



Stormwater Management Report

Horizon View

**2268-2284 Route 32
Montville CT 06353**

**Prepared for:
Honeycomb Real Estate Partners
20 Avon Meadow Lane
Avon, CT 06001**

**Prepared by:
R.J. O'Connell & Associates, Inc.
80 Montvale Ave, Suite 201
Stoneham, MA 02180**

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1.0 Introduction

R.J. O'Connell & Associates, Inc. (RJOC) has prepared this Stormwater Management report on behalf of Steve Caprio of Honeycomb Real Estate Partners – 20 Avon Meadow Lane, Avon CT, for the proposed site improvements at 2268-2284 Route 32 located in Montville, Connecticut (refer to Figure 1, “USGS Map”). This study uses the computer program HydroCAD, version 10.10, to model existing and proposed hydrologic site conditions based on the Natural Resources Conservation Service (NRCS) TR-20 Computer Program for Project Formulation Hydrology. The study presents a comparative analysis of pre-development hydrologic conditions to post-development hydrologic conditions and demonstrates that the proposed condition will be an improvement over the existing stormwater management condition.

2.0 Site Location and Description

The project site is a 3.4-acre parcel comprised entirely of open space located across from Fort Shantok Road in Montville, Connecticut. Existing conditions have been hydrologically analyzed for stormwater runoff generation. Currently there are two (2) existing sub-catchments; EX-1 & EX-OS1 refer to Figure 5 Existing Watershed Plan for details. Sub-catchment EX-1 is an open space area that discharges at the southwestern portion of the site onto Meadow Lane Road. EX-OS1 is the tributary off site areas that flows onto the property and also discharges at the Southwestern portion of the site onto Meadow Lane.

3.0 Proposed Project

The proposed project consists of constructing a new 4 story, 60,000± square foot residential building with 57 units, parking, landscaping and appurtenances. Stormwater runoff collected from the roof will be conveyed through the main on-site stormwater system. Runoff from paved areas will be collected within 4-foot-deep sump catch basins, hydro dynamic particle separator, and sub-surface infiltration system, surface wet/detention pond prior to discharge offsite to Meadow Lane. The tributary up-stream offsite area stormwater runoff will be diverted to a proposed detention basin prior to discharge to the Meadow Lane.

Hydrologic analysis was performed for the proposed conditions for the 2-year, 10-year, 25-year, and 100-year, 24-hour storm events. The site has been divided into three (3) sub-catchments, PR1-1, PR1-2, & PR-OS1. Sub-catchments PR1-1 and PR1-2 are the onsite areas located on the project parcel. Sub-catchment PR-OS-1 is the offsite upstream residential area that flows onto our site. Sub-catchment PR-1 is comprised of the proposed building, parking and accessway, and landscaped areas. Runoff from sub-catchment PR1-1 will be collected in deep sump catch basins with hoods and pre-treated within a hydro-dynamic particle separator before being directed to the proposed subsurface infiltration system and wet/detention basin prior to discharge to Meadow Lane. PR1-2 is the southern landscaped perimeter of site and shall sheet flow off the site to Meadow Lane. The PR-OS1 stormwater runoff shall be diverted to a proposed detention basin on site prior to discharge to Meadow Lane.

The on-site stormwater management system has been designed to capture, detain, and treat stormwater runoff from the on-stormwater runoff while capturing and detaining stormwater runoff from the offsite tributary area, which will improve runoff conditions. The proposed stormwater system will comply with the CT Stormwater Management Standards as described

herein. Runoff control and water quality improvements will be accomplished by implementing the following practices:

- Implement a Stormwater Pollution Prevention Plan (SWPPP) to control erosion sedimentation and other construction related impacts;
- Install a sub-surface infiltration system to retain and recharge the water quality volume
- Install detention/wet basins for peak flow mitigation
- Collect storm runoff in catch basins with deep sumps and hooded outlets;
- Install drainage manholes and a hydrodynamic particle separator
- Implement an Operation and Maintenance Plan (O&M) for the proposed stormwater management system that describes the various components of the system, identifies inspection and maintenance tasks, and provides a schedule to follow, which will ensure the proper long-term performance of the system;

The proposed stormwater management measures described above will result in an improvement to the overall stormwater management condition. Stormwater runoff will be reduced, and water quality enhanced, thereby providing an improvement compared to the existing conditions.

