STONEFIELD

ENGINEERING REPORT

PROPOSED CONVENIENCE STORE WITH FUELING OPERATIONS
TAX PARCEL 37-29, PROPOSED LOT A
1033 NORTH COLONY ROAD (U.S. ROUTE 5)
TOWN OF WALLINGFORD
NEW HAVEN COUNTY, CONNECTICUT

PREPARED FOR:

7-ELEVEN, INC.

PREPARED BY:

STONEFIELD ENGINEERING & DESIGN, LLC
DATED: OCTOBER 5, 2020
LAST REVISED: NOVEMBER 5, 2020
B-19007

CHARLES D. OLIVO P.E.
CONNECTICUT PROFESSIONAL ENGINEER LICENSE # 26843

REPORT CONTENTS

APPENDICIES

1.0 PROJECT OVERVIEW

The Applicant, 7-Eleven Inc, is proposing the construction of a new convenience store with fueling operations adjacent to the existing Sonic Development within the Town of Wallingford. The subject property is designated as Tax Parcel 37-29, commonly known as 1033 North Colony Road (U.S. Route 5) and is located on the west side of North Colony Road, north of the Wilbur Cross Parkway (Route 15) and southeast of Meetinghouse Brook. The Applicant will be seeking a lot division as part of the approval process to divide the parcel into two new parcels, for the purposes of this analysis and report proposed Lot A consists of the subject property and Lot B is the previously developed Sonic property. The Site is currently zoned Route 5 District (RF-40), which allows for convenience stores and gas stations (special exception use). The project will maintain cross-access with the Sonic Development and proposes a new fourth leg within the intersection of North Colony Road and CT Route 15 Off-Ramp. The project will be proposing additional off-site improvements within North Colony Road to accommodate the new driveway including a new signal and roadway widening. The proposed improvements meet the bulk zoning standards, and the applicant will be seeking relief for the proposed signage as required from the Zoning Board of Appeals.

The total parcel area is 154,622 SF (3.55 acres), the total area of the new lot to be developed is 93,324 SF (2.14 AC), and the total area of disturbance associated with the improvements is approximately 92,071 SF (2.11 acres). For the purposes of the stormwater analysis, the project site studied was limited to the subject property (proposed Lot A) and disturbance associated with the proposed improvements. Project Figures can be found in Appendix A of this Report.

This Engineering Report has been prepared to for the Town of Wallingford to provide sufficient information on the technical aspects of the proposed development in order to have an understanding of the proposed improvements and to review the potential impacts and proposed mitigation measures to be in full compliance with the Town of Wallingford Inland Wetlands & Watercourses Commission and the Connecticut Department of Energy and Environmental Protection (CTDEEP).

1.1 FLOODPLAIN REVIEW

The property is not located within the Coastal Area Management District and/or an Aquifer Protection Zone. The subject property is bordered by Meetinghouse Brook and based on the available FEMA Mapping a portion of the site is located within the FEMA Flood Zone AE (Flood Hazard Area) and FEMA Flood Zone X, however based on the FEMA Profile and elevation information the 100-year FEMA floodplain (flood hazard area) and associated floodway is contained within the Meetinghouse Brook stream embankment and does not impact the proposed development. The 100-year FEMA floodplain (flood hazard area) and associated floodway does not extend past the

25-foot water course setback. The project does not propose any aboveground structures and/or fill activities within the 100-year floodplain and/or floodway, and the improvements have been designed to minimize impacts to Meetinghouse Brook.

1.2 ENVIRONMENTAL REVIEW & ASSESSMENT

Goddard Consulting, LLC conducted a field evaluation on March 12, 2020 during no snow and un-frozen ground conditions and no adjacent inland wetlands were observed along the edge of this stream. The watercourse border closest to the site was flagged using the criteria in the most recent edition of the Inland Wetland and Water Course Act and the Town of Wallingford Inland Wetland and Watercourse Commission Regulations. Soils, hydric indicators, vegetation, and topography were all considered for delineation purposes. The Inland Wetland and Watercourse Act and the Town of Wallingford Inland Wetland and Watercourse Commission Regulations takes jurisdiction over this resource.

The upland review area has been determined to be 100-feet as portions of the existing stream embankment (slope) located along the rear of the property exceeds 50% average slope. The upland review area is taken from boundary of the watercourse which was field verified and flagged.

Under exiting conditions, the majority of the upland review area consist of disturbed areas and impervious surfaces (compacted gravel and broken asphalt) going right-up to the top of the slope, and an even larger portion of the subject site runoff drains uncontrolled over the slope along the perimeter of the property directly to Meetinghouse Brook. In order to help protect the existing slope and minimize impact to the Brook the proposed development reduces impervious surfaces within the 100-foot upland review area, stabilizes the area along the top of the slope, and significantly reduces the amount of water draining via sheet flow directly to Meetinghouse Brook.

The project will not disturb any wetlands as a result of the proposed improvements, and the proposed design looks to minimize disturbance within the slope and along the edge of watercourse to the maximum extent practicable in order to safely install the improvements that will help protect Meetinghouse Brook. The project will not be proposing any fill activities within the watercourse, all rip-rap associated with the outfall designed to protect the watercourse will be done at or below the existing grade.

The proposed stormwater management facilities look to further protect the slope and watercourse, and have been designed to capture, treat, and reduce the peak flows and volume of runoff discharging from the property. The reduction in stormwater and treatment is accomplished through the implementation of a conveyance and underground infiltration basin with outlet controls to regulate flow. Additional measures include water quality units to pre-treat and treat runoff, hooded catch basin with sumps, and an off-line oil-water separator. Overall, the

reduction in peak runoff volume and peak discharge rate will improve the stream bank stabilization, and help prevent downstream erosion and flooding, and not have a negative impact on Meetinghouse Brook.

See below for a summary of disturbance and improvements within each area:

LAND DISTURBANCE CHART			
	LOT A:	**LOT B:**	**TOTAL:**
AREA OF WATERCOURSE ON SITE	873 SF (0.020 AC)	392 SF (0.009 AC)	1,265 SF (0.029 AC)
AREA OF PROPOSED DISTURBANCE WITHIN WATERCOURSE	68.4 LF (205 SF / 0.005 AC)	0.0 LF (0.0 SF / 0.000 AC)	68.4 LF (205 SF / 0.005 AC)
AREA OF 100 FT UPLAND REVIEW AREA ON SITE	4,811 SF (0.110 AC)	37,405 SF (0.859 AC)	42,216 SF (0.969 AC)
AREA OF PROPOSED DISTURBANCE WITHIN 100 FT UPLAND REVIEW AREA	18,535 SF (0.426 AC)	1,290 SF (0.030 AC)	19,825 SF (0.456 AC)
AREA OF EXISTING IMPROVEMENTS WITHIN UPLAND REVIEW AREA	15,827 SF (0.363 AC)	22,674 SF (0.521 AC)	38,501 SF (0.884 AC)
AREA OF PROPOSED IMPROVEMENTS WITHIN UPLAND REVIEW AREA	10,796 SF (0.248 AC)	808 SF (0.019 AC)	11,604 SF (0.267 AC)

1.3 UTILITY SUMMARY

The proposed development is anticipated to connect to existing utility services located along the frontage and/or within North Colony Road. Proposed underground services include electrical, telephone/cable, gas, water, and sewer service. The sewer service will connect into the Town sewer within the sanitary easement that runs along the rear of the property. The existing utility services are anticipated to have adequate capacity to serve the proposed improvements.

2.0 EXISTING CONDITIONS

The project area was formally the Yankee Silversmith Inn and an office building which both have been demolished. Under current existing conditions, the northerly portion of the site consists of Sonic development (approved in 2007) and the southerly portion of the site (area of interest) is currently vacant and was most recently used by the state for a staging area for public improvements.

The subject site is cleared, and the majority of the site consists of impervious surfaces including exposed compacted gravel surfaces and broken asphalt, with sparse small shrubs and groundcover vegetation. There is an existing concrete retaining wall on the lot. Meetinghouse Brook is located on the western edge of the site and features some forested land adjacent to the watercourse. No wetlands were observed adjacent to Meetinghouse Brook or anywhere else on the site. The slope adjacent to Meetinghouse Brook was determined to be on average below 50%, and therefore the Upland Review Area extends 50' from the delineated edge of the stream. More information regarding the delineation and the watercourse can be found within the Wetland Border Report prepared by Goddard Consulting, dated March 19, 2020.

2.1 EXISTING DRAINAGE AREAS

The site is comprised of one (1) point of interest the Meetinghouse Brook and three (3) separate drainage areas. Based on a field evaluation conducted by our office the pre-existing conditions (Property/Topographic Survey dated 05/30/07) prior to the subject area being used as a stockpile and staging area were utilized for the existing condition drainage area maps and stormwater analysis.

The first drainage area consists of the western portion of the site along North Colony Road, which sheet flows into the right-of-way, where is it collected via various inlets into the stormwater system within the road, and ultimately discharges into the Meetinghouse Brook. The second drainage area consists of majority of site which sheet flows west directly into Meetinghouse Brook. The third drainage area consists of the northern portion of the site which sheet flows onto the exisitng sonic development and is collected via inlets within the parking area. The stormwater system within the sonic development contains a discharge point on the northeast corner of the development into Meetinghouse Brook.

See below for a short summary of each area:

TABLE 1: EXISTING DRAINAGE AREAS

Drainage Area	Description	Area Extents (SF)	Impervious Area (SF)	Time of Concentration (Min)
E-1	Exisitng Drainage Area to U.S. Route 5	7,028	2,495	10
E-2	Exisitng Drainage Area to Meetinghouse Brook	64,399	34,578	10
E-3	Exisitng Drainage Area to Sonic Development	23,708	19,773	10
EX-1	Point of Interest: Meetinghouse Brook	95,135	56,846	10

** The minimum time of concentration was utilized. Refer to Section 4.0 for more information regarding design parameters.*

Detailed information regarding each drainage area can be found on the Existing Drainage Area Map in Appendix E of this Report.

2.2 PROJECT SOILS

Whitestone Associates performed a "Report of Geotechnical Investigation" dated September 15, 2020 consisting of six (6) borings and three (3) test pits in order to evaluate the subsurface conditions on-site. Site subsurface conditions generally consisted of asphaltic concrete, gravel, or topsoil overlying intermittent existing fill (sand and gravel, and blast rock), underlain by a natural glaciolacustrine deposit, in turn underlain by glacial till. The glacial till is underlain by apparent bedrock. Groundwater was not encountered in the explorations. The on-site soils were classified as by the Unified Soil Classification System (USCS) as Poorly Graded Sands, Gravelly Sands, Little or No Fines (SP) and it is anticipated that results are consistent across the site including along the stream embankment and at the area of the stormwater outfall.

As part of the investigation infiltration testing was performed across the site and within the general vicinity of the proposed stormwater management facilities, based on the field testing completed it was found the soils had field permeability rate (field saturated hydraulic conductivity) ranging from 14.8 in/hr to 31.9 in/hr which far exceed the design infiltration rate used within the stormwater management design (conservative approach taken).

Per the National Resource Conservation Service (NRCS) data, the soil underlying the project site consists of:

TABLE 2: NRCS PROJECT SOILS

Soil Unit Code	Soil Description	Approximate Project Coverage	Hydrologic Soil Group
306	Udorthents – Urban Land Complex	92.4%	B
308	Udorthents, Smoothed	7.6%%	C

The hydrologic soil group classifications above have been utilized in the landcover data for the stormwater analysis performed on the project.

3.0 PROPOSED CONDITIONS

The proposed development (Lot A) consists of a 5,462 SF convenience Store with 12 MPD Fueling Canopy (24 Fueling Positions), and 43 proposed parking spaces. The site will be accessed via a proposed signalized driveway along North Colony Road (Route 5) and through cross access with the exisitng sonic development to the north of the proposed project site.

3.1 PROPOSED DRAINAGE AREAS

The proposed design maintains the existing drainage patterns and the improvements reduce the overall areas discharging to the existing Sonic development and North Colony Road. Under proposed conditions, the site is comprised of the same point of interest (Meetinghouse Brook) and four (4) drainage areas. Majority of the project site (drainage areas P-2A, P-2B, & P-2C) is designed to discharge directly into Meetinghouse Brook to the west of the property.

The first drainage area (P-2A) consists the runoff from the proposed roofs and the parking and loading areas to the south of the building and fueling area. The runoff from the proposed canopy roofs are discharged directly into the proposed Underground Infiltration Basin (B-1), and the proposed parking areas and building roof are collected via inlets and conveyed through a WQ unit which eventually discharges into the underground infiltration basin. The overflow from the proposed basin B-1 combines with the on-sites stormwater system (P-2B & P-2C) which ultimately discharges into the Meetinghouse Brook through a proposed headwall. The second drainage area (P-2B) contains the runoff from the parking & fueling area in front of the building which is collected via two (3) proposed inlets within the parking area. The third drainage area (P-2C) consist of the area in the rear of the proposed building that sheet flows directly into Meetinghouse Brook. The small uncollected portion of runoff along the proposed northern property line & along the Route 5 frontage is the fourth drainage area (P-3) which sheet flows onto the Sonic development or the Route 5 and is ultimately discharged into Meetinghouse Brook.

See below for a short summary of each area:

TABLE 3: PROPOSED DRAINAGE AREAS

Drainage Area	Description	Area Extents (SF)	Impervious Area (SF)	Time of Concentration (Min)
P-2A	Proposed Drainage Area to Infiltration Basin B-1	28,988	26,678 SF	10
P-2B	Proposed Undetained Drainage Area to WQ-1	41,312	31,345	10
P-2C	Proposed Undetained Drainage Area to Meetinghouse Brook	20,029	987	10
P-3	Proposed Drainage Area to Sonic Development / Route 5	4,806	1,443	10
PR-1	Point of Interest: Meetinghouse Brook	95,135	60,453	10

** The minimum time of concentration was utilized. Refer to Section 4.0 for more information regarding design parameters.*

Detailed information regarding each drainage area can be found on the Proposed Drainage Area Map in Appendix E of this Report.

4.0 ANALYSIS METHODOLOGY & DESIGN PARAMETERS

4.1 HYDROLOGIC & HYDRAULIC ANALYSES

The existing and proposed drainage areas have been analyzed utilizing a modified version of the NRCS SCS TR-20 method. The analysis program "HydroCAD" Version 9.10 by HydroCAD Software Solutions LLC was used to calculate and plot the runoff hydrographs. The program incorporates the time of concentration, CN values, 24 hour rainfall events, and project drainage areas to calculate the runoff characteristics. Key variables utilized include the SCS Unit Hydrograph, a minimum time of concentration of 10 minutes, separate runoff calculations for impervious and pervious areas, and dynamic storage and conveyance routing to account for any variable tailwater conditions.

4.2 STORMWATER DESIGN PARAMETERS

Please see below for a summary of the stormwater design intent to ensure compliance with the applicable standards.

TABLE 4: PROJECT STORMWATER DESIGN INTENT SUMMARY TABLE

Design Parameters	Design Intent for Compliance	
Peak Flow Control	Stormwater management design shall control the post-development peak discharge rates from the 10-, 25-, and 100-year storms to the corresponding pre-development peak discharge rates. ***The proposed development demonstrates that the proposed improvements meets and/or exceeds the peak runoff attenuation requirements.***	**Complies**
Groundwater Recharge	Maintain pre-development annual groundwater recharge volume to the maximum extent practicable through the use of infiltration measures. ***The proposed development reduces the on-site impervious surfaces (increases pervious coverage), therefore groundwater recharge requirements are naturally met.***	**Complies**
Pollutant Reduction	Stormwater management measures shall be sized to capture and treat the Water Quality Volume (WQV) on-site, and/or stormwater treatment facilities shall be sized with a flow rate equal or greater to the Water Quality Flow (WQF) on-site. ***The project incorporates both primary treatment practices and secondary treatment practices to fully capture and/or treat the water quality volume under proposed conditions.***	**Complies**

The proposed stormwater management improvements will ensure that this will be no negative impacts on the downstream properties, off-site drainage systems, or watercourses. The existing drainage patterns and discharge points will be maintained in the proposed design and appropriate measures are included to ensure the drainage will continue to flow to the existing locations. The overall reduction in peak runoff volume associated with the proposed site improvements will improve stream bank stabilization and help prevent downstream erosion and flooding.

4.3 SUBSURFACE STORMWATER INVESTIGATION

A subsurface stormwater investigation was conducted by Whitestone Associates, Inc dated September 15, 2020. A total of six (6) soil borings and three (3) tests were performed in compliance with the soil testing standards. All proposed stormwater facilities will meet or exceed the minimum separation depth from seasonal high groundwater. The full investigation report and testing results can be found in Appendix D of this Report.

Based on the testing results, the maximum design infiltration rate of 5.0 inches per hour was utilized in the design of the proposed stormwater management facilities (infiltration practices).

5.0 PROJECT ANALYSIS RESULTS

5.1 STORMWATER PEAK FLOW CONTROL

Proposed runoff is controlled through the implementation of increased pervious coverage (reduction in impervious surfaces and compacted gravel surfaces), and the proposed Underground Infiltration Basin (B-1)

To analyze runoff quantities between the existing and proposed drainage areas, one (1) point of interest was selected:

TABLE 5: QUANTITY COMPARISON POINT OF INTEREST

Point of Interest	Area Description	Existing Tributary Drainage Areas	Proposed Tributary Drainage Areas
POI - 1	Drainage to Meetinghouse Brook	E-1, E-2, & E-3	P-2A, P-2B, P-2C, & P-3

The following tables summarize the results for the 2-year, 10-year, 25-year and 100-year storm events for each project point of interest:

TABLE 6A: PEAK DISCHARGE TO MEETINGHOUSE BROOK (POI-1)

Storm Event	Pre-Development Peak Discharge	Post-Development Peak Discharge	Reduction Achieved
2-Year	3.89 CFS	2.48 CFS	36.25%
10-Year	6.63 CFS	4.35 CFS	34.39%
25-Year	7.66 CFS	5.23 CFS	31.72%
100-Year	10.31 CFS	9.01 CFS	12.61%

TABLE 6B: RUNOFF VOLUME TO MEETINGHOUSE BROOK (POI-1)

Storm Event	Pre-Development Runoff Volume	Post-Development Runoff Volume	Reduction Achieved
2-Year	15,985 CF	10,296 CF	35.6%
10-Year	26,763 CF	18,625 CF	30.4%
25-Year	30, 700 CF	21, 928 CF	28.6%
100-Year	41,105 CF	30,608 CF	25.5%

As shown in the table above, peak stormwater discharge rates are reduced by at least the required amount for each storm event. Project hydrographs and more detailed data can be found in Appendix C of this Report.

5.2 POLLUTANT REDUCTION (WATER QUALITY)

In addition to the reduction of the peak runoff rates, the project proposes various improvements including Best Management Practices (BMP) to improve the quality of runoff on-site including runoff discharging to Meetinghouse Brook. The proposed development incorporates both primary treatment practices and secondary treatment practices in order to meet the water quality (pollutant reduction) standards including infiltration practices and structured water quality units. In accordance with the 2004 Connecticut Stormwater Design Manual the project proposes to pre-treat 100% of the water quality volume (WQV) on-site.

As the project is a proposed gas station the fueling area and tank field has been designed to be sloped directly to a separate trench drain in order to collect all runoff from these areas separately prior to draining to the an oil/water separator that has been design off-line in order to by-pass any larger storm events to help minimize downstream impacts.

The project incorporates Contech Vortech Hydrodynamic Separator in order to treat stormwater runoff and they have been designed in accordance with the latest Connecticut Stormwater Manual. The remainder of the proposed improvements including the majority of the roof areas will be collected and treated by a water quality unit (100% pre-treatment) prior to discharging to the proposed Underground Infiltration Basin B-1.

Additionally, the project proposes hood and sumps within the proposed catch basins in order to collect and trap sediment carried within the runoff and trap floating debris. The single outfall proposed will include outfall protection consisting of a flared end section, rip-rap pads, filter fabric, and slope stabilization matting are designed accordance with State standards to help protect the watercourse and maintain stability within the stream bank.

The following tables summarize the calculations utilized in sizing the proposed BMPs:

TABLE 7: WATER QUALITY CALCULATION SUMMARY FOR DRAINAGE AREA P-2A & P-2B

Drainage Area	Water Quality Volume (WQV)	Water Quality Flow (WQF)
P-2A	2,122 CF	0.55 CFS
P-2B	2,523 CF	0.65 CFS

TABLE 8: WATER QUALITY TREATMENT MEASURE SUMMARY

Treatment Measure	Drainage Area	Required Volume / Flow	Proposed Volume / Flow
Contech Vortechs 1000	P-2A	0.52 CFS	1.6 CFS
Contech Vortechs 1000	P-2B	0.65 CFS	1.6 CFS
Underground Infiltration Basin B-1	P-2A	2,122 CF	2,298 CF

Water Quality calculations and specifications can be found in Appendix C of this Report.

5.3 STORMWATER CONVEYANCE SYSTEMS

The stormwater conveyance system has been designed to safely convey the 25-year storm and is able to safely convey runoff to stormwater management facilities without overflowing.

5.4 SOIL EROSION & SEDIMENT CONTROL

The project consists of a Soil Erosion & Sediment Control Plan prepared in accordance with the latest edition of the Connecticut Guidelines for Soil Erosion and Sediment Control. The project proposes temporary measures during construction include silt fencing, stabilized construction entrances, inlet filters, hay bales, and cover for soil

stabilization. Permanent post-construction measures include conduit outlet projection, native vegetation, and rip-rap lining.

In order to minimize the potential impact to the downstream system the project proposes slope stabilization matting ensure adequate vegetation coverage and protect the slope integrity. Areas disturbed during construction will be stabilized in the proposed design.

7.0 CONCLUSIONS

The proposed improvements including the implementation of the stormwater system and the reduction of impervious surfaces within the upland review area and across the subject property is anticipated to result in no adverse impacts on downstream properties, off-site drainage systems, and the watercourse as a result of the proposed development. The existing drainage areas and ultimate points of interest are maintained as part of this application and appropriate measures are included in order to ensure the stream embankment and watercourse are protected throughout construction and post-construction.

APPENDIX A
PROJECT FIGURES

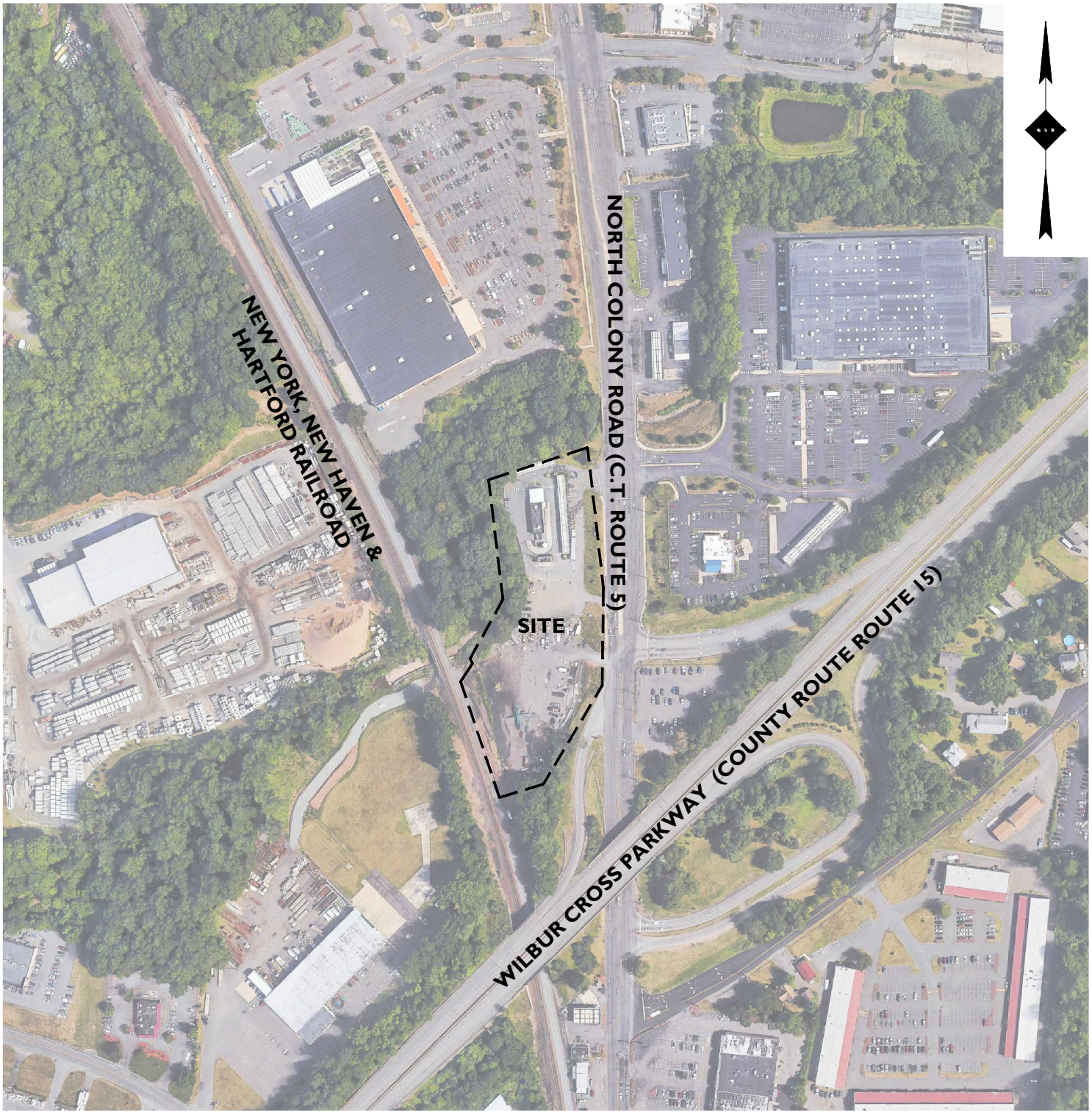
INVENTORY

USGS LOCATION MAP

TAX MAP

AERIAL MAP

FEMA MAP



AERIAL MAP

300' 0' 300' 600'

GRAPHIC SCALE IN FEET

1" = 300'

SOURCE: GOOGLE EARTH PRO IMAGERY, DATE RETRIEVED 09/29/2020

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1033 NORTH COLONY ROAD (U.S. ROUTE 15)
TOWN OF WALLINGFORD
NEW HAVEN COUNTY, CONNECTICUT

DRAWN BY:	SPM
CHECKED BY:	JHK
DATE:	09/30/2020
SCALE:	1" = 300'
PROJECT ID:	B-19007

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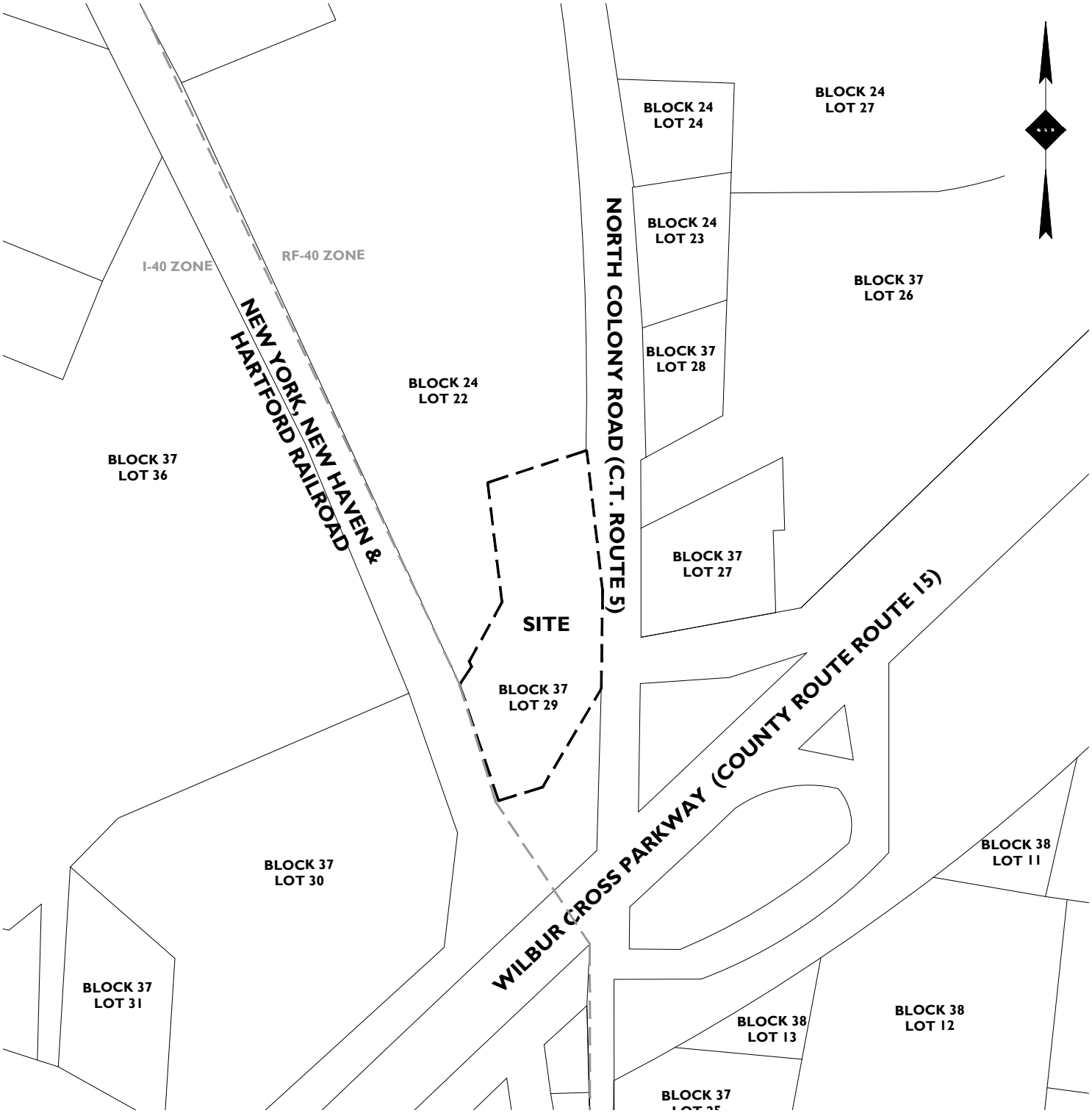

TAX & ZONING MAP

300' 0' 300' 600'

GRAPHIC SCALE IN FEET

1" = 300'

SOURCE: TOWN OF WALLINGFORD GIS, DATE RETRIEVED 06/24/2020

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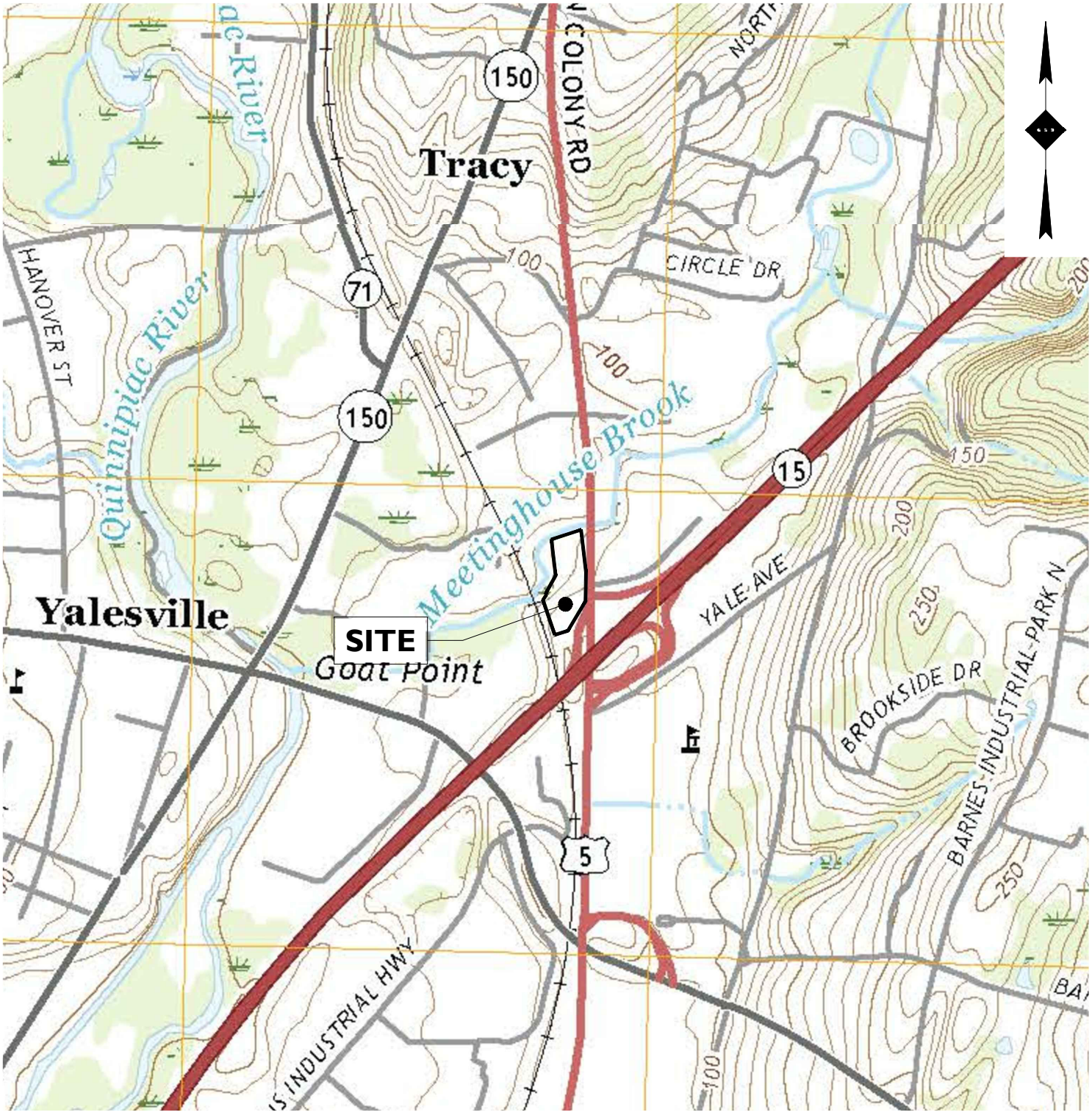

USGS QUADRANGLE MAP

1000' 0' 1000' 2000'

GRAPHIC SCALE IN FEET

1" = 1000'

SOURCE: USGS US TOPO 7.5 MINUTE MAP FOR WALLINGFORD, CT DATED 2018

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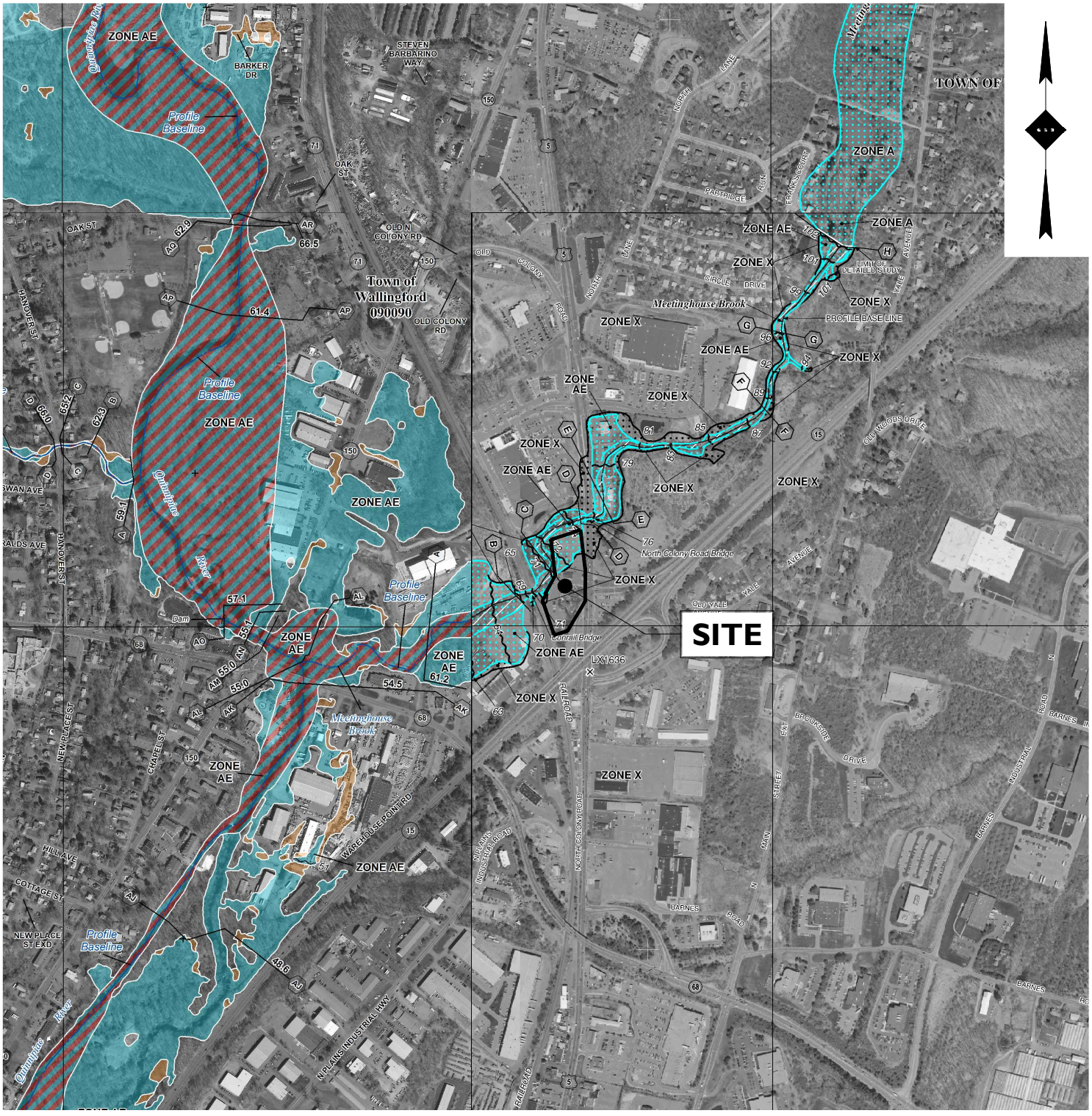

FEMA EFFECTIVE MAP

1000' 0' 1000' 2000'

GRAPHIC SCALE IN FEET

1" = 1000'

SOURCE: FEMA FLOOD INSURANCE MAP NUMBERS 09009C0306H, 09009C0164J, 09009C0302J AND 09009C0168H DATED DECEMBER 17, 2010 AND REVALIDATED ON JUNE 6, 2017.

