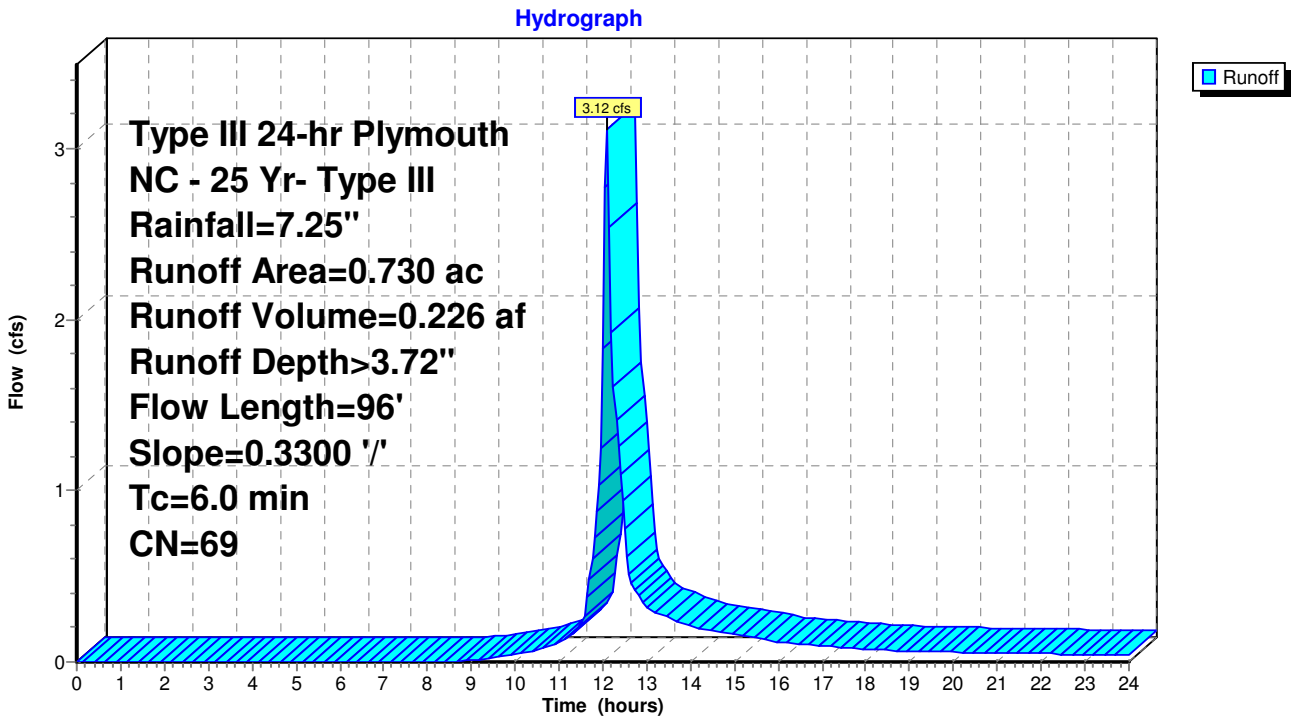
Runoff = 3.12 cfs @ 12.09 hrs, Volume= 0.226 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
0.730	69	Pasture/grassland/range, Fair, HSG B
0.730		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	96	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.4	96	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 23: DA-23



Subcatchment 24: DA-24

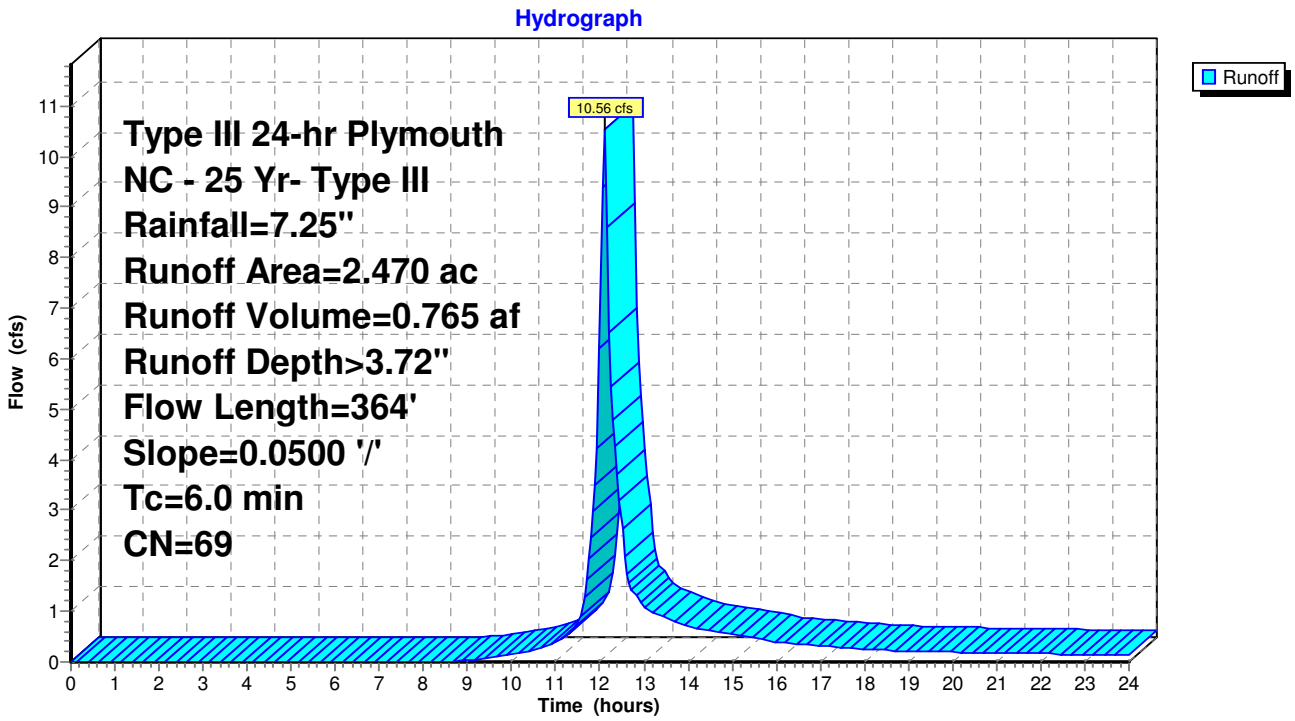
Runoff = 10.56 cfs @ 12.09 hrs, Volume= 0.765 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr- Type III Rainfall=7.25"

Area (ac)	CN	Description
2.470	69	Pasture/grassland/range, Fair, HSG B
2.470		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	364	0.0500	1.57		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
3.9	364	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 24: DA-24



Reach 1R: Culvert

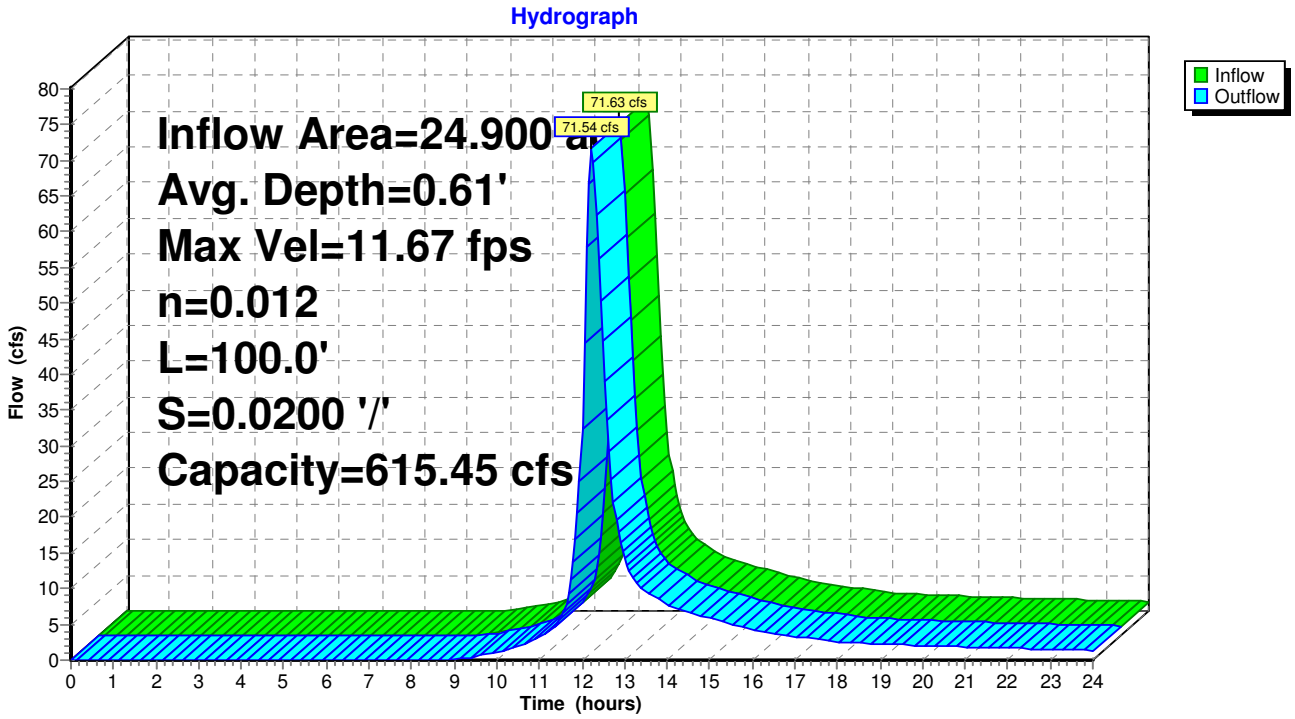
Inflow Area = 24.900 ac, Inflow Depth > 3.70" for Plymouth, NC - 25 Yr- Type III event
Inflow = 71.63 cfs @ 12.23 hrs, Volume= 7.670 af
Outflow = 71.54 cfs @ 12.23 hrs, Volume= 7.669 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.67 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.74 fps, Avg. Travel Time= 0.4 min

Peak Storage= 612 cf @ 12.23 hrs, Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 2.50', Capacity at Bank-Full= 615.45 cfs

10.00' x 2.50' deep channel, n= 0.012 Concrete pipe, finished
Length= 100.0' Slope= 0.0200 '/'
Inlet Invert= 34.00', Outlet Invert= 32.00'

Reach 1R: Culvert



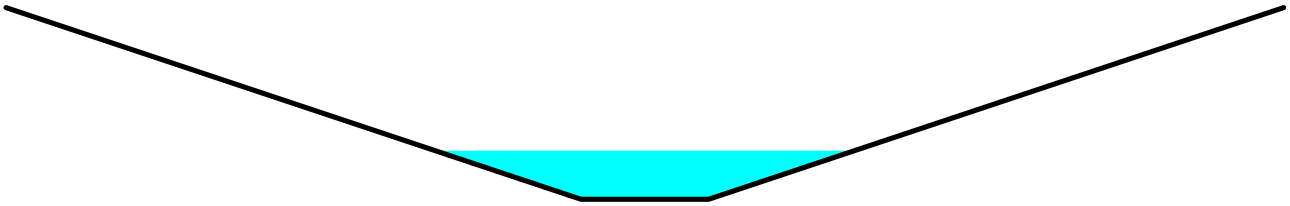
Reach SCC1: SCC-1

Inflow Area = 9.600 ac, Inflow Depth > 3.71" for Plymouth, NC - 25 Yr- Type III event
Inflow = 33.73 cfs @ 12.11 hrs, Volume= 2.967 af
Outflow = 29.76 cfs @ 12.25 hrs, Volume= 2.953 af, Atten= 12%, Lag= 8.5 min

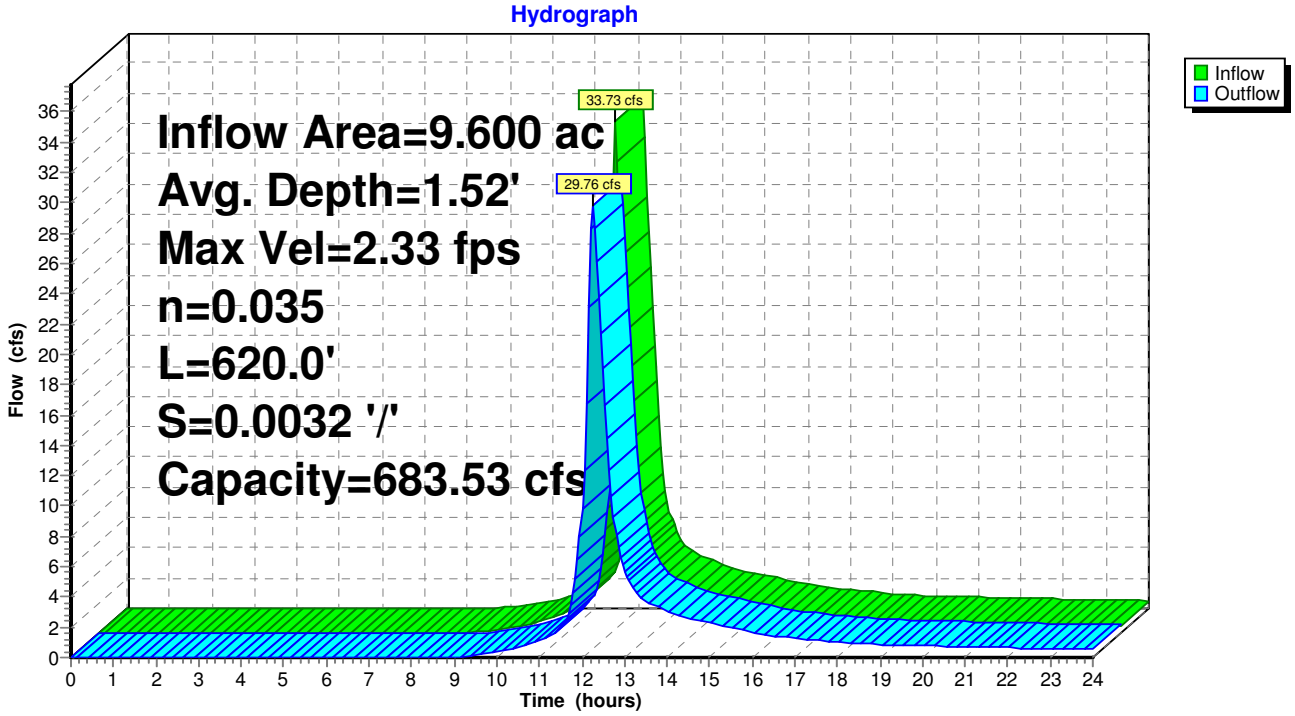
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.33 fps, Min. Travel Time= 4.4 min
Avg. Velocity = 0.93 fps, Avg. Travel Time= 11.1 min

Peak Storage= 8,053 cf @ 12.17 hrs, Average Depth at Peak Storage= 1.52'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 683.53 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 620.0' Slope= 0.0032 '/'
Inlet Invert= 44.00', Outlet Invert= 42.00'



Reach SCC1: SCC-1



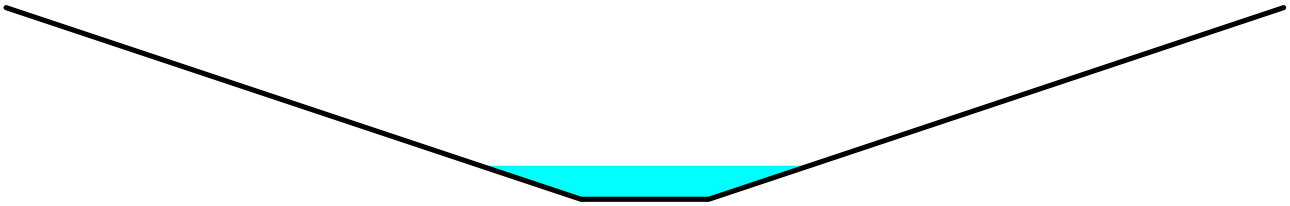
Reach SCC11: SCC-11

Inflow Area = 6.680 ac, Inflow Depth > 3.72" for Plymouth, NC - 25 Yr- Type III event
Inflow = 28.28 cfs @ 12.10 hrs, Volume= 2.068 af
Outflow = 26.01 cfs @ 12.18 hrs, Volume= 2.062 af, Atten= 8%, Lag= 4.9 min

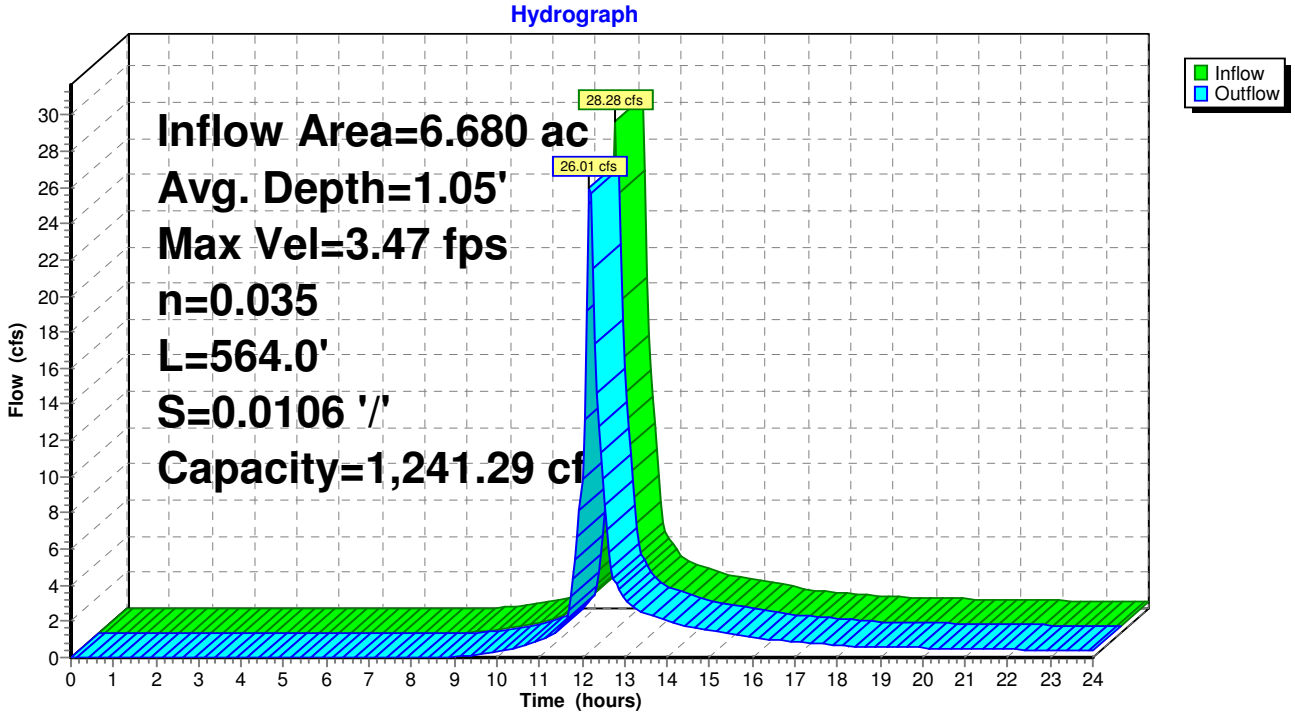
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.47 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 1.25 fps, Avg. Travel Time= 7.5 min

Peak Storage= 4,262 cf @ 12.14 hrs, Average Depth at Peak Storage= 1.05'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 1,241.29 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 564.0' Slope= 0.0106 '/'
Inlet Invert= 42.00', Outlet Invert= 36.00'



Reach SCC11: SCC-11



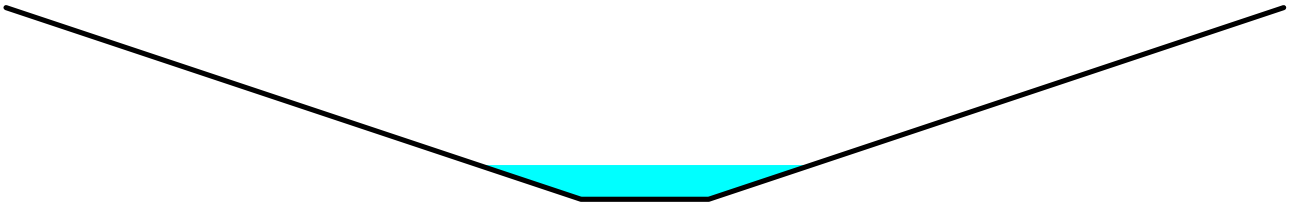
Reach SCC12: SCC-12

Inflow Area = 8.060 ac, Inflow Depth > 3.71" for Plymouth, NC - 25 Yr- Type III event
Inflow = 30.33 cfs @ 12.17 hrs, Volume= 2.489 af
Outflow = 29.33 cfs @ 12.21 hrs, Volume= 2.486 af, Atten= 3%, Lag= 2.5 min

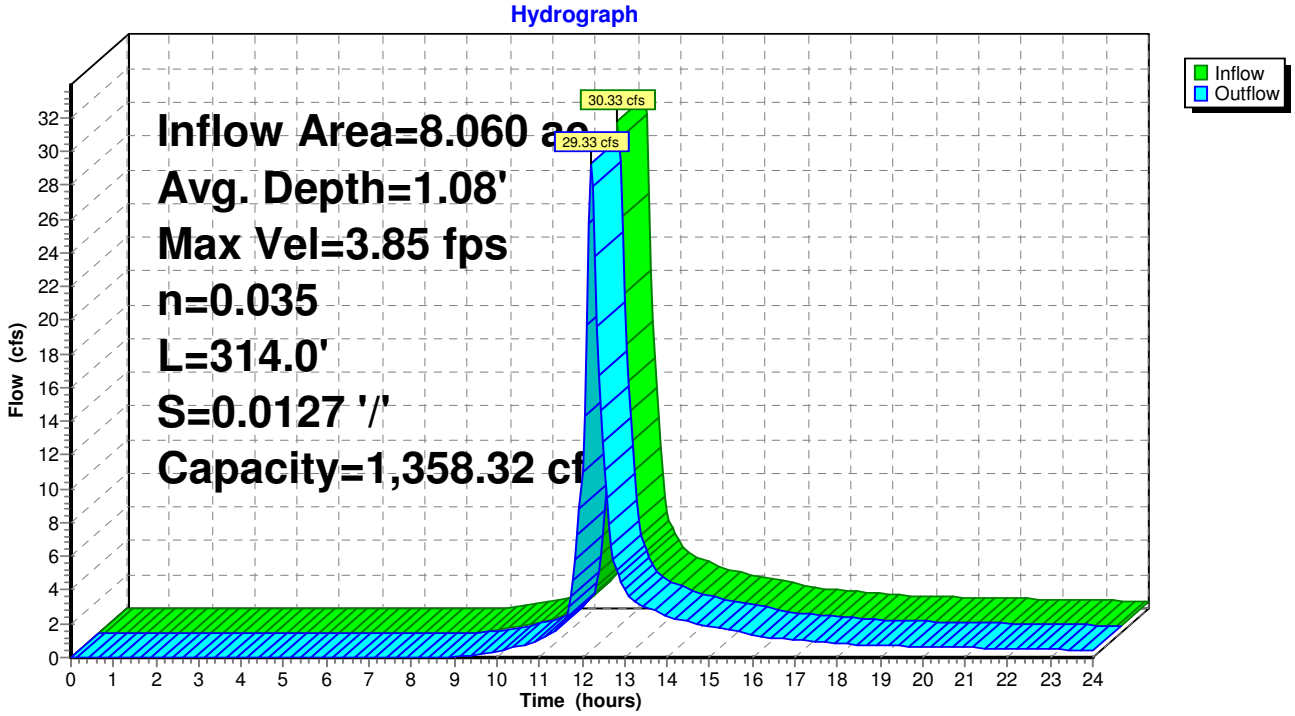
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.85 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.41 fps, Avg. Travel Time= 3.7 min

Peak Storage= 2,444 cf @ 12.19 hrs, Average Depth at Peak Storage= 1.08'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 1,358.32 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 314.0' Slope= 0.0127 '/'
Inlet Invert= 38.00', Outlet Invert= 34.00'



Reach SCC12: SCC-12



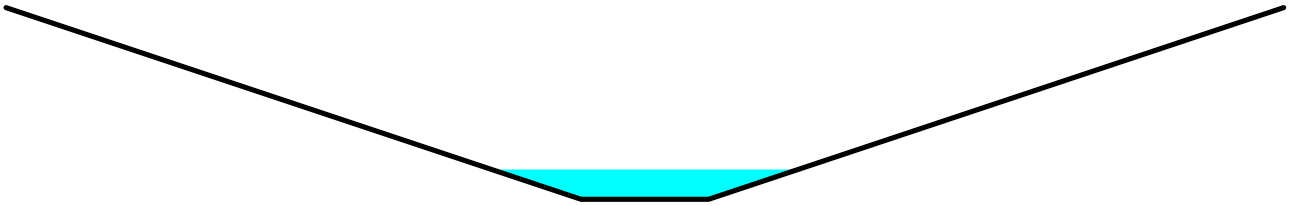
Reach SCC13: SCC-13

Inflow Area = 16.840 ac, Inflow Depth > 3.70" for Plymouth, NC - 25 Yr- Type III event
Inflow = 43.98 cfs @ 12.28 hrs, Volume= 5.186 af
Outflow = 43.89 cfs @ 12.29 hrs, Volume= 5.185 af, Atten= 0%, Lag= 0.4 min

