STORMWATER MANAGEMENT REPORT

for

Proposed Continuing Care Retirement Community

Prepared for:

REDWOOD-REC NEW PROVIDENCE, LLC

Block 320; Lots 18.01, 15 & 17
575 Mountain Ave
New Providence
Union County, New Jersey

Prepared by:

BOHLER
NJ Certification of Authorization: 24GA28161700

30 Independence Blvd., Suite 200
Warren, NJ 07059
908-668-8300

R. L. Streker, P.E.
New Jersey Professional Engineer
License No. 45344

April 2020

BENJ File No. J100690.04

Table of Contents

1. Introduction 1
2. Pre-Development Conditions 2
   2.1 Topography 2
   2.2 Site Soils 3
3. Post-Development Conditions 4
   3.1 Post-Development Conditions 4
      3.1.1 Surface Cover / Development: 4
      3.1.2 Drainage: 4
   3.2 Stormwater Management Facilities 5
4. Methodology 6
   4.1 Calculation Software 6
   4.2 Runoff "CN" Values 6
   4.3 Time of Concentration 7
   4.4 Pipe Sizing 7
   4.5 Infiltration Rates 7
   4.6 Seasonal Groundwater 7
   4.7 Water Quality / TSS Removal 7
   4.8 Water Quantity 7
   4.9 Groundwater Recharge 10
   4.10 Soil Erosion and Sediment Control 10
   4.11 Low Impact Development and Non-Structural Management Facilities 10
      4.11.1 Preservation of Natural Area 11
      4.11.2 Native Ground Cover 11
      4.11.3 Impervious Area Management 11
      4.11.4 Preventative Source Controls 11
5. Conclusions 11

Appendices

A. Pre- and Post- Development Hydrographs

- Water Quality Storm Event
- 2-Year Storm Event
- 10-Year Storm Event
- 100-Year Storm Event
- Time of Concentration

B. Design Calculations

- NJ Groundwater Recharge Spreadsheet
- Structure Report
- Pipe Sizing
- Conduit Outlet Protection Calculations
- Low Impact Development Checklist

C. Maps & Documentation

- Tax Map
- Aerial Map
- USGS Map
- Soil Map
- Hydrologic Soils Group
- Drainage Area Maps
  - Existing Drainage Area Map
  - Proposed Drainage Area Map
  - Inlet Area Map

1. Introduction

The purpose of this report is to analyze the stormwater drainage conditions that will occur as a result of the proposed development (by Redwood-ERC New Providence, LLC) located at the intersection of Mountain Ave. and Southgate Rd within the Borough of New Providence, Union County, New Jersey. The subject site is more specifically defined as Block 302, Lots 18.01, 15 and 17. Said lots will hereafter be referenced as "the Site", and its location is illustrated on the USGS Map and Site Location Map within the Appendices of this report. The site consists of approximately +/-24.62 acres, with a total study area of 25.18 acres. The site is currently developed and vacant with the former Linde Group headquarters on the property. Under existing conditions, the site is predominantly developed with several buildings, parking lots, access drives, sidewalks, and landscaping. Undeveloped portions can be characterized as upland and wetland forest with emergent wetlands located in the northeastern portions of the property which are part of the existing, overgrown and unmaintained stormwater basin.

As mentioned above, Redwood-ERC New Providence, LLC is proposing to clear the existing site features and construct a multi-building retirement community along with parking/circulation areas, landscaping, stormwater management and utility improvements. This facility will serve as an expansion to the existing retirement community on the adjacent lot.

This Stormwater Management Report is focused on the site as a whole despite being planned as a phased development. As each phase is constructed, additional stormwater management facilities will be constructed as required.

As stated, this facility will be constructed in five (5) phases. Phase 1 will consist of the two (2) eastern most buildings, while the remaining phases will consist of the buildout of the remaining buildings. Based on the impervious coverage reduction for the construction of Phase 1, only the existing detention basin is required to meet jurisdictional stormwater requirements. The addition of the later phases will trigger the quantity reductions, quality, and groundwater recharge requirements. Additional stormwater management facilities will be installed at the time of the later phase construction.

The scope of this study includes an analysis of the existing drainage characteristics of the site in its condition prior to proposed development. This Report comparatively analyzes the pre-development site runoff to the post development site runoff. Calculations documenting the design of the stormwater

management system, as illustrated on the Site Plan documents prepared by Bohler Engineering are included within the Appendix of this Report.

The following items shall be addressed within this report:

- Calculations for water quality utilizing the NJDEP 1.25”/2-hour water quality design storm.
- Stormwater Pollutant (TSS) Removal.
- Calculations for pre- and post-development storm events for the 2-, 10-, 25- and 100-year design storm peak runoff rate for the study area.
- Narrative of pre- and post-development conditions with calculations to substantiate derived runoff coefficients and times of concentration.
- Calculations for the proposed stormwater management system (consists of aboveground detention, and underground infiltration basin) including inflow hydrographs, outflow hydrographs, and a storage volume versus depth table.
- Calculations to substantiate the capacity of the proposed stormwater conveyance system.
- Pre- and post-development annual groundwater recharge analysis for the subject Site.

The primary design constraints for this project are based on the NJDEP Rules, Regulations and design standards, which have been adopted by New Providence, summarized as follows:

- Provide water quality if an additional one-quarter acre of impervious surface is proposed within the development site.
- Provide water quantity reduction and the proposed peak runoff rate from the development to be less than that under the existing condition.
- Demonstrate that post-developed project site maintains 100% of the site’s pre-developed average annual groundwater recharge volume.

2. Pre-Development Conditions

The overall study area is approximately +/- 25.18 acres, and the majority of the area is developed with some off-site drainage area that is outside of the property line.

2.1 Topography

The study area is generally characterized by significantly sloping topography. The majority of the site slopes from south to north. The southern property line is bordered by Mountain Ave, approximately 89 feet above the northern property line. The portions of the studied area that do not flow with the majority of the site discharge to the nearest property lines.

The existing site conditions for the study area are illustrated on the "Existing Drainage Area Map" included within the Appendix of this report. This map is based on a Topographic Survey, prepared by Control Point Associates, Inc. dated on 9/04/2019 last revised on 2/06/2020. Based on the analysis of the existing topography of the subject property, the existing conditions for the study area are broken down into three (3) watersheds as follows:

- **Drainage Area EDA-1** consists of +/- 21.261 acres. Stormwater flows overland from Mountain Ave. to Southgate in a south to north direction. The stormwater runoff from this drainage area eventually discharges into the existing storm conveyance system within South Gate Road, but first flows through the existing detention basin in the north side of the site. The detention basin discharges through existing drainage pipe to Point of Interest (POI #1) as shown on the Existing Drainage Area Map. A portion of EDA-1 includes area that does not drain into the existing onsite basin but does ultimately reach the storm system within South Gate Road. This area is denoted as EDA-1B.
- **Drainage Area EDA-2** consists of +/- 0.476 acres. Stormwater flows overland from the property frontage in a north to south direction to southern property line, and eventually to Point of Interest (POI #2) as shown on the Existing Drainage Area Map.
- **Drainage Area EDA-3** consists of +/- 2.353 acres. Stormwater flows overland from the subject property in a south to northern direction to the neighboring properties. This drainage area is classified as Point of Interest (POI #3).

2.2 Site Soils

The site soils as depicted by the Web Soil Survey are as follows:

Soil Symbol	Soil Description	Hydrologic Soil Group
AmhB	Amwell silt loam, 2 to 6 percent slope	C
HakB	Haledon Loam, 3 to 8 percent slope	C
NehBc	Neshaminy Silt Loam, 0 to 6 percent slope	B
NenD	Neshaminy-Urban Land complex, 12 to 18 percent slope	B
UdktB	Udorthents, Loamy substratum, 0 to 8 percent slope	D
UR	Urban Land	--

3. Post-Development Conditions

3.1 Post-Development Conditions

3.1.1 Surface Cover / Development:

The post-development condition for the development includes the construction of a Continuing Care Retirement Community with +/- 229,870 SF building area with associated parking fields, driveways, sidewalks, utility infrastructure, stormwater management facilities, and other site improvements. The proposed site is designed in a manner that generally maintains the existing drainage patterns. The total proposed land disturbance is approximately +/- 25 acres with approximately +/- 11 acres of impervious area. The proposed stormwater conveyance system will collect the runoff from the proposed building roof and proposed pavement areas, and eventually drains to the proposed stormwater management facilities (consisting of the existing aboveground detention basin with a modified outlet control structure). It shall be noted that the current existing above ground basin does not function as intended (allowing water to discharge from the emergency spillway during the 100-yr storm) and will be brought up to current NJDEP design standards regarding water quantity. As a result, the proposed stormwater management system will be designed per current NJDEP standards, and **no additional discharge is anticipated to the points of analysis as part of this design.**

3.1.2 Drainage:

The stormwater management facilities for the proposed development have been designed to maintain the existing drainage patterns to the fullest extent possible, and to meet the governing agencies' requirements with respect to water quality, groundwater recharge and peak runoff rate reductions. Under post-development conditions, three (3) drainage areas are proposed as depicted on the "Proposed Drainage Area Map" included within Appendix C of this report.

- **Drainage Area PDA-1A** consists of approximately +/- 21.93 acres, of which 11.11 acres are impervious surface that includes the majority of the proposed buildings with associated parking fields, driveways, sidewalks, utility infrastructure, stormwater management facilities, and other site improvements. The runoff from PDA-1 building roof areas as well as pavement areas will be captured via inlets and conveyed via a series of pipes into the existing aboveground detention basin under the total phase buildout. The existing detention basin will

be supplemented with an underground infiltration basin to meet the groundwater recharge requirements. Two manufactured treatment devices are required under the total phase buildout as well as meet the water quality requirements for the proposed development. The existing detention basin will have two discharge points. One outflow from the basin will be released in a controlled rate and discharged towards the northern property line into the existing conveyance system. The other outflow from the basin will be conveyed through the modified emergency spillway in storms that exceed the 100-yr event and discharge directly into South Gate Rd as it does in existing conditions.

- **Drainage Area PDA-1B** consists of approximately +/- 1.132 acres, of which 0.007 acres are impervious surface. This drainage area includes a small portion of site access drive, undisturbed offsite tributary area. The stormwater runoff from this area will join the outflow from the basin and discharge into South Gate Road. Overall, flow is greatly reduced to POI #1 when compared with that under the existing conditions.
- **Drainage Area PDA-2** consists of approximately +/- 0.397 acres and is mainly the side slope along the southern property line as the result of site grading. The stormwater runoff from this area will drain towards Mountain Ave. matching the existing conditions.
- **Drainage Area PDA-3** consists of approximately +/- 1.713 acres and when compared with drainage EDA-3, PDA-3 is reduced in size. The stormwater runoff from this area will eventually discharge across the northern property line towards neighboring properties, as it does under existing conditions.

Since the overall drainage area for PDA-2 and PDA-3 either remain the same or are reduced in size when compared with EDA-2 and EDA-3 respectively; it is expected that the overall drainage condition for these drainage areas will not be negatively impacted due to the proposed site developments. As a result, this drainage study will focus on Point of Interest #1 as specified on the Drainage Area Map: POI #1 (EDA-1 vs. PDA-1).

3.2 Stormwater Management Facilities

The proposed stormwater management system (consisting of the existing aboveground detention basin) will be used as the primary stormwater management facility for the proposed site development including the buildings, driveways, parking areas and landscape areas on the site. The aboveground detention basin supplemented with the infiltration basin and the manufactured treatment devices will

meet the NJDEP infiltration basin standards, including maintaining at least 2 feet between the bottom of the infiltration basin and the seasonal high ground water table based on available geotechnical testing data. The water quality storm will be fully treated within the manufactured treatment devices with bypass weirs for larger storm events.

Since this existing detention basin has gone un-maintained and filled with sediment, it well be dredged out and restored to its original bottom grade as part of a Freshwater Wetlands permit application.

4. Methodology

The stormwater management facilities have been designed in accordance with the local, county and state requirements.

4.1 Calculation Software

The calculations included within this report were performed using hydrologic software, HydroCAD (Version 10.00) by HydroCAD Software Solutions, LLC. The HydroCAD software was used to develop runoff hydrographs, outlet structure configurations, and basin routings using the SCS TR-20 methodology.

4.2 Runoff "CN" Values

The soil classifications for use with runoff curve numbers (CN) were taken from the NRCS Web Soil Survey (see Appendix C).

Runoff CN values for the soil groups were assigned to various surfaces as follows:

Soil Group	A	B	C	D
Ground Cover	CN Value			
Open Space	39	61	74	80
Wooded Area	30	55	70	77
Impervious/Building	98	98	98	98

Runoff CN value calculations for pre- and post-developed conditions were generated using HydroCAD software and are included within the Appendix of this report.

4.3 Time of Concentration

The time of concentration (Tc) and travel time calculations have been completed in accordance with Chapter 3 of the SCS Technical Release 55 Manual and Chapter 15 of the NRCS Engineering Handbook. As a conservative assumption, when Tc is less than 10 minutes, 10 minutes is used for both pervious and impervious areas under post-development conditions. Under pre-development conditions, Tc was calculated for drainage area EDA-1 since they are longer than 10 minutes. Using the McCuen-Spiess equation to calculate sheet flow length and shallow concentrated flow values for corresponding sections of the flow path of water, the Tc was calculated to be a total of 10.7 minutes for EDA-1.

4.4 Pipe Sizing

Pipe sizing for the stormwater conveyance system is calculated using Rational Method and Manning's Equation with a 25-year design storm. Conveyance calculations and an "Inlet Drainage Area Map" supporting pipe sizing results are included in the Appendix of this report.

4.5 Infiltration Rates

Infiltration testing is currently in progress and not completed at this time. To be conservative, the minimum allowed infiltration rate of 0.5" per hour will be used for calculations per the NJDEP BMP manual. Results of the infiltration testing will be submitted to the Borough and NJDEP for review once available.

4.6 Seasonal Groundwater

Based on available geotechnical testing results, a minimum of 2' separation is achieved between the proposed infiltration basin bottom and the seasonal high groundwater table.

4.7 Water Quality / TSS Removal

Runoff from the water quality storm will be conveyed into in the proposed manufactured treatment devices and as a result, the water quality requirement (80% TSS removal) per NJDEP is achieved. Please refer to Appendix A for water quality storm routing information, and Appendix B for basin drain down time calculation.

4.8 Water Quantity

The quantity reduction for post-construction development as detailed in the NJDEP Stormwater Management Regulations includes a 50% reduction for the 2-year storm, a 25% reduction for the 10-year storm and 20% reduction for the 100-year storm per N.J.A.C. 7:8-5.4 (3)(iii).

The following tables show the comparison between the pre-development and the post-development stormwater runoff rates for the Point of Interest and demonstrate that the site design meets the quantity reduction (peak runoff rate reduction) requirement.

RUNOFF RATE SUMMARY CHART

Phase 1

Analysis of 'EDA-1 vs. PDA-1'

Existing vs. Proposed			
	2 YEAR	**10 YEAR**	**100 YEAR**
Pre-Development Flow Rate	9.07	12.30	30.10
NJDEP Reduction Rate	N/A*	N/A*	N/A*
Maximum Allowable Post-Development Flow Rate	9.07	12.30	30.10
Post Development Flow Rate	3.88	7.68	20.10
NJDEP Reduction Rate Achieved?	YES	YES	YES

*Phase 1 development will not trigger requirements for stormwater quantity, quality or recharge.

RUNOFF RATE SUMMARY CHART

To POI #1

Analysis of 'EDA-1 vs. PDA-1'

Existing vs. Proposed			
	2 YEAR	**10 YEAR**	**100 YEAR**
Pre-Development Flow Rate	9.07	12.30	30.10
NJDEP Reduction Rate	50%	25%	20%
Maximum Allowable Post-Development Flow Rate	4.83	9.71	24.34
Post Development Flow Rate	4.81	9.71	23.98
NJDEP Reduction Rate Achieved?	YES	YES	YES

RUNOFF RATE SUMMARY CHART

To POI #2

Analysis of 'EDA-2 vs. PDA-2'

Existing vs. Proposed			
	2 YEAR	10 YEAR	100 YEAR
Pre-Development Flow Rate	0.46	1.16	2.82
NJDEP Reduction Rate	N/A	N/A	N/A
Maximum Allowable Post-Development Flow Rate	0.46	1.16	2.82
Post Development Flow Rate	0.44	1.13	2.73
NJDEP Reduction Rate Achieved?	YES	YES	YES

RUNOFF RATE SUMMARY CHART

To POI #3

Analysis of 'EDA-3 vs. PDA-3'

Existing vs. Proposed			
	2 YEAR	10 YEAR	100 YEAR
Pre-Development Flow Rate	2.81	6.12	13.38
NJDEP Reduction Rate	N/A	N/A	N/A
Maximum Allowable Post-Development Flow Rate	2.81	6.12	13.38
Post Development Flow Rate	2.22	4.75	10.22
NJDEP Reduction Rate Achieved?	YES	YES	YES

4.9 Groundwater Recharge

The current development proposes underground detention basin to address the groundwater recharge requirements per current NJDEP BMP design standards. Per the New Jersey Stormwater Best Management Practices Manual, the proposed development shall comply with one of the following two groundwater recharge requirements:

Requirement 1: That 100 percent of the Site's average annual pre-developed groundwater recharge volume be maintained after development; or

Requirement 2: That 100 percent of the difference between the Site's pre- and post-development 2-year runoff volumes be infiltrated.

For this development, as illustrated in the calculations, Requirement #1 is met to satisfy the groundwater recharge requirement. Please refer to the Groundwater Recharge Analysis located in Appendix B of this report.

4.10 Soil Erosion and Sediment Control

The Soil Erosion and Sediment Control plans and details are included within the Site Plan documents prepared by Bohler Engineering and must be followed throughout construction. Silt fences, stabilized construction entrances, temporary stockpiles and inlet filters are proposed during construction. This report and the Site Plan documents prepared by Bohler Engineering are being submitted to the Freehold Soil Conservation District for approval.

4.11 Low Impact Development and Non-Structural Management Facilities

In accordance with the NJDEP regulations and the latest *New Jersey Stormwater Best Management Practices Manual*, several non-structural stormwater management strategies have been incorporated into the design of the site and are listed below:

4.11.1 Preservation of Natural Area

The design of the improvements proposed on the site has preserved critical natural areas as part of the development. Areas that are classified as wetland and associated buffer have been identified on site and are largely left outside the limits of disturbance of the proposed development. The natural areas will be protected during construction.

4.11.2 Native Ground Cover

Native plants including ground cover, shrubs and trees instead of turf grass have been proposed as part of the landscape design for the site. The native plantings will also require little or no irrigation once they are established.

4.11.3 Impervious Area Management

The current site plan has unground parking decks that limit surface parking and reduce the over land pollutant loading.

4.11.4 Preventative Source Controls

The proposed development complies with this strategy by providing trash receptacles located throughout the site at key points and individual unit trash collection.

Additional low impact development strategies will be discussed in the "Low Impact Development Checklist" located in the Appendix B of this report.

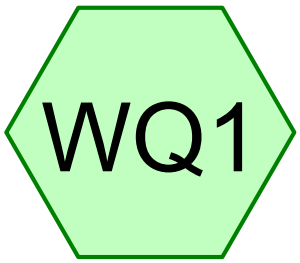
5. Conclusions

In summary, the proposed stormwater management system illustrated on the drawings prepared by Bohler Engineering NJ, LLC meets the requirements set forth by all reviewing jurisdictional agencies and the NJDEP Stormwater Regulations. Specifically, the design meets water quality, peak runoff rate reduction and groundwater recharge requirements. As a result, our office would anticipate the proposed development will have no negative impact on the existing stormwater management system in the vicinity of the subject parcel.

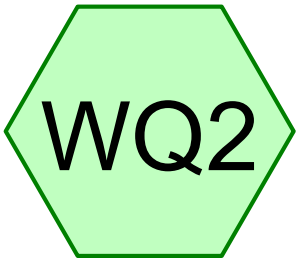
A. PRE- AND POST - DEVELOPMENT HYDROGRAPHS

- **Water Quality Storm Event**
- **2-Year Storm Event**
- **10-Year Storm Event**
- **25-Year Storm Event**
- **100-Year Storm Event**

WATER QUALITY STORM EVENT



PDA 1A WQ1



PDA 1A WQ2

Subcat Reach Pond Link

Routing Diagram for J100690.04 -Erickson WQr
Prepared by Bohler Engineering, Printed 3/10/2020
HydroCAD® 10.00-20 s/n 02612 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.278	98	Paved parking, HSG D (WQ1, WQ2)
4.278	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
4.278	HSG D	WQ1, WQ2
0.000	Other	
4.278		**TOTAL AREA**

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment WQ1: PDA 1A WQ1 Runoff Area=96,338 sf 100.00% Impervious Runoff Depth=1.03"
Tc=10.0 min CN=98 Runoff=5.70 cfs 0.191 af

Subcatchment WQ2: PDA 1A WQ2 Runoff Area=89,994 sf 100.00% Impervious Runoff Depth=1.03"
Tc=10.0 min CN=98 Runoff=5.32 cfs 0.178 af

Total Runoff Area = 4.278 ac Runoff Volume = 0.369 af Average Runoff Depth = 1.03"
0.00% Pervious = 0.000 ac 100.00% Impervious = 4.278 ac

Summary for Subcatchment WQ1: PDA 1A WQ1

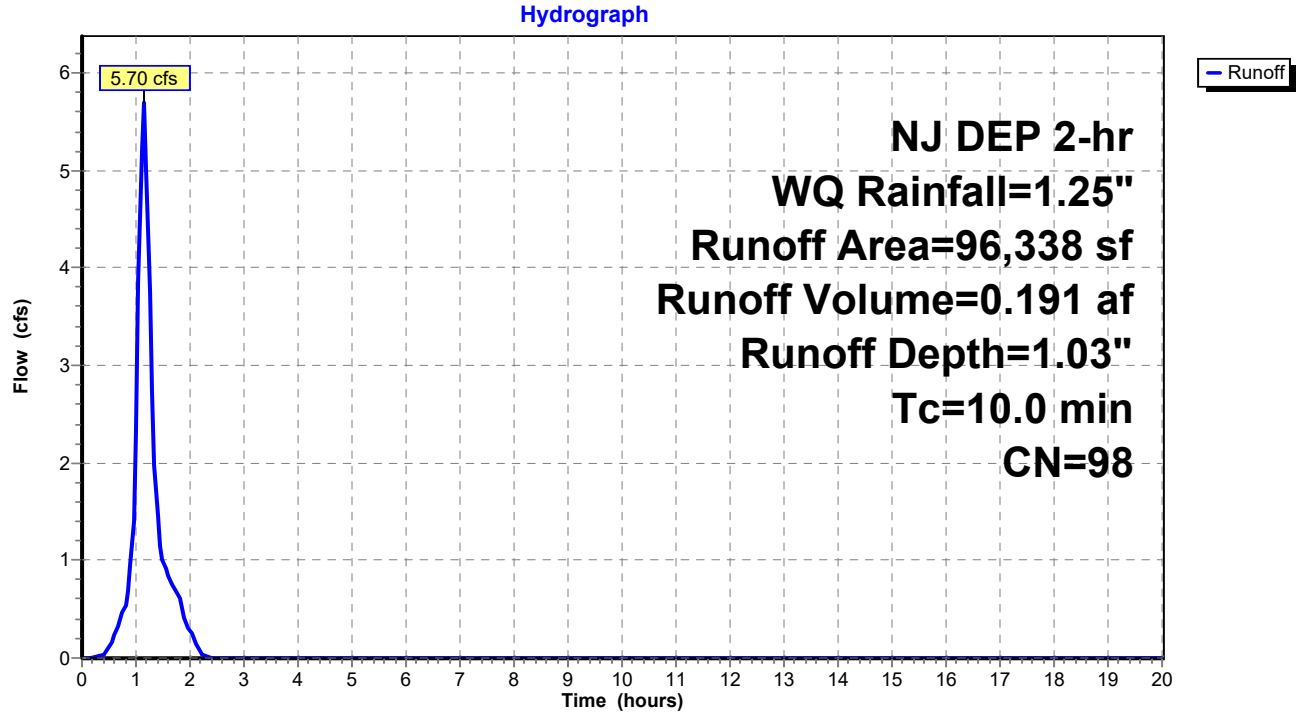
Runoff = 5.70 cfs @ 1.15 hrs, Volume= 0.191 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr WQ Rainfall=1.25"

Area (sf)	CN	Description
96,338	98	Paved parking, HSG D
96,338		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment WQ1: PDA 1A WQ1



Summary for Subcatchment WQ2: PDA 1A WQ2

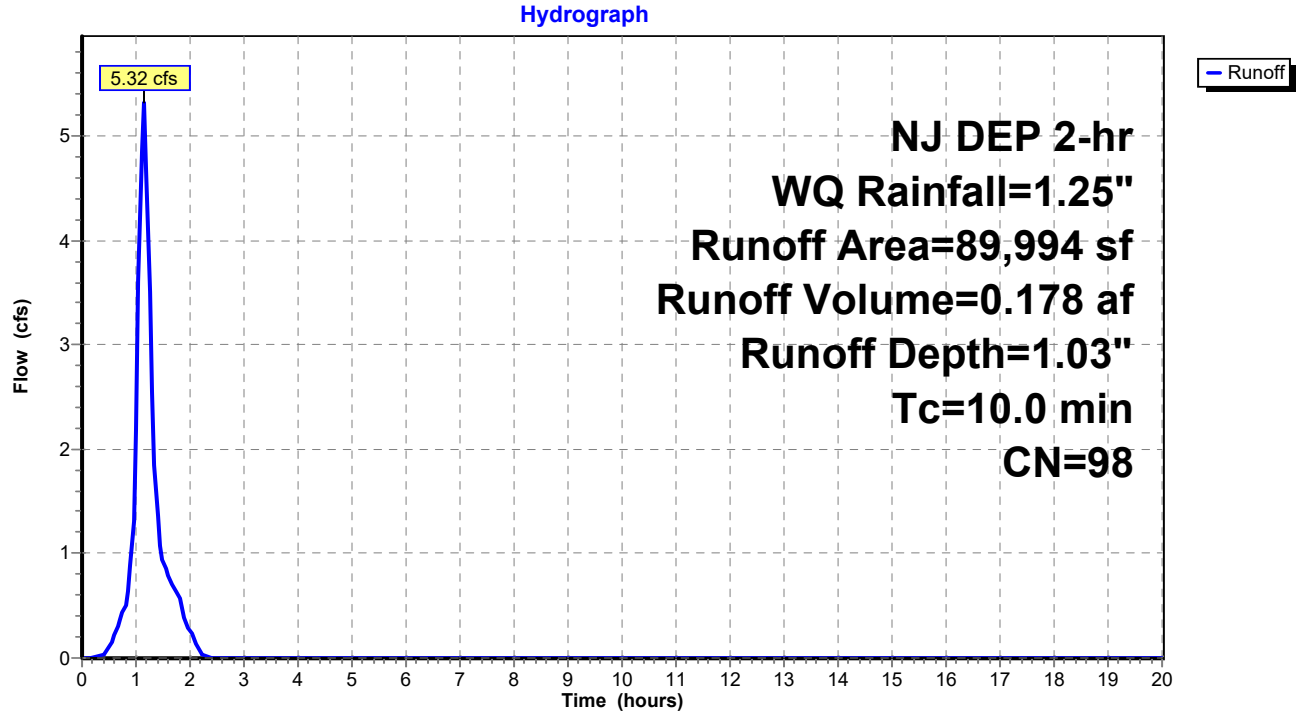
Runoff = 5.32 cfs @ 1.15 hrs, Volume= 0.178 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr WQ Rainfall=1.25"

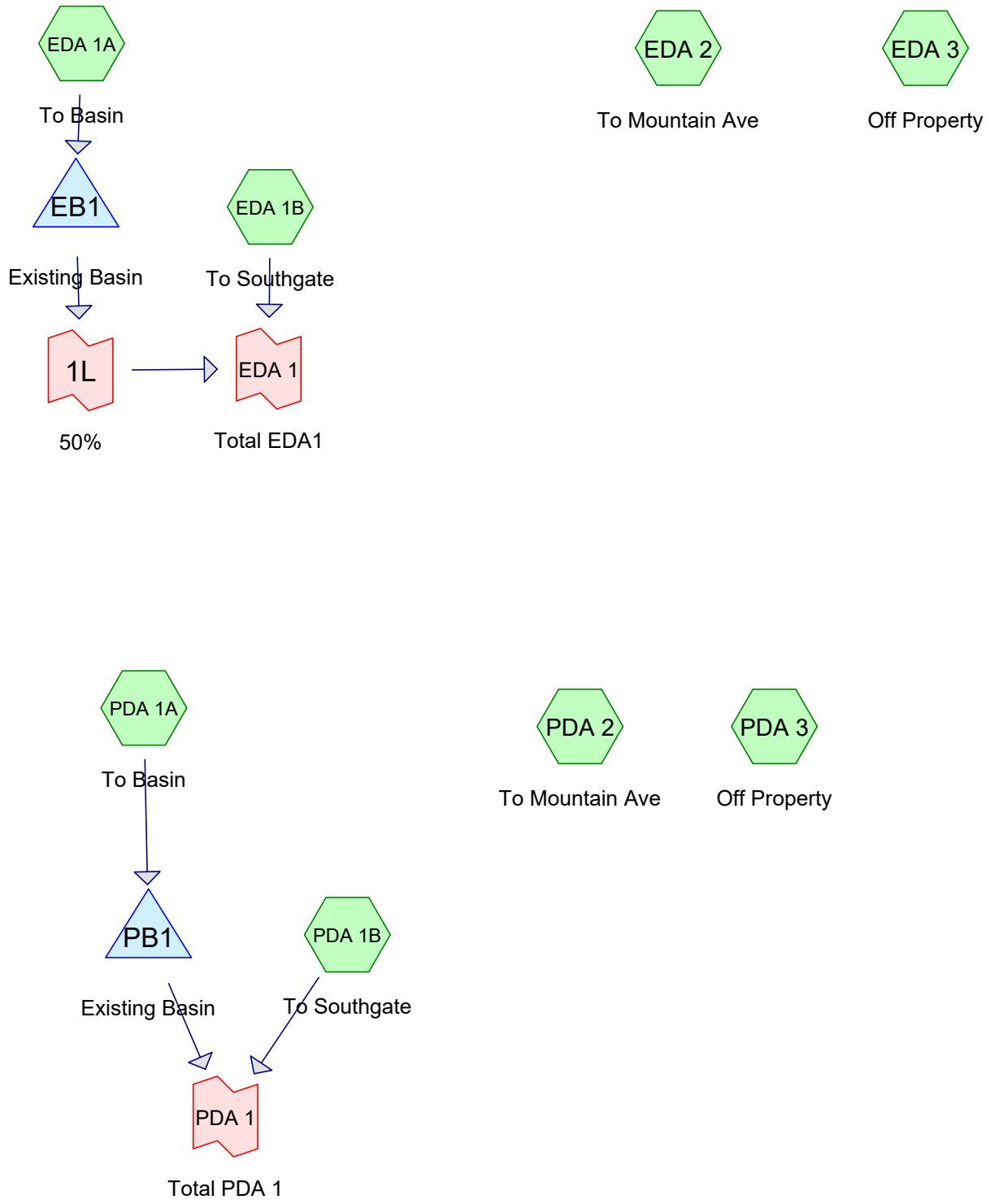
Area (sf)	CN	Description
89,994	98	Paved parking, HSG D
89,994		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment WQ2: PDA 1A WQ2



2-YEAR STORM EVENT



Routing Diagram for J100690.04 -Erickson 2-yr
Prepared by Bohler Engineering, Printed 3/10/2020
HydroCAD® 10.00-20 s/n 02612 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.311	61	>75% Grass cover, Good, HSG B (EDA 1A, EDA 1B, EDA 2, EDA 3, PDA 1A, PDA 1B, PDA 2, PDA 3)
13.547	74	>75% Grass cover, Good, HSG C (EDA 1A, EDA 1B, EDA 2, EDA 3, PDA 1A, PDA 1B, PDA 2, PDA 3)
6.876	80	>75% Grass cover, Good, HSG D (EDA 1A, EDA 1B, EDA 3, PDA 1A, PDA 1B, PDA 3)
4.621	80	>75% Grass cover, Good, HSG D (UR Zone) (EDA 1A, EDA 3, PDA 1A)
10.928	98	Paved parking, HSG D (EDA 1A, EDA 1B, PDA 1A, PDA 1B)
6.609	98	Roofs, HSG D (EDA 1A, PDA 1A)
0.893	98	Unconnected pavement, HSG D (EDA 1A)
1.462	98	Unconnected pavement, Sidewalk (PDA 1A)
0.104	98	Unconnected pavement, Walls (PDA 1A)
50.350	**84**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
5.311	HSG B	EDA 1A, EDA 1B, EDA 2, EDA 3, PDA 1A, PDA 1B, PDA 2, PDA 3
13.547	HSG C	EDA 1A, EDA 1B, EDA 2, EDA 3, PDA 1A, PDA 1B, PDA 2, PDA 3
29.927	HSG D	EDA 1A, EDA 1B, EDA 3, PDA 1A, PDA 1B, PDA 3
1.566	Other	PDA 1A
50.350		**TOTAL AREA**

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA 1A: To Basin Runoff Area=926,140 sf 41.71% Impervious Runoff Depth>1.67"
Flow Length=1,117' Tc=10.7 min CN=84 Runoff=38.03 cfs 2.966 af

Subcatchment EDA 1B: To Southgate Runoff Area=47,239 sf 0.69% Impervious Runoff Depth>1.03"
Tc=10.0 min CN=74 Runoff=1.18 cfs 0.093 af

Subcatchment EDA 2: To Mountain Ave Runoff Area=23,740 sf 0.00% Impervious Runoff Depth>0.82"
Tc=10.0 min CN=70 Runoff=0.46 cfs 0.037 af

Subcatchment EDA 3: Off Property Runoff Area=99,514 sf 0.00% Impervious Runoff Depth>1.15"
Tc=10.0 min CN=76 Runoff=2.81 cfs 0.218 af

Subcatchment PDA 1A: To Basin Runoff Area=21.933 ac 50.67% Impervious Runoff Depth>1.83"
Tc=10.0 min CN=86 Runoff=43.44 cfs 3.339 af

Subcatchment PDA 1B: To Southgate Runoff Area=49,309 sf 0.62% Impervious Runoff Depth>1.03"
Tc=10.0 min CN=74 Runoff=1.24 cfs 0.097 af

Subcatchment PDA 2: To Mountain Ave Runoff Area=17,294 sf 0.00% Impervious Runoff Depth>0.83"
Tc=0.0 min CN=70 Runoff=0.44 cfs 0.027 af

Subcatchment PDA 3: Off Property Runoff Area=74,628 sf 0.00% Impervious Runoff Depth>1.21"
Tc=10.0 min CN=77 Runoff=2.22 cfs 0.172 af

Pond EB1: Existing Basin Peak Elev=367.78' Storage=49,235 cf Inflow=38.03 cfs 2.966 af
Outflow=8.67 cfs 2.881 af

Pond PB1: Existing Basin Peak Elev=368.48' Storage=72,320 cf Inflow=43.44 cfs 3.339 af
Outflow=4.33 cfs 2.798 af

Link 1L: 50% x 0.50 Inflow=8.67 cfs 2.881 af
Primary=4.34 cfs 1.441 af Secondary=4.34 cfs 1.441 af

Link EDA 1: Total EDA1 Inflow=4.83 cfs 1.534 af
Primary=4.83 cfs 1.534 af

Link PDA 1: Total PDA 1 Inflow=4.81 cfs 2.895 af
Primary=4.81 cfs 2.895 af

Total Runoff Area = 50.350 ac Runoff Volume = 6.951 af Average Runoff Depth = 1.66"
60.29% Pervious = 30.355 ac 39.71% Impervious = 19.996 ac