4.0 Soil Data

Soil data was compiled using the Natural Resources Conservation Service (NRCS Web Soil Survey) located at URL: websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. The soil survey identified the majority of the site to be 29B-Agawam fine sandy loam. Hydrologic soil group B has been identified in the NRCS Soils classification but further exploration will have been completed to ascertain the Hydrologic Soils as per the CT Stormwater Manual.

On July 23 and August 10, 2024 Whitestone Associates, Inc performed test pits and boring to ascertain the soils data. As per the CT Stormwater Manual, the soil classification given was a Rawls rate of 1.02 via soil classification for A soils. Refer to Figure 3 Soils map and Appendix A for Geotechnical report.

5.0 Hydrologic Methodology

Pre- and post-development drainage analyses were performed for the 2, 10, 25 and 100-year storm events. Rainfall events have been compiled by NOAA Atlas for extreme precipitation for the region as noted below:

County	2-year	10-year	25-year	100-year
New London	3.46 in.	5.12 in.	6.16 in.	7.76 in.

The NRCS method uses several parameters based on watershed characteristics and configuration to generate a curvilinear unit hydrograph and produce a runoff hydrograph for the watershed. Basic input data required to generate a hydrograph are the watershed area, storm frequency, time of concentration, 24-hour rainfall, and the watershed's runoff curve number.

NRCS Technical Release 55 (TR-55) methodology was utilized to determine weighted runoff curve number (CN) for the pre- and post-development watershed areas. Inputs for obtaining the weighted CN were determined based on ground cover type and the Hydrological Soil Group (HSG), as described in the Soil Data section above. Time of concentration (Tc) was determined based on the most hydrologically distant point (time-wise) within the watershed.

Watershed boundaries were established based on topography, storm drainage layouts, and the location of major drainage discharge points, or Point of Analysis (POA). An off-site watershed plan is attached to depict the offsite residential area tributary to the project parcel. The pre-development watershed boundaries can be seen in Figure 5, “Existing Watershed Plan.” The post-development boundaries can be seen on Figure 6, “Proposed Watershed Plan”.

6.0 Existing Drainage Conditions

6.1 On-Site Resources

The site lies within flood Zone X per FEMA FIRM Map Number 09011C0351G effective date July 18, 2011. Though the proposed construction area lies outside of the flood zone.

6.2 Existing Hydrology

The existing site has been analyzed under current extreme precipitation values for the 2-year, 10-year, 25-year, and 100-year 24-hour storm events. The Point of Analysis (POA-1) has been identified as the southwestern portion of the site at Meadow Lane. The existing stormwater runoff from both on and off-site discharge to the Point of Analysis (POA-1).

Existing Sub-Catchment Area 1 (EX-1)

This 3.58-acre sub-catchment area consists of the entire open space area on the proposed development parcel and overland flow to the rear tributary to the site. Stormwater sheet flows over the open space area and form shallow concentrated flow to the Point of Analysis (POA-1)

Existing Sub-Catchment Area 1 (EX-OS1)

This 16-acre sub-catchment area consists of the upstream area tributary to the proposed project site. The upstream residential area is a residential subdivision consisting of a portion of Ridge Drive, Walnut Drive, and Cedar Lane. Stormwater is collected by 3 catch basins and discharge via a 15” culvert an open space area prior to reaching the project parcel. Stormwater Runoff flows thru a ditch and silt filled wetland area. Stormwater runoff sheet flows over the open space area and from shallow concentrated flow to the Point of Analysis (POA-1). See Figure 4 Off-site Upstream Watershed Plan for additional information.