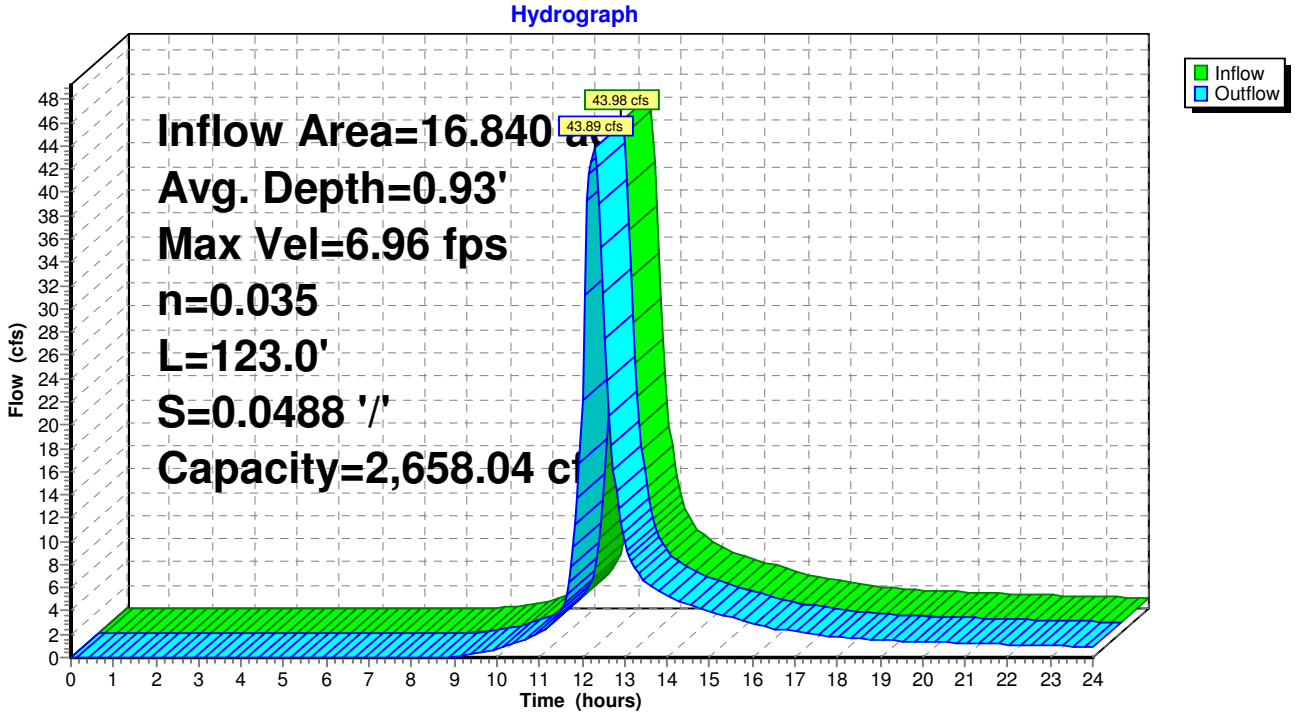
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.96 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.82 fps, Avg. Travel Time= 0.7 min

Peak Storage= 777 cf @ 12.29 hrs, Average Depth at Peak Storage= 0.93'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 2,658.04 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 123.0' Slope= 0.0488 '/'
Inlet Invert= 40.00', Outlet Invert= 34.00'



Reach SCC13: SCC-13



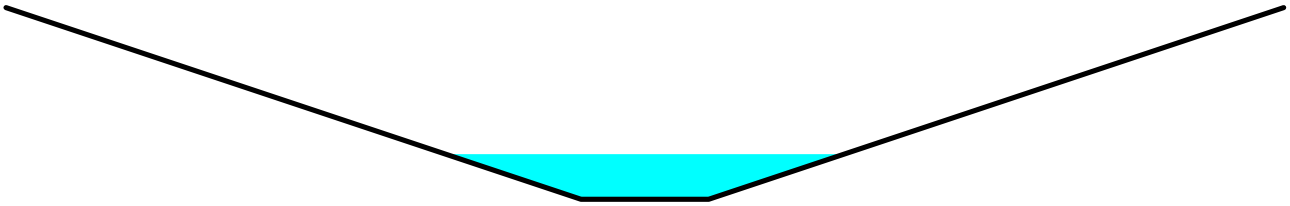
Reach SCC14: SCC-14

Inflow Area = 11.200 ac, Inflow Depth > 3.69" for Plymouth, NC - 25 Yr- Type III event
Inflow = 33.36 cfs @ 12.24 hrs, Volume= 3.448 af
Outflow = 32.73 cfs @ 12.31 hrs, Volume= 3.440 af, Atten= 2%, Lag= 4.3 min

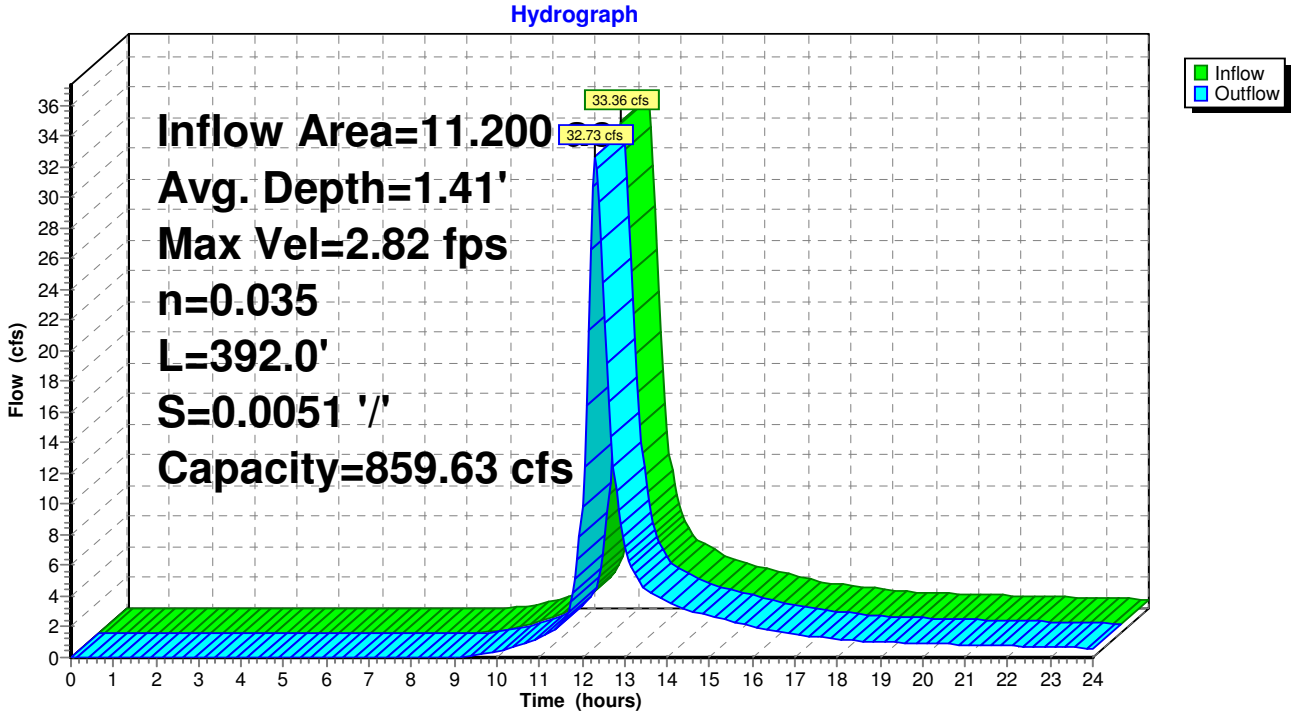
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.82 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 1.14 fps, Avg. Travel Time= 5.7 min

Peak Storage= 4,568 cf @ 12.27 hrs, Average Depth at Peak Storage= 1.41'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 859.63 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 392.0' Slope= 0.0051 '/'
Inlet Invert= 42.00', Outlet Invert= 40.00'



Reach SCC14: SCC-14



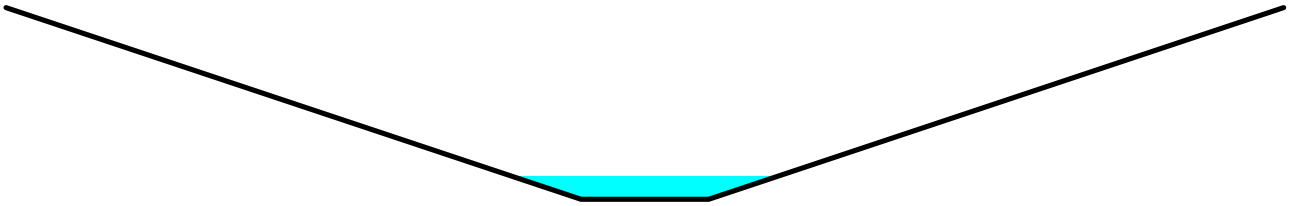
Reach SCC2: SCC-2

Inflow Area = 2.620 ac, Inflow Depth > 3.72" for Plymouth, NC - 25 Yr- Type III event
Inflow = 11.20 cfs @ 12.09 hrs, Volume= 0.811 af
Outflow = 9.10 cfs @ 12.26 hrs, Volume= 0.805 af, Atten= 19%, Lag= 10.0 min

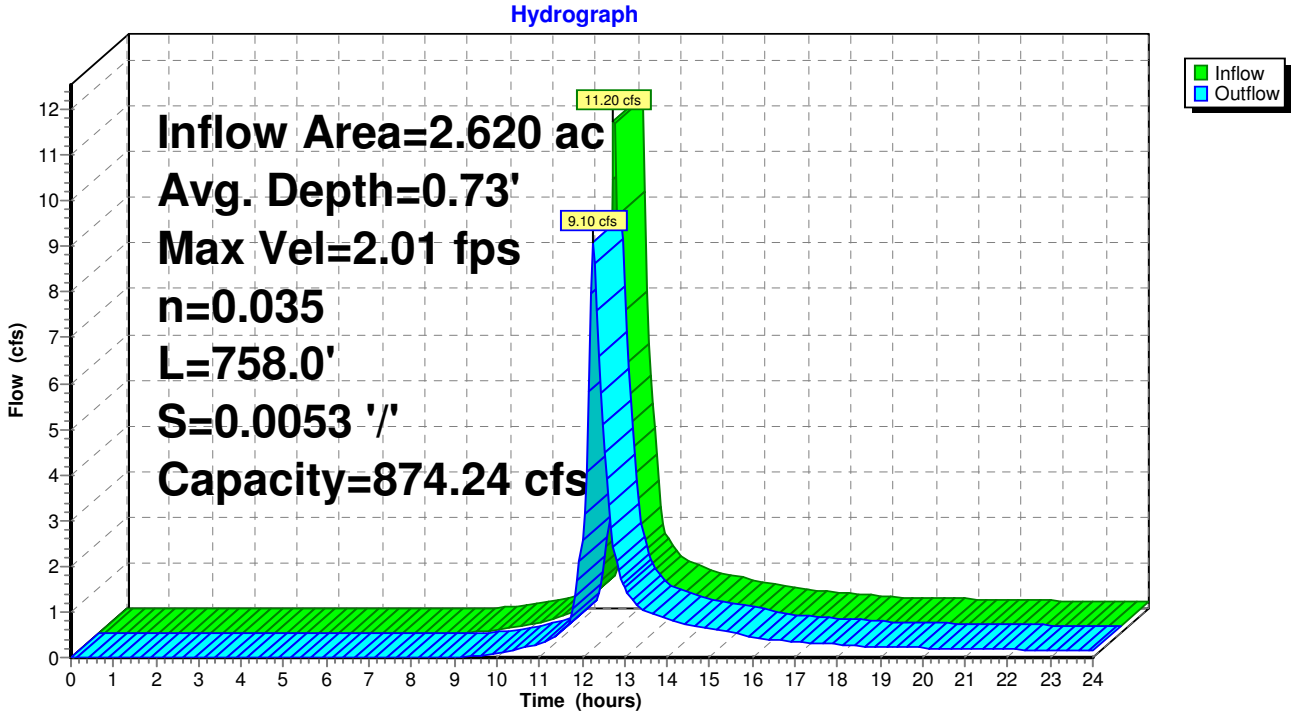
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.01 fps, Min. Travel Time= 6.3 min
Avg. Velocity = 0.73 fps, Avg. Travel Time= 17.3 min

Peak Storage= 3,453 cf @ 12.16 hrs, Average Depth at Peak Storage= 0.73'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 874.24 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 758.0' Slope= 0.0053 '/'
Inlet Invert= 48.00', Outlet Invert= 44.00'



Reach SCC2: SCC-2



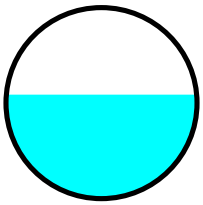
Reach SD5: SD-5

Inflow Area = 5.040 ac, Inflow Depth > 3.72" for Plymouth, NC - 25 Yr- Type III event
Inflow = 21.54 cfs @ 12.09 hrs, Volume= 1.561 af
Outflow = 21.27 cfs @ 12.10 hrs, Volume= 1.560 af, Atten= 1%, Lag= 0.5 min

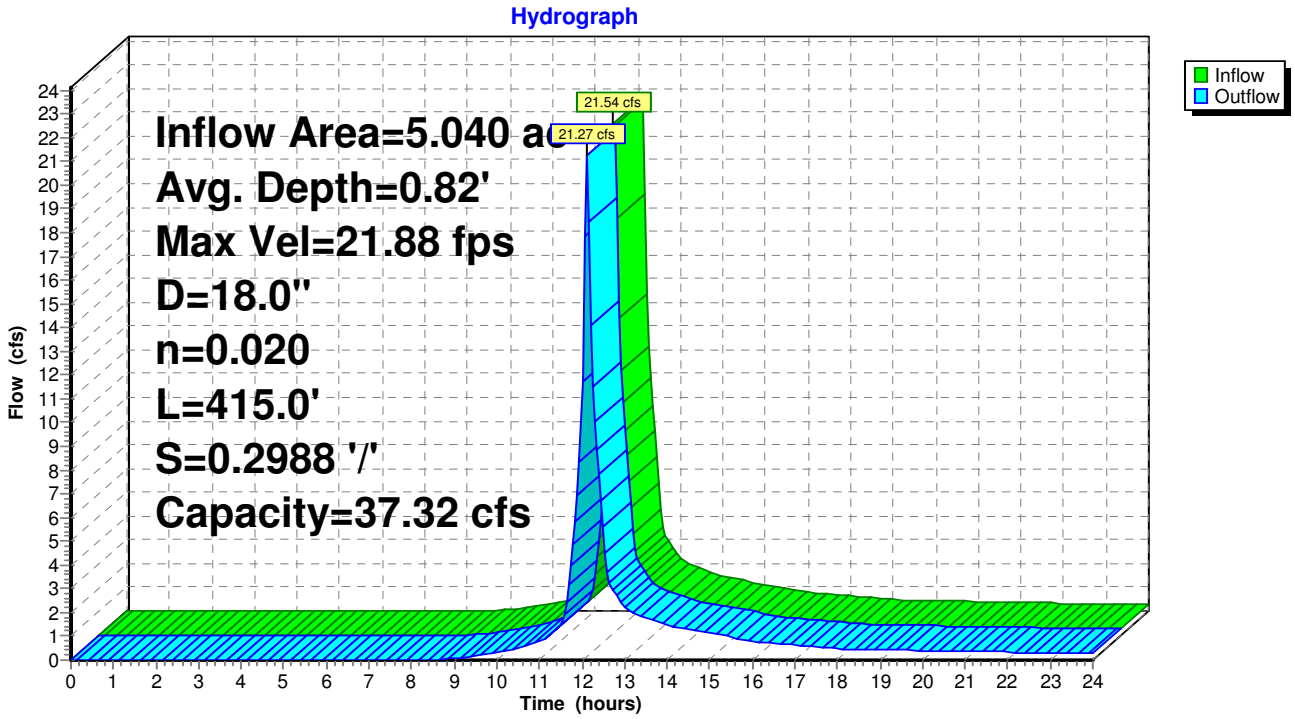
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 21.88 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 8.20 fps, Avg. Travel Time= 0.8 min

Peak Storage= 409 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.82'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 37.32 cfs

18.0" Diameter Pipe, n= 0.020
Length= 415.0' Slope= 0.2988 '/'
Inlet Invert= 170.00', Outlet Invert= 46.00'



Reach SD5: SD-5



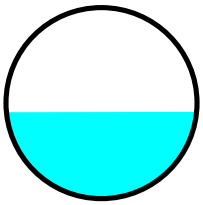
Reach SD6: SD-6

Inflow Area = 3.970 ac, Inflow Depth > 3.72" for Plymouth, NC - 25 Yr- Type III event
Inflow = 16.97 cfs @ 12.09 hrs, Volume= 1.230 af
Outflow = 16.78 cfs @ 12.10 hrs, Volume= 1.229 af, Atten= 1%, Lag= 0.5 min

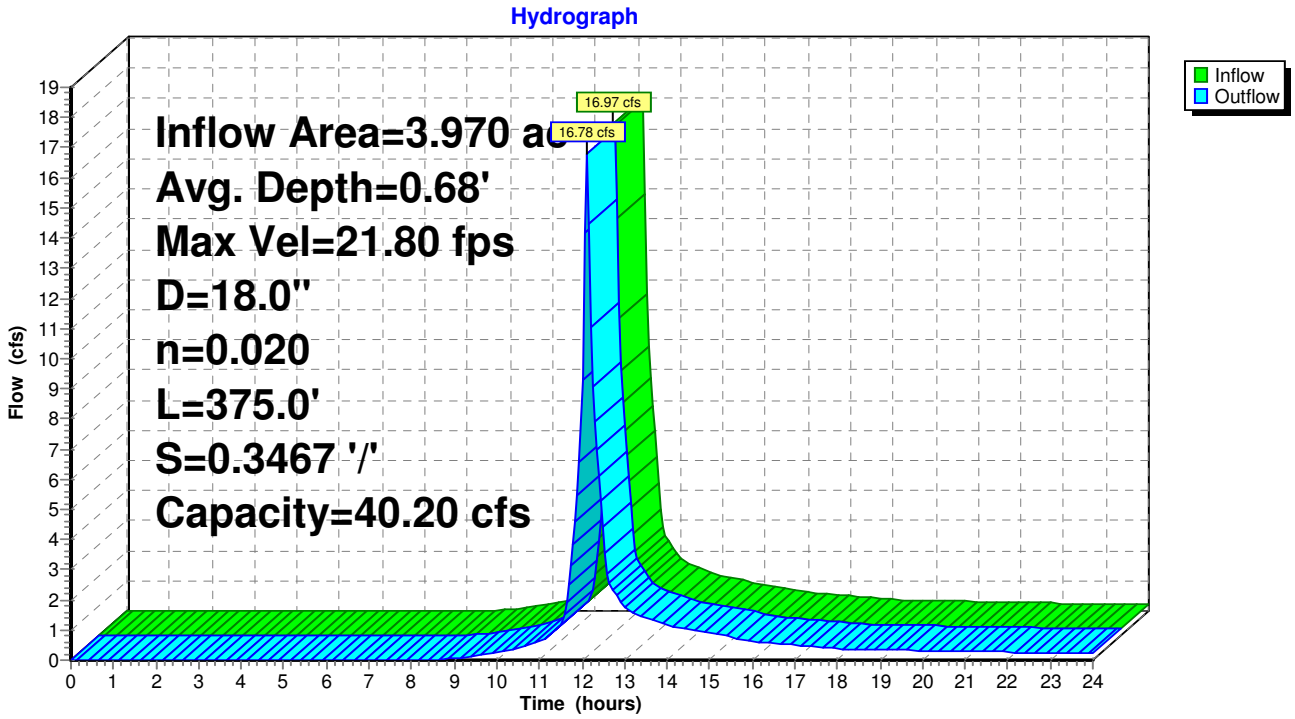
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 21.80 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 8.05 fps, Avg. Travel Time= 0.8 min

Peak Storage= 293 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.68'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 40.20 cfs

18.0" Diameter Pipe, n= 0.020
Length= 375.0' Slope= 0.3467 '/'
Inlet Invert= 170.00', Outlet Invert= 40.00'



Reach SD6: SD-6



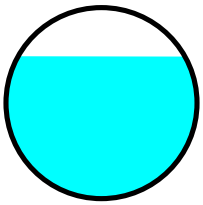
Reach SD7: SD-7

Inflow Area = 6.680 ac, Inflow Depth > 3.72" for Plymouth, NC - 25 Yr- Type III event
Inflow = 28.55 cfs @ 12.09 hrs, Volume= 2.069 af
Outflow = 28.28 cfs @ 12.10 hrs, Volume= 2.068 af, Atten= 1%, Lag= 0.4 min

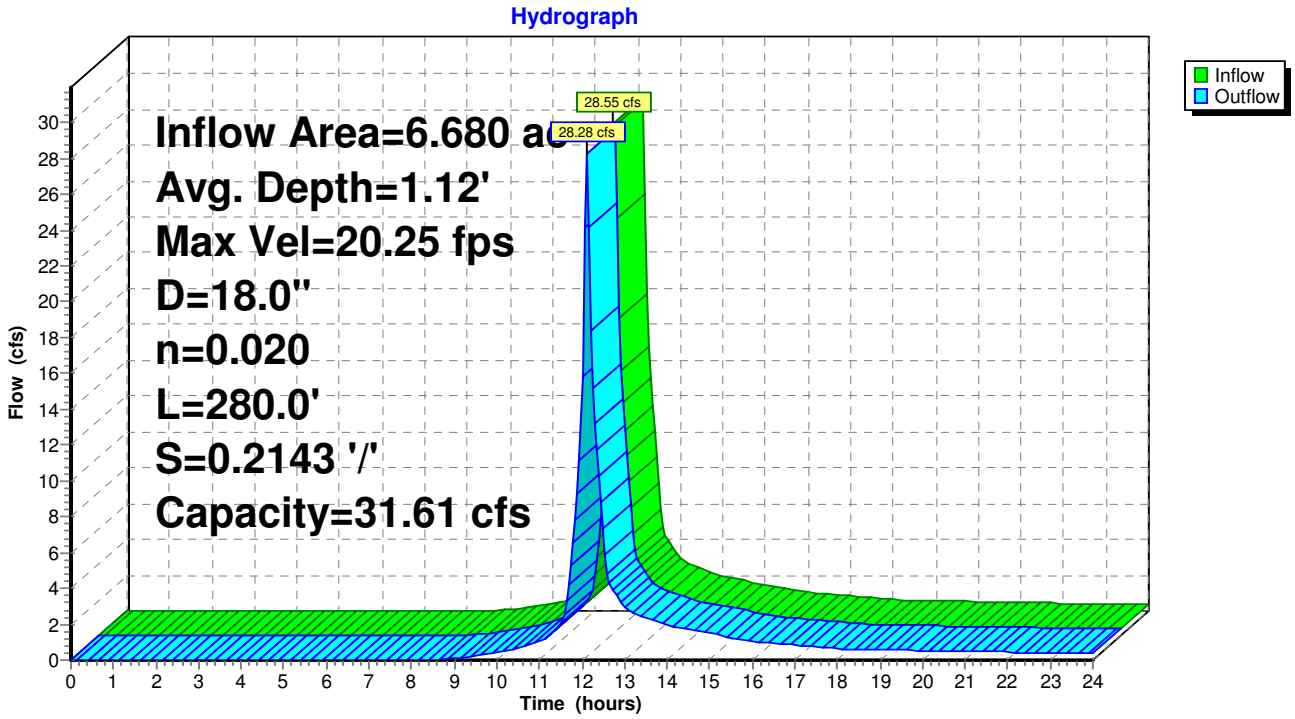
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 20.25 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 7.93 fps, Avg. Travel Time= 0.6 min

Peak Storage= 395 cf @ 12.10 hrs, Average Depth at Peak Storage= 1.12'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 31.61 cfs

18.0" Diameter Pipe, n= 0.020
Length= 280.0' Slope= 0.2143 '/'
Inlet Invert= 100.00', Outlet Invert= 40.00'



Reach SD7: SD-7



Pond SP-5: SP-5

Inflow Area = 24.900 ac, Inflow Depth > 3.70" for Plymouth, NC - 25 Yr- Type III event
Inflow = 71.54 cfs @ 12.23 hrs, Volume= 7.669 af
Outflow = 18.72 cfs @ 12.83 hrs, Volume= 7.206 af, Atten= 74%, Lag= 35.8 min
Primary = 18.72 cfs @ 12.83 hrs, Volume= 7.206 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 31.85' @ 12.83 hrs Surf.Area= 40,349 sf Storage= 131,991 cf

Plug-Flow detention time= 113.2 min calculated for 7.191 af (94% of inflow)
Center-of-Mass det. time= 82.0 min (923.9 - 841.9)

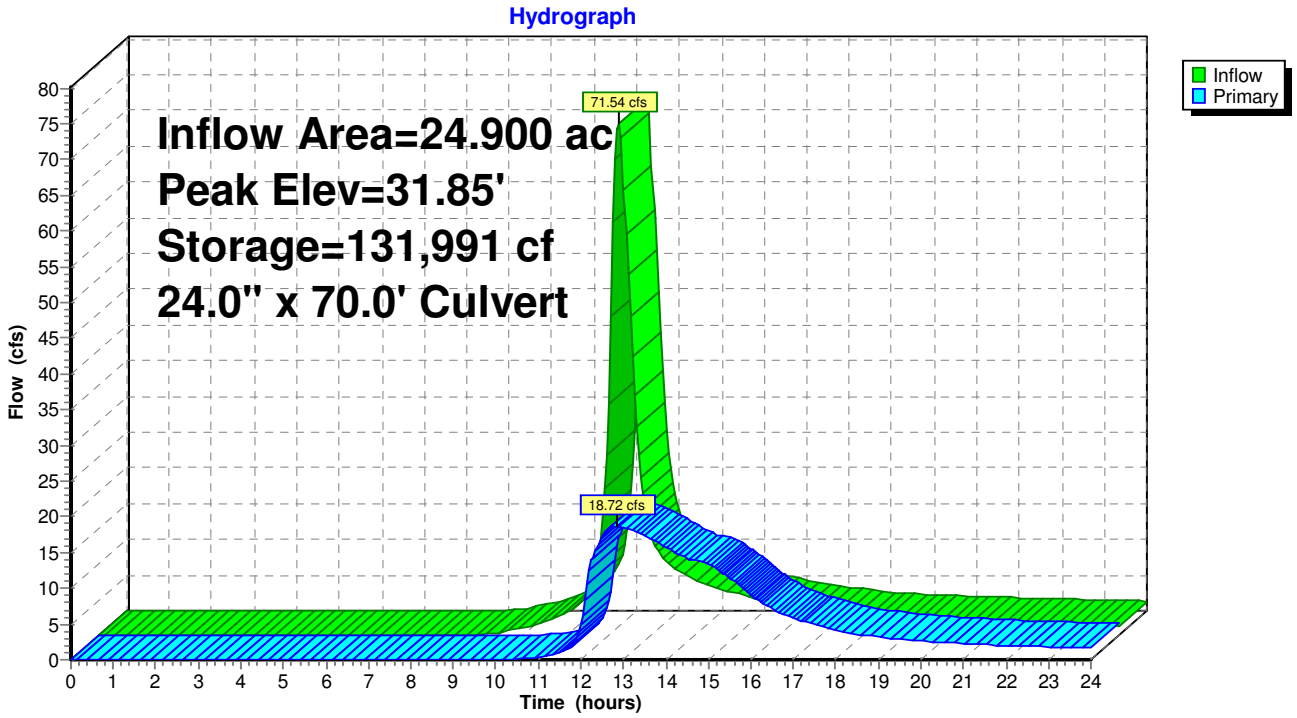
Volume	Invert	Avail.Storage	Storage Description
#1	28.00'	322,209 cf	**Custom Stage Data (Prismatic)** Listed below

