APPROVED
City of Florence
Community Development
Department
H Exhibit
PC 21 22 DR 01 File Number

Exhibit H

NORTHWEST HOUSING ALTERNATIVES, INC
SHORE PINES HOUSING
Project Address:
Tax Lot 500 Parcel,
Highway 101 at 40th Street
Florence, OR 97439

Preliminary Stormwater Management Report
Land-Use Submittal
Not for Construction

Prepared for:
DAO Architects LLC
310 SW 4th Avenue, Suite 810
Portland, OR 97204
(503) 388-3680

August 12, 2021

REGISTERED PROFESSIONAL ENGINEER
#13,624
Digitally Signed
OREGON
JULY 16, 1987
MONICA B. ANDERSON
EXPIRES 12/31/21

MAZZETTI | BHEGroup

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Contents

DESIGNER'S CERTIFICATION AND STATEMENT

I hereby certify that this Stormwater Management Report for Northwest Housing Alternatives Inc., Store Pines Housing has been prepared by me or under my supervision and meets minimum standards of the City of Florence and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by Mazzetti | BHEGroup.

This is a preliminary report to support the Land-Use submittal. A final report will be prepared for the project at building permit submittal.

REGISTERED PROFESSIONAL
ENGINEER
#13,624
OREGON
JULY 16, 1987
MONICA B. ANDERSON
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Monica Anderson, PE
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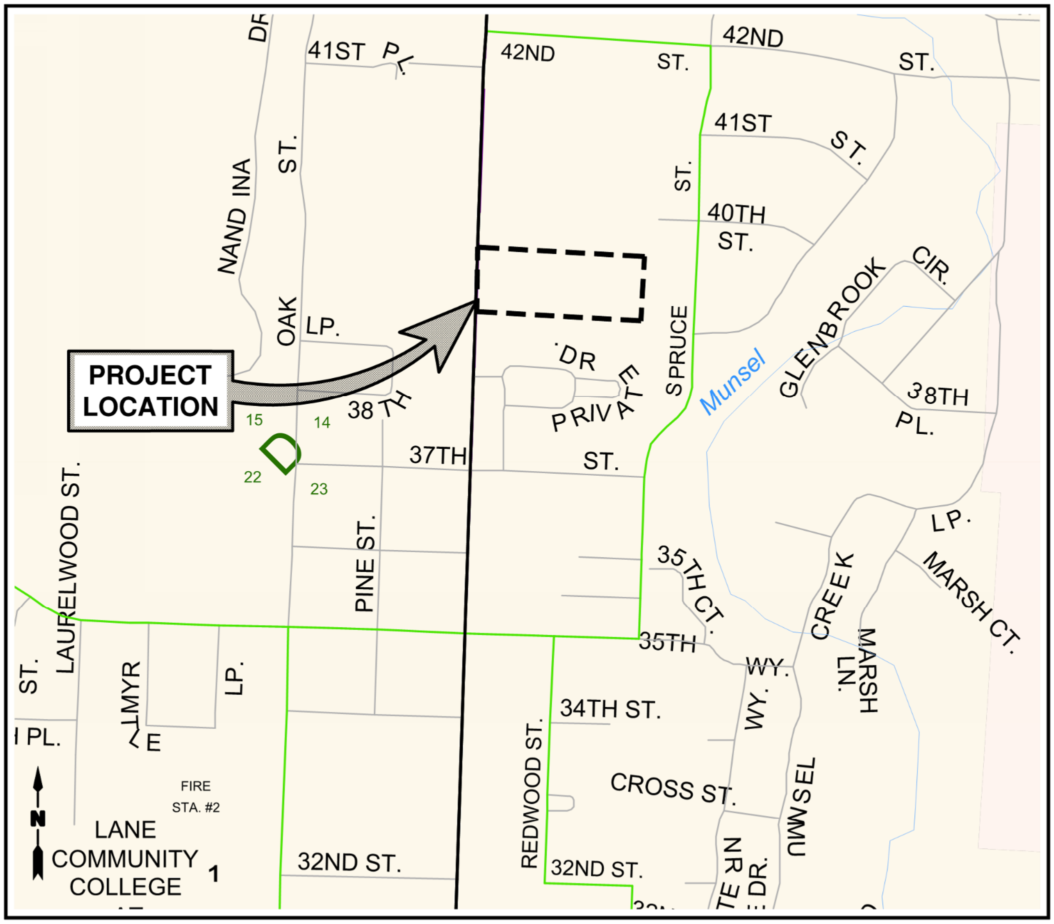
PROJECT OVERVIEW AND DESCRIPTION

This stormwater report supports the improvements proposed under the Northwest Housing Alternatives Shore Pines Housing project. The project consists of the development of 2.46 acres of densely forested greenfield site in north Florence. The site is bordered by Highway 101 at its west boundary, residential properties at the east and south, and a church development along the north boundary. The site is located on Tax Lox 500, Map 18-12-14-33 and is zoned "Commercial - Highway". Access to the site will be from Highway 101 with a new single point of entry, shared with the neighboring properties (Tax Lots 600 and 700) to the south. The proposed development will provide 68 units in two 3-story buildings with associated parking. The majority of the site will be developed, except for the far easterly portion which contains wetland areas, which will be displaced to facilitate the construction of stormwater rain gardens. The wetlands will be mitigated off-site.



VICINITY MAP

NO SCALE

PROJECT LOCATION

HIGHWAY 101 AT 40TH ST.
FLORENCE, OREGON 97439
LATITUDE= 44.0006°
LONGITUDE= −124.0999°

PROPERTY/SITE DESCRIPTION

TAX LOT 500 (LANE COUNTY TAX MAP 18121433)
LOCATED IN S.W. 1/4, SEC.14, T.18S, R.12W, W.M,
LANE COUNTY, OREGON

TOTAL SITE AREA = 2.46 ACRES

TOTAL DISTURBED AREA = 2.79 ACRES
(INCLUDES OFF SITE WORK)

Watershed Description

Under pre-development conditions, stormwater runoff on the project site is assumed to sheet flow from the west side of the site to the east side of the site where it drains to existing wetlands with two overflow area drains that discharge to a 42-inch diameter public storm drain main.

The City has confirmed that this storm drain main is an acceptable destination for the project site provided that the development retains or detain stormwater per City requirements (see Appendix B.7). The piped public storm drain main discharges to Munsel Creek which discharges to the Siuslaw River, which discharges to the Pacific Ocean.

Required Permits

City of Florence Building Permit and Erosion Control Permit, DEQ 1200C Permit, DEQ 401 Water Quality Permit, Army Corps of Engineers 404 Permit, Department of State Lands Removal Fill Permit.

PROJECT REQUIREMENTS

This report is a summary of the methodology and design criteria used to meet City of Florence, Housing and Urban Development (HUD), National Oceanic and Atmospheric Administration (NOAA) Fisheries, and the Oregon Department of Environmental Quality (DEQ) Water Quality 401 Program stormwater standards (see referenced standards used below). The stormwater management facilities for this project are designed to meet requirements for all jurisdictions and agencies noted above and the report includes a stormwater facility description as well as a summary of site variables, hydrographs, hydraulic controls, and calculated values. Also included in this report is a preliminary copy of the Stormwater Facility Operations and Maintenance (O&M) Manual.

City of Florence

The 2011 Stormwater Design Manual and the Florence City Code were referenced for stormwater design. Stormwater management requirements summarized from Table 3.1 of the Stormwater Design Manual are shown in Tables 1 and 2 below. Based on the project impacts shown below the project will need to meet City of Florence Stormwater Quantity (Flow Control) and Quality (Pollution Reduction) requirements. Additionally, as noted in the design manual, the design will maximize onsite retention, minimize impervious areas, and provide source controls for high-risk activities.

Table 1, City of Florence Stormwater Quantity (Flow Control) Triggers

Impervious Area Project Impacts	Trigger	Project Area
Net Added Area	500 ft^2	72,380 ft^2
Total Disturbed Area	10,000 ft^2	111,502 ft^2

Table 2, City of Florence Stormwater Quality (Pollution Reduction) Triggers

Impervious Area Project Impacts	Trigger	Project Area
New and Replaced Area	5,000 ft^2	72,380 ft^2

Programmatic Biological Opinion for HUD in Oregon

The 2017 Programmatic Biological Opinion for HUD in Oregon Appendices were referenced for stormwater design. Since the project will impact a wetland it cannot meet the HUD Environmental Review, No Effect requirements. Therefore, the project is designed to meet May Affect, Likely to Adversely Affect standards. Under this standard water quality facilities will be designed to treat the water quality storm per Appendix A.5 and retain or detain stormwater per Appendix A.6.

Oregon DEQ Section 401 Water Quality Certification

The 2018 Section 401 Water Quality Certification, Post-Construction Stormwater Management Plan Submission Guidelines was referenced for stormwater design. Section A requires all contributing impervious areas receive treatment in the water quality storm. Additionally, Section E.3 requires the water quality storm be infiltrated on site to the maximum extent feasible and Section E.4 requires that the project reduce stormwater runoff volumes to the maximum extent feasible.

METHODOLOGY

According to FEMA's floodplain mapping, the site has been determined to be in Zone X, area of minimal flood hazard. There are mapped wetlands on the site that will be filled and mitigated off-site (see Appendix B.4 and Wetland Report).

Existing Topography

The existing developed site is relatively flat with a relatively uniform 0.9-percent grade draining to the east with a maximum approximate elevation difference of 5.5 feet between west and east ends of the site.

Infiltration

Infiltration testing was performed on January 7, 2021 at a depth of ±28 inches below ground surface. The infiltration test was performed using the falling head infiltration test procedure by Branch Engineering, Inc. The testing indicated an average unfactored infiltration rate of 60-inches per hour (see Appendix D).

The design infiltration rate used for the project is the maximum allowed for the growing medium (4 inches per hour per the City of Florence, Stormwater Design Manual, Chapter 4.2.2) since it is the controlling infiltration rate.

Ground Water

Seasonal high groundwater elevation estimation was based on observations taken while excavating test pits performed on January 7, 2021 by Branch Engineering, Inc and review of available well logs around the site.

Soil Data

Natural Resources Conservation Service (NRCS) soil mapping indicates the soils in the western approximately 50-feet adjacent to Highway 101 is Waldport Fine Sand, 0 to 12-percent slopes (Map Unit 131C) and the remainder of the Site is Yaquina Loamy Fine Sand (Map Unit 140). The Hydrologic Soil Group for these soils is 'A' and 'A/D' respectively (see Appendix B.2).

The Natural Resources Conservation Service (NRCS) Urban Hydrology for Small Watersheds TR-55, Appendix A, guidance indicates:

> "Some soils in the list are in group D because of a high water table that creates a drainage problem. Once these soils are effectively drained, they are placed in a different group. For example, Ackerman soil is classified as A/D. This indicates that the drained Ackerman soil is in group A and the undrained soil is in group D."

Based on this guidance and the high groundwater elevations found at the site (see above) the undrained classification was used along with the Woods, good hydrologic condition (Table 2-2c) resulting in a Curve Number of 77 that used for the existing landscaped areas at the site.

Design Storm Events

Based on the guidance referenced above all of the required design storm for this project are:

Table 3, Water Quality (WQ) Design Storm Events[1]

Design Storm	Notes	Jurisdiction / Agency	Rainfall (Inches)
WQ (City)	--	City of Florence	0.83
WQ (DEQ)	50% of the 2-Year Storm[2]	DEQ 401	1.73
WQ (HUD)	50% of the 2-Year Storm[2]	HUD	1.73

Notes:

1. *Since the DEQ/HUD Water Quality Storm is larger than the City's it will be the only one used in the report since it will be the controlling design storm.*
2. *The 2-Year and 10-Year Storms were estimated from NOAA Isopluvial maps per DEQ and HUD Standards and found to match the corresponding City of Florence Design Storms.*

Table 4, Conveyance, Flow Control, and Flood Control Design Storm Events

Design Storm	Standard	Jurisdiction / Agency	Rainfall (Inches)
WQ (HUD)	Flow Control	HUD[1]	1.73
2-Year	Flow Control	City of Florence / HUD[1]	3.46
5-Year	Flow Control	HUD[2]	4.06
10-Year	Flow Control	City of Florence / HUD[1]	4.48
25-Year	Flow Control[3]	City of Florence	5.06
100-Year	Flood Control	City of Florence	5.95

Notes:

1. *The 2-Year and 10-Year Design Storms were estimated from NOAA Isopluvial maps per HUD Standards and found to match the corresponding City of Florence Design Storms.*
2. *The 5-Year Design Storm was estimated from NOAA Isopluvial maps per HUD Standards.*

ANALYSIS

Level of On-Site Retention (Infiltration)

On-site retention is implemented to the maximum extent feasible. One infiltration vegetated swale and one infiltration rain garden are included in the stormwater management approach. Together, the two facilities reduce post-development peak runoff rates and volumes from pre-development greenfield conditions for the 2-Year through the 25-Year Design Storms (see Table 5 below).

Reduce Stormwater Runoff Volume per DEQ Section 401

The primary measure taken to reduce stormwater runoff volume is using stormwater retention facilities to the maximum extent feasible. As noted above these facilities reduce stormwater runoff for all design storms above the DEQ Section 401 Water Quality Design Storm.

Other measures taken include, using multi-story buildings to limit impervious area, retaining existing trees to the maximum extent feasible, planning new trees onsite, and avoid adding impervious surfaces over areas that could be used to infiltrate post-construction stormwater runoff (the east side of the site).

Destination and Flow Control

The referenced design standards require flow control standards to be met when stormwater is being discharged offsite. Because stormwater cannot be retained onsite for the required design storms structural detention systems are included to limit post-development runoff to current levels for the water quality through the flow control storms (see Table 5).

Table 5, Pre-Development vs. Post-Development Flow Rate Table

Facility ID	Peak Flow Rates (cfs)									
	Water Quality[1]		2-Year		5-Year		10-Year		25-Year	
	Pre[2]	Post[3]	Pre	Post	Pre	Post	Pre	Post	Pre	Post
TOTAL	0.05	0.00	0.38	0.00	0.54	0.00	0.66	0.31	0.84	0.83

Notes:

1. *The DEQ/HUD Water Quality Storm (1.73-Inches).*
2. *The Time of Concentration for the existing site was calculated using TR-55 with a combined flow length of 612-feet through woods: light underbrush and unpaved surface conditions, an average slope of 1.4-percent and 0.7-percent respectively, and a resulting Tc= 61 minutes (see Appendix E.2).*
3. *The Time of Concentration used for all drainage basins in the developed site was 5 minutes.*

Pollution Reduction

The referenced design standards require treatment from all stormwater runoff from new or replaced impervious surfaces in the water quality design storm using infiltration facilities to the maximum extent feasible (see above for justification on implementation of infiltration facilities).

The water quality facilities will consist of one Infiltration Vegetated Swale and one Infiltration Rain Garden. Rain Garden 1 is an infiltration facility and is located on the east side of the site with a 5,382 ft^2 footprint with a maximum 9-inches of storage. Vegetated Swale 1 is an infiltration facility and is located south of the east apartment building with a 402 ft^2 footprint with a maximum 6-inches of storage.

All facilities have a minimum of 2-inches of freeboard, 3:1 maximum side slopes, and an area drain set at the maximum water surface elevation to allow for overflow to the public storm drain. All City of Florence setback requirements are met as well (5-feet from property lines and 10-feet from building foundations). The attached calculations are provided in Appendix E shows that the peak water surface elevation in the Water Quality Storm is 0.14 feet in the infiltration swale and 0.03 feet in the rain garden.

Table 6, Catchment and Facility Table

Facility ID	Source	Impervious Area (Acre)	Ownership (Public/Private)	Facility Type	Facility Size	Curve No.
Rain Garden 1 (Infiltration)	Roof/Road/ Sidewalk	1.75	Private	Rain Garden	5,382 ft^2	92
Vegetated Swale1 (Filtration)	Roof/Sidewalk	0.10	Private	Vegetated Swale	402 ft^2	93

Conveyance Calculations

The site is divided into three drainage basins: (1) the north conveyance system that discharges to Rain Garden 1 (Infiltration) with overflow to the public storm drain, (2) the south conveyance system that discharges to Rain Garden 1 (Infiltration) with overflow to the public storm drain, and (3) the southern portion of the east apartment building which discharges to Vegetated Swale 1 (Infiltration) then to Rain Garden 1 (Infiltration) with overflow to the public storm drain. A summary of the characteristics of each drainage basin and the associated discharge pipe capacity and peak discharge is provided below. Refer to Appendix E for full calculations.

Table 7, Facility Conveyance Summary – North Conveyance and Flood Control

Facility ID	Design Flow Capacity (cfs)	25-Year Discharge (cfs)	25-Year Velocity (ft/s)	100-Year Discharge (cfs)	100-Year Velocity (ft/s)
SD CO 15 to SD CB 2	0.22	0.21	2.81	0.25	3.25
SD CB 2 to RG 1	0.86	0.56	2.37	0.66	2.43

Table 8, Facility Conveyance Summary – South Conveyance and Flood Control

Facility ID	Design Flow Capacity (cfs)	25-Year Discharge (cfs)	25-Year Velocity (ft/s)	100-Year Discharge (cfs)	100-Year Velocity (ft/s)
SD CB 1 to Outfall 1	1.42	0.94	2.48	1.12	2.66
Outfall 1 to RG 1[1]	3.62	1.51	0.89	1.76	0.81

Notes:

1. *These velocity are for an vegetated open channel with backwater conditions in larger storm events.*

Table 9, Facility Conveyance Summary – South Building Conveyance and Flood Control

Facility ID	Design Flow Capacity (cfs)	25-Year Discharge (cfs)	25-Year Velocity (ft/s)	100-Year Discharge (cfs)	100-Year Velocity (ft/s)
SD CO 6 to RG 1	0.52	0.23	2.26	0.28	2.32

Escape Routes and Inundation Areas

Stormwater modeling indicates the storm drain system has capacity to convey stormwater in the 100-Year design storm under surcharge conditions (see Tables 8-10 above). Additionally, the site is graded to allow stormwater to sheet flow across the ground surface of the parking lot and swales and along a path to the easement along the east property line without flooding buildings or adjacent properties.

Design Assumptions

<u>Computation methods used:</u>

- Runoff calculations were performed using the Santa Barbara Urban Hydrograph (SBUH) method, using a Type 1A storm distribution per City of Florence, Stormwater Design Manual, Chapter 4.2.3 and the Programmatic Biological Opinion for HUD in Oregon, Appendix D, Stormwater Information Form, Water Quality Information, Guidance Instructions, Item 15 – Stormwater Treatment Required (Volume).

<u>Software used:</u>

- Runoff and storage calculations were done in Autodesk Storm and Sanitary Analysis 2020.

<u>Safety factors, curve numbers, and design coefficients used:</u>

- Safety Factors: Refer to Facility Sizing Calculations Below for further discussion about safety factors used.
- Curve Number: Composite curve numbers were calculated for several pedestrian and landscape areas, where runoff from impervious surfaces typically flows over pervious areas prior to entering the underground storm system. Calculations for these composite curve numbers are based on the United States Department of Agriculture (USDA) – Urban Hydrology for Small Watersheds TR-55 manual for Hydrologic Soil Group B soils. Runoff from vehicular pavements and roof areas were calculated separately from landscape areas within the parking lots, as the proposed curbs limited flow of runoff across the pervious surfaces. A curve number of 98 was used for impervious areas (pavements and roof areas) and a curve number of 80 was used for pervious areas (lawns and landscape areas).
- Time of Concentration (Tc): Time of concentration values were set based on a minimum of 5 minutes for all of the drainage basins.

OPERATIONS AND MAINTENANCE

Operations and Maintenance

A draft Operations and Maintenance (O&M) Plan for each facility for the site is included in Appendix G. The Form O&M and the Operations & Maintenance Agreement for the site will be finalized and recorded once the draft plan is approved.

Source Controls

The City of Florence requires that specific activities or uses within a site must comply with prescriptive standards to prevent the occurrence of point source pollution. These standards are referred to the Source Control standards and are presented in Chapter 7 of the Stormwater Design Manual. The following provides a summary of the regulated activities for this project and explains which source control measures are used to satisfy the requirements.

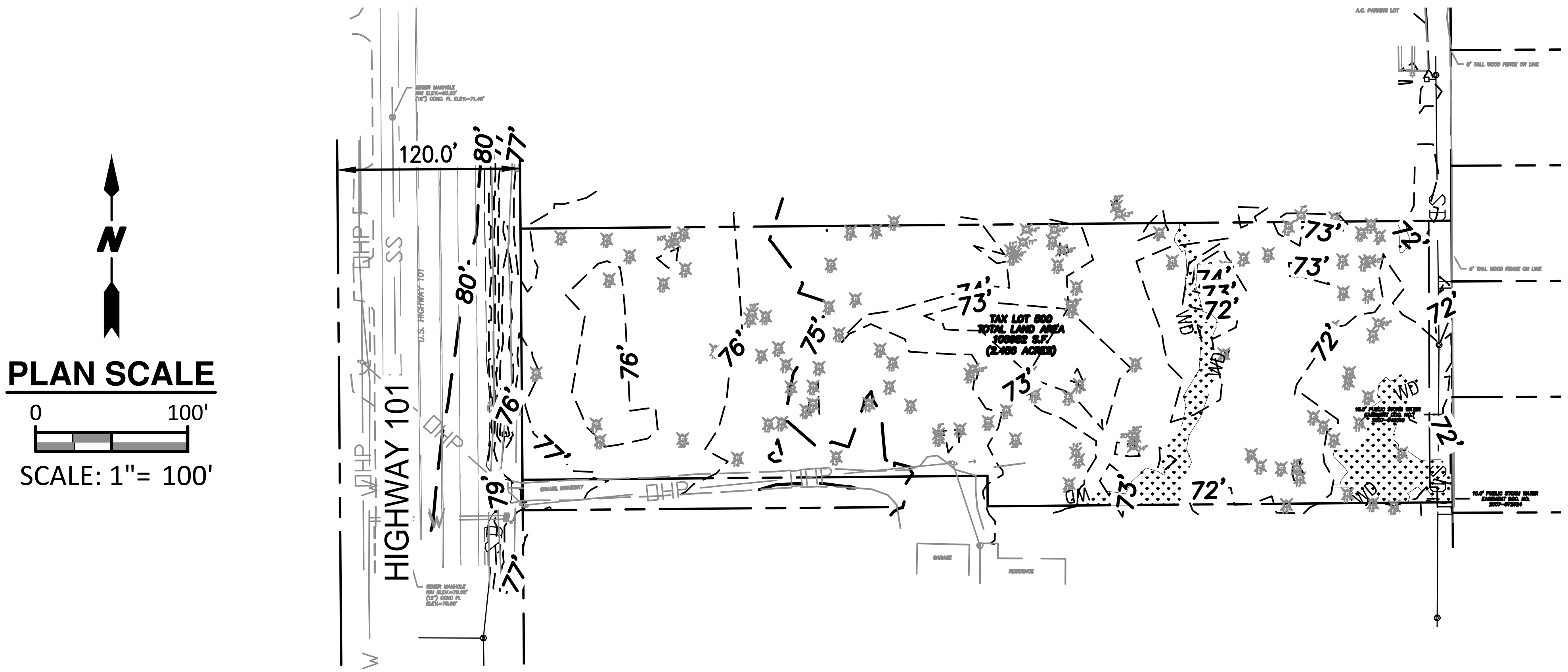
- Trash Enclosure: The trash enclosure will be covered, hydraulicly isolated, with an internal drain that discharges to sanitary sewer.

ENGINEERING CONCLUSIONS

As demonstrated in the narrative above and the attached calculations, this project complies with the above referenced requirements. The proposed water quality facilities have been designed to manage the runoff from required design storm events, with provisions to convey or safely overflow runoff from the 100-year storm without damage to nearby buildings and limit post-development runoff to pre-development levels for the required design storm.

APPENDICES

Appendix A:
Exhibit Drawings



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PROJECT TITLE

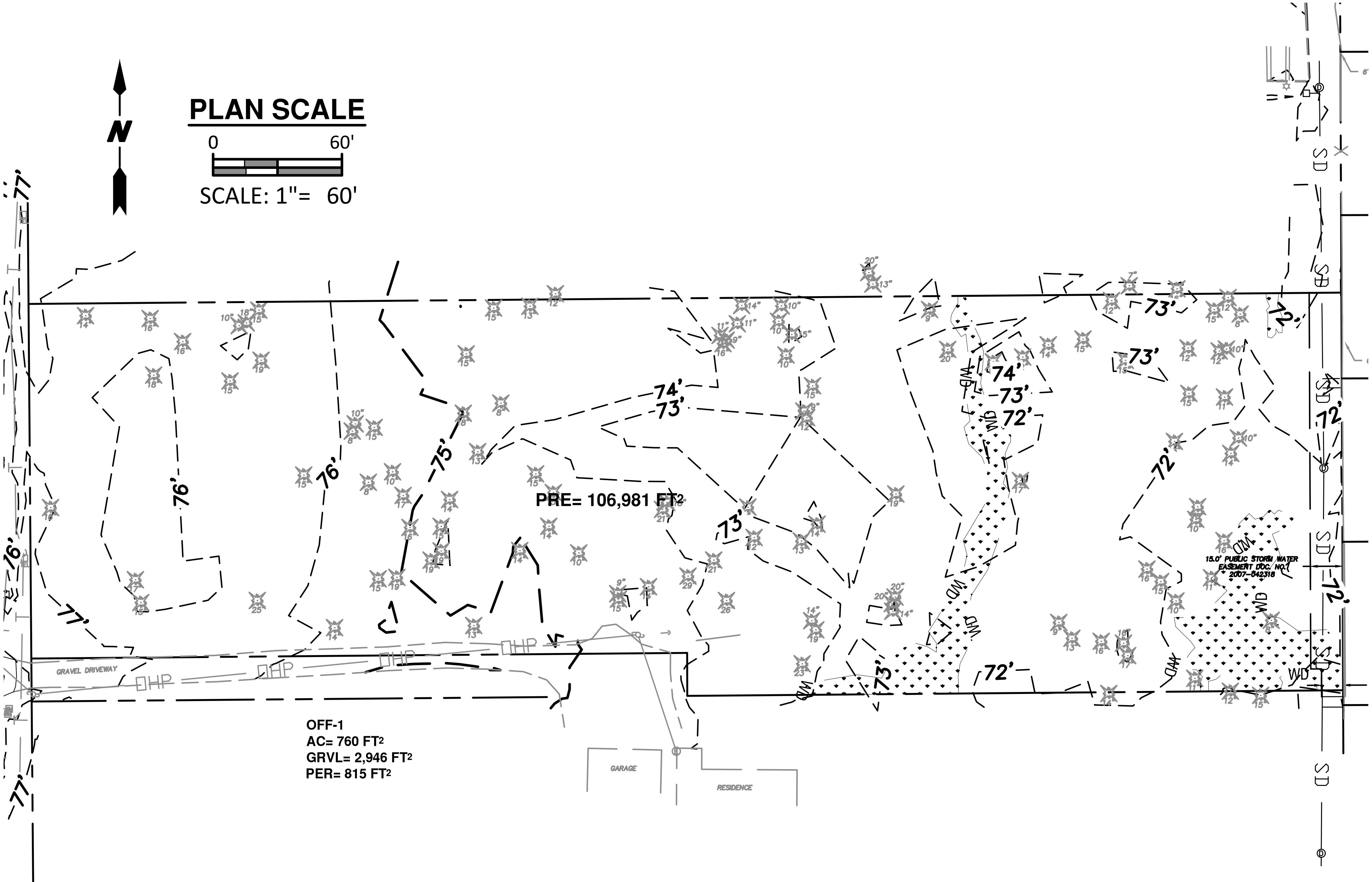
SHORE PINES HOUSING PROJECT

NORTHWEST HOUSING ALTERNATIVES, INC

SHEET TITLE

EXHIBIT 1 - EXISTING SITE MAP

DATE	08/12/2021
DESIGNER	JAH
PROJECT	205-073
FILE	Exhibit Drawings.dwg
SHEET No	EX-1



MAZZETTI BHEGroup

PROJECT TITLE

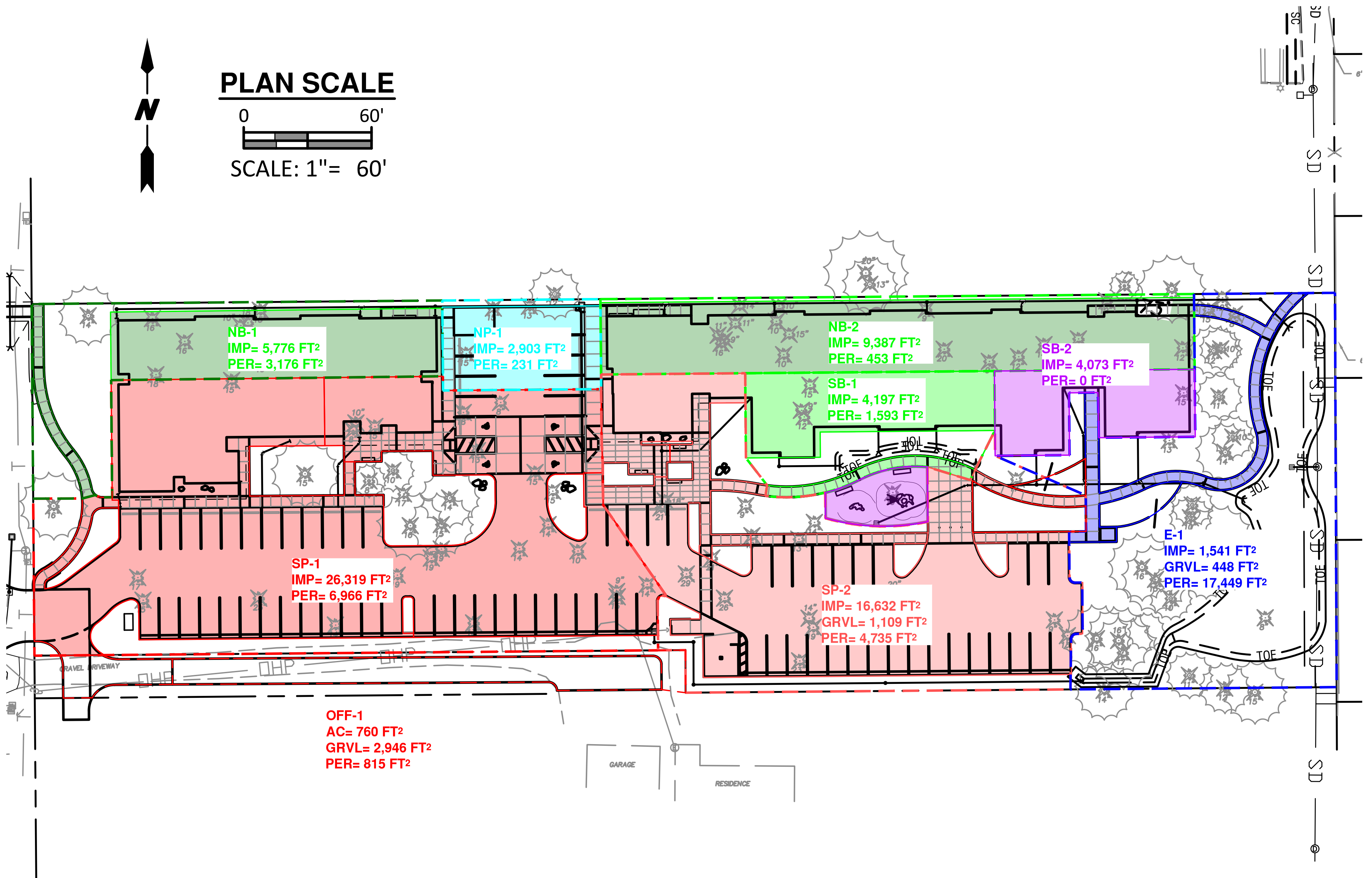
SHORE PINES HOUSING PROJECT

NORTHWEST HOUSING ALTERNATIVES, INC

SHEET TITLE

EXHIBIT 2 - PRE-DEVELOPMENT DRAINAGE BASIN

DATE	08/12/2021
DESIGNER	JAH
PROJECT	205-073
FILE	Exhibit Drawings.dwg
SHEET No	EX-2



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BHEGroup

PROJECT TITLE

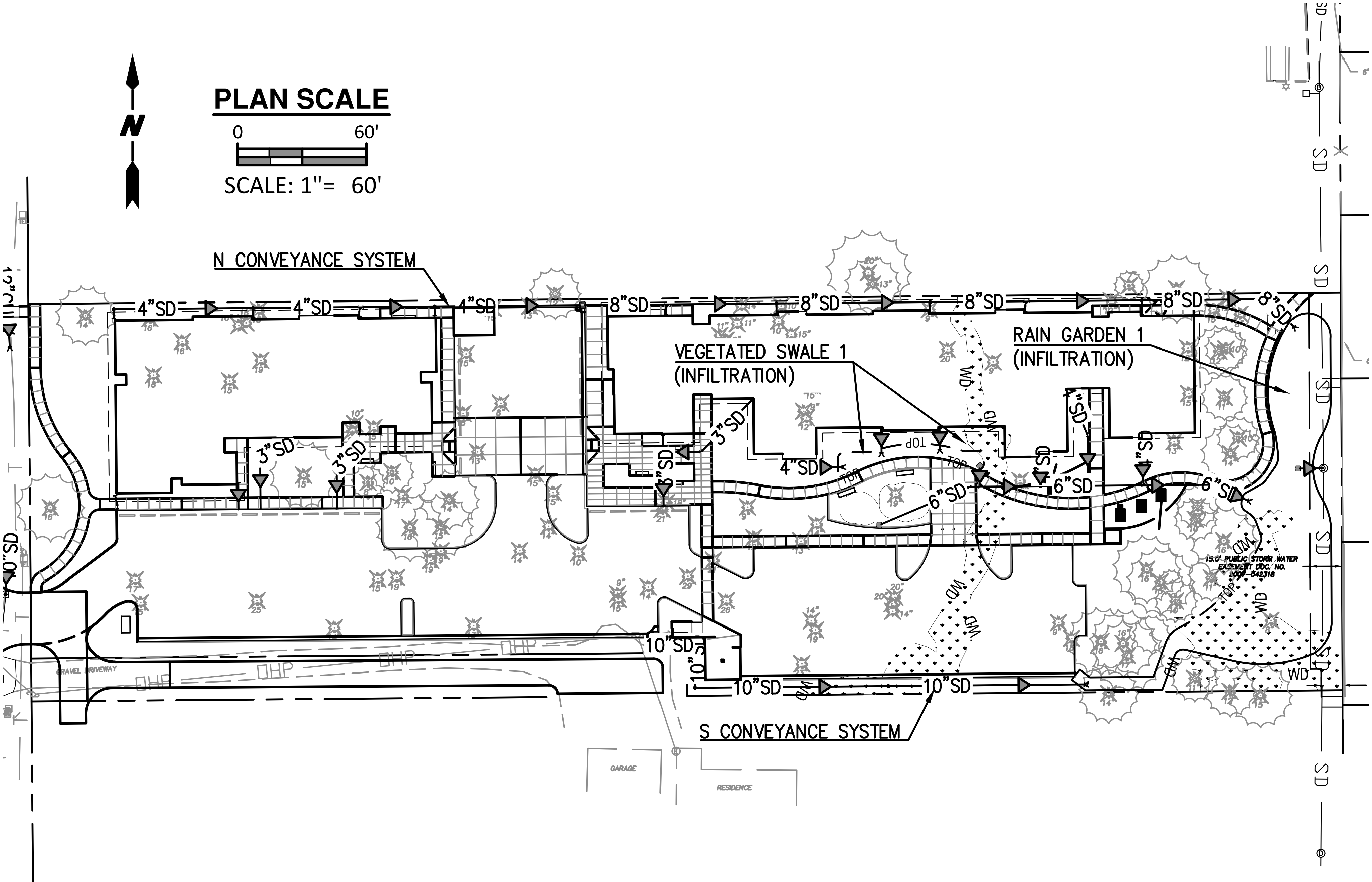
SHORE PINES HOUSING PROJECT
NORTHWEST HOUSING ALTERNATIVES, INC

SHEET TITLE

EXHIBIT 3 - POST-DEVELOPMENT DRAINAGE BASIN

DATE	08/12/2021
DESIGNER	JAH
PROJECT	205-073
FILE	Exhibit Drawings.dwg

SHEET No
EX-3



MAZZETTI BHEGroup

PROJECT TITLE

SHORE PINES HOUSING PROJECT
NORTHWEST HOUSING ALTERNATIVES, INC

SHEET TITLE

EXHIBIT 4 - STORM DRAIN PLAN

DATE	08/12/2021
DESIGNER	JAH
PROJECT	205-073
FILE	Exhibit Drawings.dwg
SHEET No	EX-4

Appendix B: Site Information

National Flood Hazard Layer FIRMette

FEMA

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

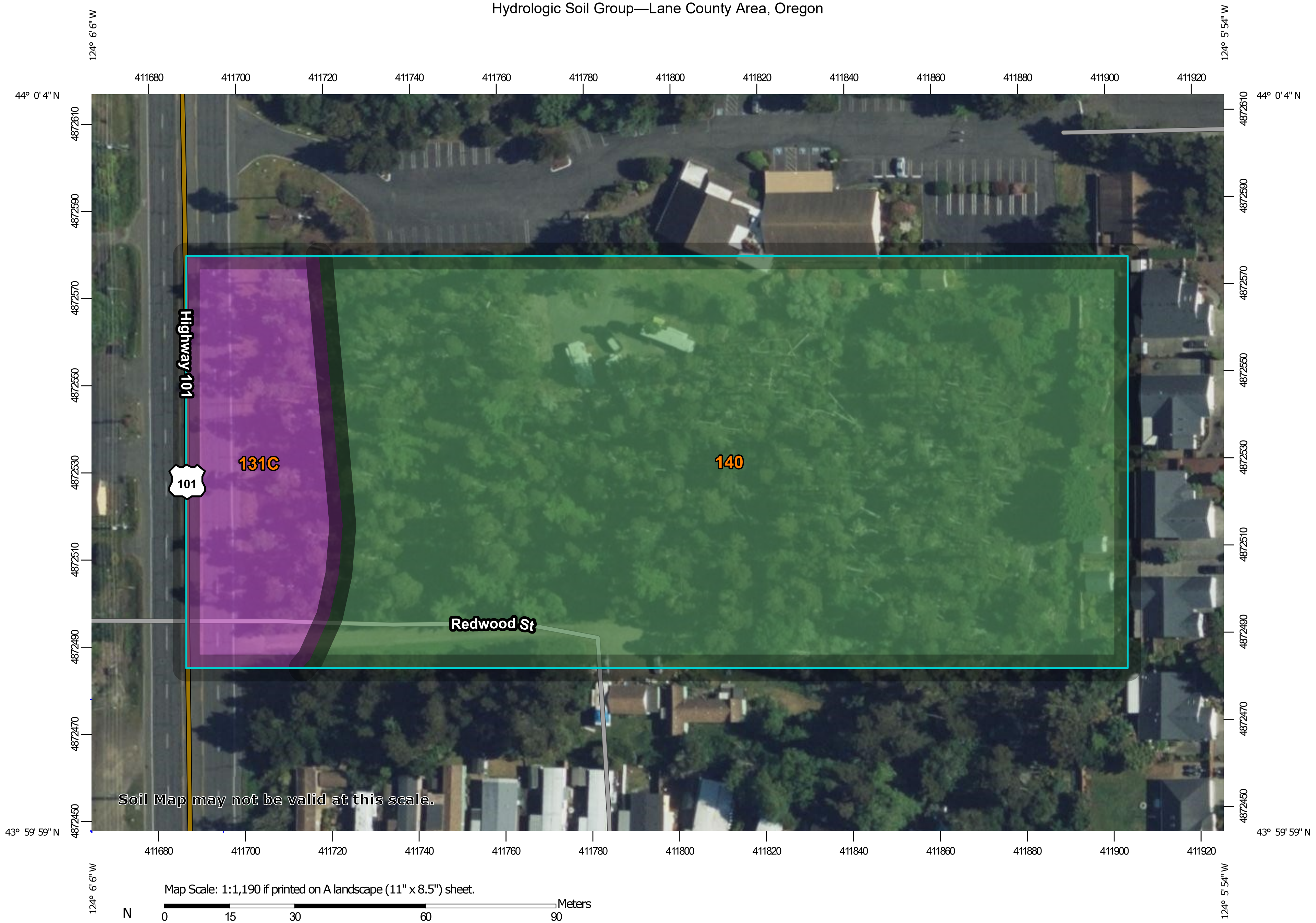
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

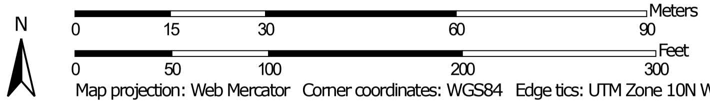
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/26/2021 at 5:22 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Hydrologic Soil Group—Lane County Area, Oregon



Map Scale: 1:1,190 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

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

Soils

Soil Rating Polygons
- ■ A
- ■ A/D
- ■ B
- ■ B/D
- ■ C
- ■ C/D
- ■ D
- □ Not rated or not available

Soil Rating Lines
- 〰 A
- 〰 A/D
- 〰 B
- 〰 B/D
- 〰 C
- 〰 C/D
- 〰 D
- 〰 Not rated or not available

Soil Rating Points
- ■ A
- ■ A/D
- ■ B
- ■ B/D
- ■ C
- ■ C/D
- ■ D
- □ Not rated or not available

Water Features
- 〰 Streams and Canals

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

Background
- ■ Aerial Photography

MAP INFORMATION

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

> Warning: Soil Map may not be valid at this scale.
>
> Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lane County Area, Oregon
Survey Area Data: Version 17, Jun 11, 2020

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

Date(s) aerial images were photographed: May 23, 2020—May 28, 2020

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
131C	Waldport fine sand, 0 to 12 percent slopes	A	0.8	15.3%
140	Yaquina loamy fine sand	A/D	4.3	84.7%
Totals for Area of Interest			**5.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

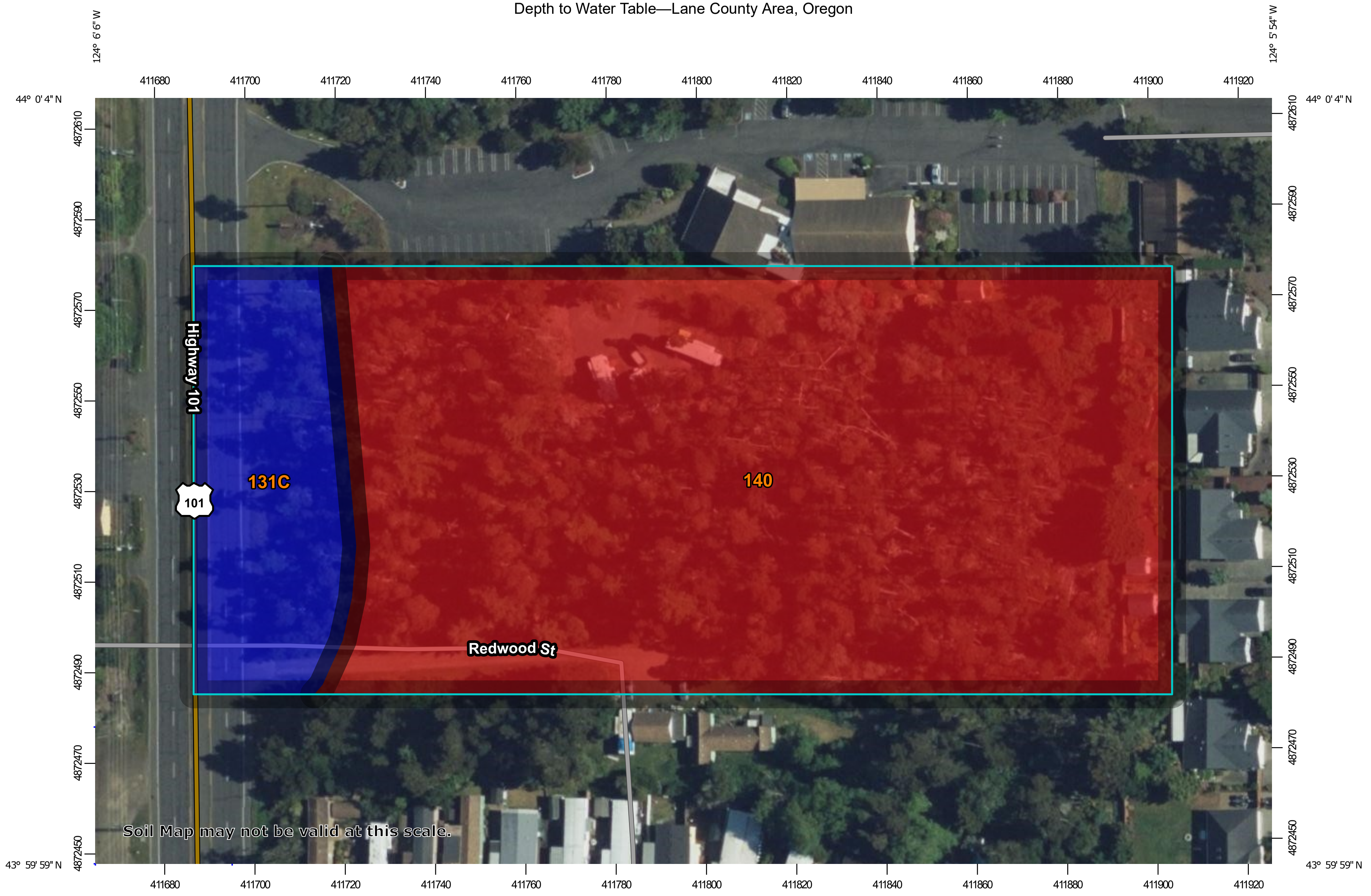
Rating Options

Aggregation Method: Dominant Condition

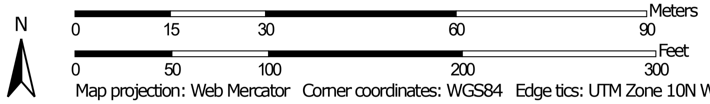
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Depth to Water Table—Lane County Area, Oregon



Map Scale: 1:1,190 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- ☐ Area of Interest (AOI)

Soils

Soil Rating Polygons

- 🟥 0 - 25
- 🟧 25 - 50
- 🟨 50 - 100
- 🟩 100 - 150
- 🟦 150 - 200
- 🟪 > 200
- ⬜ Not rated or not available

Soil Rating Lines

- 〰 0 - 25
- 〰 25 - 50
- 〰 50 - 100
- 〰 100 - 150
- 〰 150 - 200
- 〰 > 200
- 〰 Not rated or not available

Soil Rating Points

- ■ 0 - 25
- ■ 25 - 50
- ■ 50 - 100
- ■ 100 - 150
- ■ 150 - 200
- ■ > 200
- ▣ Not rated or not available

Water Features

- 〰 Streams and Canals

Transportation

- ┼┼┼ Rails
- 〰 Interstate Highways
- 〰 US Routes
- 〰 Major Roads
- 〰 Local Roads

Background

- ▨ Aerial Photography

MAP INFORMATION

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

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

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

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lane County Area, Oregon
Survey Area Data: Version 17, Jun 11, 2020

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

Date(s) aerial images were photographed: May 23, 2020—May 28, 2020

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

Depth to Water Table

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
131C	Waldport fine sand, 0 to 12 percent slopes	>200	0.8	15.3%
140	Yaquina loamy fine sand	0	4.3	84.7%
Totals for Area of Interest			**5.1**	**100.0%**

Description

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

SOURCE

The information on this map was derived from multiple sources. Extreme care was taken in the creation of this map, but it is provided "as is". Wetlands and Wildlife LLC cannot accept any responsibility for errors, omissions, or positional accuracy in the digital data or the underlying records. There are no warranties, express or implied, accompanying this product.
Questions regarding production of this map can be sent to Brian Meiering: brian@wetlandsandwildlifeLLC.com

This map precision (precision of transferring boundaries of features located on the ground to a map) for wetland boundaries, data plots and study area boundaries is within one meter (3.28 feet)

1 inch = 100 feet

0 50 100
Feet

Figure
6

Project Number: 17-0059
Drawn By BTM
Checked
Date: 11/10/2017

Revisions
Date Description

WETLAND DELINEATION MAP
MAP AND TAXLOT 1812143300500

LANE COUNTY
FLORENCE, OR

Wetlands and Wildlife LLC
P.O. Box 50878
Eugene, OR 97405

541.214.6051
http://www.wetlandsandwildlifeLLC.com

N

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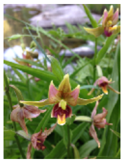


WETLANDS AND WILDLIFE LLC

FOR ASSESSMENT AND TAXATION ONLY

S.W.1/4 S.W.1/4 SEC. 14 T.18S. R.12W. W.M.

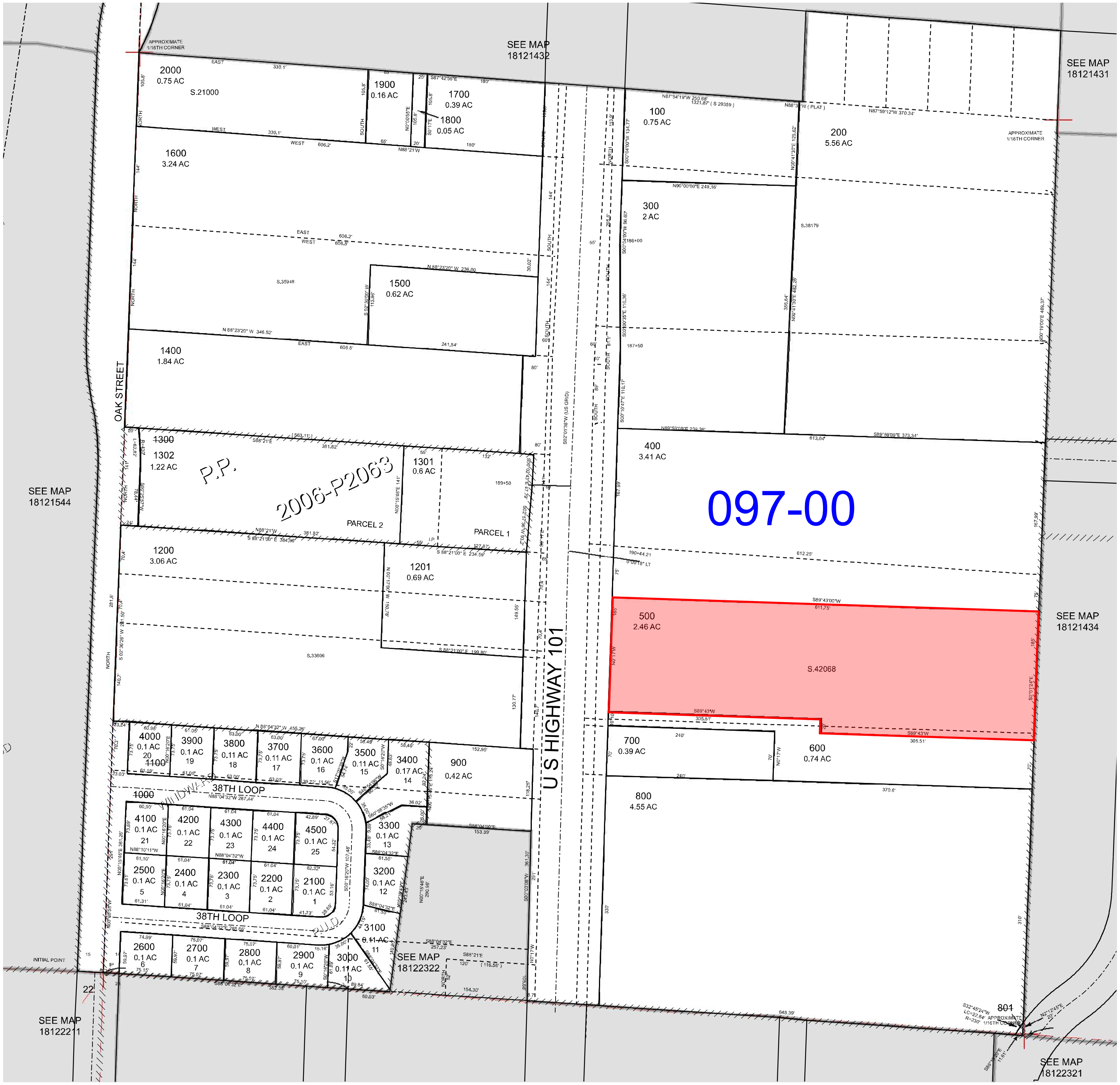
Lane County

1" = 100'

18121433
FLORENCE

lcatjcg - 2015-12-18 09:41

CANCELLED
801
1000
1100
1300

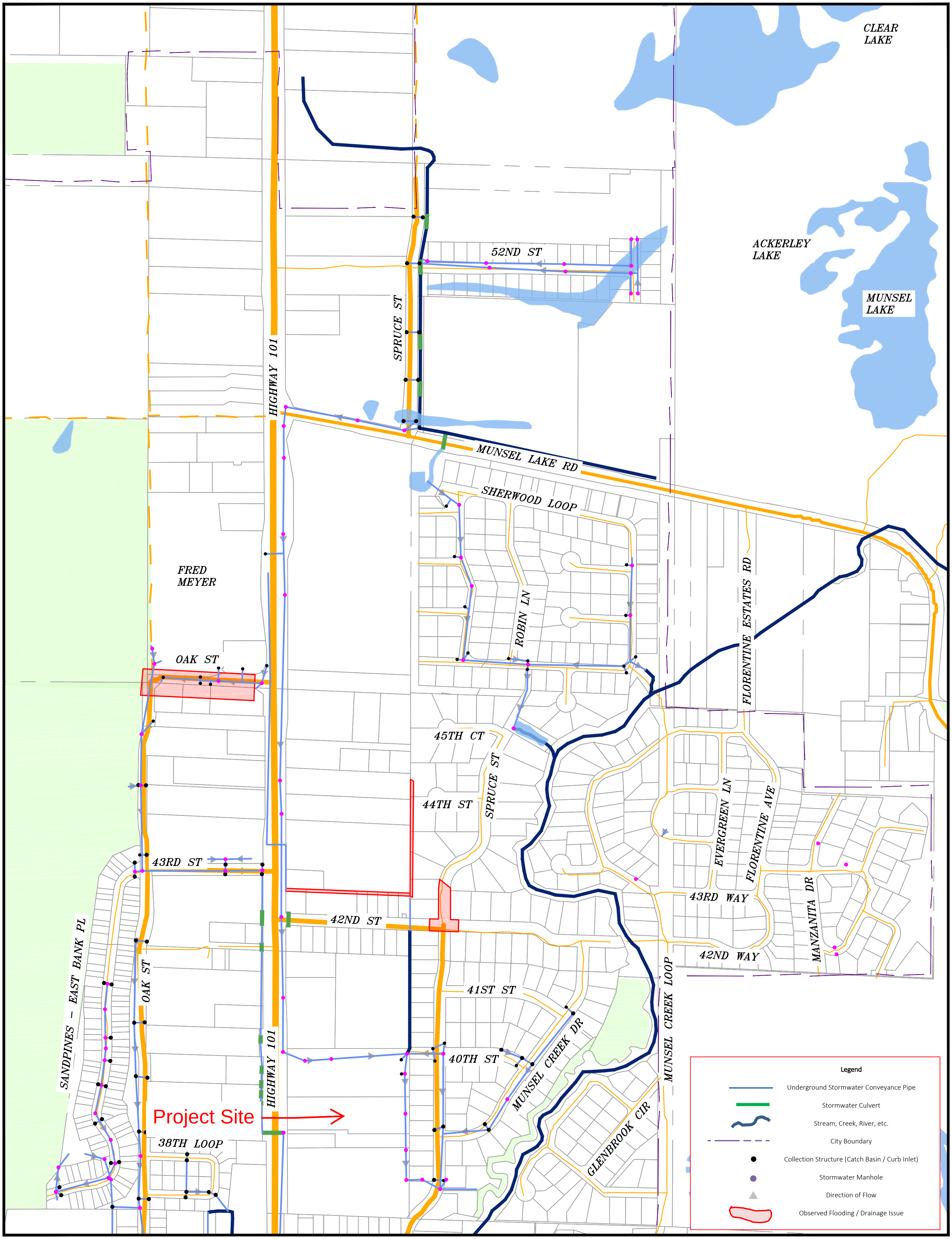


REVISIONS
10/01/2004 - LCAT130 - UPDATE CODES TO 1999 STATUS GIS
02/16/2005 - LCAT130 - CONVERT MAP TO GIS
02/16/2005 - LCAT130 - LLA BETWEEN TL 400 AND 800
06/21/2005 - LCAT130 - LLA BETWEEN TL 1000, 900, 1100, AND
06/21/2005 - LCAT130 - TL'S 300, 600, AND 700 ON 18122322
11/17/2006 - LCAT113 - CORR AC FOR TL 100, 200, 300
01/29/2006 - LCAT142 - CANC. TL 1000 & 1100 TO WINDWARD P.U.D.
03/08/2007 - LCAT140 - CANC. 1300 INTO P.P. 2006-P2063
08/24/2007 - LCAT140 - LLA BETWEEN 1301 & 1302
05/26/2011 - LCAT167 - LLA BETWEEN TL 500/600
12/18/2015 - LCAT174 - 18121432 1400, 1500, 1600 INTO TL 200
12/18/2015 - LCAT174 - 18121432 1700, 1800, 1900 INTO TL 200

FLORENCE
18121433

SEE REGION 10 MAP

SEE REGION 6 MAP



SEE REGION 4 MAP

REGION 7 MAP

DATE:2/20/18 FILE:O:\CW_Projects\1503 Florence\1503-013 Florence - Storm Water Master Plan Update\Drawings\Dwg\XREF\1503-013 SD Features.dwg

John Hornberger

From: Mike Miller <mike.miller@ci.florence.or.us>
Sent: Tuesday, March 2, 2021 10:54 AM
To: John Hornberger
Cc: Monica Anderson; David Horsley; 'Joann Le'; Aurelia Rohrbacker; Wendy Farley-Campbell; planningdepartment
Subject: RE: NHA Florence

Good morning John,

I reviewed our drawings and several design reports regarding the 42-inch stormwater line that runs along the southern line of the subject project and discharges to Munsel Creek. It has been 12 years since I reviewed the documents last and it has been interesting to relive all of the comments from Oregon Department of Fish and Wildlife (ODFW) regarding this project. As I mentioned during the pre-app meeting, we had a lot of hoops to jump through in order to complete our project. There was a very high level of scrutiny over manhole covers, grates and elevations to prevent the natural occurring wetlands from being dewatered by the pipeline installation, not to mention concerns of additional scouring of Munsel Creek and potential impacts to coho habitat (yes, there is coho and steelhead in Munsel Creek – fun little fact, Florence Salmon Trout Enhancement Program has a small hatchery on Munsel Creek near 24th and Willow Street).

The 2006 Stormwater Design Report for the Spruce Street LID (Local Improvement District) which was peer reviewed by PBS Environmental in June 2008 and the project ultimately receiving agency approvals through DSL, ACOE (Army Corp of Engineers), DEQ and ODFW.

As we understand, Munsel Creek serves as the primary drainage for northeast Florence and it has been determined to have limited capacity for stormwater runoff. Therefore, in developing the stormwater system for the Spruce Street LID, a drainage strategy for the entire sub-basin was developed. To fully understand the impacts to Munsel Creek, the 2006 Stormwater Design Report included all undeveloped properties within the upper Munsel Creek drainage basin. The NHA property is included in Basin 7 of the report.

This are of Florence has unique hydrologic characteristics. Groundwater and surface runoff are related. Groundwater in the area fluctuates seasonally and also annually. Nearly all precipitation on the pervious surfaces infiltrates the soil and contributes to the groundwater. During above average rainfall years, high groundwater levels are experienced. Seasonally, extended wet periods can cause elevated groundwater levels that increase the rates of surface runoff.

The 42-inch stormwater line was designed with the following assumptions: existing developed basins are expected to continue producing storm runoff at current rates and undeveloped areas were given new parameters based on expected development density based on the land uses shown in the City's Comprehensive Plan at the time. All runoff greater than predevelopment flows was modeled to be detained and released at predevelopment rates.

Again, the properties in Basin 7 were included in the modeling effort. This does not mean that properties in Basin 7 are allowed to fully discharge into the 42-inch stormwater line. Computer modeling of the pre and post flows are required for all new development. This development (the proposed NHA development) will be allowed to discharge to the 42-inch storm line at <u>no more than</u> the existing pre-development flow rates for the 2 through 25 year storms, and once again, pre-development flow rates must be determined using computer modeling.

As far as the flow rates at the fire hydrant is 4,071 gpm at 20 psi. The last time the hydrant was flow tested was 2011.

Please let me know if you have any additional questions.

Mike

From: John Hornberger <jhornberger@mazzetti.com>
Sent: Monday, March 1, 2021 11:53 AM
To: Mike Miller <mike.miller@ci.florence.or.us>
Cc: Monica Anderson <manderson@mazzetti.com>; David Horsley <dhorsley@daoarchitecture.com>; 'Joann Le' <jle@daoarchitecture.com>; Aurelia Rohrbacker <arohrbacker@daoarchitecture.com>; Wendy Farley-Campbell <wendy.farleycampbell@ci.florence.or.us>
Subject: RE: NHA Florence

Mike,

We wanted to check in again on the storm drain capacity question. Would it be possible to get some feedback today and, if not, could you let us know when that information would be provided?

Thanks,

John Hornberger, PE
Senior Civil Engineer | Project Manager
MAZZETTI | BHEGroup
P: 541.513.7736 **D:** 503.601.5974 **D:** 541.335.8751

The world around us is evolving… so is Mazzetti.

From: John Hornberger
Sent: Wednesday, February 24, 2021 4:06 PM
To: mike.miller@ci.florence.or.us
Cc: Monica Anderson <manderson@mazzetti.com>; David Horsley <dhorsley@daoarchitecture.com>; 'Joann Le' <jle@daoarchitecture.com>; Aurelia Rohrbacker <arohrbacker@daoarchitecture.com>; wendy.farleycampbell@ci.florence.or.us
Subject: RE: NHA Florence

Mike,

Following up to our pre-application meeting on Friday, I believe most of these questions have been addressed in the meeting (as summarized below). As discussed in the meeting, the two outstanding items are:

1. A fire flow test for the hydrant on the west side of Highway 101 on the north side of the 3757 US-101 property and just south of the project site.
2. Capacity information for the existing 42-inch public storm drain system on the east side of the site.

Please provide feedback as soon as possible.

Thanks,

John Hornberger, PE
Senior Civil Engineer | Project Manager
MAZZETTI | BHEGroup
P: 541.513.7736 **D:** 503.601.5974 **D:** 541.335.8751

"Reimagining the NICU" with top U.S. clinicians – Join us

From: John Hornberger
Sent: Wednesday, January 27, 2021 2:57 PM

To: mike.miller@ci.florence.or.us
Cc: Monica Anderson <manderson@mazzetti.com>; David Horsley <dhorsley@daoarchitecture.com>; 'Joann Le' <jle@daoarchitecture.com>; Aurelia Rohrbacker <arohrbacker@daoarchitecture.com>; wendy.farleycampbell@ci.florence.or.us
Subject: NHA Florence

Mike,

Quite a while back in March, 2019 there was a pre-development meeting for this project (the Northwest Housing Alternatives Apartments). The project was delayed but is moving forward again and we are planning to have another pre-development meeting but would like to get some feedback ahead of the meeting.

1. Please provide information on the capacity of 8-inch sanitary sewer and 10-inch water on west side of Highway 101 and verify that the City is okay with servicing the site from. No capacity issues with sanitary sewer or water. Water pressures expected to be in the 90 psi range.
2. Please provide information on the capacity of 42-inch storm drain on the east side of the site and verify this is would be an acceptable discharge location for site stormwater.
3. Please let us know if there are any development limitations associated with the storm drain easement (e.g. clearing, placing cut or fill, utility construction, etc.). The primary purpose is to provide access from the north. Proposed development will need to maintain this access.
4. Please confirm that the site is outside the wellhead protection zones. The site is outside the well head protection zones.
5. Please confirm that there isn't a minimum groundwater separation requirement for surface infiltration facilities designed per the 2011 City of Florence Stormwater Design Manual. No minimum separation requirement, only an overflow to an approved destination.

Thanks,

John Hornberger, PE
Senior Civil Engineer | Project Manager
MAZZETTI | BHEGroup
121 SW Salmon Street, Ste. 1000, Portland, OR 97204
940 Willamette Street, Ste. 310, Eugene, OR 97401
P: 541.513.7736 **D:** 503.601.5974 **D:** 541.335.8751

Reader Rankings
DJCOregon
1st Place

Appendix C:
Forms

STORMWATER INFORMATION FORM

HUD PROGRAMMATIC OPINION

If you are submitting a project that includes a stormwater plan for review, please fill out the following cover sheet **to be included with** any stormwater management plan and any other supporting materials. Submit this form with/or after the Action Implementation Form to NMFS at ***HUDBiOp.wcr@noaa.gov.***

PROJECT INFORMATION

NMFS PROJECT TRACKING #: WCR- -

PROJECT NAME Northwest Housing Alternatives Apartment **COUNTY** Lane County

TYPE OF PROJECT (select all that apply)
☐ **REDEVELOPMENT** ☒ **RESIDENTIAL** ☐ **INSTITUTIONAL**
☒ **NEW DEVELOPMENT** ☐ **COMMERCIAL** ☐ **OTHER**

HAVE YOU CONTACTED ANYONE AT NMFS ☒ **YES** ☐ **NO** **If Yes, Who:** Michelle LaRue McMullin

NEAREST RECEIVING WATER Munsel Creek which discharges to the Siuslaw River

STORMWATER DESIGNER / ENGINEER INFORMATION **NAME** John Hornberger, PE

AFFILIATION/FIRM Mazzetti | BHEGroup **PHONE** (541) 335-8751 **EMAIL** jhornberger@mazzetti.com

STORMWATER DESIGN MANUAL USED, INCLUDING YEAR/VERSION City of Florence, Stormwater Design Manual, 2011

DESCRIBE WHICH ELEMENTS OF YOUR STORMWATER PLAN THAT CAME FROM THE MANUAL EMPLOYED
Design of pollution reduction and flow control facilities as well as the design storms.

DESIGN STORMS

1	**2-YEAR, 24-HOUR STORM** [Consult: http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm]	3.46	**INCHES**	**IN/HR**
2	**WATER QUALITY DESIGN STORM (50% OF 2-YEAR, 24-HOUR STORM)** [Except climate regions 4 & 9 (67%) and climate region 5 (75%)]	1.73	**INCHES**	
3	**WATER QUANTITY DESIGN STORM (10-YEAR, 24-HOUR STORM)** [Consult: http://www.wrcc.dri.edu/pcpnfreq/or10y24.gif]	4.48	**INCHES**	

SITE CHARACTERISTICS

4	**TOTAL PROJECT AREA** [Lot/Parcel acreage + any additional ground disturbance area]	2.46	**ACRES**	**FT^2**
5	**TOTAL IMPERVIOUS SURFACE AREA** [Existing impervious acreage + Proposed impervious acreage]	1.66	**ACRES**	**FT^2**
6	**TOTAL LANDSCAPE AREA** [Landscaping acreage + Vegetated treatment facility acreage]	0.80	**ACRES**	**FT^2**
7	**WILL IMPERVIOUS AREA BE REDUCED FROM CURRENT CONDITIONS? IF YES, BY HOW MUCH?** ☐ **YES** ☒ **NO**		**ACRES**	**FT^2**
8	**IS THE SITE CONTAMINATED?** [If yes, provide investigation results to NMFS]	☐ **YES** ☒ **NO**		

Water Quality Information

9 Are low impact development (LID) methods incorporated into design? ☒ Yes ☐ No

10 How much of total stormwater is treated using LID? 100 % 72,380 ft^3

11 Specific LID water quality treatment elements incorporated

Site Design Elements

- ☒ Site layout
- ☐ Clustered development
- ☐ De-pave existing pavement
- ☒ Conserve soils w/ best drainage
- ☒ Tree protection
- ☒ Construction sequencing
- ☐ Reforestation/Tree Planting
- ☐ Restored soils
- ☐ Porous pavement

Treatment Methods

- ☐ Vegetated roof
- ☒ Infiltration rain garden / LID swale
- ☐ infiltration Stormwater planters
- ☐ Soakage Trench
- ☐ drywell
- ☐ Water quality swale
- ☐ Vegetated filter strips
- ☐ Lined Rain Garden/LID Swale
- ☐ Lined Stormwater Planter

Other LID Water Quality Treatment Methods

☐ LID Name
Source
☐ LID Name
Source
☐ LID Name
Source

12 Describe the treatment train, including pretreatment and LID BMPs used to treat water quality

Drainage from the all of the west building and the north side of the east building and all of the parking lot is conveyed to a large infiltration rain garden on the east side of the site via piped storm drain and open ditches. Drainage from the south side of the east building is discharge to a small infiltration swale near the building. Overflow from the infiltration swale is conveyed to the large infiltration rain garden. The large infiltration rain garden overflows to piped public storm drain.

13 Why this treatment train was chosen for the project site

This treatment train was chosen to maximum on-site retention and meet all water quality requirements.

14 Page in stormwater plan where more details can be found See Sheets C3.0 and 3.1

15 Stormwater treatment required Volume 2,776 ft^3 Peak Discharge 0.05 cfs Area Treated 71,872 ft^2

16 Is the water quality design storm fully treated? Volume ☒ Yes ☐ No Peak Discharge ☒ Yes ☐ No

17 If answer to 16 is "No," why not? How will project offset the effects from untreated stormwater?

Water Quantity Information

18	Pre-development runoff rate & volume	Water Quality Design storm (50% of 2-year, 24-hour)	0.05	cfs	2,776 ft^3
		Water Quantity Design Storm (10-year, 24-hour)	0.62	cfs	19,561 ft^3
19	Post-development runoff rate & volume	Water Quality Design storm (50% of 2-year, 24-hour)	0	cfs	0 ft^3
		Water Quantity Design Storm (10-year, 24-hour)	0.31	cfs	925 ft^3

**** Post-development runoff rate must be less than or equal to pre-development runoff rate ****

WATER QUANTITY INFORMATION (CONTINUED)

20	**METHODS USED TO LIMIT STORMWATER DISCHARGE FROM PROJECT** Stormwater discharge is limited using stormwater retention facilities to the maximum extent feasible (MEF). Other measures taken include, using multi-story buildings, retaining existing trees to the MEF, planning new trees onsite, and avoid adding impervious surfaces over areas that could be used to infiltrate post-construction stormwater runoff.
21	**PAGE IN STORMWATER PLAN WHERE MORE DETAILS CAN BE FOUND** The Analysis section of the Stormwater Report
22	**SPECIFIC LID DISCHARGE REDUCTION ELEMENTS INCORPORATED** **MANAGEMENT METHODS** / **OTHER LID WATER QUANTITY MANAGEMENT ELEMENTS** ☐ POROUS PAVEMENT ☐ SOAKAGE TRENCH ☐ LID NAME ■ INFILTRATION RAIN GARDEN / LID SWALE ☐ DRYWELL SOURCE ☐ INFILTRATION STORMWATER PLANTERS ☐ DOWNSPOUT DISCONNECTION
23	**ARE BOTH WATER QUANTITY DESIGN STORMS FULLY MANAGED (I.E. ATTENUATED)?** **VOLUME** ■ **YES** ☐ **NO** **PEAK DISCHARGE** ■ **YES** ☐ **NO**
24	**IF NO, WHY NOT? HOW WILL THE PROJECT OFFSET THE EFFECTS FROM UNMANAGED STORMWATER?**
25	**DOES THE PROJECT DISCHARGE DIRECTLY INTO A MAJOR WATER BODY?** [Large waterbody = ocean, estuary, mainstem Columbia River, Willamette River downstream of Eugene] ☐ **YES** ■ **NO**
26	**IS THE POST-DEVELOPED PEAK DISCHARGE >0.5 CFS DURING THE 2-YEAR, 24-HOUR STORM EVENT? IF YES, FLOW CONTROL MANAGEMENT REQUIRED** ☐ **YES** ■ **NO**
27	**FLOW CONTROL PROPOSED** N/A **CFS** N/A **% OF 2-YEAR, 24-HOUR STORM EVENT**

MAINTENANCE AND INSPECTION PLAN

28	**HAVE YOU INCLUDED A STORMWATER MAINTENANCE AND INSPECTION PLAN?** ■ **YES** ☐ **NO**
29	**CONTACT INFORMATION FOR THE PARTY/PARTIES THAT WILL BE LEGALLY RESPONSIBLE FOR PERFORMING/ CONTRACTING THE INSPECTIONS AND MAINTENANCE OF THE STORMWATER FACILITIES:**
	NAME TBD
	AFFILIATION/RESPONSIBILITY TBD
	PHONE TBD **EMAIL** TBD
	NAME
	AFFILIATION/RESPONSIBILITY
	PHONE **EMAIL**
	NAME
	AFFILIATION/RESPONSIBILITY
	PHONE **EMAIL**

OTHER RELEVANT INFORMATION

Endangered Species Act Guidance for Oregon

Prepared in collaboration with the US Fish and Wildlife Service and NOAA Fisheries Service
Applies in Oregon only

General requirements	ESA Legislation	HUD Regulations
Section 7(a)(2) of the Endangered Species Act mandates that actions that are authorized, funded, or carried out by Federal agencies do not jeopardize the continued existence of plants and animals that are listed, or result in the adverse modification or destruction of designated critical habitat.	The Endangered Species Act of 1973; 16 U.S.C. 1531 et seq.	24 CFR 58.5(e) 24 CFR 50.4(e)

Purpose

The purpose of this guidance is to assist the U.S. Department of Housing and Urban Development (HUD) and their designated responsible entities who have assumed responsibility for environmental compliance to meet their duty to consult with the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service (NOAA Fisheries) under Section 7(a)(2) of the Endangered Species Act (ESA). Users will be able to determine whether their development projects are likely to have "*no effect*" on ESA-listed species and critical habitats, and thus do not require any further coordination with, or approval from, the USFWS or NOAA Fisheries.

If you make a "*no effect*" decision for your project, please document the circumstances and reason for your decision in a memo to file for use if the decision is ever reviewed by another party. If you find that your action "*may affect*" an ESA-listed species or critical habitat, including a result of post-construction runoff, then you must contact USFWS, NOAA Fisheries, or both to determine whether the project can be modified to eliminate the possibility of an adverse effect. If the adverse effect cannot be eliminated, further consultation with USFWS and/or NOAA Fisheries will be required.

This guidance also includes links to additional resources that describe low-impact development (LID) practices, including many actions that HUD and responsible entities can use to avoid or minimize the adverse impacts of post-construction runoff. HUD or a responsible entity may still choose to complete an individual consultation when warranted by project-specific facts.

Definitions

- **Action Area** is all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.
- **Built environment** means roofs and paved areas like parking, patios, trails, retaining walls, sidewalks, streets, and amenities that prevent infiltration of rainwater into the water table.
- **Candidate Species** are plant and animal taxa considered for possible addition to the List of Endangered and Threatened Species. These are taxa for which the USFWS and NOAA Fisheries have sufficient information on biological vulnerability and threat(s) to support issuance of a proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions.
- **Critical Habitat** means those specific areas that have been designated by USFWS or NOAA Fisheries (in a rule-making in the *Federal Register*) as essential to the conservation of a listed species.
- **Impervious area** means artificial structures such as rooftops and pavements (e.g., driveways, parking lots, roads, sidewalks, trails) that are covered by impervious material like asphalt, brick, compacted soil, concrete, or stone.
- **Listed Species** means any species of fish, wildlife or plant that has been determined to be endangered or threatened under section 4 of the Endangered Species Act.

- **Low impact development (LID)** means management principles and practices that reduce post-construction runoff by infiltrating rainfall into the water table, evaporating rainwater back into the atmosphere after a storm, or finding beneficial uses for rainwater instead of exporting it from the site as a waste product.
- **Nexus** means any action that is funded, authorized or carried out by a Federal agency that may affect ESA-listed species or habitats.
- **Post-construction runoff** means runoff from the built environment that extends off-site after a project's construction is complete.
- **Proposed Species** any species of fish, wildlife or plant that has been proposed by USFWS or NOAA Fisheries in the *Federal Register* to be listed under section 4 of the Endangered Species Act.
- **Proximity** means areas or effects that occur near ESA-listed species or habitats in space or time, including areas where species roost, feed, nest, rear, overwinter, or migrate. NOAA Fisheries considers projects that discharge post-construction stormwater to be in proximity with ESA-listed species or habitats that occur downstream of the discharge site.
- **Responsible entity** means the party authorized by HUD under 24 CFR Part 58 to complete any environmental review necessary for HUD to obligate funds.
- **Riparian area** means vegetation, habitats, or ecosystems that are associated with bodies of water, typically within 150-feet of a stream bank or the shoreline of a standing body of water.
- **Take** under the ESA is defined as actions that may harass, harm, pursue, hunt, shoot, wound, kill trap, capture, or collect, or to attempt to engage in any such conduct. The ESA also protects against interfering in vital breeding and behavioral activities or degrading critical habitat.

Endangered Species Act Effects Determinations

Section 7 of the ESA requires all Federal agencies to insure that any action authorized, funded or carried out by the agency is not likely to jeopardize the continued existence of a listed species or destroy or adversely modify designated critical habitat. To this end, every project with a Federal nexus must be evaluated to determine its likely effect on listed and proposed species and designated critical habitat. HUD funding for a project serves as a Federal nexus triggering the requirement for environmental review under the ESA. HUD and Responsible Entities are also encouraged to consider candidate species in their evaluations.

- ***No effect*** means the proposed action will not have any direct or indirect effect on listed species or designated critical habitat.

  No effect is the appropriate conclusion when the action agency determines its proposed action will not affect listed species or critical habitat. A determination of '*no effect*' must be supported in the environmental review record but does not require consultation with NOAA Fisheries or USFWS.

- ***May affect*** means the proposed action may have a direct or indirect effect on an ESA-listed species or critical habitat, including any habitat modification that alters water quality, physical habitat features, or other conditions that contribute to habitat value.

  May affect, not likely to adversely affect is the appropriate conclusion when effects on listed species are expected to be ***discountable***, or ***insignificant***, or completely ***beneficial***.

  - ***Beneficial effects*** are contemporaneous positive effects without any adverse effects to the species.
  - ***Insignificant effects*** relate to the size of the impact and should never reach the scale where take occurs. Based on best judgment, a person would not be able to meaningfully measure, detect, or evaluate insignificant effects.
  - ***Discountable effects*** are those extremely unlikely to occur. Based on best judgment, a person would not expect discountable effects to occur.

A determination of '*not likely to adversely affect*' requires informal consultation with NOAA Fisheries or USFWS (or both); informal consultation results in a Letter of Concurrence from NOAA Fisheries or USFWS.

May affect, likely to adversely affect is the appropriate conclusion if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. A determination of '*likely to adversely affect*' requires formal consultation under section 7 of the ESA; formal consultation results in a Biological Opinion from NOAA Fisheries or USFWS.

Background

An ESA effects analysis must consider both the direct and indirect effects of the action. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur. Few HUD actions occur within designated critical habitat, where direct injury or harm to ESA-listed species or critical habitat is easy to discern. But many HUD actions increase the area of the built environment, and thereby release post-construction runoff to the off-site environment. The indirect effects of post-construction runoff on the aquatic environment are the primary interaction between HUD actions and ESA-listed species and habitats.

One important indirect effect of post-construction runoff occurs when sediment and chemicals like oil, pesticides, and heavy metals accumulate on the built environment where they can be picked up by rainwater and transported into wetlands, lakes, and streams. Once there, those pollutants cause harm when they enter the food chain or otherwise degrade aquatic habitats. Other indirect effects occur when the built environment interrupts the natural cycle of rainwater infiltration into soil by diverting large volumes of post-construction runoff into drainage systems that quickly discharge into the nearest water body, where the effluent can cause erosion or downstream flooding that also harms ESA-listed species and habitats.

This guidance is based on the use of LID practices and principles that are simple, flexible, and economical to use, even in redevelopment situations. LID is highly effective for controlling stormwater impacts. Examples include use of permeable pavers, rain gardens, soil amendments, and tree retention to retain or recreate natural landscape features, reduce impervious cover, and increase on-site detention and infiltration.

Working Towards Recovery

The ESA requires all federal agencies to use their authorities to help conserve listed species. Therefore, as HUD-designated responsible entities, you are encouraged to minimize the effects of your actions on listed species, designated critical habitat and habitat identified in endangered species recovery plans. For your activities, you are especially encouraged to minimize your action's contribution to water quality degradation from point and non-point discharges, and water quantity alteration due to increased impervious surfaces.

DISCLAIMER: This document is intended as a tool to help grantees and HUD staff complete NEPA requirements. This document is subject to change. This is not a policy statement, and the Endangered Species Act and associated regulations take precedence over any information found in this document.

Questions concerning environmental requirements related to HUD programs can be addressed to Deborah Peavler-Stewart (206) 220-5414 or Sara Jensen (206) 220-5226.

Procedure for Section 7 Determination

You may use the guidance below to document compliance with the Endangered Species Act.

Part A: Consultation with NOAA Fisheries Service

Step 1: Obtain Species List & Determine Critical Habitat

For NOAA Fisheries species and designated or proposed critical habitat go to:
http://www.westcoast.fisheries.noaa.gov/maps_data/endangered_species_act_critical_habitat.html

http://www.nwr.noaa.gov/maps_data/species_population_boundaries.html

With a few exceptions on the Oregon Coast, most watersheds in the land area affected by ESA-listings of salmon and steelhead are within or upstream of a watershed occupied by an ESA-listed species or habitat.[1] NOAA Fisheries considers projects that discharge post-construction stormwater to be in proximity with ESA-listed species or habitats that occur downstream of the discharge site.

However, detailed distribution maps are available from recovery planning and implementation documents and the Salmon Population Summary (SPS) Database.[2] If you need to confirm whether your action is in proximity to ESA-listed salmon or steelhead, contact the appropriate office for NOAA Fisheries.[3]

Step 2: Determine Effect

Question 1: Would the project effects overlap with federally listed or proposed species and designated or proposed critical habitat covered by NOAA Fisheries?

Note that project effects include those that extend beyond the project site itself, such as noise, water quality, stormwater discharge, visual disturbance; habitat assessment must include consideration for feeding, spawning, rearing, overwintering sites, and migratory corridors.

☐ **NO, the project and all effects are outside the range of listed species and critical habitat covered by NOAA Fisheries.**
  - ☐ Record your determination of *No Effect* on species or habitats covered by NOAA Fisheries.
  - ☐ Maintain documentation in your Environmental Review Record. For example, a map showing that your project is not in or upstream of a watershed of a listed species.
  - ☐ Section 7 Consultation with USFWS may still be necessary. CONTINUE TO Part B.

☒ **YES, project effects may overlap with ESA-listed species or designated critical habitat covered by NOAA Fisheries**.

  - ☒ Continue to Question 2.

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[1] http://www.westcoast.fisheries.noaa.gov/publications/protected_species/salmon_steelhead/status_of_esa_salmon_listings_and_ch_designations_map.pdf

[2] https://www.webapps.nwfsc.noaa.gov/apex/f?p=261:1:1530350968904#

[3] http://www.westcoast.fisheries.noaa.gov/about_us/our_locations.html

Question 2: Is the project activity listed in Table A (see next page) and does it meet all of the required parameters?

☐ **YES, the activity is listed in Table A and meets all of the required parameters.** Therefore, the project will have *No Effect* on ESA-listed species and/or designated critical habitat.

- ☐ Record your determination of *No Effect* and maintain this documentation, including a species list and map of your project location, in your Environmental Review Record.
- ☐ Attach a statement to your determination explaining how your project meets the required parameters in Table A.
- ☐ Section 7 Consultation with USFWS may still be necessary. CONTINUE TO Part B.

☒ **NO, the project description does not match a project description in Table A and all of the specified parameters**.

- ☒ Continue to Question 3.

Question 3: Do you have some other basis for a *No Effect* determination, for example a biological assessment or other documentation from a qualified professional?

☐ **YES, the project has professional documentation for *No Effect* determination.**

- ☐ Record your determination of *No Effect* and maintain this documentation, including a species list and map of your project location, in your Environmental Review Record.
- ☐ Attach the biological assessment or other professional documentation.
- ☐ Section 7 Consultation with USFWS may still be necessary. CONTINUE TO Part B.

☒ **NO, the project does not have professional documentation supporting a *No Effect* determination.**

- ☒ <u>YOU MUST INITIATE SECTION 7 CONSULTATION WITH NOAA Fisheries</u>. Contact information on Page 8.
- ☒ Consultation with USFWS may also be necessary. CONTINUE TO PART B.

TABLE A.

Potential “*No Effect*” Activity	Required Parameters
Purchase building	• No change to existing structures
Landscape repair, including adding sprinkler systems	• Does not remove trees or streamside vegetation
Interior rehabilitation	• For existing structures • Waste materials are recycled or otherwise disposed of in an EPA approved sanitary or hazardous waste disposal site
Any exterior repair or improvement that will not increase post-construction runoff, e.g. • Replace exterior paint or siding • Build a fence • Replace/repair roof without using bituminous waterproofing • Replace/repair a roof or siding without using galvanized metal • Reconstruct/repair existing curbs, sidewalks or other concrete structures • Repair existing parking lots (pot holes, repainting lines, etc.)	• Does not increase amount of impervious surface • Waste materials are recycled or otherwise disposed of in an EPA approved sanitary or hazardous waste disposal site
Special projects directed to the removal of material or architectural barriers that restrict the mobility of and accessibility to elderly and persons with disabilities, e.g. • Curb cuts • Wheelchair ramps	Meets <u>all</u> of the following: • Will not impact an area of natural habitat, a wetland, or riparian area; and • Complies with all state and local building codes and stormwater regulations
Install LID practices	• For existing structures
New construction or addition on previously developed site (for example a building over an existing parking lot)	Meets <u>all</u> of the following • not increase amount of impervious surface • Waste materials are recycled or otherwise disposed of in an EPA approved sanitary or hazardous waste disposal site • Stormwater meets NOAA Fisheries standards. [4]
Project that will add new impervious surface that will increase post-construction runoff, including new construction.	Meets <u>all</u> of the following: • All post-construction runoff will be completely infiltrated or used on-site; and • Will not impact an area of natural habitat, a wetland, or riparian area; and • Complies with all state and local building codes and stormwater regulations

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[4] Refer to HUD Programmatic Opinion or contact NOAA Fisheries.

Part B: Consultation with U.S. Fish and Wildlife Service

Step 1: Obtain Species List & Determine Critical Habitat

You must obtain a species list for the entire action area of your project. The action area encompasses all of the effects of the project, not just those that occur within the construction footprint. Note that project effects include those that extend beyond the project site itself, such as noise, air pollution, water quality, stormwater discharge, visual disturbance; effects to habitat must be considered, including the project's effects on roosting, feeding, nesting, spawning and rearing habitat, overwintering sites, and migratory corridors.

Go to http://ecos.fws.gov/ipac/ for a list of species by project area. Please note that this list includes listed, proposed *and* candidate species; consideration of project effects on candidate species is optional, unless effects are very large (contact the local USFWS field office in this case). However, candidate species may become listed as endangered or threatened species during the period of construction. If you have questions, contact the appropriate USFWS field office[5] to discuss the species list for your area.

Step 2: Determine Effect

Question 1: Would the project effects overlap with federally-listed or proposed species or designated or proposed critical habitat covered by USFWS?

Consider all effects of the project within the action area. The action area encompasses all the effects of the project, including those that occur beyond the boundaries of the property (such as noise, air pollution, water quality, stormwater discharge, visual disturbance)

☐ **NO, the project and all effects are outside the range of listed or proposed species and designated critical habitat covered by USFWS**. Therefore, the project will have *No Effect* on ESA-listed or proposed species or designated critical habitat.

- ☐ Record your determination of *No Effect* on species or habitats covered by USFWS, and maintain this documentation in your Environmental Review Record.
- ☐ Attach a statement explaining how you determined that your project's effects do not overlap with species or habitat covered by USFWS.

☒ **YES, project effects may overlap with ESA-listed or proposed species or designated critical habitat covered by USFWS**. Therefore, your project could affect species and habitat.

- ☒ Continue to Question 2.

Question 2: Will the project occur on a previously developed site?

☐ **YES, the project will have *No Effect* on ESA-listed species or designated critical habitat.**

- ☐ Record your determination of *No Effect* on species or habitats covered by USFWS, and maintain this documentation in your Environmental Review Record.

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[5] http://www.fws.gov/oregonfwo/Administration/ContactUs/

- ☐ Attach a statement explaining how you determined that your project's effects do not impact species or habitat covered by USFWS.

☒ **NO.**

- ☒ Continue to Question 3.

Question 3: Is the project activity listed in Table A and does it meet all of the required parameters?

☐ **YES, the activity is listed in Table A and meets all of the required parameters.** Therefore, the project will have *No Effect* on ESA-listed species and/or designated critical habitat.

- ☐ Record your determination of *No Effect* and maintain this documentation, including the official species list and map of your project location, in your Environmental Review Record.
- ☐ Attach a statement to your determination explaining how your project met the required parameters in Table A.

☒ **NO, the project description does not match a project description in Table A and all of the specified parameters**.

- ☒ Continue to Question 4.

Question 4: Do you have some other basis for a *No Effect* determination, for example a biological assessment or other documentation from a qualified professional?

☐ **YES, the project has professional documentation for *No Effect* determination.**

- ☐ Record your determination of *No Effect* and maintain this documentation, including the official species list and map of your project location, in your Environmental Review Record.
- ☐ Attach the biological assessment or other professional documentation.

☒ **NO, the project does not have professional documentation for a *No Effect* determination and *may affect* a listed species.**

- ☒ The project *may affect* listed or proposed species, or designated or proposed critical habitat. Consultation with the USFWS may be required. CONTACT THE USFWS TO DETERMINE THE APPROPRIATE EFFECTS DETERMINATION AND LEVEL OF CONSULTATION REQUIRED. Contact information on Page 9.

Initiating Section 7 Consultation

If the effects of the action are insignificant, discountable, or entirely beneficial, it is *not likely to adversely affect* listed or proposed species or designated critical habitats, and the section 7 consultation for the project may remain informal and relatively simple. A *May Affect, Not Likely to Adversely Affect* determination is the most common outcome of consultation for HUD-funded projects with USFWS.

However, if the effects of the action on listed or proposed species and/or critical habitat are not discountable, insignificant, or entirely beneficial, (i.e., *likely to adversely affect*), formal consultation must be initiated. In such cases, a formal consultation must be initiated prior to committing resources to the project, by which the USFWS and/or NOAA Fisheries assess the action's potential to jeopardize the listed species, to result in the destruction or adverse modification of critical habitat, or to result in incidental take of a listed species. Formal consultation will result in the USFWS and/or NOAA Fisheries issuing a Biological Opinion for the project, including an incidental take statement for project actions, if appropriate. The Biological Opinion will also include non-discretionary terms and conditions to further minimize and/or avoid project impacts to ESA-listed species. Because the constituents of stormwater runoff are particularly harmful to aquatic species, a *May Affect, Likely to Adversely Affect* determination is the most common outcome of consultation for HUD-funded projects with NOAA Fisheries.