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APPENDIX B
NRCS COUNTY SOIL SURVEY

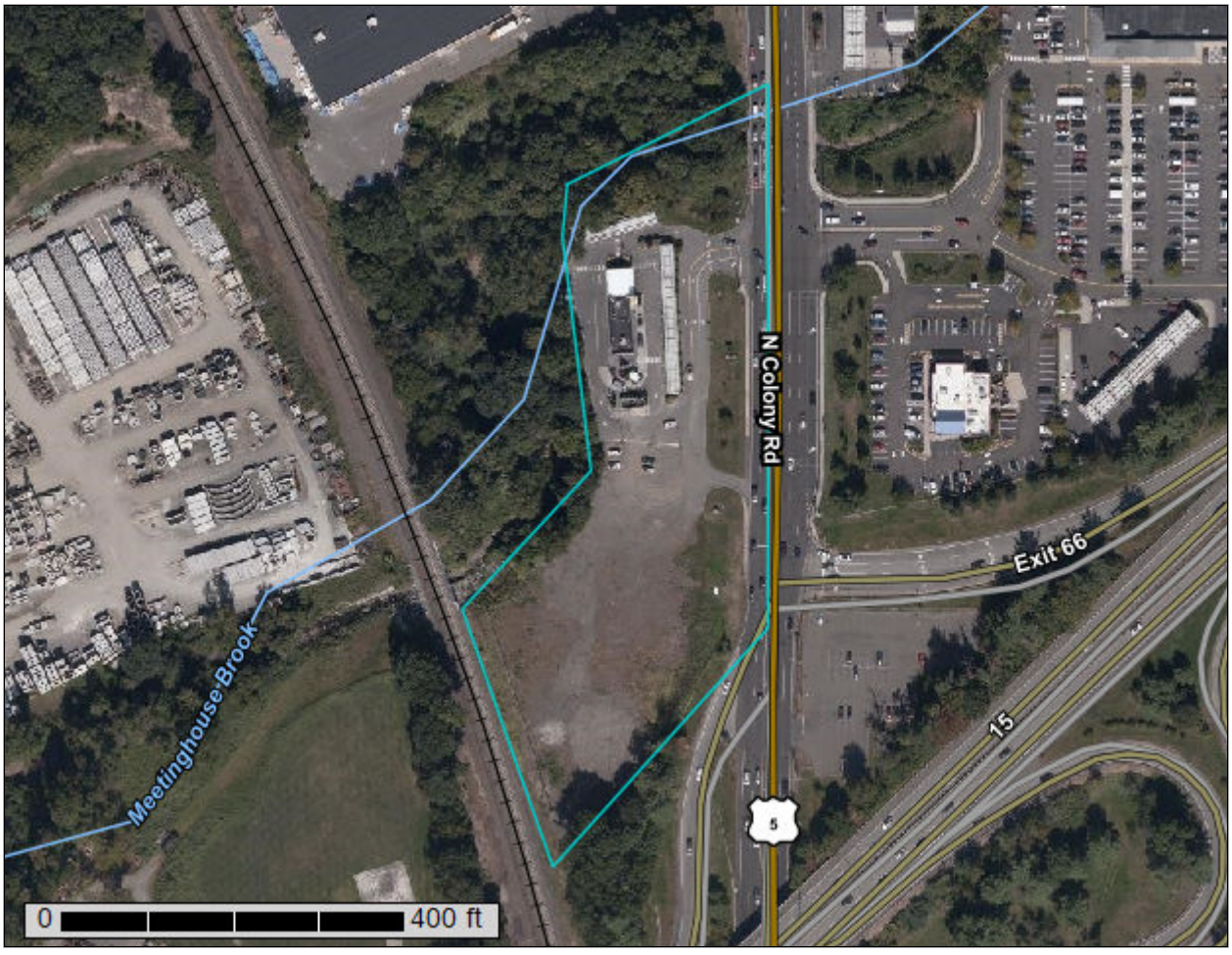
United States Department of Agriculture

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 State of Connecticut



June 24, 2020

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.

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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.

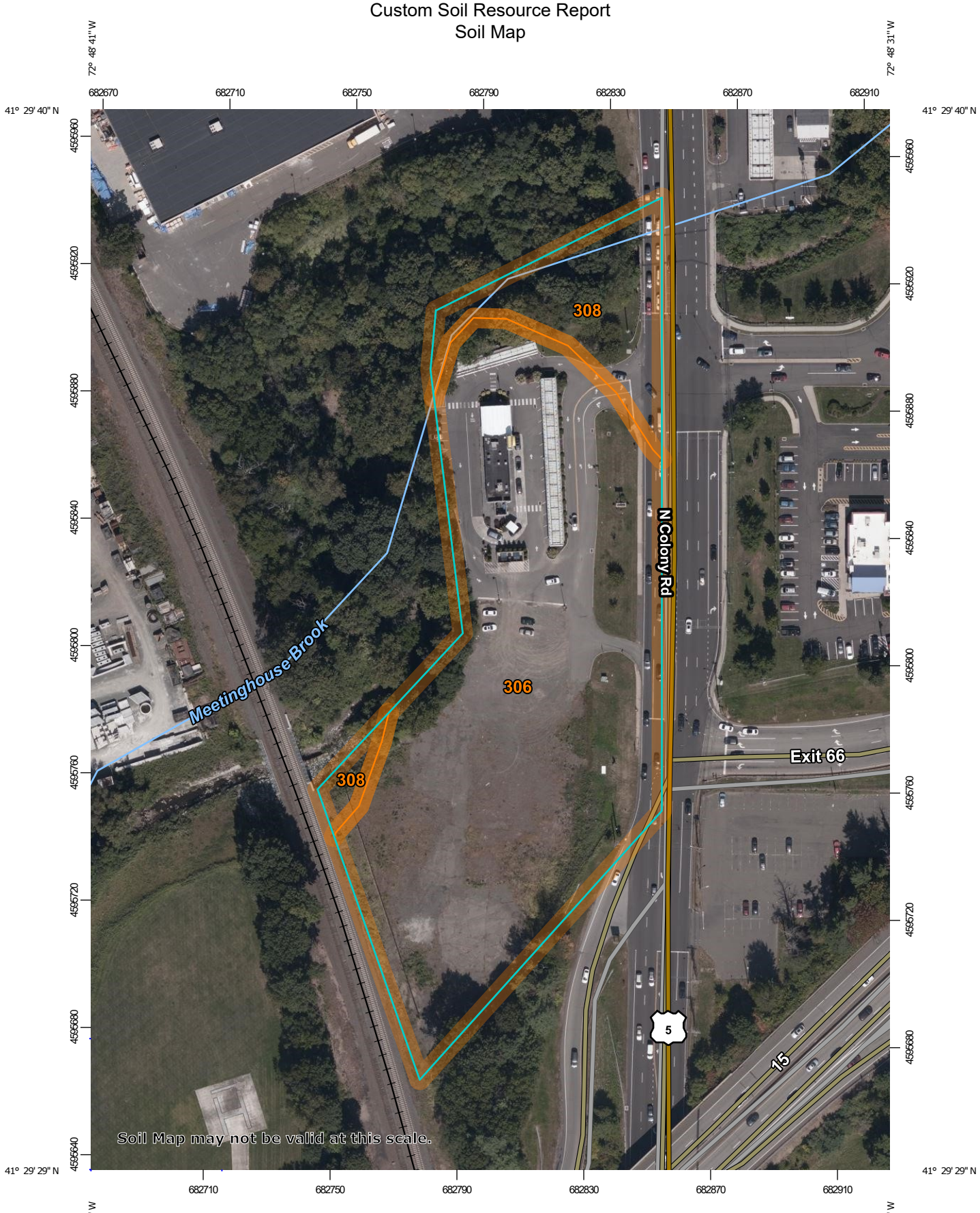
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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: 1:1,620 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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: State of Connecticut
Survey Area Data: Version 19, Sep 13, 2019

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

Date(s) aerial images were photographed: Aug 30, 2019—Oct 15, 2019

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
306	Udorthents-Urban land complex	3.7	84.7%
308	Udorthents, smoothed	0.7	15.3%
Totals for Area of Interest		**4.4**	**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.

State of Connecticut

306—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 9lmg
Elevation: 0 to 2,000 feet
Mean annual precipitation: 43 to 56 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 120 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 50 percent
Urban land: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Drift

Typical profile

A - 0 to 5 inches: loam
C1 - 5 to 21 inches: gravelly loam
C2 - 21 to 80 inches: very gravelly sandy loam

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)
Depth to water table: About 54 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Urban Land

Typical profile

H - 0 to 6 inches: material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8

Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Unnamed, undisturbed soils
Percent of map unit: 8 percent
Hydric soil rating: No

Udorthents, wet substratum
Percent of map unit: 5 percent
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Rock outcrop
Percent of map unit: 2 percent
Hydric soil rating: No

308—Udorthents, smoothed

Map Unit Setting
National map unit symbol: 9lmj
Elevation: 0 to 2,000 feet
Mean annual precipitation: 43 to 56 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 120 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition
Udorthents and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting
Down-slope shape: Convex
Across-slope shape: Linear

Typical profile
A - 0 to 5 inches: loam
C1 - 5 to 21 inches: gravelly loam
C2 - 21 to 80 inches: very gravelly sandy loam

Properties and qualities
Slope: 0 to 35 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)
Depth to water table: About 24 to 54 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Udorthents, wet substratum

Percent of map unit: 7 percent
Hydric soil rating: No

Unnamed, undisturbed soils

Percent of map unit: 7 percent
Hydric soil rating: No

Urban land

Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 1 percent
Hydric soil rating: No

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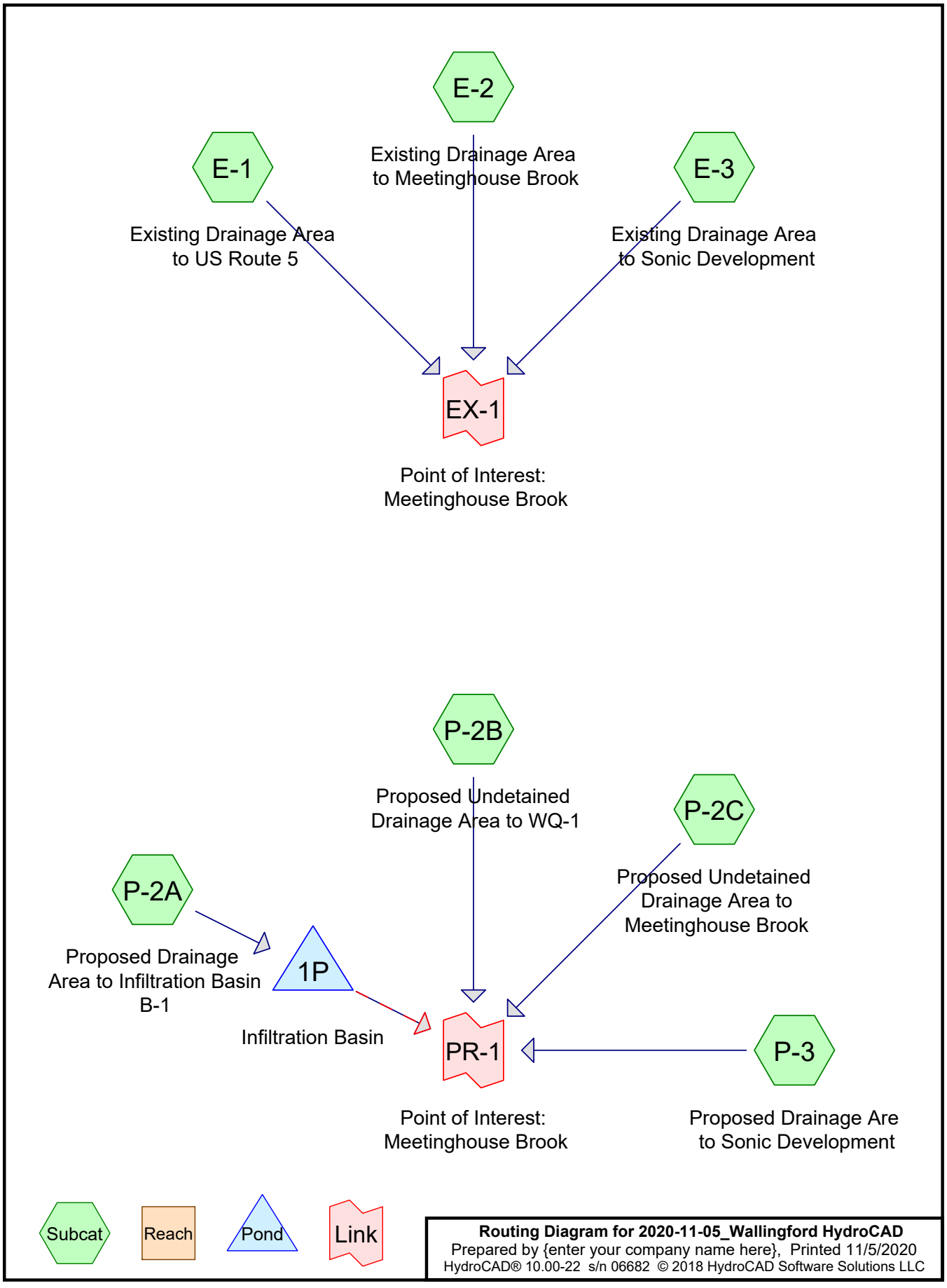
APPENDIX C
DESIGN CALCULATIONS & DIAGRAMS

APPENDIX C-1
HydroCAD Routing Diagram


E-2
Existing Drainage Area
to Meetinghouse Brook
E-1
Existing Drainage Area
to US Route 5
E-3
Existing Drainage Area
to Sonic Development
EX-1
Point of Interest:
Meetinghouse Brook
P-2B
Proposed Undetained
Drainage Area to WQ-1
P-2C
Proposed Undetained
Drainage Area to
Meetinghouse Brook
P-2A
Proposed Drainage
Area to Infiltration Basin
B-1
1P
Infiltration Basin
PR-1
P-3
Point of Interest:
Meetinghouse Brook
Proposed Drainage Are
to Sonic Development
Subcat
Reach
Pond
Link
Routing Diagram for 2020-11-05_Wallingford HydroCAD
Prepared by {enter your company name here}, Printed 11/5/2020
HydroCAD® 10.00-22 s/n 06682 © 2018 HydroCAD Software Solutions LLC

APPENDIX C-2
2-YEAR STORM EVENT HYDROGRAPHS

Summary for Subcatchment E-1: Existing Drainage Area to US Route 5

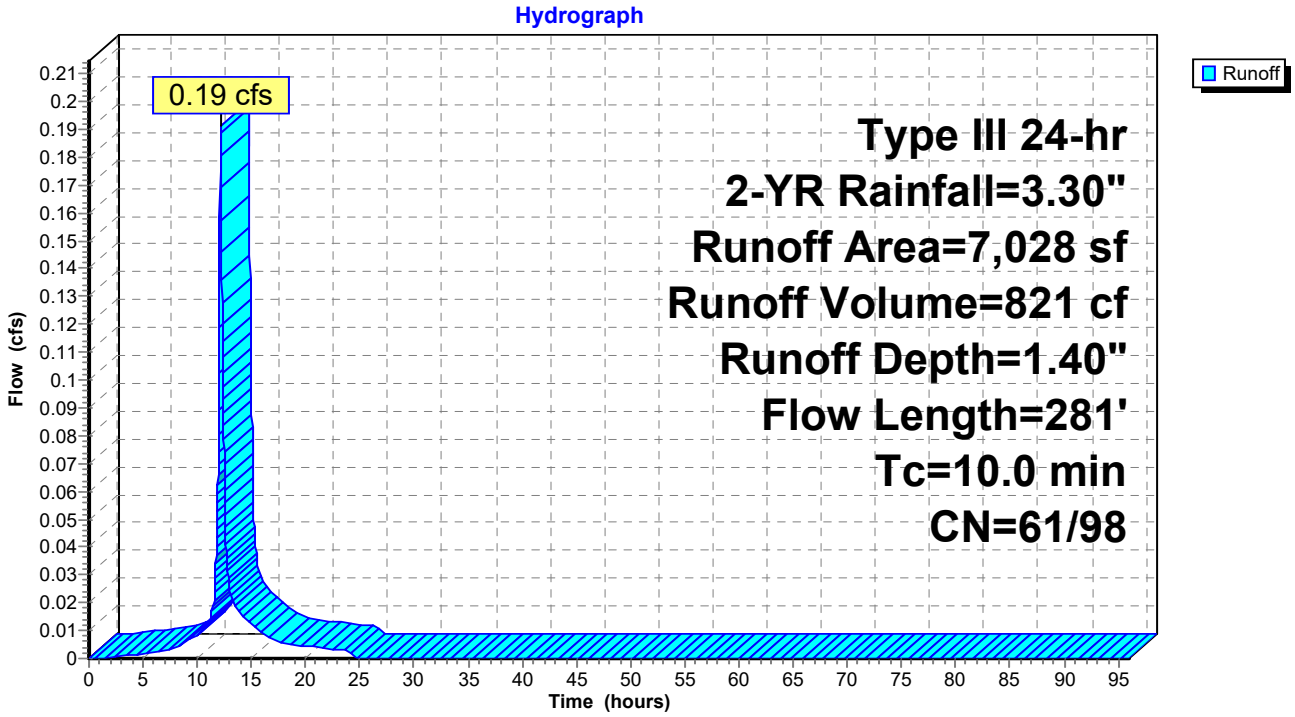
Runoff = 0.19 cfs @ 12.14 hrs, Volume= 821 cf, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.30"

	Area (sf)	CN	Description
*	2,495	98	Impervious Coverage
	4,533	61	>75% Grass cover, Good, HSG B
	7,028	74	Weighted Average
	4,533	61	64.50% Pervious Area
	2,495	98	35.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	25	0.0500	0.09		**Sheet Flow, Segment 1-2** Woods: Light underbrush n= 0.400 P2= 3.34"
0.2	21	0.0857	1.46		**Shallow Concentrated Flow, Segment 2-3** Woodland Kv= 5.0 fps
0.3	47	0.3670	3.03		**Shallow Concentrated Flow, Segement 3-4** Woodland Kv= 5.0 fps
1.2	164	0.0122	2.24		**Shallow Concentrated Flow, Segment 4-5** Paved Kv= 20.3 fps
0.1	24	0.0208	2.93		**Shallow Concentrated Flow, Segment 5-6** Paved Kv= 20.3 fps
6.6	281	Total, Increased to minimum Tc = 10.0 min			

Subcatchment E-1: Existing Drainage Area to US Route 5



Summary for Subcatchment E-2: Existing Drainage Area to Meetinghouse Brook

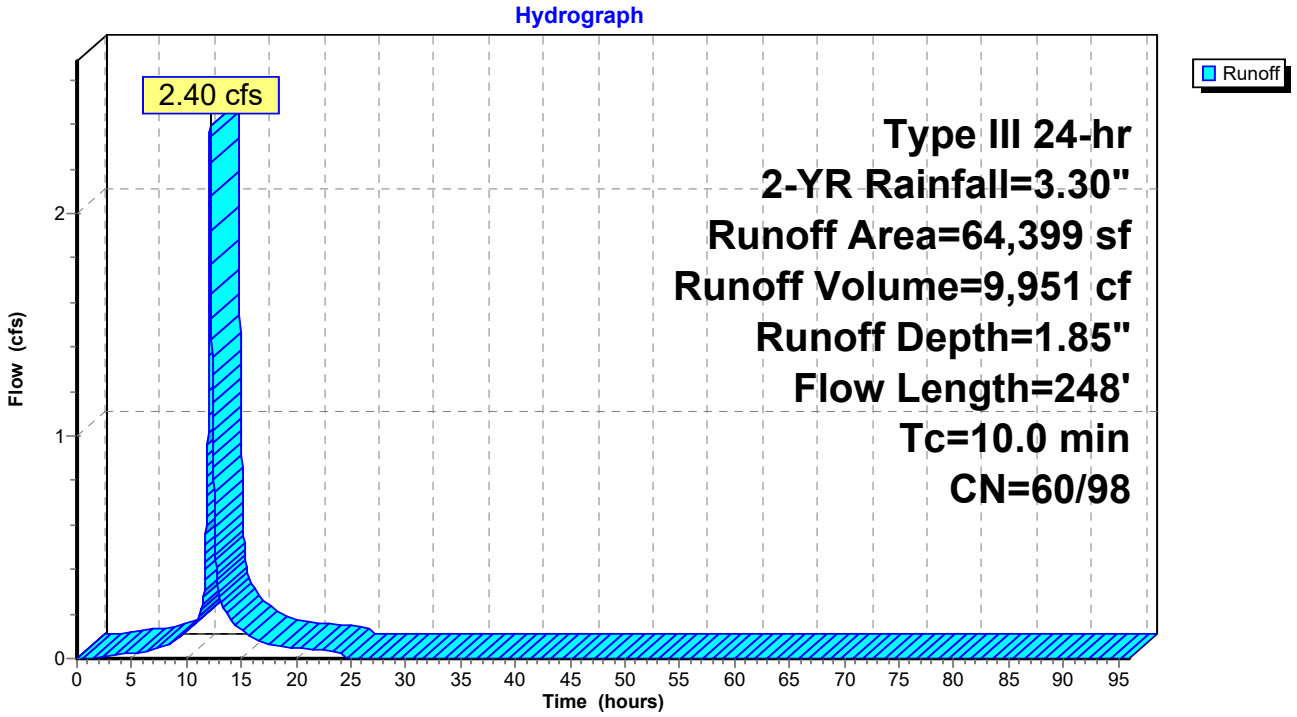
Runoff = 2.40 cfs @ 12.14 hrs, Volume= 9,951 cf, Depth= 1.85"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.30"

	Area (sf)	CN	Description
*	0	85	Gravel
	6,962	55	Woods, Good, HSG B
	1,998	70	Woods, Good, HSG C
	20,861	61	>75% Grass cover, Good, HSG B
	0	74	>75% Grass cover, Good, HSG C
*	34,578	98	Impervious Area
	64,399	80	Weighted Average
	29,821	60	46.31% Pervious Area
	34,578	98	53.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	12	0.3300	0.35		**Sheet Flow, Segment 1-2** Grass: Short n= 0.150 P2= 3.34"
1.1	134	0.0170	2.10		**Shallow Concentrated Flow, Segment 2-3** Unpaved Kv= 16.1 fps
0.4	64	0.0200	2.87		**Shallow Concentrated Flow, Segement 3-4** Paved Kv= 20.3 fps
0.3	18	0.0350	0.94		**Shallow Concentrated Flow, Segment 4-5** Woodland Kv= 5.0 fps
0.1	20	0.3300	2.87		**Shallow Concentrated Flow, Segment 5-6** Woodland Kv= 5.0 fps
2.5	248	Total, Increased to minimum Tc = 10.0 min			

Subcatchment E-2: Existing Drainage Area to Meetinghouse Brook



Summary for Subcatchment E-3: Existing Drainage Area to Sonic Development

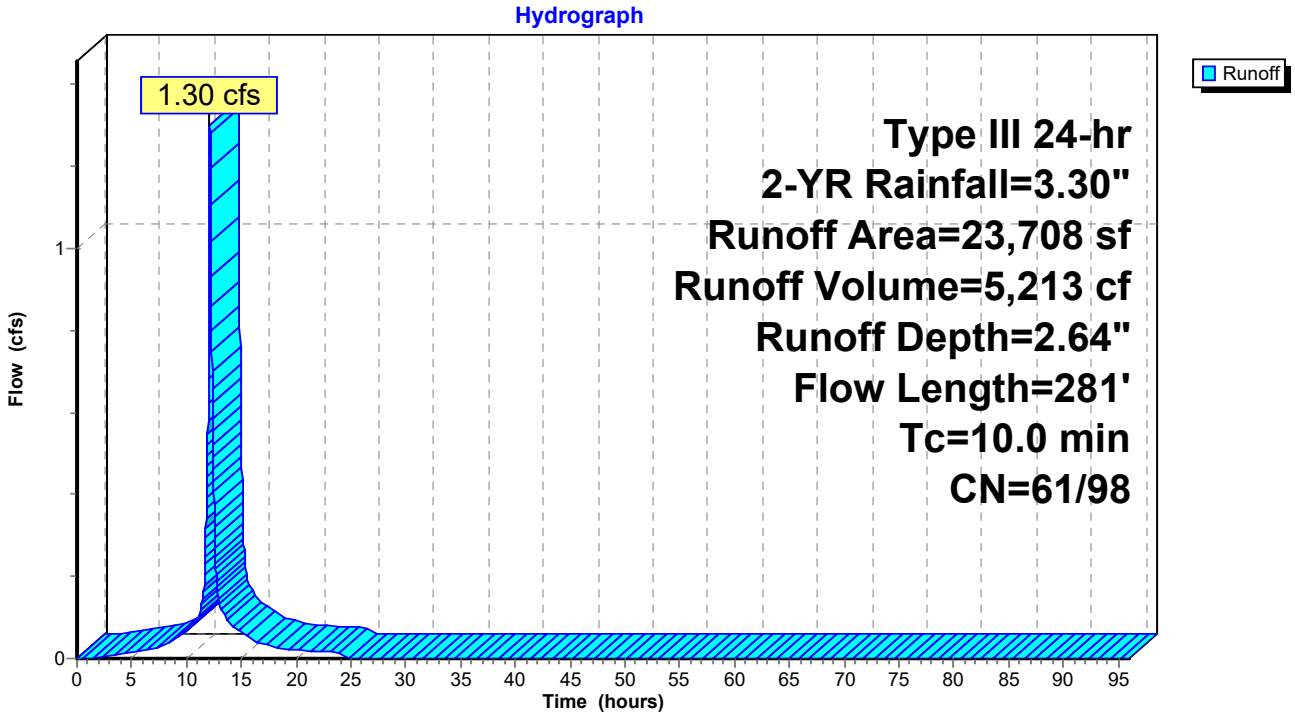
Runoff = 1.30 cfs @ 12.13 hrs, Volume= 5,213 cf, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.30"

	Area (sf)	CN	Description
*	19,773	98	Impervious Coverage
*	0	85	Gravel
	0	98	Roofs, HSG A
	80	55	Woods, Good, HSG B
	3,855	61	>75% Grass cover, Good, HSG B
	23,708	92	Weighted Average
	3,935	61	16.60% Pervious Area
	19,773	98	83.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	25	0.0500	0.09		**Sheet Flow, Segment 1-2** Woods: Light underbrush n= 0.400 P2= 3.34"
0.2	21	0.0857	1.46		**Shallow Concentrated Flow, Segment 2-3** Woodland Kv= 5.0 fps
0.3	47	0.3670	3.03		**Shallow Concentrated Flow, Segement 3-4** Woodland Kv= 5.0 fps
1.2	164	0.0122	2.24		**Shallow Concentrated Flow, Segment 4-5** Paved Kv= 20.3 fps
0.1	24	0.0208	2.93		**Shallow Concentrated Flow, Segment 5-6** Paved Kv= 20.3 fps
6.6	281	Total, Increased to minimum Tc = 10.0 min			

Subcatchment E-3: Existing Drainage Area to Sonic Development



Summary for Subcatchment P-2A: Proposed Drainage Area to Infiltration Basin B-1

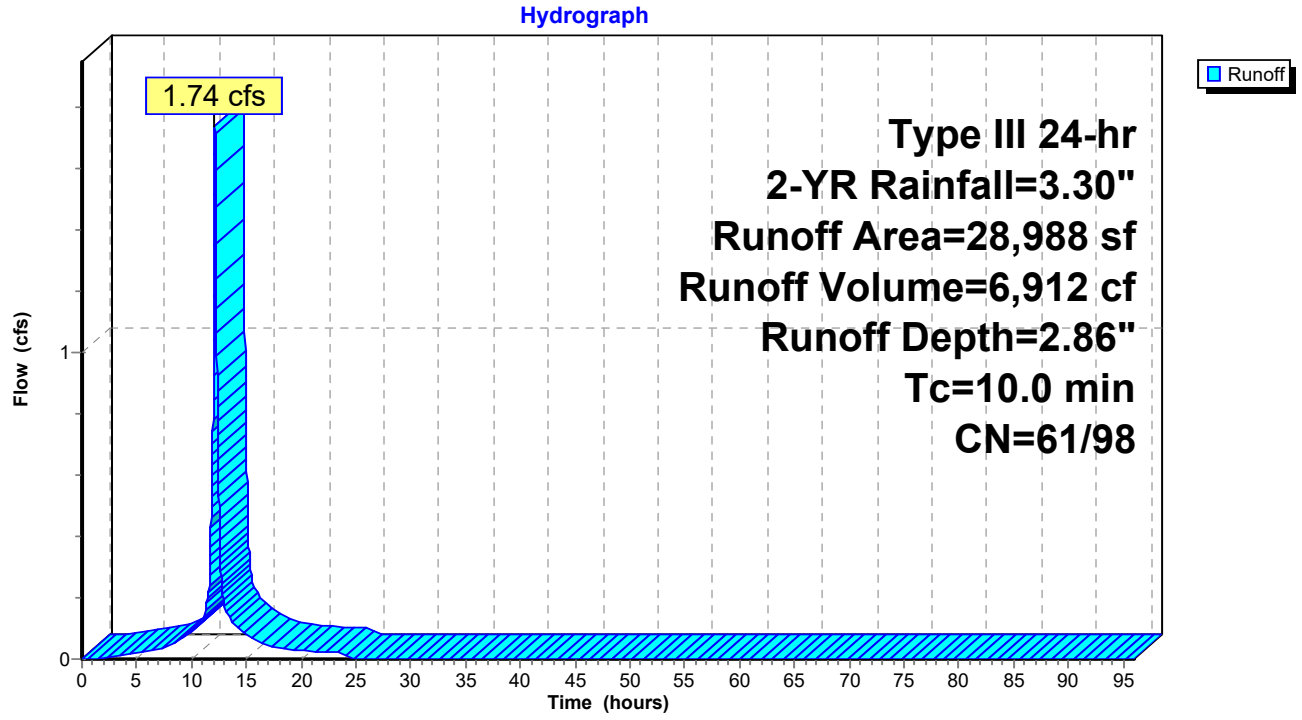
Runoff = 1.74 cfs @ 12.13 hrs, Volume= 6,912 cf, Depth= 2.86"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.30"

	Area (sf)	CN	Description
*	12,123	98	Roofs
*	14,555	98	Impervious Area
	2,310	61	>75% Grass cover, Good, HSG B
	28,988	95	Weighted Average
	2,310	61	7.97% Pervious Area
	26,678	98	92.03% Impervious Area

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

Subcatchment P-2A: Proposed Drainage Area to Infiltration Basin B-1



Summary for Subcatchment P-2B: Proposed Undetained Drainage Area to WQ-1

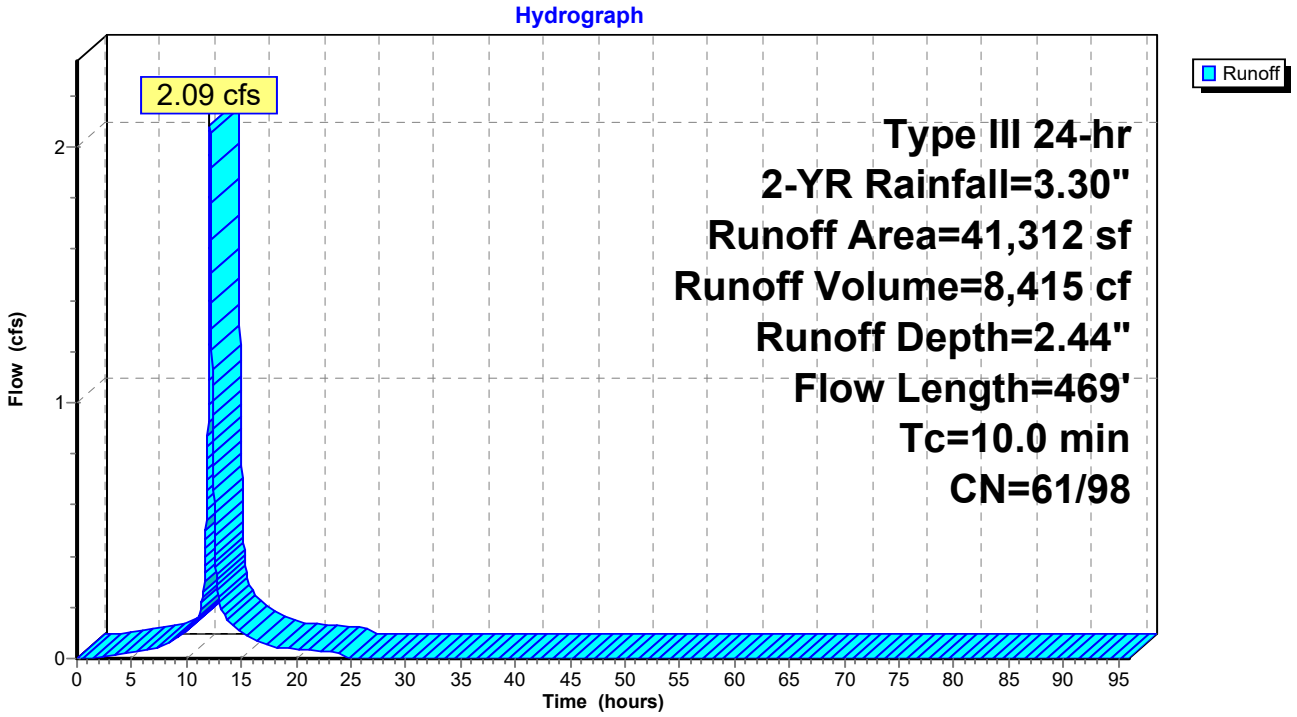
Runoff = 2.09 cfs @ 12.14 hrs, Volume= 8,415 cf, Depth= 2.44"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.30"

	Area (sf)	CN	Description
*	0	98	Roofs
*	31,345	98	Impervious Area
	9,967	61	>75% Grass cover, Good, HSG B
	41,312	89	Weighted Average
	9,967	61	24.13% Pervious Area
	31,345	98	75.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0150	1.25		**Sheet Flow, segment 1** Smooth surfaces n= 0.011 P2= 3.34"
1.0	150	0.0150	2.49		**Shallow Concentrated Flow, segment 2** Paved Kv= 20.3 fps
0.4	122	0.0100	4.91	3.86	**Pipe Channel, segment 3** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.2	67	0.0100	5.70	7.00	**Pipe Channel, segment 4** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
0.0	30	0.0500	14.40	25.45	**Pipe Channel, segment 5** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
2.9	469	Total, Increased to minimum Tc = 10.0 min			

Subcatchment P-2B: Proposed Undetained Drainage Area to WQ-1



Summary for Subcatchment P-2C: Proposed Undetained Drainage Area to Meetinghouse Brook

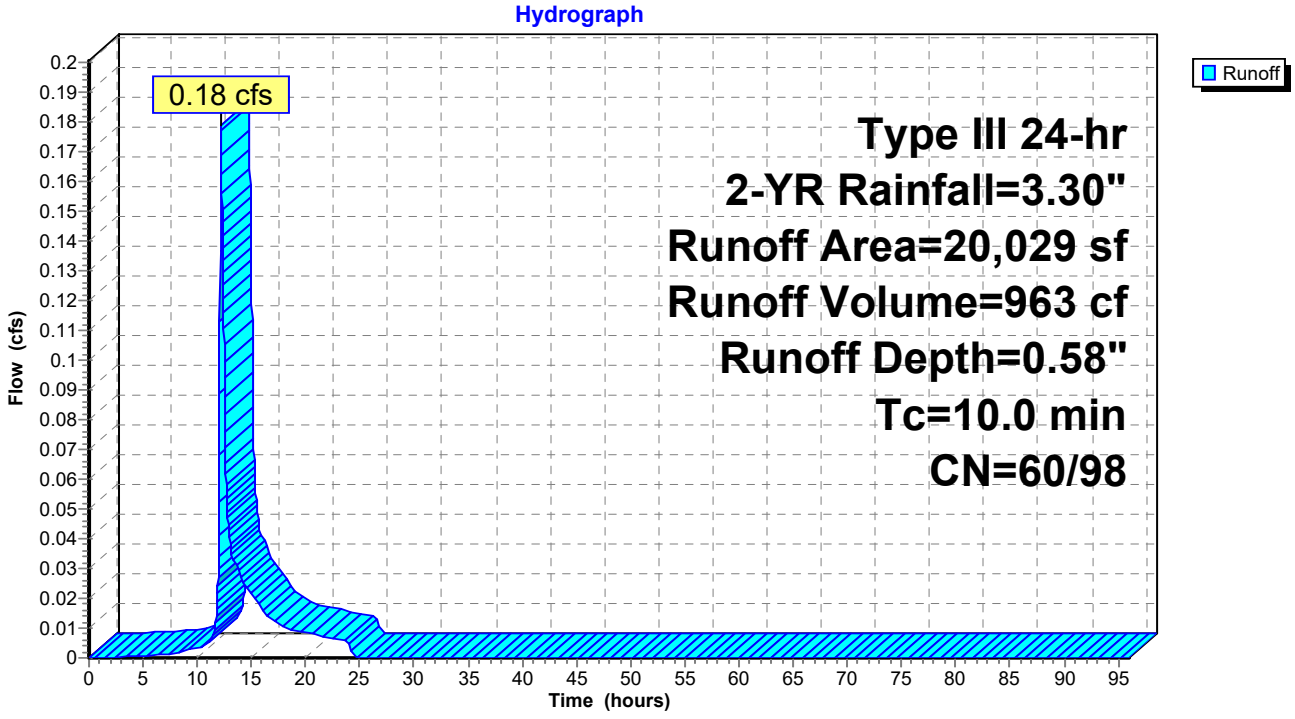
Runoff = 0.18 cfs @ 12.17 hrs, Volume= 963 cf, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.30"

	Area (sf)	CN	Description
	6,854	55	Woods, Good, HSG B
	1,998	70	Woods, Good, HSG C
	10,190	61	>75% Grass cover, Good, HSG B
*	0	98	Roofs
*	987	98	Impervious
	20,029	62	Weighted Average
	19,042	60	95.07% Pervious Area
	987	98	4.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7					**Direct Entry,**
5.7	0	Total, Increased to minimum Tc = 10.0 min			

