STONEFIELD

STORMWATER MANAGEMENT REPORT
21 & 25 GROVE AVENUE

PROPOSED RESIDENTIAL DEVELOPMENT
BLOCK 1702, LOT 22
TOWNSHIP OF VERONA
MIDDLESEX COUNTY, NEW JERSEY

PREPARED FOR:
21 & 25 GROVE ASSOCIATES, LLC

PREPARED BY:
STONEFIELD ENGINEERING & DESIGN, LLC
92 PARK AVENUE
RUTHERFORD, NEW JERSEY

REPORT DATE:
OCTOBER 11, 2019, LAST REVISED MARCH 4, 2021

MATTHEW J. SECKLER, PE, PTOE
NJ PE LICENSE # 48731

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED IN THIS DOCUMENT AND ALL ATTACHMENTS AND THAT, BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING AND PREPARING THE INFORMATION, I BELIEVE THAT THE INFORMATION IS TRUE, ACCURATE, AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR KNOWINGLY SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT.

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APPENDICES

1.0 PROJECT DESCRIPTION

21 & 25 Grove Associates, LLC is proposing to redevelop Block 1702, Lot 22 (herein referred to as the "project site") to accommodate one multi-family residential building (35 units total). Additional improvements include pedestrian plazas at the project site entrances, an off-street parking lot, lighting, and landscaping.

Refer to **APPENDIX A** for project maps of the subject site.

The project site is 31,197 square feet, the extent of land disturbance is 32,673 square feet (including areas within the public right-of-way), and a decrease in 157 square feet of impervious surfaces occurs under proposed conditions.

This Report has been prepared to analyze the potential stormwater runoff impacts of the proposed project site and outline proposed measures to conform to the stormwater management regulations set forth by the Township of Verona, Hudson-Essex-Passaic Soil Conservation District, and the New Jersey Department of Environmental Protection.

2.0 EXISTING CONDITIONS

EXISTING SITE DEVELOPMENT

The project site fronts on one roadway, Grove Avenue to the west. The project site is currently developed with two (2) two-story commercial buildings which are occupied, a one-story garage, and off-street parking. The existing developments on site will be removed entirely as part of the proposed redevelopment. An Aerial Map depicting the existing site conditions can be found in **APPENDIX A**.

EXISTING TOPOGRAPHY

The high point of the project site is at the northwest corner of the property. Grove Avenue drains to the north, ultimately to be collected by the municipal conveyance system. On-site topography slopes northeast towards the stormwater inlets located in the northeast portion of the rear-yard parking lot. Grades on site generally range from 2%-3% and gradually increases to 5%-6% in the western most corner of the lot.

PROJECT SITE SOILS

Soil mapping was obtained from the National Resource Conservation Service (NRCS) for the project site and immediate area. Generally, the project site is underlain with one major soil group: urban land. Overall, the soils drain well, and runoff flows overland and is collected by the stormwater inlets located in the northeast portion of the rear-yard parking lot. The table below provide a summary of soils for the project site:

TABLE 1: NRCS SOIL MAPPING RESULTS

Soil Unit Code	Soil Description	Approximate Project Coverage	Drainage Class	Hydrologic Soil Group
PecuuB	Peckmantown - Urban land, Peckmantown substratum complex, 0% to 8% slopes	100.0%	Well drained	C

Additional information regarding the NRCS soil mapping can be found in **APPENDIX B**.

EXISTING ENVIRONMENTAL INVENTORY

The proposed redevelopment will not disturb land within environmentally regulated areas (flood hazard area, riparian zone, freshwater wetland ditch, and freshwater wetland transition area). As such, permits and approvals will not be sought from the NJDEP to perform work within these areas.

3.0 PROPOSED CONDITIONS

PROPOSED SITE DEVELOPMENT

The proposed redevelopment will consist of one multi-family residential building (35 units total). Additional improvements include pedestrian plazas at the project site entrances, off-street parking lot, lighting, and landscaping. Access to the site will be provided via one full movement driveway on Grove Avenue.

PROPOSED TOPOGRAPHY

Project site topography and drainage patterns will generally remain similar to existing conditions; however, due to the need for more commercially friendly, ADA compliant grades (1.5% to 3%) various retaining walls, ramps, and split-level building entrances will be implemented through the project to make up for the change in grades. Additionally, slopes will increase to a 11% slope along the driveway and a retaining wall will be placed around the driveway and parking.

ANTICIPATED ENVIRONMENTAL INVENTORY IMPACTS

The proposed redevelopment will not disturb land within environmentally regulated areas (flood hazard area, riparian zone, freshwater wetland ditch, and freshwater wetland transition area). As such, permits and approvals will not be sought from the NJDEP to perform work within these areas.

4.0 STORMWATER MANAGEMENT METHODOLOGY & PARAMETERS

HYDROLOGIC METHODOLOGY

The analysis program "HydroCAD" Version 10.0 by HydroCAD Software Solutions was utilized to calculate and plot the runoff hydrographs. The program incorporates the time of concentration, C values, rainfall data, and project

drainage areas to calculate the runoff characteristics. The existing and proposed drainage areas have been analyzed utilizing Intensity-Duration-Frequency data was obtained from NOAA for the project area; specifics of the rainfall distribution can be found in Appendix C. Additional key variables utilized in the analysis include:

TABLE 2: HYDROCAD DESIGN VARIABLES

Variable	Input	Variable	Input
Runoff Calculation Method	SCS TR-20	NRCS Rainfall Frequency Data Set	Essex
Pervious/Impervious CN Calculations	Separate	Storm Intervals (Year Events)	2, 10, 100
Stage-Storage Relationship	Dynamic	Storm Duration	24 Hours
Minimum time of concentration	6 minutes	Storm Curve	NOAA D

Additional information regarding the hydrologic calculations can be found in **APPENIDX C**.

5.0 STORMWATER ANALYSIS

EXISTING DRAINAGE AREAS

Under current conditions, the project site is subdivided into two drainage areas with two ultimate point of interest (POI-1) which is taken as the onsite conveyance system and (POI-2) which is taken as the undetained portion to Grove Avenue. Essentially, there is one drainage area delineating what is tributary to the public roadway and one drainage area for the remainder of the project site which drains to the existing conveyance system on-site containing 15" RCP pipes. See below for a short summary of each area:

TABLE 4: SUMMARY OF EXISTING DRAINAGE AREAS

Drainage Area	Description	Area Extents	Impervious Area	Time of Concentration
E-1	Existing Drainage to On Site Conveyance	27,918 SF	20,661 SF	6.0 Minutes*
E-2	Existing Undetained Drainage Area to Grove	3,279 SF	1,151 SF	6.0 Minutes*

***The minimum time of concentration was utilized due to the high level of impervious coverage and proximity to the existing stormwater pipe conveyance system on site.**

All existing drainage areas were delineated based on field surveying data. Hydrologic calculations and parameters for each drainage area can be found in **APPENDIX C**; specific drainage area delineations and land cover can be found in **APPENDIX D.**

PROPOSED DRAINAGE AREAS

Under the proposed development plan, the project area will consist of a proposed residential development, associated parking, lighting, landscaping, and utility measures. Two points of interest and two drainage areas are proposed under post construction conditions in order to satisfy all NJDEP requirements.

- **Proposed Drainage to On Site Conveyance (Drainage Area P-1):** This drainage area consists of a large majority of the property inclusive of the entire building footprint and the side and back landscaping portions. A 2,500 SF green roof has been incorporated to properly convey runoff.

- **Proposed Undetained Drainage Area to Grove (Drainage Area P-2):** This drainage area consists of the front portion of the property along Grove Avenue inclusive of most of the ramp leading to the building and a small portion of the southern grass area by the building.

  See below for a short summary of each area:

TABLE 5: SUMMARY OF PROPOSED DRAINAGE AREAS

Drainage Area	Description	Area Extents	Impervious Area	Time of Concentration
P-1	Proposed Drainage to On Site Conveyance	28,173 SF	20,377 SF	6.0 Minutes*
P-2	Proposed Undetained Drainage Area to Grove	3,024 SF	1,278 SF	6.0 Minutes*

***The minimum time of concentration was utilized for all drainage areas due to the high level of impervious coverage / land disturbance and proximity to existing and proposed stormwater pipe conveyance system. Additionally, perimeter drainage areas such as P-2 while not highly impervious essentially consist of the open space areas immediately adjacent to the roadway.**

All proposed drainage areas were delineated based on the proposed grading design overlain on field survey data. Hydrologic calculations and parameters for each drainage area can be found in **APPENDIX C**; specific drainage area delineations and land cover can be found in **APPENDIX D.**

STORMWATER MANAGEMENT DESIGN PARAMETERS

The extent of redevelopment does not propose to disturb more than one acre of land or add more than one-quarter acre of new impervious surfaces; as such, it is considered a Minor Development as defined in the Township Ordinances and NJAC 7:8-1.2 and therefore us not subject to stormwater runoff quantity, quality, or groundwater recharge requirements. See below for a summary of each design parameter and compliance requirements:

TABLE 6: STORMWATER MANAGEMENT DESIGN TARGET SUMMARY

Design Parameter	Design Target for Compliance
Stormwater Runoff Quantity	Design stormwater management measures so that the post-construction peak runoff rates are either less or match pre-construction peak runoff rates.
Stormwater Quality	The project is **exempt** from water quality requirements as the project is a minor development and does not add more than 0.25 acres of impervious coverage.
Groundwater Recharge	The project is **exempt** from groundwater recharge requirements as the project site is located within State Planning Area PA-1 (Metropolitan).

STORMWATER RUNOFF QUANTITY

In addition to an on-site stormwater conveyance system in the northeast corner of the project site, a 3,000 square-foot green roof has been proposed as a part of the building to reduce or match peak pre-construction stormwater runoff rates. The tables below summarize the various drainage areas in relation to flow rates and runoff volume during regulatory storm events:

TABLE 7: SUMMARY OF EXISTING DRAINAGE AREA FLOW RATES & VOLUMES

Drainage Area	2-Year Flow Rate	10-Year Flow Rate	100-Year Flow Rate
E-1	1.77 CFS	2.85 CFS	4.98 CFS
E-2	0.15 CFS	0.28 CFS	0.53 CFS
Total POI	1.92 CFS	3.13 CFS	5.51 CFS

TABLE 8: SUMMARY OF PROPOSED DRAINAGE AREA FLOW RATES & VOLUMES

Drainage Area	2-Year Flow Rate	10-Year Flow Rate	100-Year Flow Rate
P-1	1.70 CFS	2.79 CFS	4.95 CFS
P-2	0.15 CFS	0.27 CFS	0.50 CFS
Total POI	1.85 CFS	3.06 CFS	5.45 CFS

The table below outlines the regulatory compliance parameters for runoff quantity on the project site:

TABLE 9: STORMWATER RUNOFF QUANTITY COMPLIANCE SUMMARY AT POINT OF INTEREST (E-1 / P-1)

Rainfall Event	Existing Flow Rate	Required % Reduction	Required Flow Rate	Proposed Flow Rate	Proposed % Reduction
2-Year Storm	1.77 CFS	N/A	N/A	1.70 CFS	3.95%
10-Year Storm	2.85 CFS	N/A	N/A	2.79 CFS	2.10%
00-Year Storm	4.98 CFS	N/A	N/A	4.95 CFS	0.60%

TABLE 10: STORMWATER RUNOFF QUANTITY COMPLIANCE SUMMARY AT POINT OF INTEREST (E-2 / P-2)

Rainfall Event	Existing Flow Rate	Required % Reduction	Required Flow Rate	Proposed Flow Rate	Proposed % Reduction
2-Year Storm	0.15 CFS	N/A	N/A	0.15 CFS	0.00%
10-Year Storm	0.28 CFS	N/A	N/A	0.27 CFS	3.57%
100-Year Storm	0.53 CFS	N/A	N/A	0.50 CFS	5.66%

The proposed green roof and on on-site conveyance system provides sufficient flow rate attenuation so as to ensure that no adverse impacts are anticipated downstream of the project site. Detailed hydrologic calculations for each drainage area can be found in **APPENDIX C**.

STORMWATER QUALITY CONTROL

As indicated in the Township Ordinances and NJAC 7:8-5.5, the project site is exempt from stormwater quality control requirements as the site increases impervious coverage by less than one-quarter acre on the proposed project site.

GROUNDWATER RECHARGE

As indicated in the Township Ordinances and NJAC 7:8-5.4, the project site is exempt from groundwater recharge requirements as the site is located within the Metropolitan Planning Area (PA-1) per the State Plan Policy Map and thus qualifies as an Urban Redevelopment Area (which is exempt from groundwater recharge requirements).

6.0 STORMWATER FACILITY OPERATIONS & MAINTENANCE

A Stormwater Operations & Maintenance Manual will be submitted for review to the Township and will be forwarded to the relevant jurisdictional agencies prior to obtaining final land use approvals and permits. Any

necessary easements or covenants associated with the stormwater improvements will be recorded prior to the start of construction.

7.0 EROSION & SEDIMENT CONTROL

A Soil Erosion & Sediment Control Plan has been prepared in accordance with the latest edition of the Standards for Soil Erosion and Sediment Control in New Jersey. This plan can be found within the Preliminary & Final Major Site Plans prepared by Stonefield in conjunction with this Report. Proposed temporary measures during construction include diversion swales, sediment basin, silt fencing, stabilized construction entrances, inlet filters, hay bales, street sweeping, and temporary seeding for soil stabilization. No land disturbance will occur until certification and permits have been obtained from the Hudson Essex Passaic Soil Conservation District.

8.0 PIPE CAPACITY

Under post-development conditions, the undetained flow known as Drainage Area (P-2) sheet flows towards the conveyance system within Grove Avenue. The back portion of the proposed development inclusive of the rood and entrance driveway along with the implementation of the proposed 2,500 square-foot green roof ultimately discharges into the existing stormwater system proposed that is exiting the site onto lot 8. Refer to **Appendix C** for pipe capacity calculations for the proposed reconstructed storm system.

9.0 CONCLUSIONS

As demonstrated in this Report, the increase in runoff flow rate and volume generated by the proposed redevelopment will be satisfactorily mitigated by the introduction of a 2,500 square-foot green roof and on-site stormwater conveyance system.

The proposed project complies with all applicable stormwater management regulations and standards. As such, the project is not anticipated to have any adverse drainage impacts on neighboring properties, downstream watercourses, or adjoining conveyance systems.

10.0 REFERENCES

1. New Jersey Administrative Code Title 7, Chapter 8 Stormwater Management, last amended June 20, 2016

   https://www.nj.gov/dep/rules/rules/njac7_8.pdf

2. New Jersey Stormwater Best Management Practices Manual, last revised November 2018

   https://www.njstormwater.org/bmp_manual2.htm

3. Township of Verona Zoning Ordinance, last amended August 15, 2011

   https://ecode360.com/12271174

APPENDIX A
PROJECT FIGURES

INVENTORY

FIGURE 1: USGS LOCATION MAP

FIGURE 2: AERIAL MAP

FIGURE 3: TAX & ZONING MAP

FIGURE 4: FEMA MAP

USGS QUADRANGLE MAP

1000' 0' 1000' 2000'

GRAPHIC SCALE IN FEET

1"= 1000'

SOURCE: UNITED STATES GEOLOGICAL SURVEY QUADRANGLE MAPS, VERONA, NEW JERSEY, 7.5 MINUTE SERIES, 2016.