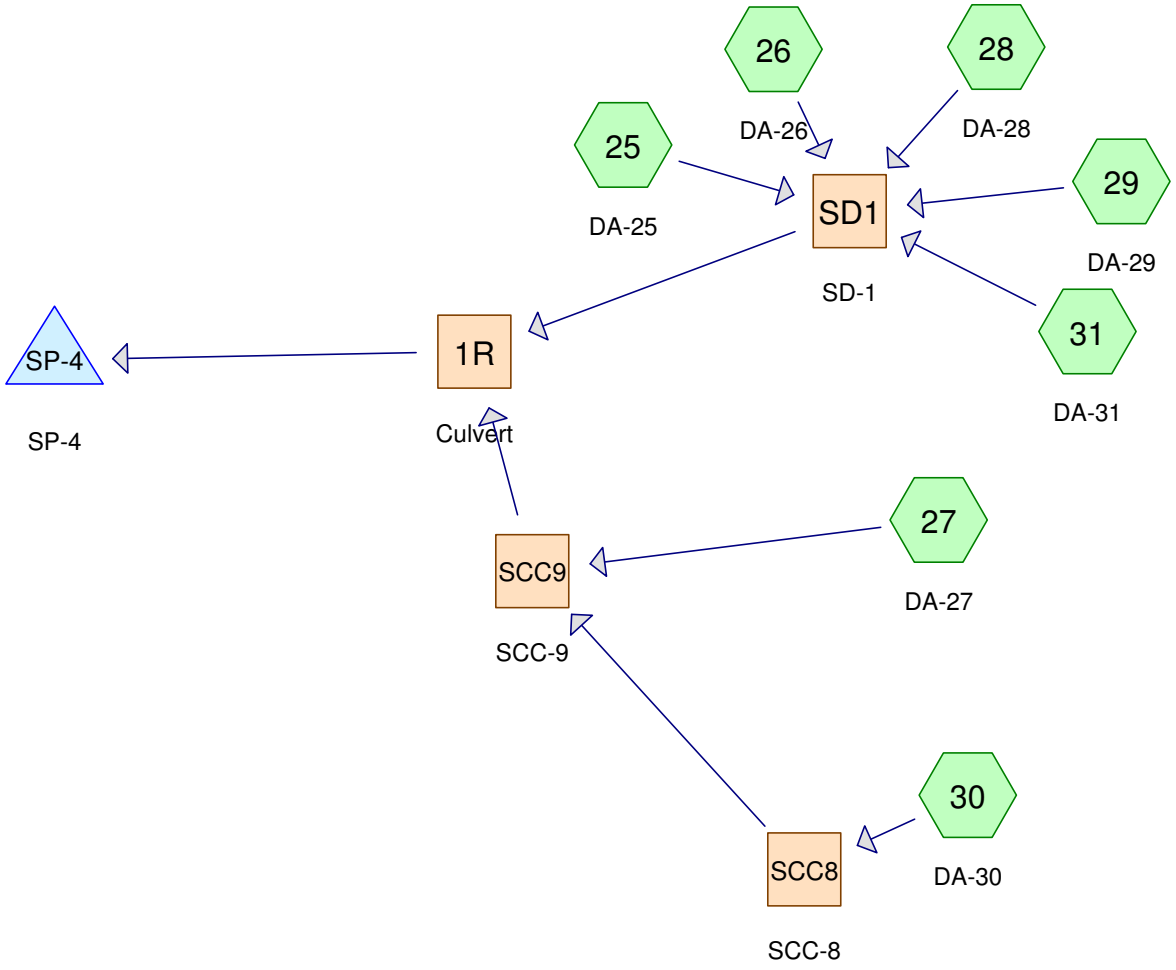
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.00	25,686	0	0
30.00	35,563	61,249	61,249
32.00	40,724	76,287	137,536
34.00	46,112	86,836	224,372
36.00	51,725	97,837	322,209

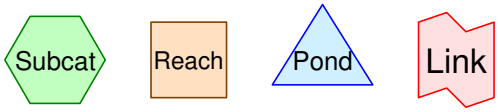
Device	Routing	Invert	Outlet Devices
#1	Primary	28.00'	**24.0" x 70.0' long Culvert** CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 27.30' S= 0.0100 '/' Cc= 0.900 n= 0.023

Primary OutFlow Max=18.72 cfs @ 12.83 hrs HW=31.85' (Free Discharge)
└─**1=Culvert** (Barrel Controls 18.72 cfs @ 5.96 fps)

Pond SP-5: SP-5


Hydrograph
Inflow Area=24.900 ac
Peak Elev=31.85'
Storage=131,991 cf
24.0" x 70.0' Culvert
71.54 cfs
18.72 cfs
Inflow
Primary
Flow (cfs)
Time (hours)





Drainage Diagram for Domtar E&S - Northwest
Prepared by {enter your company name here} 11/1/2012
HydroCAD® 8.00 s/n 004761 © 2006 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcats)
10.510	69	Pasture/grassland/range, Fair, HSG B (25,26,27,28,29,30,31)
10.510		

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 25: DA-25 Runoff Area=0.680 ac Runoff Depth>3.72"
Flow Length=100' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=2.91 cfs 0.211 af

Subcatchment 26: DA-26 Runoff Area=1.940 ac Runoff Depth>3.72"
Flow Length=282' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=8.29 cfs 0.601 af

Subcatchment 27: DA-27 Runoff Area=1.850 ac Runoff Depth>3.72"
Flow Length=250' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=7.91 cfs 0.573 af

Subcatchment 28: DA-28 Runoff Area=0.530 ac Runoff Depth>3.72"
Flow Length=103' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=2.27 cfs 0.164 af

Subcatchment 29: DA-29 Runoff Area=2.530 ac Runoff Depth>3.72"
Flow Length=414' Slope=0.0500 '/' Tc=6.0 min CN=69 Runoff=10.81 cfs 0.784 af

Subcatchment 30: DA-30 Runoff Area=1.740 ac Runoff Depth>3.72"
Flow Length=168' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=7.44 cfs 0.539 af

Subcatchment 31: DA-31 Runoff Area=1.240 ac Runoff Depth>3.72"
Flow Length=110' Slope=0.3300 '/' Tc=6.0 min CN=69 Runoff=5.30 cfs 0.384 af

Reach 1R: Culvert Avg. Depth=0.25' Max Vel=14.99 fps Inflow=37.88 cfs 3.248 af
n=0.012 L=80.0' S=0.1000 '/' Capacity=1,376.18 cfs Outflow=37.74 cfs 3.248 af

Reach SCC8: SCC-8 Avg. Depth=0.62' Max Vel=1.85 fps Inflow=7.44 cfs 0.539 af
n=0.035 L=373.0' S=0.0054 '/' Capacity=881.25 cfs Outflow=6.68 cfs 0.537 af

Reach SCC9: SCC-9 Avg. Depth=0.69' Max Vel=2.95 fps Inflow=12.82 cfs 1.110 af
n=0.035 L=496.0' S=0.0121 '/' Capacity=1,323.65 cfs Outflow=12.46 cfs 1.106 af

Reach SD1: SD-1 Avg. Depth=1.15' Max Vel=20.34 fps Inflow=29.58 cfs 2.143 af
D=18.0" n=0.020 L=410.0' S=0.2146 '/' Capacity=31.63 cfs Outflow=29.14 cfs 2.142 af

Pond SP-4: SP-4 Peak Elev=27.62' Storage=58,443 cf Inflow=37.74 cfs 3.248 af
24.0" x 100.0' Culvert Outflow=9.30 cfs 2.929 af

Total Runoff Area = 10.510 ac Runoff Volume = 3.255 af Average Runoff Depth = 3.72"
100.00% Pervious Area = 10.510 ac 0.00% Impervious Area = 0.000 ac

Subcatchment 25: DA-25

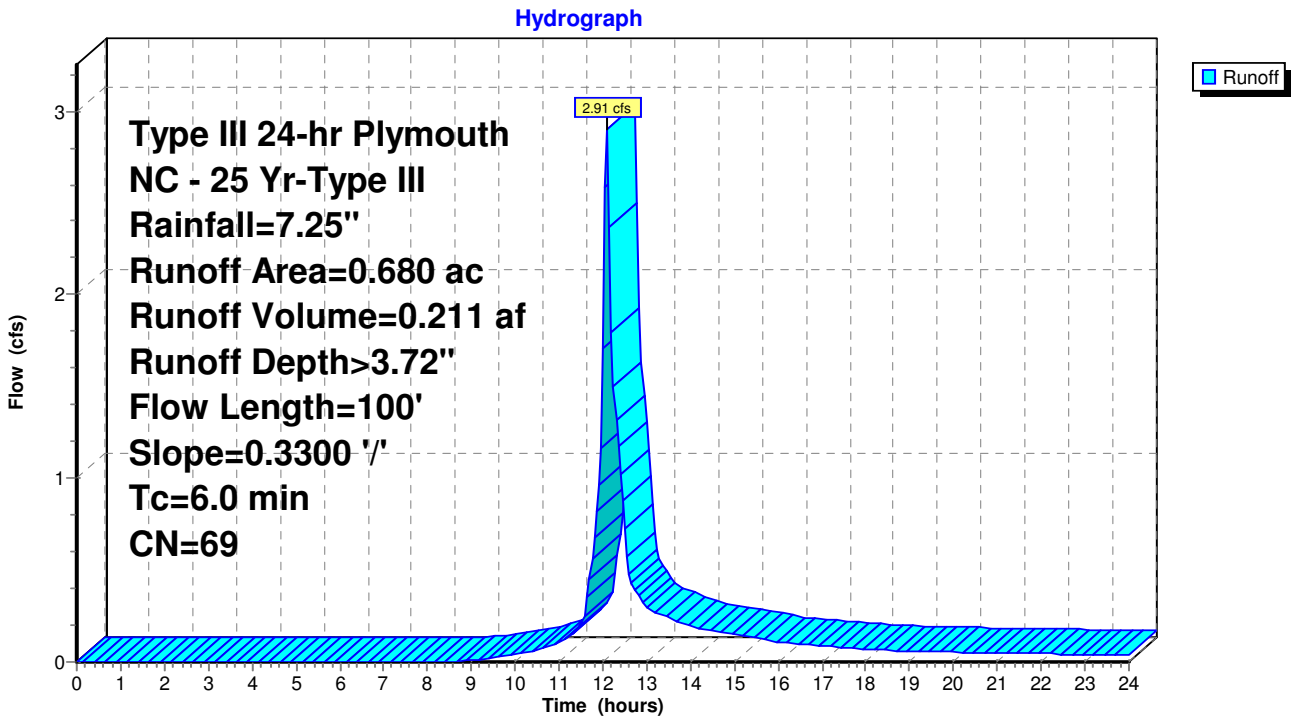
Runoff = 2.91 cfs @ 12.09 hrs, Volume= 0.211 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr-Type III Rainfall=7.25"

Area (ac)	CN	Description
0.680	69	Pasture/grassland/range, Fair, HSG B
0.680		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	100	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.4	100	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 25: DA-25



Subcatchment 26: DA-26

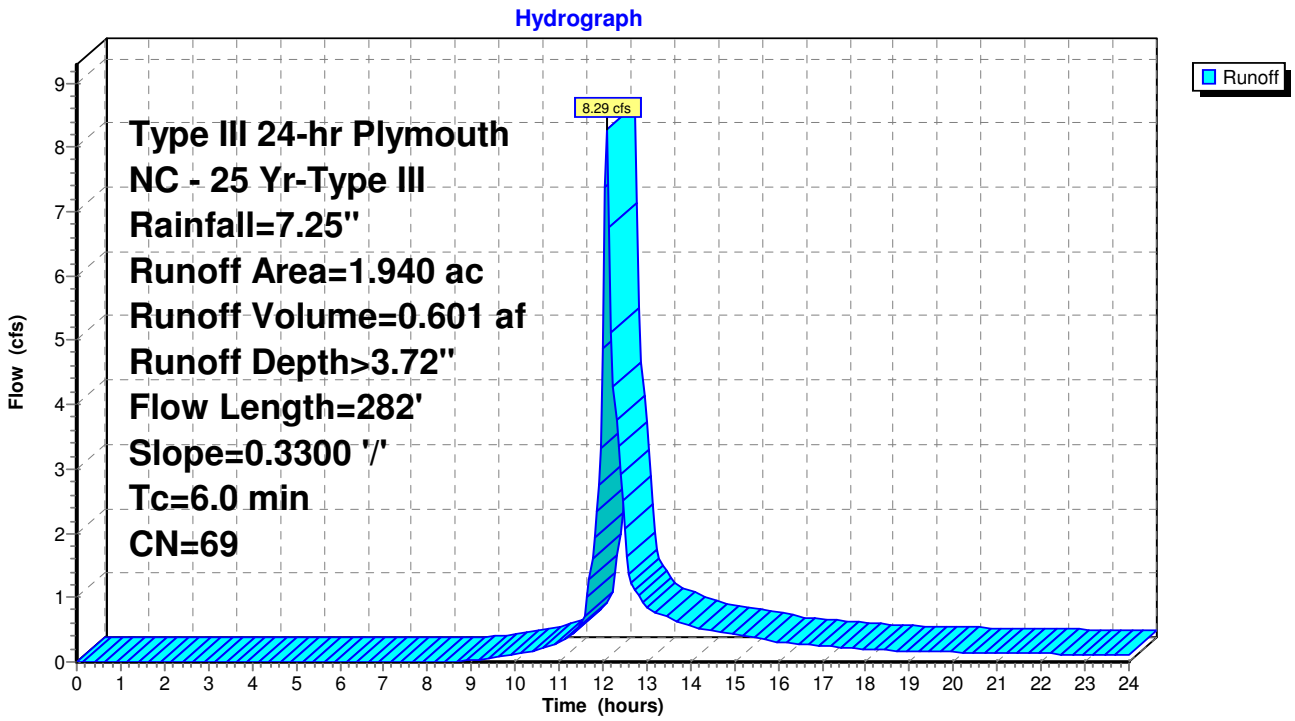
Runoff = 8.29 cfs @ 12.09 hrs, Volume= 0.601 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr-Type III Rainfall=7.25"

Area (ac)	CN	Description
1.940	69	Pasture/grassland/range, Fair, HSG B
1.940		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	282	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
1.2	282	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 26: DA-26



Subcatchment 27: DA-27

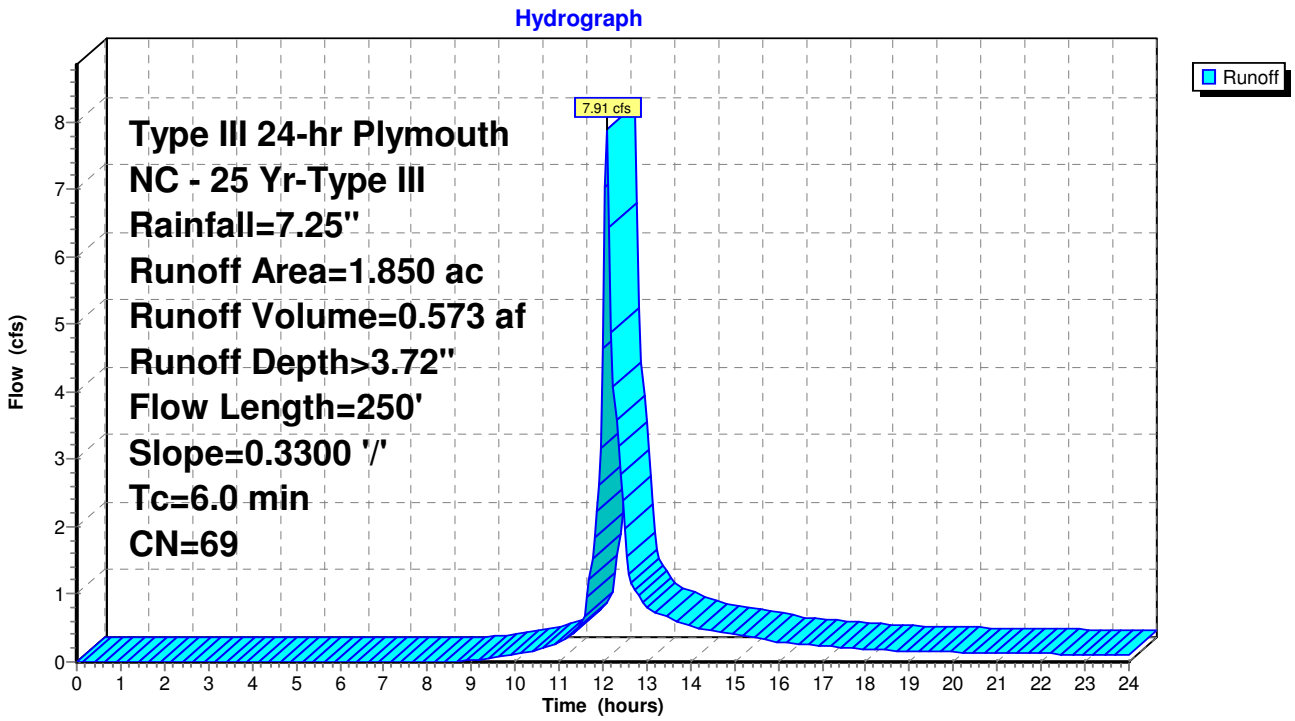
Runoff = 7.91 cfs @ 12.09 hrs, Volume= 0.573 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr-Type III Rainfall=7.25"

Area (ac)	CN	Description
1.850	69	Pasture/grassland/range, Fair, HSG B
1.850		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	250	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
1.0	250	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 27: DA-27



Subcatchment 28: DA-28

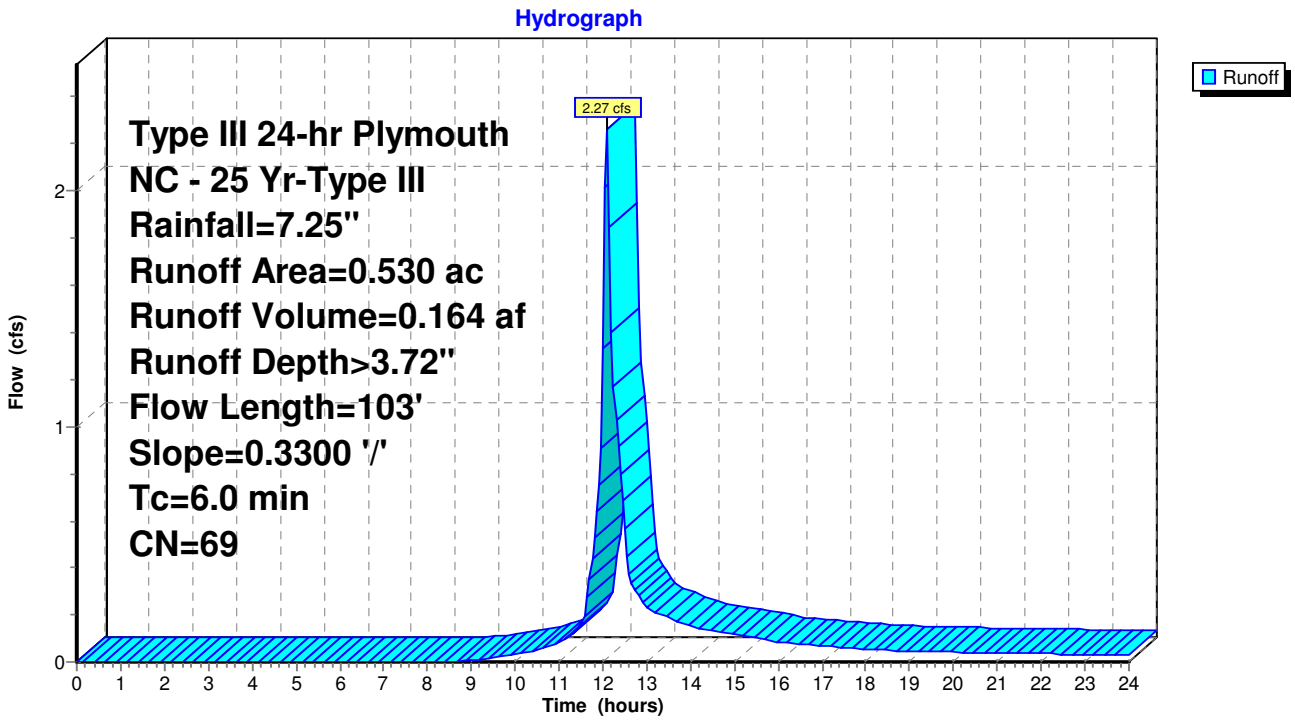
Runoff = 2.27 cfs @ 12.09 hrs, Volume= 0.164 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr-Type III Rainfall=7.25"

Area (ac)	CN	Description
0.530	69	Pasture/grassland/range, Fair, HSG B
0.530		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	103	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.4	103	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 28: DA-28



Subcatchment 29: DA-29

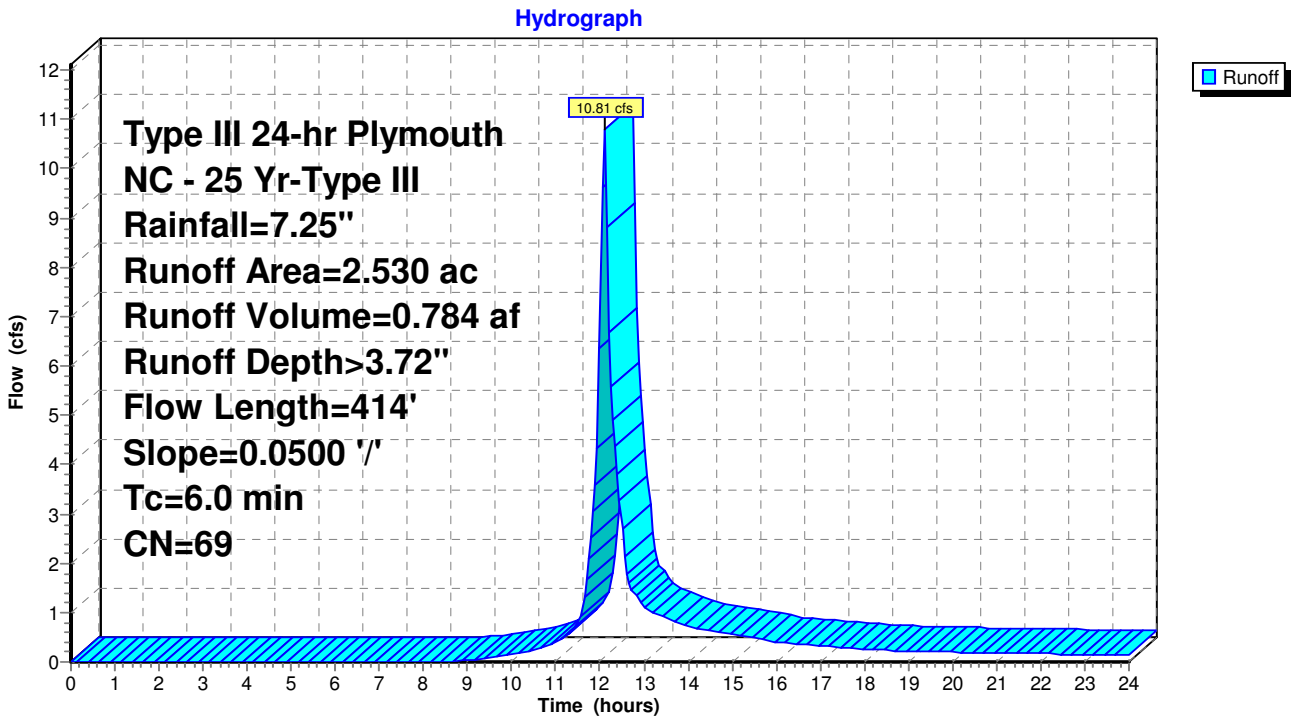
Runoff = 10.81 cfs @ 12.09 hrs, Volume= 0.784 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr-Type III Rainfall=7.25"

Area (ac)	CN	Description
2.530	69	Pasture/grassland/range, Fair, HSG B
2.530		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	414	0.0500	1.57		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
4.4	414	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 29: DA-29



Subcatchment 30: DA-30

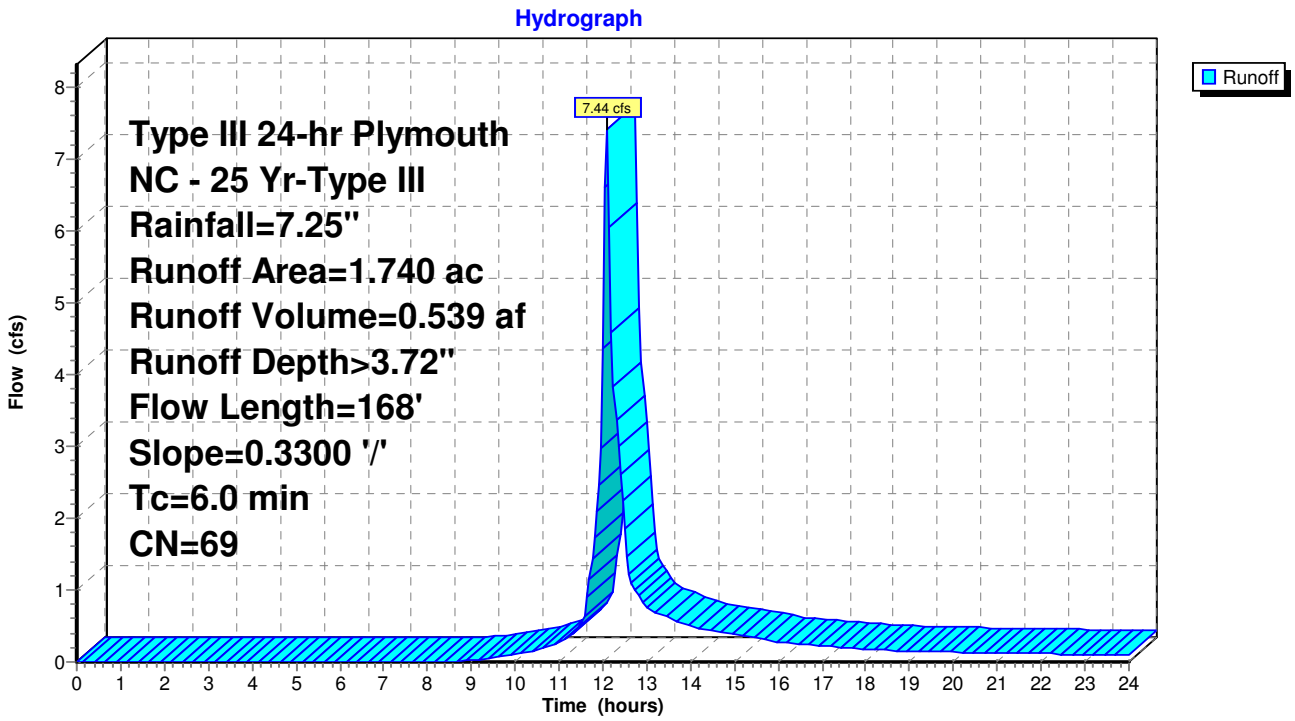
Runoff = 7.44 cfs @ 12.09 hrs, Volume= 0.539 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr-Type III Rainfall=7.25"