Subcatchment P-2C: Proposed Undetained Drainage Area to Meetinghouse Brook



Summary for Subcatchment P-3: Proposed Drainage Are to Sonic Development

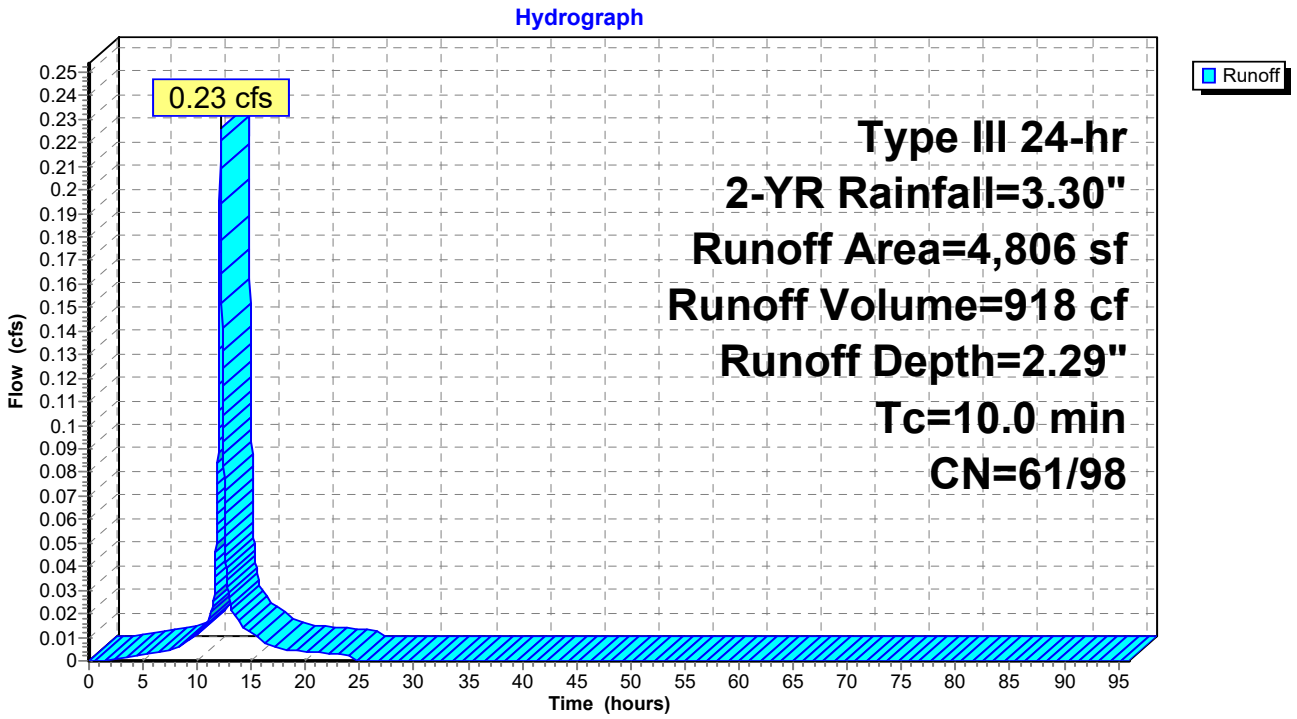
Runoff = 0.23 cfs @ 12.14 hrs, Volume= 918 cf, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.30"

	Area (sf)	CN	Description
*	3,363	98	Impervious Coverage,
	1,443	61	>75% Grass cover, Good, HSG B
	0	98	Roofs, HSG A
	4,806	87	Weighted Average
	1,443	61	30.02% Pervious Area
	3,363	98	69.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7					**Direct Entry,**
5.7	0	Total, Increased to minimum Tc = 10.0 min			

Subcatchment P-3: Proposed Drainage Are to Sonic Development



Summary for Pond 1P: Infiltration Basin

Inflow Area = 28,988 sf, 92.03% Impervious, Inflow Depth = 2.86" for 2-YR event
Inflow = 1.74 cfs @ 12.13 hrs, Volume= 6,912 cf
Outflow = 0.40 cfs @ 12.57 hrs, Volume= 6,912 cf, Atten= 77%, Lag= 26.4 min
Discarded = 0.40 cfs @ 12.57 hrs, Volume= 6,912 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 82.63' @ 12.57 hrs Surf.Area= 1,162 sf Storage= 1,994 cf

Plug-Flow detention time= 36.9 min calculated for 6,911 cf (100% of inflow)
Center-of-Mass det. time= 36.9 min (798.4 - 761.6)

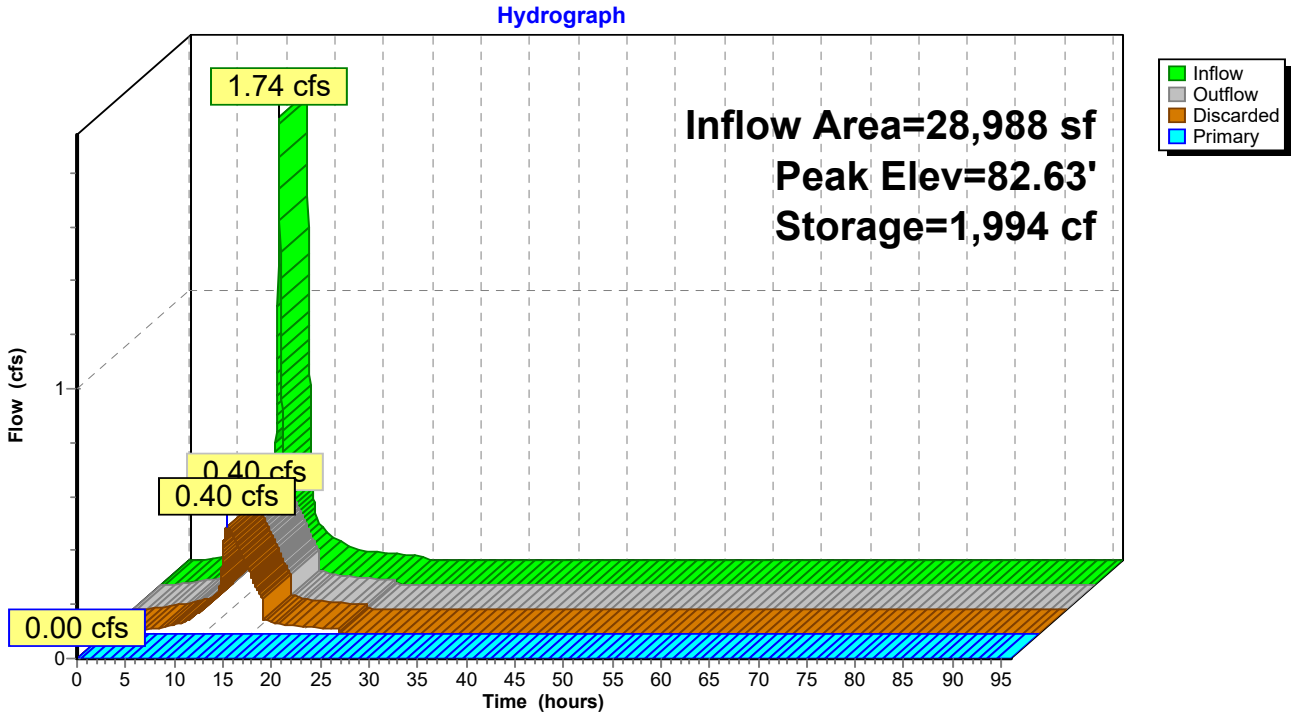
Volume	Invert	Avail.Storage	Storage Description
#1	80.50'	2,011 cf	**48.0" Round Pipe Storage** x 2 Inside #2 L= 80.0' 2,545 cf Overall - 3.0" Wall Thickness = 2,011 cf
#2	79.50'	2,003 cf	**168.0" W x 78.0" H Box Stone Storage** L= 83.0' 7,553 cf Overall - 2,545 cf Embedded = 5,008 cf x 40.0% Voids
		4,014 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	80.50'	**15.0" Round Culvert** L= 99.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 80.50' / 79.51' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Discarded	79.50'	**5.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 78.00' Phase-In= 0.01'
#3	Device 1	84.50'	**6.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 1	83.00'	**6.0" Vert. Slot** C= 0.600

Discarded OutFlow Max=0.40 cfs @ 12.57 hrs HW=82.63' (Free Discharge)
└**2=Exfiltration** (Controls 0.40 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=79.50' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
  ├**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**4=Slot** (Controls 0.00 cfs)

Pond 1P: Infiltration Basin

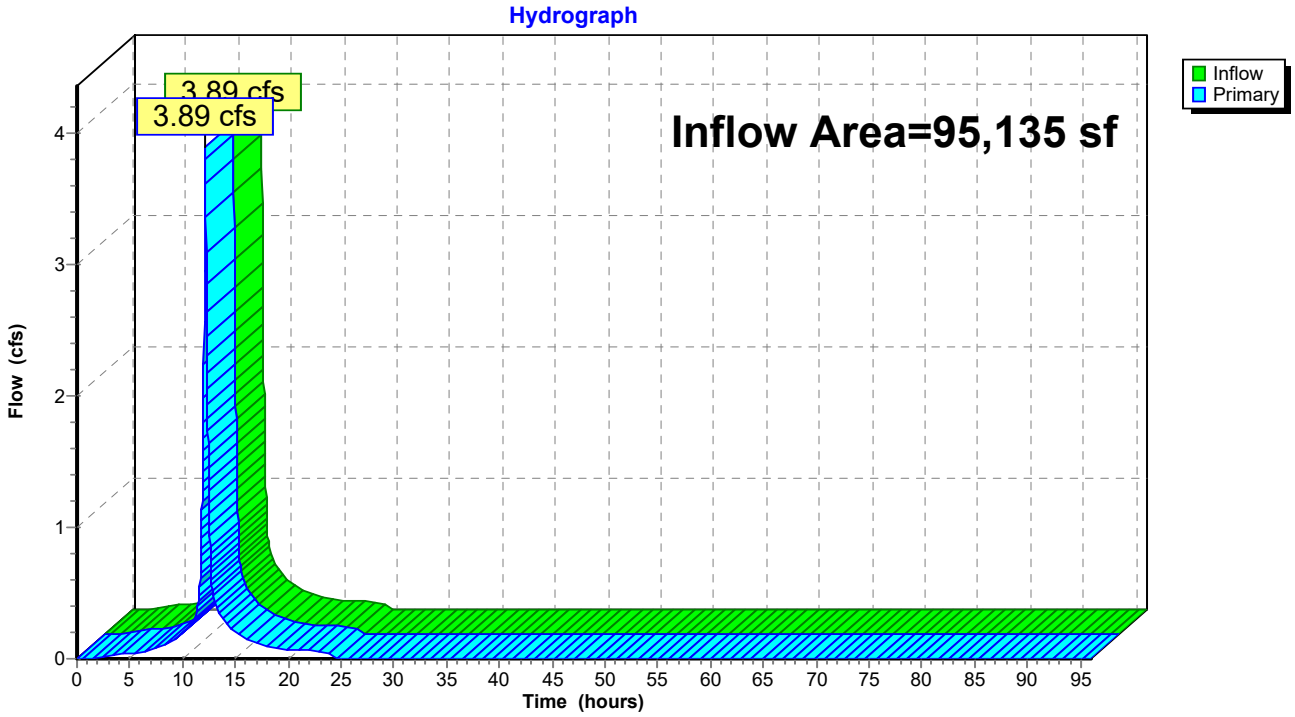


Summary for Link EX-1: Point of Interest: Meetinghouse Brook

Inflow Area = 95,135 sf, 59.75% Impervious, Inflow Depth = 2.02" for 2-YR event
Inflow = 3.89 cfs @ 12.14 hrs, Volume= 15,985 cf
Primary = 3.89 cfs @ 12.14 hrs, Volume= 15,985 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.02 hrs

Link EX-1: Point of Interest: Meetinghouse Brook

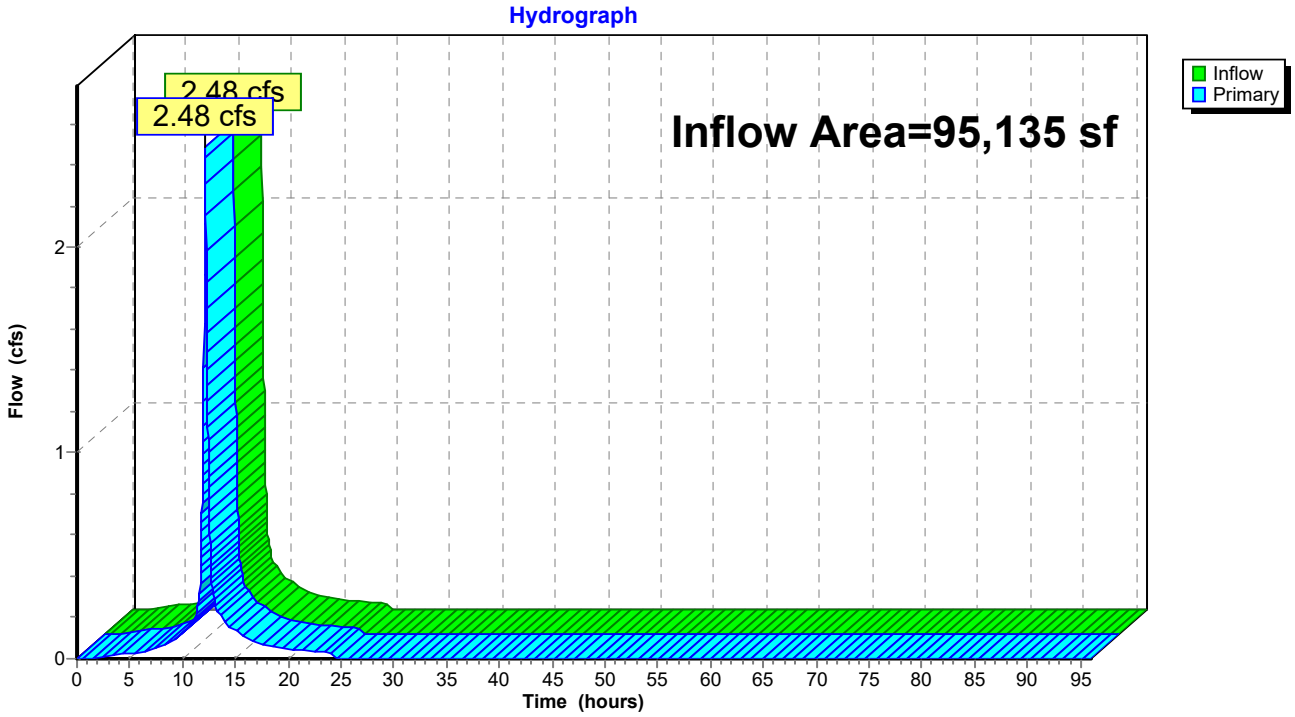


Summary for Link PR-1: Point of Interest: Meetinghouse Brook

Inflow Area = 95,135 sf, 65.56% Impervious, Inflow Depth = 1.30" for 2-YR event
Inflow = 2.48 cfs @ 12.14 hrs, Volume= 10,296 cf
Primary = 2.48 cfs @ 12.14 hrs, Volume= 10,296 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.02 hrs

Link PR-1: Point of Interest: Meetinghouse Brook



APPENDIX C-3
10-YEAR STORM EVENT HYDROGRAPHS

Summary for Subcatchment E-1: Existing Drainage Area to US Route 5

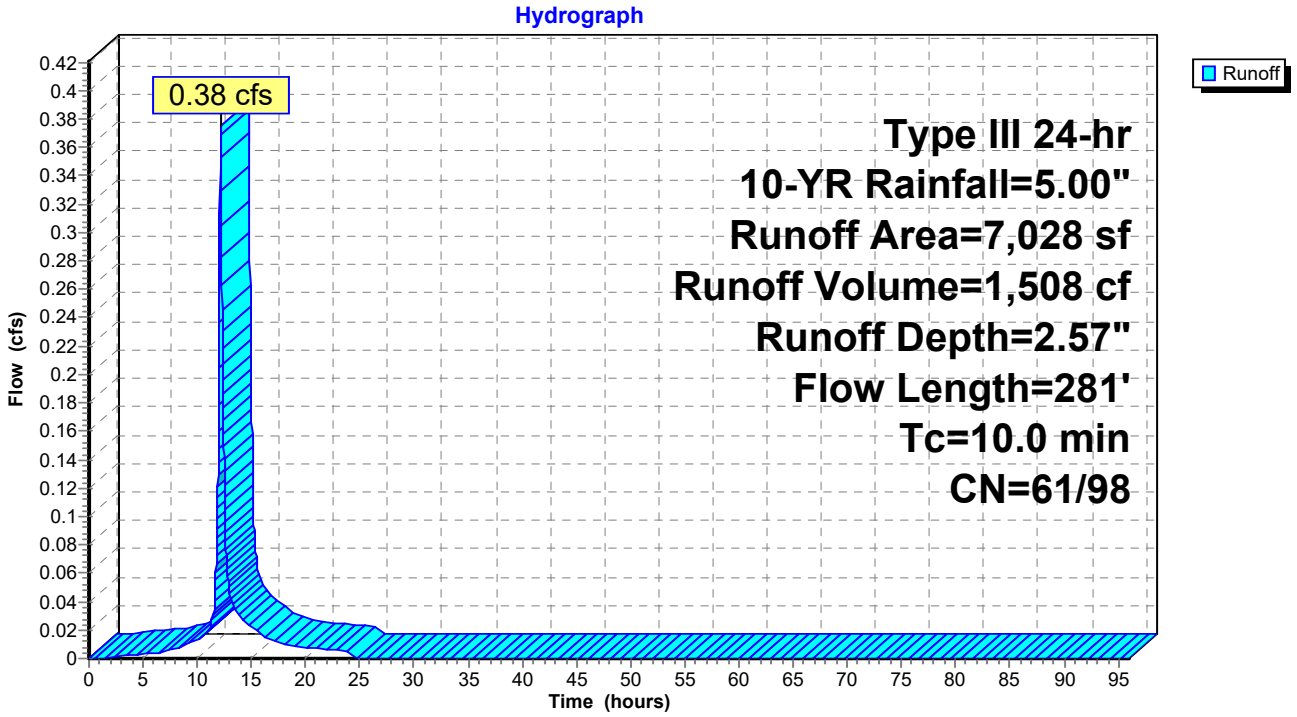
Runoff = 0.38 cfs @ 12.14 hrs, Volume= 1,508 cf, Depth= 2.57"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=5.00"

	Area (sf)	CN	Description
*	2,495	98	Impervious Coverage
	4,533	61	>75% Grass cover, Good, HSG B
	7,028	74	Weighted Average
	4,533	61	64.50% Pervious Area
	2,495	98	35.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	25	0.0500	0.09		**Sheet Flow, Segment 1-2** Woods: Light underbrush n= 0.400 P2= 3.34"
0.2	21	0.0857	1.46		**Shallow Concentrated Flow, Segment 2-3** Woodland Kv= 5.0 fps
0.3	47	0.3670	3.03		**Shallow Concentrated Flow, Segement 3-4** Woodland Kv= 5.0 fps
1.2	164	0.0122	2.24		**Shallow Concentrated Flow, Segment 4-5** Paved Kv= 20.3 fps
0.1	24	0.0208	2.93		**Shallow Concentrated Flow, Segment 5-6** Paved Kv= 20.3 fps
6.6	281	Total, Increased to minimum Tc = 10.0 min			

Subcatchment E-1: Existing Drainage Area to US Route 5



Summary for Subcatchment E-2: Existing Drainage Area to Meetinghouse Brook

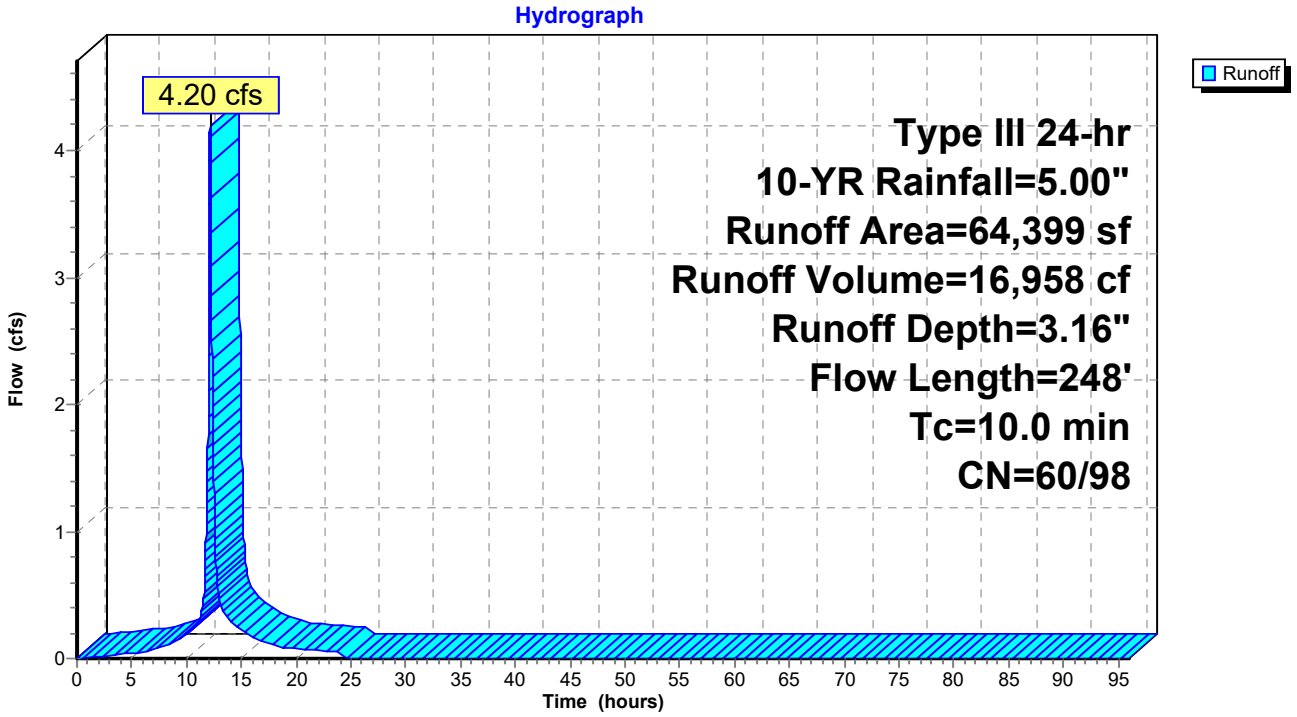
Runoff = 4.20 cfs @ 12.14 hrs, Volume= 16,958 cf, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=5.00"

	Area (sf)	CN	Description
*	0	85	Gravel
	6,962	55	Woods, Good, HSG B
	1,998	70	Woods, Good, HSG C
	20,861	61	>75% Grass cover, Good, HSG B
	0	74	>75% Grass cover, Good, HSG C
*	34,578	98	Impervious Area
	64,399	80	Weighted Average
	29,821	60	46.31% Pervious Area
	34,578	98	53.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	12	0.3300	0.35		**Sheet Flow, Segment 1-2** Grass: Short n= 0.150 P2= 3.34"
1.1	134	0.0170	2.10		**Shallow Concentrated Flow, Segment 2-3** Unpaved Kv= 16.1 fps
0.4	64	0.0200	2.87		**Shallow Concentrated Flow, Segement 3-4** Paved Kv= 20.3 fps
0.3	18	0.0350	0.94		**Shallow Concentrated Flow, Segment 4-5** Woodland Kv= 5.0 fps
0.1	20	0.3300	2.87		**Shallow Concentrated Flow, Segment 5-6** Woodland Kv= 5.0 fps
2.5	248	Total, Increased to minimum Tc = 10.0 min			

Subcatchment E-2: Existing Drainage Area to Meetinghouse Brook



Summary for Subcatchment E-3: Existing Drainage Area to Sonic Development

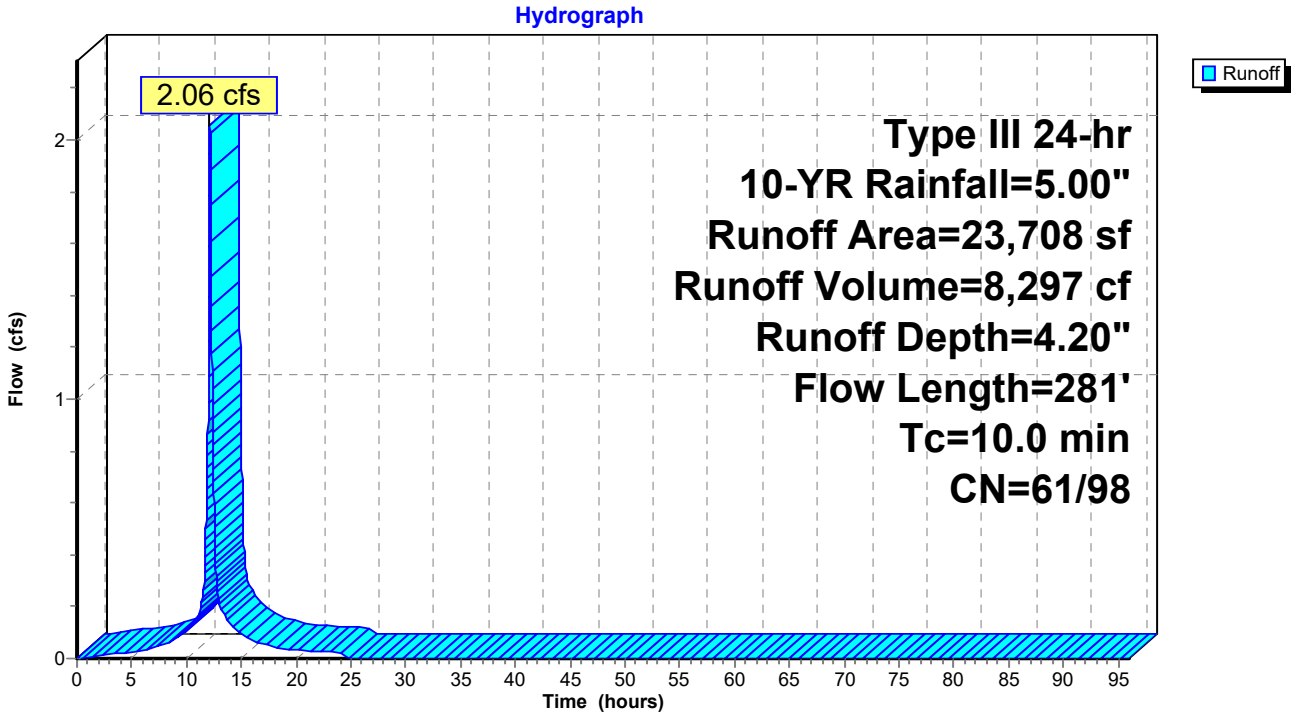
Runoff = 2.06 cfs @ 12.13 hrs, Volume= 8,297 cf, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=5.00"

	Area (sf)	CN	Description
*	19,773	98	Impervious Coverage
*	0	85	Gravel
	0	98	Roofs, HSG A
	80	55	Woods, Good, HSG B
	3,855	61	>75% Grass cover, Good, HSG B
	23,708	92	Weighted Average
	3,935	61	16.60% Pervious Area
	19,773	98	83.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	25	0.0500	0.09		**Sheet Flow, Segment 1-2** Woods: Light underbrush n= 0.400 P2= 3.34"
0.2	21	0.0857	1.46		**Shallow Concentrated Flow, Segment 2-3** Woodland Kv= 5.0 fps
0.3	47	0.3670	3.03		**Shallow Concentrated Flow, Segement 3-4** Woodland Kv= 5.0 fps
1.2	164	0.0122	2.24		**Shallow Concentrated Flow, Segment 4-5** Paved Kv= 20.3 fps
0.1	24	0.0208	2.93		**Shallow Concentrated Flow, Segment 5-6** Paved Kv= 20.3 fps
6.6	281	Total, Increased to minimum Tc = 10.0 min			

Subcatchment E-3: Existing Drainage Area to Sonic Development



Summary for Subcatchment P-2A: Proposed Drainage Area to Infiltration Basin B-1

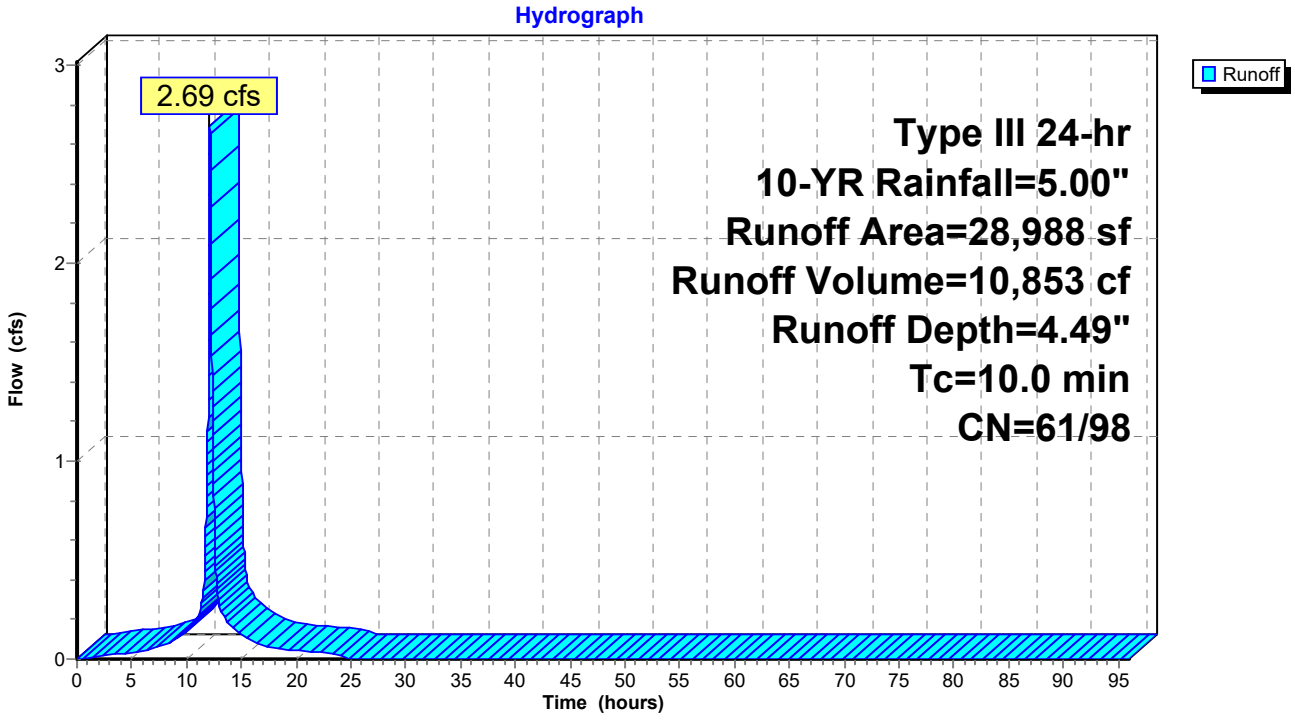
Runoff = 2.69 cfs @ 12.13 hrs, Volume= 10,853 cf, Depth= 4.49"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=5.00"

	Area (sf)	CN	Description
*	12,123	98	Roofs
*	14,555	98	Impervious Area
	2,310	61	>75% Grass cover, Good, HSG B
	28,988	95	Weighted Average
	2,310	61	7.97% Pervious Area
	26,678	98	92.03% Impervious Area

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

Subcatchment P-2A: Proposed Drainage Area to Infiltration Basin B-1



Summary for Subcatchment P-2B: Proposed Undetained Drainage Area to WQ-1

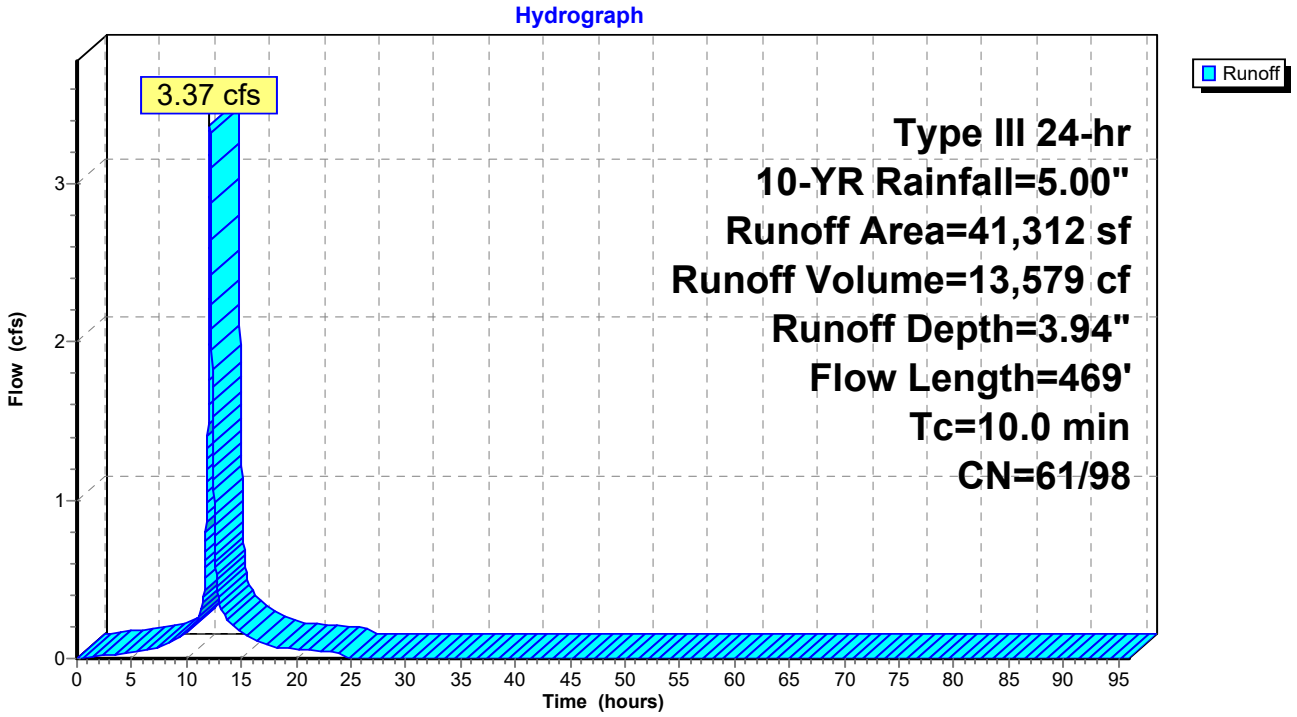
Runoff = 3.37 cfs @ 12.14 hrs, Volume= 13,579 cf, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=5.00"

	Area (sf)	CN	Description
*	0	98	Roofs
*	31,345	98	Impervious Area
	9,967	61	>75% Grass cover, Good, HSG B
	41,312	89	Weighted Average
	9,967	61	24.13% Pervious Area
	31,345	98	75.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0150	1.25		**Sheet Flow, segment 1** Smooth surfaces n= 0.011 P2= 3.34"
1.0	150	0.0150	2.49		**Shallow Concentrated Flow, segment 2** Paved Kv= 20.3 fps
0.4	122	0.0100	4.91	3.86	**Pipe Channel, segment 3** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.2	67	0.0100	5.70	7.00	**Pipe Channel, segment 4** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
0.0	30	0.0500	14.40	25.45	**Pipe Channel, segment 5** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
2.9	469	Total, Increased to minimum Tc = 10.0 min			

Subcatchment P-2B: Proposed Undetained Drainage Area to WQ-1



Summary for Subcatchment P-2C: Proposed Undetained Drainage Area to Meetinghouse Brook

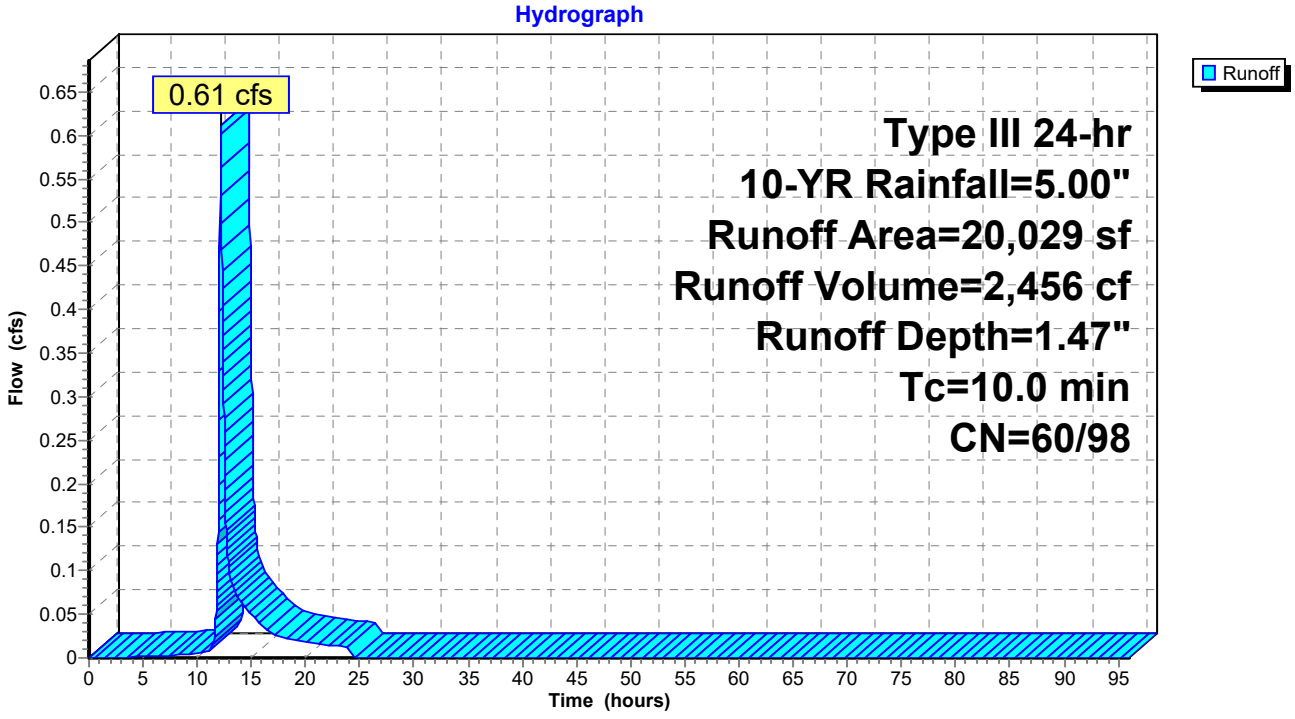
Runoff = 0.61 cfs @ 12.15 hrs, Volume= 2,456 cf, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=5.00"

	Area (sf)	CN	Description
	6,854	55	Woods, Good, HSG B
	1,998	70	Woods, Good, HSG C
	10,190	61	>75% Grass cover, Good, HSG B
*	0	98	Roofs
*	987	98	Impervious
	20,029	62	Weighted Average
	19,042	60	95.07% Pervious Area
	987	98	4.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7					**Direct Entry,**
5.7	0	Total, Increased to minimum Tc = 10.0 min			