At any stage in making your determination, you may wish to contact the appropriate USFWS and NOAA Fisheries field offices for technical assistance. Contact information is available at:

NOAA Fisheries Service
Portland Regional Office
1201 Northeast Lyon Blvd, Suite 1100
Portland, OR 97232
503-230-5400
http://www.westcoast.fisheries.noaa.gov/index.html

U.S. Fish and Wildlife Service
Oregon Fish and Wildlife Office
2600 SE 98th Ave, Suite 100
Portland, OR 97266
503-231-6179
http://www.fws.gov/oregonfwo/

For projects located in the Klamath River Basin, you must contact NOAA's Northern California Office at:

NOAA Fisheries Service
Arcata Office
1655 Heindon Road
Arcata, CA 95521
707-825-5171

For a map of the Klamath River Basin, please visit:
http://www.westcoast.fisheries.noaa.gov/publications/gis_maps/maps/salmon_steelhead/esa/chinook/web_pdfs_uktr_chinook.pdf

Links to Section 7 Handbook and additional Section 7 resources:

- **Section 7 Handbook: http://www.nmfs.noaa.gov/pr/pdfs/laws/esa_section7_handbook.pdf**
- **Overview of the Section 7 Process: http://www.fws.gov/Midwest/endangered/section7/index.html**

Additional Resources for LID

- American Rivers, 2012, Banking on Green Report: Economic Benefits of Green Infrastructure Practices
- Clean Water Services, 2009, Low Impact Development Approaches (LIDA) Handbook
- ECONorthwest, 2009, LID at the Local Level - Developers' Experiences and City and County Support
- EPA, 2005, Low Impact Development for Big Box Retailers
- Herrera, 2013, Guidance Document: Western Washington LID Operation and Maintenance
- NCHRP, 2006, Evaluation of BMPs for Highway Runoff Control – LID Design Manual
- Prince George County, Maryland, 1999, Low-Impact Development Design Strategies
- Puget Sound Partnership, 2012, Low Impact Development: Technical Guidance Manual for Puget Sound
- US EPA, 2013, Stormwater to Street Trees: Engineering Urban Forests for Stormwater Management

Appendix D:
Geotechnical Report

Branch
ENGINEERING inc
Since 1977
civil · transportation
structural · geotechnical
SURVEYING

February 10, 2021

Northwest Housing Alternatives
13819 SE McLoughlin Blvd.
Milwaukie, Oregon 97402

RE: GEOTECHNICAL ENGINEERING INVESTIGATION
SHORE PINES HOUSING PROJECT
TAX MAP & LOT NO. 18-12-14-33 00500
FLORENCE, OREGON
BRANCH ENGINEERING INC. PROJECT NO. 19-132

Pursuant to your authorization Branch Engineering Inc. (BEI) performed a geotechnical engineering investigation at the subject site for the proposed development of apartment buildings on the subject site.

On January 7, 2021 six (6) exploratory test pits were advanced, using a rubber-tracked mini-excavator. Test pits were advanced to a maximum depth of 6-feet below ground surface (BGS). The subsurface soil conditions in the test pits were logged in accordance the USCS (Unified Soil Classification System) ASTM D2488. One (1) falling head infiltration test and two (2) portable dynamic cone penetrometer (DCP) field tests were performed. The accompanying report presents the results of our site research, field exploration and testing, data analysis, our conclusions and geotechnical engineering recommendations for the project. The site is suitable for the planned development, provided the recommendations of this report are implemented in the design and construction of the project.

Sincerely,
Branch Engineering Inc.

#16,170
Ronald J. Derrick
SEPT 15, 1992
EXPIRES: 12/31/2021

Ronald J. Derrick
Digitally signed by Ronald J. Derrick
Date: 2021.02.10 14:43:11 -08'00'

Ronald J. Derrick, P.E., G.E.
Principal Geotechnical Engineer

Matt Renner P.E.
Construction Engineer

EUGENE- SPRINGFIELD

310 5th Street, Springfield, OR 97477 | p: 541.746.0637 | www.branchengineering.com

TABLE OF CONTENTS

1.0 INTRODUCTION

The subject site is located in Florence, Oregon at the project coordinates of 44.000523˚ north and 124.100174˚ west. The site consists of one parcel of vacant land, tax lot 500, approximately 2.5-acres in size.

This report presents the results and findings of Branch Engineering, Inc. (BEI) field observations, testing, and research for the subject site. Our investigation included the evaluation of the subsurface conditions at the site to provide geotechnical recommendations for the design and construction of proposed multi-unit residential buildings and site improvements for access and parking.

1.1 Project and Site Description

Our understanding of the project is that two apartment buildings with associated site improvements for parking and utilities is proposed. Based on preliminary site drawings and documents provided to BEI we anticipate that there will approximately 68 total units comprised of 1-bedroom and 3-bedroom apartments. Access to the site will be taken from a driveway connection to Highway 101 on the western site perimeter.

At the time of our visit the site was covered in dense vegetation. Shore pines and spruce trees approximately 10-inches to 24-inches in diameter are present across the site with wax myrtle up to 8-inches in diameter in the understory. Dense understory vegetation includes rhododendrons, salal, and Oregon grape. To access the test pit locations rough pathways were cleared with the mini-excavator, shrubs and small understory trees were removed however an effort was made to insure no significantly sized trees were disturbed. The site topography is relatively flat, and difficult to assess in the field due to the existing vegetation however, an existing conditions survey by BEI indicates the site surface has approximately five-feet of elevation change, sloping slightly downhill from west to east.

The site is bordered by a Presbyterian Church to the north which allowed BEI to stage equipment and access the site for our investigation. Single-family residential development is present to the east of the site and separated from the site by an alley easement running north-south. A 42-inch diameter storm line flowing north to south is present in the easement. The southern property line is bordered by a residential property and Highway 101 runs north-south along the western boundary of the site. Areas of active sand dunes are present approximately 0.5-miles from the site to the northwest and the east southeast with infill development bordering Highway 101 which runs north-south in between the dune areas. The nearest water bodies are ponds within the Sandpines Golf Course approximately 0.4-miles west of the site and ponds adjacent to dunes approximately 0.4 miles southeast of the site. Munsel Lake is located approximately 0.5-miles to the northeast of the site.

1.2 Scope of Work

Our scope of work included a site reconnaissance and subsurface investigation on January 7, 2021. Six (6) exploratory test pits were advanced at the locations shown on the attached Figure-1 Site Exploration Map with the observed soil stratigraphy classified in accordance with the American Society of Testing and Materials (ASTM) Method D-2488.

A portable dynamic cone penetrometer (DCP) which consists of graduated steel rods driven into the soil by dropping a 35-lb slide hammer a vertical distance of 18-inches was used to assess the consistency of the site soil at select locations. Infiltration testing was performed at one location shown on the attached Figure-1. Shallow groundwater presence impacted planned additional tests.

Field log summaries of the site exploratory test pits, including field test results, are presented in Appendix A. Also included in Appendix A are copies of nearby well logs from the Oregon Department of Water Resources on-line database, and the soil survey mapping of the site.

1.3 Site Information Resources

The following site investigation activities were performed and literature resources were reviewed for pertinent site information:

- Review of the United States Department of the Interior Geological Survey (USGS) 2017 Mercer Lake, Oregon Quadrangle Map and the 2017 Florence, OR Quadrangle Map.
- Six (6) exploratory test pits were advanced to a maximum depth of 6-feet below ground surface (BGS) were performed on the site at the approximate locations shown on Figure-1. A single falling head infiltration test was performed at the location shown on Figure-1.
- Review of the Lane County area Web Soil Survey, United States Department of Agricultural (USDA) Natural Resources Conservation Service (NRCS), see Appendix A.
- Review of the USGS Geologic Map of Oregon, (USGS 1991, Walker & MacLeod).
- Review of Oregon Department of Water Resources Well Logs from nearby locations, see Appendix A.
- State of Oregon, Department of Geology and Mining Industries (DOGAMI) website, Statewide Geohazards Viewer (HazVu), http://www.oregongeology.org/hazvu/

2.0 SITE SUBSURFACE CONDITIONS

The analyses, conclusions and recommendations contained in this report are based on site conditions as they presently exist and assume the exploratory test pit excavations, presented in Appendix A, are representative of the subsurface conditions throughout the site. If, during construction, subsurface conditions differ from those encountered in the exploratory test pits; BEI requests that we be informed to review the site conditions and adjust our recommendations, if necessary.

2.1 Site Soils

The NRCS Web Soil Survey maps one soil unit across the majority of the site area, Yaquina loamy fine sand with Waldport fine sand, 0 to 12 percent slopes mapped along the western site boundary.

Both soil units are described as eolian sands of mixed origins, the Yaquina loamy sand is described as somewhat poorly drained fine sand found in dune slacks with the Waldport fine sand described as excessively drained.

In the exploratory test pits, we observed a relatively consistent soil profile across the site. Beneath a topsoil zone consisting of roots, organic litter, dark brown silt and sand, light brown, moist, medium dense, fine grain sand was observed. The depth of the topsoil zone ranged from approximately 8-inches to 12-inches BGS. The consistency of the sand changes from medium dense to loose at approximately 2-feet to 3.5-feet, or as groundwater was encountered. Blow counts recorded during DCP indicated a medium dense consistency of the soil in the upper 2.5-feet to 3.5-feet of the soil profile. As the excavation depths increased below approximately 4-feet BGS sidewall caving was frequently observed. The presence of ground water seepage likely exacerbated the caving once the depths of the excavations encountered groundwater seepage.

2.2 Ground Water

Ground water was observed in all of the exploratory test pits. The water was initially observed as sidewall seepage at depths ranging from 24-inches to 40-inches BGS. As excavations were advanced the seepage volume steadily increased and static water filled the excavations.

We expect that ground water levels, from the regional water table, will fluctuate with the seasons and should be expected to be highest during the late winter and spring months when rainstorms are more intense and frequent, and soils are near saturation. The database of well logs from the Oregon Water Resources Department was researched in the site vicinity. No well logs were found at, or adjacent to the site location however groundwater monitoring well log information from USGS work in 1959-1961 was found recorded in the adjacent 1/4 section of land, approximately 0.25 miles east of the site. The well logs indicated static water levels were recorded at approximately 8-feet BGS. Records attached to the well logs indicate the ground water levels were recorded periodically over a two-year period and seasonally fluctuated approximately 5-feet in depth.

Our site investigation followed periods of significant precipitation and the groundwater levels recorded are interpreted to be near the peak seasonal levels. Recommendations to prevent groundwater from being encountered in building pad excavations are presented in Section 5 below, however groundwater seepage should be expected in excavations exceeding 24-inches below the existing ground surface during the wet season. Dewatering measures for utility installation should be expected if construction during the wet season occurs and trench depths exceed 24-inches to 36-inches BGS and may be required for building pad excavations should the excavations encounter seepage.

The presence of ground water is not expected to adversely impact the proposed development, provided the recommendations of this report are implemented in the design and construction of the project. Dewatering measures may be required depending on the seasonal groundwater depth at the time of construction and the required depth of excavations per the project design.

3.0 GEOLOGIC SETTING

The 1991 Geologic map of Oregon by Walker and MacLeod maps the site geology as lacustrine and fluvial sedimentary rocks which is described as unconsolidated to semi consolidated lacustrine clay, silt, sand, and gravel. Areas of dune sand are mapped to the west, and east of the site. Review of the well logs drilled nearby the site to the east show sand logged to the maximum depth of the well at 81-feet with two 6-inch-thick layers of peat logged at 27-feet and 52.5-feet BGS.

The subject site is located near the northern extent of the longest coastal strip of dunes on the Oregon Coast. The dunes in the area were likely formed post ice-age during the Holocene epoch by eolian processes associated with the activity of wind. The typical pattern seen in the area is transverse dunes (running parallel to the ocean) caused by the varying on, and off shore winds. The subject site is underlain by Holocene-aged sedimentary deposits of unconsolidated to poorly consolidated fine-grained sands.

The site is located on the Oregon Coast, the entire Oregon Coast is located near the Cascadia Subduction Zone (CSZ), which is a zone of converging tectonic plates that historically produces major earthquake events. The DOGAMI HazVu website shows the subject site is expected to experience severe shaking in the event of a Cascadia Subduction Zone earthquake, and very strong shaking for lesser earthquakes, with a high hazard for earthquake-initiated soil liquefaction. A depiction of the historical Subduction Zone earthquake events is shown below.

Occurrence and Relative Size of Cascadia Subduction Zone Megathrust Earthquakes

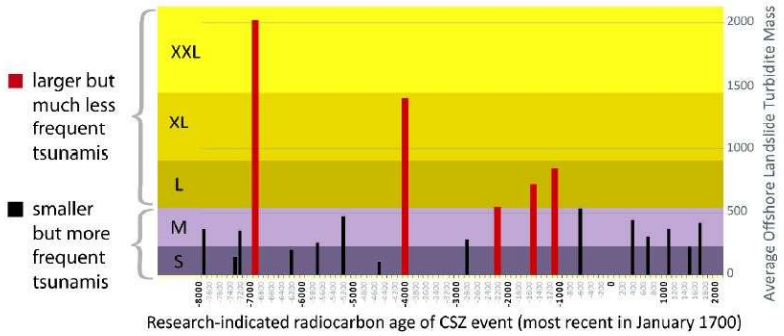


Figure 3: This chart depicts the timing, frequency, and magnitude of the last 19 great Cascadia Subduction Zone events over the past 10,000 years. The most recent event occurred on January 26, 1700. The 1700 event is considered to be a "medium sized" event. The data used to create this chart came from research that examined the many submarine landslides, known as "turbidites," that are triggered only by these great earthquakes (Witter and others, 2011). The loose correlation is "the bigger the turbidite, the bigger the earthquake."

3.1 Seismic Site Classification

Based on the soil properties encountered in our site pits and near-site well log information, Site Class D (Table 20.1-1 ASCE 7) is recommended for foundation bearing on the medium dense sand encountered in the test pits in the upper 18-inches of the soil profile, or engineered fill placed on the medium dense sand. If foundations are to be located below 18-inches of the existing ground surface Site Class E should be used for design based on the loose sand and groundwater underlying the upper soils. We do not recommend that foundations be placed below 24-inches BGS where the shallowest groundwater seepage was observed. Pursuant to the 2019 Oregon Structural Specialty Code the following potential geologic and seismic hazards are addressed.

- Slope Instability: The site topography is relatively flat, with no observable or mapped slopes present on the site or in a location that may impact the site. Our review of the online Department of Geologic and Mining Industries (DOGAMI) hazard viewer maps the risk of landslide hazard as low, the nearest mapped landslide is approximately 0.9-miles to the east of the site. The risk of landslides impacting the site is low.

- Liquefaction: The site soil consists of sand and the susceptibility to liquefaction and settlement exists if saturated at the time of a seismic event. The DOGAMI hazard viewer categorizes the risk of liquefaction on the site during seismic events as high. This is consistent with the high groundwater conditions we observed during our investigation however, we recognize that the mapped high risk of liquefaction extends beyond the site and surrounding area to include the majority of the City of Florence's Urban Growth Boundary (UGB). The existing risk of liquefaction is present for residential structures located in the greater area of the site and our recommendations in Section 5 of this report are intended to mitigate those risks to maximum extent practical by densification of the existing soil and raising site grades with engineered fill.

- Fault Rupture: There are no known active faults on the site, with mapped faults approximately 7.5-miles southwest and 8-miles east of the site and numerous fault zones mapped off the coastline. Only the off-shore faults are considered active based on a 1995 report by Geomatrix Consultants report. The risk of surface rupture is low.

- Lateral Spreading: Lateral spreading is a condition where underlying soils liquefy, thereby losing shear strength, and upper deposits migrate laterally, generally in a down slope direction. One of the conditions for lateral spread to occur is an abrupt change in topography that presents an unconfined surface for material to move in that direction. The existing site topography is flat and presently the risk of lateral spreading is low. If changes to the site surface elevations are made during site grading work the recommendations in this report are intended to mitigate the risk of lateral spreading.

- Tsunami: The risk of a large tsunami impacting the Oregon coast in the event of CSZ earthquake is high. The site is mapped as being outside the tsunami inundation line; however, this level is only an estimate and erosion of lower ground may cause instability of ground at higher elevations. The risk of tsunami impact to the site is estimated to be moderate.

4.0 CONCLUSIONS

Based on our field observations, subsurface explorations, and data analyses, we conclude that the site is geologic and geotechnically suitable for the proposed development provided that the recommendations of this report are incorporated into the design and construction of the project. Our investigation did reveal the presence of groundwater at relatively shallow depth and recommendations to mitigate the potential impact to the proposed development from the groundwater are presented in the following sections of this report. We conclude that no further geotechnical analysis is required on the subject site for the proposed site improvements.

5.0 RECOMMENDATIONS

The following sections present site-specific recommendations and design parameters for site preparation, drainage, foundations, utility excavations, and slab/pavement design. General material and construction specifications for the items discussed herein are provided in Appendix B.

The subsurface conditions observed in our site investigation are consistent; however, our field explorations only represent a very small portion of the site. Should loose or unsuitable soils extend to a depth greater than that described herein, or areas of distinct soil variation be discovered, this office shall be notified to perform site observation and additional excavation may be required.

5.1 Site Preparation, Grading, and Foundation Subgrade Requirements

The following recommendations are for earthwork in the building foundation areas, roadways, and parking areas. Earthwork shall be performed in general accordance with the standard of practice as described in Appendix J of the 2019 Oregon Structural Specialty Code and as specified in this report.

All areas intended to directly or laterally support structures or pavement areas shall be stripped of vegetation, organic soil, unsuitable fill, and/or other deleterious material. These stripping's shall be removed from the site or reserved for use in landscaping or non-structural areas. The depth to subgrade is expected to be approximately 12-inches BGS unless deeper due to tree removal. Once subgrade is exposed, expected to be medium dense sand, the recommended subgrade preparation is as follows:

Foundation Subgrade Preparation
In areas of foundation footings, organic topsoil and loose sand shall be removed to consistently medium dense sand either for the placement of foundation forms or structural fill. Upon excavation to suitable subgrade, expected at approximately 12-inches BGS, the subgrade shall be wetted and rolled with a vibratory smooth drum roller until no visual settlement of the subgrade is detected. Conventional strip and spread footings may be used for the foundation system of the proposed structure.

We recommend that the subgrade be covered with a minimum of 4-inches of compacted aggregate to mitigate wind and water erosion. After construction of footings, the perimeter of the footings shall be protected from erosion to mitigate undermining of footings. If structural fill is used to raise subgrade elevations, the fill shall conform to the recommendations in Sections 5.2 below.

Pavement Subgrade Preparation
In areas of pavement for vehicle access or parking, we recommend that the existing vegetation, topsoil, and areas of loose soil be removed to consistent subgrade material as described above. The expected depth of excavation to the subgrade material described above is approximately 12-inches. Upon excavation to suitable subgrade, the subgrade shall be wetted and rolled with a vibratory smooth drum roller until no additional visual settlement of the subgrade is detected. Fill placed to raise pavement subgrade elevations shall be placed on suitable subgrade, and conform to the recommendations below.

We recommend that a minimum of 6-inches of compacted aggregate be placed on the subgrade in light vehicle pavement areas. Heavy construction traffic will require additional aggregate thickness, a minimum of 12-inches, to mitigate rutting of the subgrade.

During subgrade excavation in foundation and pavement areas we recommend the Geotechnical Engineer of Record, or designated representative visit the site to observe the subgrade material prior to placement of structural fill or aggregate.

Site Grading

During our site investigation on January 7, 2021, we observed a seasonally high ground water table. During the site development design, it may be advantageous to raise the site surface elevations for ensuring the foundation footings are kept above the levels of the observed groundwater seepage. Raising site elevations may also be useful for stormwater drainage design and treatment. The medium dense sand underlying the existing topsoil zone is a suitable base for the placement of fill provided any areas of loose sand are compacted prior to fill placement. Locally available, clean fine grain sand is suitable for use as engineered fill provided the recommendations in Section 5.2 below are incorporated into the fill placement.

Fill slopes constructed from sand shall have a maximum slope angle of 3:1 (H:V) and shall extend horizontally outward from foundations per the setbacks described below in Section 5.5. If fill slopes are constructed from compacted aggregate, a maximum slope of 2:1 is acceptable. Sand material placed as fill shall be protected from erosion by covering the sand with compacted aggregate 4-inches in thickness, establishing vegetation on the slopes, or other means.

5.2 Engineered Fill Recommendations

All engineered fill placed on the site shall consist of homogenous material and shall meet the following recommendations. Clean, native sand is suitable for use as structural fill material.

- Areas of structural fill placement shall be stripped of organic material, loose soil, and subgrade approved by the Geotechnical Engineer prior to the placement of fill materials. Sloped areas in excess of 20% shall be properly keyed and benched horizontally into competent material as the fill height progresses. Proof-rolling or hand-probing of the subgrade may be required to assess competence.

- Prior to placement, fill material shall be approved by the Geotechnical Engineer. Acceptable fill shall be free of organics or other deleterious materials. The sand present on the site and site vicinity is acceptable for use as engineered fill upon removal of any organic material.

- The fill shall be moisture conditioned within +/-3% of optimum moisture content and compacted in lifts with loose lift thickness not exceeding 8- inches with appropriate equipment for the fill material.

- Periodic visits to the site to verify lift thickness, source material, and compaction efforts shall be conducted by the Geotechnical Engineer or designated representative and documented.

- The recommended compaction level for engineered fill is 90% of ASHTO T-180/ASTM 1557-D (modified Proctor) unless otherwise specified. Compaction shall be measured by testing with nuclear densometer ASTM D-6938, or D-1556 sand cone method. If compaction testing by nuclear densometer is not possible due to the nature of the approved fill material, proof rolling with a fully loaded 10 CY dump truck observed by the Geotechnical Engineer or designated representative shall be conducted.

5.3 Lateral Earth Pressures and Friction Coefficient

We are not aware of any retaining wall structures proposed are part of the site development, the following equivalent fluid pressure parameters may be used for design of site retaining structures that are free draining with no hydrostatic pressures.

Table-1 Lateral Earth Pressures

Material	Passive Earth Pressure (Kp)[1]	Active Earth Pressure (Ka)	At-Rest Earth Pressure (Ko)[2]
Sand (Level Backfill)	325 pcf	30 pcf	45 pcf
Sand (2:1 Backfill Slope)	325 pcf	40 pcf	55 pcf

1 – Neglect upper foot of material unless covered by foundation footing or pavement.
2 – For walls restrained at the top from movement
For seismic design increase earth pressure by 0.7 of the peak ground acceleration (PGA) and apply at 0.4H above the base of the wall, where H is the wall height.

The coefficient of friction for concrete poured neat against undisturbed or compacted sand subgrade is 0.4, a coefficient of 0.5 may be used for concrete poured on a minimum of 12-inches of compacted aggregate.

5.4 Drainage and Infiltration Testing

An on-site storm drainage system is expected to be engineered for this project. Alteration of existing grades for this project will likely change drainage patterns but should not adversely affect adjacent properties. We recommend that areas of structural fill be evaluated to ensure proper drainage away from structures is maintained. Accumulation of drainage near structural fills may result in saturation and softening of material. Final perimeter landscape grades shall slope away from the foundation and surface water shall not be allowed to pond adjacent to foundations.

As part of our site investigation a falling head infiltration test was performed at the location shown on the attached Figure-1. Additional infiltration tests were planned at depths of 3-feet to 4-feet BGS however groundwater seepage which led to static water in the excavations was encountered. The infiltration test that was performed was at a depth of approximately 28-inches BGS, above the depth where groundwater seepage was encountered in the adjacent test pit excavation. The infiltration test results are attached in Appendix A with the average infiltration rates exceeding 60-inches per hour.

5.5 Soil Bearing Capacity

Based on our site observations and review of proposed building plans, conventional spread footings are suitable for the proposed site development provided the building pad area preparation is in conformance with the recommendations described above in Section 5.1.

The allowable bearing capacity for foundation elements placed on compacted sand subgrade or prepared structural fill is 2,000 psf. The allowable bearing capacity may be increased by 1/3 for short-term loading such as wind and seismic. Additionally, structural fill should extend laterally, from all foundation edges, a minimum distance or 2-feet or within a 1:1 plane from at least 1-foot outside the edge of footing. Perimeter landscape grades shall be sloped away from all foundations and water should not be allowed to pond within 10-feet of footings.

The following recommendations shall be implemented in the design and construction of the project. Periodic site observations by a geotechnical representative of Branch Engineering, Inc. are recommended during the construction of the project. The specific phases of construction that should be observed are:

Table 2:

Recommended Construction Phases to be Observed by the Geotechnical Engineer	
Phase	*Observation*
At completion of street excavation	Subgrade observation by the geotechnical engineer before fabric and aggregate placement.
Imported fill material	Observation of material or information on material type and source.
Placement or compaction of fill material	Observation by geotechnical engineer or test results by qualified testing agency.

5.6 Settlement

The maximum building foundation loads are estimated to be 1.5 kip/linear foot for wall loads and/or 3 kips for column loads. Site-specific consolidation testing was not performed; however, based on soil observations and test results in similar soil conditions, the estimated total settlement at the site is not expected to exceed 0.75-inches with a differential settlement up to 0.5-inches over a span of 20 feet. The settlement estimates are based on the building load effects and area expected to occur over a short-term, generally by the time construction is completed.

These settlement estimates do not account for seismic induced settlement, which may be as much as 2+ inches, but is expected to be relatively uniform across a building footprint. Foundations should be placed a minimum distance from each other to prevent overlapping of stress distributions defined as a 1:1 (H:V) slope projection from all foundation edges to a minimum depth of two (2) times the foundation width of the largest footing.

5.7 Slabs-On-Grade

After site preparation to expose suitable subgrade prepared in accordance with Section 5.1, load bearing concrete slabs shall be underlain by a compacted sand subgrade or leveling course of compacted, crushed aggregate, if necessary. A modulus of subgrade reaction of 150 pci may be used for design of slabs on approved native subgrade material or structural fill. Non-load bearing slabs or pavements do not require geotechnical design criteria; however, BEI recommends a stable subgrade to mitigate un-controlled cracks.

The edges of slabs shall be protected from erosion and undermining of the slab; a vapor barrier system shall be selected by the project architect and may be dependent on slab cover materials.

5.8 Pavement Design Recommendations

Our recommendations for any parking or driveway improvements used a CBR of 8 and the guidance of the 1993 AASHTO Guide for Design of Pavement Structures and 2003 revised Asphalt Pavement Design Guide, published by the Asphalt Pavement Association of Oregon.

For new AC pavement installation in parking areas and light vehicle routes, we recommend a minimum pavement thickness of 3-inches of AC over a minimum of 6-inches of compacted base rock. We recommend that the AC thickness be increased to 4-inches in areas of heavier traffic, such as refuse truck routes or delivery vehicles.

Prior to placement of base rock any soft soil, wet soil, or organic soil shall be removed from the pavement subgrade. The geotechnical engineer of record, or designated representative should visit the site to approve the subgrade soil prior to the placement of the base rock. Proof rolls with a loaded 10 CY haul truck shall be observed on the compacted base rock prior to pavement installation and any areas of deflection under wheel loads shall be corrected by over-excavation replacing subgrade material with additional compacted aggregate.

The base rock shall be compacted to at least 90% relative compaction as determined by ASTM 1557/AASHTO T-180 (modified Proctor). The base rock shall be tested to measure compliance with this compaction standard prior to placement of asphalt concrete.

The above recommended structural pavement sections are designed for the type of vehicle use on the site after construction completion, not for construction vehicle traffic which is generally heavier, occurs over a short time, and impacts the site before full pavement sections are constructed. The construction traffic may cause subgrade failures and the site contractor should consider over-building designated haul routes through the site to mitigate soft areas at the time of final paving.

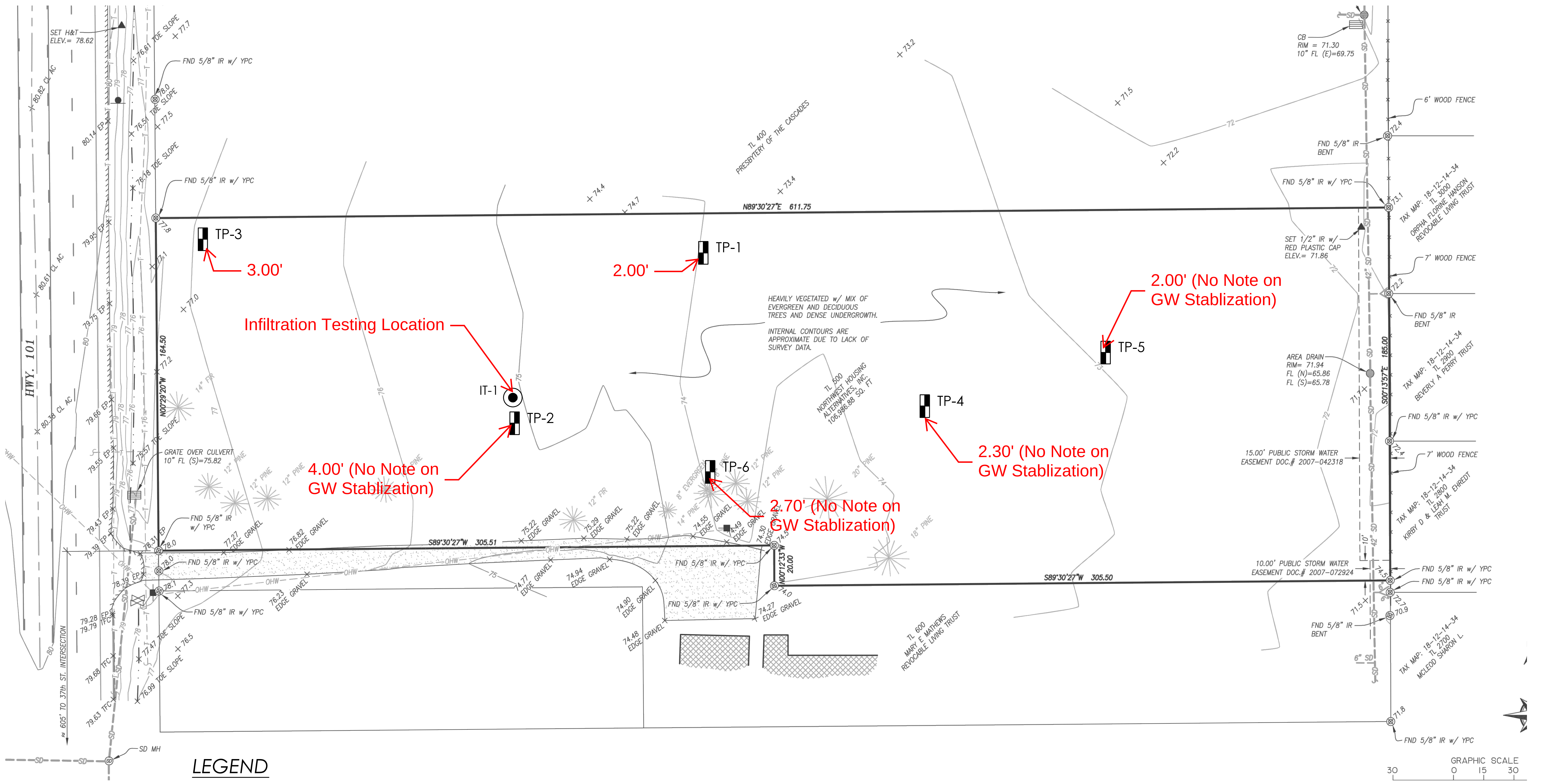
5.9 Wet Weather/Dry Weather Construction Practices

The site material is sand to depths over 50-feet and is relatively free-draining. Precipitation will not adversely impact site earthwork; however, perched water during the wet season may impact site trenching activities and cause “pumping” of the subgrade with repeated heavy vehicle traffic. Dewatering and/or shoring of excavation sidewalls is expected to be required for excavations exceeding 3-feet BGS of the existing ground surface. Construction traffic routes should have a minimum of 12-inches of aggregate, with preferably 3-inch minus angular aggregate in the lower 8-inches of the temporary road section to mitigate subgrade degradation during wet weather conditions. Final design pavement sections and foundation subgrade recommendations do not account for repeated heavy truck traffic associated with construction.

6.0 REPORT LIMITATIONS

This report has presented BEI's site observations and research, subsurface explorations, geotechnical engineering analyses, and recommendations for the proposed site development. The conclusions in this report are based on the conditions described in this report and are intended for the exclusive use of Northwest Housing Alternatives and their representatives for use in design and construction of the development described herein. The analysis and recommendations may not be suitable for other structures or purposes.

Services performed by the geotechnical engineer for this project have been conducted with the level of care and skill exercised by other current geotechnical professionals in this area. No warranty is herein expressed or implied. The conclusions in this report are based on the site conditions as they currently exist and it is assumed that the limited site locations that were physically investigated generally represent the subsurface conditions at the site. Should site development or site conditions change, or if a substantial amount of time goes by between our site investigation and site development, we reserve the right to review this report for its applicability. If you have any questions regarding the contents of this report please contact our office.



LEGEND

TP-4	INDICATES APPROXIMATE LOCATION OF EXPLORATORY TEST PIT
IT-1 ●	INDICATES APPROXIMATE LOCATION OF INFILTRATION TEST

Branch ENGINEERING Inc
Since 1977

SCALE: 1:50 (11X17)

SITE EXPLORATION MAP - NORTHWEST HOUSING ALTERNATIVES - SHORE PINES HOUSING PROJECT

TAX MAP AND LOT NO. 18-12-14-33 00500 FLORENCE, OREGON

FIGURE-1

JANUARY 7, 2021

PROJECT NO. 19-132-01

310 5th STREET, SPRINGFIELD, OREGON 97477

APPENDIX A

Test Pit Log Summaries, Infiltration Test Results, NRCS Soil Survey, and Well Logs

RELATIVE DENSITY - COARSE GRAINED SOILS

RELATIVE DENSITY	SPT N-VALUE	D&M SAMPLER (140 lbs hammer)	D&M SAMPLER (300 lbs hammer)
VERY LOOSE	< 4	< 11	< 4
LOOSE	4 - 10	11 - 26	4 - 10
MEDIUM DENSE	10 - 30	26 - 74	10 - 30
DENSE	30 - 50	74 - 120	30 - 47
VERY DENSE	> 50	> 120	> 47

USCS GRAIN SIZE

FINES		< #200 (.075 mm)
SAND	Fine	#200 - #40 (.425 mm)
	Medium	#40 - #10 (2 mm)
	Coarse	#10 - #4 (4.75 mm)
GRAVEL	Fine	#4 - 0.75 inch
	Coarse	0.75 - 3 inch
COBBLES		3 - 12 inches

CONSISTENCY - FINE GRAINED SOILS

CONSISTENCY	SPT N-VALUE	D&M SAMPLER (140 lbs hammer)	D&M SAMPLER (300 lbs hammer)	POCKET PEN. / UNCONFINED (TSF)	MANUAL PENETRATION TEST
VERY SOFT	< 2	< 3	< 2	< 0.25	Easy several inches by fist
SOFT	2 - 4	3 - 6	2 - 5	0.25 - 0.50	Easy several inches by thumb
MEDIUM STIFF	4 - 8	6 - 12	5 - 9	0.50 - 1.00	Moderate several inches by thumb
STIFF	8 - 15	12 - 25	9 - 19	1.00 - 2.00	Readily indented by thumb
VERY STIFF	15 - 30	25 - 65	19 - 31	2.00 - 4.00	Readily indented by thumbnail
HARD	> 30	> 65	> 31	> 4.00	Difficult by thumbnail

UNIFIED SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			GROUP SYMBOLS AND TYPICAL NAMES	
COARSE-GRAINED SOILS: More than 50% retained on No. 200 sieve	GRAVELS: 50% or more *retained* on the No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS: 50% or more *passing* the No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines.
			SP	Poorly-graded sands and gravelly sands, little or no fines.
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS: Less than 50% retained on No. 200 sieve	SILT AND CLAY	LIQUID LIMIT LESS THAN 50	ML	Inorganic silts, rock flour, clayey silts.
			CL	Inorganic clays of low to medium plasticity, lean clays.
			OL	Organic silt and organic silty clays of low plasticity.
		LIQUID LIMIT 50 OR GREATER	MH	Inorganic silts, clayey silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS			PT	Peat, muck, and other highly organic soil.

MOISTURE CONTENT

DRY: Absence of moisture, dusty, dry to the touch
DAMP: Some moisture but leaves no moisture on hand
MOIST: Leaves moisture on hand
WET: Visble free water, usually saturated

	PLASTICITY	DRY STRENGTH	DILATANCY	TOUGHNESS
ML	Non to Low	Non to Low	Slow to Rapid	Low, can't roll
CL	Low to Med.	Med. to High	None to Slow	Medium
MH	Med. to High	Low to Med.	None to Slow	Low to Med.
CH	Med. to High	High to V.High	None	High

STRUCTURE

STRATIFIED: Alternating layers of material or color > 6mm thick.
LAMINATED: Alternating layers < 6mm thick.
FISSURED: Breaks along definate fracture planes.
SLICKENSIDED: Striated, polished, or glossy fracture planes.
BLOCKY: Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
LENSES: Has small pockets of different soils, note thickness.
HOMOGENEOUS: Same color and appearance throughout.

LIST OF ABBREVIATION & EXPLANATIONS

SPT	Standard Penetration Test split barrel sampler
D&M	Dames and Moore sampler
LL	Atterberg Liquid Limit
PL	Atterberg Plastic Limit
PP	Pocket Penetrometer
VS	Vane Shear
G	Grab sample
MC	Moisture Content
MD	Moisture Density
UC	Unconfined Compressive Strength
DCP	Dynamic Cone Penetrometer

TABLE A-1

Branch ENGINEERING inc
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GEOTECHNICAL INVESTIGATION

EXPLORATORY KEY

Borehole ID: TP-1

Sheet 1 of 1

Client: Northwest Housing Alternatives
Project Name: Shore Pines Housing Project
Project Number: 19-132-01
Project Location: Tax Map and Lot No. 18-12-14-33 00500
Date Started: Jan 07 2021 **Completed:** Jan 07 2021
Logged By: MWR **Checked By:** RJD
Drilling Contractor:
Latitude: 44.000523 **Longitude:** -124.100174 **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
▽ At time of drilling 3.00 on Jan 07 2021
Hammer Type: 35 lb Slide Hammer
▼ After drilling 2.00 on Jan 07 2021
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content 10 20 30 40 50 60 70 80 90
		Topsoil Zone: Dark Brown silt and organics with Sand					
1		(SP) Light brown, moist, medium dense fine grain Sand with oxidation staining and fine roots, strong seepage at 36" with static water level measured at 24" after approx. 2 hours					
2	▼						
3	▽						
4		(SP) Light brown, moist, loose fine grain sand with fine roots					
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DYNAMIC CONE LOG

PROJECT NUMBER: 19-132
DATE STARTED: 01-07-2021
DATE COMPLETED: 01-07-2021

HOLE #: TP-1
CREW: MWR
PROJECT: Northwest Housing Alternatives
ADDRESS: Tax Lot 500
LOCATION: Florence, Oregon

SURFACE ELEVATION: N/A
WATER ON COMPLETION: Yes
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE	N'	TESTED CONSISTENCY	
			0 50 100 150		NON-COHESIVE	COHESIVE
-						
-						
- 1 ft						
-						
-	9	40.0	•••••••••••	11	MEDIUM DENSE	STIFF
- 2 ft	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
-	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
-	12	53.3	•••••••••••••••	15	MEDIUM DENSE	STIFF
- 3 ft						
- 1 m						
-						
- 4 ft						
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Borehole ID: TP-2

Sheet 1 of 1

Client: Northwest Housing Alternatives
Project Name: Shore Pines Housing Project
Project Number: 19-132-01
Project Location: Tax Map and Lot No. 18-12-14-33 00500
Date Started: Jan 07 2021 **Completed:** Jan 07 2021
Logged By: MWR **Checked By:** RJD
Drilling Contractor:
Latitude: 44.000523 **Longitude:** -124.100174 **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
▽ At time of drilling 4.00 on Jan 07 2021
Hammer Type: 35 lb Slide Hammer
▼
Notes:
▽

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content 10 20 30 40 50 60 70 80 90
		Topsoil Zone: Dark Brown silt and organics with Sand					
1 2		(SP) Light brown, moist, medium dense fine grain Sand with oxidation staining and fine roots					
3 4 5 6	▽	(SP) Light brown, moist, loose fine grain sand with seepage first observed at 48" increasing with depth					
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30							

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ENGINEERING inc
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civil · transportation
structural · geotechnical
SURVEYING

DYNAMIC CONE LOG

PROJECT NUMBER: 19-132
DATE STARTED: 01-07-2021
DATE COMPLETED: 01-07-2021

HOLE #: TP-2
CREW: MWR
PROJECT: Northwest Housing Alternatives
ADDRESS: Tax Lot 500
LOCATION: Florence, Oregon

SURFACE ELEVATION: N/A
WATER ON COMPLETION: No
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-						
-						
- 1 ft						
-						
-	25	111.0	••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 2 ft	20	88.8	•••••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
-	13	57.7	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	16	71.0	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
- 3 ft	12	53.3	•••••••••••••••	15	MEDIUM DENSE	STIFF
- 1 m	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
-						
- 4 ft						
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Borehole ID: TP-3

Sheet 1 of 1

Client: Northwest Housing Alternatives
Project Name: Shore Pines Housing Project
Project Number: 19-132-01
Project Location: Tax Map and Lot No. 18-12-14-33 00500
Date Started: Jan 07 2021 **Completed:** Jan 07 2021
Logged By: MWR **Checked By:** RJD
Drilling Contractor:
Latitude: 44.000523 **Longitude:** -124.100174 **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
▽ At time of drilling 3.40 on Jan 07 2021
Hammer Type:
▼ After drilling 3.00 on Jan 07 2021
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content
		Topsoil Zone: Dark Brown silt and organics with Sand					
1		(SP) Tan, moist, dense fine grain Sand					
2							
3	▼ ▽	(SP) Light brown, moist, medium dense fine grain Sand, seepage first observed at 44" and measured at 36" after approx. 2 hours					
4							
5							
6							
7							
8							
9							
10							
11							
12							
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24							
25							
26							
27							
28							
29							
30							

10 20 30 40 50 60 70 80 90

Borehole ID: TP-4

Sheet 1 of 1

Client: Northwest Housing Alternatives
Project Name: Shore Pines Housing Project
Project Number: 19-132-01
Project Location: Tax Map and Lot No. 18-12-14-33 00500
Date Started: Jan 07 2021 **Completed:** Jan 07 2021
Logged By: MWR **Checked By:** RJD
Drilling Contractor:
Latitude: 44.000523 **Longitude:** -124.100174 **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
▽ At time of drilling 2.30 on Jan 07 2021
Hammer Type:
▼
Notes:
◩

Depth	**Graphic**	**Material Description**	**Sample**	**Recovery % RQD**	**Blow Counts (N Value)**	**Pocket Pen. (tsf)**	**SPT N-Value PL MC LL Fines Content** 10 20 30 40 50 60 70 80 90
		Topsoil Zone: Dark Brown silt and organics with Sand					
1		(SP) Light brown, moist, medium dense fine grain Sand with scattered fine roots					
2	▽						
3		(SP) Light brown, moist, medium dense fine grain Sand, caving excavation walls at 48" seepage first observed at 28"					
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
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25							
26							
27							
28							
29							
30							10 20 30 40 50 60 70 80 90

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Borehole ID: TP-5

Sheet 1 of 1

Client: Northwest Housing Alternatives
Project Name: Shore Pines Housing Project
Project Number: 19-132-01
Project Location: Tax Map and Lot No. 18-12-14-33 00500
Date Started: Jan 07 2021 **Completed:** Jan 07 2021
Logged By: MWR **Checked By:** RJD
Drilling Contractor:
Latitude: 44.000523 **Longitude:** -124.100174 **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
▽ At time of drilling 2.00 on Jan 07 2021
Hammer Type:
▼
Notes:
▼

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content
0–1		Topsoil Zone: Dark Brown silt and organics with Sand, glass jars partially buried					
1–2.3	▽	(SP) Light brown, moist, medium dense to loose fine grain Sand with roots					
2.3–6		(SP) Light brown, wet, loose fine grain Sand, caving at 48" seepage first observed at 24"					

Depth scale: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

SPT chart scale: 10 20 30 40 50 60 70 80 90

Borehole ID: TP-6

Sheet 1 of 1

Client: Northwest Housing Alternatives
Project Name: Shore Pines Housing Project
Project Number: 19-132-01
Project Location: Tax Map and Lot No. 18-12-14-33 00500
Date Started: Jan 07 2021 **Completed:** Jan 07 2021
Logged By: MWR **Checked By:** RJD
Drilling Contractor:
Latitude: 44.000523 **Longitude:** -124.100174 **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
▽ At time of drilling 2.70 on Jan 07 2021
Hammer Type:
▼
Notes:
▽

Depth	**Graphic**	**Material Description**	**Sample**	**Recovery % RQD**	**Blow Counts (N Value)**	**Pocket Pen. (tsf)**	**SPT N-Value PL MC LL Fines Content** 10 20 30 40 50 60 70 80 90
		Topsoil Zone: Dark Brown silt and organics with Sand					
1		(SP) Grey, loose fine grain sand with organics					
2		(SP) Light brown, moist to wet, medium dense fine grain Sand, seepage first observed at 32"					
3		▽					
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
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20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

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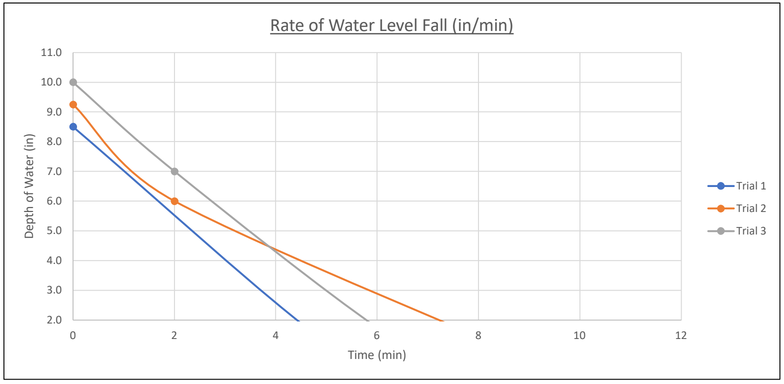
Infiltration Test Results

Project: NW Housing Alternatives - Shore Pines
Testing Date: 01/07/2021
BEI Project Number: 19-132
Test Type: Encased Falling Head Infiltration
Time = 0 at addition of H2O

Infiltration Test 1 Trial 1			**Elapsed Time (min)**	**Depth to Water Surface (in)**	**Depth of Water (in)**	**Rate of Fall (in/min)**	**Rate of Fall (in/hr)**	**Avg Rate of Fall T-1 (in/hr)**
Standpipe Diameter (in)	6		0	39.5	8.5			
Standpipe Height AGS (in)	20		5	46.8	1.3	1.45	87.0	
Test Depth BGS (in)	28		7	48.0	0.0	0.63	37.5	62.3
Volume of Water Added (gal)	1							
Clocktime at Start	12:30							
ASTM Soil Type	(SP)							
Infiltration Test 1 Trial 2			**Elapsed Time (min)**	**Depth to Water Surface (in)**	**Depth of Water (in)**	**Rate of Fall (in/min)**	**Rate of Fall (in/hr)**	**Avg Rate of Fall T-2 (in/hr)**
Volume of Water Added (gal)	1.1		0	38.8	9.3			
Clocktime	12:37		2	42.0	6.0	1.63	97.5	
			10	48.0	0.0	0.75	45.0	
								71.3
Infiltration Test 1 Trial 3			**Elapsed Time (min)**	**Depth to Water Surface (in)**	**Depth of Water (in)**	**Rate of Fall (in/min)**	**Rate of Fall (in/hr)**	**Avg Rate of Fall T-3 (in/hr)**
Volume of Water Added (gal)	1		0	38.0	10.0			
Clocktime	12:48		2	41.0	7.0	1.50	90.0	
			6	46.3	1.8	1.31	78.8	
			8	48.0	0.0	0.88	52.5	
								73.8



Soil Map—Lane County Area, Oregon

Map Scale: 1:1,340 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- □ Area of Interest (AOI)

Soils

- □ Soil Map Unit Polygons
- Soil Map Unit Lines
- ■ Soil Map Unit Points

Special Point Features

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lane County Area, Oregon
Survey Area Data: Version 17, Jun 11, 2020

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

Date(s) aerial images were photographed: May 23, 2020—May 28, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
131C	Waldport fine sand, 0 to 12 percent slopes	1.0	11.1%
140	Yaquina loamy fine sand	8.0	88.9%
Totals for Area of Interest		**9.0**	**100.0%**

Lane County Area, Oregon

131C—Waldport fine sand, 0 to 12 percent slopes

Map Unit Setting

National map unit symbol: 234r
Elevation: 0 to 150 feet
Mean annual precipitation: 60 to 100 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 165 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Waldport and similar soils: 85 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Waldport

Setting

Landform: Dunes
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sand of mixed origin

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oe - 1 to 3 inches: moderately decomposed plant material
H1 - 3 to 8 inches: fine sand
H2 - 8 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Yaquina

Percent of map unit: 4 percent

Landform: Marine terraces
Hydric soil rating: Yes

Heceta

Percent of map unit: 4 percent
Landform: Interdunes
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Lane County Area, Oregon
Survey Area Data: Version 17, Jun 11, 2020

Lane County Area, Oregon

140—Yaquina loamy fine sand

Map Unit Setting

National map unit symbol: 2359
Elevation: 20 to 130 feet
Mean annual precipitation: 70 to 80 inches
Mean annual air temperature: 50 to 52 degrees F
Frost-free period: 180 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Yaquina and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Yaquina

Setting

Landform: Dune slacks
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sand of mixed origin

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 9 inches: loamy fine sand
H2 - 9 to 30 inches: fine sand
H3 - 30 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 0 to 24 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Forage suitability group: Somewhat Poorly Drained (G004AY017OR)
Other vegetative classification: Somewhat Poorly Drained (G004AY017OR)

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Lane County Area, Oregon
Survey Area Data: Version 17, Jun 11, 2020

STATE ENGINEER
Salem, Oregon

Well Record

LANE

019226

STATE WELL NO. 18/12-14P(1)
COUNTY Lane
APPLICATION NO.

OWNER: U. S. Geol. Survey

MAILING ADDRESS:

LOCATION OF WELL: Owner's No.

CITY AND STATE:

SE ¼ SW ¼ Sec. 14 T. 18 ~~N.~~ S., R. 12 ~~E.~~ W., W.M.

Bearing and distance from section or subdivision corner

Altitude at well 72

Section 14

TYPE OF WELL: Driven Date Constructed

Depth drilled 15.3 Depth cased 12.8

CASING RECORD:

1¼ inch

FINISH:

Screened 12.8 to 15.3

AQUIFERS:

Dune sand

WATER LEVEL:

8.55 feet below land surface on June 2, 1959

PUMPING EQUIPMENT: Type H.P.
Capacity G.P.M.

WELL TESTS:
Drawdown ft. after hours G.P.M.
Drawdown ft. after hours G.P.M.

USE OF WATER Observation Temp. °F. , 19
SOURCE OF INFORMATION USGS
DRILLER or DIGGER
ADDITIONAL DATA:
Log Water Level Measurements ✓ Chemical Analysis * Aquifer Test

REMARKS:

State Printing 89316

STATE ENGINEER
Salem, Oregon

State Well No. 18/12W-14P(1)
County LANE
Application No.

Water Level Record

OWNER: [redacted] USGS WELL OWNER'S NO.

Description of measuring point: TOP OF 1¼" PIPE AT 74.749 M.S.L.

Date	Water Level Feet ~~(above)~~ (below) Land Surface	Remarks	Date	Water Level Feet ~~(above)~~ (below) Land Surface	Remarks
6-2-59	11.30		4-4-61	9.22	
7-10	12.00		5-17	9.90	
8-7	12.64		8-14	12.52	
9-3	13.09		10-2	13.10	
10-1	12.86		11-29	10.20	
11-7	12.52				
12-10	12.31				
1-7-60	11.13				
2-5	8.40				
3-3	9.75				
4-1	9.41				
5-4	9.13				
6-16	10.79				
7-1	11.37				
10-1	13.11				
12-13	10.28				
1-27-61	10.60				
2-27	8.26				

REMARKS:

State Printing 89314

RECEIVED
DEC 28 1959
STATE ENGINEER
SALEM, OREGON

File Original and
First Copy with the
STATE ENGINEER,
SALEM, OREGON

OBSERVATION WELL

WATER WELL REPORT
STATE OF OREGON

State Well No. 18/12W-14-P4
State Permit No. LANE 019228

(1) OWNER:
Name U.S. Geological Survey G.W.
Address Box 3418 Portland 8
~~1001 N.E. Lloyd Blvd, Port~~

(2) LOCATION OF WELL: Florence
County Lane Owner's number, if any 18/12W-14P3
SE ¼ SW ¼ Section 14 T. 18S R. 12W W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

[illegible] PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☒ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☒
6" Diam. from +1.5 ft. to -44 ft. Gage 18/14/14
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes ☒ No
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed ☑ Yes ☐ No
Manufacturer's Name Edw. E Johnson Co
Type everdur Model No.
Diam. 3½OD Slot size 10 Set from 44 ft. to 59 ft.
[illegible]m. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.
Was a surface seal provided? ☐ Yes ☐ No To what depth? ft.
Material used in seal—
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 8 ft. below land surface Date 18 Dec 59
Artesian pressure lbs. per square inch Date

Log Accepted by:
[Signed] E R Hampton (Owner) Date Dec 21, 1959
for U.S. Geol Survey

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? U.S.G.S.
Yield: 50 gal./min. with 8 ft. drawdown after 3 hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG:
Diameter of well 6 inches.
Depth drilled 81 ft. Depth of completed well 59 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Sand, dune	0	27
Peat	27	27½
Sand, dune	27½	52½
Peat	52½	53
Sand, dune	53	81
Note: locations of peat layers, and their thicknesses estimated in part.		

Work started 14 Dec 1959 Completed 18 Dec 1959

(13) PUMP:
Manufacturer's Name
Type: H.P.

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME CHARLES E. PANSCHOW
(Person, firm, or corporation) (Type or print)
Address RTE 1, BOX 192, FLORENCE, ORE
Driller's well number 120
[Signed] Charles Panschow (Well Driller)
License No. 87 Date Dec 24, 1959

(USE ADDITIONAL SHEETS IF NECESSARY)

STATE ENGINEER
Salem, Oregon

State Well No. 18/12-14P4
County Lane
Application No.

Well Log

Owner: U. S. Geological Survey
Owner's No.

Driller: C. E. Panschow
Date Drilled 1959

CHARACTER OF MATERIAL	(Feet below land surface)		Thickness (feet)
	From	To	
Deposits of Quaternary age:			
Sand, dune, fine-grained, gray	0	27	27
Peat, dark-brown, and wood	27	27½	½
Sand, dune, fine-grained, gray	27½	52½	25
Peat, dark-brown, and wood	52½	53	½
Sand, dune	53	81	28

STATE ENGINEER
Salem, Oregon

State Well No. 18/12W-14P(4)
County LANE
Application No.

Water Level Record

OWNER: U.S.G.S. OWNER'S NO.

Description of measuring point: TOP OF 6" CASING, W-SIDE

Date	Water Level Feet ~~(above)~~ (below) Land Surface	Remarks	Date	Water Level Feet (above) (below) Land Surface	Remarks
12-6-61	7.60				
1-2-62	7.07				

REMARKS:

State Printing 89314

APPENDIX B:

Recommended Earthwork Specifications

GEOTECHNICAL SPECIFICATIONS

General Earthwork

1. All areas where structural fills, fill slopes, structures, or roadways are to be constructed shall be stripped of organic topsoil and cleared of surface and subsurface deleterious material, including but limited to vegetation, roots, or other organic material, undocumented fill, construction debris, soft or unsuitable soils as directed by the Geotechnical Engineer of Record. These materials shall be removed from the site or stockpiled in a designated location for reuse in landscape areas if suitable for that purpose. Existing utilities and structures that are not to be used as part of the project design or by neighboring facilities, shall be removed or properly abandoned, and the associated debris removed from the site.
2. Upon completion of site stripping and clearing, the exposed soil and/or rock shall be observed by the Geotechnical Engineer of Record or a designated representative to assess the subgrade condition for the intended overlying use. Pits, depressions, or holes created by the removal of root wads, utilities, structures, or deleterious material shall be properly cleared of loose material, benched and backfilled with fill material approved by the Geotechnical Engineer of Record compacted to the project specifications.
3. In structural fill areas, the subgrade soil shall be scarified to a depth of 4-inches, if soil fill is used, moisture conditioned to within 2% of the materials optimum moisture for compaction, and blended with the first lift of fill material. The fill placement and compaction equipment shall be appropriate for fill material type, required degree of blending, and uncompacted lift thickness. Assuming proper equipment selection, the total uncompacted thickness of the scarified subgrade and first fill lift shall not exceed 8-inches, subsequent lifts of uncompacted fill shall not exceed 8-inches unless otherwise approved by the Geotechnical Engineer of Record. The uncompacted lift thickness shall be assessed based on the type of compaction equipment used and the results of initial compaction testing. Fine-grain soil fill is generally most effectively compacted using a kneading style compactor, such as a sheeps-foot roller; granular materials are more effectively compacted using a smooth, vibratory roller or impact style compactor.
4. All structural soil fill shall be well blended, moisture conditioned to within 2% of the material’s optimum moisture content for compaction and compacted to at least 90% of the material’s maximum dry density as determined by ASTM Method D-1557, or an equivalent method. Soil fill shall not contain more than 10% rock material and no solid material over 3-inches in diameter unless approved by the Geotechnical Engineer of Record. Rocks shall be evenly distributed throughout each lift of fill that they are contained within and shall not be clumped together in such a way that voids can occur.
5. All structural granular fill shall be well blended, moisture conditioned at or up to 3% above of the material’s optimum moisture content for compaction and compacted to at least 90% of the material’s maximum dry density as determined by ASTM Method D-1557, or an equivalent method. 95% relative compaction may be required for pavement base rock or in upper lifts of the granular structural fill where a sufficient thickness of the fill section allows for higher compaction percentages to be achieved. The granular fill shall not contain solid particles over 2-inches in diameter unless special density testing methods or proof-rolling is approved by the Geotechnical Engineer of Record. Granular fill is generally considered to be a crushed aggregate with a fracture surface of at least 70% and a maximum size not exceeding 1.5-inches in diameter, well-graded with less than 10%, by weight, passing the No. 200 Sieve.
6. Structural fill shall be field tested for compliance with project specifications for every 2-feet in vertical rise or 500 cy placed, whichever is less. In-place field density testing shall be performed by a competent individual, trained in the testing and placement of soil and aggregate fill placement, using either ASTM Method D-1556/4959/4944 (Sand Cone), D-6938 (Nuclear Densometer), or D-2937/4959/4944 (Drive Cylinder). Should the fill materials not be suitable for testing by the above methods, then observation of placement, compaction and proof-rolling with a loaded 10 cy dump-truck, or equivalent ground pressure equipment, by a trained individual may be used to assess and document the compliance with structural fill specifications.

Utility Excavations

1. Utility excavations are to be excavated to the design depth for bedding and placement and shall not be over-excavated. Trench widths shall only be of sufficient width to allow placement and proper construction of the utility and backfill of the trench.
2. Backfilling of a utility trench will be dependent on its location, use, depth, and utility line material type. Trenches that are required to meet structural fill specifications, such as those under or near buildings, or within pavement areas, shall have granular material strategically compacted to at least the spring-line of the utility conduit to mitigate pipeline movement and deformation. The initial lift thickness of backfill overlying the pipeline will be dependent on the pipeline material, type of backfill, and the compaction equipment, so as not to cause deflection or deformation of the pipeline. Trench backfill shall conform to the General Earthwork specifications for placement, compaction, and testing of structural fill.

Geotextiles

1. All geotextiles shall be resistant to ultraviolet degradation, and to biological and chemical environments normally found in soils. Geotextiles shall be stored so that they are not in direct sunlight or exposed to chemical products. The use of a geotextile shall be specified and shall meet the following specification for each use.

<u>Subgrade/Aggregate Separation</u>

Woven or nonwoven fabric conforming to the following physical properties:

• Minimum grab tensile strength	ASTM Method D-4632	180 lb
• Minimum puncture strength (CBR)	ASTM Method D-6241	371 lb
• Elongation	ASTM Method D-4632	15%
• Maximum apparent opening size	ASTM Method D-4751	No. 40
• Minimum permittivity	ASTM Method D-4491	0.05 s^{-1}

<u>Drainage Filtration</u>

Woven fabric conforming to the following physical properties:

• Minimum grab tensile strength	ASTM Method D-4632	110 lb
• Minimum puncture strength (CBR)	ASTM Method D-6241	220 lb
• Elongation	ASTM Method D-4632	50%
• Maximum apparent opening size	ASTM Method D-4751	No. 40
• Minimum permittivity	ASTM Method D-4491	0.5 s^{-1}

<u>Geogrid Base Reinforcement</u>

Extruded biaxially or triaxially oriented polypropylene conforming to the following physical properties:

• Peak tensile strength lb/ft	ASTM Method D-6637	925
• Tensile strength at 2% strain lb/ft	ASTM Method D-6637	300
• Tensile strength at 5% strain lb/ft	ASTM Method D-6637	600
• Flexural Rigidity	ASTM Method D-1388	250,000 mg-cm
• Effective Opening Size rock size	ASTM Method D-4751	1.5x

Appendix E:
Model Output and Calculations

Pre-Development Sub-Basin Areas and Runoff Characteristics

Curve Numbers

Cover Type	***CN***	***Notes***
Pavement or Roof	98	Represents to paved parking lots, roofs, driveways, etc (refer to NRCS TR-55 Manual, Table 2-2a, HSG-D)
Gravel Road or Storage	91	Represents gravel parking/storage areas (refer to NRCS TR-55 Manual, Table 2-2a, HSG-D)
Landscape and Lawn Areas	80	Represents Open Space lawns, parks, gold courses, cemeteries, etc. in good condition (Refer to NRCS TR-55 Manual, Table2-2a, HSG-D)
Natural Areas	77	Based on field verification, existing pervious surface consists of predominantly Woods in good condition (refer to NRCS TR55 Manual, Table 2-2c, HSD-D).

Entire Site

Sub-Basin	Sub-Basin Area			Internal Area Characteristics								
				Impervious		Pervious						
			Composite Curve Number	Pavement, Roof, or Inundated Areas		Landscape Areas		Gravel Areas		Natural Areas		Time of Concentration
	ft^2	acre	CN	ft^2	% of Total	ft^2	% of Total	ft^2	% of Total	ft^2	% of Total	Tc
Entire Site	111,502	2.560	77	0	0	0	0	2,946	3	108,556	97	61

Shore Pines Housing Project
Project No. 205-073

August 12, 2021
By: JAH
Page: 1

Post-Development Sub-Basin Areas and Runoff Characteristics

Curve Numbers

Cover Type	***CN***	***Notes***
Pavement or Roof	98	Represents to paved parking lots, roofs, driveways, etc (refer to NRCS TR-55 Manual, Table 2-2a, HSG-D)
Gravel Road or Storage	91	Represents gravel parking/storage areas (refer to NRCS TR-55 Manual, Table 2-2a, HSG-D)
Landscape and Lawn Areas	80	Represents Open Space lawns, parks, gold courses, cemeteries, etc. in good condition (Refer to NRCS TR-55 Manual, Table2-2a, HSG-D)
Natural Areas	77	Based on field verification, existing pervious surface consists of predominantly Woods in good condition (refer to NRCS TR55 Manual, Table 2-2c, HSD-D).

Entire Site

Sub-Basin	Sub-Basin Area			Internal Area Characteristics								
				Impervious		Pervious						
			Composite Curve Number	Pavement, Roof, or Inundated Areas		Landscape Areas		Gravel Areas		Natural Areas		Time of Concentration
	ft^2	acre	CN	ft^2	% of Total	ft^2	% of Total	ft^2	% of Total	ft^2	% of Total	Tc
SB-1	5,790	0.133	93	4,197	72	1,593	28	0	0	0	0	5
SB-2	4,073	0.094	98	4,073	100	0	0	0	0	0	0	5
NB-1	8,947	0.205	92	5,772	65	3,176	35	0	0	0	0	5
NP-1	3,134	0.072	97	2,903	93	231	7	0	0	0	0	5
NB-2	9,840	0.226	97	9,387	95	453	5	0	0	0	0	5
SP-1	33,285	0.764	94	26,319	79	6,966	21	0	0	0	0	5
SP-2	22,475	0.516	94	16,632	74	4,735	21	1,109	5	0	0	5
E-1	19,438	0.446	79	1,541	8	0	0	448	2	17,449	90	5
TOTAL SITE	106,982	2.456	92	70,823	66	17,153	16	1,557	1	17,449	16	5
OFF-1	4,521	0.104	90	760	17	815	18	2,946	65	0	0	5
TOTAL	111,503	2.560	92	71,583	64	17,968	16	4,503	4	17,449	16	5

Northwest Housing Alternatives Inc. - Shore Pines Housing
Project No. 205-073

By: JAH
Checked by: MBA

8/12/2021

Time of Concentration (Tc) Calculations for Surface Flows[1]

Basin	Sheet Flow						Shallow Concentrated Flow					Total	
	Surface Description[1]	Manning's Coefficient[1]	Flow Length[2], L_1 (ft)	2-yr, 24-hr Rainfall[3], P_2 (in)	Slope, s_1 (ft/ft)	Tc_1 (hr)	Flow Length, L_2 (ft)	Slope, s_2 (ft/ft)	Surface Conditions	Average Velocity, V (fps)	Tc_2 (hr)	Tc (hr)	Tc (min)
1	Woods: Light underbrush	0.4	300	3.46	0.014	0.95	309.8	0.007	Unpaved	1.39	0.06	1.02	61
2	Woods: Light underbrush	0.4	120	3.46	0.01	0.53	0	0	Unpaved	-	-	-	32
3	Select from pull-down list	-				-			Select from pull-down list	-	-	-	-
4	Select from pull-down list	-				-			Select from pull-down list	-	-	-	-
5	Select from pull-down list	-				-			Select from pull-down list	-	-	-	-
6	Select from pull-down list	-				-			Select from pull-down list	-	-	-	-
7	Select from pull-down list	-				-			Select from pull-down list	-	-	-	-
8	Select from pull-down list	-				-			Select from pull-down list	-	-	-	-
9	Select from pull-down list	-				-			Select from pull-down list	-	-	-	-
10	Select from pull-down list	-				-			Select from pull-down list	-	-	-	-

Note: Shaded cells require user input

Methodology and Equations:

This spreadsheet is based off of the methods and equations in Chapter 3 of the USDA Urban Hydrology for Small Watersheds TR-55. Refer to this document for a detailed narrative of these procedures.

Tc_1 is calculated using Manning's kinematic solution, where Tc_1=(0.007*(n*L_1)^0.8)/(P_2^0.5*s_1^0.4)

V is calculated from Figure 3-1 of the TR-55, where V=20.3282*s_2^0.5 for "Paved" conditions, and V=16.1345*s_2^0.5 for "Unpaved" conditions

Tc_2 is calculated using Equation 3-1 of the TR-55, where Tc_2=L_2/(3600*V)

Tc is a summation of Tc_1 and Tc_2

Footnotes:

1 These calculations do not address open channel flow

2 Surface descriptions and Manning's Coefficients are from Table 3-1 of the USDA Urban Hydrology for Small Watersheds TR-55
The TR55 notes that after an average of 300', sheet flow becomes shallow concentrated flow. Therefore, the sheet flow equation should not be used for lengths (L_1) in excess of 300'.

3 Rainfall data can be obtained at the following web address: http://www.wrcc.dri.edu/pcpnfreq.html

Project Description

File Name	calc jah 210817 Model.SPF
Description	J:\9700-003-13\Civil\CX5_PIPES\BHE STRM (2013).dwg

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Santa Barbara UH
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Feb 25, 2013	00:00:00
End Analysis On	Feb 26, 2013	06:00:00
Start Reporting On	Feb 25, 2013	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	10
Nodes	10
Junctions	7
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	2
Links	9
Channels	3
Pipes	6
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	WQ-NOAA/DEQ	Cumulative	inches	Oregon	Lane	1	1.73	SCS Type IA 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Impervious Area (%)	Impervious Area Curve Number	Pervious Area Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	E-1	0.45	9.00	98.00	77.00	1.73	0.42	0.19	0.02	0 00:32:00
2	EX_SITE	2.56	3.00	91.00	77.00	1.73	0.33	0.84	0.05	0 01:01:00
3	NB-1	0.21	65.00	98.00	80.00	1.73	1.12	0.23	0.06	0 00:05:00
4	NB-2	0.23	95.00	98.00	80.00	1.73	1.45	0.33	0.08	0 00:05:00
5	NP-1	0.07	93.00	98.00	80.00	1.73	1.43	0.10	0.03	0 00:05:00
6	OFF-1	0.10	82.00	92.00	80.00	1.73	0.89	0.09	0.02	0 00:05:00
7	SB-1	0.13	72.00	98.00	80.00	1.73	1.20	0.16	0.04	0 00:05:00
8	SB-2	0.09	100.00	98.00	80.00	1.73	1.51	0.14	0.04	0 00:05:00
9	SP-1	0.76	79.00	98.00	80.00	1.73	1.28	0.97	0.24	0 00:05:00
10	SP-2	0.52	77.00	98.00	80.00	1.73	1.25	0.65	0.16	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	ORIFICE	Junction	67.30	75.00	67.30	74.00	10000.00	0.00	67.30	0.00	7.71	0 00:00	0.00	0.00
2	OUTFALL_1	Junction	71.67	75.00	71.67	74.00	10000.00	0.42	72.08	0.00	2.92	0 00:00	0.00	0.00
3	SD_CB_1	Junction	72.41	73.56	72.41	73.48	10000.00	0.26	72.63	0.00	0.93	0 00:00	0.00	0.00
4	SD_CB_2	Junction	72.61	76.50	72.61	75.50	10000.00	0.16	72.81	0.00	3.69	0 00:00	0.00	0.00
5	SD_CO_15	Junction	76.21	78.50	76.21	78.00	10000.00	0.05	76.31	0.00	2.19	0 00:00	0.00	0.00
6	SD_CO_6	Junction	71.68	75.00	71.68	74.00	10000.00	0.04	71.95	0.00	3.29	0 00:00	0.00	0.00
7	SD_CO_9	Junction	71.65	75.00	71.65	74.00	10000.00	0.16	71.88	0.00	3.12	0 00:00	0.00	0.00
8	NEW_OUT	Outfall	65.83					0.05	65.83					
9	INFL_RG_1	Storage Node	71.42	75.00	0.00		10000.00	0.63	71.45				0.00	0.00
10	INFL_RG_2	Storage Node	73.94	76.00	0.00		0.00	0.04	74.08				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Reported Condition
1	LINK_01	Pipe	ORIFICE	NEW_OUT	12.00	69.29	69.05	2.0000	10.000	0.0100	0.00	4.03	0.00	0.00	0.00	0.00	0.00	Calculated
2	LINK-12	Pipe	SD_CB_1	OUTFALL_1	222.93	72.23	71.67	0.2500	10.000	0.0100	0.26	1.64	0.16	1.37	0.32	0.38	0.00	Calculated
3	LINK-20	Pipe	SD_CO_6	INFL_RG_1	19.69	71.85	71.75	0.5000	6.000	0.0100	0.04	0.51	0.07	1.43	0.09	0.19	0.00	Calculated
4	LINK-30	Pipe	SD_CO_9	INFL_RG_1	18.32	71.65	71.60	0.3000	8.000	0.0100	0.16	0.86	0.19	1.79	0.21	0.31	0.00	Calculated
5	LINK-31	Pipe	SD_CB_2	SD_CO_9	318.43	72.61	71.65	0.3000	8.000	0.0100	0.16	0.86	0.19	1.73	0.21	0.32	0.00	Calculated
6	LINK-32	Pipe	SD_CO_15	SD_CB_2	218.21	74.35	72.61	0.8000	4.000	0.0100	0.05	0.32	0.17	1.50	0.15	0.44	0.00	Calculated
7	LINK-10	Channel	OUTFALL_1	INFL_RG_1	50.68	71.67	71.52	0.3000	12.000	0.0800	0.42	3.62	0.12	0.58	0.26	0.26	0.00	
8	OVERFLOW_01	Channel	INFL_RG_1	ORIFICE	20.00	72.20	71.81	1.9500	12.000	0.0100	0.00	63.34	0.00	0.00	0.00	0.00	0.00	
9	OVERFLOW_02	Channel	INFL_RG_2	SD_CO_6	20.00	74.44	74.24	1.0000	12.000	0.0100	0.00	45.36	0.00	0.00	0.00	0.00	0.00	

Subbasin Hydrology

Subbasin : E-1

Input Data

Area (ac) 0.45
Impervious Area (%) 9.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 77.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

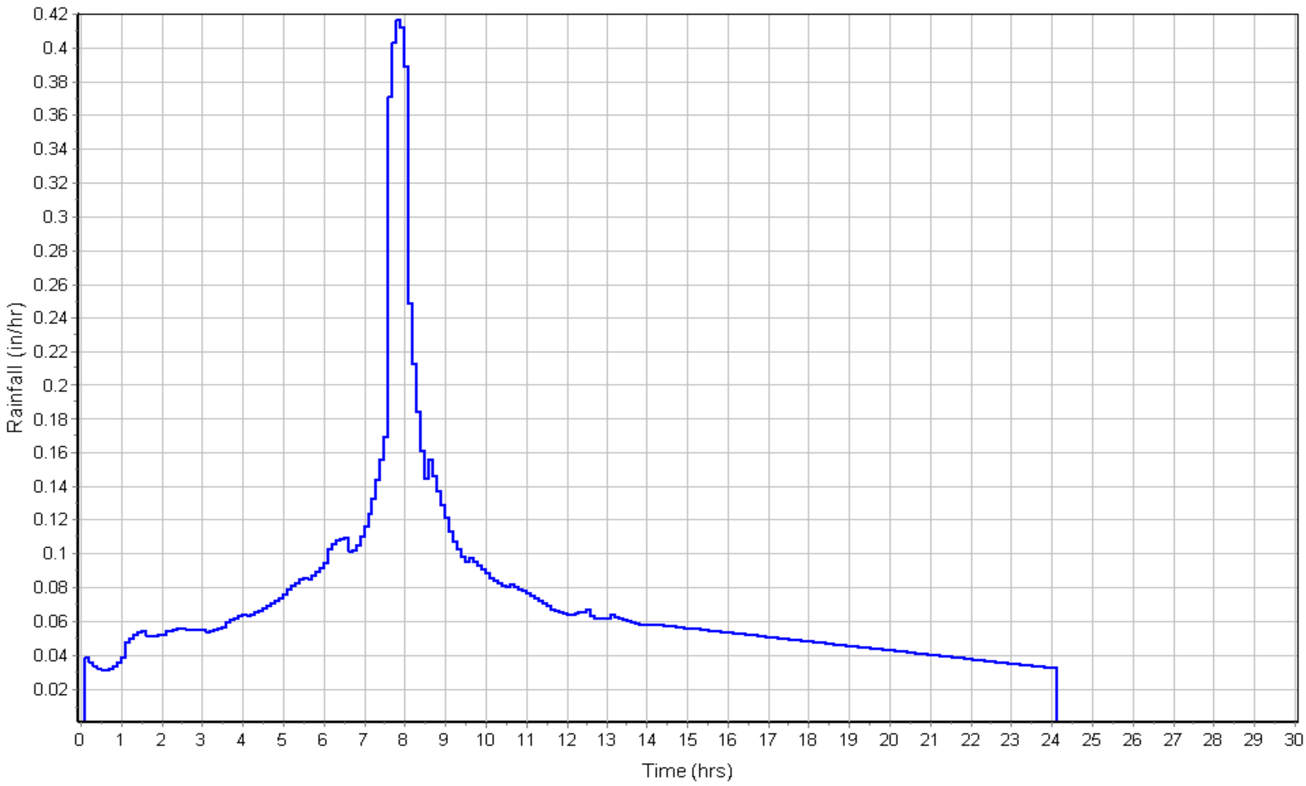
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.45		78.89

Subbasin Runoff Results

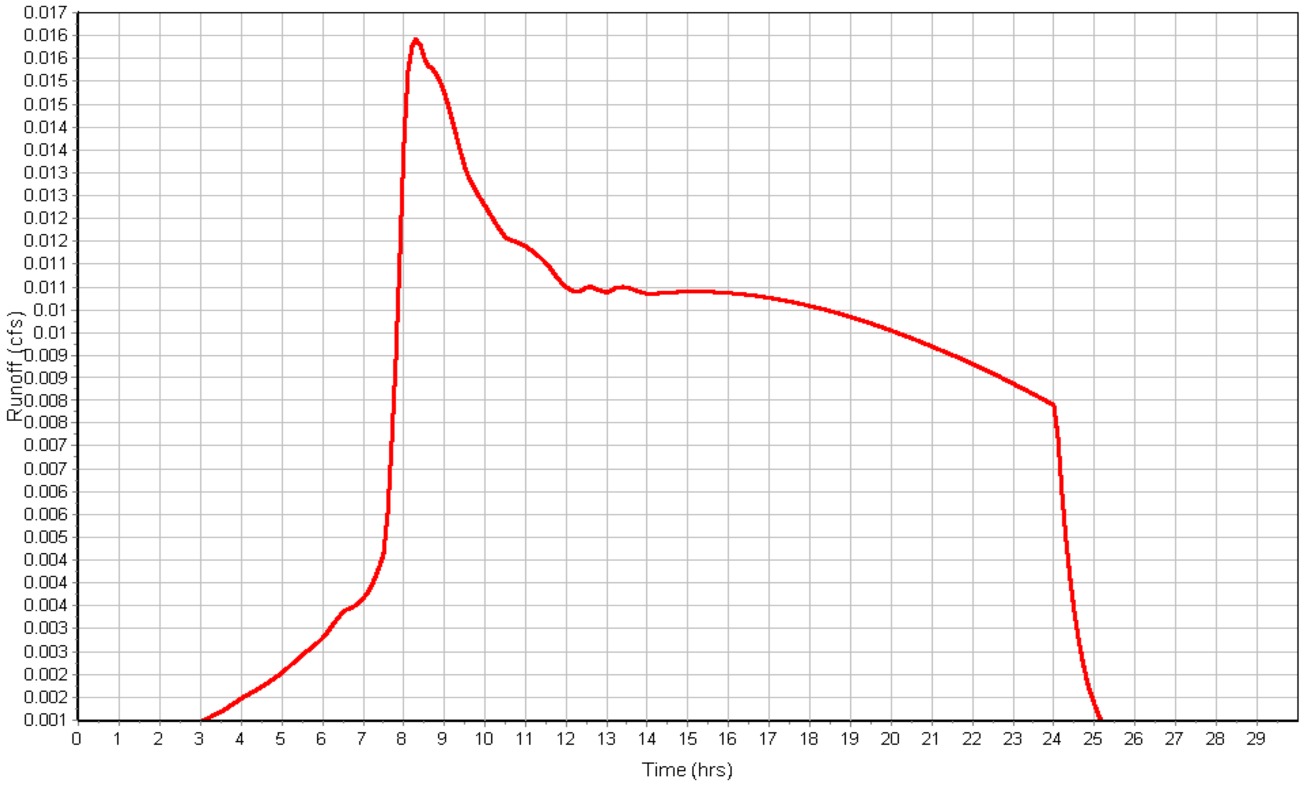
Total Rainfall (in) 1.73
Total Runoff (in) 0.42
Peak Runoff (cfs) 0.02
Weighted Curve Number 78.89
Time of Concentration (days hh:mm:ss) 0 00:32:00

Subbasin : E-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : EX_SITE

Input Data

Area (ac) 2.56
Impervious Area (%) 3.00
Impervious Area Curve Number 91.00
Pervious Area Curve Number 77.00
Rain Gage ID .... Rain Gage-01

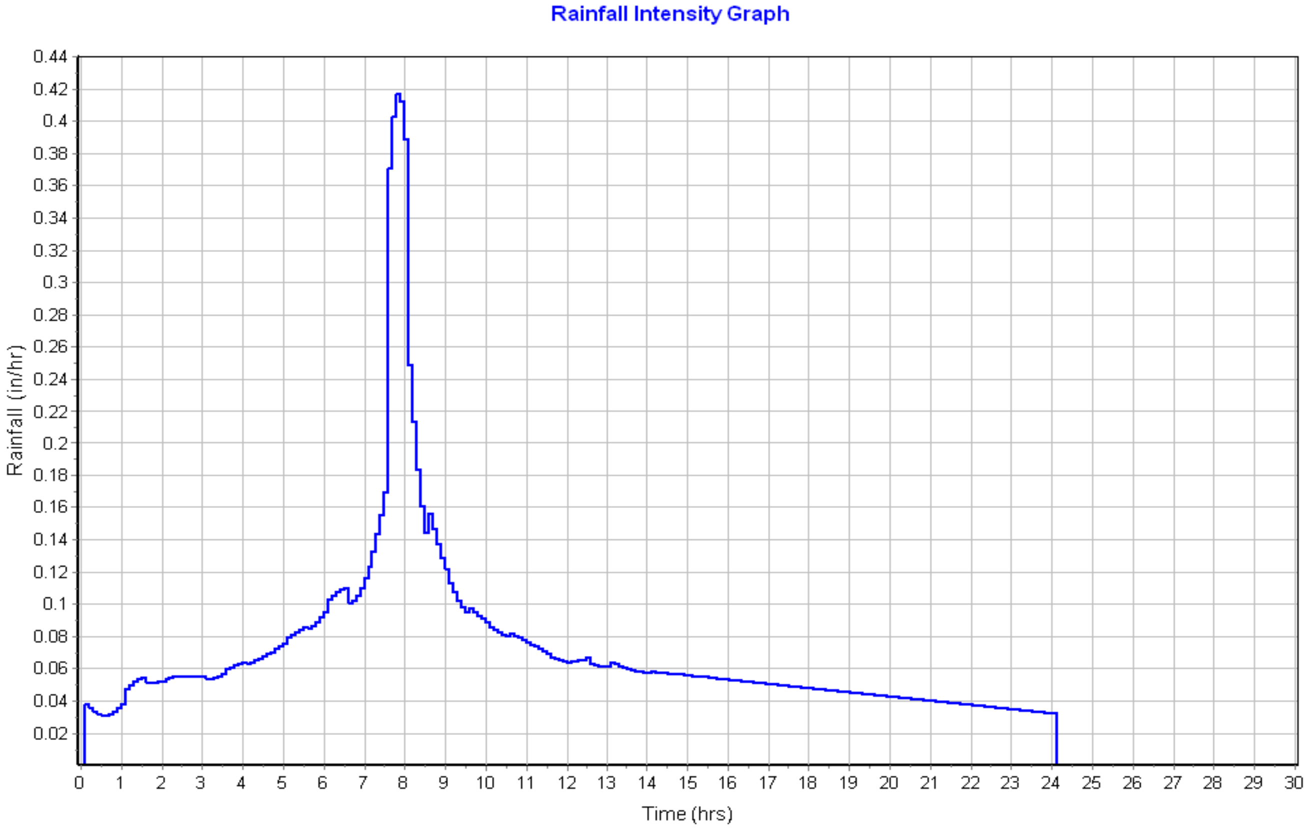
Composite Curve Number

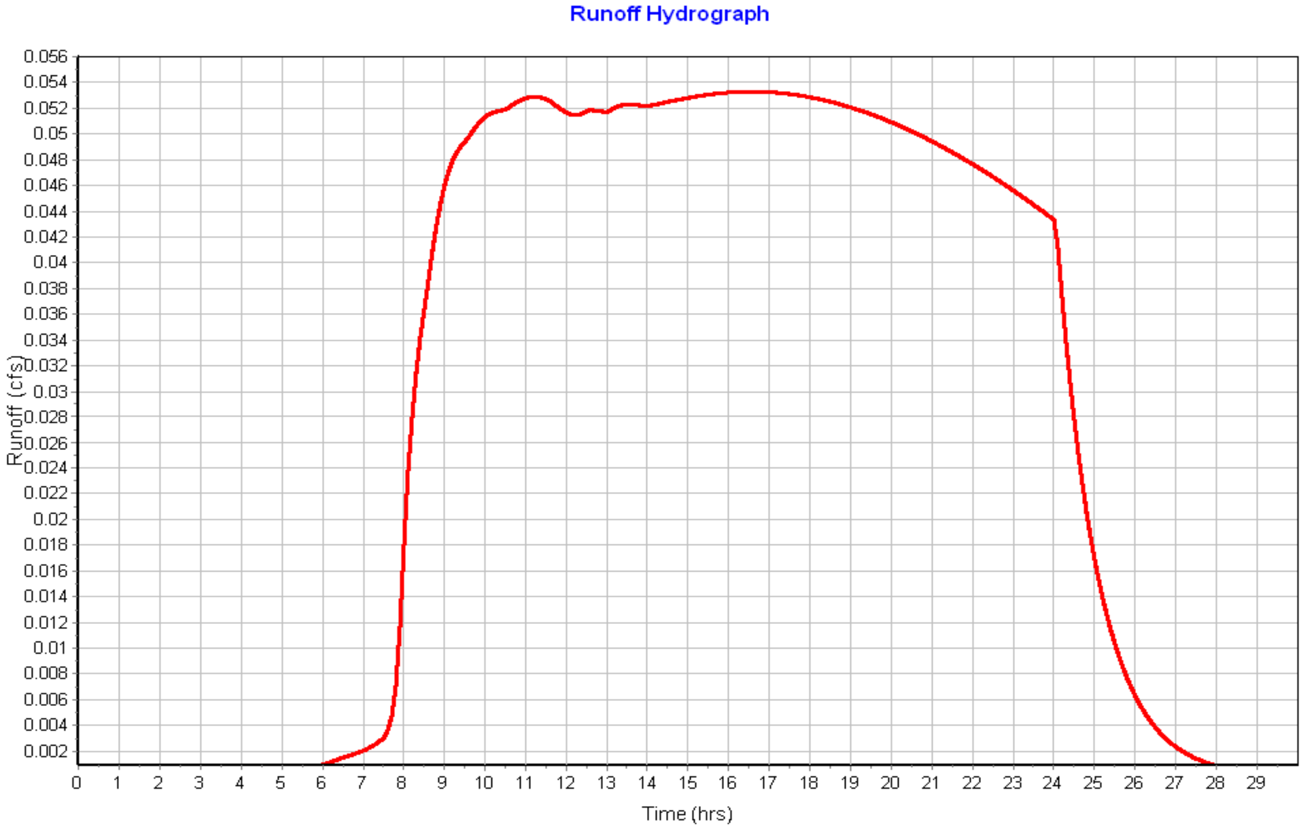
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	2.56		77.42

Subbasin Runoff Results

Total Rainfall (in) 1.73
Total Runoff (in) 0.33
Peak Runoff (cfs) 0.05
Weighted Curve Number 77.42
Time of Concentration (days hh:mm:ss) 0 01:01:00

Subbasin : EX_SITE





Subbasin : NB-1

Input Data

Area (ac) 0.21
Impervious Area (%) 65.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

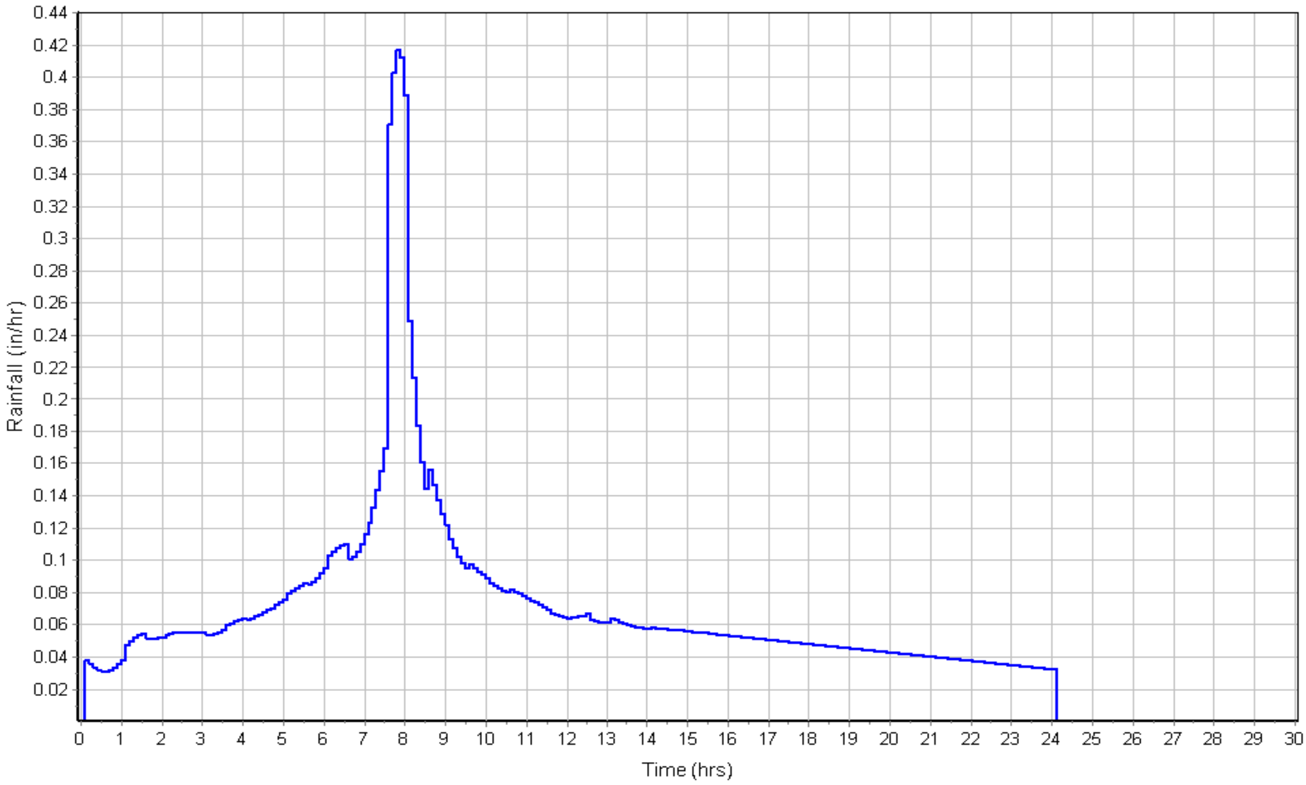
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.21		91.7