Area (ac)	CN	Description
1.740	69	Pasture/grassland/range, Fair, HSG B
1.740		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	168	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.7	168	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 30: DA-30



Subcatchment 31: DA-31

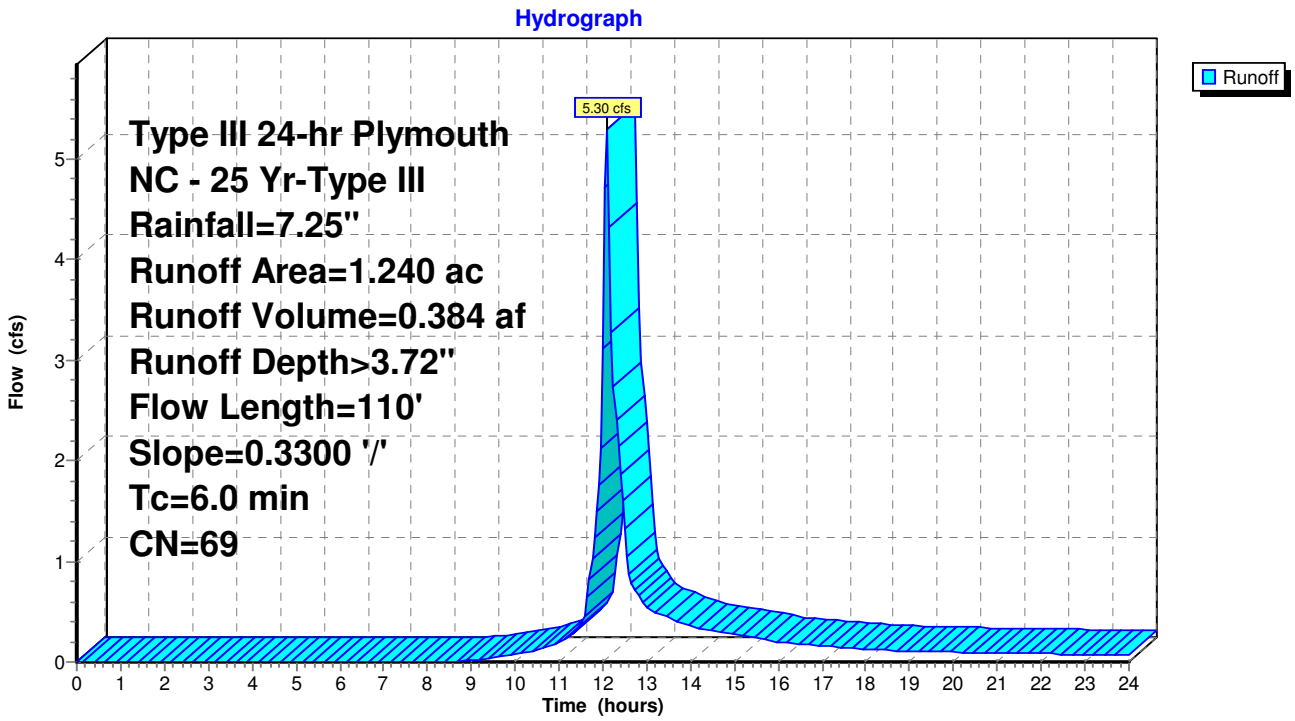
Runoff = 5.30 cfs @ 12.09 hrs, Volume= 0.384 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Plymouth, NC - 25 Yr-Type III Rainfall=7.25"

Area (ac)	CN	Description
1.240	69	Pasture/grassland/range, Fair, HSG B
1.240		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	110	0.3300	4.02		**Shallow Concentrated Flow, Tc1** Short Grass Pasture Kv= 7.0 fps
0.5	110	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 31: DA-31



Reach 1R: Culvert

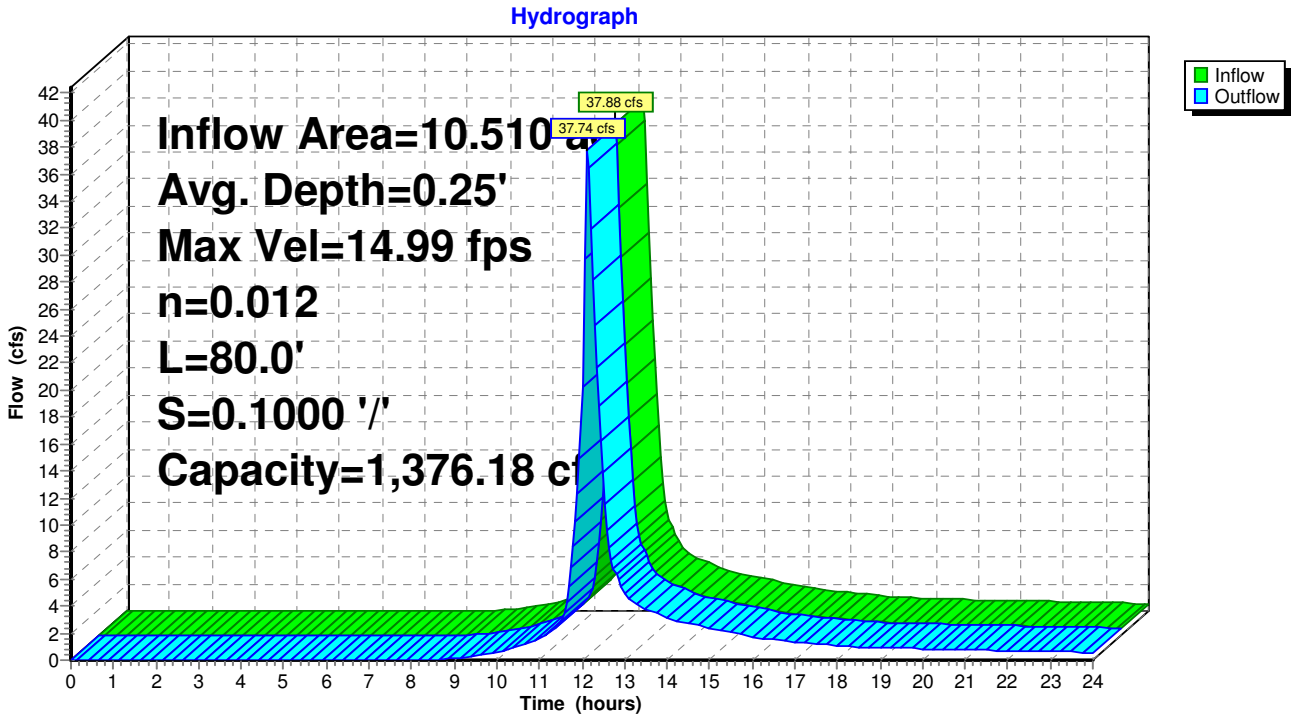
Inflow Area = 10.510 ac, Inflow Depth > 3.71" for Plymouth, NC - 25 Yr-Type III event
Inflow = 37.88 cfs @ 12.12 hrs, Volume= 3.248 af
Outflow = 37.74 cfs @ 12.12 hrs, Volume= 3.248 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 14.99 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.56 fps, Avg. Travel Time= 0.3 min

Peak Storage= 201 cf @ 12.12 hrs, Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 2.50', Capacity at Bank-Full= 1,376.18 cfs

10.00' x 2.50' deep channel, n= 0.012 Concrete pipe, finished
Length= 80.0' Slope= 0.1000 '/'
Inlet Invert= 34.00', Outlet Invert= 26.00'

Reach 1R: Culvert



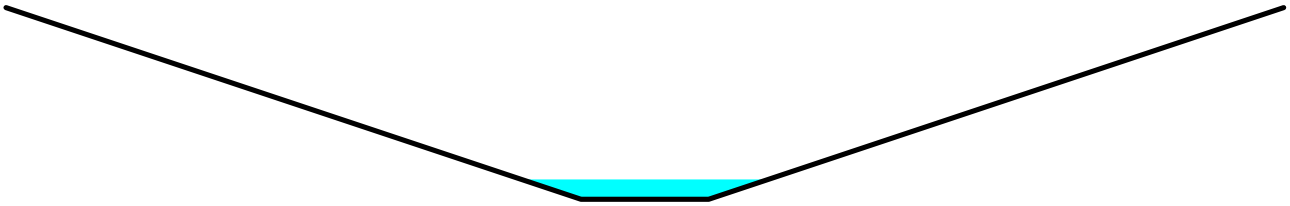
Reach SCC8: SCC-8

Inflow Area = 1.740 ac, Inflow Depth > 3.72" for Plymouth, NC - 25 Yr-Type III event
Inflow = 7.44 cfs @ 12.09 hrs, Volume= 0.539 af
Outflow = 6.68 cfs @ 12.19 hrs, Volume= 0.537 af, Atten= 10%, Lag= 5.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.85 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 0.64 fps, Avg. Travel Time= 9.7 min

Peak Storage= 1,360 cf @ 12.13 hrs, Average Depth at Peak Storage= 0.62'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 881.25 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 373.0' Slope= 0.0054 '/'
Inlet Invert= 46.00', Outlet Invert= 44.00'



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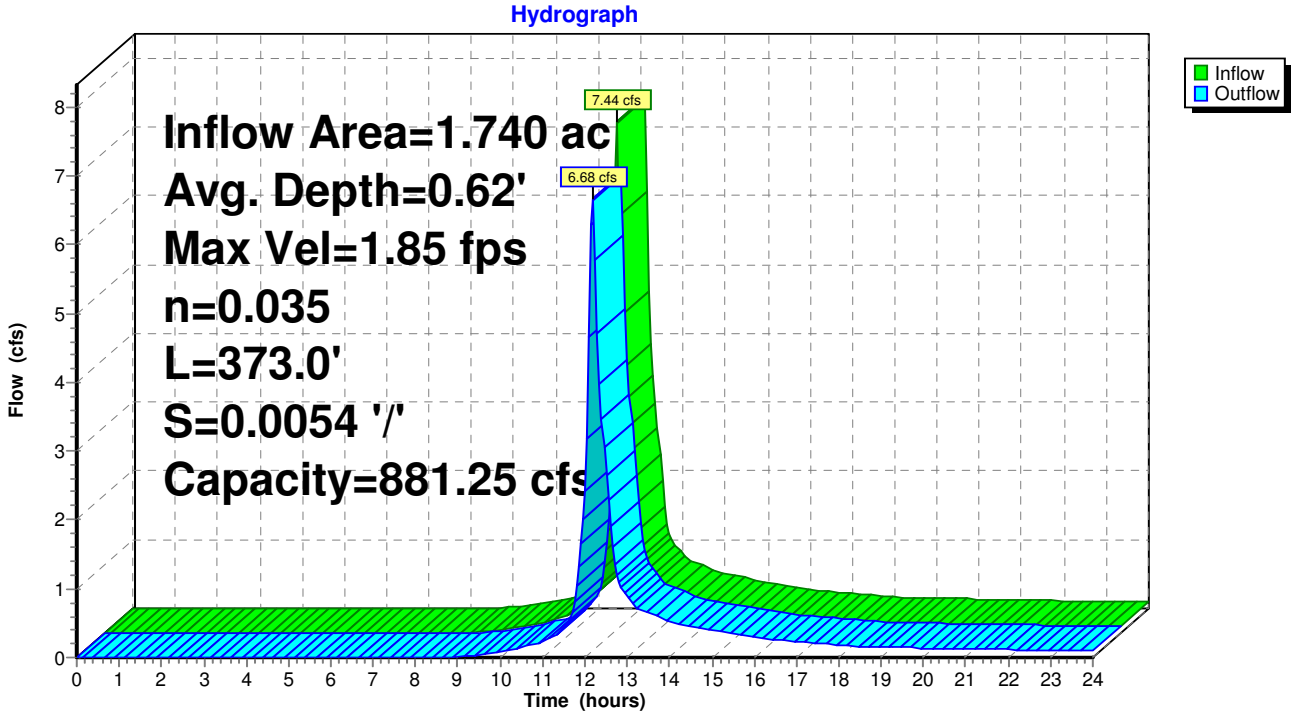


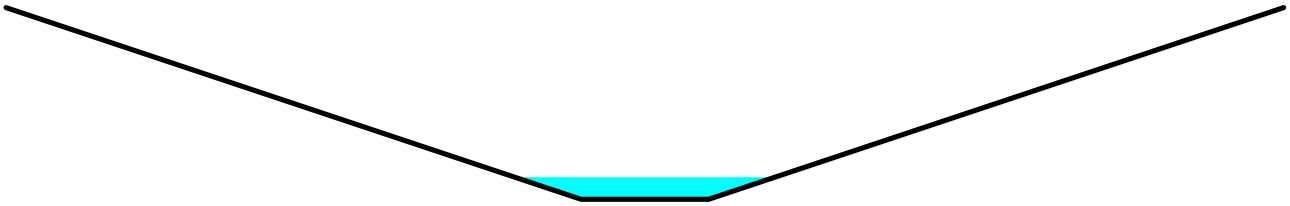
Reach SCC9: SCC-9

Inflow Area = 3.590 ac, Inflow Depth > 3.71" for Plymouth, NC - 25 Yr-Type III event
Inflow = 12.82 cfs @ 12.13 hrs, Volume= 1.110 af
Outflow = 12.46 cfs @ 12.22 hrs, Volume= 1.106 af, Atten= 3%, Lag= 5.1 min

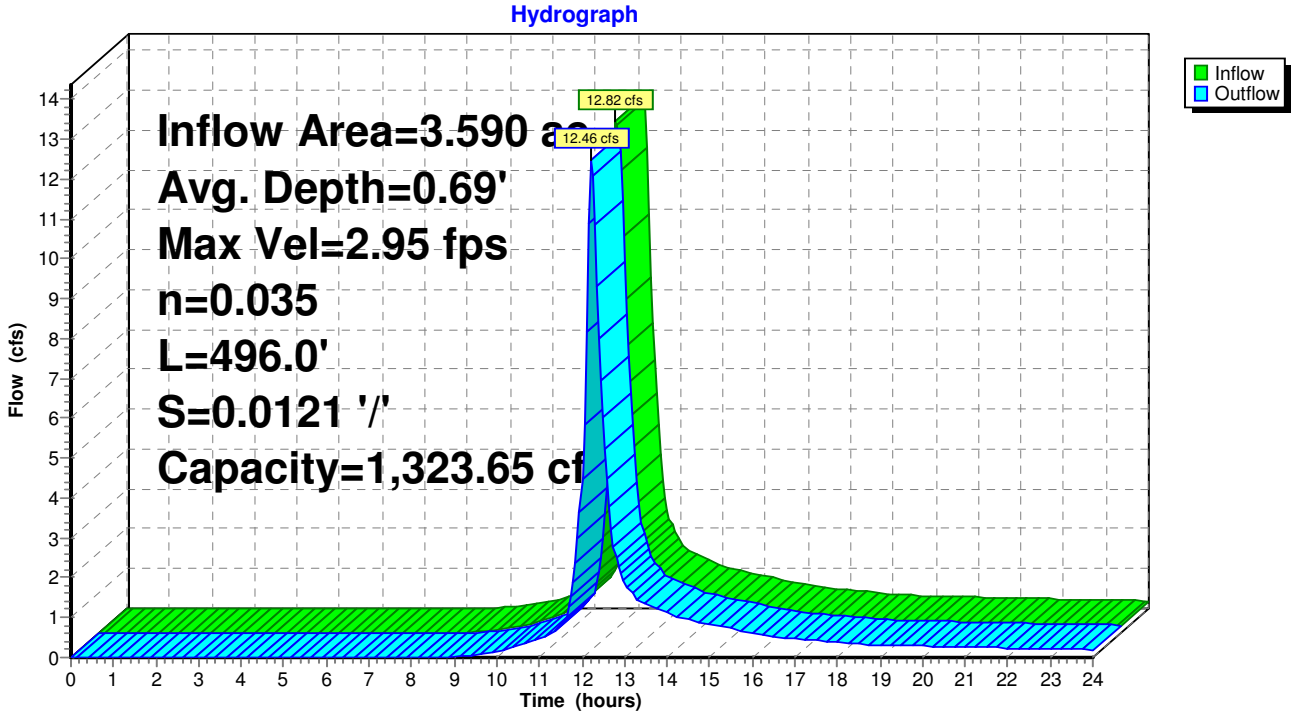
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.95 fps, Min. Travel Time= 2.8 min
Avg. Velocity = 1.07 fps, Avg. Travel Time= 7.7 min

Peak Storage= 2,096 cf @ 12.17 hrs, Average Depth at Peak Storage= 0.69'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 1,323.65 cfs

4.00' x 6.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 496.0' Slope= 0.0121 '/'
Inlet Invert= 42.00', Outlet Invert= 36.00'



Reach SCC9: SCC-9



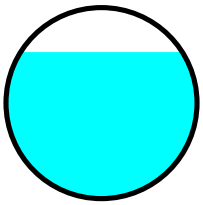
Reach SD1: SD-1

Inflow Area = 6.920 ac, Inflow Depth > 3.72" for Plymouth, NC - 25 Yr-Type III event
Inflow = 29.58 cfs @ 12.09 hrs, Volume= 2.143 af
Outflow = 29.14 cfs @ 12.10 hrs, Volume= 2.142 af, Atten= 1%, Lag= 0.6 min

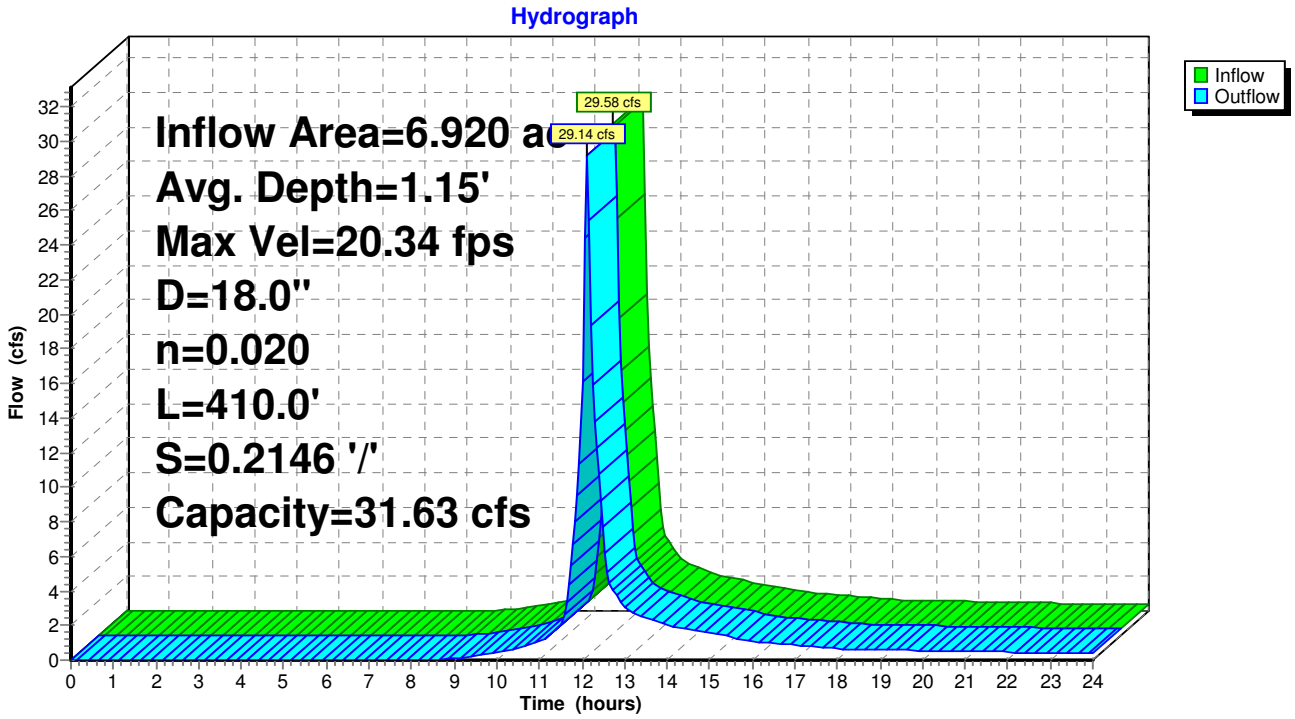
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 20.34 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 8.01 fps, Avg. Travel Time= 0.9 min

Peak Storage= 596 cf @ 12.10 hrs, Average Depth at Peak Storage= 1.15'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 31.63 cfs

18.0" Diameter Pipe, n= 0.020
Length= 410.0' Slope= 0.2146 '/'
Inlet Invert= 128.00', Outlet Invert= 40.00'



Reach SD1: SD-1



Pond SP-4: SP-4

Inflow Area = 10.510 ac, Inflow Depth > 3.71" for Plymouth, NC - 25 Yr-Type III event
Inflow = 37.74 cfs @ 12.12 hrs, Volume= 3.248 af
Outflow = 9.30 cfs @ 12.61 hrs, Volume= 2.929 af, Atten= 75%, Lag= 29.6 min
Primary = 9.30 cfs @ 12.61 hrs, Volume= 2.929 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 27.62' @ 12.61 hrs Surf.Area= 38,165 sf Storage= 58,443 cf

Plug-Flow detention time= 139.7 min calculated for 2.929 af (90% of inflow)
Center-of-Mass det. time= 92.3 min (927.2 - 835.0)

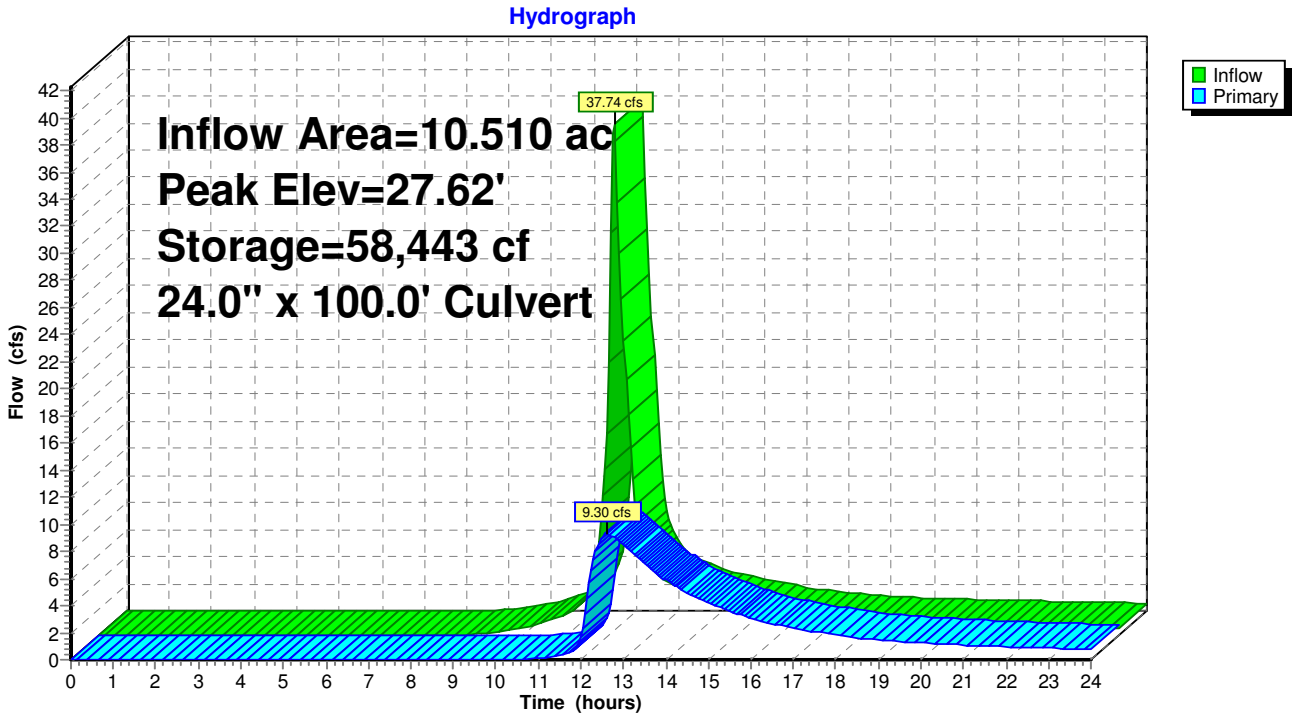
Volume	Invert	Avail.Storage	Storage Description
#1	26.00'	250,919 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
26.00	34,112	0	0
28.00	39,125	73,237	73,237
30.00	44,364	83,489	156,726
32.00	49,829	94,193	250,919

Device	Routing	Invert	Outlet Devices
#1	Primary	26.00'	**24.0" x 100.0' long Culvert** CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 24.00' S= 0.0200 '/' Cc= 0.900 n= 0.023