WEISS REALTY
PROPOSED MIXED-USE DEVELOPMENT

BLOCK 1702, LOT 22
21-25 GROVE AVENUE
TOWNSHIP OF VERONA
ESSEX COUNTY, NEW JERSEY

DRAWN BY:	CRP
CHECKED BY:	MEM
DATE:	07/31/2019
SCALE:	1" = 1000'
PROJECT ID:	T-19059

STONEFIELD engineering & design
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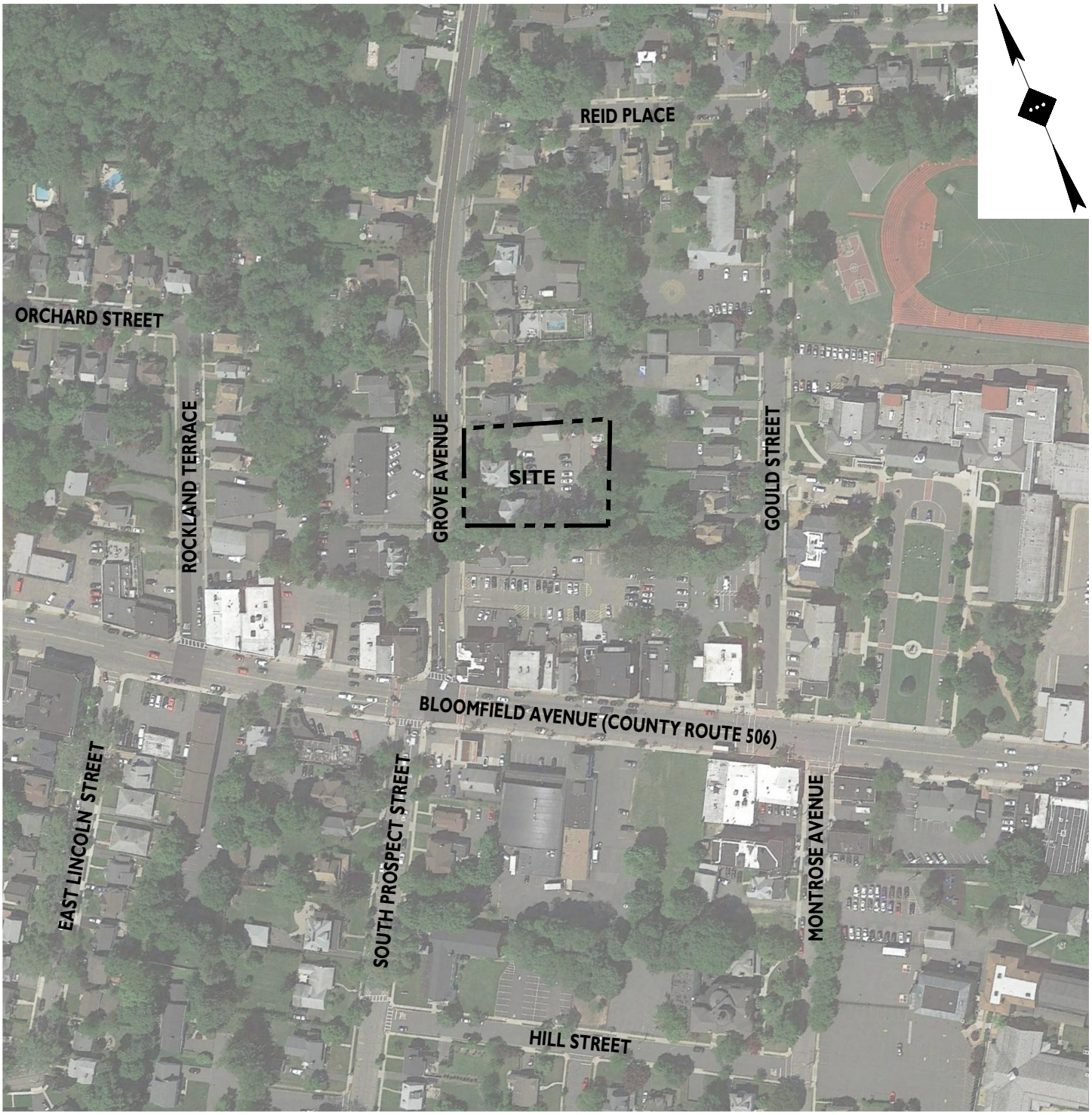

AERIAL MAP

200' 0' 200' 400'

GRAPHIC SCALE IN FEET

1" = 200'

SOURCE: GOOGLE EARTH PRO, RETRIEVED 07/31/2019

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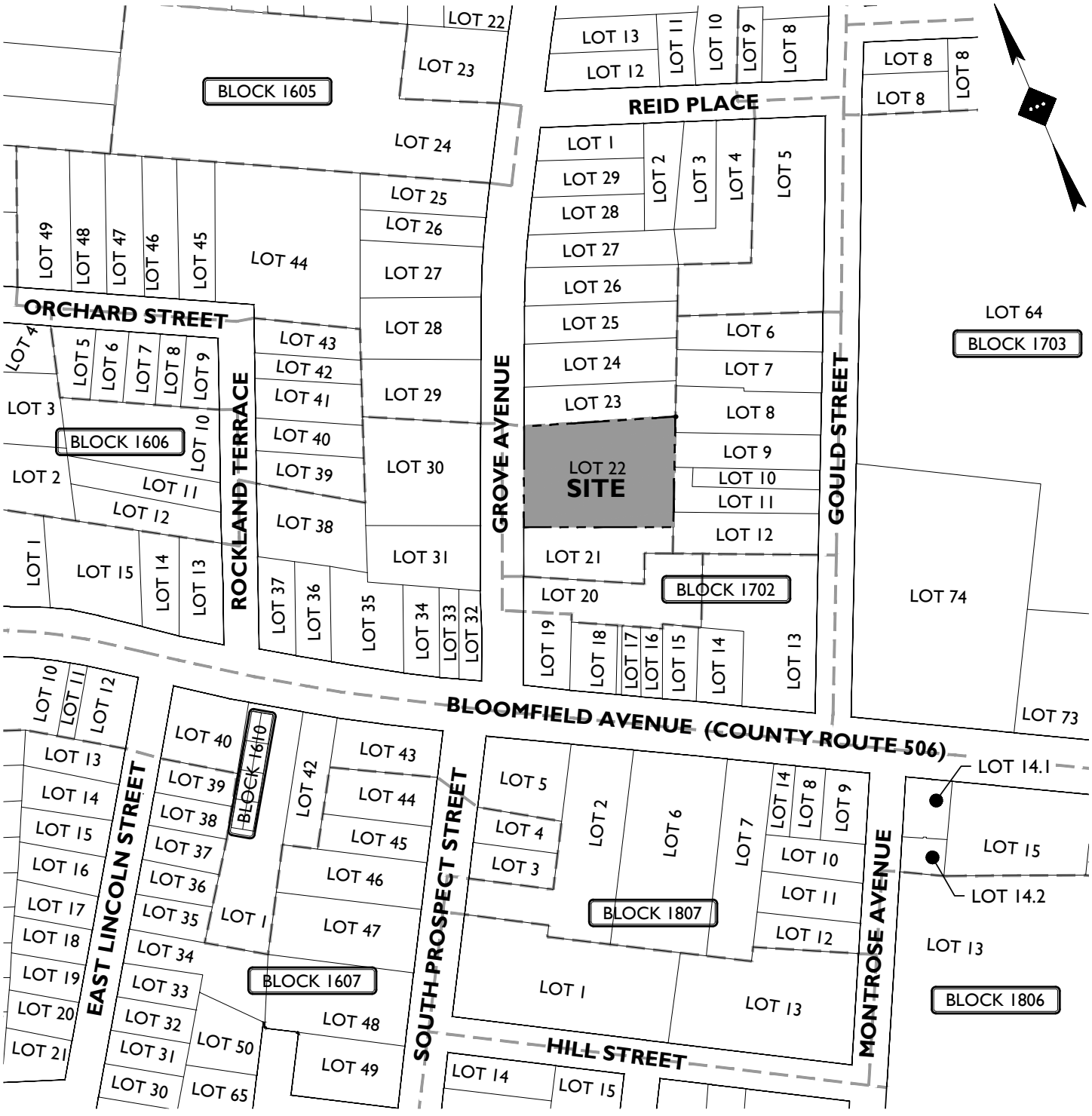

TAX AND ZONING MAP

200' 0' 200' 400'

GRAPHIC SCALE IN FEET

1" = 200'

SOURCE: TOWNSHIP OF VERONA TAX MAP, SHEETS 6, 16, 17 & 18. TOWNSHIP OF VERONA ZONING MAP, DATED 11/27/2015.

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EFFECTIVE FEMA FLOOD INSURANCE RATE MAP

1000' 0' 1000' 2000'

GRAPHIC SCALE IN FEET

1" = 1000'

SOURCE: FLOOD INSURANCE RATE MAP, ESSEX COUNTY, NEW JERSEY, MAP NUMBERS 34013C0084F & 34013C0103F, DATED JUNE 4, 2007.

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APPENDIX B
NRCS SOILS REPORT

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Essex County, New Jersey

July 25, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:634 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 30 60 120 180

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

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

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

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

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

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

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

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

Soil Survey Area: Essex County, New Jersey
Survey Area Data: Version 14, Sep 13, 2018

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

Date(s) aerial images were photographed: Aug 25, 2014—Sep 27, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PecuuB	Peckmantown - Urban land, Peckmantown substratum complex, 0 to 8 percent slopes	1.0	100.0%
Totals for Area of Interest		**1.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Essex County, New Jersey

PecuuB—Peckmantown - Urban land, Peckmantown substratum complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: w8qf
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Peckmantown and similar soils: 55 percent
Urban land, peckmantown substratum: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peckmantown

Setting

Landform: Outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-silty glaciolacustrine deposits derived from basalt

Typical profile

A - 0 to 2 inches: silt loam
Ap - 2 to 8 inches: loam
BAt - 8 to 14 inches: loam
Bt - 14 to 27 inches: silt loam
Btx1 - 27 to 37 inches: loam
Btx2 - 37 to 40 inches: silt loam
BCtx - 40 to 59 inches: silt loam
2C1 - 59 to 63 inches: gravelly loamy coarse sand
2C2 - 63 to 74 inches: coarse sand
2C3 - 74 to 88 inches: coarse sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to fragipan
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Hydric soil rating: No

Description of Urban Land, Peckmantown Substratum

Setting

Landform: Outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Surface covered by pavement, concrete, buildings, and other structures underlain by disturbed and natural soil material

Typical profile

H1 - 0 to 12 inches: material
H2 - 12 to 59 inches: silt loam
2C1 - 59 to 63 inches: gravelly loamy coarse sand
2C2 - 63 to 74 inches: coarse sand
2C3 - 74 to 88 inches: coarse sand

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Udorthents, peckmantown substratum

Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (three-dimensional): Tread, rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

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APPENDIX C
HYDROLOGIC & HYDRAULIC CALCULATIONS

INVENTORY

NEW JERSEY 24 HOUR RAINFALL FREQUENCY DATA

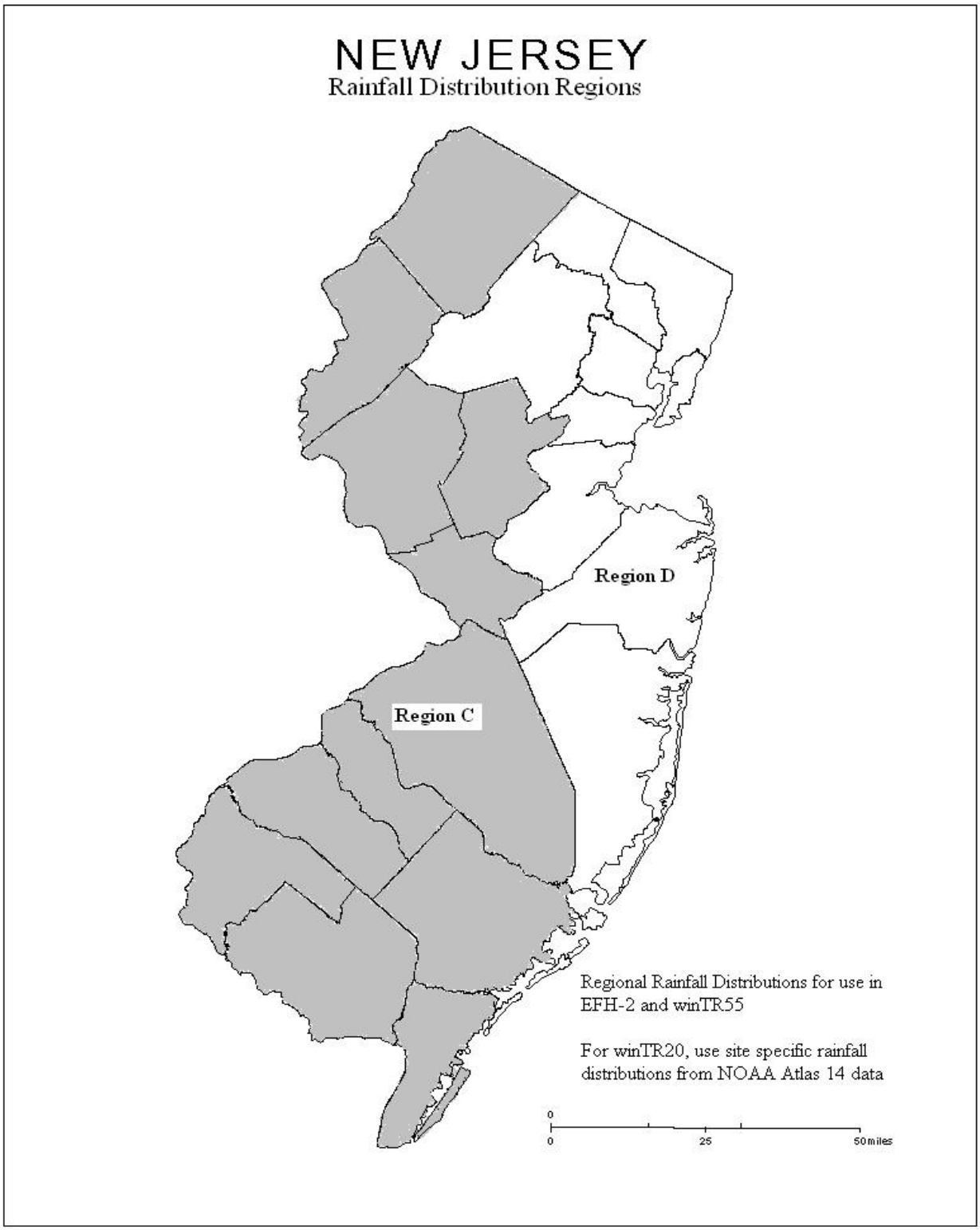
Rainfall amounts in Inches

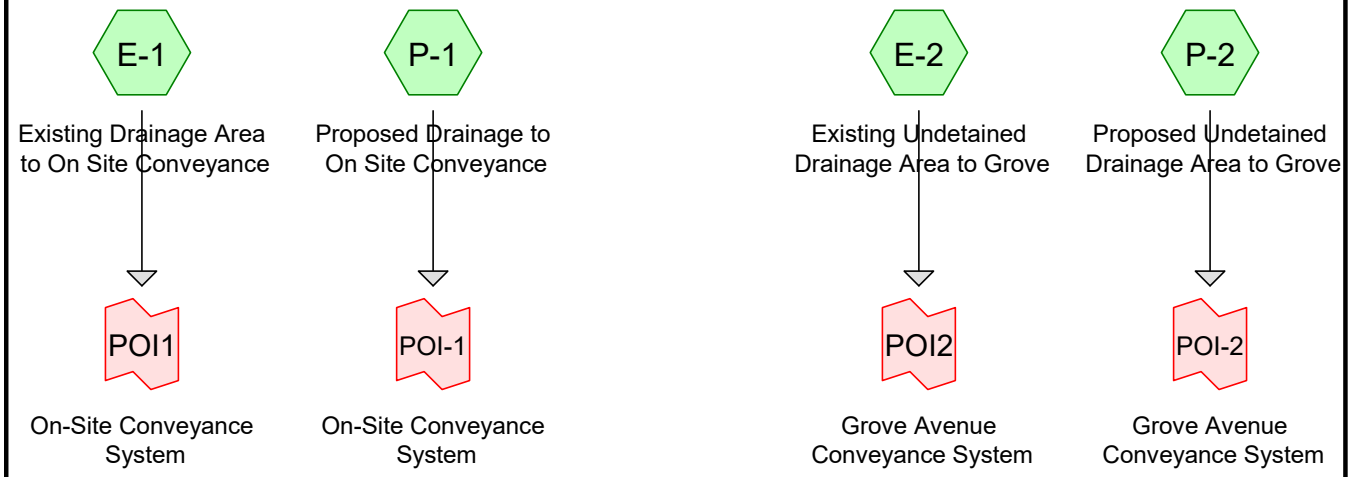
County	1 year	2 year	5 year	10 year	25 year	50 year	100 year
Atlantic	2.72	3.31	4.30	5.16	6.46	7.61	8.90
Bergen	2.75	3.34	4.27	5.07	6.28	7.32	8.47
Burlington	2.77	3.36	4.34	5.18	6.45	7.56	8.81
Camden	2.73	3.31	4.25	5.06	6.28	7.34	8.52
Cape May	2.67	3.25	4.22	5.07	6.34	7.47	8.73
Cumberland	2.69	3.27	4.25	5.09	6.37	7.49	8.76
Essex	2.85	3.44	4.40	5.22	6.44	7.49	8.66
Gloucester	2.71	3.29	4.24	5.05	6.29	7.36	8.55
Hudson	2.73	3.31	4.23	5.02	6.19	7.20	8.31
Hunterdon	2.80	3.38	4.26	5.00	6.09	7.02	8.03
Mercer	2.74	3.31	4.23	5.01	6.19	7.20	8.33
Middlesex	2.76	3.35	4.30	5.12	6.36	7.43	8.63
Monmouth	2.79	3.38	4.38	5.23	6.53	7.66	8.94
Morris	2.94	3.54	4.47	5.24	6.37	7.32	8.35
Ocean	2.81	3.42	4.45	5.33	6.68	7.87	9.20
Passaic	2.87	3.47	4.42	5.23	6.43	7.47	8.62
Salem	2.69	3.26	4.20	5.00	6.22	7.28	8.45
Somerset	2.76	3.34	4.25	5.01	6.15	7.13	8.21
Sussex	2.68	3.22	4.02	4.70	5.72	6.60	7.58
Union	2.80	3.39	4.35	5.17	6.42	7.49	8.69
Warren	2.78	3.34	4.18	4.89	5.93	6.83	7.82

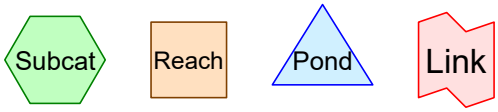
Notes: The average point rainfall amounts listed above were developed from data contained in NOAA Atlas 14 Volume 2.