Subbasin Runoff Results

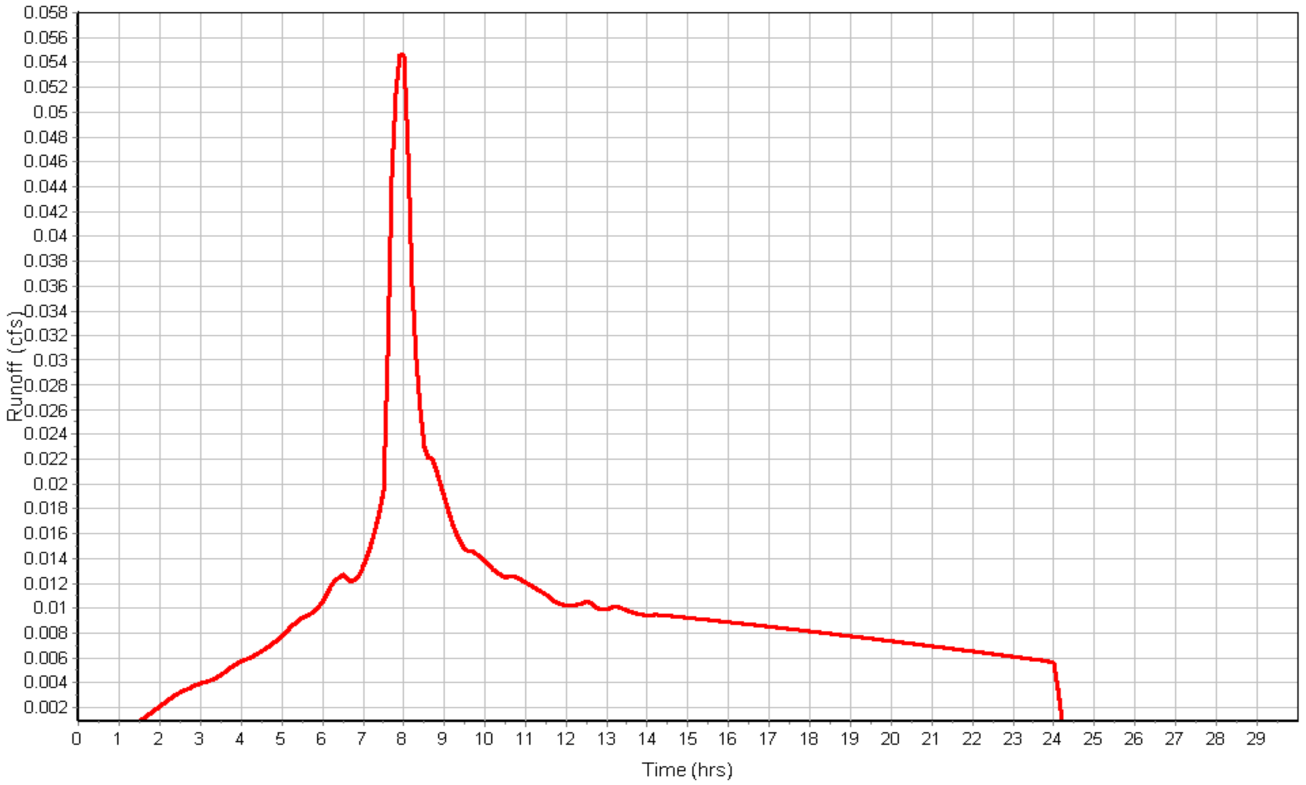
Total Rainfall (in) 1.73
Total Runoff (in) 1.12
Peak Runoff (cfs) 0.06
Weighted Curve Number 91.70
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : NB-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NB-2

Input Data

Area (ac) 0.23
Impervious Area (%) 95.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

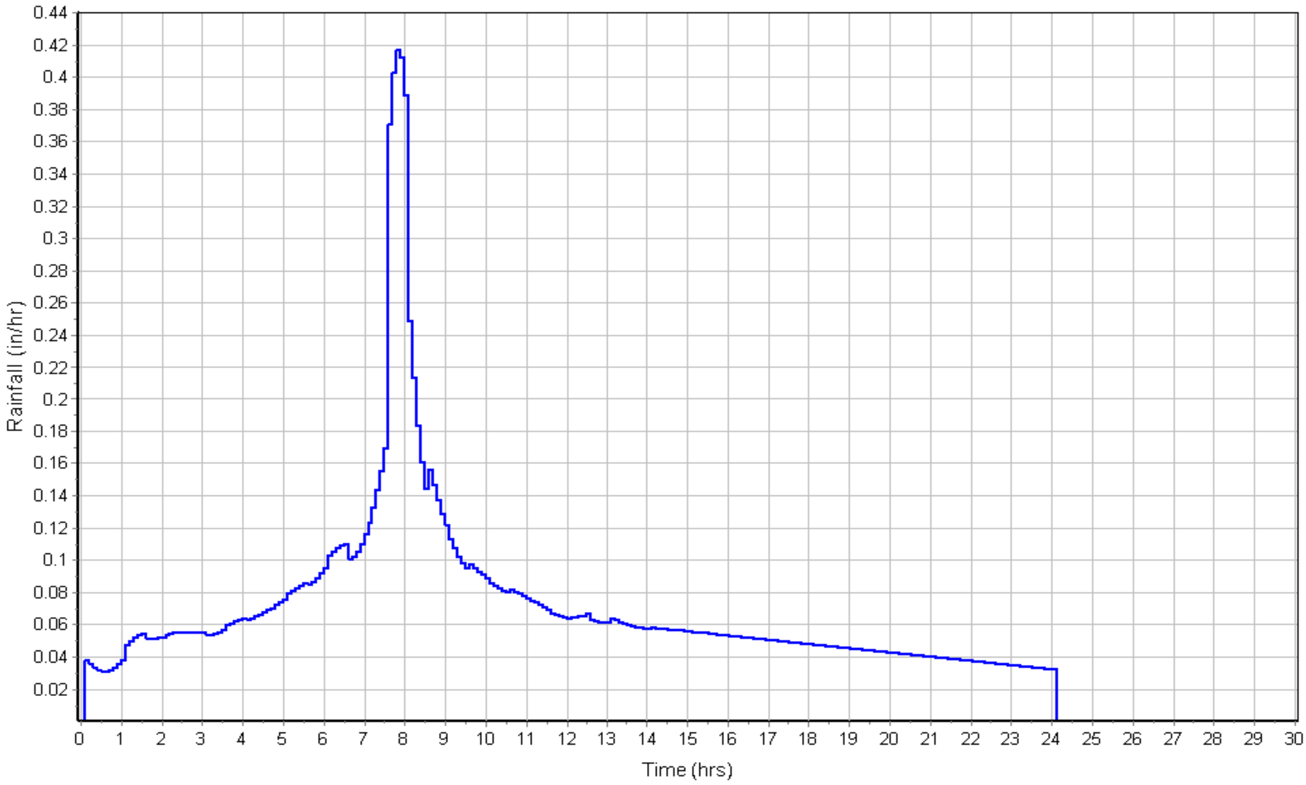
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.23		97.1

Subbasin Runoff Results

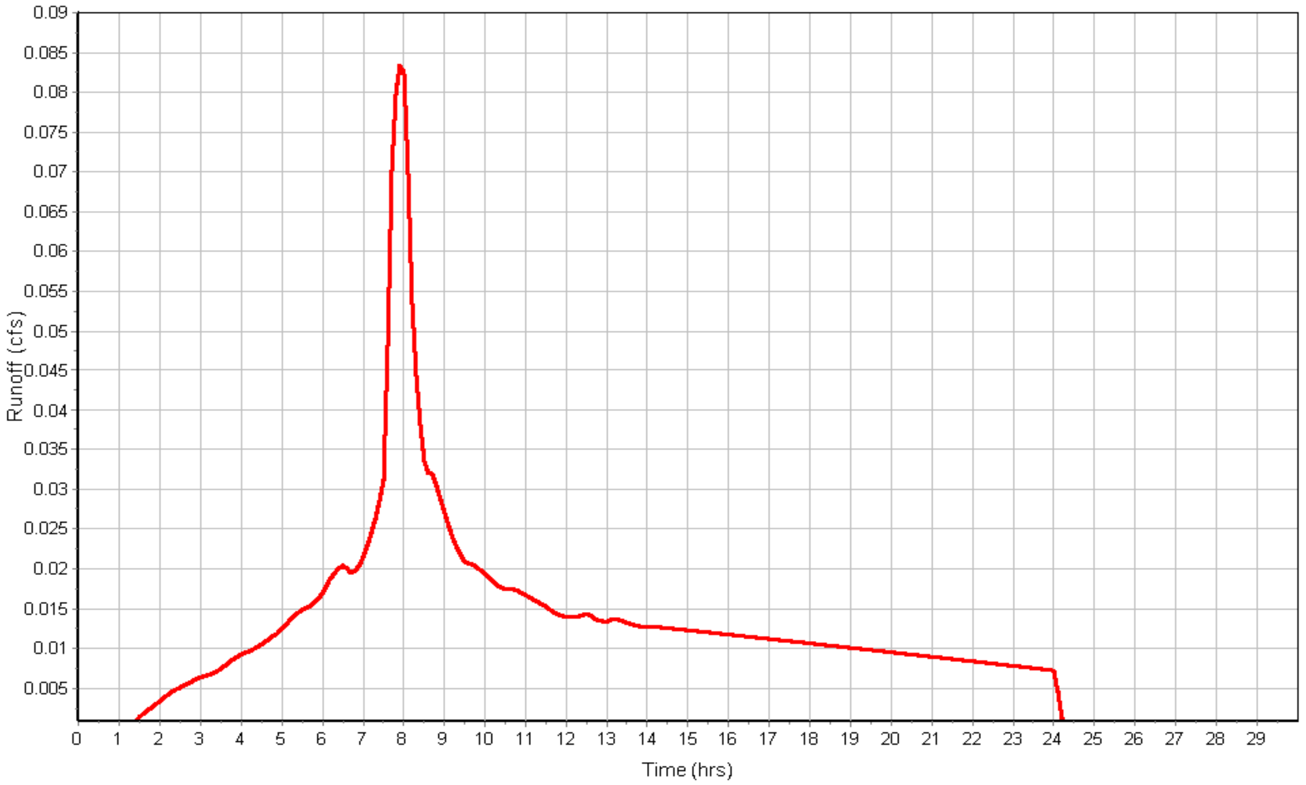
Total Rainfall (in) 1.73
Total Runoff (in) 1.45
Peak Runoff (cfs) 0.08
Weighted Curve Number 97.10
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : NB-2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NP-1

Input Data

Area (ac) 0.07
Impervious Area (%) 93.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

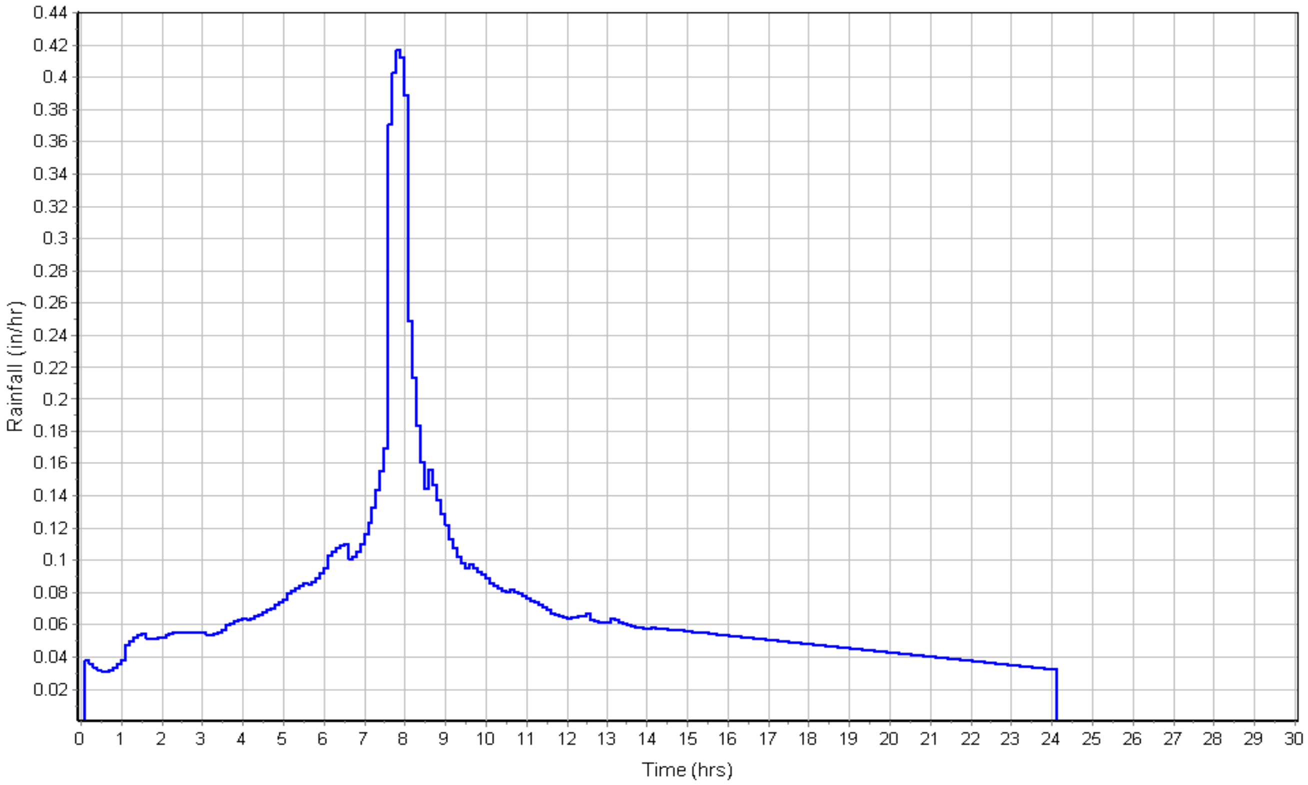
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.07		96.74

Subbasin Runoff Results

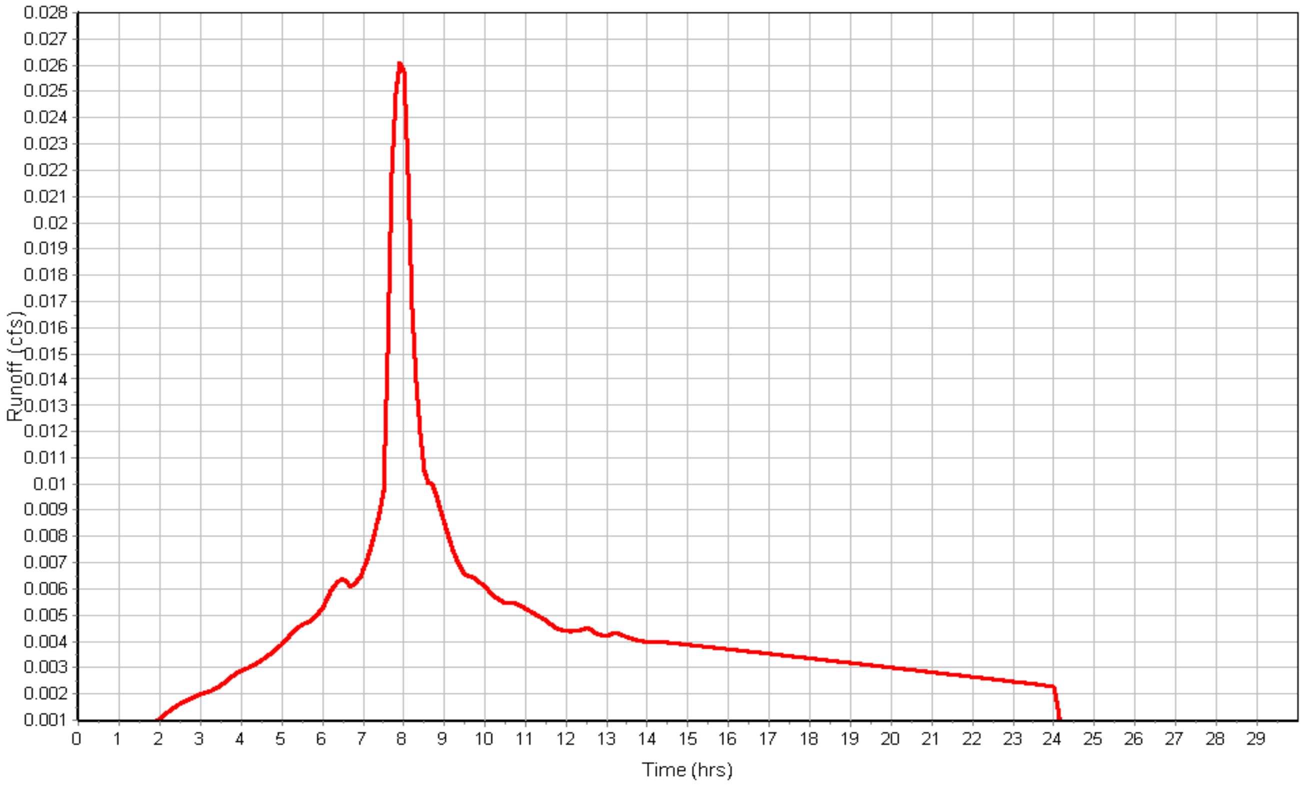
Total Rainfall (in) 1.73
Total Runoff (in) 1.43
Peak Runoff (cfs) 0.03
Weighted Curve Number 96.74
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : NP-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : OFF-1

Input Data

Area (ac) 0.10
Impervious Area (%) 82.00
Impervious Area Curve Number 92.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

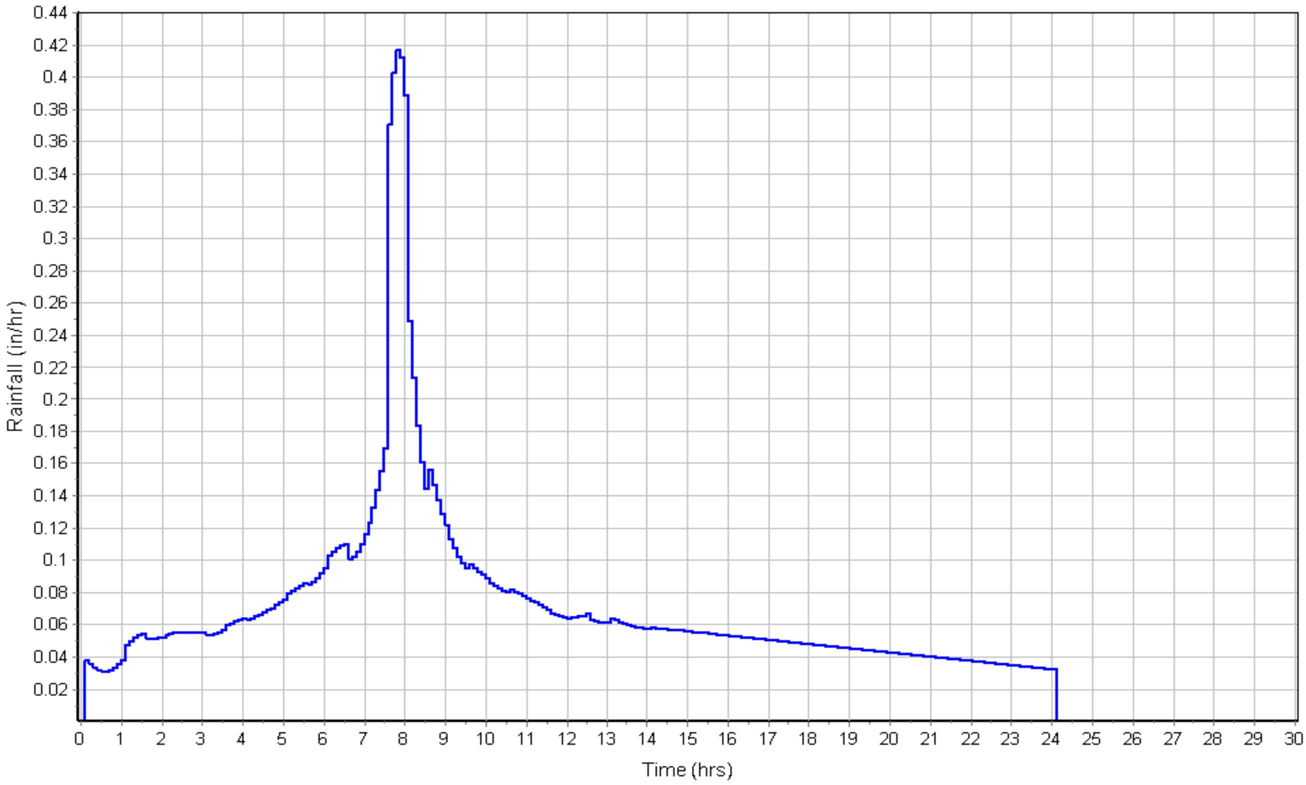
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.10		89.84

Subbasin Runoff Results

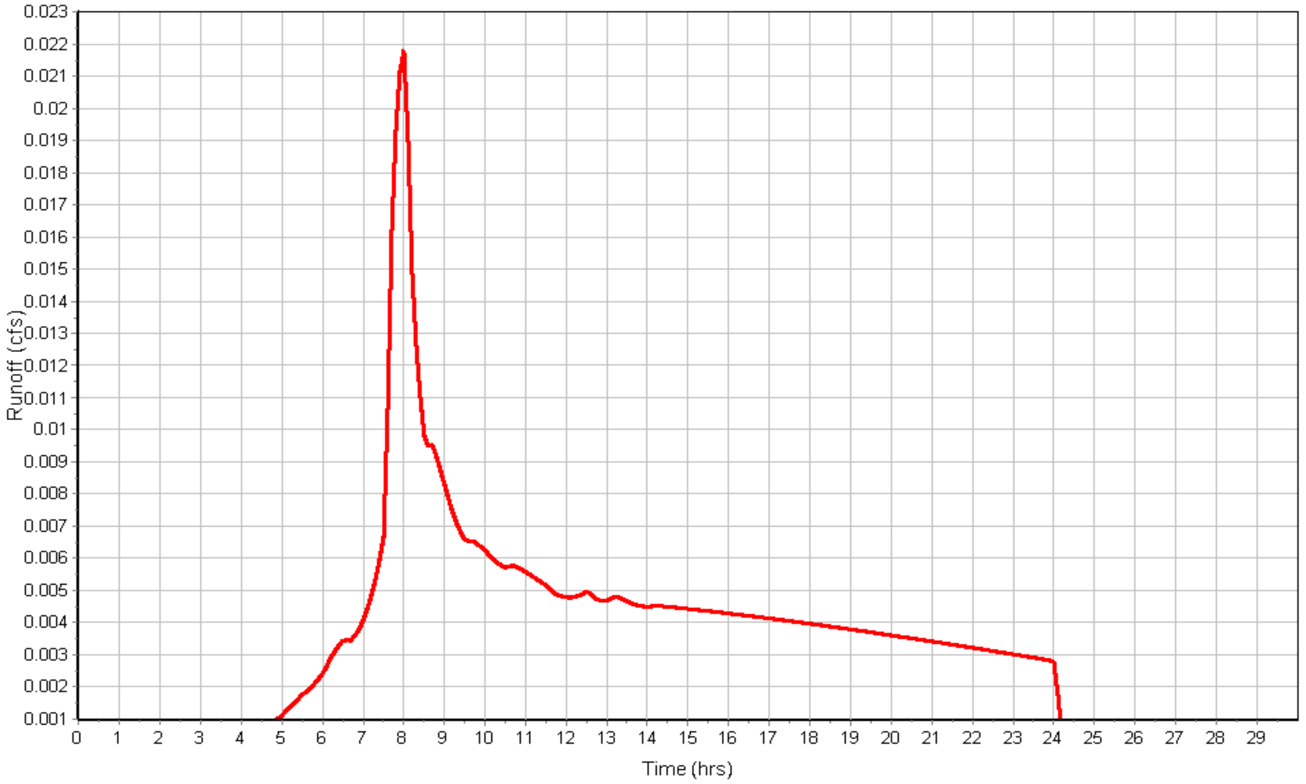
Total Rainfall (in) 1.73
Total Runoff (in) 0.89
Peak Runoff (cfs) 0.02
Weighted Curve Number 89.84
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : OFF-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SB-1

Input Data

Area (ac) 0.13
Impervious Area (%) 72.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

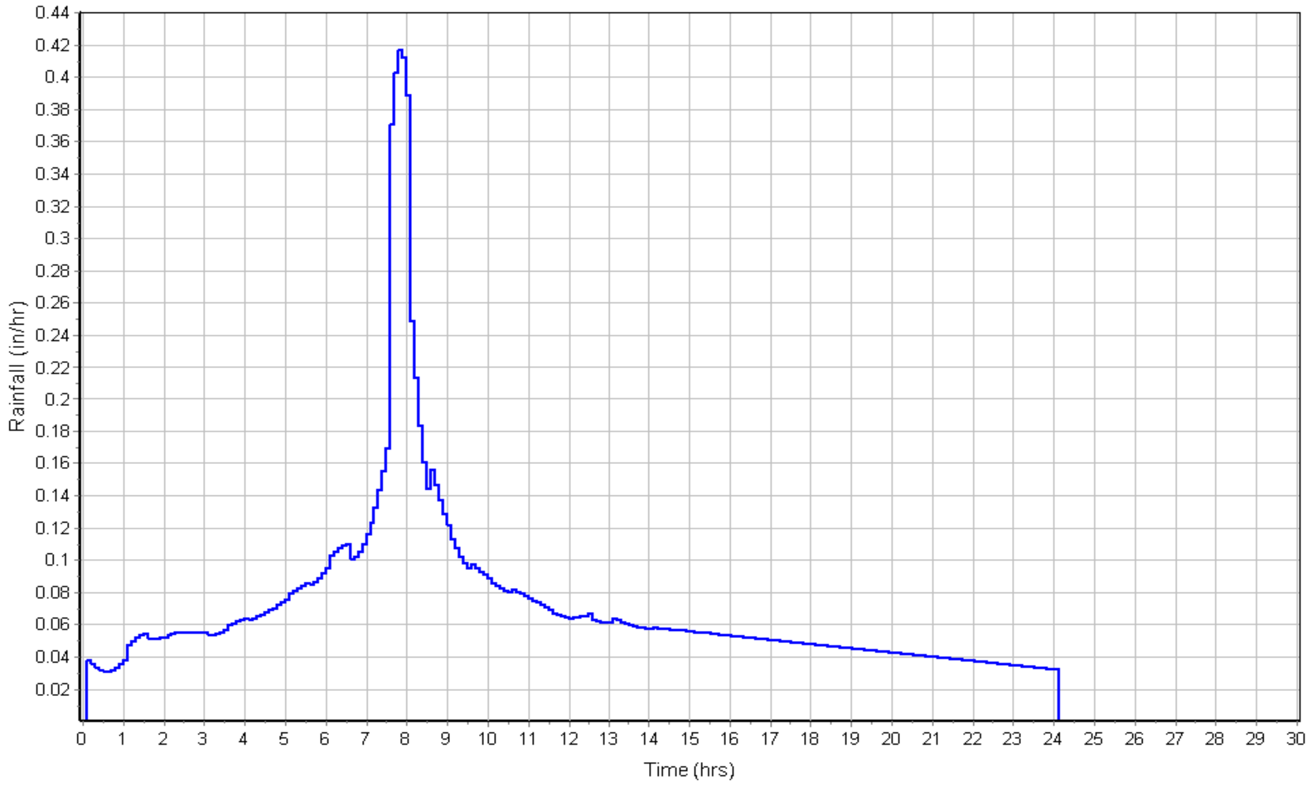
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.13		92.96

Subbasin Runoff Results

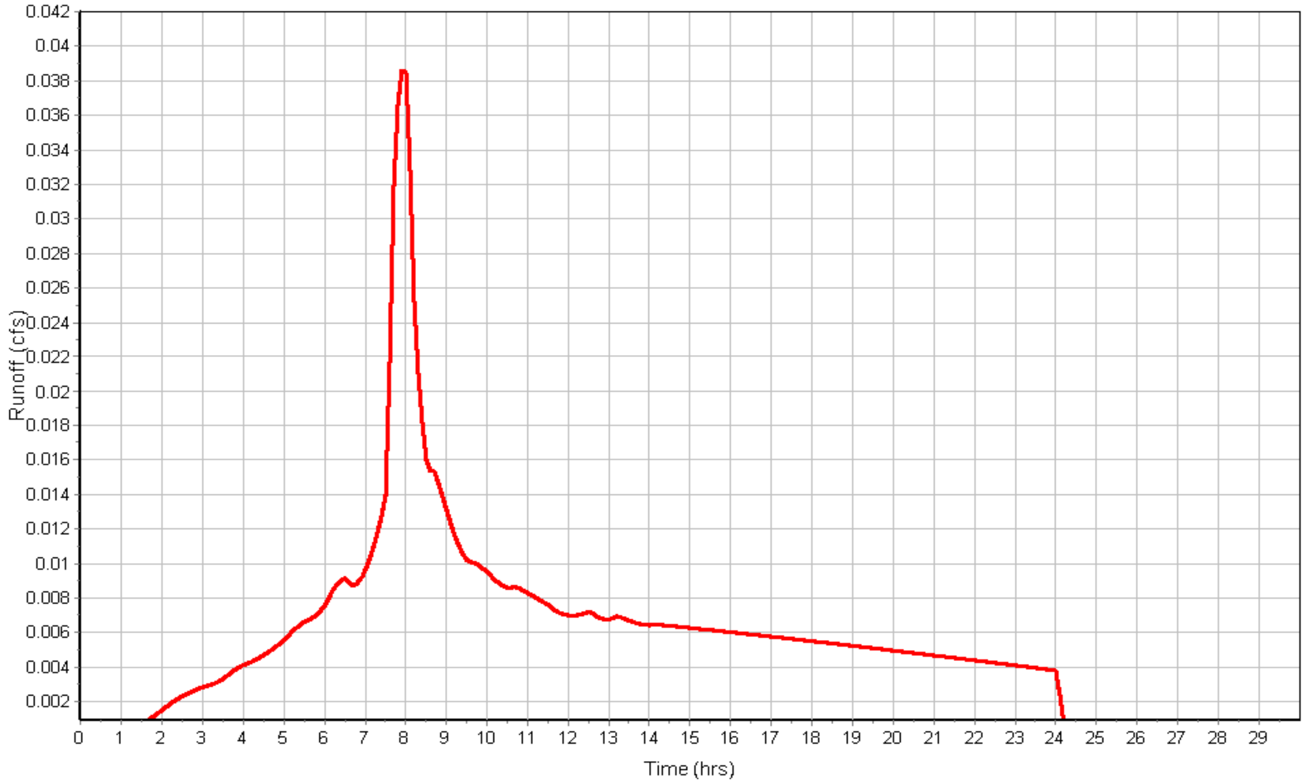
Total Rainfall (in) 1.73
Total Runoff (in) 1.20
Peak Runoff (cfs) 0.04
Weighted Curve Number 92.96
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SB-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SB-2

Input Data

Area (ac) 0.09
Impervious Area (%) 100.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

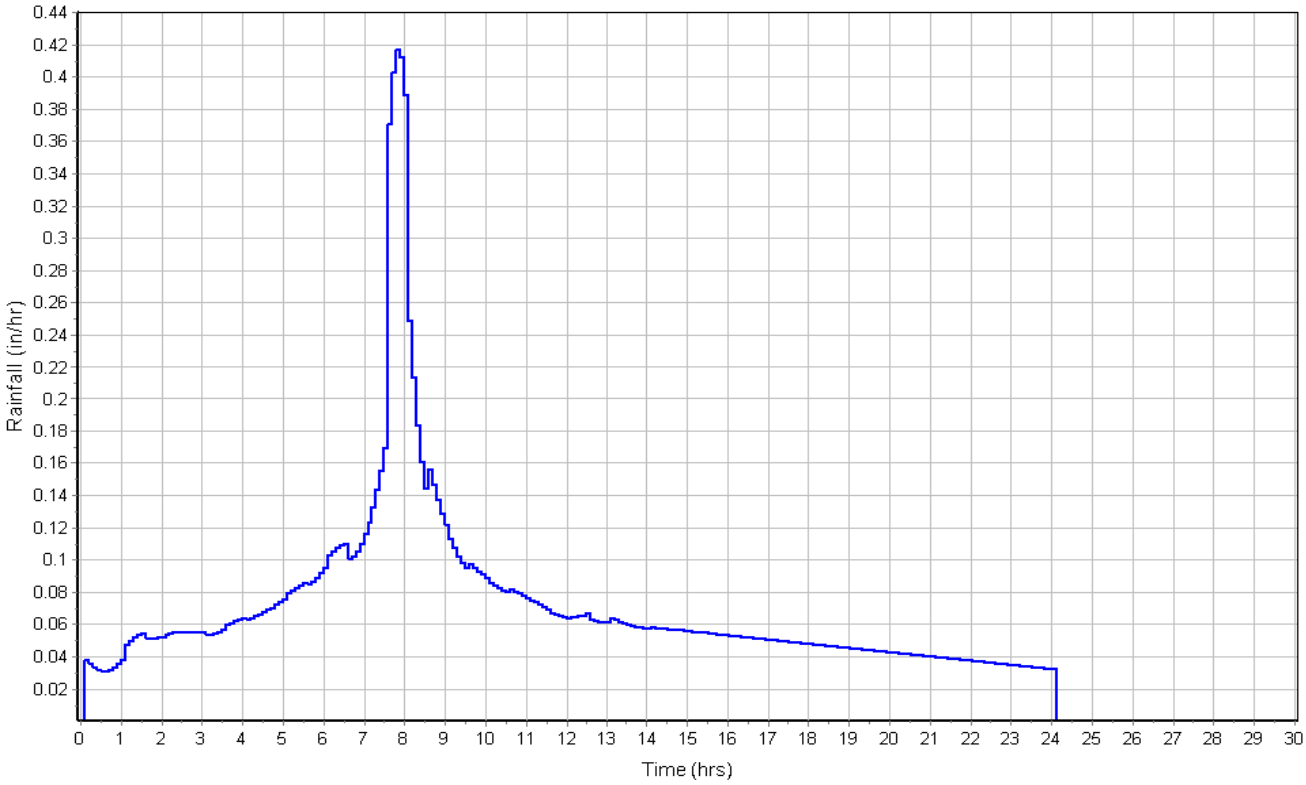
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.09		98

Subbasin Runoff Results

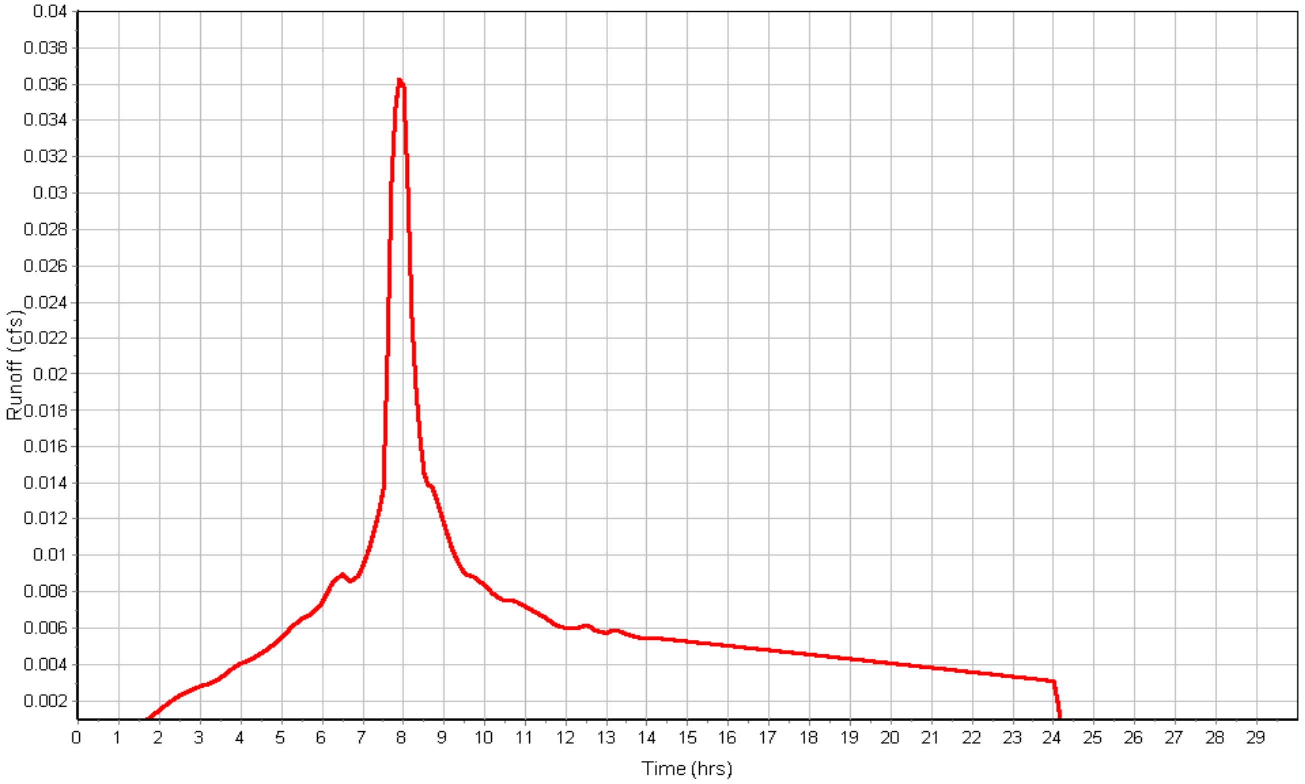
Total Rainfall (in) 1.73
Total Runoff (in) 1.51
Peak Runoff (cfs) 0.04
Weighted Curve Number 98.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SB-2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SP-1

Input Data

Area (ac) 0.76
Impervious Area (%) 79.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

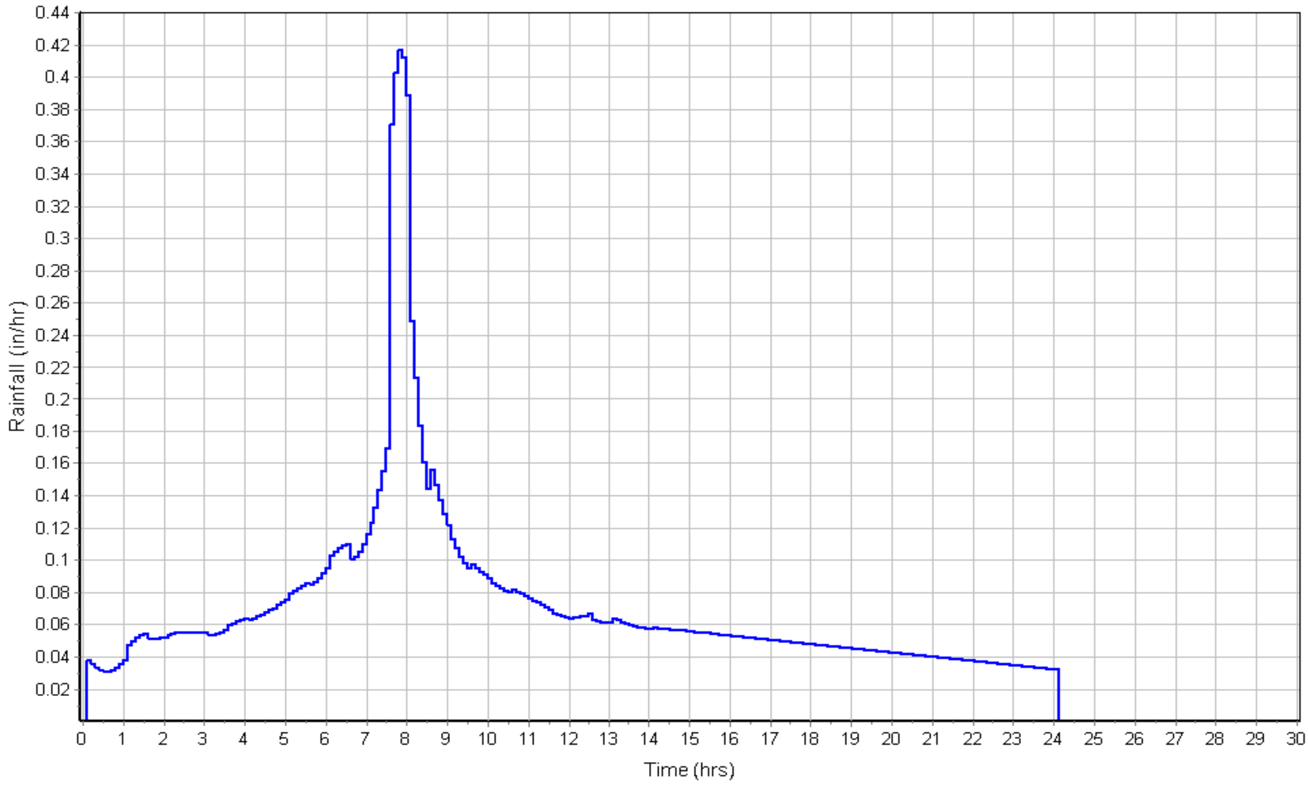
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.76		94.22

Subbasin Runoff Results

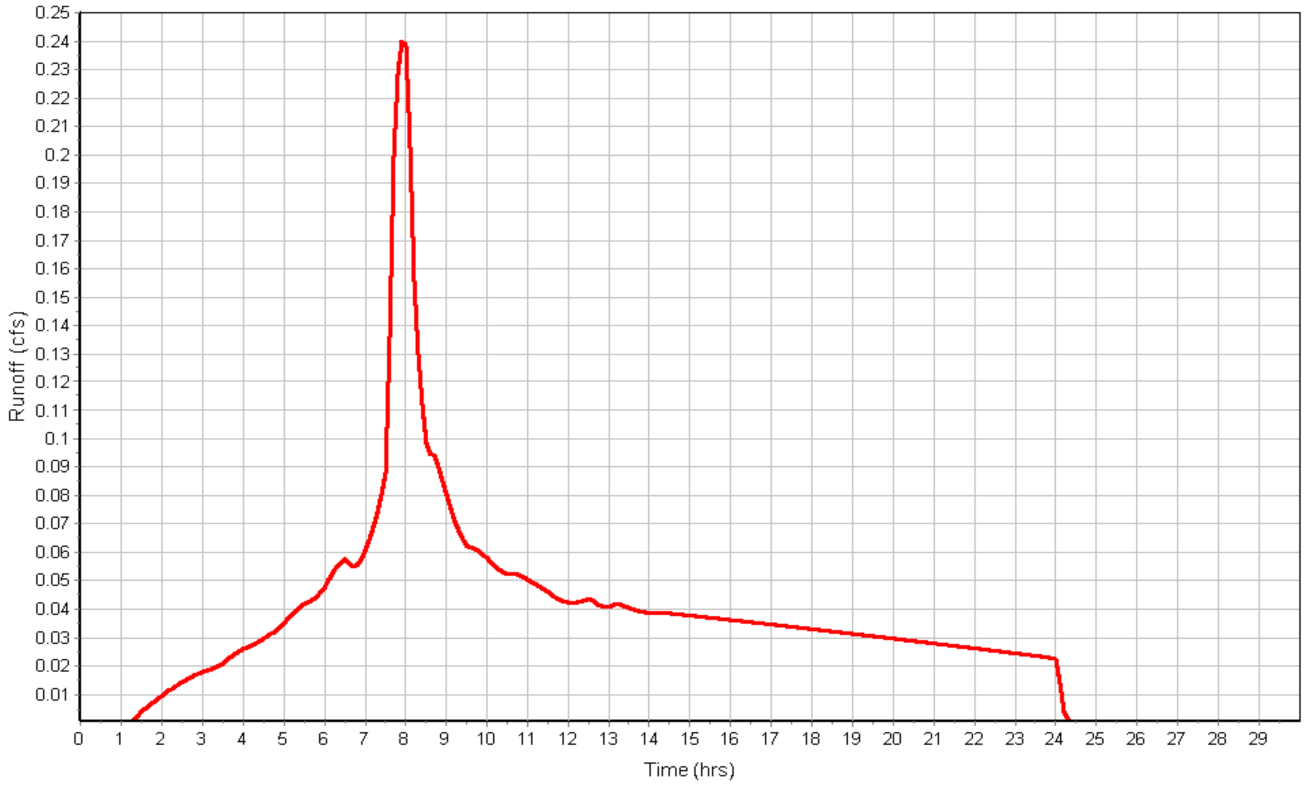
Total Rainfall (in) 1.73
Total Runoff (in) 1.28
Peak Runoff (cfs) 0.24
Weighted Curve Number 94.22
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SP-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SP-2

Input Data

Area (ac)	0.52
Impervious Area (%)	77.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	80.00
Rain Gage ID	Rain Gage-01

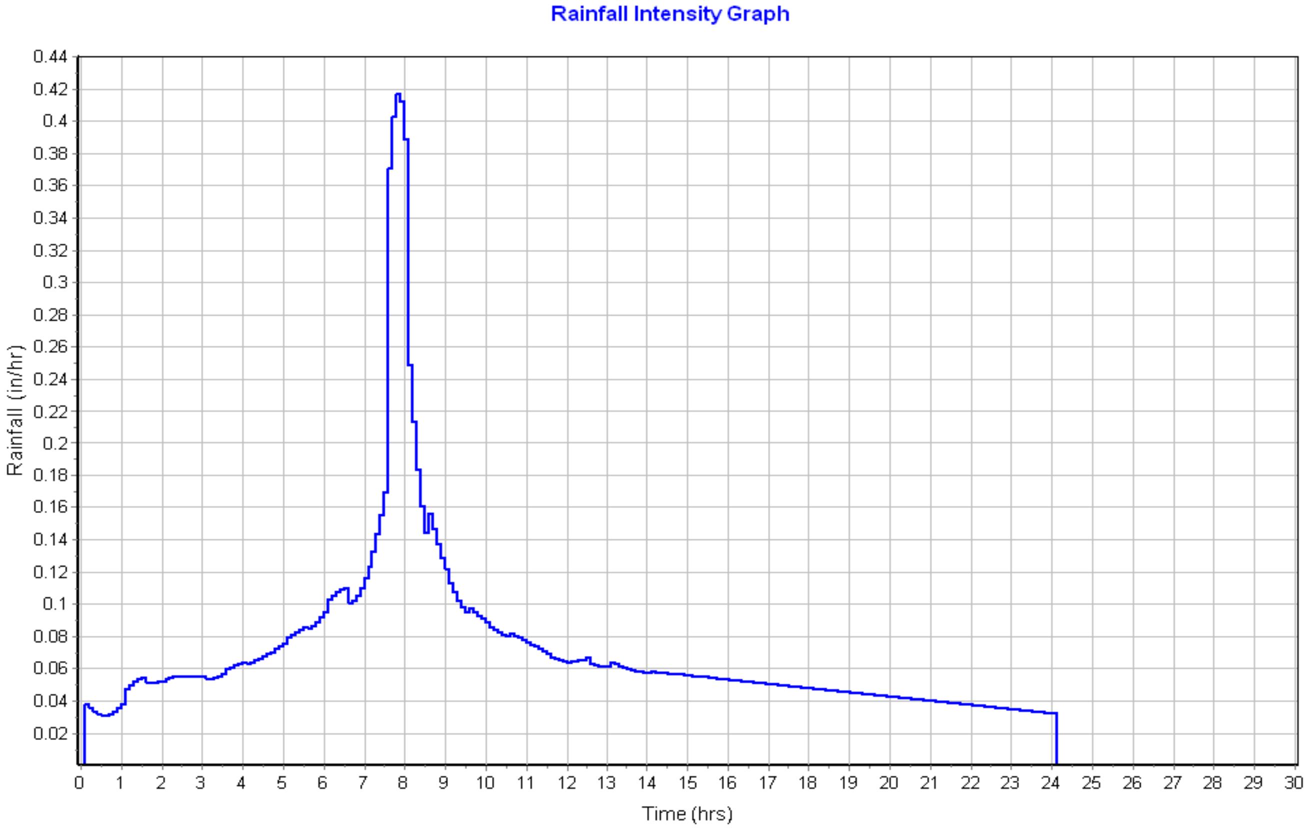
Composite Curve Number

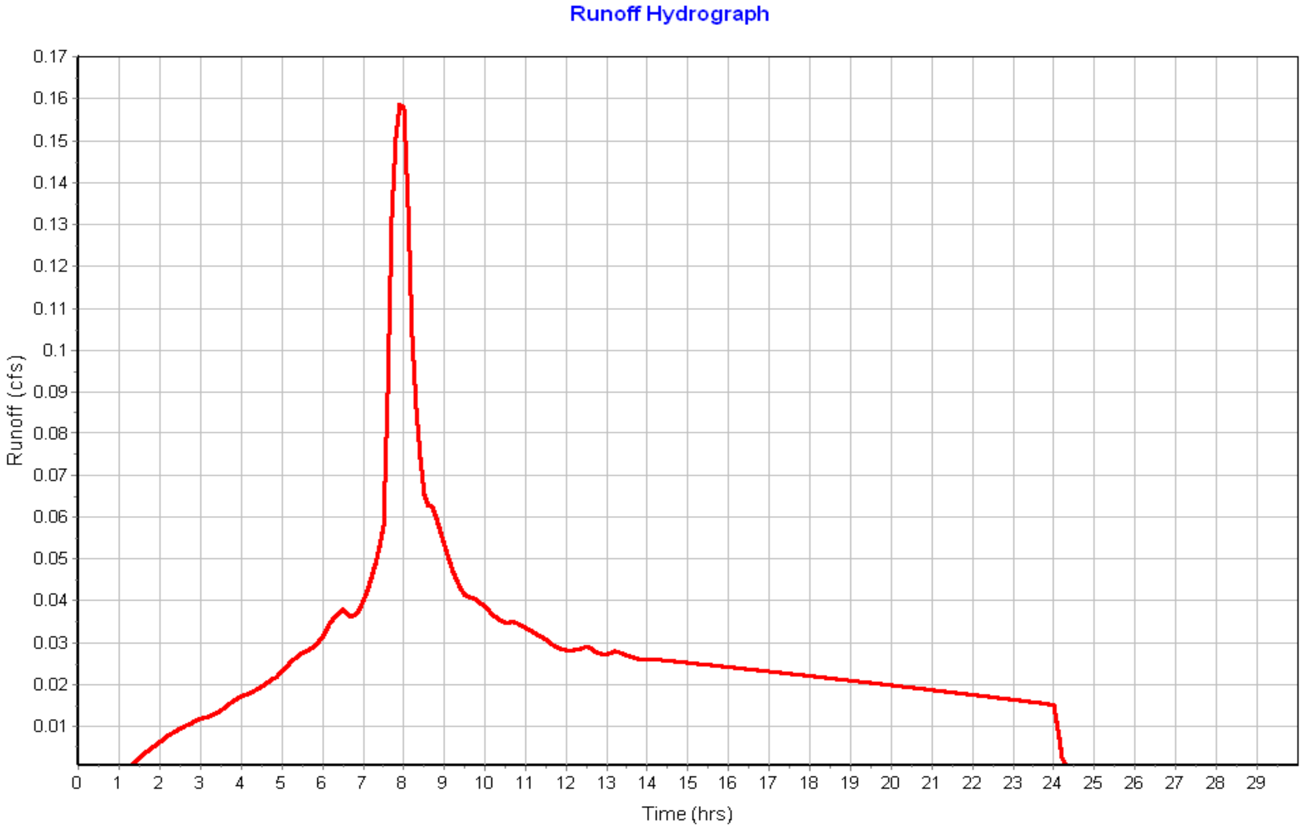
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.52		93.86

Subbasin Runoff Results

Total Rainfall (in)	1.73
Total Runoff (in)	1.25
Peak Runoff (cfs)	0.16
Weighted Curve Number	93.86
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : SP-2





Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	ORIFICE	67.30	75.00	7.71	67.30	0.00	74.00	-1.00	10000.00	0.00
2	OUTFALL_1	71.67	75.00	3.33	71.67	0.00	74.00	-1.00	10000.00	0.00
3	SD_CB_1	72.41	73.56	1.15	72.41	0.00	73.48	-0.08	10000.00	0.00
4	SD_CB_2	72.61	76.50	3.89	72.61	0.00	75.50	-1.00	10000.00	0.00
5	SD_CO_15	76.21	78.50	2.29	76.21	0.00	78.00	-0.50	10000.00	0.00
6	SD_CO_6	71.68	75.00	3.32	71.68	0.00	74.00	-1.00	10000.00	0.00
7	SD_CO_9	71.65	75.00	3.35	71.65	0.00	74.00	-1.00	10000.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	ORIFICE	0.00	0.00	67.30	0.00	0.00	7.71	67.30	0.00	0 00:00	0 00:00	0.00	0.00
2	OUTFALL_1	0.42	0.16	72.08	0.41	0.00	2.92	71.82	0.15	0 08:00	0 00:00	0.00	0.00
3	SD_CB_1	0.26	0.26	72.63	0.22	0.00	0.93	72.49	0.08	0 07:57	0 00:00	0.00	0.00
4	SD_CB_2	0.16	0.11	72.81	0.20	0.00	3.69	72.68	0.07	0 07:58	0 00:00	0.00	0.00
5	SD_CO_15	0.05	0.05	76.31	0.10	0.00	2.19	76.25	0.04	0 08:00	0 00:00	0.00	0.00
6	SD_CO_6	0.04	0.04	71.95	0.27	0.00	3.29	71.87	0.19	0 07:54	0 00:00	0.00	0.00
7	SD_CO_9	0.16	0.00	71.88	0.23	0.00	3.12	71.73	0.08	0 08:00	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	LINK-10	50.68	71.67	0.00	71.52	0.10	0.15	0.3000	Trapezoidal	1.000	8.000	0.0800	0.5000	0.5000	0.0000	0.00	No
2	OVERFLOW_01	20.00	72.20	0.78	71.81	4.52	0.39	1.9500	Rectangular	1.000	4.000	0.0100	0.5000	0.5000	0.0000	0.00	No
3	OVERFLOW_02	20.00	74.44	0.50	74.24	2.56	0.20	1.0000	Rectangular	1.000	4.000	0.0100	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	LINK-10	0.42	0 08:00	3.62	0.12	0.58	1.46	0.26	0.26	0.00		
2	OVERFLOW_01	0.00	0 00:00	63.34	0.00	0.00		0.00	0.00	0.00		
3	OVERFLOW_02	0.00	0 00:00	45.36	0.00	0.00		0.00	0.00	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	LINK_01	12.00	69.29	2.00	69.05	3.22	0.24	2.0000	CIRCULAR	9.960	9.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1
2	LINK-12	222.93	72.23	-0.18	71.67	0.00	0.56	0.2500	CIRCULAR	9.960	9.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1
3	LINK-20	19.69	71.85	0.17	71.75	0.33	0.10	0.5000	CIRCULAR	6.000	6.000	0.0100	0.5000	0.5000	0.0000	0.00	No	1
4	LINK-30	18.32	71.65	0.00	71.60	0.18	0.05	0.3000	CIRCULAR	8.040	8.040	0.0100	0.5000	0.5000	0.0000	0.00	No	1
5	LINK-31	318.43	72.61	0.00	71.65	0.00	0.95	0.3000	CIRCULAR	8.040	8.040	0.0100	0.5000	0.5000	0.0000	0.00	No	1
6	LINK-32	218.21	74.35	-1.86	72.61	0.00	1.75	0.8000	CIRCULAR	3.960	3.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	LINK_01	0.00	0 00:00	4.03	0.00	0.00		0.00	0.00	0.00		Calculated
2	LINK-12	0.26	0 07:57	1.64	0.16	1.37	2.71	0.32	0.38	0.00		Calculated
3	LINK-20	0.04	0 07:54	0.51	0.07	1.43	0.23	0.09	0.19	0.00		Calculated
4	LINK-30	0.16	0 08:00	0.86	0.19	1.79	0.17	0.21	0.31	0.00		Calculated
5	LINK-31	0.16	0 07:58	0.86	0.19	1.73	3.07	0.21	0.32	0.00		Calculated
6	LINK-32	0.05	0 08:00	0.32	0.17	1.50	2.42	0.15	0.44	0.00		Calculated

Storage Nodes

Storage Node : INFL_RG_1

Input Data

Invert Elevation (ft)	71.42
Max (Rim) Elevation (ft)	75.00
Max (Rim) Offset (ft)	3.58
Initial Water Elevation (ft)	0.00
Initial Water Depth (ft)	-71.42
Ponded Area (ft²)	10000.00
Evaporation Loss	0.00

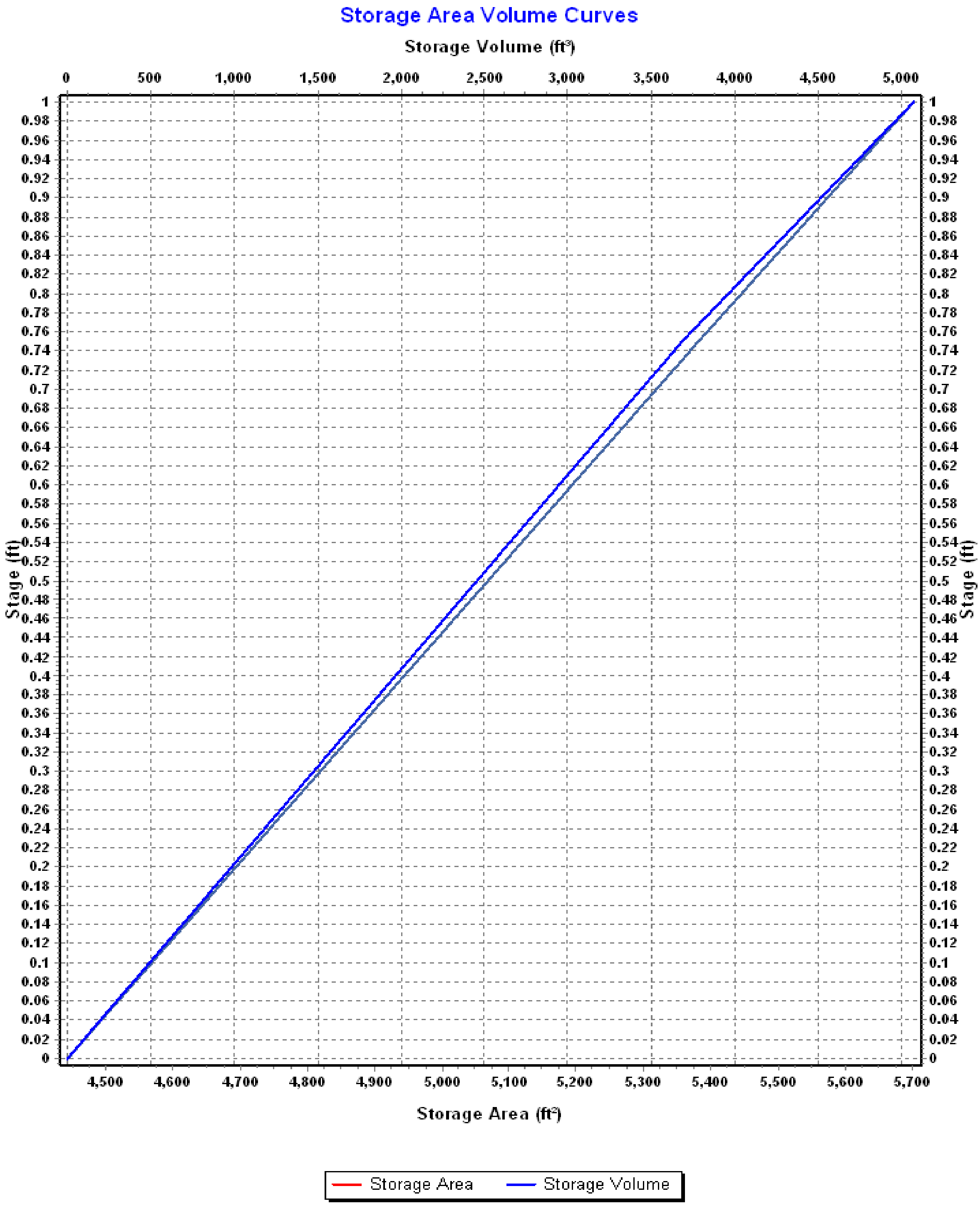
Infiltration/Exfiltration

Constant Flow Rate (cfs) 0.4983

Storage Area Volume Curves

Storage Curve : WETLAND

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0.00	4443.1	0.000
0.75	5381.7	3684.30
1.00	5701.6	5069.71



Storage Area Volume Curves

Storage Node : INFL_RG_1 (continued)

Output Summary Results

Peak Inflow (cfs) 0.63
Peak Lateral Inflow (cfs) 0.02
Peak Outflow (cfs) 0.00
Peak Exfiltration Flow Rate (cfm) 29.90
Max HGL Elevation Attained (ft) 71.45
Max HGL Depth Attained (ft) 0.03
Average HGL Elevation Attained (ft) 71.42
Average HGL Depth Attained (ft) 0
Time of Max HGL Occurrence (days hh:mm) 0 08:11
Total Exfiltration Volume (1000-ft^3) 9.813
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Storage Node : INFL_RG_2

Input Data

Invert Elevation (ft)	73.94
Max (Rim) Elevation (ft)	76.00
Max (Rim) Offset (ft)	2.06
Initial Water Elevation (ft)	0.00
Initial Water Depth (ft)	-73.94
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

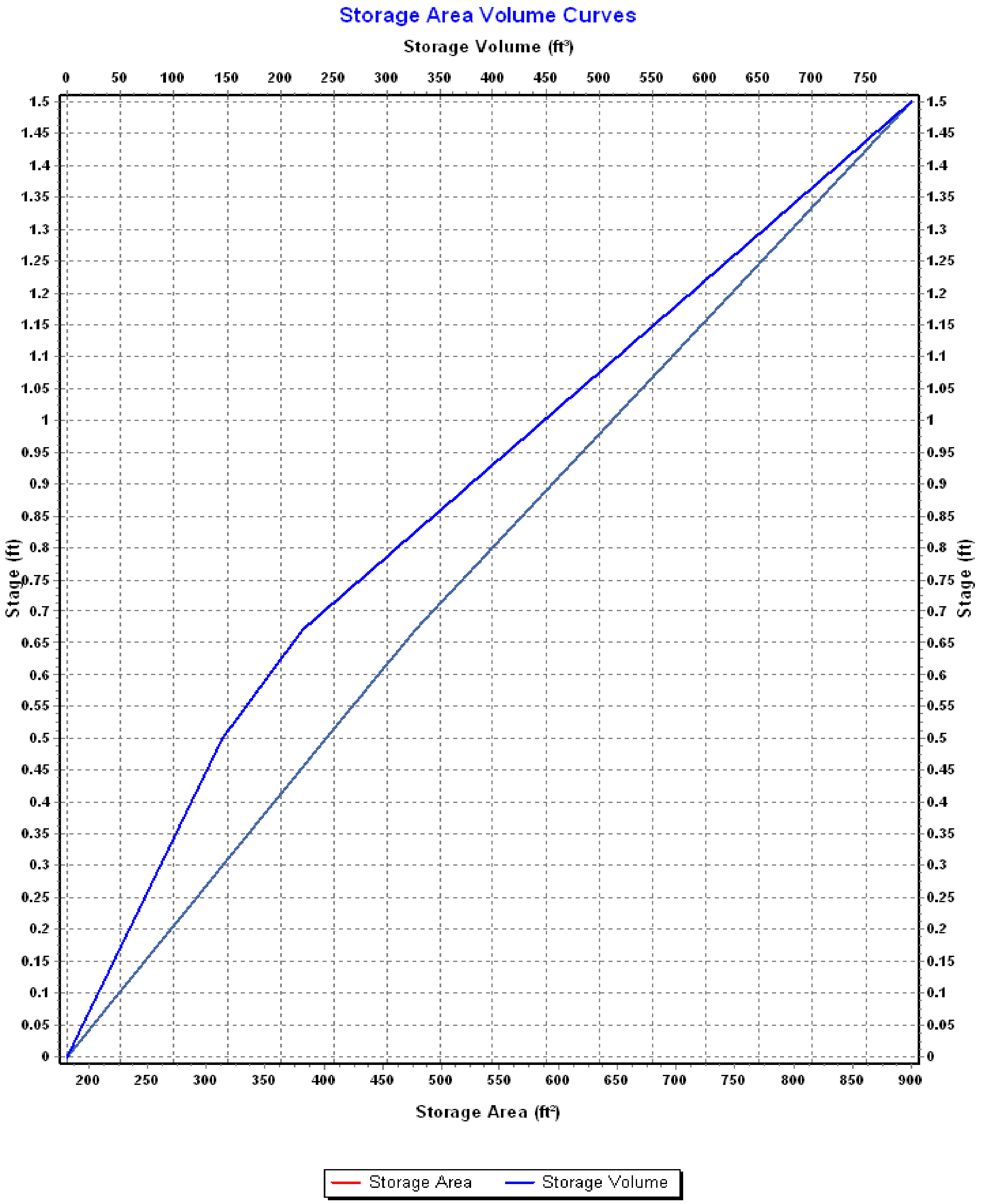
Infiltration/Exfiltration

Constant Flow Rate (cfs)	0.0200

Storage Area Volume Curves

Storage Curve : SB-2_RG

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	182	0.000
0.50	402	146.00
0.67	478	220.80
1.50	900	792.67


Storage Area Volume Curves
Storage Volume (ft³)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Stage (ft)
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : INFL_RG_2 (continued)

Output Summary Results

Peak Inflow (cfs) 0.04
Peak Lateral Inflow (cfs) 0.04
Peak Outflow (cfs) 0.00
Peak Exfiltration Flow Rate (cfm) 1.20
Max HGL Elevation Attained (ft) 74.08
Max HGL Depth Attained (ft) 0.14
Average HGL Elevation Attained (ft) 73.95
Average HGL Depth Attained (ft) 0.00999999999999999
Time of Max HGL Occurrence (days hh:mm) 0 08:20
Total Exfiltration Volume (1000-ft³) 0.579
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Project Description

File Name	calc jah 210817 Model.SPF
Description	J:\9700-003-13\Civil\CX5_PIPES\BHE STRM (2013).dwg

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Santa Barbara UH
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Feb 25, 2013	00:00:00
End Analysis On	Feb 26, 2013	06:00:00
Start Reporting On	Feb 25, 2013	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	10
Nodes	10
Junctions	7
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	2
Links	9
Channels	3
Pipes	6
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	002-Year	Cumulative	inches	Oregon	Lincoln	2	3.46	SCS Type IA 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Impervious Area (%)	Impervious Area Curve Number	Pervious Area Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	E-1	0.45	9.00	98.00	77.00	3.46	1.57	0.70	0.10	0 00:32:00
2	EX_SITE	2.56	3.00	91.00	77.00	3.46	1.43	3.67	0.38	0 01:01:00
3	NB-1	0.21	65.00	98.00	80.00	3.46	2.66	0.55	0.13	0 00:05:00
4	NB-2	0.23	95.00	98.00	80.00	3.46	3.15	0.71	0.18	0 00:05:00
5	NP-1	0.07	93.00	98.00	80.00	3.46	3.11	0.22	0.06	0 00:05:00
6	OFF-1	0.10	82.00	92.00	80.00	3.46	2.42	0.25	0.06	0 00:05:00
7	SB-1	0.13	72.00	98.00	80.00	3.46	2.77	0.37	0.09	0 00:05:00
8	SB-2	0.09	100.00	98.00	80.00	3.46	3.23	0.30	0.08	0 00:05:00
9	SP-1	0.76	79.00	98.00	80.00	3.46	2.89	2.20	0.54	0 00:05:00
10	SP-2	0.52	77.00	98.00	80.00	3.46	2.85	1.47	0.36	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	ORIFICE	Junction	67.30	75.00	67.30	74.00	10000.00	0.00	67.30	0.00	7.71	0 00:00	0.00	0.00
2	OUTFALL_1	Junction	71.67	75.00	71.67	74.00	10000.00	0.97	72.27	0.00	2.73	0 00:00	0.00	0.00
3	SD_CB_1	Junction	72.41	73.56	72.41	73.48	10000.00	0.61	72.76	0.00	0.80	0 00:00	0.00	0.00
4	SD_CB_2	Junction	72.61	76.50	72.61	75.50	10000.00	0.37	72.91	0.00	3.59	0 00:00	0.00	0.00
5	SD_CO_15	Junction	76.21	78.50	76.21	78.00	10000.00	0.13	76.36	0.00	2.14	0 00:00	0.00	0.00
6	SD_CO_6	Junction	71.68	75.00	71.68	74.00	10000.00	0.08	72.00	0.00	3.24	0 00:00	0.00	0.00
7	SD_CO_9	Junction	71.65	75.00	71.65	74.00	10000.00	0.36	72.01	0.00	2.99	0 00:00	0.00	0.00
8	NEW_OUT	Outfall	65.83					0.38	65.83					
9	INFL_RG_1	Storage Node	71.42	75.00	0.00		10000.00	1.50	71.92				0.00	0.00
10	INFL_RG_2	Storage Node	73.94	76.00	0.00		0.00	0.09	74.45				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	LINK_01	Pipe	ORIFICE	NEW_OUT	12.00	69.29	69.05	2.0000	10.000	0.0100	0.00	4.03	0.00	0.00	0.00	0.00	0.00	Calculated
2	LINK-12	Pipe	SD_CB_1	OUTFALL_1	222.93	72.23	71.67	0.2500	10.000	0.0100	0.61	1.64	0.37	1.91	0.47	0.57	0.00	Calculated
3	LINK-20	Pipe	SD_CO_6	INFL_RG_1	19.69	71.85	71.75	0.5000	6.000	0.0100	0.08	0.51	0.15	1.75	0.14	0.28	0.00	Calculated
4	LINK-30	Pipe	SD_CO_9	INFL_RG_1	18.32	71.65	71.60	0.3000	8.000	0.0100	0.36	0.86	0.42	2.22	0.32	0.48	0.00	Calculated
5	LINK-31	Pipe	SD_CB_2	SD_CO_9	318.43	72.61	71.65	0.3000	8.000	0.0100	0.36	0.86	0.42	2.13	0.33	0.49	0.00	Calculated
6	LINK-32	Pipe	SD_CO_15	SD_CB_2	218.21	74.35	72.61	0.8000	4.000	0.0100	0.13	0.32	0.42	2.10	0.23	0.68	0.00	Calculated
7	LINK-10	Channel	OUTFALL_1	INFL_RG_1	50.68	71.67	71.52	0.3000	12.000	0.0800	0.97	3.62	0.27	0.80	0.38	0.38	0.00	
8	OVERFLOW_01	Channel	INFL_RG_1	ORIFICE	20.00	72.20	71.81	1.9500	12.000	0.0100	0.00	63.34	0.00	0.00	0.00	0.00	0.00	
9	OVERFLOW_02	Channel	INFL_RG_2	SD_CO_6	20.00	74.44	74.24	1.0000	12.000	0.0100	0.03	45.36	0.00	0.74	0.01	0.01	0.00	

Subbasin Hydrology

Subbasin : E-1

Input Data

Area (ac) 0.45
Impervious Area (%) 9.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 77.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

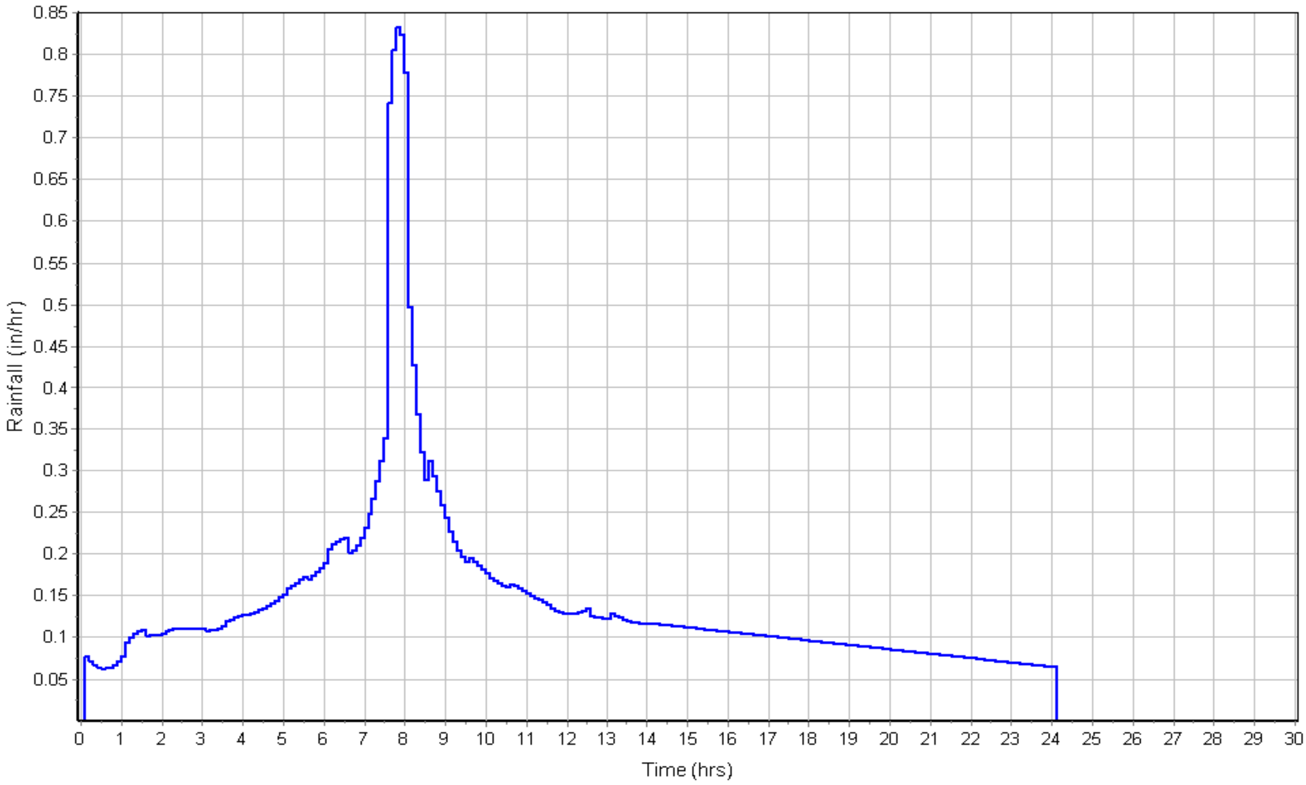
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.45		78.89

Subbasin Runoff Results

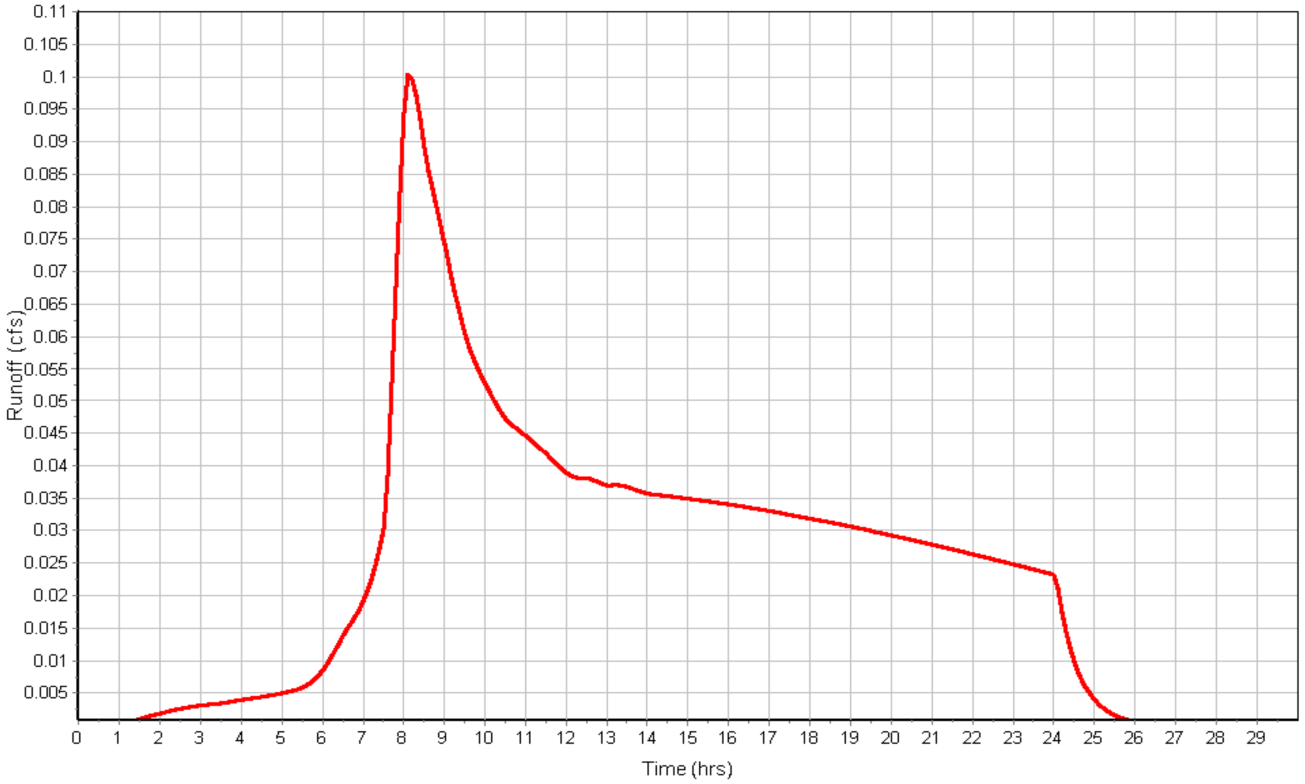
Total Rainfall (in) 3.46
Total Runoff (in) 1.57
Peak Runoff (cfs) 0.10
Weighted Curve Number 78.89
Time of Concentration (days hh:mm:ss) 0 00:32:00

Subbasin : E-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : EX_SITE

Input Data

Area (ac) 2.56
Impervious Area (%) 3.00
Impervious Area Curve Number 91.00
Pervious Area Curve Number 77.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

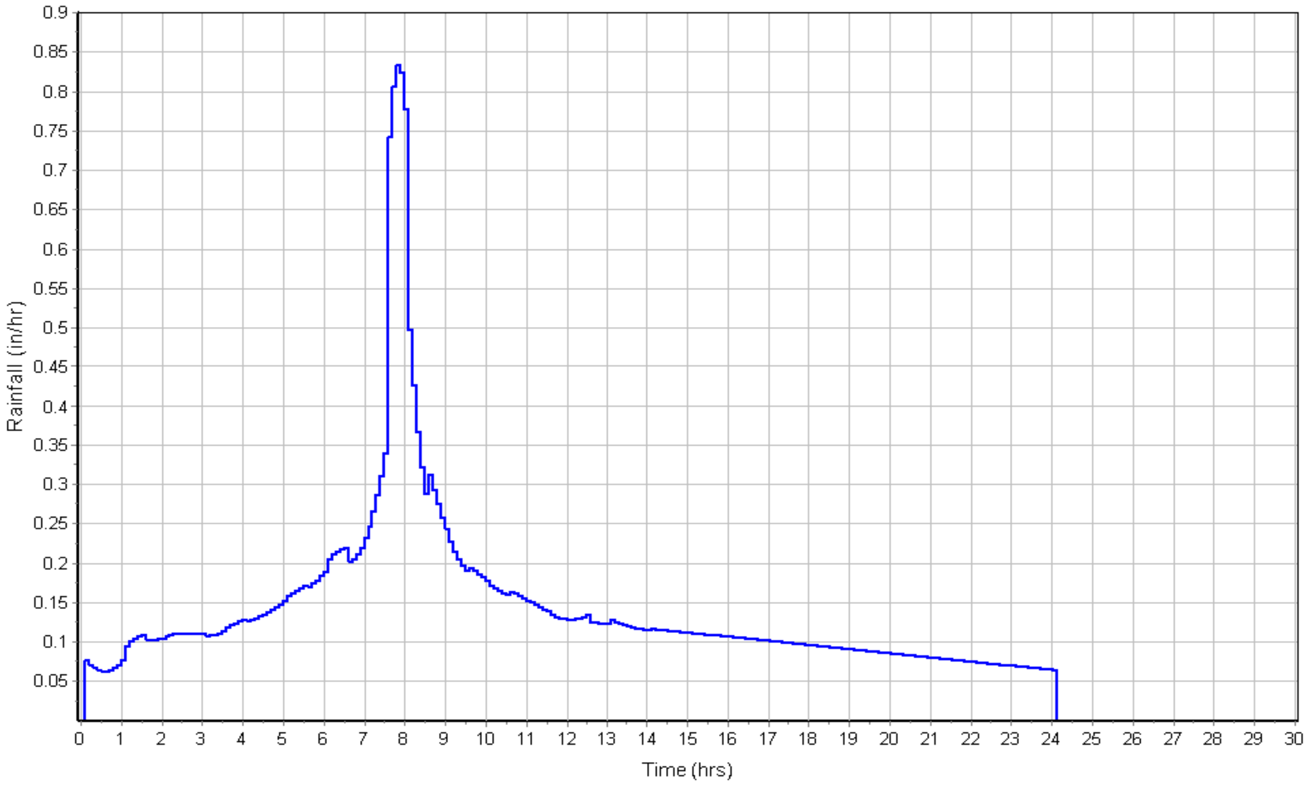
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	2.56		77.42

Subbasin Runoff Results

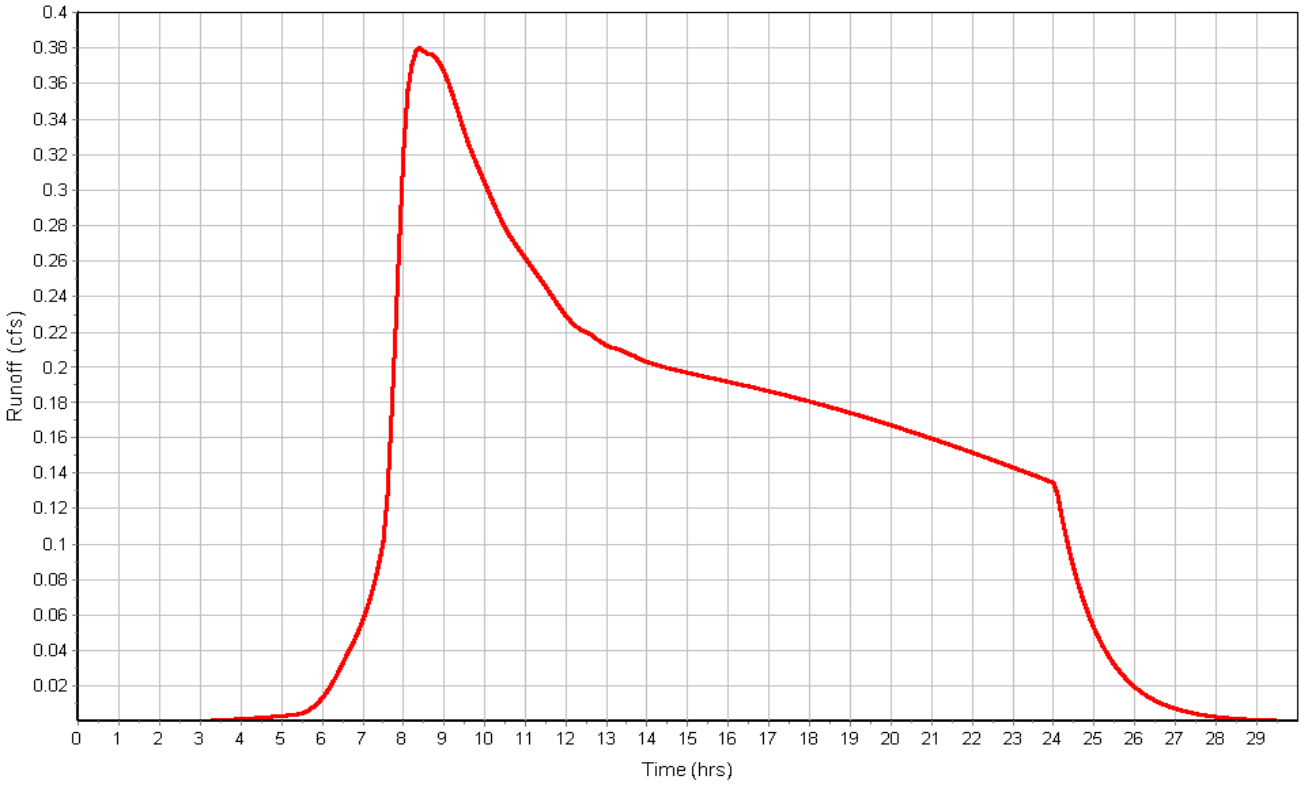
Total Rainfall (in) 3.46
Total Runoff (in) 1.43
Peak Runoff (cfs) 0.38
Weighted Curve Number 77.42
Time of Concentration (days hh:mm:ss) 0 01:01:00

Subbasin : EX_SITE

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NB-1

Input Data

Area (ac)	0.21
Impervious Area (%)	65.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	80.00
Rain Gage ID	Rain Gage-01

Composite Curve Number

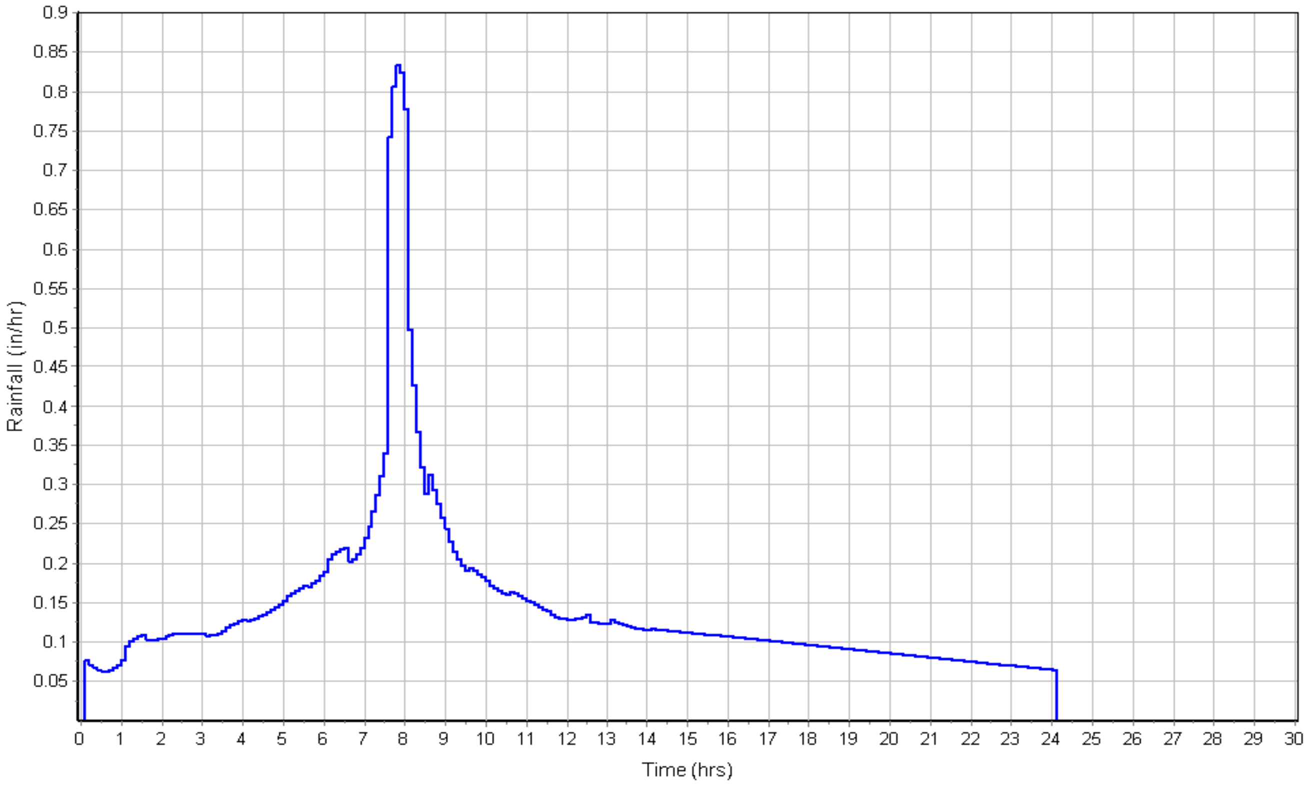
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.21		91.7

Subbasin Runoff Results

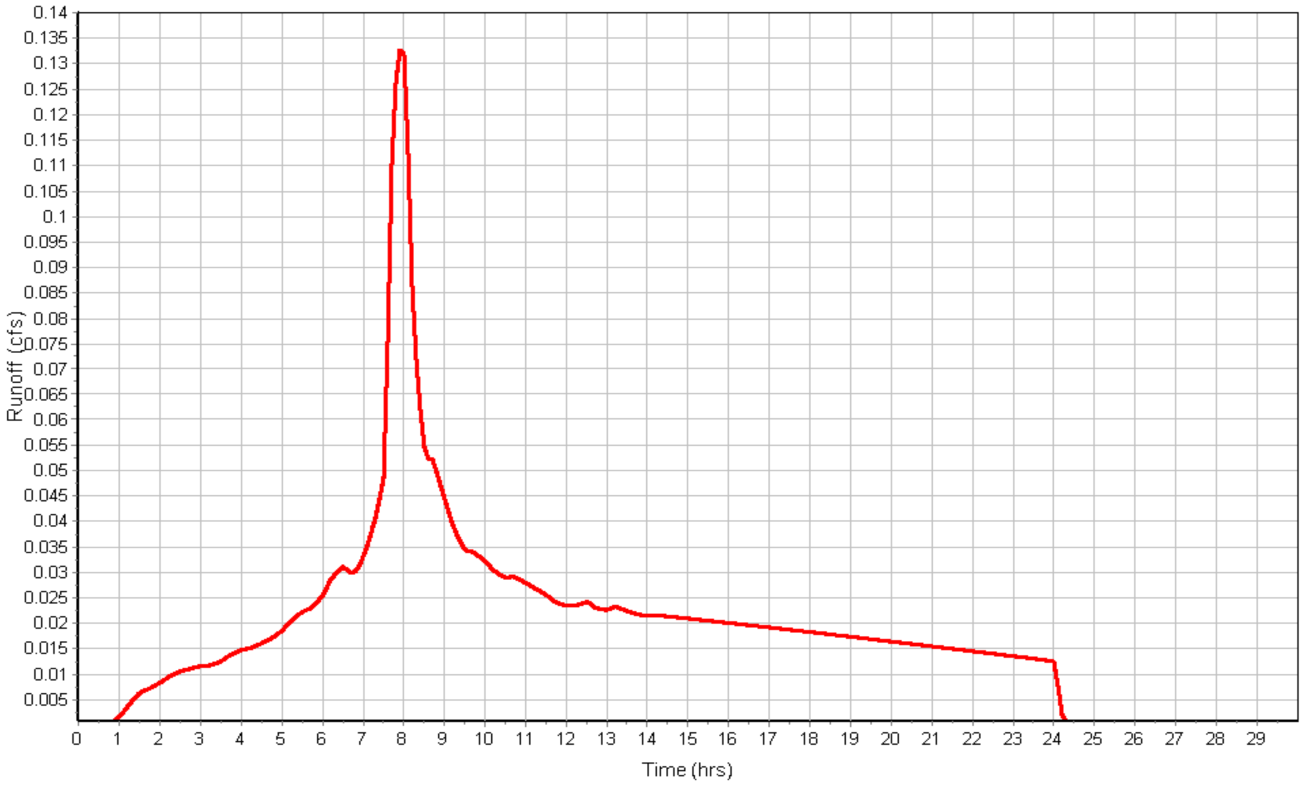
Total Rainfall (in)	3.46
Total Runoff (in)	2.66
Peak Runoff (cfs)	0.13
Weighted Curve Number	91.70
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : NB-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NB-2

Input Data

Area (ac) 0.23
Impervious Area (%) 95.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