Subcatchment P-2C: Proposed Undetained Drainage Area to Meetinghouse Brook



Summary for Subcatchment P-3: Proposed Drainage Are to Sonic Development

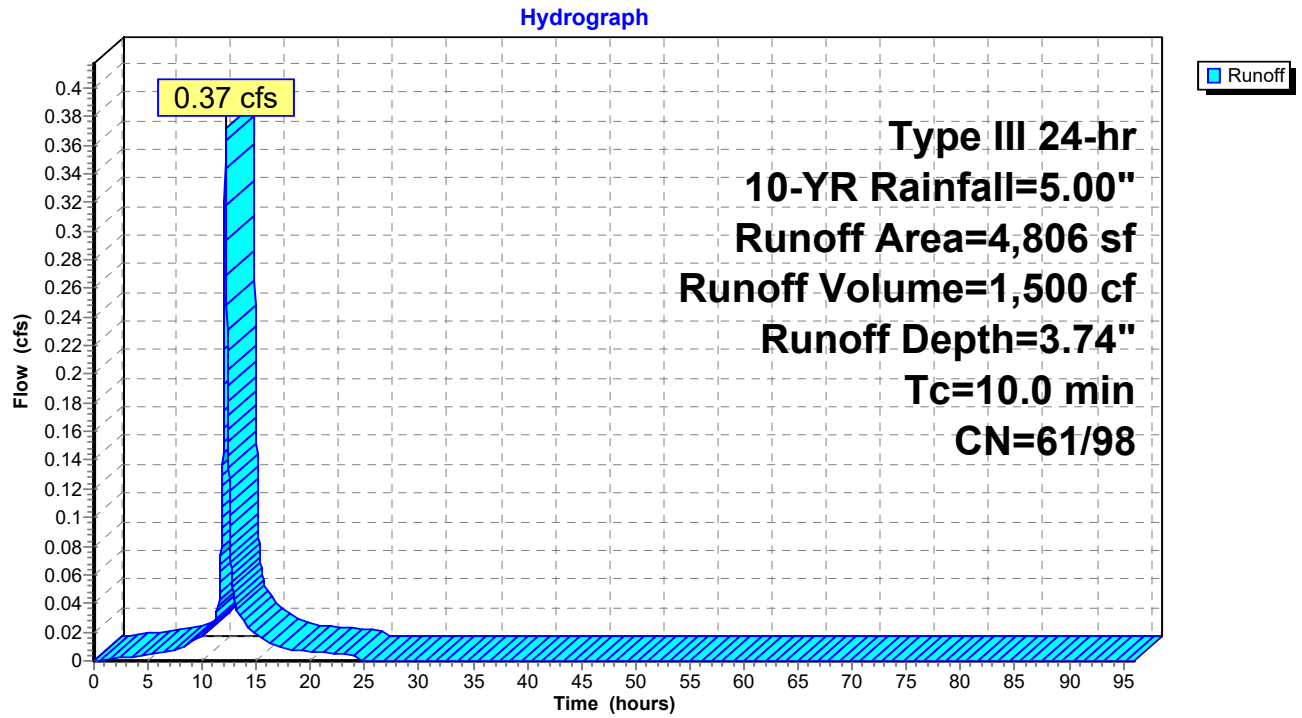
Runoff = 0.37 cfs @ 12.14 hrs, Volume= 1,500 cf, Depth= 3.74"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=5.00"

	Area (sf)	CN	Description
*	3,363	98	Impervious Coverage,
	1,443	61	>75% Grass cover, Good, HSG B
	0	98	Roofs, HSG A
	4,806	87	Weighted Average
	1,443	61	30.02% Pervious Area
	3,363	98	69.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7					**Direct Entry,**
5.7	0	Total, Increased to minimum Tc = 10.0 min			

Subcatchment P-3: Proposed Drainage Are to Sonic Development



Summary for Pond 1P: Infiltration Basin

Inflow Area = 28,988 sf, 92.03% Impervious, Inflow Depth = 4.49" for 10-YR event
Inflow = 2.69 cfs @ 12.13 hrs, Volume= 10,853 cf
Outflow = 1.17 cfs @ 12.39 hrs, Volume= 10,853 cf, Atten= 56%, Lag= 15.2 min
Discarded = 0.50 cfs @ 12.39 hrs, Volume= 9,763 cf
Primary = 0.68 cfs @ 12.39 hrs, Volume= 1,090 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 83.77' @ 12.39 hrs Surf.Area= 1,162 sf Storage= 2,887 cf

Plug-Flow detention time= 40.2 min calculated for 10,851 cf (100% of inflow)
Center-of-Mass det. time= 40.2 min (794.9 - 754.7)

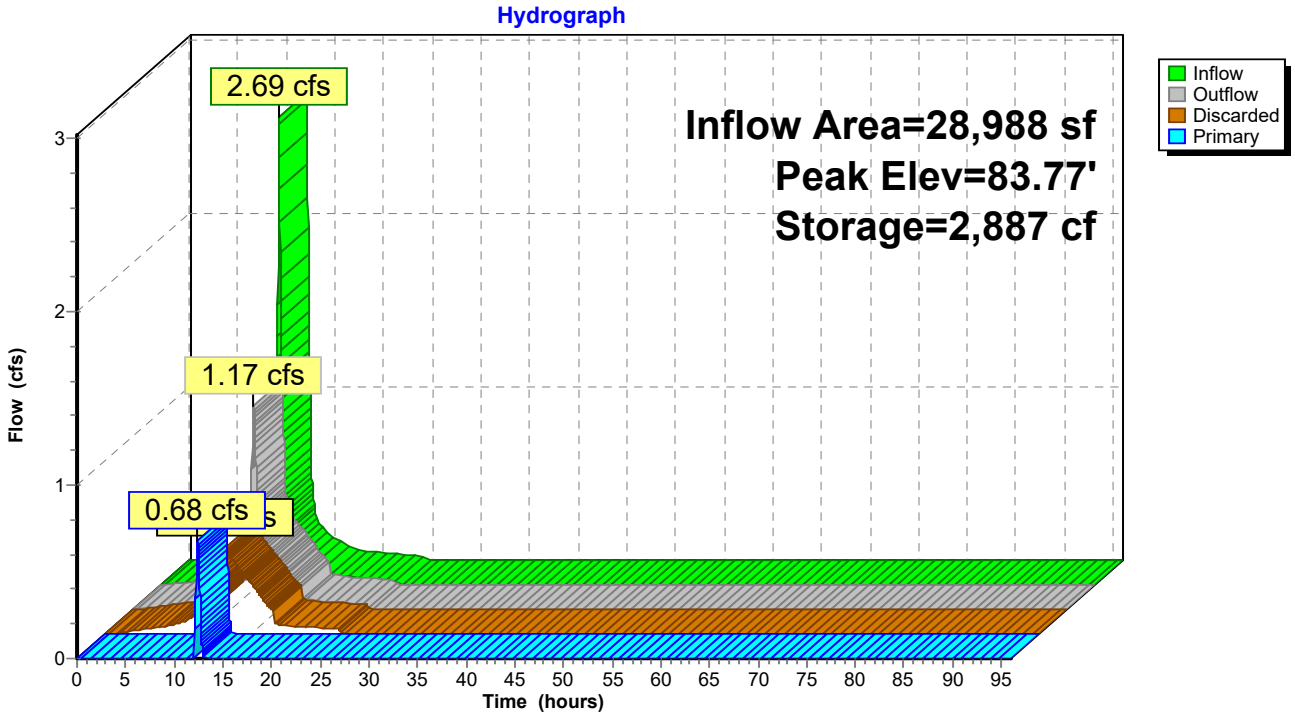
Volume	Invert	Avail.Storage	Storage Description
#1	80.50'	2,011 cf	**48.0" Round Pipe Storage** x 2 Inside #2 L= 80.0' 2,545 cf Overall - 3.0" Wall Thickness = 2,011 cf
#2	79.50'	2,003 cf	**168.0" W x 78.0" H Box Stone Storage** L= 83.0' 7,553 cf Overall - 2,545 cf Embedded = 5,008 cf x 40.0% Voids
		4,014 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	80.50'	**15.0" Round Culvert** L= 99.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 80.50' / 79.51' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Discarded	79.50'	**5.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 78.00' Phase-In= 0.01'
#3	Device 1	84.50'	**6.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 1	83.00'	**6.0" Vert. Slot** C= 0.600

Discarded OutFlow Max=0.50 cfs @ 12.39 hrs HW=83.77' (Free Discharge)
└**2=Exfiltration** (Controls 0.50 cfs)

Primary OutFlow Max=0.68 cfs @ 12.39 hrs HW=83.77' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.68 cfs of 9.17 cfs potential flow)
  ├**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**4=Slot** (Orifice Controls 0.68 cfs @ 3.46 fps)

Pond 1P: Infiltration Basin

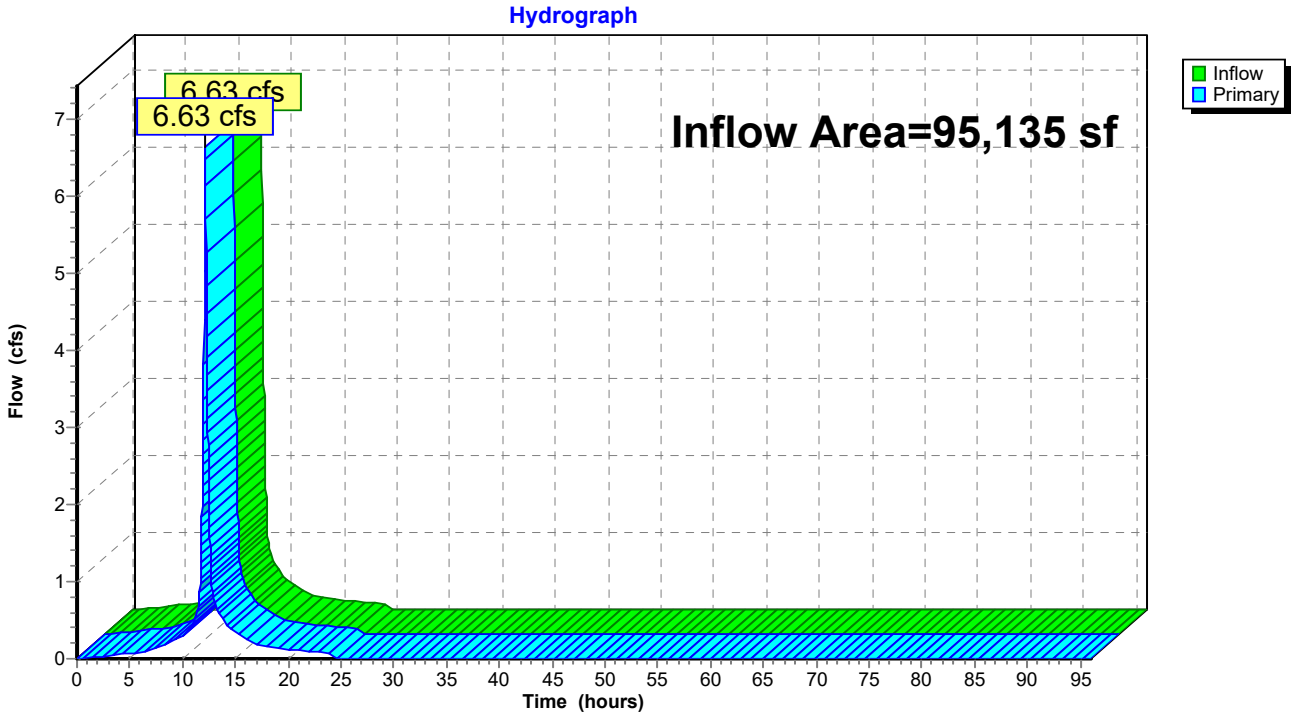


Summary for Link EX-1: Point of Interest: Meetinghouse Brook

Inflow Area = 95,135 sf, 59.75% Impervious, Inflow Depth = 3.38" for 10-YR event
Inflow = 6.63 cfs @ 12.14 hrs, Volume= 26,763 cf
Primary = 6.63 cfs @ 12.14 hrs, Volume= 26,763 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.02 hrs

Link EX-1: Point of Interest: Meetinghouse Brook

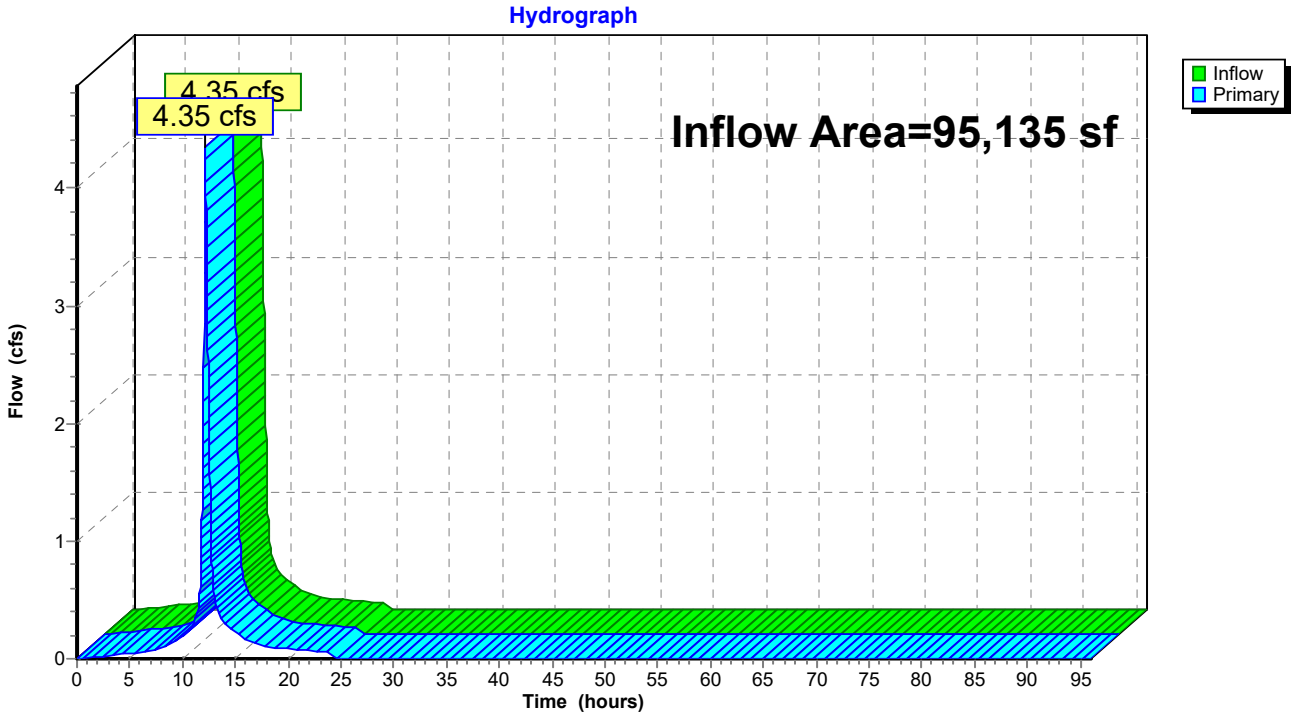


Summary for Link PR-1: Point of Interest: Meetinghouse Brook

Inflow Area = 95,135 sf, 65.56% Impervious, Inflow Depth = 2.35" for 10-YR event
Inflow = 4.35 cfs @ 12.14 hrs, Volume= 18,625 cf
Primary = 4.35 cfs @ 12.14 hrs, Volume= 18,625 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.02 hrs

Link PR-1: Point of Interest: Meetinghouse Brook



APPENDIX C-4
25-YEAR STORM EVENT HYDROGRAPHS

Summary for Subcatchment E-1: Existing Drainage Area to US Route 5

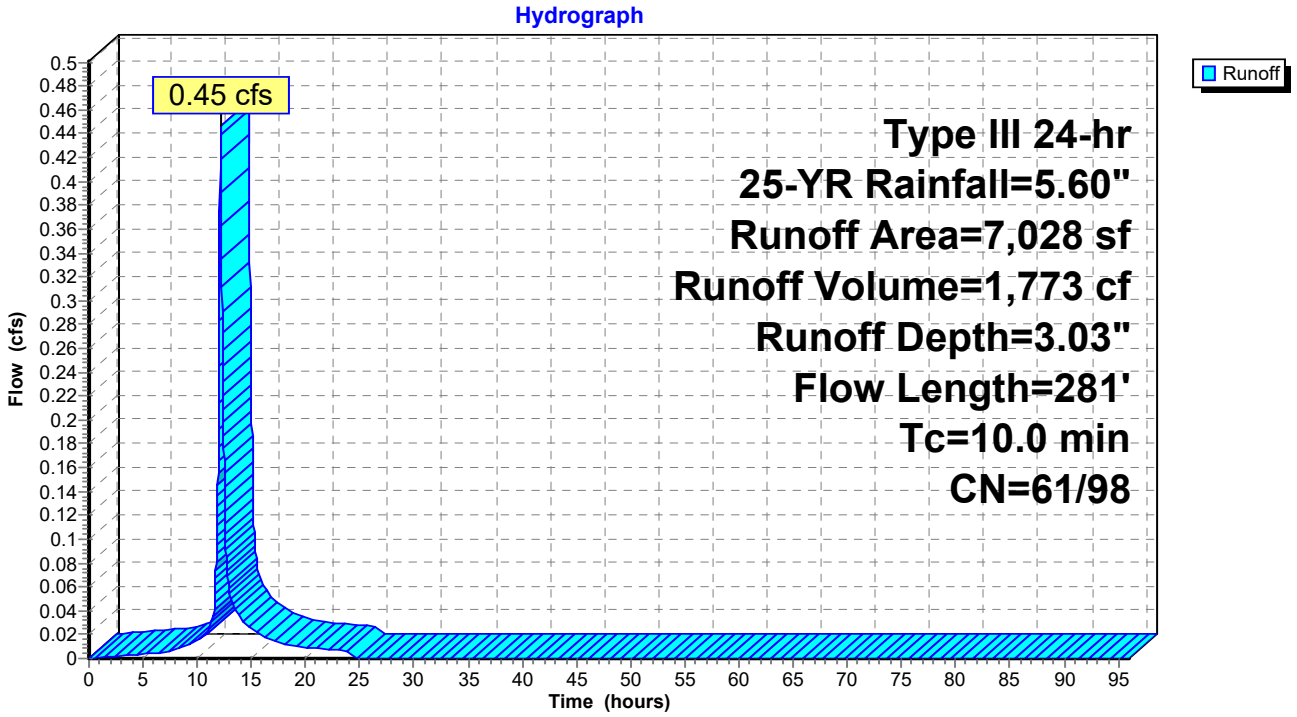
Runoff = 0.45 cfs @ 12.14 hrs, Volume= 1,773 cf, Depth= 3.03"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.60"

	Area (sf)	CN	Description
*	2,495	98	Impervious Coverage
	4,533	61	>75% Grass cover, Good, HSG B
	7,028	74	Weighted Average
	4,533	61	64.50% Pervious Area
	2,495	98	35.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	25	0.0500	0.09		**Sheet Flow, Segment 1-2** Woods: Light underbrush n= 0.400 P2= 3.34"
0.2	21	0.0857	1.46		**Shallow Concentrated Flow, Segment 2-3** Woodland Kv= 5.0 fps
0.3	47	0.3670	3.03		**Shallow Concentrated Flow, Segement 3-4** Woodland Kv= 5.0 fps
1.2	164	0.0122	2.24		**Shallow Concentrated Flow, Segment 4-5** Paved Kv= 20.3 fps
0.1	24	0.0208	2.93		**Shallow Concentrated Flow, Segment 5-6** Paved Kv= 20.3 fps
6.6	281	Total, Increased to minimum Tc = 10.0 min			

Subcatchment E-1: Existing Drainage Area to US Route 5



Summary for Subcatchment E-2: Existing Drainage Area to Meetinghouse Brook

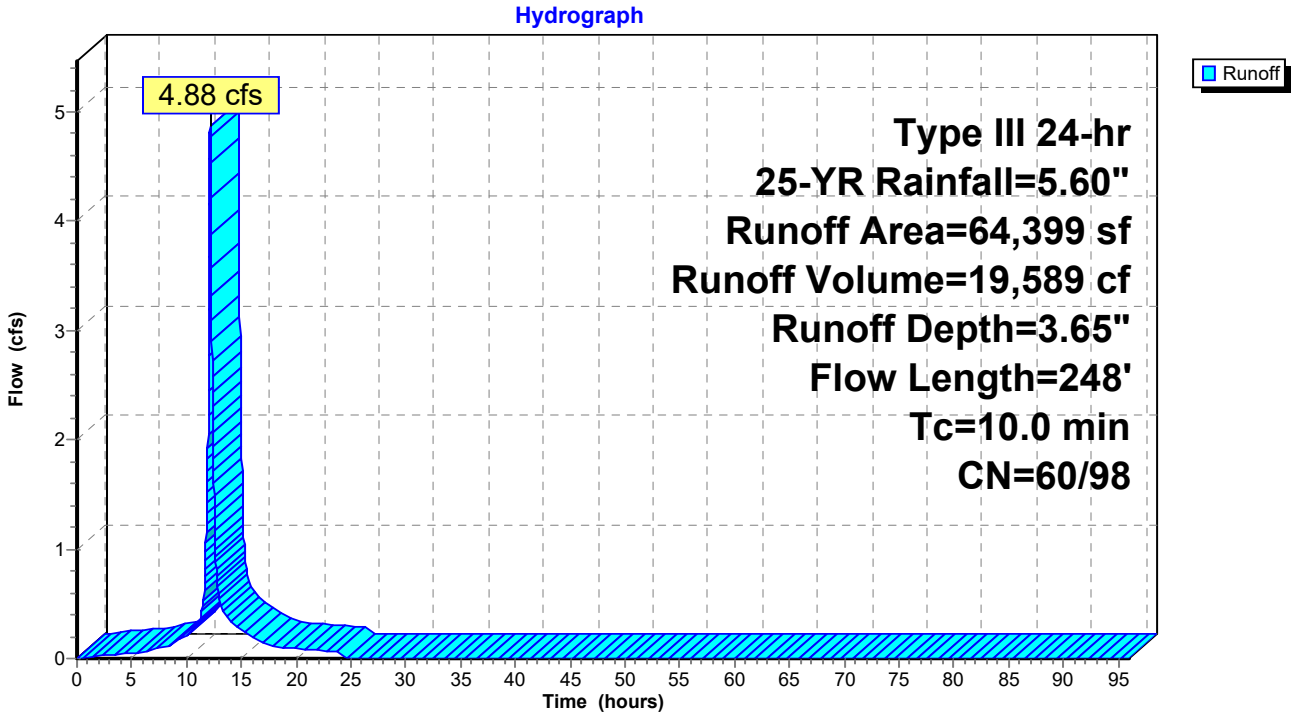
Runoff = 4.88 cfs @ 12.14 hrs, Volume= 19,589 cf, Depth= 3.65"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.60"

	Area (sf)	CN	Description
*	0	85	Gravel
	6,962	55	Woods, Good, HSG B
	1,998	70	Woods, Good, HSG C
	20,861	61	>75% Grass cover, Good, HSG B
	0	74	>75% Grass cover, Good, HSG C
*	34,578	98	Impervious Area
	64,399	80	Weighted Average
	29,821	60	46.31% Pervious Area
	34,578	98	53.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	12	0.3300	0.35		**Sheet Flow, Segment 1-2** Grass: Short n= 0.150 P2= 3.34"
1.1	134	0.0170	2.10		**Shallow Concentrated Flow, Segment 2-3** Unpaved Kv= 16.1 fps
0.4	64	0.0200	2.87		**Shallow Concentrated Flow, Segement 3-4** Paved Kv= 20.3 fps
0.3	18	0.0350	0.94		**Shallow Concentrated Flow, Segment 4-5** Woodland Kv= 5.0 fps
0.1	20	0.3300	2.87		**Shallow Concentrated Flow, Segment 5-6** Woodland Kv= 5.0 fps
2.5	248	Total, Increased to minimum Tc = 10.0 min			

Subcatchment E-2: Existing Drainage Area to Meetinghouse Brook



Summary for Subcatchment E-3: Existing Drainage Area to Sonic Development

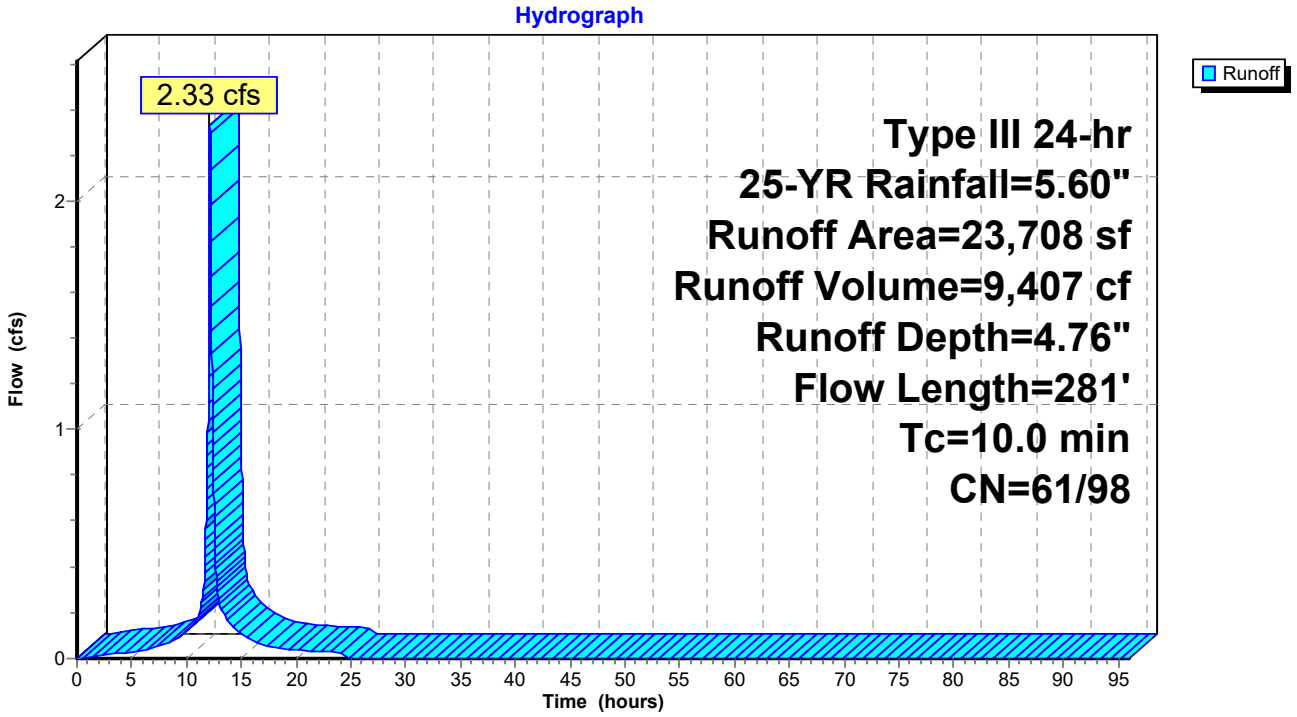
Runoff = 2.33 cfs @ 12.13 hrs, Volume= 9,407 cf, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.60"

	Area (sf)	CN	Description
*	19,773	98	Impervious Coverage
*	0	85	Gravel
	0	98	Roofs, HSG A
	80	55	Woods, Good, HSG B
	3,855	61	>75% Grass cover, Good, HSG B
	23,708	92	Weighted Average
	3,935	61	16.60% Pervious Area
	19,773	98	83.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	25	0.0500	0.09		**Sheet Flow, Segment 1-2** Woods: Light underbrush n= 0.400 P2= 3.34"
0.2	21	0.0857	1.46		**Shallow Concentrated Flow, Segment 2-3** Woodland Kv= 5.0 fps
0.3	47	0.3670	3.03		**Shallow Concentrated Flow, Segement 3-4** Woodland Kv= 5.0 fps
1.2	164	0.0122	2.24		**Shallow Concentrated Flow, Segment 4-5** Paved Kv= 20.3 fps
0.1	24	0.0208	2.93		**Shallow Concentrated Flow, Segment 5-6** Paved Kv= 20.3 fps
6.6	281	Total, Increased to minimum Tc = 10.0 min			

Subcatchment E-3: Existing Drainage Area to Sonic Development



Summary for Subcatchment P-2A: Proposed Drainage Area to Infiltration Basin B-1

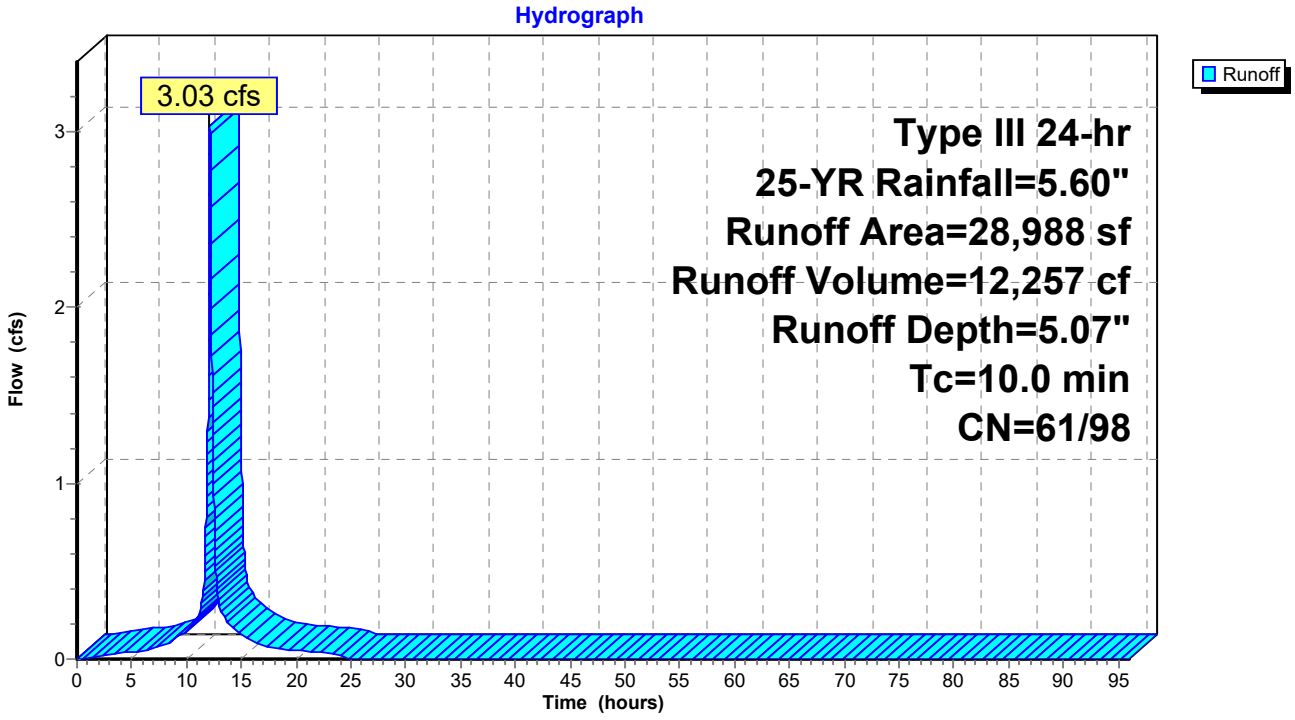
Runoff = 3.03 cfs @ 12.13 hrs, Volume= 12,257 cf, Depth= 5.07"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.60"

	Area (sf)	CN	Description
*	12,123	98	Roofs
*	14,555	98	Impervious Area
	2,310	61	>75% Grass cover, Good, HSG B
	28,988	95	Weighted Average
	2,310	61	7.97% Pervious Area
	26,678	98	92.03% Impervious Area

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

Subcatchment P-2A: Proposed Drainage Area to Infiltration Basin B-1



Summary for Subcatchment P-2B: Proposed Undetained Drainage Area to WQ-1

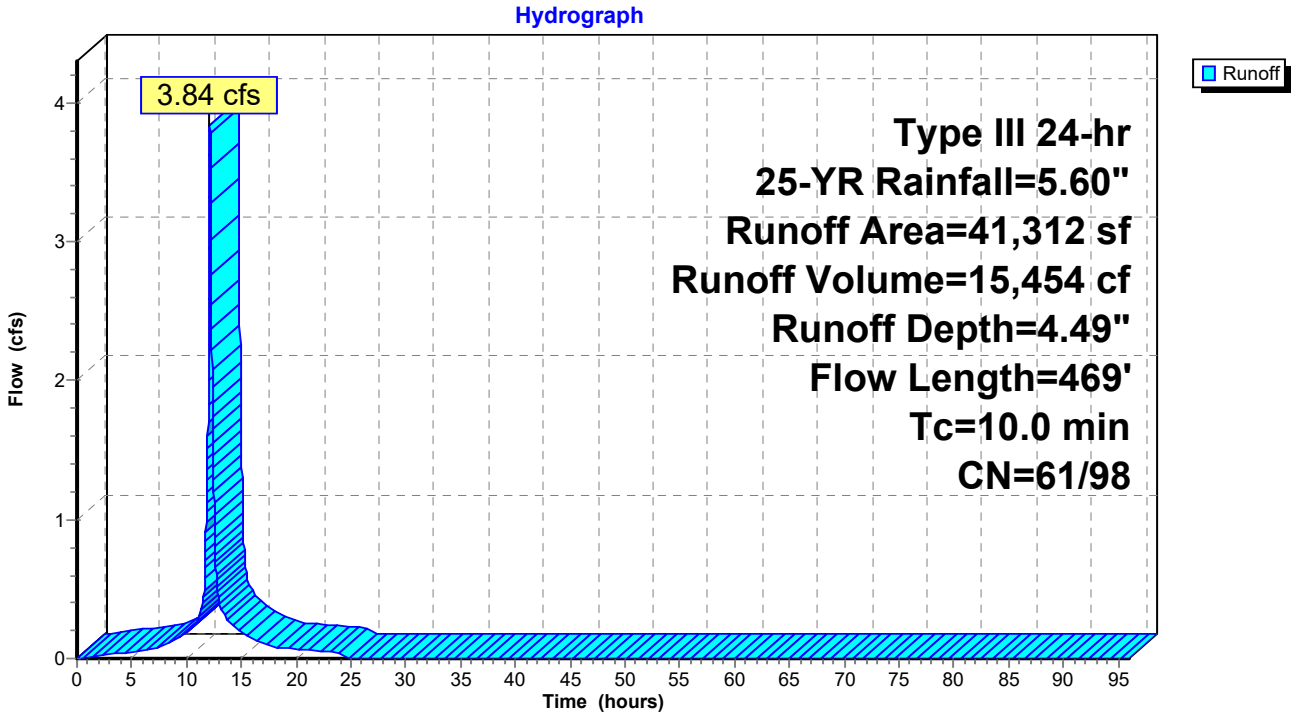
Runoff = 3.84 cfs @ 12.14 hrs, Volume= 15,454 cf, Depth= 4.49"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.60"

	Area (sf)	CN	Description
*	0	98	Roofs
*	31,345	98	Impervious Area
	9,967	61	>75% Grass cover, Good, HSG B
	41,312	89	Weighted Average
	9,967	61	24.13% Pervious Area
	31,345	98	75.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0150	1.25		**Sheet Flow, segment 1** Smooth surfaces n= 0.011 P2= 3.34"
1.0	150	0.0150	2.49		**Shallow Concentrated Flow, segment 2** Paved Kv= 20.3 fps
0.4	122	0.0100	4.91	3.86	**Pipe Channel, segment 3** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.2	67	0.0100	5.70	7.00	**Pipe Channel, segment 4** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
0.0	30	0.0500	14.40	25.45	**Pipe Channel, segment 5** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
2.9	469	Total, Increased to minimum Tc = 10.0 min			

Subcatchment P-2B: Proposed Undetained Drainage Area to WQ-1



Summary for Subcatchment P-2C: Proposed Undetained Drainage Area to Meetinghouse Brook

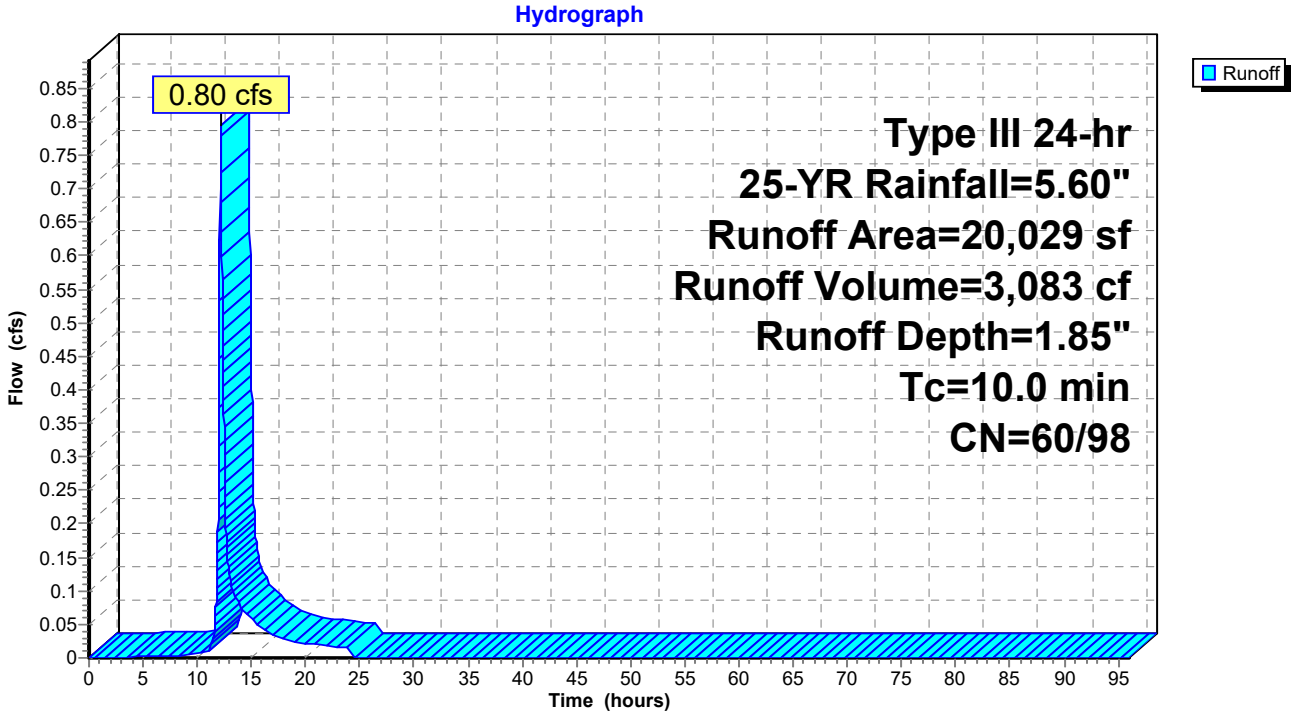
Runoff = 0.80 cfs @ 12.15 hrs, Volume= 3,083 cf, Depth= 1.85"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.60"