6.3 Pre-Development Hydrological Conditions

Below is a summary of the pre-development hydrological conditions at the Point of analysis

Pre-Development Peak Rates of Runoff in Cubic Feet per Second (cfs)

Location	24-Hour Storm Events				
	1-year	2-year	10-year	25-year	100-year
POA-1	0.59	1.47	7.53	13.08	23.12

Comprehensive hydrological computations for pre-development conditions are included in Appendix B.

7.0 Proposed Drainage Conditions

7.1 Application of Stormwater Management Standards and Performance Criteria

The proposed development project is made up of three (3) sub-catchment areas for analysis (see Figure 5 – “Proposed Watershed Plan”). Stormwater runoff generated over paved areas will be captured by a deep sump catch basin with hooded outlets and routed through a hydrodynamic particle separator and a subsurface infiltration system prior to discharge to POA-1.

Proposed Sub-Catchment Area 1 (PRI-1)

This 3.4-acre sub-catchment area consists of the proposed residential building, parking area, access drive, associated landscaping and appurtenances. Stormwater runoff collected over the roof will be collected by roof drains flow to the proposed stormwater system. Stormwater runoff from paved surfaces will be collected in deep sump catch basins with hooded outlets, hydrodynamic particle separator, and subsurface infiltration system and detention basin prior to discharge to Meadow Lane POA-1.

Proposed Sub-Catchment Area 2 (PRI-2)

This 0.18-acre sub-catchment area consists of the southern perimeter of the site. The sub-catchment is entirely open space and runoff sheet off the site to the south to Meadow Lane POA-1.

Proposed Sub-Catchment Area 3 (PR-OS1)

This 16-acre sub-catchment area consists of the upstream area tributary to the proposed project site. Stormwater runoff sheet is collected by a depression at the northern proposed head wall and is piped to a proposed wet basin. The wet basin discharges to the southwestern portion of the site to Meadow Lane at POA-1.

7.2 Post-Development Hydrological Conditions

For the on-site stormwater management program, under proposed developed conditions, deep-sump catch basins with hooded outlets, hydrodynamic particle separator, subsurface infiltration, and detention basin will treat stormwater runoff before it is discharged off-site at Meadow Lane POA-1. The off-site stormwater management program consists of a wet basin to divert and mitigate peak flows prior to discharge to Meadow Lane POA-1. Below is a comparison summary table of the pre- and post-development peak rates of runoff at the point of analysis. The peak rates of stormwater discharged from the site for the storm events analyzed will be reduced under proposed conditions as compared to existing conditions.

Pre- and Post-Development Peak Rates of Runoff in Cubic Feet per Second (cfs)

Point of Analysis 1				
Storm Frequency	Existing Flow Rate (cfs)	Proposed Flow Rate (cfs)	Change (cfs)	% Reduction
2-Year	1.47	1.17	-0.30	20%
10-Year	7.53	7.27	-0.26	3%
25-Year	13.08	12.02	-1.06	8%
100-Year	23.15	16.51	-6.64	29%

Pre- and Post-Development Volume of Runoff in Acre-Feet (af)

Point of Analysis 1				
Storm Frequency	Existing Volume (ac-ft)	Proposed Volume (ac-ft)	Change (ac-ft)	% Reduction
2-Year	0.527	0.379	-0.148	28%
10-Year	1.659	1.488	-0.171	10%
25-Year	2.576	2.456	-0.120	5%
100-Year	4.206	4.132	-0.074	2%

Comprehensive hydrological computations for post-development conditions are included in Appendix A.

7.3 Catch Basin Grate Capacity Analysis

Grate capacity calculations have been performed for the proposed inlet structures for the 25-year storm event. Refer to Appendix A for calculations.

7.4 Pipe Capacity and Level Spreader Analysis

Pipe capacity calculations have been performed for the proposed inlet structures for the 10-year storm event. Level spreader calculations have been performed for the 100-yr storm event. Refer to Appendix A for calculations.

7.5 Groundwater Recharge

As the site is comprised of Sandy Loam with a Hydrologic Soil Group A. See Section 7.7 below for calculations.