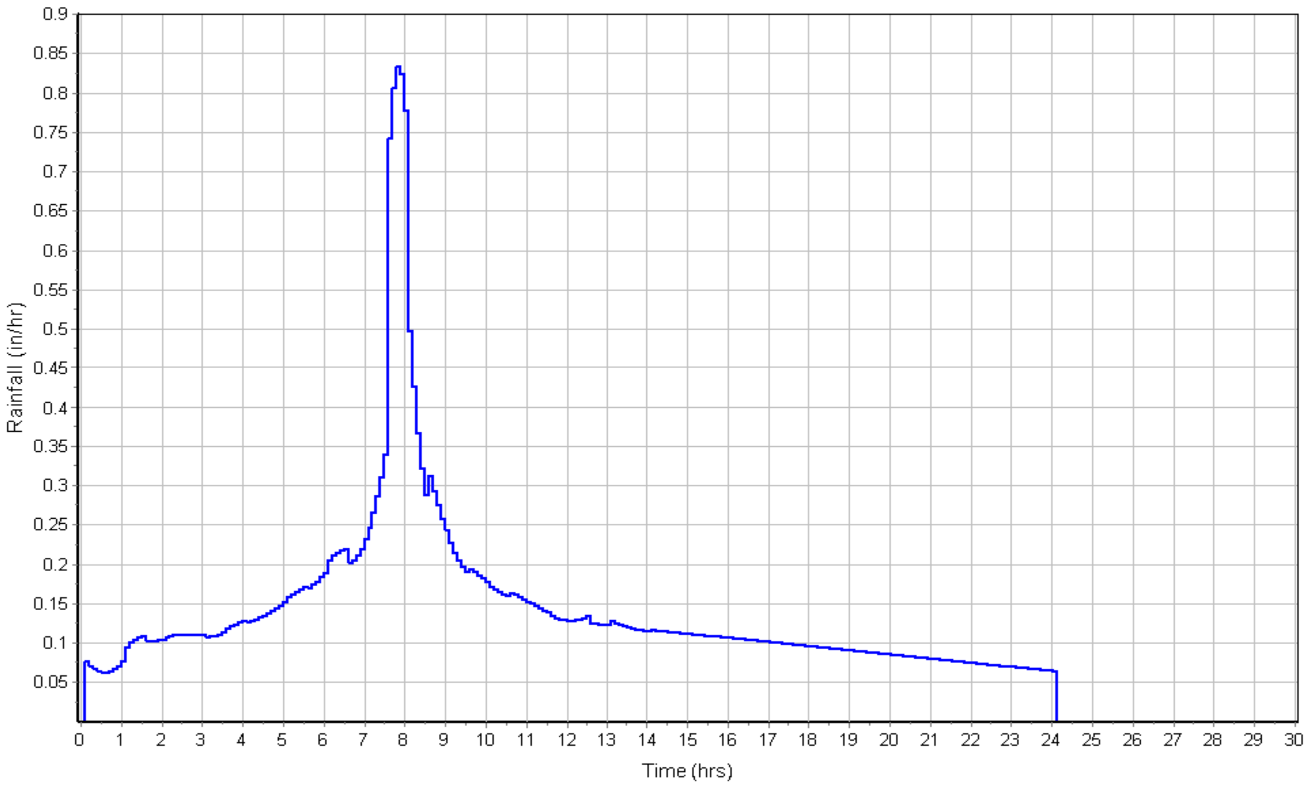
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.23		97.1

Subbasin Runoff Results

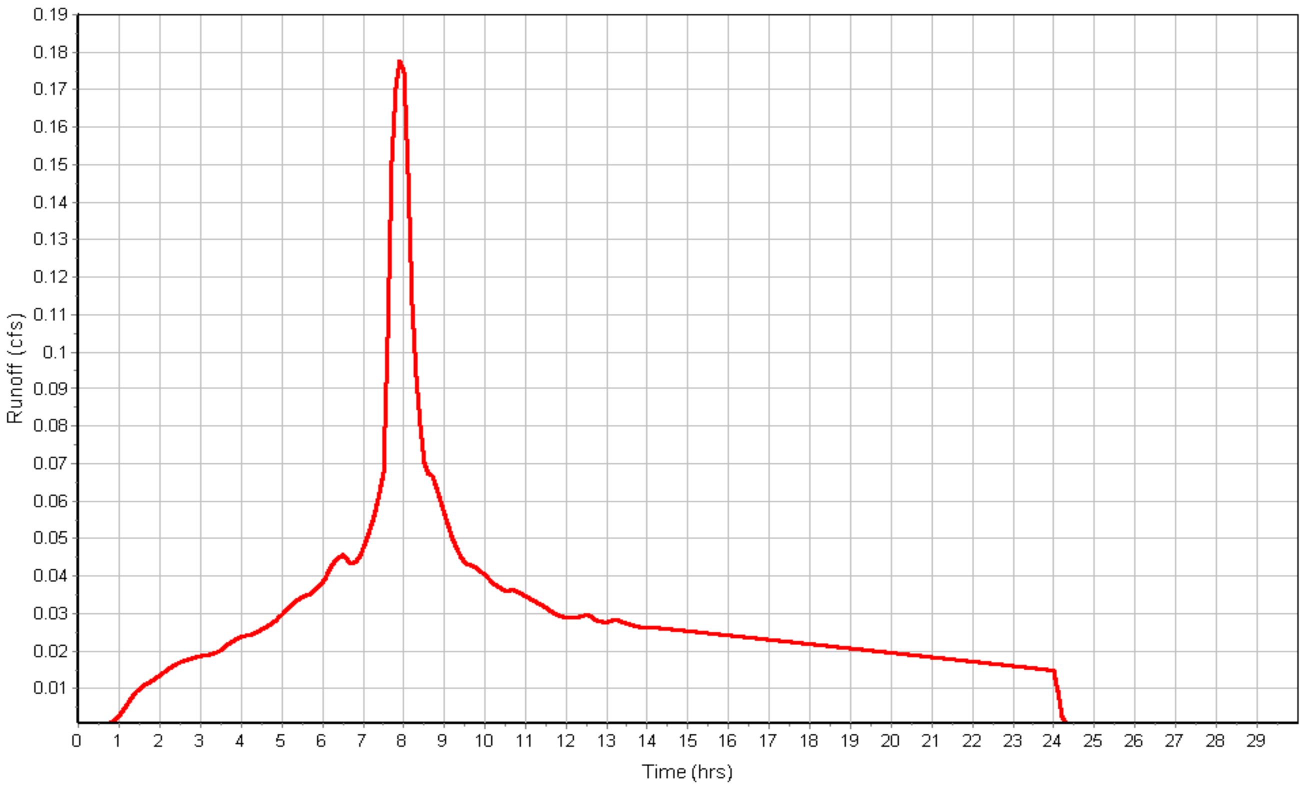
Total Rainfall (in) 3.46
Total Runoff (in) 3.15
Peak Runoff (cfs) 0.18
Weighted Curve Number 97.10
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : NB-2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NP-1

Input Data

Area (ac)	0.07
Impervious Area (%)	93.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	80.00
Rain Gage ID	Rain Gage-01

Composite Curve Number

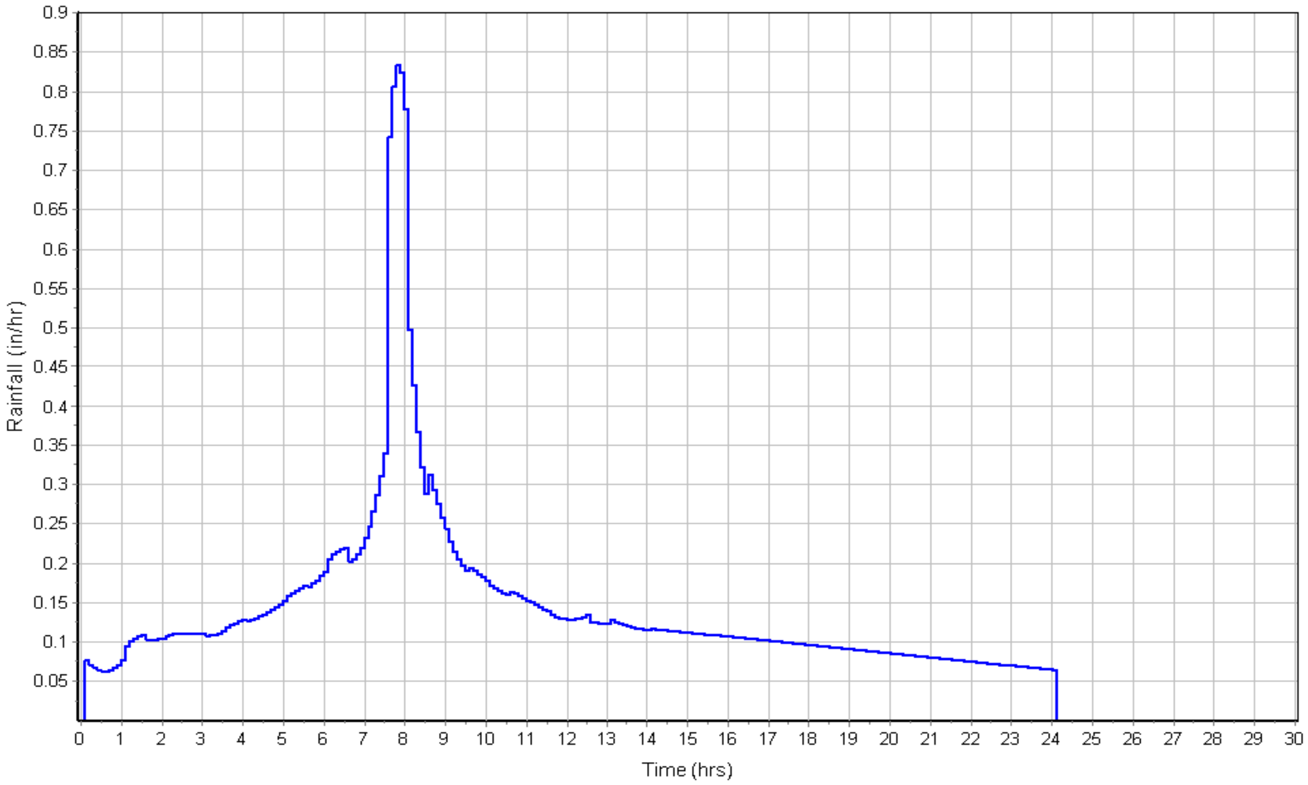
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.07		96.74

Subbasin Runoff Results

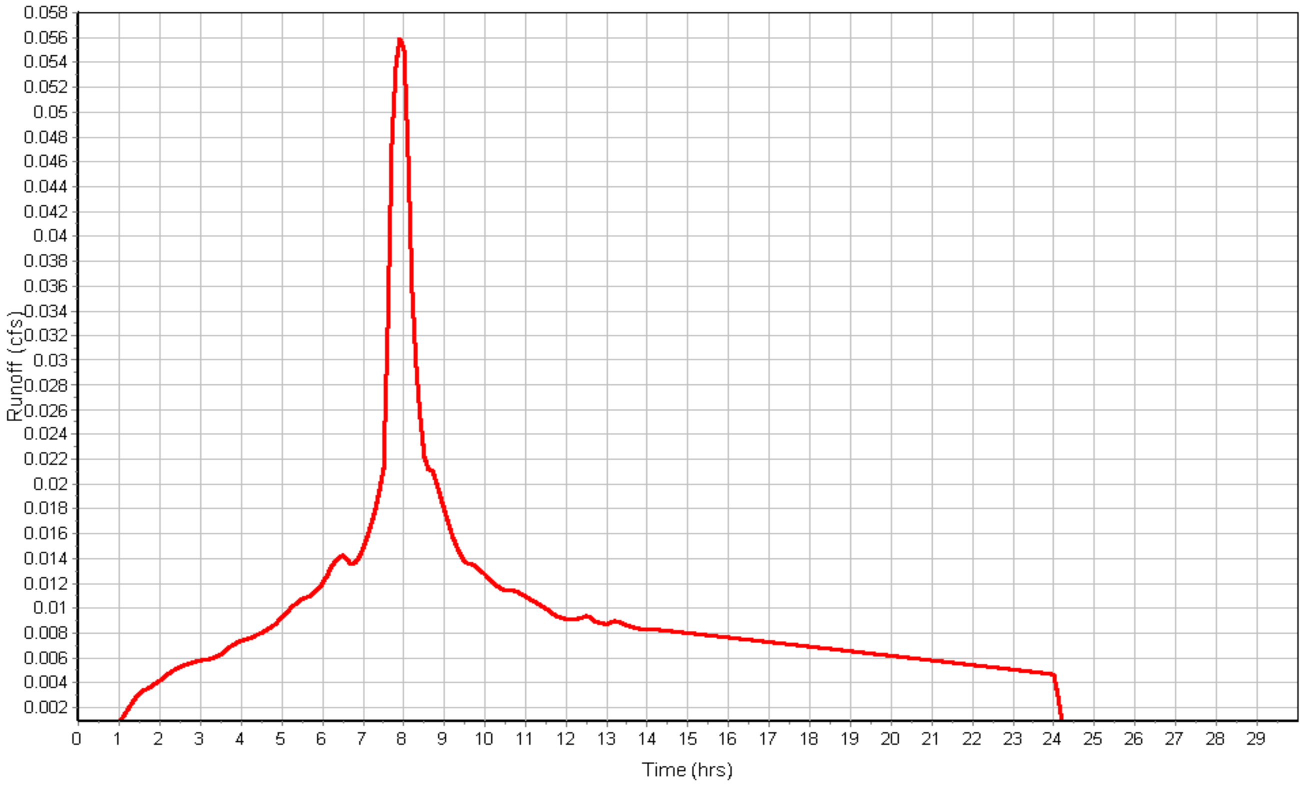
Total Rainfall (in)	3.46
Total Runoff (in)	3.11
Peak Runoff (cfs)	0.06
Weighted Curve Number	96.74
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : NP-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : OFF-1

Input Data

Area (ac) 0.10
Impervious Area (%) 82.00
Impervious Area Curve Number 92.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

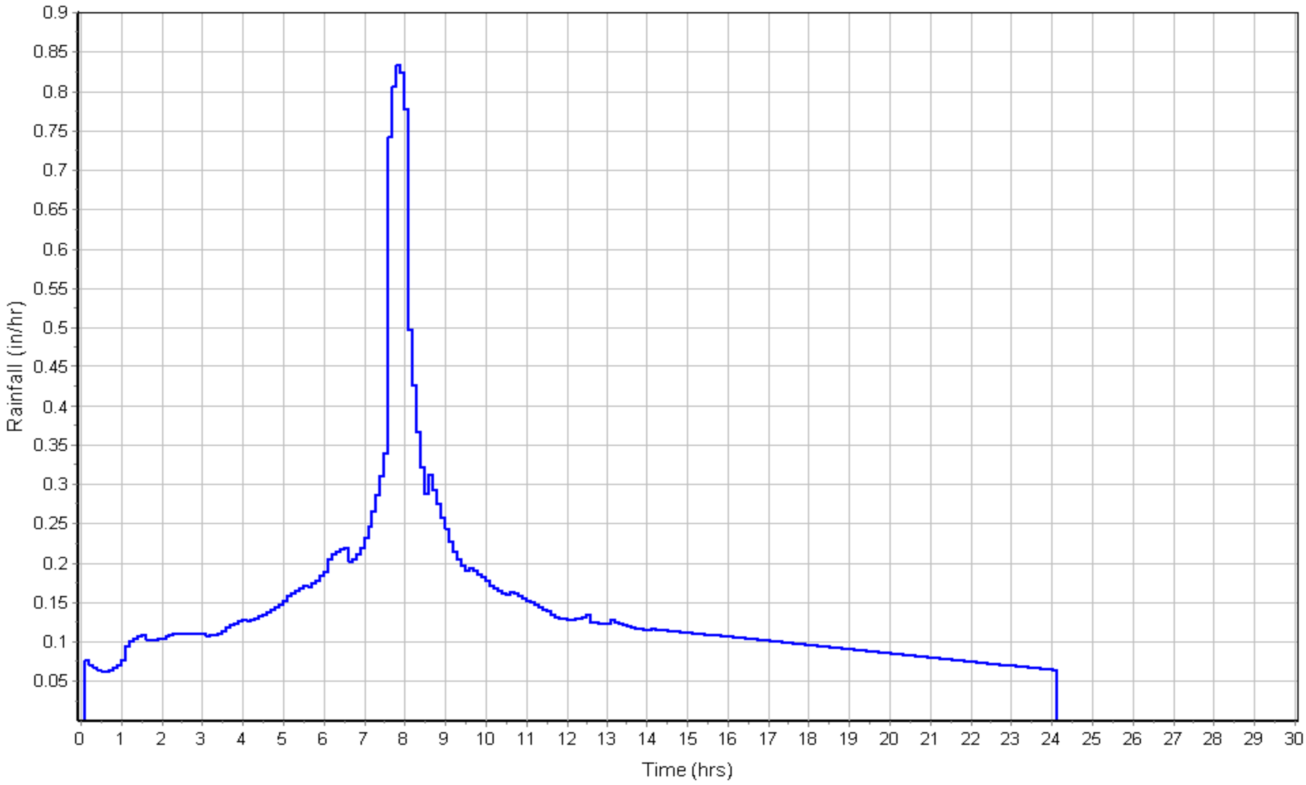
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.10		89.84

Subbasin Runoff Results

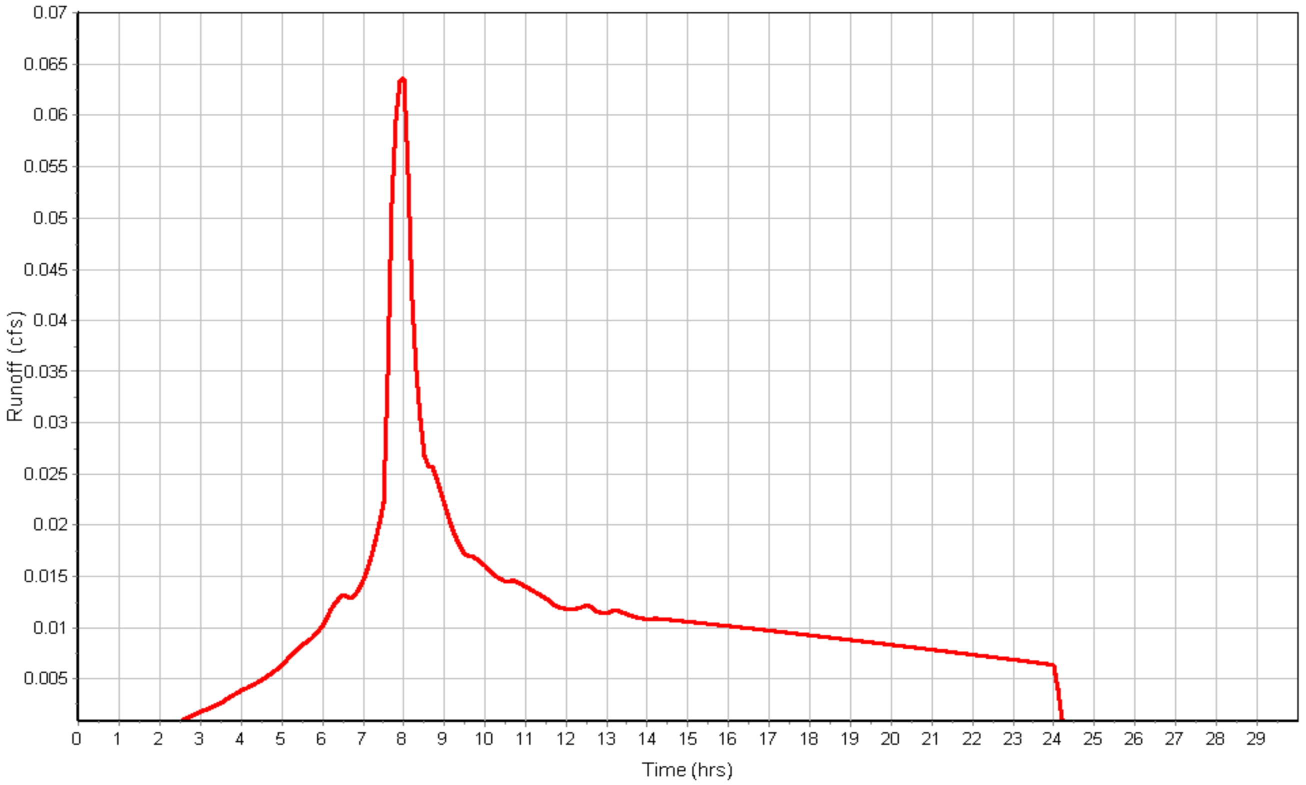
Total Rainfall (in) 3.46
Total Runoff (in) 2.42
Peak Runoff (cfs) 0.06
Weighted Curve Number 89.84
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : OFF-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SB-1

Input Data

Area (ac) 0.13
Impervious Area (%) 72.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

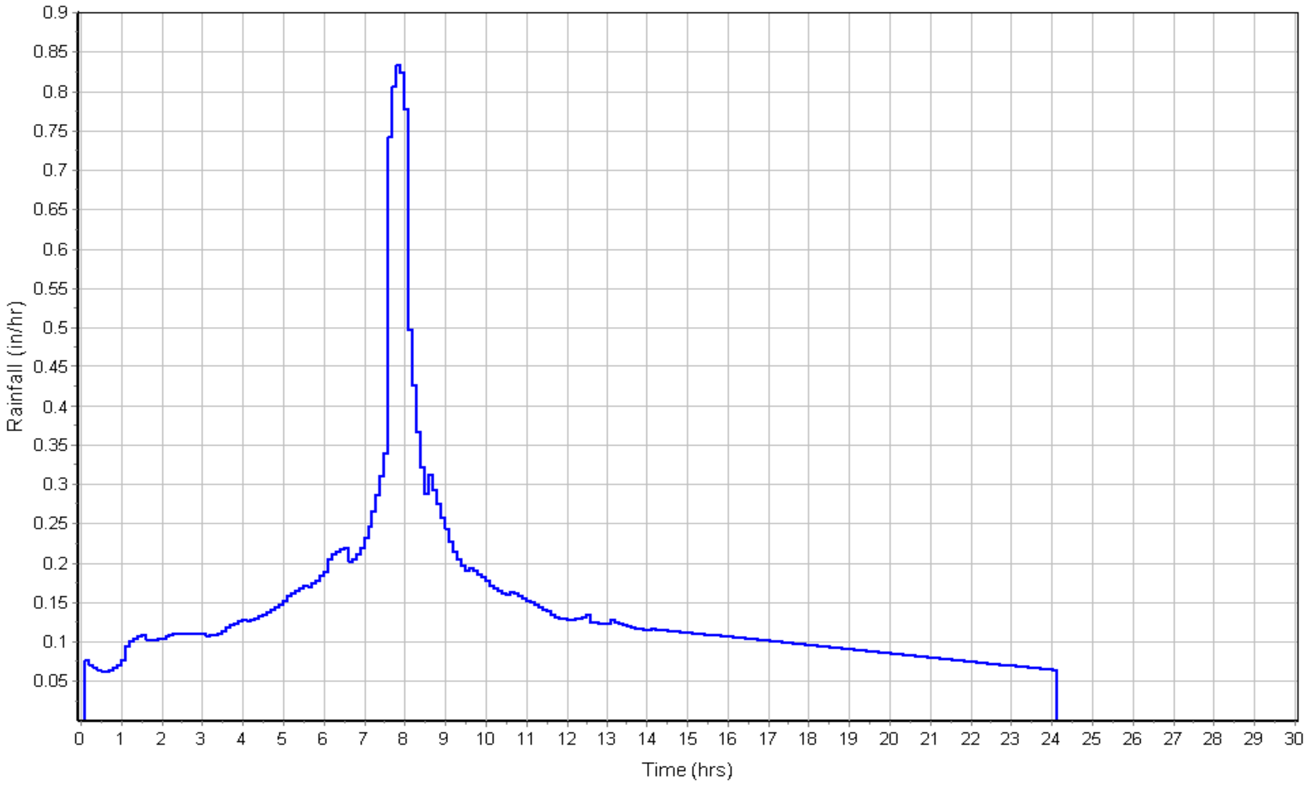
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.13		92.96

Subbasin Runoff Results

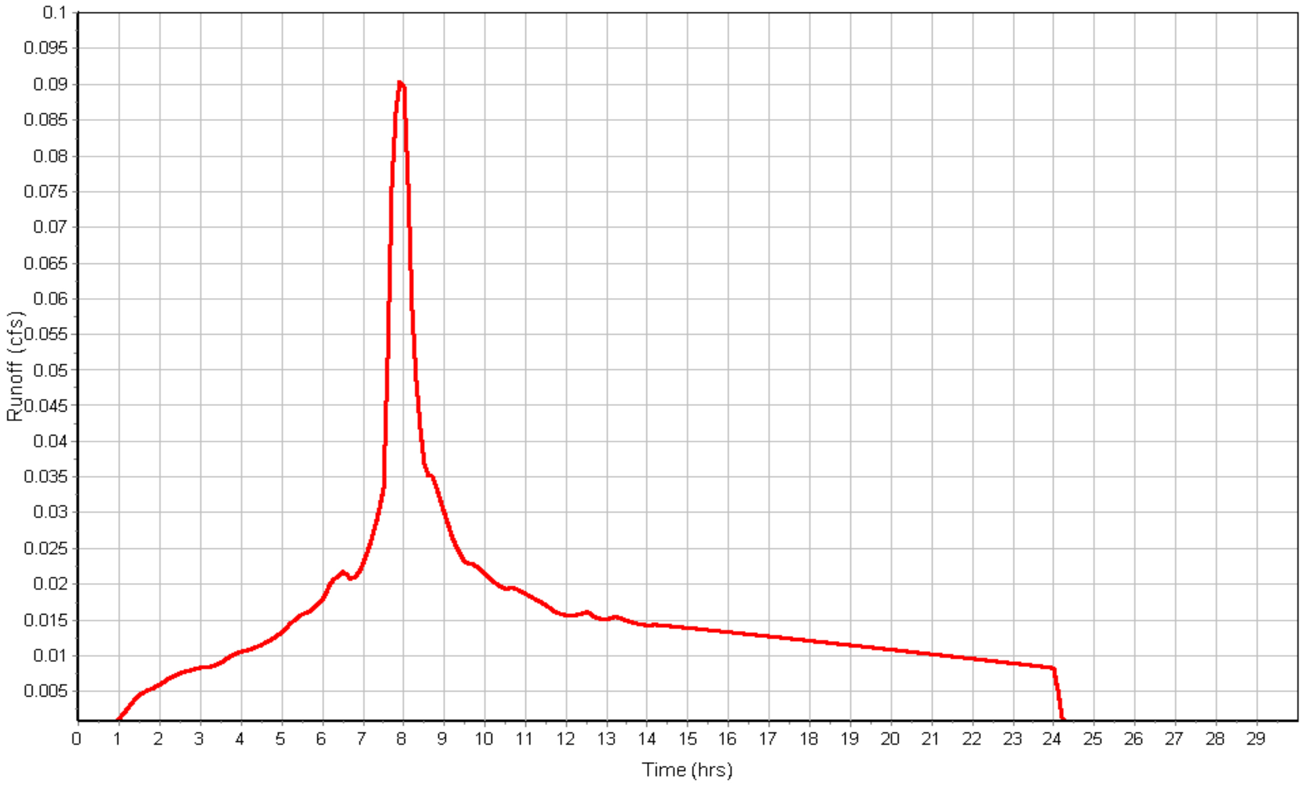
Total Rainfall (in) 3.46
Total Runoff (in) 2.77
Peak Runoff (cfs) 0.09
Weighted Curve Number 92.96
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SB-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SB-2

Input Data

Area (ac) 0.09
Impervious Area (%) 100.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

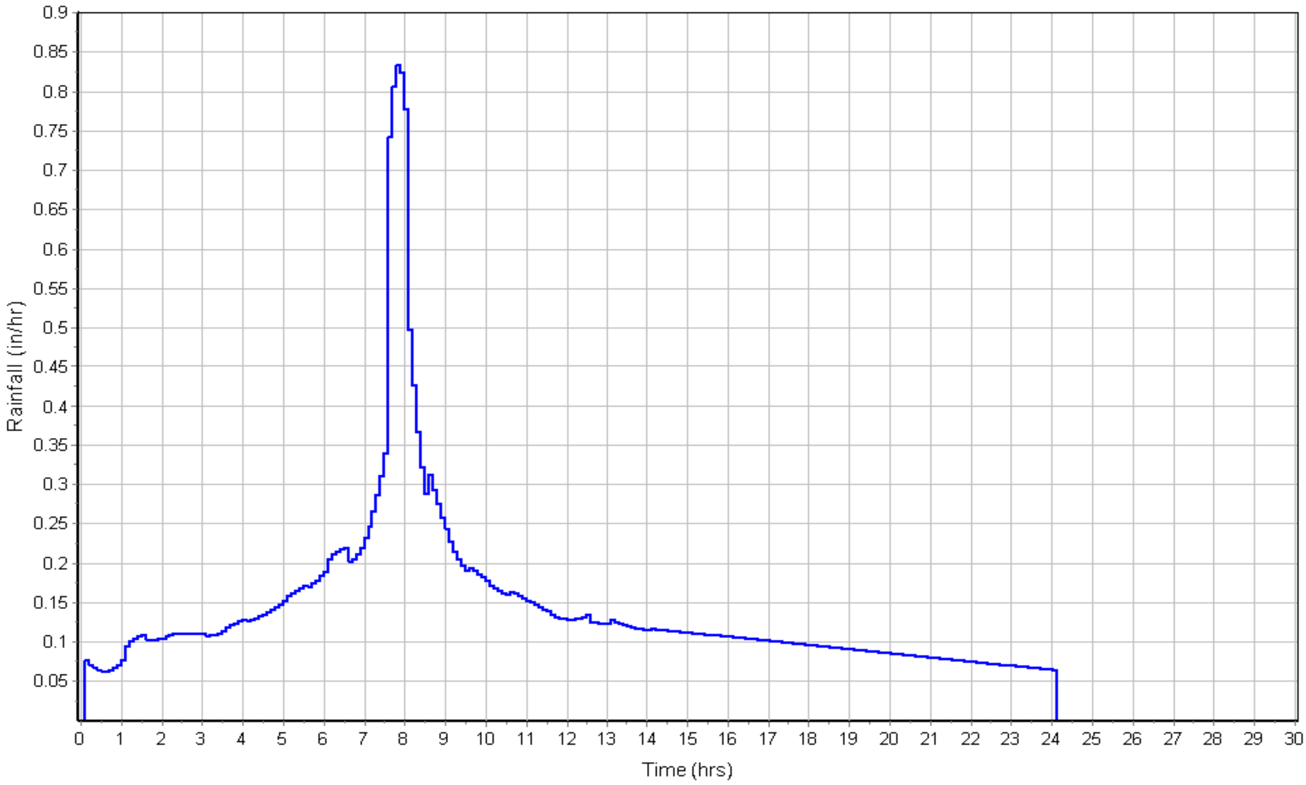
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.09		98

Subbasin Runoff Results

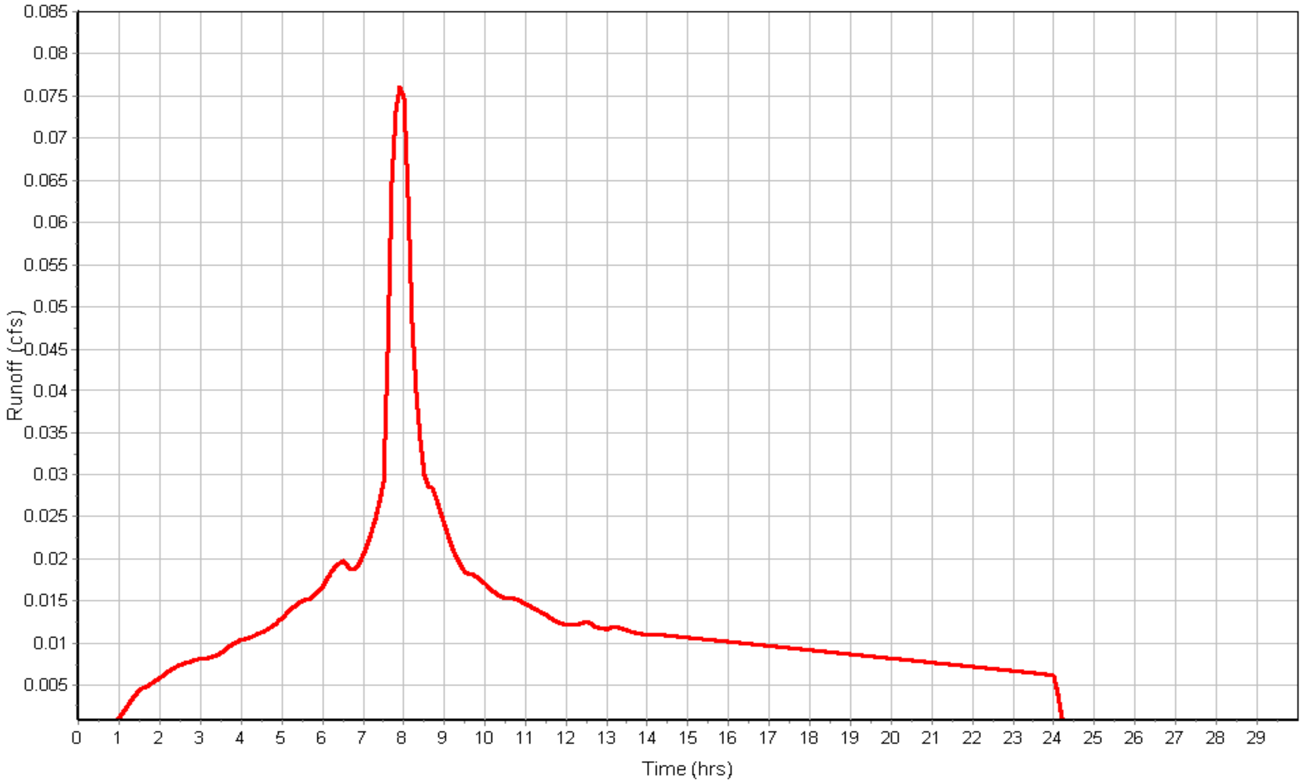
Total Rainfall (in) 3.46
Total Runoff (in) 3.23
Peak Runoff (cfs) 0.08
Weighted Curve Number 98.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SB-2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SP-1

Input Data

Area (ac) 0.76
Impervious Area (%) 79.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

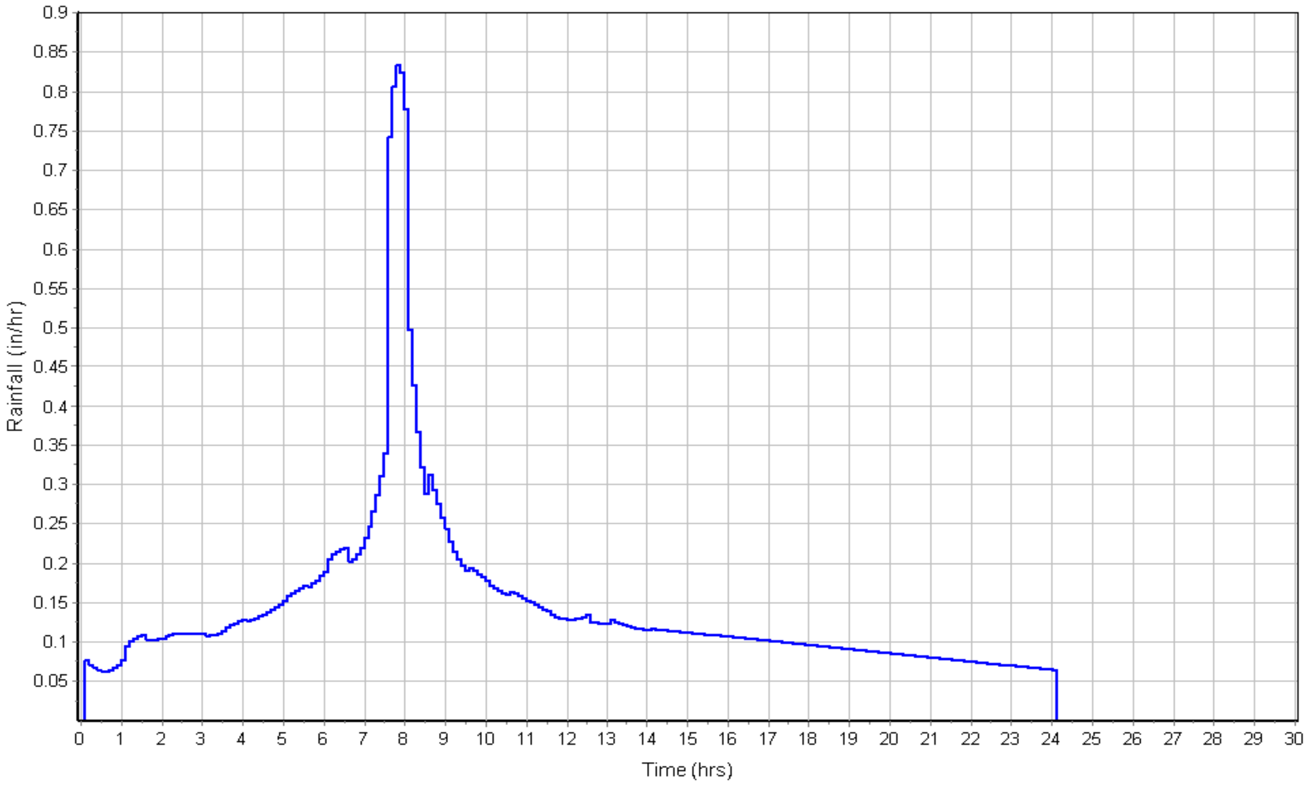
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.76		94.22

Subbasin Runoff Results

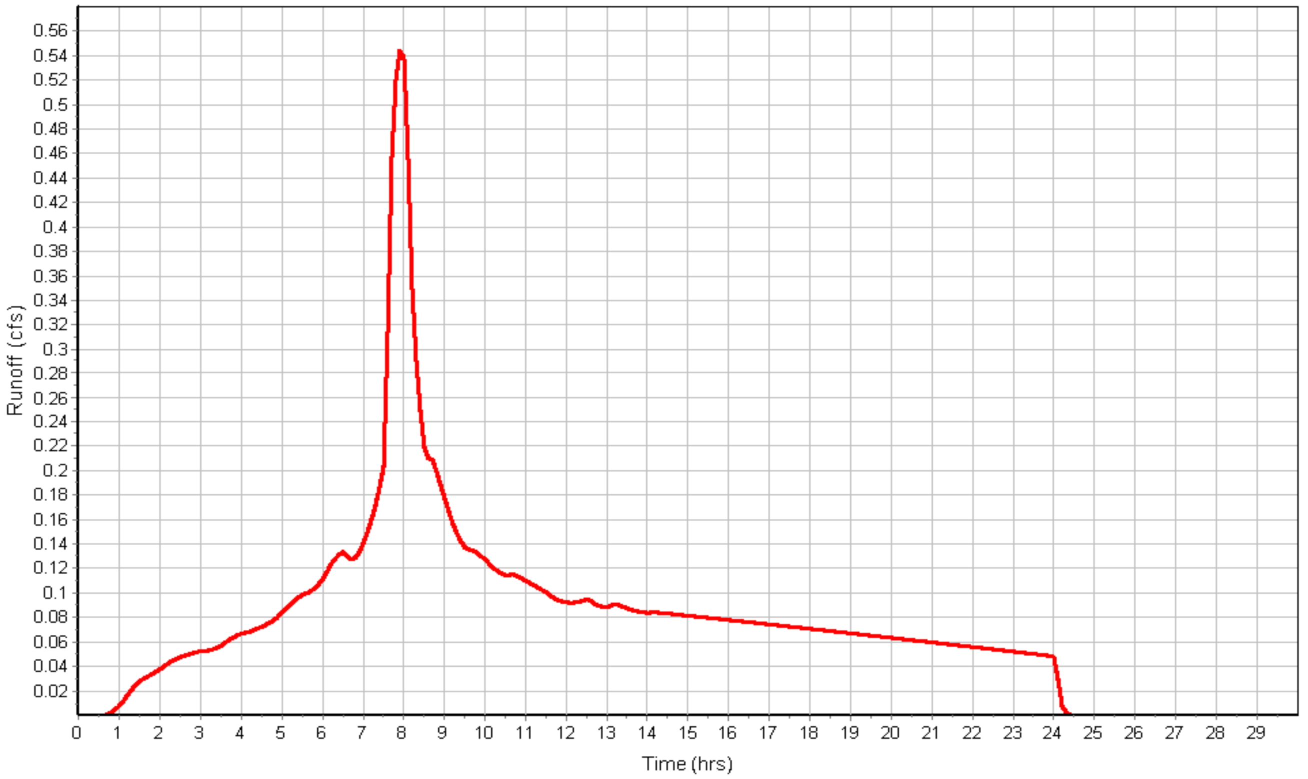
Total Rainfall (in) 3.46
Total Runoff (in) 2.89
Peak Runoff (cfs) 0.54
Weighted Curve Number 94.22
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SP-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SP-2

Input Data

Area (ac) 0.52
Impervious Area (%) 77.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

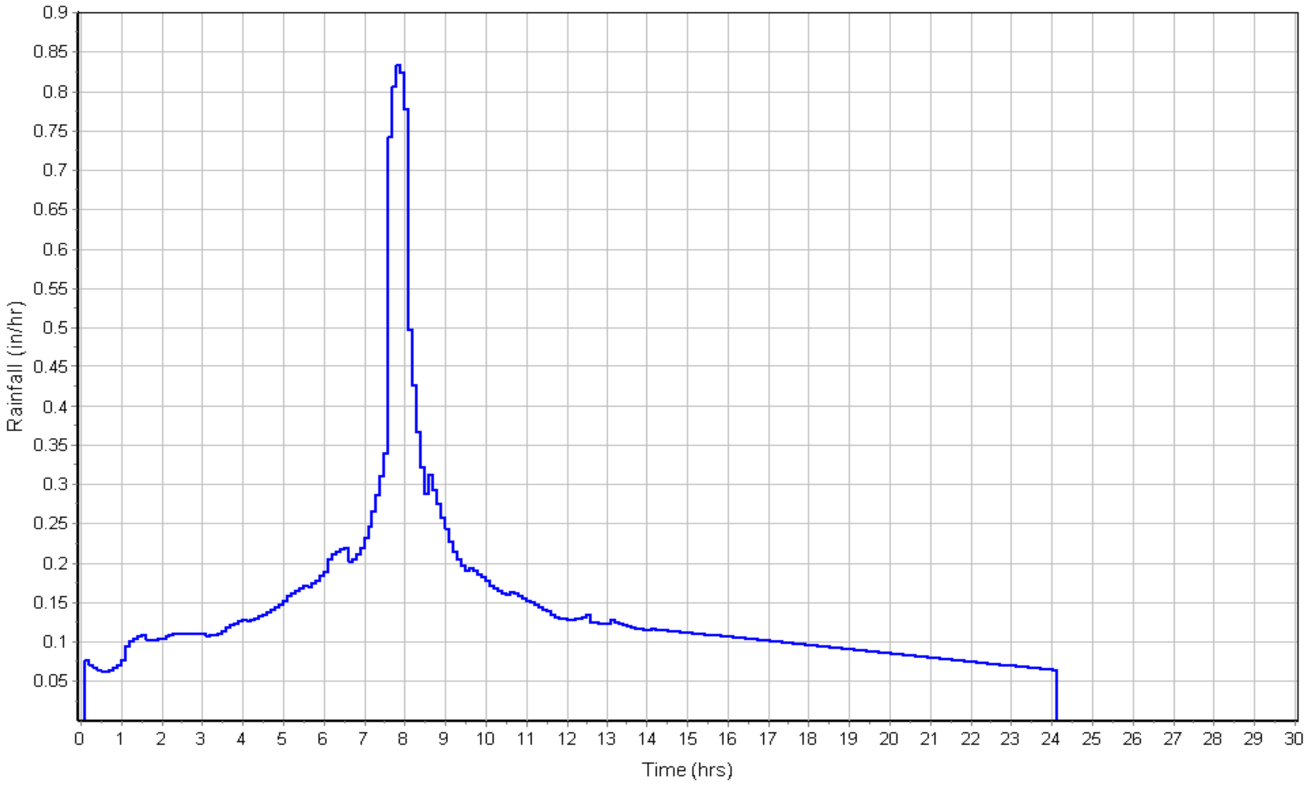
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.52		93.86

Subbasin Runoff Results

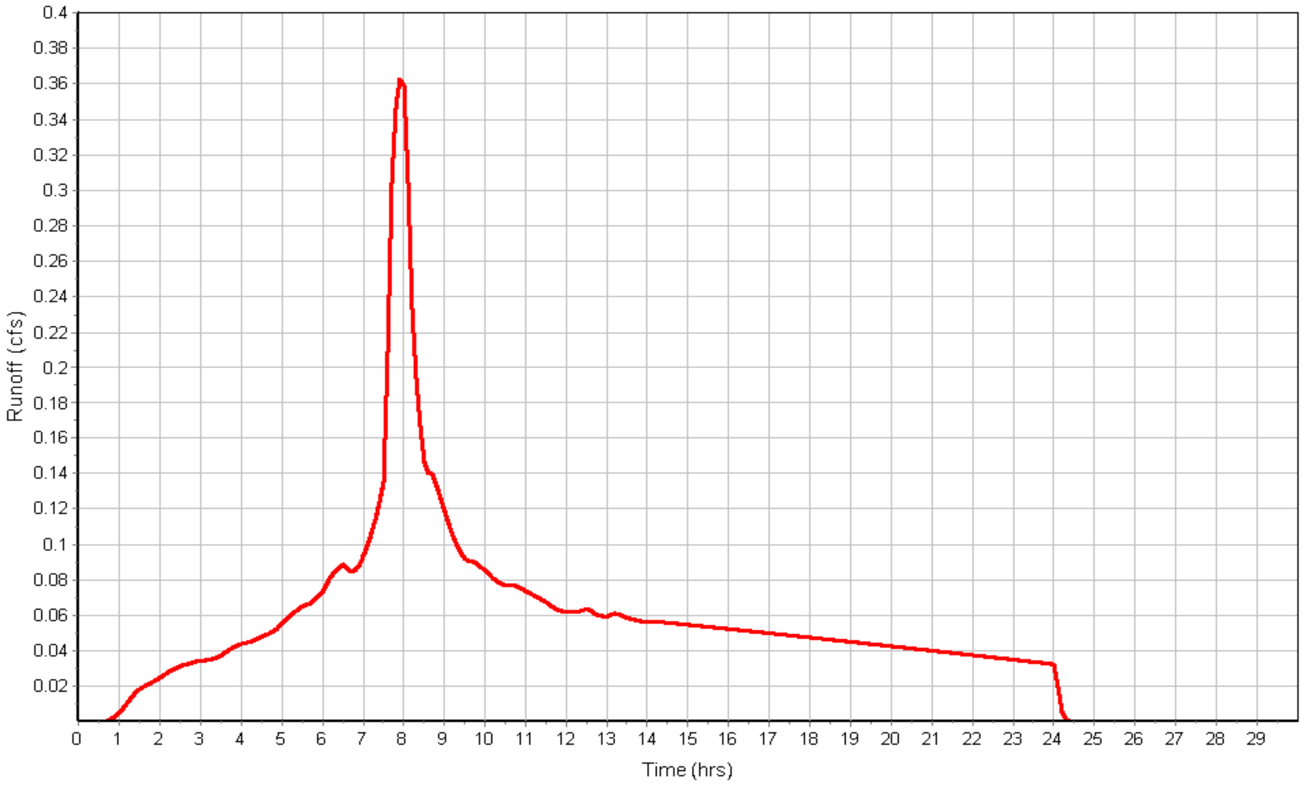
Total Rainfall (in) 3.46
Total Runoff (in) 2.85
Peak Runoff (cfs) 0.36
Weighted Curve Number 93.86
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SP-2

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	ORIFICE	67.30	75.00	7.71	67.30	0.00	74.00	-1.00	10000.00	0.00
2	OUTFALL_1	71.67	75.00	3.33	71.67	0.00	74.00	-1.00	10000.00	0.00
3	SD_CB_1	72.41	73.56	1.15	72.41	0.00	73.48	-0.08	10000.00	0.00
4	SD_CB_2	72.61	76.50	3.89	72.61	0.00	75.50	-1.00	10000.00	0.00
5	SD_CO_15	76.21	78.50	2.29	76.21	0.00	78.00	-0.50	10000.00	0.00
6	SD_CO_6	71.68	75.00	3.32	71.68	0.00	74.00	-1.00	10000.00	0.00
7	SD_CO_9	71.65	75.00	3.35	71.65	0.00	74.00	-1.00	10000.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	ORIFICE	0.00	0.00	67.30	0.00	0.00	7.71	67.30	0.00	0 00:00	0 00:00	0.00	0.00
2	OUTFALL_1	0.97	0.36	72.27	0.60	0.00	2.73	71.91	0.24	0 07:57	0 00:00	0.00	0.00
3	SD_CB_1	0.61	0.61	72.76	0.35	0.00	0.80	72.54	0.13	0 07:55	0 00:00	0.00	0.00
4	SD_CB_2	0.37	0.23	72.91	0.30	0.00	3.59	72.72	0.11	0 07:56	0 00:00	0.00	0.00
5	SD_CO_15	0.13	0.13	76.36	0.15	0.00	2.14	76.27	0.06	0 07:55	0 00:00	0.00	0.00
6	SD_CO_6	0.08	0.08	72.00	0.32	0.00	3.24	71.90	0.22	0 08:14	0 00:00	0.00	0.00
7	SD_CO_9	0.36	0.00	72.01	0.36	0.00	2.99	71.79	0.14	0 07:58	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	LINK-10	50.68	71.67	0.00	71.52	0.10	0.15	0.3000	Trapezoidal	1.000	8.000	0.0800	0.5000	0.5000	0.0000	0.00	No
2	OVERFLOW_01	20.00	72.20	0.78	71.81	4.52	0.39	1.9500	Rectangular	1.000	4.000	0.0100	0.5000	0.5000	0.0000	0.00	No
3	OVERFLOW_02	20.00	74.44	0.50	74.24	2.56	0.20	1.0000	Rectangular	1.000	4.000	0.0100	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	LINK-10	0.97	0 07:57	3.62	0.27	0.80	1.06	0.38	0.38	0.00		
2	OVERFLOW_01	0.00	0 00:00	63.34	0.00	0.00		0.00	0.00	0.00		
3	OVERFLOW_02	0.03	0 08:15	45.36	0.00	0.74	0.45	0.01	0.01	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	LINK_01	12.00	69.29	2.00	69.05	3.22	0.24	2.0000	CIRCULAR	9.960	9.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1
2	LINK-12	222.93	72.23	-0.18	71.67	0.00	0.56	0.2500	CIRCULAR	9.960	9.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1
3	LINK-20	19.69	71.85	0.17	71.75	0.33	0.10	0.5000	CIRCULAR	6.000	6.000	0.0100	0.5000	0.5000	0.0000	0.00	No	1
4	LINK-30	18.32	71.65	0.00	71.60	0.18	0.05	0.3000	CIRCULAR	8.040	8.040	0.0100	0.5000	0.5000	0.0000	0.00	No	1
5	LINK-31	318.43	72.61	0.00	71.65	0.00	0.95	0.3000	CIRCULAR	8.040	8.040	0.0100	0.5000	0.5000	0.0000	0.00	No	1
6	LINK-32	218.21	74.35	-1.86	72.61	0.00	1.75	0.8000	CIRCULAR	3.960	3.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	LINK_01	0.00	0 00:00	4.03	0.00	0.00		0.00	0.00	0.00		Calculated
2	LINK-12	0.61	0 07:55	1.64	0.37	1.91	1.95	0.47	0.57	0.00		Calculated
3	LINK-20	0.08	0 08:14	0.51	0.15	1.75	0.19	0.14	0.28	0.00		Calculated
4	LINK-30	0.36	0 07:58	0.86	0.42	2.22	0.14	0.32	0.48	0.00		Calculated
5	LINK-31	0.36	0 07:56	0.86	0.42	2.13	2.49	0.33	0.49	0.00		Calculated
6	LINK-32	0.13	0 07:55	0.32	0.42	2.10	1.73	0.23	0.68	0.00		Calculated

Storage Nodes

Storage Node : INFL_RG_1

Input Data

Invert Elevation (ft) 71.42
Max (Rim) Elevation (ft) 75.00
Max (Rim) Offset (ft) 3.58
Initial Water Elevation (ft) 0.00
Initial Water Depth (ft) .... -71.42
Ponded Area (ft²) 10000.00
Evaporation Loss 0.00

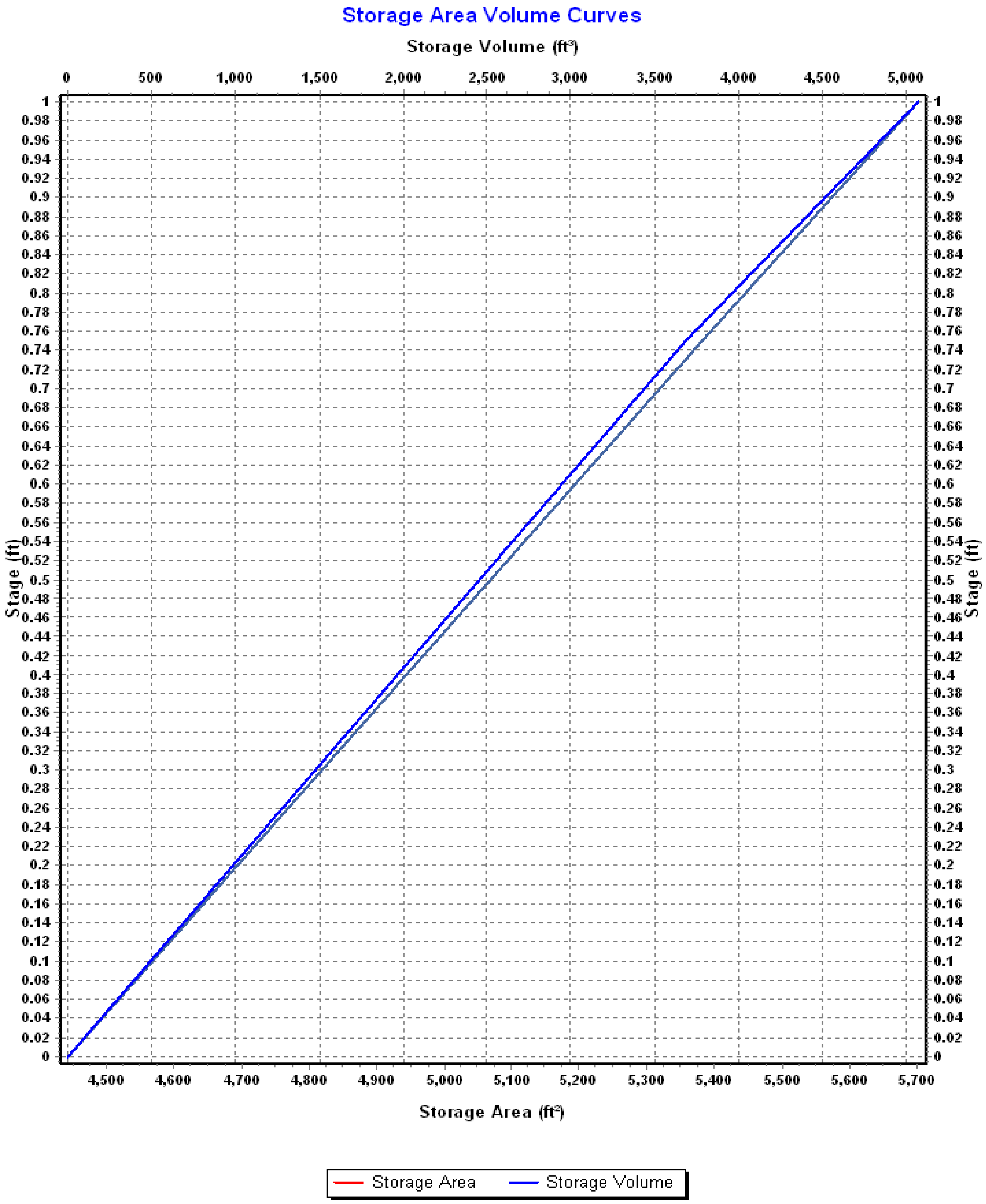
Infiltration/Exfiltration

Constant Flow Rate (cfs) 0.4983

Storage Area Volume Curves

Storage Curve : WETLAND

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0.00	4443.1	0.000
0.75	5381.7	3684.30
1.00	5701.6	5069.71


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Stage (ft)
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
0.84
0.82
0.8
0.78
0.76
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0.56
0.54
0.52
0.5
0.48
0.46
0.44
0.42
0.4
0.38
0.36
0.34
0.32
0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
4,500
4,600
4,700
4,800
4,900
5,000
5,100
5,200
5,300
5,400
5,500
5,600
5,700
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : INFL_RG_1 (continued)

Output Summary Results

Peak Inflow (cfs)	1.50
Peak Lateral Inflow (cfs)	0.10
Peak Outflow (cfs)	0.00
Peak Exfiltration Flow Rate (cfm)	29.90
Max HGL Elevation Attained (ft)	71.92
Max HGL Depth Attained (ft)	0.5
Average HGL Elevation Attained (ft)	71.51
Average HGL Depth Attained (ft)	0.09
Time of Max HGL Occurrence (days hh:mm)	0 09:10
Total Exfiltration Volume (1000-ft^3)	23.319
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : INFL_RG_2

Input Data

Invert Elevation (ft)	73.94
Max (Rim) Elevation (ft)	76.00
Max (Rim) Offset (ft)	2.06
Initial Water Elevation (ft)	0.00
Initial Water Depth (ft)	-73.94
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

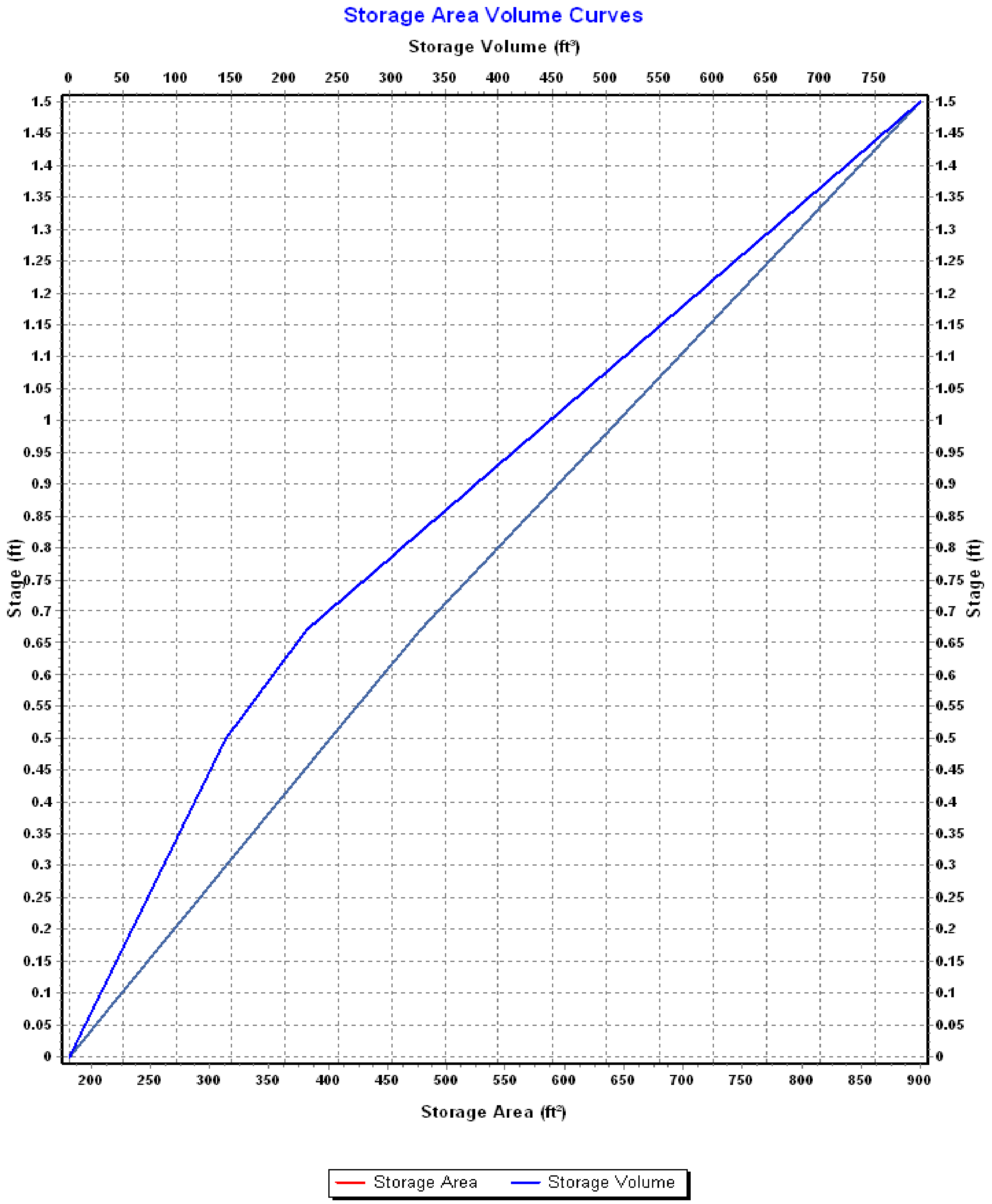
Infiltration/Exfiltration

Constant Flow Rate (cfs)	0.0200

Storage Area Volume Curves

Storage Curve : SB-2_RG

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	182	0.000
0.50	402	146.00
0.67	478	220.80
1.50	900	792.67


Storage Area Volume Curves
Storage Volume (ft³)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Stage (ft)
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Stage (ft)
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : INFL_RG_2 (continued)

Output Summary Results

Peak Inflow (cfs) 0.09
Peak Lateral Inflow (cfs) 0.09
Peak Outflow (cfs) 0.03
Peak Exfiltration Flow Rate (cfm) 1.20
Max HGL Elevation Attained (ft) 74.45
Max HGL Depth Attained (ft) 0.51
Average HGL Elevation Attained (ft) 74.12
Average HGL Depth Attained (ft) 0.18
Time of Max HGL Occurrence (days hh:mm) 0 08:15
Total Exfiltration Volume (1000-ft^3) 1.263
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Project Description

File Name	calc jah 210817 Model.SPF
Description	J:\9700-003-13\Civil\CX5_PIPES\BHE STRM (2013).dwg

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Santa Barbara UH
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Feb 25, 2013	00:00:00
End Analysis On	Feb 26, 2013	06:00:00
Start Reporting On	Feb 25, 2013	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	10
Nodes	10
Junctions	7
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	2
Links	9
Channels	3
Pipes	6
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	005-Year	Cumulative	inches	Oregon	Lincoln	5	4.06	SCS Type IA 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Impervious Area (%)	Impervious Area Curve Number	Pervious Area Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	E-1	0.45	9.00	98.00	77.00	4.06	2.04	0.91	0.14	0 00:32:00
2	EX_SITE	2.56	3.00	91.00	77.00	4.06	1.90	4.85	0.54	0 01:01:00
3	NB-1	0.21	65.00	98.00	80.00	4.06	3.22	0.66	0.16	0 00:05:00
4	NB-2	0.23	95.00	98.00	80.00	4.06	3.74	0.84	0.21	0 00:05:00
5	NP-1	0.07	93.00	98.00	80.00	4.06	3.70	0.27	0.07	0 00:05:00
6	OFF-1	0.10	82.00	92.00	80.00	4.06	2.98	0.31	0.08	0 00:05:00
7	SB-1	0.13	72.00	98.00	80.00	4.06	3.34	0.44	0.11	0 00:05:00
8	SB-2	0.09	100.00	98.00	80.00	4.06	3.83	0.36	0.09	0 00:05:00
9	SP-1	0.76	79.00	98.00	80.00	4.06	3.46	2.64	0.65	0 00:05:00
10	SP-2	0.52	77.00	98.00	80.00	4.06	3.43	1.77	0.44	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	ORIFICE	Junction	67.30	75.00	67.30	74.00	10000.00	0.00	67.30	0.00	7.71	0 00:00	0.00	0.00
2	OUTFALL_1	Junction	71.67	75.00	71.67	74.00	10000.00	1.16	72.31	0.00	2.69	0 00:00	0.00	0.00
3	SD_CB_1	Junction	72.41	73.56	72.41	73.48	10000.00	0.73	72.80	0.00	0.76	0 00:00	0.00	0.00
4	SD_CB_2	Junction	72.61	76.50	72.61	75.50	10000.00	0.44	72.95	0.00	3.55	0 00:00	0.00	0.00
5	SD_CO_15	Junction	76.21	78.50	76.21	78.00	10000.00	0.16	76.38	0.00	2.12	0 00:00	0.00	0.00
6	SD_CO_6	Junction	71.68	75.00	71.68	74.00	10000.00	0.17	72.17	0.00	3.07	0 00:00	0.00	0.00
7	SD_CO_9	Junction	71.65	75.00	71.65	74.00	10000.00	0.44	72.17	0.00	2.83	0 00:00	0.00	0.00
8	NEW_OUT	Outfall	65.83					0.54	65.83					
9	INFL_RG_1	Storage Node	71.42	75.00	0.00		10000.00	1.92	72.17				0.00	0.00
10	INFL_RG_2	Storage Node	73.94	76.00	0.00		0.00	0.11	74.46				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Reported Condition
1	LINK_01	Pipe	ORIFICE	NEW_OUT	12.00	69.29	69.05	2.0000	10.000	0.0100	0.00	4.03	0.00	0.00	0.00	0.00	0.00	Calculated
2	LINK-12	Pipe	SD_CB_1	OUTFALL_1	222.93	72.23	71.67	0.2500	10.000	0.0100	0.73	1.64	0.45	2.11	0.52	0.62	0.00	Calculated
3	LINK-20	Pipe	SD_CO_6	INFL_RG_1	19.69	71.85	71.75	0.5000	6.000	0.0100	0.17	0.51	0.33	2.11	0.37	0.75	0.00	Calculated
4	LINK-30	Pipe	SD_CO_9	INFL_RG_1	18.32	71.65	71.60	0.3000	8.000	0.0100	0.44	0.86	0.51	2.33	0.55	0.82	0.00	Calculated
5	LINK-31	Pipe	SD_CB_2	SD_CO_9	318.43	72.61	71.65	0.3000	8.000	0.0100	0.44	0.86	0.51	2.23	0.37	0.55	0.00	Calculated
6	LINK-32	Pipe	SD_CO_15	SD_CB_2	218.21	74.35	72.61	0.8000	4.000	0.0100	0.16	0.32	0.51	2.29	0.25	0.75	0.00	Calculated
7	LINK-10	Channel	OUTFALL_1	INFL_RG_1	50.68	71.67	71.52	0.3000	12.000	0.0800	1.19	3.62	0.33	0.85	0.58	0.58	0.00	
8	OVERFLOW_01	Channel	INFL_RG_1	ORIFICE	20.00	72.20	71.81	1.9500	12.000	0.0100	0.00	63.34	0.00	0.00	0.00	0.00	0.00	
9	OVERFLOW_02	Channel	INFL_RG_2	SD_CO_6	20.00	74.44	74.24	1.0000	12.000	0.0100	0.08	45.36	0.00	1.06	0.02	0.02	0.00	

Subbasin Hydrology

Subbasin : E-1

Input Data

Area (ac)	0.45
Impervious Area (%)	9.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	77.00
Rain Gage ID	Rain Gage-01

Composite Curve Number

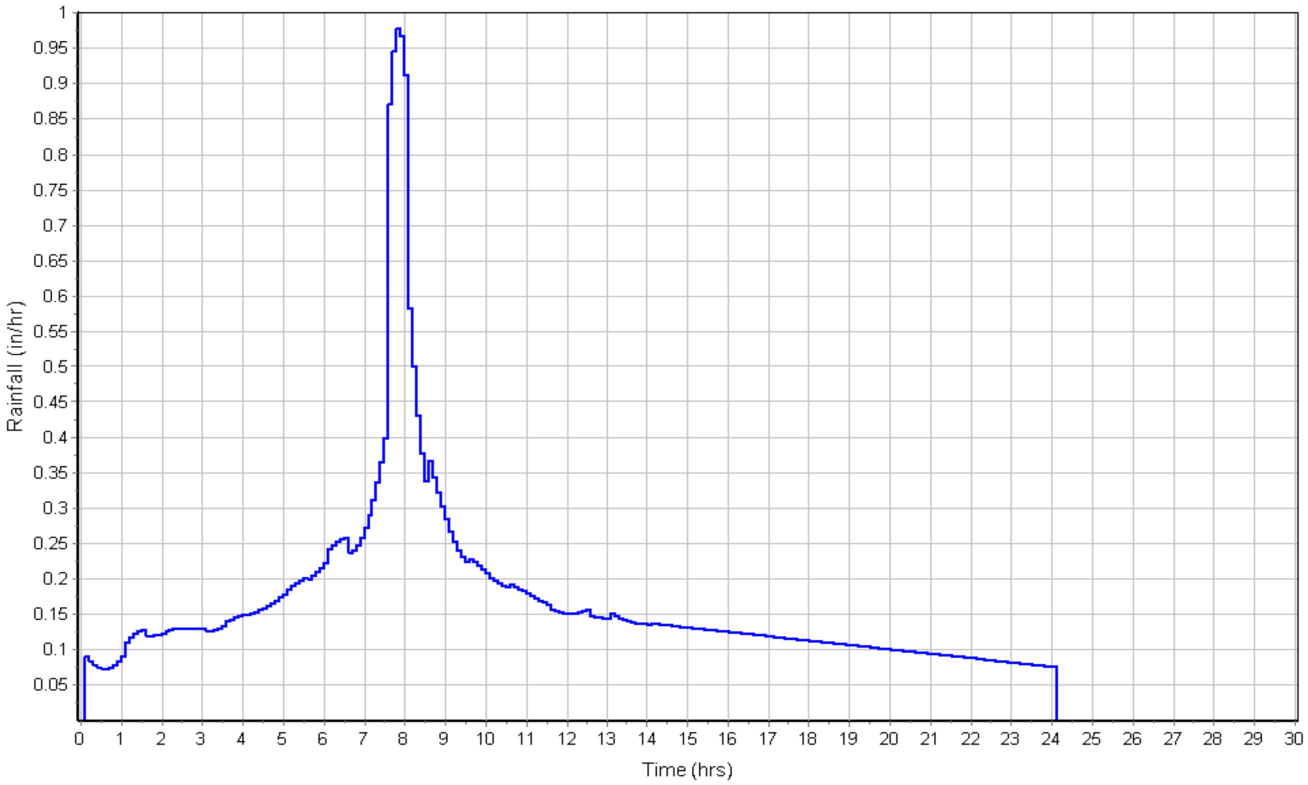
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.45		78.89

Subbasin Runoff Results

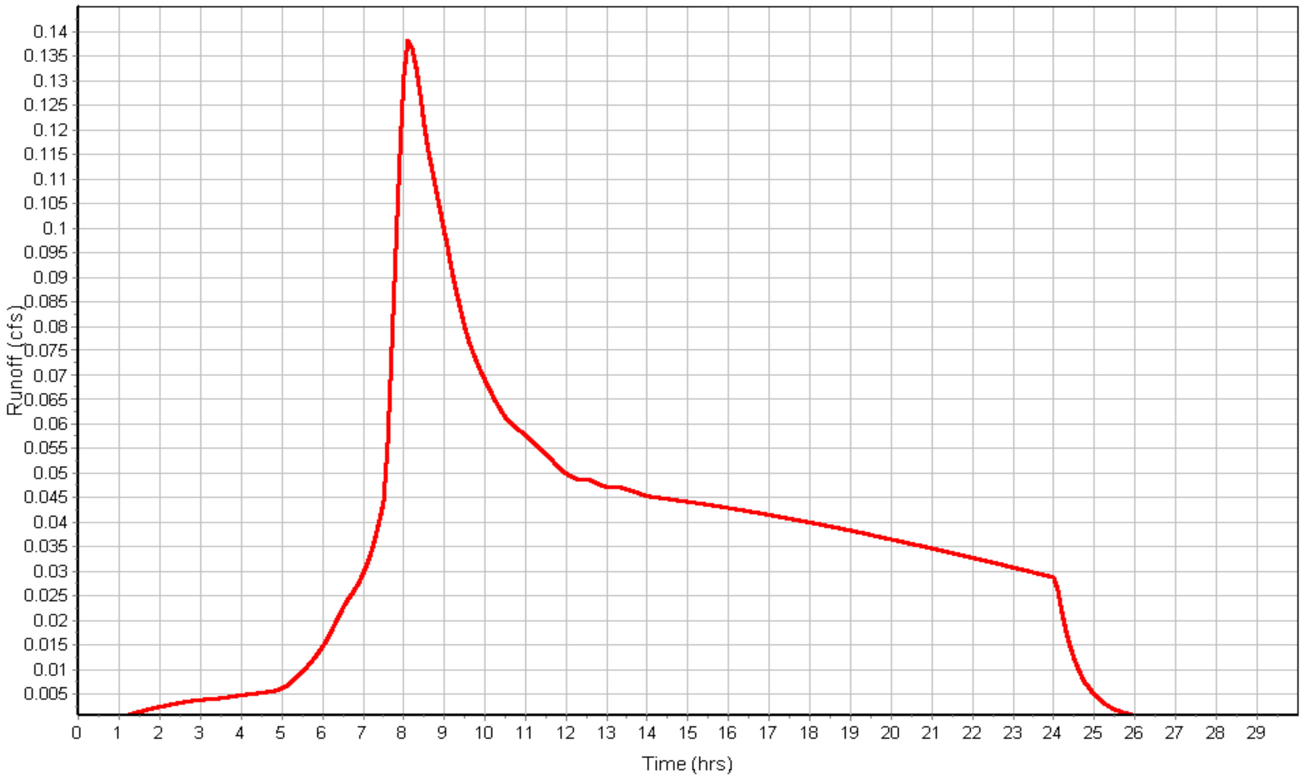
Total Rainfall (in)	4.06
Total Runoff (in)	2.04
Peak Runoff (cfs)	0.14
Weighted Curve Number	78.89
Time of Concentration (days hh:mm:ss)	0 00:32:00

Subbasin : E-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : EX_SITE

Input Data

Area (ac) 2.56
Impervious Area (%) 3.00
Impervious Area Curve Number 91.00
Pervious Area Curve Number 77.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

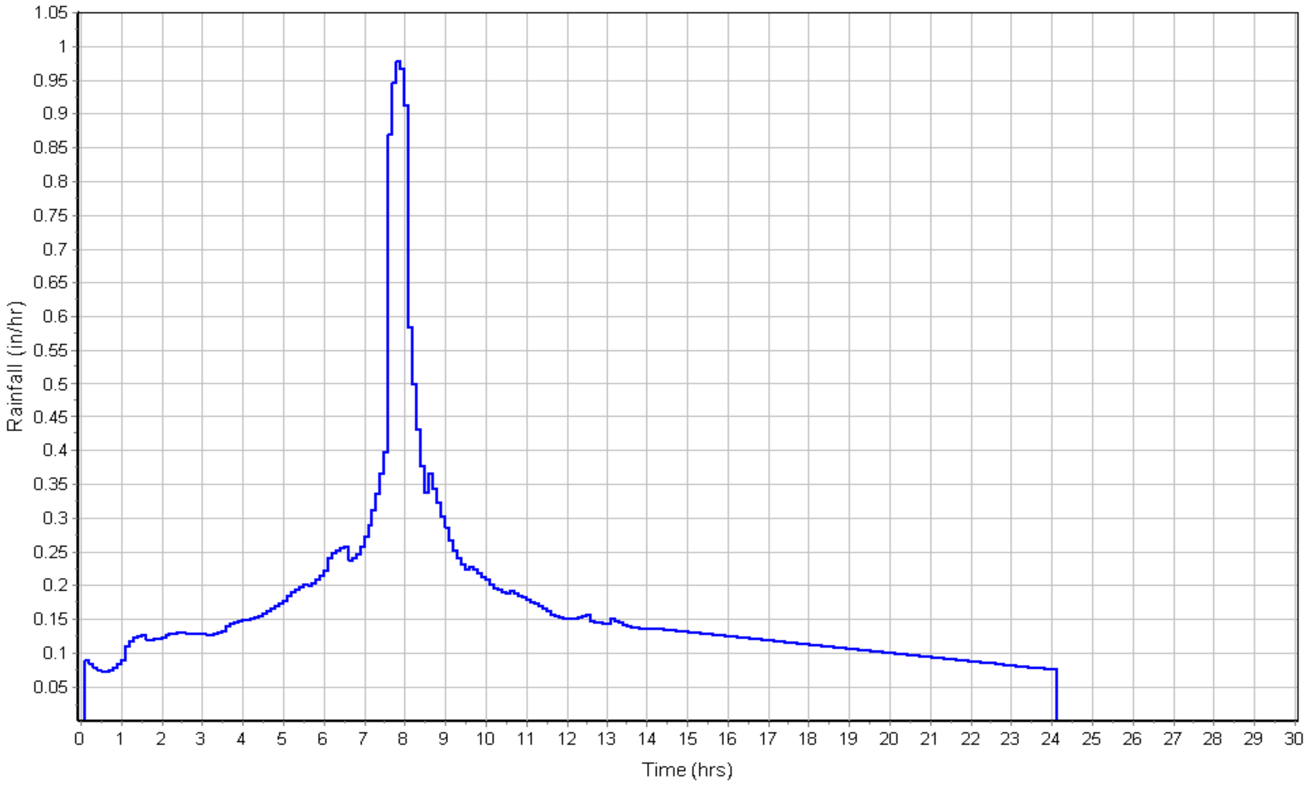
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	2.56		77.42

Subbasin Runoff Results

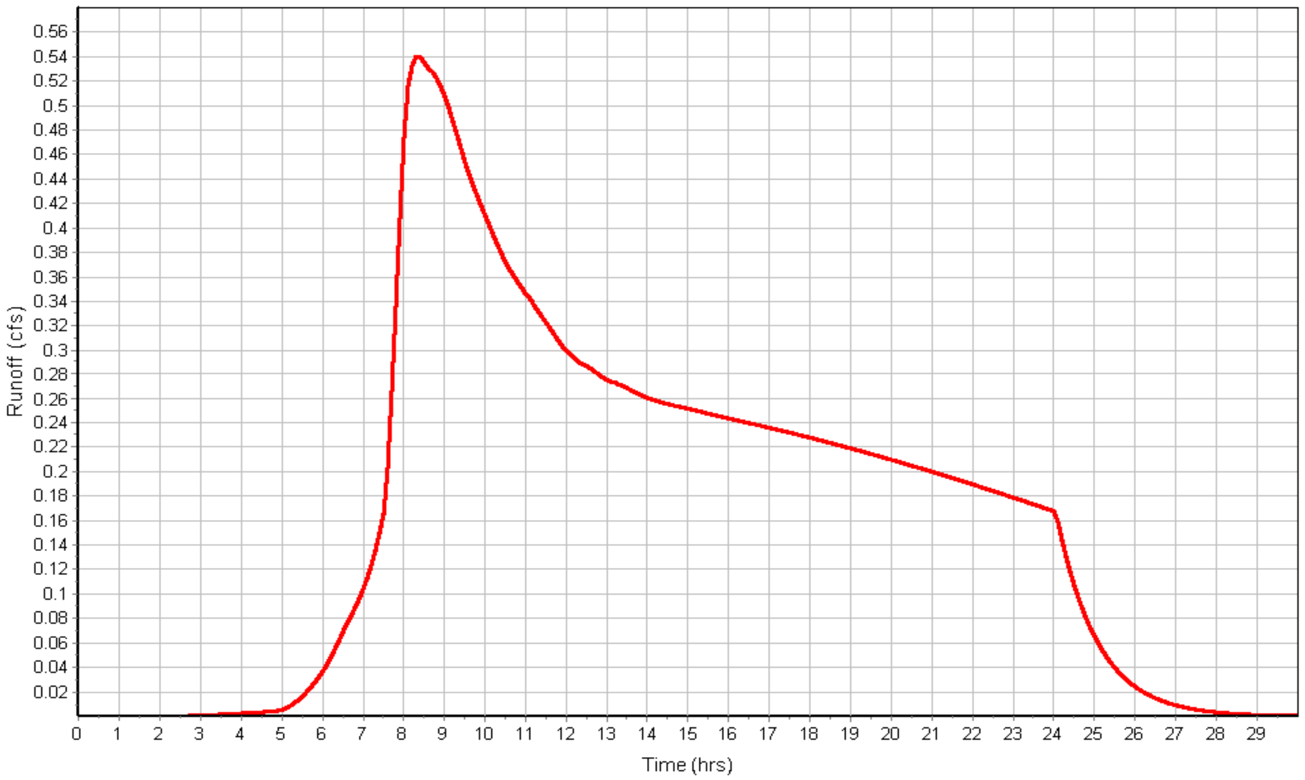
Total Rainfall (in) 4.06
Total Runoff (in) 1.90
Peak Runoff (cfs) 0.54
Weighted Curve Number 77.42
Time of Concentration (days hh:mm:ss) 0 01:01:00

Subbasin : EX_SITE

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NB-1

Input Data

Area (ac)	0.21
Impervious Area (%)	65.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	80.00
Rain Gage ID	Rain Gage-01

Composite Curve Number

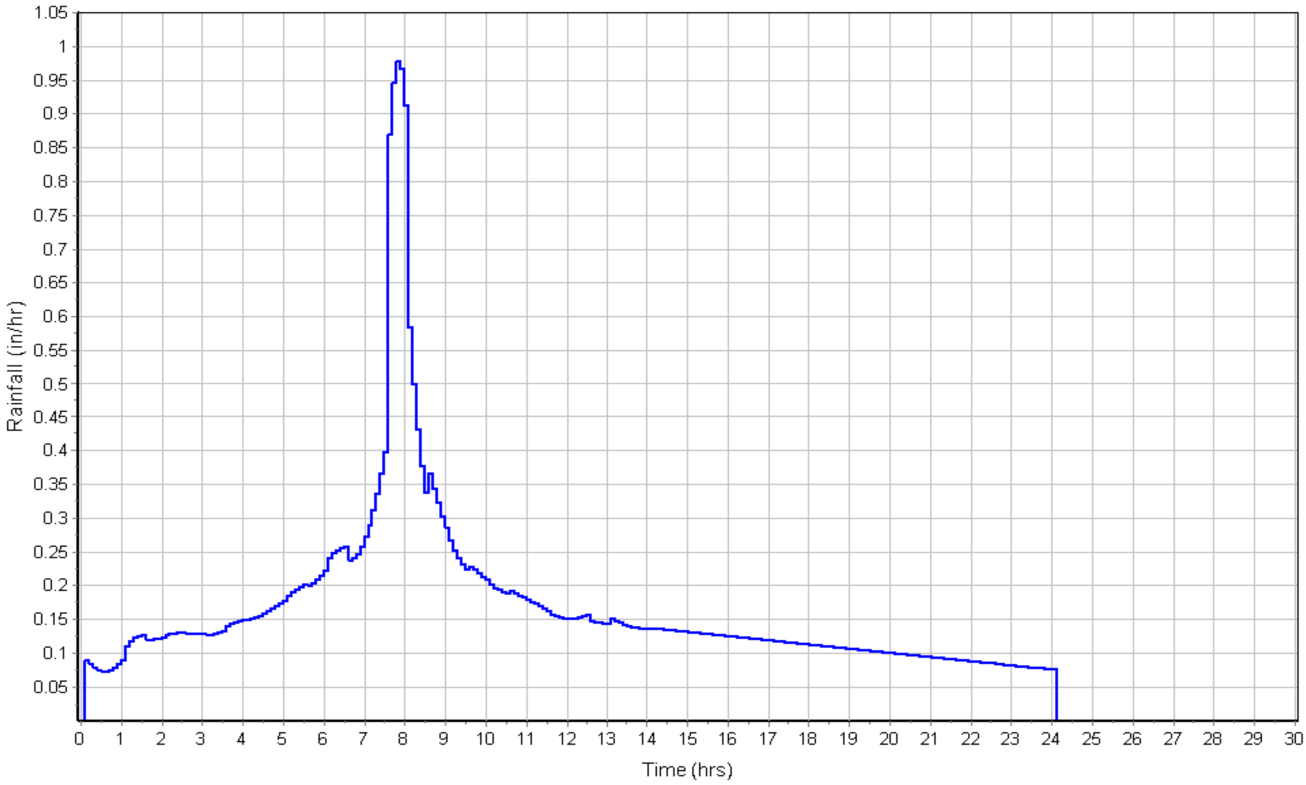
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.21		91.7

Subbasin Runoff Results

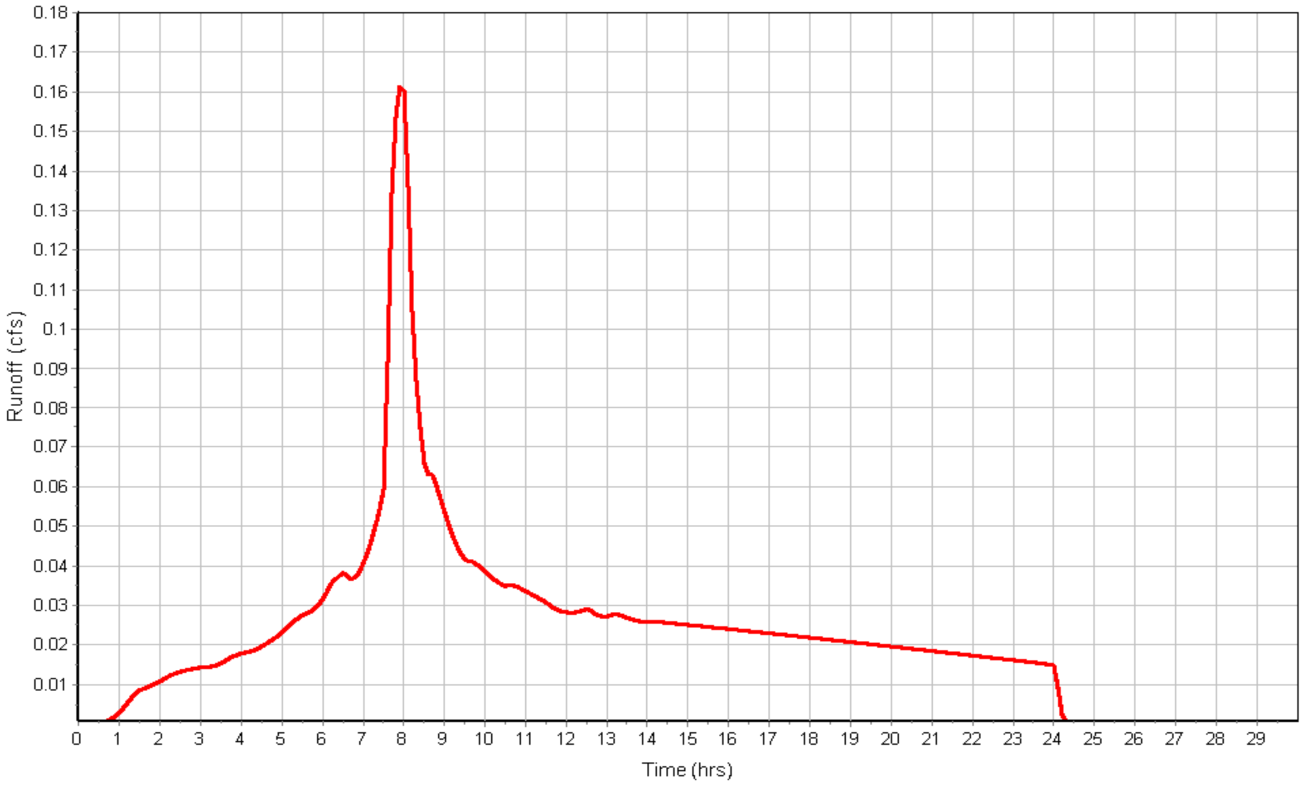
Total Rainfall (in)	4.06
Total Runoff (in)	3.22
Peak Runoff (cfs)	0.16
Weighted Curve Number	91.70
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : NB-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NB-2

Input Data

Area (ac) 0.23
Impervious Area (%) 95.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

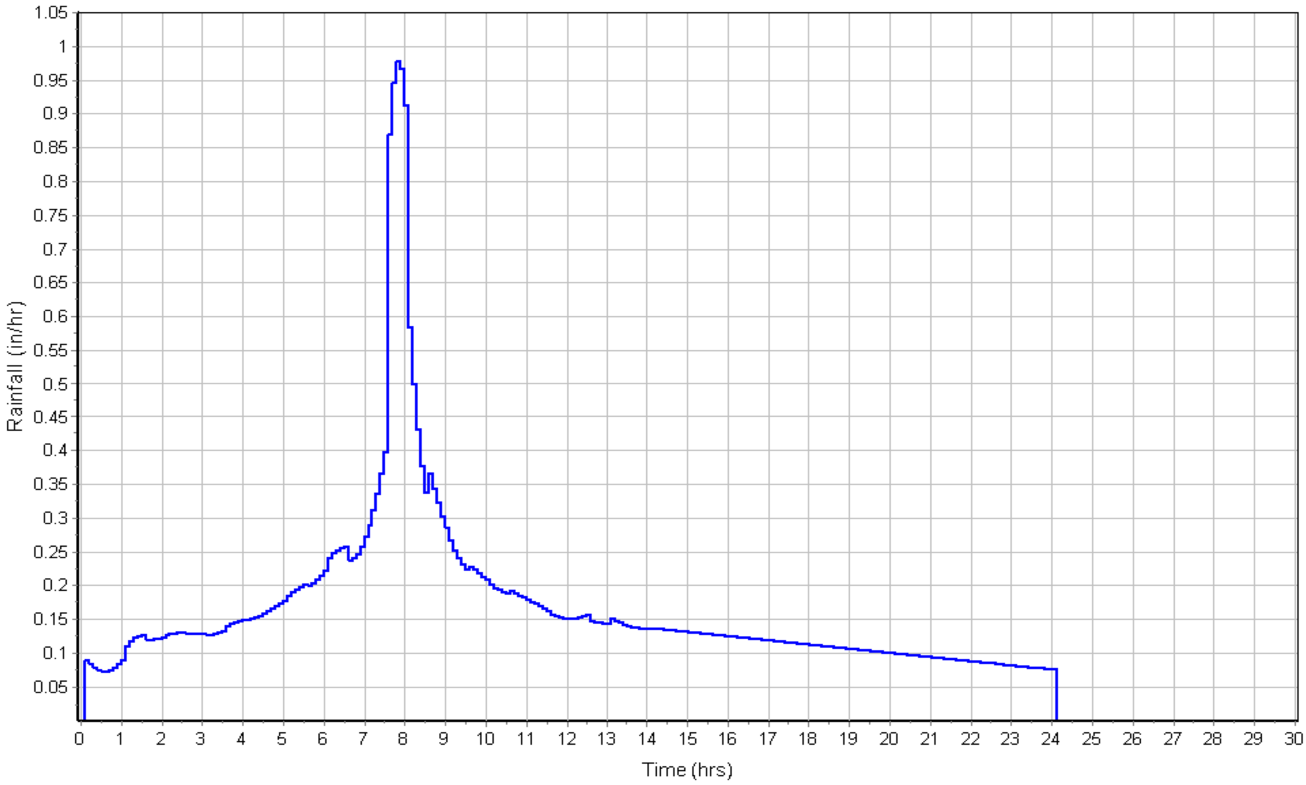
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.23		97.1