Summary for Subcatchment EDA 1A: To Basin

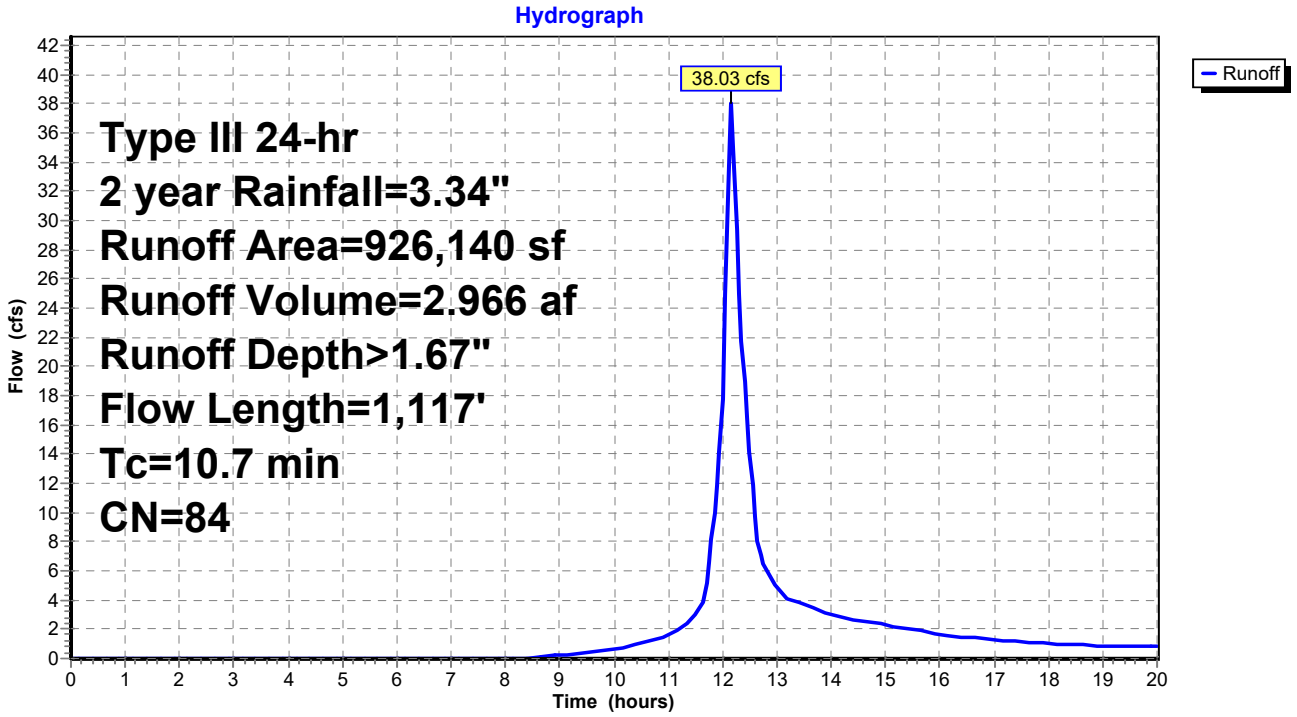
Runoff = 38.03 cfs @ 12.15 hrs, Volume= 2.966 af, Depth> 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.34"

	Area (sf)	CN	Description
	289,374	98	Paved parking, HSG D
	58,022	98	Roofs, HSG D
	88,253	61	>75% Grass cover, Good, HSG B
	284,975	74	>75% Grass cover, Good, HSG C
	83,505	80	>75% Grass cover, Good, HSG D
*	83,112	80	>75% Grass cover, Good, HSG D (UR Zone)
	38,899	98	Unconnected pavement, HSG D
	926,140	84	Weighted Average
	539,845		58.29% Pervious Area
	386,295		41.71% Impervious Area
	38,899		10.07% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	156	0.0550	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.2	352	0.0889	4.80		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	609	0.0680	15.50	27.39	**Pipe Channel, RCP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
10.7	1,117	Total			

Subcatchment EDA 1A: To Basin



Summary for Subcatchment EDA 1B: To Southgate

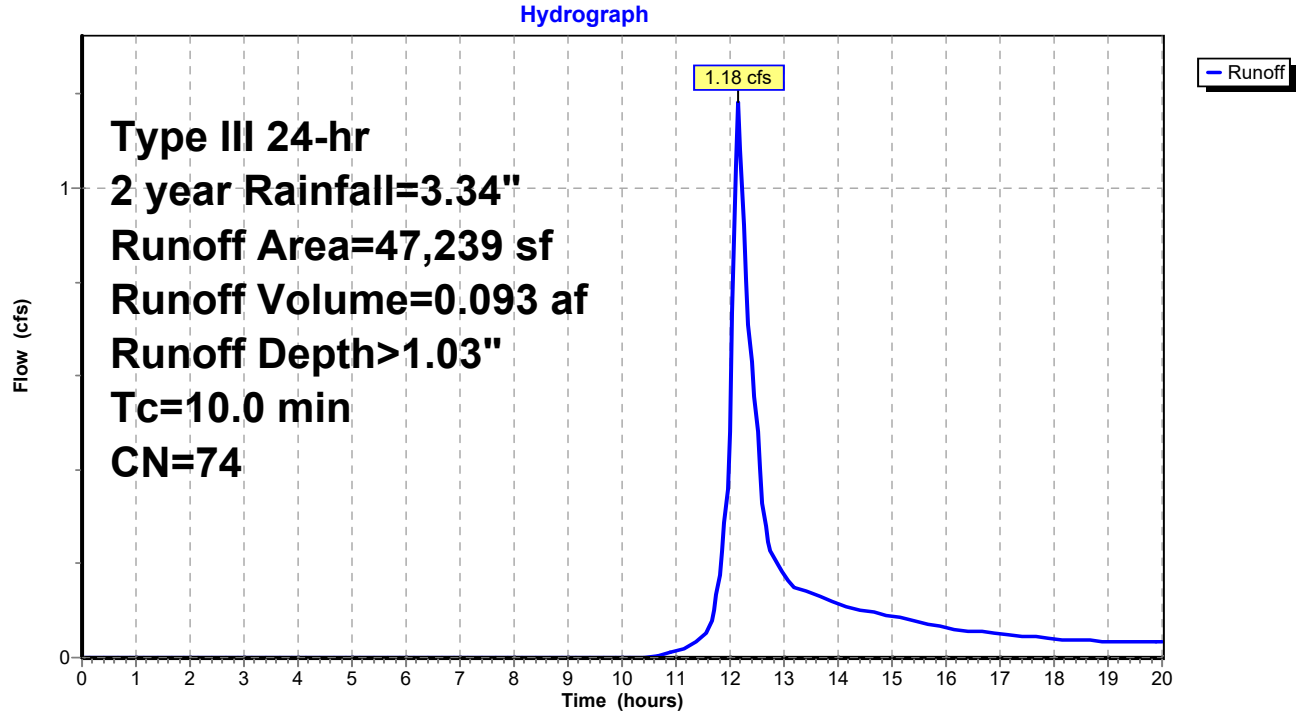
Runoff = 1.18 cfs @ 12.15 hrs, Volume= 0.093 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.34"

Area (sf)	CN	Description
3,194	61	>75% Grass cover, Good, HSG B
36,234	74	>75% Grass cover, Good, HSG C
7,487	80	>75% Grass cover, Good, HSG D
324	98	Paved parking, HSG D
47,239	74	Weighted Average
46,915		99.31% Pervious Area
324		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment EDA 1B: To Southgate



Summary for Subcatchment EDA 2: To Mountain Ave

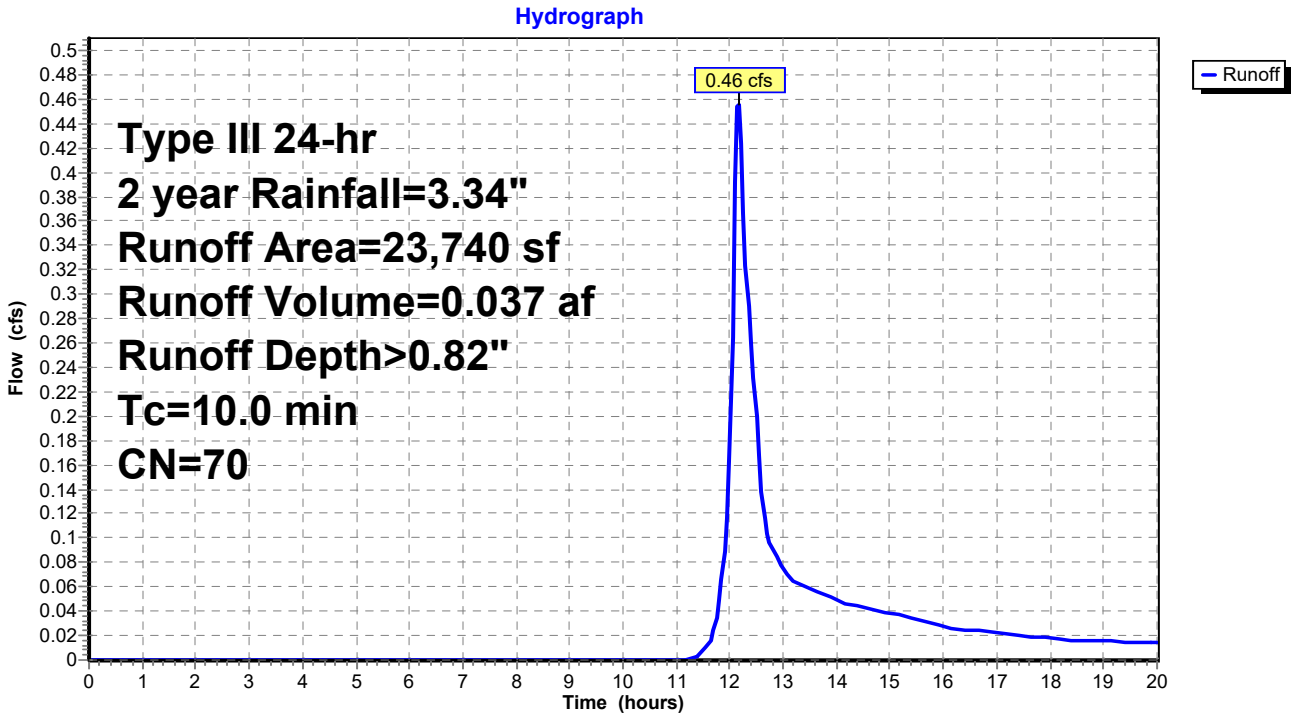
Runoff = 0.46 cfs @ 12.16 hrs, Volume= 0.037 af, Depth> 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.34"

Area (sf)	CN	Description
7,806	61	>75% Grass cover, Good, HSG B
15,934	74	>75% Grass cover, Good, HSG C
23,740	70	Weighted Average
23,740		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment EDA 2: To Mountain Ave



Summary for Subcatchment EDA 3: Off Property

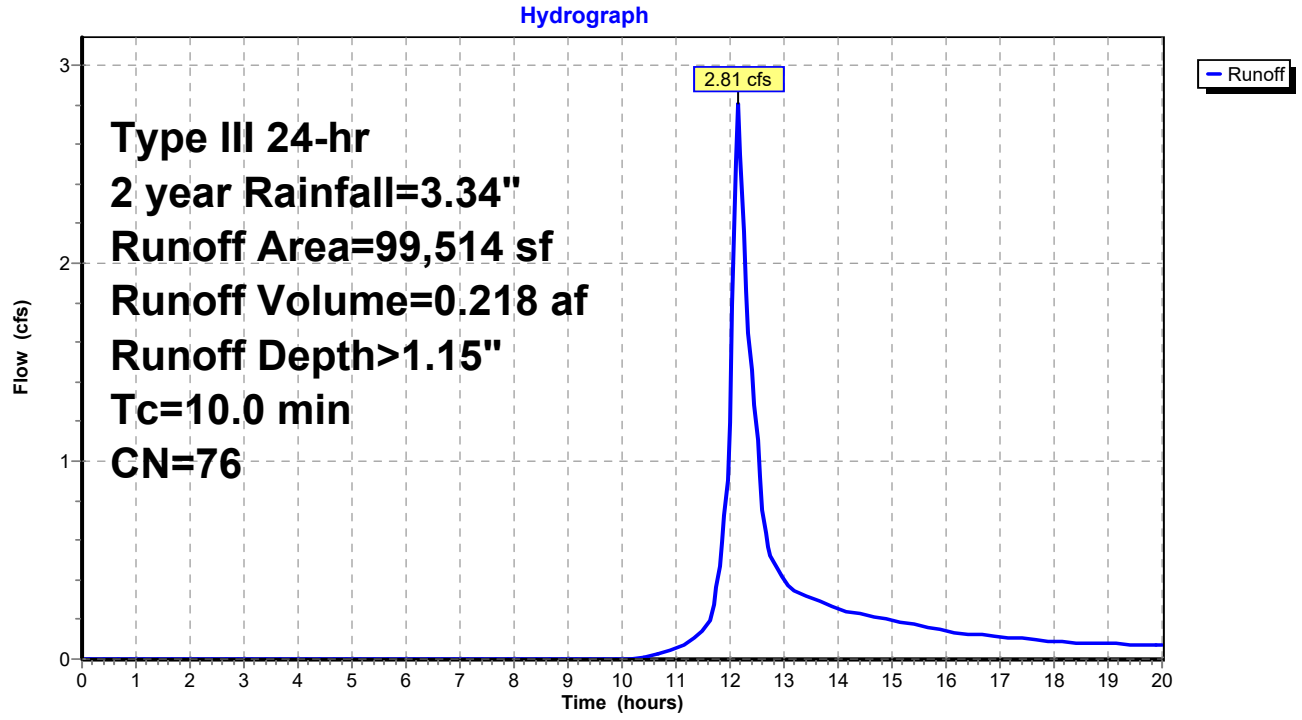
Runoff = 2.81 cfs @ 12.15 hrs, Volume= 0.218 af, Depth> 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.34"

	Area (sf)	CN	Description
	20,666	61	>75% Grass cover, Good, HSG B
	2,183	74	>75% Grass cover, Good, HSG C
	61,865	80	>75% Grass cover, Good, HSG D
*	14,800	80	>75% Grass cover, Good, HSG D (UR Zone)
	99,514	76	Weighted Average
	99,514		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment EDA 3: Off Property



Summary for Subcatchment PDA 1A: To Basin

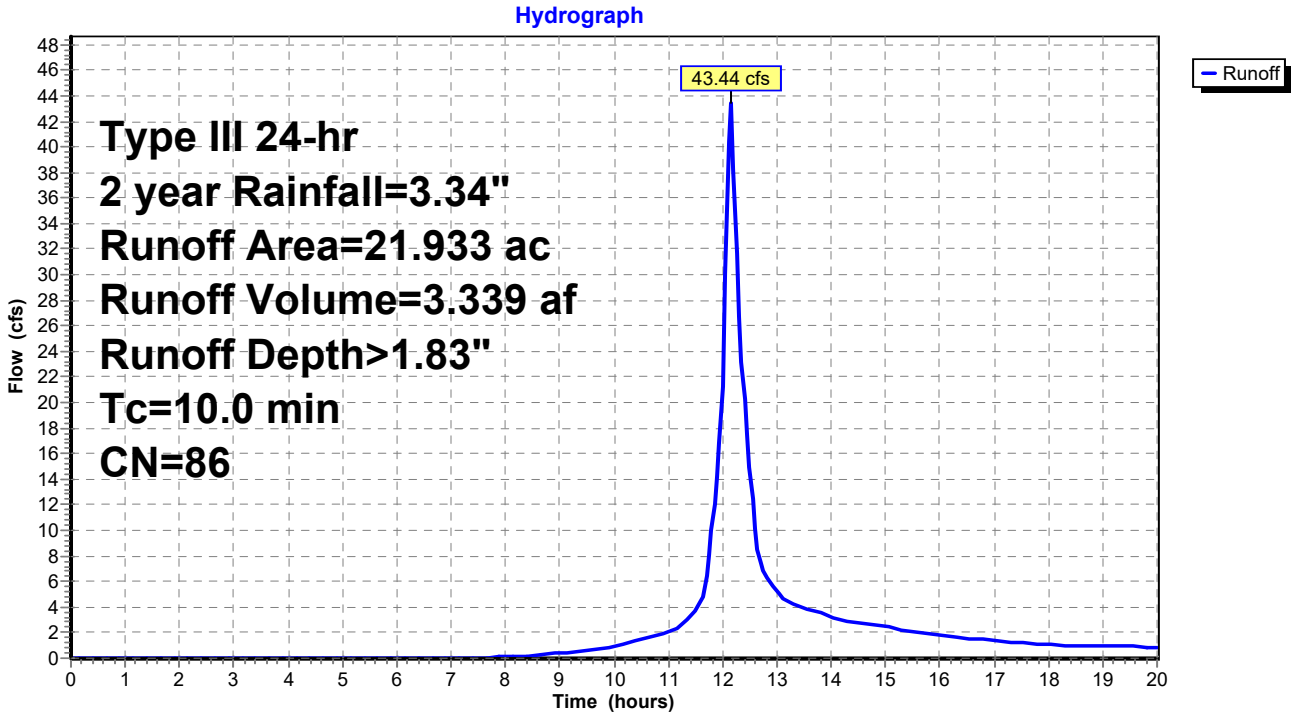
Runoff = 43.44 cfs @ 12.14 hrs, Volume= 3.339 af, Depth> 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.34"

	Area (ac)	CN	Description
	4.270	98	Paved parking, HSG D
*	1.462	98	Unconnected pavement, Sidewalk
*	0.104	98	Unconnected pavement, Walls
*	5.277	98	Roofs, HSG D
	2.131	61	>75% Grass cover, Good, HSG B
	4.541	74	>75% Grass cover, Good, HSG C
	1.775	80	>75% Grass cover, Good, HSG D
*	2.373	80	>75% Grass cover, Good, HSG D (UR Zone)
	21.933	86	Weighted Average
	10.820		49.33% Pervious Area
	11.113		50.67% Impervious Area
	1.566		14.09% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment PDA 1A: To Basin



Summary for Subcatchment PDA 1B: To Southgate

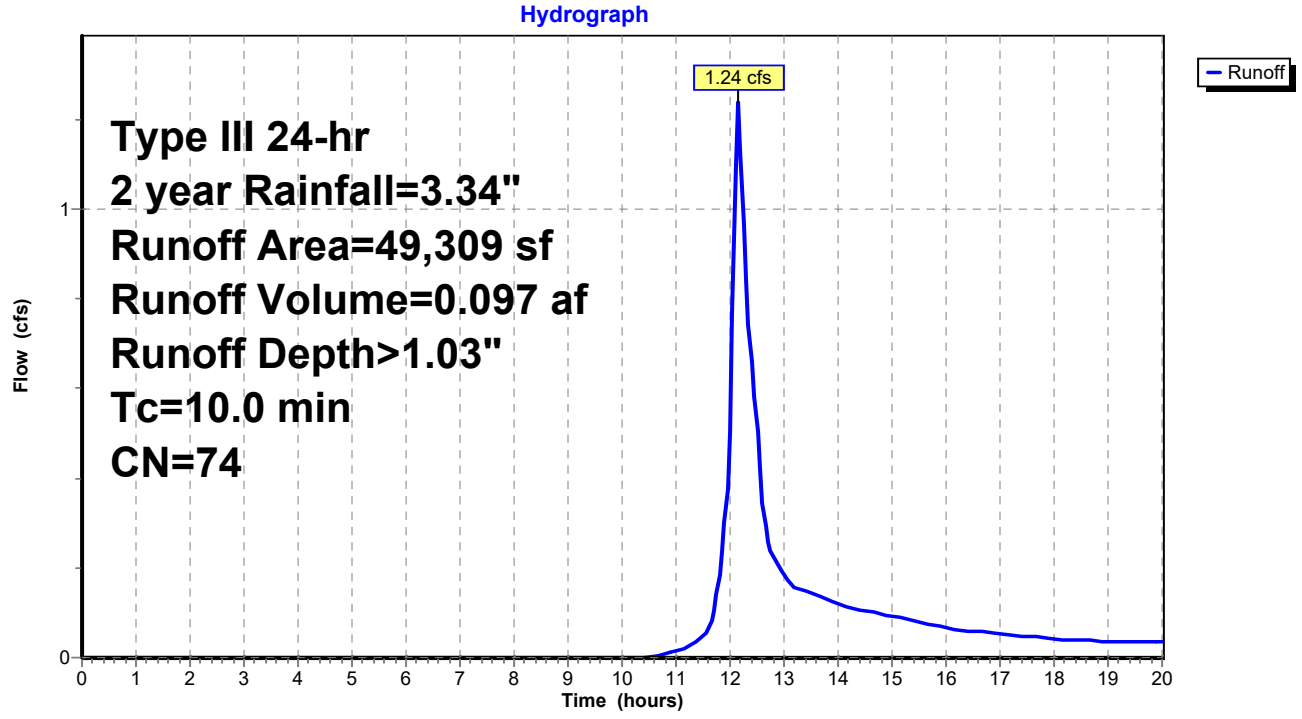
Runoff = 1.24 cfs @ 12.15 hrs, Volume= 0.097 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.34"

Area (sf)	CN	Description
3,223	61	>75% Grass cover, Good, HSG B
38,289	74	>75% Grass cover, Good, HSG C
7,492	80	>75% Grass cover, Good, HSG D
305	98	Paved parking, HSG D
49,309	74	Weighted Average
49,004		99.38% Pervious Area
305		0.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment PDA 1B: To Southgate



Summary for Subcatchment PDA 2: To Mountain Ave

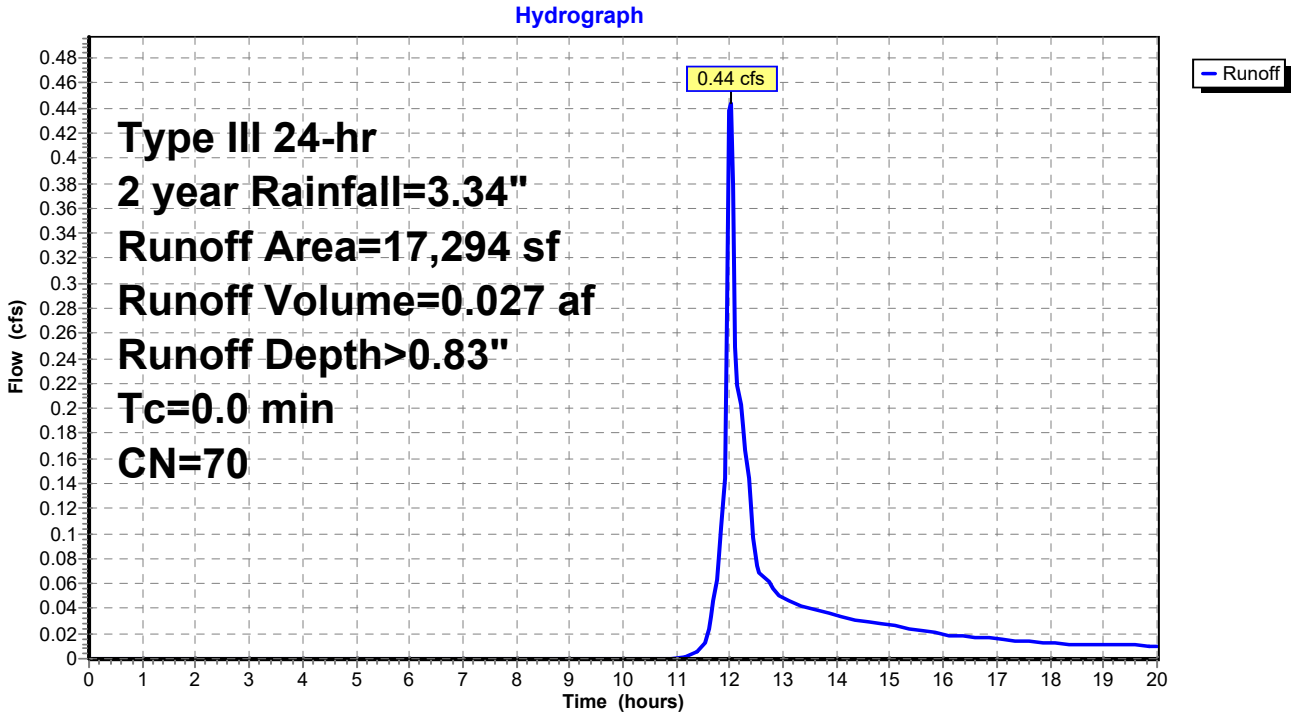
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.44 cfs @ 12.01 hrs, Volume= 0.027 af, Depth> 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.34"

Area (sf)	CN	Description
12,502	74	>75% Grass cover, Good, HSG C
4,792	61	>75% Grass cover, Good, HSG B
17,294	70	Weighted Average
17,294		100.00% Pervious Area

Subcatchment PDA 2: To Mountain Ave



Summary for Subcatchment PDA 3: Off Property

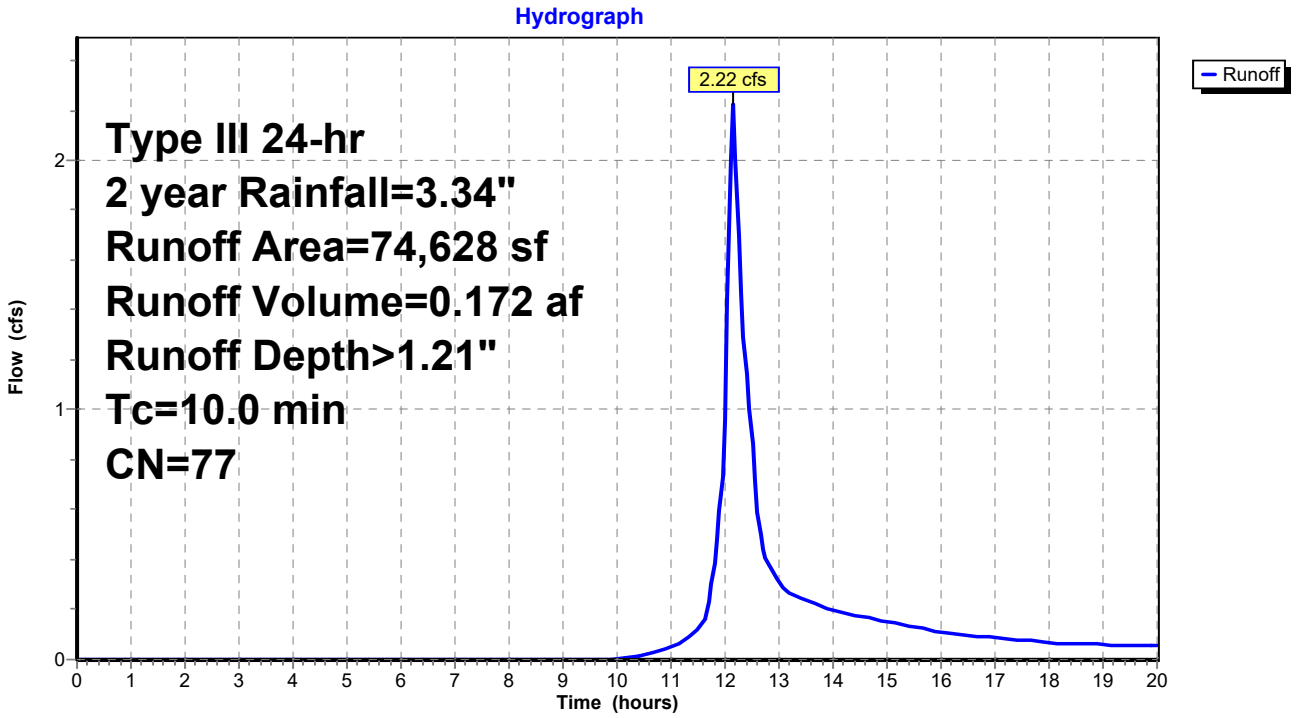
Runoff = 2.22 cfs @ 12.15 hrs, Volume= 0.172 af, Depth> 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.34"

Area (sf)	CN	Description
10,580	61	>75% Grass cover, Good, HSG B
2,183	74	>75% Grass cover, Good, HSG C
61,865	80	>75% Grass cover, Good, HSG D
74,628	77	Weighted Average
74,628		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment PDA 3: Off Property



Summary for Pond EB1: Existing Basin

Inflow Area = 21.261 ac, 41.71% Impervious, Inflow Depth > 1.67" for 2 year event
Inflow = 38.03 cfs @ 12.15 hrs, Volume= 2.966 af
Outflow = 8.67 cfs @ 12.63 hrs, Volume= 2.881 af, Atten= 77%, Lag= 28.8 min
Primary = 8.67 cfs @ 12.63 hrs, Volume= 2.881 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 367.78' @ 12.63 hrs Surf.Area= 30,508 sf Storage= 49,235 cf

Plug-Flow detention time= 69.3 min calculated for 2.881 af (97% of inflow)
Center-of-Mass det. time= 58.5 min (853.9 - 795.4)

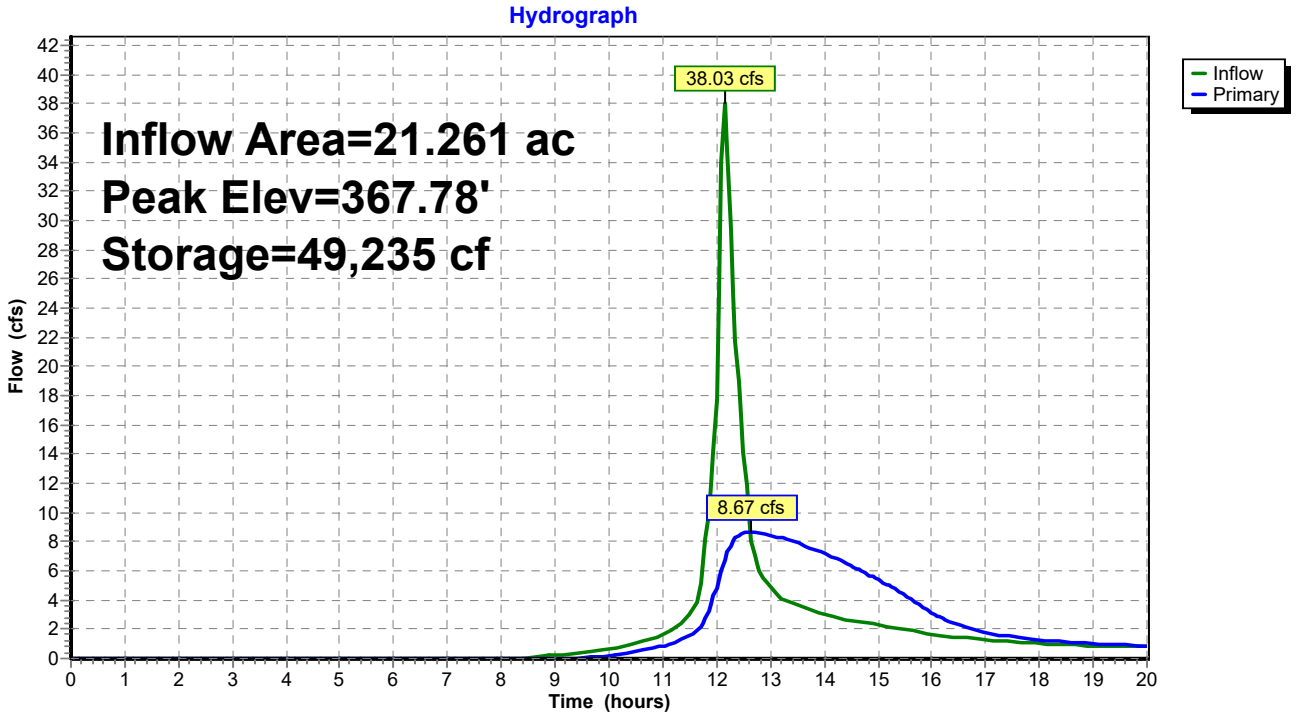
Volume	Invert	Avail.Storage	Storage Description
#1	365.00'	325,654 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
365.00	6,932	0	0
366.00	13,758	10,345	10,345
367.00	22,618	18,188	28,533
368.00	32,742	27,680	56,213
369.00	36,200	34,471	90,684
370.00	40,703	38,452	129,136
371.00	44,437	42,570	171,706
372.00	49,381	46,909	218,615
373.00	53,570	51,476	270,090
374.00	57,558	55,564	325,654

Device	Routing	Invert	Outlet Devices
#1	Primary	365.00'	**15.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	371.68'	**16.5' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 3.0' Crest Height

Primary OutFlow Max=8.67 cfs @ 12.63 hrs HW=367.78' (Free Discharge)
1=Orifice/Grate (Orifice Controls 8.67 cfs @ 7.07 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond EB1: Existing Basin



Summary for Pond PB1: Existing Basin

Inflow Area = 21.933 ac, 50.67% Impervious, Inflow Depth > 1.83" for 2 year event
Inflow = 43.44 cfs @ 12.14 hrs, Volume= 3.339 af
Outflow = 4.33 cfs @ 13.24 hrs, Volume= 2.798 af, Atten= 90%, Lag= 65.9 min
Primary = 4.33 cfs @ 13.24 hrs, Volume= 2.798 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 368.48' @ 13.24 hrs Surf.Area= 34,401 sf Storage= 72,320 cf

Plug-Flow detention time= 181.5 min calculated for 2.791 af (84% of inflow)
Center-of-Mass det. time= 135.8 min (925.0 - 789.3)

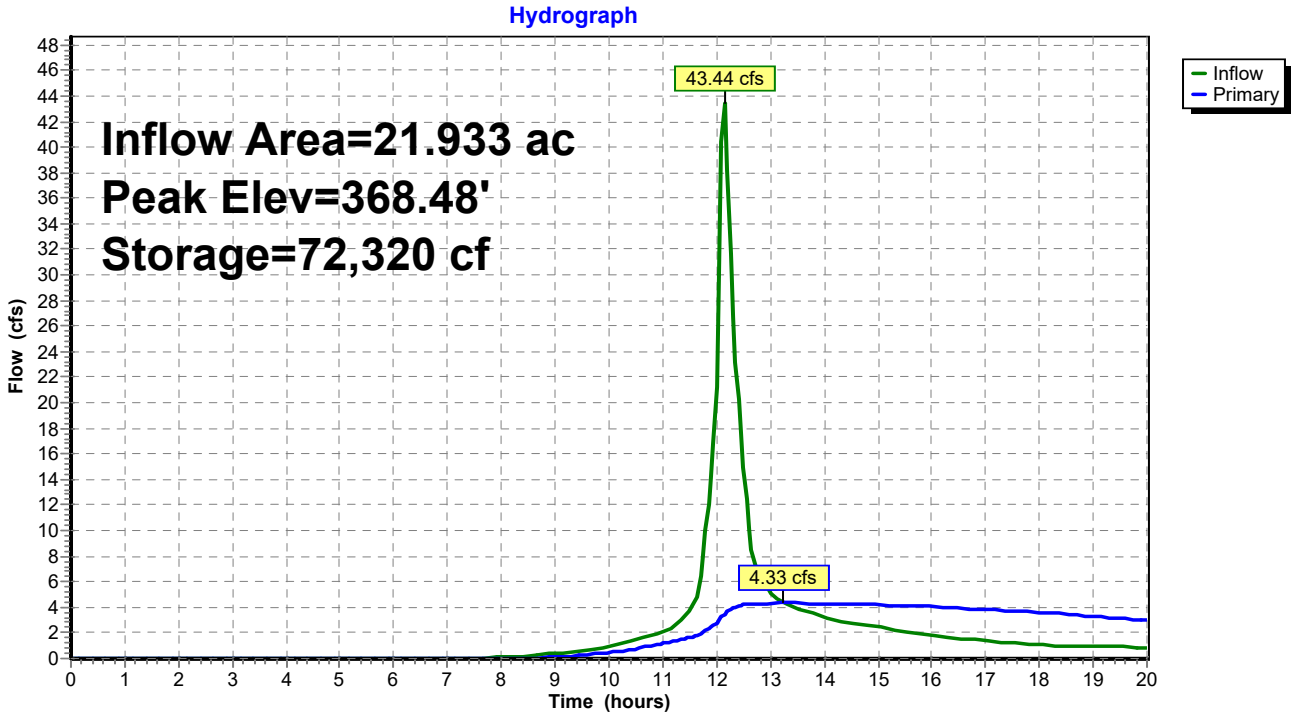
Volume	Invert	Avail.Storage	Storage Description
#1	365.00'	325,654 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
365.00	6,932	0	0
366.00	13,758	10,345	10,345
367.00	22,618	18,188	28,533
368.00	32,742	27,680	56,213
369.00	36,200	34,471	90,684
370.00	40,703	38,452	129,136
371.00	44,437	42,570	171,706
372.00	49,381	46,909	218,615
373.00	53,570	51,476	270,090
374.00	57,558	55,564	325,654

Device	Routing	Invert	Outlet Devices
#1	Primary	365.00'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	368.48'	**12.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	370.18'	**15.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#4	Primary	373.00'	**16.5' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 3.0' Crest Height

Primary OutFlow Max=4.33 cfs @ 13.24 hrs HW=368.48' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 4.33 cfs @ 8.65 fps)
- **2=Orifice/Grate** (Controls 0.00 cfs)
- **3=Orifice/Grate** (Controls 0.00 cfs)
- **4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond PB1: Existing Basin