	Area (sf)	CN	Description
	6,854	55	Woods, Good, HSG B
	1,998	70	Woods, Good, HSG C
	10,190	61	>75% Grass cover, Good, HSG B
*	0	98	Roofs
*	987	98	Impervious
	20,029	62	Weighted Average
	19,042	60	95.07% Pervious Area
	987	98	4.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7					**Direct Entry,**
5.7	0	Total, Increased to minimum Tc = 10.0 min			

Subcatchment P-2C: Proposed Undetained Drainage Area to Meetinghouse Brook



Summary for Subcatchment P-3: Proposed Drainage Are to Sonic Development

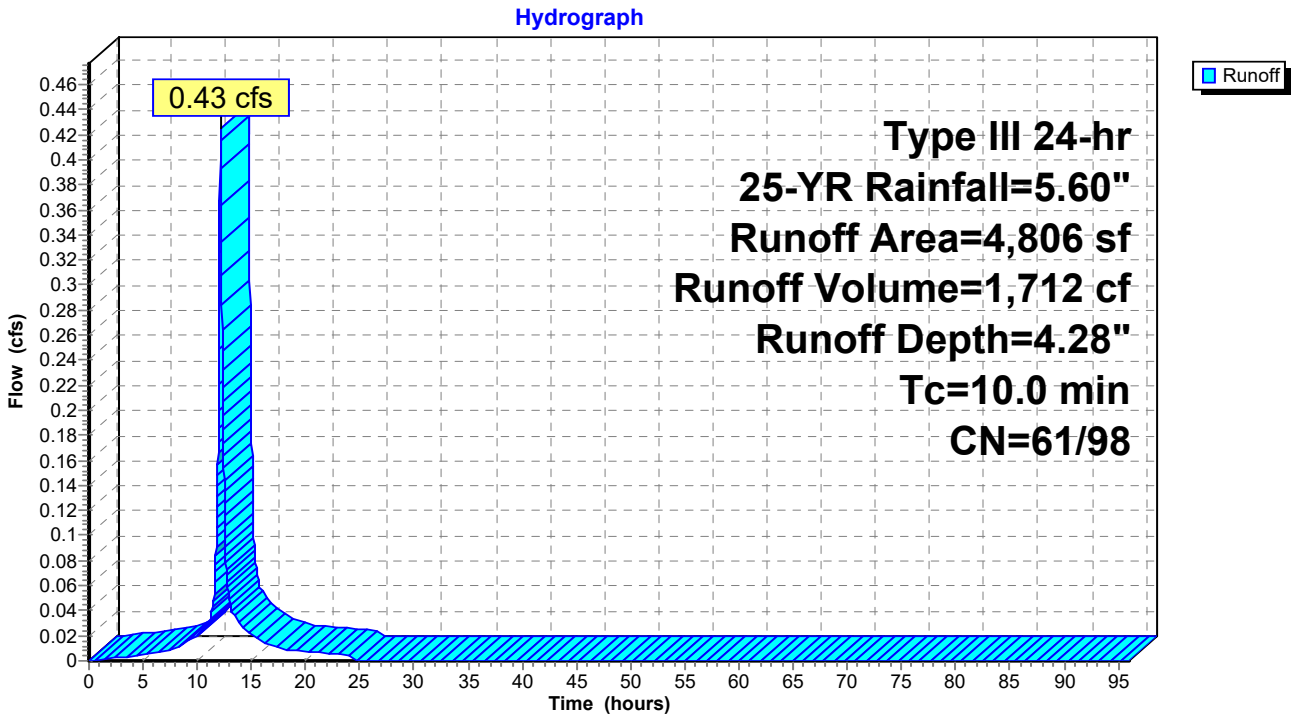
Runoff = 0.43 cfs @ 12.14 hrs, Volume= 1,712 cf, Depth= 4.28"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.60"

	Area (sf)	CN	Description
*	3,363	98	Impervious Coverage,
	1,443	61	>75% Grass cover, Good, HSG B
	0	98	Roofs, HSG A
	4,806	87	Weighted Average
	1,443	61	30.02% Pervious Area
	3,363	98	69.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7					**Direct Entry,**
5.7	0	Total, Increased to minimum Tc = 10.0 min			

Subcatchment P-3: Proposed Drainage Are to Sonic Development



Summary for Pond 1P: Infiltration Basin

Inflow Area = 28,988 sf, 92.03% Impervious, Inflow Depth = 5.07" for 25-YR event
Inflow = 3.03 cfs @ 12.13 hrs, Volume= 12,257 cf
Outflow = 1.43 cfs @ 12.36 hrs, Volume= 12,257 cf, Atten= 53%, Lag= 13.6 min
Discarded = 0.53 cfs @ 12.36 hrs, Volume= 10,579 cf
Primary = 0.90 cfs @ 12.36 hrs, Volume= 1,678 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 84.16' @ 12.36 hrs Surf.Area= 1,162 sf Storage= 3,153 cf

Plug-Flow detention time= 39.7 min calculated for 12,254 cf (100% of inflow)
Center-of-Mass det. time= 39.7 min (792.9 - 753.1)

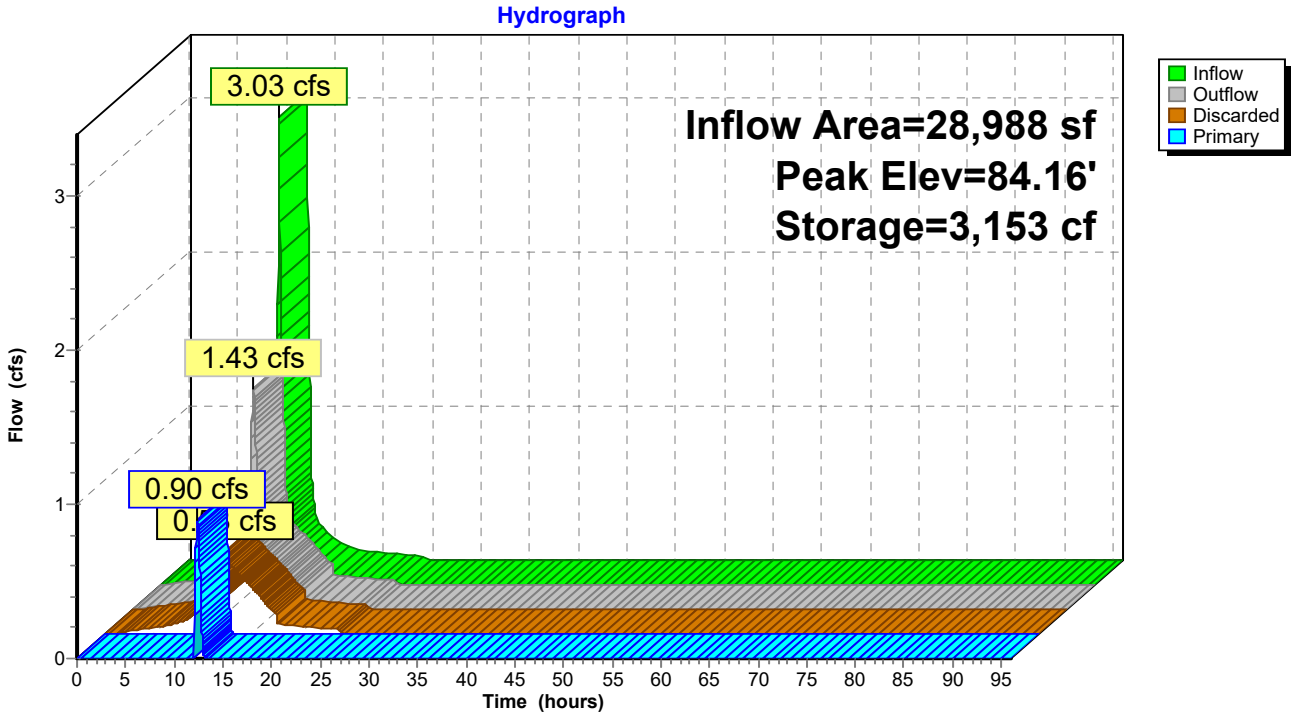
Volume	Invert	Avail.Storage	Storage Description
#1	80.50'	2,011 cf	**48.0" Round Pipe Storage** x 2 Inside #2 L= 80.0' 2,545 cf Overall - 3.0" Wall Thickness = 2,011 cf
#2	79.50'	2,003 cf	**168.0" W x 78.0" H Box Stone Storage** L= 83.0' 7,553 cf Overall - 2,545 cf Embedded = 5,008 cf x 40.0% Voids
		4,014 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	80.50'	**15.0" Round Culvert** L= 99.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 80.50' / 79.51' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Discarded	79.50'	**5.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 78.00' Phase-In= 0.01'
#3	Device 1	84.50'	**6.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 1	83.00'	**6.0" Vert. Slot** C= 0.600

Discarded OutFlow Max=0.53 cfs @ 12.36 hrs HW=84.16' (Free Discharge)
└**2=Exfiltration** (Controls 0.53 cfs)

Primary OutFlow Max=0.90 cfs @ 12.36 hrs HW=84.16' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.90 cfs of 9.75 cfs potential flow)
  ├**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**4=Slot** (Orifice Controls 0.90 cfs @ 4.58 fps)

Pond 1P: Infiltration Basin

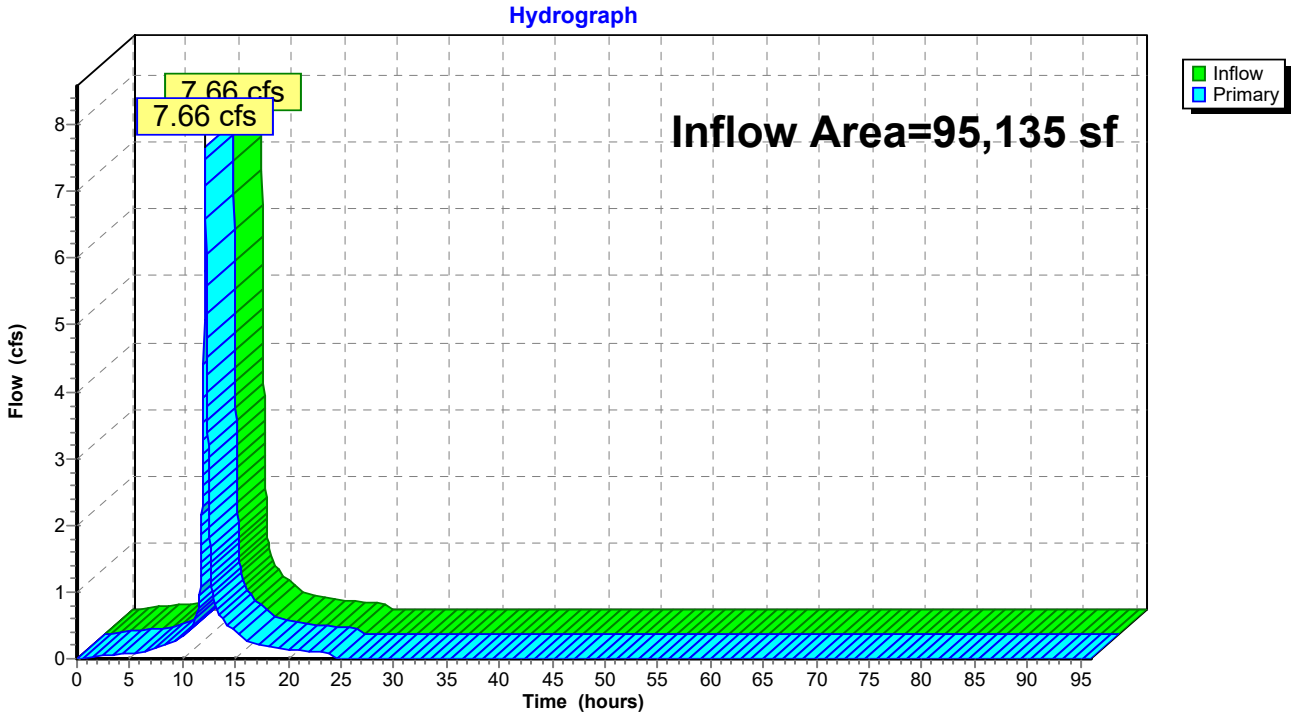


Summary for Link EX-1: Point of Interest: Meetinghouse Brook

Inflow Area = 95,135 sf, 59.75% Impervious, Inflow Depth = 3.88" for 25-YR event
Inflow = 7.66 cfs @ 12.14 hrs, Volume= 30,770 cf
Primary = 7.66 cfs @ 12.14 hrs, Volume= 30,770 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.02 hrs

Link EX-1: Point of Interest: Meetinghouse Brook

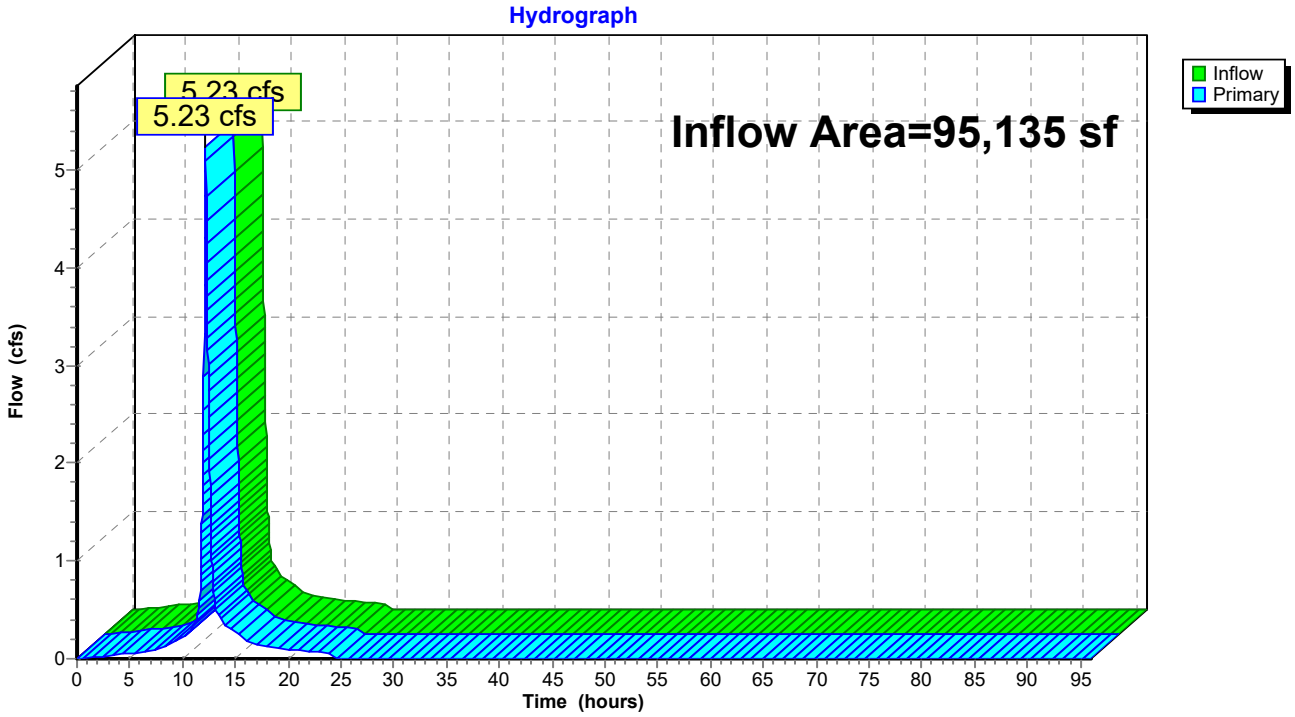


Summary for Link PR-1: Point of Interest: Meetinghouse Brook

Inflow Area = 95,135 sf, 65.56% Impervious, Inflow Depth = 2.77" for 25-YR event
Inflow = 5.23 cfs @ 12.17 hrs, Volume= 21,928 cf
Primary = 5.23 cfs @ 12.17 hrs, Volume= 21,928 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.02 hrs

Link PR-1: Point of Interest: Meetinghouse Brook



APPENDIX C-5
100-YEAR STORM EVENT HYDROGRAPHS

Summary for Subcatchment E-1: Existing Drainage Area to US Route 5

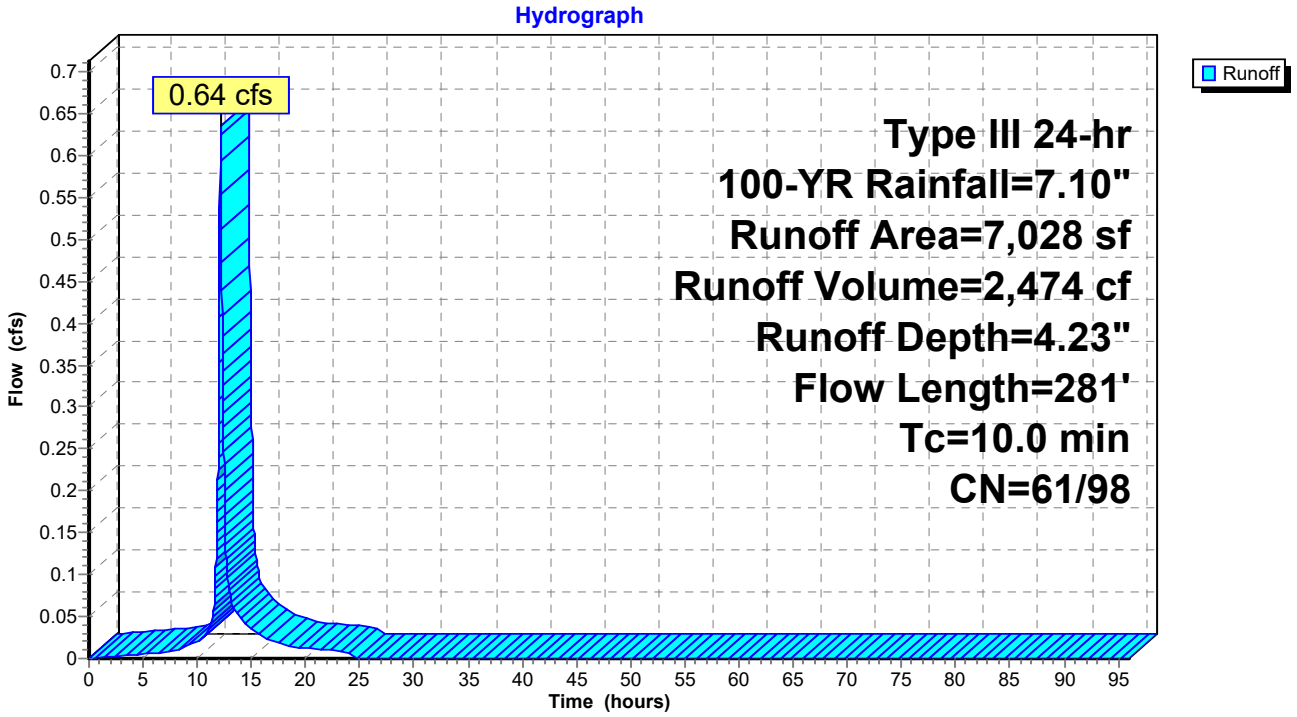
Runoff = 0.64 cfs @ 12.14 hrs, Volume= 2,474 cf, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=7.10"

	Area (sf)	CN	Description
*	2,495	98	Impervious Coverage
	4,533	61	>75% Grass cover, Good, HSG B
	7,028	74	Weighted Average
	4,533	61	64.50% Pervious Area
	2,495	98	35.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	25	0.0500	0.09		**Sheet Flow, Segment 1-2** Woods: Light underbrush n= 0.400 P2= 3.34"
0.2	21	0.0857	1.46		**Shallow Concentrated Flow, Segment 2-3** Woodland Kv= 5.0 fps
0.3	47	0.3670	3.03		**Shallow Concentrated Flow, Segement 3-4** Woodland Kv= 5.0 fps
1.2	164	0.0122	2.24		**Shallow Concentrated Flow, Segment 4-5** Paved Kv= 20.3 fps
0.1	24	0.0208	2.93		**Shallow Concentrated Flow, Segment 5-6** Paved Kv= 20.3 fps
6.6	281	Total, Increased to minimum Tc = 10.0 min			

Subcatchment E-1: Existing Drainage Area to US Route 5



Summary for Subcatchment E-2: Existing Drainage Area to Meetinghouse Brook

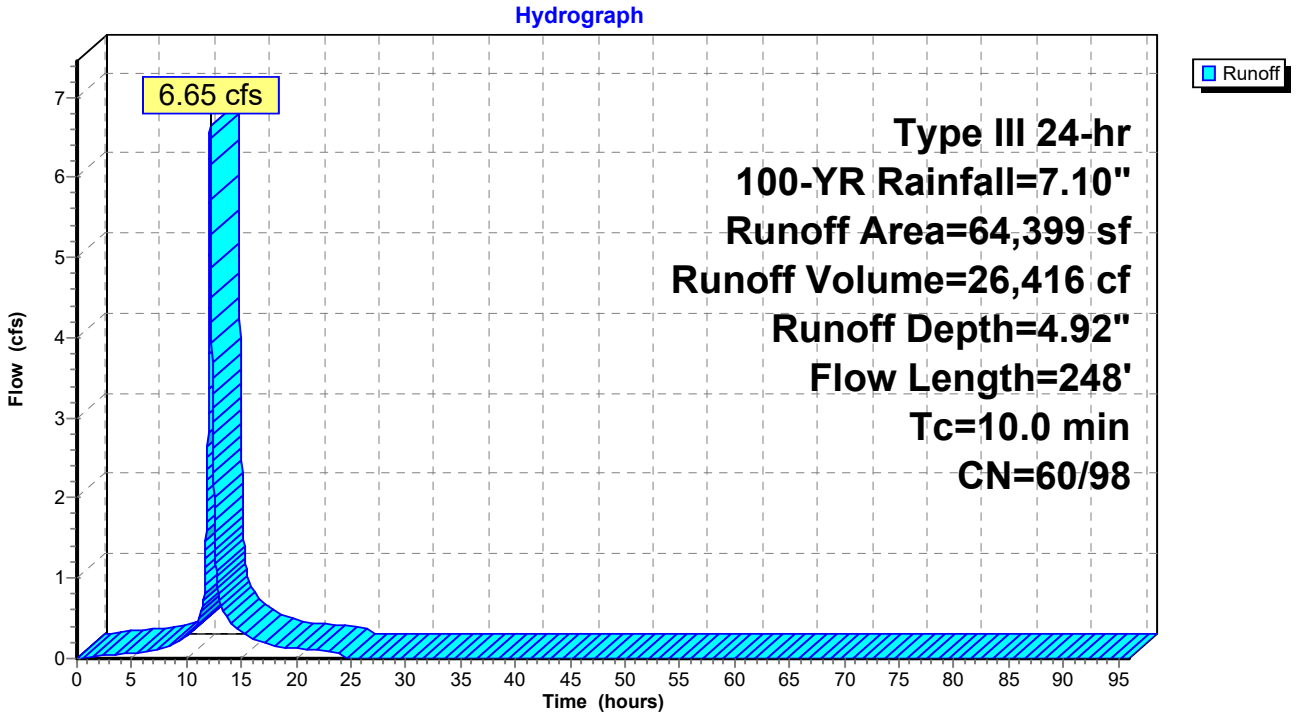
Runoff = 6.65 cfs @ 12.14 hrs, Volume= 26,416 cf, Depth= 4.92"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=7.10"

	Area (sf)	CN	Description
*	0	85	Gravel
	6,962	55	Woods, Good, HSG B
	1,998	70	Woods, Good, HSG C
	20,861	61	>75% Grass cover, Good, HSG B
	0	74	>75% Grass cover, Good, HSG C
*	34,578	98	Impervious Area
	64,399	80	Weighted Average
	29,821	60	46.31% Pervious Area
	34,578	98	53.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	12	0.3300	0.35		**Sheet Flow, Segment 1-2** Grass: Short n= 0.150 P2= 3.34"
1.1	134	0.0170	2.10		**Shallow Concentrated Flow, Segment 2-3** Unpaved Kv= 16.1 fps
0.4	64	0.0200	2.87		**Shallow Concentrated Flow, Segement 3-4** Paved Kv= 20.3 fps
0.3	18	0.0350	0.94		**Shallow Concentrated Flow, Segment 4-5** Woodland Kv= 5.0 fps
0.1	20	0.3300	2.87		**Shallow Concentrated Flow, Segment 5-6** Woodland Kv= 5.0 fps
2.5	248	Total, Increased to minimum Tc = 10.0 min			

Subcatchment E-2: Existing Drainage Area to Meetinghouse Brook



Summary for Subcatchment E-3: Existing Drainage Area to Sonic Development

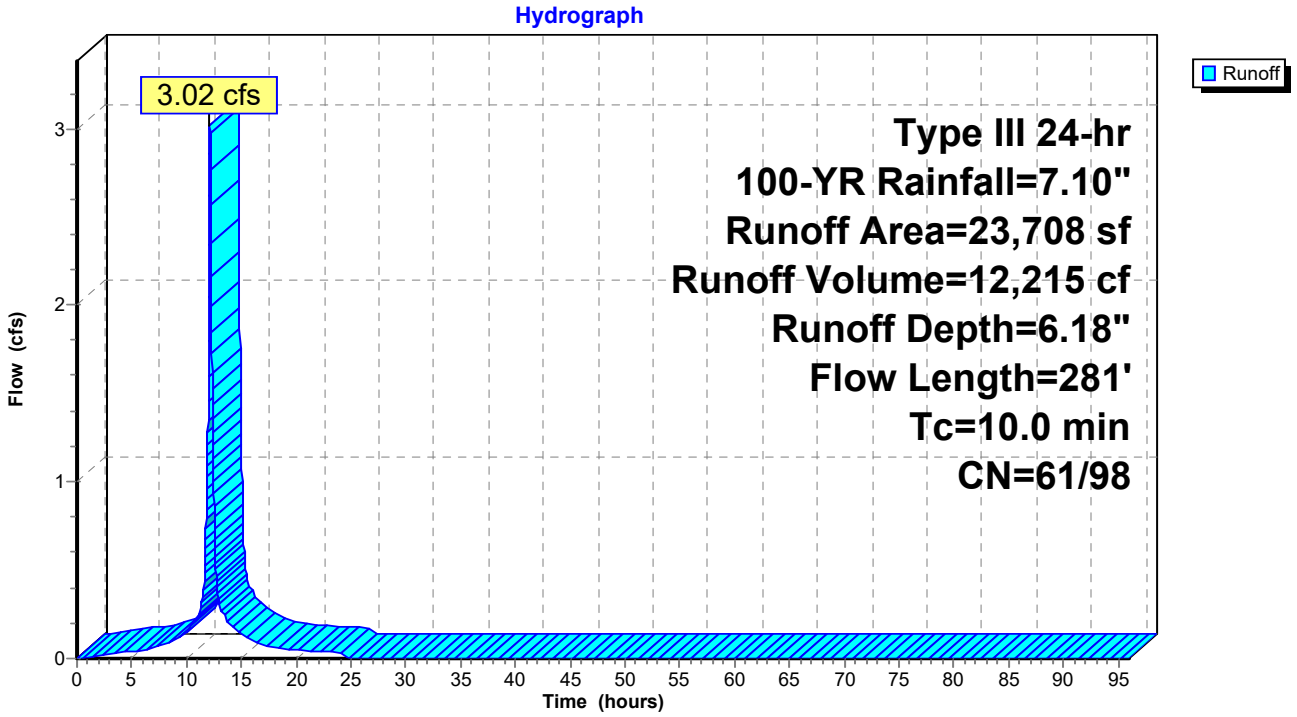
Runoff = 3.02 cfs @ 12.13 hrs, Volume= 12,215 cf, Depth= 6.18"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=7.10"

	Area (sf)	CN	Description
*	19,773	98	Impervious Coverage
*	0	85	Gravel
	0	98	Roofs, HSG A
	80	55	Woods, Good, HSG B
	3,855	61	>75% Grass cover, Good, HSG B
	23,708	92	Weighted Average
	3,935	61	16.60% Pervious Area
	19,773	98	83.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	25	0.0500	0.09		**Sheet Flow, Segment 1-2** Woods: Light underbrush n= 0.400 P2= 3.34"
0.2	21	0.0857	1.46		**Shallow Concentrated Flow, Segment 2-3** Woodland Kv= 5.0 fps
0.3	47	0.3670	3.03		**Shallow Concentrated Flow, Segement 3-4** Woodland Kv= 5.0 fps
1.2	164	0.0122	2.24		**Shallow Concentrated Flow, Segment 4-5** Paved Kv= 20.3 fps
0.1	24	0.0208	2.93		**Shallow Concentrated Flow, Segment 5-6** Paved Kv= 20.3 fps
6.6	281	Total, Increased to minimum Tc = 10.0 min			

Subcatchment E-3: Existing Drainage Area to Sonic Development



Summary for Subcatchment P-2A: Proposed Drainage Area to Infiltration Basin B-1

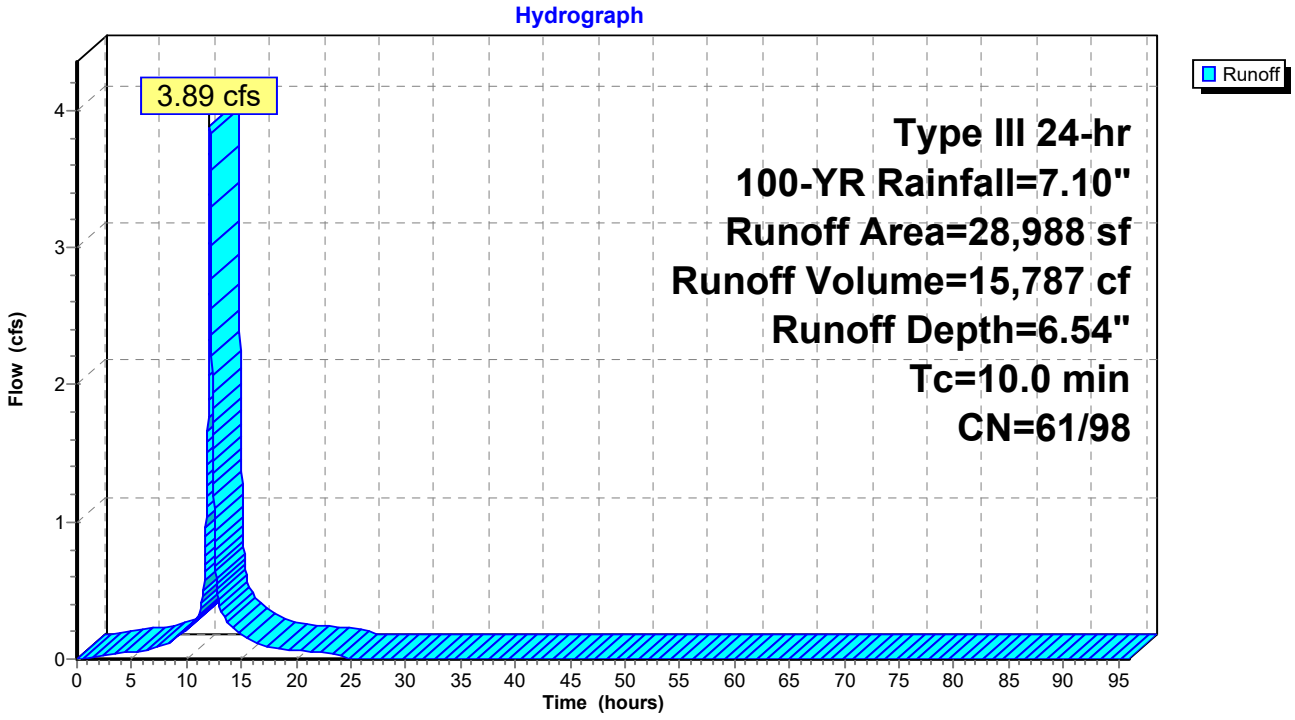
Runoff = 3.89 cfs @ 12.13 hrs, Volume= 15,787 cf, Depth= 6.54"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=7.10"

	Area (sf)	CN	Description
*	12,123	98	Roofs
*	14,555	98	Impervious Area
	2,310	61	>75% Grass cover, Good, HSG B
	28,988	95	Weighted Average
	2,310	61	7.97% Pervious Area
	26,678	98	92.03% Impervious Area

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

Subcatchment P-2A: Proposed Drainage Area to Infiltration Basin B-1



Summary for Subcatchment P-2B: Proposed Undetained Drainage Area to WQ-1

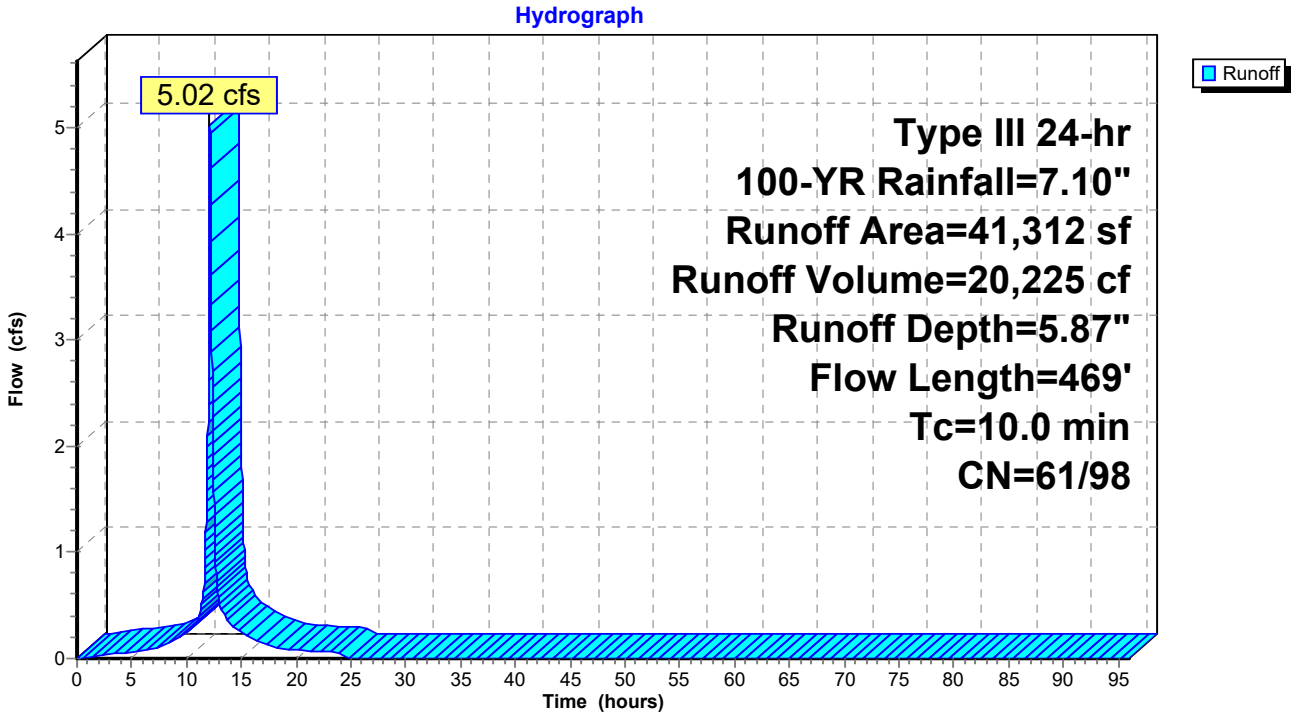
Runoff = 5.02 cfs @ 12.14 hrs, Volume= 20,225 cf, Depth= 5.87"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=7.10"

	Area (sf)	CN	Description
*	0	98	Roofs
*	31,345	98	Impervious Area
	9,967	61	>75% Grass cover, Good, HSG B
	41,312	89	Weighted Average
	9,967	61	24.13% Pervious Area
	31,345	98	75.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0150	1.25		**Sheet Flow, segment 1** Smooth surfaces n= 0.011 P2= 3.34"
1.0	150	0.0150	2.49		**Shallow Concentrated Flow, segment 2** Paved Kv= 20.3 fps
0.4	122	0.0100	4.91	3.86	**Pipe Channel, segment 3** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.2	67	0.0100	5.70	7.00	**Pipe Channel, segment 4** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
0.0	30	0.0500	14.40	25.45	**Pipe Channel, segment 5** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
2.9	469	Total, Increased to minimum Tc = 10.0 min			

Subcatchment P-2B: Proposed Undetained Drainage Area to WQ-1



Summary for Subcatchment P-2C: Proposed Undetained Drainage Area to Meetinghouse Brook

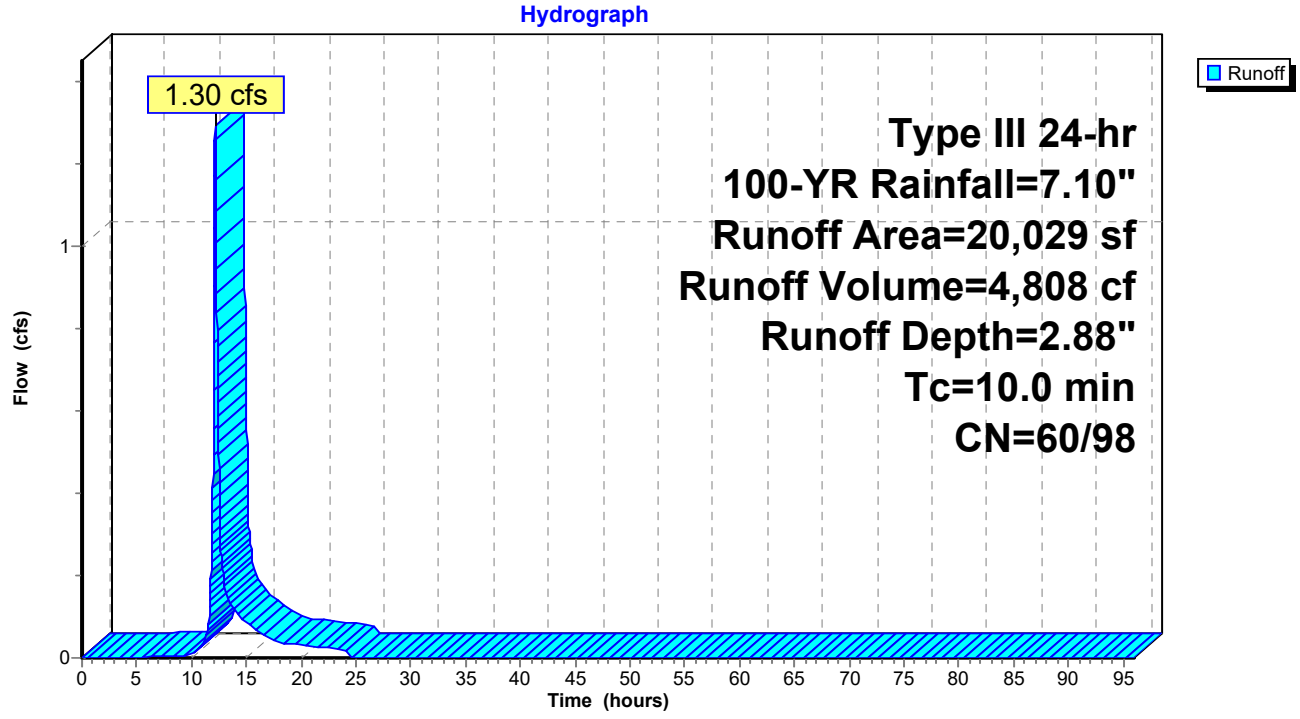
Runoff = 1.30 cfs @ 12.15 hrs, Volume= 4,808 cf, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=7.10"