Subbasin Runoff Results

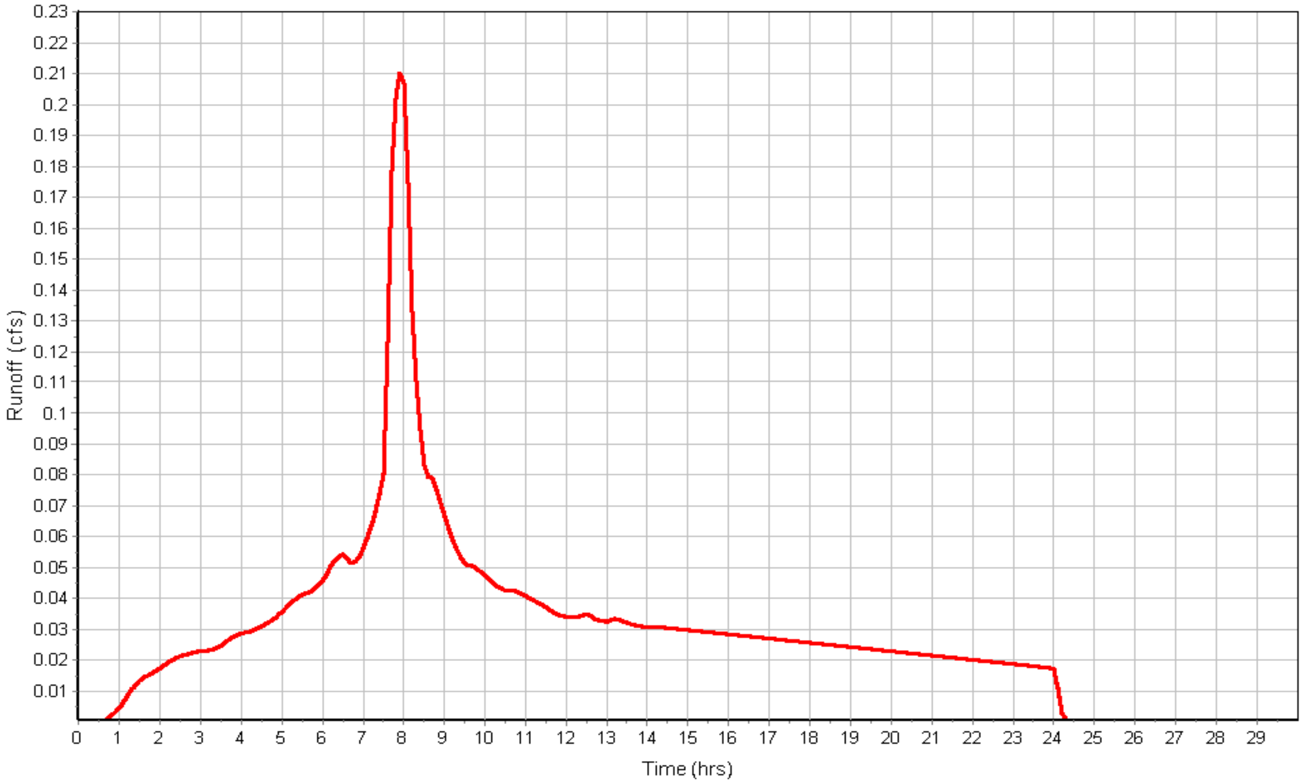
Total Rainfall (in) 4.06
Total Runoff (in) 3.74
Peak Runoff (cfs) 0.21
Weighted Curve Number 97.10
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : NB-2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NP-1

Input Data

Area (ac) 0.07
Impervious Area (%) 93.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

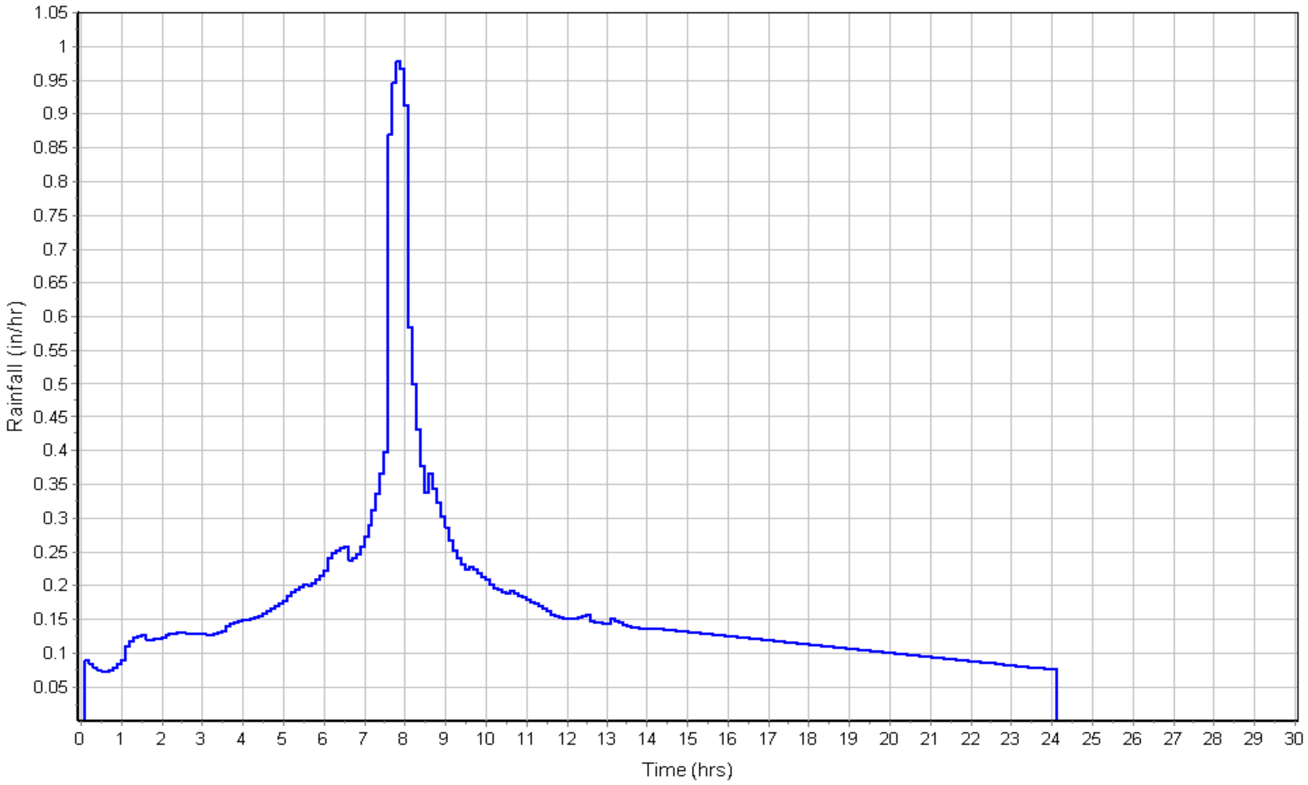
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.07		96.74

Subbasin Runoff Results

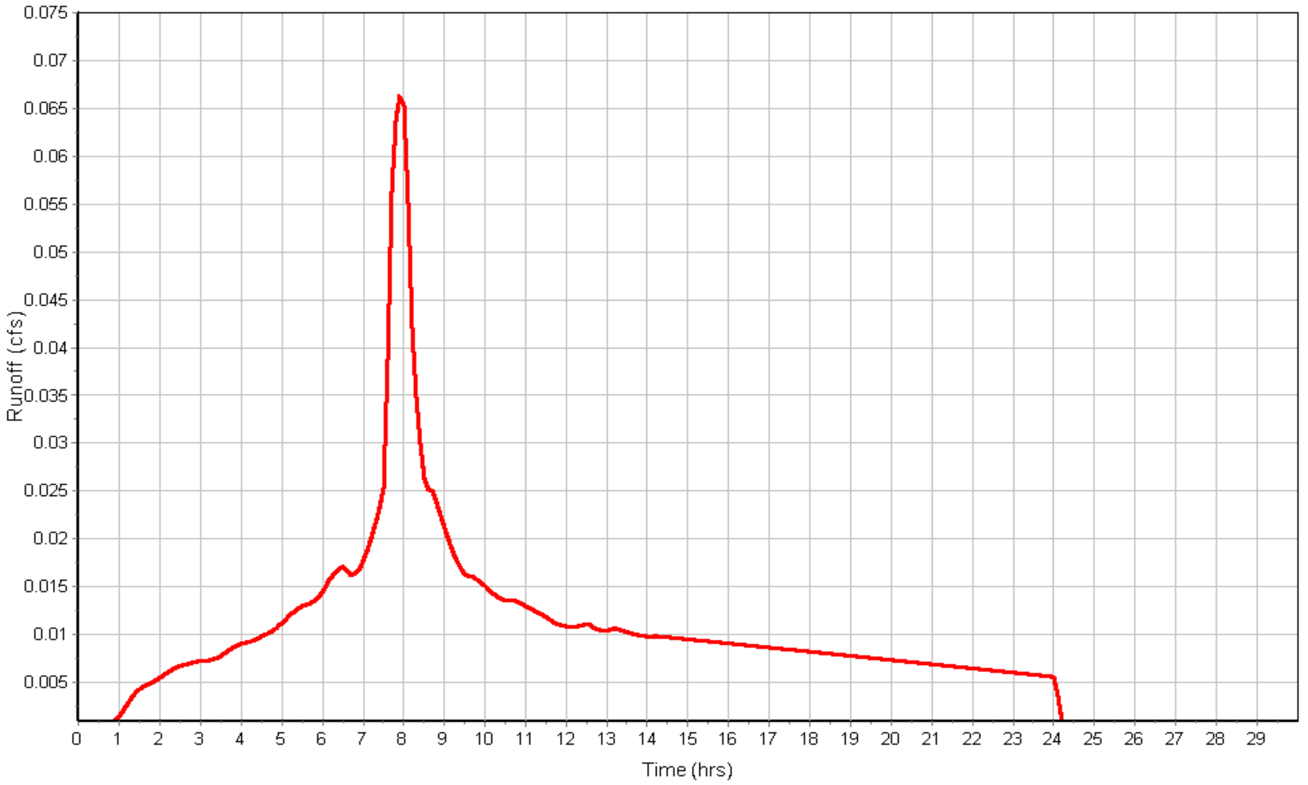
Total Rainfall (in) 4.06
Total Runoff (in) 3.70
Peak Runoff (cfs) 0.07
Weighted Curve Number 96.74
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : NP-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : OFF-1

Input Data

Area (ac) 0.10
Impervious Area (%) 82.00
Impervious Area Curve Number 92.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

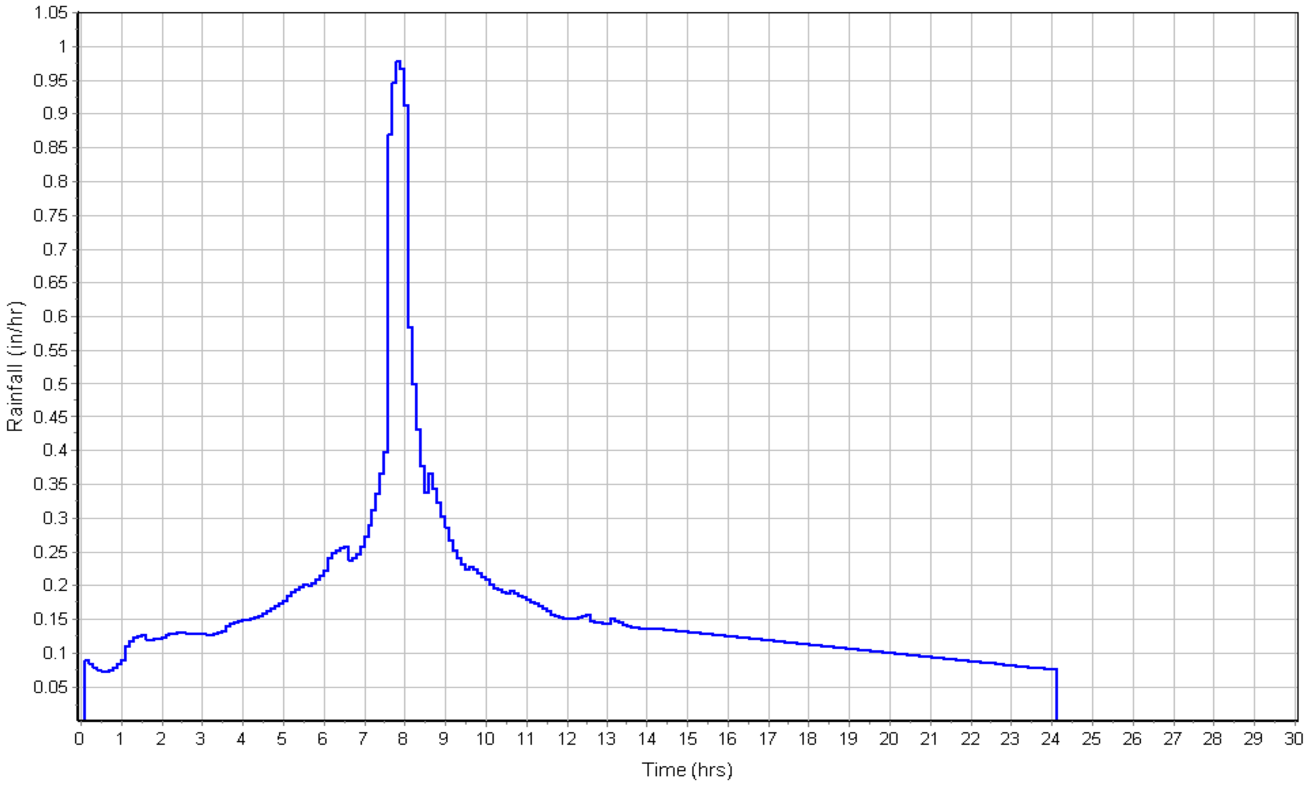
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.10		89.84

Subbasin Runoff Results

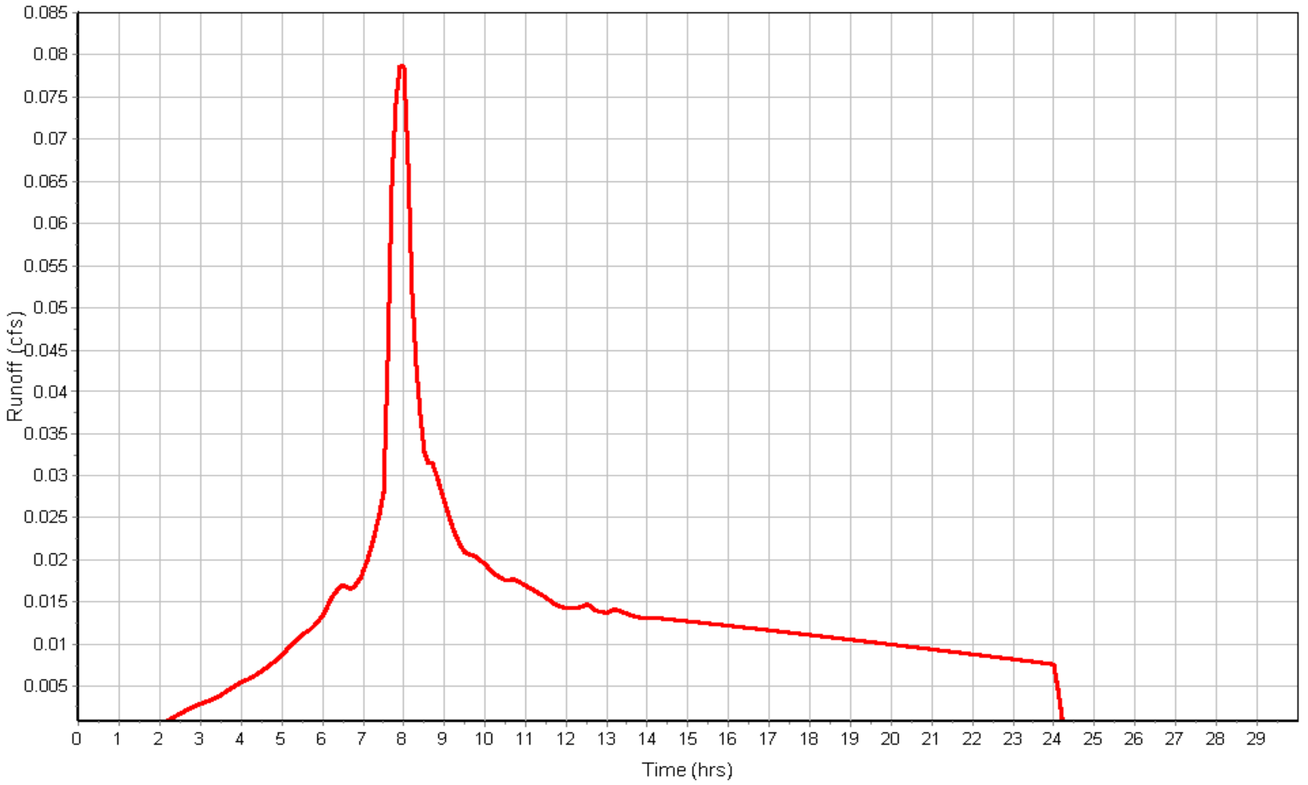
Total Rainfall (in) 4.06
Total Runoff (in) 2.98
Peak Runoff (cfs) 0.08
Weighted Curve Number 89.84
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : OFF-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SB-1

Input Data

Area (ac) 0.13
Impervious Area (%) 72.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

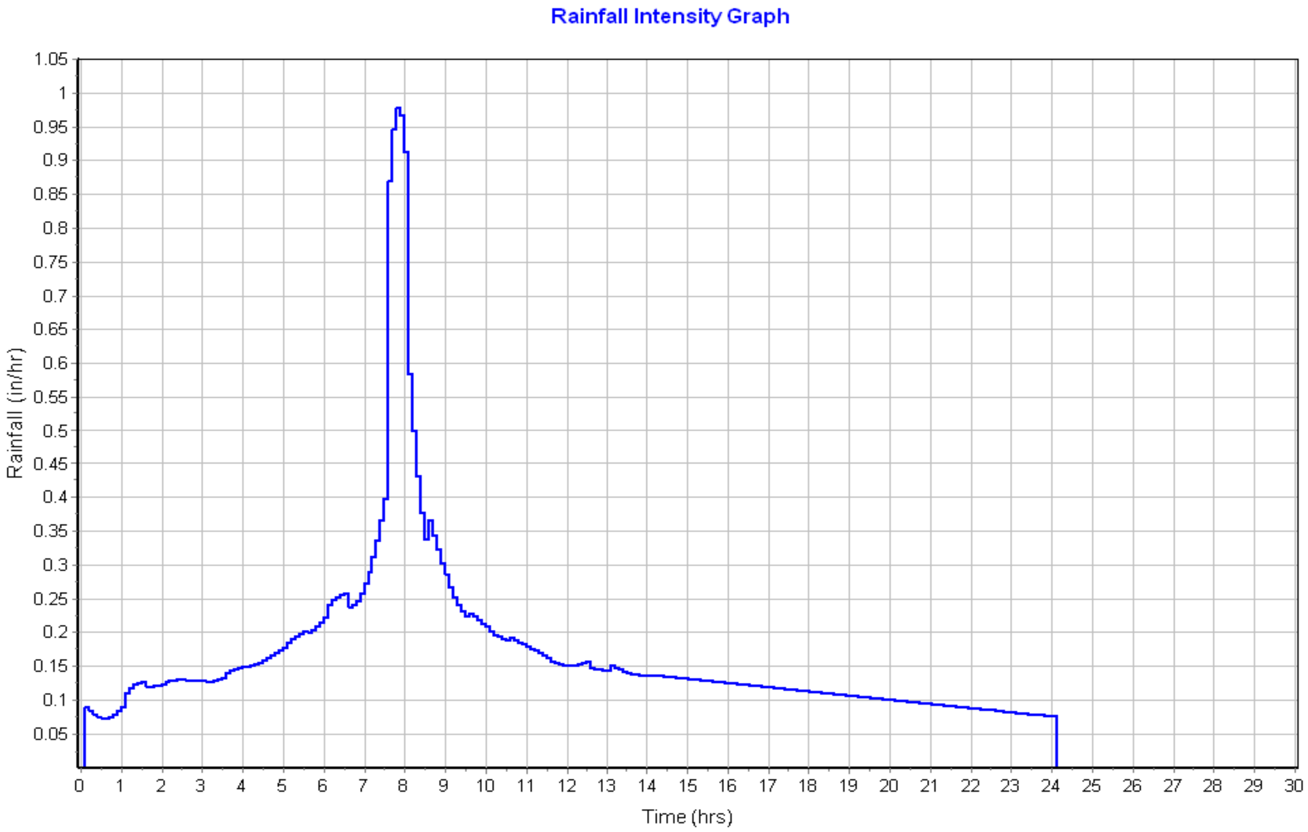
Composite Curve Number

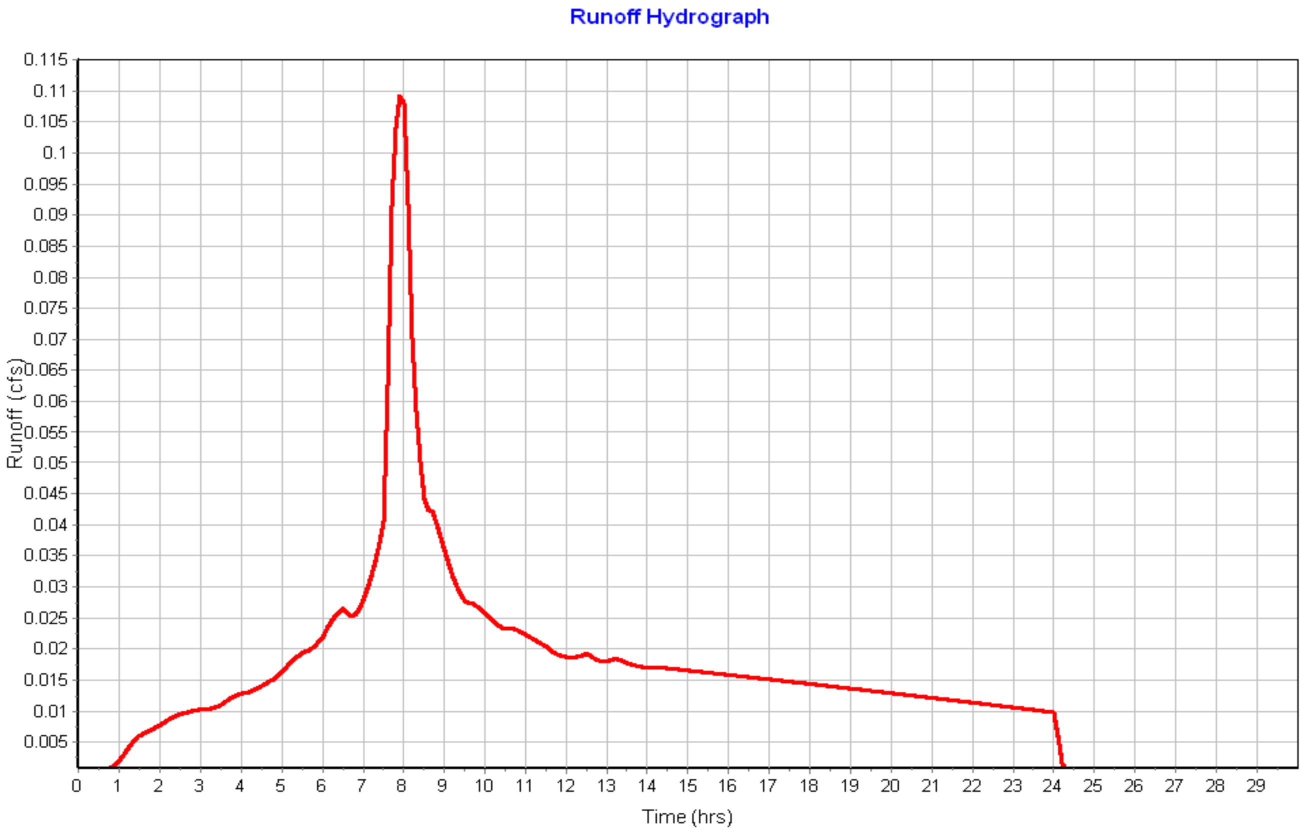
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.13		92.96

Subbasin Runoff Results

Total Rainfall (in) 4.06
Total Runoff (in) 3.34
Peak Runoff (cfs) 0.11
Weighted Curve Number 92.96
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SB-1





Subbasin : SB-2

Input Data

Area (ac) 0.09
Impervious Area (%) 100.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

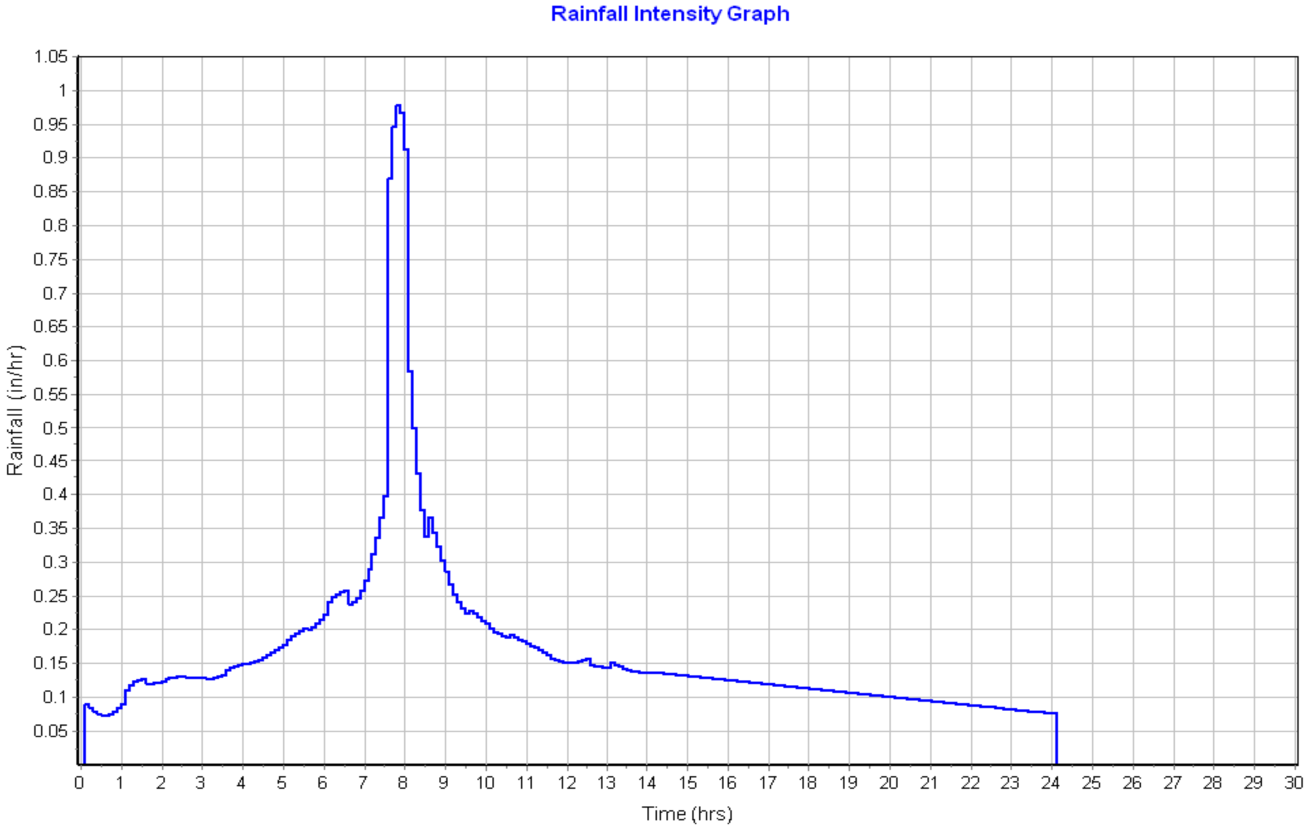
Composite Curve Number

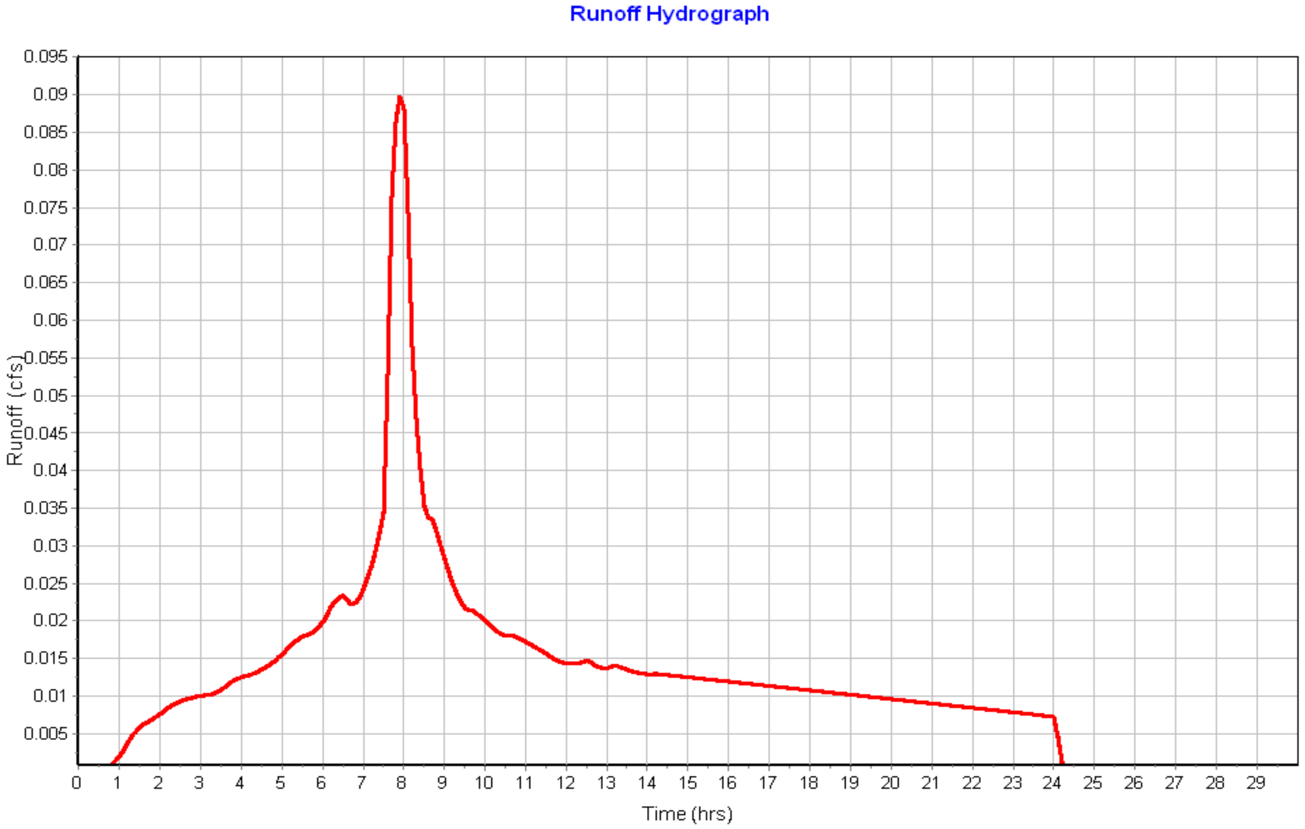
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.09		98

Subbasin Runoff Results

Total Rainfall (in) 4.06
Total Runoff (in) 3.83
Peak Runoff (cfs) 0.09
Weighted Curve Number 98.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SB-2





Subbasin : SP-1

Input Data

Area (ac) 0.76
Impervious Area (%) 79.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

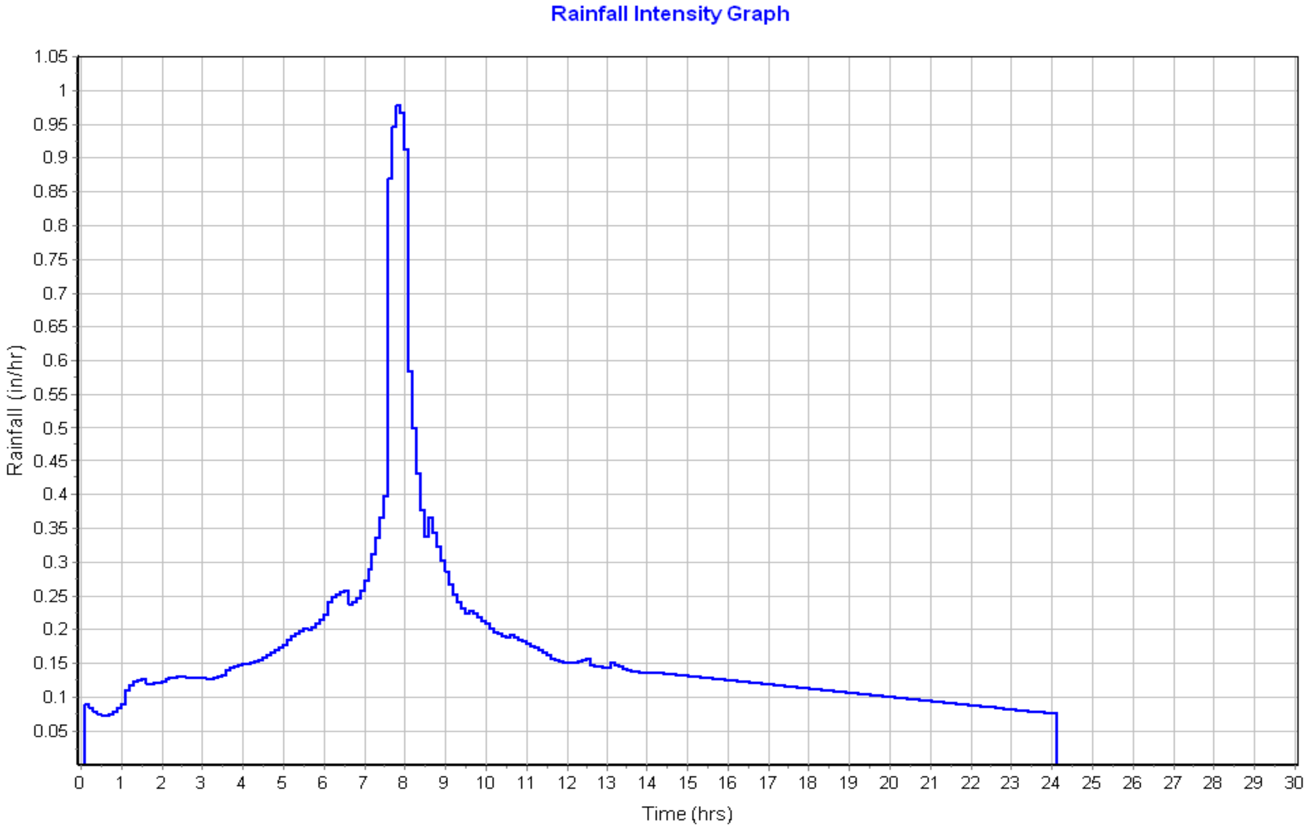
Composite Curve Number

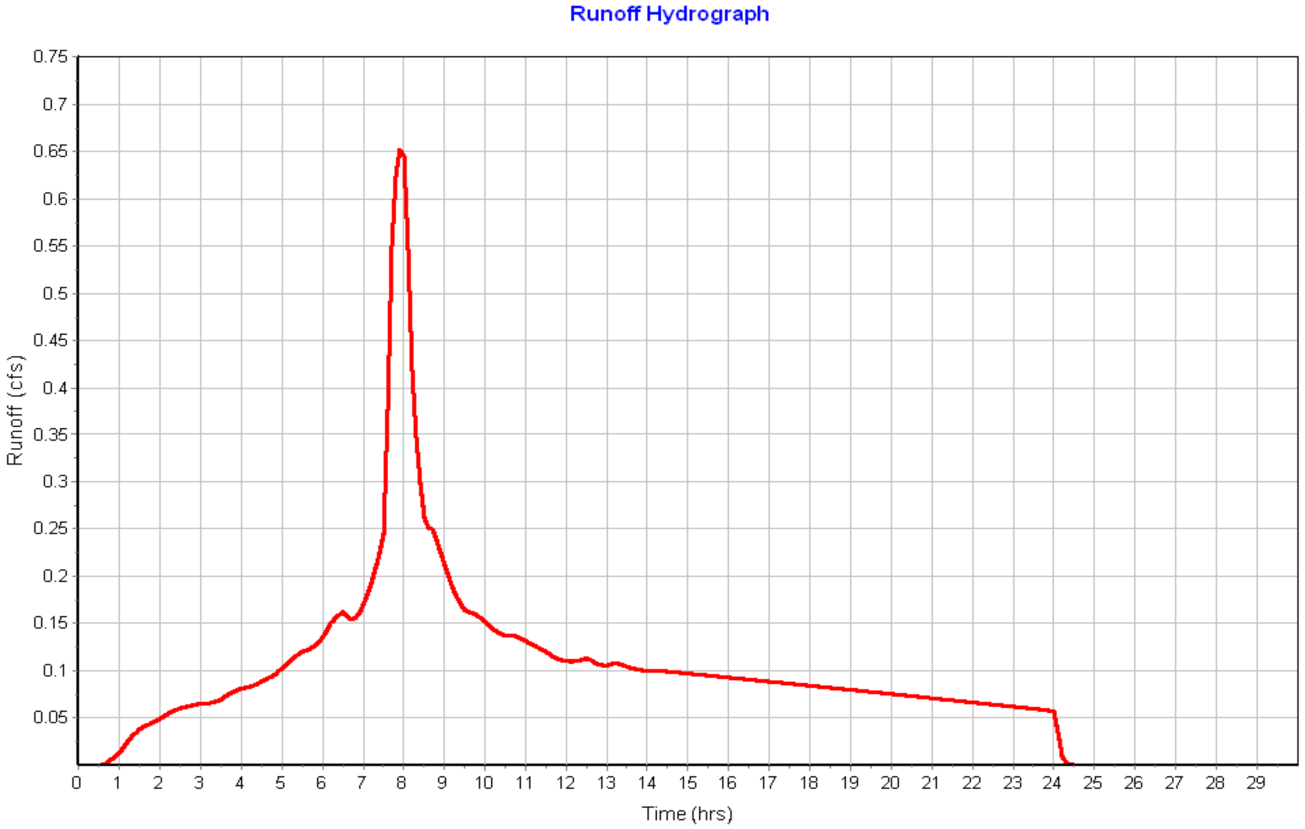
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.76		94.22

Subbasin Runoff Results

Total Rainfall (in) 4.06
Total Runoff (in) 3.46
Peak Runoff (cfs) 0.65
Weighted Curve Number 94.22
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SP-1





Subbasin : SP-2

Input Data

Area (ac)	0.52
Impervious Area (%)	77.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	80.00
Rain Gage ID	Rain Gage-01

Composite Curve Number

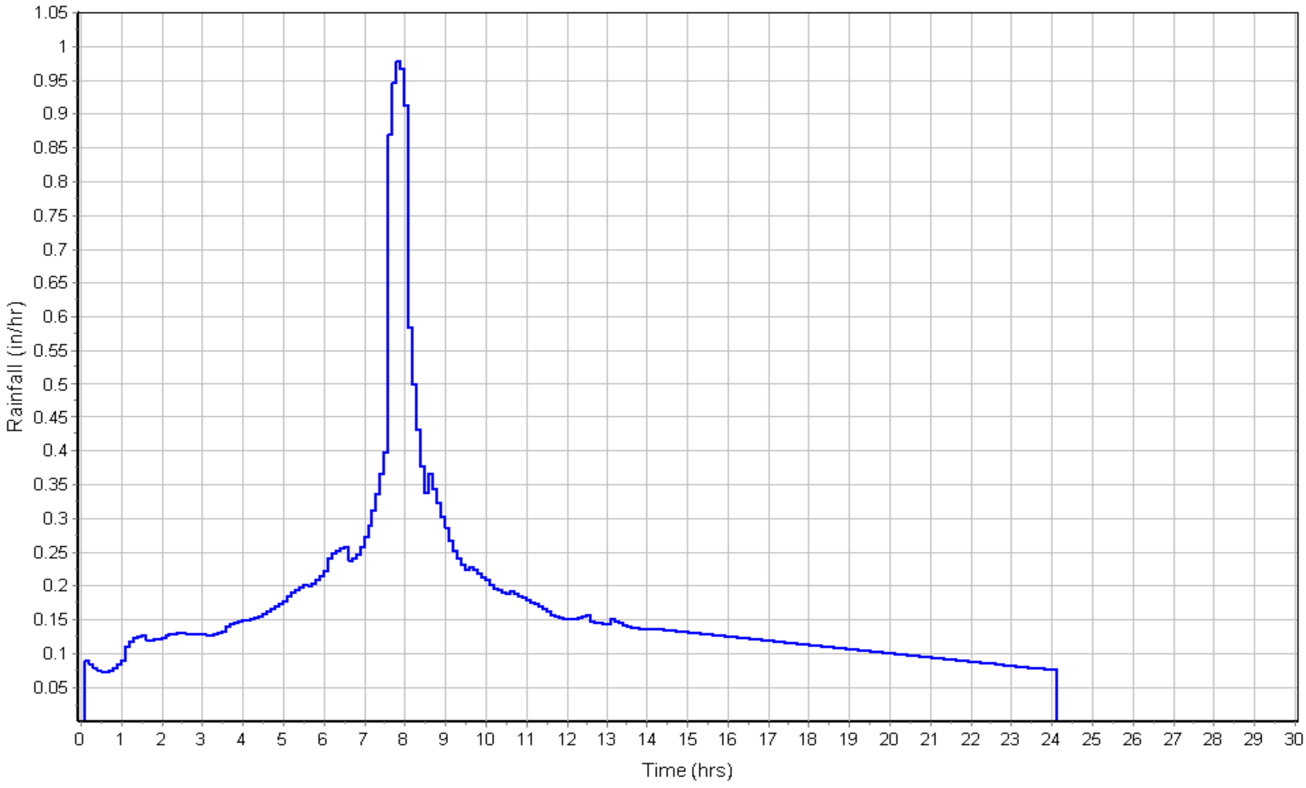
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.52		93.86

Subbasin Runoff Results

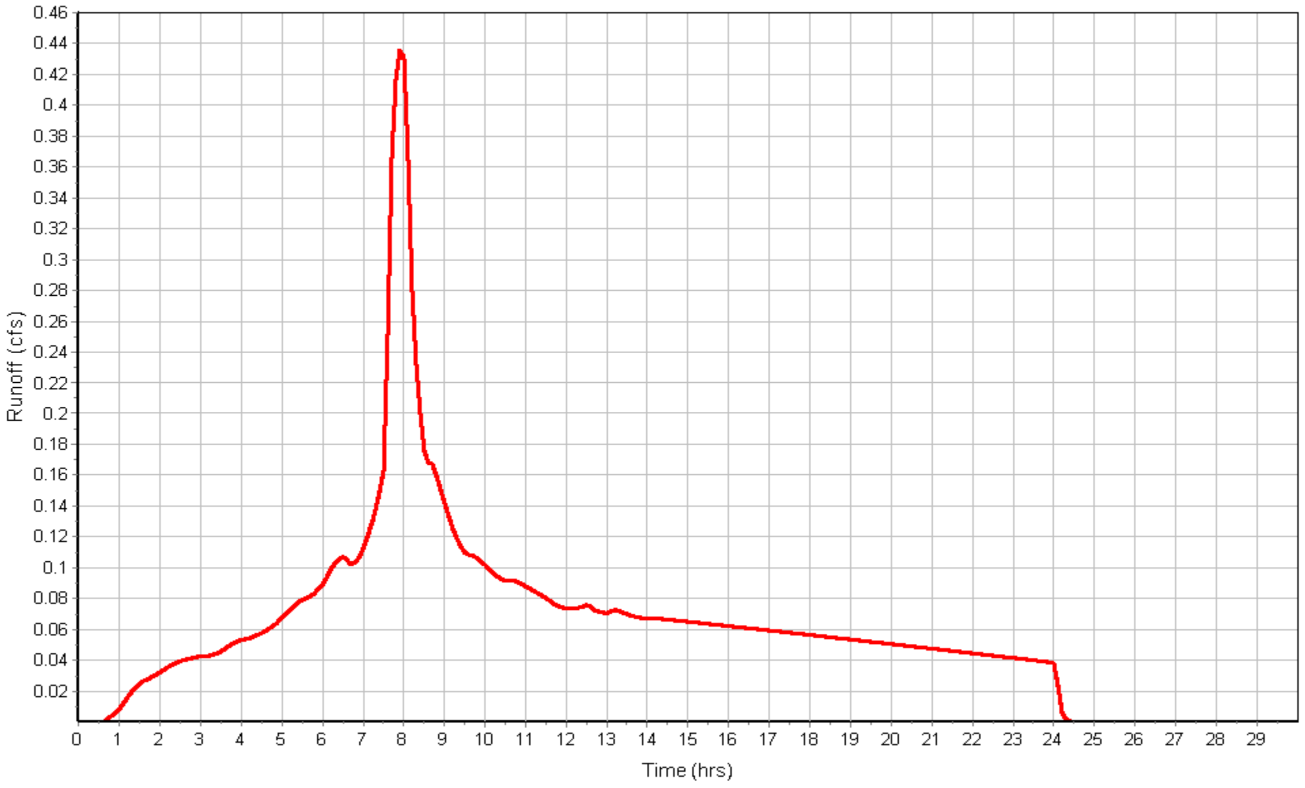
Total Rainfall (in)	4.06
Total Runoff (in)	3.43
Peak Runoff (cfs)	0.44
Weighted Curve Number	93.86
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : SP-2

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	ORIFICE	67.30	75.00	7.71	67.30	0.00	74.00	-1.00	10000.00	0.00
2	OUTFALL_1	71.67	75.00	3.33	71.67	0.00	74.00	-1.00	10000.00	0.00
3	SD_CB_1	72.41	73.56	1.15	72.41	0.00	73.48	-0.08	10000.00	0.00
4	SD_CB_2	72.61	76.50	3.89	72.61	0.00	75.50	-1.00	10000.00	0.00
5	SD_CO_15	76.21	78.50	2.29	76.21	0.00	78.00	-0.50	10000.00	0.00
6	SD_CO_6	71.68	75.00	3.32	71.68	0.00	74.00	-1.00	10000.00	0.00
7	SD_CO_9	71.65	75.00	3.35	71.65	0.00	74.00	-1.00	10000.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	ORIFICE	0.00	0.00	67.30	0.00	0.00	7.71	67.30	0.00	0 00:00	0 00:00	0.00	0.00
2	OUTFALL_1	1.16	0.44	72.31	0.64	0.00	2.69	71.96	0.29	0 07:56	0 00:00	0.00	0.00
3	SD_CB_1	0.73	0.73	72.80	0.39	0.00	0.76	72.55	0.14	0 07:55	0 00:00	0.00	0.00
4	SD_CB_2	0.44	0.28	72.95	0.34	0.00	3.55	72.73	0.12	0 07:56	0 00:00	0.00	0.00
5	SD_CO_15	0.16	0.16	76.38	0.17	0.00	2.12	76.28	0.07	0 07:55	0 00:00	0.00	0.00
6	SD_CO_6	0.17	0.09	72.17	0.49	0.00	3.07	71.95	0.27	0 09:43	0 00:00	0.00	0.00
7	SD_CO_9	0.44	0.00	72.17	0.52	0.00	2.83	71.87	0.22	0 09:43	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	LINK-10	50.68	71.67	0.00	71.52	0.10	0.15	0.3000	Trapezoidal	1.000	8.000	0.0800	0.5000	0.5000	0.0000	0.00	No
2	OVERFLOW_01	20.00	72.20	0.78	71.81	4.52	0.39	1.9500	Rectangular	1.000	4.000	0.0100	0.5000	0.5000	0.0000	0.00	No
3	OVERFLOW_02	20.00	74.44	0.50	74.24	2.56	0.20	1.0000	Rectangular	1.000	4.000	0.0100	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	LINK-10	1.19	0 07:59	3.62	0.33	0.85	0.99	0.58	0.58	0.00		
2	OVERFLOW_01	0.00	0 00:00	63.34	0.00	0.00		0.00	0.00	0.00		
3	OVERFLOW_02	0.08	0 08:01	45.36	0.00	1.06	0.31	0.02	0.02	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	LINK_01	12.00	69.29	2.00	69.05	3.22	0.24	2.0000	CIRCULAR	9.960	9.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1
2	LINK-12	222.93	72.23	-0.18	71.67	0.00	0.56	0.2500	CIRCULAR	9.960	9.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1
3	LINK-20	19.69	71.85	0.17	71.75	0.33	0.10	0.5000	CIRCULAR	6.000	6.000	0.0100	0.5000	0.5000	0.0000	0.00	No	1
4	LINK-30	18.32	71.65	0.00	71.60	0.18	0.05	0.3000	CIRCULAR	8.040	8.040	0.0100	0.5000	0.5000	0.0000	0.00	No	1
5	LINK-31	318.43	72.61	0.00	71.65	0.00	0.95	0.3000	CIRCULAR	8.040	8.040	0.0100	0.5000	0.5000	0.0000	0.00	No	1
6	LINK-32	218.21	74.35	-1.86	72.61	0.00	1.75	0.8000	CIRCULAR	3.960	3.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	LINK_01	0.00	0 00:00	4.03	0.00	0.00		0.00	0.00	0.00		Calculated
2	LINK-12	0.73	0 07:55	1.64	0.45	2.11	1.76	0.52	0.62	0.00		Calculated
3	LINK-20	0.17	0 08:01	0.51	0.33	2.11	0.16	0.37	0.75	0.00		Calculated
4	LINK-30	0.44	0 07:57	0.86	0.51	2.33	0.13	0.55	0.82	0.00		Calculated
5	LINK-31	0.44	0 07:56	0.86	0.51	2.23	2.38	0.37	0.55	0.00		Calculated
6	LINK-32	0.16	0 07:55	0.32	0.51	2.29	1.59	0.25	0.75	0.00		Calculated

Storage Nodes

Storage Node : INFL_RG_1

Input Data

Invert Elevation (ft) 71.42
Max (Rim) Elevation (ft) 75.00
Max (Rim) Offset (ft) 3.58
Initial Water Elevation (ft) 0.00
Initial Water Depth (ft) .... -71.42
Ponded Area (ft²) 10000.00
Evaporation Loss 0.00

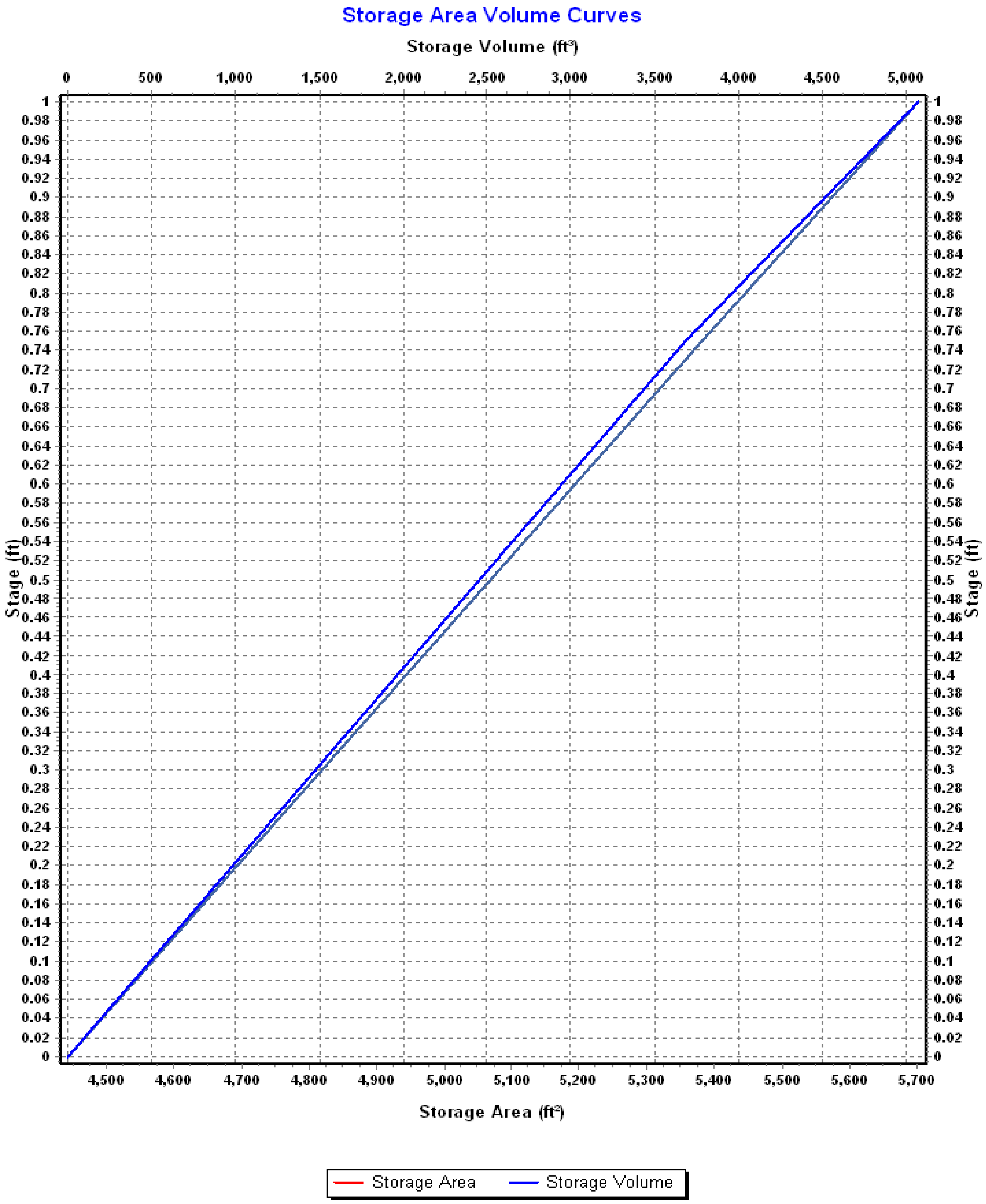
Infiltration/Exfiltration

Constant Flow Rate (cfs) 0.4983

Storage Area Volume Curves

Storage Curve : WETLAND

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0.00	4443.1	0.000
0.75	5381.7	3684.30
1.00	5701.6	5069.71


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Stage (ft)
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
0.84
0.82
0.8
0.78
0.76
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0.56
0.54
0.52
0.5
0.48
0.46
0.44
0.42
0.4
0.38
0.36
0.34
0.32
0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
4,500
4,600
4,700
4,800
4,900
5,000
5,100
5,200
5,300
5,400
5,500
5,600
5,700
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : INFL_RG_1 (continued)

Output Summary Results

Peak Inflow (cfs)	1.92
Peak Lateral Inflow (cfs)	0.14
Peak Outflow (cfs)	0.00
Peak Exfiltration Flow Rate (cfm)	29.90
Max HGL Elevation Attained (ft)	72.17
Max HGL Depth Attained (ft)	0.75
Average HGL Elevation Attained (ft)	71.64
Average HGL Depth Attained (ft)	0.22
Time of Max HGL Occurrence (days hh:mm)	0 09:44
Total Exfiltration Volume (1000-ft^3)	28.342
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : INFL_RG_2

Input Data

Invert Elevation (ft)	73.94
Max (Rim) Elevation (ft)	76.00
Max (Rim) Offset (ft)	2.06
Initial Water Elevation (ft)	0.00
Initial Water Depth (ft)	-73.94
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

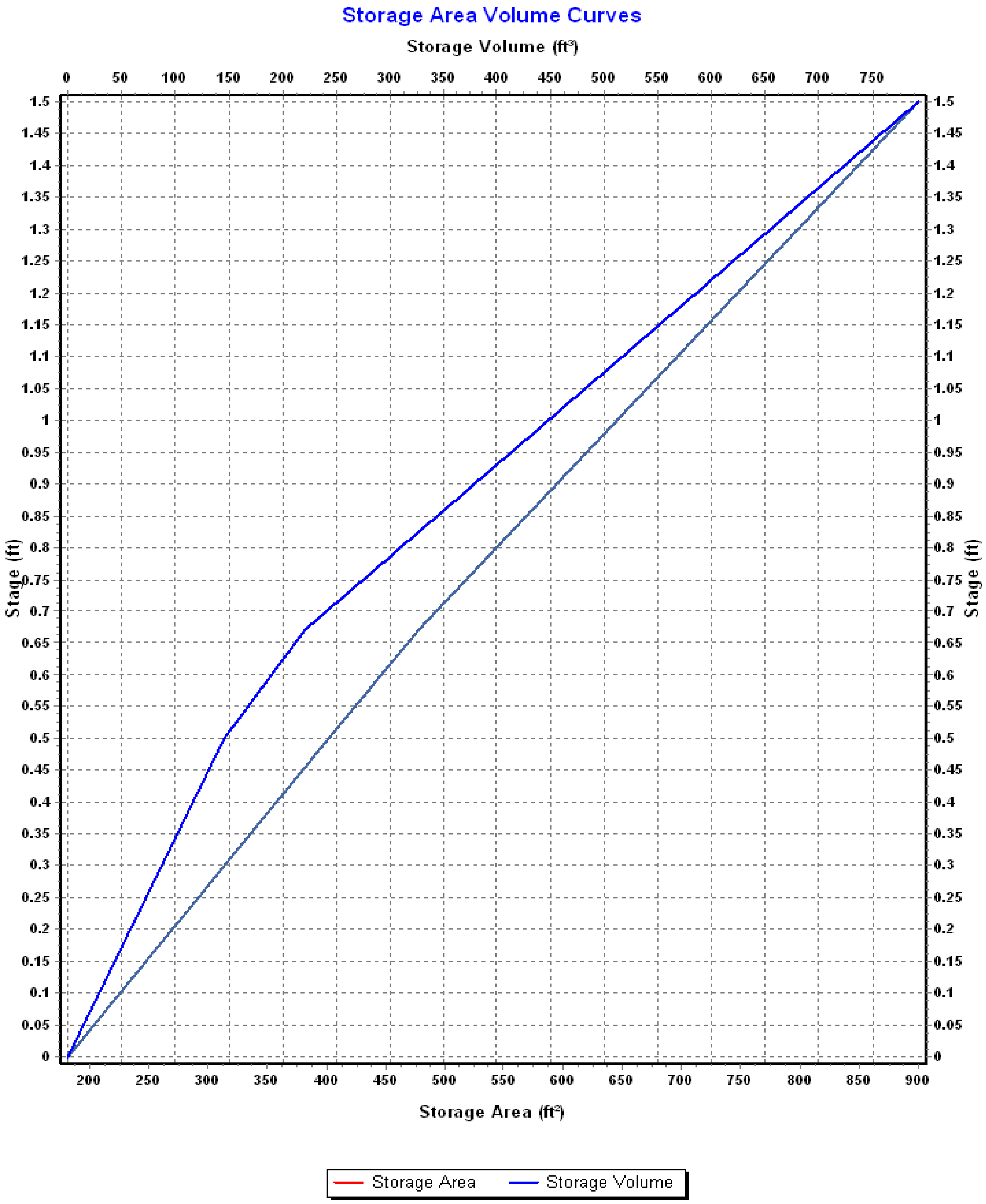
Infiltration/Exfiltration

Constant Flow Rate (cfs)	0.0200

Storage Area Volume Curves

Storage Curve : SB-2_RG

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	182	0.000
0.50	402	146.00
0.67	478	220.80
1.50	900	792.67


Storage Area Volume Curves
Storage Volume (ft³)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Stage (ft)
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : INFL_RG_2 (continued)

Output Summary Results

Peak Inflow (cfs) 0.11
Peak Lateral Inflow (cfs) 0.11
Peak Outflow (cfs) 0.08
Peak Exfiltration Flow Rate (cfm) 1.20
Max HGL Elevation Attained (ft) 74.46
Max HGL Depth Attained (ft) 0.52
Average HGL Elevation Attained (ft) 74.18
Average HGL Depth Attained (ft) 0.24
Time of Max HGL Occurrence (days hh:mm) 0 08:01
Total Exfiltration Volume (1000-ft^3) 1.417
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Project Description

File Name	calc jah 210817 Model.SPF
Description	J:\9700-003-13\Civil\CX5_PIPES\BHE STRM (2013).dwg

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Santa Barbara UH
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Feb 25, 2013	00:00:00
End Analysis On	Feb 26, 2013	06:00:00
Start Reporting On	Feb 25, 2013	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	10
Nodes	10
Junctions	7
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	2
Links	9
Channels	3
Pipes	6
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	010-Year	Cumulative	inches	Oregon	Lincoln	10	4.48	SCS Type IA 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Impervious Area (%)	Impervious Area Curve Number	Pervious Area Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	E-1	0.45	9.00	98.00	77.00	4.48	2.38	1.06	0.17	0 00:32:00
2	EX_SITE	2.56	3.00	91.00	77.00	4.48	2.23	5.72	0.66	0 01:01:00
3	NB-1	0.21	65.00	98.00	80.00	4.48	3.61	0.74	0.18	0 00:05:00
4	NB-2	0.23	95.00	98.00	80.00	4.48	4.15	0.94	0.23	0 00:05:00
5	NP-1	0.07	93.00	98.00	80.00	4.48	4.12	0.30	0.07	0 00:05:00
6	OFF-1	0.10	82.00	92.00	80.00	4.48	3.38	0.35	0.09	0 00:05:00
7	SB-1	0.13	72.00	98.00	80.00	4.48	3.74	0.50	0.12	0 00:05:00
8	SB-2	0.09	100.00	98.00	80.00	4.48	4.24	0.40	0.10	0 00:05:00
9	SP-1	0.76	79.00	98.00	80.00	4.48	3.87	2.95	0.73	0 00:05:00
10	SP-2	0.52	77.00	98.00	80.00	4.48	3.83	1.98	0.49	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	ORIFICE	Junction	67.30	75.00	67.30	74.00	10000.00	0.31	69.49	0.00	5.51	0 00:00	0.00	0.00
2	OUTFALL_1	Junction	71.67	75.00	71.67	74.00	10000.00	1.30	72.34	0.00	2.66	0 00:00	0.00	0.00
3	SD_CB_1	Junction	72.41	73.56	72.41	73.48	10000.00	0.82	72.83	0.00	0.73	0 00:00	0.00	0.00
4	SD_CB_2	Junction	72.61	76.50	72.61	75.50	10000.00	0.49	72.97	0.00	3.53	0 00:00	0.00	0.00
5	SD_CO_15	Junction	76.21	78.50	76.21	78.00	10000.00	0.18	76.39	0.00	2.11	0 00:00	0.00	0.00
6	SD_CO_6	Junction	71.68	75.00	71.68	74.00	10000.00	0.20	72.25	0.00	2.99	0 00:00	0.00	0.00
7	SD_CO_9	Junction	71.65	75.00	71.65	74.00	10000.00	0.49	72.25	0.00	2.75	0 00:00	0.00	0.00
8	NEW_OUT	Outfall	65.83					0.93	65.83					
9	INFL_RG_1	Storage Node	71.42	75.00	0.00		10000.00	2.17	72.25				0.00	0.00
10	INFL_RG_2	Storage Node	73.94	76.00	0.00		0.00	0.12	74.46				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Reported Condition
1	LINK_01	Pipe	ORIFICE	NEW_OUT	12.00	69.29	69.05	2.0000	10.000	0.0100	0.31	4.03	0.08	3.62	0.18	0.21	0.00	Calculated
2	LINK-12	Pipe	SD_CB_1	OUTFALL_1	222.93	72.23	71.67	0.2500	10.000	0.0100	0.82	1.64	0.50	2.29	0.54	0.65	0.00	Calculated
3	LINK-20	Pipe	SD_CO_6	INFL_RG_1	19.69	71.85	71.75	0.5000	6.000	0.0100	0.20	0.51	0.39	2.19	0.45	0.90	0.00	Calculated
4	LINK-30	Pipe	SD_CO_9	INFL_RG_1	18.32	71.65	71.60	0.3000	8.000	0.0100	0.49	0.86	0.56	2.41	0.62	0.93	0.00	Calculated
5	LINK-31	Pipe	SD_CB_2	SD_CO_9	318.43	72.61	71.65	0.3000	8.000	0.0100	0.49	0.86	0.57	2.29	0.40	0.60	0.00	Calculated
6	LINK-32	Pipe	SD_CO_15	SD_CB_2	218.21	74.35	72.61	0.8000	4.000	0.0100	0.18	0.32	0.57	2.51	0.26	0.77	0.00	Calculated
7	LINK-10	Channel	OUTFALL_1	INFL_RG_1	50.68	71.67	71.52	0.3000	12.000	0.0800	1.33	3.62	0.37	0.88	0.66	0.66	0.00	
8	OVERFLOW_01	Channel	INFL_RG_1	ORIFICE	20.00	72.21	71.81	2.0000	12.000	0.0100	0.31	64.15	0.00	2.14	0.04	0.04	0.00	
9	OVERFLOW_02	Channel	INFL_RG_2	SD_CO_6	20.00	74.44	74.24	1.0000	12.000	0.0100	0.10	45.36	0.00	1.14	0.02	0.02	0.00	

Subbasin Hydrology

Subbasin : E-1

Input Data

```
Area (ac) .....................................................  0.45
Impervious Area (%) ...................................  9.00
Impervious Area Curve Number .................. 98.00
Pervious Area Curve Number .....................  77.00
Rain Gage ID ............................................... Rain Gage-01
```

Composite Curve Number

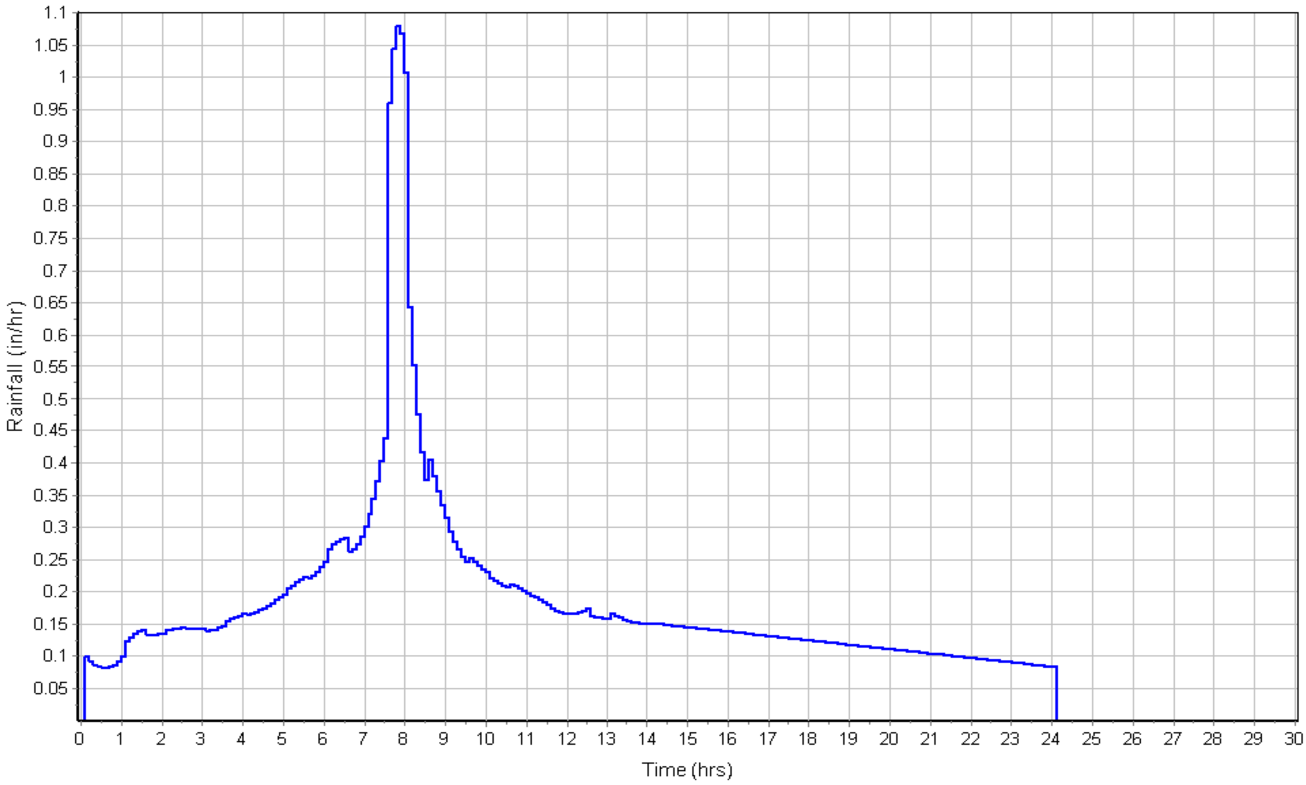
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.45		78.89

Subbasin Runoff Results

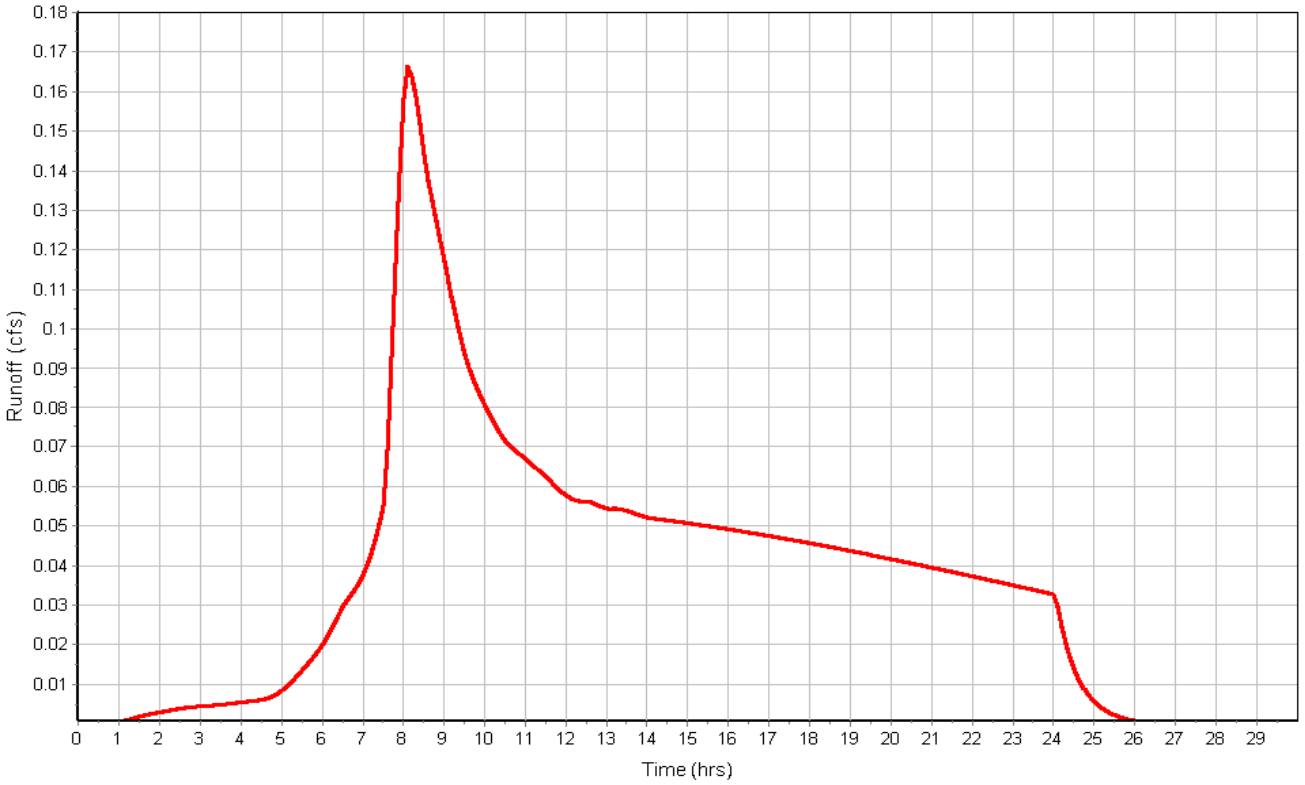
```
Total Rainfall (in) .........................................  4.48
Total Runoff (in) ..........................................  2.38
Peak Runoff (cfs) ........................................  0.17
Weighted Curve Number ............................  78.89
Time of Concentration (days hh:mm:ss) .....  0 00:32:00
```

Subbasin : E-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : EX_SITE

Input Data

Area (ac) 2.56
Impervious Area (%) 3.00
Impervious Area Curve Number 91.00
Pervious Area Curve Number 77.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

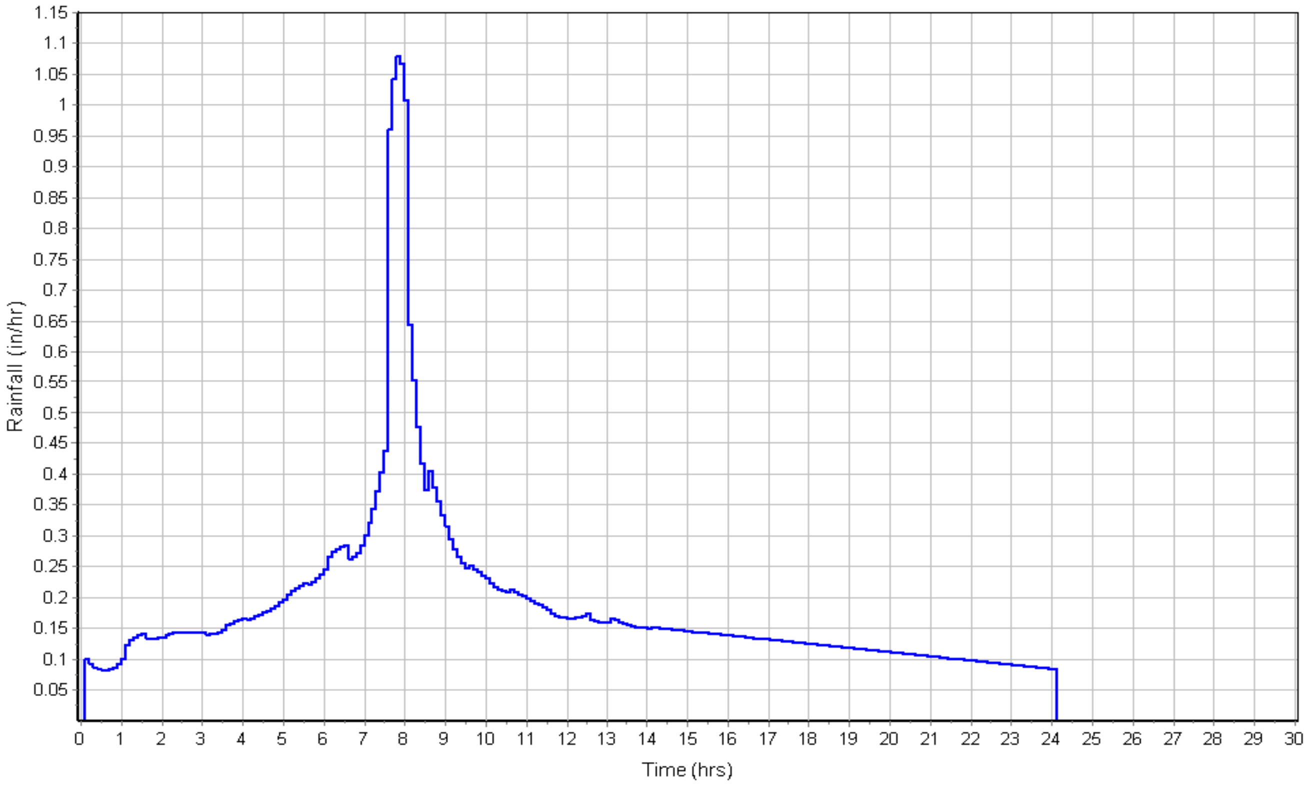
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	2.56		77.42

Subbasin Runoff Results

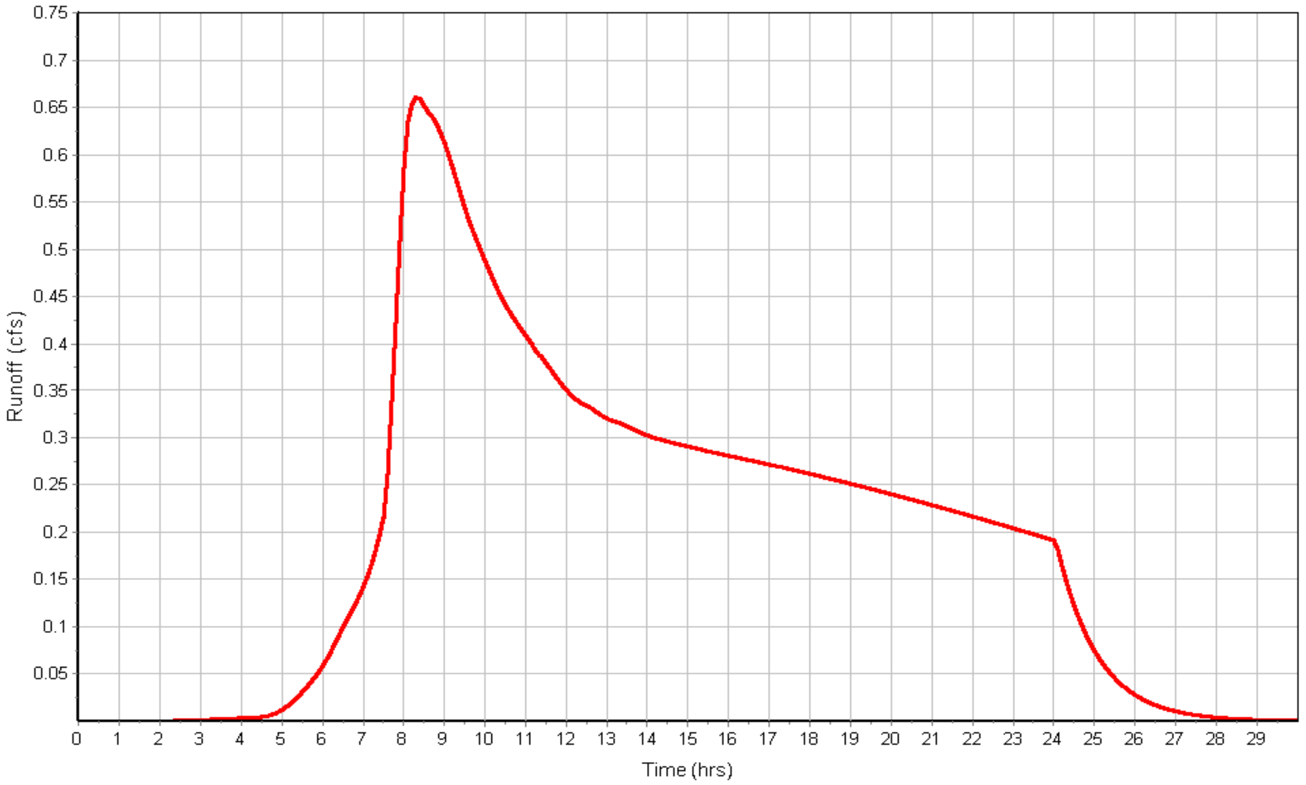
Total Rainfall (in) 4.48
Total Runoff (in) 2.23
Peak Runoff (cfs) 0.66
Weighted Curve Number 77.42
Time of Concentration (days hh:mm:ss) 0 01:01:00

Subbasin : EX_SITE

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NB-1

Input Data

Area (ac)	0.21
Impervious Area (%)	65.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	80.00
Rain Gage ID	Rain Gage-01

Composite Curve Number

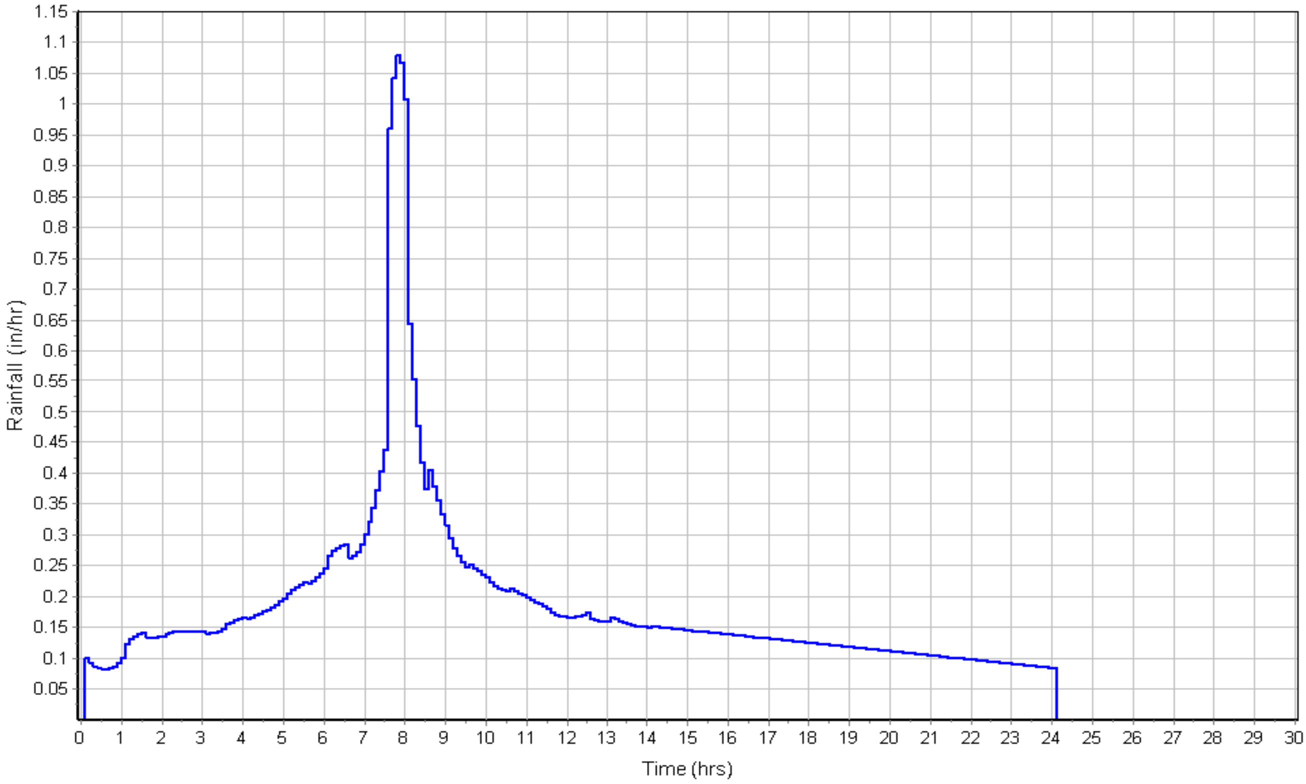
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.21		91.7

Subbasin Runoff Results

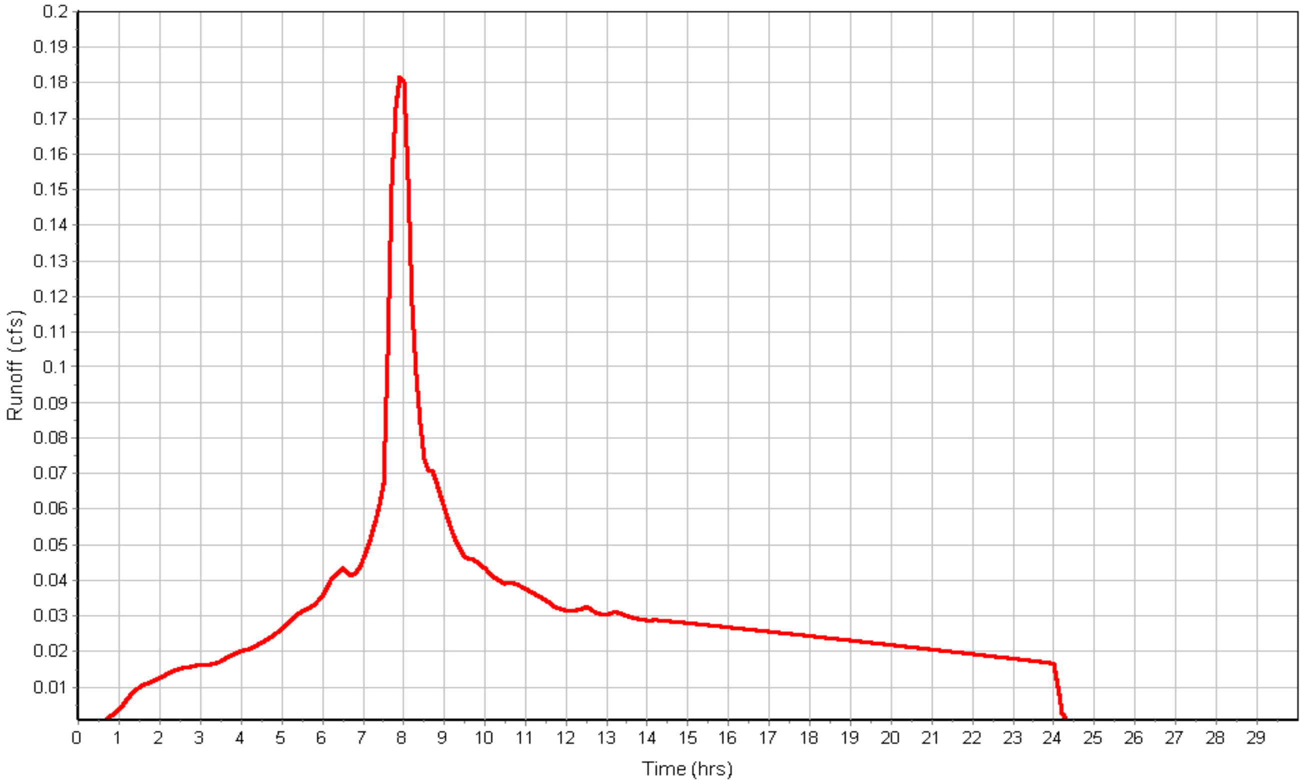
Total Rainfall (in)	4.48
Total Runoff (in)	3.61
Peak Runoff (cfs)	0.18
Weighted Curve Number	91.70
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : NB-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NB-2

Input Data

Area (ac) 0.23
Impervious Area (%) 95.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

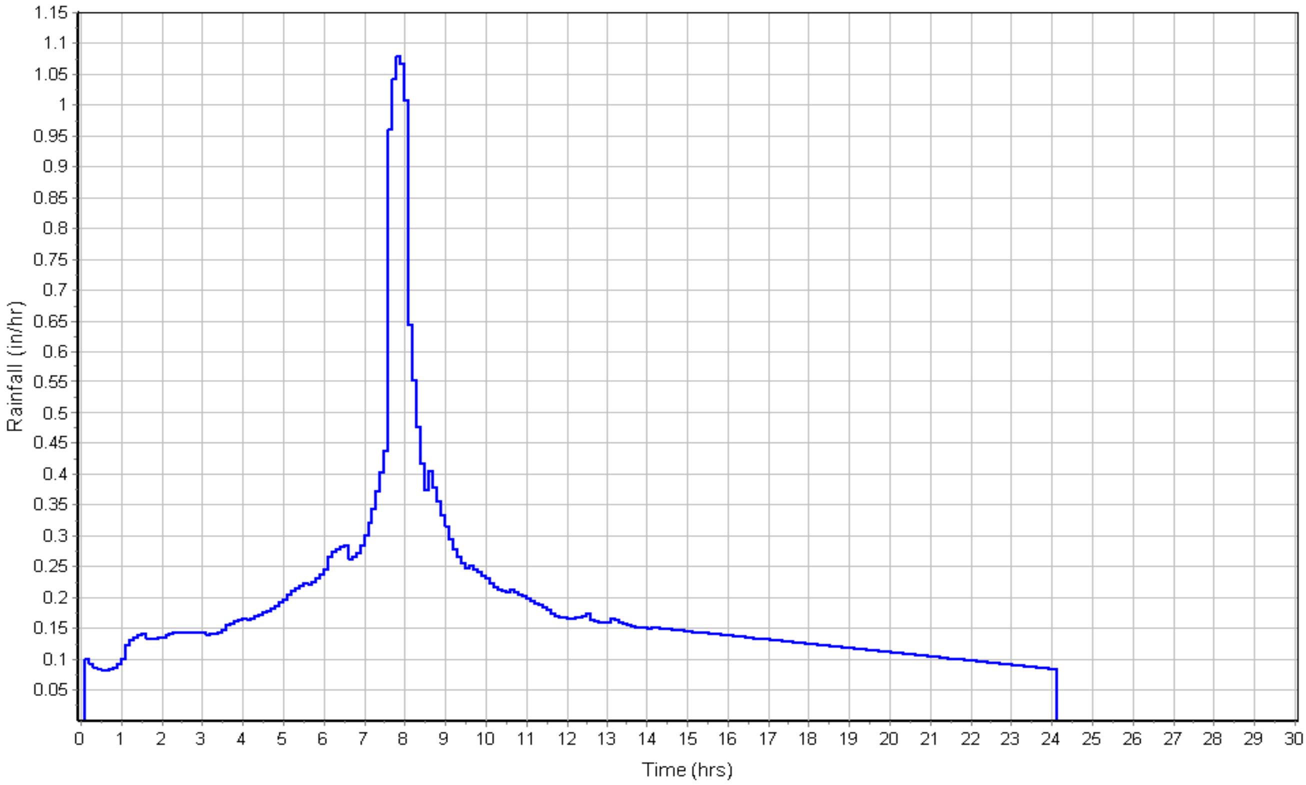
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.23		97.1