Point rainfall estimates for specific locations may be obtained from the Precipitation Frequency Data Server located at http://www.nws.noaa.gov/ohd/hdsc/

For most hydrologic design procedures, the rainfall amounts listed above may be rounded to the nearest tenth of an inch.


NEW JERSEY
Rainfall Distribution Regions
Region D
Region C
Regional Rainfall Distributions for use in EFH-2 and winTR55
For winTR20, use site specific rainfall distributions from NOAA Atlas 14 data
0
0
25
50 miles





Routing Diagram for 2021-02-22_HydroCAD
Prepared by {enter your company name here}, Printed 3/4/2021

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1: Existing Drainage Area Runoff Area=27,918 sf 74.01% Impervious Runoff Depth=2.68"
Flow Length=207' Tc=6.0 min CN=74/98 Runoff=1.77 cfs 6,246 cf

Subcatchment E-2: Existing Undetained Runoff Area=3,279 sf 35.10% Impervious Runoff Depth=1.90"
Tc=6.0 min CN=74/98 Runoff=0.15 cfs 520 cf

Subcatchment P-1: Proposed Drainage to Runoff Area=28,173 sf 63.45% Impervious Runoff Depth=2.52"
Flow Length=204' Tc=6.0 min CN=76/98 Runoff=1.70 cfs 5,911 cf

Subcatchment P-2: Proposed Undetained Runoff Area=3,024 sf 42.26% Impervious Runoff Depth=2.05"
Flow Length=176' Tc=6.0 min CN=74/98 Runoff=0.15 cfs 516 cf

Link POI-1: On-Site Conveyance System Inflow=1.70 cfs 5,911 cf
Primary=1.70 cfs 5,911 cf

Link POI-2: Grove Avenue Conveyance System Inflow=0.15 cfs 516 cf
Primary=0.15 cfs 516 cf

Link POI1: On-Site Conveyance System Inflow=1.77 cfs 6,246 cf
Primary=1.77 cfs 6,246 cf

Link POI2: Grove Avenue Conveyance System Inflow=0.15 cfs 520 cf
Primary=0.15 cfs 520 cf

Total Runoff Area = 62,394 sf Runoff Volume = 13,193 cf Average Runoff Depth = 2.54"
34.34% Pervious = 21,427 sf 65.66% Impervious = 40,967 sf

Summary for Subcatchment E-1: Existing Drainage Area to On Site Conveyance

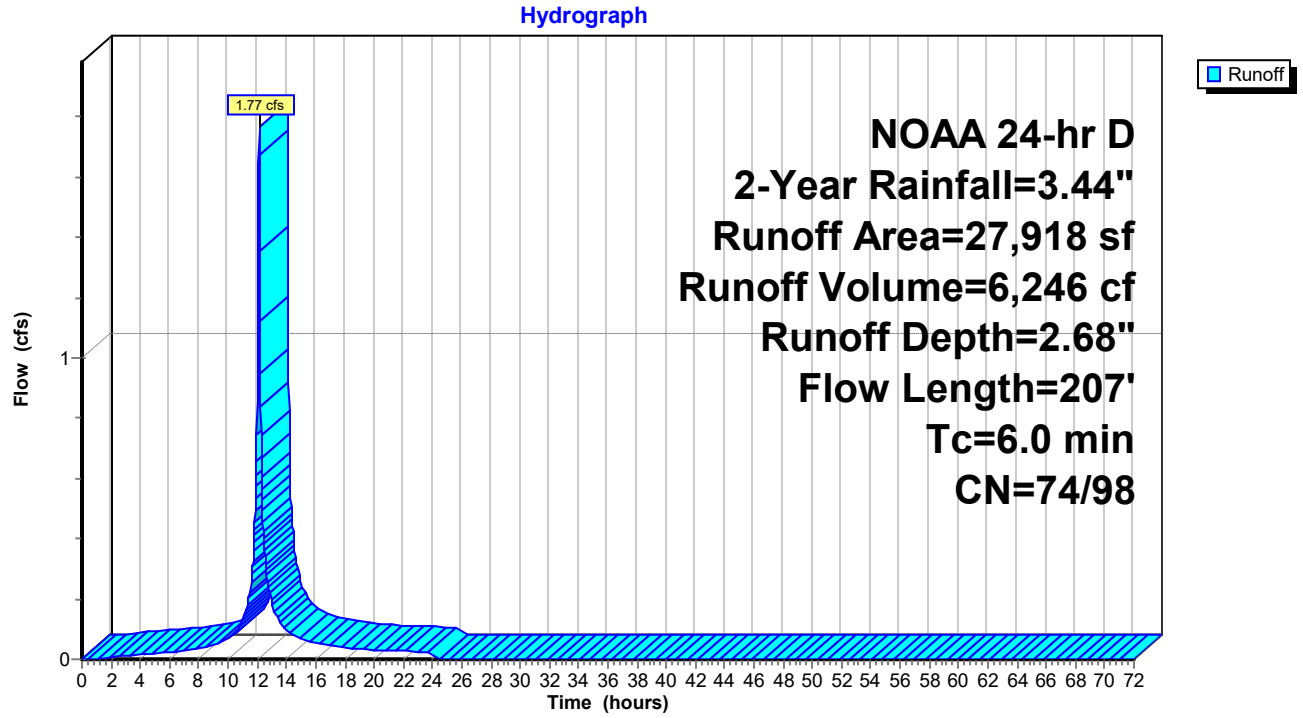
Runoff = 1.77 cfs @ 12.13 hrs, Volume= 6,246 cf, Depth= 2.68"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 2-Year Rainfall=3.44"

	Area (sf)	CN	Description
*	20,661	98	Impervious Coverage
	7,257	74	>75% Grass cover, Good, HSG C
	27,918	92	Weighted Average
	7,257	74	25.99% Pervious Area
	20,661	98	74.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	70	0.0850	2.37		**Sheet Flow, segement 1** Smooth surfaces n= 0.011 P2= 3.44"
0.1	42	0.0550	4.76		**Shallow Concentrated Flow, segment 2** Paved Kv= 20.3 fps
0.2	39	0.0450	4.31		**Shallow Concentrated Flow, segment 3** Paved Kv= 20.3 fps
0.1	56	0.0200	8.80	10.80	**Pipe Channel, segment 4** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011 Concrete pipe, straight & clean
0.9	207	Total, Increased to minimum Tc = 6.0 min			

Subcatchment E-1: Existing Drainage Area to On Site Conveyance



Summary for Subcatchment E-2: Existing Undetained Drainage Area to Grove

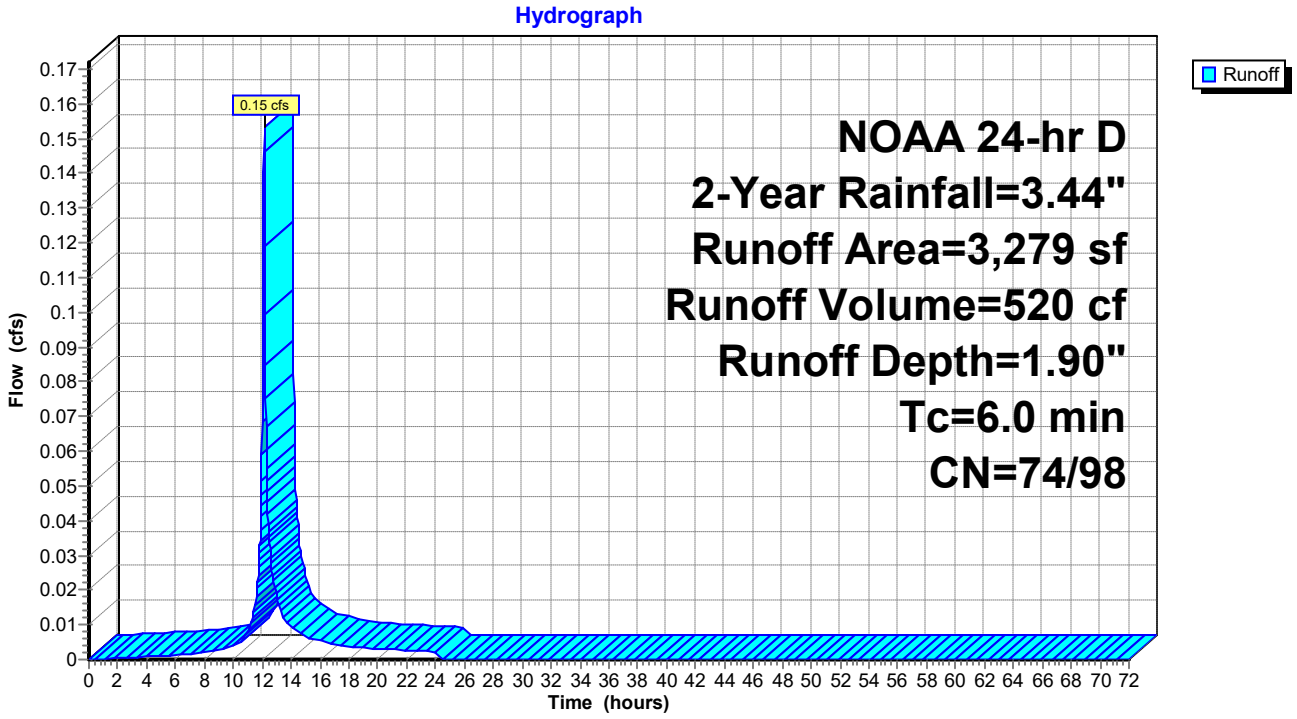
Runoff = 0.15 cfs @ 12.13 hrs, Volume= 520 cf, Depth= 1.90"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 2-Year Rainfall=3.44"

	Area (sf)	CN	Description
*	1,151	98	Impervious Coverage
	2,128	74	>75% Grass cover, Good, HSG C
	3,279	82	Weighted Average
	2,128	74	64.90% Pervious Area
	1,151	98	35.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9					**Direct Entry,**
0.9	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment E-2: Existing Undetained Drainage Area to Grove



Summary for Subcatchment P-1: Proposed Drainage to On Site Conveyance

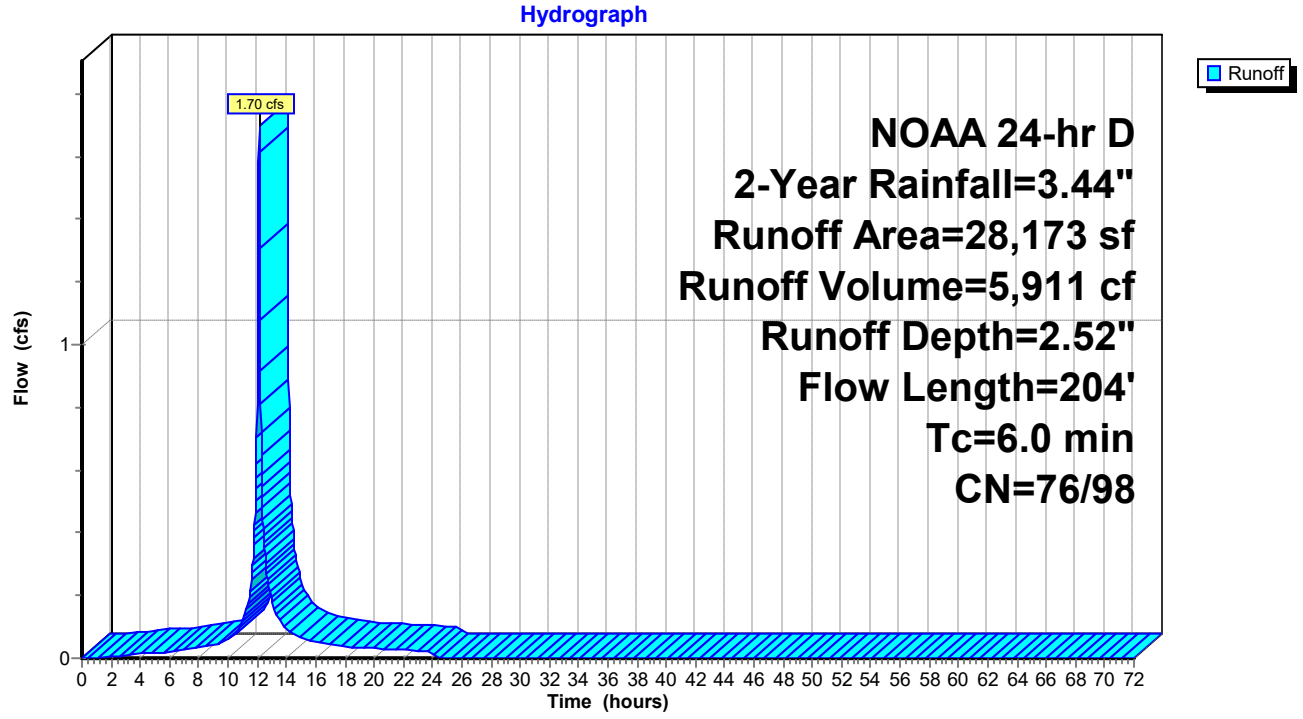
Runoff = 1.70 cfs @ 12.13 hrs, Volume= 5,911 cf, Depth= 2.52"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 2-Year Rainfall=3.44"

	Area (sf)	CN	Description
*	17,877	98	Impervious Coverage
*	2,500	82	Green Roof
	7,796	74	>75% Grass cover, Good, HSG C
	28,173	90	Weighted Average
	10,296	76	36.55% Pervious Area
	17,877	98	63.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	58	0.0862	0.28		**Sheet Flow, segment 1** Grass: Short n= 0.150 P2= 3.44"
1.7	133	0.0359	1.33		**Shallow Concentrated Flow, segment 2** Short Grass Pasture Kv= 7.0 fps
0.4	13	0.0050	0.49		**Shallow Concentrated Flow, segment 3** Short Grass Pasture Kv= 7.0 fps
5.5	204	Total, Increased to minimum Tc = 6.0 min			

Subcatchment P-1: Proposed Drainage to On Site Conveyance



Summary for Subcatchment P-2: Proposed Undetained Drainage Area to Grove

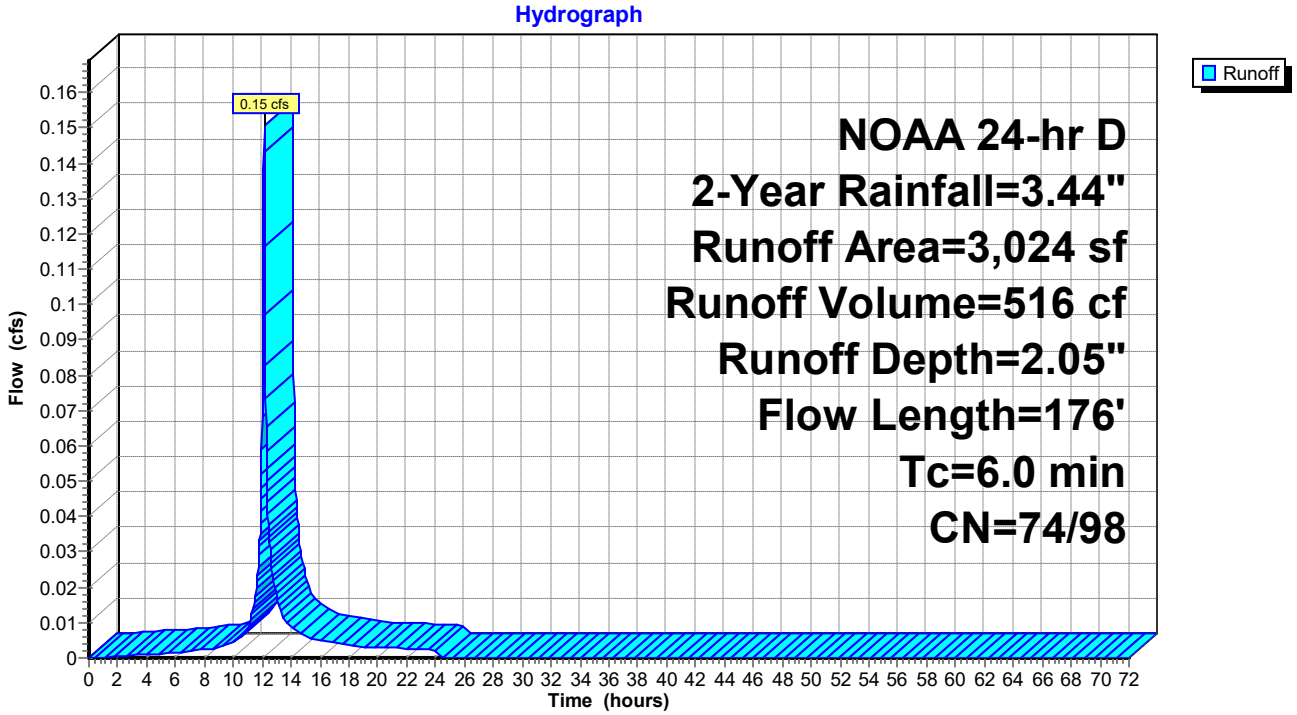
Runoff = 0.15 cfs @ 12.13 hrs, Volume= 516 cf, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 2-Year Rainfall=3.44"