	Area (sf)	CN	Description
	6,854	55	Woods, Good, HSG B
	1,998	70	Woods, Good, HSG C
	10,190	61	>75% Grass cover, Good, HSG B
*	0	98	Roofs
*	987	98	Impervious
	20,029	62	Weighted Average
	19,042	60	95.07% Pervious Area
	987	98	4.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7					**Direct Entry,**
5.7	0	Total, Increased to minimum Tc = 10.0 min			

Subcatchment P-2C: Proposed Undetained Drainage Area to Meetinghouse Brook



Summary for Subcatchment P-3: Proposed Drainage Are to Sonic Development

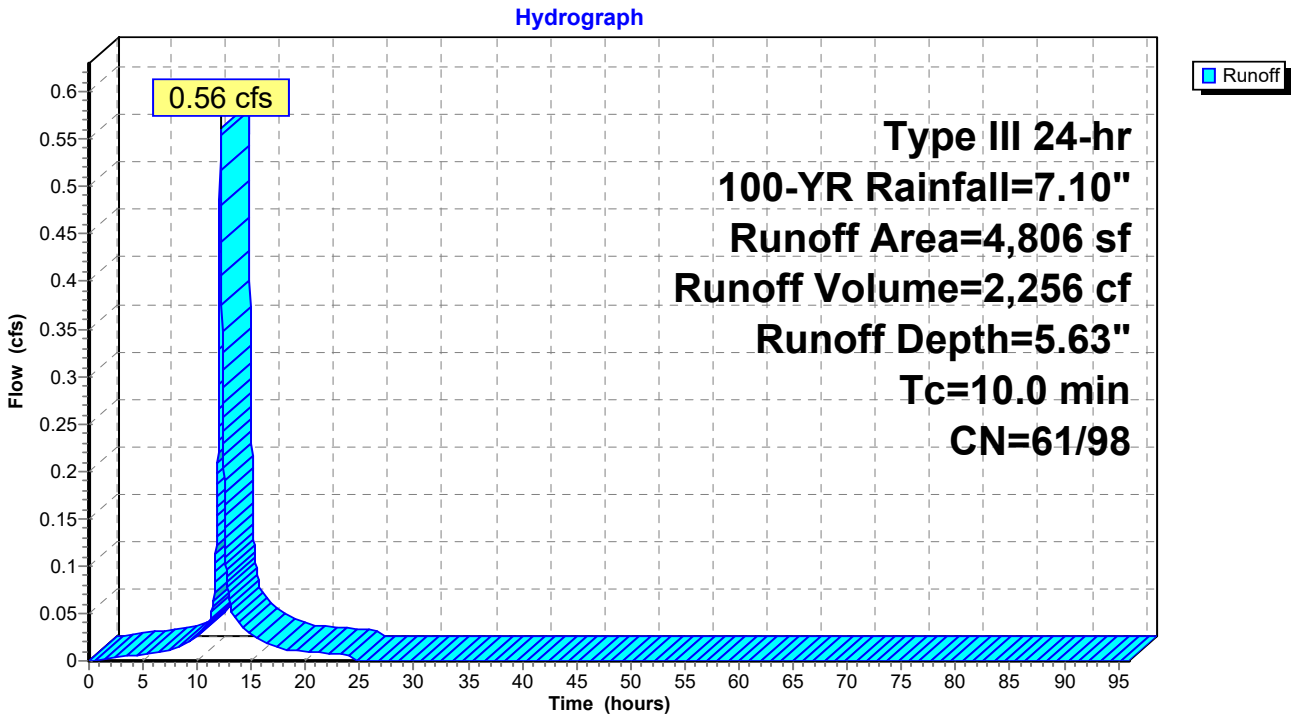
Runoff = 0.56 cfs @ 12.14 hrs, Volume= 2,256 cf, Depth= 5.63"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=7.10"

	Area (sf)	CN	Description
*	3,363	98	Impervious Coverage,
	1,443	61	>75% Grass cover, Good, HSG B
	0	98	Roofs, HSG A
	4,806	87	Weighted Average
	1,443	61	30.02% Pervious Area
	3,363	98	69.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7					**Direct Entry,**
5.7	0	Total, Increased to minimum Tc = 10.0 min			

Subcatchment P-3: Proposed Drainage Are to Sonic Development



Summary for Pond 1P: Infiltration Basin

Inflow Area = 28,988 sf, 92.03% Impervious, Inflow Depth = 6.54" for 100-YR event
Inflow = 3.89 cfs @ 12.13 hrs, Volume= 15,787 cf
Outflow = 3.43 cfs @ 12.20 hrs, Volume= 15,787 cf, Atten= 12%, Lag= 4.0 min
Discarded = 0.58 cfs @ 12.20 hrs, Volume= 12,469 cf
Primary = 2.86 cfs @ 12.20 hrs, Volume= 3,318 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 84.72' @ 12.20 hrs Surf.Area= 1,162 sf Storage= 3,419 cf

Plug-Flow detention time= 38.4 min calculated for 15,784 cf (100% of inflow)
Center-of-Mass det. time= 38.4 min (788.5 - 750.1)

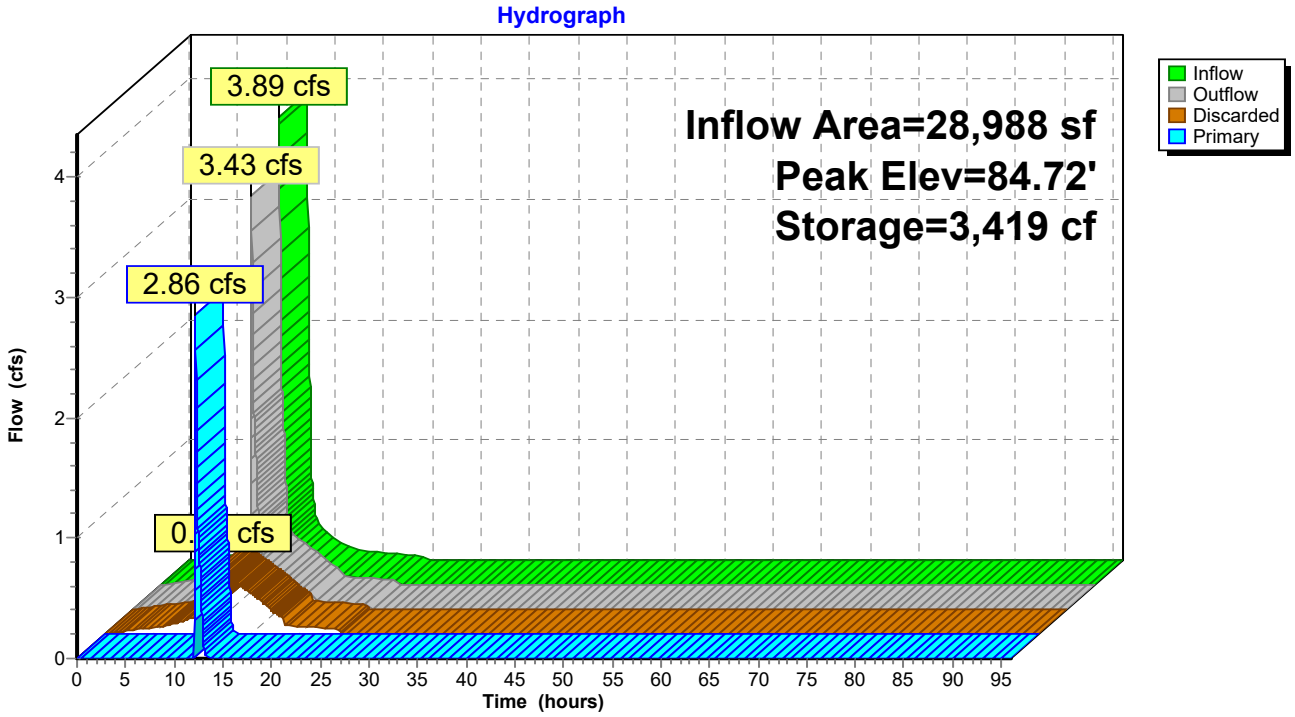
Volume	Invert	Avail.Storage	Storage Description
#1	80.50'	2,011 cf	**48.0" Round Pipe Storage** x 2 Inside #2 L= 80.0' 2,545 cf Overall - 3.0" Wall Thickness = 2,011 cf
#2	79.50'	2,003 cf	**168.0" W x 78.0" H Box Stone Storage** L= 83.0' 7,553 cf Overall - 2,545 cf Embedded = 5,008 cf x 40.0% Voids
		4,014 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	80.50'	**15.0" Round Culvert** L= 99.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 80.50' / 79.51' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Discarded	79.50'	**5.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 78.00' Phase-In= 0.01'
#3	Device 1	84.50'	**6.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 1	83.00'	**6.0" Vert. Slot** C= 0.600

Discarded OutFlow Max=0.58 cfs @ 12.20 hrs HW=84.72' (Free Discharge)
└**2=Exfiltration** (Controls 0.58 cfs)

Primary OutFlow Max=2.85 cfs @ 12.20 hrs HW=84.72' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 2.85 cfs of 10.52 cfs potential flow)
  ├**3=Broad-Crested Rectangular Weir** (Weir Controls 1.70 cfs @ 1.31 fps)
  └**4=Slot** (Orifice Controls 1.15 cfs @ 5.83 fps)

Pond 1P: Infiltration Basin

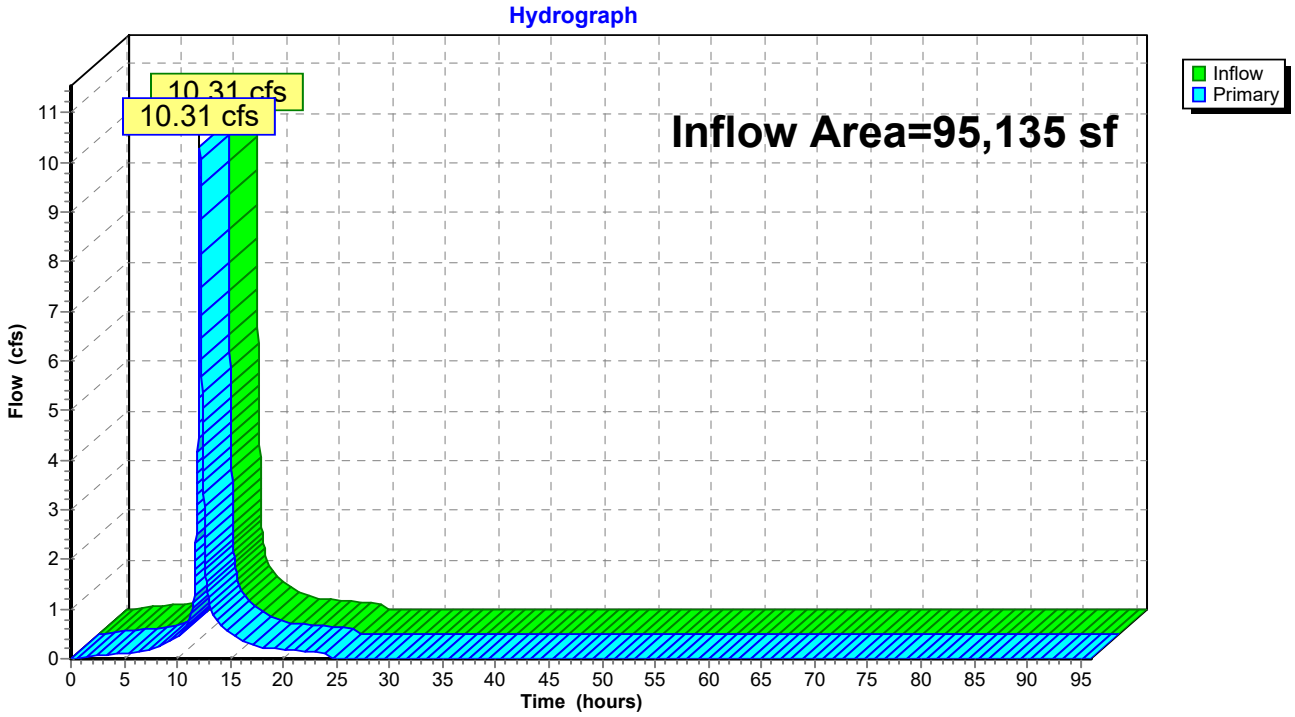


Summary for Link EX-1: Point of Interest: Meetinghouse Brook

Inflow Area = 95,135 sf, 59.75% Impervious, Inflow Depth = 5.18" for 100-YR event
Inflow = 10.31 cfs @ 12.14 hrs, Volume= 41,105 cf
Primary = 10.31 cfs @ 12.14 hrs, Volume= 41,105 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.02 hrs

Link EX-1: Point of Interest: Meetinghouse Brook

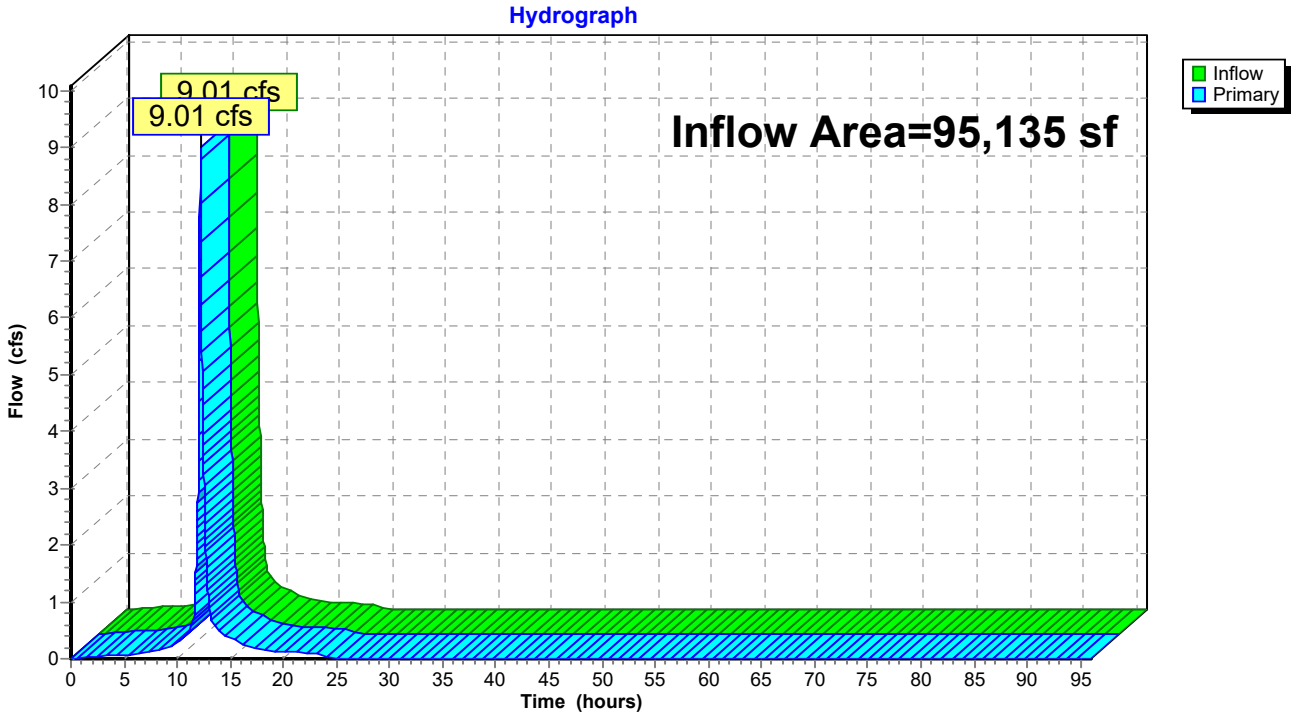


Summary for Link PR-1: Point of Interest: Meetinghouse Brook

Inflow Area = 95,135 sf, 65.56% Impervious, Inflow Depth = 3.86" for 100-YR event
Inflow = 9.01 cfs @ 12.19 hrs, Volume= 30,608 cf
Primary = 9.01 cfs @ 12.19 hrs, Volume= 30,608 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.02 hrs

Link PR-1: Point of Interest: Meetinghouse Brook



APPENDIX C-6
BMP DISCHARGE & STORAGE TABLES

Stage-Discharge for Pond 1P: Infiltration Basin

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
79.50	0.00	0.00	0.00
79.60	0.14	0.14	0.00
79.70	0.15	0.15	0.00
79.80	0.15	0.15	0.00
79.90	0.16	0.16	0.00
80.00	0.17	0.17	0.00
80.10	0.18	0.18	0.00
80.20	0.19	0.19	0.00
80.30	0.20	0.20	0.00
80.40	0.21	0.21	0.00
80.50	0.21	0.21	0.00
80.60	0.22	0.22	0.00
80.70	0.23	0.23	0.00
80.80	0.24	0.24	0.00
80.90	0.25	0.25	0.00
81.00	0.26	0.26	0.00
81.10	0.27	0.27	0.00
81.20	0.27	0.27	0.00
81.30	0.28	0.28	0.00
81.40	0.29	0.29	0.00
81.50	0.30	0.30	0.00
81.60	0.31	0.31	0.00
81.70	0.32	0.32	0.00
81.80	0.33	0.33	0.00
81.90	0.34	0.34	0.00
82.00	0.34	0.34	0.00
82.10	0.35	0.35	0.00
82.20	0.36	0.36	0.00
82.30	0.37	0.37	0.00
82.40	0.38	0.38	0.00
82.50	0.39	0.39	0.00
82.60	0.40	0.40	0.00
82.70	0.40	0.40	0.00
82.80	0.41	0.41	0.00
82.90	0.42	0.42	0.00
83.00	0.43	0.43	0.00
83.10	0.47	0.44	0.03
83.20	0.56	0.45	0.11
83.30	0.68	0.46	0.23
83.40	0.83	0.46	0.36
83.50	0.95	0.47	0.47
83.60	1.04	0.48	0.56
83.70	1.12	0.49	0.63
83.80	1.20	0.50	0.70
83.90	1.27	0.51	0.76
84.00	1.33	0.52	0.82
84.10	1.40	0.52	0.87
84.20	1.45	0.53	0.92
84.30	1.51	0.54	0.97
84.40	1.56	0.55	1.01
84.50	1.62	0.56	1.06
84.60	2.20	0.57	1.63
84.70	3.22	0.58	2.64
84.80	4.58	0.58	4.00
84.90	6.24	0.59	5.65
85.00	8.22	0.60	7.61
85.10	10.48	0.61	9.87
85.20	11.76	0.62	11.14
85.30	11.90	0.63	11.27
85.40	12.03	0.64	11.39
85.50	12.16	0.64	11.51
85.60	12.29	0.65	11.64
85.70	12.42	0.66	11.76
85.80	12.54	0.67	11.87
85.90	12.67	0.68	11.99
86.00	**12.79**	**0.69**	**12.11**

Stage-Area-Storage for Pond 1P: Infiltration Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
79.50	**0**	0
79.60	**1,162**	46
79.70	1,162	93
79.80	1,162	139
79.90	1,162	186
80.00	1,162	232
80.10	1,162	279
80.20	1,162	325
80.30	1,162	370
80.40	1,162	408
80.50	1,162	443
80.60	1,162	488
80.70	1,162	542
80.80	1,162	602
80.90	1,162	665
81.00	1,162	731
81.10	1,162	799
81.20	1,162	870
81.30	1,162	942
81.40	1,162	1,016
81.50	1,162	1,092
81.60	1,162	1,169
81.70	1,162	1,246
81.80	1,162	1,325
81.90	1,162	1,404
82.00	1,162	1,485
82.10	1,162	1,565
82.20	1,162	1,646
82.30	1,162	1,728
82.40	1,162	1,809
82.50	1,162	1,891
82.60	1,162	1,972
82.70	1,162	2,054
82.80	1,162	2,135
82.90	1,162	2,216
83.00	1,162	2,297
83.10	1,162	2,377
83.20	1,162	2,457
83.30	1,162	2,535
83.40	1,162	2,613
83.50	1,162	2,690
83.60	1,162	2,765
83.70	1,162	2,839
83.80	1,162	2,912
83.90	1,162	2,982
84.00	1,162	3,051
84.10	1,162	3,117
84.20	1,162	3,180
84.30	1,162	3,239
84.40	1,162	3,293
84.50	1,162	3,339
84.60	1,162	3,374
84.70	1,162	3,412
84.80	1,162	3,456
84.90	1,162	3,503
85.00	1,162	3,549
85.10	1,162	3,596
85.20	1,162	3,642
85.30	1,162	3,689
85.40	1,162	3,735
85.50	1,162	3,782
85.60	1,162	3,828
85.70	1,162	3,875
85.80	1,162	3,921
85.90	1,162	3,967
86.00	1,162	**4,014**

APPENDIX C-7
WATER QUALITY CALCULATIONS & UNIT SPECIFICATIONS

WATER QUALITY VOLUME CALCULATIONS - DRAINAGE AREA P-2A

PROJECT:	Proposed Convenience Store with Fueling	**LAST REVISED:**	11/5/2020
LOCATION:	1033 North Colony Road, Wallingford, CT		

PERFORMED BY:	MEM	**CHECKED BY:**	JHK	**JOB REFERENCE:**	B-19007

Basin Name	***Area P-2A Main Site Development***	
Rainfall, P (in)	1.00	*a*
Area, A (ac)	0.67	*b*
Impervious Cover Area (ac)	0.61	*c*
% Impervious, I	92.03%	
Volumetric Runoff Coeff., R	0.88	*d*
Water Quality Volume, WQV	0.05 ac-ft	*e*
	2,122 cf	

a First one inch rainfall; 2004 Connecticut Stormwater Quality Manual

b Area tributary to the stormwater management basin

c Impervious cover area tributary to the stormwater management basin

*d R=0.05+0.009*I; Section 7.4.1 from 2004 Connecticut Stormwater Quality Manual*

*e WQV=P*R*A/12; Section 7.4.1 from 2004 Connecticut Stormwater Quality Manual*

WATER QUALITY VOLUME CALCULATIONS - DRAINAGE AREA P-2A

PROJECT:	Proposed Convenience Store with Fueling	**LAST REVISED:**	11/5/2020
LOCATION:	1033 North Colony Road, Wallingford, CT		

PERFORMED BY:	MEM	**CHECKED BY:**	JHK	**JOB REFERENCE:**	B-19007

Basin Name	***Area P-2A Main Site Development***	
Area, Am	0.67 ac	
	0.0010 mi^2	
Water Quality Volume, WQV (cf)	2,122 cf	
Runoff, Q	0.878 in	*a*
Rainfall, P	1.0 in	*b*
CN	99	*c*
Tc	0.17 hr	
Rainfall Distribution	III Type	
Initial Abstraction, Ia	0.041 in	*d*
Ia/P	0.041	
Unit Peak Discharge, qu	600 csm/in	*e*
Water Quality Flow, WQF	0.548 cfs	*f*

a *Q=WQV / Am / 5280 / 5280 *12*

b *First inch of rainfall, 90% of average annual storm events, 2004 Connecticut Stormwater Quality Manual*

c *$CN = 1000/[10+5P+10Q-10(Q^2+1.25QP)^{1/2}]$*
Estimated Curve Number from Appendix B-1 of 2004 Connecticut Stormwater Quality Manual

d *Derived from Table 4-1 from NRCS TR-55 Urban Hydrology for Small Watersheds*

e *Derived from Exhibit 4-III from NRCS TR-55 Urban Hydrology for Small Watersheds*

f *WQF=qp=qu*Am*Q; Equation 4-1 from NRCS TR-55 Urban Hydrology for Small Watersheds*

WATER QUALITY VOLUME CALCULATIONS - DRAINAGE AREA P-2B

PROJECT:	Proposed Convenience Store with Fueling	**LAST REVISED:**	11/5/2020
LOCATION:	1033 North Colony Road, Wallingford, CT		

PERFORMED BY:	MEM	**CHECKED BY:**	JHK	**JOB REFERENCE:**	B-19007

Basin Name	***Area P-2A Main Site Development***	
Rainfall, P (in)	1.00	*a*
Area, A (ac)	0.95	*b*
Impervious Cover Area (ac)	0.72	*c*
% Impervious, I	75.87%	
Volumetric Runoff Coeff., R	0.73	*d*
Water Quality Volume, WQV	0.06 ac-ft	*e*
	2,523 cf	

a First one inch rainfall; 2004 Connecticut Stormwater Quality Manual

b Area tributary to the stormwater management basin

c Impervious cover area tributary to the stormwater management basin

*d R=0.05+0.009*I; Section 7.4.1 from 2004 Connecticut Stormwater Quality Manual*

*e WQV=P*R*A/12; Section 7.4.1 from 2004 Connecticut Stormwater Quality Manual*

WATER QUALITY VOLUME CALCULATIONS - DRAINAGE AREA P-2B

PROJECT:	Proposed Convenience Store with Fueling	**LAST REVISED:**	11/5/2020
LOCATION:	1033 North Colony Road, Wallingford, CT		

PERFORMED BY:	MEM	**CHECKED BY:**	JHK	**JOB REFERENCE:**	B-19007

Basin Name	***Area P-2A Main Site Development***	
Area, Am	0.95 ac	
	0.0015 mi^2	
Water Quality Volume, WQV (cf)	2,523 cf	
Runoff, Q	0.733 in	*a*
Rainfall, P	1.0 in	*b*
CN	97	*c*
Tc	0.17 hr	
Rainfall Distribution	III Type	
Initial Abstraction, Ia	0.041 in	*d*
Ia/P	0.041	
Unit Peak Discharge, qu	600 csm/in	*e*
Water Quality Flow, WQF	0.652 cfs	*f*

a *Q=WQV / Am / 5280 / 5280 *12*

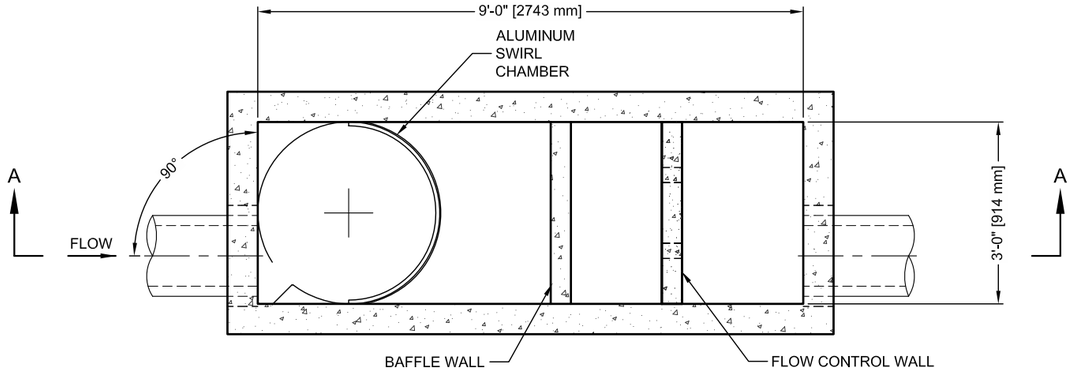
b *First inch of rainfall, 90% of average annual storm events, 2004 Connecticut Stormwater Quality Manual*

c *$CN = 1000/[10+5P+10Q-10(Q^2+1.25QP)^{1/2}]$*
Estimated Curve Number from Appendix B-1 of 2004 Connecticut Stormwater Quality Manual

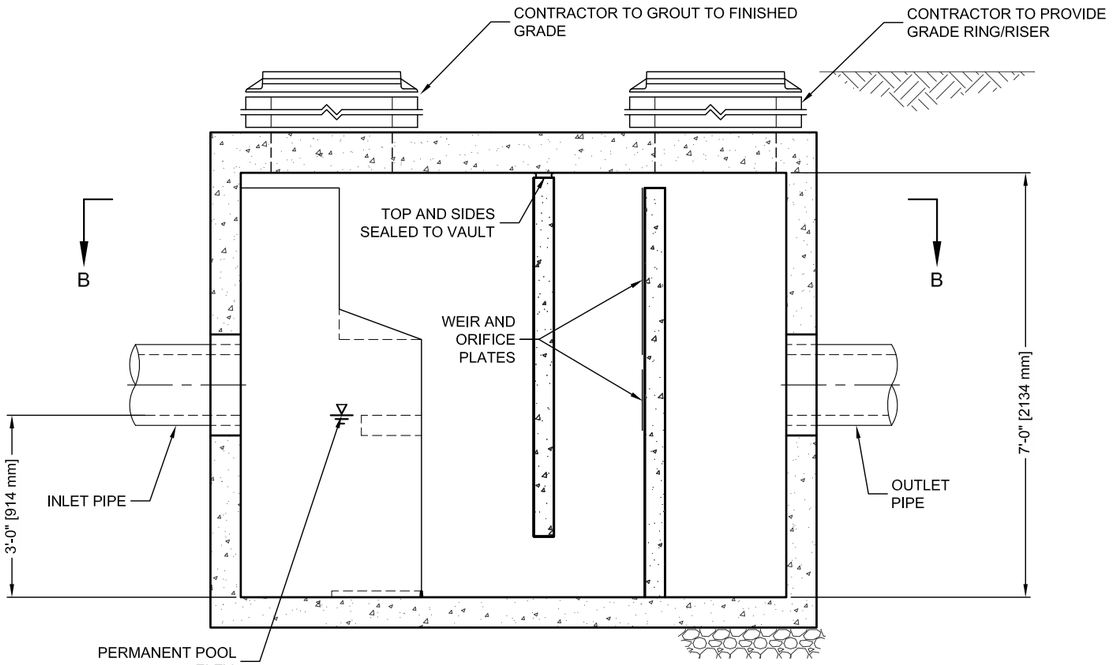
d *Derived from Table 4-1 from NRCS TR-55 Urban Hydrology for Small Watersheds*

e *Derived from Exhibit 4-III from NRCS TR-55 Urban Hydrology for Small Watersheds*

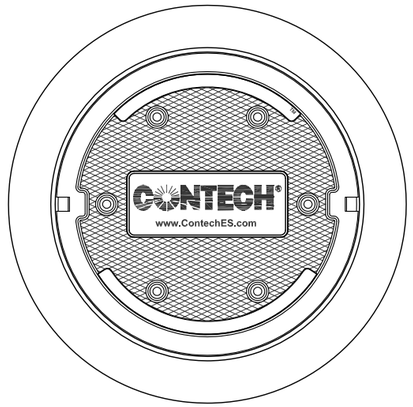
f *WQF=qp=qu*Am*Q; Equation 4-1 from NRCS TR-55 Urban Hydrology for Small Watersheds*



SECTION B-B



SECTION A-A



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

VORTECHS 1000 DESIGN NOTES

VORTECHS 1000 RATED TREATMENT CAPACITY IS 1.6 CFS, OR PER LOCAL REGULATIONS. IF THE SITE CONDITIONS EXCEED RATED TREATMENT CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

THE STANDARD INLET/OUTLET CONFIGURATION IS SHOWN. FOR OTHER CONFIGURATION OPTIONS , PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.ContechES.com

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	*
WATER QUALITY FLOW RATE (CFS)	*
PEAK FLOW RATE (CFS)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.ContechES.com
4. VORTECHS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET AASHTO M306 LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. INLET PIPE(S) MUST BE PERPEDICULAR TO THE VAULT AND AT THE CORNER TO INTRODUCE THE FLOW TANGENTIALLY TO THE SWIRL CHAMBER. DUAL INLETS NOT TO HAVE OPPOSING TANGENTIAL FLOW DIRECTIONS.
7. OUTLET PIPE(S) MUST BE DOWN STREAM OF THE FLOW CONTROL BAFFLE AND MAY BE LOCATED ON THE SIDE OR END OF THE VAULT. THE FLOW CONTROL WALL MAY BE TURNED TO ACCOMODATE OUTLET PIPE KNOCKOUTS ON THE SIDE OF THE VAULT.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE VORTECHS STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

Vortechs®

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

VORTECHS 1000
STANDARD DETAIL

APPENDIX C-8
RIP-RAP CALCULATIONS

OUTLET NO. HW-1

OUTLET PARAMETERS

OPENING WIDTH:	1.50	FT	HEIGHT:	1.50	FT
FLOW AT OUTLET:	4.35	CFS	UNIT DISCHARGE:	2.90	CFS/FT
TAILWATER DEPTH:	1.00	FT	TAILWATER?	YES	

RIP RAP PAD DIMENSIONS

LENGTH:	7.10	FT	RIPRAP SIZE:	0.79	IN*
WIDTH:	11.60	FT	*A minimum riprap size of 6" shall be used.		
WIDTH (OUTLET):	4.50	FT			

APPENDIX D
SUBSURFACE STORMWATER INVESTIGATION RESULTS

WHITESTONE
ASSOCIATES, INC.
Environmental & Geotechnical Engineers & Consultants

16 OLD FORGE ROAD
SUITE A
ROCKY HILL, CT 06067
860.726.7889
whitestoneassoc.com

REPORT OF GEOTECHNICAL INVESTIGATION

PROPOSED 7-ELEVEN CONVENIENCE STORE WITH FUEL SALES
1033 NORTH COLONY ROAD
PORTION OF MAP 37, LOT 29
TOWN OF WALLINGFORD, NEW HAVEN COUNTY, CONNECTICUT

Prepared for:

STONEFIELD ENGINEERING & DESIGN, LLC
27-02 41st Avenue
Long Island City, New York 11101

Prepared by:

WHITESTONE ASSOCIATES, INC.
16 Old Forge Road
Rocky Hill, Connecticut 06067

Richard W.M. McLaren, P.E.
Senior Consultant

Ryan R. Roy, P.E.
Principal, New England Region

Whitestone Project No.: GM2017332.000
September 15, 2020

WHITESTONE
ASSOCIATES, INC.
Environmental & Geotechnical Engineers & Consultants

16 OLD FORGE ROAD
SUITE A
ROCKY HILL, CT 06067
860.726.7889
whitestoneassoc.com

September 15, 2020

via email

STONEFIELD ENGINEERING & DESIGN, LLC
27-02 41st Avenue
Long Island City, New York 11101

Attention: Joshua Kline, P.E.
Project Manager

Regarding: REPORT OF GEOTECHNICAL INVESTIGATION
PROPOSED 7-ELEVEN CONVENIENCE STORE WITH FUEL SALES
1033 NORTH COLONY ROAD
PORTION OF MAP 37, LOT 29
WALLINGFORD, NEW HAVEN COUNTY, CONNECTICUT
WHITESTONE PROJECT NO.: GM2017332.000

Dear Mr. Kline:

Whitestone Associates, Inc. (Whitestone) is pleased to submit the attached *Report of Geotechnical Investigation* for the above-referenced project. This report presents the results of Whitestone's subsurface exploration and includes design recommendations for the foundations, mats, slabs, underground storage tanks, pavements, and related earthwork associated with the proposed convenience store with fuel sales development.

Whitestone appreciates the opportunity to be of continued service to Stonefield Engineering & Design, LLC. Should you have questions regarding the enclosed report, please contact us at (860) 726-7889.

Sincerely,

WHITESTONE ASSOCIATES, INC.

Richard W.M. McLaren, P.E.
Senior Consultant

Ryan R. Roy, P.E.
Principal, New England Region

RWM/br N:\Job Folders\2020\2017332GM\Reports and Submittals\Wallingford CT GM2017332 ROGI.DOCX
Enclosures
Copy: Laurence W. Keller, P.E., Whitestone Associates, Inc.
Kyle J. Kopacz, P.E., Whitestone Associates, Inc.

REPORT OF
GEOTECHNICAL INVESTIGATION
PROPOSED 7-ELEVEN CONVENIENCE STORE WITH FUEL SALES
1033 North Colony Road
Map 37, Lot 29
Town of Wallingford, New Haven County, Connecticut

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REPORT OF
GEOTECHNICAL INVESTIGATION
PROPOSED 7-ELEVEN CONVENIENCE STORE WITH FUEL SALES
1033 North Colony Road
Map 37, Lot 29
Town of Wallingford, New Haven County, Connecticut

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(Continued)

FIGURES

APPENDICES

SECTION 1.0
Summary of Findings

Whitestone has completed an exploration and evaluation of the subsurface conditions at the site of the proposed 7-Eleven convenience store with fuel sales located at 1033 North Colony Road in the Town of Wallingford, New Haven County, Connecticut. Based on the July 8, 2020 *Concept Plan (Overlay)* prepared by Stonefield Engineering & Design, LLC (Stonefield) of Boston, Massachusetts, the project consists of the construction of a one-story convenience store building, a canopy for fueling positions of gasoline and diesel service, underground storage tanks (USTs), a dumpster, and associated paving, utilities, and landscaped areas. The finished floor elevation of the convenience store is anticipated to be close to existing grade to match the adjacent roadway. A stormwater management (SWM) area is planned at the southern end of the site. No new retaining walls are indicated on the *Concept Plan (Overlay)*.

The geotechnical investigation included performing a reconnaissance of the project site, advancing six soil borings and three test pits, and collecting soil samples for laboratory testing and characterization. Infiltration testing was performed in the proposed SWM area. Site subsurface conditions generally consisted of asphaltic concrete, gravel, or topsoil overlying intermittent existing fill (sand and gravel, and blast rock), underlain by a natural glaciolacustrine deposit, in turn underlain by glacial till. The glacial till is underlain by apparent bedrock. Groundwater was not encountered in the explorations.

The results of the investigation indicate that, where natural soils are encountered at footing level, conventional shallow foundations bearing on the glaciofluvial deposit are appropriate. However, where existing fill is encountered at footing level, overexcavation of two feet of the existing fill below foundations and replacement with crushed stone (and geotextile/geogrid, as discussed in the report) would allow supporting conventional shallow foundations, with limited risk, on controlled fill placed over approved existing fill, the surface of which should be thoroughly compacted. Prepared subgrades should be reviewed by the geotechnical engineer, as specified in this report. The results also indicate that the site is suitable for ground-supported slabs and mats deriving support from the improved and approved natural glaciofluvial deposit or existing fill, and/or structural fill placed over these materials. However, where blast rock fill is encountered at underside of slab/mat level, overexcavation of one foot of the blast rock fill below slabs/mats and replacement with crushed stone (and geotextile/geogrid) would allow supporting slabs/mats, with limited risk, on blast rock fill. Additionally, the site conditions support the use of typical pavement sections using standard Connecticut Department of Transportation (CTDOT) specified materials. Further exploration by means of test pits will be required before or at the early stages of construction to further delineate the zones of existing fill, in particular the blast rock fill.