Subbasin Runoff Results

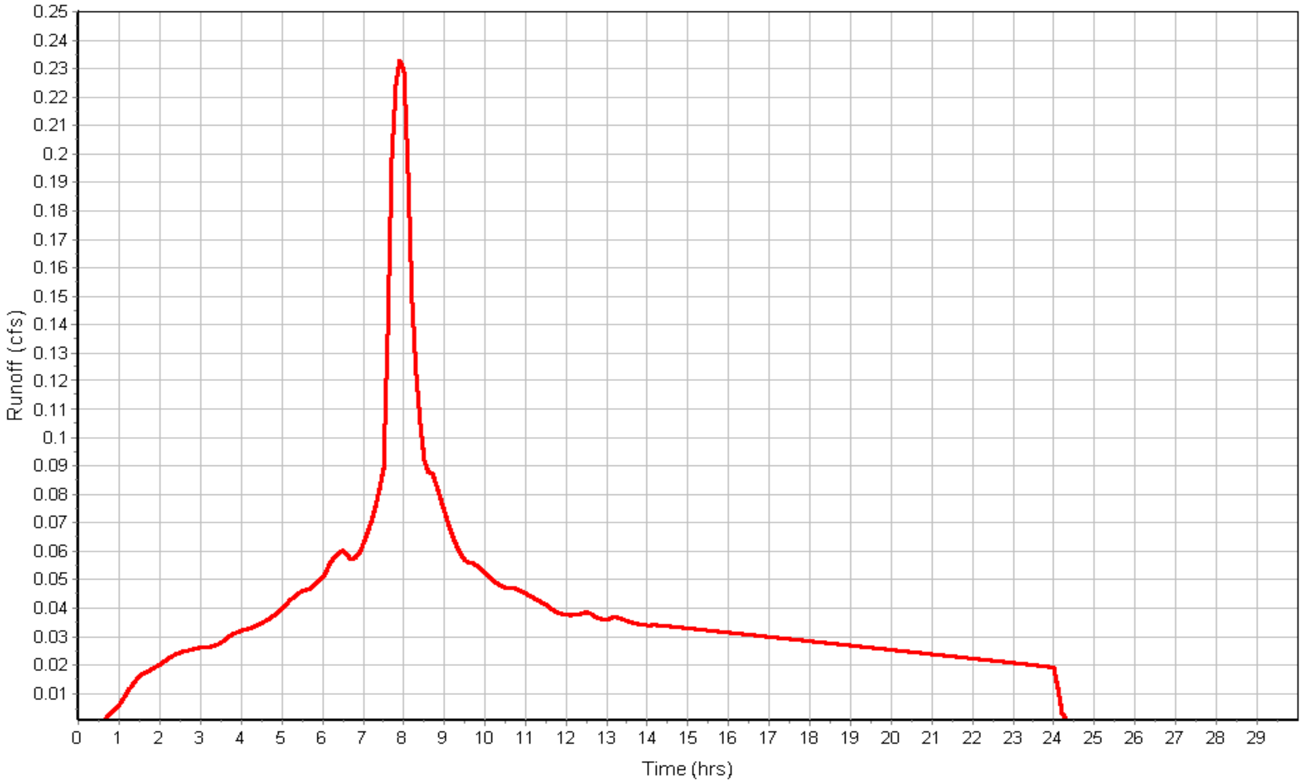
Total Rainfall (in) 4.48
Total Runoff (in) 4.15
Peak Runoff (cfs) 0.23
Weighted Curve Number 97.10
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : NB-2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NP-1

Input Data

Area (ac) 0.07
Impervious Area (%) 93.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

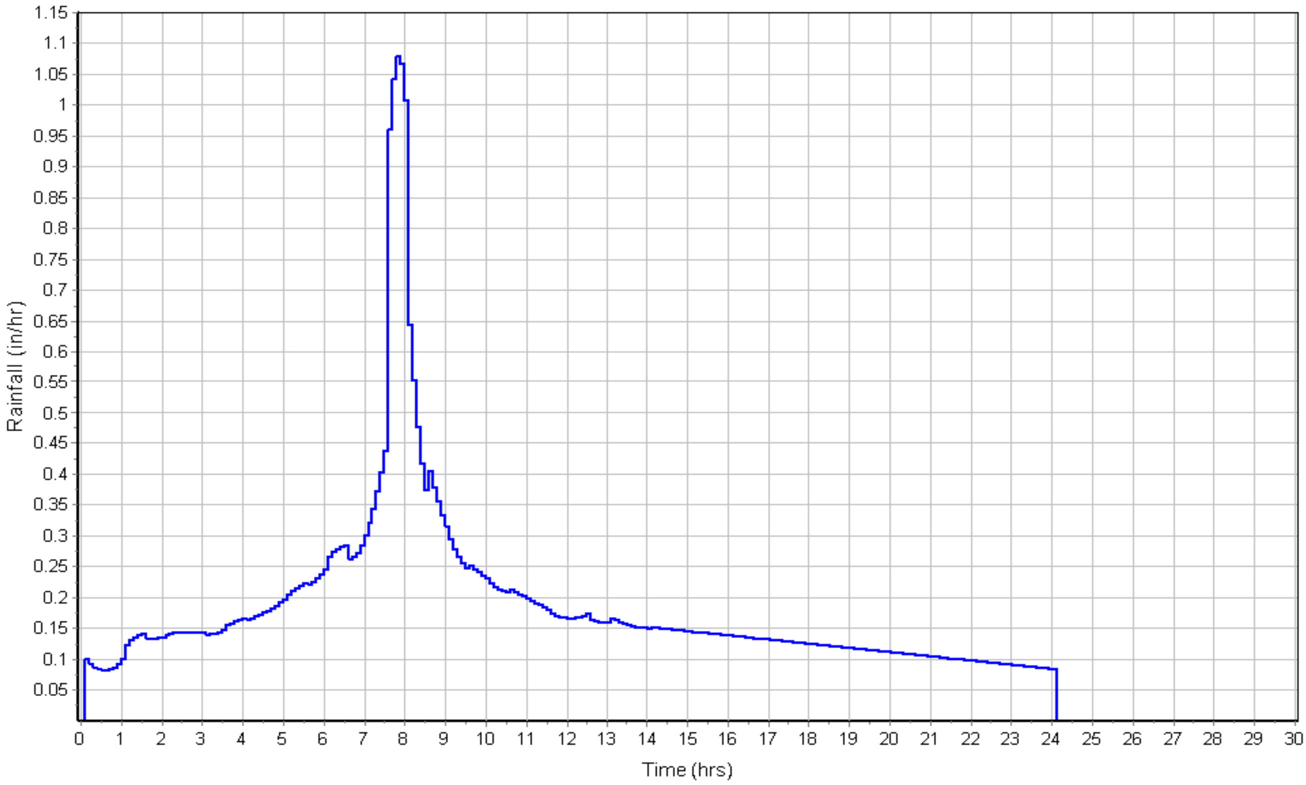
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.07		96.74

Subbasin Runoff Results

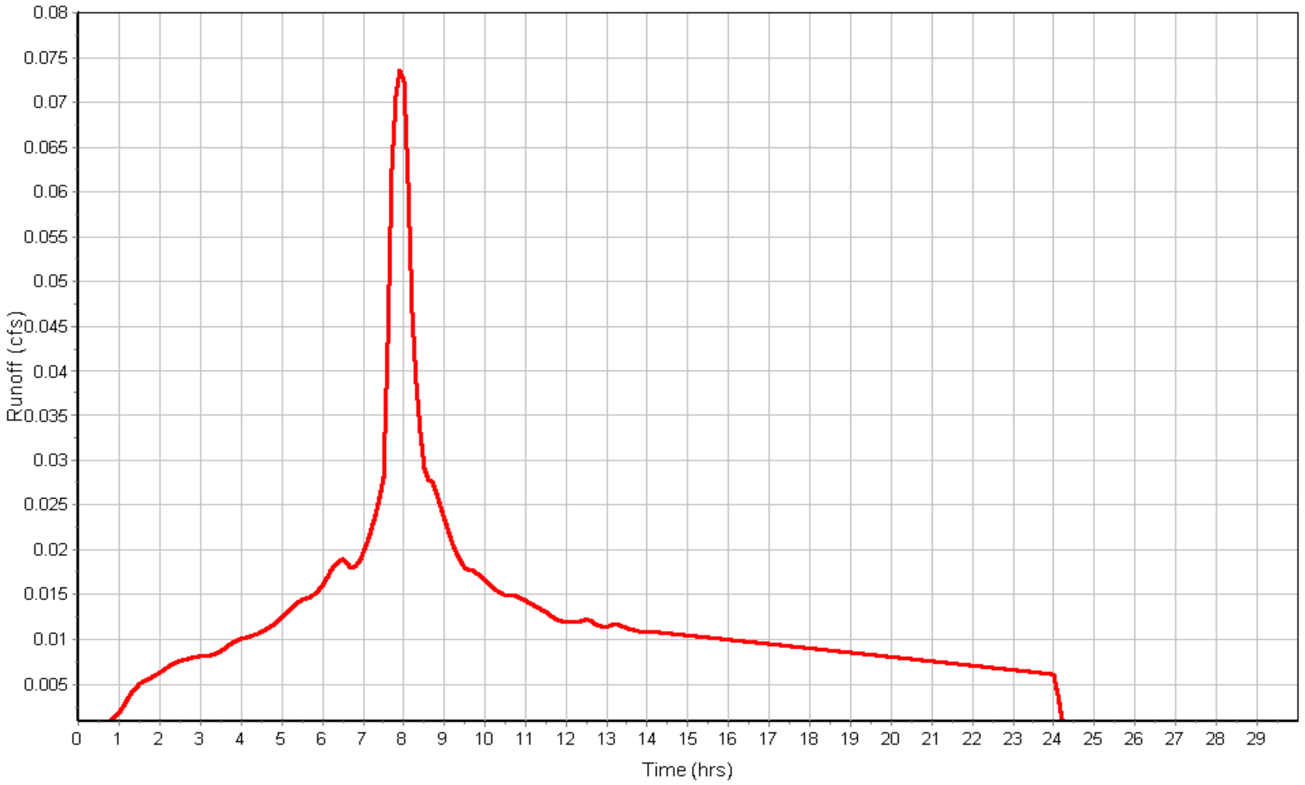
Total Rainfall (in) 4.48
Total Runoff (in) 4.12
Peak Runoff (cfs) 0.07
Weighted Curve Number 96.74
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : NP-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : OFF-1

Input Data

Area (ac) 0.10
Impervious Area (%) 82.00
Impervious Area Curve Number 92.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

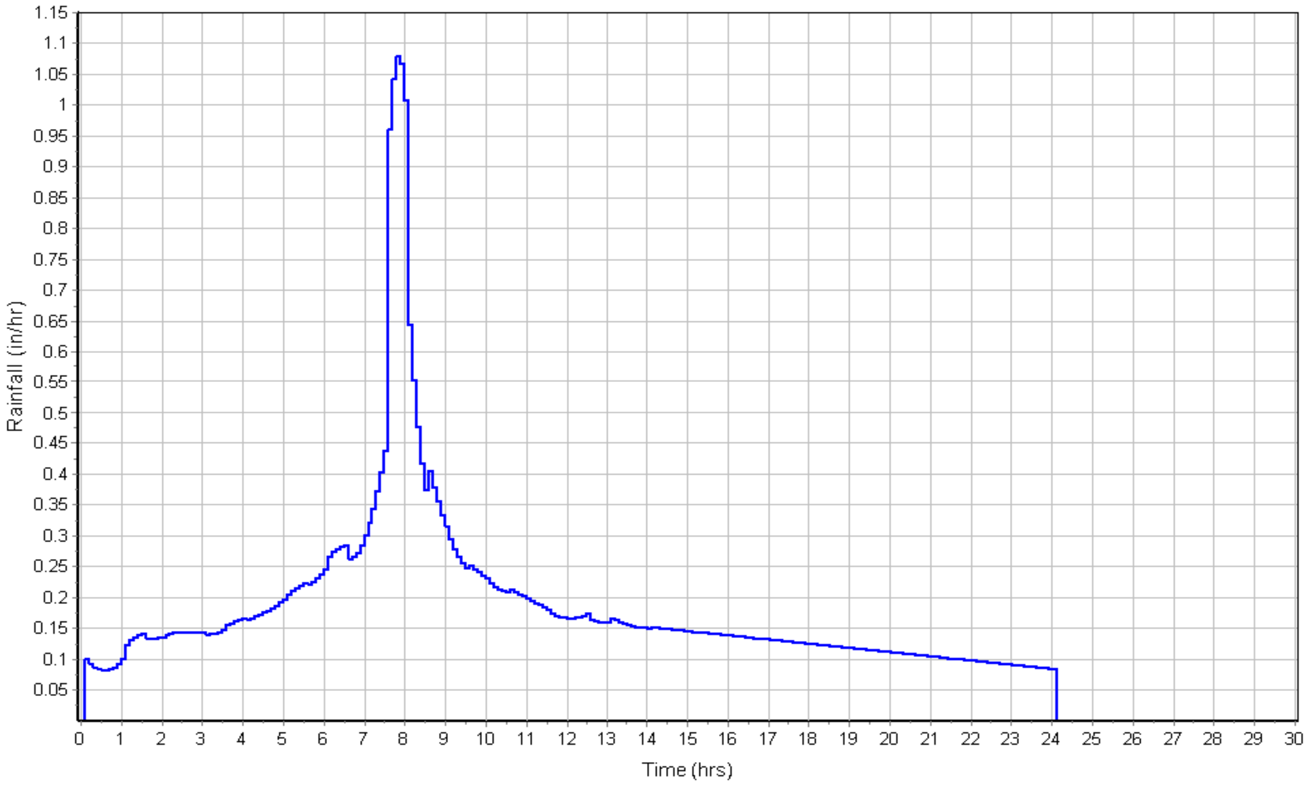
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.10		89.84

Subbasin Runoff Results

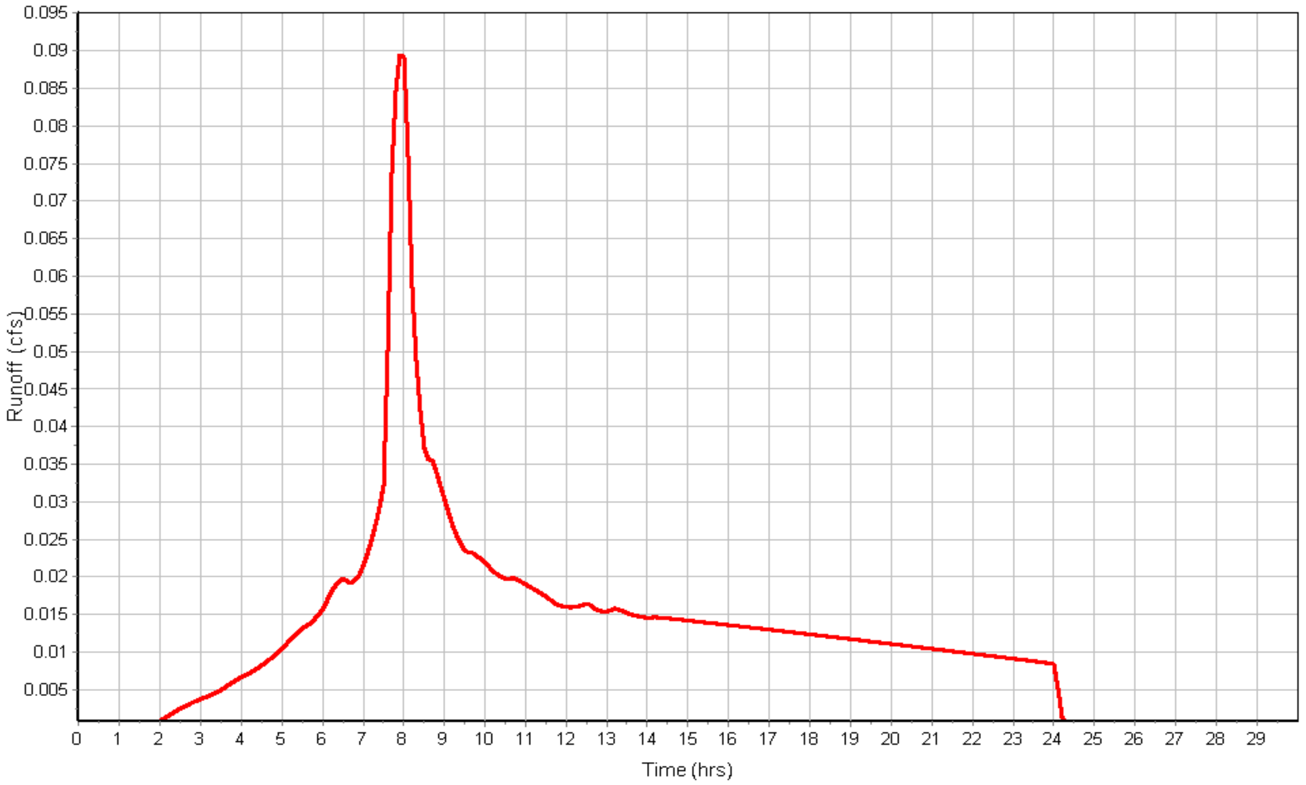
Total Rainfall (in) 4.48
Total Runoff (in) 3.38
Peak Runoff (cfs) 0.09
Weighted Curve Number 89.84
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : OFF-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SB-1

Input Data

Area (ac) 0.13
Impervious Area (%) 72.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

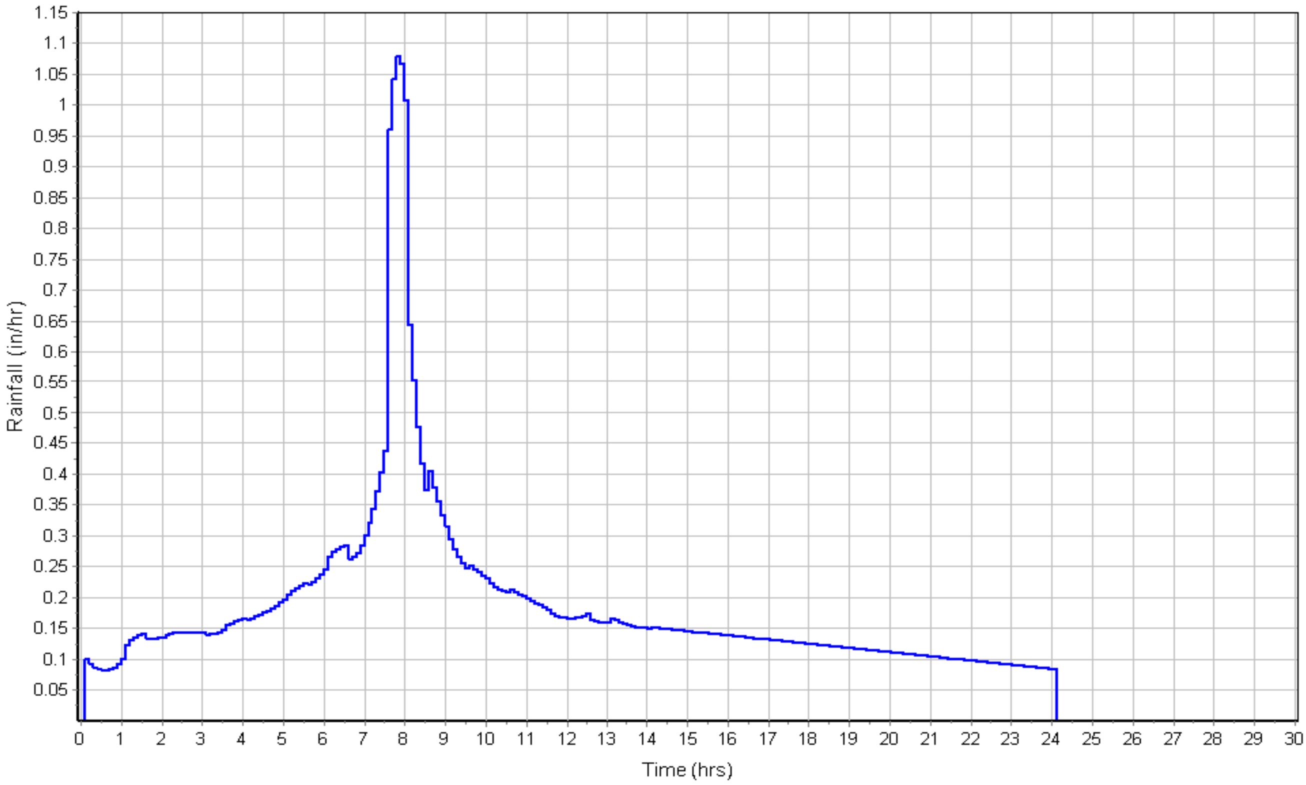
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.13		92.96

Subbasin Runoff Results

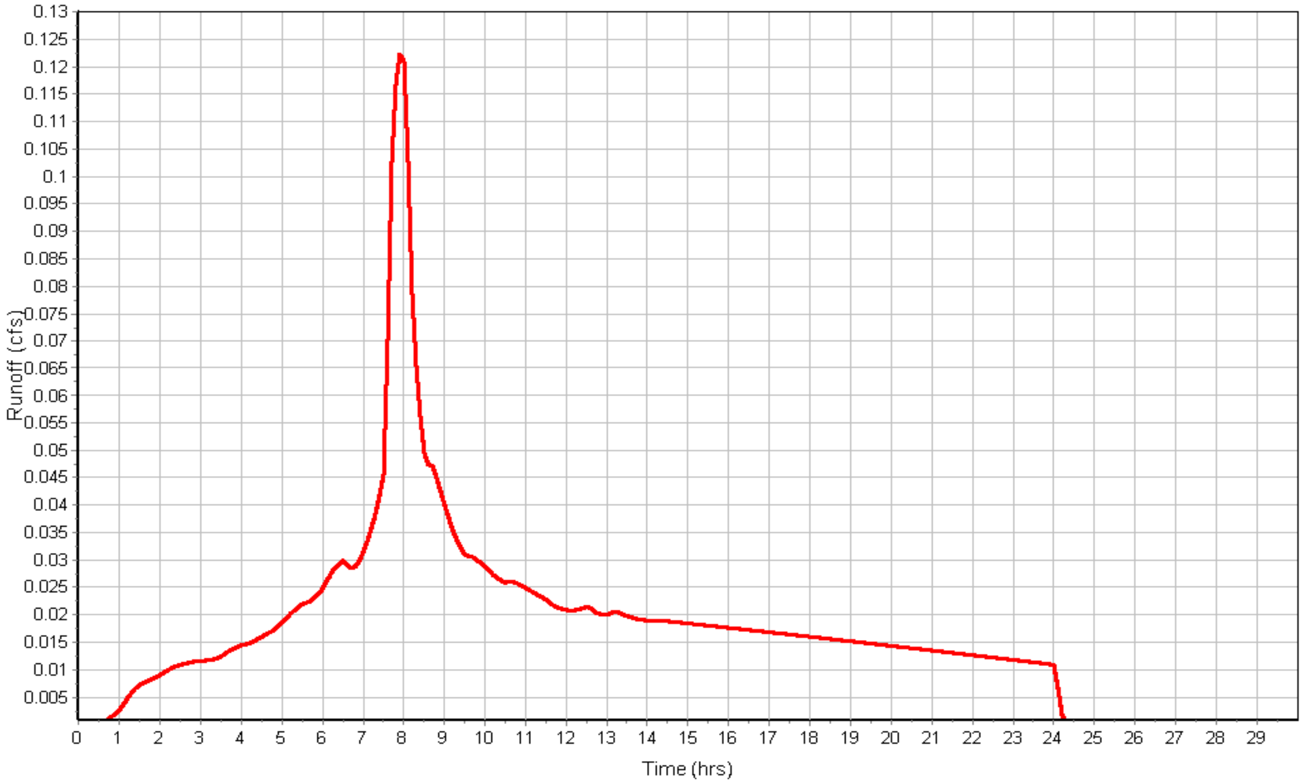
Total Rainfall (in) 4.48
Total Runoff (in) 3.74
Peak Runoff (cfs) 0.12
Weighted Curve Number 92.96
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SB-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SB-2

Input Data

Area (ac)	0.09
Impervious Area (%)	100.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	80.00
Rain Gage ID	Rain Gage-01

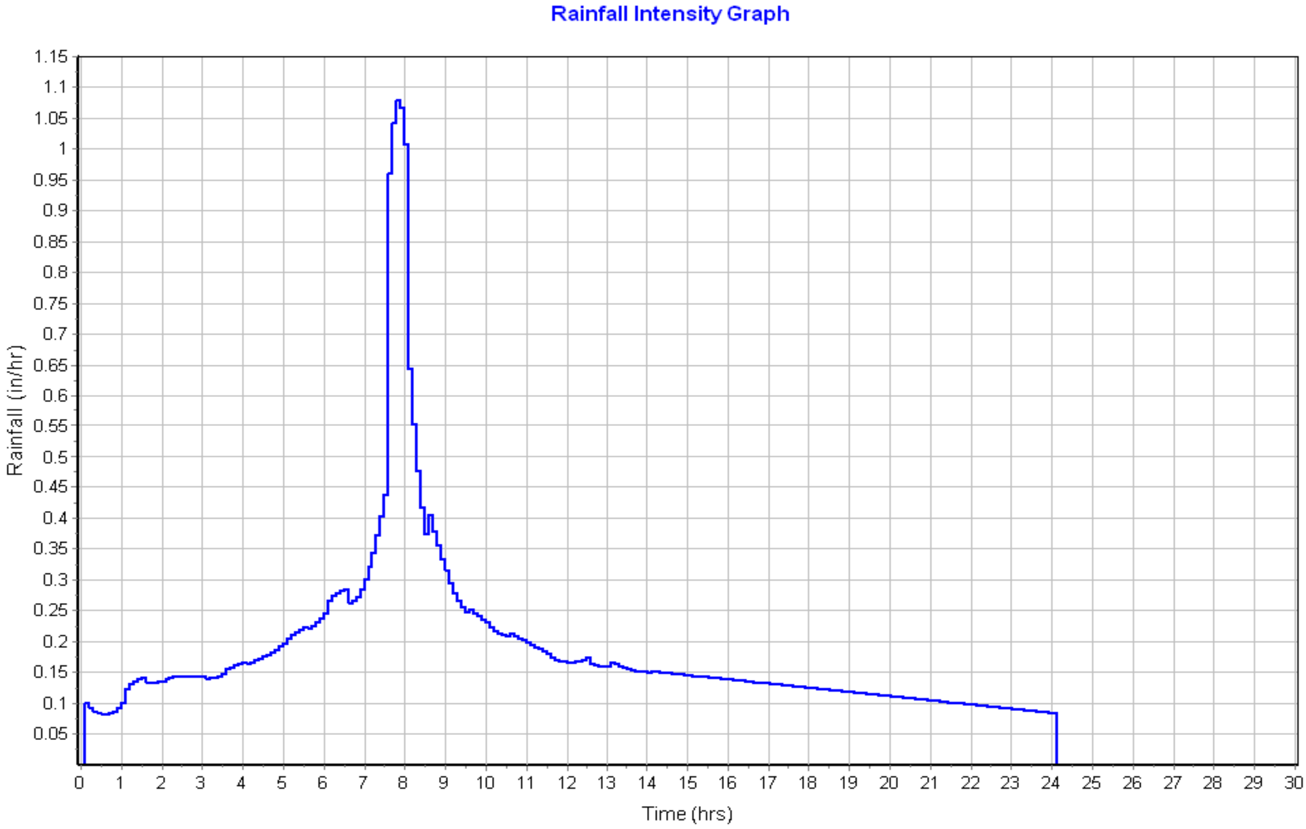
Composite Curve Number

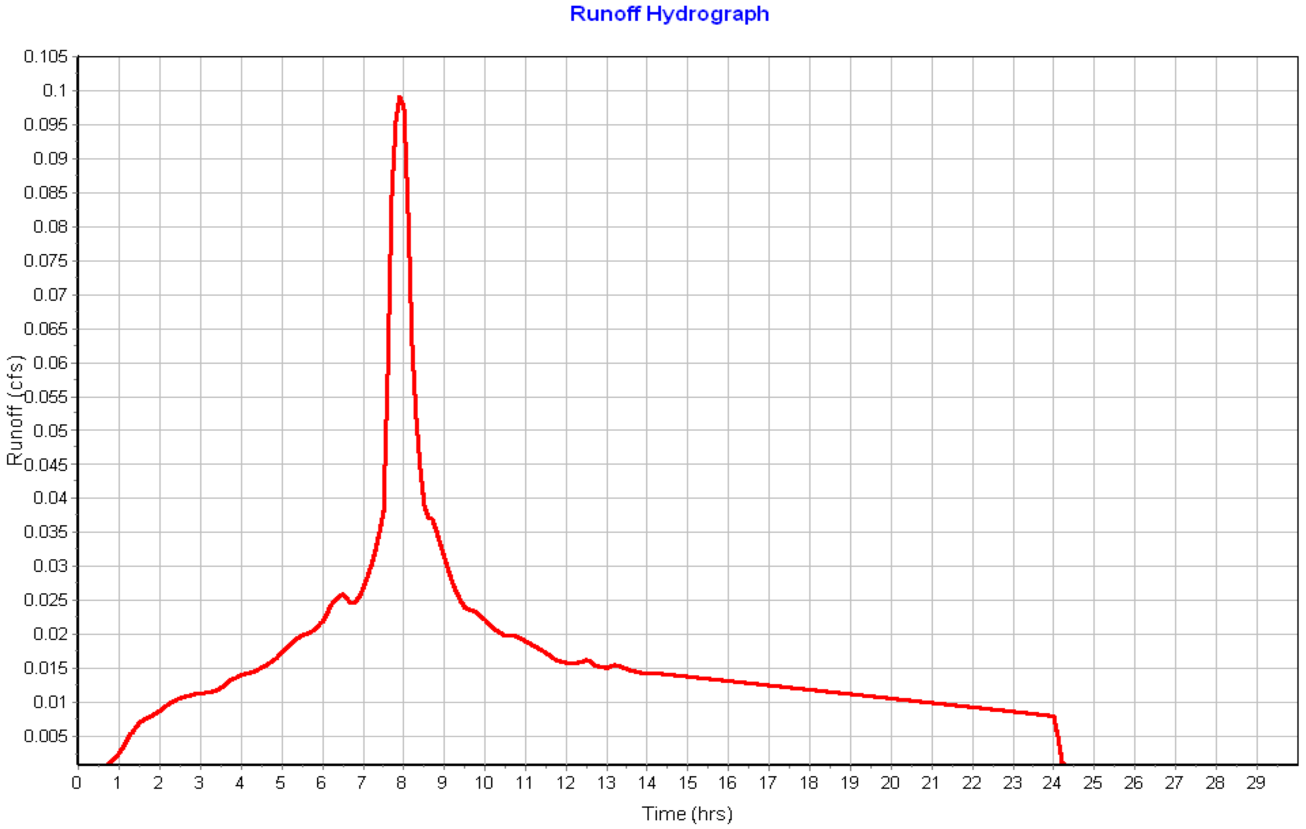
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.09		98

Subbasin Runoff Results

Total Rainfall (in)	4.48
Total Runoff (in)	4.24
Peak Runoff (cfs)	0.10
Weighted Curve Number	98.00
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : SB-2





Subbasin : SP-1

Input Data

Area (ac) 0.76
Impervious Area (%) 79.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

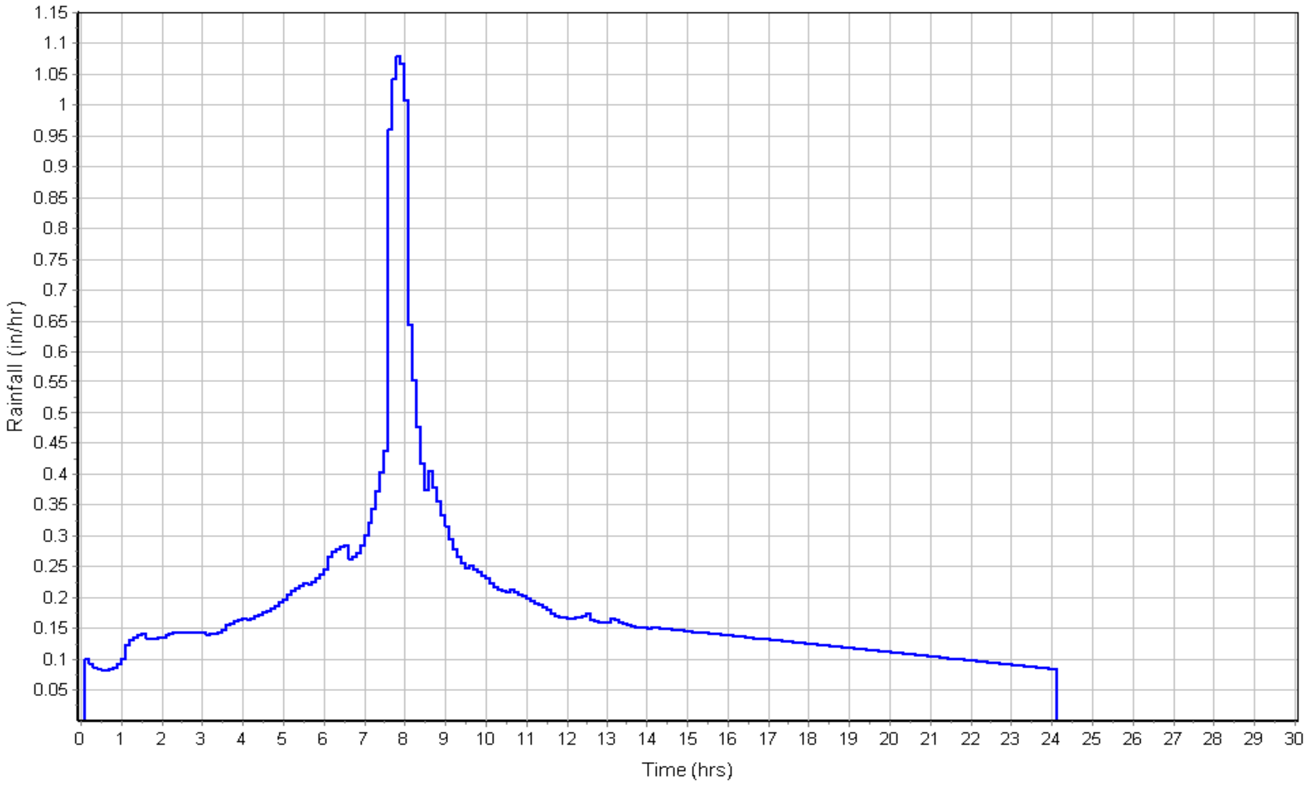
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.76		94.22

Subbasin Runoff Results

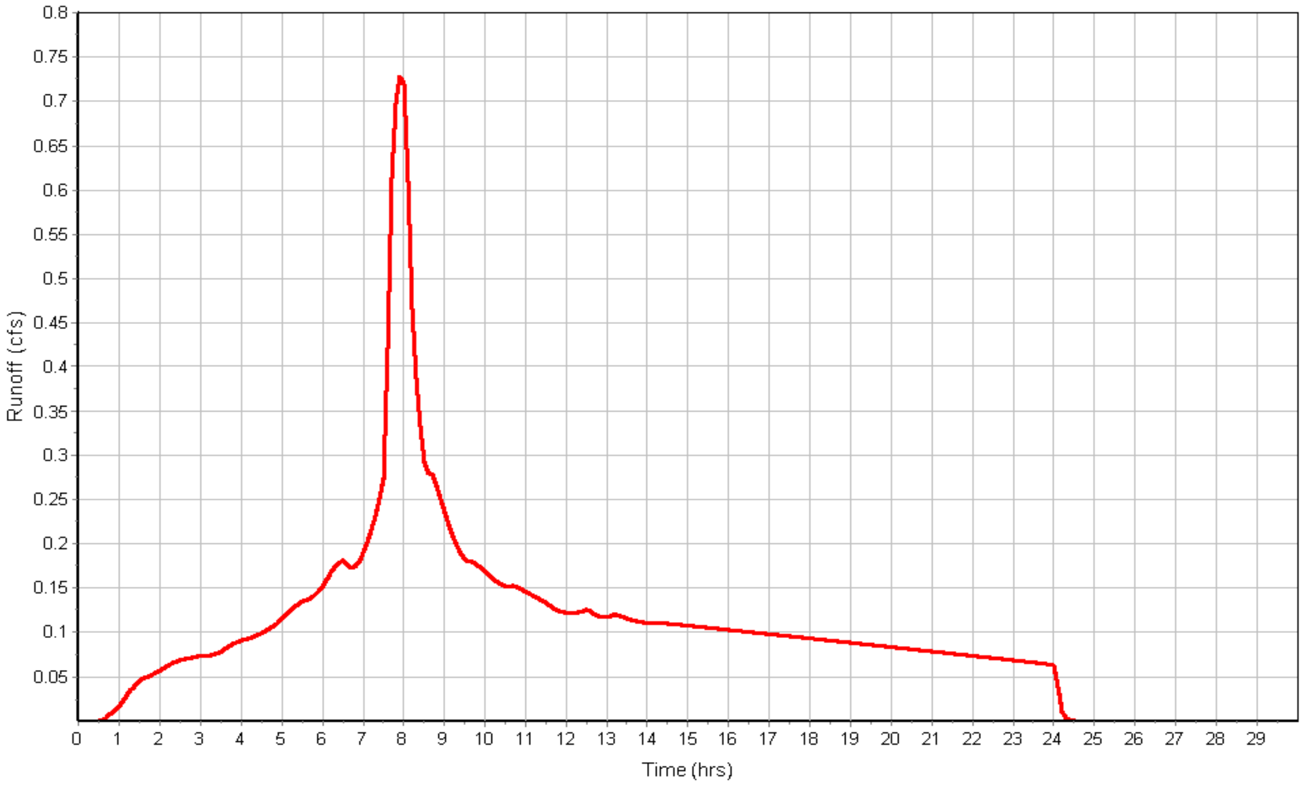
Total Rainfall (in) 4.48
Total Runoff (in) 3.87
Peak Runoff (cfs) 0.73
Weighted Curve Number 94.22
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SP-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SP-2

Input Data

Area (ac) 0.52
Impervious Area (%) 77.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

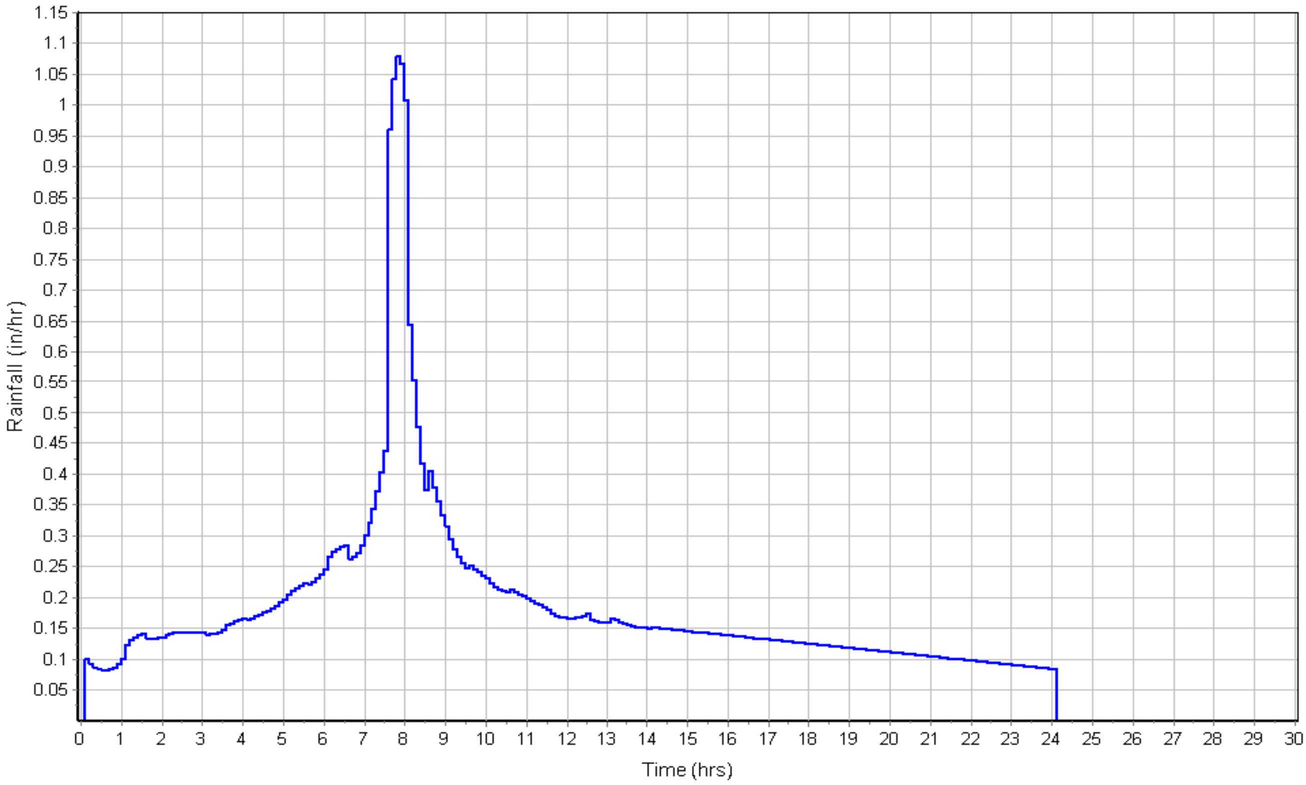
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.52		93.86

Subbasin Runoff Results

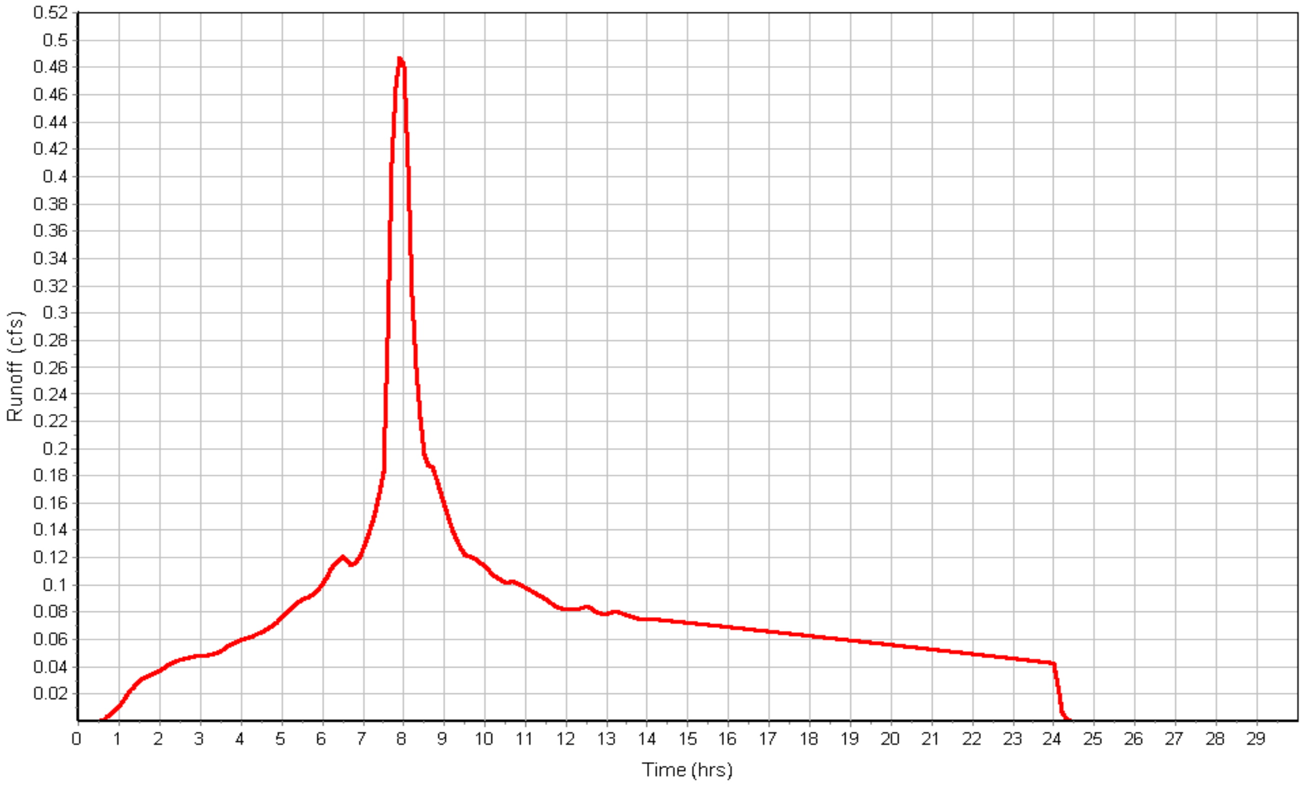
Total Rainfall (in) 4.48
Total Runoff (in) 3.83
Peak Runoff (cfs) 0.49
Weighted Curve Number 93.86
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SP-2

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	ORIFICE	67.30	75.00	7.71	67.30	0.00	74.00	-1.00	10000.00	0.00
2	OUTFALL_1	71.67	75.00	3.33	71.67	0.00	74.00	-1.00	10000.00	0.00
3	SD_CB_1	72.41	73.56	1.15	72.41	0.00	73.48	-0.08	10000.00	0.00
4	SD_CB_2	72.61	76.50	3.89	72.61	0.00	75.50	-1.00	10000.00	0.00
5	SD_CO_15	76.21	78.50	2.29	76.21	0.00	78.00	-0.50	10000.00	0.00
6	SD_CO_6	71.68	75.00	3.32	71.68	0.00	74.00	-1.00	10000.00	0.00
7	SD_CO_9	71.65	75.00	3.35	71.65	0.00	74.00	-1.00	10000.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	ORIFICE	0.31	0.00	69.49	2.19	0.00	5.51	68.74	1.44	0 08:54	0 00:00	0.00	0.00
2	OUTFALL_1	1.30	0.49	72.34	0.67	0.00	2.66	72.01	0.34	0 07:52	0 00:00	0.00	0.00
3	SD_CB_1	0.82	0.82	72.83	0.42	0.00	0.73	72.57	0.16	0 07:55	0 00:00	0.00	0.00
4	SD_CB_2	0.49	0.31	72.97	0.36	0.00	3.53	72.74	0.13	0 07:56	0 00:00	0.00	0.00
5	SD_CO_15	0.18	0.18	76.39	0.18	0.00	2.11	76.28	0.07	0 07:55	0 00:00	0.00	0.00
6	SD_CO_6	0.20	0.10	72.25	0.57	0.00	2.99	71.99	0.31	0 08:53	0 00:00	0.00	0.00
7	SD_CO_9	0.49	0.00	72.25	0.60	0.00	2.75	71.92	0.27	0 08:52	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	LINK-10	50.68	71.67	0.00	71.52	0.10	0.15	0.3000	Trapezoidal	1.000	8.000	0.0800	0.5000	0.5000	0.0000	0.00	No
2	OVERFLOW_01	20.00	72.21	0.79	71.81	4.52	0.40	2.0000	Rectangular	1.000	4.000	0.0100	0.5000	0.5000	0.0000	0.00	No
3	OVERFLOW_02	20.00	74.44	0.50	74.24	2.56	0.20	1.0000	Rectangular	1.000	4.000	0.0100	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	LINK-10	1.33	0 07:56	3.62	0.37	0.88	0.96	0.66	0.66	0.00		
2	OVERFLOW_01	0.31	0 08:53	64.15	0.00	2.14	0.16	0.04	0.04	0.00		
3	OVERFLOW_02	0.10	0 07:57	45.36	0.00	1.14	0.29	0.02	0.02	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	LINK_01	12.00	69.29	2.00	69.05	3.22	0.24	2.0000	CIRCULAR	9.960	9.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1
2	LINK-12	222.93	72.23	-0.18	71.67	0.00	0.56	0.2500	CIRCULAR	9.960	9.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1
3	LINK-20	19.69	71.85	0.17	71.75	0.33	0.10	0.5000	CIRCULAR	6.000	6.000	0.0100	0.5000	0.5000	0.0000	0.00	No	1
4	LINK-30	18.32	71.65	0.00	71.60	0.18	0.05	0.3000	CIRCULAR	8.040	8.040	0.0100	0.5000	0.5000	0.0000	0.00	No	1
5	LINK-31	318.43	72.61	0.00	71.65	0.00	0.95	0.3000	CIRCULAR	8.040	8.040	0.0100	0.5000	0.5000	0.0000	0.00	No	1
6	LINK-32	218.21	74.35	-1.86	72.61	0.00	1.75	0.8000	CIRCULAR	3.960	3.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	LINK_01	0.31	0 08:54	4.03	0.08	3.62	0.06	0.18	0.21	0.00		Calculated
2	LINK-12	0.82	0 07:55	1.64	0.50	2.29	1.62	0.54	0.65	0.00		Calculated
3	LINK-20	0.20	0 07:57	0.51	0.39	2.19	0.15	0.45	0.90	0.00		Calculated
4	LINK-30	0.49	0 07:57	0.86	0.56	2.41	0.13	0.62	0.93	0.00		Calculated
5	LINK-31	0.49	0 07:56	0.86	0.57	2.29	2.32	0.40	0.60	0.00		Calculated
6	LINK-32	0.18	0 07:55	0.32	0.57	2.51	1.45	0.26	0.77	0.00		Calculated

Storage Nodes

Storage Node : INFL_RG_1

Input Data

Invert Elevation (ft) 71.42
Max (Rim) Elevation (ft) 75.00
Max (Rim) Offset (ft) 3.58
Initial Water Elevation (ft) 0.00
Initial Water Depth (ft) .... -71.42
Ponded Area (ft²) 10000.00
Evaporation Loss 0.00

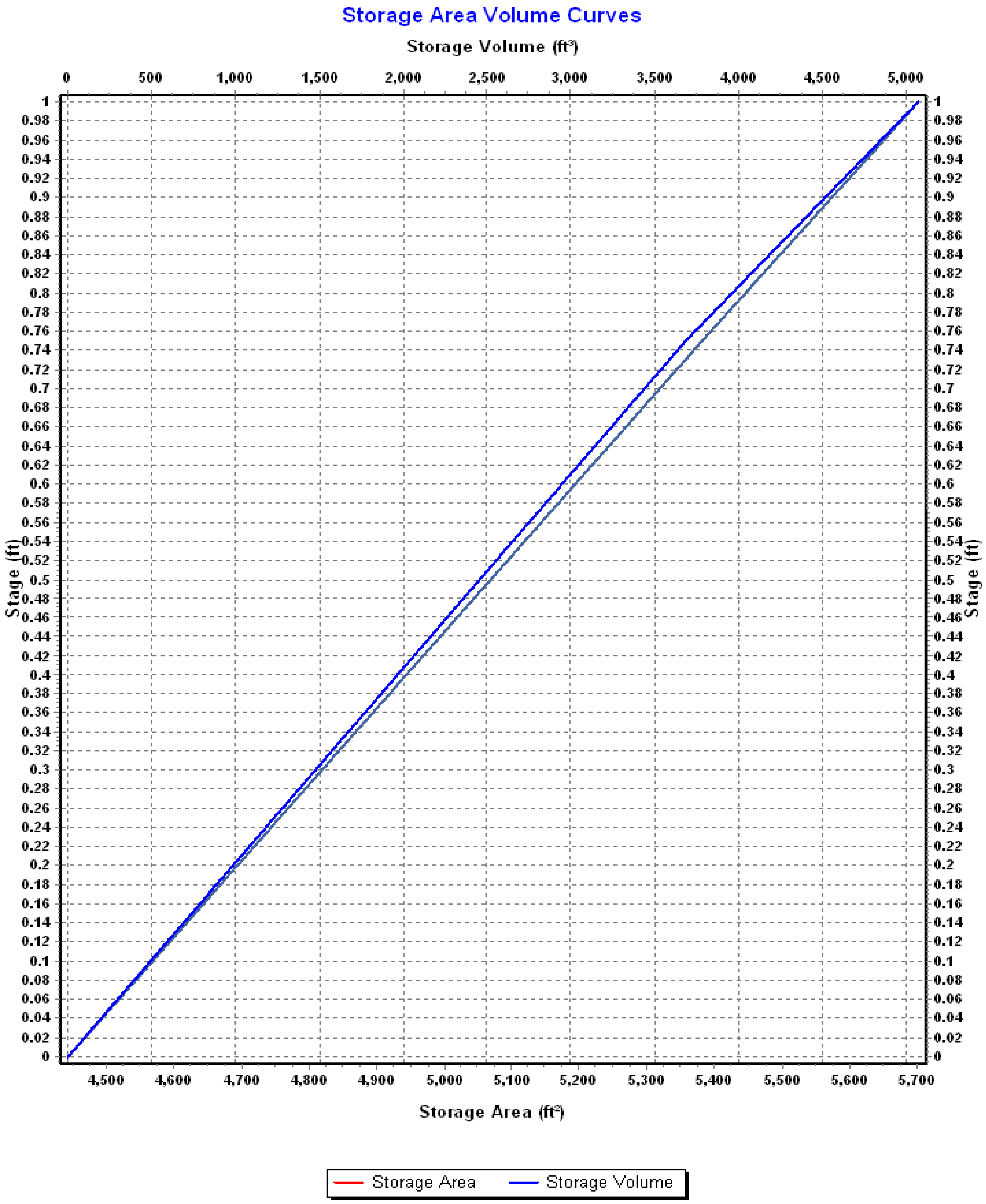
Infiltration/Exfiltration

Constant Flow Rate (cfs) 0.4983

Storage Area Volume Curves

Storage Curve : WETLAND

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0.00	4443.1	0.000
0.75	5381.7	3684.30
1.00	5701.6	5069.71


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Stage (ft)
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
0.84
0.82
0.8
0.78
0.76
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0.56
0.54
0.52
0.5
0.48
0.46
0.44
0.42
0.4
0.38
0.36
0.34
0.32
0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
4,500
4,600
4,700
4,800
4,900
5,000
5,100
5,200
5,300
5,400
5,500
5,600
5,700
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : INFL_RG_1 (continued)

Output Summary Results

Peak Inflow (cfs)	2.17
Peak Lateral Inflow (cfs)	0.17
Peak Outflow (cfs)	0.31
Peak Exfiltration Flow Rate (cfm)	29.90
Max HGL Elevation Attained (ft)	72.25
Max HGL Depth Attained (ft)	0.83
Average HGL Elevation Attained (ft)	71.72
Average HGL Depth Attained (ft)	0.3
Time of Max HGL Occurrence (days hh:mm)	0 08:53
Total Exfiltration Volume (1000-ft³)	30.966
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : INFL_RG_2

Input Data

Invert Elevation (ft)	73.94
Max (Rim) Elevation (ft)	76.00
Max (Rim) Offset (ft)	2.06
Initial Water Elevation (ft)	0.00
Initial Water Depth (ft)	-73.94
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

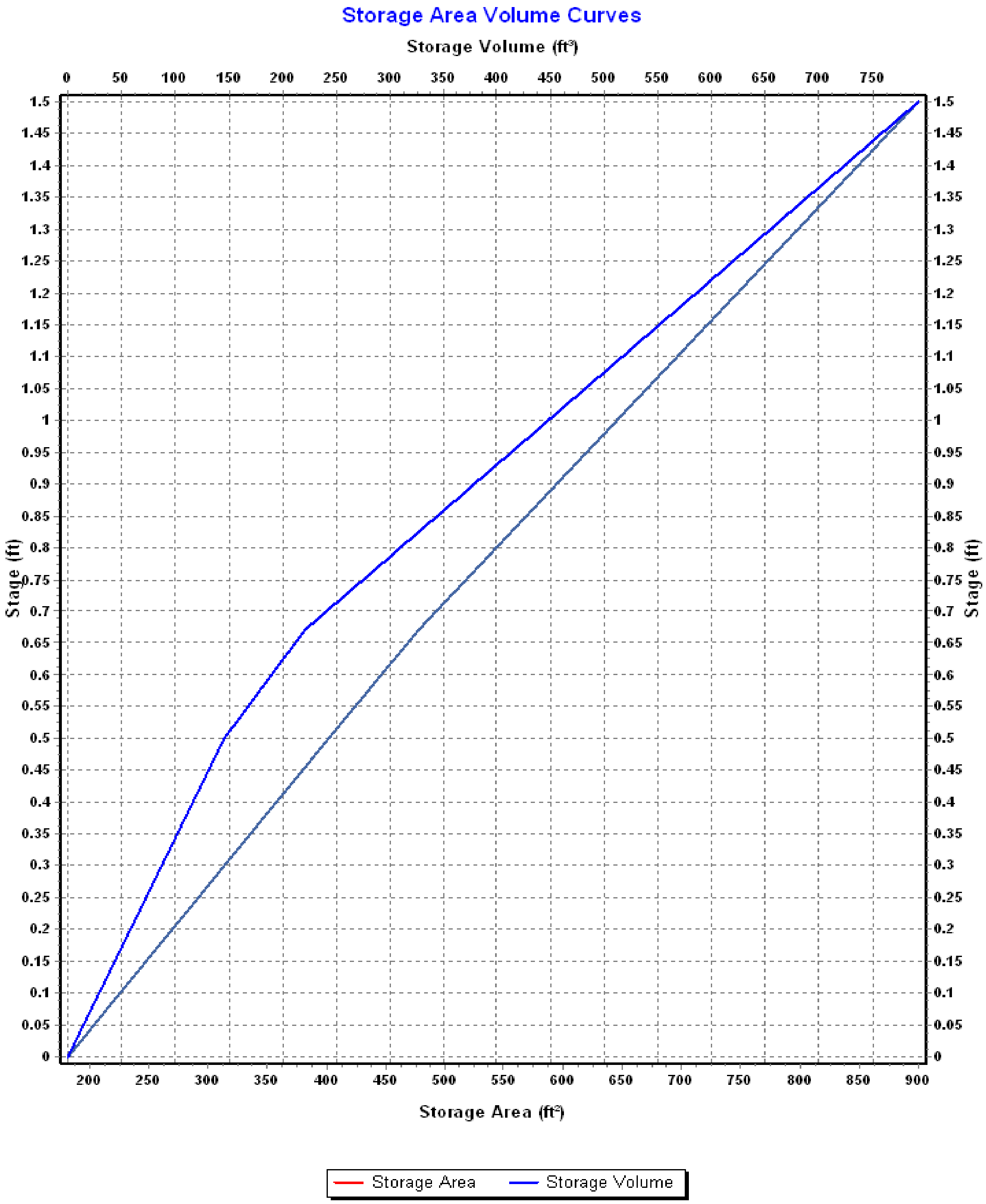
Infiltration/Exfiltration

Constant Flow Rate (cfs)	0.0200

Storage Area Volume Curves

Storage Curve : SB-2_RG

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	182	0.000
0.50	402	146.00
0.67	478	220.80
1.50	900	792.67


Storage Area Volume Curves
Storage Volume (ft³)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Stage (ft)
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : INFL_RG_2 (continued)

Output Summary Results

Peak Inflow (cfs)	0.12
Peak Lateral Inflow (cfs)	0.12
Peak Outflow (cfs)	0.10
Peak Exfiltration Flow Rate (cfm)	1.20
Max HGL Elevation Attained (ft)	74.46
Max HGL Depth Attained (ft)	0.52
Average HGL Elevation Attained (ft)	74.23
Average HGL Depth Attained (ft)	0.29
Time of Max HGL Occurrence (days hh:mm)	0 07:57
Total Exfiltration Volume (1000-ft³)	1.510
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Project Description

File Name	calc jah 210817 Model.SPF
Description	J:\9700-003-13\Civil\CX5_PIPES\BHE STRM (2013).dwg

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Santa Barbara UH
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Feb 25, 2013	00:00:00
End Analysis On	Feb 26, 2013	06:00:00
Start Reporting On	Feb 25, 2013	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	10
Nodes	10
Junctions	7
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	2
Links	9
Channels	3
Pipes	6
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	025-Year	Cumulative	inches	Oregon	Lincoln	25	5.06	SCS Type IA 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Impervious Area (%)	Impervious Area Curve Number	Pervious Area Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	E-1	0.45	9.00	98.00	77.00	5.06	2.87	1.28	0.21	0 00:32:00
2	EX_SITE	2.56	3.00	91.00	77.00	5.06	2.71	6.95	0.84	0 01:01:00
3	NB-1	0.21	65.00	98.00	80.00	5.06	4.17	0.85	0.21	0 00:05:00
4	NB-2	0.23	95.00	98.00	80.00	5.06	4.73	1.07	0.26	0 00:05:00
5	NP-1	0.07	93.00	98.00	80.00	5.06	4.69	0.34	0.08	0 00:05:00
6	OFF-1	0.10	82.00	92.00	80.00	5.06	3.93	0.41	0.10	0 00:05:00
7	SB-1	0.13	72.00	98.00	80.00	5.06	4.30	0.57	0.14	0 00:05:00
8	SB-2	0.09	100.00	98.00	80.00	5.06	4.82	0.45	0.11	0 00:05:00
9	SP-1	0.76	79.00	98.00	80.00	5.06	4.43	3.38	0.83	0 00:05:00
10	SP-2	0.52	77.00	98.00	80.00	5.06	4.39	2.27	0.56	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	ORIFICE	Junction	67.30	75.00	67.30	74.00	10000.00	0.83	69.65	0.00	5.35	0 00:00	0.00	0.00
2	OUTFALL_1	Junction	71.67	75.00	71.67	74.00	10000.00	1.49	72.35	0.00	2.65	0 00:00	0.00	0.00
3	SD_CB_1	Junction	72.41	73.56	72.41	73.48	10000.00	0.94	72.86	0.00	0.70	0 00:00	0.00	0.00
4	SD_CB_2	Junction	72.61	76.50	72.61	75.50	10000.00	0.56	73.00	0.00	3.50	0 00:00	0.00	0.00
5	SD_CO_15	Junction	76.21	78.50	76.21	78.00	10000.00	0.21	76.41	0.00	2.09	0 00:00	0.00	0.00
6	SD_CO_6	Junction	71.68	75.00	71.68	74.00	10000.00	0.23	72.29	0.00	2.95	0 00:00	0.00	0.00
7	SD_CO_9	Junction	71.65	75.00	71.65	74.00	10000.00	0.56	72.30	0.00	2.70	0 00:00	0.00	0.00
8	NEW_OUT	Outfall	65.83					1.66	65.83					
9	INFL_RG_1	Storage Node	71.42	75.00	0.00		10000.00	2.48	72.28				0.00	0.00
10	INFL_RG_2	Storage Node	73.94	76.00	0.00		0.00	0.14	74.47				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Reported Condition
1	LINK_01	Pipe	ORIFICE	NEW_OUT	12.00	69.29	69.05	2.0000	10.000	0.0100	0.83	4.03	0.21	4.48	0.31	0.37	0.00	Calculated
2	LINK-12	Pipe	SD_CB_1	OUTFALL_1	222.93	72.23	71.67	0.2500	10.000	0.0100	0.94	1.64	0.57	2.48	0.56	0.67	0.00	Calculated
3	LINK-20	Pipe	SD_CO_6	INFL_RG_1	19.69	71.85	71.75	0.5000	6.000	0.0100	0.23	0.51	0.45	2.26	0.47	0.94	0.00	Calculated
4	LINK-30	Pipe	SD_CO_9	INFL_RG_1	18.32	71.65	71.60	0.3000	8.000	0.0100	0.55	0.86	0.64	2.50	0.66	0.98	0.00	Calculated
5	LINK-31	Pipe	SD_CB_2	SD_CO_9	318.43	72.61	71.65	0.3000	8.000	0.0100	0.56	0.86	0.65	2.37	0.47	0.70	0.00	Calculated
6	LINK-32	Pipe	SD_CO_15	SD_CB_2	218.21	74.35	72.61	0.8000	4.000	0.0100	0.21	0.32	0.66	2.81	0.27	0.80	0.00	Calculated
7	LINK-10	Channel	OUTFALL_1	INFL_RG_1	50.68	71.67	71.52	0.3000	12.000	0.0800	1.51	3.62	0.42	0.89	0.70	0.70	0.00	
8	OVERFLOW_01	Channel	INFL_RG_1	ORIFICE	20.00	72.21	71.81	2.0000	12.000	0.0100	0.83	64.15	0.01	3.05	0.07	0.07	0.00	
9	OVERFLOW_02	Channel	INFL_RG_2	SD_CO_6	20.00	74.44	74.24	1.0000	12.000	0.0100	0.12	45.36	0.00	1.21	0.02	0.02	0.00	

Subbasin Hydrology

Subbasin : E-1

Input Data

Area (ac) 0.45
Impervious Area (%) 9.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 77.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

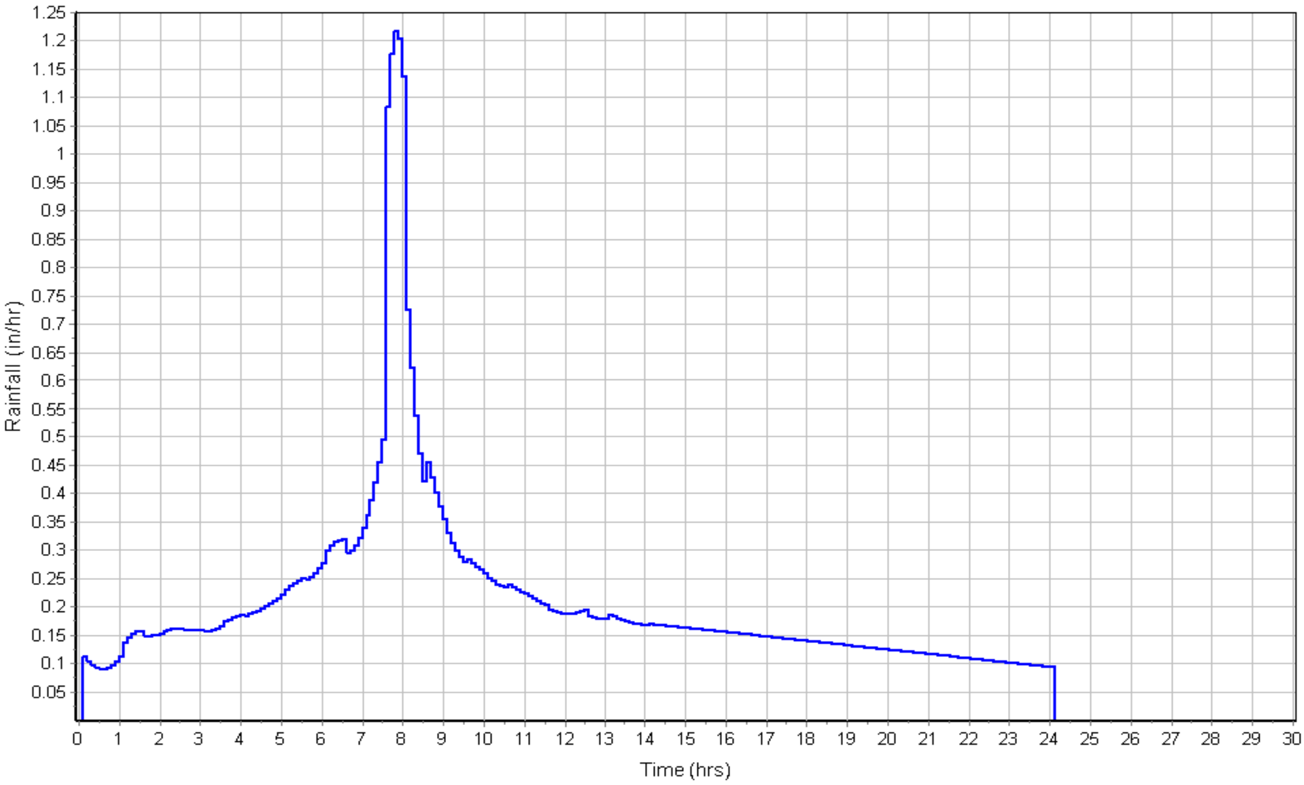
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.45		78.89

Subbasin Runoff Results

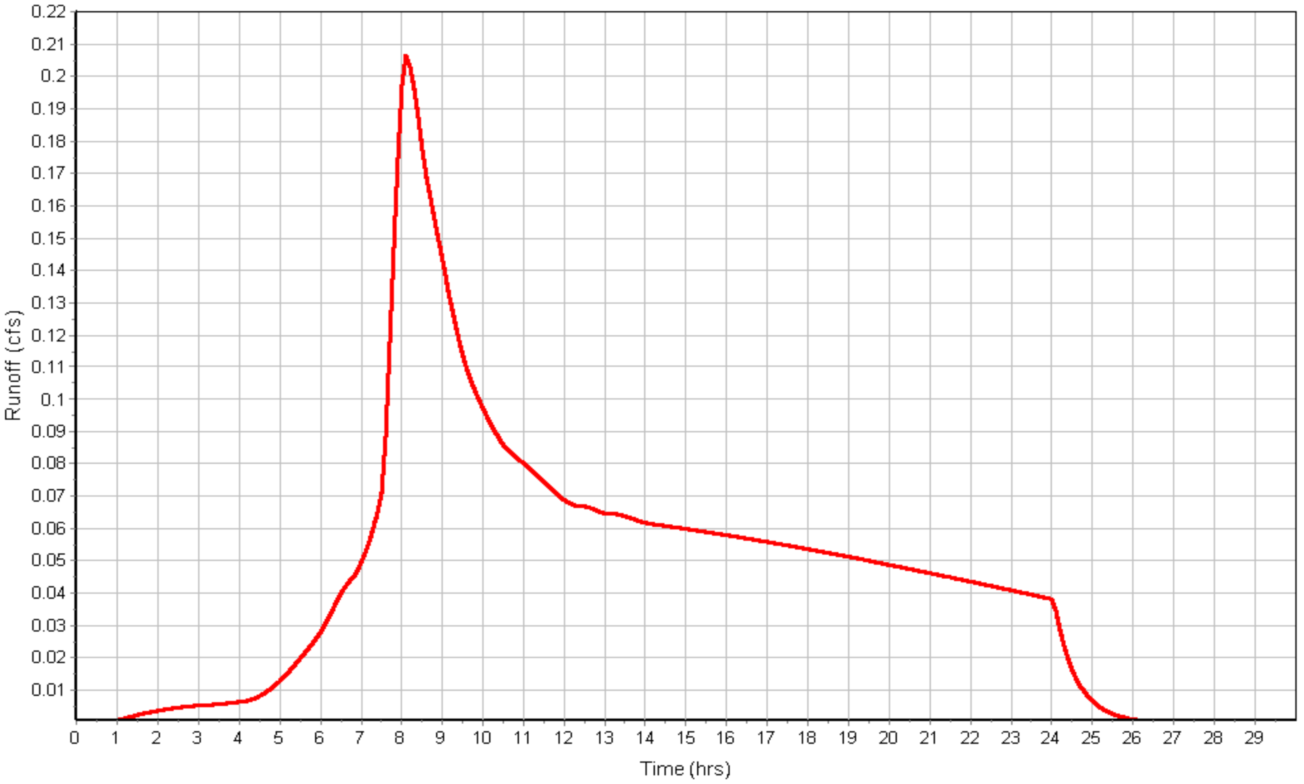
Total Rainfall (in) 5.06
Total Runoff (in) 2.87
Peak Runoff (cfs) 0.21
Weighted Curve Number 78.89
Time of Concentration (days hh:mm:ss) 0 00:32:00

Subbasin : E-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : EX_SITE

Input Data

Area (ac) 2.56
Impervious Area (%) 3.00
Impervious Area Curve Number 91.00
Pervious Area Curve Number 77.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

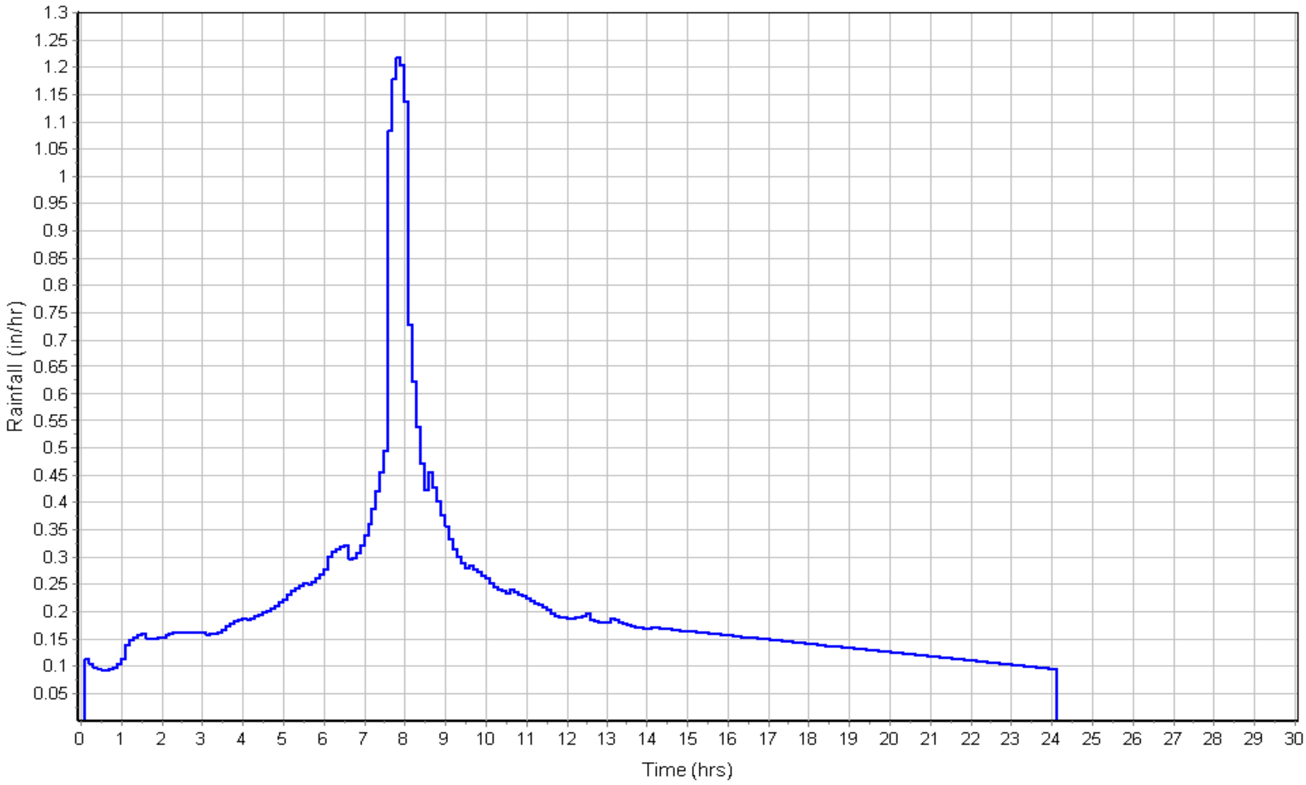
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	2.56		77.42

Subbasin Runoff Results

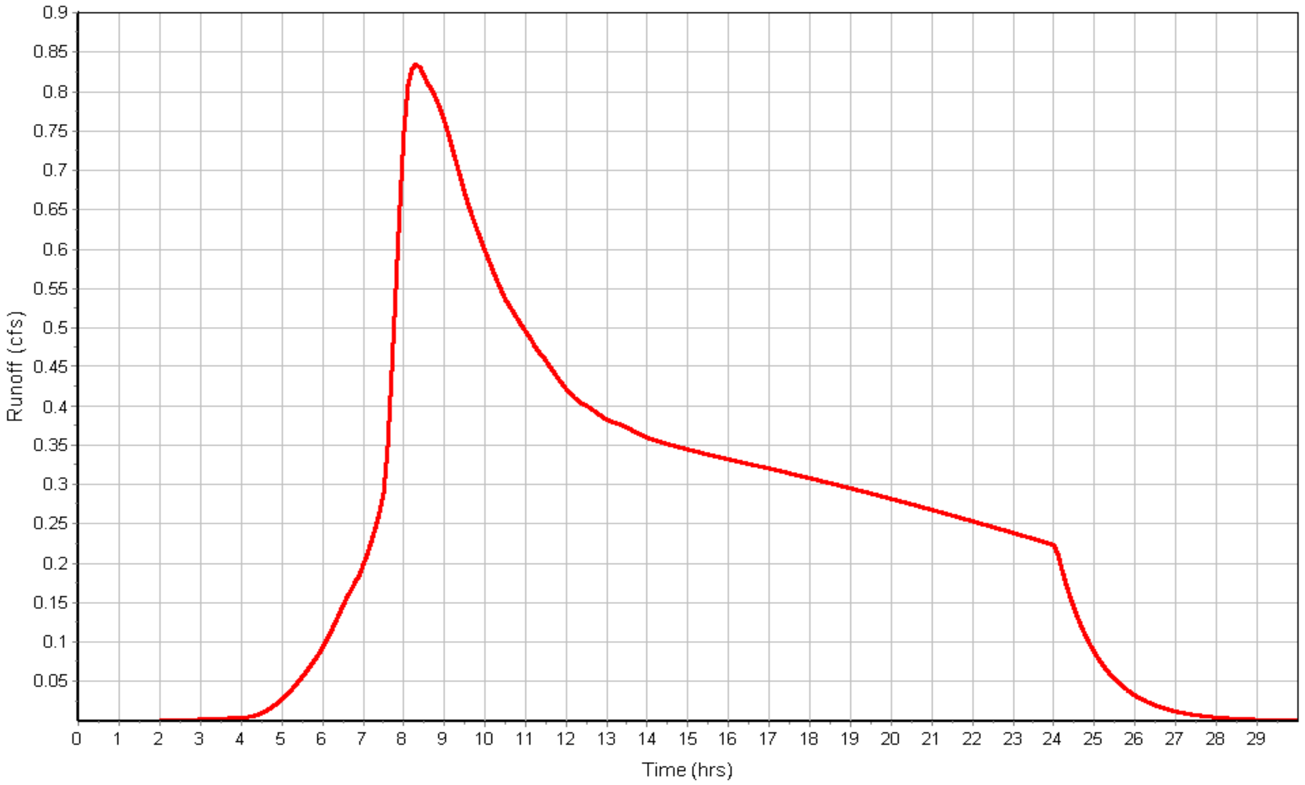
Total Rainfall (in) 5.06
Total Runoff (in) 2.71
Peak Runoff (cfs) 0.84
Weighted Curve Number 77.42
Time of Concentration (days hh:mm:ss) 0 01:01:00

Subbasin : EX_SITE

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NB-1

Input Data

Area (ac)	0.21
Impervious Area (%)	65.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	80.00
Rain Gage ID	Rain Gage-01

Composite Curve Number

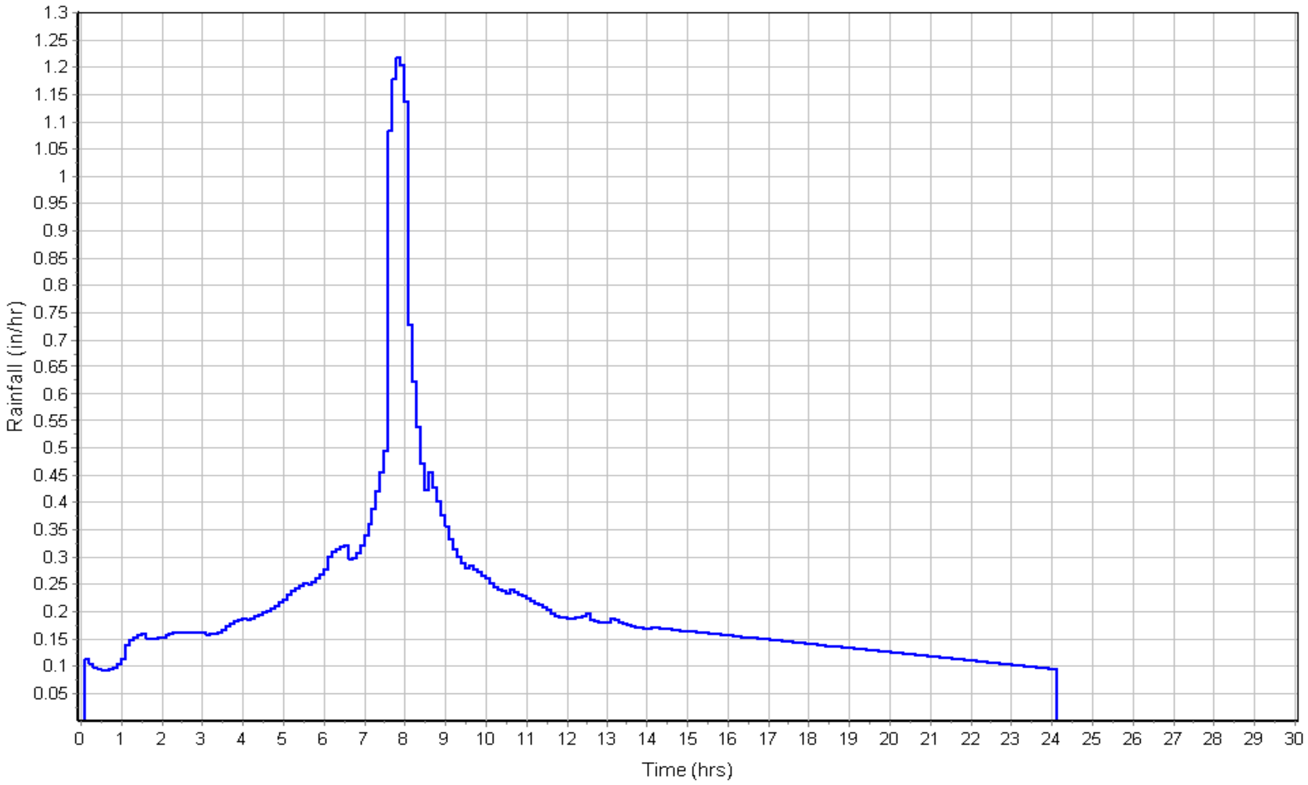
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.21		91.7

Subbasin Runoff Results

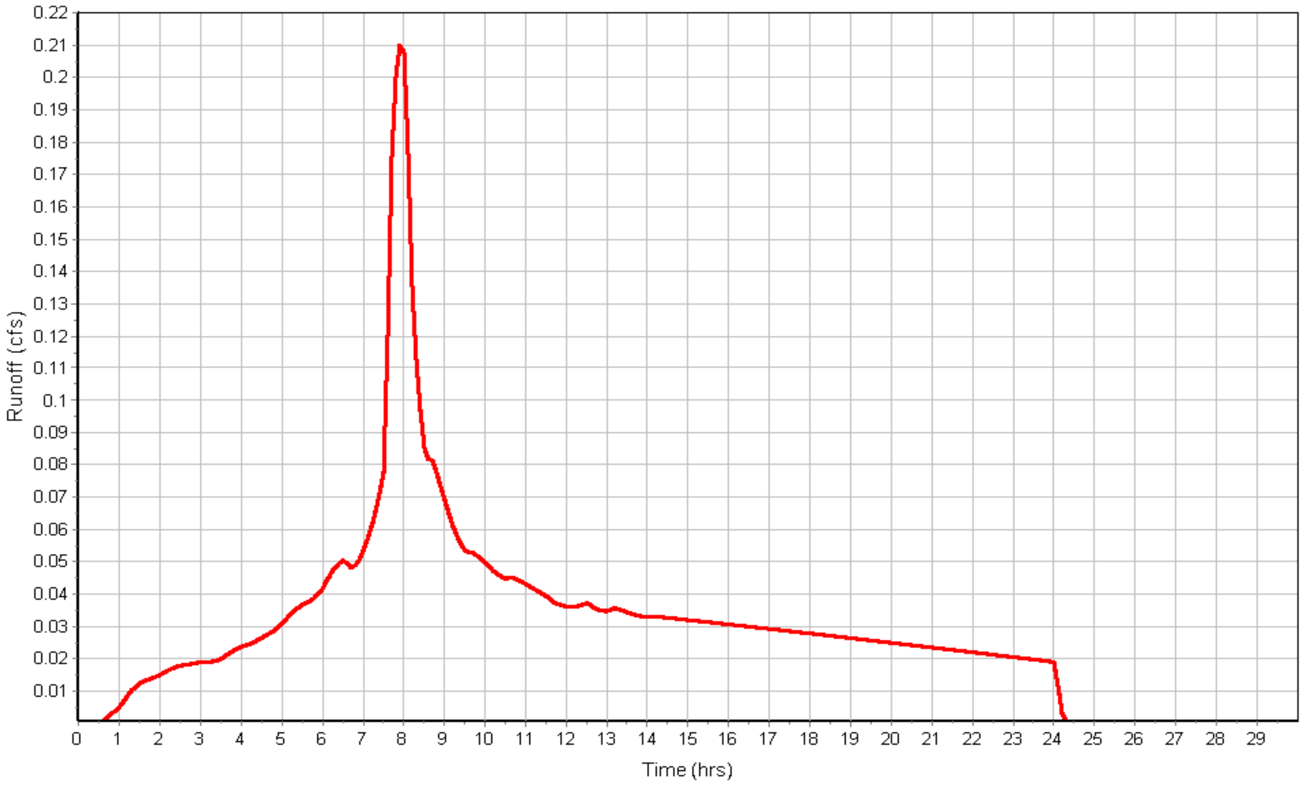
Total Rainfall (in)	5.06
Total Runoff (in)	4.17
Peak Runoff (cfs)	0.21
Weighted Curve Number	91.70
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : NB-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NB-2

Input Data

Area (ac) 0.23
Impervious Area (%) 95.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

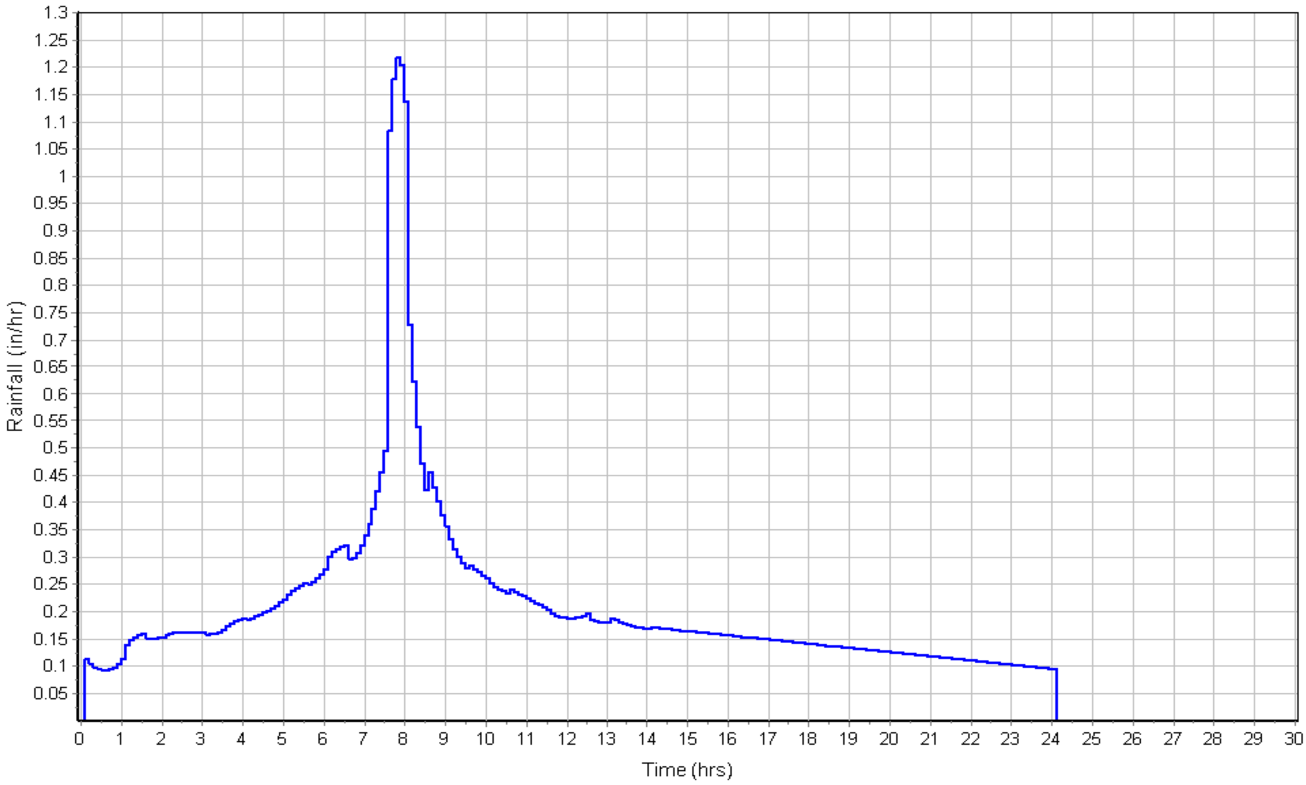
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.23		97.1

Subbasin Runoff Results

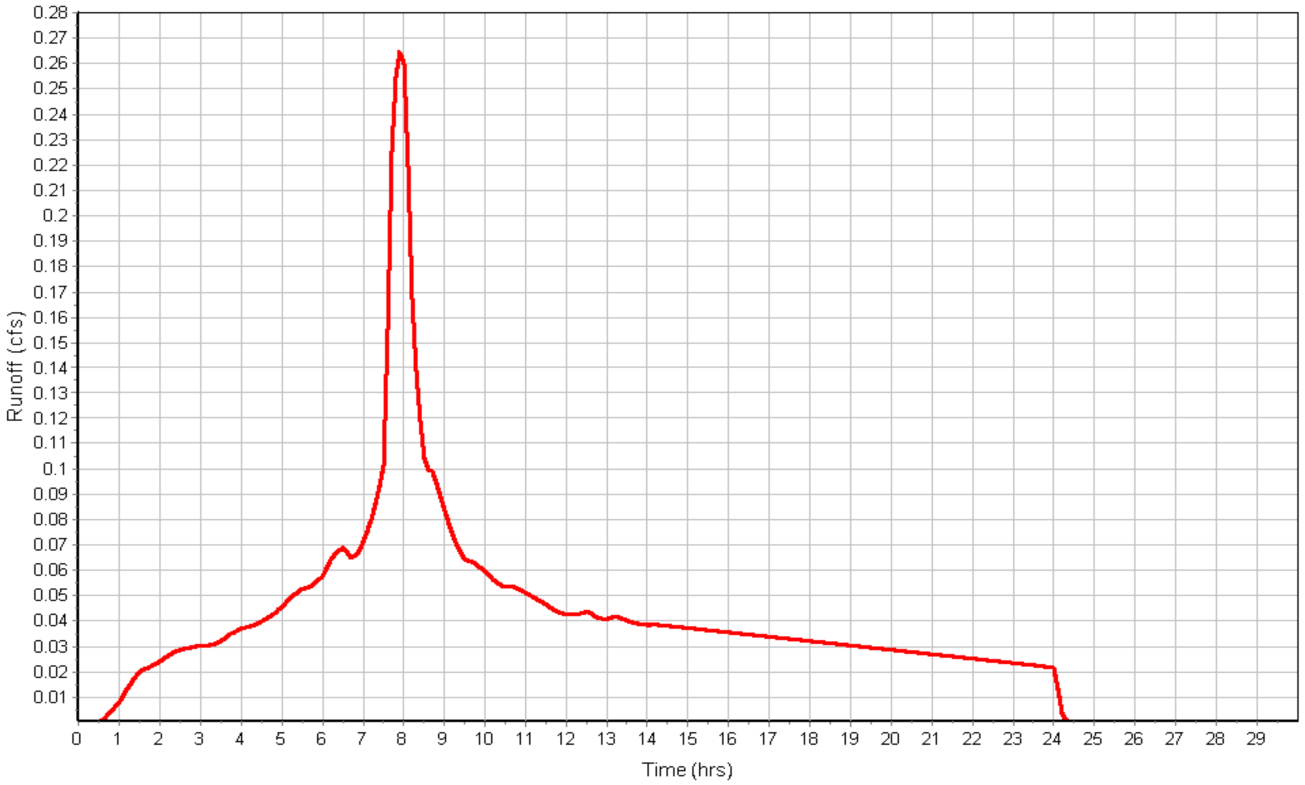
Total Rainfall (in) 5.06
Total Runoff (in) 4.73
Peak Runoff (cfs) 0.26
Weighted Curve Number 97.10
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : NB-2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NP-1

Input Data

Area (ac) 0.07
Impervious Area (%) 93.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