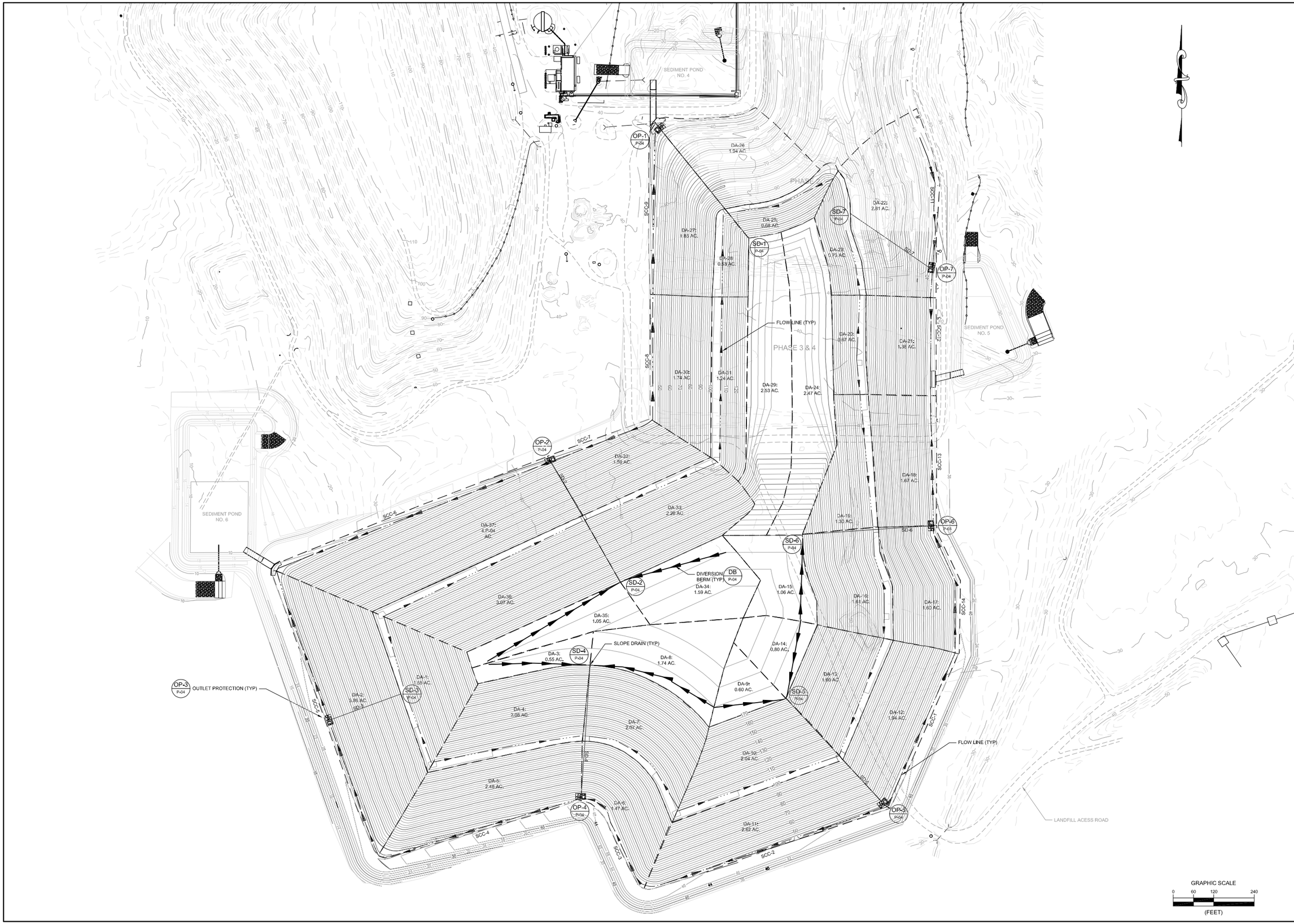
Primary OutFlow Max=9.30 cfs @ 12.61 hrs HW=27.62' (Free Discharge)
└─**1=Culvert** (Inlet Controls 9.30 cfs @ 3.42 fps)

Pond SP-4: SP-4


Hydrograph
Inflow Area=10.510 ac
Peak Elev=27.62'
Storage=58,443 cf
24.0" x 100.0' Culvert
37.74 cfs
9.30 cfs
Inflow
Primary
Flow (cfs)
Time (hours)

APPENDIX NO. 3

DRAINAGE EXHIBIT



DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

DESIGNED CTM
DRAWN RWH
CHECKED EEA
APPROVED EEA
DATE 10/19/12

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NC CORP LIC: C-0782

DOMTAR PAPER
PLYMOUTH, NORTH CAROLINA

2012 PERMIT RENEWAL
REVISED CAP DESIGN REPORT
DRAINAGE EXHIBIT

PROJECT NO.
853.1201.11

SCALE
AS SHOWN

DRAWING NO.
EX

L:\DOMTAR PAPER\drainage area.dwg LayoutLayout1

APPENDIX M

OPERATIONS PLAN

***PREPARED FOR*:**

DOMTAR PAPER COMPANY, LLC
HIGHWAY 149 NORTH
PLYMOUTH, NC 27962

DOMTAR PAPER COMPANY, LLC
ON-SITE INDUSTRIAL WASTE LANDFILL NO. 3
PLYMOUTH, NORTH CAROLINA
PERMIT NO. 94-01

REVISED CAP DESIGN OPERATIONS PLAN PHASES 2, 3 AND 4

NOVEMBER 2012

NORTH CAROLINA PROFESSIONAL SEAL 037933 11/14/12 ENGINEER CARRIE T. MITCHELL

***PREPARED BY*:**

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JOYCE PROJECT NO. 853.1201.11.01

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1.0 INTRODUCTION

The purpose of this Operations Plan is to outline procedures that will provide for the proper operation of the Domtar Paper Company, LLC (Domtar) On-site Industrial Waste Landfill No. 3 throughout the active life and post-closure care period. Located in Plymouth, North Carolina Domtar (formerly the Weyerhaeuser Company) contains a kraft process pulp mill. Waste generated by Domtar and Weyerhaeuser Plymouth Lumber Technology Facility is placed in the active on-site landfill. Domtar is currently operating under Permit No. 94-01 for Phases 2, 3 and 4 issued by the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Waste Management. Waste is actively being placed in Phase 2; Phases 3 and 4 were constructed in 2011 and commencement to operate has been approved.

1.1 Overview

Landfill No. 3 will be operated as an area fill. An operating area will be established on the waste surface where loads of waste will be dumped from transport. Landfill operating equipment will spread and compact waste materials into a working face that will slope downward from the operating area into the open cell bottom. The landfill operations described in the following sections will be conducted to accomplish the following objectives:

- Compact waste materials into a stable fill mass.
- Cover wastes that might present a blowing litter problem with soil-like waste materials such as dewatered wastewater treatment solids (fiber sludge), boiler ash, and woodyard waste (bark, grit, and reject wood chips).
- Grade all waste surfaces to promote drainage to the leachate collection drainage layer on the bottom and sides of the landfill.
- Maintain as small an operating area as practical.

In addition, operations will be conducted in compliance with the provisions of NCDENR regulations Section .1626. Asbestos waste will be placed in the asbestos landfill located east of Landfill No. 2 and west of Phase 1 of Landfill No. 3.

2.0 GENERAL FACILITY OPERATIONS

Landfill No. 3 is an industrial waste disposal facility owned and operated by Domtar. The landfill is located entirely on property owned by Domtar and lies within the Welch Creek drainage basin. The landfill will occupy approximately 96 acres of the 300 acre tract of land that has been approved by NCDENR for landfill use. Landfill No. 3 is located east of the closed Landfill No. 2 and southeast of the asbestos landfill.

Domtar has the potential to alternate between landfilling and stockpiling recoverable materials for agricultural utilization or other beneficial reuse applications. The materials will be blended and used by farmers for agricultural utilization. During the period when agricultural utilization or beneficial reuse is not practicable, the material will be stored on the working face.

2.1 Contact Information

Correspondence and questions concerning the operation of Landfill No. 3 should be directed to the appropriate entity as follows:

Owner

Domtar Paper Company, LLC.
Highway 149 North
Plymouth, NC 27962
(252) 793-8163
Facility Contact: Environmental Engineer

State Regulatory Agency

North Carolina Department of Environment and Natural Resources (NCDENR)
Division of Waste Management
Solid Waste Section-Permitting Branch
2090 US Highway 70
Swannanoa, North Carolina 28778
(828) 296-4500
Environmental Engineer: Larry Frost

2.2 Safety

There is an obligation to maintain safe and secure working conditions for all landfill personnel. Landfill operations at Domtar were developed considering the health and safety of the facility's operating staff. The operating staff is provided with site-specific safety training prior to landfill operations and on-site activities are to be conducted to keep operating staff abreast of new and existing safety requirements.

2.3 Access and Security Requirements

The landfill is located entirely on property owned by Domtar. Site control will be maintained at all times by a security fence and a manned guard station at the entrance to Domtar facilities.

A permanent haul road constructed of pavement is located to the west of the landfill. Trucks will unload at the active end of the phase and exit along a temporary access road on the outside of the delineation berm for the active phase. Temporary access roads will be constructed, modified, and

maintained as necessary for each phase of development.

Telephone, potable water, and toilets will be available in the secondary sludge building. Back-up communication to and from the site will be provided by radio or cellular telephone.

2.4 Operating Hours

The onsite landfill is open seven days a week, as needed to support plant operations. During agriculture utilization/beneficial reuse operations, the landfill operating hours will be modified.

2.5 Signs

Signs providing the landfill truck unloading procedure, permit number, stating no hazardous or liquid waste accepted, and other pertinent information is posted next to the access road towards the landfills.

Edge-of-waste markers are installed to delineate the edge of waste. These markers shall be maintained in good condition and remain visible at all times.

2.6 Training

Each employee must be thoroughly familiar with his or her responsibilities and maintain technical competence. The facility operators will complete operator training courses in accordance with the permit and regulatory requirements. Training records will be kept on-site.

2.7 Record Keeping

The following records will be maintained at the on-site records room throughout the active life of the landfill and throughout the post-closure care period. These records shall be made available to the NCDENR for examination or use when requested:

- Leachate Collection and Removal System (LCRS)—Line Cleanout and Camera Monitoring Documentation
- Inspection Logs
- Maintenance and Repair Logs
- Groundwater Monitoring (and Sampling) Documentation
- Operations Plan
- Solid waste facility permits
- Record of the amount of solid waste received summarized on a monthly basis based on scale records

- Regulatory agency inspection reports
- Permit-to-Construct Application
- Training Certificates
- State approved landfill drawings and specifications

3.0 SITE OPERATIONS MANAGEMENT

The primary objective of operations management at the landfill is to dispose of waste material in compliance with permit conditions while operating in a safe manner. Landfill operations will be conducted by a Domtar employee or a contract operator to Domtar. Site control will be maintained at all times by a security fence and a manned guard station at the entrance to the Domtar mill. The landfill area will be accessible only to landfill operations personnel, Domtar supervisory personnel, and authorized visitors. The following activities are prohibited:

- Scavenging of waste materials
- Feeding of farm or domestic animals
- Waste fill in standing water
- Open burning

Access to the disposal area of the landfill will be established using temporary culverts and soil, ash waste or gravel as appropriate to construct ramps off the perimeter dike road into the lined fill area. Runon and runoff from waste-filled areas will be controlled at all times by the leachate collection system and the perimeter berm. Waste will be placed from the perimeter inward so that the side slopes may be covered as they reach final grades.

An alternative to placing the pulp mill waste into the landfill is using the material for agricultural utilization or other beneficial reuse applications. The interior of the landfill will be used to store materials for recovery and use at a later date. Materials including waste lime, lime mud, grits, dregs, ash and dewatered fiber wastewater solids will be separated into stockpiles to be used as a soil amendment or other application. The material will later be combined into a mixture, screened, and hauled off site. Recoverable materials will be segregated from the active waste disposal operation to the extent possible and stored temporarily on the working face. Care will be taken to protect the liner system and prevent odors and vectors. No segregating or mixing will take place within 10 feet of the liner. No hazardous wastes will be stored in the landfill.

Routine inspections will be documented in a log and may include actions taken or to be taken. The inspections should also be performed to evaluate leachate levels within the landfill. Impermeable waste streams, such as ash, should be concentrated within the cell as much as possible to allow direct runoff into the leachate collection layer. Care should be taken to place various waste streams in appropriate locations that assist the operation of the leachate system as well as the evolution of the cell. This includes leaving some space along the edge of the

perimeter berms. Waste should not be placed in such a manner as to spill on to the tops of these berms. The space will leave access to the drainage layer against the wall of the berm allowing leachate runoff access to the collection system below.

Working faces should be kept as small as possible, and areas should be capped with intermediate cover as they are completed to the designed grades. Stormwater that flows off the capped/covered sections will be diverted to the perimeter drainage ditches and will not be collected as leachate.

To minimize the potential occurrence of these conditions, the following operational procedures are recommended:

- Control the equipment traffic and drainage during operations (especially during rainy weather) to prevent destabilization of the subgrade soils.
- Place and compact the waste material in lifts no more than 3 feet thick. Waste material placed in the facility should be compacted by repeated passes of the bulldozer until firm.
- Keep all waste material well drained by sloping the surface of the waste material to allow for stormwater drainage.
- Let down berms or pipes may be utilized to remove stormwater from covered slopes.
- Maintain adequate drainage of any leachate generated during waste placement operations. No more than 1 foot of head will be allowed to build up within the solid waste facility.

3.1 Waste Handling and Landfill Sequencing

3.1.1 Landfilling Capacity

Landfill No. 3 will be developed and closed in Phase 18. The landfill is currently in Phase 2. Phase 2 is estimated to have a remaining storage life of approximately three years based on a projected 61,000 tons per year disposal rate. The remaining life was determined by evaluating the volume of airspace between topography and the projected final waste grades. The remaining waste airspace for Phase 2 is 176,309 cubic yards (cy); Phase 3 and 4 have a capacity of capacity of 900,000 cy. However, with agricultural utilization and beneficial reuse, Domtar will significantly increase the storage life of the landfill. It is estimate that waste will be reduced up to 95 percent during portions of the year. This would increase the life of Phase 2 by approximately 75 years. Landfill sequencing is further described in Section 3.1.5.

3.1.2 Waste Acceptance, Disposal, and Screening Requirements

The landfill accepts process wastes such as boiler ash, grits, liquor dregs, lime mud, wood wastes, pulp rejects, general mill trash, demolition debris, dewatering solids, and other related materials generated by Domtar and Weyerhaeuser's Lumber Facility. The landfill operator shall notify the Division of Waste Management (Division) within 24 hours of attempt of any wastes

the landfill is not permitted to receive. No hazardous, liquid or infectious waste shall be disposed of in the landfill. Asbestos waste will be placed in the asbestos landfill.

The landfill operator or designated inspector will conduct inspections of all landfill operating systems on a routine basis. Inspections will be conducted and documented using an inspection log. A typical example is included as Appendix No. 1.

3.1.3 Dust, Litter, Odor, and Vector Control

A water pump with a sprayer is used to keep dusting under control. Due to the characteristics of the wastes to be placed in the landfill, problems typical of municipal landfills, such as vectors, blowing litter, and odor generation, should not exist at Domtar. The waste is predominantly ash and wastewater solids. The ash is inert, and therefore poses no odor problems and is not attractive to vectors and other animals. The wastewater solids pose no odor problems; in addition, the wastewater solids are not attractive to vectors and other animals. Litter susceptible to being blown away will be covered during daily operation.

A portion of the waste disposed of in the landfill will be general trash. This waste type will be dumped in the active work face. The waste material will be compacted by repeated passes of the compactor or bulldozer. Each day, or more frequently if required by weather conditions, blowing waste will be covered with soil-like waste materials or soil if suitable wastes are unavailable. If necessary, litter-control fencing will be used to prevent litter from blowing beyond the landfill area.

3.1.4 Fire Control

No open burning shall be permitted at the landfill. The wastes placed in this landfill are anticipated to have negligible potential for generating gas due to the inert nature of the waste.

3.1.5 Landfilling Sequencing

Landfill No. 3 will consist of 18 phases. The initial phases will progress to the south. Once the landfill reaches Phases 5 and 6 it will begin to move towards the west. Phases 1A and 1B were capped in 2011. Phase 2 is in active operation, while Phase 3 and 4 have been constructed. Filling of the phases will progress from the edge of the cell inward. As waste is progressively constructed to final grades, an active working face for the placement activity will be maintained.

3.1.6 Waste Placement and Cover Material

During initial placement of waste in a phase, special care will be taken to protect the leachate collection and removal system and the underlying liner system. The initial step for the development of a phase after the liner and leachate collection and removal systems are in place will be to ensure a minimum of 1 foot of select waste covers the lined area. This layer of select

waste (protective layer) will be placed immediately after placement of the sand layer and just prior to placement of the waste. This select waste will consist of ash void of cinders and other large particles that could adversely impact the liner. The select waste will be unloaded from the perimeter berm into the phase to be developed. A bulldozer will then place the waste appropriately. Trucks will not be permitted on the lined area until the protection layer is in place.

After placement of the protection layer, wastes will be placed in lifts that average between 2 and 3 feet in thickness. The waste will be compacted by the successive passes of the bulldozer and the truck traffic from the hauling and dumping of the waste. As the waste grades increase with each successive lift, slopes no steeper than 3 horizontal to 1 vertical will be maintained. Maintaining the waste slopes facilitates and encourages surface drainage within the active phase. This will also ease the construction effort when the final cover is applied by minimizing the amount of regrading required. The waste mound will be built up while its leading face will advance towards the subsequent phase. This method of waste placement has been termed the "moving face" concept. Waste placement will continue to advance upward until the surface grades intersect the final waste grades.

Final grades will be achieved first in the earliest part of the phase. Prior to the placement of the final cover, a 12-inch intermediate select waste layer will be placed. Placement of the temporary covers and final cap system will occur as required to minimize leachate generation in a completed or partially completed phase.

Each subsequent phase will be constructed before the active phase reaches capacity. Construction in the subsequent phase will consist of the liner system, the leachate collection and removal system, the protection layer (select waste), and diversion berms to control stormwater runon and runoff. This will provide continuous operating capacity and compensate for construction delays due to uncontrollable circumstances such as inclement weather.

3.1.6.1 Intermediate Cover

Intermediate cover will consist of 12 inches of select waste (ash). This layer will serve as a smooth support layer for the geosynthetics. The intermediate cover will be placed at Domtar's discretion on the waste in areas that have reached final waste grade elevations.

3.1.6.2 Final Cover

Final cover will be progressively placed on areas of the landfill that have been graded to final contours. Cap construction will typically be performed in areas of 5 acres or less. Final grading and cap construction will proceed from north to south and west, as the fill reaches final grades. The cap for the landfill includes geotextile and a 40-mil textured liner low density polyethylene (LLDPE) geomembrane liner. These materials will be protected from the elements and operating equipment by a vegetative soil layer.

Maintenance of the vegetative layer is critical to protect the integrity of the landfill cap system.

The cap will be sown according to approved seeding specifications for perennial vegetation. Vegetated cap areas will be mowed at least annually using equipment that will not damage the integrity of the soil cover layer. Vegetated areas will be inspected during the course of landfill operations. Conditions that may require repair include the following:

- Sparse or unhealthy vegetation
- Improper vegetation, such as trees or woody shrubs
- Erosion of the soil cover layer
- Slope failures, such as soil creep and sloughing
- Rutting from vehicular traffic or equipment operation

Damaged areas will be repaired as weather permits.

See Closure/Post-Closure Plan dated November 2012 prepared by Joyce Engineering for final cover specifications and maintenance and operations requirements.

3.1.7 Compaction

Effective compaction of waste placed in the landfill is critical in maximizing the life of the landfill. Compaction at the landfill is accomplished by utilizing either tracked equipment or compactors as the material is spread and pushed over the top of the working face.

The effectiveness of compaction depends on the frequency and technique of compaction passes. The initial lift height before compaction also affects the resulting density, as the efficiency of compaction begins to drop significantly as lift thickness increases. Waste will typically be placed in layers approximately 2-3 feet in thickness prior to compaction. Although not required, in-place density testing may be performed at Domtar's discretion to verify compaction.

3.2 Leachate and Stormwater Management

Surface water runon will be prevented by the perimeter ditch and berm around the landfill. The operating area must be nearly level to function as a turnaround and dumping area for waste transport vehicles. The working face and operating area will be kept as small as practical, and will be sloped or crowned so that water drains from the surface to the leachate collection sand layer at the toe of the waste fill. Depressions in the operating area will be filled to prevent ponding. The working face of the fill will be maintained to promote runoff to the leachate collection layer at the toe of the slope.

Temporary stormwater control berms may be constructed in unfilled areas of the active cell to divert clean stormwater away from the leachate collection system. The berm will be located to provide adequate storage space for waste as well as temporary storage of runoff from the working face. It will also be sited to maximize segregation of stormwater and leachate.

Leachate will be collected in a series of sumps equipped with both primary and secondary submersible pumps. It is anticipated that during normal landfill operations the pumps will cycle to extend pump life. In the event of an extraordinary rainfall event, primary and secondary pumps will be active thereby minimizing the amount and holding time of leachate within the landfill.

The following stormwater and leachate management practices will be maintained at the landfill:

- Limitation of the active filling area of the landfill to as small of an area as possible to minimize the volume of leachate generated.
- Maintain a filling sequence that reaches final waste grades as soon as possible so that the final cover can be placed to further divert surface water.
- Proper maintenance, operation, and monitoring of the leachate pumps, pump controls, discharge piping, leachate collection piping, and clean-outs.

3.3 Leachate Collection and Removal System (LCRS)

The leachate collection and removal system (LCRS) will be comprised of the following components:

- A granular drainage layer
- Perforated leachate collection lines
- Dual submersible pumps in each leachate collection sump
- Leachate pump station at each sump location
- A force main header pipe

The lined area inside the landfill will be covered with an 18-inch thick drainage layer. The drainage layer will consist of a graded filter composed of a 6-inch thick layer of select clean sand above a 12-inch thick layer of select gravel. The select gravel will also serve to provide bedding for the leachate collection piping and protection of the liner. The composite liner system below the drainage layer will be protected from the gravel layer, construction activities, and from operation activities with a 32-ounce geotextile.

The leachate collection lines within the landfill will consist of 6-inch diameter HDPE perforated pipes that provide chemical resistance and flexibility, and will be placed in v-notched trenches at a minimum slope of 0.5 percent. The base of the landfill will have a herringbone design

consisting of a series of ridges and valleys with the maximum distance from a ridge to a valley of 100-feet. This design will direct the flow of leachate collected in the drainage layer towards collection pipes that will be located in each valley. The collection pipes will have a maximum spacing of 200 feet. The base of the landfill will slope from one side to the opposite side so leachate collected in the pipes will flow to sumps located in each phase at the low side of the landfill. This design is capable of maintaining leachate heads of less than 12-inches above the liner system. The ends of the leachate collection lines will be fitted with 6-inch diameter SDR 17 solid wall cleanout pipe that will provide access for inspections and periodic cleaning.

In each phase of the landfill, leachate will be collected through perforations in the collection pipes and will flow by gravity from the high end of the liner to the low end where it discharges into one or more collection sumps. Each sump will have 18-inch diameter perforated HDPE inclined riser pipes that will lay across the sump and perpendicular to the landfill perimeter berm. The pipes will run from the bottom of the sump and up the inside slope of the landfill perimeter berm where it will connect to a pumping station located at the top of the perimeter berm. Leachate collected in the sump will be removed by using submersible pumps placed inside the 18-inch diameter pipes at the bottom of the sump. A level switch in the sump will automatically activate the dual submersible pump system that will pump the collected leachate up to the pumping station through a 3-inch flexible hose. The hose will connect to a 3-inch diameter solid wall HDPE force main pipe. Each wheeled submersible leachate collection pump will have a cable attached to allow for retrieval and maintenance of the pumps.

Leachate in the 3-inch diameter HDPE force main pipe inside the pumping station will exit through 3-inch diameter double wall pipe. The 3-inch diameter double -wall pipe runs for a short distance where it will connect to a 6-inch diameter double-wall force main header pipe. Leachate pipes located outside the pumping station will consist of double-wall pipes and will be buried a minimum of 3-feet below the ground surface. The header pipe is buried inside the landfill perimeter berm and transports collected leachate around the outside perimeter of the landfill where it will discharge the leachate into a wet well located at the secondary sludge building located on the western side of the landfill. The leachate will be used for dust control as needed or will be transferred to the facility permitted wastewater treatment system located on Domtar's property.

3.3.1 Leachate Collection and Removal System Maintenance

Leachate control and migration begins with proper operational safeguards. Proper facility operation by maintaining design grades, placement of daily cover, intermediate and final covers, maintaining good vegetative cover, and applying run-on and run-off controls will help to reduce leachate production. A Domtar representative or designated inspector will conduct weekly inspections of the leachate collection and storage system. Maintenance needs will be re-evaluated if there is an unexpected decrease or increase in leachate production rates.

Cleanouts pipes are provided at the end of the leachate collection and header pipes. Cleanouts are provided to allow access to the leachate collection system. If a clogging problem exists within a pipe, the pipe can be cleaned out by high pressure water flushing or chemical cleaning agents may also be used to mitigate clogging. LCRS pipes will be cleaned out by the use of a clean-out snake or high-pressure water flushing every other year and will be remote-camera monitored at least once every 5 years. The frequency of clean-out and camera inspections may be modified based on consecutive inspection results and observed operating conditions. Records will be maintained at Domtar documenting the leachate line cleanout and camera monitoring.

3.3.2 Leachate Collection and Removal System Pumps

Redundant submersible pump systems remove leachate from the bottom of the landfill and transfer it by force main to the storage tank/sump of the leachate transfer station, then to the mill wastewater treatment system. Maintenance of the pumps will be conducted in accordance with manufacturer's recommendations.

The totalizers at the leachate stations will be recorded regularly and will be used in monitoring the system. If flow is lower than anticipated, the system should be thoroughly inspected and any problems repaired. The pumps have a performance maintenance schedule to ensure pump integrity.

3.4 Stormwater Controls

The drainage system is designed to control the 24-hour, 25-year storm. Facility personnel will maintain stormwater conveyance channels, pipes, diversion berms, and sediment basins. Perimeter ditches should be maintained clear of waste and debris. Ditches that may be necessary for drainage of the haul road should also be periodically maintained. All surface runoff from Landfill No. 3 will be directed to one of the permanent sedimentation basins. Accumulated sediment will be excavated when the sediment reaches the elevation corresponding to half of the design capacity.

3.4.1 Stormwater Discharge

The stormwater system at the landfill was designed to help prevent the discharge of pollutants. Stormwater discharge from the sediment basins will be controlled with the spillway outlet pipe. The discharge will enter Welch Creek or Little Mill Creek. Landfill operation shall not cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirement of the Clean Water Act, including, but not limited to NPDES requirements, pursuant to Section 402. In addition, under the requirements of Section 404 of the Clean Water Act, the discharge of dredged or fill material into waters of the state that would be in violation of the requirements shall not be allowed by landfill operations.

Operations at the landfill shall not cause the discharge of a non-point source of pollution to waters of the United States, including wetlands, that violates any requirement of an area-wide or statewide water quality management plan that has been approved under Section 208 or 319 of the Clean Water Act, as amended.

3.5 Operating Equipment

Landfill No. 3 will be operated with a mid-size bulldozer. Support equipment will consist of over-the-road transport vehicles, including standard dump trucks. A motor-grader, roller, and compactor will be used for road maintenance, but will not necessarily be dedicated to the landfill operations.