7.6 Stormwater Quality

The development program includes suitable Best Management Practices (BMPs) to pre-treat runoff from paved parking lot areas prior to infiltration. Stormwater quality will be improved through the use of the following BMPs to remove 80% of TSS overall prior to discharge off-site. See below for TSS removal calculations.

- Catch Basins with Deep Sumps and Hooded Outlets
Stormwater runoff from pavement areas will be directed via curbing and site grading to catch basins with deep sumps and hooded outlets. Catch basins trap and remove sediments and larger particles from stormwater runoff and improve the performance of subsequent BMP's. The catch basin sumps will be a minimum of 4 feet in depth, and a regular inspection and cleaning schedule will be followed to ensure optimal effectiveness. When properly constructed and maintained, catch basins with deep sumps and hooded outlets are effective in reducing the sediment and pollutant load in runoff.
- Hydrodynamic Particle Separators
The hydrodynamic particle separator is a precast concrete structure that uses a helical flow pattern that enhances trapping and containment of pollutants and provides effective removal of settleable solids and floating contaminants from stormwater runoff. Low storm flows are directed into a tangentially oriented downward pipe that induces a swirling motion in the treatment chamber that increases capture and containment abilities. Moderate storm flows are directed into the treatment chamber through a secondary inlet, which allows for capture of floating trash and debris. The secondary inlet also provides treatment of higher flows without significantly increasing the velocity or turbulence in the treatment chamber. This allows for a separation environment. Settleable solids and pollutants are captured and contained in the treatment chamber. Flow exits the treatment chamber through the outlet flow control, which manages the amount of flow that is treated and helps maintain the helical flow patterns developed within the treatment chamber. Flows exceeding the system's rated treatment flows are diverted away from the

treatment chamber by the flow partition. Internal diversion of high flows eliminates the need for external by-pass structures. During by-pass, the head equalizing baffle applies head on the outlet flow control to limit the flow through the treatment chamber. This helps prevent the re-suspension of previously captured pollutants. Stormwater will be routed through the hydrodynamic separators prior to discharging into the surface infiltration system.

- Subsurface Infiltration System

The subsurface infiltration system is similar to a subsurface detention system although they have a perforated pipes set in crushed stone to promote infiltration into the groundwater. Four (4) feet of separation from groundwater is required to install a subsurface infiltration system. The infiltration chambers are sized to store the recharge volume below the lowest outlet invert to retain and promote the infiltration of the recharge volume.

- Detention Basin

Detention Basins are designed to capture, temporarily hold, and gradually release a volume of stormwater runoff to attenuate and delay stormwater runoff peaks. Detention Basins are typically designed as on-line systems and provide stormwater quality control but only limited water quality benefits. The primary outlet of a detention basin is located at the bottom of the basin and is sized to limit the max flow rate from the basin for the water quality storm. The higher stages of the basin attenuate the peak rates of runoff from larger storm events. Detention Basins are designed to completely empty between storms, typically in 24 to 48 hours, resulting in limited settling of particulate matter and the potential for re-suspension of sediment by subsequent runoff events.

7.7 Stormwater Calculations

1. Water Quality Volume (PR-1):

$$WQV = (P) * (R) * (A) \left(\frac{1ft}{12in} \right)$$

Where:

WQV = Water Quality Volume

R = Volumetric Runoff Coefficient (dimensionless) = $0.05 + 0.009(I)$

I = Percent Impervious Cover = $90,735 \text{ SF} / 148,322 \text{ SF} = 62 \%$

A = Drainage Area in Acres = $148,322 \text{ SF}$

$$R = 0.05 + 0.009(I)$$

$$R = 0.05 + 0.009(62)$$

$$R = 0.608$$

$$WQV = 1.30 * 0.608 * 148,322 \left(\frac{1ft}{12in} \right)$$

$$\frac{WQV = 9,770 \text{ CF} = 0.224 \text{ acre feet}}{\text{Proposed Volume provided } 21,318 \text{ CF}}$$