	Area (sf)	CN	Description
*	1,278	98	Impervious Coverage
	1,746	74	>75% Grass cover, Good, HSG C
	3,024	84	Weighted Average
	1,746	74	57.74% Pervious Area
	1,278	98	42.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0690	0.25		**Sheet Flow, segment 1** Grass: Short n= 0.150 P2= 3.44"
1.5	112	0.0330	1.27		**Shallow Concentrated Flow, segment 2** Short Grass Pasture Kv= 7.0 fps
0.5	14	0.0050	0.49		**Shallow Concentrated Flow, segment 3** Short Grass Pasture Kv= 7.0 fps
5.3	176	Total, Increased to minimum Tc = 6.0 min			

Subcatchment P-2: Proposed Undetained Drainage Area to Grove

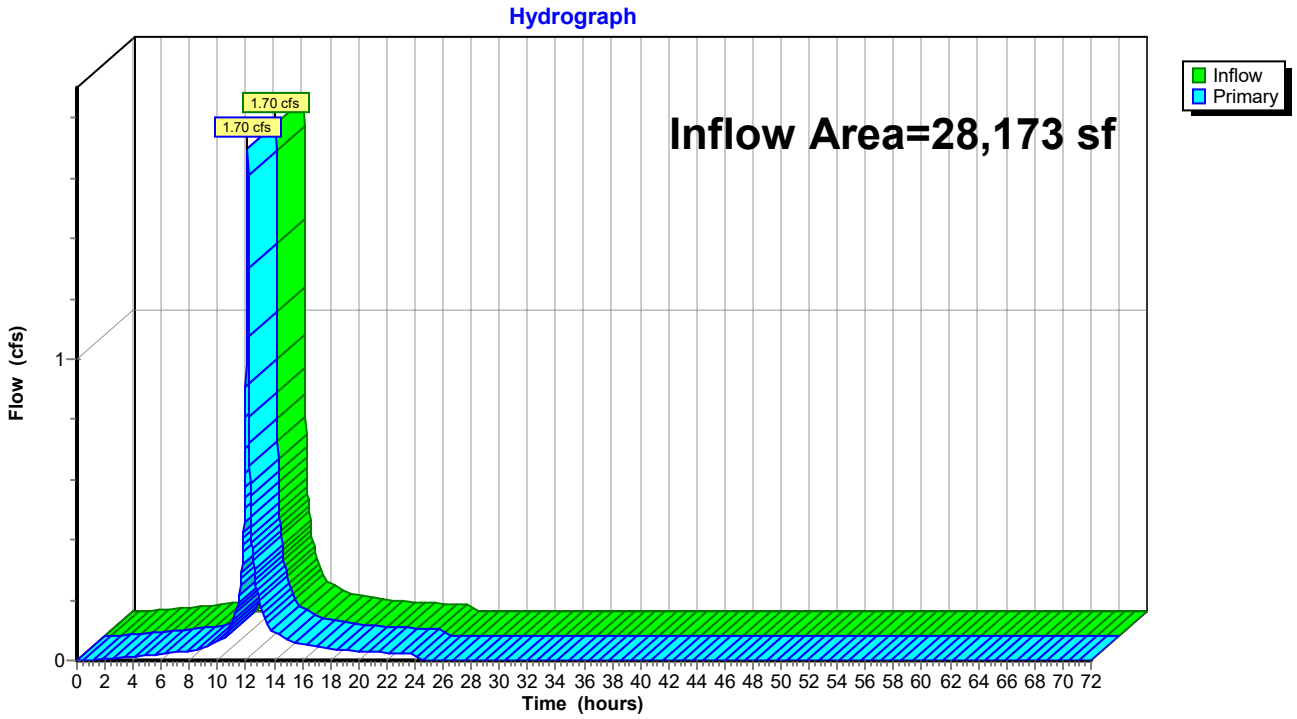


Summary for Link POI-1: On-Site Conveyance System

Inflow Area = 28,173 sf, 63.45% Impervious, Inflow Depth = 2.52" for 2-Year event
Inflow = 1.70 cfs @ 12.13 hrs, Volume= 5,911 cf
Primary = 1.70 cfs @ 12.13 hrs, Volume= 5,911 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Link POI-1: On-Site Conveyance System

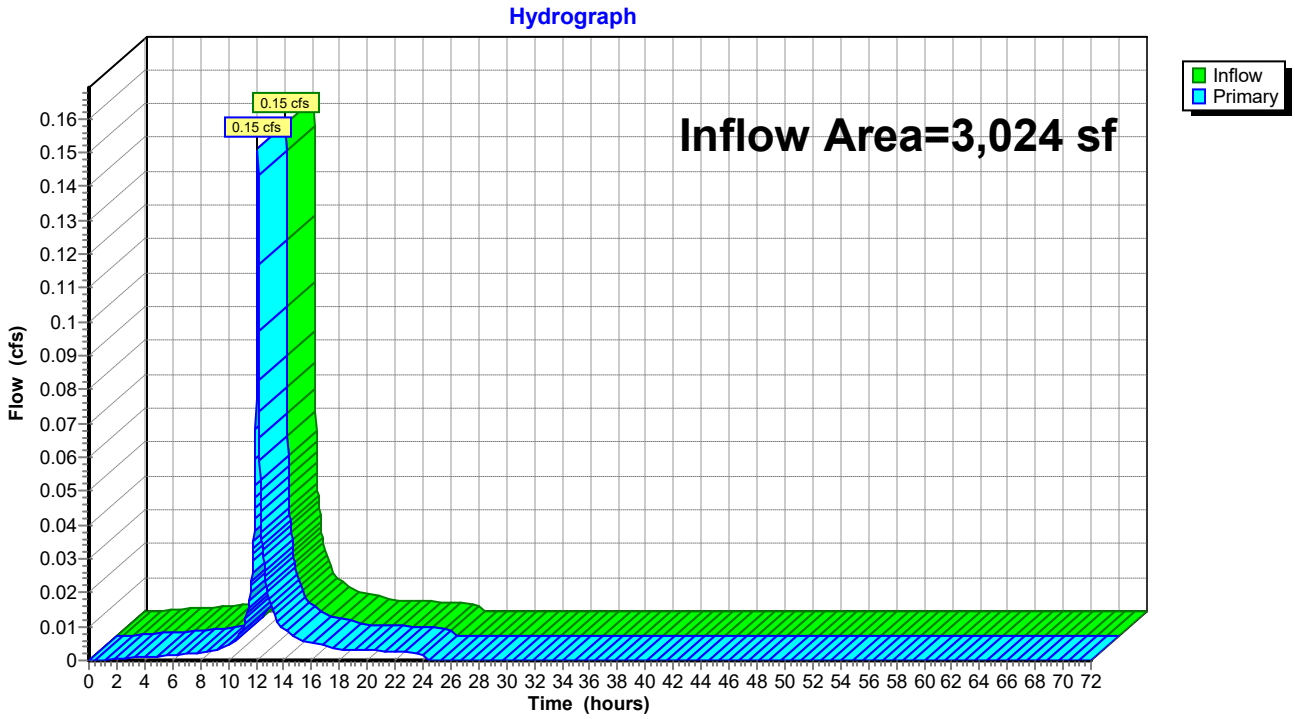


Summary for Link POI-2: Grove Avenue Conveyance System

Inflow Area = 3,024 sf, 42.26% Impervious, Inflow Depth = 2.05" for 2-Year event
Inflow = 0.15 cfs @ 12.13 hrs, Volume= 516 cf
Primary = 0.15 cfs @ 12.13 hrs, Volume= 516 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Link POI-2: Grove Avenue Conveyance System

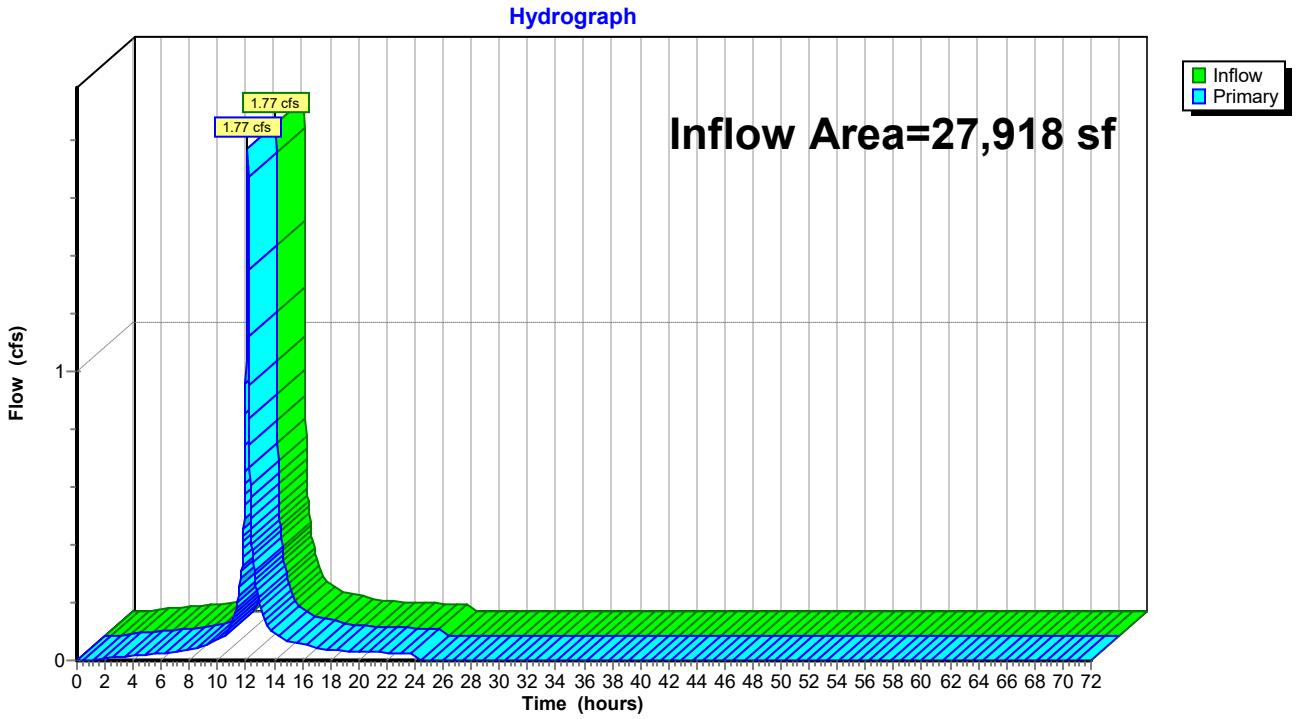


Summary for Link POI1: On-Site Conveyance System

Inflow Area = 27,918 sf, 74.01% Impervious, Inflow Depth = 2.68" for 2-Year event
Inflow = 1.77 cfs @ 12.13 hrs, Volume= 6,246 cf
Primary = 1.77 cfs @ 12.13 hrs, Volume= 6,246 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Link POI1: On-Site Conveyance System

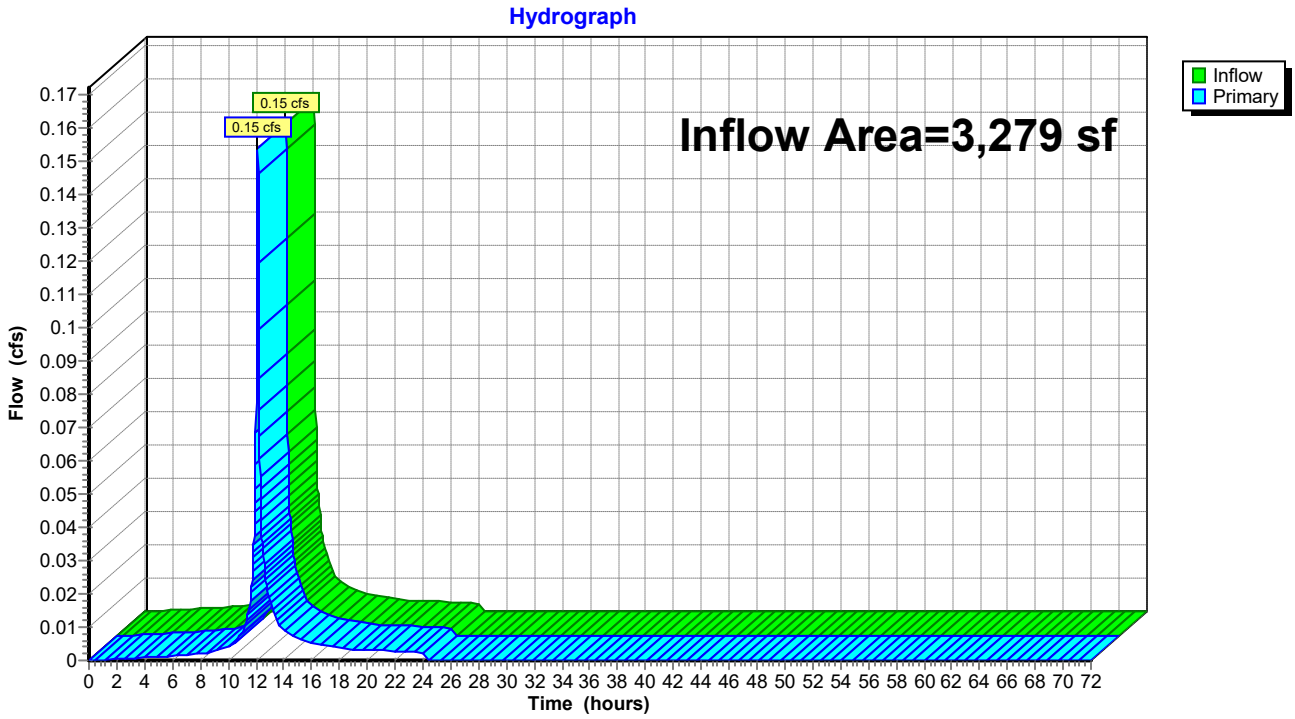


Summary for Link POI2: Grove Avenue Conveyance System

Inflow Area = 3,279 sf, 35.10% Impervious, Inflow Depth = 1.90" for 2-Year event
Inflow = 0.15 cfs @ 12.13 hrs, Volume= 520 cf
Primary = 0.15 cfs @ 12.13 hrs, Volume= 520 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Link POI2: Grove Avenue Conveyance System



Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1: Existing Drainage Area Runoff Area=27,918 sf 74.01% Impervious Runoff Depth=4.35"
Flow Length=207' Tc=6.0 min CN=74/98 Runoff=2.85 cfs 10,116 cf

Subcatchment E-2: Existing Undetained Runoff Area=3,279 sf 35.10% Impervious Runoff Depth=3.40"
Tc=6.0 min CN=74/98 Runoff=0.28 cfs 929 cf

Subcatchment P-1: Proposed Drainage to Runoff Area=28,173 sf 63.45% Impervious Runoff Depth=4.16"
Flow Length=204' Tc=6.0 min CN=76/98 Runoff=2.79 cfs 9,755 cf

Subcatchment P-2: Proposed Undetained Runoff Area=3,024 sf 42.26% Impervious Runoff Depth=3.57"
Flow Length=176' Tc=6.0 min CN=74/98 Runoff=0.27 cfs 900 cf

Link POI-1: On-Site Conveyance System Inflow=2.79 cfs 9,755 cf
Primary=2.79 cfs 9,755 cf

Link POI-2: Grove Avenue Conveyance System Inflow=0.27 cfs 900 cf
Primary=0.27 cfs 900 cf

Link POI1: On-Site Conveyance System Inflow=2.85 cfs 10,116 cf
Primary=2.85 cfs 10,116 cf

Link POI2: Grove Avenue Conveyance System Inflow=0.28 cfs 929 cf
Primary=0.28 cfs 929 cf

Total Runoff Area = 62,394 sf Runoff Volume = 21,700 cf Average Runoff Depth = 4.17"
34.34% Pervious = 21,427 sf 65.66% Impervious = 40,967 sf