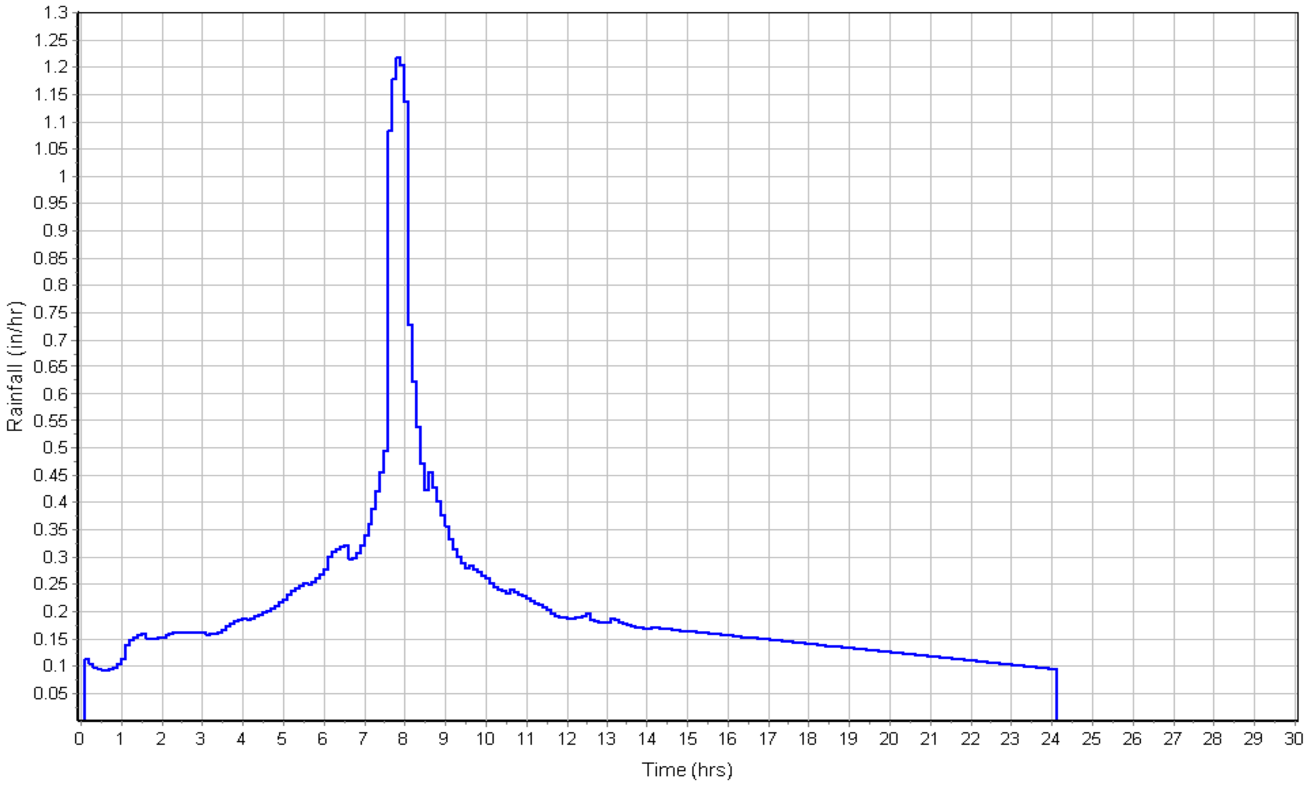
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.07		96.74

Subbasin Runoff Results

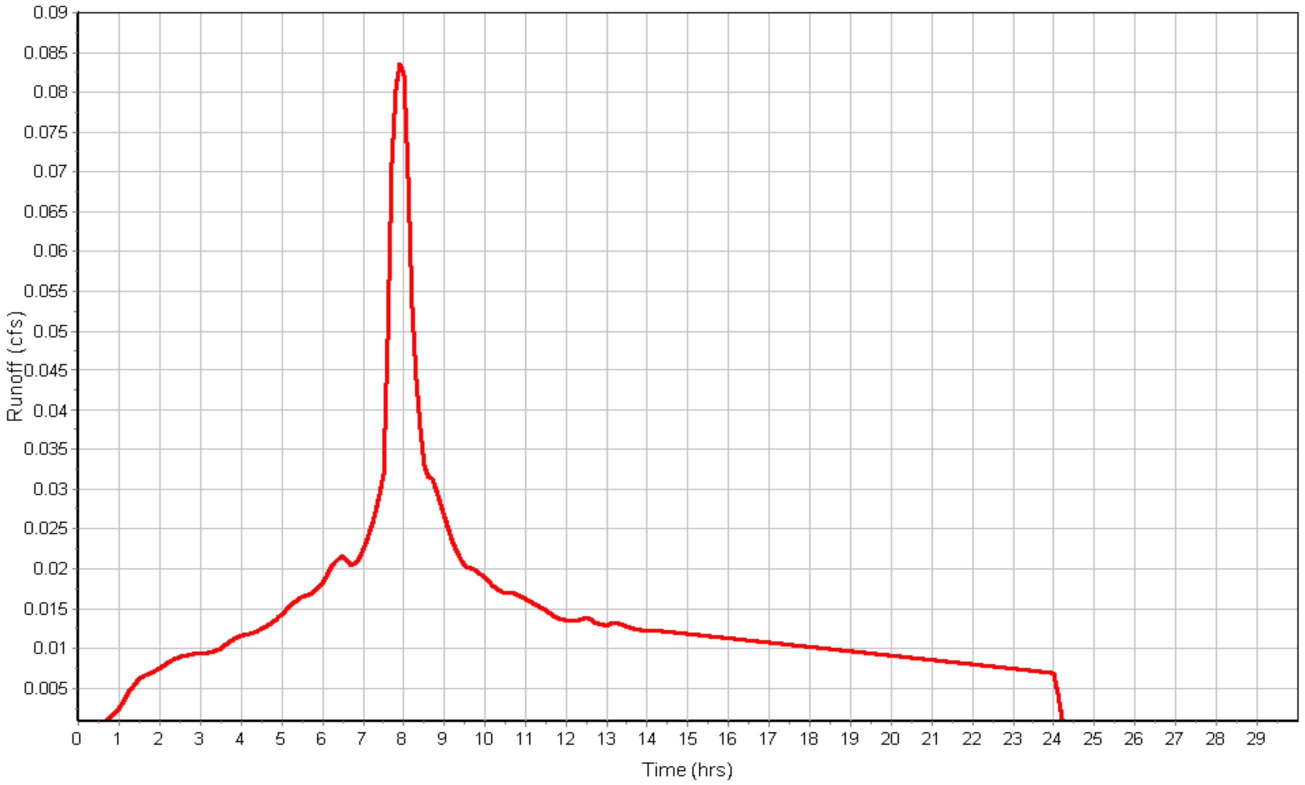
Total Rainfall (in) 5.06
Total Runoff (in) 4.69
Peak Runoff (cfs) 0.08
Weighted Curve Number 96.74
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : NP-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : OFF-1

Input Data

```
Area (ac) .................................................... 0.10
Impervious Area (%) .................................. 82.00
Impervious Area Curve Number ................. 92.00
Pervious Area Curve Number .................... 80.00
Rain Gage ID .............................................. Rain Gage-01
```

Composite Curve Number

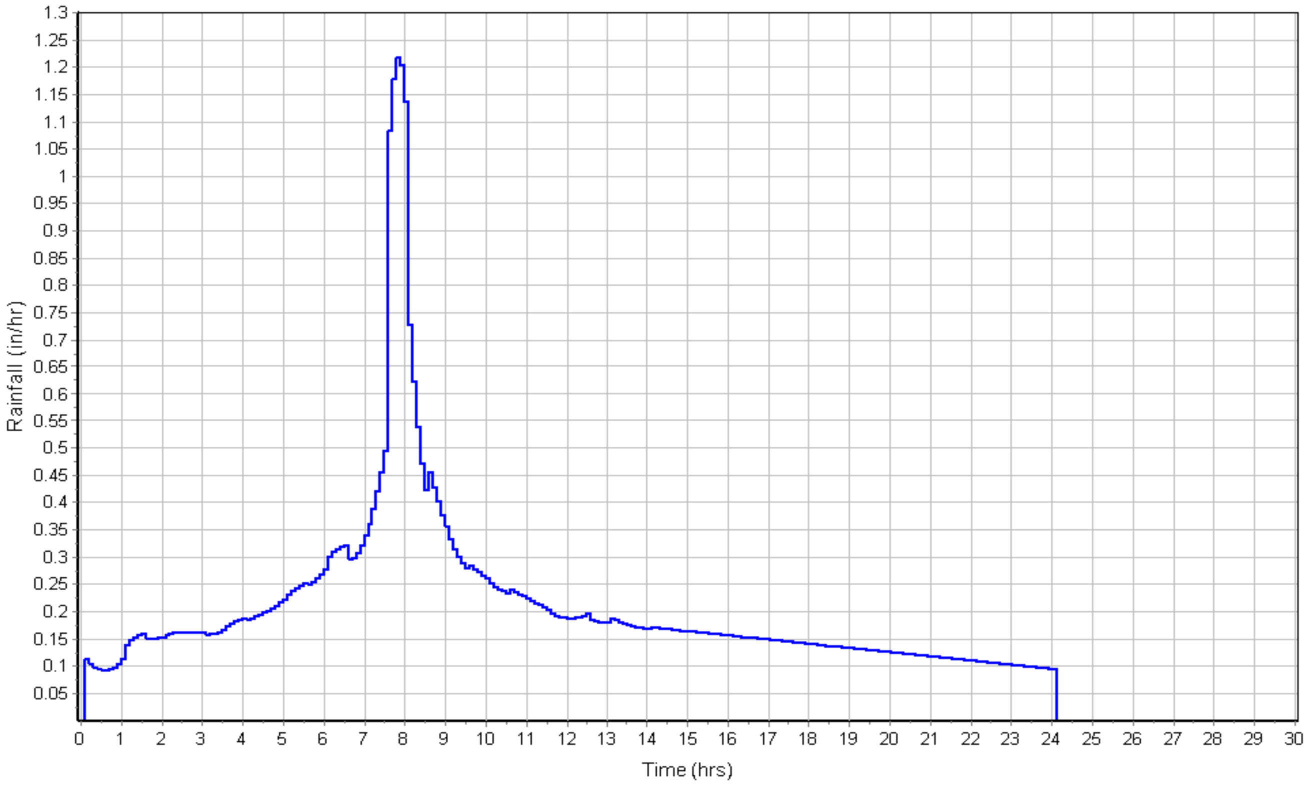
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.10		89.84

Subbasin Runoff Results

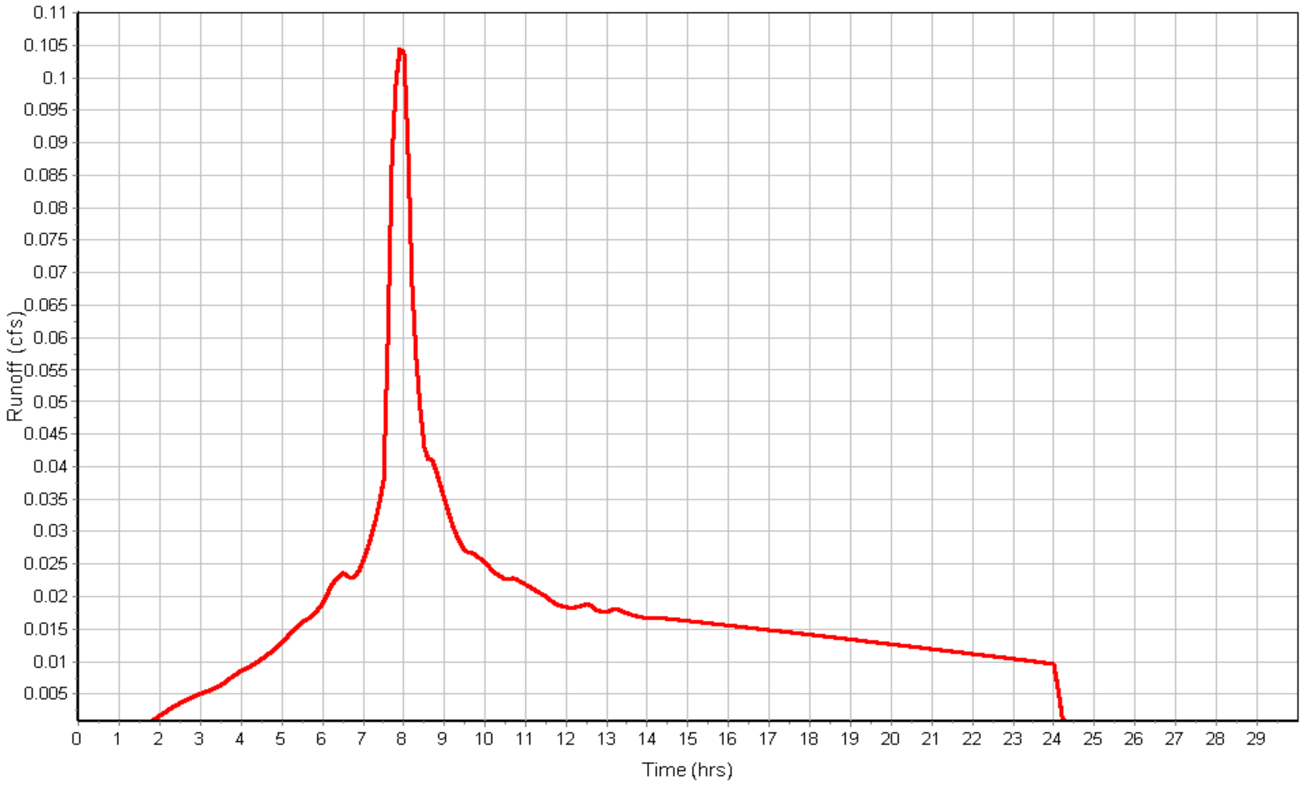
```
Total Rainfall (in) ......................................... 5.06
Total Runoff (in) .......................................... 3.93
Peak Runoff (cfs) ........................................ 0.10
Weighted Curve Number ............................ 89.84
Time of Concentration (days hh:mm:ss) ..... 0 00:05:00
```

Subbasin : OFF-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SB-1

Input Data

```
Area (ac) ..................................................... 0.13
Impervious Area (%) ................................... 72.00
Impervious Area Curve Number .................. 98.00
Pervious Area Curve Number ..................... 80.00
Rain Gage ID ............................................... Rain Gage-01
```

Composite Curve Number

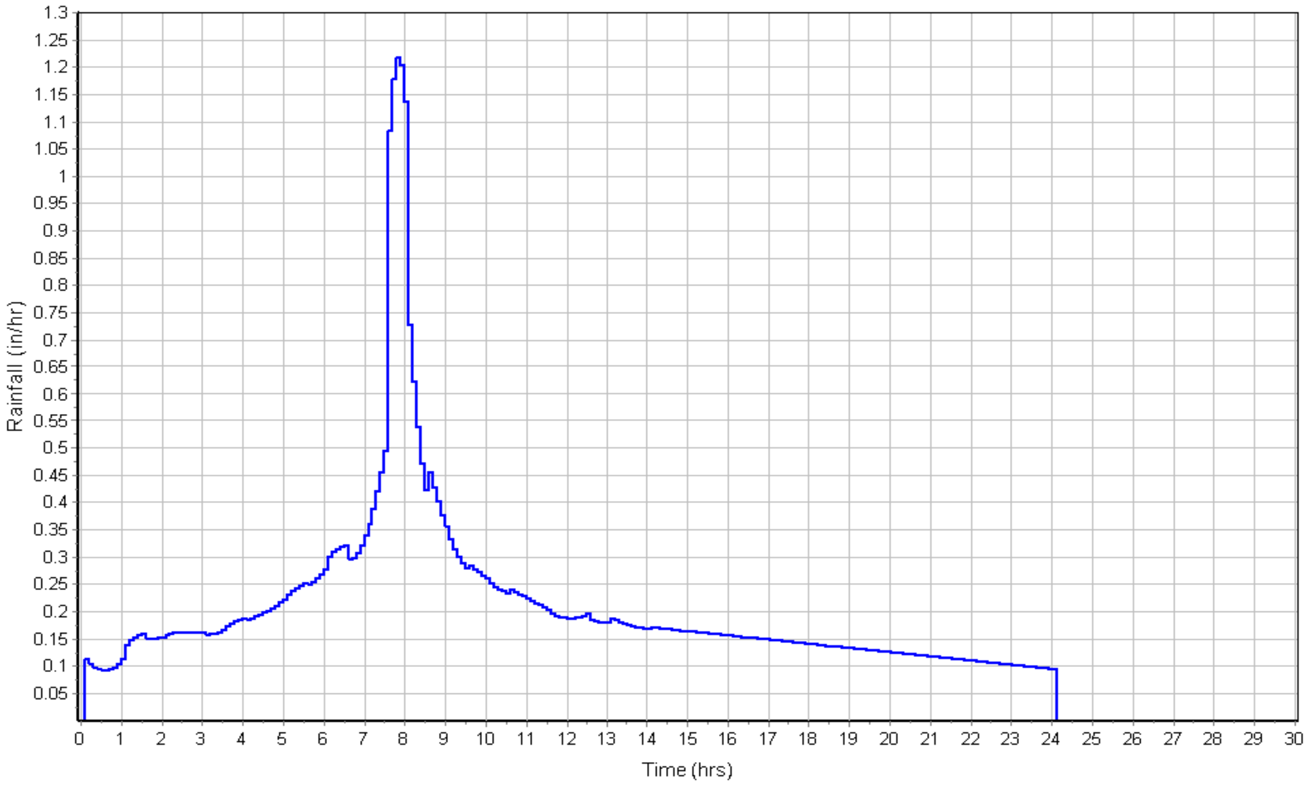
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.13		92.96

Subbasin Runoff Results

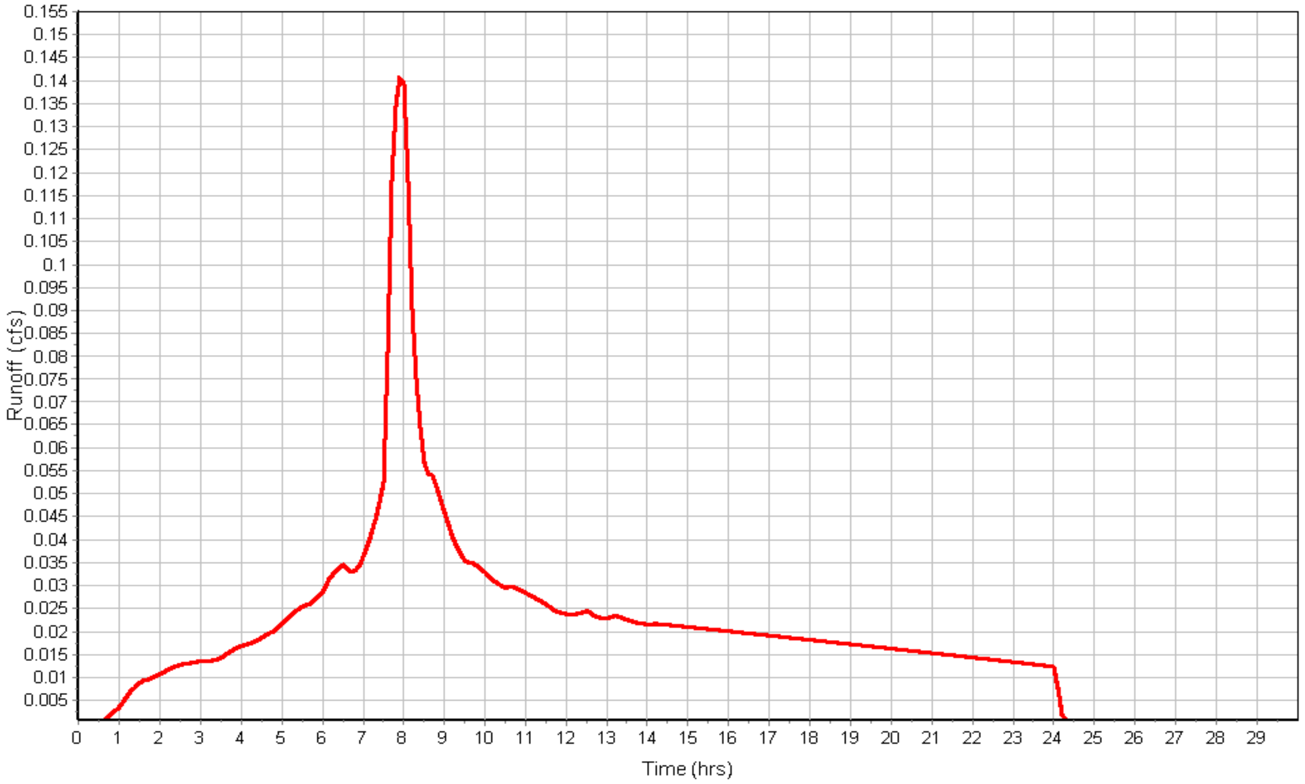
```
Total Rainfall (in) ......................................... 5.06
Total Runoff (in) .......................................... 4.30
Peak Runoff (cfs) ........................................ 0.14
Weighted Curve Number ............................ 92.96
Time of Concentration (days hh:mm:ss) ..... 0 00:05:00
```

Subbasin : SB-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SB-2

Input Data

Area (ac)	0.09
Impervious Area (%)	100.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	80.00
Rain Gage ID	Rain Gage-01

Composite Curve Number

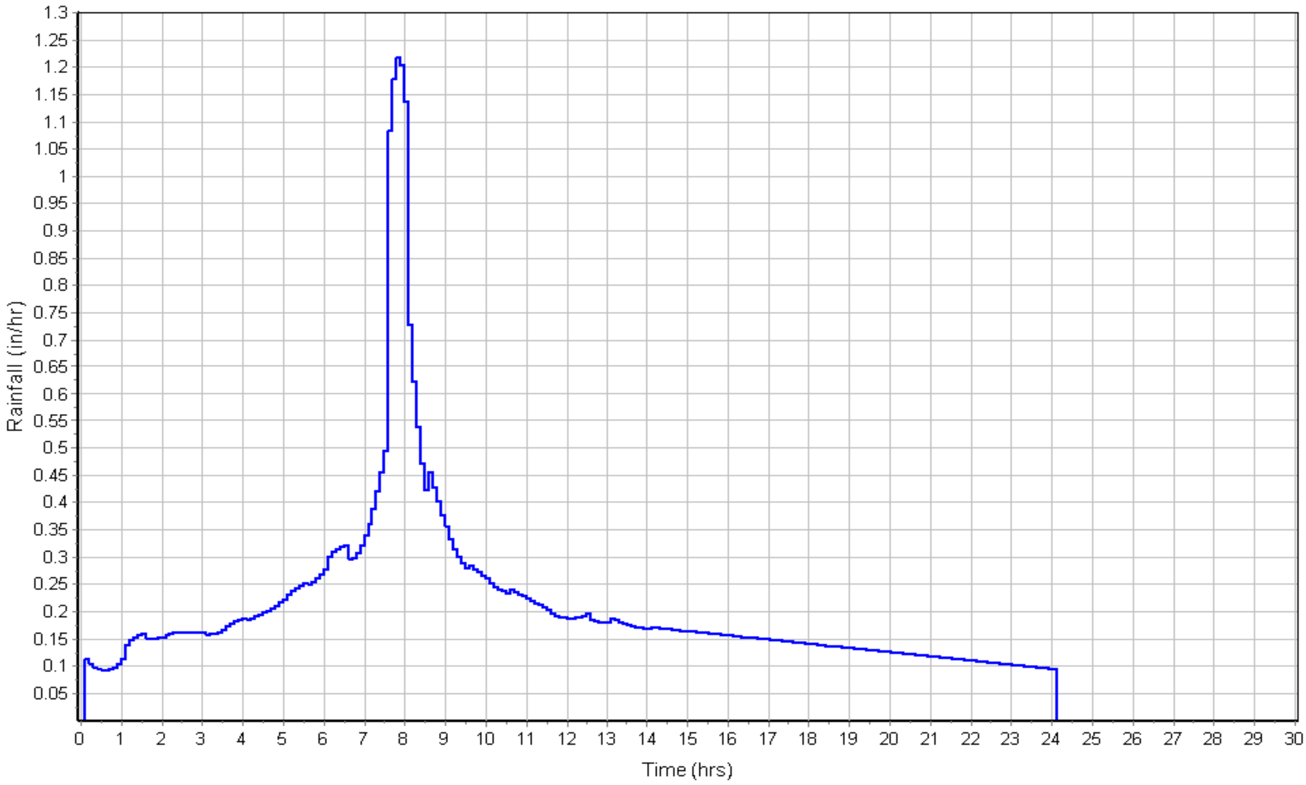
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.09		98

Subbasin Runoff Results

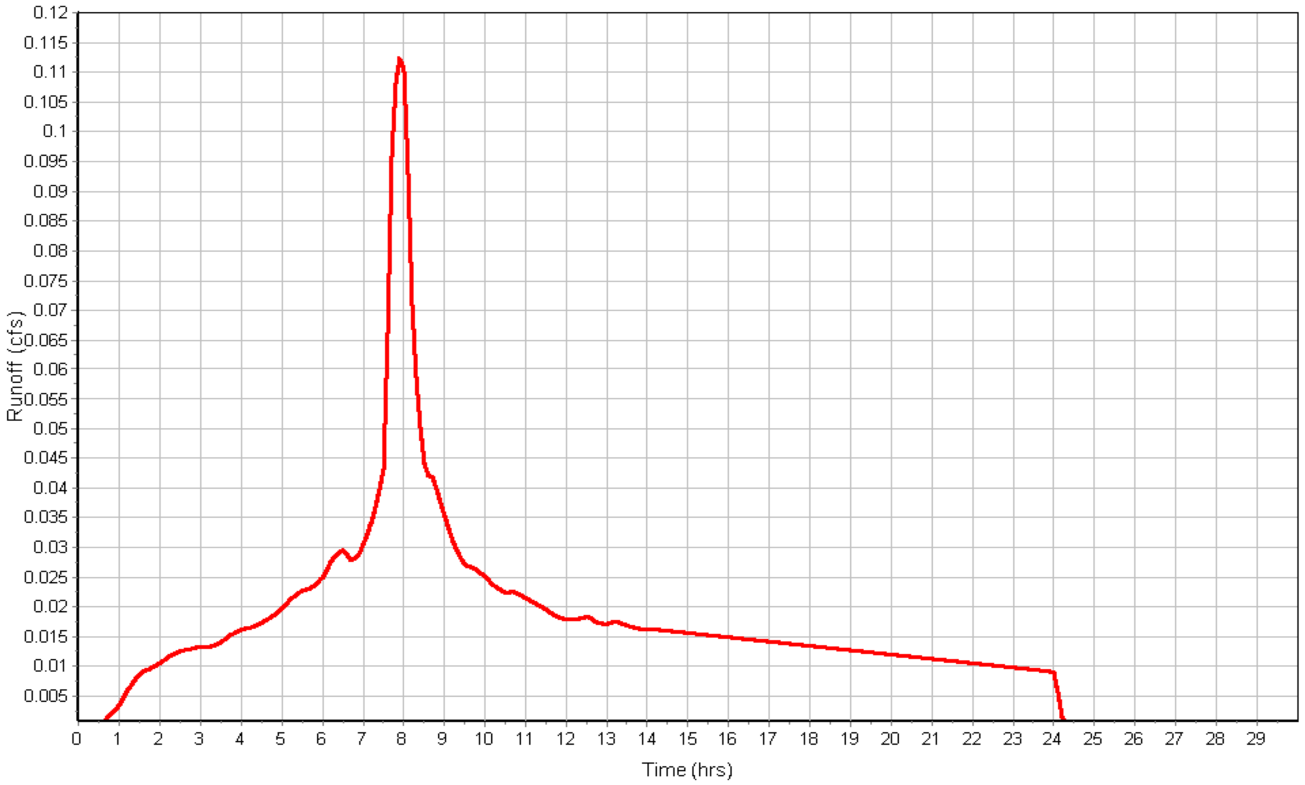
Total Rainfall (in)	5.06
Total Runoff (in)	4.82
Peak Runoff (cfs)	0.11
Weighted Curve Number	98.00
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : SB-2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SP-1

Input Data

Area (ac) 0.76
Impervious Area (%) 79.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

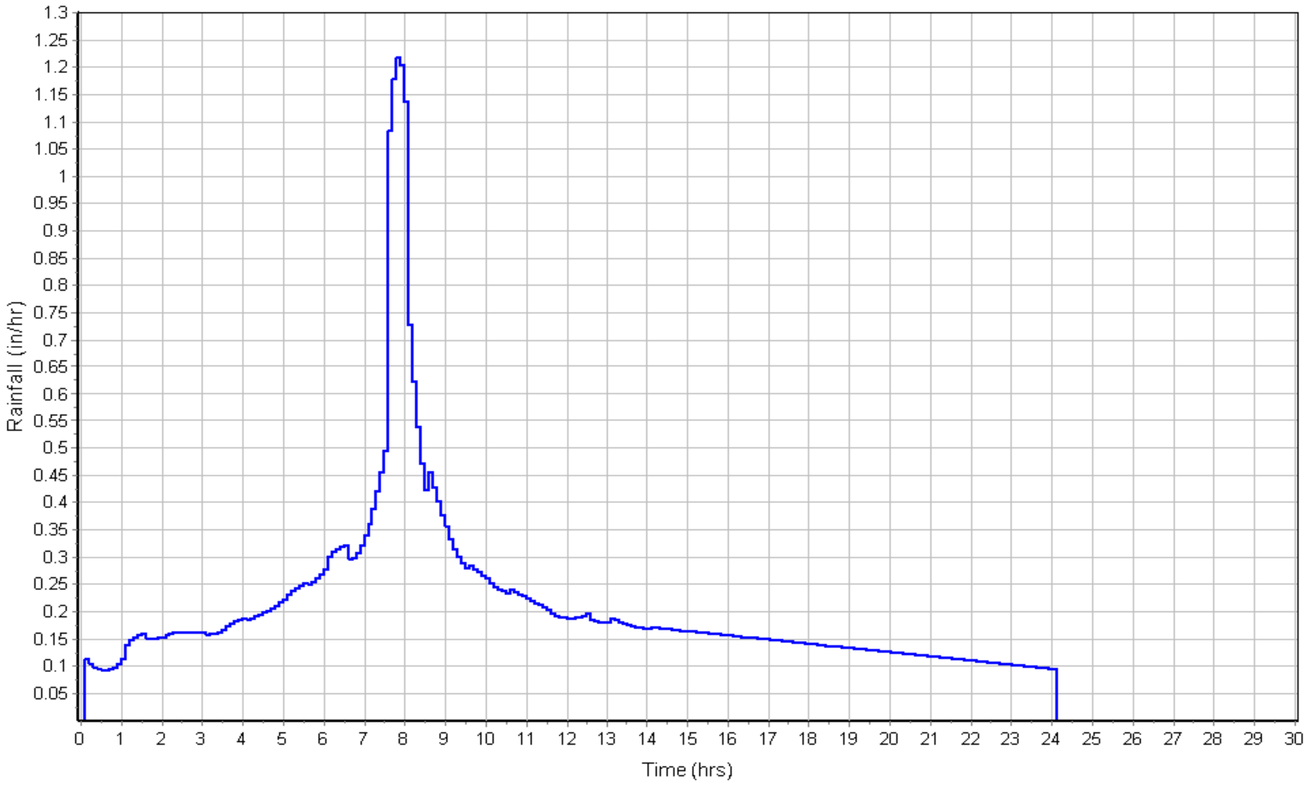
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.76		94.22

Subbasin Runoff Results

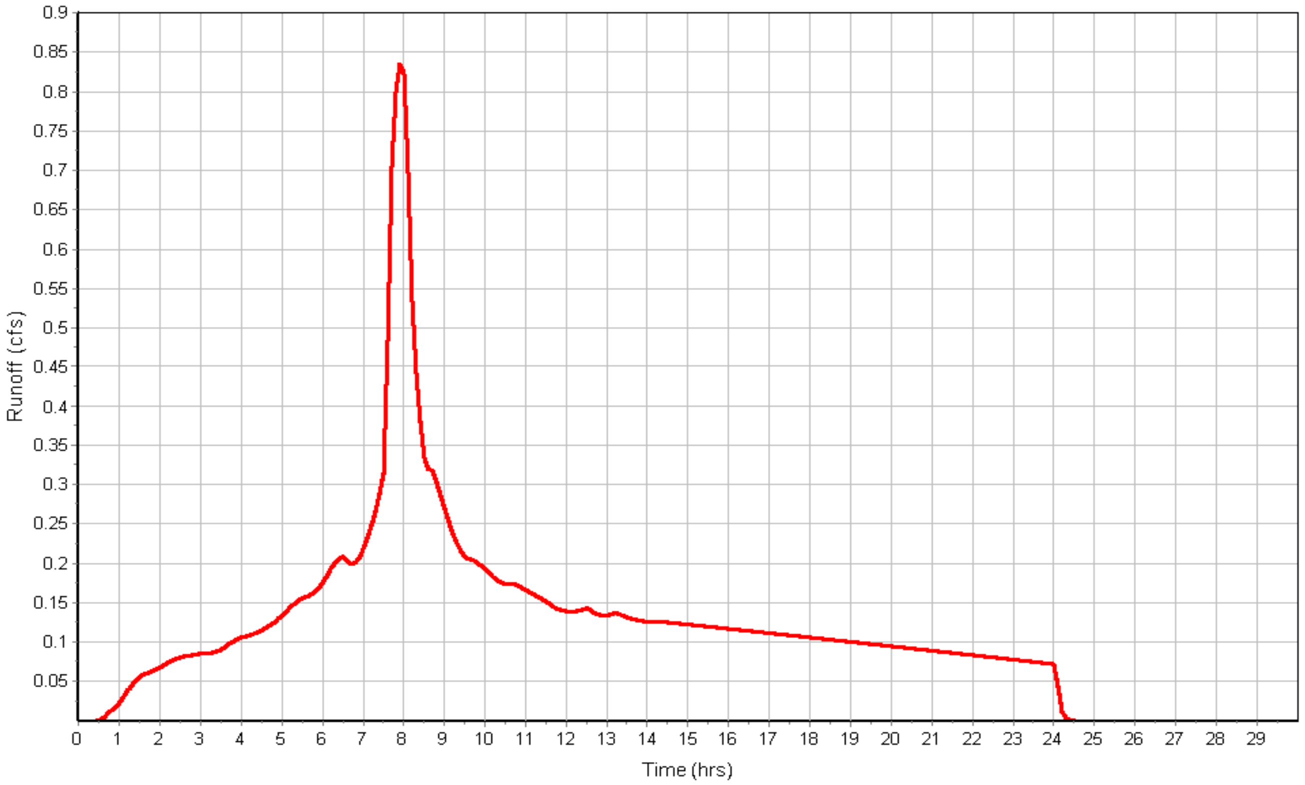
Total Rainfall (in) 5.06
Total Runoff (in) 4.43
Peak Runoff (cfs) 0.83
Weighted Curve Number 94.22
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SP-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SP-2

Input Data

Area (ac) 0.52
Impervious Area (%) 77.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

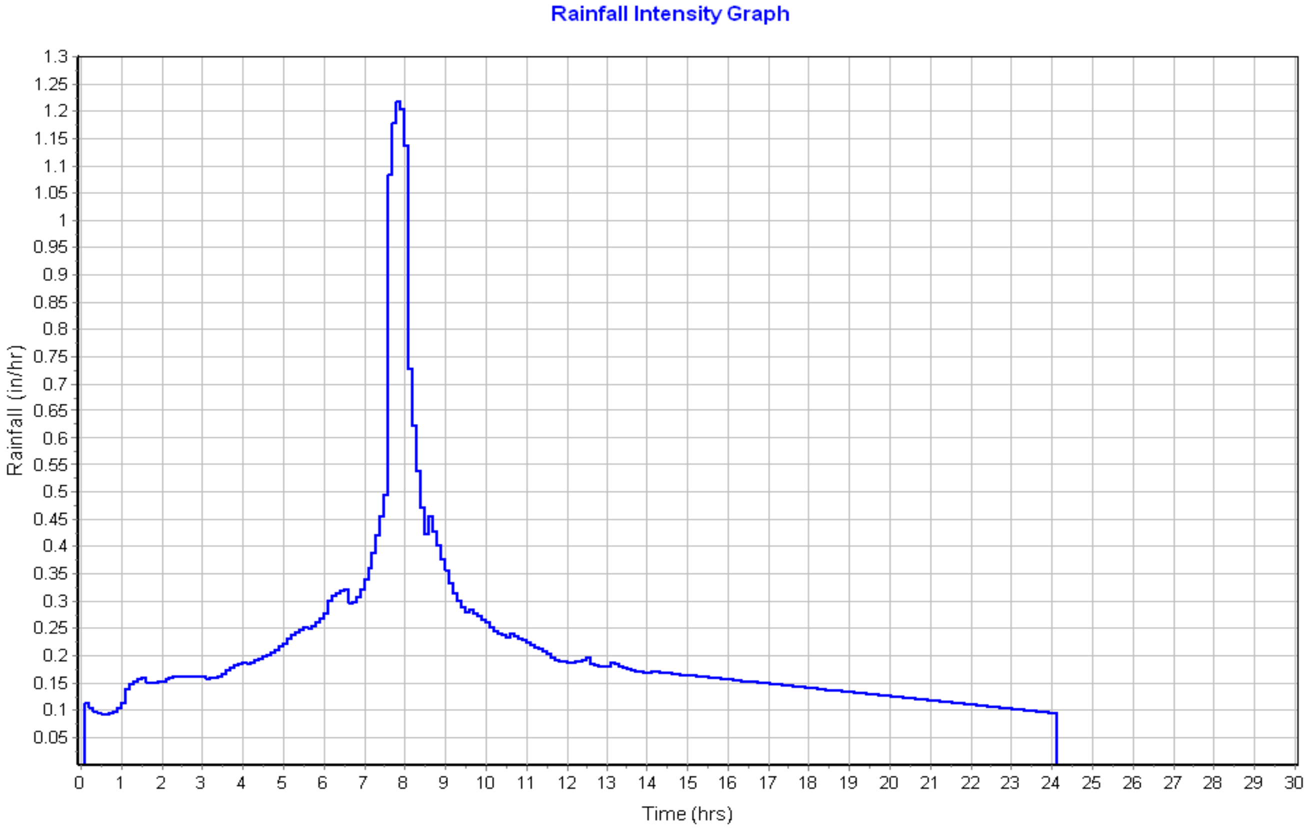
Composite Curve Number

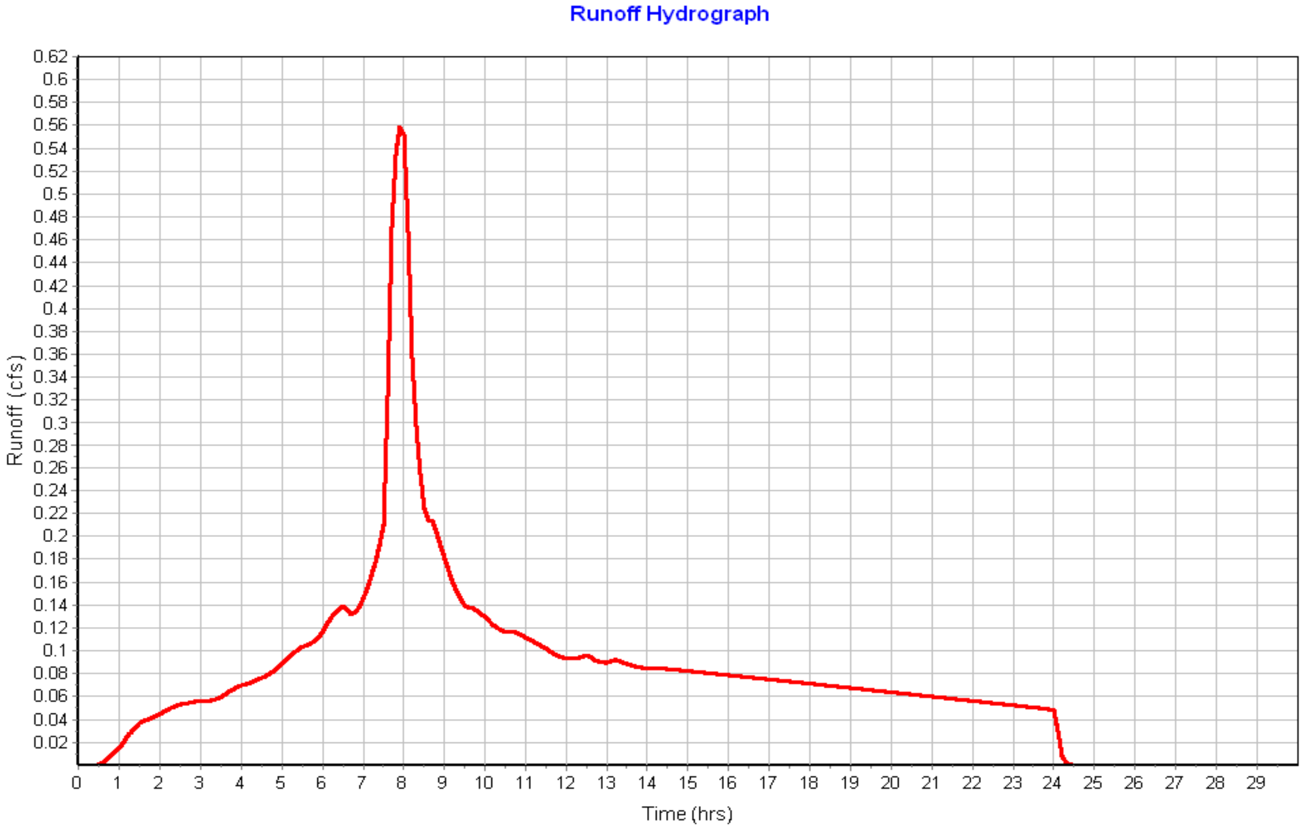
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.52		93.86

Subbasin Runoff Results

Total Rainfall (in) 5.06
Total Runoff (in) 4.39
Peak Runoff (cfs) 0.56
Weighted Curve Number 93.86
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SP-2





Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	ORIFICE	67.30	75.00	7.71	67.30	0.00	74.00	-1.00	10000.00	0.00
2	OUTFALL_1	71.67	75.00	3.33	71.67	0.00	74.00	-1.00	10000.00	0.00
3	SD_CB_1	72.41	73.56	1.15	72.41	0.00	73.48	-0.08	10000.00	0.00
4	SD_CB_2	72.61	76.50	3.89	72.61	0.00	75.50	-1.00	10000.00	0.00
5	SD_CO_15	76.21	78.50	2.29	76.21	0.00	78.00	-0.50	10000.00	0.00
6	SD_CO_6	71.68	75.00	3.32	71.68	0.00	74.00	-1.00	10000.00	0.00
7	SD_CO_9	71.65	75.00	3.35	71.65	0.00	74.00	-1.00	10000.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	ORIFICE	0.83	0.00	69.65	2.35	0.00	5.35	68.84	1.54	0 08:21	0 00:00	0.00	0.00
2	OUTFALL_1	1.49	0.56	72.35	0.68	0.00	2.65	72.05	0.38	0 07:47	0 00:00	0.00	0.00
3	SD_CB_1	0.94	0.94	72.86	0.45	0.00	0.70	72.58	0.17	0 07:55	0 00:00	0.00	0.00
4	SD_CB_2	0.56	0.35	73.00	0.39	0.00	3.50	72.76	0.15	0 07:55	0 00:00	0.00	0.00
5	SD_CO_15	0.21	0.21	76.41	0.20	0.00	2.09	76.29	0.08	0 07:55	0 00:00	0.00	0.00
6	SD_CO_6	0.23	0.11	72.29	0.61	0.00	2.95	72.03	0.35	0 08:20	0 00:00	0.00	0.00
7	SD_CO_9	0.56	0.00	72.30	0.65	0.00	2.70	71.97	0.32	0 08:19	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	LINK-10	50.68	71.67	0.00	71.52	0.10	0.15	0.3000	Trapezoidal	1.000	8.000	0.0800	0.5000	0.5000	0.0000	0.00	No
2	OVERFLOW_01	20.00	72.21	0.79	71.81	4.52	0.40	2.0000	Rectangular	1.000	4.000	0.0100	0.5000	0.5000	0.0000	0.00	No
3	OVERFLOW_02	20.00	74.44	0.50	74.24	2.56	0.20	1.0000	Rectangular	1.000	4.000	0.0100	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	LINK-10	1.51	0 07:55	3.62	0.42	0.89	0.95	0.70	0.70	0.00		
2	OVERFLOW_01	0.83	0 08:21	64.15	0.01	3.05	0.11	0.07	0.07	0.00		
3	OVERFLOW_02	0.12	0 07:56	45.36	0.00	1.21	0.28	0.02	0.02	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	LINK_01	12.00	69.29	2.00	69.05	3.22	0.24	2.0000	CIRCULAR	9.960	9.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1
2	LINK-12	222.93	72.23	-0.18	71.67	0.00	0.56	0.2500	CIRCULAR	9.960	9.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1
3	LINK-20	19.69	71.85	0.17	71.75	0.33	0.10	0.5000	CIRCULAR	6.000	6.000	0.0100	0.5000	0.5000	0.0000	0.00	No	1
4	LINK-30	18.32	71.65	0.00	71.60	0.18	0.05	0.3000	CIRCULAR	8.040	8.040	0.0100	0.5000	0.5000	0.0000	0.00	No	1
5	LINK-31	318.43	72.61	0.00	71.65	0.00	0.95	0.3000	CIRCULAR	8.040	8.040	0.0100	0.5000	0.5000	0.0000	0.00	No	1
6	LINK-32	218.21	74.35	-1.86	72.61	0.00	1.75	0.8000	CIRCULAR	3.960	3.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	LINK_01	0.83	0 08:21	4.03	0.21	4.48	0.04	0.31	0.37	0.00		Calculated
2	LINK-12	0.94	0 07:55	1.64	0.57	2.48	1.50	0.56	0.67	0.00		Calculated
3	LINK-20	0.23	0 07:55	0.51	0.45	2.26	0.15	0.47	0.94	0.00		Calculated
4	LINK-30	0.55	0 07:55	0.86	0.64	2.50	0.12	0.66	0.98	0.00		Calculated
5	LINK-31	0.56	0 07:55	0.86	0.65	2.37	2.24	0.47	0.70	0.00		Calculated
6	LINK-32	0.21	0 07:55	0.32	0.66	2.81	1.29	0.27	0.80	0.00		Calculated

Storage Nodes

Storage Node : INFL_RG_1

Input Data

Invert Elevation (ft) 71.42
Max (Rim) Elevation (ft) 75.00
Max (Rim) Offset (ft) 3.58
Initial Water Elevation (ft) 0.00
Initial Water Depth (ft) .... -71.42
Ponded Area (ft²) 10000.00
Evaporation Loss 0.00

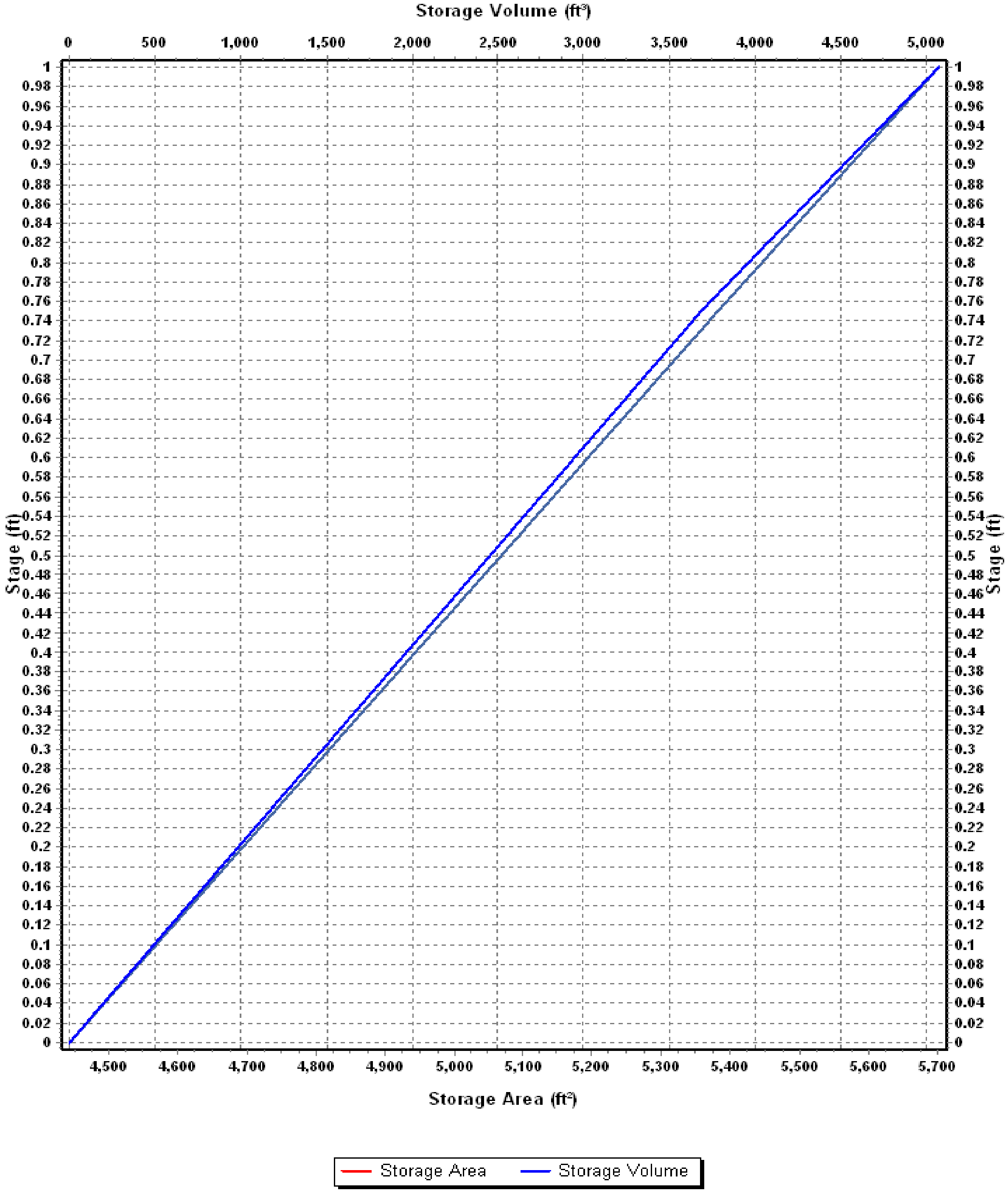
Infiltration/Exfiltration

Constant Flow Rate (cfs) 0.4983

Storage Area Volume Curves

Storage Curve : WETLAND

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0.00	4443.1	0.000
0.75	5381.7	3684.30
1.00	5701.6	5069.71



Storage Area Volume Curves

Storage Node : INFL_RG_1 (continued)

Output Summary Results

Peak Inflow (cfs)	2.48
Peak Lateral Inflow (cfs)	0.21
Peak Outflow (cfs)	0.83
Peak Exfiltration Flow Rate (cfm)	29.90
Max HGL Elevation Attained (ft)	72.28
Max HGL Depth Attained (ft)	0.86
Average HGL Elevation Attained (ft)	71.80
Average HGL Depth Attained (ft)	0.38
Time of Max HGL Occurrence (days hh:mm)	0 08:21
Total Exfiltration Volume (1000-ft³)	33.866
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : INFL_RG_2

Input Data

```
Invert Elevation (ft) ................................................ 73.94
Max (Rim) Elevation (ft) ........................................ 76.00
Max (Rim) Offset (ft) ............................................. 2.06
Initial Water Elevation (ft) ..................................... 0.00
Initial Water Depth (ft) ........................................... -73.94
Ponded Area (ft²) .................................................. 0.00
Evaporation Loss .................................................. 0.00
```

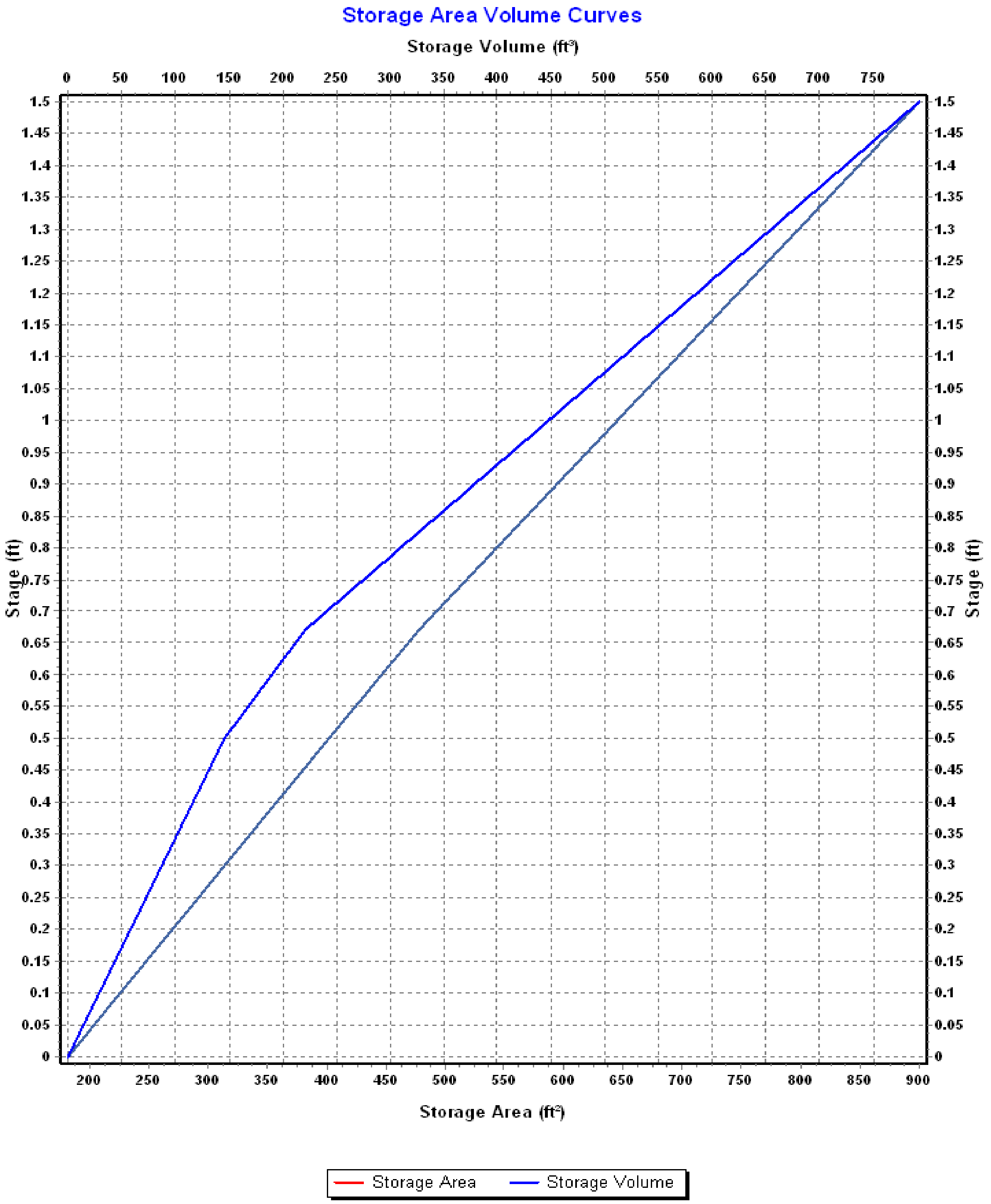
Infiltration/Exfiltration

```
Constant Flow Rate (cfs) ...................................... 0.0200
```

Storage Area Volume Curves

Storage Curve : SB-2_RG

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	182	0.000
0.50	402	146.00
0.67	478	220.80
1.50	900	792.67


Storage Area Volume Curves
Storage Volume (ft³)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Stage (ft)
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : INFL_RG_2 (continued)

Output Summary Results

Peak Inflow (cfs)	0.14
Peak Lateral Inflow (cfs)	0.14
Peak Outflow (cfs)	0.12
Peak Exfiltration Flow Rate (cfm)	1.20
Max HGL Elevation Attained (ft)	74.47
Max HGL Depth Attained (ft)	0.53
Average HGL Elevation Attained (ft)	74.29
Average HGL Depth Attained (ft)	0.35
Time of Max HGL Occurrence (days hh:mm)	0 07:56
Total Exfiltration Volume (1000-ft^3)	1.611
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Project Description

File Name	calc jah 210817 Model.SPF
Description	J:\9700-003-13\Civil\CX5_PIPES\BHE STRM (2013).dwg

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Santa Barbara UH
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Feb 25, 2013	00:00:00
End Analysis On	Feb 26, 2013	06:00:00
Start Reporting On	Feb 25, 2013	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	10
Nodes..	10
Junctions	7
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	2
Links..	9
Channels	3
Pipes	6
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	100-Year	Cumulative	inches	Oregon	Lincoln	100	5.95	SCS Type IA 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Impervious Area (%)	Impervious Area Curve Number	Pervious Area Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	E-1	0.45	9.00	98.00	77.00	5.95	3.64	1.62	0.27	0 00:32:00
2	EX_SITE	2.56	3.00	91.00	77.00	5.95	3.48	8.91	1.12	0 01:01:00
3	NB-1	0.21	65.00	98.00	80.00	5.95	5.02	1.03	0.25	0 00:05:00
4	NB-2	0.23	95.00	98.00	80.00	5.95	5.61	1.27	0.31	0 00:05:00
5	NP-1	0.07	93.00	98.00	80.00	5.95	5.57	0.40	0.10	0 00:05:00
6	OFF-1	0.10	82.00	92.00	80.00	5.95	4.79	0.50	0.13	0 00:05:00
7	SB-1	0.13	72.00	98.00	80.00	5.95	5.16	0.69	0.17	0 00:05:00
8	SB-2	0.09	100.00	98.00	80.00	5.95	5.71	0.54	0.13	0 00:05:00
9	SP-1	0.76	79.00	98.00	80.00	5.95	5.30	4.05	1.00	0 00:05:00
10	SP-2	0.52	77.00	98.00	80.00	5.95	5.26	2.71	0.67	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	ORIFICE	Junction	67.30	75.00	67.30	74.00	10000.00	1.97	69.93	0.00	5.07	0 00:00	0.00	0.00
2	OUTFALL_1	Junction	71.67	75.00	71.67	74.00	10000.00	1.79	72.43	0.00	2.57	0 00:00	0.00	0.00
3	SD_CB_1	Junction	72.41	73.56	72.41	73.48	10000.00	1.12	72.92	0.00	0.64	0 00:00	0.00	0.00
4	SD_CB_2	Junction	72.61	76.50	72.61	75.50	10000.00	0.66	73.05	0.00	3.45	0 00:00	0.00	0.00
5	SD_CO_15	Junction	76.21	78.50	76.21	78.00	10000.00	0.25	76.44	0.00	2.06	0 00:00	0.00	0.00
6	SD_CO_6	Junction	71.68	75.00	71.68	74.00	10000.00	0.28	72.39	0.00	2.85	0 00:00	0.00	0.00
7	SD_CO_9	Junction	71.65	75.00	71.65	74.00	10000.00	0.66	72.41	0.00	2.59	0 00:00	0.00	0.00
8	NEW_OUT	Outfall	65.83					3.06	65.83					
9	INFL_RG_1	Storage Node	71.42	75.00	0.00		10000.00	2.94	72.35				0.00	0.00
10	INFL_RG_2	Storage Node	73.94	76.00	0.00		0.00	0.17	74.47				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Reported Condition
1	LINK_01	Pipe	ORIFICE	NEW_OUT	12.00	69.29	69.05	2.0000	10.000	0.0100	1.97	4.03	0.49	5.40	0.53	0.63	0.00	Calculated
2	LINK-12	Pipe	SD_CB_1	OUTFALL_1	222.93	72.23	71.67	0.2500	10.000	0.0100	1.12	1.64	0.69	2.66	0.63	0.75	0.00	Calculated
3	LINK-20	Pipe	SD_CO_6	INFL_RG_1	19.69	71.85	71.75	0.5000	6.000	0.0100	0.28	0.51	0.53	2.32	0.50	1.00	17.00	SURCHARGED
4	LINK-30	Pipe	SD_CO_9	INFL_RG_1	18.32	71.65	71.60	0.3000	8.000	0.0100	0.66	0.86	0.76	2.52	0.67	1.00	29.00	SURCHARGED
5	LINK-31	Pipe	SD_CB_2	SD_CO_9	318.43	72.61	71.65	0.3000	8.000	0.0100	0.66	0.86	0.77	2.43	0.55	0.83	0.00	Calculated
6	LINK-32	Pipe	SD_CO_15	SD_CB_2	218.21	74.35	72.61	0.8000	4.000	0.0100	0.25	0.32	0.80	3.25	0.28	0.84	0.00	Calculated
7	LINK-10	Channel	OUTFALL_1	INFL_RG_1	50.68	71.67	71.52	0.3000	12.000	0.0800	1.76	3.62	0.49	0.81	0.79	0.79	0.00	
8	OVERFLOW_01	Channel	INFL_RG_1	ORIFICE	20.00	72.21	71.81	2.0000	12.000	0.0100	1.97	64.15	0.03	4.02	0.12	0.12	0.00	
9	OVERFLOW_02	Channel	INFL_RG_2	SD_CO_6	20.00	74.44	74.24	1.0000	12.000	0.0100	0.15	45.36	0.00	1.31	0.03	0.03	0.00	

Subbasin Hydrology

Subbasin : E-1

Input Data

Area (ac)	0.45
Impervious Area (%)	9.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	77.00
Rain Gage ID	Rain Gage-01

Composite Curve Number

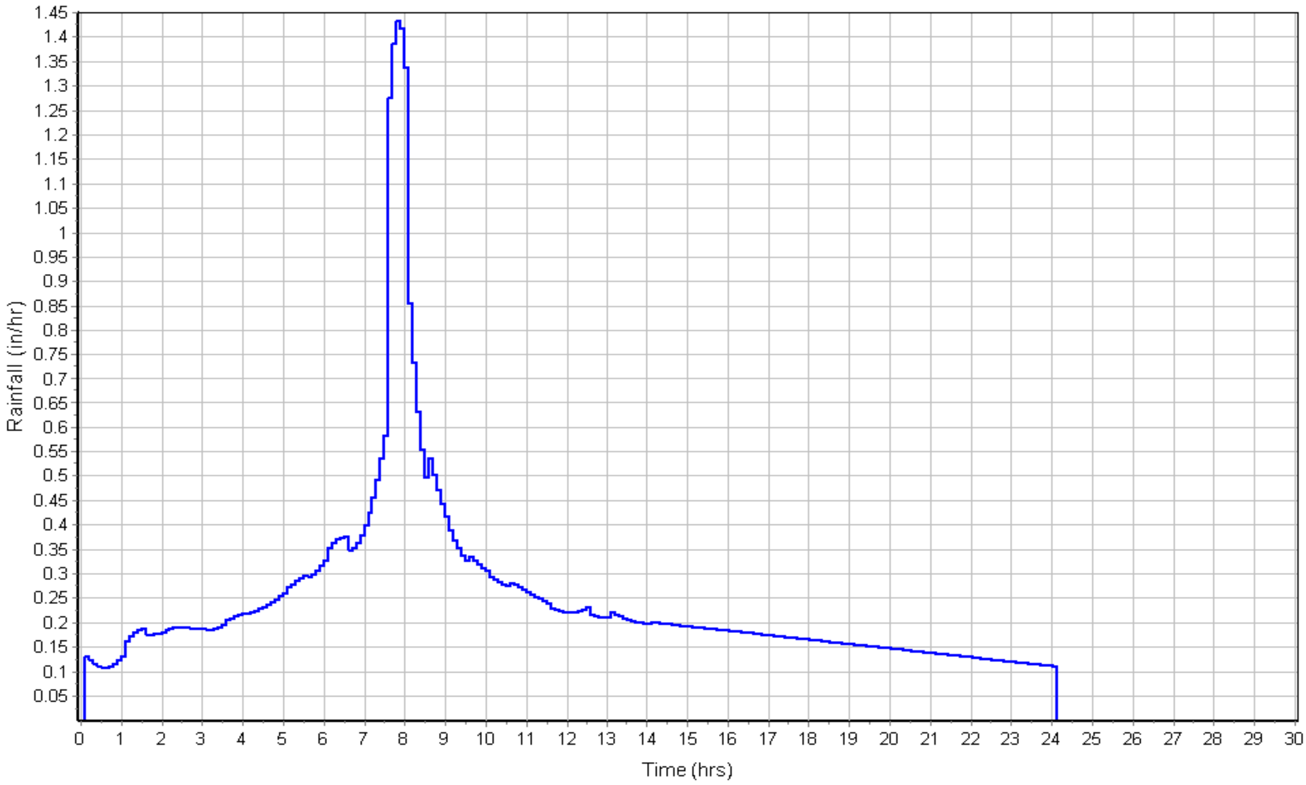
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.45		78.89

Subbasin Runoff Results

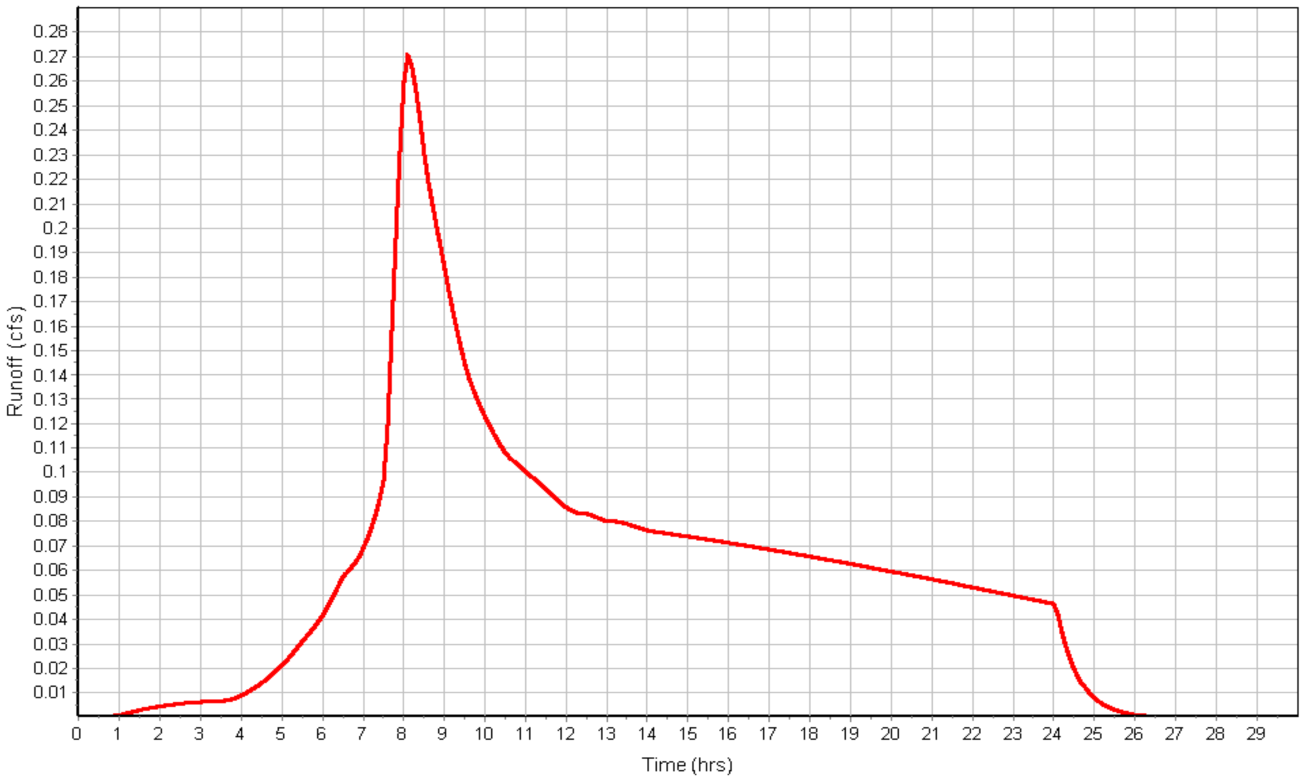
Total Rainfall (in)	5.95
Total Runoff (in)	3.64
Peak Runoff (cfs)	0.27
Weighted Curve Number	78.89
Time of Concentration (days hh:mm:ss)	0 00:32:00

Subbasin : E-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : EX_SITE

Input Data

Area (ac) 2.56
Impervious Area (%) 3.00
Impervious Area Curve Number 91.00
Pervious Area Curve Number 77.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

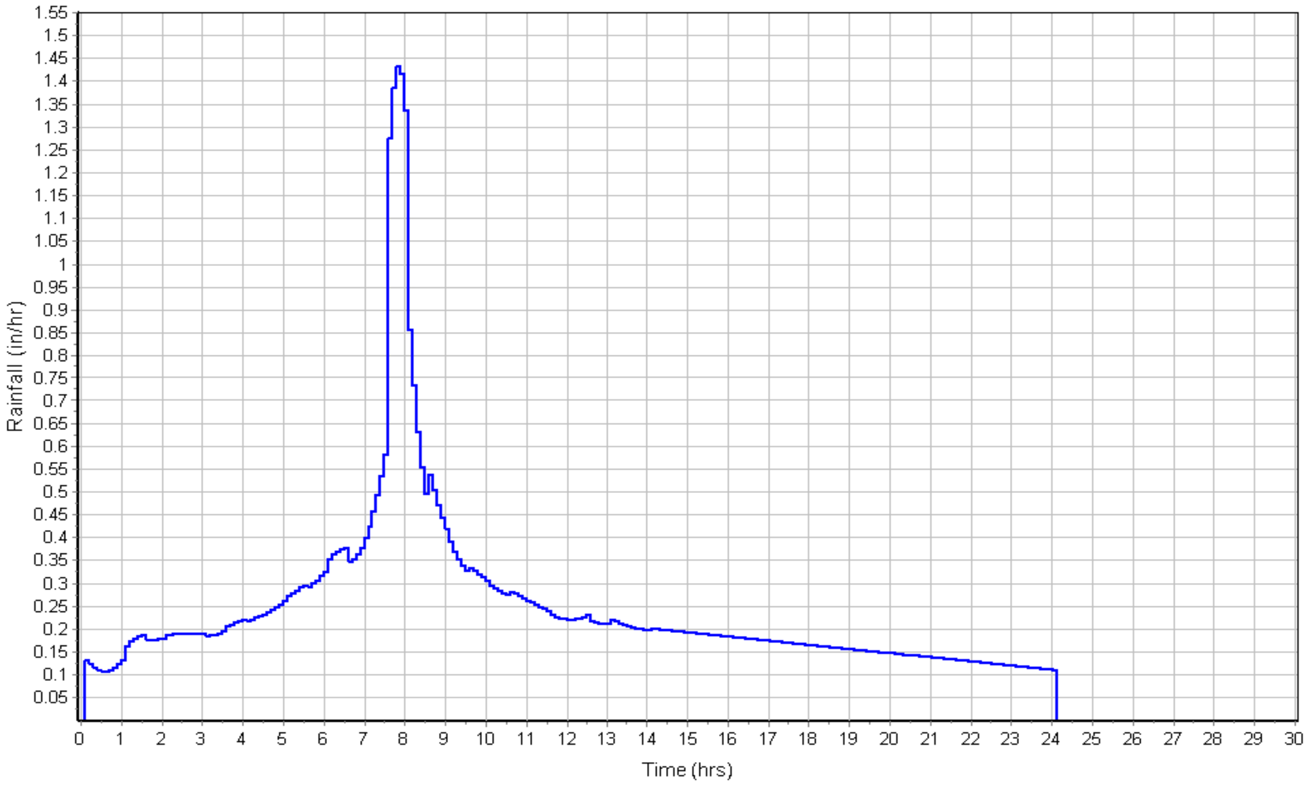
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	2.56		77.42

Subbasin Runoff Results

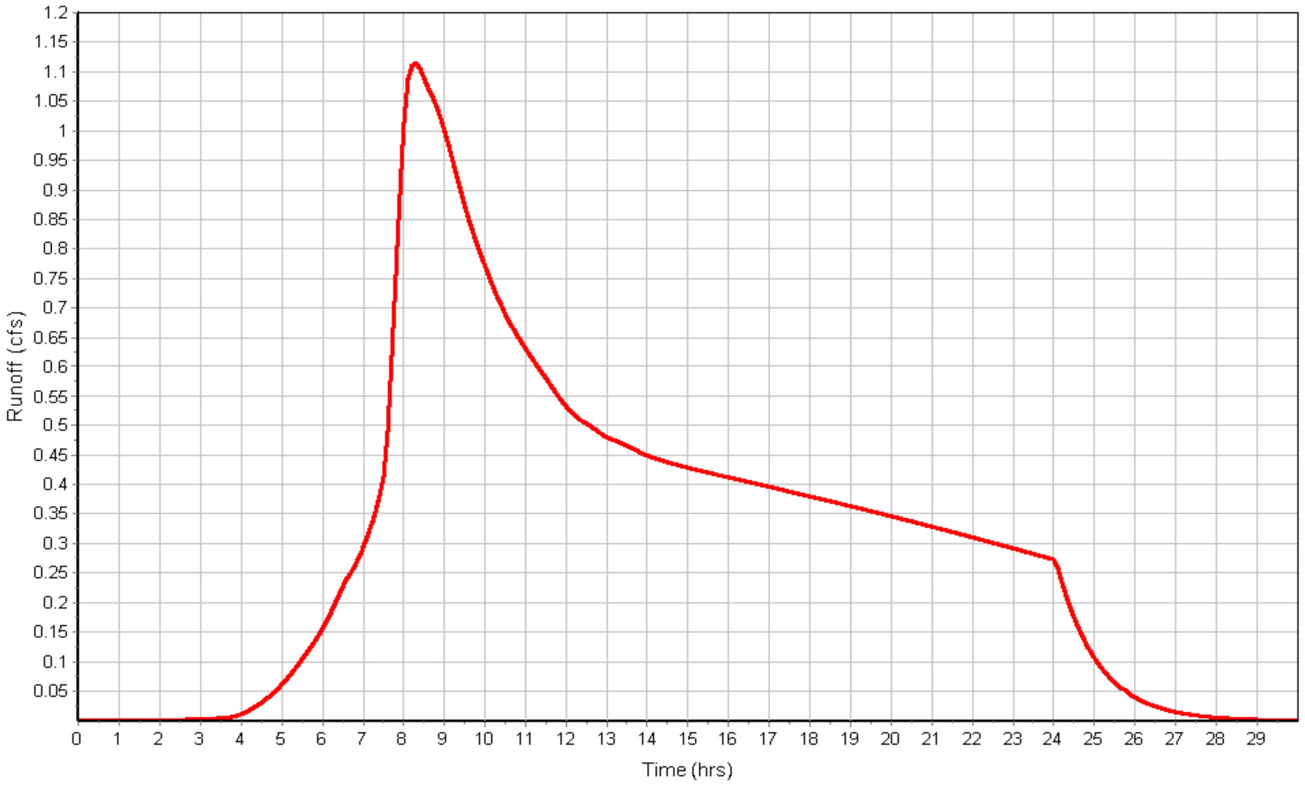
Total Rainfall (in) 5.95
Total Runoff (in) 3.48
Peak Runoff (cfs) 1.12
Weighted Curve Number 77.42
Time of Concentration (days hh:mm:ss) 0 01:01:00

Subbasin : EX_SITE

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NB-1

Input Data

Area (ac)	0.21
Impervious Area (%)	65.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	80.00
Rain Gage ID	Rain Gage-01

Composite Curve Number

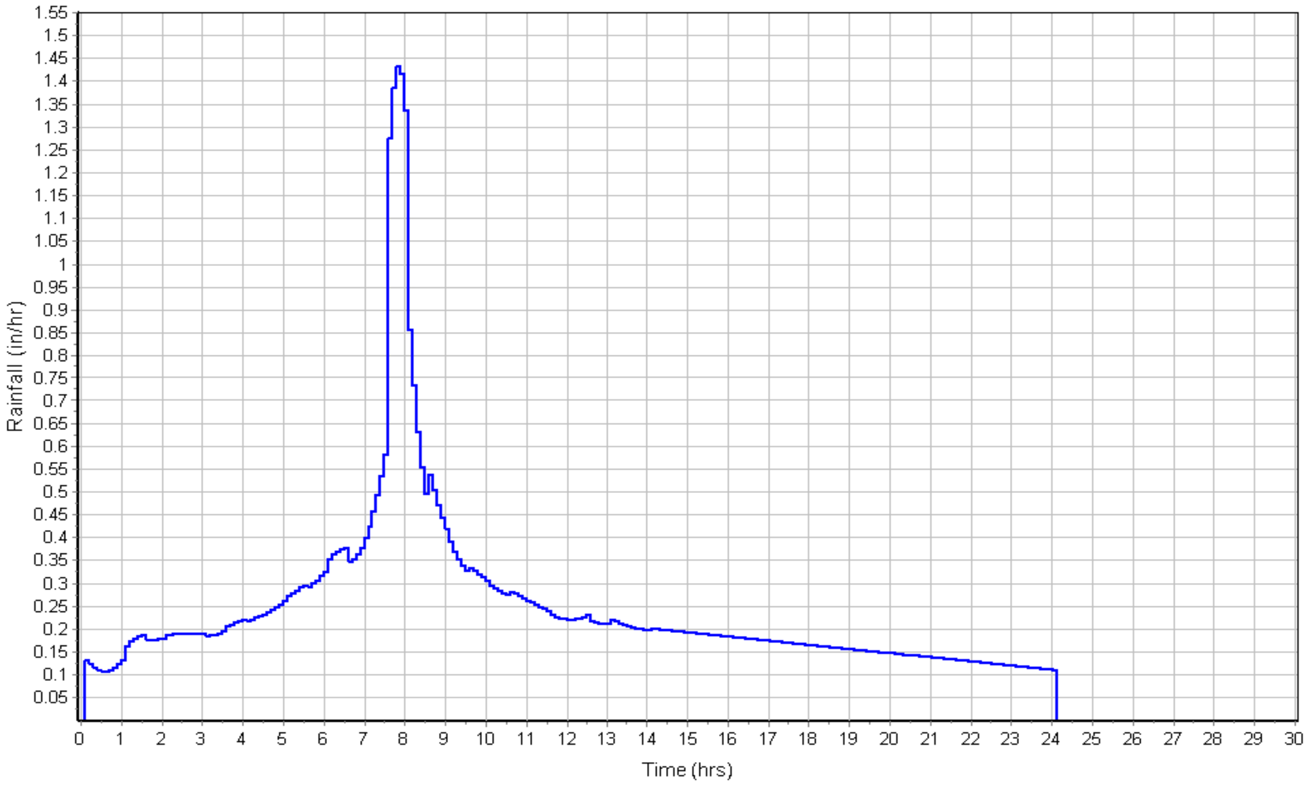
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.21		91.7

Subbasin Runoff Results

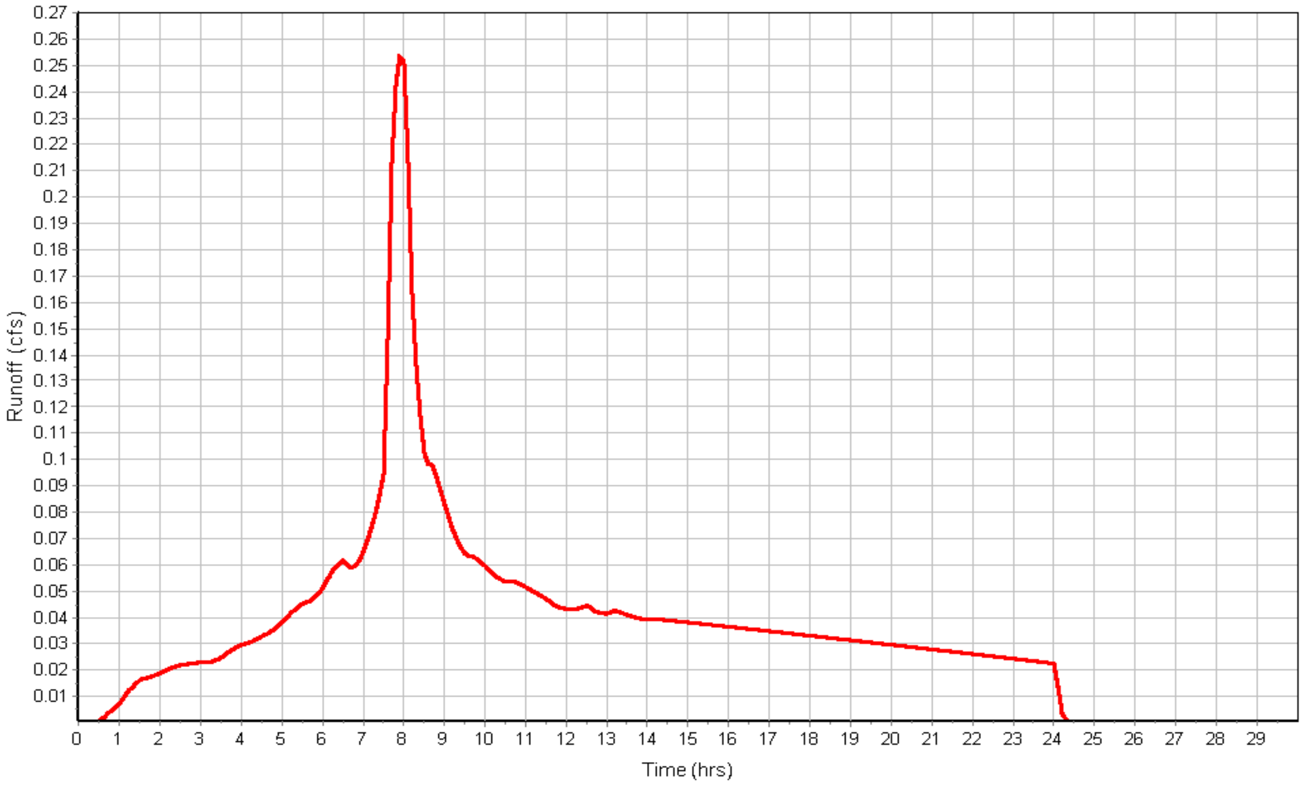
Total Rainfall (in)	5.95
Total Runoff (in)	5.02
Peak Runoff (cfs)	0.25
Weighted Curve Number	91.70
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : NB-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NB-2

Input Data

Area (ac) 0.23
Impervious Area (%) 95.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

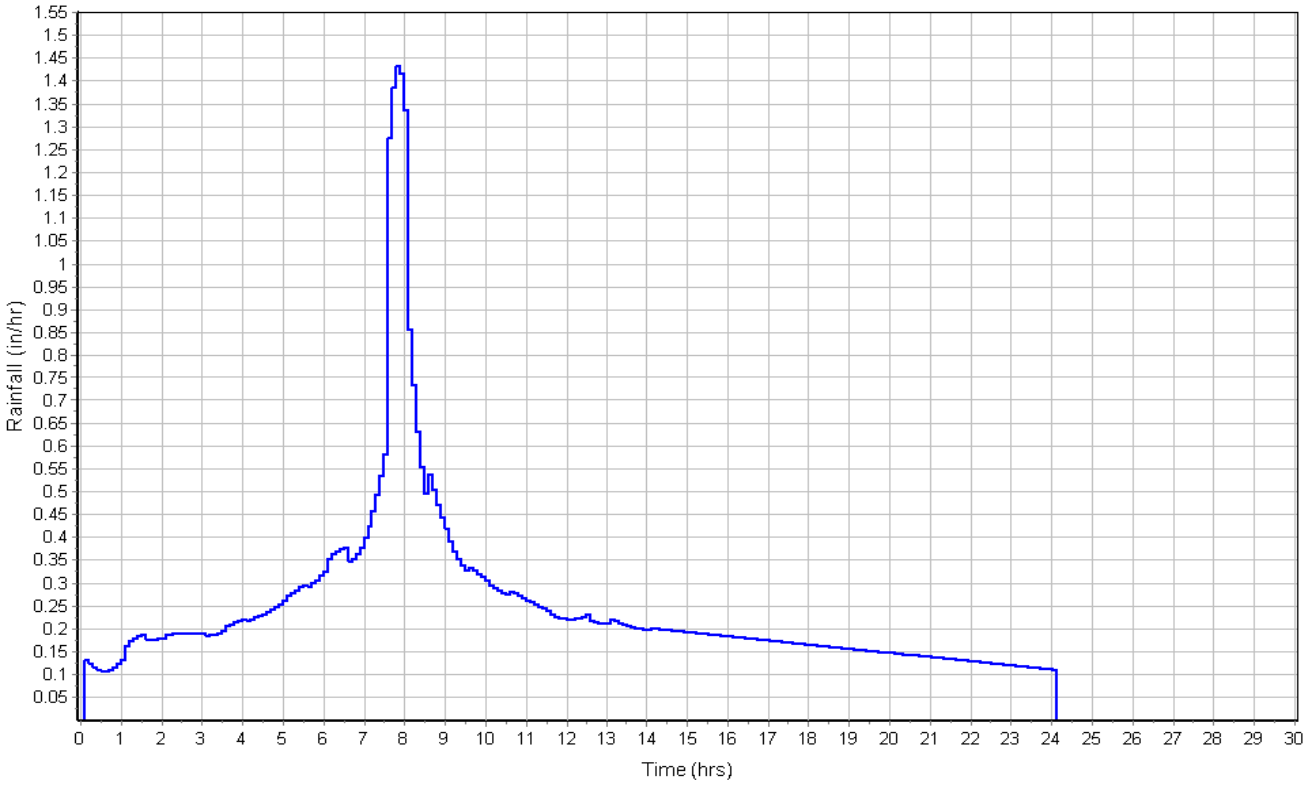
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.23		97.1

Subbasin Runoff Results

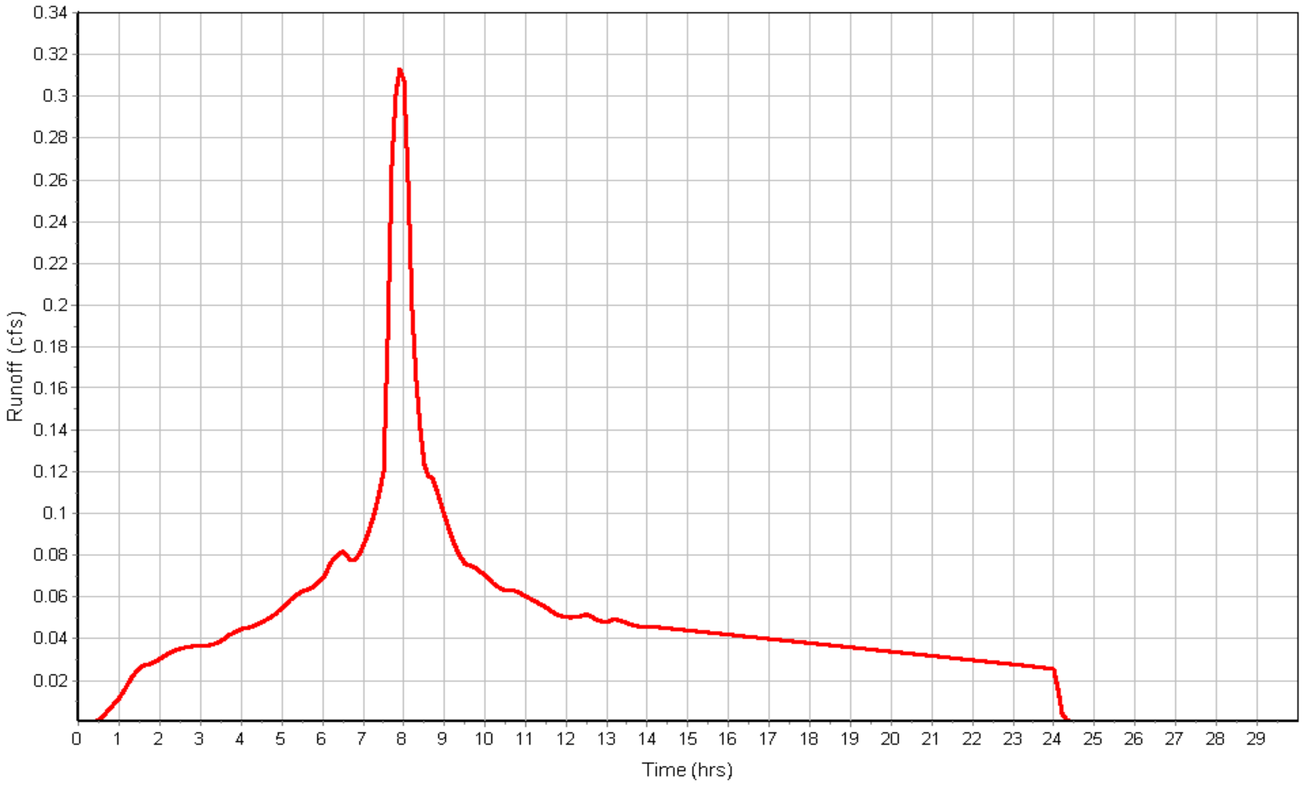
Total Rainfall (in) 5.95
Total Runoff (in) 5.61
Peak Runoff (cfs) 0.31
Weighted Curve Number 97.10
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : NB-2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NP-1

Input Data

Area (ac) 0.07
Impervious Area (%) 93.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

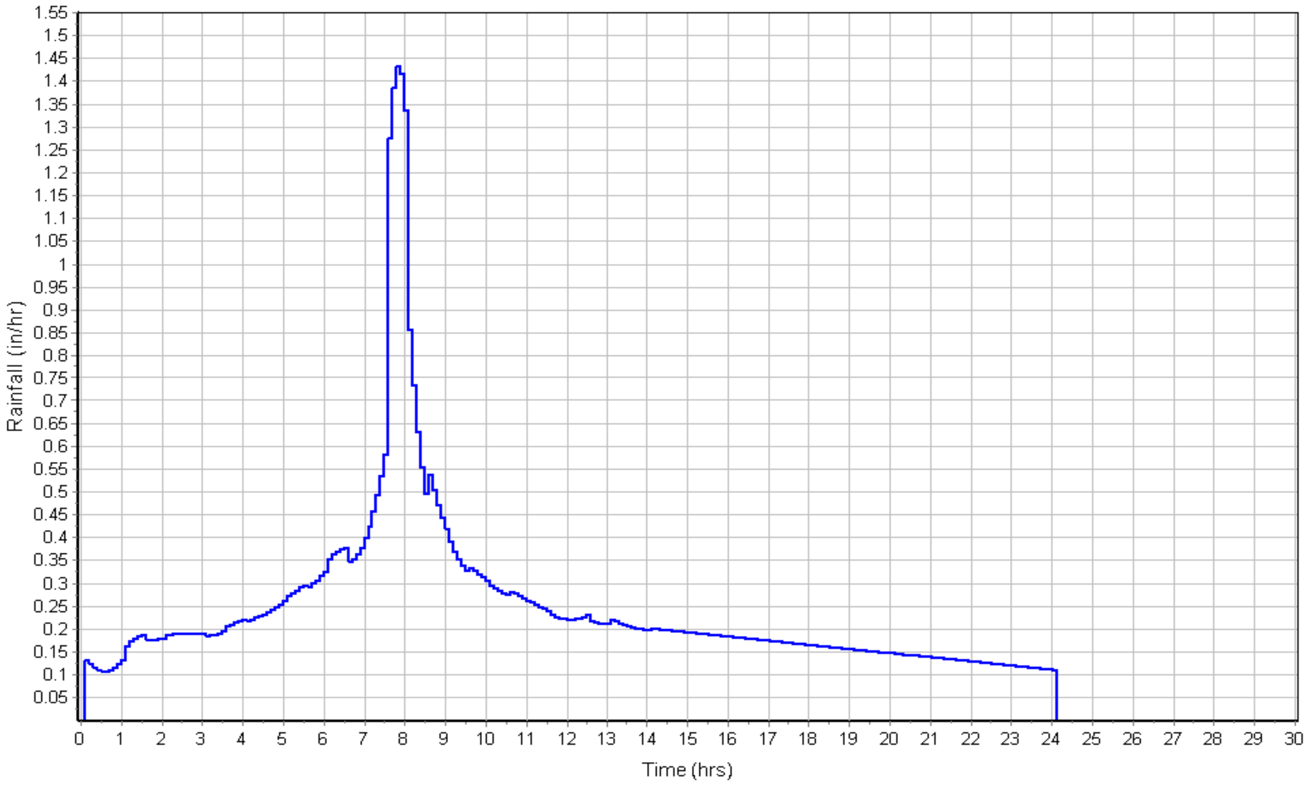
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.07		96.74