In general, a bulldozer will be used to spread waste and compact the working face. The bulldozer will be used to maintain access from the perimeter road to the operating area, and to spread soil-like waste materials to prevent litter from leaving the work face.

If extended service should be required on the landfill bulldozer, a substitute bulldozer will be provided by other operations at the Domtar mill or leased from a local contractor to ensure continuous operations.

3.6 Groundwater Monitoring Well Accessibility

Groundwater monitoring wells are located around the landfill perimeter. A readily accessible, unobstructed, path shall be maintained so that monitoring wells may be accessed by vehicles. Care must be taken around the wells to prevent any damage to the wells.

3.7 Landfill Gas Management

Because of the nature of the waste to be placed in the Landfill No. 3, Domtar does not anticipate that methane or hydrogen sulfide gas will be generated or that odor will be an issue during operations. Therefore, landfill gas monitoring and management is not proposed.

A landfill gas venting system is provided as part of the engineered cover system.

4.0 EROSION AND SEDIMENTATION CONTROL

Erosion and sedimentation control (E&SC) during operations consist of monitoring stormwater conveyance features and surface erosion. The site is designed with erosion and sedimentation control in accordance with the requirements of the Sedimentation Pollution Control Law. Erosion and sediment control measures will be taken to provide protection both during construction and operation of the landfill. In order to preserve the integrity of the final cover, a suitable stand of grass will be planted over the majority of the landfill.

Measures have been placed to reduce the amount of erosion on the landfill and control the amount of sediment being discharged from the landfill. In order to reduce the erosive effects of the increased runoff from the landfill, sediment basins have been designed to attenuate the runoff from the finished landfill to the peak runoff rate of the existing terrain. Erosion control devices and the landfill facility shall be inspected after each significant rainfall event and periodically. All necessary repairs shall be made immediately.

5.0 VEGETATION MANAGEMENT

Supplemental vegetation, such as temporary and permanent seeding, shall be used to reduce erosion and sedimentation, as well as to reduce damage to downstream and offsite areas. Schedules for planting supplemental vegetation, as well as the vegetation types, are contained in the permit documents.

5.1 Temporary Seeding

Temporary seeding is used to reduce erosion and sedimentation in disturbed areas that will not be brought to final grade for a time period of more than 21 days. Temporary seeding will also help reduce the damage from runoff downstream or offsite by protecting bare soils that are exposed during construction until permanent vegetation, or other erosion control measures, are in place. Areas that require temporary seeding shall be seeded as soon as possible and shall be seeded in accordance with the North Carolina Erosion and Sediment Control Planning and Design Manual. Areas that fail to establish adequate vegetative cover to prevent rill erosion shall be reseeded as soon as such areas are identified.

5.2 Permanent Seeding

Permanent seeding shall take place after the placement of the vegetative support layer. The vegetative support layer shall be six inches thick and shall be topsoil free of subsoil, clay lumps, brush, weeds, roots larger than 2 inches in diameter, and other materials deemed toxic or harmful to growth. Permanent seeding shall be accomplished on final grades, on cut and fill slopes, surface water ditches, rough-graded areas that will not be brought to final grade for a year or more, and other areas as required. Permanent seeding shall be completed by a contractor. The contractor shall be responsible for final ground cover; any area that fails to develop a successful stand of grass up to one year after final inspection shall be reseeded until a successful stand develops. Any significantly large (1/2 acre) areas that require reseeding shall be guaranteed for one year after the reseeding date.

6.0 LANDFILL CLOSURE

Landfill No. 3 will be closed in accordance with the design drawings and Closure/Post-Closure Plan. The Closure/Post-Closure Plan outlines the sequence for closing the landfill and the post-closure maintenance activities. Closure is designed to minimize the need for long-term

maintenance and to control the post-closure release of contaminants. Closure activities may be revised as appropriate for materials, specifications, technology advancements, or changes in regulations at the time the landfill is closed or in post-closure. In general, the landfill development is designed so that final cover can be established as soon as possible.

7.0 REGULATORY SUBMITTALS

Submittal	Requirement	Reporting/Action Frequency
Groundwater Monitoring Reports	Maintain a record of all monitoring events and analytical data in accordance with the Groundwater Monitoring Plan. Reports of the analytical data for each water quality monitoring sampling event shall be submitted to NCDENR Division of Waste Management (DWM) in a timely manner.	Semi-annually
Annual Tonnage Reports	Tons of waste received and disposed of in the landfill shall be reported to the DWM on forms prescribed by the DWM. As approved by DWM, Domtar does not have to list the amount of waste by specific type and disposal location within the facility. Refer to the Permit to Operate for additional annual reporting requirement information.	Annually Must submit no later than August 1 each year
10-Year Waste Management Plan	Per North Carolina G.S. 130A-309.09D (c): • A 10-year waste management plan shall be developed for this landfill and submitted to DWM. • The plan shall be updated and submitted to DWM at least every three years. • A report on the implementation of the plan is required to be submitted to DWM by August 1 of each year.	10-year plan prepared every 10 years 10-year plan updated every 3 years Implementation report annually

APPENDIX NO. 1

SAMPLE LANDFILL INSPECTION CHECKLIST

Sample Landfill Inspection Checklist

INSPECTION CHECKLIST	INSPECTION	INITIAL AND DATE THE APPROPRIATE BOX									
		S	M	T	W	T	F	S	STORMS	MONTHLY	QUARTERLY
Pumps											
1	Weekly - switch on and check current, check flashing light and standing water.										
2											
3											
4											
Ditches	Inspect monthly and after storms.										
Sediment Basin	Inspect monthly and after storms.										
Dikes and Berms	Inspect monthly and after storms.										
Fence and Gates											

Comments:

Work Orders Placed:

DATE	ORDER NUMBER	DESCRIPTION OF REQUEST

APPENDIX N

CLOSURE/POST-CLOSURE PLAN

***PREPARED FOR*:**

DOMTAR PAPER COMPANY, LLC.
HIGHWAY 149 NORTH
PLYMOUTH, NC 27962

DOMTAR PAPER COMPANY, LLC
ON-SITE INDUSTRIAL WASTE LANDFILL NO. 3
PLYMOUTH, NORTH CAROLINA
PERMIT NO. 94-01

REVISED CAP DESIGN
CLOSURE AND POST CLOSURE PLAN

NOVEMBER 2012

NORTH CAROLINA PROFESSIONAL SEAL 037933 11/14/12 ENGINEER CARRIE T. MITCHELL

***PREPARED BY*:**

JOYCE ENGINEERING

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Drawing No. CP-02 Final Grading Plan
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1.0 CLOSURE ACTIVITIES

Domtar Paper Company, LLC (Domtar), formerly the Weyerhaeuser Company, is located in Plymouth, North Carolina. Waste generated by Domtar's fluff pulp mill and Weyerhaeuser Plymouth Lumber Technology Facility is placed in the active on-site landfill. The current active landfill (Landfill No. 3) is located to the east of the asbestos landfill and the secondary sludge building. Domtar is currently operating under a Permit-To-Operate, No. 94-01, for Phases 2, 3 and 4 issued by the North Carolina Department of Environment and Natural Resources, Division of Waste Management (Division).

Pursuant to the North Carolina Solid Waste Management Rules (15A NCAC 13B .1629), this Closure and Post-Closure Plan is submitted as part of the permit renewal application to operate Phases 2, 3 and 4 of the active landfill. Phase 1A was constructed in 2000, and began accepting waste the same year. Phase 1B was subsequently constructed. Both phases were closed in 2011 after the construction of Phases 3 and 4. Phase 2 is currently accepting waste and commencement to operate in Phases 3 and 4 has been permitted.

The purpose of the Closure/Post-Closure Plan is to outline the sequence for closing the landfill phases and the post-closure maintenance activities for each phase. Closure is designed to minimize the need for long term maintenance and to control the post-closure release of contaminants. Closure activities may be revised as appropriate for materials, specifications, technology advances or changes in regulations at that time.

1.1 Closure of Disposal Units

1.1.1 Cap Design

Proposed final grading contours for Phases 2, 3 and 4 are provided on Drawing No. CP-02 of the Closure Plan. Final contours have been designed with post-settlement surface slopes of at least five percent on top of the cell and slopes no steeper than 3 horizontal to 1 vertical. Passive gas vents will be installed at the crest of the landfill as designed by RMT North Carolina, Inc. Passive venting of landfill gases will protect the integrity of the cap by preventing pressure buildup beneath the cap. The following components (bottom to top) are proposed as shown on the details:

a. Intermediate Cover - Select waste (ash) will be placed over the waste to provide at least 12 inches of intermediate cover and a uniform base for construction of the cap.

b. 40-mil LLDPE Membrane - A textured 40-mil linear low-density polyethylene (LLDPE) membrane will be used. The membrane will be in direct contact with the underlying layer.

c. Geocomposite Drainage Layer - A drainage layer consisting of a geotextile/geonet/geotextile composite will be placed directly over the geomembrane to promote drainage.

d. Protective Layer - A layer consisting of at least 18 inches of local soil or a mixture of dewatered wastewater solids and ash will be placed above the drainage layer to provide a protective cover for the underlying cap components.

e. Erosion Layer - A layer of topsoil material or organically amended local soil will be placed above the protective layer. This soil layer will be at least 6 inches in thickness. The topsoil material will be lightly compacted so that a good stand of vegetation can be established. Soil tests will be conducted prior to seeding to determine if soil additives are needed to establish vegetation.

f. Vegetation - After placement of the erosion layer, the area will be seeded. Seeding will be accomplished in accordance with the "North Carolina Erosion and Sediment Control Planning and Design Manual", and recommendations from local agricultural specialists. Mulch and erosion matting will be used as needed to control erosion and promote vegetative growth. The vegetative cover will be inspected regularly. Areas found to be sparsely covered will be revegetated.

1.1.2 Area to Be Capped

Phases 1A and 1B have been capped and entered post closure care in 2011. Currently, the total area needing to be capped is appromiately 19.5 acres (Phase 2, 3, and 4). The landfill is designed so that closure can occur in stages. Partial closure can occur when final contours are reached, and the waste appears reasonably stabilized, in a given area. Once an area of sufficient size to make construction cost-effective has reached final elevations, closure activities will be carried out according to the schedule presented later in this report.

1.1.3 Drainage and Erosion

A combination of slope drains, grassed channels, diversion berms, vegetative cover, and sediment traps and basins will control drainage and erosion. Construction and design of sediment and erosion control features will be in accordance with applicable sections of the "North Carolina Erosion and Sediment Control Planning and Design Manual." Drainage will be directed to the proposed slope drains on the landfill cap and channels along the perimeter. These channels will receive runoff from the cap, conveying the flow to on-site sediment basins. The updated Erosion and Sediment Control Plan can be found in Appendix L of the Revised Cap Design Report.

1.2 Waste Volume

Phase 2 is estimated to have a remaining storage life of approximately three years based on a projected 61,000 tons per year disposal rate. The remaining life was determined by evaluating

the volume of airspace between topography and the projected final waste grades. The remaining waste airspace for Phase 2 is 176,309 (cy); Phase 3 and 4 have a capacity of approximately 900,000 cy. The storage life of the phases will be extended if Domtar participates in agricultural utilization or other beneficial reuse applications. It is estimated that waste will be reduced up to 95% during the year. Agricultural utilization and the beneficial reuse application are discussed in more detail in the Operations Plan dated November 2012.

1.3 Closure Plan Schedule

Following the completion of waste placement, a final cover system will be constructed. The primary purpose of a final cover system is to minimize infiltration of stormwater into the waste, thus limiting generation of leachate. The proposed final cover system cross section is presented in the Closure Plan Drawings date November 2012 prepared by Joyce Engineering.

Final closure of the landfill will commence when final design grades are achieved, Domtar declares that no more waste will be accepted, or as directed by the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Waste Management – Solid Waste Section (the Division). Prior to beginning final closure, Domtar will notify the Division that a Notice of Intent to close the facility has been placed in the Operating Record. Closure activities for the landfill shall begin no later than 30 days after final receipt of waste unless otherwise approved by the Division or, if the landfill has remaining capacity and there is a reasonable likelihood that the landfill will receive additional wastes, no later than one year after the most recent receipt of wastes. Extensions beyond the one-year deadline for beginning closure may be granted by the Division if the operator demonstrates that the landfill has the capacity to receive additional wastes and the operator has taken and will continue to take the steps necessary to prevent threats to human health and the environment from the unclosed landfill.

The final cover system will be finished within 180 days following the beginning of closure activities unless otherwise approved by the Division. Extensions of the closure period may be granted by the Division if the operator demonstrates that closure will, of necessity, take longer than 180 days and they have taken and will continue to take the necessary steps to prevent threats to human health and the environment from the unclosed landfill unit. The final cover system for the closed phases will be certified by a professional engineer as being complete.

Following cover system construction, the landfill will be vegetated with grass and maintained. A final cover will be established over the landfill unit being closed. The maximum waste-filled area of the proposed landfill that would require closure operations at any one time is approximately 19.5 acres. If the landfill is closed prior to reaching capacity, revised closure drawings will be submitted to the Division for approval.

1.4 Notification

Within 90 days of closure completion, Domtar will record a notation onto the land deed or some other instrument that is normally examined during title search stating the following information:

- The land has been used as a solid waste disposal facility landfill unit.
- The land use is restricted to ensure that the cap system integrity or other containment components are not compromised and monitoring systems are not disturbed.
- That any re-use of the property will not increase the potential threat to human health or environment.
- The name of the permittee, the type of disposal facility, and the beginning and closure dates of the disposal activities will be included.
- The locations and dimensions of the landfill unit with respect to permanent surveyed benchmarks and section corners on a plat prepared and sealed by a land surveyor will be included.

Copies of the deed notations as recorded will be placed in the Operating Record and forwarded to the Division.

1.5 Certification

Upon completion of closure, a licensed professional engineer acting on behalf of Domtar will submit a Certification of Closure to the Division. This Certification will state that the site was closed in accordance with the Closure Plan and applicable solid waste regulations and laws as required by 15A NCAC 13 B.

The owner must record a notation on the deed to the landfill facility property or some other instrument that is normally examined during title search, and notify the Division that the notation has been recorded and a copy has been placed in the Operating Record. The notation shall in perpetuity notify any potential purchaser of the property that the land has been used as a disposal facility and its use is restricted under the closure plan approved by the Division.

1.6 Closure Cost Estimate

An estimate of closure costs is provided in Appendix No. 1. All costs are given in 2012 dollars.

2.0 POST-CLOSURE ACTIVITIES

The Post-Closure Plan outlines the monitoring and maintenance activities intended to maintain cover system integrity during the post-closure period, which is proposed to be 30 years. During the post-closure period the landfill cover system and related facilities must be monitored and maintained per NCDENR requirements.

2.1 Contact

All correspondence and questions concerning the post-closure care of the unit should be directed to:

Environmental Engineer
Domtar Paper Company, LLC
PO Box 747
Highway 149 North
Plymouth, North Carolina 27962
252-793-8163

2.2 Security

The landfill is located entirely on property owned by Domtar. Site control will be maintained by a security fence for the duration of the post-closure period.

2.3 Post-Closure Maintenance

Post-closure maintenance and monitoring will be conducted at the Landfill No. 3 for a period of 30 years after final closure. The Division may decrease the length of the post-closure period if the owner or operator demonstrates that the reduced period is sufficient to protect human health and the environment, and the Division approves this demonstration. The period might be increased if the Division determines that the lengthened period is necessary to protect human health and the environment. Monitoring will include semi-annual sampling of groundwater and quarterly inspection of the final cover and monitoring and control systems.

Maintenance activities will be required for the final cover system to remain functional. The vegetative cover shall be mowed a minimum of once a year. The vegetative cover shall be amended and fertilized as needed to maintain healthy vegetation. Depressions in the cover that pond water or otherwise impair the function of the final cover will be filled and/or regraded. Areas subject to regrading will be revegetated. Animal burrows and eroded areas should be filled in with compacted soil and reseeded. If vegetative cover is not adequate in a particular area, fertilizer should be applied and the area reseeded in order to re-establish vegetation. Insecticides may be used to eliminate insect populations that are detrimental to the vegetation. Any deep-rooted or woody vegetation that may have established itself on the cover soil will be removed.

Maintenance needs identified through the monitoring program will be initiated no later than 60 days after the discovery, and within 24 hours if a danger or eminent threat to human health or the environment is indicated. Minor cap maintenance may be deferred until there is a sufficient amount of work to justify the mobilization of equipment and personnel. Unusual or extreme maintenance needs due to calamities or vandalism might require the implementation of emergency contract service procedures established by Domtar.

2.4 Inspection Plan

Routine inspections will be conducted throughout the post-closure care period. These inspections will be carried out quarterly unless problems are detected which indicate more frequent visits. Potential impacts to the public and environment will be considered in determining the inspection frequency. Items to be included in the quarterly inspection will be as follows:

- Access and security control
- Leachate management system
- Stormwater management
- Erosion and sediment control
- Groundwater monitoring systems
- Integrity of site benchmarks
- Integrity of the final cover system
- Vector control

Inspection forms have been prepared for use during each inspection (see Appendix No. 2). Completed copies of the inspection forms will be kept by the owner and copies will be forwarded to the Division for its records.

2.5 Monitoring Plan

2.5.1 Groundwater Monitoring

Groundwater monitoring will occur semi-annually throughout the post-closure care period. The monitoring schedule will continue as established during the active life of the facility. The applicable procedures outlined in Rules .0601 will be followed through post-closure as required by site findings. Once the post-closure care period is completed, the groundwater wells will be abandoned in accordance with NCAC Title 15A, Subchapter 2C. A blank groundwater monitoring well maintenance record form is provided in Appendix No. 3.

2.5.2 Landfill Gas Monitoring

Due to the nature of the waste, Landfill No. 3 is not anticipated to generate gas. Therefore gas monitoring at the site will not be performed at the landfill. However, a venting system is currently in place.

2.5.3 Stormwater, Erosion, and Sedimentation Control Facilities

Stormwater management features proposed in the Erosion and Sediment Control Plan are designed to function throughout the post-closure care period. Drainage ditches and sediment ponds will be inspected and maintained as needed to control surface water runoff and erosion.

2.5.4 Leachate Management and Closure Plan

Leachate management will continue according to the approved practices at the facility during the post-closure period as long as leachate continues to be generated. The leachate collection system will be checked periodically and maintained to prevent clogging.

When leachate collection ceases, the following closure activities will be completed within 180 days: Leachate removal pipes will be securely plugged, using the cleanouts and manholes for access, removing pumps, valves, controls, and flow measuring devices, and liquid and solid waste will be removed from associated piping network. Contaminated subsoils, structures, and equipment will also be removed. Material that is removed will be disposed in accordance with applicable requirements.

2.5.5 Record Keeping

The following records will be maintained in the Operating Record at the on-site records room or an alternative location approved by the Division throughout post closure care of the facility and made available to the Division upon request:

- The facility permit and pertinent correspondence;
- Emergency Response Plan;
- Inspection records, repair and maintenance records;
- Historical amounts by weight of solid waste received at the facility, including the source of generation;
- Water Quality Monitoring Plan and any demonstration, certification, finding, monitoring, testing, or analytical data required by the water quality monitoring program at the site;
- Required cost estimates and financial assurance documentation;
- Closure and Post-Closure Plans; and
- Leachate generation rates

2.6 Training

Personnel responsible for conducting monitoring activities, site inspections and maintenance will be competent individuals trained in the skills needed for their duties. Personnel will continue to receive training as new programs become available.

Groundwater monitoring will be performed by a qualified consultant and laboratory analysis will be conducted by a certified environmental laboratory.

2.7 Post-Closure Land Use

Currently, there are no planned uses for the site after closure of the landfill. Limited passive recreational uses may be proposed at a later time.

2.8 Certification

Consistent with regulations, the end of the closure-post closure period must be certified by a registered professional engineer. To accomplish certification over the required 30-year duration, a registered professional engineer will prepare annual certifications. The annual certifications will document that the cover system has been monitored and maintained in accordance with the Post-Closure Plan. The annual certifications shall be based on observations and results documented on regular post-closure monitoring reports, maintenance records, and compliance monitoring reports maintained in the Operating Record.

2.9 Post-Closure Cost Estimate

An estimate of post-closure care costs is provided in Appendix No. 4. All costs are given in 2012 dollars.

(End)

APPENDIX NO. 1

CLOSURE COST ESTIMATE

Appendix 1
Estimate of Closure Cost:
On-Site Industrial Landfill No. 3
Phases 2, 3 and 4

ITEM	UNIT	QUANTITY	UNIT COST	COST $
FINAL CAP SYSTEM- 19.5 ACRES (PHASE 2-4)				
Intermediate Cover (12" Selected Ash)	cy	32,000	$5.00	$160,000
Geomembrane (40 mil)	sf	850,000	$0.45	$382,500
Geonet Composite (Drainage Layer)	sf	850,000	$0.70	$595,000
Geotextile	sf	2,100	$0.55	$1,155
Protective cover (18")	cy	48,000	$5.00	$240,000
Erosion Layer (6")	cy	16,000	$6.00	$96,000
Subtotal				**$1,474,655**
SEDIMENTATION AND EROSION CONTROLS				
	lump sum	-	-	**$130,000.00**
PASSIVE GAS SYSTEM				
Passive Gas Vents	each	11	$5,000	$55,000
Gas Line	lf	3,500	$15	$52,500
Subtotal				**$107,500**
VEGETATIVE COVER				
	acre	20	$1,750	**$35,000**
TOTAL OF ABOVE ITEMS				**$1,747,155**
MOBILIZATION / DEMOBILIZATION	(construction only)		5%	$87,358
ENGINEERING FEE	-	-	2%	$34,943
CQA	(cap only)	-	6%	$104,829
CONTINGENCY	-	-	5%	$87,358
ADMINISTRATION	lump sum	-	-	$2,500
CLOSURE CERTIFICATION	lump sum	-	-	$25,000
SURVEY AND DEED	lump sum	-	-	$12,000
TOTAL CLOSURE COST (IN 2012 DOLLARS)				**$2,101,143**

Notes:
1. Costs are based on conceptual design and should be considered approximate.

APPENDIX NO. 2

POST-CLOSURE INSPECTION RECORD

POST-CLOSURE INSPECTION RECORD

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

---

1. Access and Security Control

- ☐ Is a notice prohibiting the further disposal of waste materials clearly visible at the entrance to the facility?
- ☐ Is the site adequately secured by means of gates, chains, berms, fences or other security measures to prevent unauthorized entry?
- ☐ Are the access roads to and within the site maintained to provide access to the closed disposal area and to all monitoring points?

2. Erosion and Sediment Control

- ☐ Is the vegetation adequate to stabilize the site and prevent erosion?
- ☐ Are the erosion control measures adequate to prevent silt from leaving the site and to prevent excessive on-site erosion?
- ☐ Do the sediment basins require cleaning out, as indicted by the level of sediment buildup?

3. Drainage Control Requirements

- ☐ Are all areas adequately sloped to promote surface water runoff in a controlled manner?
- ☐ Are there areas of observed settlement, subsidence, and/or displacement of the closure cap?
- ☐ Are all drainage channels free of accumulated sediment?

4. Uncontrolled Escape of Leachate or Landfill Gas

- ☐ Are there any leachate seeps observed?
- ☐ Are there any signs of uncontrolled releases of landfill gas?

5. Environmental Monitoring Systems

- ☐ Are all monitoring wells (groundwater) properly maintained? (Note: Complete the Groundwater Monitoring Well Maintenance Record during semi-annual sampling events.)

6. Miscellaneous

- ☐ Are all site benchmarks marked and evident?
- ☐ Do vector control measures appear adequate?

7. Final Cover System Inspection

- ☐ Are there areas of settlement and/or subsidence on the cap system?
- ☐ Are there areas of erosion or animal burrows on the cap system?

APPENDIX NO. 3

GROUNDWATER MONITORING WELL MAINTENANCE RECORD

GROUNDWATER MONITORING WELL MAINTENANCE RECORD

FACILITY: _____ WELL #:

LOCATION: _____ DATE:

INSPECTOR: _____ COMPANY:

1. Is surface water diverted away from the wellhead?

2. Is the concrete pad still intact and free of cracks?

3. Has surface water runoff undercut the concrete pad

4. Is the outer casing still secure and locked?

5. Is the well identification tag present and is it legible?

   5a. Does the well identification tag provide the following information:

   - The well identification number?
   - Drilling contractor name and registration number?
   - Total depth of well?
   - Depth to screen?
   - A warning that the well is not for water supply and that the ground water may contain hazardous materials.

6. Is the grout between the inner and outer well casings all the way to the ground surface?

7. Is the inner casing firmly grouted in place?

8. Are the inner and outer casings upright and unobstructed?

9. Is water collecting in the outer casing? Does a weep hole need to be bored in the outer casing to provide drainage?

10. Is the monitoring well accessible by a four-wheel drive vehicle?

11. Have brush and weeds been trimmed so that the well is easy to locate and access?

12. Does the inner well casing have a vented cap?

13. Is the monitoring well visible and adequately protected from moving equipment?

APPENDIX NO. 4

POST-CLOSURE COST ESTIMATE

Appendix 4
Estimate of Post-Closure Care Costs:
On-site Industrial Waste Landfill No. 3
Phase 1A, 1B, 2, 3, and 4

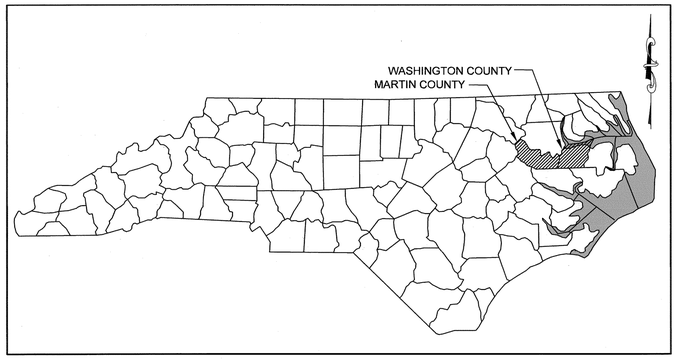
ITEM	UNIT	QUANTITY	UNIT COST	ANNUAL COST
INSPECTIONS/ RECORD KEEPING	per trip	4	$500	**$2,000**
30 Year Subtotal				**$60,000**
LEACHATE MANAGEMENT	lump sum	1	$14,000	**$14,000**
30 Year Subtotal				**$420,000**
ROUTINE MAINTENANCE				
Mowing	acre	34.3	$164	$5,625
Fertilizing	acre	34.3	$300	$10,290
Reseeding (once every 3 years)	acre	11.4	$1,800	$20,580
Vector and Rodent Control	acre	34.3	$30	$1,029
Subtotal				**$37,524**
30 Year Subtotal				**$714,126**
WELL MAINTENANCE				
Groundwater Wells	lump sum	1	$1,000	$1,000
Gas Vents	lump sum	1	$1,000	$1,000
Subtotal				**$2,000**
30 YearSubtotal				**$60,000**
CAP REPAIR	lump sum	1	$9,000	**$9,000**
30 Year Subtotal				**$270,000**
TOTAL OF ABOVE ITEMS				**$64,524**
TOTAL OF ABOVE ITEMS (LIFE TIME)				**$1,524,126**
ENGINEERING	-	-	3%	$45,724
CONTINGENCY	-	-	5%	$76,206
INITIAL ANNUAL POST-CLOSURE COST (IN 2012 DOLLARS)				**$69,686**
TOTAL 30 YEAR POST-CLOSURE COST (IN 2012 DOLLARS)				**$1,646,056**
POTENTIAL ASSESSMENT & CORRECTIVE ACTION				**$2,000,000**
TOTAL				**$3,646,056**

Notes:
1. All costs include labor by a third party.
2. Water quality monitoring and leachate management costs are estimated.
3. Cost for groundwater wells assumes maintenance of each well during the period.
4. Cost for the gas vents assumes maintenance of each probe during the period.