2. Water Quality Flow (PR-1):

$$WQF = q_u * A_{sm} * Q$$

Where:

WQF = Water Quality Flow (cfs)

q_u = Volumetric Runoff Coefficient from Exhibit 4-11 in Chp. 4 of TR-55 (csm/inch)

A_{sm} = Drainage Area in square miles = $3.41 \text{ acres} * (1 \text{ sq. mi.} / 640 \text{ acres}) = 0.0053 \text{ acres}$

Q = Runoff Depth (inches)

a.) Compute the Runoff Depth (Q):

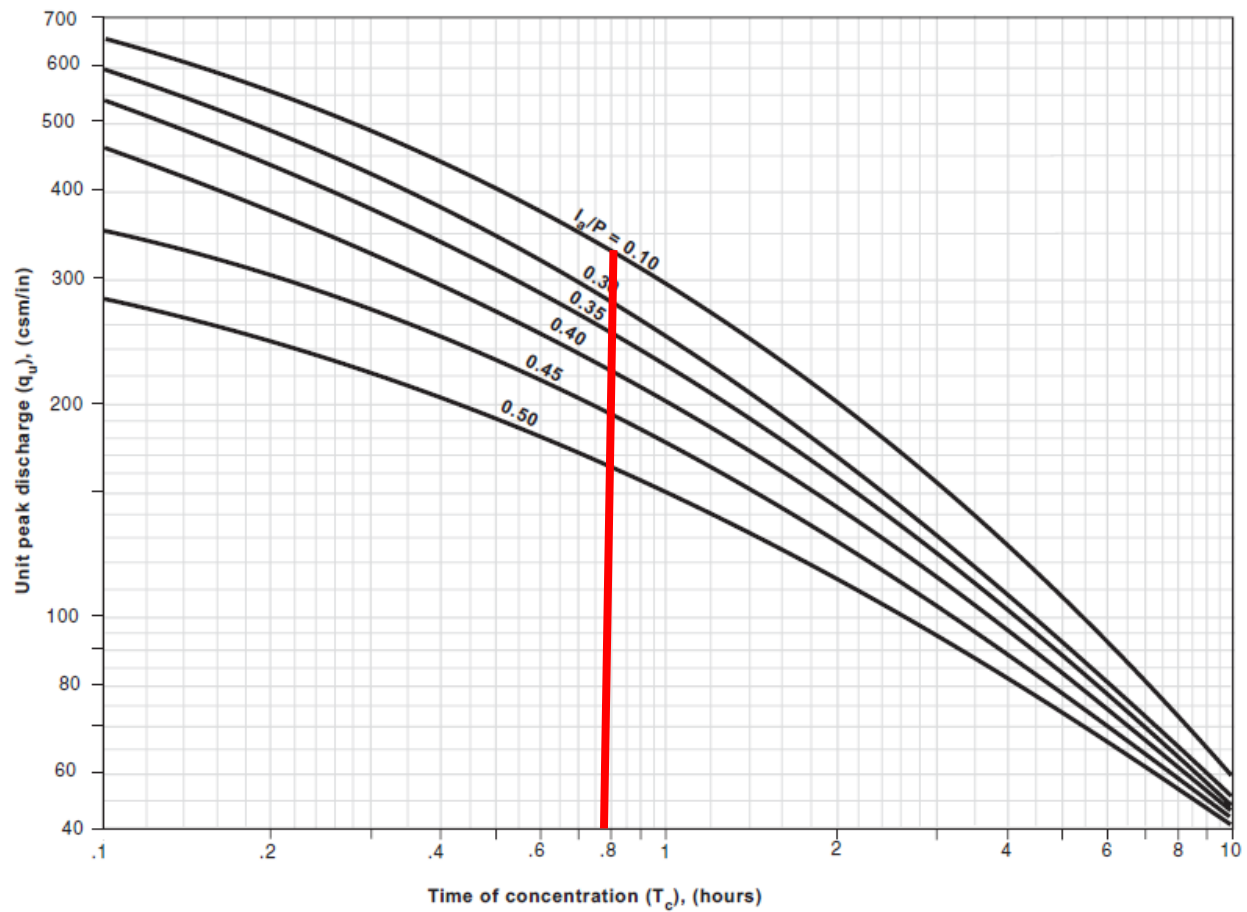
$$Q = \frac{WQV * (12 \text{ Inches/foot})}{A}$$