Subbasin Runoff Results

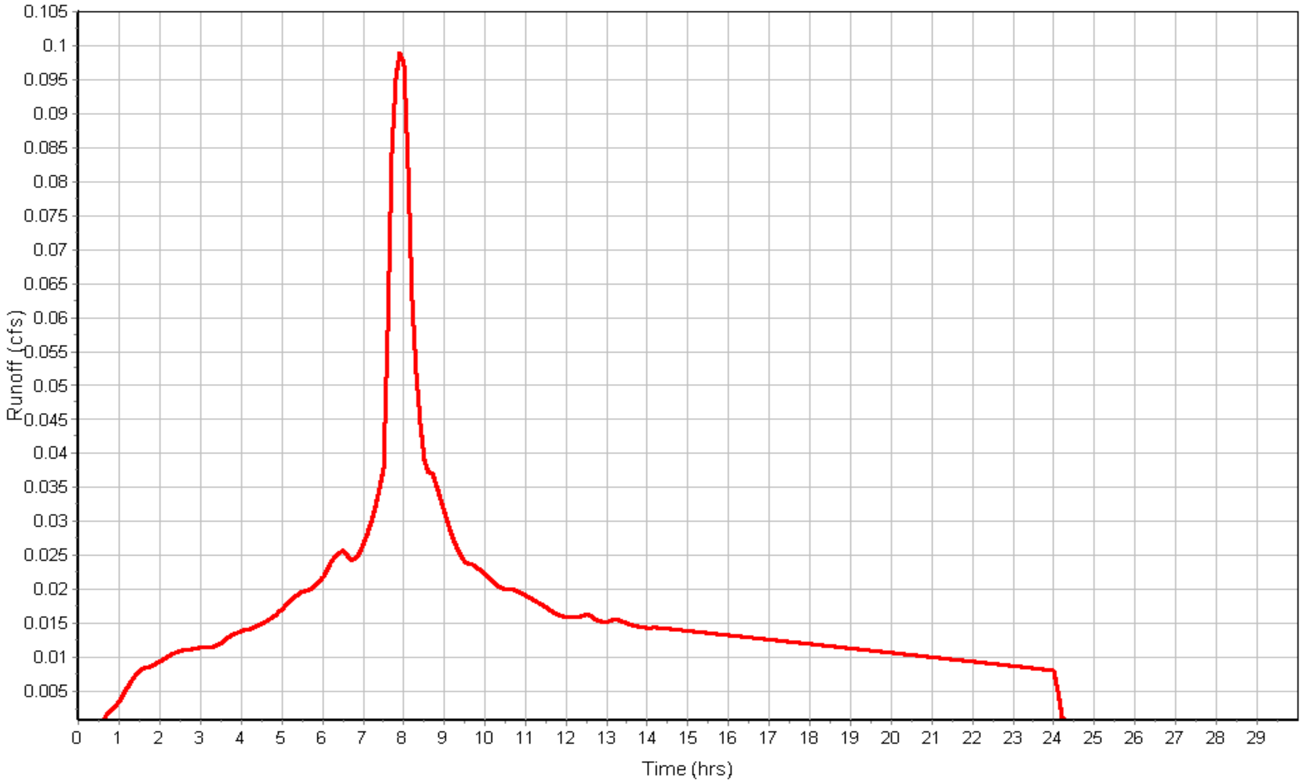
Total Rainfall (in) 5.95
Total Runoff (in) 5.57
Peak Runoff (cfs) 0.10
Weighted Curve Number 96.74
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : NP-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : OFF-1

Input Data

Area (ac) 0.10
Impervious Area (%) 82.00
Impervious Area Curve Number 92.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

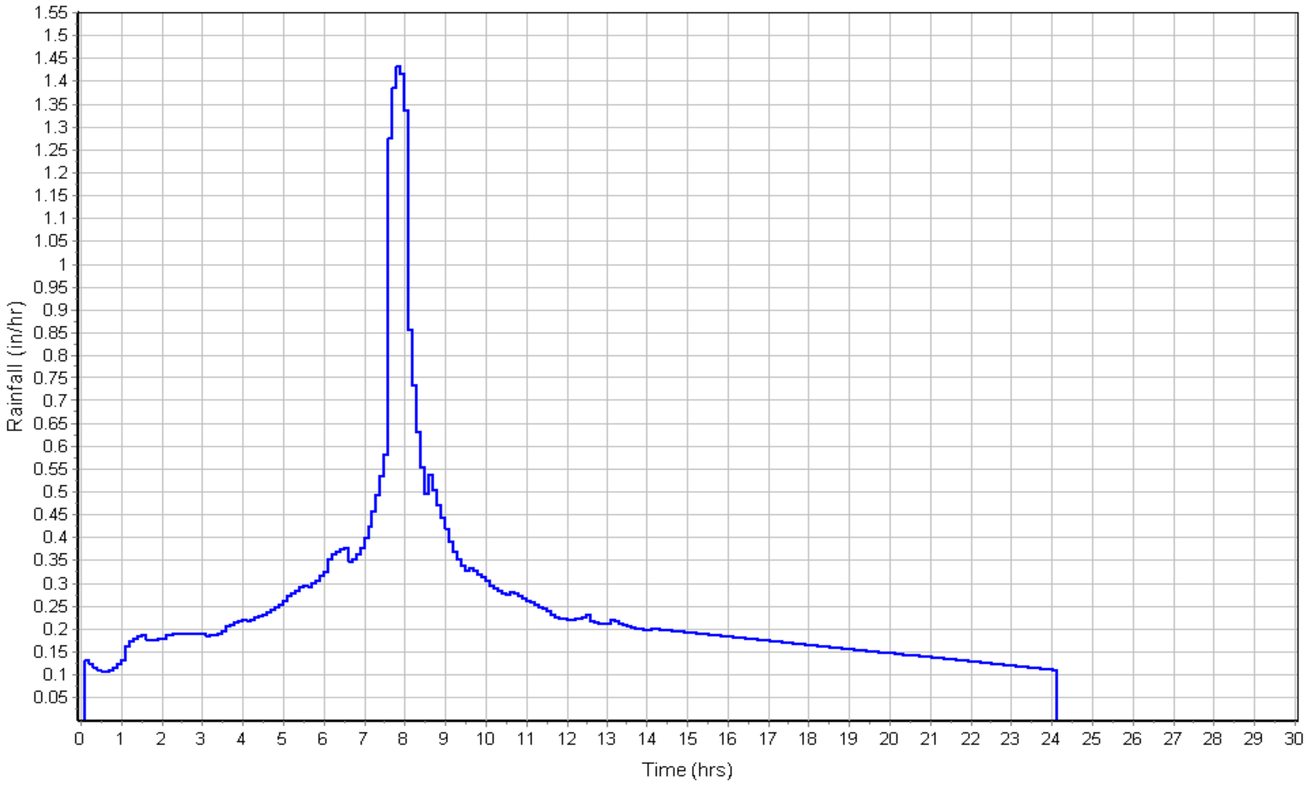
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.10		89.84

Subbasin Runoff Results

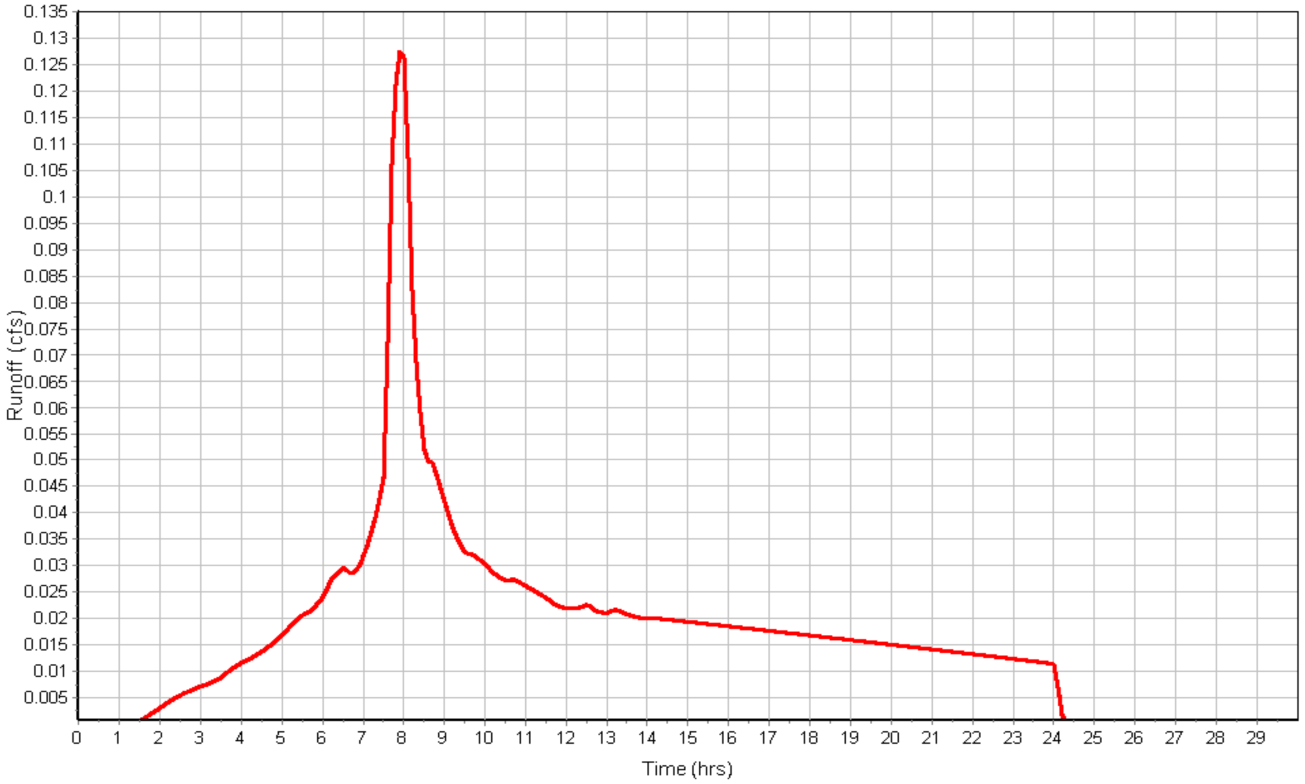
Total Rainfall (in) 5.95
Total Runoff (in) 4.79
Peak Runoff (cfs) 0.13
Weighted Curve Number 89.84
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : OFF-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SB-1

Input Data

Area (ac) 0.13
Impervious Area (%) 72.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

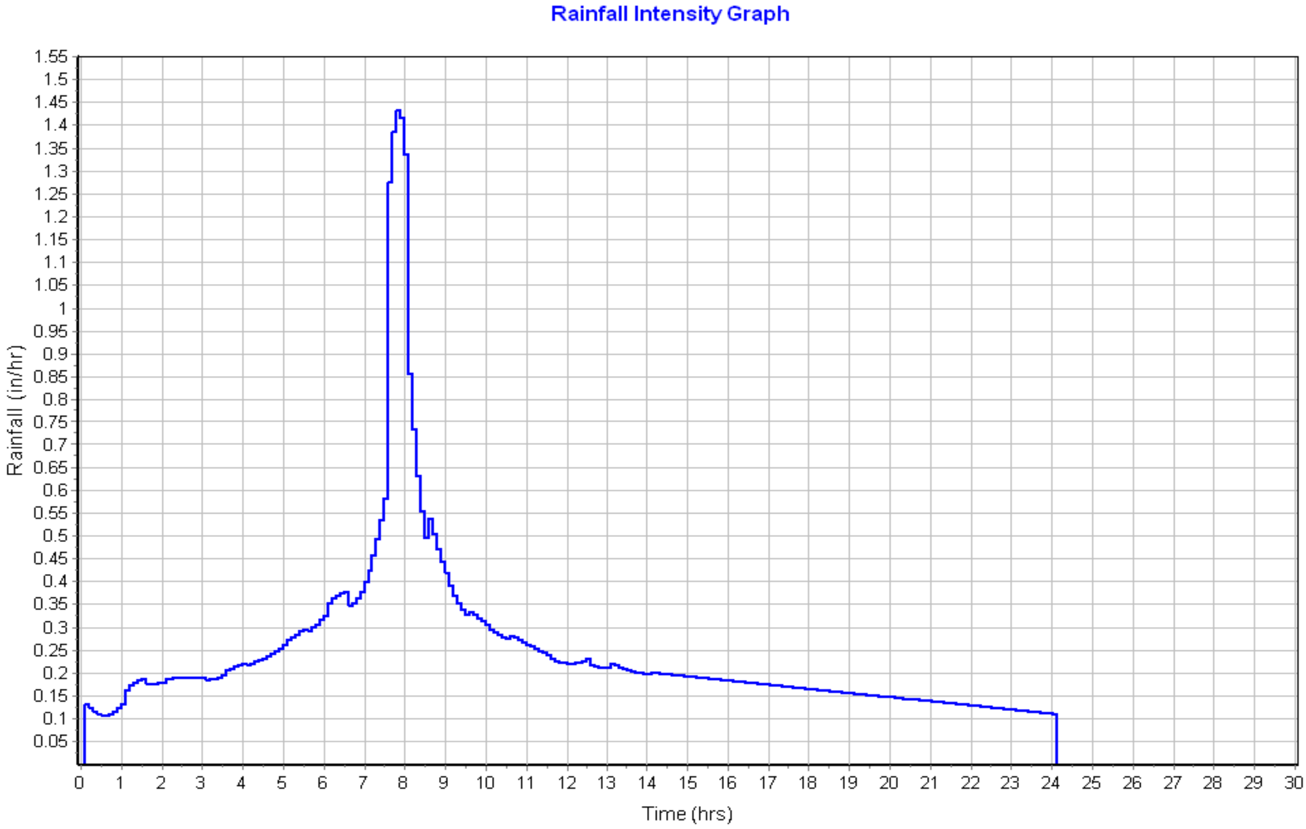
Composite Curve Number

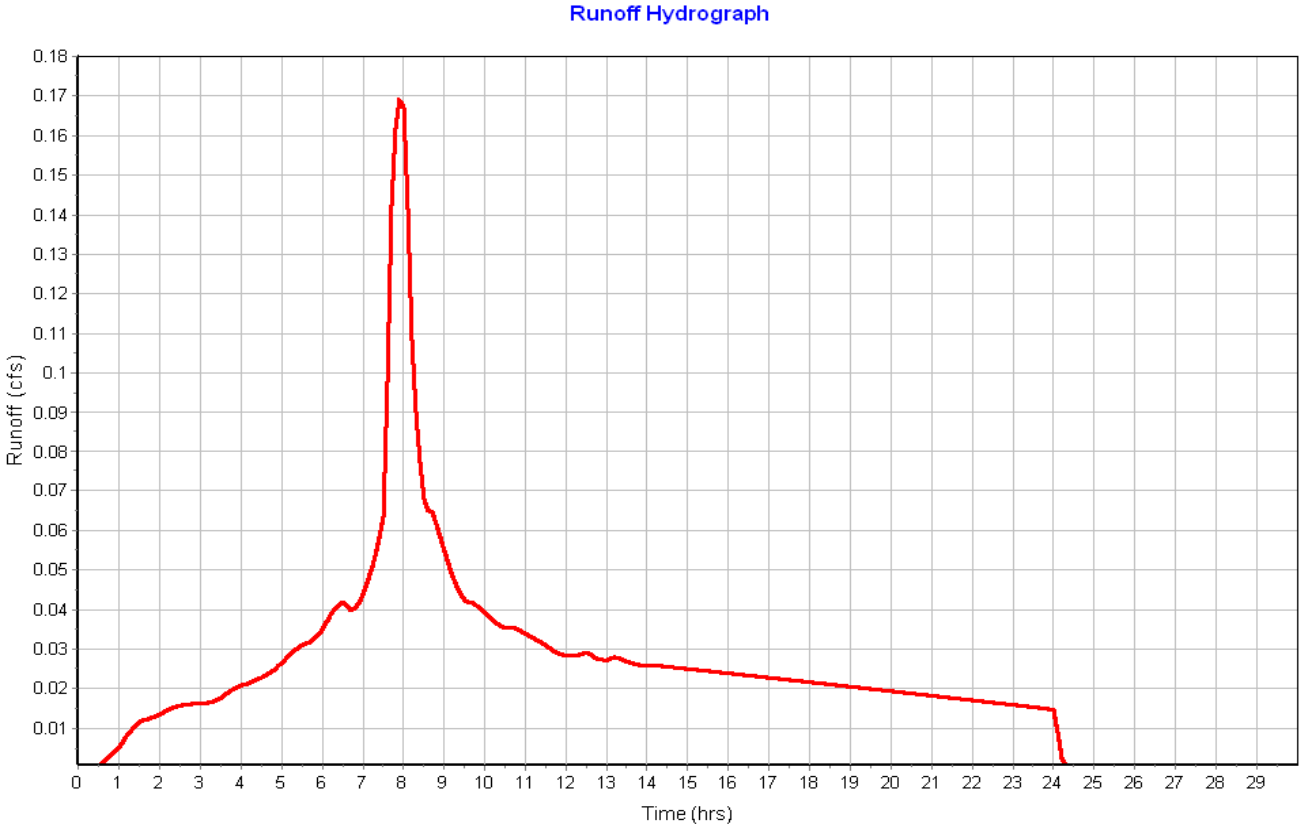
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.13		92.96

Subbasin Runoff Results

Total Rainfall (in) 5.95
Total Runoff (in) 5.16
Peak Runoff (cfs) 0.17
Weighted Curve Number 92.96
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SB-1





Subbasin : SB-2

Input Data

Area (ac) 0.09
Impervious Area (%) 100.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

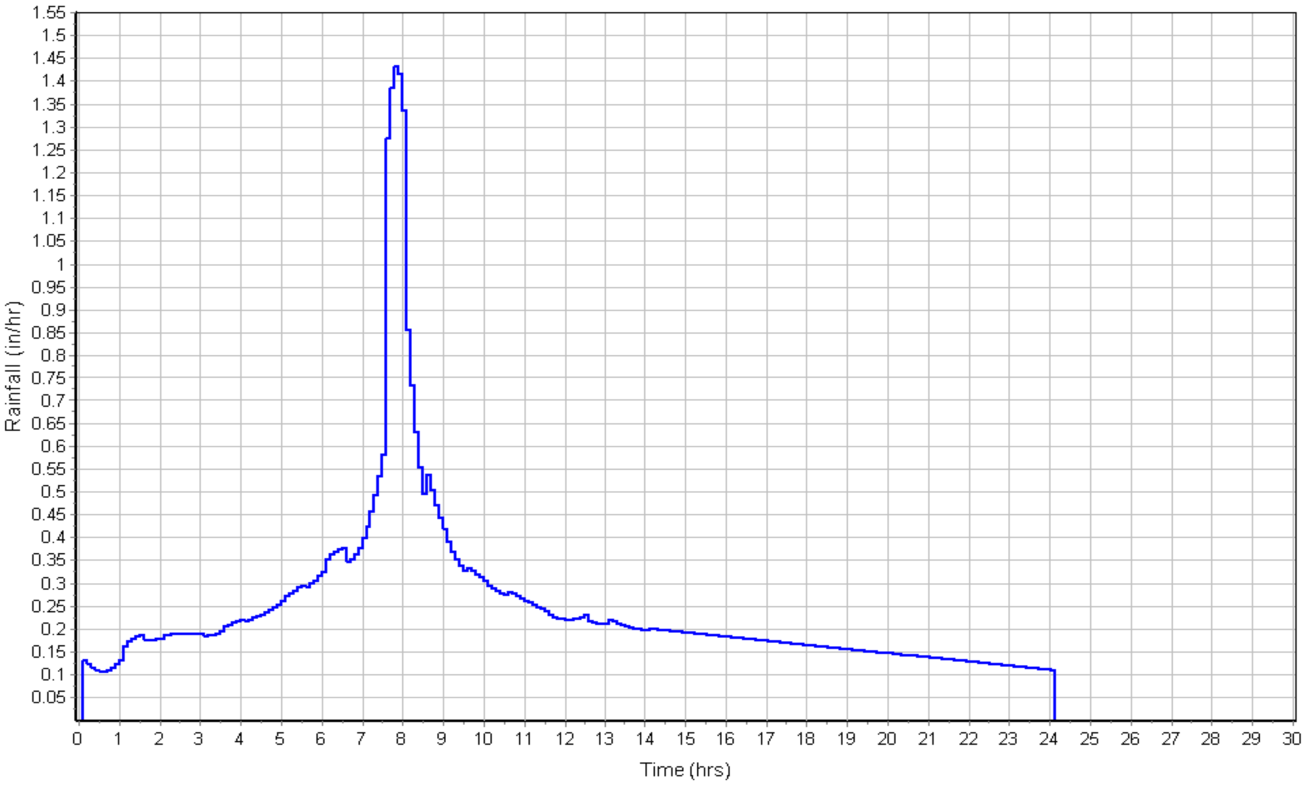
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.09		98

Subbasin Runoff Results

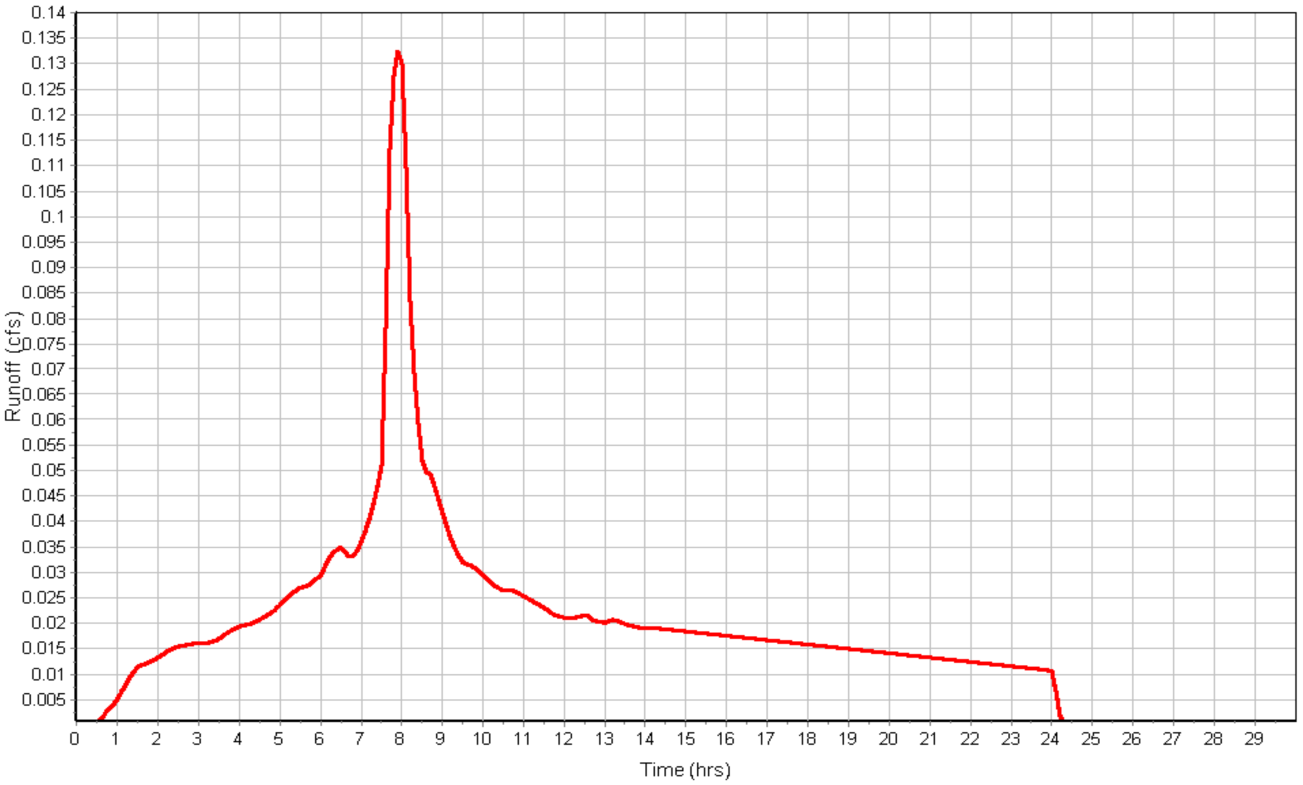
Total Rainfall (in) 5.95
Total Runoff (in) 5.71
Peak Runoff (cfs) 0.13
Weighted Curve Number 98.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SB-2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SP-1

Input Data

Area (ac)	0.76
Impervious Area (%)	79.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	80.00
Rain Gage ID	Rain Gage-01

Composite Curve Number

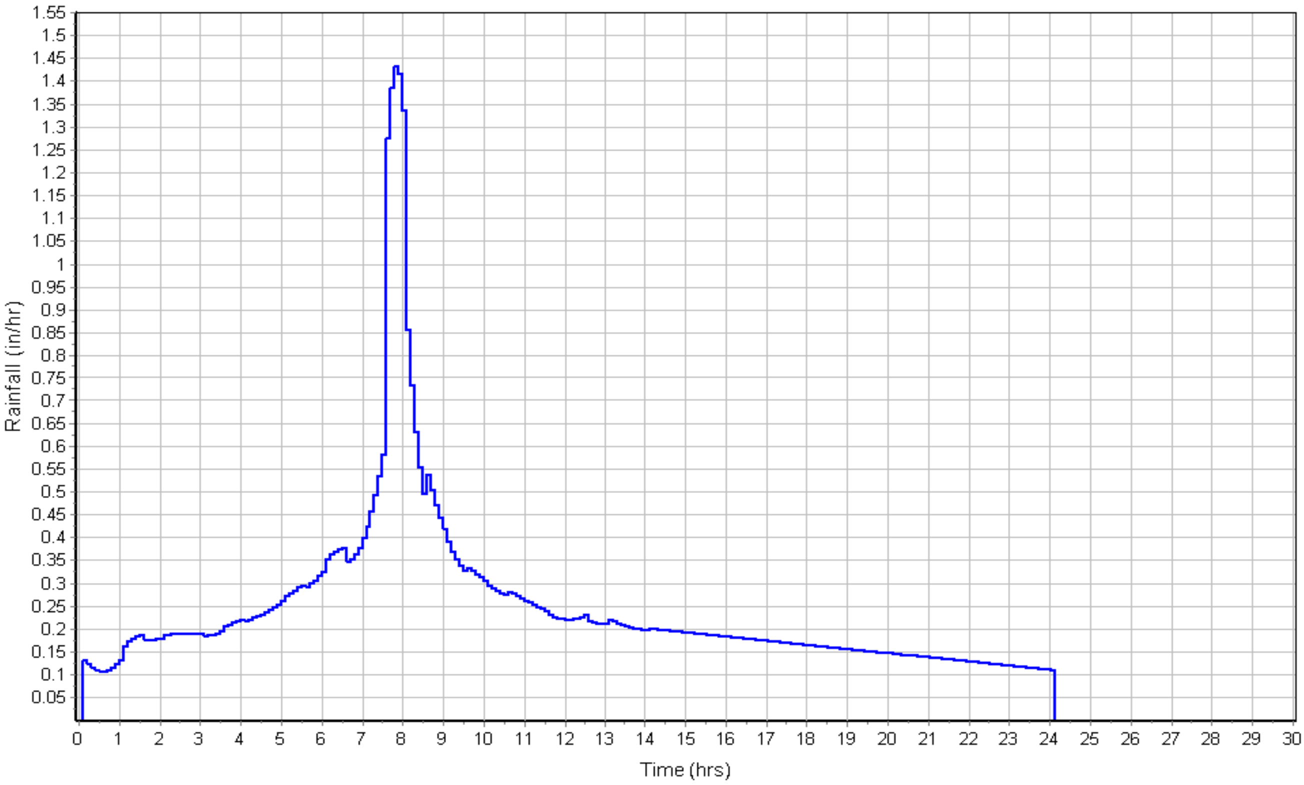
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.76		94.22

Subbasin Runoff Results

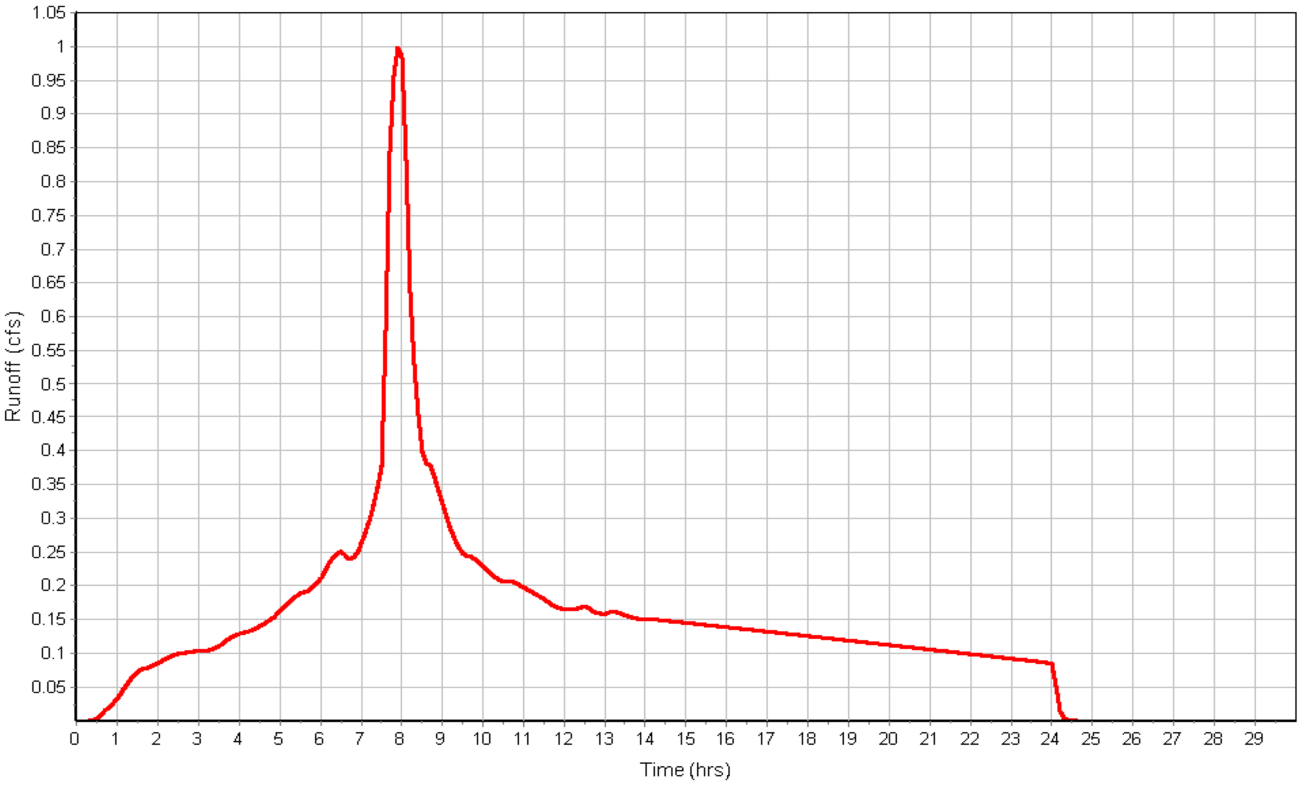
Total Rainfall (in)	5.95
Total Runoff (in)	5.30
Peak Runoff (cfs)	1.00
Weighted Curve Number	94.22
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : SP-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SP-2

Input Data

Area (ac) 0.52
Impervious Area (%) 77.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

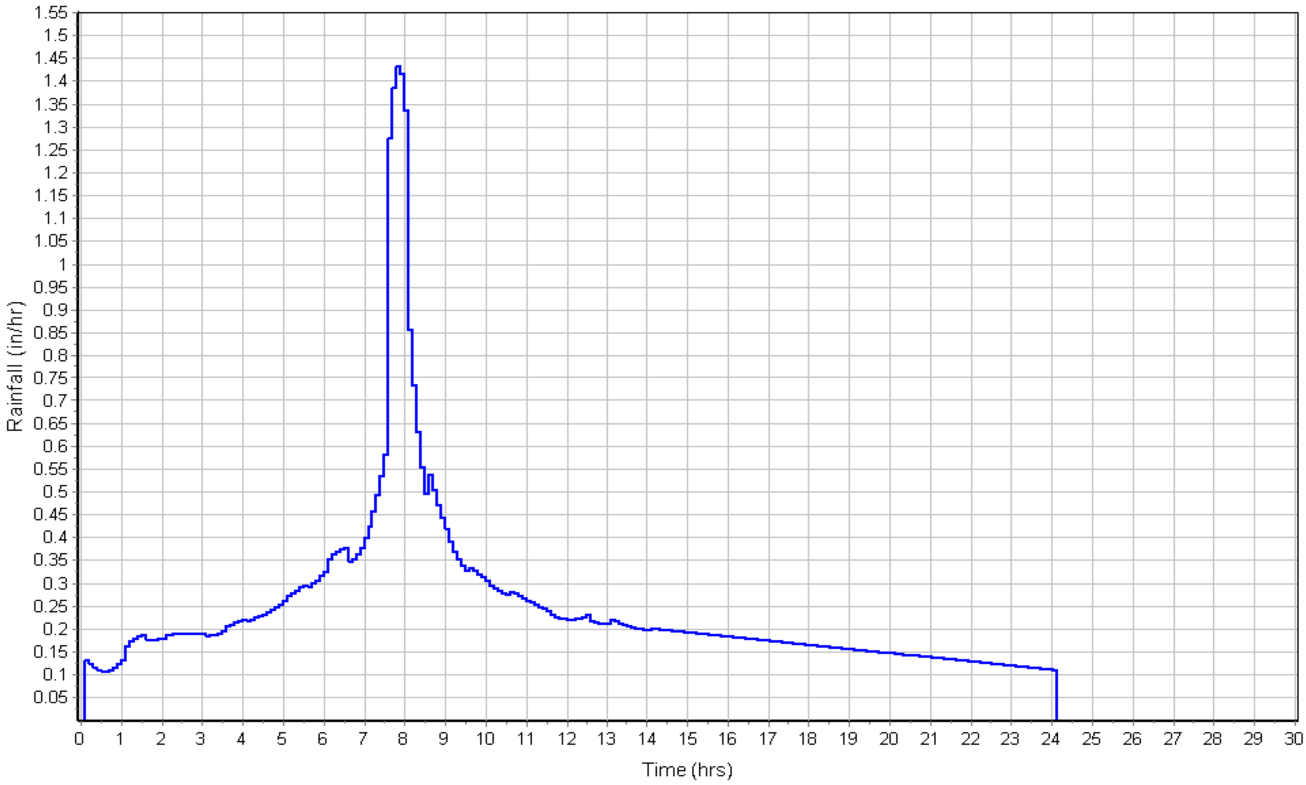
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.52		93.86

Subbasin Runoff Results

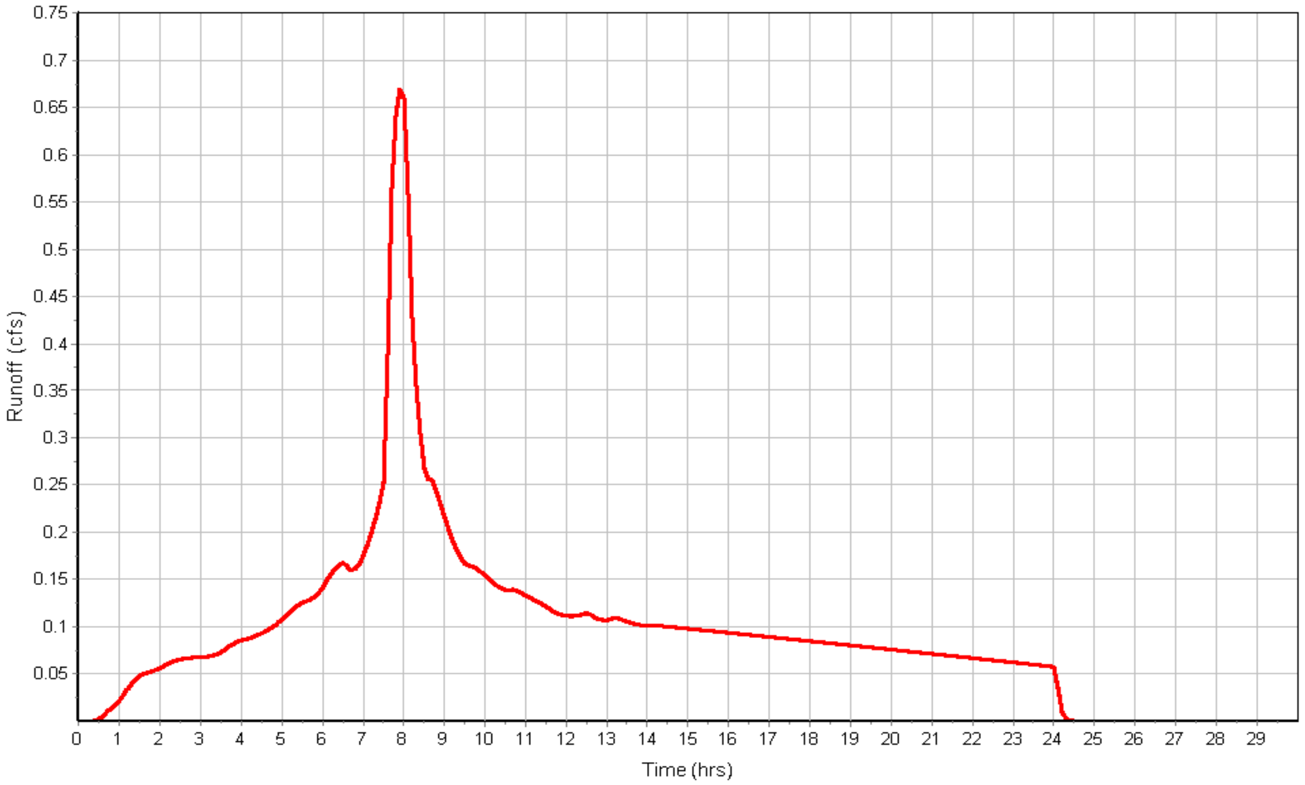
Total Rainfall (in) 5.95
Total Runoff (in) 5.26
Peak Runoff (cfs) 0.67
Weighted Curve Number 93.86
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : SP-2

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	ORIFICE	67.30	75.00	7.71	67.30	0.00	74.00	-1.00	10000.00	0.00
2	OUTFALL_1	71.67	75.00	3.33	71.67	0.00	74.00	-1.00	10000.00	0.00
3	SD_CB_1	72.41	73.56	1.15	72.41	0.00	73.48	-0.08	10000.00	0.00
4	SD_CB_2	72.61	76.50	3.89	72.61	0.00	75.50	-1.00	10000.00	0.00
5	SD_CO_15	76.21	78.50	2.29	76.21	0.00	78.00	-0.50	10000.00	0.00
6	SD_CO_6	71.68	75.00	3.32	71.68	0.00	74.00	-1.00	10000.00	0.00
7	SD_CO_9	71.65	75.00	3.35	71.65	0.00	74.00	-1.00	10000.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	ORIFICE	1.97	0.00	69.93	2.63	0.00	5.07	68.94	1.64	0 08:08	0 00:00	0.00	0.00
2	OUTFALL_1	1.79	0.67	72.43	0.76	0.00	2.57	72.11	0.44	0 08:03	0 00:00	0.00	0.00
3	SD_CB_1	1.12	1.12	72.92	0.51	0.00	0.64	72.60	0.19	0 07:54	0 00:00	0.00	0.00
4	SD_CB_2	0.66	0.41	73.05	0.44	0.00	3.45	72.78	0.17	0 07:55	0 00:00	0.00	0.00
5	SD_CO_15	0.25	0.25	76.44	0.23	0.00	2.06	76.30	0.09	0 07:55	0 00:00	0.00	0.00
6	SD_CO_6	0.28	0.13	72.39	0.71	0.00	2.85	72.09	0.41	0 08:05	0 00:00	0.00	0.00
7	SD_CO_9	0.66	0.00	72.41	0.76	0.00	2.59	72.05	0.40	0 08:04	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	LINK-10	50.68	71.67	0.00	71.52	0.10	0.15	0.3000	Trapezoidal	1.000	8.000	0.0800	0.5000	0.5000	0.0000	0.00	No
2	OVERFLOW_01	20.00	72.21	0.79	71.81	4.52	0.40	2.0000	Rectangular	1.000	4.000	0.0100	0.5000	0.5000	0.0000	0.00	No
3	OVERFLOW_02	20.00	74.44	0.50	74.24	2.56	0.20	1.0000	Rectangular	1.000	4.000	0.0100	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	LINK-10	1.76	0 07:54	3.62	0.49	0.81	1.04	0.79	0.79	0.00		
2	OVERFLOW_01	1.97	0 08:08	64.15	0.03	4.02	0.08	0.12	0.12	0.00		
3	OVERFLOW_02	0.15	0 07:55	45.36	0.00	1.31	0.25	0.03	0.03	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	LINK_01	12.00	69.29	2.00	69.05	3.22	0.24	2.0000	CIRCULAR	9.960	9.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1
2	LINK-12	222.93	72.23	-0.18	71.67	0.00	0.56	0.2500	CIRCULAR	9.960	9.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1
3	LINK-20	19.69	71.85	0.17	71.75	0.33	0.10	0.5000	CIRCULAR	6.000	6.000	0.0100	0.5000	0.5000	0.0000	0.00	No	1
4	LINK-30	18.32	71.65	0.00	71.60	0.18	0.05	0.3000	CIRCULAR	8.040	8.040	0.0100	0.5000	0.5000	0.0000	0.00	No	1
5	LINK-31	318.43	72.61	0.00	71.65	0.00	0.95	0.3000	CIRCULAR	8.040	8.040	0.0100	0.5000	0.5000	0.0000	0.00	No	1
6	LINK-32	218.21	74.35	-1.86	72.61	0.00	1.75	0.8000	CIRCULAR	3.960	3.960	0.0100	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	LINK_01	1.97	0 08:08	4.03	0.49	5.40	0.04	0.53	0.63	0.00		Calculated
2	LINK-12	1.12	0 07:54	1.64	0.69	2.66	1.40	0.63	0.75	0.00		Calculated
3	LINK-20	0.28	0 07:59	0.51	0.53	2.32	0.14	0.50	1.00	17.00		SURCHARGED
4	LINK-30	0.66	0 07:58	0.86	0.76	2.52	0.12	0.67	1.00	29.00		SURCHARGED
5	LINK-31	0.66	0 07:55	0.86	0.77	2.43	2.18	0.55	0.83	0.00		Calculated
6	LINK-32	0.25	0 07:55	0.32	0.80	3.25	1.12	0.28	0.84	0.00		Calculated

Storage Nodes

Storage Node : INFL_RG_1

Input Data

Invert Elevation (ft) 71.42
Max (Rim) Elevation (ft) 75.00
Max (Rim) Offset (ft) 3.58
Initial Water Elevation (ft) 0.00
Initial Water Depth (ft) .... -71.42
Ponded Area (ft²) 10000.00
Evaporation Loss 0.00

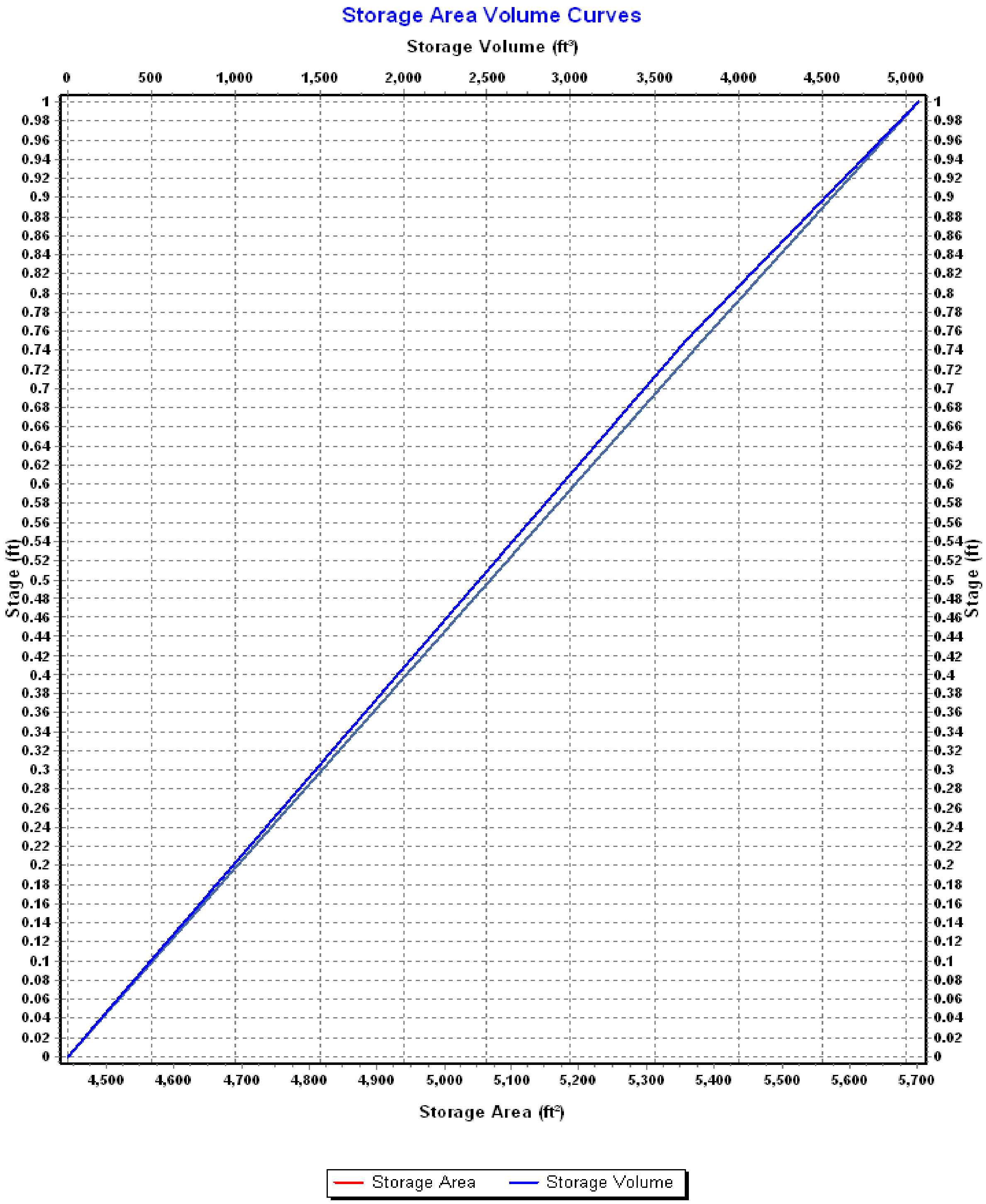
Infiltration/Exfiltration

Constant Flow Rate (cfs) 0.4983

Storage Area Volume Curves

Storage Curve : WETLAND

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0.00	4443.1	0.000
0.75	5381.7	3684.30
1.00	5701.6	5069.71


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Stage (ft)
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
0.84
0.82
0.8
0.78
0.76
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0.56
0.54
0.52
0.5
0.48
0.46
0.44
0.42
0.4
0.38
0.36
0.34
0.32
0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
4,500
4,600
4,700
4,800
4,900
5,000
5,100
5,200
5,300
5,400
5,500
5,600
5,700
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : INFL_RG_1 (continued)

Output Summary Results

Peak Inflow (cfs)	2.94
Peak Lateral Inflow (cfs)	0.27
Peak Outflow (cfs)	1.97
Peak Exfiltration Flow Rate (cfm)	29.90
Max HGL Elevation Attained (ft)	72.35
Max HGL Depth Attained (ft)	0.93
Average HGL Elevation Attained (ft)	71.93
Average HGL Depth Attained (ft)	0.51
Time of Max HGL Occurrence (days hh:mm)	0 08:07
Total Exfiltration Volume (1000-ft³)	37.774
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : INFL_RG_2

Input Data

Invert Elevation (ft) 73.94
Max (Rim) Elevation (ft) 76.00
Max (Rim) Offset (ft) 2.06
Initial Water Elevation (ft) 0.00
Initial Water Depth (ft) .... -73.94
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

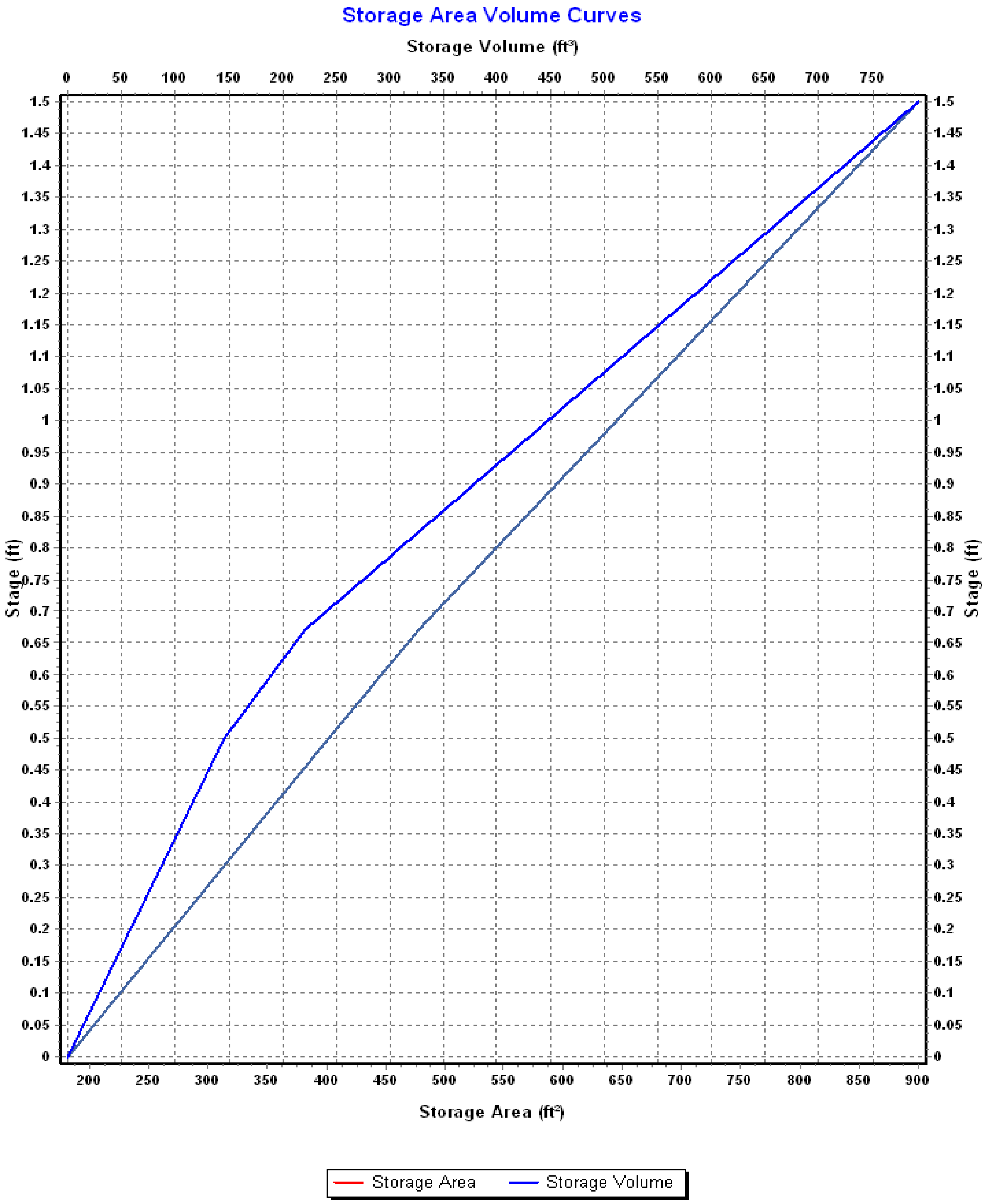
Infiltration/Exfiltration

Constant Flow Rate (cfs) 0.0200

Storage Area Volume Curves

Storage Curve : SB-2_RG

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	182	0.000
0.50	402	146.00
0.67	478	220.80
1.50	900	792.67

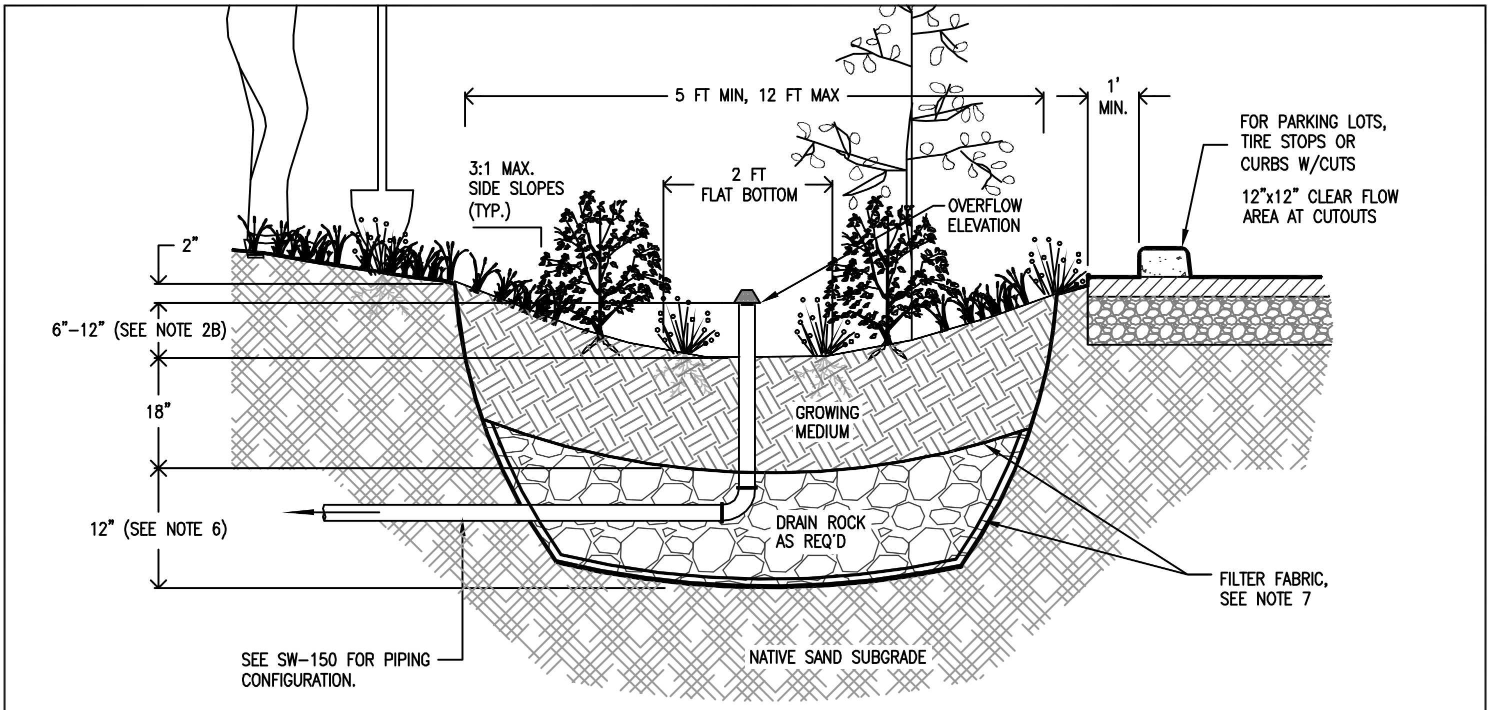

Storage Area Volume Curves
Storage Volume (ft³)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Stage (ft)
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : INFL_RG_2 (continued)

Output Summary Results

Peak Inflow (cfs)	0.17
Peak Lateral Inflow (cfs)	0.17
Peak Outflow (cfs)	0.15
Peak Exfiltration Flow Rate (cfm)	1.20
Max HGL Elevation Attained (ft)	74.47
Max HGL Depth Attained (ft)	0.53
Average HGL Elevation Attained (ft)	74.33
Average HGL Depth Attained (ft)	0.39
Time of Max HGL Occurrence (days hh:mm)	0 07:55
Total Exfiltration Volume (1000-ft^3)	1.714
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Appendix F:
Facility Details



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.

2. Dimensions:
    - a. Width of swale: 5' - 12'.
    - b. Depth of swale (from top of growing medium to overflow elevation); Simplified: 9", Presumptive: 6"-12".
    - c. Longitudinal slope of swale: 6.0% or less.
    - d. Flat bottom width: 2'.
    - e. Side slopes of swale: 3:1 maximum.

3. Setbacks (from centerline of facility):
    - a. Infiltration swales must be 10' from foundations and 5' from property lines.
    - b. Flow-through swales must be lined with connection to approved discharge point according to SWDM Section 2.1.

4. Overflow:
    - a. Overflow required for Simplified Approach
    - b. Inlet elevation must allow for 2" of freeboard, minimum.
    - c. Protect from debris and sediment with strainer or grate.

5. Piping: shall be ABS Sch.40, cast iron, or PVS Sch.40. 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping must have 1% grade and follow the Uniform Plumbing Code.

6. Drain rock:
    - a. Infiltration swale: None required
    - b. Size for flow-through swale: ¾" washed
    - c. Depth for Simplified and Presumptive: 12"

7. Separation between drain rock and growing medium: Use filter fabric.

8. Growing medium:
    - a. 18" minimum
    - b. See Appendix B for specification.

9. Vegetation: Follow landscape plans otherwise refer to plant list in SWDM Appendix G. Minimum container size is 1 gallon. # of plantings per 100sf of facility area:
    - a. Zone A (wet): 115 herbaceous plants OR 100 herbaceous plants and 4 small shrubs.
    - b. Zone B (moderate to dry): 1 tree AND 3 large shrubs / small trees AND 4 small shrubs AND 140 groundcover plants.

   The delineation between Zone A and B shall be either at the outlet elevation or the check dam elevation, whichever is lowest.

10. Waterproof liner: Shall be 30 mil PVC or equivalent for flow-through facilities.

11. Install washed pea gravel or river rock to transition from inlets and splash pad to growing medium.

12. Check dams: Shall be placed according to facility design. Refer to SW-340 for profile and spacing.

13. Inspections: Call City of Florence Public Works (541) 997-4106 to schedule appropriate inspections.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT MANUAL TYPICAL DETAILS

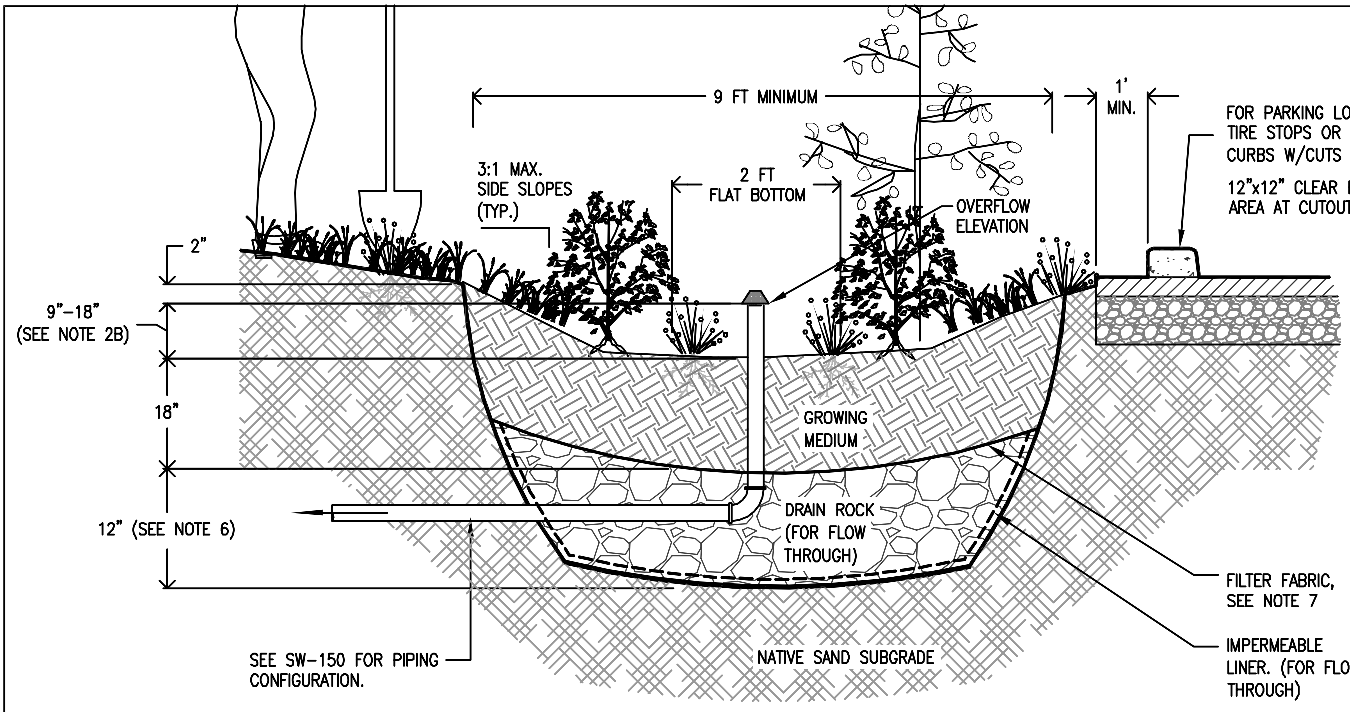
CITY OF FLORENCE
PUBLIC WORKS DEPARTMENT
989 Spruce Street
Florence, OR 97439
Phone: 541-997-4106

DATE: 11-30-10

- Simplified / Presumptive Design Approach -

Swale

NUMBER
SW-120



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1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.

2. Dimensions:
   a. Width of basin: 9' minimum.
   b. Depth of basin (from top of growing medium to overflow elevation); Simplified: 12", Presumptive: 9"-18".
   c. Flat bottom width: 2' min.
   d. Side slopes of basin: 3:1 maximum.

3. Setbacks (from midpoint of facility):
   a. Infiltration basins must be 10' from foundations and 5' from property lines.
   b. Flow-through swales must be lined with connection to approved discharge point according to SWDM Section 2.1.

4. Overflow:
   a. Overflow required for Simplified Approach.
   b. Inlet elevation must allow for 2" of freeboard, minimum.
   c. Protect from debris and sediment with strainer or grate.

5. Piping: shall be ABS Sch.40, cast iron, or PVC Sch.40. 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping must have 1% grade and follow the Uniform Plumbing Code.

6. Drain rock:
   a. None required for infiltration basin
   b. Size for flow-through basin: ¾" washed

7. Separation between drain rock and growing medium: Use filter fabric (see SWDM Exhibit 2-5).

8. Growing medium:
   a. 18" minimum
   b. See Appendix B for specification.

9. Vegetation: Follow landscape plans otherwise refer to plant list in SWDM Appendix G. Minimum container size is 1 gallon. # of plantings per 100sf of facility area):
   a. Zone A (wet): 115 herbaceous plants OR 100 herbaceous plants and 4 shrubs
   b. Zone B (moderate to dry): 1 tree AND 3 large shrubs AND 4 medium to small shrubs.

   The delineation between Zone A and B shall be either at the outlet elevation or the check dam elevation, whichever is lowest.

10. Install washed pea gravel or river rock to transition from inlets and splash pad to growing medium.

11. Inspections: Call City of Florence Public Works (541) 997-4106 to schedule appropriate inspections.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT MANUAL TYPICAL DETAILS

CITY OF FLORENCE
PUBLIC WORKS DEPARTMENT
989 Spruce Street
Florence, OR 97439
Phone: 541-997-4106

DATE: 11-30-10

- Simplified / Presumptive Design Approach -

Rain Garden

NUMBER

SW-140

Appendix G:
Operations and Maintenance

After Recording Return to:
Name:
Address:

Place Recording Label Here

APPENDIX A.4

Form O&M: Operations and Maintenance Plan

Permit Application No . TBD

Owner Name: Northwest Housing Alternatives, Inc.

Phone: (*area code required*) (503) 654-1007

Mailing Address: (*return address for records*) 2316 SE Willard St.

City/State/Zip: Milwaukie, OR 97222

Site Address: Tax Lot 500 Parcel (On U.S. Highway 101 Near 40th Avenue)

City/State/Zip: Florence, OR 97439

Site Legal Description:
See attached

1 Responsible Party for Maintenance (*check one*)

__ Homeowner association __ Property Owner __ Other *(describe)*

____

2 Contact Information for Responsible Party(ies) if Other than Owner

Daytime Phone: (*area code required*) ________- __________-_____________
Emergency/After Hours Phone: ________- __________-______________
Contact Name and Address:

____

Instructions

Simplified Sizing Approach: *Attach O&M Specifications from the Florence Stormwater Design Manual Appendix H.*

Presumptive and Performance Sizing Approach: *Attach the site-specific O&M Plan (See Stormwater Design Manual Section 6).*

3 Site Plan

Show all facility locations in relation to labeled streets, buildings, or other permanent features on the site. Also show the sources of runoff entering the facility, and the final onsite/offsite discharge point.
Please complete the table below

Maintaining the stormwater management facility on this site plan is a required condition of building permit approval for the identified property. The property owner is required to operate and maintain this facility in accordance with the O&M specifications or plan on file with the City of Florence. That requirement is binding on all current and future owners of the property. Failure to comply with the O&M specifications or plan may result in enforcement action, including penalties. The O&M specifications or plan may be modified by written consent of new owners and written approval by re-filing with the Community Development Department.

Complete and recorded O&M Forms shall be submitted to:
Community Development Department, 250 Highway 101, Florence, OR, 97439
Office hours are 8 - 5, Monday through Friday. Call 541-997-3436 for assistance.

Required Site Plan (insert here or attach separate sheet)

■ I Have Attached a Site Plan

Please complete this table

Facility Type	Size (sf)	Drainage is from:	Impervious Area Treated (sf)	Discharge Point	
Rain Garden 1 (Infiltration)	5,382	Roof/Road/Sidewalk	67,070	Public Storm Drain	
Vegetated Swale 1 (Infiltration)	402	Roof/Sidewalk	4,197	Public Storm Drain	

BY SIGNING BELOW *filer accepts and agrees to the terms and conditions contained in this O&M Form and in any document executed by filer and recorded with it. To be signed in the presence of a notary.*

Filer signature

INDIVIDUAL Acknowledgement
STATE of OREGON county of:

This instrument was acknowledged before me on:

By:

Notary Signature:

My Commission Expires: ___________________________________ *for notary seal*

CORPORATE Acknowledgement
STATE of OREGON county of:
____

This instrument was acknowledged before me on:
____

By:
____

As (title):
____

Of (corporation):
____

Notary Signature:
____

My Commission Expires: ______________________________

Real Property Tax Lot Record

Lane County Assessment and Taxation
Print Date: Mar 25, 2021

The legal descriptions contained herein are for tax lot purposes only.

Included in this report:

1. A listing of documents affecting ownership and/or property boundary changes.
2. The scanned tax lot record image and any legal description changes made since .

Map & Tax Lot 1812143300500
Status Active

Current Parcel/Account 0782480
Current TCA 09700

Document #	Type	Date	Effective Year	Tax Lot Acres
2016-012733	Warranty Deed	03/08/2016	2016	2.46
Comments:				
2015-059986	Quit Claim Deed	12/09/2015	2016	2.46
Comments:				
2012-034370	Trustee Deed	07/09/2012	2012	2.46
Comments:				
	Description Card			2.46
Comments:				

PARCEL RECORD – Cartographic Unit

0782480 Page 1 of

Code Area	Township	Range	Section	¼	1/16	Parcel Number	Type	Number
	18	12	14	3	3	00500		

Map Number

Tax Lot Number

Special Interest

Formerly part of

History of Parcel

Exceptions/Additions	Date of Entry/ Acquisition	Deed Record Volume	Deed Record Page	Acre Remai
New Description	2006LLA	2004	083464	2.46
	2006wd	2005-	014991	
ALSO 0.07 ac to TL 600 EXCEPT 0.07 from TL 600 by 2011-014782 for 2011; cont m/l				2.46
NEW DESCRIPTION (Exh A) 2011 LLA 2011-014782				

History of Parcel Prior to Re-mapping

Previous Account Number

Previous Tax Lot Number

OFFICIAL RECORD OF DESCRIPTIONS OF REAL PROPERTIES

OFFICE OF COUNTY ASSESSOR LANE COUNTY, OREGON

OLD NUMBER

CODE NO.

MAP NO.

NEW 18 12 14 33 500

OLD 18 12 14 5500

ACCT NO. 782480

TOWNSHIP 18 S. RANGE 12W W.M.

AERIAL PHOTO

LOT NO.

BLOCK NO.

ADDITION

CITY

INDENT EACH NEW COURSE TO THIS POINT

CANCELLED

LEGAL DESCRIPTION	DEED RECORD DATE OF ENTRY	DEED RECORD DEED NUMBER	ACRES REMAINING
Beginning at a point on the E R/W line of U.S. Hwy. 101, said point being North 410 ft from the section line between sections 14 & 23 T 18 S,R 12 WWM. thence following said Hwy R/W North 250 ft thence East 644 ft thence South 250 ft thence West to the point of beginning (F.T.L.P.O.)			3.36 M/L
Beginning at a point in the center of the Roosevelt Highway as located and graded 330 feet Northerly from the South line of Sec. 14, T18S, R12W, WM, thence Northerly 330 feet along the center of the Roosevelt Highway as located and graded thence Easterly at right angles 660 feet thence Southerly 330 feet parallel to 1st line thence Westerly 660 feet parallel to the South line of Sec. 14, to the point of beginning and containing 5 acres of land more or less all in Lane County, Oregon. Containing more or less	1948 1953	339/537 453/451	5.00
EXCEPT: That part to tax lot 5600 by 358/556 in 1948.			

Remarks			
Containing more or less			3.36
BAP in the ctr. of US Hwy. #101, (Roosevelt Hwy.) 410 ft. N'ly from the S ln. of Sec. 14, T18S., R12W., WM., th	1967 1968	R296/62848 R404/35240 (Pass)	
N'ly alg. the ctrln. of sd. Roosevelt Hwy, 250 ft., th	1969 1975	R408/39626 R594/8189	
E'ly at rt. angles 660 th, th			
S'ly parallel to the first ln. in Roosevelt Hwy. 250 ft., th	1990wd	R1655/9045446	
W'ly parallel with the S ln. of Sec. 14, 660 ft. to the POB, LCO. Cont m/l	2003WD 2003 BS	2003-061023 2003-061367	3.36

CANCEL

2006

continued

Page 2

CANCELLED

18 12 14 5500

OFFICIAL RECORD OF DESCRIPTIONS OF REAL PROPERTIES

OFFICE OF COUNTY ASSESSOR LANE COUNTY, OREGON

OLD NUMBER

CODE NO.

MAP NO. 18 12 14 -33 TAX LOT NO. ~~5500~~ 00500

ACCOUNT NUMBER 782 480

SECTION 14 TOWNSHIP 18 S. RANGE 12W W.M.

AERIAL PHOTO

LOT NO.

BLOCK NO.

ADDITION

CITY

INDENT EACH NEW COURSE TO THIS POINT

LEGAL DESCRIPTION	DEED RECORD		ACRES REMAINING
	DATE OF ENTRY	DEED NUMBER	
EXCEPT 0.17 ac out of TL 5500 into Oregon Coast Highway, U.S. Hwy. 101, per R1351/85-18983 (corr. WD) and R1327/84-46686 to the State of Oregon for 1987.			
Containing more or less			3.19
Acreage correction for TL 5500 for 1987			
Containing more or less			3.44

CANCELLED 2006

18-12-14-33-00500
Acct-0782480
Page-3

Doc 2004-083461

"EXHIBIT B"

Beginning at a point in the center of U.S. Highway No. 101 (Roosevelt Highway) 410 feet Northerly from the South line of Section 14, Township 18 South, Range 12 West of the Willamette Meridian; thence Northerly along the center line of said Roosevelt Highway, 250 feet; thence Easterly at right angles 660 feet; thence Southerly parallel to the first line in Roosevelt Highway 250 feet; thence Westerly parallel with the South line of Section 14, 660 feet to the place of beginning, in Lane County, Oregon.

EXCEPT Beginning at a point in the center of U.S. Highway No. 101 (Roosevelt Highway) 585.00 feet Northerly from the South line of Section 14, Township 18 South, Range 12 West of the Willamette Meridian; thence Northerly along the center line of said Roosevelt Highway, 75.00 feet; thence Easterly at right angles 660 feet more or less to the East line of the Southwest one quarter of the Southwest one quarter of said Section 14; thence Southerly along said East line 75.00 feet; thence Westerly at right angles to the center line of said Roosevelt Highway 660 feet more or less to the place of beginning, in Lane County, Oregon.

SAVE AND EXCEPT that portion conveyed to the State of Oregon, by and through its Department of Transportation, Highway Division, recorded May 30, 1985, Reception No. 85-18983, Official Records of Lane County, Oregon.

CANCELLED 2011

2011-014782

EXHIBIT “A”

Beginning at the southwest corner of Section 14, Township 18 South, Range 12 West, Willamette Meridian; thence along the south line of said Section 14, South 88°22’00” East, 652.51 feet to the point of intersection with the centerline of Hwy 101; thence along said Hwy 101 centerline North 00°17’00” West, 420.00 feet; thence leaving said Hwy 101 centerline South 89°43’00” East, 60.00 feet to a point on the easterly right-of-way of said Hwy 101, this point being the **True Point of Beginning**, said point monumented with a 5/8” rebar with cap marked “LS 1091”; thence along said easterly right-of-way North 0°17’00” West, 165.00 feet to a point monumented by a 5/8” rebar with cap marked “WOBBE-PLS 1093”; thence leaving said easterly right-of-way on a line at right angles to said Hwy 101 centerline North 89°43’00” East, 611.75 feet to a point monumented by a 5/8” rebar with cap marked “WOBBE-PLS 1093”; thence South 0°01’24” East, 42.50 feet to a point monumented by a 5/8” rebar with no cap; thence continuing South 0°01’24” East, 132.50 feet to a point monumented by a 5/8” rebar with cap marked “WOBBE-PLS 1093”; thence continuing South 0°01’24” East, 10.00 feet to a point monumented by a 5/8” rebar with cap marked “LS 1091”; thence South 89°43’00” West on a line at right angles to said hwy 101 centerline, 305.51 feet to a point monumented by a 5/8” rebar with cap marked “LS 1091”; thence North 0°00’00” East, 20.00 feet to a point monumented by a 5/8” rebar with cap marked “LS 1091”; thence South 89°43’00” West, 305.51 feet to the **True Point of Beginning**, all in Florence, Lane County, Oregon.

18-12-14-33-00500
0782480
Pg 4

Swales (Vegetated, Grassy, and Street)
Operations & Maintenance Plan

- Obstacles preventing maintenance personnel and/or equipment access to the swale shall be removed.
- Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Insects & Rodents shall not be harbored in the swale. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  - i) Installation of predacious bird or bat nesting boxes.
  - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the swale shall be filled.

If used at this site, the following will be applicable:

Check Dams shall control and distribute flow.

- Causes for altered water flow shall be identified, and obstructions cleared upon discovery.
- Causes for channelization shall be identified and repaired.

Swales (Vegetated, Grassy, and Street)
Operations & Maintenance Plan

Swales are planted or grassed open channels that trap pollutants by filtering and slowing flows, allowing particles to settle out. The swale should drain within 48 hours of a storm event. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Swale Inlet (such as curb cuts or pipes) shall maintain a calm flow of water entering the swale**.**

- Source of erosion shall be identified and controlled when native soil is exposed or erosion channels are forming.
- Sediment accumulation shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4" thick or so thick as to damage or kill vegetation.
- Inlet shall be cleared when conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.
- Rock splash pads shall be replenished to prevent erosion.

Side Slopes shall be maintained to prevent erosion that introduces sediment into the swale.

- Slopes shall be stabilized and planted using appropriate erosion control measures when native soil is exposed or erosion channels are forming.

Swale Media shall allow stormwater to percolate uniformly through the landscape swale. If the swale does not drain within 48 hours, it shall be tilled and replanted according to design specifications.

- Annual or semi-annual tilling shall be implemented if compaction or clogging continues.
- Debris in quantities that inhibit operation shall be removed routinely (e.g., no less than quarterly), or upon discovery.

Swale Outlet shall maintain sheet flow of water exiting swale unless a collection drain is used. Source of erosion damage shall be identified and controlled when native soil is exposed or erosion channels are forming.

- Outlets such as drains and overland flow paths shall be cleared when 50% of the conveyance capacity is plugged.
- Sources of sediment and debris shall be identified and corrected.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion.

Mulch shall be replenished as needed to ensure survival of vegetation.

- Vegetation, large shrubs or trees that interfere with landscape swale operation shall be pruned.
- Fallen leaves and debris from deciduous plant foliage shall be removed.
- Grassy swales shall be mowed to keep grass 4" to 9" in height. Clippings shall be removed to remove pollutants absorbed in grasses.
- Nuisance and prohibited vegetation from the Eugene Plant List (such as blackberries and English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Dead vegetation and woody material shall be removed to maintain less than 10% of area coverage or when swale function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.

Debris and Litter shall be removed to ensure stormwater conveyance and to prevent clogging of inlet drains and interference with plant growth.

Spill Prevention measures shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining swales shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the swale shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

Rain Gardens

Operations & Maintenance Plan

Training and/or written guidance information for operating and maintaining vegetated infiltration basins shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the infiltration basin shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- Obstacles preventing maintenance personnel and/or equipment access to the infiltration basin shall be removed.
- Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Insects & Rodents shall not be harbored in the infiltration basin. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  i) Installation of predacious bird or bat nesting boxes.
  ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the infiltration basin shall be filled.

If used at this site, the following will be applicable:

Fences shall be maintained to preserve their functionality and appearance.

- Collapsed fences shall be restored to an upright position.
- Jagged edges and damaged fences shall be repaired or replaced.

Rain Gardens

Operations & Maintenance Plan

A **vegetated Infiltration Basin** is a vegetated depression created by excavation, berms, or small dams to provide for short-term ponding of surface water until it percolates into the soil. The basin shall infiltrate stormwater within 24 hours. All facility components and vegetation shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Basin Inlet shall assure unrestricted stormwater flow to the vegetated basin.

- Sources of erosion shall be identified and controlled when native soil is exposed or erosion channels are present.
- Inlet shall be cleared when conveyance capacity is plugged.
- Rock splash pads shall be replenished to prevent erosion.

Embankment, Dikes, Berms & Side Slopes retain water in the infiltration basin.

- Structural deficiencies shall be corrected upon discovery:
- Slopes shall be stabilized using appropriate erosion control measures when soil is exposed/ flow channels are forming.
- Sources of erosion damage shall be identified and controlled.

Overflow or Emergency Spillway conveys flow exceeding reservoir capacity to an approved stormwater receiving system.

- Overflow shall be cleared when 25% of the conveyance capacity is plugged.
- Sources of erosion damage shall be identified and controlled when soil is exposed.
- Rocks or other armament shall be replaced when only one layer of rock exists.

Filter Media shall allow stormwater to percolate uniformly through the infiltration basin. If water remains 36-48 hours after storm, sources of possible clogging shall be identified and corrected.

- Basin shall be raked and, if necessary, soil shall be excavated, and cleaned or replaced.

Sediment/ Basin Debris Management shall prevent loss of infiltration basin volume caused by sedimentation. Gauges located at the opposite ends of the basin shall be maintained to monitor sedimentation.

- Sediment and debris exceeding 4″ in depth shall be removed every 2-5 years or sooner if performance is affected.

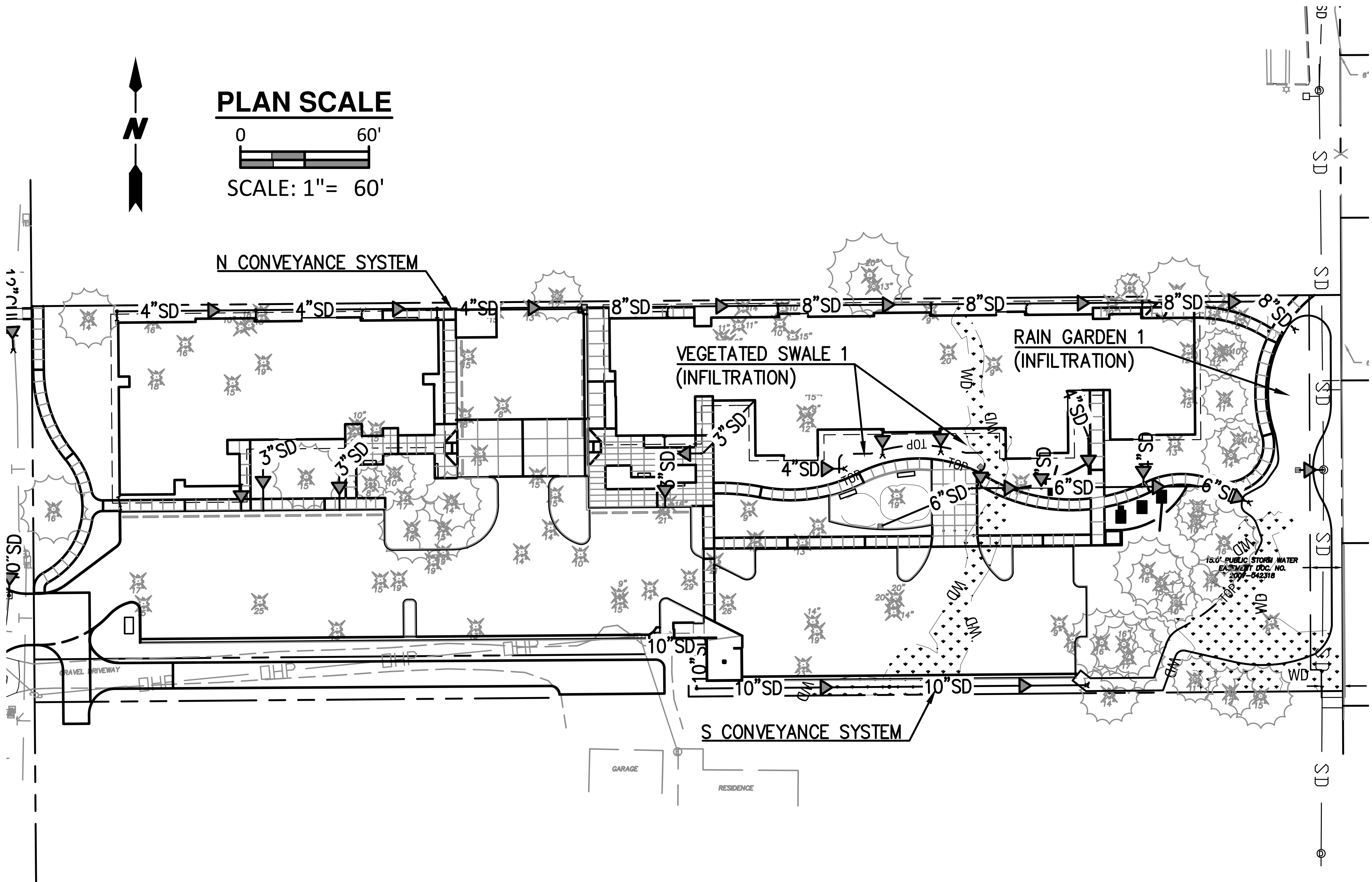
Debris and Litter shall be removed to ensure stormwater infiltration and to prevent clogging of overflow drains and interference with plant growth.

- Restricted sources of sediment and debris, such as discarded lawn clippings, shall be identified and prevented.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion.

- Mulch shall be replenished as needed to ensure healthy plant growth.
- Vegetation, large shrubs or trees that limit access or interfere with basin operation shall be pruned or removed.
- Grass shall be mowed to 4″-9″ high and grass clippings shall be removed no less than 2 times per year.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance or prohibited vegetation from the Eugene Plant List (such as blackberries or English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when infiltration basin function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to control erosion.

Spill Prevention measures shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.



MAZZETTI
BHEGroup

PROJECT TITLE

SHORE PINES HOUSING PROJECT

NORTHWEST HOUSING ALTERNATIVES, INC

SHEET TITLE

EXHIBIT 4 - STORM DRAIN PLAN

DATE 08/12/2021
DESIGNER JAH
PROJECT 205-073
FILE Exhibit Drawings.dwg
SHEET No
EX-4

(SAMPLE)
STORMWATER MANAGEMENT FACILITY
CITY OF FLORENCE, OREGON
OPERATION & MAINTENANCE AGREEMENT

Sediment and other pollutants that degrade water quality will accumulate in urban stormwater facilities. The operation and maintenance of stormwater management facilities including the implementation of pollution reduction facilities is essential to the protection of the city's water quality. Removal of accumulated pollutants and sediment is important for proper operation. All property owners are expected to conduct business in a manner that promotes resource protection. This agreement contains specific provisions with respect to city maintenance of private stormwater management facilities and use of pollution reduction facilities.

Property Address:

Legal description:

Whereas, ____________________, herein referred to as Owner, has constructed improvements, including but not limited to buildings, pavement, and stormwater management facilities on the property described above. In order to further the goals of the City of Florence to ensure the protection and enhancement of water quality, the City of Florence and Owner hereby enter into this Agreement. The responsibilities of each party to this Agreement are identified below.

Recitals

1. Owner owns the above described property within the City of Florence, Lane County, Oregon.
2. Owner owns and operates stormwater management facilities approved and permitted as required by land use permit _________.
3. Owner has requested the city to provide the functional maintenance of the facility.
4. City approved construction plans dedicating the drainage system conveying the runoff from the residential properties to the stormwater facility as a public drainage system are on file.
5. Access routes for maintenance have been located within a dedicated public easement on private or commonly held property, within the public right-of-way or on city owned property.
6. Sufficient easement area, right-of-way width or property have been provided to accommodate the construction and maintenance of all existing and proposed utilities and public infrastructure.

Owner shall:

1. Implement the stormwater management plan included herein as Attachment "A". (Stormwater disposal and pollution reduction construction details, and source control protection, etc.)
2. Implement the stormwater maintenance plan included herein as Attachment "B". (Owner responsibilities such as vegetation control, debris pickup, etc.)
3. Inspect the facilities monthly and after significant storm events to determine if maintenance activity is warranted.
4. Maintain maintenance and inspection records (in the form of a log book) of steps taken to implement the programs referenced in (1) and (2) above. The log book shall be available for inspection by appointment at _________________________. The log book shall catalog any action taken, who took the action, when it was taken, how it was done, and any problems encountered or follow-on actions recommended. Maintenance items ("problems") listed in Attachment "A" shall be inspected as specified in the attached instructions or more often if necessary. The Owner and Users are encouraged to photocopy the individual checklists in Attachment "A" and use them to complete its inspections. These completed checklists would then, in combination, comprise the logbook.
5. Submit an annual report to the City of Florence regarding implementation programs referenced in (1) and (2) above. The report must be submitted on or before June 30 of each calendar year after execution of this agreement. At a minimum, the following items shall be included in the report:
    a. Name, address, and telephone number of the businesses, persons, or firms responsible for maintenance plan implementation, and the persons completing the report.

   b. Time period covered by the report.
   c. A chronological summary of activities conducted to implement the program and plan referenced in (1) and (2) above. A photocopy of the applicable sections of the logbook with any additional explanations needed shall suffice. For any activities conducted by paid parties, include a copy of the invoice for services.
   d. Any outline planned activities for the upcoming year.
6. Allow the City of Florence staff to inspect stormwater management facilities at the above referenced site.

City of Florence shall:

1. Execute the following periodic major maintenance on the subdivision’s pollution reduction facilities: sediment removal from facilities, resetting orifice sizes and elevations, and adding baffles.
2. Maintain all stormwater management facility elements within the public rights of way and dedicated easements, such as catch basins, weirs, oil-water separators, and pipes.
3. Provide technical assistance to the Owner in support of its operation and maintenance activities conducted pursuant to its maintenance and source control programs. Said assistance shall be provided upon request and as the City of Florence’s time and resources permit.
4. Review the annual report and conduct a minimum of one (1) site visit per year to discuss performance and problems with the stormwater management facilities.
5. Review the agreement with the Owner and modify it as necessary at least once every three (3) years.

Remedies:

1. If the City of Florence determines that maintenance that maintenance or repair work is required to be done to the stormwater management facilities located in the subdivision, the City of Florence shall give the Owner notice of the specific maintenance and/or repair required. The City of Florence shall set a reasonable time in which such work is to be completed the persons who were given notice. If the above required maintenance and/or repair is not completed within the time set by the City of Florence, written notice will be sent to the Owner stating the City of Florence’s intention to perform such maintenance and bill the Owner for all incurred expenses.
2. If, at any time, the City of Florence determines that the existing facility creates any imminent threat to public health, safety, or welfare, the City of Florence may take immediate measures to remedy said threat. No notice to the persons listed in Remedies (1), above shall be required under such circumstances. All other

Owner responsibilities shall remain in effect.

1. The Owner shall grant unrestricted authority to the City of Florence for access to any and all stormwater management facilities for the purpose of performing maintenance or repair as may become necessary under Remedies (1) and/or (2).
2. The Owner shall assume responsibility for the cost of maintenance and repairs to the stormwater management facilities, except for those maintenance actions explicitly assumed by the City of Florence in the preceding section. Such responsibility shall include reimbursement to the City of Florence within 90 days of the receipt of the invoice for any such work performed. Overdue payments will require payment of interest at the current legal rate for liquidated judgments. If legal action ensues, any costs or fees incurred by the City of Florence will be borne by the parties responsible for said reimbursements. This Agreement is intended to protect the value and desirability of the real property described above and to benefit all the citizens of the City of Florence. It shall run with the land and be binding on all parties having or acquiring any right, title, or interest or any part thereof, of real property in the subdivision. They shall inure to the benefit of each present or future successor in interest of said property or any part thereof or interest therein, and to the benefit of all citizens of the City of Florence.

This instrument is intended to be binding upon the parties hereto, their heirs, successors and assignees.

In Witness whereof, the undersigned has executed this instrument on this _________ day of __________________,20____.

OWNER(s):

Signature ____

____
(print name)

STATE OF OREGON,
County of Lane, ss:
This instrument was acknowledged before me this ________ day of _______________________________,
20__,by ______________________________________, owner(s) of the above described premises.

____
Notary Public for Oregon

____
My commission expires

MANAGER, CITY OF FLORENCE
In Witness whereof, the undersigned agent of the City of Florence has executed this instrument and acknowledged
the said instrument to be free and voluntary act and deed on this _______ day of _____________________,
20____ for the purposes herein mentioned and on oath states he is authorized to execute said instrument.

____
City Manager

STATE OF OREGON,
County of Lane, ss:
This instrument was acknowledged before me this ________ day of _______________________________,
20__, by ______________________________________, owner(s) of the above described premises.

____
Notary Public for Oregon

____
My commission expires