DRAWINGS

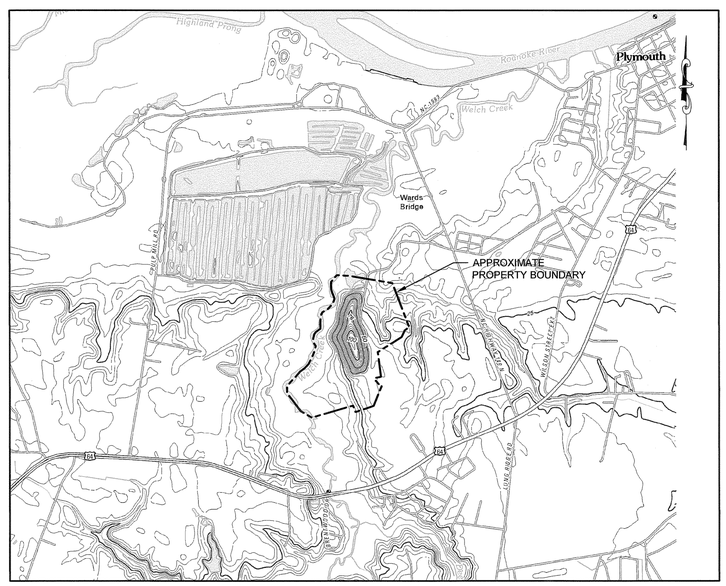
DOMTAR PAPER COMPANY, LLC.
ON-SITE INDUSTRIAL WASTE LANDFILL NO. 3
PHASES 2, 3 & 4

PLYMOUTH, NORTH CAROLINA



NORTH CAROLINA
COUNTY LOCATION MAP

Domtar



VICINITY MAP

DRAWING INDEX

SHEET	DESCRIPTION
CP-T	TITLE SHEET
CP-L	LEGEND AND GENERAL NOTES
CP-01	EXISTING CONDITIONS
CP-02	FINAL CLOSURE GRADE
CP-03	PROJECT DETAILS

OWNER INFORMATION

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PROPERTY INFORMATION

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NCDENR PERMIT: 9401 - INDUS

ACREAGE: 350.49

CLOSURE PLAN
NOVEMBER 2012

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037933 CARRIE T. MITCHELL 11/14/12

DESIGNED CTM
DRAWN RWH
CHECKED LBB
APPROVED EEA
DATE 11/14/12

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2211 W. MEADOWVIEW ROAD
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NC CORP LIC. C-0792

DOMTAR PAPER
PLYMOUTH, NORTH CAROLINA

2012 PERMIT RENEWAL
CLOSURE PLAN
TITLE SHEET

PROJECT NO.
853.1201.11

SCALE
N.T.S.

DRAWING NO.
CP-T

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CONVENTIONAL SYMBOLS AND GENERAL NOTES

ENVIRONMENTAL MONITORING FEATURES

MW-X	EXISTING GROUNDWATER MONITORING WELL
MW-#	PROPOSED GROUNDWATER MONITORING WELL
MW-OW-#	EXISTING OBSERVATION WELL
MW-OW-X	PROPOSED OBSERVATION WELL
NES-OW-X	EXISTING NES WELL
NES-OW-#	PROPOSED NES WELL
MW-PW-X	EXISTING PERFORMANCE WELL
MW-PW-#	PROPOSED PERFORMANCE WELL
MW-X	EXISTING SENTINEL WELL
MW-#	PROPOSED SENTINEL WELL
PZ-#	WETLANDS PIEZOMETER
PZ-X	PIEZOMETER
SMP-X	SURFACE WATER MONITORING POINT
LMP-1	LEACHATE MONITORING POINT
B-X	BORE HOLE LOCATION
C-X	CORING LOCATION
SS-X	SOIL SAMPLING LOCATION
TP-X	TEST PIT LOCATION
W	WELL LOCATION
S-X	SPRINGHEAD LOCATION

LANDFILL GAS FEATURES

EW-X	EXISTING EXTRACTION WELL
EW-#	PROPOSED EXTRACTION WELL
GW-X	EXISTING LEACHATE CLEAN-OUT GAS EXTRACTION WELL
GW-#	PROPOSED LEACHATE CLEAN-OUT GAS EXTRACTION WELL
GP-X	GAS PROBE
GV-X	EXISTING GAS VENT
GV-#	PROPOSED GAS VENT
J	CONDENSATE TRAP
CO	CLEAN-OUT
V21	VALVE DESIGNATION (SEE SCHEDULE)

SURVEY FEATURES

BM	BENCHMARK
CP	CONTROL POINT
	PROPERTY LINE
	EASEMENT
R/W	RIGHT OF WAY
x	FENCE LINE
	RAILROAD
	GUARDRAIL
	RESOURCE PROTECTION AREA

UTILITIES

	UTILITY POLE
	HYDRANT
	LIGHT POLE
	TANK (SIZE VARIES)
	TRANSFORMER
M	MANHOLE
	CLEANOUT
	VALVE
OHE	OVERHEAD ELECTRIC
UGE	UNDERGROUND ELECTRIC
OHT	OVERHEAD TELEPHONE
UGT	UNDERGROUND TELEPHONE
FM	LEACHATE FORCE MAIN
DCFM	DUAL CONTAINED LEACHATE FORCE MAIN
SS	SANITARY SEWER
PS	PROCESS SEWER
G	LANDFILL GAS LINE
UGG	NATURAL GAS LINE
W	POTABLE WATER
	SOLID PIPE (TYPE NOTED)
	PERFORATED PIPE (TYPE NOTED)
	CULVERT (SIZE NOTED)

LANDFILL AND ROAD FEATURES

	PAVED ROAD
	GRAVEL/DIRT ROAD
	EDGE OF PAVEMENT
	LIMIT OF WASTE/EDGE OF LINER
	FACILITY BOUNDARY/CELL LIMITS/PHASE LIMITS

BUILDINGS AND STRUCTURES

	BUILDING
	DAM
	FOUNDATION

HYDROLOGY

	APPROXIMATE 100 YEAR FLOOD PLAIN
	DITCH FLOW
	STREAM OR RIVER

VEGETATION

	SINGLE TREE
	TREE LINE
	SHRUB

EROSION AND SEDIMENT CONTROL FEATURES

SF	SILT FENCE
IP	INLET PROTECTION
	OUTLET PROTECTION (SIZE VARIES)
	DIVERSION BERM

TOPOGRAPHICAL FEATURES

100	EXISTING 10' TOPO CONTOUR
	EXISTING 2' TOPO CONTOUR
100	PROPOSED 10' TOPO CONTOUR
	PROPOSED 2' TOPO CONTOUR
100	GROUNDWATER SURFACE CONTOUR (FT ABOVE MEAN SEA LEVEL)
100	BEDROCK SURFACE CONTOUR (FT ABOVE MEAN SEA LEVEL)
100.00	SPOT ELEVATION
X	GRADE BREAK AND RUNOFF FLOW DIRECTION

HATCHING

	WETLANDS
	RIPRAP
	WASHED STONE
	BUFFER AREA
	PROPOSED ROAD
	COMPACTED BACKFILL

SURVEY NOTES:

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET, UNLESS INDICATED OTHERWISE.
2. ON-SITE TOPOGRAPHY PROVIDED BY: McKIM AND CREED
   6905 DOWNWIND ROAD
   GREENSBORO, NC.
3. AERIAL SURVEY DATED APRIL 7, 2012

GENERAL NOTES:

1. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR INITIATING, MAINTAINING, AND SUPERVISING ALL SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK. CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE LAWS AND REGULATIONS RELATING TO THE SAFETY OF PERSONS OR PROPERTY, AND TO THE PROTECTION OF PERSONS OR PROPERTY FROM DAMAGE, INJURY, OR LOSS, AND SHALL ERECT AND MAINTAIN ALL NECESSARY SAFEGUARDS FOR SUCH SAFETY AND PROTECTION.

GENERAL EROSION AND SEDIMENT CONTROL NOTES:

1. UNLESS OTHERWISE INDICATED, ALL VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CONSTRUCTED AND MAINTAINED ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE NC EROSION AND SEDIMENT CONTROL HANDBOOK AND NC REGULATIONS.
2. ALL DISTURBED AREAS ARE TO DRAIN TO APPROVED SEDIMENT CONTROL MEASURES AT ALL TIMES DURING LAND DISTURBING ACTIVITIES AND DURING SITE DEVELOPMENT UNTIL FINAL STABILIZATION IS ACHIEVED.
3. THE CONTRACTOR SHALL INSPECT ALL EROSION CONTROL MEASURES PERIODICALLY AND AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT. ANY NECESSARY REPAIRS OR CLEANUP TO MAINTAIN THE EFFECTIVENESS OF THE EROSION CONTROL DEVICES SHALL BE MADE IMMEDIATELY.
4. PERMANENT OR TEMPORARY SOIL STABILIZATION SHALL BE APPLIED TO DENUDED AREAS WITHIN SEVEN DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. TEMPORARY SOIL STABILIZATION SHALL BE APPLIED WITHIN SEVEN DAYS TO DENUDED AREAS THAT MAY NOT BE A FINAL GRADE BUT WILL REMAIN DORMANT (UNDISTURBED) FOR LONGER THAN 30 DAYS. PERMANENT STABILIZATION SHALL BE APPLIED TO AREAS THAT ARE TO BE LEFT DORMANT FOR MORE THAN ONE YEAR.

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 035433 CARRIE T. MITCHELL

11/14/12

DESIGNED CTM
DRAWN RWH
CHECKED EEA
APPROVED CTM
DATE 11/14/12

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NC CORP LIC. C-0782

DOMTAR PAPER
PLYMOUTH, NORTH CAROLINA

2012 PERMIT RENEWAL
CLOSURE PLAN
LEGEND AND GENERAL NOTES

PROJECT NO.
853.1201.11

SCALE
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DRAWING NO.
CP-L

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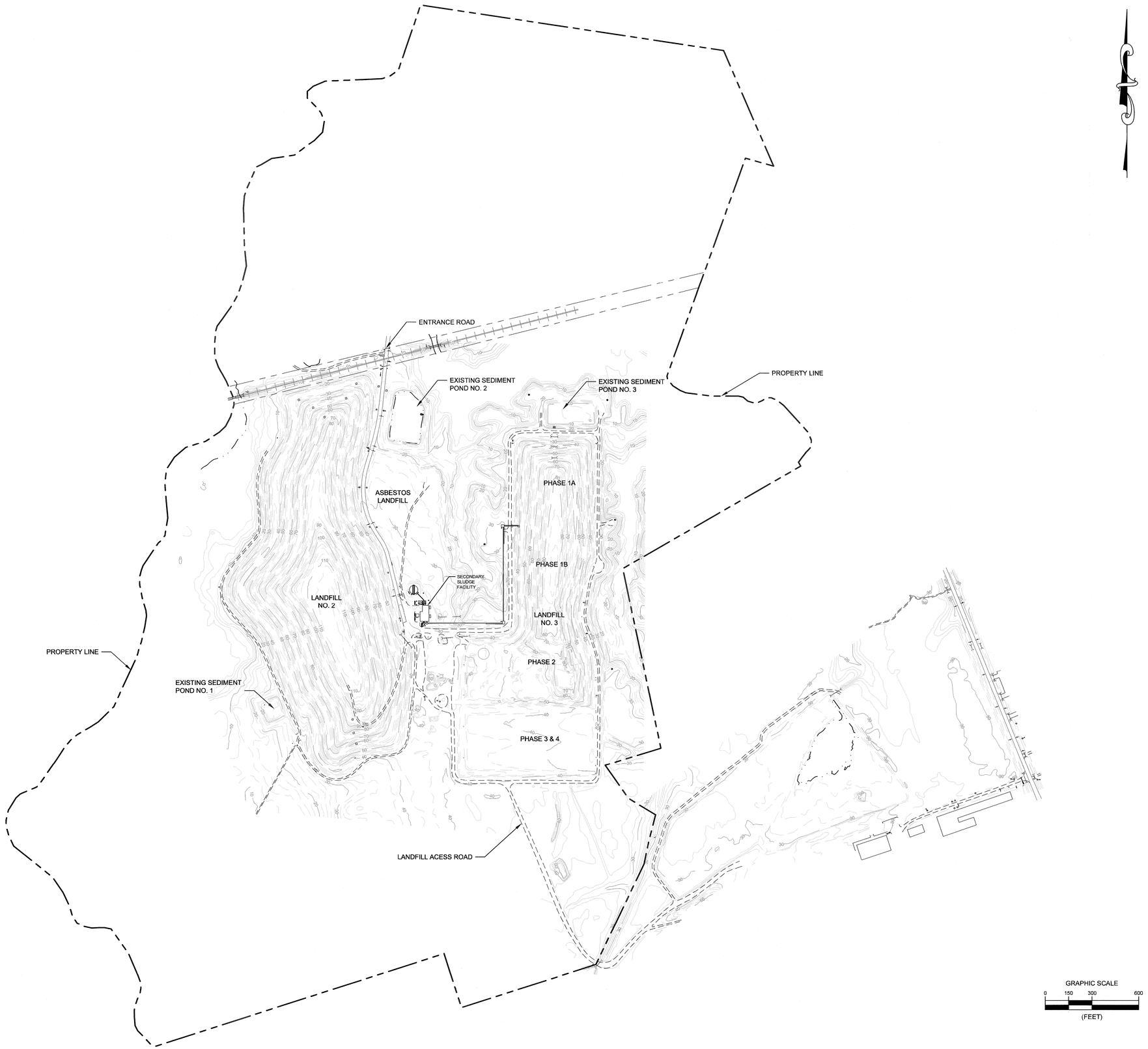

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037933 CARRIE T. MCCOLL

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PLYMOUTH, NORTH CAROLINA

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EXISTING CONDITIONS

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853.1201.11

SCALE
AS SHOWN

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CP-01

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NOTE:

SECTIONS OF ON-SITE INDUSTRIAL WASTE LANDFILL NO. 3 WILL BE CAPPED AND CLOSED UNDER THE LANDFILL DESIGN BY RMT, INC. AS APPROVED BY NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES. PHASE 1A AND 1B HAVE CLOSED AND ENTERED POST CLOSURE CARE IN 2011. THE PROPOSED CAP FOR PHASE 2 AS WELL AS THE SEDIMENT PONDS, PERIMETER CHANNELS AND CULVERTS ARE SHOWN AS DESIGNED IN THE PHASE 3 AND PHASE 4 CONSTRUCTION PLAN APPLICATION, ON-SITE INDUSTRIAL WASTE LANDFILL NO. 3 DOMTAR PAPER COMPANY, LLC. (FORMERLY WEYERHAEUSER COMPANY), PLYMOUTH, NORTH CAROLINA, JUNE 2008, REVISED AUGUST 2009, AUGUST 2010, AND NOVEMBER 2010.

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037933 CARRIE T. MITCHELL 11/14/12

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DOMTAR PAPER
PLYMOUTH, NORTH CAROLINA

2012 PERMIT RENEWAL
CLOSURE PLAN
PHASE 2, 3 & 4: FINAL CAP GRADE

PROJECT NO.
853.1201.11

SCALE
AS SHOWN

DRAWING NO.
CP-02

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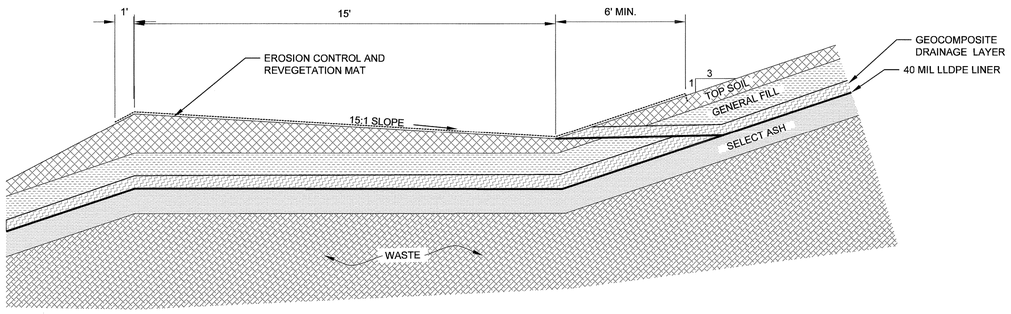

1 DRAINAGE BENCH
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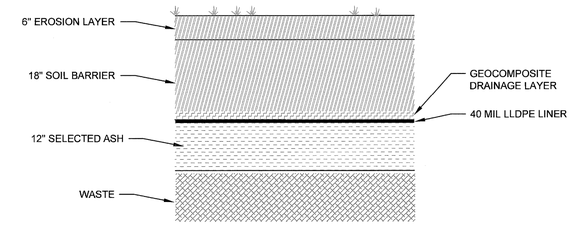

FINAL COVER
DETAIL
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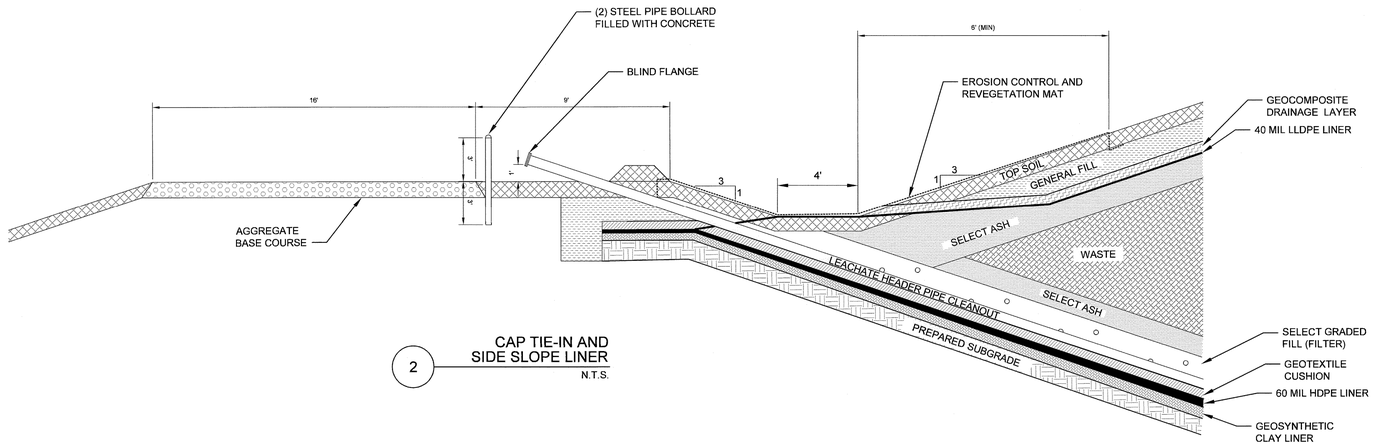
3



2 CAP TIE-IN AND
SIDE SLOPE LINER
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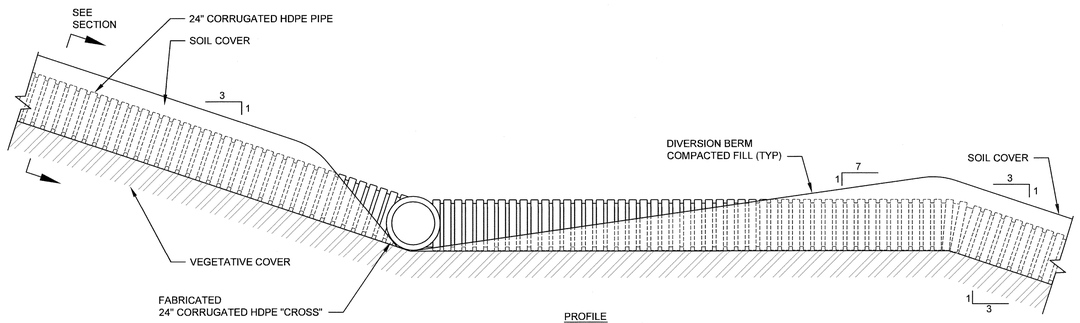

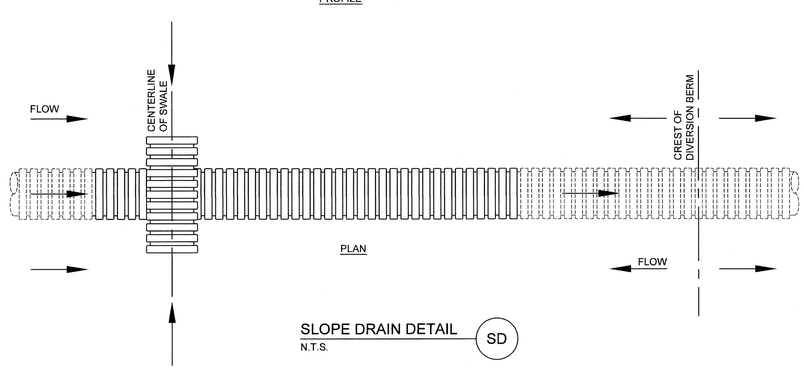

SLOPE DRAIN DETAIL
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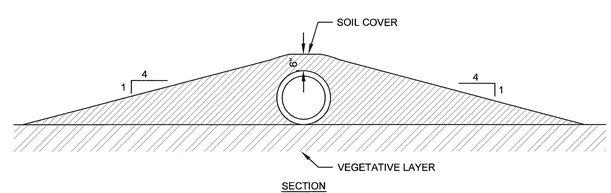

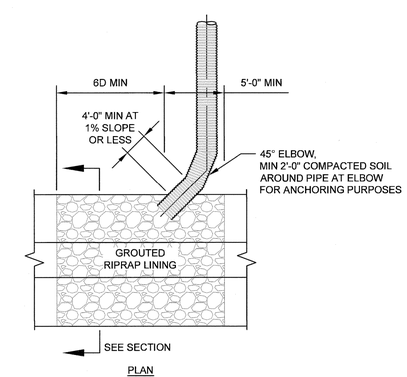

OUTPET PROTECTION
DETAIL - TYPE I
N.T.S.
OP

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037933 CARRIE T. MITCHELL

DESIGNED CTM
DRAWN RWH
CHECKED EEA
APPROVED CTM
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DOMTAR PAPER
PLYMOUTH, NORTH CAROLINA

2012 PERMIT RENEWAL
CLOSURE PLAN
PROJECT DETAILS

PROJECT NO.
853.1201.11

SCALE
AS SHOWN

DRAWING NO.
CP-03

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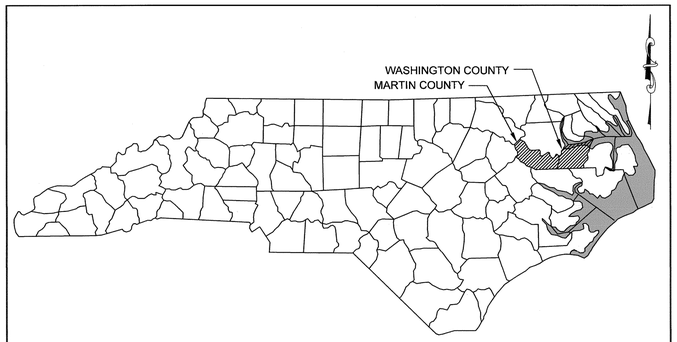
DRAWINGS

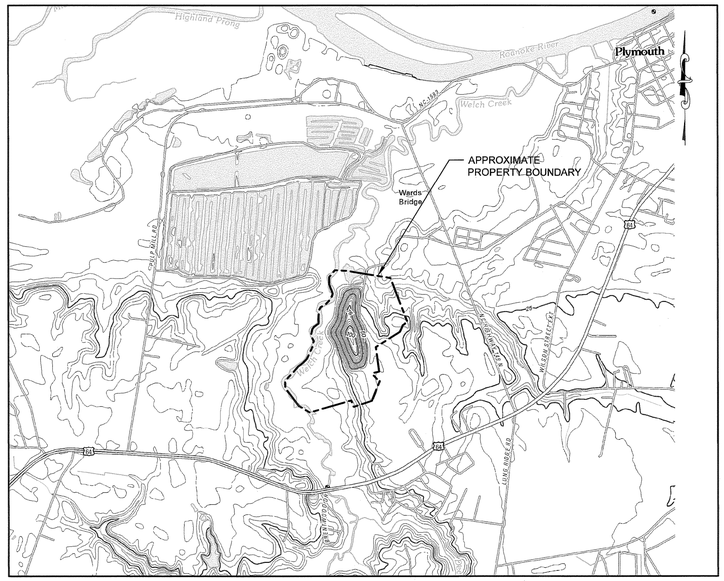
DOMTAR PAPER COMPANY, LLC.
ON-SITE INDUSTRIAL WASTE LANDFILL NO. 3
2012 PERMIT RENEWAL

PLYMOUTH, NORTH CAROLINA



NORTH CAROLINA
COUNTY LOCATION MAP

Domtar



VICINITY MAP

OWNER INFORMATION

PREPARED FOR: DOMTAR PAPER COMPANY, LLC

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kari.cahoon@domtar.com

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ADDRESS: HIGHWAY 149 NORTH, PLYMOUTH NC 27962

NCDENR PERMIT: 9401 - INDUS

ACREAGE: 350.49

DRAWING INDEX

SHEET	DESCRIPTION
P-T	TITLE SHEET
P-L	LEGEND AND GENERAL NOTES
P-01	EXISTING CONDITIONS
P-02	FINAL CAP DESIGN
P-03	EROSION AND SEDIMENT CONTROL PLAN
P-04	PROJECT DETAILS

REVISED CAP DESIGN
NOVEMBER 2012

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL SEAL 037933 ENGINEER CARRIE T. MUNSELL 11/14/12

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NC CORP LIC: C-0762

DOMTAR PAPER
PLYMOUTH, NORTH CAROLINA

2012 PERMIT RENEWAL
REVISED CAP DESIGN
TITLE SHEET

PROJECT NO.
853.1201.11

SCALE
N.T.S.