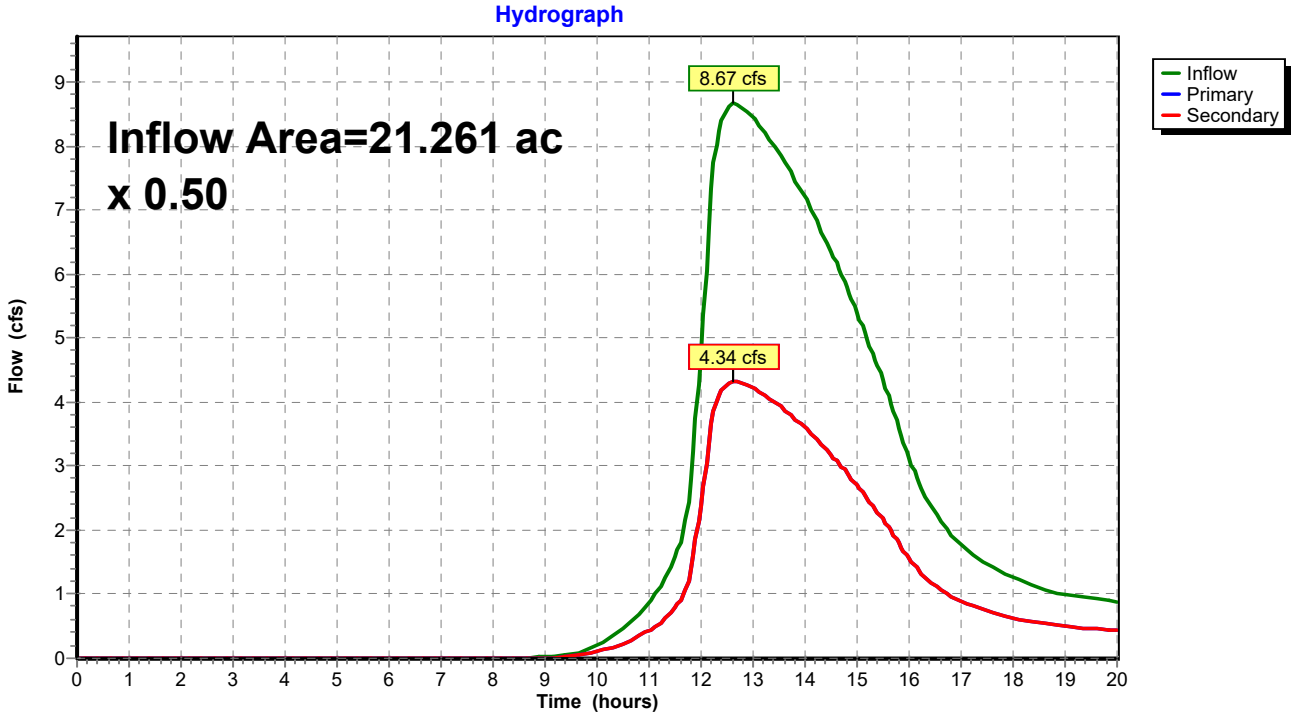


Summary for Link 1L: 50%

Inflow Area = 21.261 ac, 41.71% Impervious, Inflow Depth > 1.63" for 2 year event
Inflow = 8.67 cfs @ 12.63 hrs, Volume= 2.881 af
Primary = 4.34 cfs @ 12.63 hrs, Volume= 1.441 af, Atten= 50%, Lag= 0.0 min
Secondary = 4.34 cfs @ 12.63 hrs, Volume= 1.441 af

Primary outflow = Inflow x 0.50, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link 1L: 50%

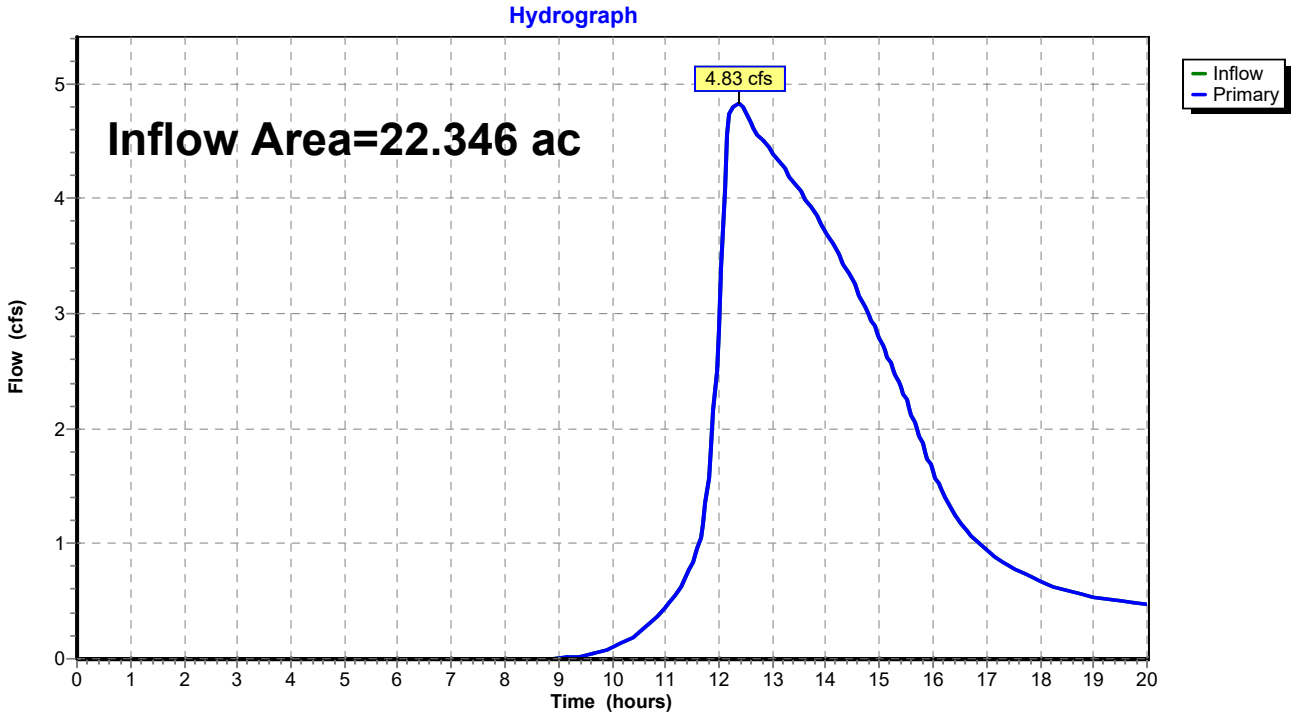


Summary for Link EDA 1: Total EDA1

Inflow Area = 22.346 ac, 39.72% Impervious, Inflow Depth > 0.82" for 2 year event
Inflow = 4.83 cfs @ 12.38 hrs, Volume= 1.534 af
Primary = 4.83 cfs @ 12.38 hrs, Volume= 1.534 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link EDA 1: Total EDA1

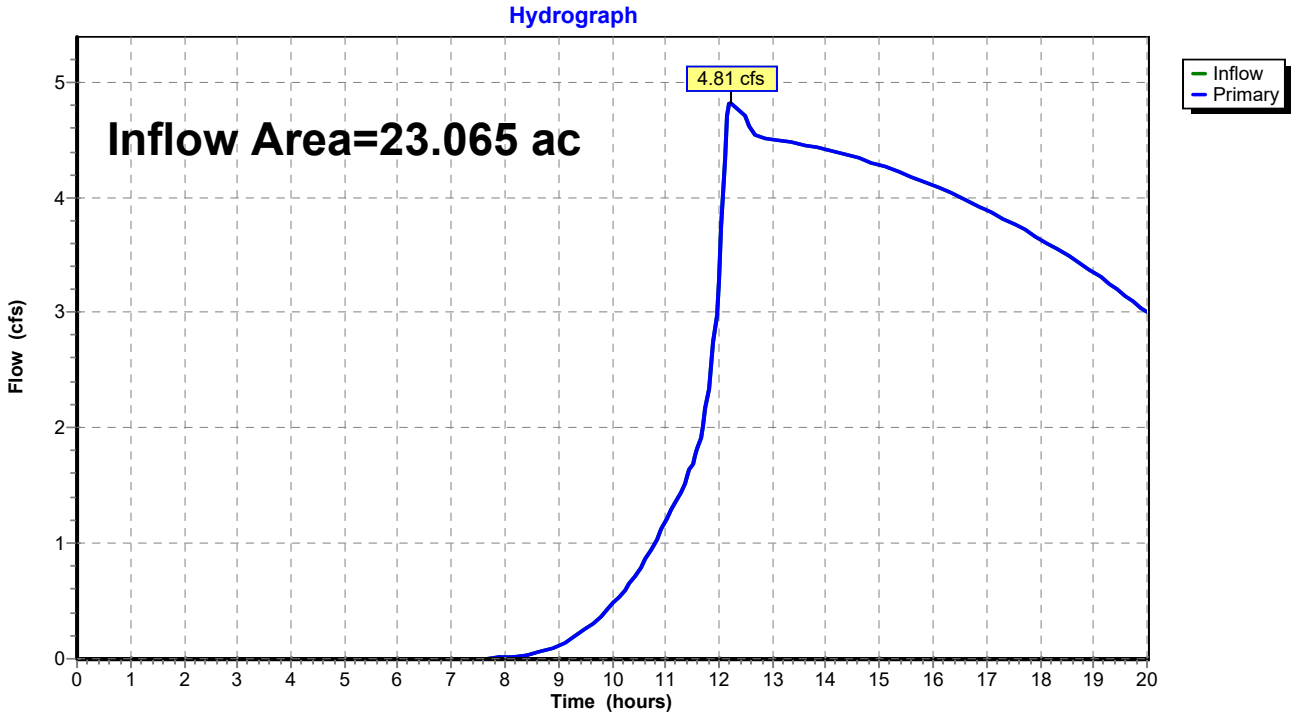


Summary for Link PDA 1: Total PDA 1

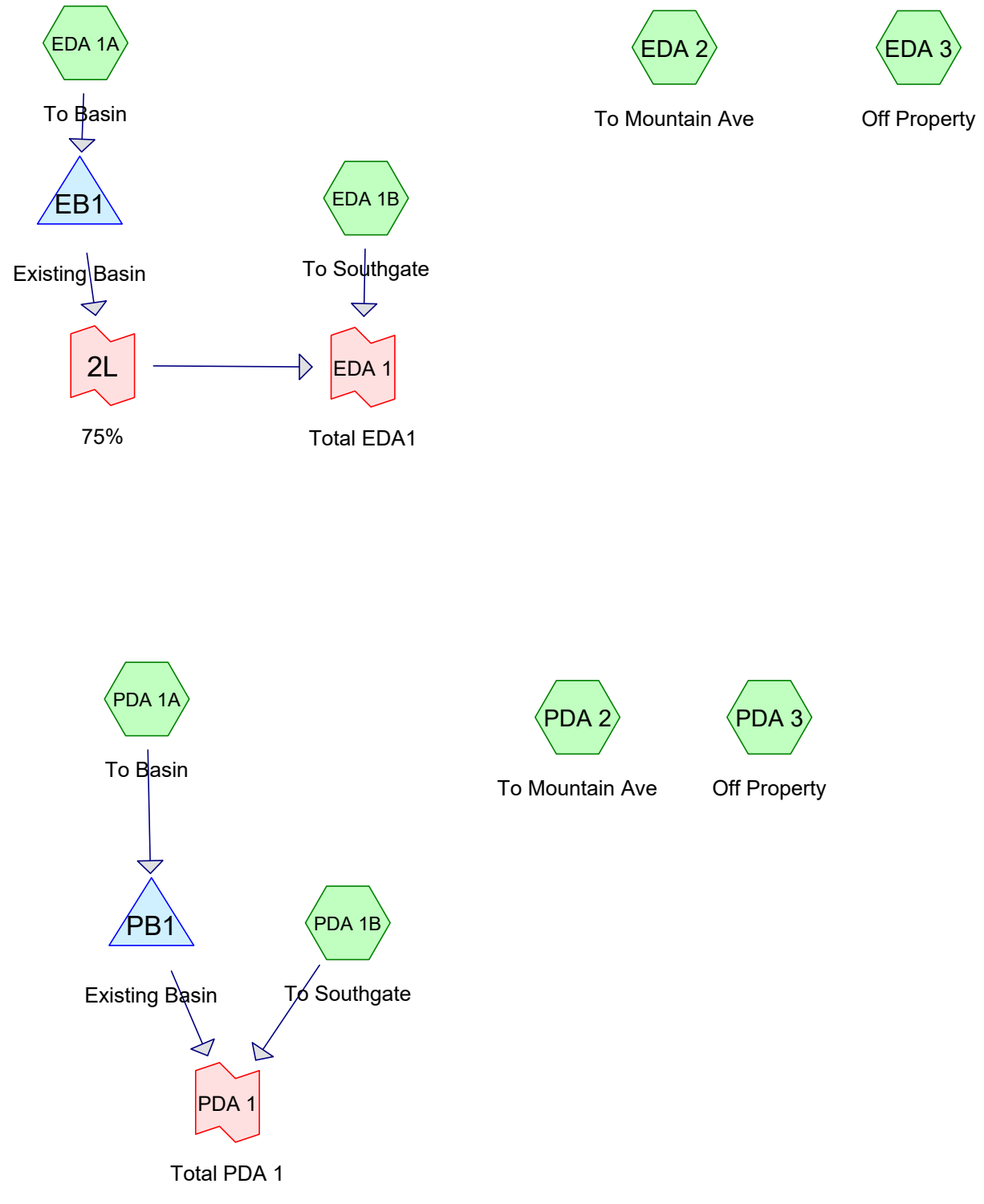
Inflow Area = 23.065 ac, 48.21% Impervious, Inflow Depth > 1.51" for 2 year event
Inflow = 4.81 cfs @ 12.22 hrs, Volume= 2.895 af
Primary = 4.81 cfs @ 12.22 hrs, Volume= 2.895 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link PDA 1: Total PDA 1



10-YEAR STORM EVENT



Routing Diagram for J100690.04 -Erickson 10-yr
Prepared by Bohler Engineering, Printed 3/10/2020
HydroCAD® 10.00-20 s/n 02612 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.311	61	>75% Grass cover, Good, HSG B (EDA 1A, EDA 1B, EDA 2, EDA 3, PDA 1A, PDA 1B, PDA 2, PDA 3)
13.547	74	>75% Grass cover, Good, HSG C (EDA 1A, EDA 1B, EDA 2, EDA 3, PDA 1A, PDA 1B, PDA 2, PDA 3)
6.876	80	>75% Grass cover, Good, HSG D (EDA 1A, EDA 1B, EDA 3, PDA 1A, PDA 1B, PDA 3)
4.621	80	>75% Grass cover, Good, HSG D (UR Zone) (EDA 1A, EDA 3, PDA 1A)
10.928	98	Paved parking, HSG D (EDA 1A, EDA 1B, PDA 1A, PDA 1B)
6.609	98	Roofs, HSG D (EDA 1A, PDA 1A)
0.893	98	Unconnected pavement, HSG D (EDA 1A)
1.462	98	Unconnected pavement, Sidewalk (PDA 1A)
0.104	98	Unconnected pavement, Walls (PDA 1A)
50.350	**84**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
5.311	HSG B	EDA 1A, EDA 1B, EDA 2, EDA 3, PDA 1A, PDA 1B, PDA 2, PDA 3
13.547	HSG C	EDA 1A, EDA 1B, EDA 2, EDA 3, PDA 1A, PDA 1B, PDA 2, PDA 3
29.927	HSG D	EDA 1A, EDA 1B, EDA 3, PDA 1A, PDA 1B, PDA 3
1.566	Other	PDA 1A
50.350		**TOTAL AREA**

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA 1A: To Basin Runoff Area=926,140 sf 41.71% Impervious Runoff Depth>3.19"
Flow Length=1,117' Tc=10.7 min CN=84 Runoff=71.29 cfs 5.648 af

Subcatchment EDA 1B: To Southgate Runoff Area=47,239 sf 0.69% Impervious Runoff Depth>2.29"
Tc=10.0 min CN=74 Runoff=2.71 cfs 0.207 af

Subcatchment EDA 2: To Mountain Ave Runoff Area=23,740 sf 0.00% Impervious Runoff Depth>1.97"
Tc=10.0 min CN=70 Runoff=1.16 cfs 0.089 af

Subcatchment EDA 3: Off Property Runoff Area=99,514 sf 0.00% Impervious Runoff Depth>2.46"
Tc=10.0 min CN=76 Runoff=6.12 cfs 0.469 af

Subcatchment PDA 1A: To Basin Runoff Area=21.933 ac 50.67% Impervious Runoff Depth>3.38"
Tc=10.0 min CN=86 Runoff=78.72 cfs 6.184 af

Subcatchment PDA 1B: To Southgate Runoff Area=49,309 sf 0.62% Impervious Runoff Depth>2.29"
Tc=10.0 min CN=74 Runoff=2.83 cfs 0.216 af

Subcatchment PDA 2: To Mountain Ave Runoff Area=17,294 sf 0.00% Impervious Runoff Depth>1.98"
Tc=0.0 min CN=70 Runoff=1.13 cfs 0.065 af

Subcatchment PDA 3: Off Property Runoff Area=74,628 sf 0.00% Impervious Runoff Depth>2.55"
Tc=10.0 min CN=77 Runoff=4.75 cfs 0.364 af

Pond EB1: Existing Basin Peak Elev=369.38' Storage=104,714 cf Inflow=71.29 cfs 5.648 af
Outflow=11.45 cfs 5.522 af

Pond PB1: Existing Basin Peak Elev=370.17' Storage=136,276 cf Inflow=78.72 cfs 6.184 af
Outflow=9.08 cfs 4.866 af

Link 2L: 75% x 0.75 Inflow=11.45 cfs 5.522 af
Primary=8.59 cfs 4.142 af Secondary=2.86 cfs 1.381 af

Link EDA 1: Total EDA1 Inflow=9.71 cfs 4.349 af
Primary=9.71 cfs 4.349 af

Link PDA 1: Total PDA 1 Inflow=9.71 cfs 5.082 af
Primary=9.71 cfs 5.082 af

Total Runoff Area = 50.350 ac Runoff Volume = 13.243 af Average Runoff Depth = 3.16"
60.29% Pervious = 30.355 ac 39.71% Impervious = 19.996 ac

Summary for Subcatchment EDA 1A: To Basin

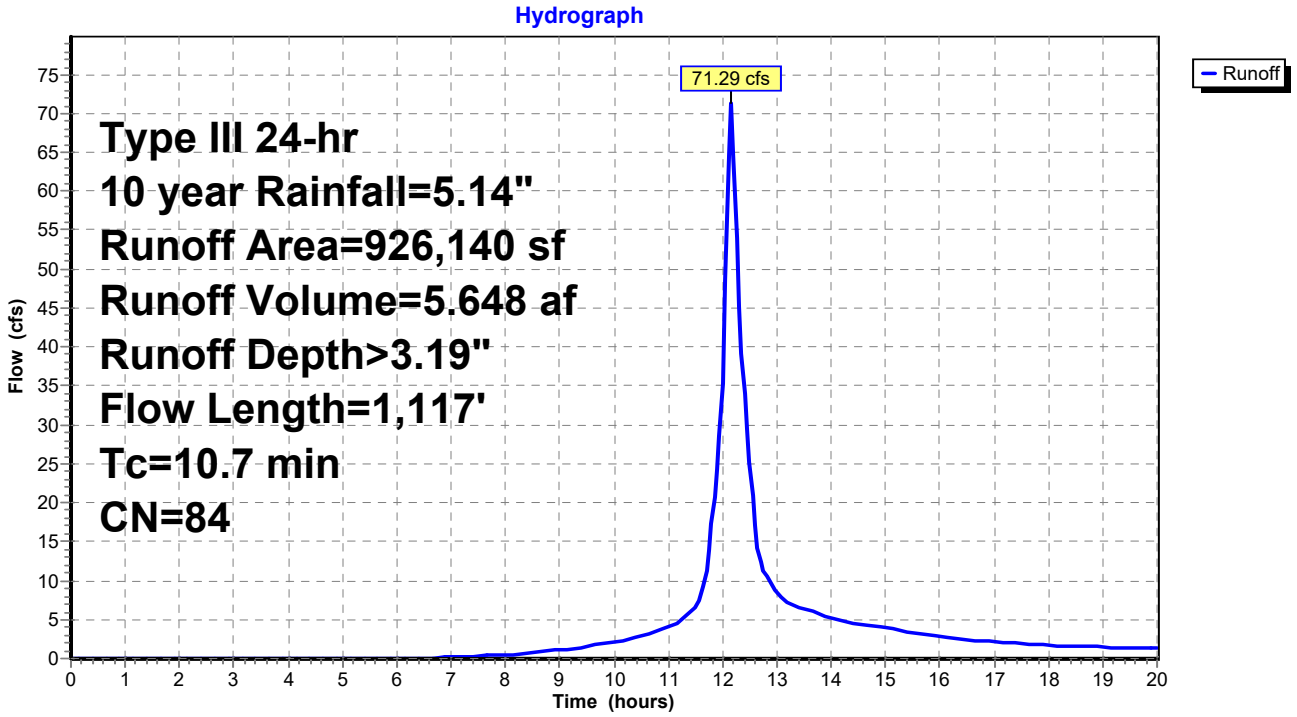
Runoff = 71.29 cfs @ 12.15 hrs, Volume= 5.648 af, Depth> 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=5.14"

	Area (sf)	CN	Description
	289,374	98	Paved parking, HSG D
	58,022	98	Roofs, HSG D
	88,253	61	>75% Grass cover, Good, HSG B
	284,975	74	>75% Grass cover, Good, HSG C
	83,505	80	>75% Grass cover, Good, HSG D
*	83,112	80	>75% Grass cover, Good, HSG D (UR Zone)
	38,899	98	Unconnected pavement, HSG D
	926,140	84	Weighted Average
	539,845		58.29% Pervious Area
	386,295		41.71% Impervious Area
	38,899		10.07% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	156	0.0550	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.2	352	0.0889	4.80		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	609	0.0680	15.50	27.39	**Pipe Channel, RCP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
10.7	1,117	Total			

Subcatchment EDA 1A: To Basin



Summary for Subcatchment EDA 1B: To Southgate

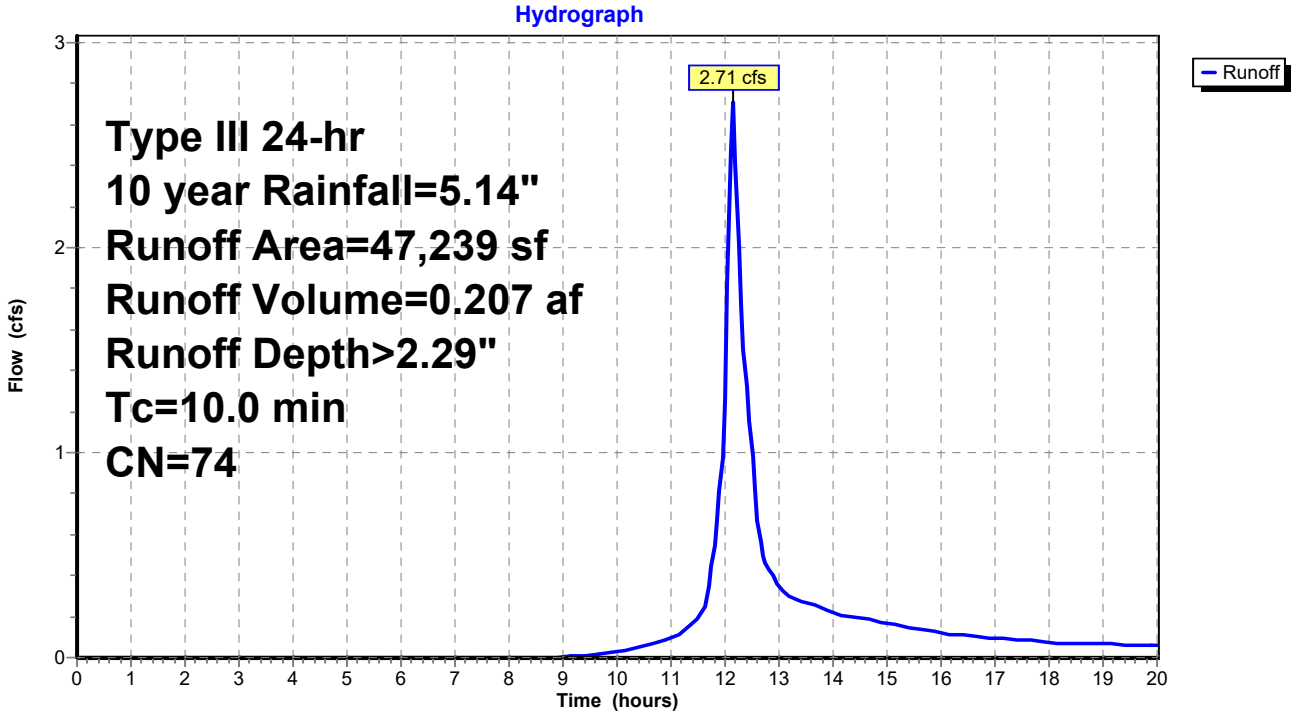
Runoff = 2.71 cfs @ 12.15 hrs, Volume= 0.207 af, Depth> 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=5.14"

Area (sf)	CN	Description
3,194	61	>75% Grass cover, Good, HSG B
36,234	74	>75% Grass cover, Good, HSG C
7,487	80	>75% Grass cover, Good, HSG D
324	98	Paved parking, HSG D
47,239	74	Weighted Average
46,915		99.31% Pervious Area
324		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment EDA 1B: To Southgate



Summary for Subcatchment EDA 2: To Mountain Ave

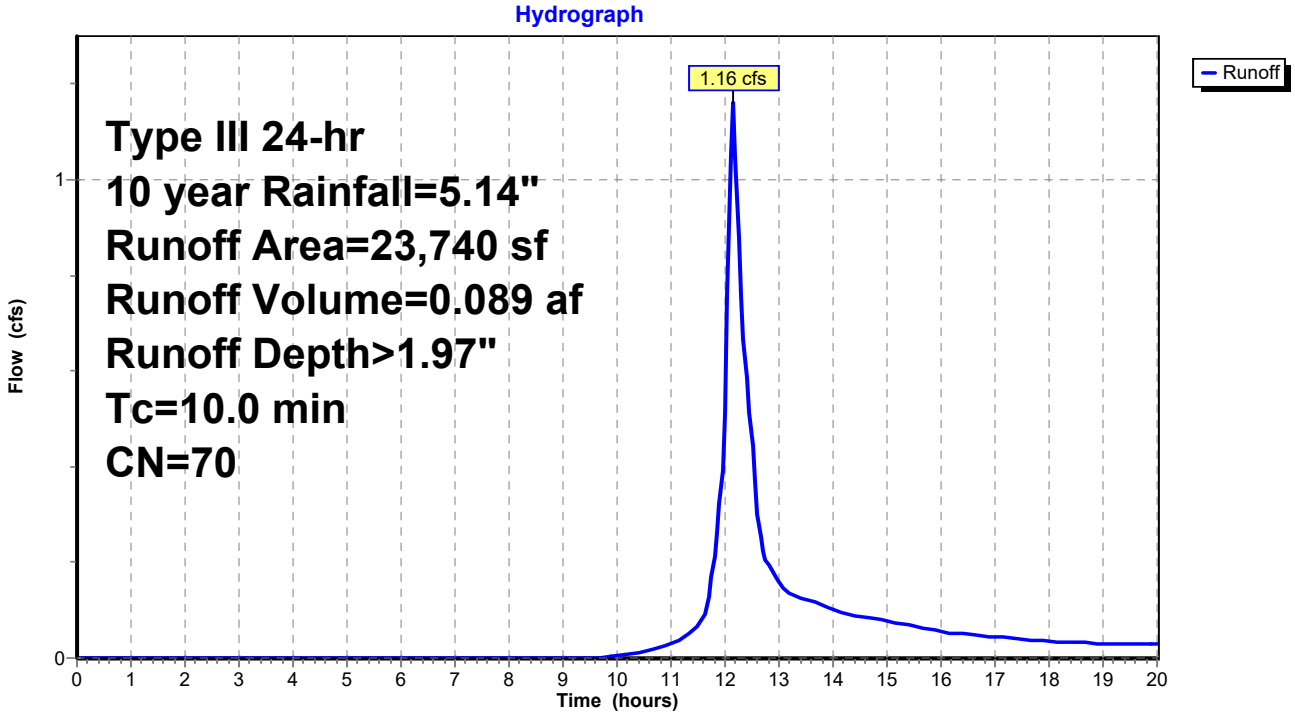
Runoff = 1.16 cfs @ 12.15 hrs, Volume= 0.089 af, Depth> 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=5.14"

Area (sf)	CN	Description
7,806	61	>75% Grass cover, Good, HSG B
15,934	74	>75% Grass cover, Good, HSG C
23,740	70	Weighted Average
23,740		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment EDA 2: To Mountain Ave



Summary for Subcatchment EDA 3: Off Property

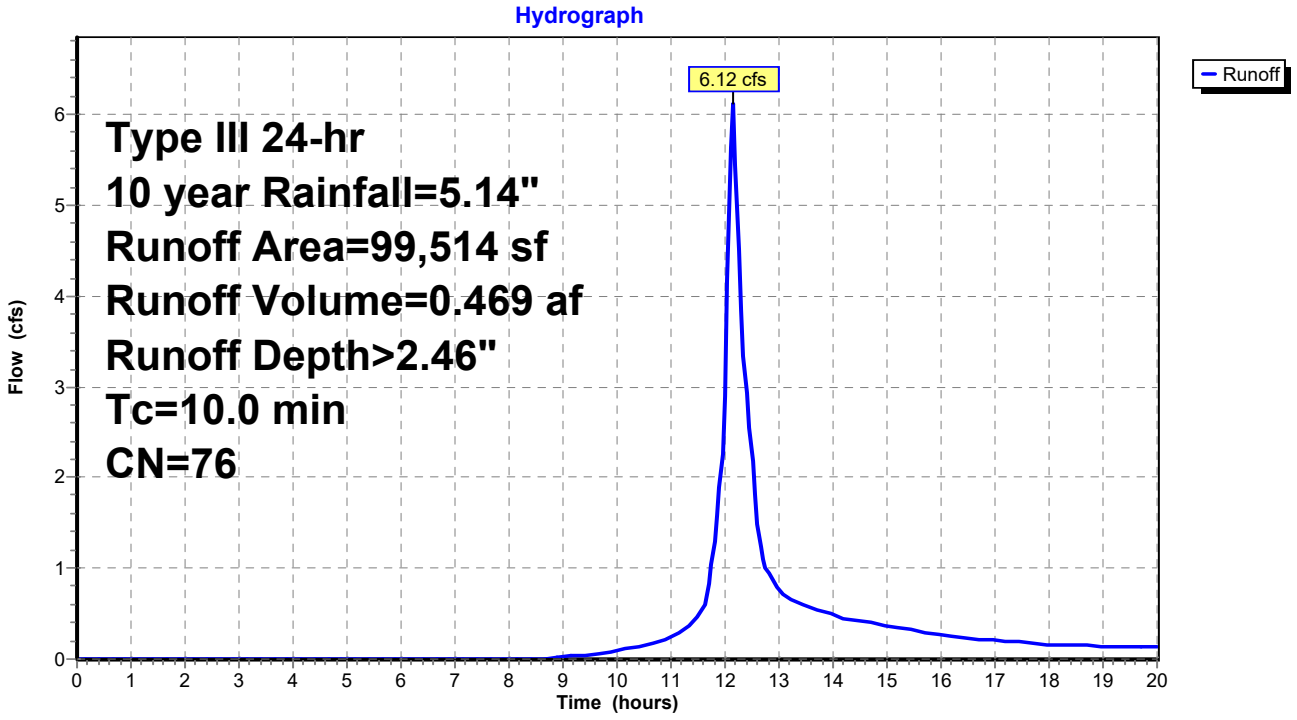
Runoff = 6.12 cfs @ 12.15 hrs, Volume= 0.469 af, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=5.14"

	Area (sf)	CN	Description
	20,666	61	>75% Grass cover, Good, HSG B
	2,183	74	>75% Grass cover, Good, HSG C
	61,865	80	>75% Grass cover, Good, HSG D
*	14,800	80	>75% Grass cover, Good, HSG D (UR Zone)
	99,514	76	Weighted Average
	99,514		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment EDA 3: Off Property



Summary for Subcatchment PDA 1A: To Basin

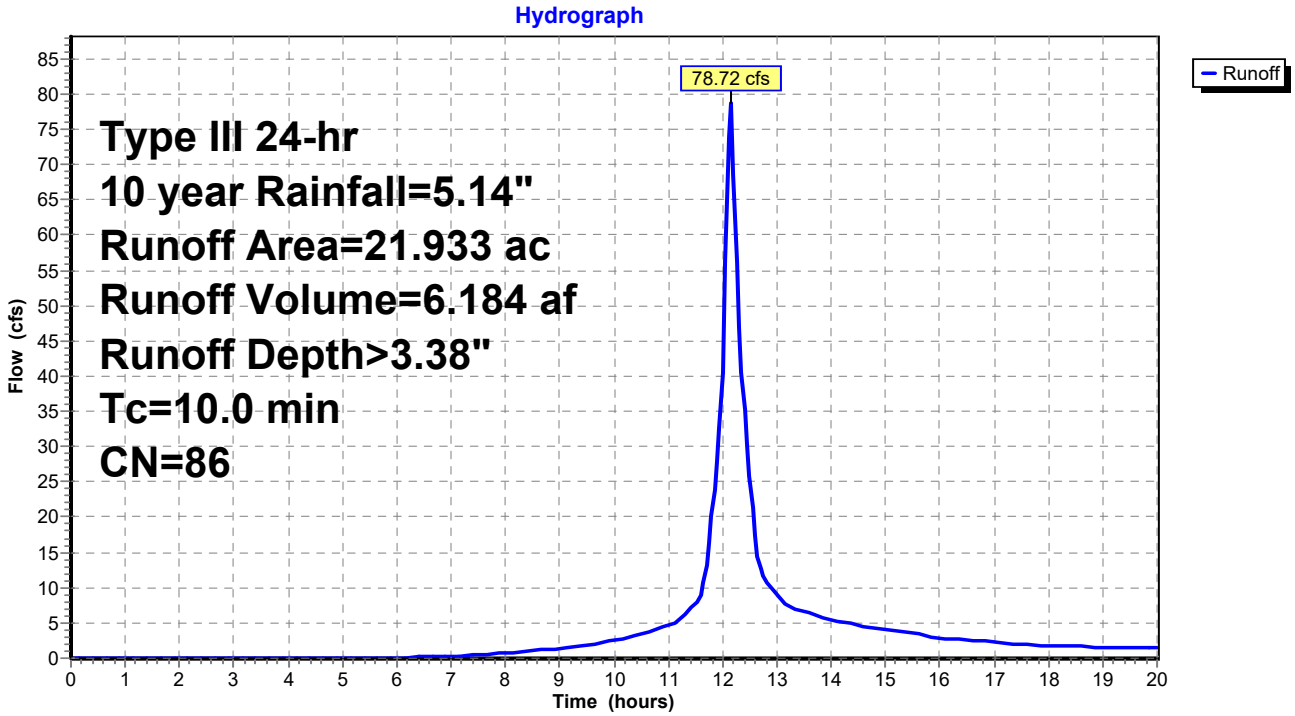
Runoff = 78.72 cfs @ 12.14 hrs, Volume= 6.184 af, Depth> 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=5.14"

	Area (ac)	CN	Description
	4.270	98	Paved parking, HSG D
*	1.462	98	Unconnected pavement, Sidewalk
*	0.104	98	Unconnected pavement, Walls
*	5.277	98	Roofs, HSG D
	2.131	61	>75% Grass cover, Good, HSG B
	4.541	74	>75% Grass cover, Good, HSG C
	1.775	80	>75% Grass cover, Good, HSG D
*	2.373	80	>75% Grass cover, Good, HSG D (UR Zone)
	21.933	86	Weighted Average
	10.820		49.33% Pervious Area
	11.113		50.67% Impervious Area
	1.566		14.09% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment PDA 1A: To Basin