$$Q = \frac{0.224 \text{ acre - feet} * (12 \text{ inches/foot})}{3.41 \text{ acres}}$$

$$\underline{Q = 0.79 \text{ inches}}$$

b.) Read Unit Peak Discharge, q_u , from Exhibit 4-11 in Chp 4 of TR-55:

Exhibit 4-III Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



Where:

T_c = Time of Concentration in Hours: 6 minutes * (1 hour / 60 minutes) = 0.1 hours

q_u = Unit Peak Discharge (csm/in): 330 csm/in

c.) Compute the Water Quality Flow:

$$WQF = q_u * A_{sm} * Q$$

$$WQF = 330 \text{ csm/in} * 0.0053 \text{ sq.mi.} * 0.61 \text{ inches}$$

$$\underline{WQF = 1.06 \text{ cfs}}$$

3. *Groundwater Recharge Volume*

As the site has HSG A soils on site with a design infiltration volume 100% of the Water quality/Retention Volume plus additional runoff volume to attenuate peak runoff rates associated with the 2-year, 10-year, and 100-year storm. The required recharge volume is 9,770 cf.

Total Recharge Volume Provided:

The proposed infiltration system is designed to retain and infiltrate the water quality volume. Storm events greater than 1-inch shall be conveyed through the subsurface infiltration basin to the proposed detention basin then to Meadow Lane

The total recharge volume provided is:

Stormwater BMP	Elevation	Groundwater Elevation	Recharge Volume (cf)
Infiltration Basin	143.0 – 146.0	138.0	21,318
Total Volume Provided			21,318

Total Water Quality Drain Time

$$T_d = (V/K \times A) \times 12 \text{ inches/foot}$$

T_d = Drain time Hours

V = Design Infiltration Volume = 9,770 cf

K = Design infiltration rate (inches per hour) = 0.51 inches per hour

A = Average surface area of infiltration system = 49 x 155 = 7,595

$$T_d = (21,318/0.51 \times 10,812) \times 12 \text{ inches/foot}$$

$$T_d = 46 \text{ hours}$$

4. *Dynamic Storage/retention Volume*

The proposed Dynamic storage/retention volume is included in the stage storage table. The storage volume on-site is the volume of water stored in the proposed subsurface infiltration system below the low flow orifice. The total storage volume is 21,085 cf and can be found in appendix A Proposed HydroCAD Stage Storage Tables.

5. *Stream Channel Protection (Not Applicable)*

6. *Conveyance Protection (Not Applicable)*

The proposed drainage conveyance system has been sized for the 25-year, 24-hour post development peak flow. Refer to Appendix A for the Pipe and Grate Capacity Analysis for additional information.

7. Peak Runoff Attenuation (DAA-1)

Storm Event	Pre-Development Flow (cfs)	Post-Development Flow (cfs)	Delta (cfs)
1-year, 24-hour	0.59	0.31	0.28
2-year, 24-hour	1.47	1.17	0.30
10-year, 24-hour	7.53	7.27	0.26
25-year, 24-hour	13.08	12.02	1.06
100-year, 24-hour	23.15	16.51	6.64

8. Emergency Outlet Sizing (PR-1)

The proposed detention stormwater basin includes an emergency spillway but the peak elevation of the 100-year storm event is below the emergency spillway elevation.

9. Erosion Control/Scour Protection

Erosion control or scour protection will be placed at all pipe and flume locations where erosion or scour may occur.