Summary for Subcatchment E-1: Existing Drainage Area to On Site Conveyance

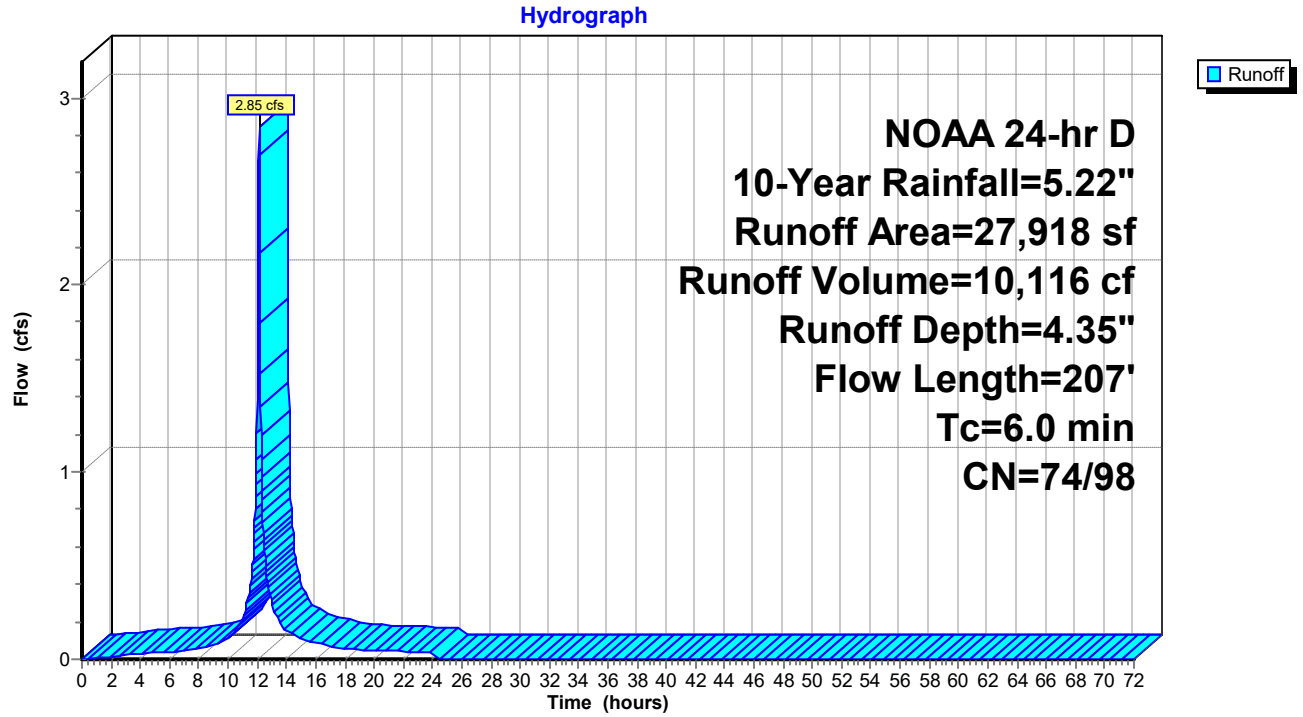
Runoff = 2.85 cfs @ 12.13 hrs, Volume= 10,116 cf, Depth= 4.35"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 10-Year Rainfall=5.22"

	Area (sf)	CN	Description
*	20,661	98	Impervious Coverage
	7,257	74	>75% Grass cover, Good, HSG C
	27,918	92	Weighted Average
	7,257	74	25.99% Pervious Area
	20,661	98	74.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	70	0.0850	2.37		**Sheet Flow, segement 1** Smooth surfaces n= 0.011 P2= 3.44"
0.1	42	0.0550	4.76		**Shallow Concentrated Flow, segment 2** Paved Kv= 20.3 fps
0.2	39	0.0450	4.31		**Shallow Concentrated Flow, segment 3** Paved Kv= 20.3 fps
0.1	56	0.0200	8.80	10.80	**Pipe Channel, segment 4** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011 Concrete pipe, straight & clean
0.9	207	Total, Increased to minimum Tc = 6.0 min			

Subcatchment E-1: Existing Drainage Area to On Site Conveyance



Summary for Subcatchment E-2: Existing Undetained Drainage Area to Grove

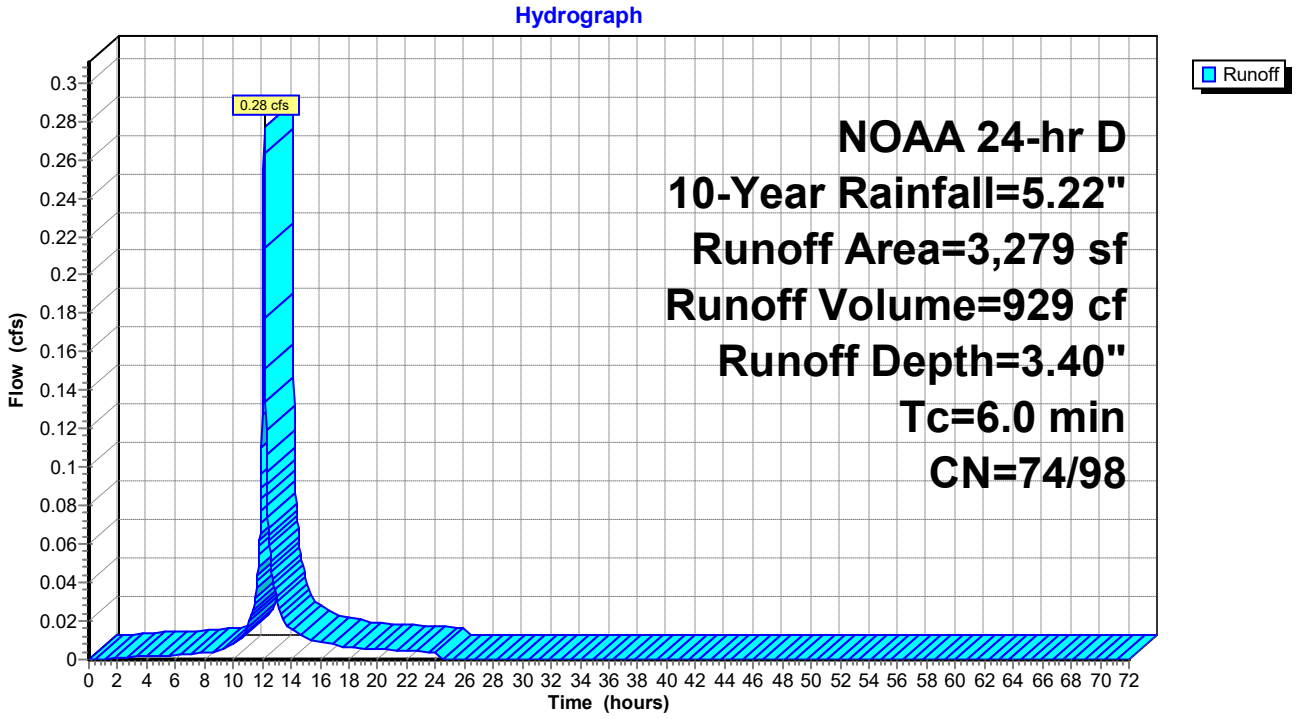
Runoff = 0.28 cfs @ 12.13 hrs, Volume= 929 cf, Depth= 3.40"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 10-Year Rainfall=5.22"

	Area (sf)	CN	Description
*	1,151	98	Impervious Coverage
	2,128	74	>75% Grass cover, Good, HSG C
	3,279	82	Weighted Average
	2,128	74	64.90% Pervious Area
	1,151	98	35.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9					**Direct Entry,**
0.9	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment E-2: Existing Undetained Drainage Area to Grove



Summary for Subcatchment P-1: Proposed Drainage to On Site Conveyance

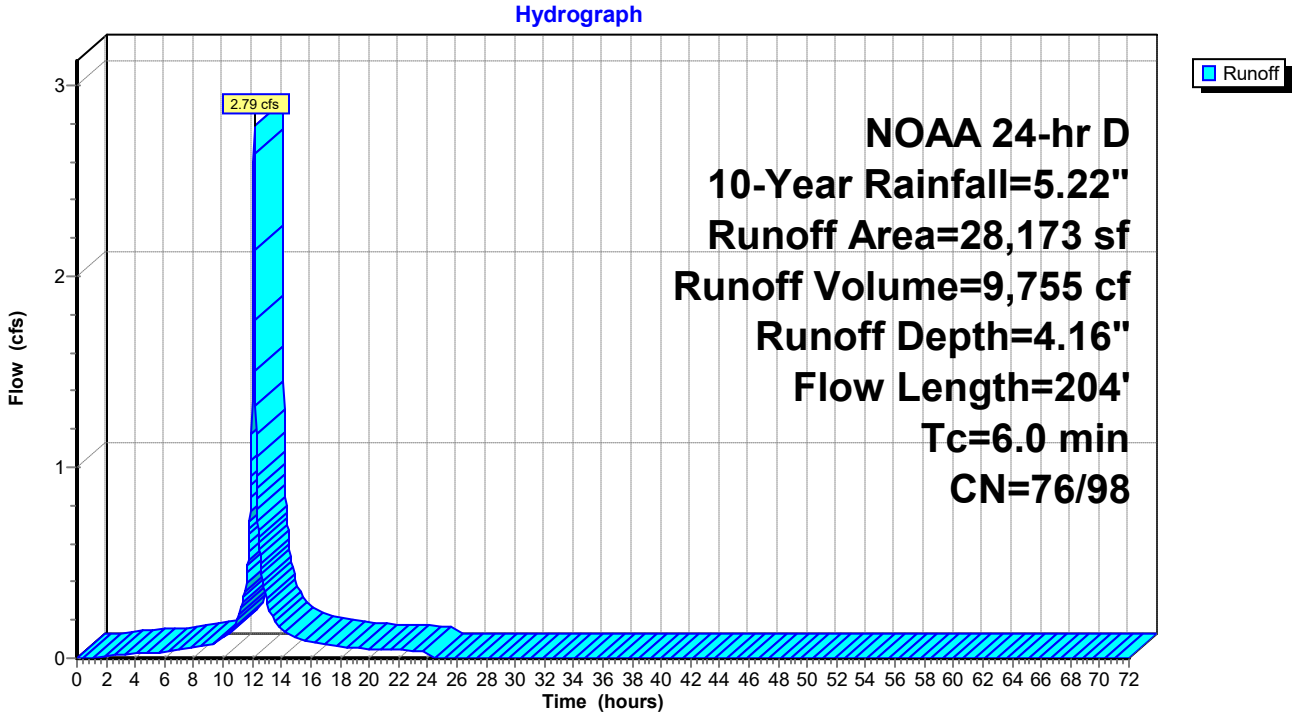
Runoff = 2.79 cfs @ 12.13 hrs, Volume= 9,755 cf, Depth= 4.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 10-Year Rainfall=5.22"

	Area (sf)	CN	Description
*	17,877	98	Impervious Coverage
*	2,500	82	Green Roof
	7,796	74	>75% Grass cover, Good, HSG C
	28,173	90	Weighted Average
	10,296	76	36.55% Pervious Area
	17,877	98	63.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	58	0.0862	0.28		**Sheet Flow, segment 1** Grass: Short n= 0.150 P2= 3.44"
1.7	133	0.0359	1.33		**Shallow Concentrated Flow, segment 2** Short Grass Pasture Kv= 7.0 fps
0.4	13	0.0050	0.49		**Shallow Concentrated Flow, segment 3** Short Grass Pasture Kv= 7.0 fps
5.5	204	Total, Increased to minimum Tc = 6.0 min			

Subcatchment P-1: Proposed Drainage to On Site Conveyance



Summary for Subcatchment P-2: Proposed Undetained Drainage Area to Grove

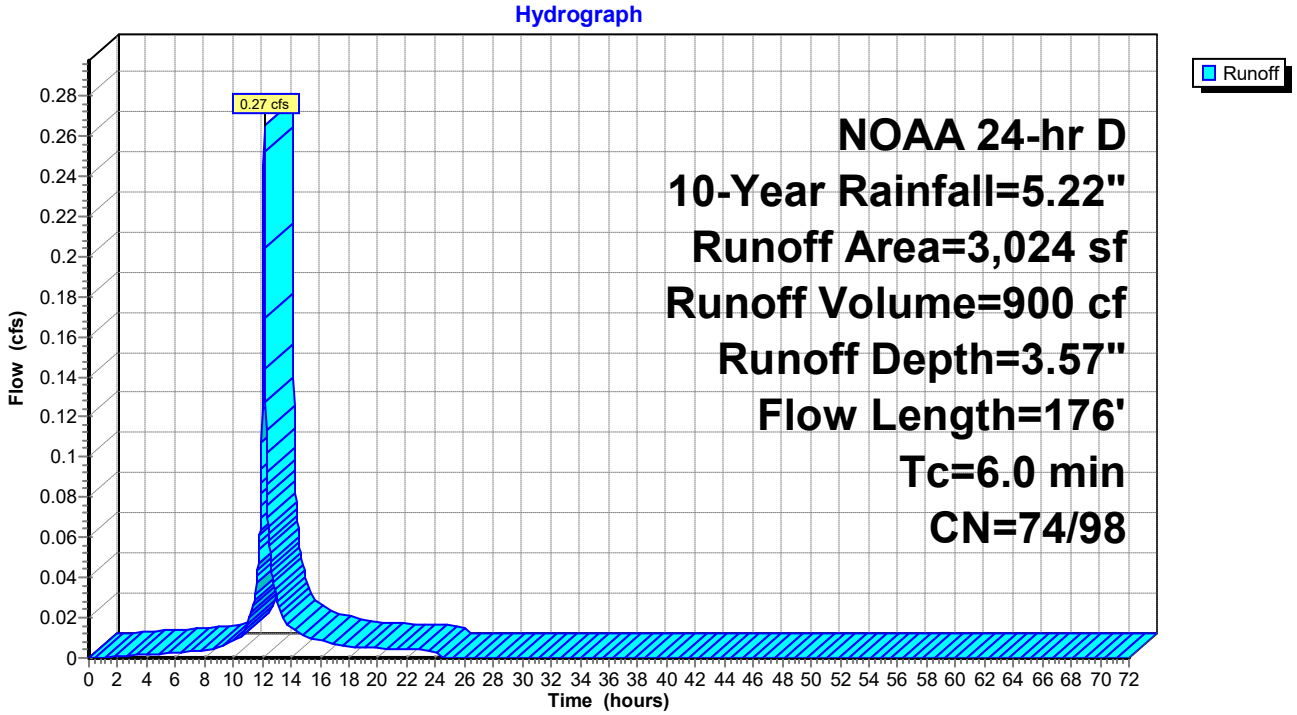
Runoff = 0.27 cfs @ 12.13 hrs, Volume= 900 cf, Depth= 3.57"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 10-Year Rainfall=5.22"

	Area (sf)	CN	Description
*	1,278	98	Impervious Coverage
	1,746	74	>75% Grass cover, Good, HSG C
	3,024	84	Weighted Average
	1,746	74	57.74% Pervious Area
	1,278	98	42.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0690	0.25		**Sheet Flow, segment 1** Grass: Short n= 0.150 P2= 3.44"
1.5	112	0.0330	1.27		**Shallow Concentrated Flow, segment 2** Short Grass Pasture Kv= 7.0 fps
0.5	14	0.0050	0.49		**Shallow Concentrated Flow, segment 3** Short Grass Pasture Kv= 7.0 fps
5.3	176	Total, Increased to minimum Tc = 6.0 min			

Subcatchment P-2: Proposed Undetained Drainage Area to Grove

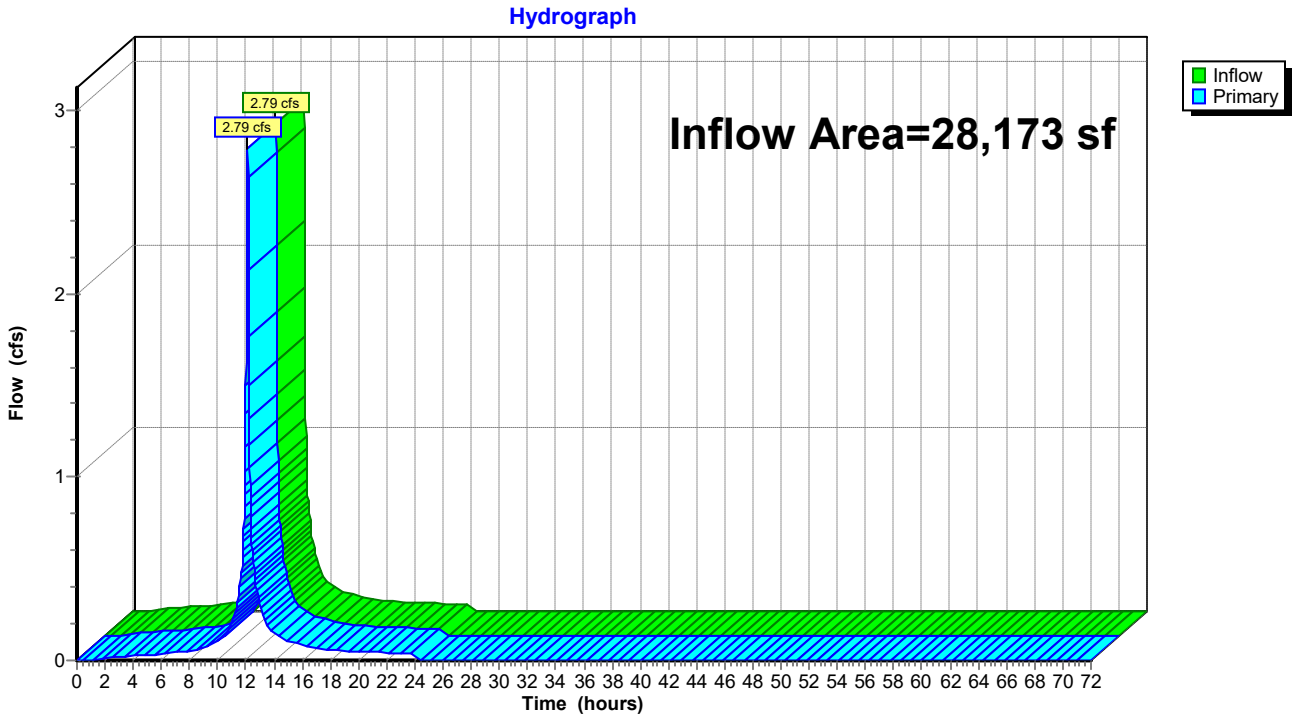


Summary for Link POI-1: On-Site Conveyance System

Inflow Area = 28,173 sf, 63.45% Impervious, Inflow Depth = 4.16" for 10-Year event
Inflow = 2.79 cfs @ 12.13 hrs, Volume= 9,755 cf
Primary = 2.79 cfs @ 12.13 hrs, Volume= 9,755 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Link POI-1: On-Site Conveyance System