Summary for Subcatchment PDA 1B: To Southgate

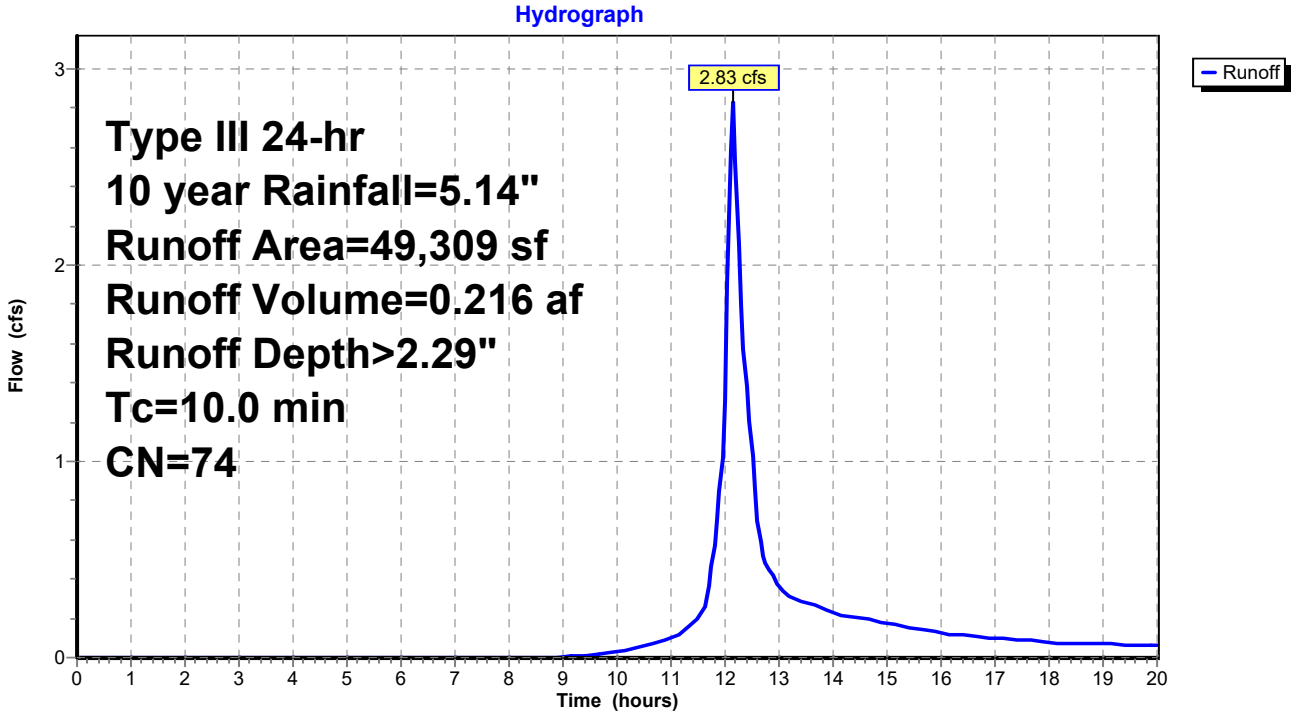
Runoff = 2.83 cfs @ 12.15 hrs, Volume= 0.216 af, Depth> 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=5.14"

Area (sf)	CN	Description
3,223	61	>75% Grass cover, Good, HSG B
38,289	74	>75% Grass cover, Good, HSG C
7,492	80	>75% Grass cover, Good, HSG D
305	98	Paved parking, HSG D
49,309	74	Weighted Average
49,004		99.38% Pervious Area
305		0.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment PDA 1B: To Southgate



Summary for Subcatchment PDA 2: To Mountain Ave

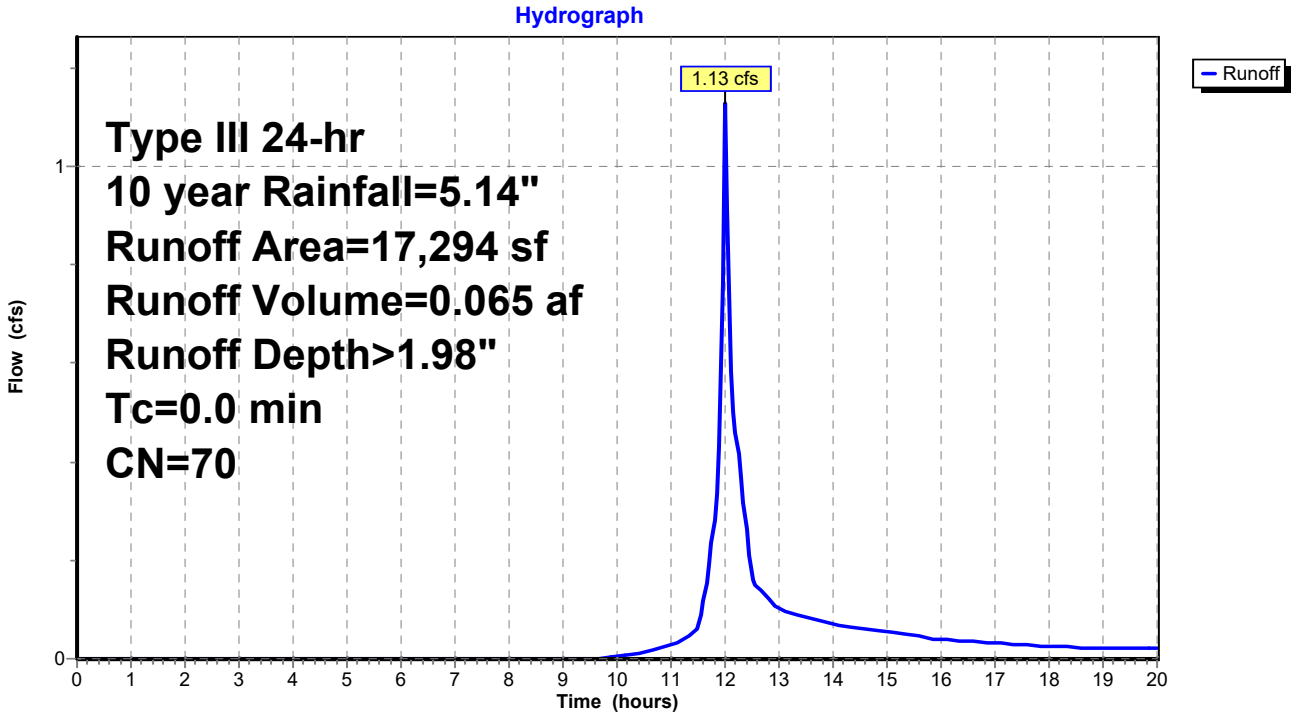
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.13 cfs @ 12.01 hrs, Volume= 0.065 af, Depth> 1.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=5.14"

Area (sf)	CN	Description
12,502	74	>75% Grass cover, Good, HSG C
4,792	61	>75% Grass cover, Good, HSG B
17,294	70	Weighted Average
17,294		100.00% Pervious Area

Subcatchment PDA 2: To Mountain Ave



Summary for Subcatchment PDA 3: Off Property

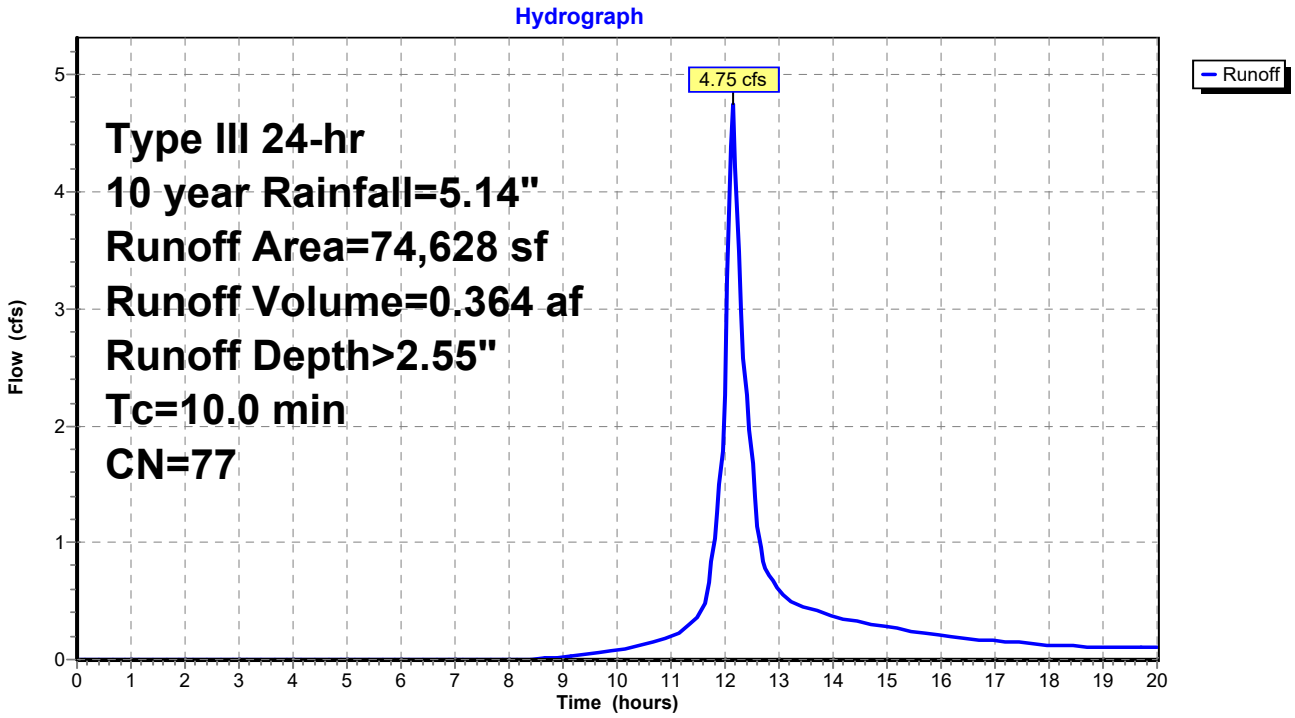
Runoff = 4.75 cfs @ 12.15 hrs, Volume= 0.364 af, Depth> 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=5.14"

Area (sf)	CN	Description
10,580	61	>75% Grass cover, Good, HSG B
2,183	74	>75% Grass cover, Good, HSG C
61,865	80	>75% Grass cover, Good, HSG D
74,628	77	Weighted Average
74,628		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment PDA 3: Off Property



Summary for Pond EB1: Existing Basin

Inflow Area = 21.261 ac, 41.71% Impervious, Inflow Depth > 3.19" for 10 year event
Inflow = 71.29 cfs @ 12.15 hrs, Volume= 5.648 af
Outflow = 11.45 cfs @ 12.75 hrs, Volume= 5.522 af, Atten= 84%, Lag= 35.7 min
Primary = 11.45 cfs @ 12.75 hrs, Volume= 5.522 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 369.38' @ 12.75 hrs Surf.Area= 37,905 sf Storage= 104,714 cf

Plug-Flow detention time= 101.9 min calculated for 5.522 af (98% of inflow)
Center-of-Mass det. time= 93.2 min (873.7 - 780.5)

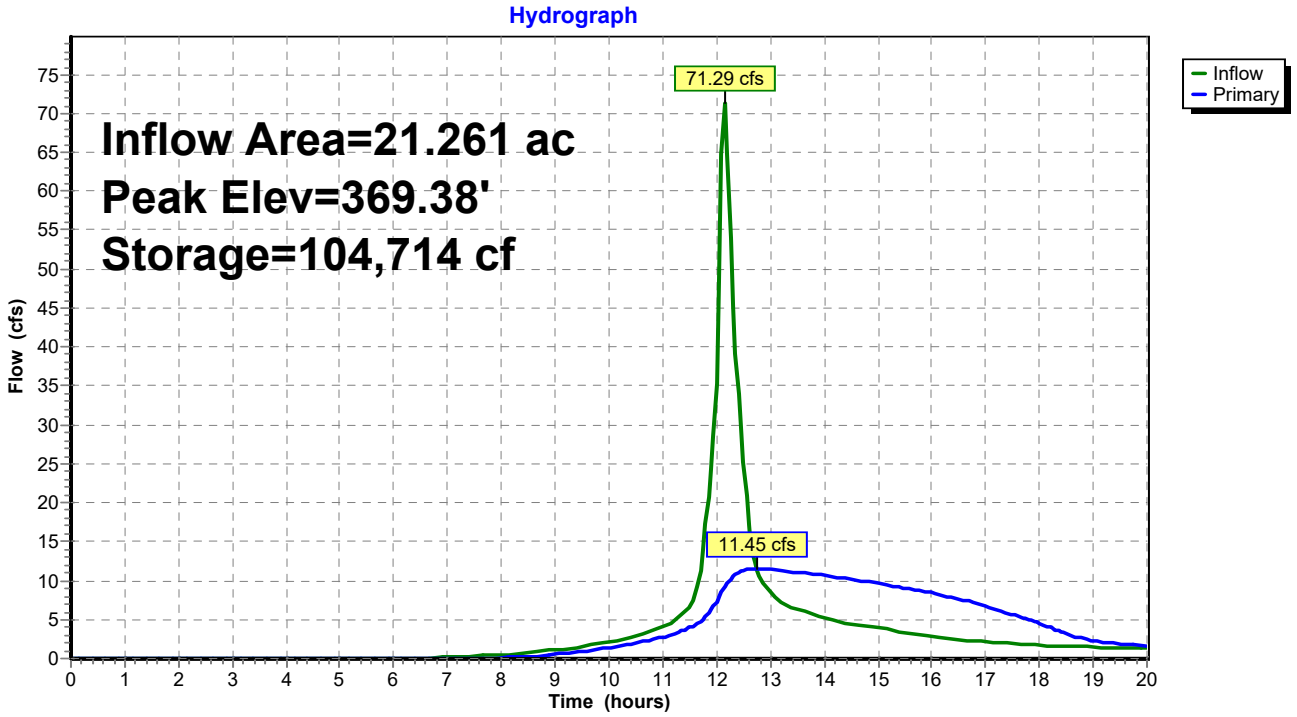
Volume	Invert	Avail.Storage	Storage Description
#1	365.00'	325,654 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
365.00	6,932	0	0
366.00	13,758	10,345	10,345
367.00	22,618	18,188	28,533
368.00	32,742	27,680	56,213
369.00	36,200	34,471	90,684
370.00	40,703	38,452	129,136
371.00	44,437	42,570	171,706
372.00	49,381	46,909	218,615
373.00	53,570	51,476	270,090
374.00	57,558	55,564	325,654

Device	Routing	Invert	Outlet Devices
#1	Primary	365.00'	**15.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	371.68'	**16.5' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 3.0' Crest Height

Primary OutFlow Max=11.45 cfs @ 12.75 hrs HW=369.38' (Free Discharge)
1=Orifice/Grate (Orifice Controls 11.45 cfs @ 9.33 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond EB1: Existing Basin



Summary for Pond PB1: Existing Basin

Inflow Area = 21.933 ac, 50.67% Impervious, Inflow Depth > 3.38" for 10 year event
Inflow = 78.72 cfs @ 12.14 hrs, Volume= 6.184 af
Outflow = 9.08 cfs @ 12.98 hrs, Volume= 4.866 af, Atten= 88%, Lag= 50.5 min
Primary = 9.08 cfs @ 12.98 hrs, Volume= 4.866 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 370.17' @ 12.98 hrs Surf.Area= 41,353 sf Storage= 136,276 cf

Plug-Flow detention time= 173.5 min calculated for 4.866 af (79% of inflow)
Center-of-Mass det. time= 118.7 min (893.5 - 774.8)

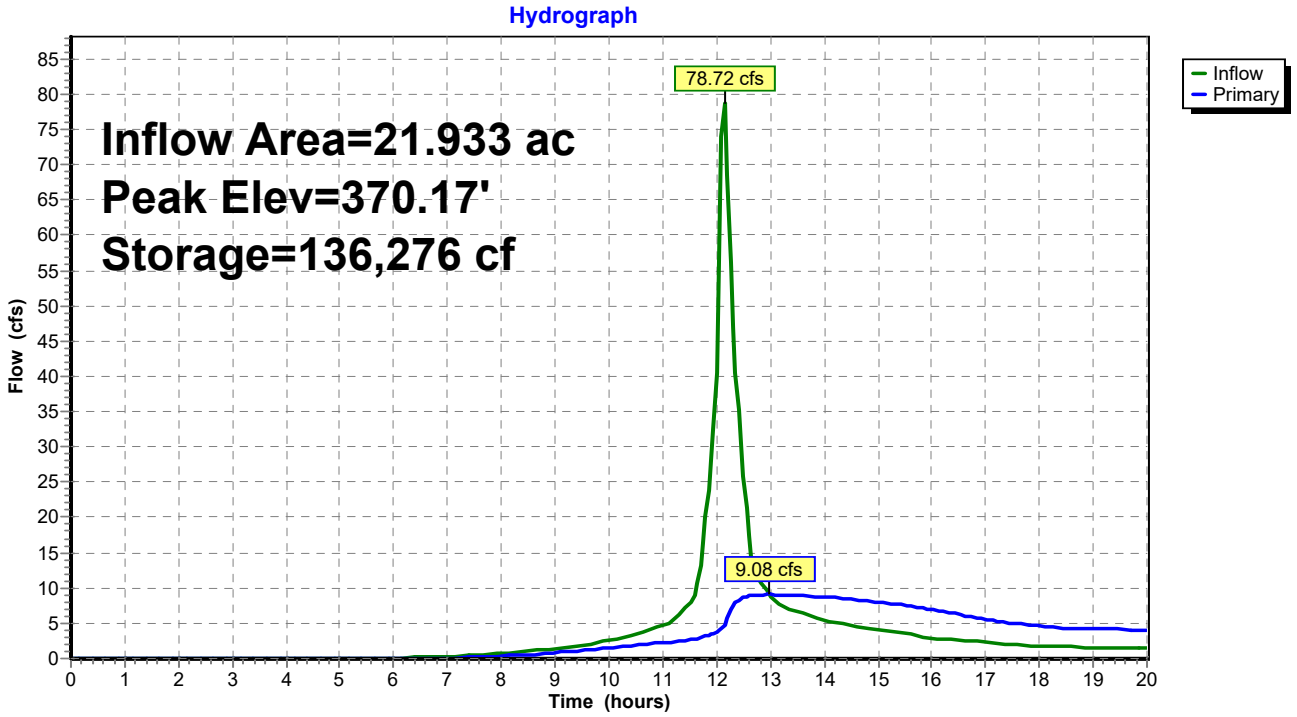
Volume	Invert	Avail.Storage	Storage Description
#1	365.00'	325,654 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
365.00	6,932	0	0
366.00	13,758	10,345	10,345
367.00	22,618	18,188	28,533
368.00	32,742	27,680	56,213
369.00	36,200	34,471	90,684
370.00	40,703	38,452	129,136
371.00	44,437	42,570	171,706
372.00	49,381	46,909	218,615
373.00	53,570	51,476	270,090
374.00	57,558	55,564	325,654

Device	Routing	Invert	Outlet Devices
#1	Primary	365.00'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	368.48'	**12.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	370.18'	**15.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#4	Primary	373.00'	**16.5' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 3.0' Crest Height

Primary OutFlow Max=9.08 cfs @ 12.98 hrs HW=370.17' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 5.34 cfs @ 10.68 fps)
- **2=Orifice/Grate** (Orifice Controls 3.73 cfs @ 5.60 fps)
- **3=Orifice/Grate** (Controls 0.00 cfs)
- **4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond PB1: Existing Basin

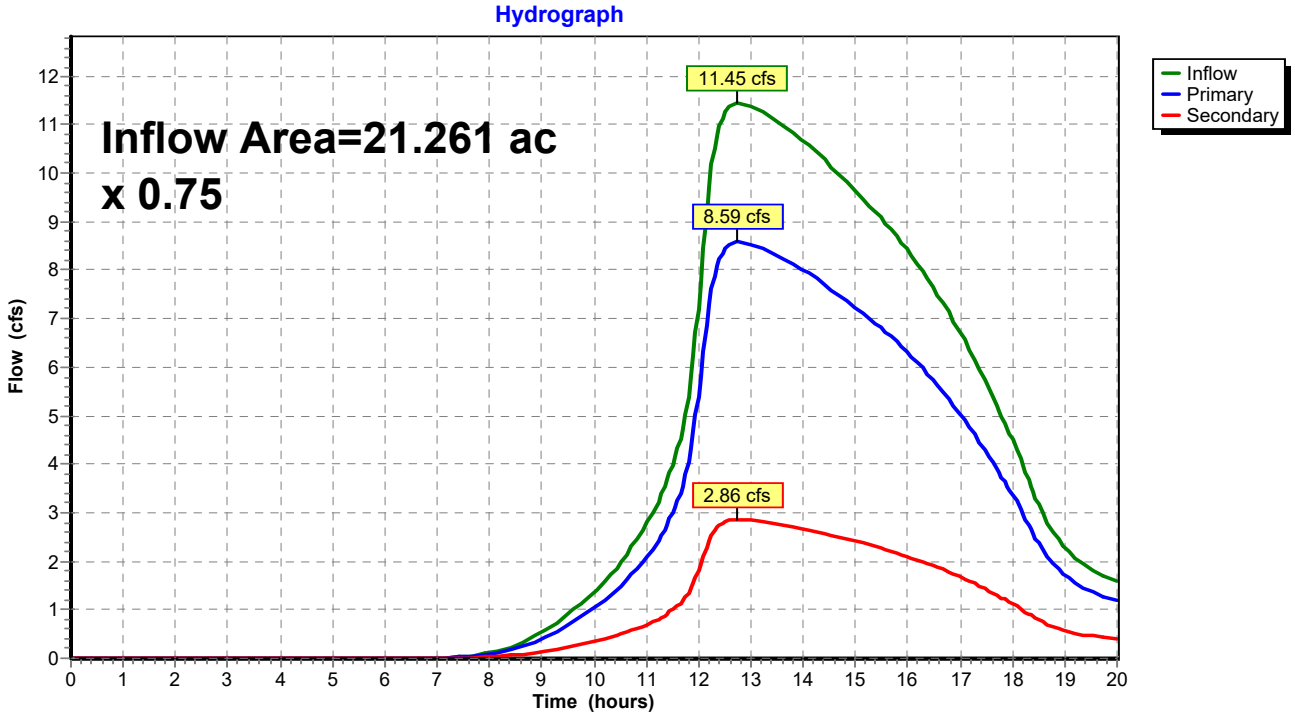


Summary for Link 2L: 75%

Inflow Area = 21.261 ac, 41.71% Impervious, Inflow Depth > 3.12" for 10 year event
Inflow = 11.45 cfs @ 12.75 hrs, Volume= 5.522 af
Primary = 8.59 cfs @ 12.75 hrs, Volume= 4.142 af, Atten= 25%, Lag= 0.0 min
Secondary = 2.86 cfs @ 12.75 hrs, Volume= 1.381 af

Primary outflow = Inflow x 0.75, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link 2L: 75%

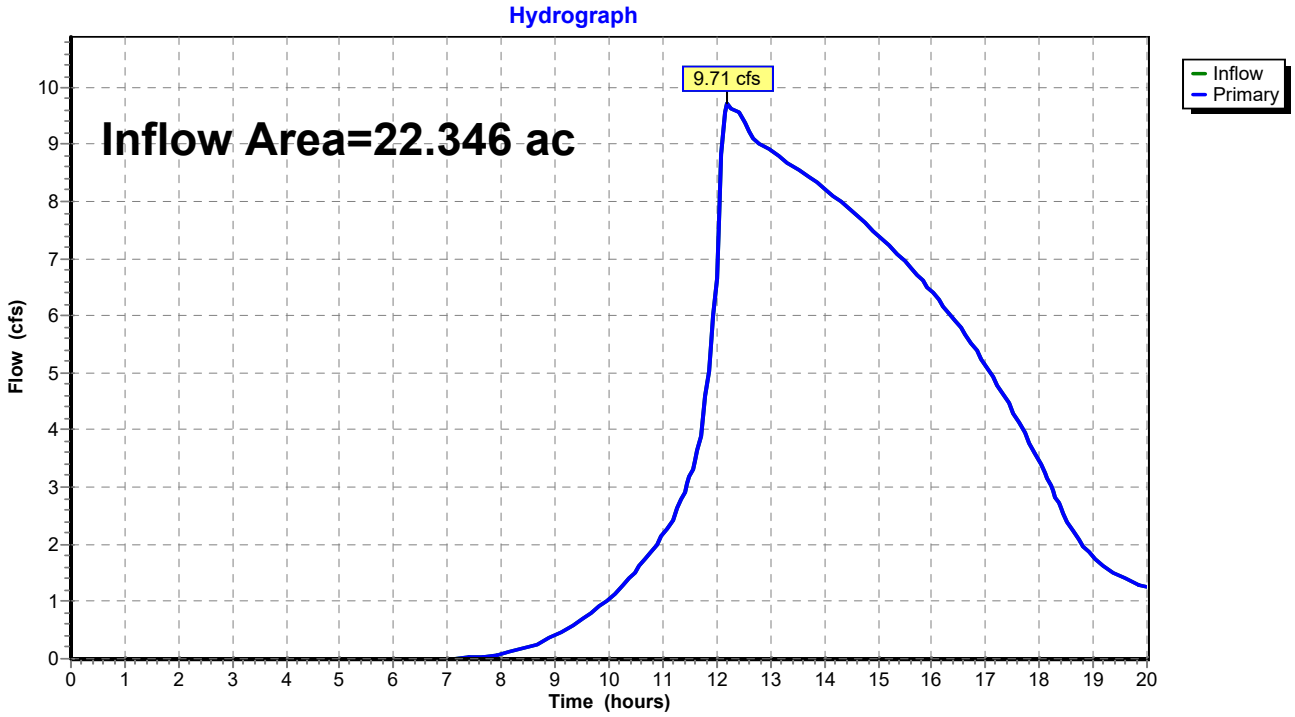


Summary for Link EDA 1: Total EDA1

Inflow Area = 22.346 ac, 39.72% Impervious, Inflow Depth > 2.34" for 10 year event
Inflow = 9.71 cfs @ 12.21 hrs, Volume= 4.349 af
Primary = 9.71 cfs @ 12.21 hrs, Volume= 4.349 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link EDA 1: Total EDA1

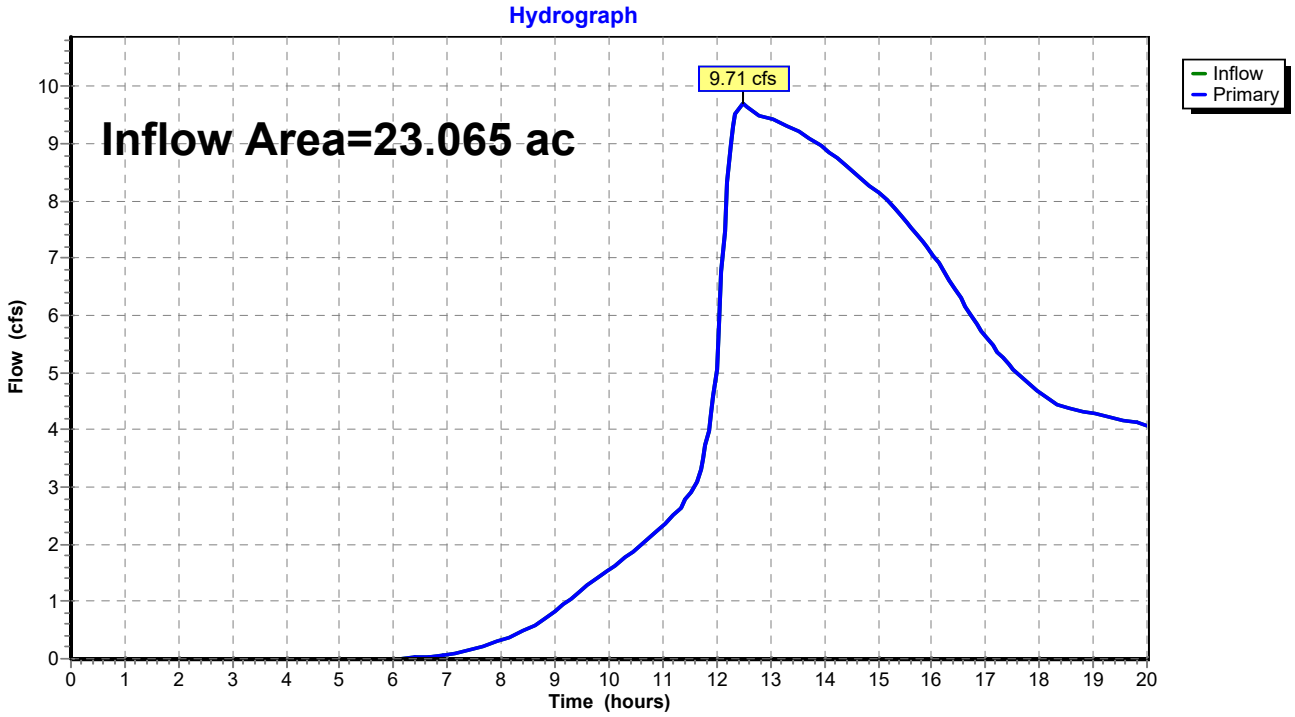


Summary for Link PDA 1: Total PDA 1

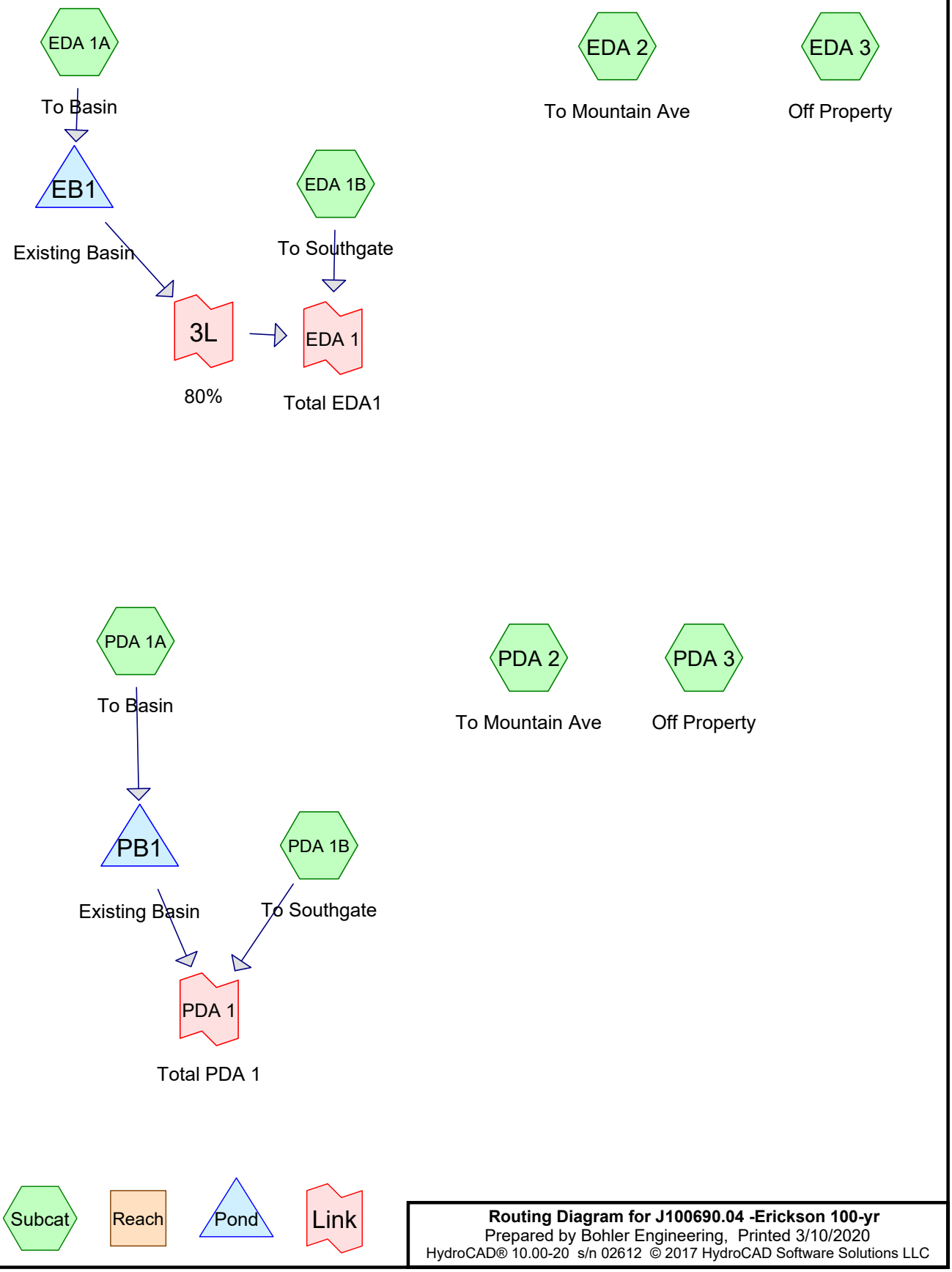
Inflow Area = 23.065 ac, 48.21% Impervious, Inflow Depth > 2.64" for 10 year event
Inflow = 9.71 cfs @ 12.49 hrs, Volume= 5.082 af
Primary = 9.71 cfs @ 12.49 hrs, Volume= 5.082 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link PDA 1: Total PDA 1



100-YEAR STORM EVENT



Routing Diagram for J100690.04 -Erickson 100-yr
Prepared by Bohler Engineering, Printed 3/10/2020
HydroCAD® 10.00-20 s/n 02612 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.311	61	>75% Grass cover, Good, HSG B (EDA 1A, EDA 1B, EDA 2, EDA 3, PDA 1A, PDA 1B, PDA 2, PDA 3)
13.547	74	>75% Grass cover, Good, HSG C (EDA 1A, EDA 1B, EDA 2, EDA 3, PDA 1A, PDA 1B, PDA 2, PDA 3)
6.876	80	>75% Grass cover, Good, HSG D (EDA 1A, EDA 1B, EDA 3, PDA 1A, PDA 1B, PDA 3)
4.621	80	>75% Grass cover, Good, HSG D (UR Zone) (EDA 1A, EDA 3, PDA 1A)
10.928	98	Paved parking, HSG D (EDA 1A, EDA 1B, PDA 1A, PDA 1B)
6.609	98	Roofs, HSG D (EDA 1A, PDA 1A)
0.893	98	Unconnected pavement, HSG D (EDA 1A)
1.462	98	Unconnected pavement, Sidewalk (PDA 1A)
0.104	98	Unconnected pavement, Walls (PDA 1A)
50.350	**84**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
5.311	HSG B	EDA 1A, EDA 1B, EDA 2, EDA 3, PDA 1A, PDA 1B, PDA 2, PDA 3
13.547	HSG C	EDA 1A, EDA 1B, EDA 2, EDA 3, PDA 1A, PDA 1B, PDA 2, PDA 3
29.927	HSG D	EDA 1A, EDA 1B, EDA 3, PDA 1A, PDA 1B, PDA 3
1.566	Other	PDA 1A
50.350		**TOTAL AREA**

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA 1A: To Basin Runoff Area=926,140 sf 41.71% Impervious Runoff Depth>6.43"
Flow Length=1,117' Tc=10.7 min CN=84 Runoff=138.89 cfs 11.392 af

Subcatchment EDA 1B: To Southgate Runoff Area=47,239 sf 0.69% Impervious Runoff Depth>5.24"
Tc=10.0 min CN=74 Runoff=6.11 cfs 0.473 af

Subcatchment EDA 2: To Mountain Ave Runoff Area=23,740 sf 0.00% Impervious Runoff Depth>4.77"
Tc=10.0 min CN=70 Runoff=2.82 cfs 0.216 af

Subcatchment EDA 3: Off Property Runoff Area=99,514 sf 0.00% Impervious Runoff Depth>5.48"
Tc=10.0 min CN=76 Runoff=13.38 cfs 1.043 af

Subcatchment PDA 1A: To Basin Runoff Area=21.933 ac 50.67% Impervious Runoff Depth>6.67"
Tc=10.0 min CN=86 Runoff=149.47 cfs 12.192 af

Subcatchment PDA 1B: To Southgate Runoff Area=49,309 sf 0.62% Impervious Runoff Depth>5.24"
Tc=10.0 min CN=74 Runoff=6.38 cfs 0.494 af

Subcatchment PDA 2: To Mountain Ave Runoff Area=17,294 sf 0.00% Impervious Runoff Depth>4.78"
Tc=0.0 min CN=70 Runoff=2.73 cfs 0.158 af

Subcatchment PDA 3: Off Property Runoff Area=74,628 sf 0.00% Impervious Runoff Depth>5.60"
Tc=10.0 min CN=77 Runoff=10.22 cfs 0.799 af

Pond EB1: Existing Basin Peak Elev=372.08' Storage=222,508 cf Inflow=138.89 cfs 11.392 af
Outflow=28.77 cfs 10.443 af

Pond PB1: Existing Basin Peak Elev=372.96' Storage=268,021 cf Inflow=149.47 cfs 12.192 af
Outflow=22.29 cfs 10.107 af

Link 3L: 80% x 0.80 Inflow=28.77 cfs 10.443 af
Primary=23.02 cfs 8.355 af Secondary=5.75 cfs 2.089 af

Link EDA 1: Total EDA1 Inflow=24.34 cfs 8.828 af
Primary=24.34 cfs 8.828 af

Link PDA 1: Total PDA 1 Inflow=23.98 cfs 10.601 af
Primary=23.98 cfs 10.601 af

Total Runoff Area = 50.350 ac Runoff Volume = 26.768 af Average Runoff Depth = 6.38"
60.29% Pervious = 30.355 ac 39.71% Impervious = 19.996 ac