The above summary is intended to provide an overview of the geotechnical findings and recommendations and is not fully developed. Greater detail is presented in the following sections. The entire report must be read for comprehensive understanding of the information contained herein.

SECTION 2.0
Introduction

2.1 AUTHORIZATION

Mr. Joshua Kline, P.E., Project Manager at Stonefield Engineering & Design, LLC, issued authorization to Whitestone to perform a geotechnical investigation on this site relevant to the construction of a proposed 7-Eleven convenience store with fuel sales located at 1033 North Colony Road in the Town of Wallingford, New Haven County, Connecticut. The geotechnical investigation was performed in general accordance with Whitestone's July 15, 2020 *Proposal*.

2.2 PURPOSE

The purpose of this exploration and analysis was to:

- ascertain the various soil profile components at test locations;
- estimate the engineering characteristics of the proposed foundation bearing and subgrade materials;
- provide geotechnical criteria for use by the design engineers in preparing the foundation, mat/slab, underground storage tank, and pavement design;
- provide recommendations for required earthwork and subgrade preparation;
- perform infiltration testing within proposed SWM area;
- record groundwater and/or bedrock levels (if encountered) at the time of the investigation and discuss the potential impact on the proposed construction; and
- recommend additional investigation and/or analysis, if warranted.

2.3 SCOPE

The scope of the exploration and analysis included the subsurface exploration, field testing and sampling, laboratory analysis, and a geotechnical engineering analysis and evaluation of the subsurface materials. This *Report of Geotechnical Investigation* is limited to addressing the site conditions related to the physical support of the proposed construction. Environmental sampling was not completed during the geotechnical investigation.

2.3.1 Field Exploration

Field exploration of the project site was conducted by means of six soil borings, identified as B-1 through B-6, advanced with a truck-mounted Diedrich D-50 drill rig equipped with hollow stem augers to termination depths ranging from 10.8 feet below ground surface (fbgs) to 22 fbgs. The soil borings were backfilled with excavated soils generated from the investigation and, where appropriate, patched with "cold-patch" asphalt. Test locations are shown on the *Test Location Plan* included as Figure 1.

Three test pits, identified as TP-1, TP-2, and TP-3 were excavated with a Kubota KX080 mini excavator in the proposed SWM area to depths of 10 fbgs to 10.5 fbgs. The test pits were backfilled immediately after observing the soil and groundwater conditions and performing the infiltration testing. The test pit locations are shown on the *Test Location Plan* included as Figure 1.

Test locations were based on project information provided to Whitestone at the time of the investigation, including the aforementioned July 8, 2020 *Concept Plan (Overlay)*. The subsurface tests were conducted in the presence of a Whitestone field engineer, who performed field tests, recorded visual classifications, and collected samples of the various strata encountered. Test locations were established in the field using normal taping procedures and estimated right angles. These locations are presumed to be accurate to the degree implied by the method used.

Soil borings and Standard Penetration Tests (SPTs) were conducted in general accordance with ASTM International (ASTM) designation D1586. The Standard Penetration Resistance value (N) can be used as an indicator of the consistency of fine-grained soils and the relative density of coarse-grained soils. The N-value for various soil types can be correlated with the engineering behavior of earthworks and foundations.

Groundwater level observations, where encountered, were recorded during and immediately following the completion of the testing operations within the soil borings. Seasonal variations, temperature effects, and recent rainfall conditions may influence the levels of the groundwater, and the observed levels will depend on the permeability of the soils. Groundwater elevations derived from sources other than seasonally observed groundwater monitoring wells may not be representative of true groundwater levels.

2.3.2 Infiltration Testing

The results of the field infiltration testing performed with a Guelph permeameter, which are tabulated below, indicated field-saturated hydraulic conductivities, k_{fs}, ranging from 14.8 inches per hour to 31.9 inches per hour. The measured hydraulic conductivities are higher than the appropriate range for the Guelph permeameter, but are considered representative of the soils tested. There was no indication of seasonal high groundwater level in the test pits.

SUMMARY OF INFILTRATION TESTING					
Guelph Permeameter Testing					
Location	**Ground Elevation (feet above NAVD)**	**Groundwater Depth/Elevation (fbgs/feet NAVD)**	**Test Depth/Elevation (fbgs/feet NAVD)**	**Tested Soil Type (USCS)**	**Field Saturated Hydraulic Conductivity, k_{fs} (in/hr)**
I-1 (TP-1)	89	NE	4.5/84.5	SP	14.8
I-2 (TP-2)	89	NE	4.5/84.5	SP	28.9
I-3 (TP-3)	87	NE	4.5/82.5	SP	31.9

NE: Not encountered; fbgs: feet below ground surface

2.3.3 Laboratory Program

In addition to the field investigation, a laboratory program was conducted to determine additional, pertinent engineering characteristics of representative samples of on-site soils. The laboratory program was performed in general accordance with applicable ASTM standard test methods and included physical testing of the proposed building foundation bearing stratum.

Physical/Textural Analysis: Two representative samples of the site soils were subjected to a laboratory program that included moisture content determination (ASTM D2216) and washed gradation analysis (ASTM D422) in order to perform supplementary engineering soil classifications in general accordance with ASTM D2487. The soils tested were classified by the Unified Soil Classification System (USCS). The results of the laboratory testing program are summarized in the following table:

LABORATORY TESTING SUMMARY					
Boring	**Sample Number**	**Depth (fbgs)**	**Moisture Content (%)**	**Passing No. 200 Sieve (%)**	**USCS Classification**
B-1	S-2	3.0 - 5.0	4.1	1.6	SP
TP-1	S-1	5.0	3.1	2.2	SP

The engineering classifications are useful when considered in conjunction with the additional site data to estimate properties of the soil types encountered and to predict soil behavior under construction and service loads. Laboratory test results are provided in Appendix B.

SECTION 3.0
Site Description

3.1 LOCATION AND DESCRIPTION

The subject site is located at 1033 Federal Road in the Town of Wallingford, New Haven County, Connecticut, Latitude 41.4926 North, Longitude 72.8103 West. The site is the southern, approximately two-acre portion of a 3.55-acre property, which is identified further as Map 37, Lot 29, currently vacant and used for parking.

The irregularly shaped site is bounded to the east by North Colony Road (Connecticut State Route 5) and the Connecticut State Route 15 on-ramp, to the south by a wooded area then Connecticut State Route 15, to the west by the Amtrak New Haven–Springfield Line railroad, and to the north by a *Sonic Drive-In* restaurant and a wooded area with a stream. Access to the site is from North Colony Road. The site of the proposed construction is shown on the *Test Location Plan* included as Figure 1.

3.2 EXISTING CONDITIONS

Existing Development: The subject site currently is vacant, used as parking. The *Yankee Silversmith Inn* occupied the site until being demolished around 2009.

Topography: Based on a review of the *USGS 7.5 Minute Series Wallingford Quadrangle, Connecticut (2018)* and on Whitestone's visual observations, the site is generally level at approximately elevation 90 feet above National American Vertical Datum of 1988 (NAVD) with a slight slope down to the north.

Utilities: The site of the proposed development is not serviced by utilities, though there would have been utilities associated with the demolished building. The utility information contained in this report is presented for general discussion only and is not intended for construction purposes.

Site Drainage: Surface run-off will tend to flow to the north and toward North Colony Road, on which there are existing catch basins, which are presumed to drain to the local storm sewer system.

3.3 SITE GEOLOGY

On the *Surficial Materials Map of Connecticut (1992)*, the site is shown generally underlain by glaciofluvial sand and gravel, likely underlain by glacial till. The *Bedrock Geologic Map of Connecticut (1985)* indicates that the subject property is underlain by Upper Triassic-aged (possibly Lower Jurassic at top) New Haven Arkose, part of Central Lowlands; Newark Terrane - Hartford and Pomperaug Mesozoic Basins and part of Newark Supergroup (Upper Triassic and Lower Jurassic), consisting of arkose with minor siltstone, conglomerate, and sandstone.

3.4 PROPOSED CONSTRUCTION

Based on the aforementioned *Concept Plan (Overlay)*, the project consists of the construction of a one-story convenience store building, a canopy for fueling positions of gasoline and diesel service, USTs, a dumpster, and associated paving, utilities, and landscaped areas. The finished floor elevation of the convenience store is anticipated to be close to existing grade to match the adjacent roadway. A stormwater management area is planned at the southern end of the site. No new retaining walls are indicated on the *Site Plan*.

Whitestone anticipates the proposed building will be a single-story, masonry and metal-framed structure constructed with a ground-supported concrete floor slab and no basement. The fuel island canopies will be supported on shallow concrete foundations. Maximum column, wall, and slab loads are expected to be on the order of:

- columns - 50.0 kips (compression) and 25 kips (uplift);
- load bearing walls - 2.0 kips per linear foot; and
- floor slab - 100 pounds per square foot.

The scope of Whitestone's investigation and the professional advice contained in this report were generated based on the project details and loading noted herein. Revisions or additions to the design details enumerated in this report should be brought to the attention of Whitestone for additional evaluation as warranted.

SECTION 4.0
Subsurface Conditions

Details of the subsurface materials encountered are presented on the *Records of Subsurface Exploration* presented in Appendix A of this report. The subsurface soil conditions encountered in the test locations consisted of the following generalized strata in order of increasing depth.

4.1 SUBSURFACE SOIL CONDITIONS

Surface Cover Materials: Borings B-1, B-2, and B-3 and test pits TP-1 and TP-2 encountered three inches of asphaltic concrete at the ground surface underlain by six inches of granular subbase. Test pit TP-3 encountered four inches of asphaltic concrete at the ground surface underlain by 10 inches of granular subbase. Borings B-4 and B-5 encountered three inches of gravel at the ground surface. Boring B-6 encountered six inches of topsoil at the ground surface underlain by six inches of sandy subsoil. The pavement section in test pit TP-1 was underlain by three inches of former topsoil and six inches of former subsoil. The pavement section in test pit TP-2 was underlain by three inches of former topsoil.

Existing Fill: Beneath the surface cover materials, borings B-2, B-4, and B-6 encountered existing fill, which was also encountered within the northwestern half of test pit TP-3. In borings, B-4 and B-6, the existing fill consisted of brown, very loose to medium dense, silty sand with gravel. In boring B-2 and the northwestern half of test pit TP-3, the existing fill appeared to be loose to medium dense blast rock fill with voids. Two exploration logs are presented for test pit TP-3 to reflect the different materials within the northwestern half (blast rock fill) and the southeastern half (natural glaciofluvial deposit). SPT N-values recorded within the existing fill ranged from three blows per foot (bpf) to 25 bpf. The existing fill extended to depths of two fbgs to 11 fbgs.

Glaciofluvial Deposit: Beneath the surface cover materials or existing fill, the explorations, except borings B-2 and B-4, encountered a glaciofluvial deposit, consisting of consisting of brown, medium dense, poorly graded sand with gravel (USCS: SP). SPT N-values recorded within the glaciofluvial deposit ranged from 10 bpf to 22 bpf. The test pits terminated in this stratum at depths of 10 fbgs to 10.5 fbgs.

Glacial Till: Beneath the glaciofluvial deposit or existing fill, borings B-1 and B-3 through B6 encountered glacial till, consisting of reddish-brown, dense to very dense (occasionally medium dense), silty sand with gravel, cobbles, boulders (USCS: SM). SPT N-values recorded within the glacial till were variable, ranging from 17 bpf to 84 bpf. Boring B-4 terminated in this stratum at a depth of 22 fbgs.

Apparent Bedrock: Beneath the glacial till or existing fill, the borings, except B-4, encountered auger refusal on apparent bedrock at depths of 10.8 fbgs to 12 fbgs. Bedrock was not sampled through rock coring efforts, but was inferred by refusal of the hollow stem augers. Rock coring techniques would be required to further characterize the nature and extent of the refusal materials.

4.2 GROUNDWATER

Groundwater was not encountered in the borings and test pits during Whitestone's subsurface exploration activities. Additionally, static and perched/trapped water conditions generally will fluctuate seasonally and following periods of precipitation.

SECTION 5.0
Conclusions and Recommendations

5.1 GENERAL

Portions of the site are underlain by sand and gravel fill and by blast rock fill. Based on the explorations, within the proposed building footprint, the northwestern portion is underlain by deep blast rock fill and the southeastern portion is underlain by deep sand and gravel fill. The remainder of the footprint is underlain by a natural glaciofluvial deposit. The existing fill encountered in the explorations extended to depths of up to about 10 fbgs to 11 fbgs. In order to eliminate risk associated with variability in the existing fill, all existing fill would be removed under the footings and replaced with structural fill. However, this option is unlikely to be cost effective. As an alternative, Whitestone considers that the proposed structure may be supported, with limited risk, on conventional shallow foundations following supplemental evaluation of the existing fill and limited overexcavation of existing fill below foundation subgrade elevation.

After foundation excavation in existing fill areas, which would include two feet of overexcavation, the owner's geotechnical engineer should probe areas of exposed existing fill and further assess by excavating shallow test pits in the existing fill to check that conditions are consistent with the materials discussed in the borings. Conventional shallow foundations in existing fill areas may then bear on two feet of geogrid-reinforced crushed stone wrapped in a geotextile filter fabric placed over approved and improved existing fill. Elsewhere within the building footprint, conventional shallow foundations may then bear directly on the natural glaciofluvial deposit.

Mats and slabs may derive support from properly evaluated and approved natural glaciofluvial deposit or existing fill, and/or structural fill placed over these materials. Probing by the owner's geotechnical engineer and shallow test pits will be required in existing fill areas. Where the existing fill is blast rock fill, overexcavation of one foot and replacement with a geogrid-reinforced crushed stone layer underlain by a geotextile filter fabric is recommended.

Additionally, the site conditions support the use of typical pavement sections using standard Connecticut Department of Transportation (CTDOT) specified materials, however, placement of geotextile over areas of blast rock fill will be required.

5.2 SITE PREPARATION AND EARTHWORK

Surface Cover Stripping: Prior to stripping operations, any underground utilities should be identified and secured. Pavements, trees, shrubs, vegetation, topsoil, organic matter, should also be removed from within and at least five feet beyond the limits of the proposed building footprint, as well as any other area

that will require controlled structural fill placement. Obstructions from previous development should be expected. The contractor should be required to perform earthwork in accordance with the recommendations in this report, including backfilling any excavation, etc. with structural fill. Fill or backfill placed within the proposed structural areas during demolition operations should be placed as structural fill in accordance with Section 5.2 and 5.3 of this report.

Surface Preparation/Proofrolling: Before placing fill or subbase materials to raise or restore grades to the desired subgrade elevations, the existing exposed soils should be compacted to a firm surface with several passes in two perpendicular directions of a minimum 10-ton vibratory roller. The surface should then be proofrolled with a loaded tandem axle truck in the presence of the geotechnical engineer to help identify soft or loose pockets that may require removal and replacement or further investigation. Proofrolling should be performed after a suitable period of dry and non-freezing weather to reduce the likelihood of degrading an otherwise stable subgrade. Should construction be attempted in the winter or when temperatures are below freezing, Whitestone should be contacted for alternative surface preparation recommendations. Fill or backfill should be placed and compacted in accordance with Section 5.3.

Excavation Difficulties: Cobbles and boulders typically encountered in glacial till will likely present difficulties during excavations for underground storage tanks. Bedrock was encountered near the likely depth of excavation for the tanks. Heavy excavating equipment and ripping tools will typically be effective in removing rock close to the bedrock surface. However, the speed and ease of excavation will depend on the type of equipment, the skill of the equipment operators, and the geological structure of the bedrock, such as spacing between discontinuities and planes of weakness. Excavation difficulties also will be affected by excavation size and depth. Pneumatic hammers may be required to remove bedrock to allow tank installation.

Weather Performance Criteria: Because the natural glaciofluvial deposit and existing fill are typically well drained, achieving compaction and maintaining surface compaction during dry weather will be difficult. These soils will need to be wetted on a regular basis to achieve compaction and will be easily disturbed at the surface by construction activities. Routine grading, wetting of soil, and proofrolling may be required to maintain exposed subgrades.

5.3 STRUCTURAL FILL AND BACKFILL

Imported Fill Material: Imported material to be placed on existing fill under footings and on blast rock fill under footings and slabs/mats should be minus 0.75-inch crushed stone. Imported material placed as general structural fill or backfill to raise elevations or restore design grades should consist of clean, relatively well graded sand or gravel with a maximum particle size of three inches and up to 15 percent, by weight, of material finer than a #200 sieve. Imported material should be free of silt, clay, organics, and deleterious material. Imported material should be approved by a qualified geotechnical engineer prior to delivery to the site.

On-Site Reuse: Whitestone anticipates that portions of the site soils will be suitable for selective reuse as structural fill/backfill, provided that soil moisture contents are controlled within three percent of optimum moisture level, particles larger than three inches in diameter are either removed or crushed, and objectionable portions, such as organics, are segregated. Excavated blast rock fill will not be suitable for reuse unless processed by crusher or individually seated more than three feet from subsurface construction in a soil matrix. Reuse of the site soils will be contingent on careful review in the field by the owner's geotechnical engineer immediate reuse of on-site soil should not be expected.

Compaction and Placement Requirements: Fill and backfill should be placed in maximum eight-inch loose lifts and compacted using a vibratory drum roller during mass grading activities or a small hand-held vibratory compactor within excavations. Structural fill and backfill should be compacted to at least 95 percent of the maximum dry density within three percent of the optimum moisture content, as determined by ASTM D1557 (Modified Proctor).

Structural Fill Testing: A sample of the imported fill material or on-site material proposed for re-use as structural fill or backfill should be submitted to the owner's geotechnical engineer for analysis and approval at least one week prior to its use. The placement of fill and backfill should be monitored by a qualified engineering technician, so such that the specified material and lift thicknesses are properly installed. A sufficient number of in-place density tests should be performed to check that the specified compaction is achieved throughout the height of the fill or backfill.

5.4 GROUNDWATER CONTROL

Static groundwater was not encountered within the explorations during this investigation. However, perched/trapped water may be encountered above non-permeable strata. As such, construction phase dewatering may consist of removing surface water runoff, infiltrating water, or trapped water at this site. Whitestone anticipates that construction phase dewatering, if required, would typically include installing temporary sump pits and pumps within trenches and excavations.

Proper grading and drainage should be incorporated into the site design and construction phase grading to discourage ponding of surface runoff. Every effort should be made to maintain drainage of surface run-off away from construction areas by grading. The contractor should limit exposure of excavations and prepared subgrades to rainfall. Overexcavation of wet soils and replacement with controlled structural fill per Section 5.3 of this report may be required prior to resuming work on disturbed subgrade soils.

5.5 FOUNDATIONS

Shallow Foundation Design Criteria: Portions of the proposed building footprint are underlain by (i) a natural glaciofluvial deposit, (ii) existing fill consisting of sand and gravel, and (iii) existing fill consisting of blast rock fill. Foundation options for these three conditions are presented below.

Where natural soils are exposed at footing level, Whitestone recommends supporting the proposed

structure on conventional spread and continuous wall footings designed to bear on the natural glaciofluvial deposit or structural fill placed over the glaciofluvial deposit, provided these materials are properly evaluated, placed and compacted in accordance with Sections 5.2, 5.3, and 5.12 of this report.

Where existing fill is exposed at footing level, following supplemental evaluation, the existing fill should be overexcavated to two feet below foundations and two feet out from the foundation edges. The exposed surface of the existing fill should be thoroughly compacted with a walk-behind, twin drum vibratory roller and reviewed by the geotechnical engineer, prior to re-establishing foundation subgrade level. Where the existing fill is blast rock fill, a geotextile (Mirafi 500X or similar approved by owner's engineer) should be placed on the compacted surface, and the subgrade re-established with minus 0.75-inch crushed stone with a geogrid layer (Tensar TriAx TX130S, or similar) at the mid-height of the crushed stone layer. Where the existing fill is sand and gravel fill, the geotextile is not required before placing the geogrid-reinforced crushed stone. After this preparatory work, the proposed structure may be supported, with limited risk, on conventional spread and continuous wall footings designed to bear on controlled structural fill placed over the approved and improved existing fill, provided the existing fill materials are properly evaluated, in accordance with Sections 5.2, 5.3, and 5.12 of this report.

Foundations bearing within the materials described above may be designed to impart a maximum allowable net bearing pressure of 3,000 pounds per square foot. Foundation subgrades should be prepared and compacted in the presence of the geotechnical engineer to densify any disturbed soils. Regardless of loading conditions, new foundations should be sized no less than minimum dimensions of 24 inches for continuous wall footings and 36 inches for isolated column footings.

Below-grade footings should be designed so that the maximum toe pressure due to the combined effect of vertical loads (including soil weight) and overturning moment does not exceed the recommended maximum allowable bearing pressure. In addition, positive contact pressure should be maintained throughout the base of the footings, such that no uplift or tension exists between the base of the footings and the supporting soil. Uplift loads should be resisted by the weight of the concrete footing and the weight of the soil above the footing. Side friction should be neglected when proportioning the footings, so that lateral resistance is provided by friction resistance at the base of the footings. A coefficient of friction against sliding of 0.4 is recommended for use in the design of the foundations bearing within the site soils or imported structural fill.

Foundation Inspection/Overexcavation Criteria: Whitestone recommends that the suitability of the bearing materials along new footing bottoms be reviewed by a geotechnical engineer prior to placing concrete for the footings. Special attention should be given to areas of the site underlain by soft/loose conditions. In the event that isolated areas of unsuitable materials are encountered in footing excavations, overexcavation and replacement of the materials or deeper foundation embedment may be necessary to provide a suitable footing subgrade. Overexcavation to be restored with structural fill will need to extend at least one foot laterally beyond footing edges for each vertical foot of overexcavation. Lateral overexcavation may be eliminated if grade is restored with lean concrete.

Settlement: Whitestone estimates post-construction settlements of building foundations will be on the order of one inch, if the recommendations outlined in this report are properly implemented. Differential settlements of building foundations should be less than about one half to three quarters of total settlement.

Frost Coverage: Footings subject to frost action should be placed at least 42 inches below adjacent exterior grades, as specified by the *Connecticut State Building Code*, to provide protection from frost penetration. Interior footings not subject to frost action may be placed at a minimum depth of 18 inches below the slab subgrade.

5.6 SLABS AND MATS

Following surficial compaction and proofrolling to densify any upper loose zones, Whitestone anticipates that the improved and approved glaciofluvial deposit or existing fill, and/or controlled structural fill will be suitable for support of the proposed slabs and mats provided these materials are properly evaluated, compacted and proofrolled in accordance with Sections 5.2, 5.3, and 5.12 of this report. Any areas that become softened or disturbed as a result of wetting and/or repeated exposure to construction traffic should be removed and replaced with compacted structural fill. The properly prepared on-site soils are expected to yield a minimum subgrade modulus (k) of 150 psi/in.

Where the underside of slab/mat is within the natural glaciofluvial deposit or existing fill consisting of sand and gravel, a minimum six-inch thick layer of CTDOT *M.05.01 Processed Aggregate Base* (or approved equivalent) should be placed below slabs and mats to provide a uniform granular base. Where the underside of slab/mat is within blast rock fill, the area should be overexcavated by 12 inches, a geotextile (Mirafi 500X or similar approved by owner's engineer) placed, and the subgrade re-established with minus 0.75-inch crushed stone with a geogrid layer (Tensar TriAx TX130S, or similar) at the mid-height of the crushed stone layer. The six inches of CTDOT *M.05.01 Processed Aggregate Base* should then be placed over the crushed stone.

A moisture vapor barrier should be installed beneath the floor slab in accordance with flooring manufacturer recommendations. A moisture vapor barrier should also be installed if the floor supports moisture-sensitive equipment.

5.7 PAVEMENT DESIGN CRITERIA

General: Whitestone anticipates that improved and approved glaciofluvial deposit and existing fill, and/or compacted structural fill are expected to be suitable for support of the proposed pavements, provided these materials are properly evaluated, compacted, and proofrolled in accordance with Sections 5.2, 5.3, and 5.12 of this report during favorable weather conditions.

Design Criteria: A California Bearing Ratio value of 8.0 has been assigned to the properly prepared subgrade soils for pavement design purposes. This value was correlated with pertinent soil support values and assumed traffic loads to prepare flexible and rigid pavement designs per the AASHTO *Guide for the*

Design of Pavement Structures.

Design traffic loads were assumed based on typical volumes for similar facilities and correlated with 18-kip equivalent single axle loads (ESAL) for a 20-year life. Estimated maximum pavement loads of 15,000 ESALs and 150,000 ESALs were used for the standard-duty and heavy-duty pavement areas, respectively. These values assume the pavements primarily will accommodate both automobile and limited heavier truck traffic, with the heavier truck traffic designated to the main drive/access lanes.

Pavement Sections: Pavement components should meet material specifications from CTDOT *Standard Specifications* specified below. The recommended flexible pavement sections are tabulated below:

FLEXIBLE PAVEMENT SECTION			
Layer	**Material**	**Standard-Duty Thickness (inches)**	**Heavy-Duty Thickness (inches)**
Asphalt Wearing Course	CTDOT HMA S0.375 (Superpave); PG 64S-22	1.5	1.5
Asphalt Binder Course	CTDOT HMA S0.5 (Superpave); PG 64S-22	1.5	2.5
Granular Base	CTDOT M.05.01 Processed Aggregate Base	6.0	6.0
Granular Subbase [1]	CTDOT M.02.02 Subbase; M.02.06 Gradation A	6.0	6.0

[1] Where pavement subgrade is blast rock fill, granular subbase should be placed over robust geotextile (Mirafi 500X, or similar).

A rigid concrete pavement should be used to provide suitable support at areas of high traffic or severe turns, such as at the fueling lanes, trash enclosure, and ingress/egress locations. The recommended rigid pavement is tabulated below:

RIGID PAVEMENT SECTION		
Layer	**Material**	**Thickness (inches)**
Surface	4,000 psi Air-Entrained Concrete	6.0 [1]
Granular Base	CTDOT M.05.01 Processed Aggregate Base	6.0
Granular Subbase [2]	CTDOT M.02.02 Subbase; M.02.06 Gradation A	6.0

[1] The outer edges of concrete pavements are susceptible to damage as trucks move from rigid pavement to adjacent flexible pavement. Therefore, the thickness at the outer two feet of the rigid concrete pavement should be 12 inches.

[2] Where pavement subgrade is blast rock fill, granular subbase should be placed over robust geotextile (Mirafi 500X, or similar).

Additional Design Considerations: The pavement section thickness designs presented in this report are based on the design parameters detailed herein and are contingent on proper construction, inspection, and maintenance. Additional pavement thickness may be required by local code. The designs are contingent on achieving the minimum soil support value in the field. To accomplish this requirement, subgrade soil and supporting fill or backfill should be placed, compacted, and evaluated in accordance with Sections 5.2, 5.3, and 5.12 of this report. Proper drainage should be provided for the pavement structure, including appropriate grading and surface water control.

The performance of the pavement also will depend on the quality of materials and workmanship. Whitestone recommends that CTDOT standards for materials, workmanship, and maintenance be applied to this site. Project specifications should require that the installed asphaltic concrete material composition be within tolerance for the specified materials and that the percentage of air voids of the installed pavement be within specified ranges for the respective materials. Rigid concrete pavements should be suitably air-entrained, jointed, and reinforced in general accordance with ACI 330R-08 *Guide for the Design and Construction of Concrete Parking Lots*.

5.8 RETAINING WALLS/LATERAL EARTH PRESSURES

Proposed site retaining walls were not indicated at this time. However, Whitestone anticipates that temporarily shoring may be required during installation of the proposed USTs.

Lateral Earth Pressures: Retaining/below-grade walls should be capable of withstanding active and at-rest earth pressures. With an active earth pressure coefficient (K_a) of 0.33 and assuming a level backfill and an assumed maximum backfill soil unit weight of 140 pounds per cubic foot (pcf), an equivalent fluid pressure of 46 psf per foot of wall height should be used in design of retaining/below-grade walls which are free to rotate.

Retaining/below-grade walls and wall corners typically are restrained from lateral movement and should be designed using at-rest earth pressures. A coefficient of at-rest earth pressure (K_o) of 0.5, for a level backfill, is recommended for retaining/below-grade walls designed to resist at-rest earth pressures, which assume no lateral movement. With an assumed maximum total unit weight of backfill of approximately 140 pcf, an equivalent fluid pressure of 70 pounds per square foot per foot of wall height should be used in design of restrained retaining/below-grade wall and wall corners. A coefficient of friction of 0.4 against sliding can be used for concrete on the existing site soils. Additional lateral earth pressures from a sloped backfill or any temporary or long-term surcharge loads also should be included in the design. Retaining wall design should include a global stability analysis.

Backfill Criteria: Whitestone recommends that granular soils be used to backfill behind retaining walls. The granular backfill materials should consist of clean, relatively well graded sand or gravel with a maximum particle size of three inches and up to 15 percent of material finer than a #200 U.S. Standard sieve.

Whitestone recommends that backfill directly behind any walls be compacted with light, hand-held compactors. Heavy compactors and grading equipment should not be allowed to operate within a zone of influence measured at a 45-degree angle from the base of the walls during backfilling to avoid developing excessive temporary or long-term lateral soil pressures.

Wall Drainage: Positive drainage should be provided at the base of the below-grade walls. Where wall drainage is not provided, the wall should be designed to withstand full hydrostatic pressure.

Whitestone should be notified if any other retaining structures or design considerations requiring lateral earth pressure estimations are proposed. Specific recommendations for temporary retaining structures are beyond Whitestone's scope of work.

5.9 SEISMIC AND LIQUEFACTION CONSIDERATIONS

The subsurface conditions are most consistent with a Site Class D, as defined by the *Connecticut State Building Code*. Based on the type of building (single story), seismic zone, and soil/groundwater profile, liquefaction considerations are not expected to have a substantial impact on design.

5.10 EXCAVATIONS

The site soils encountered during this investigation typically is, at a minimum, consistent with Type C Soil Conditions as defined by 29 CFR Part 1926 (OSHA), which require a maximum unbraced excavation angle of 1.5:1 (horizontal:vertical). Actual conditions encountered during construction should be evaluated by a competent person (as defined by OSHA), so that safe excavation methods and/or shoring and bracing requirements are implemented. Competent bedrock may be excavated at an angle of 1:6 (horizontal:vertical). A steeper excavation angle in the bedrock may be feasible, if the exposed bedrock is reviewed by a professional engineer or geologist.

5.11 UNDERGROUND STORAGE TANK EMBEDMENT

The proposed USTs may be embedded in part below groundwater in extreme conditions, resulting, at least temporarily, in uplift conditions for proposed USTs. To prevent hydrostatic uplift of the tanks due to groundwater or perched water within the tank pit, fastening of the tanks to anchors, such as tie-downs and/or "dead men" to the bottom of the excavation, should be provided to counteract the effects of buoyancy. Additionally, USTs should be properly embedded beneath a properly designed concrete mat.

5.12 SUPPLEMENTAL POST INVESTIGATION SERVICES

Construction Phase Evaluation of Existing Fill: Whitestone recommends further reviewing the extent and condition of the existing fill, in particular the blast rock fill, for building, floor slab, and pavement support, and/or re-use as structural fill by means of supplemental test pit evaluation either prior to or during the early stages of construction to identify areas requiring removal and possible uncontrolled conditions or deleterious materials not disclosed by the soil borings and test pits conducted during this exploration.

Construction Inspection and Monitoring: The owner's geotechnical engineer with specific knowledge of the site subsurface conditions and design intent should perform inspection, testing, and consultation during construction, as described in previous sections of this report. Monitoring and testing should be performed to confirm that any unsuitable material is overexcavated below foundations and slabs/mats where necessary, and suitable materials are used for controlled fill. Monitoring and testing should also be

performed to confirm that the existing surface cover materials are properly removed, the foundation elements of the previously demolished building (if encountered) are removed, and suitable materials used for controlled fill are properly placed and compacted over suitable subgrade soils. Placement of fill should be witnessed and documented by the owner's geotechnical engineer.

SECTION 6.0
General Comments

Supplemental recommendations may be required upon finalization of construction plans or if significant changes are made in the characteristics or location of the proposed structure. Soil bearing conditions should be checked at the appropriate time for consistency with those conditions encountered during Whitestone's geotechnical investigation.

The recommendations presented herein should be utilized by a qualified engineer in preparing the project plans and specifications. The engineer should consider these recommendations as minimum physical standards which may be superseded by local and regional building codes and structural considerations. These recommendations are prepared for the sole use of Stonefield Engineering & Design, LLC for the specific project detailed and should not be used by any third party. These recommendations are relevant to the design phase and should not be substituted for construction specifications.

The possibility exists that conditions between borings may differ from those at specific test locations, and conditions may not be as anticipated by the designers or contractors. In addition, the construction process may alter soil and rock conditions. Therefore, experienced geotechnical personnel should observe and document the construction procedures used and the conditions encountered.

Whitestone assumes that a qualified contractor will be employed to perform the construction work, and that the contractor will be required to exercise care to ensure all excavations are performed in accordance with applicable regulations and good practice. Particular attention should be paid to avoiding damaging or undermining adjacent properties and maintaining slope stability.

Whitestone recommends that the services of the geotechnical engineer be engaged to test and evaluate the soils in the footing excavations prior to concreting in order to determine that the soils will support the bearing pressures. Monitoring and testing also should be performed to verify that suitable materials are used for controlled fills and that they are properly placed and compacted over suitable subgrade soils.

The exploration and analysis of the foundation conditions reported herein are considered sufficient in detail and scope to form a reasonable basis for the foundation design. The recommendations submitted for the proposed construction are based on the available soil information and the design details furnished by Stonefield Engineering & Design, LLC. Deviations from the noted subsurface conditions encountered during construction should be brought to the attention of the geotechnical engineer.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been promulgated after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology. No other warranties, express or implied, are made.

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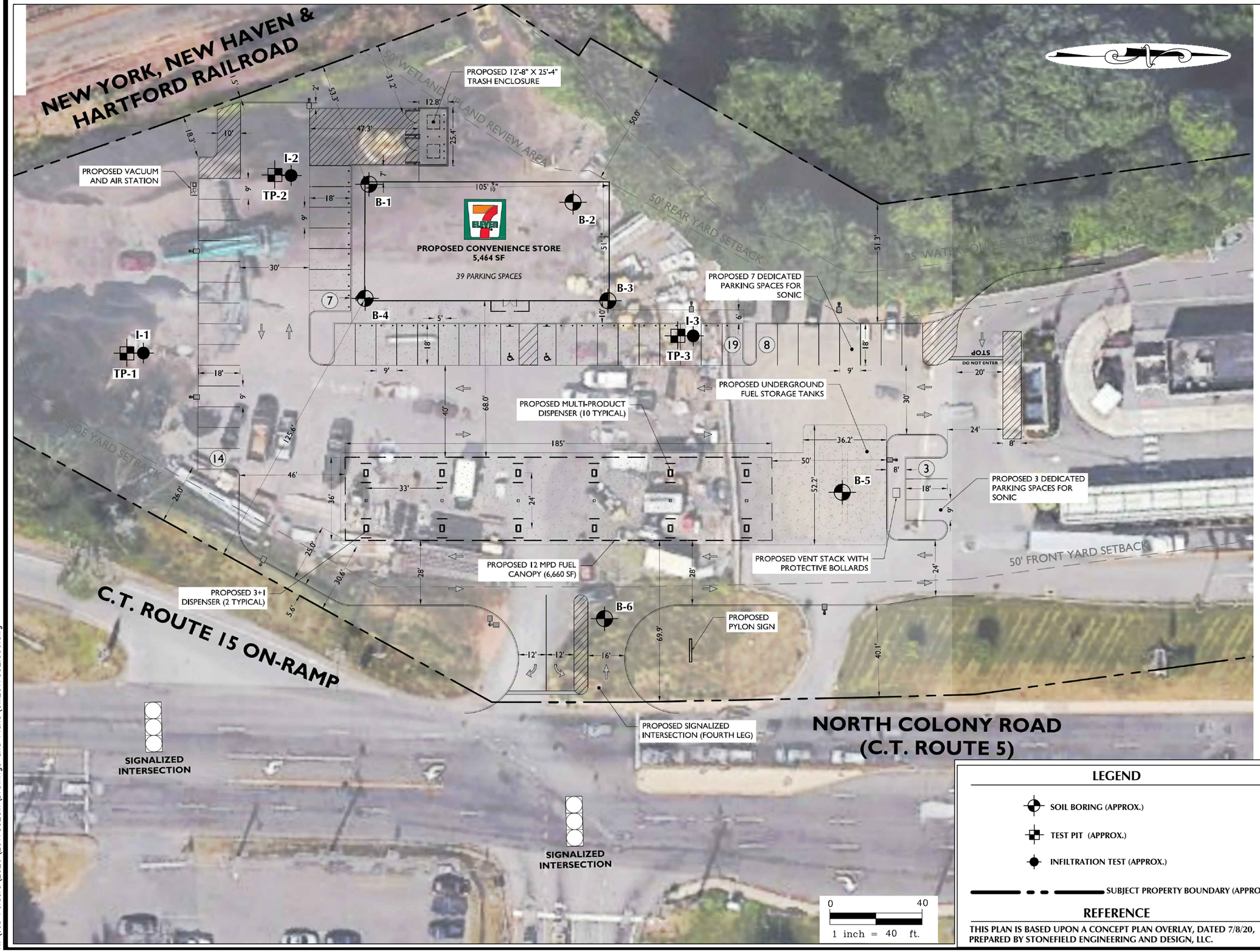
FIGURE 1
Test Location Plan



LEGEND

- SOIL BORING (APPROX.)
- TEST PIT (APPROX.)
- INFILTRATION TEST (APPROX.)
- SUBJECT PROPERTY BOUNDARY (APPROX.)

REFERENCE

THIS PLAN IS BASED UPON A CONCEPT PLAN OVERLAY, DATED 7/8/20, PREPARED BY STONEFIELD ENGINEERING AND DESIGN, LLC.