8.0 Summary

This hydrologic analysis estimates peak storm runoff discharged from the site under both the existing and proposed conditions. The stormwater management system for the proposed development includes measures for collecting, controlling, and treating stormwater runoff from the site. The proposed measures comply with the stormwater management standards of the CT Stormwater Manual and represent an improvement over the existing conditions. The drainage improvements proposed herein will reduce stormwater runoff peak flow rates leaving the site and improve the overall water quality of stormwater runoff.

An Operation and Maintenance Manual has been included as part of this report to ensure the long-term operation of the proposed stormwater management system. As part of the proposed Operation and Maintenance Manual, a Long-Term Pollution Prevention Plan (LTPPP) has been incorporated to ensure proper spill prevention and management materials area available on site and staff are properly trained to prevent additional pollutant loading.

II. FIGURES

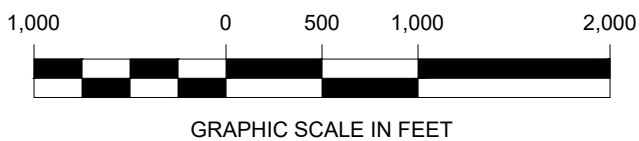
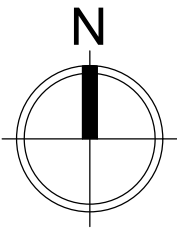
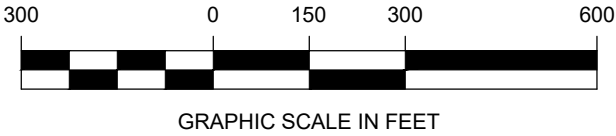


FIGURE 1
USGS MAP
MONTVILLE, CT

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LEGEND

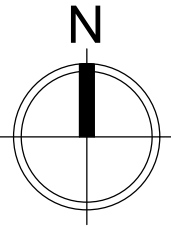
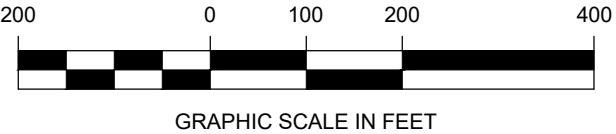
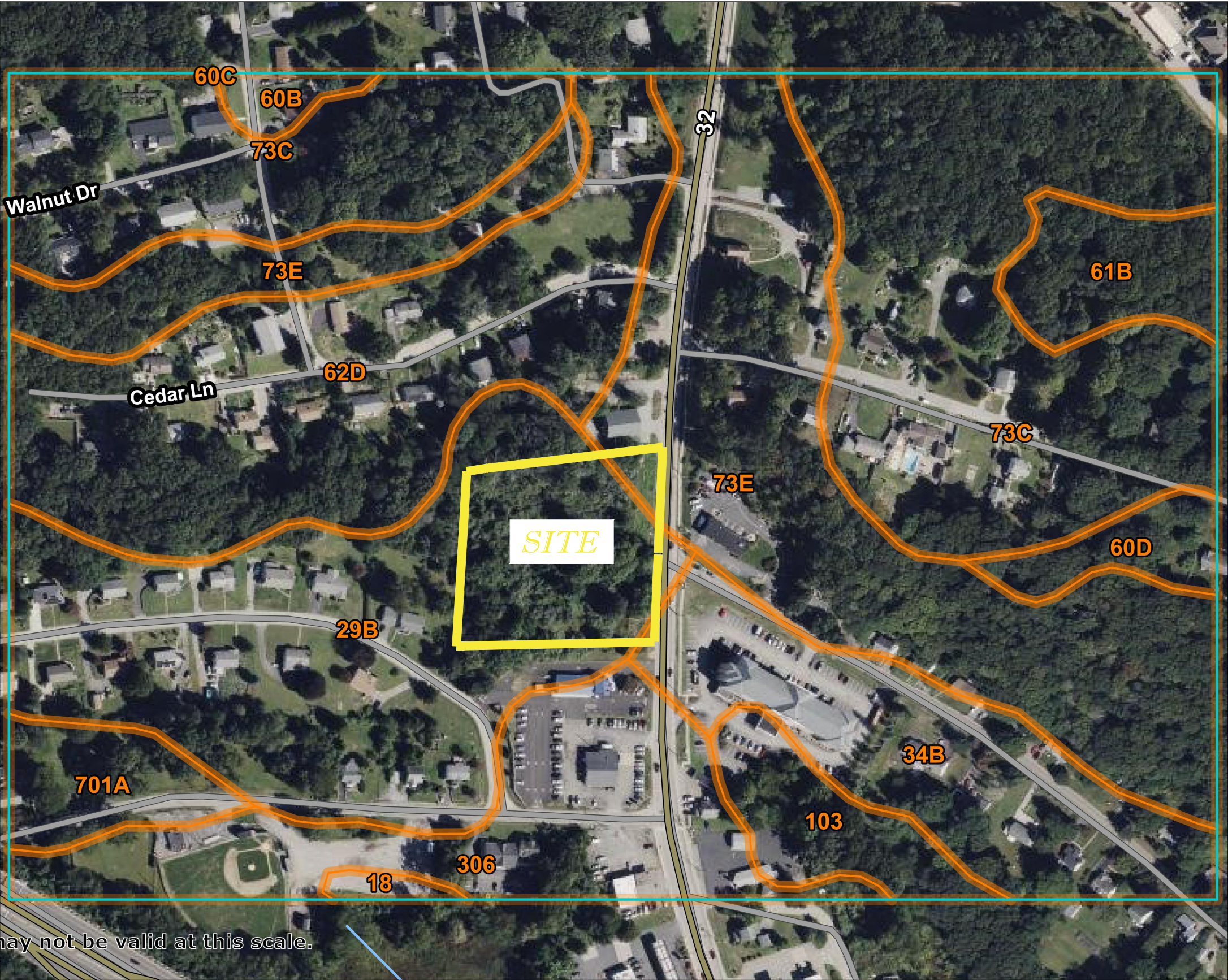
	SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.
ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
	FLOODWAY AREAS IN ZONE AE The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.
	OTHER FLOOD AREAS
ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	OTHER AREAS
ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.
	COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS
	OTHERWISE PROTECTED AREAS (OPAs) CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
	1% Annual Chance Floodplain Boundary
	0.2% Annual Chance Floodplain Boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
	Base Flood Elevation line and value; elevation in feet*
	Base Flood Elevation value where uniform within zone; elevation in feet*
	Cross section line