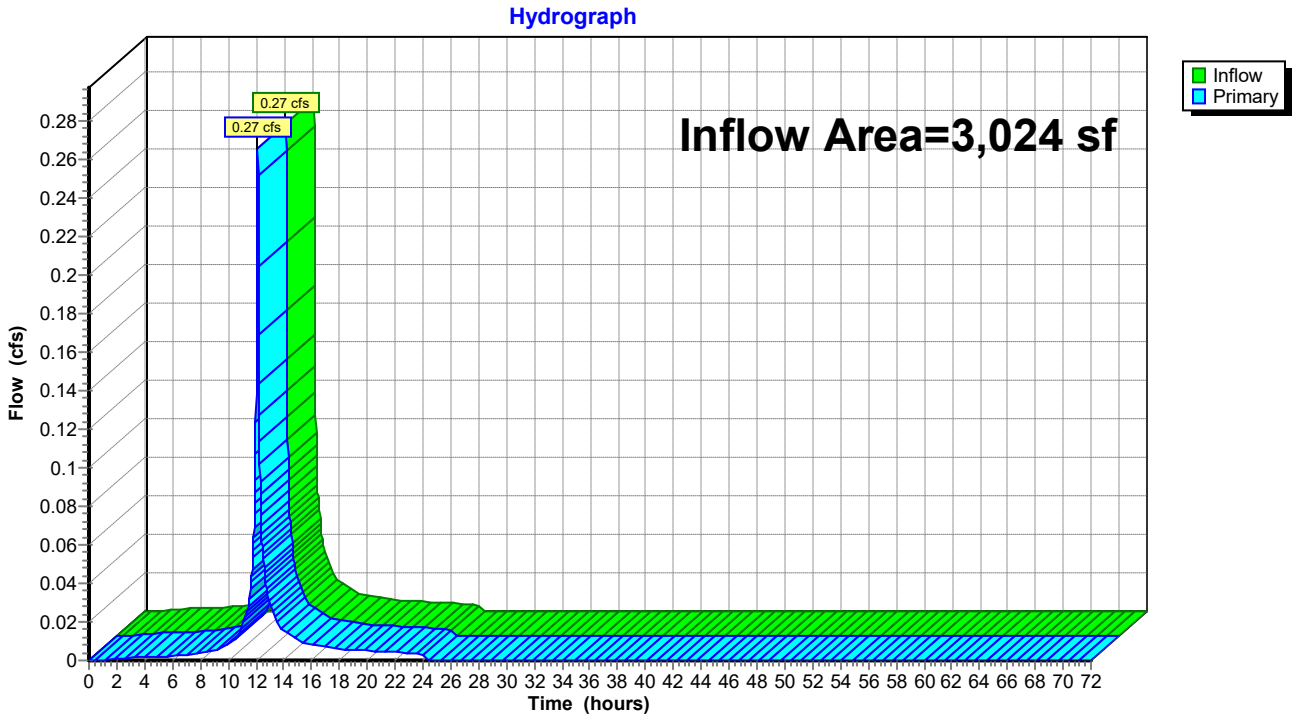


Summary for Link POI-2: Grove Avenue Conveyance System

Inflow Area = 3,024 sf, 42.26% Impervious, Inflow Depth = 3.57" for 10-Year event
Inflow = 0.27 cfs @ 12.13 hrs, Volume= 900 cf
Primary = 0.27 cfs @ 12.13 hrs, Volume= 900 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Link POI-2: Grove Avenue Conveyance System

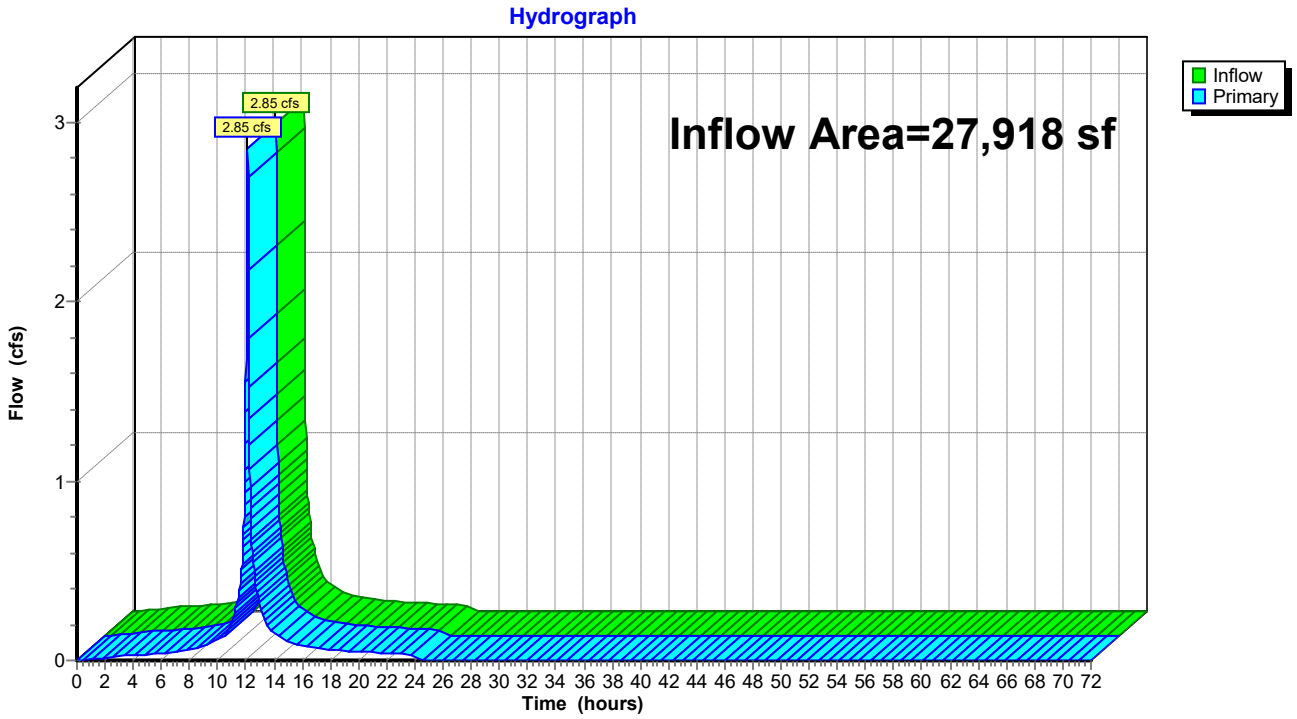


Summary for Link POI1: On-Site Conveyance System

Inflow Area = 27,918 sf, 74.01% Impervious, Inflow Depth = 4.35" for 10-Year event
Inflow = 2.85 cfs @ 12.13 hrs, Volume= 10,116 cf
Primary = 2.85 cfs @ 12.13 hrs, Volume= 10,116 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Link POI1: On-Site Conveyance System

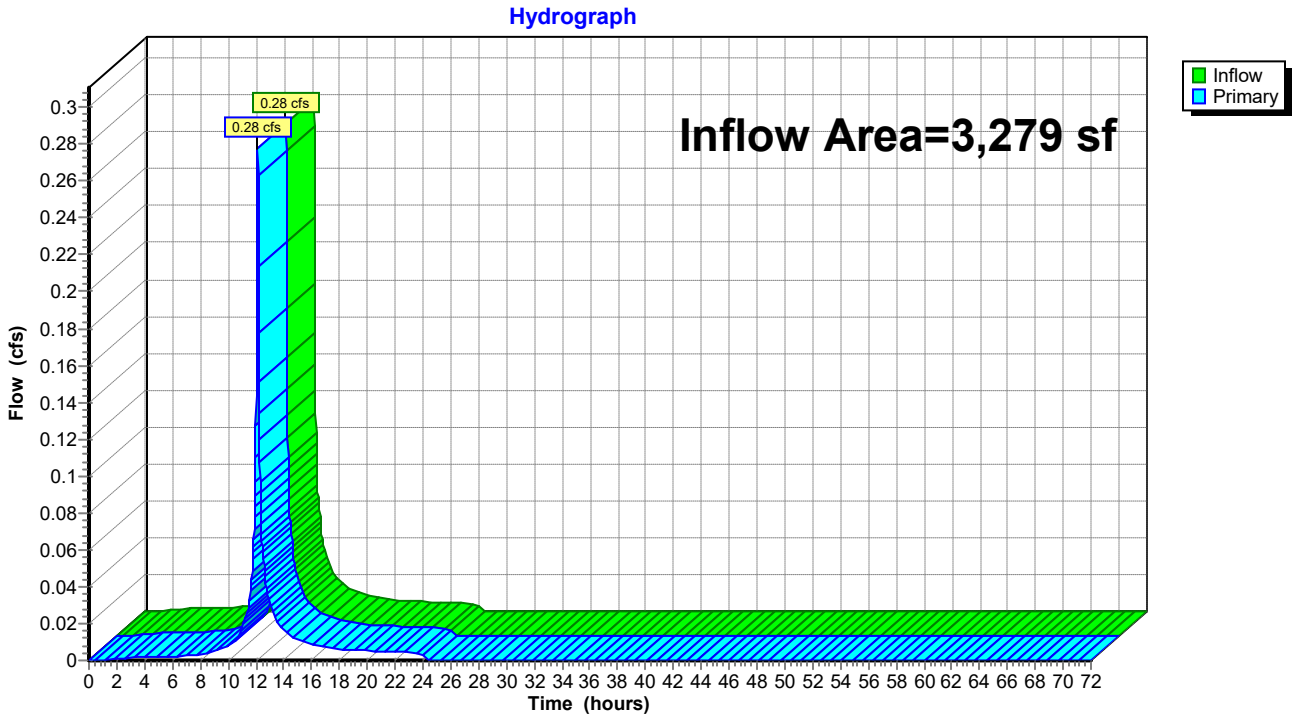


Summary for Link POI2: Grove Avenue Conveyance System

Inflow Area = 3,279 sf, 35.10% Impervious, Inflow Depth = 3.40" for 10-Year event
Inflow = 0.28 cfs @ 12.13 hrs, Volume= 929 cf
Primary = 0.28 cfs @ 12.13 hrs, Volume= 929 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Link POI2: Grove Avenue Conveyance System



Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1: Existing Drainage Area Runoff Area=27,918 sf 74.01% Impervious Runoff Depth=7.67"
Flow Length=207' Tc=6.0 min CN=74/98 Runoff=4.98 cfs 17,835 cf

Subcatchment E-2: Existing Undetained Runoff Area=3,279 sf 35.10% Impervious Runoff Depth=6.54"
Tc=6.0 min CN=74/98 Runoff=0.53 cfs 1,786 cf

Subcatchment P-1: Proposed Drainage to Runoff Area=28,173 sf 63.45% Impervious Runoff Depth=7.45"
Flow Length=204' Tc=6.0 min CN=76/98 Runoff=4.95 cfs 17,487 cf

Subcatchment P-2: Proposed Undetained Runoff Area=3,024 sf 42.26% Impervious Runoff Depth=6.75"
Flow Length=176' Tc=6.0 min CN=74/98 Runoff=0.50 cfs 1,700 cf

Link POI-1: On-Site Conveyance System Inflow=4.95 cfs 17,487 cf
Primary=4.95 cfs 17,487 cf

Link POI-2: Grove Avenue Conveyance System Inflow=0.50 cfs 1,700 cf
Primary=0.50 cfs 1,700 cf

Link POI1: On-Site Conveyance System Inflow=4.98 cfs 17,835 cf
Primary=4.98 cfs 17,835 cf

Link POI2: Grove Avenue Conveyance System Inflow=0.53 cfs 1,786 cf
Primary=0.53 cfs 1,786 cf

Total Runoff Area = 62,394 sf Runoff Volume = 38,809 cf Average Runoff Depth = 7.46"
34.34% Pervious = 21,427 sf 65.66% Impervious = 40,967 sf

Summary for Subcatchment E-1: Existing Drainage Area to On Site Conveyance

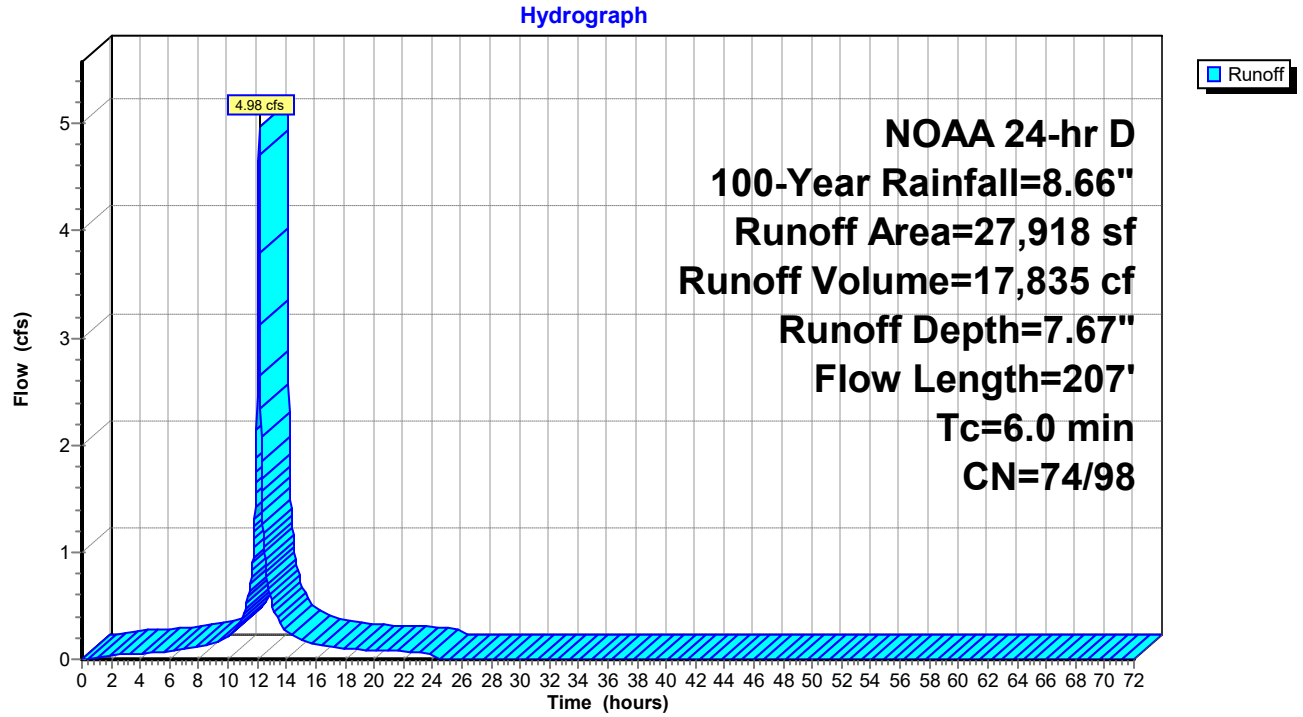
Runoff = 4.98 cfs @ 12.13 hrs, Volume= 17,835 cf, Depth= 7.67"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 100-Year Rainfall=8.66"

	Area (sf)	CN	Description
*	20,661	98	Impervious Coverage
	7,257	74	>75% Grass cover, Good, HSG C
	27,918	92	Weighted Average
	7,257	74	25.99% Pervious Area
	20,661	98	74.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	70	0.0850	2.37		**Sheet Flow, segement 1** Smooth surfaces n= 0.011 P2= 3.44"
0.1	42	0.0550	4.76		**Shallow Concentrated Flow, segment 2** Paved Kv= 20.3 fps
0.2	39	0.0450	4.31		**Shallow Concentrated Flow, segment 3** Paved Kv= 20.3 fps
0.1	56	0.0200	8.80	10.80	**Pipe Channel, segment 4** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011 Concrete pipe, straight & clean
0.9	207	Total, Increased to minimum Tc = 6.0 min			