Summary for Subcatchment EDA 1A: To Basin

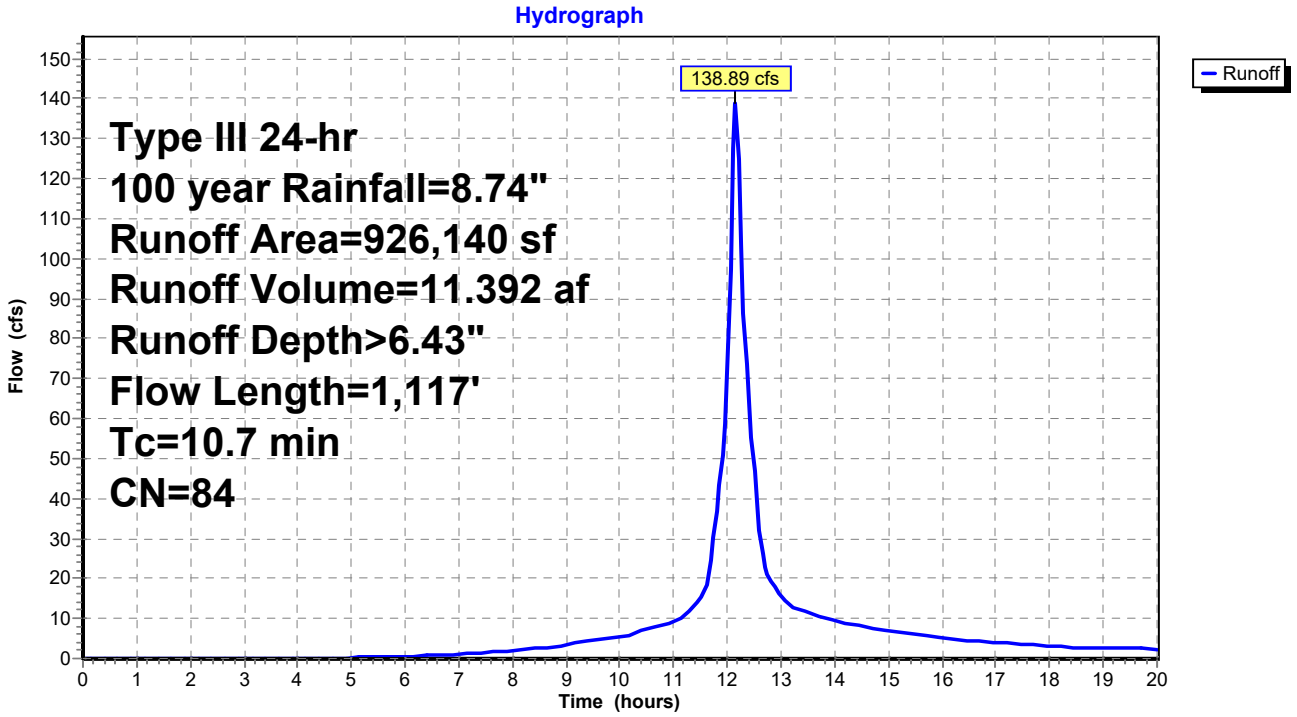
Runoff = 138.89 cfs @ 12.15 hrs, Volume= 11.392 af, Depth> 6.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=8.74"

	Area (sf)	CN	Description
	289,374	98	Paved parking, HSG D
	58,022	98	Roofs, HSG D
	88,253	61	>75% Grass cover, Good, HSG B
	284,975	74	>75% Grass cover, Good, HSG C
	83,505	80	>75% Grass cover, Good, HSG D
*	83,112	80	>75% Grass cover, Good, HSG D (UR Zone)
	38,899	98	Unconnected pavement, HSG D
	926,140	84	Weighted Average
	539,845		58.29% Pervious Area
	386,295		41.71% Impervious Area
	38,899		10.07% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	156	0.0550	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.2	352	0.0889	4.80		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	609	0.0680	15.50	27.39	**Pipe Channel, RCP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
10.7	1,117	Total			

Subcatchment EDA 1A: To Basin



Summary for Subcatchment EDA 1B: To Southgate

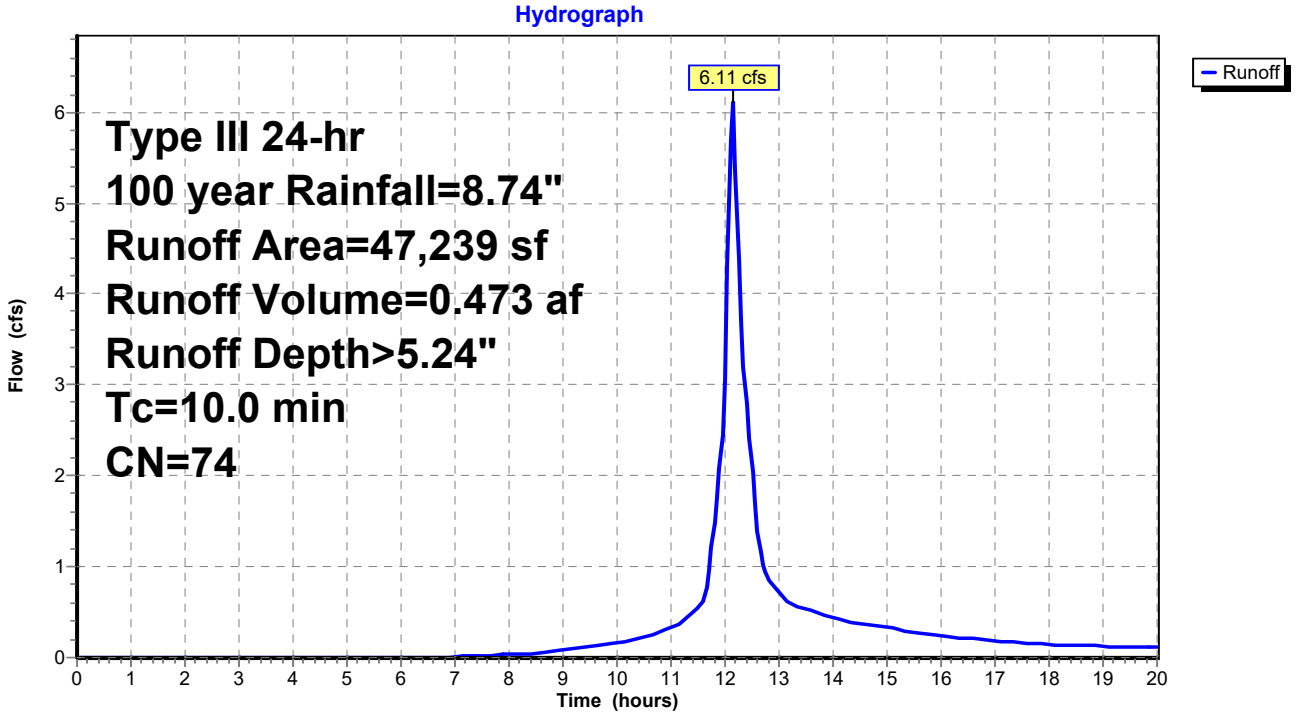
Runoff = 6.11 cfs @ 12.14 hrs, Volume= 0.473 af, Depth> 5.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=8.74"

Area (sf)	CN	Description
3,194	61	>75% Grass cover, Good, HSG B
36,234	74	>75% Grass cover, Good, HSG C
7,487	80	>75% Grass cover, Good, HSG D
324	98	Paved parking, HSG D
47,239	74	Weighted Average
46,915		99.31% Pervious Area
324		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment EDA 1B: To Southgate



Summary for Subcatchment EDA 2: To Mountain Ave

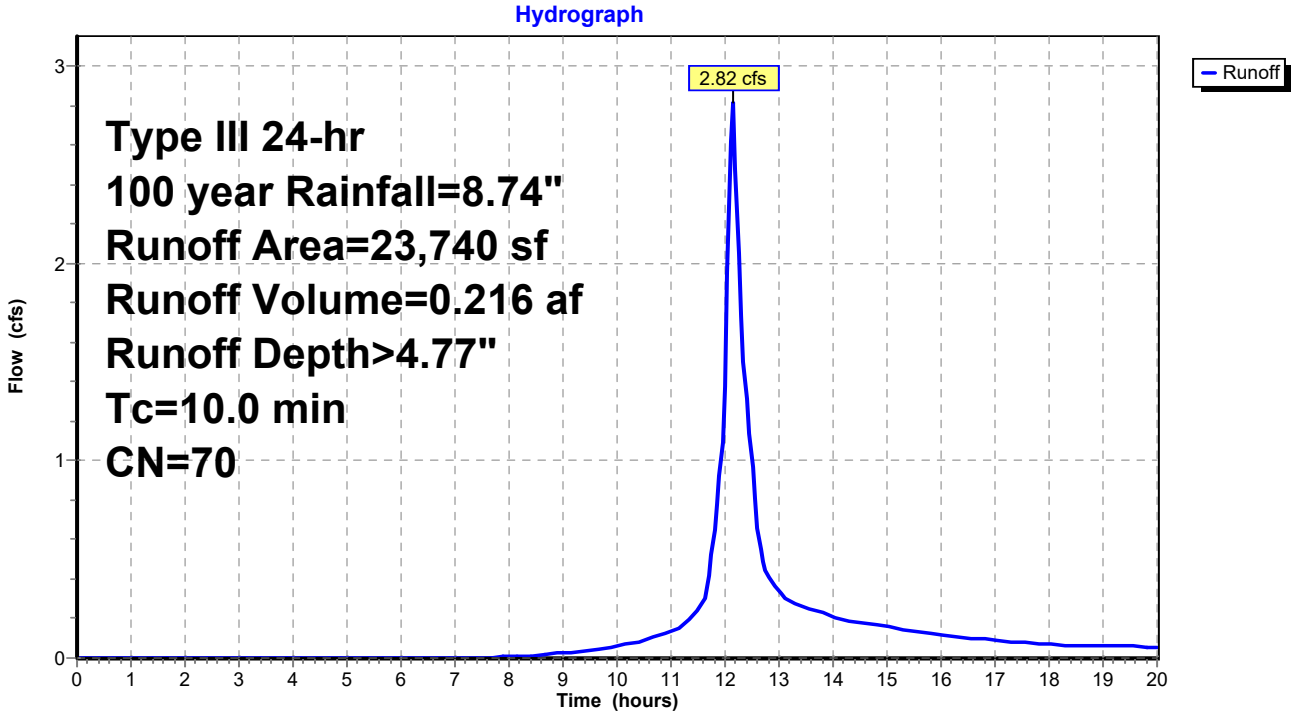
Runoff = 2.82 cfs @ 12.14 hrs, Volume= 0.216 af, Depth> 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=8.74"

Area (sf)	CN	Description
7,806	61	>75% Grass cover, Good, HSG B
15,934	74	>75% Grass cover, Good, HSG C
23,740	70	Weighted Average
23,740		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment EDA 2: To Mountain Ave



Summary for Subcatchment EDA 3: Off Property

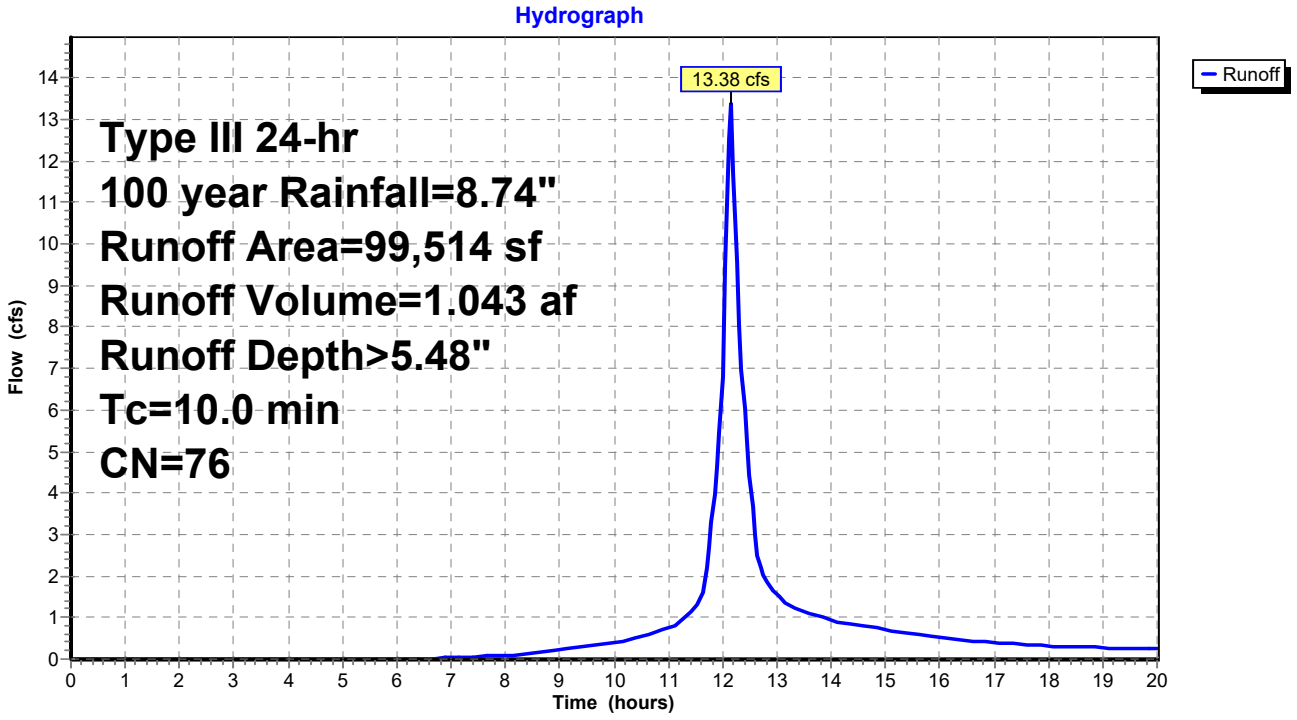
Runoff = 13.38 cfs @ 12.14 hrs, Volume= 1.043 af, Depth> 5.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=8.74"

	Area (sf)	CN	Description
	20,666	61	>75% Grass cover, Good, HSG B
	2,183	74	>75% Grass cover, Good, HSG C
	61,865	80	>75% Grass cover, Good, HSG D
*	14,800	80	>75% Grass cover, Good, HSG D (UR Zone)
	99,514	76	Weighted Average
	99,514		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment EDA 3: Off Property



Summary for Subcatchment PDA 1A: To Basin

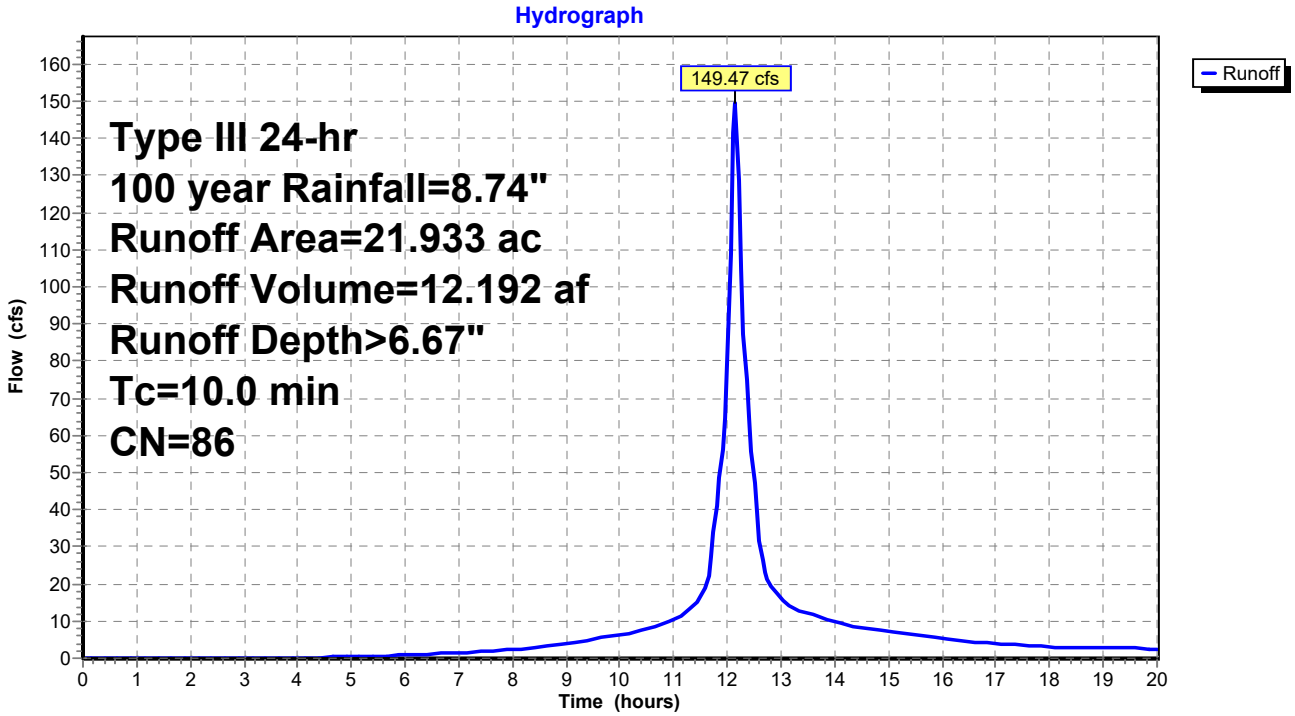
Runoff = 149.47 cfs @ 12.14 hrs, Volume= 12.192 af, Depth> 6.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=8.74"

	Area (ac)	CN	Description
	4.270	98	Paved parking, HSG D
*	1.462	98	Unconnected pavement, Sidewalk
*	0.104	98	Unconnected pavement, Walls
*	5.277	98	Roofs, HSG D
	2.131	61	>75% Grass cover, Good, HSG B
	4.541	74	>75% Grass cover, Good, HSG C
	1.775	80	>75% Grass cover, Good, HSG D
*	2.373	80	>75% Grass cover, Good, HSG D (UR Zone)
	21.933	86	Weighted Average
	10.820		49.33% Pervious Area
	11.113		50.67% Impervious Area
	1.566		14.09% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment PDA 1A: To Basin



Summary for Subcatchment PDA 1B: To Southgate

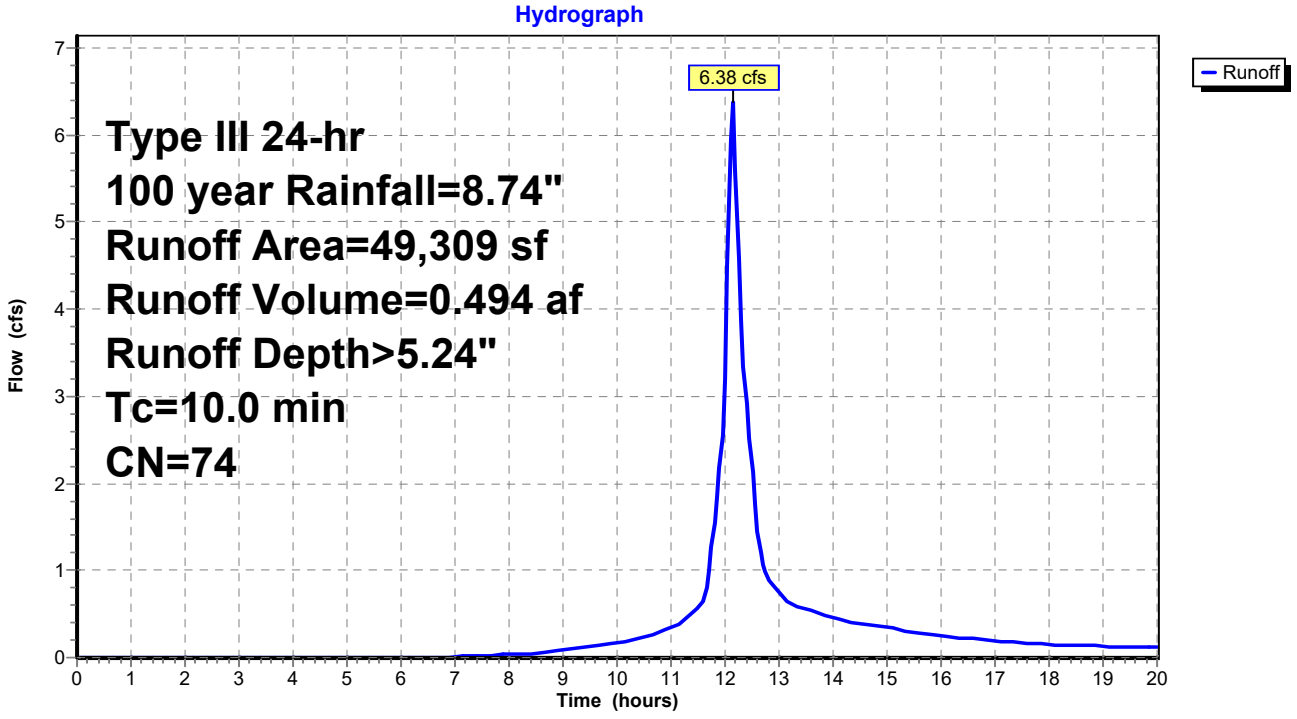
Runoff = 6.38 cfs @ 12.14 hrs, Volume= 0.494 af, Depth> 5.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=8.74"

Area (sf)	CN	Description
3,223	61	>75% Grass cover, Good, HSG B
38,289	74	>75% Grass cover, Good, HSG C
7,492	80	>75% Grass cover, Good, HSG D
305	98	Paved parking, HSG D
49,309	74	Weighted Average
49,004		99.38% Pervious Area
305		0.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment PDA 1B: To Southgate



Summary for Subcatchment PDA 2: To Mountain Ave

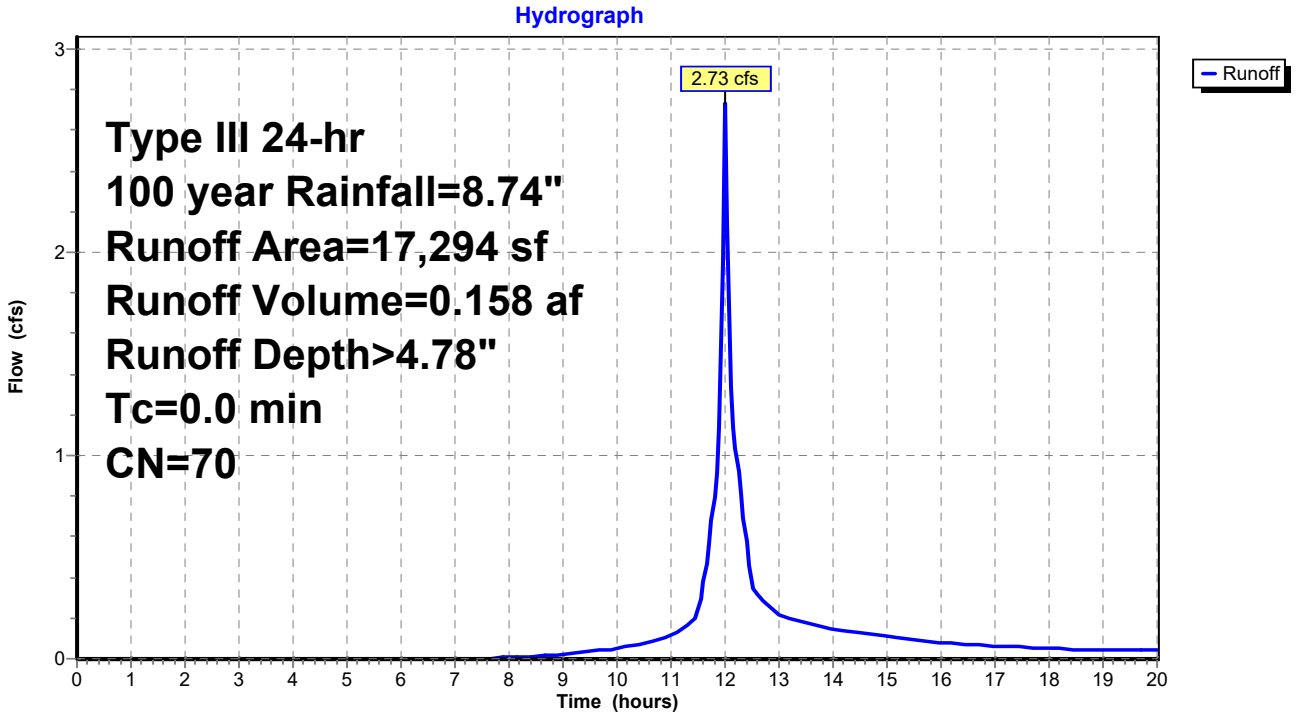
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 2.73 cfs @ 12.00 hrs, Volume= 0.158 af, Depth> 4.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=8.74"

Area (sf)	CN	Description
12,502	74	>75% Grass cover, Good, HSG C
4,792	61	>75% Grass cover, Good, HSG B
17,294	70	Weighted Average
17,294		100.00% Pervious Area

Subcatchment PDA 2: To Mountain Ave



Summary for Subcatchment PDA 3: Off Property

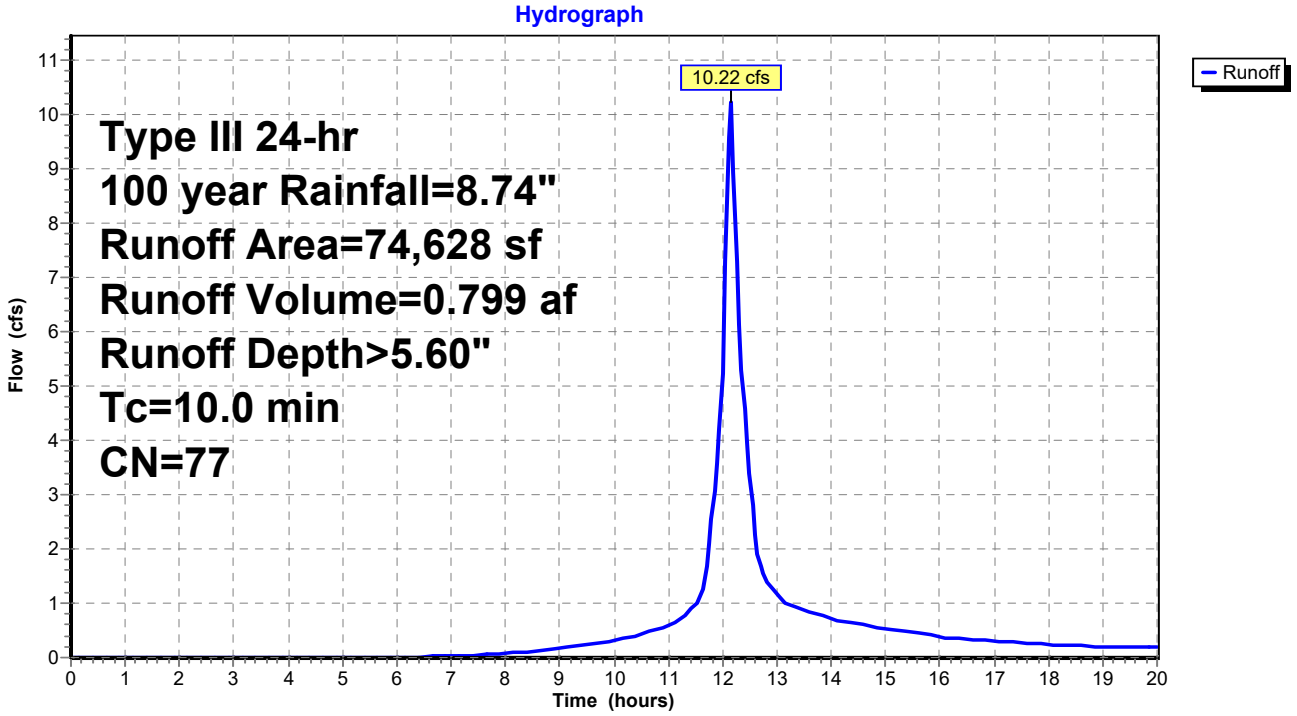
Runoff = 10.22 cfs @ 12.14 hrs, Volume= 0.799 af, Depth> 5.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=8.74"

Area (sf)	CN	Description
10,580	61	>75% Grass cover, Good, HSG B
2,183	74	>75% Grass cover, Good, HSG C
61,865	80	>75% Grass cover, Good, HSG D
74,628	77	Weighted Average
74,628		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment PDA 3: Off Property



Summary for Pond EB1: Existing Basin

Inflow Area = 21.261 ac, 41.71% Impervious, Inflow Depth > 6.43" for 100 year event
Inflow = 138.89 cfs @ 12.15 hrs, Volume= 11.392 af
Outflow = 28.77 cfs @ 12.63 hrs, Volume= 10.443 af, Atten= 79%, Lag= 29.0 min
Primary = 28.77 cfs @ 12.63 hrs, Volume= 10.443 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 372.08' @ 12.63 hrs Surf.Area= 49,710 sf Storage= 222,508 cf

Plug-Flow detention time= 146.3 min calculated for 10.443 af (92% of inflow)
Center-of-Mass det. time= 117.6 min (881.3 - 763.7)

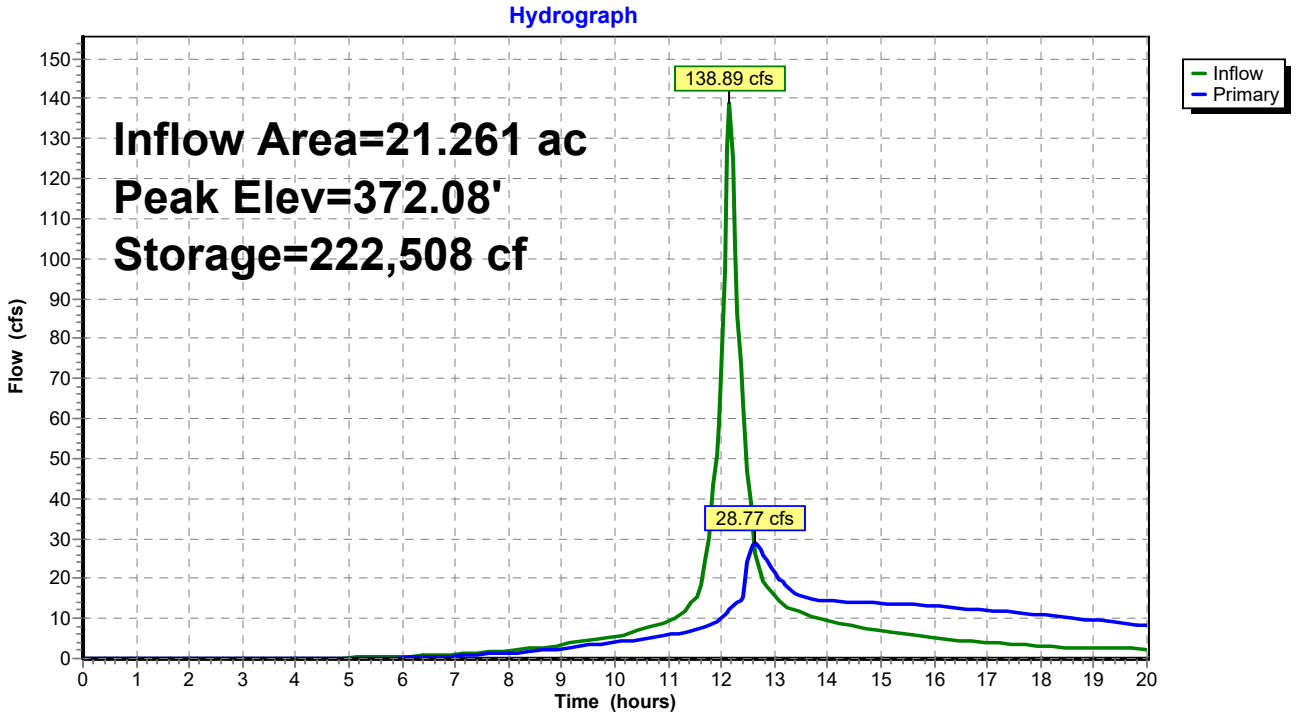
Volume	Invert	Avail.Storage	Storage Description
#1	365.00'	325,654 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
365.00	6,932	0	0
366.00	13,758	10,345	10,345
367.00	22,618	18,188	28,533
368.00	32,742	27,680	56,213
369.00	36,200	34,471	90,684
370.00	40,703	38,452	129,136
371.00	44,437	42,570	171,706
372.00	49,381	46,909	218,615
373.00	53,570	51,476	270,090
374.00	57,558	55,564	325,654

Device	Routing	Invert	Outlet Devices
#1	Primary	365.00'	**15.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	371.68'	**16.5' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 3.0' Crest Height

Primary OutFlow Max=28.65 cfs @ 12.63 hrs HW=372.08' (Free Discharge)
1=Orifice/Grate (Orifice Controls 15.01 cfs @ 12.23 fps)
2=Sharp-Crested Rectangular Weir (Weir Controls 13.64 cfs @ 2.09 fps)

Pond EB1: Existing Basin



Summary for Pond PB1: Existing Basin

Inflow Area = 21.933 ac, 50.67% Impervious, Inflow Depth > 6.67" for 100 year event
Inflow = 149.47 cfs @ 12.14 hrs, Volume= 12.192 af
Outflow = 22.29 cfs @ 12.72 hrs, Volume= 10.107 af, Atten= 85%, Lag= 35.2 min
Primary = 22.29 cfs @ 12.72 hrs, Volume= 10.107 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 372.96' @ 12.72 hrs Surf.Area= 53,408 sf Storage= 268,021 cf

Plug-Flow detention time= 161.2 min calculated for 10.082 af (83% of inflow)
Center-of-Mass det. time= 113.2 min (871.8 - 758.5)

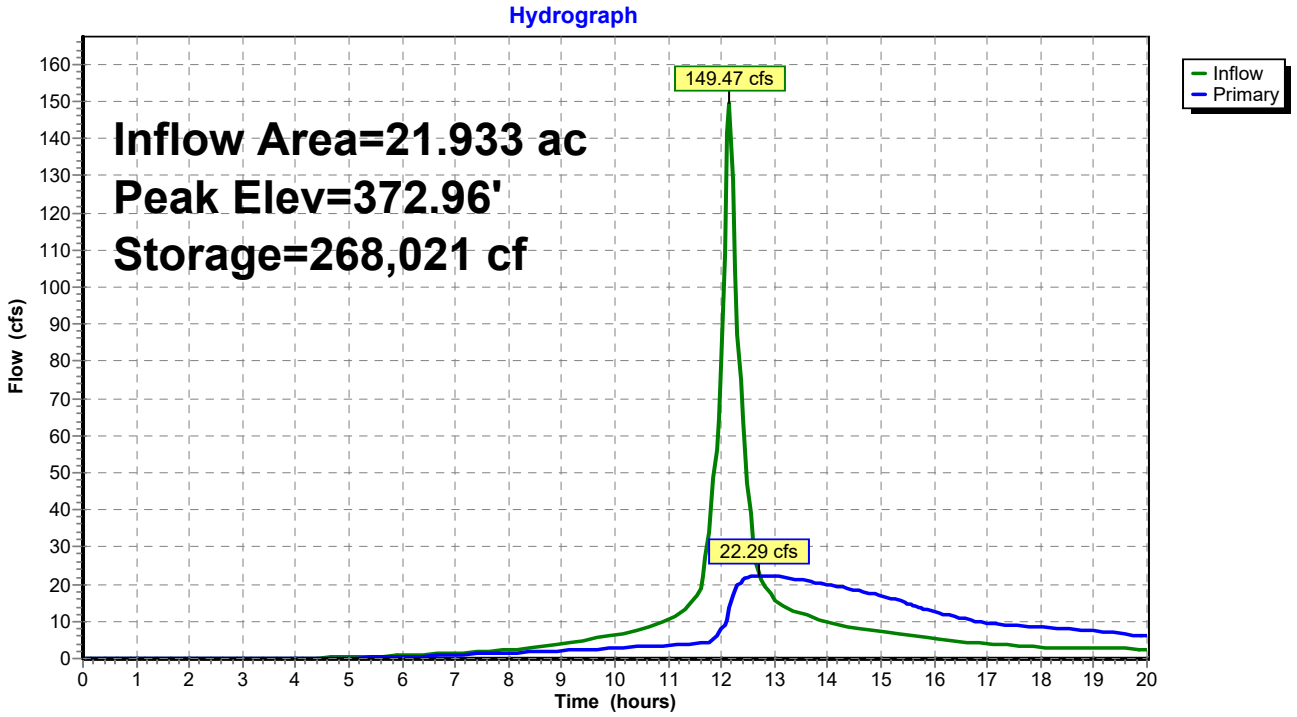
Volume	Invert	Avail.Storage	Storage Description
#1	365.00'	325,654 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
365.00	6,932	0	0
366.00	13,758	10,345	10,345
367.00	22,618	18,188	28,533
368.00	32,742	27,680	56,213
369.00	36,200	34,471	90,684
370.00	40,703	38,452	129,136
371.00	44,437	42,570	171,706
372.00	49,381	46,909	218,615
373.00	53,570	51,476	270,090
374.00	57,558	55,564	325,654