WHITESTONE ASSOCIATES, INC.
Environmental & Geotechnical Engineers & Consultants
16 OLD FORGE ROAD, SUITE A, ROCKY HILL, CT 06067
860.726.7889 WHITESTONEASSOC.COM

DRAWING TITLE: **TEST LOCATION PLAN**

CLIENT: **STONEFIELD ENGINEERING & DESIGN, LLC**

PROJECT: **PROPOSED 7-ELEVEN CONVENIENCE STORE WITH FUEL SALES**
1033 NORTH COLONY ROAD
WALLINGFORD, NEW HAVEN COUNTY, NEW YORK

PROJECT #: GM2017332.000	
DESIGNED BY: MR	PROJ. MGR.: RR
DATE: 9/15/20	FIGURE: 1
SCALE: 1" = 40'	

N:\Job Folders\2020\20173320M\Drawings and Plans\GM2017332.000.dwg

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APPENDIX A
Records of Subsurface Exploration

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-1

Page 1 of 1

Project:	Proposed 7-Eleven Convenience Store with Fuel Sales	**WAI Project No.:**	GM2017332.000
Location:	1033 North Colony Road, Wallingford, New Haven County, Connecticut	**Client:**	Stonefield Engineering & Design, LLC

Surface Elevation:	± NS feet	**Date Started:**	8/24/2020	**Water Depth | Elevation (feet bgs) | (feet)**		**Cave-In Depth | Elevation (feet bgs) | (feet)**	
Termination Depth:	10.8 feet bgs	**Date Completed:**	8/24/2020				
Proposed Location:	Building	**Logged By:**	RK	**During:**	-- | --		
Drill / Test Method:	HSA / SPT	**Contractor:**	GB	**At Completion:**	-- | --	**At Completion:**	-- | --
		Equipment:	Diedrich D-50	**24 Hours:**	-- | --	**24 Hours:**	-- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		3" Asphalt	
							GRAVEL		6" Granular Base	
1 - 3	S-1	X	5 - 6 - 8 - 6	16	14		GLACIO-FLUVIAL DEPOSIT		Brown, Medium Dense, Poorly Graded Sand with Gravel (SP)	
3 - 5	S-2	X	6 - 7 - 7 - 5	14	14	5.0			As Above (SP)	
5 - 7	S-3	X	3 - 5 - 5 - 5	14	10				As Above, Loose to Medium Dense (SP)	
7 - 9	S-4	X	8 - 17 - 24 - 26	20	41	7.5	GLACIAL TILL		Reddish-Brown, Dense, Silty Sand with Gravel (SM)	
						10.0				
10 - 10.3	S-5	X	50/3"	0	-				No Recovery. Very Dense	Cobbles
									Boring Log B-1 Terminated upon Auger Refusal at a Depth of 10.8 fbgs.	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-2

Page 1 of 1

Project:	Proposed 7-Eleven Convenience Store with Fuel Sales	**WAI Project No.:**	GM2017332.000
Location:	1033 North Colony Road, Wallingford, New Haven County, Connecticut	**Client:**	Stonefield Engineering & Design, LLC

Surface Elevation:	± NS feet	**Date Started:**	8/24/2020	**Water Depth (feet bgs) | Elevation (feet)**		**Cave-In Depth (feet bgs) | Elevation (feet)**	
Termination Depth:	11.0 feet bgs	**Date Completed:**	8/24/2020				
Proposed Location:	Building	**Logged By:**	RK	**During:**	-- | --		
Drill / Test Method:	HSA / SPT	**Contractor:**	GB	**At Completion:**	-- | --	**At Completion:**	-- | --
		Equipment:	Diedrich D-50	**24 Hours:**	-- | --	**24 Hours:**	-- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		3" Asphalt	
							GRAVEL		6" Granular Base	
1 - 3	S-1	X	18 - 16 - 9 - 8	2	25		EXISTING FILL		Brown, Medium Dense, Poorly Graded Gravel with Sand, Cobbles, Boulders (FILL)	Blast Rock Fill with Voids
3 - 5	S-2	X	12 - 10 - 6 - 5	2	16				As Above (FILL)	
						5.0				
5 - 7	S-3	X	4 - 4 - 4 - 4	3	8				As Above, Loose (FILL)	
7 - 9	S-4	X	6 - 6 - 6 - 12	2	12				As Above, Medium Dense (FILL)	
						10.0				
10 - 10.8	S-5	X	42 - 50/4"	1	-				As Above, Dense (FILL)	
									Boring Log B-2 Terminated upon Auger Refusal at a Depth of 11 fbgs.	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-3

Page 1 of 1

Project:	Proposed 7-Eleven Convenience Store with Fuel Sales	**WAI Project No.:**	GM2017332.000
Location:	1033 North Colony Road, Wallingford, New Haven County, Connecticut	**Client:**	Stonefield Engineering & Design, LLC

Surface Elevation:	± NS feet	**Date Started:**	8/24/2020	**Water Depth | Elevation (feet bgs) | (feet)**		**Cave-In Depth | Elevation (feet bgs) | (feet)**	
Termination Depth:	11.8 feet bgs	**Date Completed:**	8/24/2020				
Proposed Location:	Building	**Logged By:**	RK	**During:**	-- | --		
Drill / Test Method:	HSA / SPT	**Contractor:**	GB	**At Completion:**	-- | --	**At Completion:**	-- | --
		Equipment:	Diedrich D-50	**24 Hours:**	-- | --	**24 Hours:**	-- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		3" Asphalt	
							GRAVEL		6" Granular Base	
1 - 3	S-1	X	4 - 5 - 5 - 5	18	10		GLACIO-FLUVIAL DEPOSIT		Brown, Loose to Medium Dense, Poorly Graded Sand with Gravel (SP)	
3 - 5	S-2	X	5 - 6 - 8 - 8	8	14	5.0			As Above, Medium Dense (SP)	
5 - 7	S-3	X	5 - 6 - 5 - 9	12	11				As Above (SP)	
7 - 9	S-4	X	8 - 16 - 20 - 14	14	36	7.5	GLACIAL TILL		Reddish-Brown, Dense, Silty Sand with Gravel (SM)	
						10.0				
10 - 11.3	S-5	X	28 - 42 - 50/4"	10	84				As Above, Very Dense (SM)	Cobbles
									Boring Log B-3 Terminated upon Auger Refusal at a Depth of 11.8 fbgs.	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-4

Page 1 of 1

Project:	Proposed 7-Eleven Convenience Store with Fuel Sales	**WAI Project No.:**	GM2017332.000
Location:	1033 North Colony Road, Wallingford, New Haven County, Connecticut	**Client:**	Stonefield Engineering & Design, LLC

Surface Elevation:	± NS feet	**Date Started:**	8/24/2020	**Water Depth | Elevation (feet bgs) | (feet)**		**Cave-In Depth | Elevation (feet bgs) | (feet)**	
Termination Depth:	22.0 feet bgs	**Date Completed:**	8/24/2020				
Proposed Location:	Building	**Logged By:**	RK	**During:**	-- | --		
Drill / Test Method:	HSA / SPT	**Contractor:**	GB	**At Completion:**	-- | --	**At Completion:**	-- | --
		Equipment:	Diedrich D-50	**24 Hours:**	-- | --	**24 Hours:**	-- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							GRAVEL		3" Gravel	
1 - 3	S-1	X	4 - 7 - 4 - 2	12	11		EXISTING FILL		Brown, Medium Dense, Silty Sand with Gravel, Brick Fragmebts (FILL)	
3 - 5	S-2	X	3 - 4 - 5 - 4	6	9				As Above, Loose (FILL)	
						5.0				
5 - 7	S-3	X	3 - 2 - 1 - 1	12	3				As Above, Very Loose (FILL)	
7 - 9	S-4	X	4 - 4 - 5 - 5	3	9				As Above, Loose (FILL)	
						10.0				
10 - 12	S-5	X	13 - 16 - 24 - 23	14	40		GLACIAL TILL		Reddish-Brown, Dense, Silty Sand with Gravel (SM)	
						15.0				
15 - 17	S-6	X	12 - 14 - 12 - 15	18	26				As Above, Medium Dense (SM)	
						20.0				
20 - 22	S-7	X	8 - 8 - 9 - 9	14	17				As Above (SM)	
						25.0			Boring Log B-4 Terminated at a Depth of 22 fbgs.	

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-5

Page 1 of 1

Project:	Proposed 7-Eleven Convenience Store with Fuel Sales	**WAI Project No.:**	GM2017332.000
Location:	1033 North Colony Road, Wallingford, New Haven County, Connecticut	**Client:**	Stonefield Engineering & Design, LLC

Surface Elevation:	± NS feet	**Date Started:**	8/24/2020	**Water Depth | Elevation (feet bgs) | (feet)**		**Cave-In Depth | Elevation (feet bgs) | (feet)**	
Termination Depth:	11.8 feet bgs	**Date Completed:**	8/24/2020				
Proposed Location:	Underground Storage Tanks	**Logged By:**	RK	**During:**	-- | --		
Drill / Test Method:	HSA / SPT	**Contractor:**	GB	**At Completion:**	-- | --	**At Completion:**	-- | --
		Equipment:	Diedrich D-50	**24 Hours:**	-- | --	**24 Hours:**	-- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							GRAVEL		3" Gravel	
1 - 3	S-1	X	9 - 12 - 10 - 10	14	22		GLACIO-FLUVIAL DEPOSIT		Brown, Medium Dense, Poorly Graded Sand with Gravel (SP)	
3 - 5	S-2	X	9 - 10 - 8 - 6	12	18				As Above (SP)	
						5.0				
5 - 7	S-3	X	4 - 6 - 6 - 8	16	12				As Above (SP)	
						7.5				
7 - 9	S-4	X	5 - 28 - 27 - 27	12	55		GLACIAL TILL		Reddish-Brown, Very Dense, Silty Sand with Gravel (SM)	
						10.0				
10 - 11.3	S-5	X	22 - 38 - 50/4"	12	76				As Above (SM)	Cobbles
									Boring Log B-5 Terminated upon Auger Refusal at a Depth of 11.8 fbgs.	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-6

Page 1 of 1

Project:	Proposed 7-Eleven Convenience Store with Fuel Sales	**WAI Project No.:**	GM2017332.000
Location:	1033 North Colony Road, Wallingford, New Haven County, Connecticut	**Client:**	Stonefield Engineering & Design, LLC

Surface Elevation:	± NS feet	**Date Started:**	8/24/2020	**Water Depth | Elevation (feet bgs) | (feet)**		**Cave-In Depth | Elevation (feet bgs) | (feet)**	
Termination Depth:	12.0 feet bgs	**Date Completed:**	8/24/2020				
Proposed Location:	Entrance/Exit	**Logged By:**	RK	**During:**	-- | --		
Drill / Test Method:	HSA / SPT	**Contractor:**	GB	**At Completion:**	-- | --	**At Completion:**	-- | --
		Equipment:	Diedrich D-50	**24 Hours:**	-- | --	**24 Hours:**	-- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
0 - 2	S-1		7 - 11 - 18 - 15	8	29		TS		6" Topsoil	
							SUBSOIL		6" Sandy Subsoil	
							EXISTING FILL		Brown, Medium Dense, Silty Sand with Gravel (FILL)	
2 - 4	S-2		10 - 8 - 7 - 5	14	15		GLACIO-FLUVIAL DEPOSIT		Brown, Medium Dense, Poorly Graded Sand with Gravel (SP)	
						5.0				
5 - 7	S-3		4 - 5 - 6 - 7	12	11				As Above (SP)	
7 - 9	S-4		11 - 12 - 23 - 14	16	35	8.0			As Above (SP)	
							GLACIAL TILL		Reddish-Brown, Dense, Silty Sand with Gravel (SM)	
						10.0				
10 - 11.3	S-5		30 - 36 - 50/3"	12	72				As Above, Very Dense (SM)	Cobbles
									Boring Log B-6 Terminated upon Auger Refusal at a Depth of 12 fbgs.	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Test Pit No.: TP-1

Page 1 of 1

Project:	Proposed 7-Eleven Convenience Store with Fuel Sales	**WAI Project No.:**	GM2017332.000
Location:	1033 North Colony Road, Wallingford, New Haven County, Connecticut	**Client:**	Stonefield Engineering & Design, LLC

Surface Elevation:	± NS feet NAVD88	**Date Started:**	8/21/2020		**Water Depth (feet bgs) | Elevation (ft NAVD88)**	**Cave-In Depth (feet bgs) | Elevation (ft NAVD88)**	
Termination Depth:	10.0 feet bgs	**Date Completed:**	8/21/2020				
Proposed Location:	SWM Area	**Logged By:**	RK	**During:**	-- | --		
Excavating Method:	Mini Excavator	**Contractor:**	PS	**At Completion:**	-- | --	**At Completion:**	-- | --
Test Method:	Visual Observation	**Rig Type:**	Kubota KX080	**24 Hours:**	-- | --		

SAMPLE INFORMATION			DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (ft.)	Number	Type	(feet)				
			0.0				
				PAVEMENT		3" Asphalt	No groundwater
				GRAVEL		6" Granular Base	No indications of seasonal high groundwater level
				TOPSOIL		3" Former Topsoil and 6" Former Subsoil	
5'	S-1	Grab	5.0	GLACIO-FLUVIAL DEPOSIT		Brown, Poorly Graded Sand with Gravel (SP)	
			10.0			Test Pit TP-1 Terminated at Depth of 10 Feet Below Ground Surface.	
			15.0				

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Test Pit No.: TP-2

Page 1 of 1

Project:	Proposed 7-Eleven Convenience Store with Fuel Sales	**WAI Project No.:**	GM2017332.000
Location:	1033 North Colony Road, Wallingford, New Haven County, Connecticut	**Client:**	Stonefield Engineering & Design, LLC

Surface Elevation:	± NS feet NAVD88	**Date Started:**	8/21/2020		**Water Depth (feet bgs) | Elevation (ft NAVD88)**	**Cave-In Depth (feet bgs) | Elevation (ft NAVD88)**	
Termination Depth:	10.5 feet bgs	**Date Completed:**	8/21/2020				
Proposed Location:	SWM Area	**Logged By:**	RK	**During:**	-- | --		
Excavating Method:	Mini Excavator	**Contractor:**	PS	**At Completion:**	-- | --	**At Completion:**	-- | --
Test Method:	Visual Observation	**Rig Type:**	Kubota KX080	**24 Hours:**	-- | --		

SAMPLE INFORMATION			DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (ft.)	Number	Type	(feet)				
			0.0				
				PAVEMENT		3" Asphalt and 6" Granular Base	No groundwater
				TOPSOIL		3" Former Topsoil	No indications of seasonal high groundwater level
				GLACIO-FLUVIAL DEPOSIT			
5'	S-1	Grab	5.0			Brown, Poorly Graded Sand with Gravel (SP)	
9'	S-2	Grab	10.0			Brown, Poorly Graded Gravel with Sand (GP)	
						Test Pit TP-2 Terminated at Depth of 10.5 Feet Below Ground Surface.	
			15.0				

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Test Pit No.: TP-3A

Page 1 of 1

Project:	Proposed 7-Eleven Convenience Store with Fuel Sales	**WAI Project No.:**	GM2017332.000
Location:	1033 North Colony Road, Wallingford, New Haven County, Connecticut	**Client:**	Stonefield Engineering & Design, LLC

Surface Elevation:	± NS feet NAVD88	**Date Started:**	8/21/2020		**Water Depth (feet bgs) | Elevation (ft NAVD88)**	**Cave-In Depth (feet bgs) | Elevation (ft NAVD88)**	
Termination Depth:	10.0 feet bgs	**Date Completed:**	8/21/2020				
Proposed Location:	SWM Area	**Logged By:**	RK	**During:**	-- | --		
Excavating Method:	Mini Excavator	**Contractor:**	PS	**At Completion:**	-- | --	**At Completion:**	-- | --
Test Method:	Visual Observation	**Rig Type:**	Kubota KX080	**24 Hours:**	-- | --		

SAMPLE INFORMATION			DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (ft.)	Number	Type	(feet)				
			0.0			**Represents the southeastern half of test pit**	
				PAVEMENT		4" Asphalt	No groundwater
				GRAVEL		12" Granular Base	No indications of seasonal high groundwater level
				GLACIO-FLUVIAL DEPOSIT			
5'	S-1	Grab	5.0			Brown, Poorly Graded Sand with Gravel (SP)	
			10.0				
						Test Pit TP-3 Terminated at Depth of 10 Feet Below Ground Surface.	
			15.0				

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Test Pit No.: TP-3B

Page 1 of 1

Project:	Proposed 7-Eleven Convenience Store with Fuel Sales	**WAI Project No.:**	GM2017332.000
Location:	1033 North Colony Road, Wallingford, New Haven County, Connecticut	**Client:**	Stonefield Engineering & Design, LLC

Surface Elevation:	± NS feet NAVD88	**Date Started:**	8/21/2020		**Water Depth (feet bgs) | Elevation (ft NAVD88)**	**Cave-In Depth (feet bgs) | Elevation (ft NAVD88)**	
Termination Depth:	10.0 feet bgs	**Date Completed:**	8/21/2020				
Proposed Location:	SWM Area	**Logged By:**	RK	**During:**	-- | --		
Excavating Method:	Mini Excavator	**Contractor:**	PS	**At Completion:**	-- | --	**At Completion:**	-- | --
Test Method:	Visual Observation	**Rig Type:**	Kubota KX080	**24 Hours:**	-- | --		

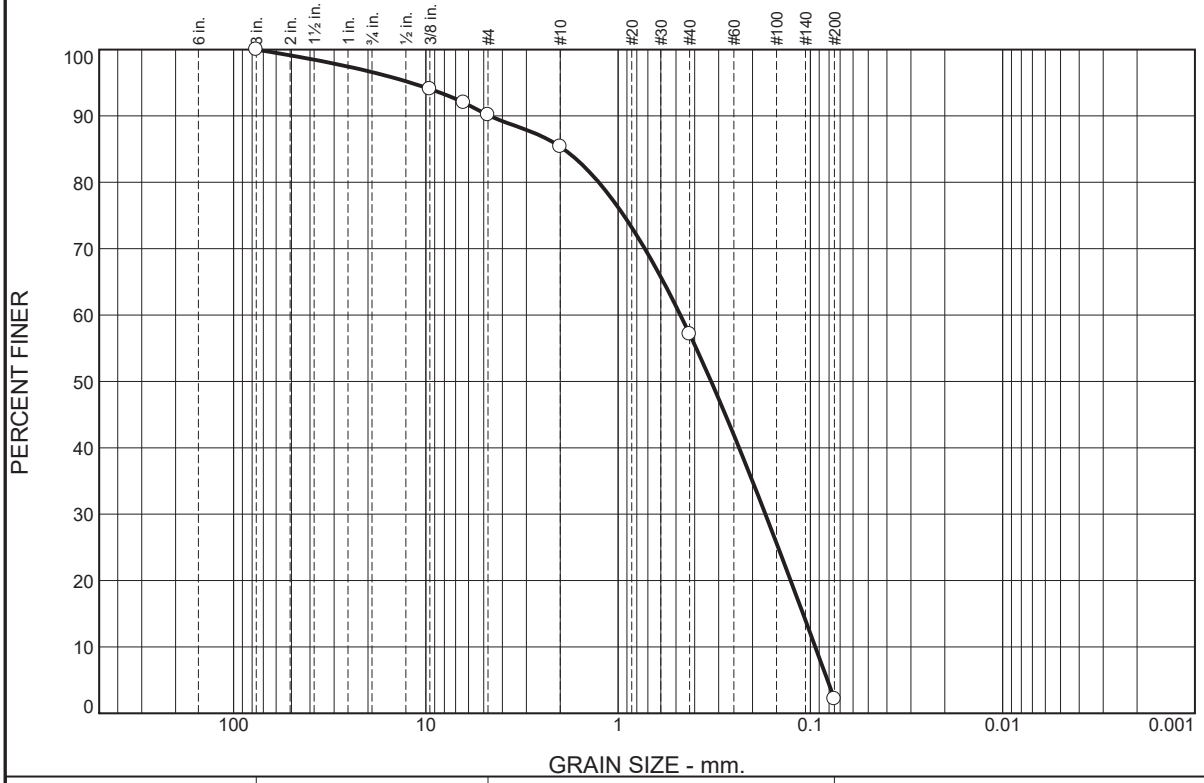
SAMPLE INFORMATION			DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (ft.)	Number	Type	(feet)				
			0.0			**Represents the northwestern half of test pit**	
				PAVEMENT		4" Asphalt	No groundwater
				GRAVEL		12" Granular Base	No indications of seasonal high groundwater level
			5.0	EXISTING FILL		Brown, Poorly Graded Gravel with Sand, Cobbles, Boulders (FILL)	Blast rock fill
			10.0			Test Pit TP-3 Terminated at Depth of 10 Feet Below Ground Surface.	
			15.0				

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

APPENDIX B
Laboratory Test Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.4	6.5	4.7	28.3	54.9	2.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0	100.0	
3/8"	94.1		
1/4"	92.0		
#4	90.1		
#10	85.4		
#40	57.1		
#200	2.2	0.0 - 15.0	

* Whitestone Structural Fill

Material Description

Poorly Graded Sand

Atterberg Limits

PL= NP LL= NP PI= NV

Coefficients

D_{90}= 4.6426 D_{85}= 1.9168 D_{60}= 0.4742
D_{50}= 0.3282 D_{30}= 0.1714 D_{15}= 0.1092
D_{10}= 0.0943 C_u= 5.03 C_c= 0.66

Classification

USCS= SP AASHTO= A-3

Remarks

Moisture Content = 3.1%

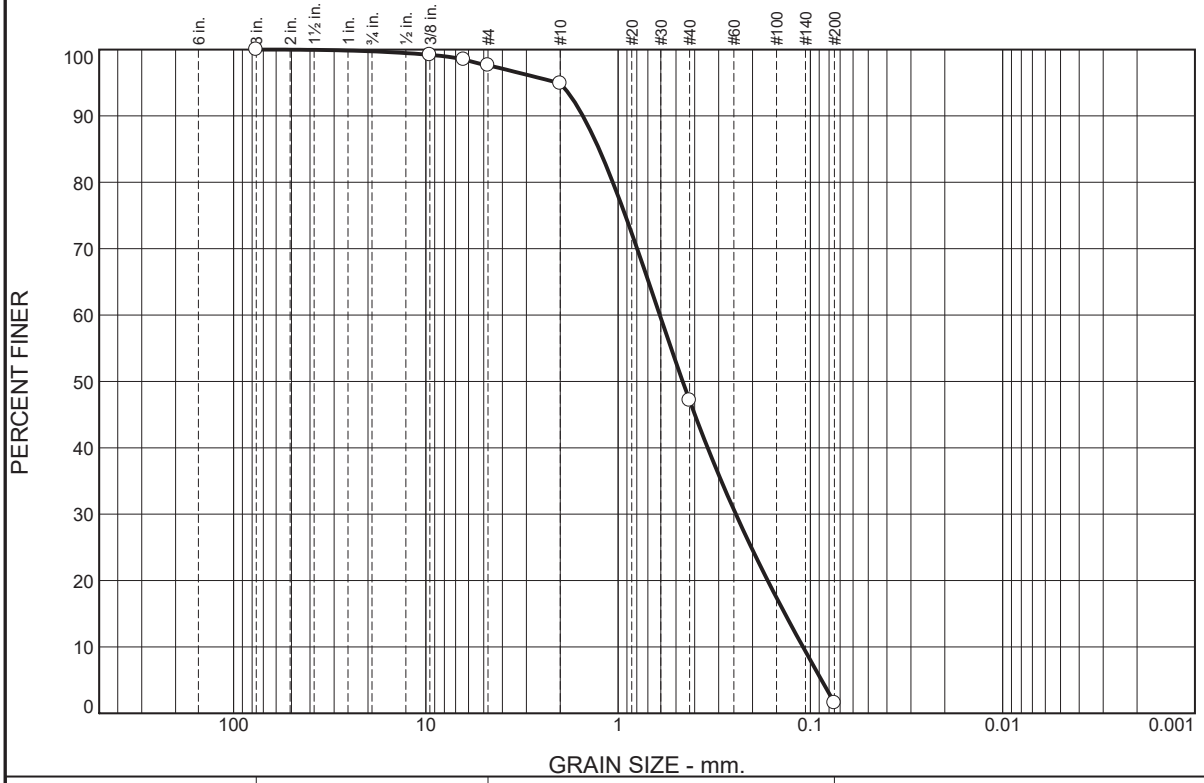
Location: Boring B-1
Sample Number: S-2 **Depth:** 3.0'-5.0' **Date:** 8/27/2020

WHITESTONE ASSOCIATES, INC.

Client: Stonefield Engineering & Design, LLC
Project: Proposed 7-Eleven Convenience Store With Fuel Sales
1033 North Colony Road, Wallingford, New Haven County, CT
Project No: GM2017332.000 **Figure** S-1

Tested By: JM **Checked By:** RWM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.3	2.1	2.7	47.8	45.5	1.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0	100.0	
3/8"	99.2		
1/4"	98.5		
#4	97.6		
#10	94.9		
#40	47.1		
#200	1.6	0.0 - 15.0	

* Whitestone Structural Fill

Material Description

Poorly Graded Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 1.5251 D_{85}= 1.2561 D_{60}= 0.6067
D_{50}= 0.4612 D_{30}= 0.2440 D_{15}= 0.1355
D_{10}= 0.1092 C_u= 5.55 C_c= 0.90

Classification

USCS= SP AASHTO= A-1-b

Remarks

Moisture Content = 4.1%

Location: Test Pit TP-1
Sample Number: S-1 **Depth:** 5.0' **Date:** 8/27/2020

WHITESTONE ASSOCIATES, INC.

Client: Stonefield Engineering & Design, LLC
Project: Proposed 7-Eleven Convenience Store With Fuel Sales
1033 North Colony Road, Wallingford, New Haven County, CT
Project No: GM2017332.000 **Figure** S-1

Tested By: JM **Checked By:** RWM

WHITESTONE ASSOCIATES, INC.

APPENDIX C
Supplemental Information (USCS, Terms and Symbols)

WHITESTONE ASSOCIATES, INC.
Environmental & Geotechnical Engineers & Consultants

16 OLD FORGE ROAD
SUITE A
ROCKY HILL, CT 06067
860.726.7889
whitestoneassoc.com

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMITS LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMITS GREATER THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS FOR SAMPLES WITH 5% TO 12% FINES

GRADATION*

% FINER BY WEIGHT

TRACE..... 1% TO 10%
LITTLE..... 10% TO 20%
SOME..... 20% TO 35%
AND..... 35% TO 50%

COMPACTNESS*
Sand and/or Gravel

RELATIVE DENSITY

LOOSE. ..... 0% TO 40%
MEDIUM DENSE.... 40% TO 70%
DENSE..... 70% TO 90%
VERY DENSE..... 90% TO 100%

CONSISTENCY*
Clay and/or Silt

RANGE OF SHEARING STRENGTH IN POUNDS PER SQUARE FOOT

VERY SOFT..... LESS THAN 250
SOFT..... ..... 250 TO 500
MEDIUM..... 500 TO 1000
STIFF..... 1000 TO 2000
VERY STIFF..... 2000 TO 4000
HARD..... GREATER THAN 4000

** VALUES ARE FROM LABORATORY OR FIELD TEST DATA, WHERE APPLICABLE. WHEN NO TESTING WAS PERFORMED, VALUES ARE ESTIMATED.*

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Other Office Locations:

WARREN, NJ 908.668.7777
CHALFONT, PA 215.712.2700
SOUTHBOROUGH, MA 508.485.0755
WALL, NJ 732.592.2101
STERLING, VA 703.464.5858
EVERGREEN, CO 303.670.6905

WHITESTONE ASSOCIATES, INC.
Environmental & Geotechnical Engineers & Consultants

16 OLD FORGE ROAD
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GEOTECHNICAL TERMS AND SYMBOLS

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

N: Standard Penetration Value: Blows per ft. of a 140 lb. hammer falling 30" on a 2" O.D. split-spoon.
Qu: Unconfined compressive strength, TSF.
Qp: Penetrometer value, unconfined compressive strength, TSF.
Mc: Moisture content, %.
LL: Liquid limit, %.
PI: Plasticity index, %.
δd: Natural dry density, PCF.
▼: Apparent groundwater level at time noted after completion of boring.

DRILLING AND SAMPLING SYMBOLS

NE: Not Encountered (Groundwater was not encountered).
SS: Split-Spoon - 1 ⅜" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
AU: Auger Sample.
OB: Diamond Bit.
CB: Carbide Bit
WS: Washed Sample.

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

Term (Non-Cohesive Soils)	Standard Penetration Resistance
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Term (Cohesive Soils)	Qu (TSF)
Very Soft	0 - 0.25
Soft	0.25 - 0.50
Firm (Medium)	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

PARTICLE SIZE

Boulders	8 in.+	Coarse Sand	5mm-0.6mm	Silt	0.074mm-0.005mm
Cobbles	8 in.-3 in.	Medium Sand	0.6mm-0.2mm	Clay	-0.005mm
Gravel	3 in.-5mm	Fine Sand	0.2mm-0.074mm		

Other Office Locations:

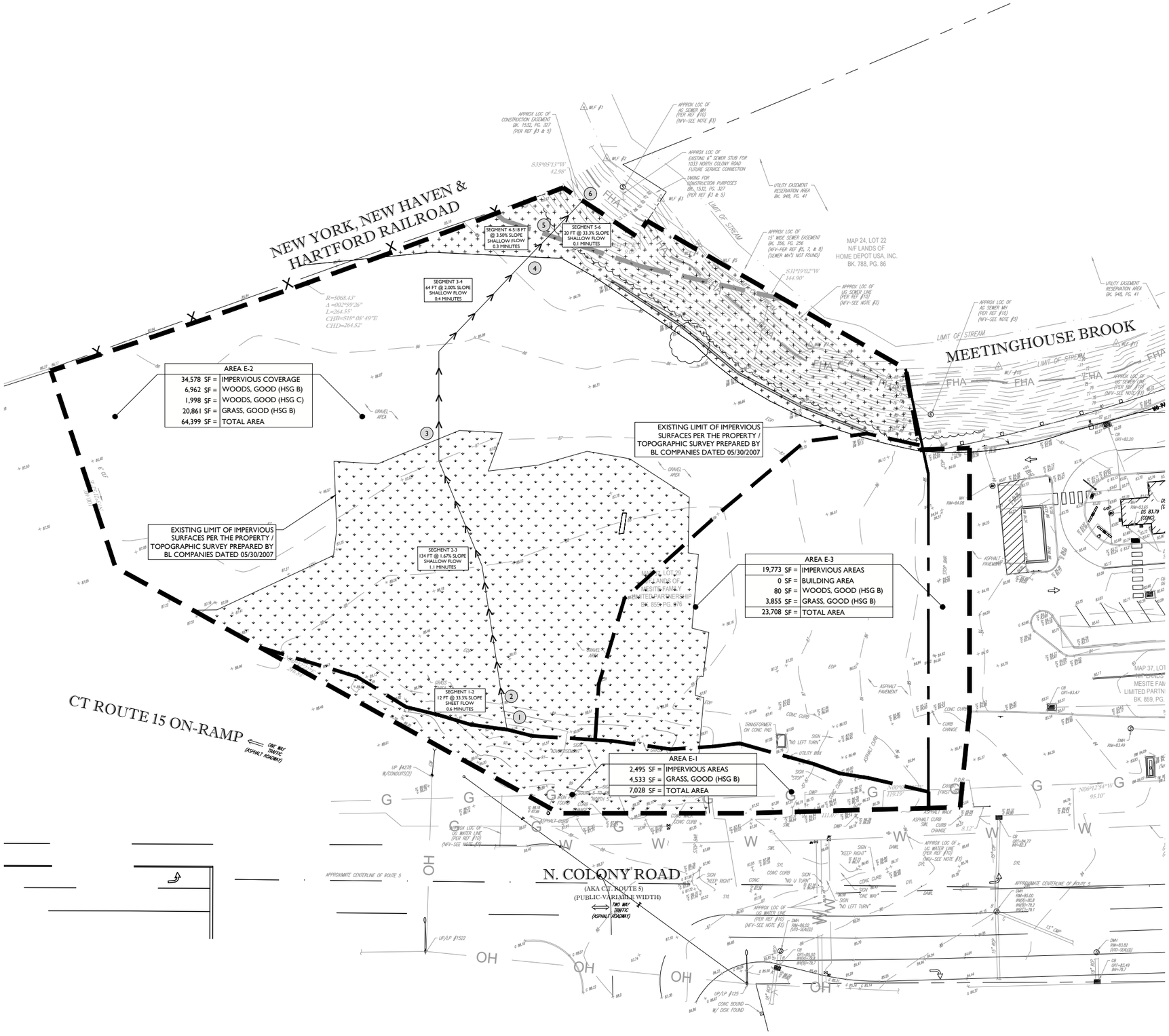
WARREN, NJ 908.668.7777
CHALFONT, PA 215.712.2700
SOUTHBOROUGH, MA 508.485.0755
WALL, NJ 732.592.2101
STERLING, VA 703.464.5858
EVERGREEN, CO 303.670.6905

APPENDIX E
DRAINAGE AREA MAPS

INVENTORY

EXISTING DRAINAGE AREA MAP

PROPOSED DRAINAGE AREA MAP



SYMBOL	DESCRIPTION
	PROPERTY LINE
	SITE AREA
	EXISTING SITE DRAINAGE AREA
	EXISTING PERVIOUS AREA
	EXISTING WOODED AREA
	EXISTING TIME OF CONCENTRATION

ISSUE	DATE	BY	DESCRIPTION
1	09/25/2020	DBB	INITIAL SUBMISSION SET

STONEFIELD engineering & design
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DRAINAGE AREA MAPS

7-ELEVEN, INC.
PROPOSED CONVENIENCE STORE WITH FUELING OPERATIONS

TAX PARCEL 37-29
1033 NORTH COLONY ROAD (U.S. ROUTE 15)
TOWN OF WALLINGFORD
NEW HAVEN COUNTY, CONNECTICUT

CHARLES D. OLIVO, P.E.
CONNECTICUT LICENSE No. 26845
LICENSED PROFESSIONAL ENGINEER

NOT APPROVED FOR CONSTRUCTION

SCALE: (H) 1" = 50'

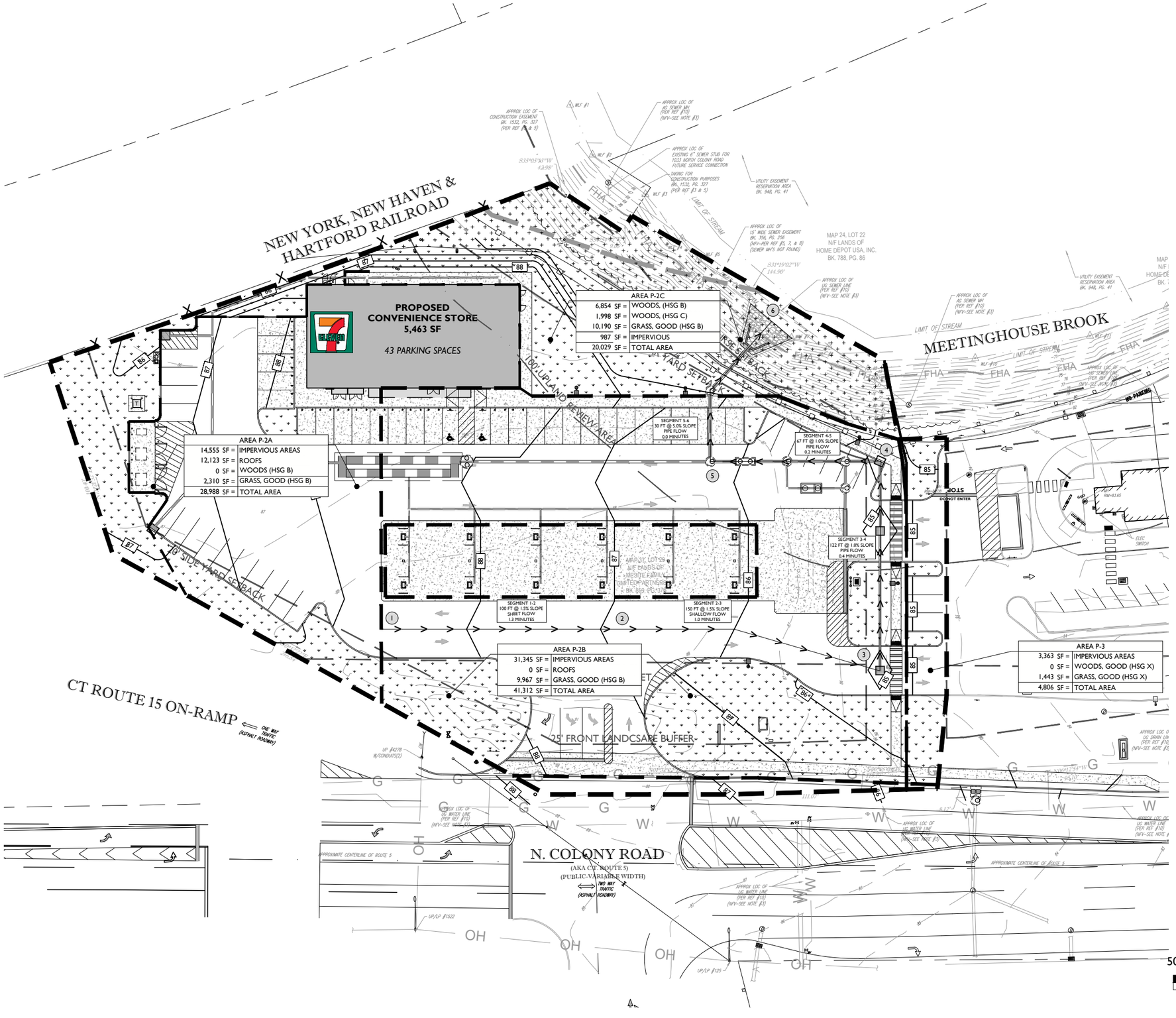
PROJECT ID: B-19007

STONEFIELD engineering & design

TITLE: EXISTING DRAINAGE AREA MAP

SHEET: SW-1

Z:\Boston\B\2019\B-19007 7-Eleven - 1033 North Colony Road, Wallingford, CT\CADD\Exhibits\Drainage Area Maps\2020-09-23_Drainage Area Maps.dwg



SYMBOL	DESCRIPTION
	PROPERTY LINE
	SITE AREA
	PROPOSED SITE DRAINAGE AREA
	PROPOSED PERVIOUS AREA
	WOODED AREA
	PROPOSED TIME OF CONCENTRATION

ISSUE	DATE	BY	DESCRIPTION
1	09/25/2020	DBB	INITIAL SUBMISSION SET

STONEFIELD engineering & design
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DRAINAGE AREA MAPS

7-ELEVEN, INC.
PROPOSED CONVENIENCE STORE WITH FUELING OPERATIONS

TAX PARCEL 37-29
1033 NORTH COLONY ROAD (U.S. ROUTE 15)
TOWN OF WALLINGFORD
NEW HAVEN COUNTY, CONNECTICUT

CHARLES D. OLIVO, P.E.
CONNECTICUT LICENSE No. 26843
LICENSED PROFESSIONAL ENGINEER

NOT APPROVED FOR CONSTRUCTION

SCALE: (H) 1" = 50'

PROJECT ID: B-19007

STONEFIELD engineering & design

TITLE:
PROPOSED DRAINAGE AREA MAP

SHEET:
SW-2

Z:\Boston\B\2019\B-19007 7-Eleven - 1033 North Colony Road, Wallingford, CT\CADD\Exhibits\Drainage Area Maps\2020-09-23_Drainage Area Maps.dwg