**RJO'CONNELL
& ASSOCIATES, INC.**
CIVIL ENGINEERS, SURVEYORS & LAND PLANNERS

DATE: 07/18/2024 SCALE: 1"=300'

FIGURE 2
FEMA FLOOD INSURANCE RATE MAP
MONTVILLE, CT

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NRCS SOIL MAP LEGEND

MAP UNIT SYMBOL	MAP UNIT NAME	HSG
29B	AGAWAM FINE SANDY LOAM 3 TO 8 PERCENT SLOPES	B
62D	CANTO AND CHARLTON FINE SANDY LOAMS 15 TO 35 PERCENT SLOPES EXTREMELY STONEY	B
73E	CHARLTON-CHATFIELD COMPLEX 15 TO 45 PERCENT SLOPE	B
34B	MERRIMAC FINE SANDY LOAM 3 TO 8 PERCENT SLOPES	A

**RJO'CONNELL
& ASSOCIATES, INC.**
CIVIL ENGINEERS, SURVEYORS & LAND PLANNERS

DATE: 09/25/2024 SCALE: 1"=200'

FIGURE 3
NRCS SOILS MAPS
MONTVILLE, CT

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RICHARD BROWN DR

CRESTVIEW DR

WEBB DR

ROUTE 32

RIDGE DR

WALNUT DR

CEDAR LN

BROADVIEW AVE

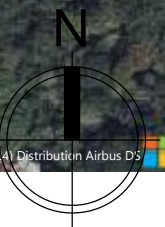
EX-OS1

TOTAL AREA = 17.070 ACRES
CN = 53
Tc = 30 MINUTES

SITE



GRAPHIC SCALE IN FEET



RJOC