Device	Routing	Invert	Outlet Devices
#1	Primary	365.00'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	368.48'	**12.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	370.18'	**15.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#4	Primary	373.00'	**16.5' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 3.0' Crest Height

Primary OutFlow Max=22.29 cfs @ 12.72 hrs HW=372.96' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 6.68 cfs @ 13.37 fps)
- **2=Orifice/Grate** (Orifice Controls 6.54 cfs @ 9.80 fps)
- **3=Orifice/Grate** (Orifice Controls 9.07 cfs @ 7.26 fps)
- **4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond PB1: Existing Basin

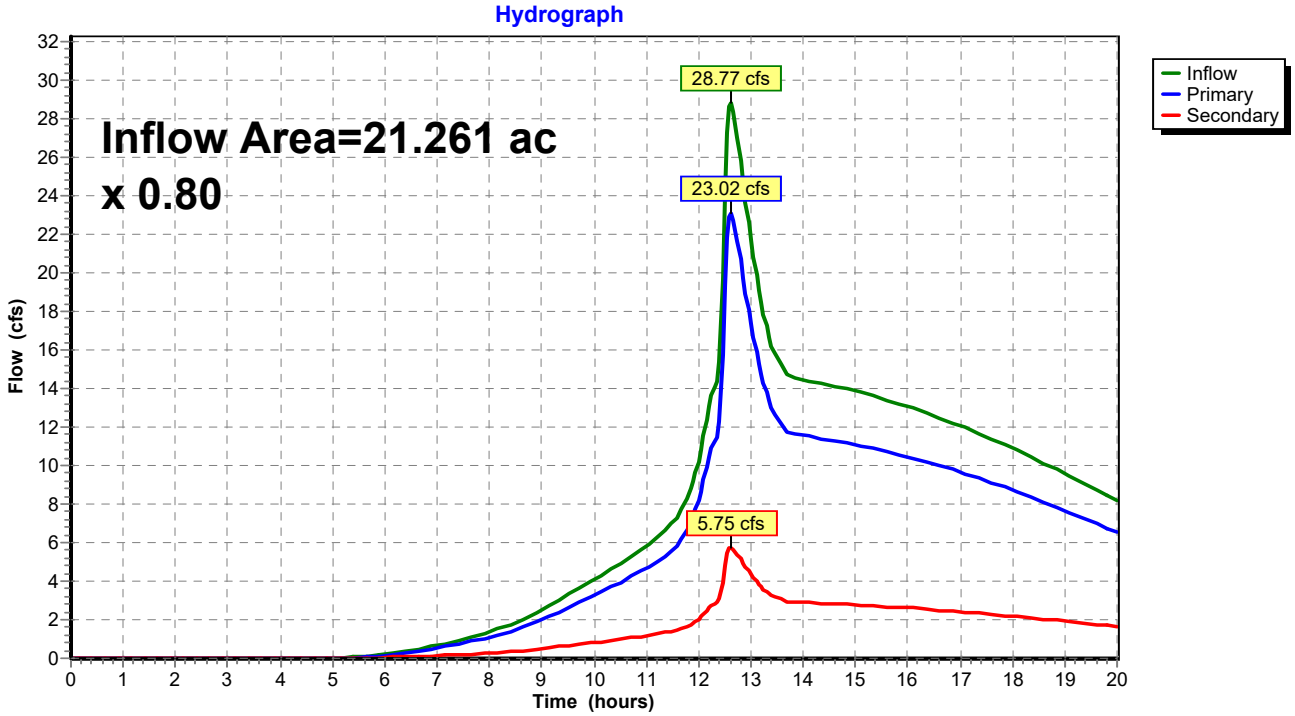


Summary for Link 3L: 80%

Inflow Area = 21.261 ac, 41.71% Impervious, Inflow Depth > 5.89" for 100 year event
Inflow = 28.77 cfs @ 12.63 hrs, Volume= 10.443 af
Primary = 23.02 cfs @ 12.63 hrs, Volume= 8.355 af, Atten= 20%, Lag= 0.0 min
Secondary = 5.75 cfs @ 12.63 hrs, Volume= 2.089 af

Primary outflow = Inflow x 0.80, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link 3L: 80%

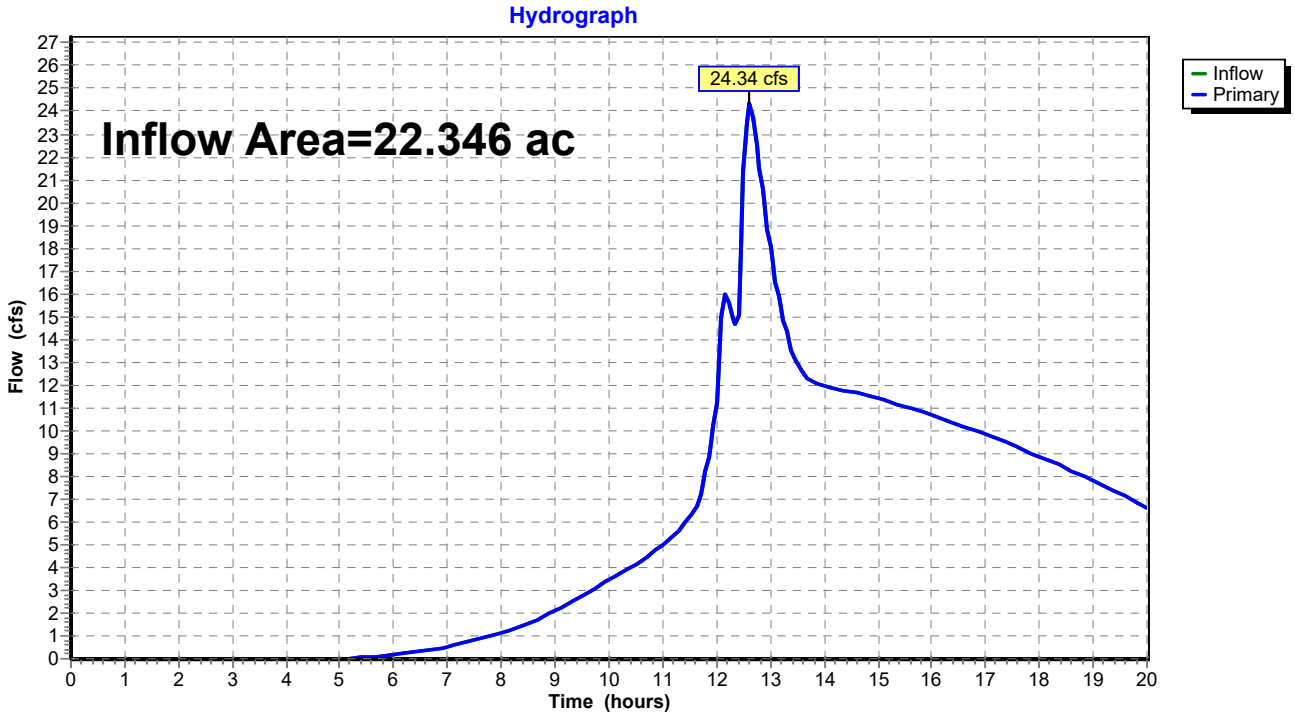


Summary for Link EDA 1: Total EDA1

Inflow Area = 22.346 ac, 39.72% Impervious, Inflow Depth > 4.74" for 100 year event
Inflow = 24.34 cfs @ 12.62 hrs, Volume= 8.828 af
Primary = 24.34 cfs @ 12.62 hrs, Volume= 8.828 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link EDA 1: Total EDA1

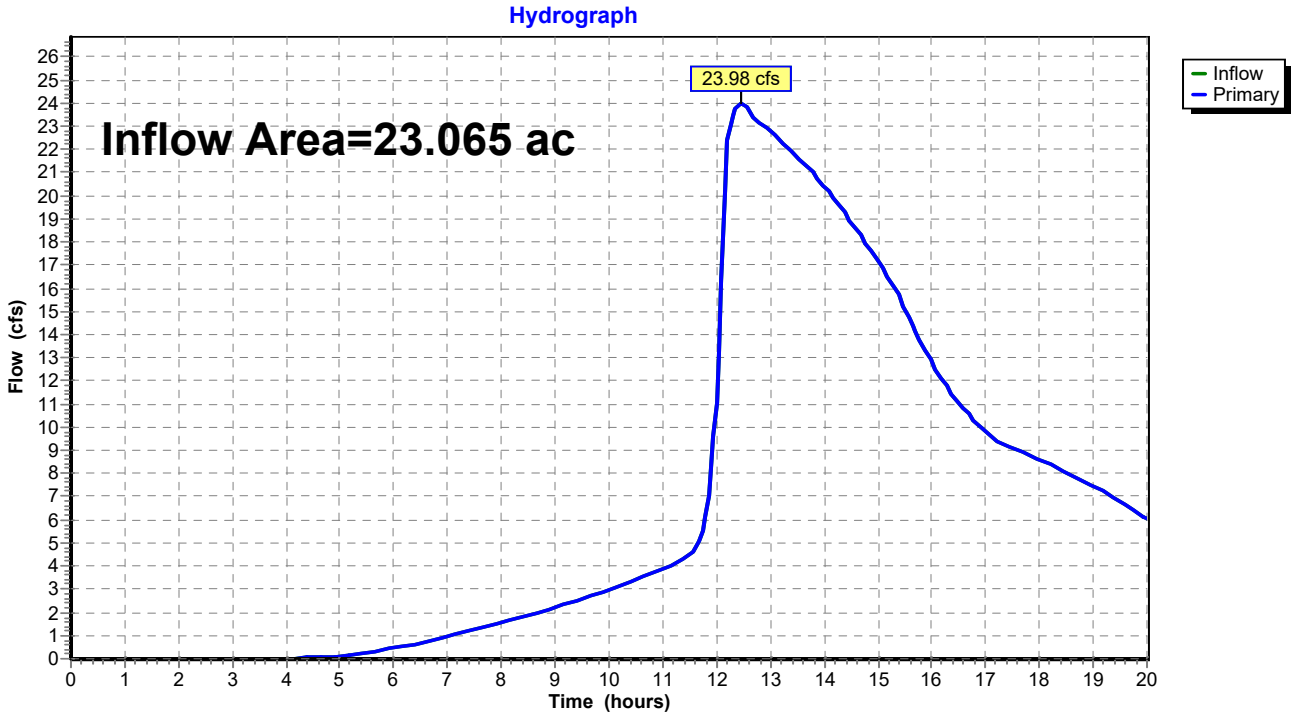


Summary for Link PDA 1: Total PDA 1

Inflow Area = 23.065 ac, 48.21% Impervious, Inflow Depth > 5.52" for 100 year event
Inflow = 23.98 cfs @ 12.46 hrs, Volume= 10.601 af
Primary = 23.98 cfs @ 12.46 hrs, Volume= 10.601 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link PDA 1: Total PDA 1



Time of Concentration Calculation

Maximum sheet flow lengths are based on the McCuen-Spiess equation as outlined in Chapter 15 of the NRCS Engineering Handbook, dated May 2010. Below are the equations used to calculate the maximum sheet flow lengths for the existing drainage areas, all of the proposed drainage areas do not exceed the maximum flow lengths.

McCuen-Spiess Equation

$$l = \frac{100\sqrt{S}}{n}$$

Where:

l = Limiting flow length (ft)

S = Slope (ft/ft)

n = Manning's roughness coefficient

EDA 1

$$l = \frac{100\sqrt{0.055}}{0.15} = 156$$

B. DESIGN CALCULATIONS

- **NJ Groundwater Recharge Spreadsheet**
- **Structure Report**
- **Pipe Sizing**
- **Conduit Outlet Protection Calculations**
- **Low Impact Development Checklist**

NJ GROUNDWATER RECHARGE SPREADSHEET

Project Name	Description	Analysis Date	BMP or LID Type
J180852	Old Bridge, NJ - Phase I	11/15/19	

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	2500.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	8.6	in
Upper level of the BMP surface (negative if above ground)	dBMPu	12.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	24.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	0	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.19	in
ERWC Modified to consider dEXC	EDRWC	0.06	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.05	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	0.05	in
Inches of Rainfall to capture	Pdesign	0.10	in
Recharge Provided Avg. over Imp. Area		3.5	in
Runoff Captured Avg. over imp. Area		3.5	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.01	unitless
BMP Volume	VBMP	1,797	cu.ft

CALCULATION CHECK MESSAGES

Volume Balance-> OK
dBMP Check---> OK
dEXC Check---> OK

BMP Location---> Location is selected as distributed or undetermined

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	141,173	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	484,431	sq.ft
Root Zone Water Capacity	RWC	1.25	in
RWC Modified to consider dEXC	DRWC	0.40	in
Climatic Factor	C-factor	1.69	no units
Average Annual P	Pavg	49.2	in
Recharge Requirement over Imp. Area	dr	3.5	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		141,173	cu.ft
Avg BMP Recharge Efficiency		99.4%	Represents % Infiltration Recharged
%Rainfall became Runoff		78.5%	%
%Runoff Infiltrated		9.1%	%
%Runoff Recharged		9.0%	%
%Rainfall Recharged		7.1%	%

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.

STRUCTURE REPORT

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	INLET 2	Grate	387.74	Cir	5.00	5.00	36	Cir	381.85	36	Cir	382.14
2	INLET 3	Grate	389.94	Cir	5.00	5.00	36	Cir	384.05	33 18	Cir Cir	384.05 384.47
3	INLET 4	Grate	398.05	Cir	5.00	5.00	33	Cir	389.94	33 12	Cir Cir	390.04 391.77
4	INLET 5	Grate	400.61	Cir	4.00	4.00	33	Cir	394.62	33	Cir	395.01
5	INLET 6	Grate	407.56	Cir	5.00	5.00	33	Cir	396.78	30 12	Cir Cir	396.78 402.79
6	INLET 7	Grate	412.93	Cir	5.00	5.00	30	Cir	397.15	30	Cir	397.15
7	INLET 8	Grate	415.44	Cir	5.00	5.00	30	Cir	397.43	30	Cir	397.43
8	INLET 9	Grate	418.61	Cir	5.00	5.00	30	Cir	397.68	30	Cir	397.68
9	INLET 10	Grate	419.20	Cir	5.00	5.00	30	Cir	398.26	30	Cir	398.26
10	INLET 11	Grate	413.99	Cir	5.00	5.00	30	Cir	399.09	30	Cir	399.09
11	INLET 12	Grate	429.56	Cir	2.50	2.50	30	Cir	420.47	24	Cir	424.86
12	INLET 13	Grate	429.56	Cir	2.50	2.50	24	Cir	424.98	24	Cir	424.98
13	INLET 14	Grate	435.24	Cir	2.50	2.50	24	Cir	430.44	24 12	Cir Cir	430.44 431.54
14	INLET 15	Grate	442.15	Cir	2.50	2.50	24	Cir	437.36	24 12	Cir Cir	437.57 438.48
15	INLET 16	Grate	447.04	Cir	2.50	2.50	24	Cir	439.30	24 12	Cir Cir	439.30 443.17
16	INLET 17	Grate	447.60	Cir	2.50	2.50	24	Cir	439.43	18 12	Cir Cir	443.53 439.43
17	INLET 18	Grate	450.20	Cir	3.50	3.50	18	Cir	444.48	12 18	Cir Cir	444.48 445.19
18	INLET 19	Grate	450.21	Cir	3.50	3.50	12	Cir	444.60	12	Cir	444.60
19	INLET 20	Grate	450.50	Cir	3.50	3.50	12	Cir	445.32	12 12	Cir Cir	446.83 445.32

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
20	INLET 20.1	Grate	450.50	Cir	3.50	3.50	12	Cir	446.95			
21	INLET 18.1	Grate	449.77	Cir	3.50	3.50	18	Cir	445.71	12	Cir	446.22
22	INLET 18.2	Grate	450.70	Cir	3.50	3.50	12	Cir	447.15			
23	INLET 21	Grate	449.69	Cir	3.50	3.50	12	Cir	446.02	12	Cir	446.02
24	INLET 22	Grate	449.69	Cir	3.50	3.50	12	Cir	446.14			
25	INLET 16.1	Grate	447.00	Cir	2.50	2.50	12	Cir	443.45			
26	INLET 17.1	Grate	449.48	Cir	3.50	3.50	12	Cir	439.63	12	Cir	439.63
27	INLET 17.2	Grate	449.08	Cir	3.50	3.50	12	Cir	444.44			
28	INLET 15.1	Grate	442.15	Cir	2.50	2.50	12	Cir	438.60			
29	INLET 14.1	Grate	435.21	Cir	2.50	2.50	12	Cir	431.66			
30	INLET 3.1	Grate	395.00	Cir	5.00	5.00	18	Cir	389.64	18	Cir	390.77
31	Structure - (315)	Grate	397.64	Cir	4.00	4.00	18	Cir	391.19	18 12	Cir Cir	391.19 391.51
32	INLET 3.4	Grate	400.50	Cir	5.00	5.00	18	Cir	396.32	18	Cir	396.32
33	INLET 3.5	Grate	409.06	Cir	5.00	5.00	18	Cir	403.92	18	Cir	403.92
34	INLET 3.6	Grate	408.50	Cir	4.00	4.00	18	Cir	404.29	15 12	Cir Cir	404.69 404.87
35	INLET 3.7	Grate	415.50	Cir	4.00	4.00	15	Cir	408.18	12	Cir	408.60
36	INLET 3.8	Grate	412.83	Cir	4.00	4.00	12	Cir	409.28			
37	INLET 6.1	Grate	409.73	Cir	3.50	3.50	12	Cir	404.75	12	Cir	406.06
38	INLET 6.2	Grate	409.73	Cir	3.50	3.50	12	Cir	406.18			
39	Structure - (298)	Grate	415.00	Cir	4.00	4.00	12	Cir	411.36			
40	INLET 3.2	Grate	397.03	Cir	3.50	3.50	12	Cir	391.91	12	Cir	391.91
41	INLET 3.3	Grate	397.07	Cir	3.50	3.50	12	Cir	392.03			

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
42	INLET 4.1	Grate	398.00	Cir	5.00	5.00	12	Cir	394.03			
43	INLET 24	Grate	387.99	Cir	5.00	5.00	48	Cir	373.21	48	Cir	376.21
44	INLET 24.1	Grate	387.72	Cir	5.00	5.00	48	Cir	376.33	42 12 15	Cir Cir Cir	381.61 381.21 376.33
45	INLET 25	Grate	387.28	Cir	5.00	5.00	42	Cir	383.46	42	Cir	383.46
46	INLET 26	Grate	396.85	Cir	5.00	5.00	42	Cir	390.74	42 12	Cir Cir	390.73 392.22
47	MANHOLE 27	Grate	405.80	Cir	5.00	5.00	42	Cir	395.32	42	Cir	395.32
48	INLET 28	Grate	407.63	Cir	5.00	5.00	42	Cir	395.54	36 24	Cir Cir	402.03 395.54
49	INLET 29	Grate	411.07	Cir	5.00	5.00	36	Cir	404.47	36 12	Cir Cir	404.47 406.15
50	INLET 30	Grate	423.30	Cir	5.00	5.00	36	Cir	416.82	33 12 12	Cir Cir Cir	417.70 417.33 413.64
51	INLET 31	Grate	426.67	Cir	5.00	5.00	33	Cir	419.38	33 12	Cir Cir	420.21 419.38
52	INLET 32	Grate	427.55	Cir	5.00	5.00	33	Cir	421.96	30	Cir	422.46
53	INLET 33	Grate	428.56	Cir	5.00	5.00	30	Cir	423.16	30	Cir	423.16
54	INLET 34	Grate	428.37	Cir	5.00	5.00	30	Cir	423.28	24	Cir	423.65
55	INLET 35	Grate	429.11	Cir	5.00	5.00	24	Cir	424.14	18 15	Cir Cir	424.14 425.52
56	INLET 36	Grate	435.81	Cir	5.00	5.00	18	Cir	431.25	18 12	Cir Cir	431.25 431.45
57	INLET 37	Grate	441.28	Cir	5.00	5.00	18	Cir	435.41	15 12	Cir Cir	437.47 435.41
58	INLET 38	Grate	448.60	Cir	5.00	5.00	15	Cir	444.63	12 15	Cir Cir	444.91 444.63

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
59	INLET 38.1	Grate	448.58	Cir	3.50	3.50	12	Cir	445.03			
60	INLET 39	Grate	448.62	Cir	5.00	5.00	15	Cir	444.81			
61	INLET 37.1	Grate	441.71	Cir	5.00	5.00	12	Cir	437.66			
62	INLET 36.1	Grate	435.12	Cir	5.00	5.00	12	Cir	431.57			
63	INLET 35.1	Grate	429.21	Cir	5.00	5.00	15	Cir	425.64			
64	INLET 31.1	Grate	426.68	Cir	5.00	5.00	12	Cir	419.50			
65	INLET 30.4	Grate	423.30	Cir	5.00	5.00	12	Cir	417.45			
66	INLET 30.1	Grate	422.13	Cir	5.00	5.00	12	Cir	413.81	12	Cir	413.81
67	INLET 30.2	Grate	418.36	Cir	3.50	3.50	12	Cir	414.01	12	Cir	414.01
68	INLET 30.3	Grate	418.36	Cir	3.50	3.50	12	Cir	414.13			
69	INLET 29.1	Grate	412.34	Cir	5.00	5.00	12	Cir	408.29			
70	INLET 28.1	Grate	406.06	Cir	5.00	5.00	24	Cir	395.94	24	Cir	395.94
71	INLET 28.2	Grate	405.56	Cir	5.00	5.00	24	Cir	396.01	24 12	Cir Cir	396.01 401.92
72	INLET 28.3	Grate	407.36	Cir	4.00	4.00	24	Cir	396.60	18 12	Cir Cir	396.58 396.60
73	INLET 28.4	Grate	408.10	Cir	5.00	5.00	18	Cir	396.88	15 12	Cir Cir	401.63 396.88
74	INLET 28.5	Grate	407.20	Cir	2.50	2.50	15	Cir	402.07	12	Cir	402.07
75	INLET 28.6	Grate	407.18	Cir	5.00	5.00	12	Cir	402.60	12	Cir	402.60
76	INLET 28.7	Grate	407.48	Cir	5.00	5.00	12	Cir	402.94	12	Cir	402.94
77	INLET 28.8	Grate	407.11	Rect	5.00	5.00	12	Cir	403.56			
78	Structure - (312)	Grate	406.07	Cir	4.00	4.00	12	Cir	402.52			
79	INLET 28.3.1	Grate	422.50	Cir	5.00	5.00	12	Cir	418.40			

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
80	Null Structure	Grate	0.00	Cir	0.00	0.00	12	Cir	396.77			
81	INLET 26.1	Grate	398.52	Cir	5.00	5.00	12	Cir	392.40	12	Cir	392.40
82	INLET 26.2	Grate	396.26	Cir	3.50	3.50	12	Cir	392.59	12	Cir	392.59
83	INLET 26.3	Grate	396.26	Cir	3.50	3.50	12	Cir	392.71			
84	INLET 24.2	Grate	387.11	Cir	3.50	3.50	12	Cir	381.61	12 12	Cir Cir	381.70 381.61
85	INLET 24.2.1	Grate	385.48	Cir	3.50	3.50	12	Cir	381.93			
86	INLET 24.3	Grate	385.35	Cir	3.50	3.50	12	Cir	381.68	12	Cir	381.68
87	INLET 24.4	Grate	385.35	Cir	3.50	3.50	12	Cir	381.80			
88	INLET 24.5	Grate	385.84	Cir	5.00	5.00	15	Cir	376.86	15	Cir	376.86
89	INLET 24.6	Grate	384.39	Cir	5.00	5.00	15	Cir	377.19	12 12	Cir Cir	378.33 377.19
90	Null Structure	Grate	0.00	Rect	0.00	0.00	12	Cir	378.54			
91	INLET 24.7	Grate	383.47	Cir	5.00	5.00	12	Cir	377.51	12	Cir	377.51
92	INLET 24.8	Grate	383.00	Cir	5.00	5.00	12	Cir	377.54	12	Cir	377.54
93	INLET 24.9	Grate	383.00	Cir	5.00	5.00	12	Cir	378.97			

PIPE SIZING

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe - (35)	28.65	36	Cir	67.968	371.44	381.85	15.316	373.13	383.58	n/a	383.58	End	Grate
2	Pipe - (34) (1) (1)	27.99	36	Cir	54.706	382.14	384.05	3.491	383.58	385.76	n/a	385.76	1	Grate
3	Pipe - (32)	18.98	33	Cir	136.205	384.05	389.94	4.324	385.76	391.37	n/a	391.37 j	2	Grate
4	Pipe - (31)	18.80	33	Cir	50.672	390.04	394.62	9.038	391.37	396.05	0.52	396.05	3	Grate
5	Pipe - (30)	18.43	33	Cir	53.513	395.01	396.78	3.308	396.05	398.19	n/a	398.19	4	Grate
6	Pipe - (29)	17.38	30	Cir	73.648	396.78	397.15	0.502	398.19	398.56	0.72	398.56	5	Grate
7	Pipe - (28)	17.26	30	Cir	54.923	397.15	397.43	0.510	398.56	398.83	n/a	398.83 j	6	Grate
8	Pipe - (27)	16.60	30	Cir	51.100	397.43	397.68	0.489	398.83	399.06	n/a	399.06 j	7	Grate
9	Pipe - (26)	16.48	30	Cir	114.584	397.68	398.26	0.506	399.06	399.63	n/a	399.63 j	8	Grate
10	Pipe - (25)	15.91	30	Cir	167.526	398.26	399.09	0.495	399.63	400.44	n/a	400.44 j	9	Grate
11	Pipe - (92)	14.95	30	Cir	106.809	399.09	420.47	20.017	400.44	421.77	n/a	421.77 j	10	Grate
12	Pipe - (91)	14.73	24	Cir	24.000	424.86	424.98	0.500	426.10	426.36	n/a	426.36	11	Grate
13	Pipe - (96)	12.17	24	Cir	57.745	424.98	430.44	9.455	426.36	431.69	n/a	431.69 j	12	Grate
14	Pipe - (95)	11.45	24	Cir	125.280	430.44	437.36	5.524	431.69	438.57	n/a	438.57 j	13	Grate
15	Pipe - (94)	11.26	24	Cir	90.056	437.57	439.30	1.921	438.57	440.50	0.75	440.50	14	Grate
16	Pipe - (93)	9.74	24	Cir	24.970	439.30	439.43	0.521	440.50	440.55	n/a	440.55 j	15	Grate
17	Pipe - (106)	8.87	18	Cir	149.489	443.53	444.48	0.636	444.56	445.63	1.00	445.63	16	Grate
18	Pipe - (107)	1.85	12	Cir	24.053	444.48	444.60	0.499	445.63*	445.69*	0.13	445.82	17	Grate
19	Pipe - (254) (1)	1.49	12	Cir	144.138	444.60	445.32	0.500	445.82	445.96	0.26	446.22	18	Grate
20	Pipe - (256)	0.10	12	Cir	24.000	446.83	446.95	0.500	446.95	447.08	0.05	447.08	19	Grate
21	Pipe - (255)	5.55	18	Cir	104.300	445.19	445.71	0.499	446.01	446.62	n/a	446.62	17	Grate
22	Pipe - (103)	0.81	12	Cir	82.329	446.22	447.15	1.130	446.62	447.53	n/a	447.53 j	21	Grate
23	Pipe - (254)	1.34	12	Cir	141.061	445.32	446.02	0.496	446.22	446.51	n/a	446.51 j	19	Grate
24	Pipe - (110)	0.64	12	Cir	24.000	446.02	446.14	0.500	446.51	446.47	n/a	446.47	23	Grate

Project File: Pipe Sizing.stm | Number of lines: 93 | Run Date: 3/11/2020

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
25	Pipe - (101)	1.63	12	Cir	56.509	443.17	443.45	0.495	443.73	444.01	0.20	444.21	15	Grate
26	Pipe - (109)	0.80	12	Cir	40.033	439.43	439.63	0.500	440.55	440.56	0.01	440.57	16	Grate
27	Pipe - (108)	0.49	12	Cir	24.065	439.63	444.44	19.987	440.57	444.73	n/a	444.73 j	26	Grate
28	Pipe - (97)	0.19	12	Cir	24.000	438.48	438.60	0.500	438.66	438.78	0.06	438.84	14	Grate
29	Pipe - (98)	0.19	12	Cir	24.000	431.54	431.66	0.500	431.72	431.84	0.06	431.90	13	Grate
30	Pipe - (102)	7.67	18	Cir	25.844	384.47	389.64	20.004	385.76	390.71	n/a	390.71 j	2	Grate
31	Pipe - (247) (1)	7.49	18	Cir	85.591	390.77	391.19	0.491	391.77	392.25	n/a	392.25	30	Grate
32	Pipe - (243)	6.63	18	Cir	84.837	391.19	396.32	6.047	392.25	397.31	n/a	397.31 j	31	Grate
33	Pipe - (58)	6.40	18	Cir	83.715	396.32	403.92	9.078	397.31	404.90	n/a	404.90 j	32	Grate
34	Pipe - (252)	6.10	18	Cir	74.845	403.92	404.29	0.494	404.90	405.24	n/a	405.24 j	33	Grate
35	Pipe - (251)	3.71	15	Cir	113.442	404.69	408.18	3.076	405.24	408.96	0.17	408.96	34	Grate
36	Pipe - (250)	2.75	12	Cir	136.466	408.60	409.28	0.498	409.30	409.99	0.33	409.99	35	Grate
37	Pipe - (116)	1.37	12	Cir	30.327	402.79	404.75	6.463	403.04	405.24	0.17	405.24	5	Grate
38	Pipe - (115)	0.63	12	Cir	23.999	406.06	406.18	0.500	406.39	406.51	0.12	406.51	37	Grate
39	Pipe - (253)	1.69	12	Cir	34.200	404.87	411.36	18.977	405.24	411.91	0.22	411.91	34	Grate
40	Pipe - (247)	0.96	12	Cir	9.287	391.51	391.91	4.307	392.25	392.32	n/a	392.32 j	31	Grate
41	Pipe - (59) (1)	0.90	12	Cir	24.000	391.91	392.03	0.500	392.32	392.43	n/a	392.43 j	40	Grate
42	Pipe - (37)	0.31	12	Cir	38.139	391.77	394.03	5.926	391.90	394.26	0.08	394.26	3	Grate
43	Pipe - (42)	46.24	48	Cir	21.348	368.94	373.21	20.002	370.91	375.24	0.40	375.24	End	Grate
44	Pipe - (267)	43.30	48	Cir	24.842	376.21	376.33	0.483	377.80	378.30	1.15	378.30	43	Grate
45	Pipe - (53)	36.99	42	Cir	96.820	381.61	383.46	1.911	382.68	385.35	n/a	385.35	44	Grate
46	Pipe - (52)	37.30	42	Cir	110.798	383.46	390.74	6.570	385.35	392.63	0.77	392.63	45	Grate
47	Pipe - (51)	35.28	42	Cir	122.972	390.73	395.32	3.733	392.63	397.16	n/a	397.16 j	46	Grate
48	Pipe - (50)	35.45	42	Cir	44.019	395.32	395.54	0.500	397.16	397.38	n/a	397.38	47	Grate

Project File: Pipe Sizing.stm | Number of lines: 93 | Run Date: 3/11/2020

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
49	Pipe - (68)	23.30	36	Cir	44.352	402.03	404.47	5.501	402.72	406.02	n/a	406.02	48	Grate
50	Pipe - (67)	23.24	36	Cir	148.448	404.47	416.82	8.319	406.02	418.37	n/a	418.37 j	49	Grate
51	Pipe - (66) (1)	19.93	33	Cir	118.491	417.70	419.38	1.418	418.62	420.85	n/a	420.85	50	Grate
52	Pipe - (73)	18.58	33	Cir	48.065	420.21	421.96	3.641	420.91	423.38	n/a	423.38	51	Grate
53	Pipe - (72)	16.61	30	Cir	34.980	422.46	423.16	2.001	423.38	424.54	n/a	424.54	52	Grate
54	Pipe - (71)	15.75	30	Cir	25.201	423.16	423.28	0.476	424.54	424.62	n/a	424.62	53	Grate
55	Pipe - (66)	12.94	24	Cir	42.494	423.65	424.14	1.153	424.62	425.43	0.69	425.43	54	Grate
56	Pipe - (65)	8.39	18	Cir	126.825	424.14	431.25	5.606	425.43	432.37	n/a	432.37 j	55	Grate
57	Pipe - (64)	6.55	18	Cir	116.189	431.25	435.41	3.580	432.37	436.40	n/a	436.40 j	56	Grate
58	Pipe - (63)	5.06	15	Cir	144.413	437.47	444.63	4.958	437.91	445.54	n/a	445.54	57	Grate
59	Pipe - (114)	0.28	12	Cir	24.003	444.91	445.03	0.500	445.54	445.25	n/a	445.25	58	Grate
60	Pipe - (62)	4.31	15	Cir	36.980	444.63	444.81	0.487	445.54	445.65	n/a	445.65 j	58	Grate
61	Pipe - (69)	0.98	12	Cir	24.042	435.41	437.66	9.358	436.40	438.07	n/a	438.07 j	57	Grate
62	Pipe - (74)	1.07	12	Cir	24.304	431.45	431.57	0.494	432.37	432.38	0.04	432.42	56	Grate
63	Pipe - (75)	4.49	15	Cir	24.113	425.52	425.64	0.498	426.33	426.50	0.39	426.50	55	Grate
64	Pipe - (70)	0.94	12	Cir	24.008	419.38	419.50	0.500	420.85*	420.86*	0.02	420.89	51	Grate
65	Pipe - (77)	0.94	12	Cir	24.049	417.33	417.45	0.499	418.37	418.38	0.02	418.41	50	Grate
66	Pipe - (76)	2.40	12	Cir	32.554	413.64	413.81	0.522	418.37*	418.50*	0.11	418.61	50	Grate
67	Pipe - (88)	2.30	12	Cir	41.478	413.81	414.01	0.482	418.61*	418.76*	0.18	418.94	66	Grate
68	Pipe - (87)	0.19	12	Cir	24.000	414.01	414.13	0.500	418.94*	418.94*	0.00	418.94	67	Grate
69	Pipe - (78)	0.28	12	Cir	26.000	406.15	408.29	8.231	406.26	408.51	n/a	408.51	49	Grate
70	Pipe - (49)	12.71	24	Cir	81.394	395.54	395.94	0.491	397.38	397.22	n/a	397.22	48	Grate
71	Pipe - (48)	12.16	24	Cir	12.855	395.94	396.01	0.545	397.22	397.26	0.84	397.26	70	Grate
72	Pipe - (257) (1)	10.43	24	Cir	118.203	396.01	396.60	0.499	397.26	397.76	n/a	397.76 j	71	Grate

Project File: Pipe Sizing.stm | Number of lines: 93 | Run Date: 3/11/2020

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
73	Pipe - (257)	8.58	18	Cir	60.396	396.58	396.88	0.497	397.76	398.01	0.73	398.01	72	Grate
74	Pipe - (90)	3.79	15	Cir	87.359	401.63	402.07	0.504	402.35	402.86	n/a	402.86	73	Grate
75	Pipe - (242)	2.85	12	Cir	106.804	402.07	402.60	0.496	402.86	403.33	0.38	403.71	74	Grate
76	Pipe - (241)	2.75	12	Cir	68.735	402.60	402.94	0.495	403.71	403.94	0.28	404.22	75	Grate
77	Pipe - (240)	2.25	12	Cir	123.150	402.94	403.56	0.503	404.22	404.48	0.14	404.62	76	Grate
78	Pipe - (264)	0.06	12	Cir	24.223	401.92	402.52	2.477	401.99	402.62	n/a	402.62	71	Grate
79	Pipe - (46)	3.40	12	Cir	145.363	396.88	418.40	14.804	398.01	419.19	n/a	419.19 j	73	Grate
80	Pipe - (265)	0.31	12	Cir	29.543	396.60	396.77	0.575	397.76	397.76	0.00	397.76	72	Grate
81	Pipe - (79)	1.96	12	Cir	34.684	392.22	392.40	0.519	392.77	393.00	n/a	393.00	46	Grate
82	Pipe - (206)	1.25	12	Cir	38.651	392.40	392.59	0.492	393.00	393.06	n/a	393.06 j	81	Grate
83	Pipe - (205)	0.63	12	Cir	24.000	392.59	392.71	0.500	393.06	393.04	n/a	393.04 j	82	Grate
84	Pipe - (83)	3.16	12	Cir	79.698	381.21	381.61	0.502	382.00	382.40	0.53	382.93	44	Grate
85	Pipe - (117)	0.94	12	Cir	45.034	381.70	381.93	0.511	382.93	382.93	0.02	382.95	84	Grate
86	Pipe - (82)	1.25	12	Cir	13.820	381.61	381.68	0.507	382.93*	382.94*	0.02	382.96	84	Grate
87	Pipe - (84)	1.00	12	Cir	23.570	381.68	381.80	0.509	382.96*	382.98*	0.03	383.00	86	Grate
88	Pipe - (41)	4.86	15	Cir	105.532	376.33	376.86	0.502	378.30*	378.65*	0.12	378.77	44	Grate
89	Pipe - (40)	4.61	15	Cir	66.597	376.86	377.19	0.496	378.77*	378.97*	0.33	379.30	88	Grate
90	Pipe - (261)	0.06	12	Cir	42.373	378.33	378.54	0.496	379.30	378.64	n/a	378.64	89	Grate
91	Pipe - (39)	1.44	12	Cir	63.628	377.19	377.51	0.503	379.30*	379.39*	0.08	379.47	89	Grate
92	Pipe - (44)	1.13	12	Cir	6.075	377.51	377.54	0.494	379.47*	379.47*	0.02	379.49	91	Grate
93	Pipe - (43)	1.06	12	Cir	24.000	377.54	378.97	5.958	379.49	379.45	0.13	379.57	92	Grate

Project File: Pipe Sizing.stm | Number of lines: 93 | Run Date: 3/11/2020

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

CONDUIT OUTLET PROTECTION CALCULATIONS

BOHLER

Date: 3/10/2020
Project: Erickson
Project No: J100690.04

30 independence Blvd., Suite 200
(908) 668-8300

Calculated By: DM
Checked By: MD

Conduit Outlet Protection Calculations

Scour Hole # 1

Design Parameters:

Design Storm Flow for 25 Year, Q	26.98	cfs
Vertical Dimension of Outlet Pipe, D_o	36	in
Horizontal Dimension of Outlet Pipe, W_o	36	in
Tailwater Depth, TW [1]	0.60	ft
Scour Hole Depth, y (1/2 D_o or D_o)	36	in

Apron Dimension Calculations:

Minimum Bottom Width, $W_1 = 2W_o$	W_1 = 6.00 ft
Minimum Bottom Length, $L_1 = 3D_o$	L_1 = 9.00 ft
Minimum Top Width *(max side slope of 3:1)*, W_2	W_2 = 24.00 ft
Minimum Top Length *(max side slope of 3:1)*, L_2	L_2 = 27.00 ft

Rip Rap Stone Size Calculations:

Unit Dicharge, $q = Q/D_o$ = 8.99 cfs per foot

- **Case I: $y = 1/2\ D_o$**

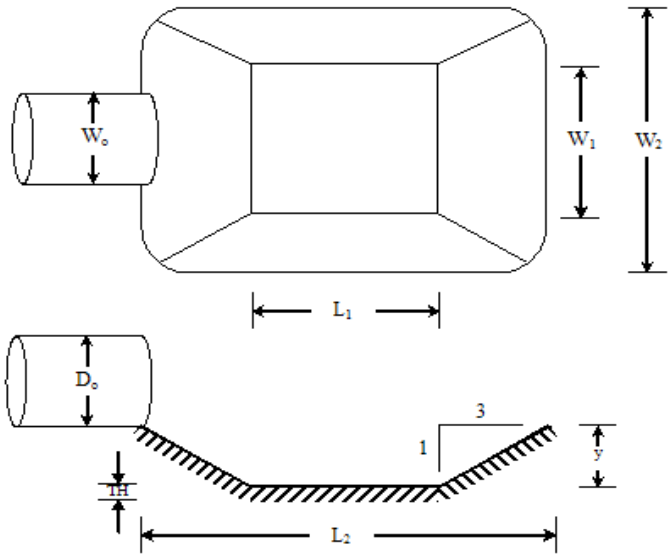
  Median Stone, $d_{50} = \dfrac{0.0125\ q^{1.33}}{TW}$ =

  Apron Thickness, $TH = 2 \times d_{50}$ with filter fabric . . . . . .