Subcatchment E-1: Existing Drainage Area to On Site Conveyance



Summary for Subcatchment E-2: Existing Undetained Drainage Area to Grove

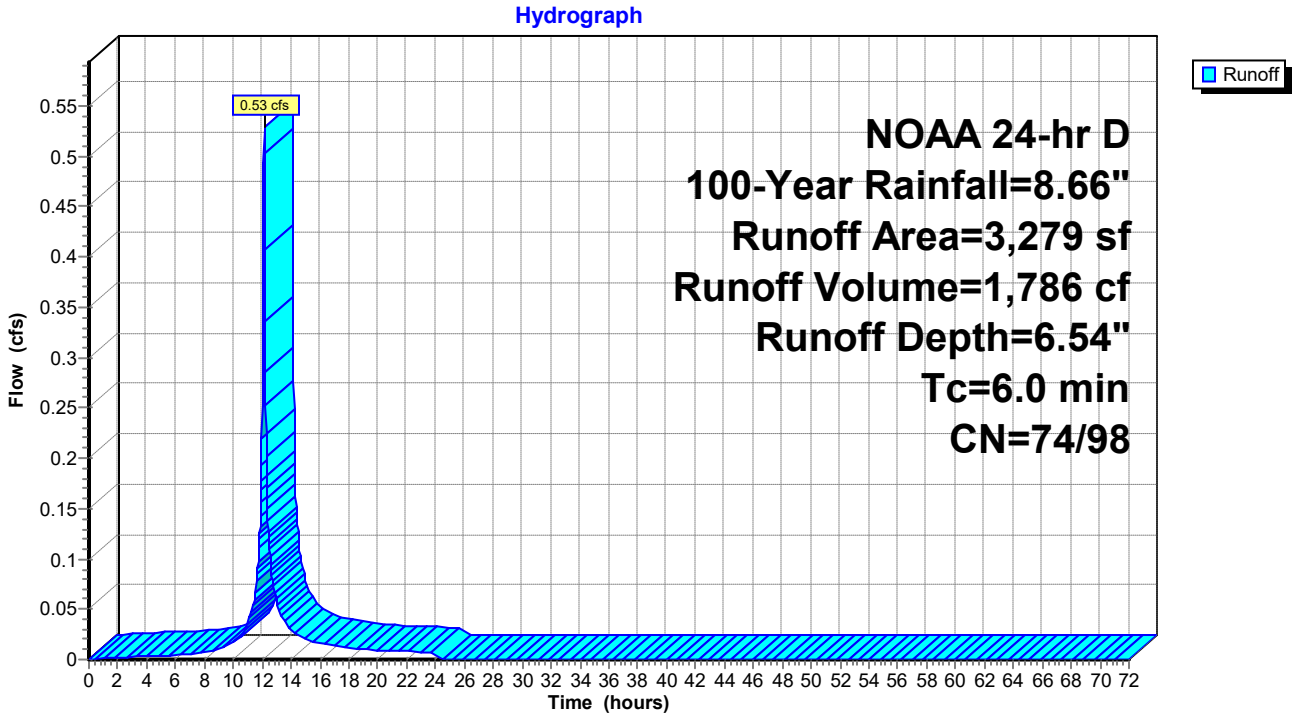
Runoff = 0.53 cfs @ 12.13 hrs, Volume= 1,786 cf, Depth= 6.54"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 100-Year Rainfall=8.66"

	Area (sf)	CN	Description
*	1,151	98	Impervious Coverage
	2,128	74	>75% Grass cover, Good, HSG C
	3,279	82	Weighted Average
	2,128	74	64.90% Pervious Area
	1,151	98	35.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9					**Direct Entry,**
0.9	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment E-2: Existing Undetained Drainage Area to Grove



Summary for Subcatchment P-1: Proposed Drainage to On Site Conveyance

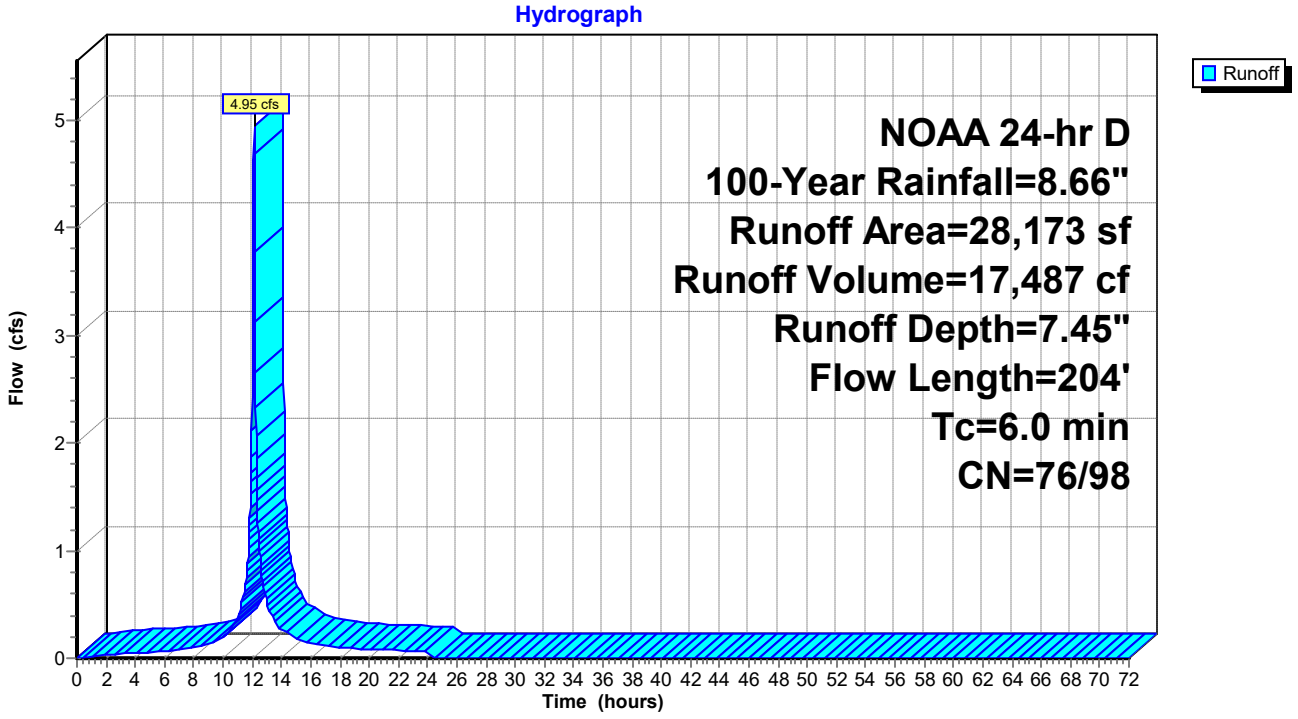
Runoff = 4.95 cfs @ 12.13 hrs, Volume= 17,487 cf, Depth= 7.45"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 100-Year Rainfall=8.66"

	Area (sf)	CN	Description
*	17,877	98	Impervious Coverage
*	2,500	82	Green Roof
	7,796	74	>75% Grass cover, Good, HSG C
	28,173	90	Weighted Average
	10,296	76	36.55% Pervious Area
	17,877	98	63.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	58	0.0862	0.28		**Sheet Flow, segment 1** Grass: Short n= 0.150 P2= 3.44"
1.7	133	0.0359	1.33		**Shallow Concentrated Flow, segment 2** Short Grass Pasture Kv= 7.0 fps
0.4	13	0.0050	0.49		**Shallow Concentrated Flow, segment 3** Short Grass Pasture Kv= 7.0 fps
5.5	204	Total, Increased to minimum Tc = 6.0 min			

Subcatchment P-1: Proposed Drainage to On Site Conveyance



Summary for Subcatchment P-2: Proposed Undetained Drainage Area to Grove

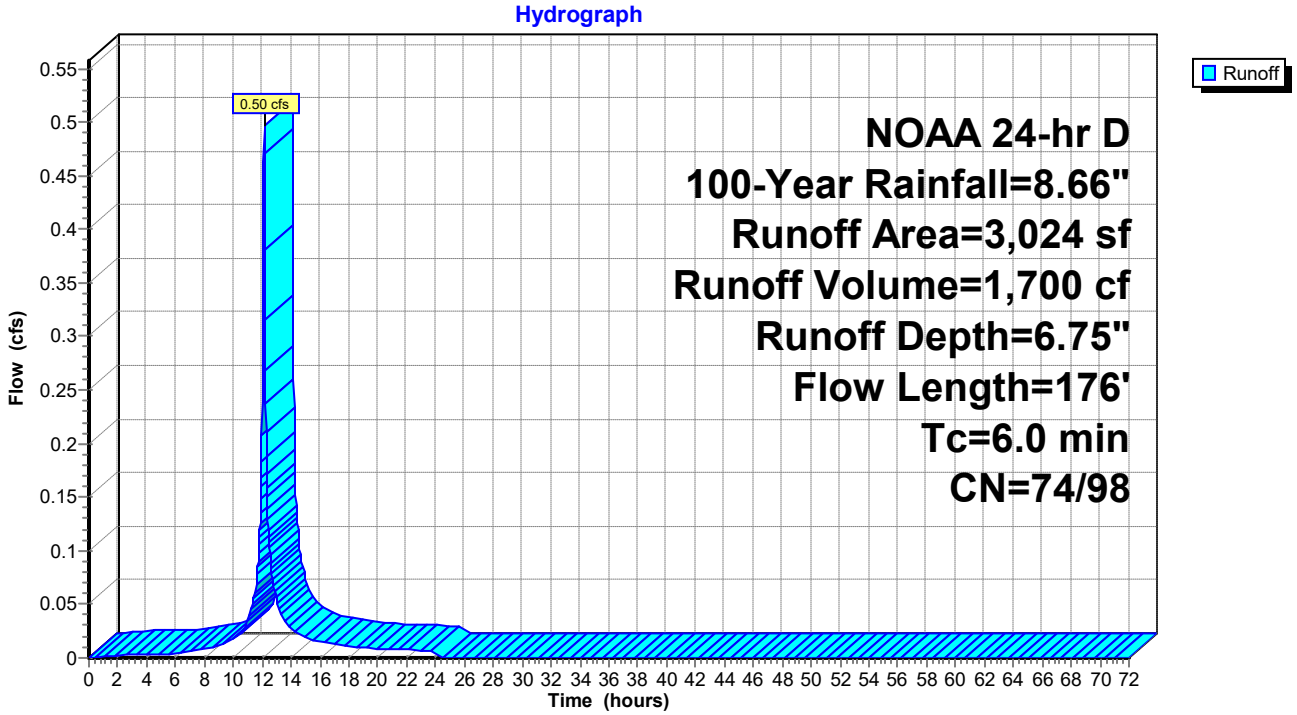
Runoff = 0.50 cfs @ 12.13 hrs, Volume= 1,700 cf, Depth= 6.75"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 100-Year Rainfall=8.66"

	Area (sf)	CN	Description
*	1,278	98	Impervious Coverage
	1,746	74	>75% Grass cover, Good, HSG C
	3,024	84	Weighted Average
	1,746	74	57.74% Pervious Area
	1,278	98	42.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0690	0.25		**Sheet Flow, segment 1** Grass: Short n= 0.150 P2= 3.44"
1.5	112	0.0330	1.27		**Shallow Concentrated Flow, segment 2** Short Grass Pasture Kv= 7.0 fps
0.5	14	0.0050	0.49		**Shallow Concentrated Flow, segment 3** Short Grass Pasture Kv= 7.0 fps
5.3	176	Total, Increased to minimum Tc = 6.0 min			

Subcatchment P-2: Proposed Undetained Drainage Area to Grove

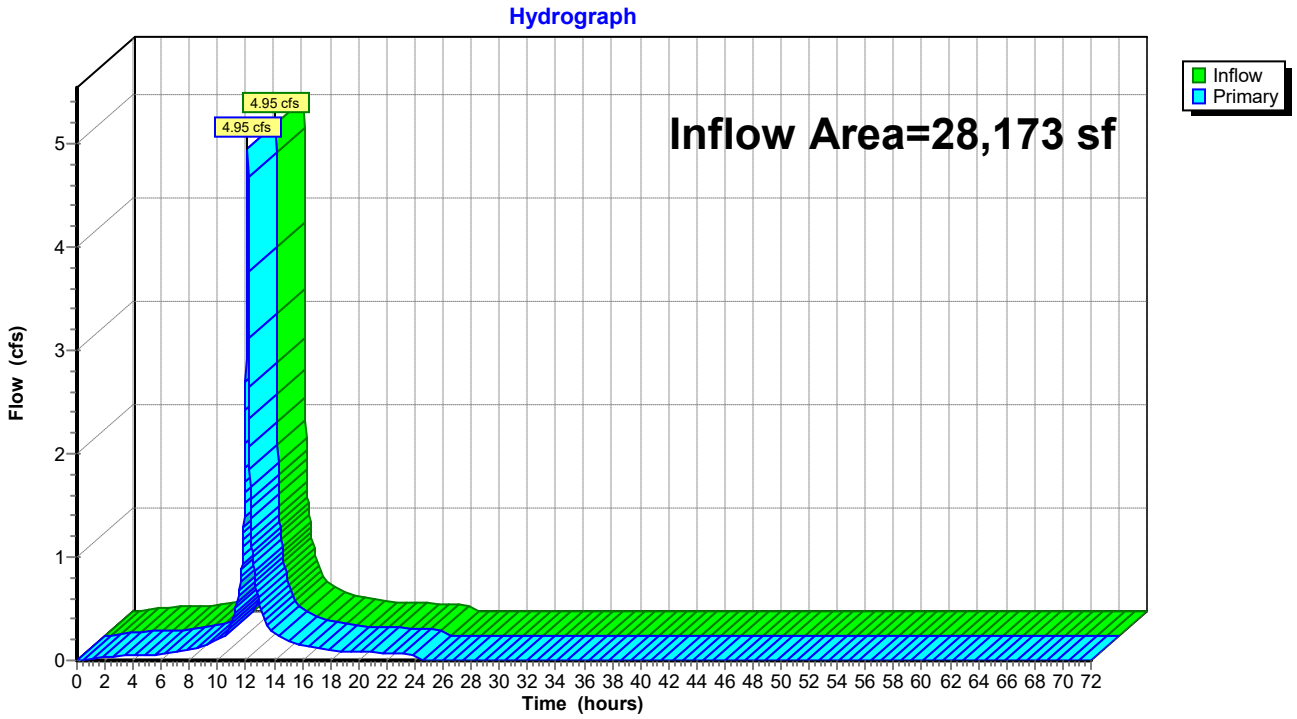


Summary for Link POI-1: On-Site Conveyance System

Inflow Area = 28,173 sf, 63.45% Impervious, Inflow Depth = 7.45" for 100-Year event
Inflow = 4.95 cfs @ 12.13 hrs, Volume= 17,487 cf
Primary = 4.95 cfs @ 12.13 hrs, Volume= 17,487 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Link POI-1: On-Site Conveyance System

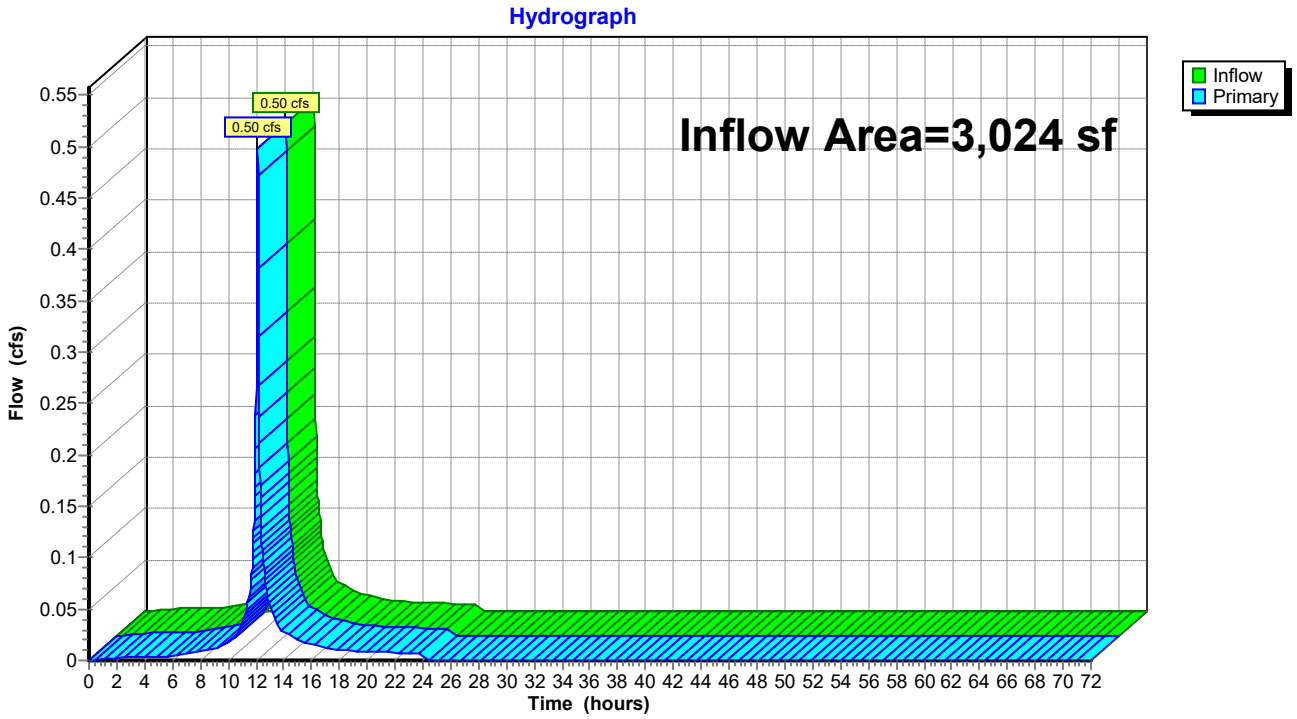


Summary for Link POI-2: Grove Avenue Conveyance System

Inflow Area = 3,024 sf, 42.26% Impervious, Inflow Depth = 6.75" for 100-Year event
Inflow = 0.50 cfs @ 12.13 hrs, Volume= 1,700 cf
Primary = 0.50 cfs @ 12.13 hrs, Volume= 1,700 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Link POI-2: Grove Avenue Conveyance System