DRAWING NO.
P-T

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CONVENTIONAL SYMBOLS AND GENERAL NOTES

ENVIRONMENTAL MONITORING FEATURES

MW-X	EXISTING GROUNDWATER MONITORING WELL
MW-#	PROPOSED GROUNDWATER MONITORING WELL
MW-OW-#	EXISTING OBSERVATION WELL
MW-OW-X	PROPOSED OBSERVATION WELL
NES-OW-X	EXISTING NES WELL
NES-OW-#	PROPOSED NES WELL
MW-PW-X	EXISTING PERFORMANCE WELL
MW-PW-#	PROPOSED PERFORMANCE WELL
MW-X	EXISTING SENTINEL WELL
MW-#	PROPOSED SENTINEL WELL
PZ-#	WETLANDS PIEZOMETER
PZ-X	PIEZOMETER
SMP-X	SURFACE WATER MONITORING POINT
LMP-1	LEACHATE MONITORING POINT
B-X	BORE HOLE LOCATION
C-X	CORING LOCATION
SS-X	SOIL SAMPLING LOCATION
TP-X	TEST PIT LOCATION
W	WELL LOCATION
S-X	SPRINGHEAD LOCATION

LANDFILL GAS FEATURES

EW-X	EXISTING EXTRACTION WELL
EW-#	PROPOSED EXTRACTION WELL
GW-X	EXISTING LEACHATE CLEAN-OUT GAS EXTRACTION WELL
GW-#	PROPOSED LEACHATE CLEAN-OUT GAS EXTRACTION WELL
GP-X	GAS PROBE
GV-X	EXISTING GAS VENT
GV-#	PROPOSED GAS VENT
J	CONDENSATE TRAP
CO	CLEAN-OUT
V21	VALVE DESIGNATION (SEE SCHEDULE)

SURVEY FEATURES

BM	BENCHMARK
CP	CONTROL POINT
	PROPERTY LINE
	EASEMENT
RW	RIGHT OF WAY
X	FENCE LINE
	RAILROAD
	GUARDRAIL
	RESOURCE PROTECTION AREA

UTILITIES

	UTILITY POLE
	HYDRANT
	LIGHT POLE
	TANK (SIZE VARIES)
	TRANSFORMER
M	MANHOLE
	CLEANOUT
	VALVE
OHE	OVERHEAD ELECTRIC
UGE	UNDERGROUND ELECTRIC
OHT	OVERHEAD TELEPHONE
UGT	UNDERGROUND TELEPHONE
FM	LEACHATE FORCE MAIN
DCFM	DUAL CONTAINED LEACHATE FORCE MAIN
SS	SANITARY SEWER
PS	PROCESS SEWER
G	LANDFILL GAS LINE
UGG	NATURAL GAS LINE
W	POTABLE WATER
	SOLID PIPE (TYPE NOTED)
	PERFORATED PIPE (TYPE NOTED)
	CULVERT (SIZE NOTED)

LANDFILL AND ROAD FEATURES

	PAVED ROAD
	GRAVEL/DIRT ROAD
	EDGE OF PAVEMENT
	LIMIT OF WASTE/EDGE OF LINER
	FACILITY BOUNDARY/CELL LIMITS/PHASE LIMITS

BUILDINGS AND STRUCTURES

	BUILDING
	DAM
	FOUNDATION

HYDROLOGY

	APPROXIMATE 100 YEAR FLOOD PLAIN
	DITCH FLOW
	STREAM OR RIVER

VEGETATION

	SINGLE TREE
	TREE LINE
	SHRUB

EROSION AND SEDIMENT CONTROL FEATURES

SF	SILT FENCE
IP	INLET PROTECTION
	OUTLET PROTECTION (SIZE VARIES)
	DIVERSION BERM

TOPOGRAPHICAL FEATURES

100	EXISTING 10' TOPO CONTOUR
	EXISTING 2' TOPO CONTOUR
100	PROPOSED 10' TOPO CONTOUR
	PROPOSED 2' TOPO CONTOUR
100	GROUNDWATER SURFACE CONTOUR (FT ABOVE MEAN SEA LEVEL)
100	BEDROCK SURFACE CONTOUR (FT ABOVE MEAN SEA LEVEL)
100.00	SPOT ELEVATION
X	GRADE BREAK AND RUNOFF FLOW DIRECTION

HATCHING

	WETLANDS
	RIPRAP
	WASHED STONE
	BUFFER AREA
	PROPOSED ROAD
	COMPACTED BACKFILL

SURVEY NOTES:

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET, UNLESS INDICATED OTHERWISE.
2. ON-SITE TOPOGRAPHY PROVIDED BY: McKIM AND CREED
   6905 DOWNWIND ROAD
   GREENSBORO, NC.
3. AERIAL SURVEY DATED APRIL 7, 2012

GENERAL NOTES:

1. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR INITIATING, MAINTAINING, AND SUPERVISING ALL SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK. CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE LAWS AND REGULATIONS RELATING TO THE SAFETY OF PERSONS OR PROPERTY, AND TO THE PROTECTION OF PERSONS OR PROPERTY FROM DAMAGE, INJURY, OR LOSS, AND SHALL ERECT AND MAINTAIN ALL NECESSARY SAFEGUARDS FOR SUCH SAFETY AND PROTECTION.
2. SECTIONS OF ON-SITE INDUSTRIAL WASTE LANDFILL NO. 3 WILL BE CAPPED AND CLOSED UNDER THE LANDFILL DESIGN BY RMT, INC. AS APPROVED BY NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES. PHASE 1A AND 1B HAVE CLOSED AND ENTERED POST CLOSURE CARE IN 2011. THE PROPOSED CAP FOR PHASE 2 AS WELL AS THE SEDIMENT PONDS, PERIMETER CHANNELS AND CULVERTS ARE SHOWN AS DESIGNED IN THE PHASE 3 AND PHASE 4 CONSTRUCTION PLAN APPLICATION, ON-SITE INDUSTRIAL WASTE LANDFILL NO. 3 DOMTAR PAPER COMPANY, LLC. (FORMERLY WEYERHAEUSER COMPANY), PLYMOUTH, NORTH CAROLINA, JUNE 2008, REVISED AUGUST 2009, AUGUST 2010, AND NOVEMBER 2010.

GENERAL EROSION AND SEDIMENT CONTROL NOTES:

1. UNLESS OTHERWISE INDICATED, ALL VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CONSTRUCTED AND MAINTAINED ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE NC EROSION AND SEDIMENT CONTROL HANDBOOK AND NC REGULATIONS.
2. ALL DISTURBED AREAS ARE TO DRAIN TO APPROVED SEDIMENT CONTROL MEASURES AT ALL TIMES DURING LAND DISTURBING ACTIVITIES AND DURING SITE DEVELOPMENT UNTIL FINAL STABILIZATION IS ACHIEVED.
3. THE CONTRACTOR SHALL INSPECT ALL EROSION CONTROL MEASURES PERIODICALLY AND AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT. ANY NECESSARY REPAIRS OR CLEANUP TO MAINTAIN THE EFFECTIVENESS OF THE EROSION CONTROL DEVICES SHALL BE MADE IMMEDIATELY.
4. PERMANENT OR TEMPORARY SOIL STABILIZATION SHALL BE APPLIED TO DENUDED AREAS WITHIN SEVEN DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. TEMPORARY SOIL STABILIZATION SHALL BE APPLIED WITHIN SEVEN DAYS TO DENUDED AREAS THAT MAY NOT BE A FINAL GRADE BUT WILL REMAIN DORMANT (UNDISTURBED) FOR LONGER THAN 30 DAYS. PERMANENT STABILIZATION SHALL BE APPLIED TO AREAS THAT ARE TO BE LEFT DORMANT FOR MORE THAN ONE YEAR.

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL SEAL 037933 ENGINEER CARRIE T. MITCHELL 11/14/12

DESIGNED CTM
DRAWN RWH
CHECKED LBB
APPROVED EEA
DATE 11/14/12

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JOYCE ENGINEERING
2211 W. MEADOWVIEW ROAD
GREENSBORO, NC 27407
PHONE: (336) 323-0092
NC CORP LIC. C-0782

DOMTAR PAPER
PLYMOUTH, NORTH CAROLINA

2012 PERMIT RENEWAL
REVISED CAP DESIGN
LEGEND AND GENERAL NOTES

PROJECT NO.
853.1201.11

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DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037933 CARRIE T. MITCHELL 12/12/12

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DOMTAR PAPER
PLYMOUTH, NORTH CAROLINA

2012 PERMIT RENEWAL
REVISED CAP DESIGN
EXISITING CONDITIONS

PROJECT NO.
853.1201.11

SCALE
AS SHOWN

DRAWING NO.
P-01

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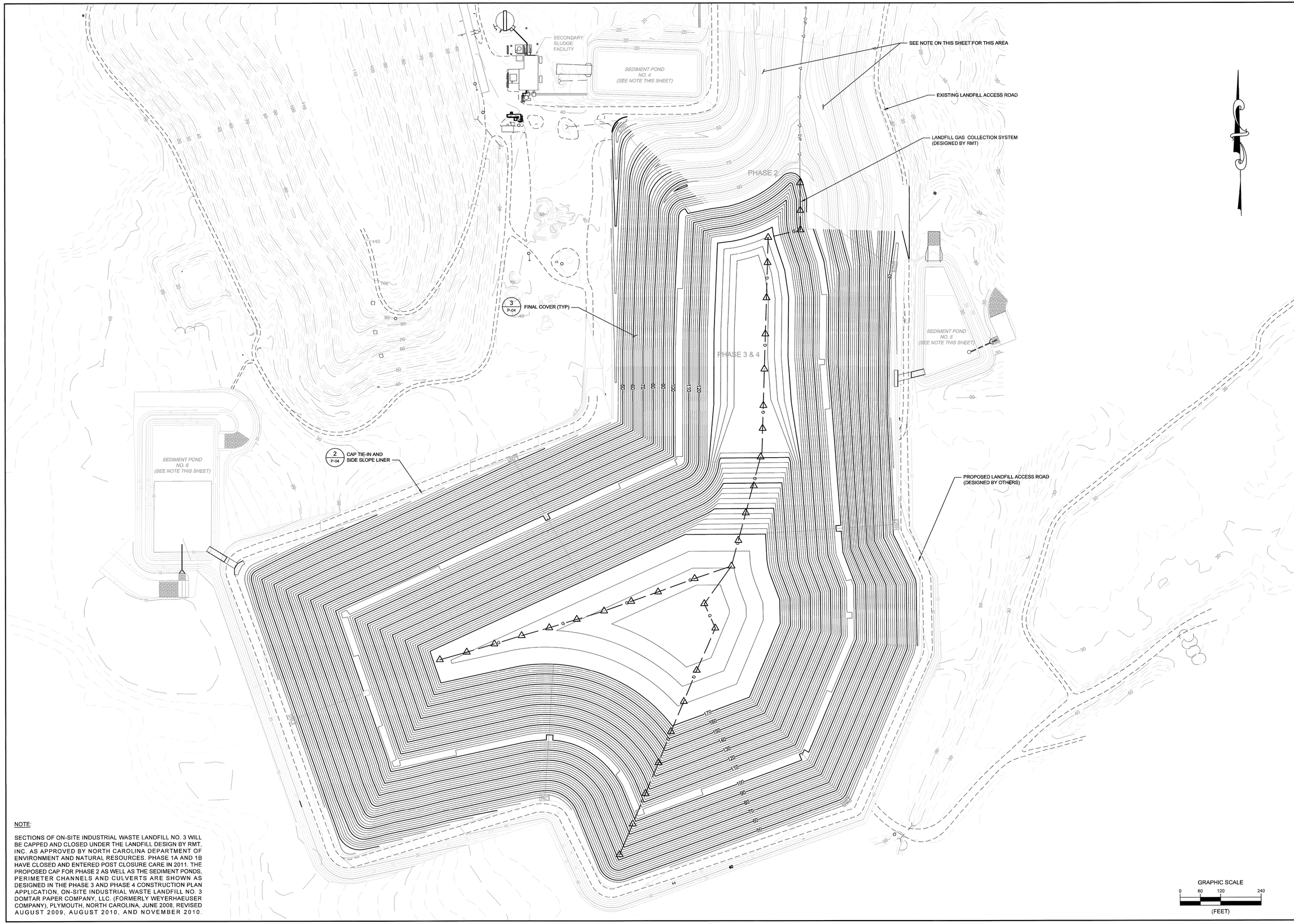

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DOMTAR PAPER
PLYMOUTH, NORTH CAROLINA

2012 PERMIT RENEWAL
REVISED CAP DESIGN
FINAL CAP DESIGN

PROJECT NO.
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AS SHOWN

DRAWING NO.
P-02

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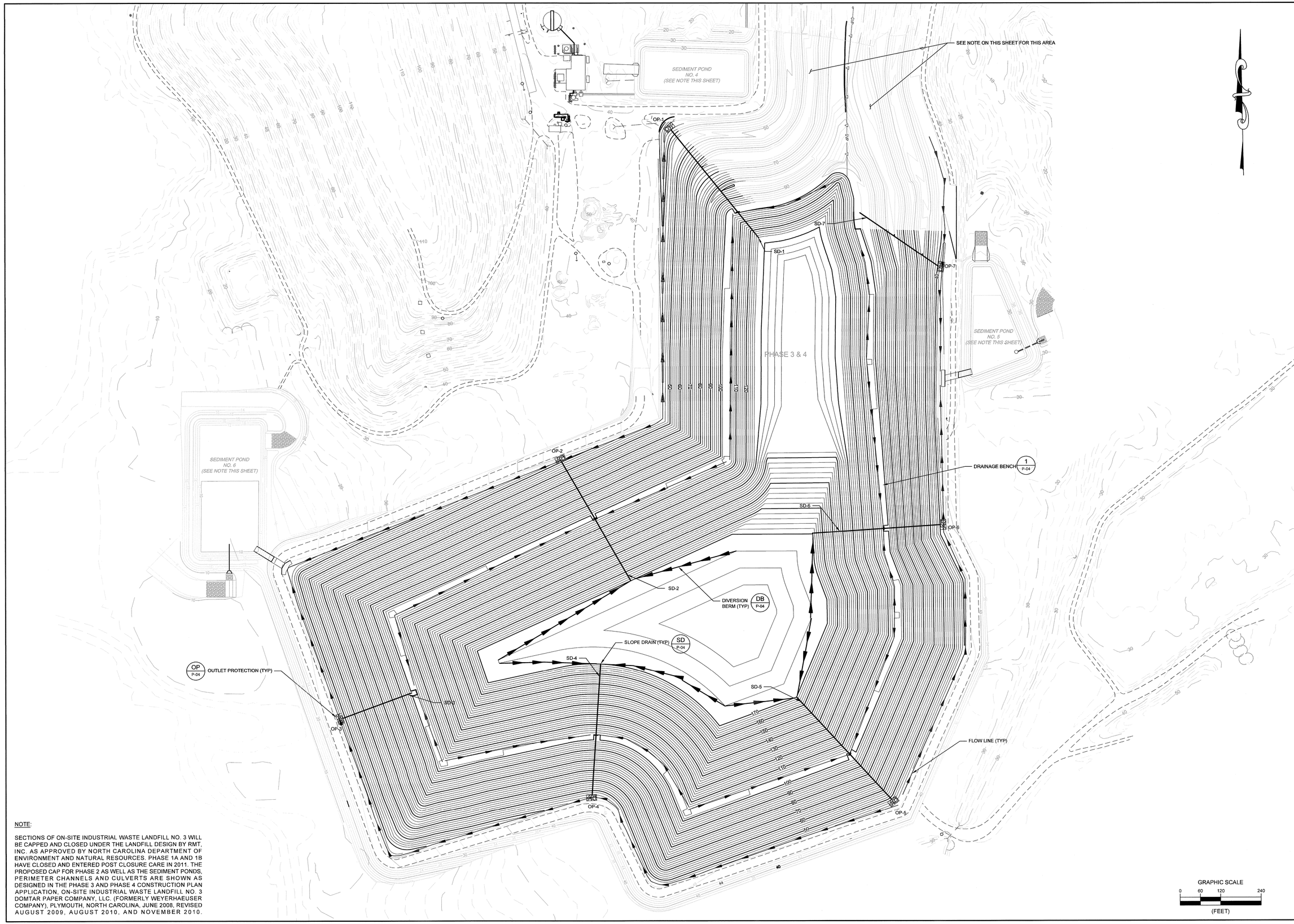

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DOMTAR PAPER
PLYMOUTH, NORTH CAROLINA

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EROSION AND SEDIMENT CONTROL PLAN

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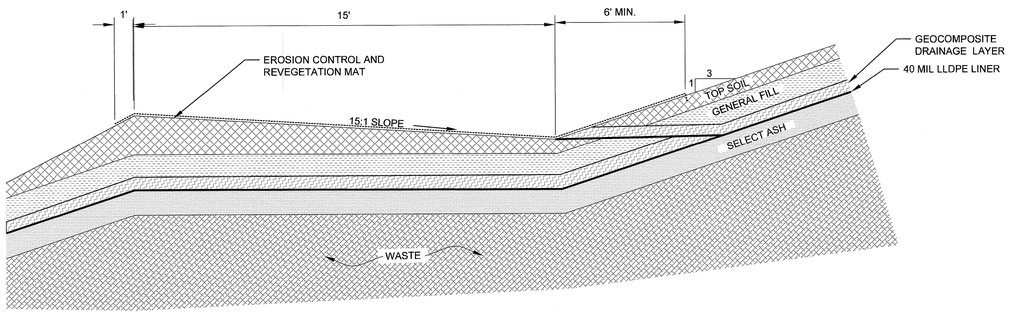

1 DRAINAGE BENCH
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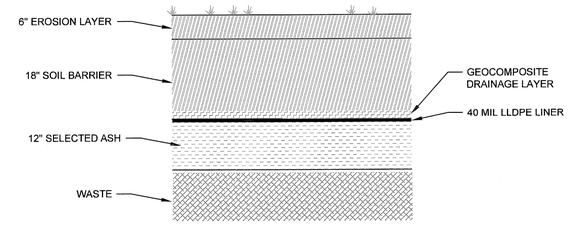

FINAL COVER DETAIL
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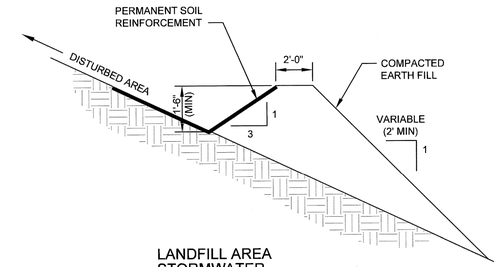
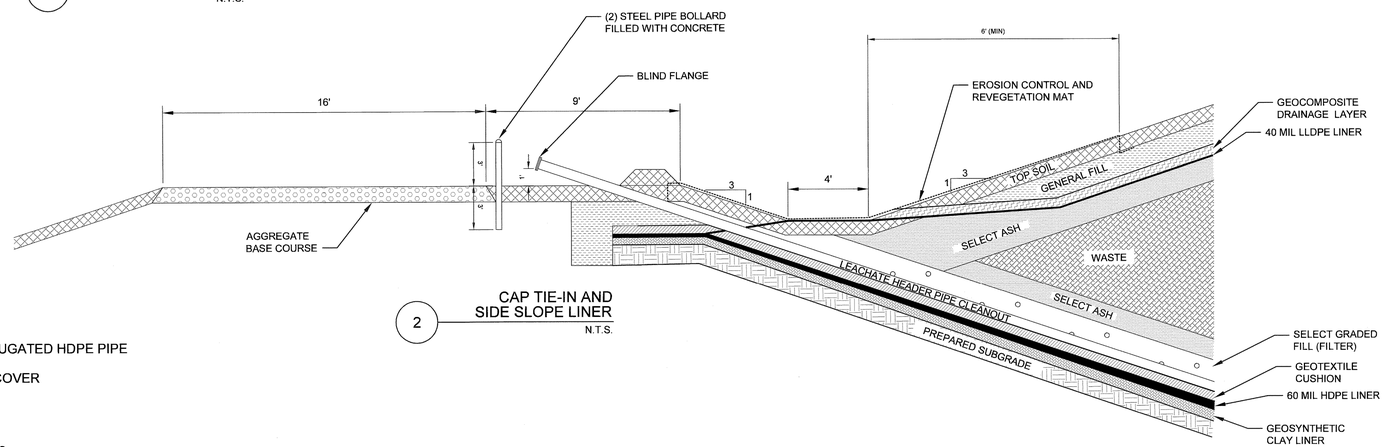
3



LANDFILL AREA STORMWATER DIVERSION BERM
N.T.S.
DB



2 CAP TIE-IN AND SIDE SLOPE LINER
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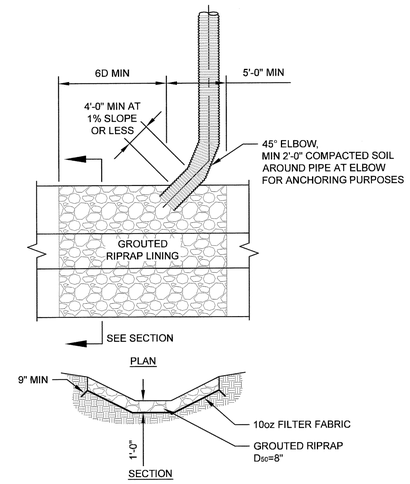
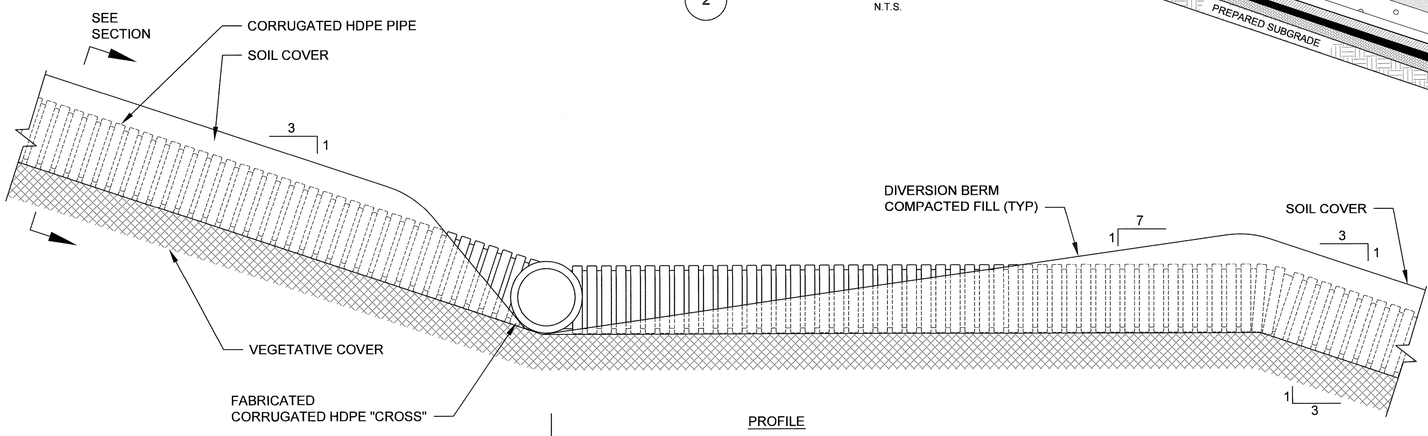
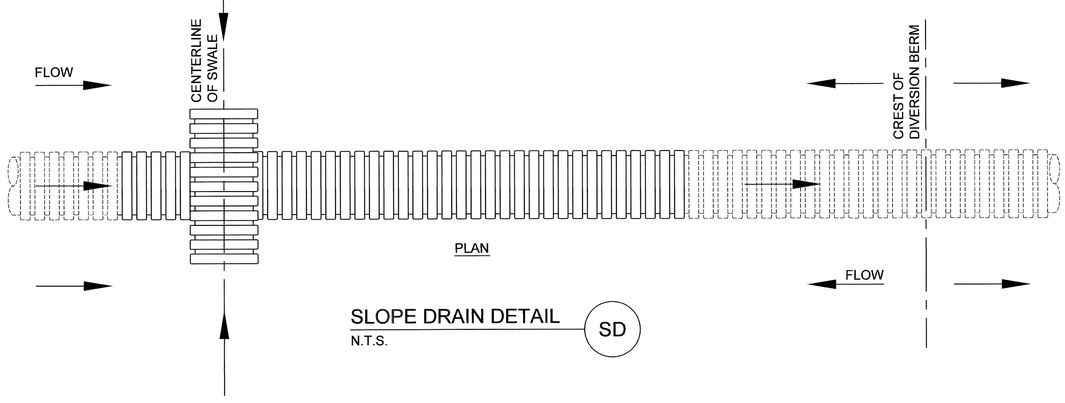


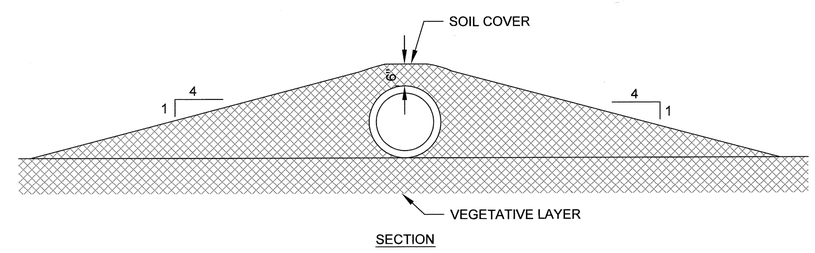
OUTLET PROTECTION DETAIL - TYPE I
N.T.S.
OP



SLOPE DRAIN SCHEDULE			
SD #	DIAMETER (IN.)	PIPE MATERIAL	APPROX. LENGTH (FT)
SD-1	18	HDPE	410
SD-2	18	HDPE	410
SD-3	18	HDPE	220
SD-4	18	HDPE	390
SD-5	18	HDPE	415
SD-6	18	HDPE	375
SD-7	18	HDPE	280



SLOPE DRAIN DETAIL
N.T.S.
SD



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