- **Case II: $y = D_o$**

  Median Stone, $d_{50} = \dfrac{0.0082\ q^{1.33}}{TW}$ = 3.04 in Therefore, use *d50* = 6 in

  Apron Thickness, $TH = 2 \times d_{50}$ with filter fabric . . . . . *TH* = 12 in



Notes:

1. The side slopes shall be 3:1 or flatter.
2. The bottom grade shall be 0.0% (level).
3. There shall be no overfall at the end of the apron or at the end of the culvert.
4. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d_{50}. The largest stone size in the mixture shall be 1.5 times the d_{50} size. The rip-rap shall be reasonably well graded.
5. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
6. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
7. Where the scour hole is to be placed within an existing or proposed waterway:
   a. The scour hole sidewalls should be eliminated to maintain a smooth hydraulic line along the waterway bottom to avoid inviting turbulent flow from a sudden depression in the waterway.
   b. If the flow in the waterway is greater than the flow from the proposed outlet, the rip-rap used to construct the scour hole should be sized based on the greater flow value according to the standard rip-rap.

Footnote:

1. Tailwater depth shall be the 2 year storm if discharging into a detention basin. For areas where tailwater cannot be computed, use $TW = 0.2D_o$.

BOHLER

Date: 3/10/2020
Project: Erickson
Project No: J100690.04

30 independence Blvd., Suite 200
(908) 668-8300

Calculated By: DM
Checked By: MD

Conduit Outlet Protection Calculations

Scour Hole # 2

Design Parameters:

Design Storm Flow for 25 Year, Q	44.49	cfs
Vertical Dimension of Outlet Pipe, D_o	48	in
Horizontal Dimension of Outlet Pipe, W_o	48	in
Tailwater Depth, TW [1]	0.80	ft
Scour Hole Depth, y (1/2 D_o or D_o)	36	in

Apron Dimension Calculations:

Minimum Bottom Width, $W_1 = 2W_o$	W_1 = 8.00 ft
Minimum Bottom Length, $L_1 = 3D_o$	L_1 = 12.00 ft
Minimum Top Width *(max side slope of 3:1)*, W_2	W_2 = 26.00 ft
Minimum Top Length *(max side slope of 3:1)*, L_2	L_2 = 30.00 ft

Rip Rap Stone Size Calculations:

Unit Dicharge, $q = Q/D_o$ = 11.12 cfs per foot

- **Case I: $y = 1/2\ D_o$**

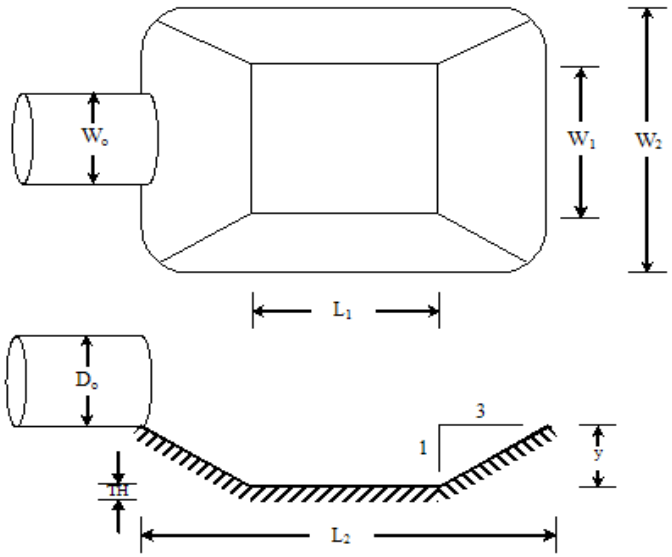
  Median Stone, $d_{50} = \dfrac{0.0125\ q^{1.33}}{TW}$ =

  Apron Thickness, $TH = 2 \times d_{50}$ with filter fabric . . . . . .

- **Case II: $y = D_o$**

  Median Stone, $d_{50} = \dfrac{0.0082\ q^{1.33}}{TW}$ =

  Apron Thickness, $TH = 2 \times d_{50}$ with filter fabric . . . . . .



Notes:

1. The side slopes shall be 3:1 or flatter.
2. The bottom grade shall be 0.0% (level).
3. There shall be no overfall at the end of the apron or at the end of the culvert.
4. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d_{50}. The largest stone size in the mixture shall be 1.5 times the d_{50} size. The rip-rap shall be reasonably well graded.
5. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
6. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
7. Where the scour hole is to be placed within an existing or proposed waterway:
   a. The scour hole sidewalls should be eliminated to maintain a smooth hydraulic line along the waterway bottom to avoid inviting turbulent flow from a sudden depression in the waterway.
   b. If the flow in the waterway is greater than the flow from the proposed outlet, the rip-rap used to construct the scour hole should be sized based on the greater flow value according to the standard rip-rap.

Footnote:

1. Tailwater depth shall be the 2 year storm if discharging into a detention basin. For areas where tailwater cannot be computed, use $TW = 0.2D_o$.

LOW IMPACT DEVELOPMENT CHECKLIST

New Jersey Stormwater Best Management Practices Manual

February 2004

http://www.state.nj.us/dep/watershedmgt/bmpmanualfeb2004.htm

A P P E N D I X A

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

According to the NJDEP Stormwater Management Rules at N.J.A.C. 7:8, the groundwater recharge, stormwater quality, and stormwater quantity standards established by the Rules for major land development projects must be met by incorporating nine specific nonstructural stormwater management strategies into the project's design to the maximum extent practicable.

To accomplish this, the Rules require an applicant seeking land development approval from a regulatory board or agency to identify those nonstructural strategies that have been incorporated into the project's design. In addition, if an applicant contends that it is not feasible to incorporate any of the specific strategies into the project's design, particularly for engineering, environmental, or safety reasons, the Rules further require that the applicant provide a basis for that contention.

This checklist has been prepared to assist applicants, site designers, and regulatory boards and agencies in ensuring that the nonstructural stormwater management requirements of the Rules are met. It provides an applicant with a means to identify both the nonstructural strategies incorporated into the development's design and the specific low impact development BMPs (LID-BMPs) that have been used to do so. It can also help an applicant explain the engineering, environmental, and/or safety reasons that a specific nonstructural strategy could not be incorporated into the development's design.

The checklist can also assist municipalities and other land development review agencies in the development of specific requirements for both nonstructural strategies and LID-BMPs in zoning and/or land use ordinances and regulations. As such, where requirements consistent with the Rules have been adopted, they may supersede this checklist.

Finally, the checklist can be used during a pre-design meeting between an applicant and pertinent review personnel to discuss local nonstructural strategies and LID-BMPs requirements in order to optimize the development's nonstructural stormwater management design.

Since this checklist is intended to promote the use of nonstructural stormwater management strategies and provide guidance in their incorporation in land development projects, municipalities are permitted to revise it as necessary to meet the goals and objectives of their specific stormwater management program and plan within the limits of N.J.A.C. 7:8.

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

Municipality: New Providence

County: Union County Date: March, 2020

Review board or agency: Borough of New Providence, Union County, Somerset County SCD, NJDEP

Proposed land development name: Proposed Continuing Care Retirement Community

Lot(s): 15, 17, 18.01 Block(s): 320

Project or application number: BENJ # J100690.04

Applicant's name: Redwood-ERC New Providence, LLC

Applicant's address: _____

_____

Telephone: _____ Fax: _____

Email address: _____

Designer's name: Bohler Engineering (R.L. Streker P.E)

Designer's address: 30 Independence Blvd.

Warren, NJ 07059

Telephone: (908) 668-8300 Fax: (908) 754-4401

Email address: RStreker@bohlereng.com

Part 1: Description of Nonstructural Approach to Site Design

In narrative form, provide an overall description of the nonstructural stormwater management approach and strategies incorporated into the proposed site's design. Attach additional pages as necessary. Details of each nonstructural strategy are provided in Part 3 below.

The site has been designed to minimize the site disturbance, maintain existing natural features, and reduce the overall building areas and parking spaces as much as practical. Silt fencing, tree protection fencing, and inlet protection devices have been proposed during construction. The limit of disturbance will be clearly defined and maintained during construction. In addition, contractors are instructed to minimize and strictly regulate construction areas, access roads, material and equipment storage areas. Light weight, rubber tired construction equipment will be used whenever possible, with movements limited to a few repetitive routes to prevent over compaction of the subject site. Curbed catch basin grates will also be N-eco type, to reduce the derbis entering the stormwater conveyance system. In addition, strategical placement of trash enclosures and trash receptacles will provide preventive source control to ensure that larger pollutants do not make their way into the stormwater drainage system. Native ground cover will be proposed as part of landscaping plan, which requires little or no irrigation once they area established. Wetland with associated wetland buffer will be clearly marked and fenced to ensure no disturbance during construction. Vegetative conveyance is also proposed as part of stormwater conveyance system for the proposed development.

Part 2: Review of Local Stormwater Management Regulations

Title and date of stormwater management regulations used in development design:

Stormwater Management Regulations NJAC 7:8, dated 6/2016 and N.J. Best Management Practices, dated 09/2017

Do regulations include nonstructural requirements? Yes: ✔ No: _____

If yes, briefly describe: Minimize impervious surface, minimize land disturbance and soil compaction, maximize the protection of wetland and associated buffers.

List LID-BMPs prohibited by local regulations: N/A

Pre-design meeting held? Yes: ✔ Date: _____ No: _____

Meeting held with: Township Professionals, NJDEP and Bohler Engineering NJ

Pre-design site walk held? Yes: ✔ Date: 9/13/2019 & 02/11/2020 No: _____

Site walk held with: Site visits were held by Bohler Engineering

Other agencies with stormwater review jurisdiction:

Name: Borough of New Providence

Required approval: Site Plan Approval

Name: Somerset-Union Soil Conservation District

Required approval: Soil Erosion and Sediment Control Certification

Name: New Jersey Department of Environmental Protection

Required approval: Freshwater Wetlands General Permits

Part 3: Nonstructural Strategies and LID-BMPs in Design

3.1 Vegetation and Landscaping

Effective management of both existing and proposed site vegetation can reduce a development's adverse impacts on groundwater recharges and runoff quality and quantity. This section of the checklist helps identify the vegetation and landscaping strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to help maintain existing recharge rates and/or minimize or prevent increases in runoff quantity and pollutant loading.

A. Has an inventory of existing site vegetation been performed? Yes: ✔ No: _____

If yes, was this inventory a factor in the site's layout and design? Yes: ✔ No: _____

B. Does the site design utilize any of the following nonstructural LID-BMPs?

Preservation of natural areas? Yes: ✔ No: _____ If yes, specify % of site: +/-12%

Native ground cover? Yes: ✔ No: _____ If yes, specify % of site: +/-16%

Vegetated buffers? Yes: ✔ No: _____ If yes, specify % of site: +/-14%

C. Do the land development regulations require these nonstructural LID-BMPs?

Preservation of natural areas? Yes: _____ No: ✔ If yes, specify % of site: _____

Native ground cover? Yes: _____ No: ✔ If yes, specify % of site: _____

Vegetated buffers? Yes: _____ No: ✔ If yes, specify % of site: _____

D. If vegetated filter strips or buffers are utilized, specify their functions: N/A

Reduce runoff volume increases through lower runoff coefficient: Yes: _____ No: _____

Reduce runoff pollutant loads through runoff treatment: Yes: _____ No: _____

Maintain groundwater recharge by preserving natural areas: Yes: _____ No: _____

3.2 Minimize Land Disturbance

Minimizing land disturbance is a nonstructural LID-BMP that can be applied during both the development's construction and post-construction phases. This section of the checklist helps identify those land disturbance strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to minimize land disturbance and the resultant change in the site's hydrologic character.

A. Have inventories of existing site soils and slopes been performed? Yes: ✔ No: _____

If yes, were these inventories factors in the site's layout and design? Yes: ✔ No: _____

B. Does the development's design utilize any of the following nonstructural LID-BMPs?

Restrict permanent site disturbance by land owners? Yes: ✔ No: _____

If yes, how: The existing wetland and associated wetland buffer will be preserved to the greatest extent allowable.

Restrict temporary site disturbance during construction? Yes: ✔ No: _____

If yes, how: Silt fence will be installed prior to construction activities to define the proposed limit of disturbance. In addition, tree protection fence will be installed to preserve natural area.

Consider soils and slopes in selecting disturbance limits? Yes: ✔ No: _____

If yes, how: The current design is largely contained within existing developed areas

C. Specify percentage of site to be cleared: +/- 81% Regraded: +/- 81%

D. Specify percentage of cleared areas done so for buildings: +/- 21%

For driveways and parking: +/- 10% For roadways: +/- 7%

E. What design criteria and/or site changes would be required to reduce the percentages in C and D above?

The existing site is already developed within the limits of proposed development, underground parking is utilized to minimize surface runoff. The majority of the impervious surface proposed on site not subject to pollutant loading

F. Specify site's hydrologic soil group (HSG) percentages:

HSG A: +/- 0% HSG B: +/- 21.1% HSG C: +/- 54.7% HSG D: +/- 5.3%

G. Specify percentage of each HSG that will be permanently disturbed:

HSG A: +/-0 % HSG B: +/- 10% HSG C: +/- 23% HSG D: +/- 14%

H. Locating site disturbance within areas with less permeable soils (HSG C and D) and minimizing disturbance within areas with greater permeable soils (HSG A and B) can help maintain groundwater recharge rates and reduce runoff volume increases. In light of the HSG percentages in F and G above, what other practical measures if any can be taken to achieve this?

Please note this site is currently developed and the currently proposed development is largely limited to currently disturbed areas. The majority of the soils on site are HSG C, D or urban, meaning the proposed development with be within these areas

I. Does the site include Karst topography? Yes: _____ No: ✔

If yes, discuss measures taken to limit Karst impacts:

N/A

3.3 Impervious Area Management

New impervious surfaces at a development site can have the greatest adverse effect on groundwater recharge and stormwater quality and quantity. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into a proposed development's design to comprehensively manage the extent and impacts of new impervious surfaces.

A. Specify impervious cover at site: Existing: +/- 35% Proposed: +/- 44%

B. Specify maximum site impervious coverage allowed by regulations: 60%

C. Compare proposed street cartway widths with those required by regulations:

Type of Street	Proposed Cartway Width (feet)	Required Cartway Width (feet)
Residential access – low intensity	24'	24'
Residential access – medium intensity	-	-
Residential access – high intensity with parking	-	-
Residential access – high intensity without parking	-	-
Neighborhood	24'	24'
Minor collector – low intensity without parking	-	-
Minor collector – with one parking lane	-	-
Minor collector – with two parking lanes	-	-
Minor collector – without parking	-	-
Major collector	-	-

D. Compare proposed parking space dimensions with those required by regulations:

Proposed: 9' x 18' Regulations: 9' x 18'

E. Compare proposed number of parking spaces with those required by regulations:

Proposed: 939 Regulations: 775

F. Specify percentage of total site impervious cover created by buildings: +/- 21%

By driveways and parking: +/- 10% By roadways: +/-7%

G. What design criteria and/or site changes would be required to reduce the percentages in F above?

Additional parking spaces are required for medical staff parking as part of the continuing care aspect of the retirement community.

H. Specify percentage of total impervious area that will be unconnected:

Total site: 6% Buildings: 0% Driveways and parking: 0% Roads: 0%

Unconnected impervious areas consist of sidewalks and walls, all other impervious areas are collected and managed through the stormwater system

I. Specify percentage of total impervious area that will be porous:

Total site: 0% Buildings: 0% Driveways and parking: 0% Roads: 0%

J. Specify percentage of total building roof area that will be vegetated: 0%

K. Specify percentage of total parking area located beneath buildings: 80%

L. Specify percentage of total parking located within multi-level parking deck: 0%

3.4 Time of Concentration Modifications

Decreasing a site's time of concentration (Tc) can lead directly to increased site runoff rates which, in turn, can create new and/or aggravate existing erosion and flooding problems downstream. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to effectively minimize such Tc decreases.

When reviewing Tc modification strategies, it is important to remember that a drainage area's Tc should reflect the general conditions throughout the area. As a result, Tc modifications must generally be applied throughout a drainage area, not just along a specific Tc route.

A. Specify percentage of site's total stormwater conveyance system length that will be:

Storm sewer: +/- 89% Vegetated swale: +/- 0%* Natural channel: N/A

Stormwater management facility: +/- 11% Other: N/A

Note: the total length of the stormwater conveyance system should be measured from the site's downstream property line to the downstream limit of sheet flow at the system's headwaters.

*Vegetated swale is not on the main branch of the stormwater conveyance system.

B. What design criteria and/or site changes would be required to reduce the storm sewer percentages and increase the vegetated swale and natural channel percentages in A above?

The extreme slope of the existing topography will not allow for a stable vegetated swale.

Where applicable, overland conveyance is utilized.

C. In conveyance system subareas that have overland or sheet flow over impervious surfaces or turf grass, what practical and effective site changes can be made to:

Decrease overland flow slope: Decreasing slopes on the sheet flow section of the proposed impervious area will not increase the time of concentration.

Increase overland flow roughness: For the proposed development, overland flow only happens at the pavement parking area before the inlets. Increase overland flow roughness will not increase time of concentration, and time of concentration of 10 minutes is used in calculation.

3.5 Preventative Source Controls

The most effective way to address water quality concerns is by pollution prevention. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to reduce the exposure of pollutants to prevent their release into the stormwater runoff.

A. Trash Receptacles

Specify the number of trash receptacles provided: Trash receptacles are provided inside of the building. Waste management inside the building will be specified by Architect.

Specify the spacing between the trash receptacles: Trash receptacles spacing will be specified by Landscape Architect.

Compare trash receptacles proposed with those required by regulations:

Proposed: Waste management in the building will be specified by Architect. Regulations: Not Specified

B. Pet Waste Stations

Specify the number of pet waste stations provided: 0

Specify the spacing between the pet waste stations: N/A

Compare pet waste stations proposed with those required by regulations:

Proposed: N/A Regulations: N/A

C. Inlets, Trash Racks, and Other Devices that Prevent Discharge of Large Trash and Debris

Specify percentage of total inlets that comply with the NJPDES storm drain inlet criteria: 100%

D. Maintenance

Specify the frequency of the following maintenance activities:

Street sweeping: Proposed: Once every week Regulations: Not Specified

Litter collection: Proposed: Estimated to be three times a week. Regulations: Not Specified

Identify other stormwater management measures on the site that prevent discharge of large trash and debris:

Catch basin grates will be N-eco type to ensure that large trash and debris do not make their way into the drainage system.

E. Prevention and Containment of Spills

Identify locations where pollutants are located on the site, and the features that prevent these pollutants from being exposed to stormwater runoff:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Part 4: Compliance with Nonstructural Requirements of NJDEP Stormwater Management Rules

1. Based upon the checklist responses above, indicate which nonstructural strategies have been incorporated into the proposed development's design in accordance with N.J.A.C. 7:8-5.3(b):

No.	Nonstructural Strategy	Yes	No
1.	Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.	✔	
2.	Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.	✔	
3.	Maximize the protection of natural drainage features and vegetation.	✔	
4.	Minimize the decrease in the pre-construction time of concentration.	✔	
5.	Minimize land disturbance including clearing and grading.	✔	
6.	Minimize soil compaction.	✔	
7.	Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.	✔	
8.	Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.	✔	
9.	Provide preventative source controls.	✔	

2. For those strategies that have not been incorporated into the proposed development's design, provide engineering, environmental, and/or safety reasons. Attached additional pages as necessary.

All of the above referenced strategies have been incorporated into the proposed development. The site has been designed to minimize the site disturbance, maintain existing natural features, and limit disturbance to previously developed areas.

C. MAPS & DOCUMENTATION

- **Tax Map**
- **Aerial Map**
- **USGS Map**
- **Soils Map**
- **Hydrologic Soils Group**
- **Drainage Area Maps**
  - **Existing Drainage Area Map**
  - **Proposed Drainage Area Map**
  - **Inlet Area Map**

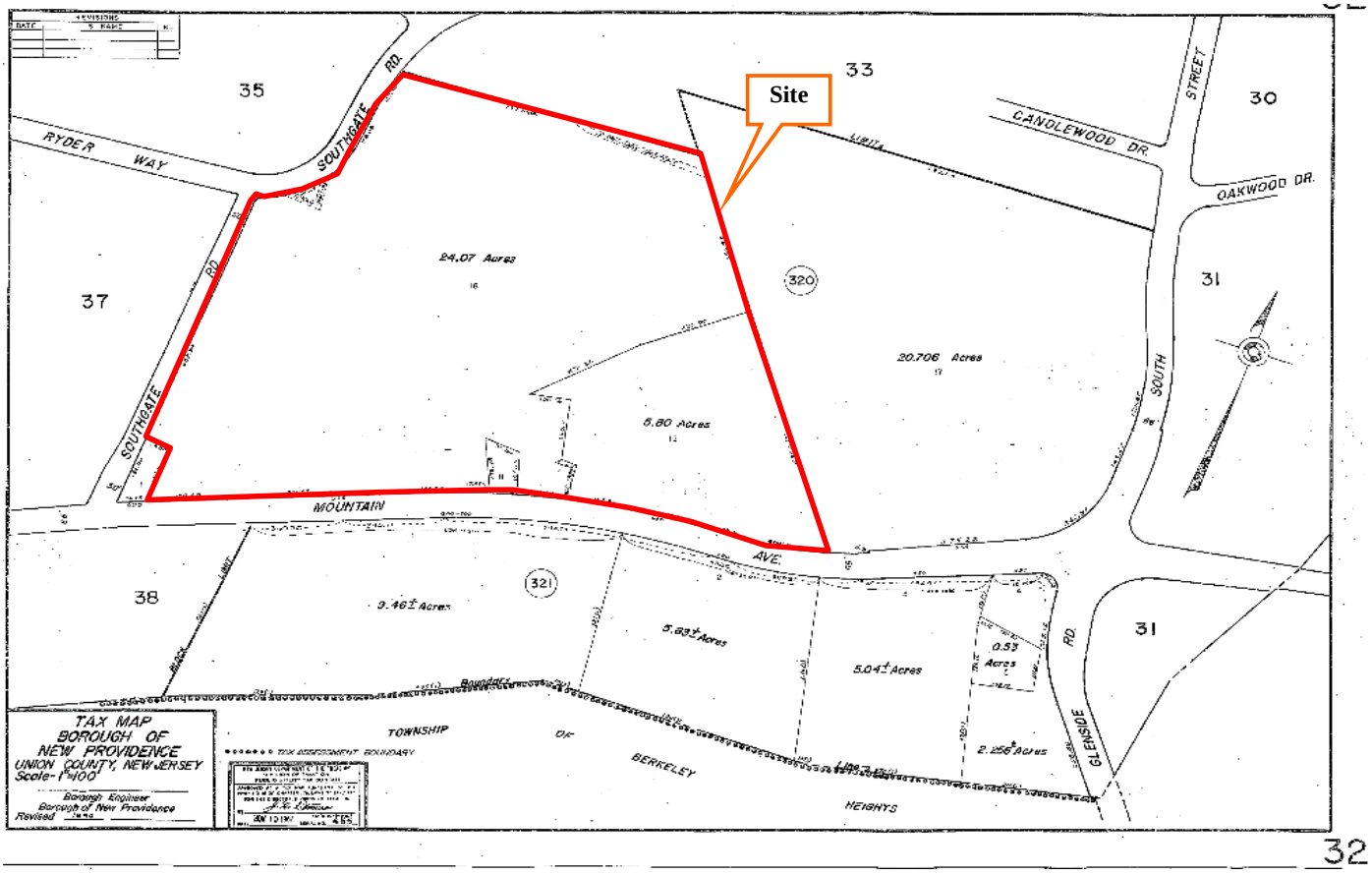


Figure 1
Tax Map

Source: New Providence Borough Tax Map, Sheet #15

Date Access: 02/25/2020

REDWOOD-ERC NEW PROVIDENCE, LLC	
575 Mountain Avenue **Block320; Lots 18.01, 15 and 17**	**Borough of New Providence, Union County, NJ**
BENJ #100690.04	
Prepared by: mm	Date: 2/25/2020
Checked by: md	Scale: nts



Figure 2
Aerial Map

Source: NJ GeoWeb

Date Access: 02/25/2020

REDWOOD-ERC NEW PROVIDENCE, LLC	
575 Mountain Avenue **Block320; Lots 18.01, 15 and 17**	**Borough of New Providence, Union County, NJ**
BENJ #100690.04	
Prepared by: mm	Date: 2/25/2020
Checked by: md	Scale: nts

BOHLER

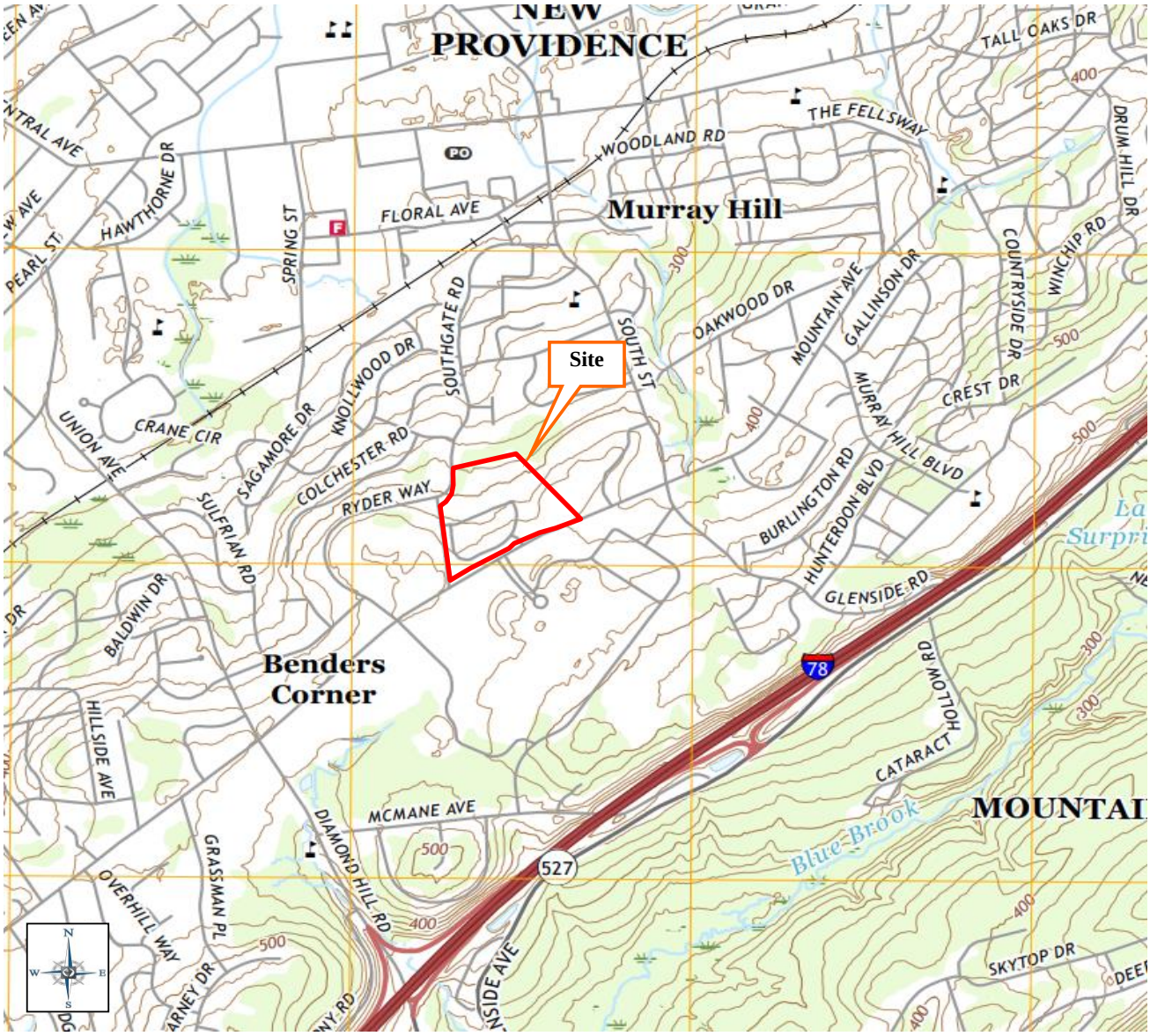
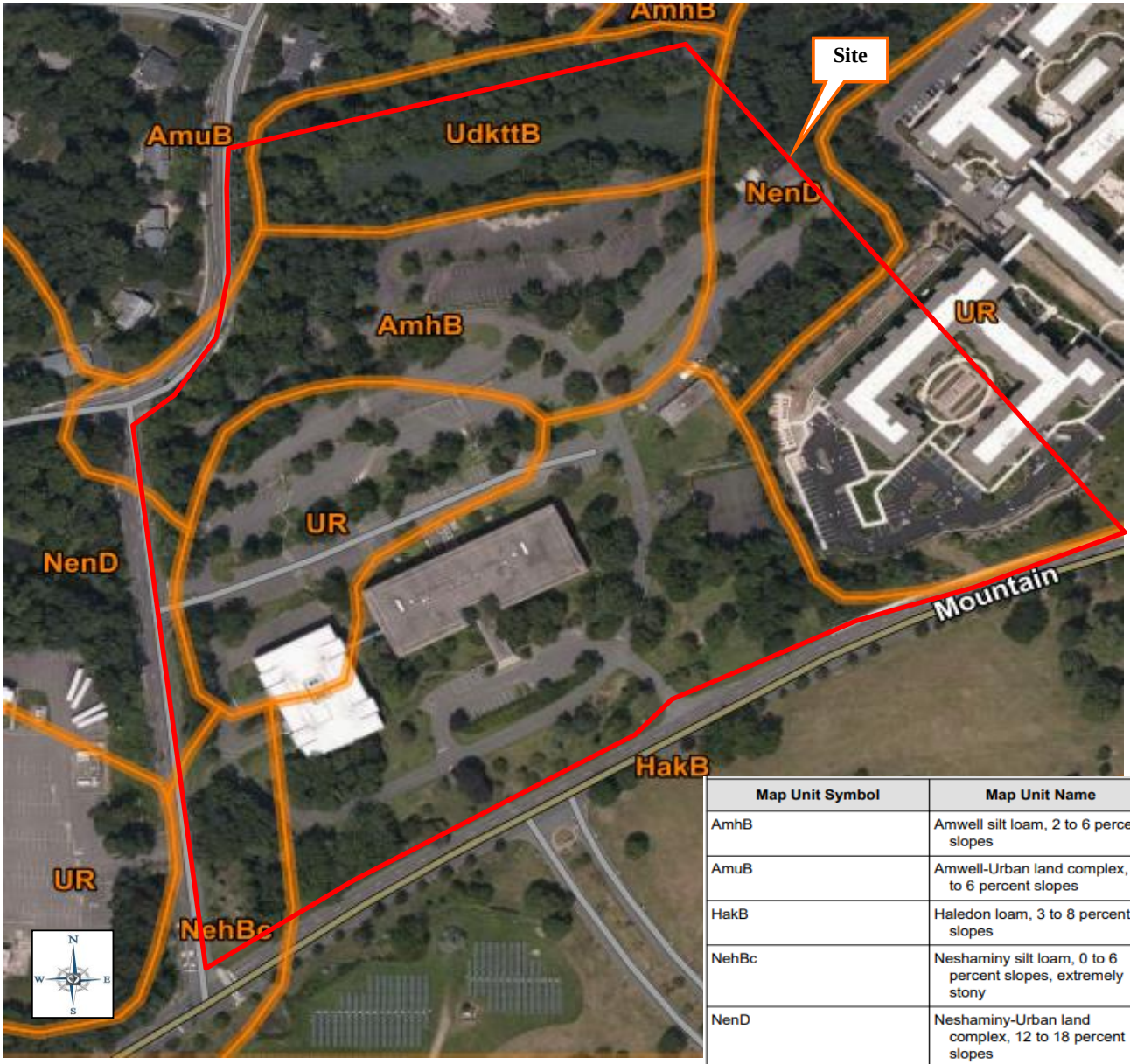


Figure 3
USGS Map
Chatham Quadrangle

Source: USGS, 2019

Date Access: 02/25/2020

REDWOOD-ERC NEW PROVIDENCE, LLC	
575 Mountain Avenue **Block320; Lots 18.01, 15 and 17**	**Borough of New Providence, Union County, NJ**
BENJ #100690.04	
Prepared by: mm	Date: 2/25/2020
Checked by: md	Scale: nts
	BOHLER