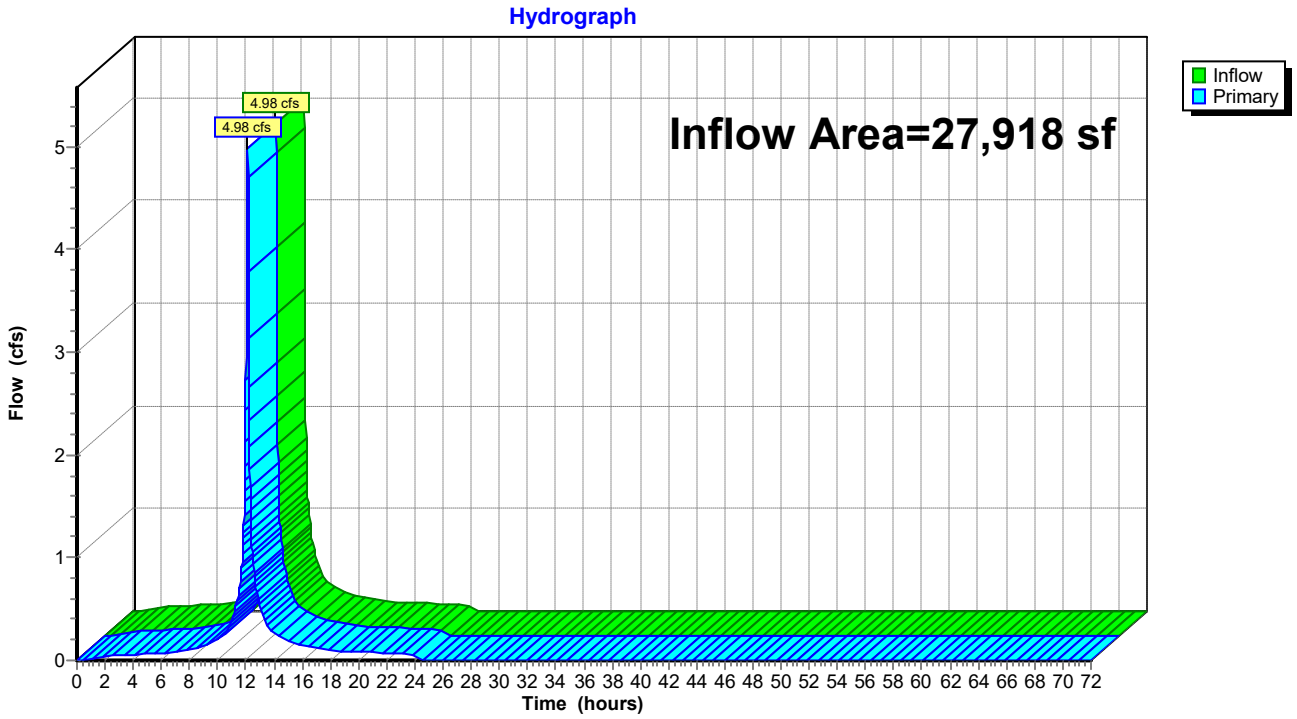


Summary for Link POI1: On-Site Conveyance System

Inflow Area = 27,918 sf, 74.01% Impervious, Inflow Depth = 7.67" for 100-Year event
Inflow = 4.98 cfs @ 12.13 hrs, Volume= 17,835 cf
Primary = 4.98 cfs @ 12.13 hrs, Volume= 17,835 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Link POI1: On-Site Conveyance System

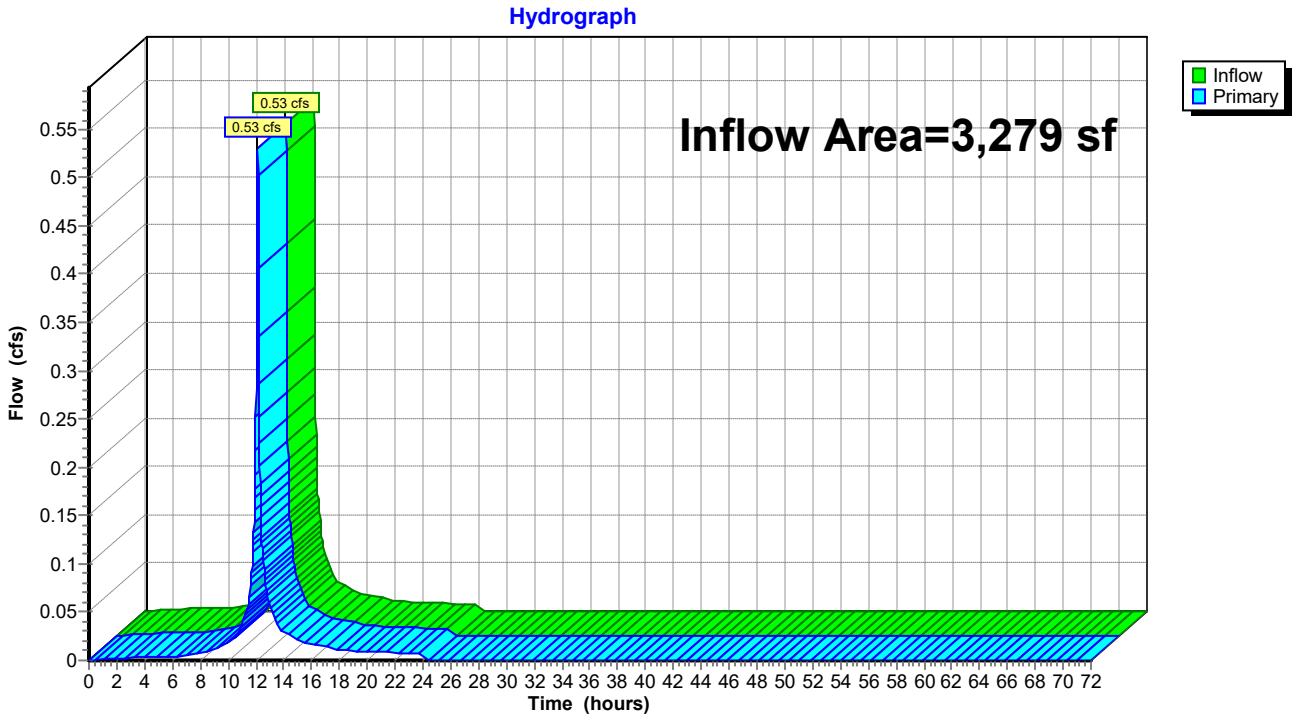


Summary for Link POI2: Grove Avenue Conveyance System

Inflow Area = 3,279 sf, 35.10% Impervious, Inflow Depth = 6.54" for 100-Year event
Inflow = 0.53 cfs @ 12.13 hrs, Volume= 1,786 cf
Primary = 0.53 cfs @ 12.13 hrs, Volume= 1,786 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Link POI2: Grove Avenue Conveyance System

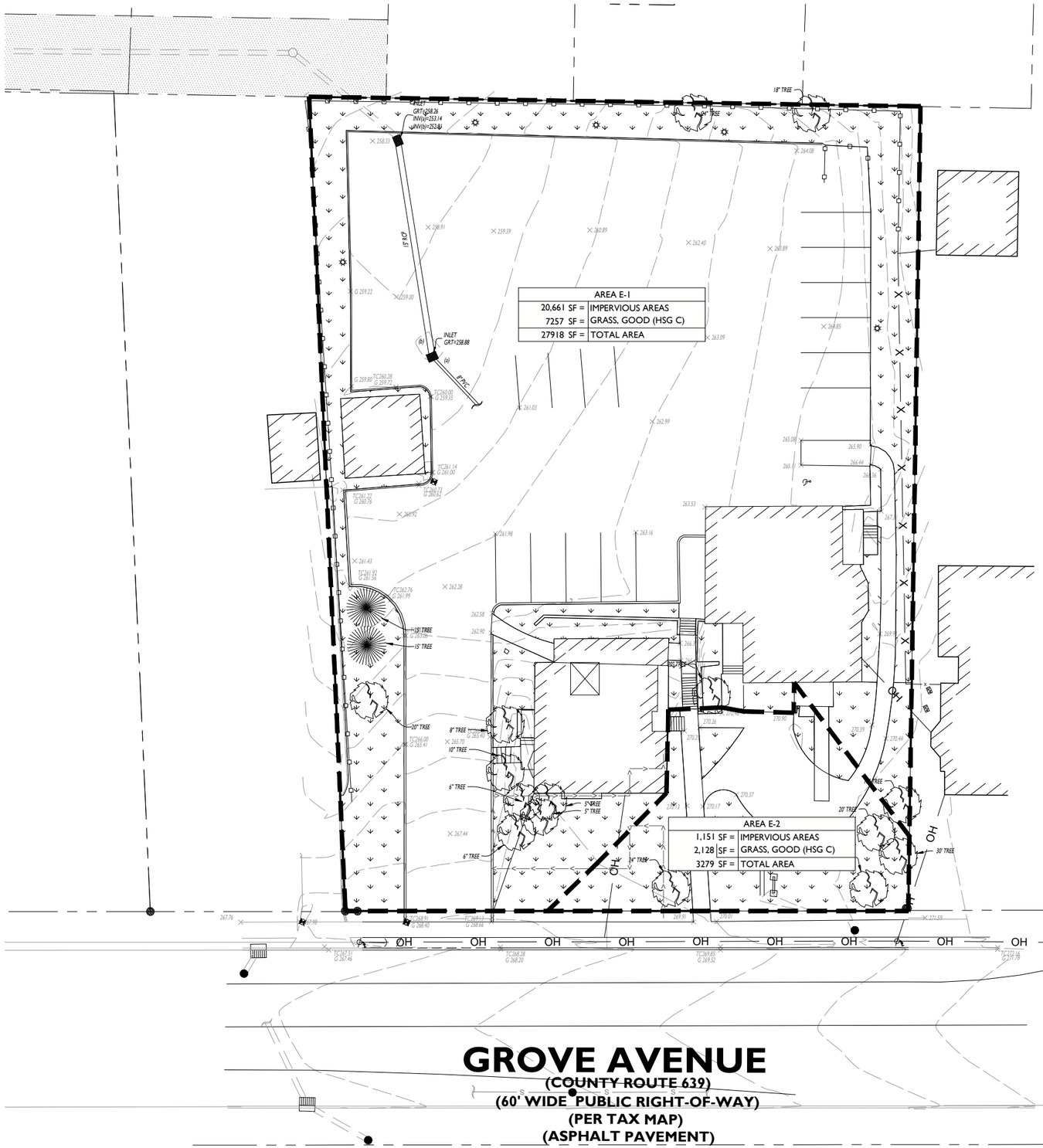


APPENDIX D
DRAINAGE AREA MAPS

INVENTORY

SHEET 1 OF 2: EXISTING DRAINAGE AREA MAP

SHEET 2 OF 2: PROPOSED DRAINAGE AREA MAP



SYMBOL — **DESCRIPTION**

- PROPERTY LINE
- EXISTING SITE DRAINAGE AREA
- EXISTING PERVIOUS AREA

30' 0' 30' 60'

GRAPHIC SCALE IN FEET
1" = 30'

ISSUE	DATE	BY	DESCRIPTION
04	03/04/2021	BJD	FOR MUNICIPAL RESUBMISSION
03	07/30/2020	MEM	FOR MUNICIPAL RESUBMISSION
02	02/28/2020	ANV	FOR MUNICIPAL RESUBMISSION
01	10/07/2019	ANV	PLANNING BOARD SUBMISSION

STONEFIELD engineering & design
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Princeton, NJ · Tampa, FL · Detroit, MI
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DRAINAGE AREA MAPS

21 & 25 GROVE ASSOCIATES, LLC
PROPOSED RESIDENTIAL DEVELOPMENT

BLOCK 1702, LOT 22
21 GROVE AVENUE
TOWNSHIP OF VERONA
ESSEX COUNTY, NEW JERSEY

MATTHEW J. SECKLER, P.E.
NEW JERSEY LICENSE No. 48731
LICENSED PROFESSIONAL ENGINEER

NOT APPROVED FOR CONSTRUCTION

SCALE: (H) 1" = 30'

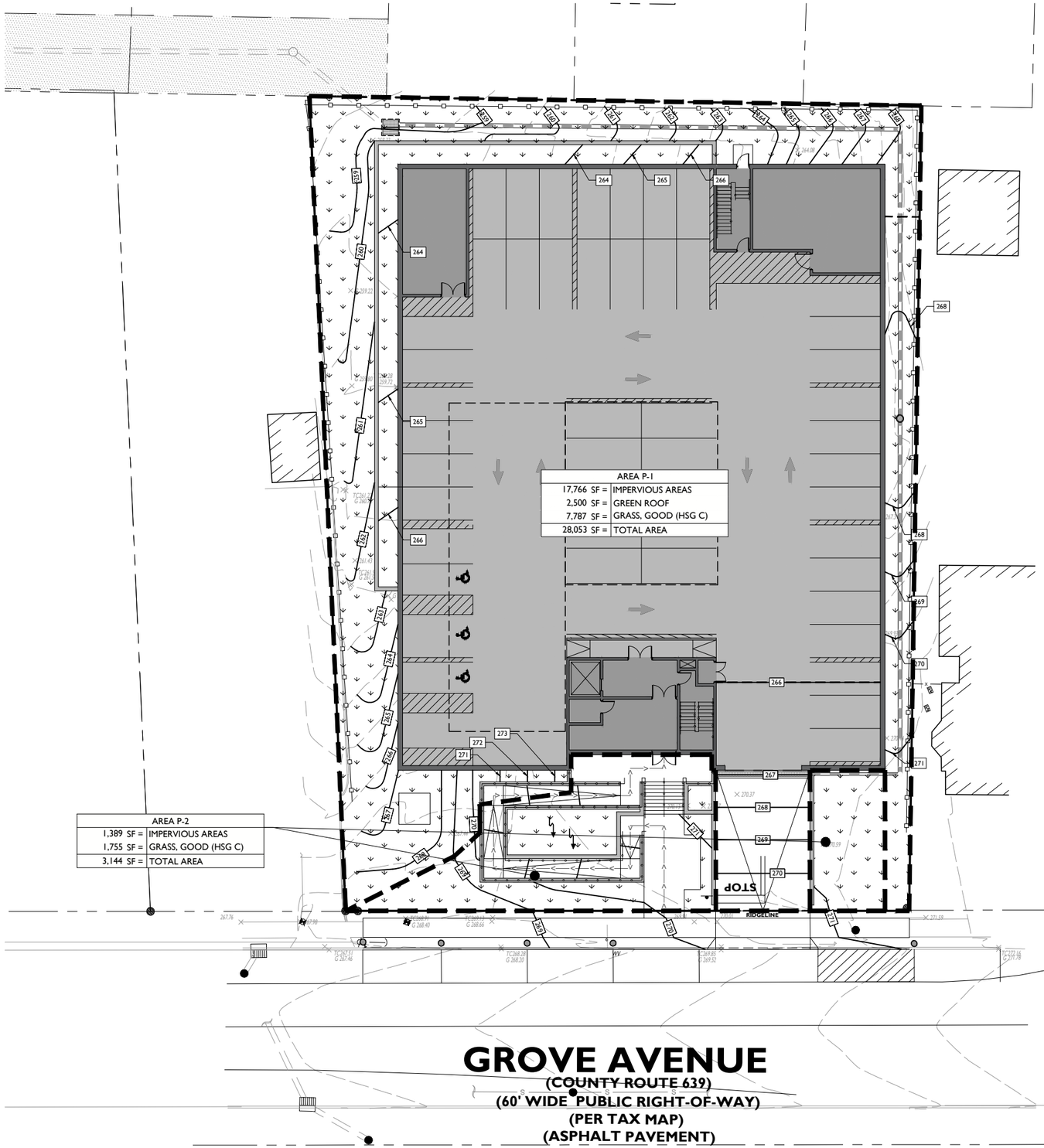
PROJECT ID: T-19059

STONEFIELD engineering & design

TITLE: EXISTING DRAINAGE AREA MAP

SHEET: 1 OF 2

T:\2019\T-19059 21 and 25 Grove Associates LLC - 21 Grove Avenue, Verona, NJ\CADD\Exhibits\Drainage Area Maps\2021-03-04 Drainage Area Maps.dwg



SYMBOL | **DESCRIPTION**

- PROPERTY LINE
- PROPOSED SITE DRAINAGE AREA
- PROPOSED PERVIOUS AREA

30' 0' 30' 60'

GRAPHIC SCALE IN FEET
1" = 30'

ISSUE	DATE	BY	DESCRIPTION
04	03/04/2021	BJD	FOR MUNICIPAL RESUBMISSION
03	07/30/2020	MEM	FOR MUNICIPAL RESUBMISSION
02	02/28/2020	ANV	FOR MUNICIPAL RESUBMISSION
01	10/07/2019	ANV	PLANNING BOARD SUBMISSION

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DRAINAGE AREA MAPS

21 & 25 GROVE ASSOCIATES, LLC
PROPOSED RESIDENTIAL DEVELOPMENT
BLOCK 1702, LOT 22
21 GROVE AVENUE
TOWNSHIP OF VERONA
ESSEX COUNTY, NEW JERSEY

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2 OF 2

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