Map Unit Symbol	Map Unit Name
AmhB	Amwell silt loam, 2 to 6 percent slopes
AmuB	Amwell-Urban land complex, 0 to 6 percent slopes
HakB	Haledon loam, 3 to 8 percent slopes
NehBc	Neshaminy silt loam, 0 to 6 percent slopes, extremely stony
NenD	Neshaminy-Urban land complex, 12 to 18 percent slopes
UdkttB	Udorthents, loamy substratum, 0 to 8 percent slopes
UR	Urban land

Figure 4
Soils Map

Source: NRCS Web Soil Survey, 2012

Date Access: 02/25/2020

REDWOOD-ERC NEW PROVIDENCE, LLC

575 Mountain Avenue **Block320; Lots 18.01, 15 and 17**	**Borough of New Providence, Union County, NJ**
BENJ #100690.04	
Prepared by: mm — Date: 2/25/2020	BOHLER
Checked by: md — Scale: nts	

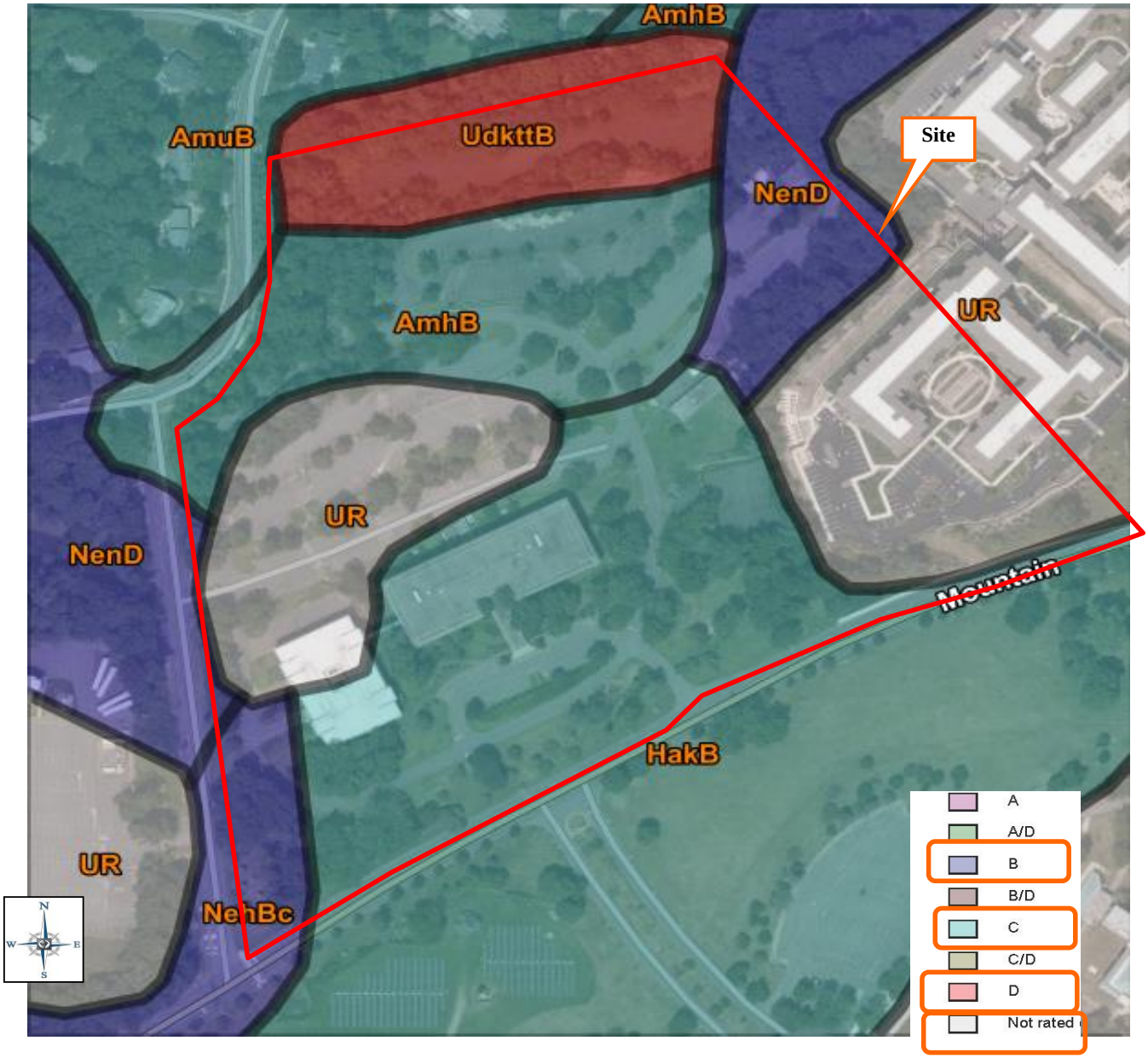


Figure 5
Hydrologic Soils Group

Source: NRCS Web Soil Survey, 2012

Date Access: 02/25/2020

REDWOOD-ERC NEW PROVIDENCE, LLC	
575 Mountain Avenue **Block320; Lots 18.01, 15 and 17**	**Borough of New Providence, Union County, NJ**
BENJ #100690.04	
Prepared by: mm	Date: 2/25/2020
Checked by: md	Scale: nts

DRAINAGE AREA MAPS

NAD83

SOUTHGATE ROAD
(FORMERLY KNOWN AS RYDER WAY)
(50' WIDE R.O.W.)
(ASPHALT ROADWAY)
(TWO WAY TRAFFIC)

RYDER WAY
60' (WIDE R.O.W.)
(ASPHALT ROADWAY)
(TWO WAY TRAFFIC)

SOUTHGATE ROAD
(A.K.A. NORTH STREET)
(50' WIDE R.O.W.)
(ASPHALT ROADWAY)
(TWO WAY TRAFFIC)

MOUNTAIN AVENUE
(VARIABLE WIDTH R.O.W.)
(ASPHALT ROADWAY)
(TWO WAY TRAFFIC)

POI #1

POI #2

POI #3

EDA - 1B
TOTAL = 1.084 AC
GRASS = 0.073 AC. (B)
GRASS = 0.832 AC. (C)
GRASS = 0.172 AC. (D)
PAVEMENT = 0.007 AC.

EDA - 1A
TOTAL = 21.261 AC
IMP. AREA = 8.868 AC.
GRASS = 2.026 AC. (B)
GRASS = 6.542 AC. (C)
GRASS = 1.917 AC. (D)
URBAN COMMERCIAL = 1.908 AC.

EDA - 2
TOTAL = 0.476 AC
GRASS = 0.110 AC. (B)
GRASS = 0.366 AC. (C)

EDA - 3
TOTAL = 2.353 AC
GRASS = 0.543 AC. (B)
GRASS = 0.050 AC. (C)
GRASS = 1.420 AC. (D)
URBAN COMMERCIAL = 0.340 AC.

BLOCK 335
LOT 30
N/F LANDS OF
DAVID M. KEYSER &
GINA PRIANO-KEYSER

BLOCK 335
LOT 29

BLOCK 335
LOT 26
N/F LANDS OF
SCOTT S. & LINDS T. LITTLEJOHN

BLOCK 335
LOT 25
N/F LANDS OF
RBY COURT LLC

BLOCK 320
LOT 18.01
N/F LANDS OF
MURRAY HILL LLC
D.B. 6313, PG. 616

BLOCK 320
LOT 17
N/F LANDS OF
REDWOOD-ERC NEW PROVIDENCE LLC

BLOCK 320
LOT 15
N/F LANDS OF
REDWOOD-ERC NEW
PROVIDENCE II LLC

FORMER
BLOCK 320
LOT 1

269.18'
S64°33'41"W

60 0 30 60 120 240
GRAPHIC SCALE
1 INCH = 60 FEET

© 2019 BOHLER ENGINEERING NJ, LLC

DWG: J:\J100690.04\DRAWINGS\CURRENT DRAWINGS\SUPPLEMENT DRAWINGS\DRAINAGE MAPS\J100690.04-EDA-0A---LAYOUT: EX-01 EDA

BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

THE BOHLER LOGO AND CONTENT OF THIS PLANSET (DIGITAL OR HARD COPY) ARE NOT TO BE ALTERED OR USED FOR ANY PURPOSE, WITHOUT PRIOR WRITTEN AUTHORIZATION FROM BOHLER. ONLY APPROVED, SIGNED, AND SEALED PLANS SHALL BE UTILIZED FOR CONSTRUCTION PURPOSES.

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

811 Know what's below. Call before you dig.
NEW JERSEY
YOU MUST CALL 811 BEFORE ANY EXCAVATION WHETHER IT'S ON PRIVATE OR PUBLIC LAND.
1-800-272-1000
www.nj-call.org

PRELIMINARY

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	J100690.04
DRAWN BY:	DM / MFS
CHECKED BY:	MD
DATE:	02/11/2020
CAD I.D.:	J100690.04-EDA-0A

PROJECT:

PRELIMINARY/FINAL MAJOR SITE PLAN

FOR

REDWOOD-ERC NEW PROVIDENCE, LLC

PROPOSED CONTINUING CARE RETIREMENT COMMUNITY

575 MOUNTAIN AVE
UNION COUNTY
NEW PROVIDENCE, NJ
BLOCK 320 | LOTS 18.01, 15, 17

BOHLER
BOHLER ENGINEERING NJ, LLC
35 TECHNOLOGY DRIVE
WARREN, NJ 07059
Phone: (908) 668-8300
Fax: (908) 754-4401
www.BohlerEngineering.com
NJ CERT. OF AUTHORIZATION NO. 24GA28161700

R.L. STREKER
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 45344
NEW YORK LICENSE No. 079512

SHEET TITLE:

EXISTING DRAINAGE AREA PLAN

SHEET NUMBER:

EX-01

ORG. DATE - 02/11/2020

NAD83

BLOCK 335
LOT 30
N/F LANDS OF
DAVID M. KEYSER &
GINA PRIANO-KEYSER

BLOCK 335
LOT 29

BLOCK 335
LOT 26
N/F LANDS OF
SCOTT S. & LINDS T. LITTLEJOHN

BLOCK 335
LOT 25
N/F LANDS OF
DARBY COURT LLC

BLOCK 320
LOT 18.01
N/F LANDS OF
MURRAY HILL LLC
D.B. 6313, PG. 616

BLOCK 320
LOT 17
N/F LANDS OF
REDWOOD-ERC NEW PROVIDENCE LLC

BLOCK 320
LOT 15
N/F LANDS OF
REDWOOD-ERC NEW
PROVIDENCE II LLC

FORMER
BLOCK 320
LOT 1

SOUTHGATE ROAD
(FORMERLY KNOWN AS RYDER WAY)
(50' WIDE R.O.W.)
(ASPHALT ROADWAY)
(TWO WAY TRAFFIC)

RYDER WAY
60' (WIDE R.O.W.)
(ASPHALT ROADWAY)
(TWO WAY TRAFFIC)

SOUTHGATE ROAD
(A.K.A. NORTH STREET)
(50' WIDE R.O.W.)
(ASPHALT ROADWAY)
(TWO WAY TRAFFIC)

MOUNTAIN AVENUE
(VARIABLE WIDTH R.O.W.)
(ASPHALT ROADWAY)
(TWO WAY TRAFFIC)

POI #1
POI #2
POI #3

PDA - 1B
TOTAL = 1.132 AC
GRASS = 0.074 AC. (B)
GRASS = 0.879 AC. (C)
GRASS = 0.172 AC. (D)
PAVEMENT = 0.007 AC.

EDA - 3
TOTAL = 1.713 AC
GRASS = 0.243 AC. (B)
GRASS = 0.050 AC. (C)
GRASS = 1.420 AC. (D)

PDA - 1A
TOTAL = 21.933 AC
IMP. AREA = 11.113 AC.
GRASS = 2.131 AC. (B)
GRASS = 4.541 AC. (C)
GRASS = 1.775 AC. (D)
URBAN COMMERCIAL = 2.373 AC.

PDA - 2
TOTAL = 0.397 AC
GRASS = 0.110 AC. (B)
GRASS = 0.287 AC. (C)

PROPOSED BUILDING 2.5 6 STORY
PROPOSED BUILDING 2.3 6 STORY
PROPOSED BUILDING 2.4 5 STORY
PROPOSED BUILDING 2.2 6 STORY
PROPOSED CC BUILDING 4 STORY
PROPOSED BUILDING 2.1 5 STORY

200 FT ZONE SETBACK LINE

269.51'
S64°33'47"W

GRAPHIC SCALE
60 0 30 60 120 240
1 INCH = 60 FEET

BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL ESSENTIALS
PERMITTING SERVICES
TRANSPORTATION SERVICES

THE BOHLER CIVIL DESIGN AND CONTENT OF THIS PLAN IS PROPRIETARY AND SHALL NOT BE COPIED OR USED FOR ANY PURPOSE, WITHOUT PRIOR WRITTEN AUTHORIZATION FROM BOHLER. ONLY APPROVED, SIGNED AND SEALED PLANS SHALL BE UTILIZED FOR CONSTRUCTION PURPOSES.

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

Know what's below. Call before you dig.
NEW JERSEY
YOU MUST CALL 811 BEFORE ANY EXCAVATION WHETHER IT'S ON PRIVATE OR PUBLIC LAND.
1-800-272-1000
www.nj1-call.org

PRELIMINARY

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	J100690.04
DRAWN BY:	DM / MFS
CHECKED BY:	MD
DATE:	02/11/2020
CAD I.D.:	J100690.04-PDA-0A

PROJECT:

PRELIMINARY/FINAL MAJOR SITE PLAN

FOR

REDWOOD-ERC NEW PROVIDENCE, LLC

PROPOSED CONTINUING CARE RETIREMENT COMMUNITY

575 MOUNTAIN AVE
UNION COUNTY
NEW PROVIDENCE, NJ
BLOCK 320 | LOTS 18.01, 15, 17

BOHLER
BOHLER ENGINEERING NJ, LLC
35 TECHNOLOGY DRIVE
WARREN, NJ 07059
Phone: (908) 668-8300
Fax: (908) 754-4401
www.BohlerEngineering.com
NJ CERT. OF AUTHORIZATION NO. 24GA28161700

R.L. STREKER
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 45344
NEW YORK LICENSE No. 079512

SHEET TITLE:

PROPOSED DRAINAGE AREA PLAN

SHEET NUMBER:

EX-02

ORG. DATE - 02/11/2020

C:\2019\J100690.04\DRAWINGS\CURRENT DRAWINGS\SUPPLEMENT DRAWINGS\DRAINAGE MAPS\J100690.04-PDA-0A-----LAYOUT EX-02 PDA

NAD83

SOUTHGATE ROAD
(FORMERLY KNOWN AS RYDER WAY)
(50' WIDE R.O.W.)
(ASPHALT ROADWAY)
(TWO WAY TRAFFIC)

N06°29'44"E
108.08'

R=262.32'
D=068°07'06"
L=311.87'
CHB=N40°33'17"E
CHD=293.82'

10 16 APPROXIMATE LOCATION OF 15' WIDE SANITARY SEWER EASEMENT TO BOROUGH OF NEW PROVIDENCE PER D.B. 1632 PG. 179

15 APPROXIMATE LOCATION OF 30' WIDE EASEMENT TO JERSEY CENTRAL POWER AND LIGHT COMPANY PER D.B. 1561, PG. 354

RYDER WAY
60' (WIDE R.O.W.)
(ASPHALT ROADWAY)
(TWO WAY TRAFFIC)

SOUTHGATE ROAD
(A.K.A. NORTH STREET)
(50' WIDE R.O.W.)
(ASPHALT ROADWAY)
(TWO WAY TRAFFIC)

N01°33'14"E
876.36'

MATCH LINE - SEE LAYOUT B

MATCH LINE - SEE LAYOUT C

MATCH LINE - SEE LAYOUT D

PROP. INLET 24
AREA = 0.06 AC.
C=0.90

PROP. INLET 24.5
AREA = 0.05 AC.
C=0.90

PROP. INLET 25
AREA = 0.05 AC.
C=0.90

PROP. INLET 24.8
AREA = 0.01 AC.
C=0.98

PROP. INLET 26
AREA = 0.18 AC.
C=0.90

PROP. INLET 24.2
AREA = 0.26 AC.
C=0.90

PROP. INLET 28
AREA = 0.03 AC.
C=0.90

PROP. INLET 24.6
AREA = 0.52 AC.
C=0.88

PROP. INLET 24.3
AREA = 0.04 AC.
C=0.90

PROP. INLET 26.1
AREA = 0.21 AC.
C=0.50

PROP. INLET 29.1
AREA = 0.18 AC.
C=0.90

PROP. INLET 24.2.1
AREA = 0.34 AC.
C=0.90

PROP. INLET 24.4
AREA = 0.16 AC.
C=0.90

PROP. INLET 29
AREA = 0.06 AC.
C=0.90

PROP. INLET 26.3
AREA = 0.20 AC.
C=0.90

PROP. INLET 26.2
AREA = 0.10 AC.
C=0.90

PROP. INLET 28.1
AREA = 0.10 AC.
C=0.50

PROPOSED BUILDING 2.1 6 STORY

PROPOSED BUILDING 2.2 6 STORY

PROPOSED UTILITY CONNECTIONS

PROP. INLET 28.2
AREA = 0.59 AC.
C=0.50

PROP. INLET 28.3
AREA = 0.39 AC.
C=0.65

PROP. INLET 30.3
AREA = 0.03 AC.
C=0.90

PROP. INLET 28.6
AREA = 0.40 AC.
C=0.20

PROP. INLET 30.1
AREA = 0.08 AC.
C=0.20

PROP. INLET 28.5
AREA = 0.10 AC.
C=0.20

PROP. INLET 30.4
AREA = 0.27 AC.
C=0.50

PROP. INLET 30
AREA = 0.21 AC.
C=0.50

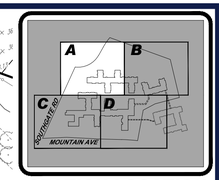
PROP. INLET 28.4
AREA = 0.30 AC.
C=0.50

PROP. INLET 30.2
AREA = 0.34 AC.
C=0.90

PROP. INLET 3.8
AREA = 0.44 AC.
C=0.9

FFE: 397.00
FFE: 386.00
FFE: 386.00
FFE: 386.00
FFE: 408.00
FFE: 441.00

WETLANDS
UPLANDS
PIPE INVERT BURIED - UNABLE TO LOCATE
RIM=403.93 (SEALED)



SECTION LOCATION KEY
SCALE: 1" = 800'

GRAPHIC SCALE
30 0 15 30 60 120
1 INCH = 30 FEET

BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL SERVICES
PERMITTING SERVICES
TRANSPORTATION SERVICES

THE WORKING DOCUMENTS AND CONTENT OF THESE PLANS ARE PROPRIETARY AND SHALL NOT BE REPRODUCED, USED OR DISCLOSED TO ANY PERSON OR ENTITY WITHOUT THE WRITTEN AUTHORIZATION FROM BOHLER. ONLY APPROVED, SIGNED AND SEALED PLANS SHALL BE UTILIZED FOR CONSTRUCTION PURPOSES.

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

Know what's below. Call before you dig.
NEW JERSEY
YOU MUST CALL 811 BEFORE ANY EXCAVATION WHETHER IT'S ON PRIVATE OR PUBLIC LAND.
1-800-272-1000
www.nj1-call.org

PRELIMINARY

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	J100690.04
DRAWN BY:	DM / MFS
CHECKED BY:	MD
DATE:	02/11/2020
CAD I.D.:	J100690.04-IDA-0A

PROJECT:

PRELIMINARY/FINAL MAJOR SITE PLAN

FOR

REDWOOD-ERC NEW PROVIDENCE, LLC

PROPOSED CONTINUING CARE RETIREMENT COMMUNITY

575 MOUNTAIN AVE
UNION COUNTY
NEW PROVIDENCE, NJ
BLOCK 320 | LOTS 18.01, 15, 17

BOHLER
BOHLER ENGINEERING NJ, LLC
35 TECHNOLOGY DRIVE
WARREN, NJ 07059
Phone: (908) 668-8300
Fax: (908) 754-4401
www.BohlerEngineering.com
NJ CERT. OF AUTHORIZATION NO: 24GA28161700

R.L. STREKER
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 45344
NEW YORK LICENSE No. 079512

SHEET TITLE:

INLET DRAINAGE AREA MAP (A)

SHEET NUMBER:

1

ORG. DATE - 02/11/2020

© 2019 BOHLER

J:\2019\J100690.04\DRAWINGS\CURRENT DRAWINGS\SUPPLEMENT DRAWINGS\DRAINAGE MAPS\J100690.04-IDA-0A.dwg — LAYOUT: 1 INDA

NAD83

MATCH LINE - SEE LAYOUT A

BLOCK 335
LOT 26
N/F LANDS OF
SCOTT S. & LINDS T. LITTLEJOHN

N86°55'24"E
717.66'

BLOCK 335
LOT 25
N/F LANDS OF
4 DARBY COURT LLC

CONC. MON. FOUND

IRON BAR FOUND

CONC. MON. FOUND

APPROXIMATE LOCATION OF 15" WIDE STORM SEWER AND DRAINAGE EASEMENT TO BEARSON OF NEW PROVIDENCE PER D.B. 2860 PG. 776

BLOCK 320
LOT 18.01
N/F LANDS OF
MURRAY HILL LLC
D.B. 6313, PG. 616

BLOCK 320
LOT 17

N/F LANDS OF
REDWOOD-ERC NEW PROVIDENCE LLC

PIPE INVERT BURIED UNABLE TO LOCATE

PROP. INLET 24.8
AREA = 0.01 AC.
C=0.98

PROP. INLET 24.9
AREA = 0.17 AC.
C=0.90

PROP. INLET 24.6
AREA = 0.52 AC.
C=0.88

PROP. INLET 24.7
AREA = 0.24 AC.
C=0.90

PROP. INLET 2
AREA = 0.03 AC.
C=0.90

PROP. INLET 4.1
AREA = 0.05 AC.
C=0.90

PROP. INLET 3
AREA = 0.55 AC.
C=0.90

PROP. INLET 4
AREA = 0.10 AC.
C=0.90

PROP. INLET 6
AREA = 0.05 AC.
C=0.90

PROP. INLET 3.1
AREA = 0.05 AC.
C=0.90

PROP. INLET 7
AREA = 0.02 AC.
C=0.90

PROP. INLET 6.1
AREA = 0.12 AC.
C=0.90

PROP. INLET 6.2
AREA = 0.10 AC.
C=0.90

PROP. INLET 10
AREA = 0.18 AC.
C=0.90

PROP. INLET 3.4
AREA = 0.24 AC.
C=0.20

PROP. INLET 11
AREA = 0.25 AC.
C=0.90

PROP. INLET 3.5
AREA = 0.28 AC.
C=0.28

28.5
AC.

PROPOSED BUILDING 6.1
6 STORY

PROPOSED BUILDING 6.2
6 STORY

FFE: 386.00
FFE: 421.00
FFE: 410.00
FFE: 410.00
FFE: 408.00

ENEXT

WETLANDS

UPLANDS

GRASS

GRT=411.39

5 STORY MASONRY BUILDING

RIM=414.06

RIM=413.84

MATCH LINE - SEE LAYOUT D

SECTION LOCATION KEY

A B C D

SOUTHGATE RD

MOUNTAIN AVE

SCALE: 1" = 800'

30 0 15 30 60 120

GRAPHIC SCALE

1 INCH = 30 FEET

© [2019] BOHLER ENGINEERING NJ, LLC

DM

G:\2019\J100690.04\DRAWINGS\CURRENT DRAWINGS\SUPPLEMENT DRAWINGS\DRAINAGE MAPS\J100690.04-IDA-0A-----LAYOUT 2 INDA

BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL SERVICES
PERMITTING SERVICES
TRANSPORTATION SERVICES

THE INFORMATION, DESIGN AND CONTENT OF THIS PLAN IS PROPRIETARY AND SHALL NOT BE DISCLOSED OR USED FOR ANY PURPOSE, WITHOUT THE EXPRESS AUTHORIZATION FROM BOHLER. ONLY APPROVED, SIGNED AND SEALED PLANS SHALL BE UTILIZED FOR CONSTRUCTION PURPOSES.

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

811 Know what's below. Call before you dig.
NEW JERSEY
YOU MUST CALL 811 BEFORE ANY EXCAVATION WHETHER IT'S ON PRIVATE OR PUBLIC LAND.
1-800-272-1000
www.nj1-call.org

PRELIMINARY

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.: J100690.04
DRAWN BY: DM / MFS
CHECKED BY: MD
DATE: 02/11/2020
CAD I.D.: J100690.04-IDA-0A

PROJECT:

PRELIMINARY/FINAL MAJOR SITE PLAN

FOR

REDWOOD-ERC NEW PROVIDENCE, LLC

PROPOSED CONTINUING CARE RETIREMENT COMMUNITY

575 MOUNTAIN AVE
UNION COUNTY
NEW PROVIDENCE, NJ
BLOCK 320 | LOTS 18.01, 15, 17

BOHLER
BOHLER ENGINEERING NJ, LLC
35 TECHNOLOGY DRIVE
WARREN, NJ 07059
Phone: (908) 668-8300
Fax: (908) 754-4401
www.BohlerEngineering.com
NJ CERT. OF AUTHORIZATION NO. 24GA28161700

R.L. STREKER
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 45344
NEW YORK LICENSE No. 079512

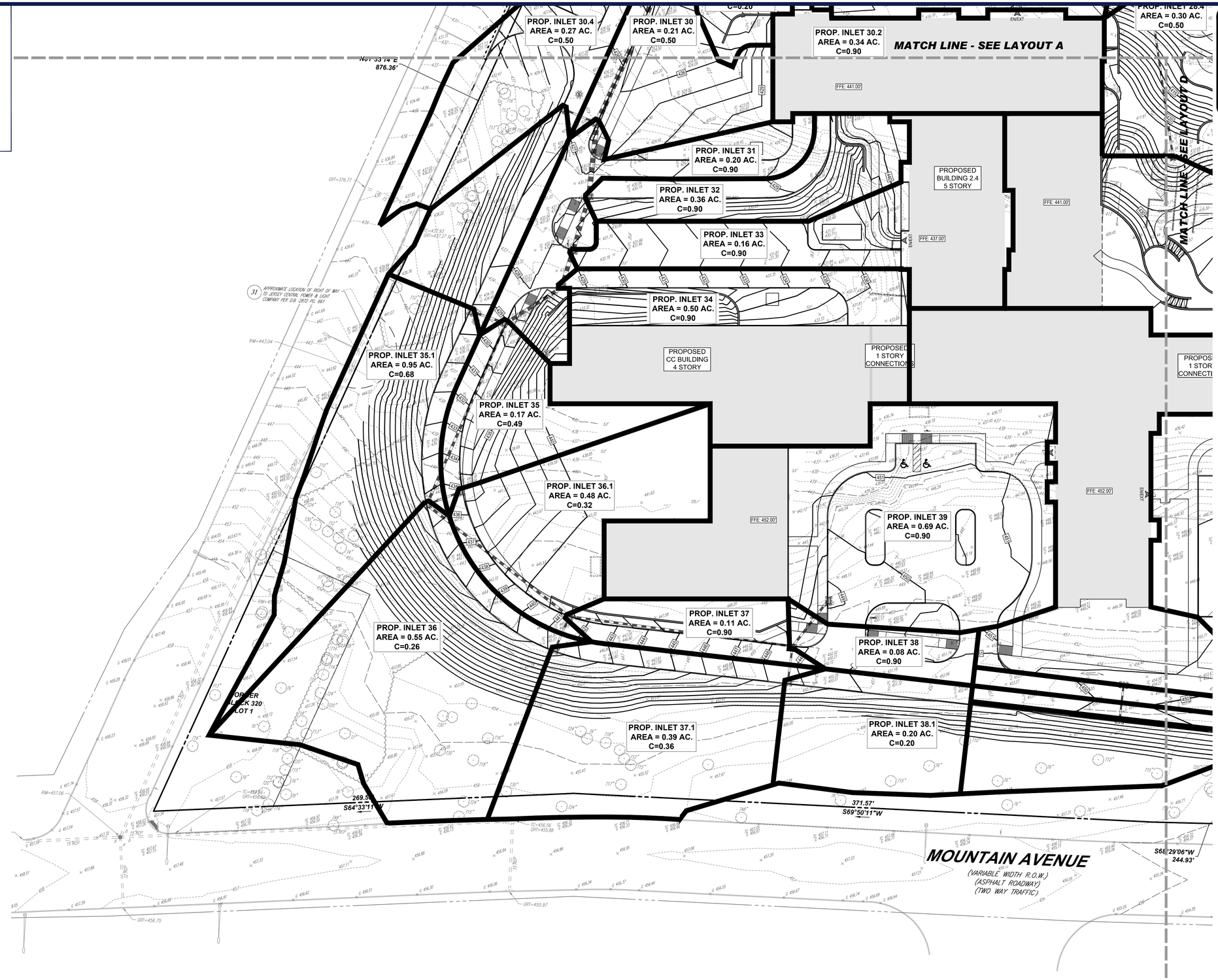
SHEET TITLE:

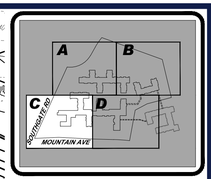
INLET DRAINAGE AREA MAP (B)

SHEET NUMBER:

2

ORG. DATE - 02/11/2020





SECTION LOCATION KEY

SCALE: 1" = 800'

GRAPHIC SCALE: 30 0 15 30 60 120 — 1 INCH = 30 FEET

BOHLER

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL SERVICES
PERMITTING SERVICES
TRANSPORTATION SERVICES

THE WORKING DAYS, DESIGN AND CONTENT OF THIS PLAN ARE PROPRIETARY AND SHALL NOT BE DISCLOSED OR USED FOR ANY PURPOSE WITHOUT THE EXPRESS AUTHORIZATION FROM BOHLER. ONLY APPROVED, SEALED PLANS SHALL BE UTILIZED FOR CONSTRUCTION PURPOSES.
© 2020 BOHLER

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

811 Know what's below. Call before you dig.

NEW JERSEY
YOU MUST CALL 811 BEFORE ANY EXCAVATION WHETHER IT'S ON PRIVATE OR PUBLIC LAND.
1-800-272-1000
www.nj1-call.org

PRELIMINARY

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	J100690.04
DRAWN BY:	DM / MFS
CHECKED BY:	MD
DATE:	02/11/2020
CAD I.D.:	J100690.04-IDA-0A

PROJECT:

PRELIMINARY/FINAL MAJOR SITE PLAN

FOR

REDWOOD-ERC NEW PROVIDENCE, LLC

PROPOSED CONTINUING CARE RETIREMENT COMMUNITY

575 MOUNTAIN AVE
UNION COUNTY
NEW PROVIDENCE, NJ
BLOCK 320 | LOTS 18.01, 15, 17

BOHLER
BOHLER ENGINEERING NJ, LLC
35 TECHNOLOGY DRIVE
WARREN, NJ 07059
Phone: (908) 668-8300
Fax: (908) 754-4401
www.BohlerEngineering.com
NJ CERT. OF AUTHORIZATION NO. 24GA28161700

R.L. STREKER
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 45344
NEW YORK LICENSE No. 079512

SHEET TITLE:

INLET DRAINAGE AREA MAP (C)

SHEET NUMBER:

3

ORG. DATE - 02/11/2020

G:\2019\J100690.04\DRAWINGS\CURRENT DRAWINGS\SUPPLEMENT DRAWINGS\DRAINAGE MAPS\J100690.04-IDA-0A-----LAYOUT 3.IND

NAD83

PROP. INLET 20.4
AREA = 0.30 AC.
C=0.50

C=0.20

MATCH LINE - SEE LAYOUT A

MATCH LINE - SEE LAYOUT B

MATCH LINE - SEE LAYOUT C

PROP. INLET 3.8
AREA = 0.44 AC.
C=0.9

PROP. INLET 3.8
AREA = 0.44 AC.
C=0.9

PROP. INLET 3.6
AREA = 0.22 AC.
C=0.58

PROP. INLET 3.5
AREA = 0.28 AC.
C=0.28

AREA = 0.25 AC.
C=0.90

PROP. INLET 12
AREA = 0.25 AC.
C=0.90

PROP. INLET 13
AREA = 0.57 AC.
C=0.76

PROP. INLET 14
AREA = 0.25 AC.
C=0.50

PROP. INLET 14.1
AREA = 0.06 AC.
C=0.90

FFE: 430.00'

FFE: 441.00'

FFE: 452.00'

FFE: 452.00'

PROPOSED
1 STORY
CONNECTIONS

PROPOSED
BUILDING 2.1
5 STORY

PROP. INLET 15
AREA = 0.30 AC.
C=0.90

PROP. INLET 15.1
AREA = 0.06 AC.
C=0.90

PROP. INLET 18.2
AREA = 0.13 AC.
C=0.9

PROP. INLET 16.1
AREA = 0.26 AC.
C=0.90

PROP. INLET 16
AREA = 0.06 AC.
C=0.90

PROP. INLET 18.1
AREA = 0.77 AC.
C=0.9

PROP. INLET 17
AREA = 0.06 AC.
C=0.90

PROP. INLET 20.1
AREA = 0.03 AC.
C=0.50

PROP. INLET 17.1
AREA = 0.09 AC.
C=0.90

PROP. INLET 18
AREA = 0.36 AC.
C=0.72

PROP. INLET 17.1
AREA = 0.09 AC.
C=0.50

PROP. INLET 17.2
AREA = 0.14 AC.
C=0.50

PROP. INLET 20
AREA = 0.06 AC.
C=0.20

PROP. INLET 19
AREA = 0.12 AC.
C=0.50

PORTION OF
EASEMENT PER
D.B. 2185 PG. 594

PORTION OF
EASEMENT PER
D.B. 2185 PG. 592

APPROXIMATE LOCATION OF 40' WIDE
EASEMENT TO COMMONWEALTH WATER
COMPANY PER D.B. 2185 PG. 592, D.B.
2185 PG. 594, & D.B. 2185 PG. 600

17 18 19

151.27'
S38°52'15"W

2ND FLOOR WALKWAY ELEV.=465.89

5 STORY
MASONRY BUILDING

S66°29'06"W
244.93'

S68°29'06"W
244.93'

R=2030.00'
D=005°01'38"
L=178.11'
CHB=S70°59'55"W

SECTION LOCATION KEY
SCALE: 1" = 800'

A B C D

Southgate Rd

MOUNTAIN AVE

30 0 15 30 60 120

GRAPHIC SCALE

1 INCH = 30 FEET

BOHLER

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
LAND PLANNING
PERMITTING SERVICES
TRANSPORTATION SERVICES

THE BOHLER CIVIL DESIGN AND CONTENT OF THIS PLAN IS FOR CONCEPTUAL USE ONLY AND IS NOT TO BE USED FOR CONSTRUCTION, BIDDING OR PERMIT PURPOSES. ALL DESIGN AND CONTENT SHOWN HEREON IS SUBJECT TO CHANGE AND REVISION BASED ON FINAL ENGINEERING, AGENCY REVIEW AND ACQUISITION FROM ADJACENT PROPERTIES. ONLY APPROVED, SIGNED AND SEALED PLANS SHALL BE UTILIZED FOR CONSTRUCTION PURPOSES.

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

811
Know what's below. Call before you dig.

NEW JERSEY
YOU MUST CALL 811 BEFORE ANY EXCAVATION
WHETHER IT'S ON PRIVATE OR PUBLIC LAND.
1-800-272-1000
www.nj1-call.org

PRELIMINARY

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	J100690.04
DRAWN BY:	DM / MFS
CHECKED BY:	MD
DATE:	02/11/2020
CAD I.D.:	J100690.04-IDA-0A

PROJECT:

PRELIMINARY/FINAL MAJOR SITE PLAN

FOR

REDWOOD-ERC NEW PROVIDENCE, LLC

PROPOSED CONTINUING CARE RETIREMENT COMMUNITY

575 MOUNTAIN AVE
UNION COUNTY
NEW PROVIDENCE, NJ
BLOCK 320 | LOTS 18.01, 15, 17

BOHLER
BOHLER ENGINEERING NJ, LLC
35 TECHNOLOGY DRIVE
WARREN, NJ 07059
Phone: (908) 668-8300
Fax: (908) 754-4401
www.BohlerEngineering.com
NJ CERT. OF AUTHORIZATION NO. 24GA28161700

R.L. STREKER
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 45344
NEW YORK LICENSE No. 079512

SHEET TITLE:

INLET DRAINAGE AREA MAP (D)

SHEET NUMBER:

4

ORG. DATE - 02/11/2020

© 2019 BOHLER

J:\J100690.04\DRAWINGS\CURRENT DRAWINGS\SUPPLEMENT DRAWINGS\DRAINAGE MAPS\J100690.04-IDA-0A-----LAYOUT 4.INDA