May
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Civil Engineering, Site Planning, and Consulting
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DRAINAGE REPORT
Stormwater Mitigation Plan

October 11, 2021
REV October 26, 2021

Property Located at:

121 Upper Pattagansett Rd.
East Lyme, CT 06333

Prepared For:
Project: Nottingham Hills Subdivision Phase V

English Harbor Asset Management, LLC
38 Granite Street
New London, CT 06320

Prepared By:
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SITE DESCRIPTION:

The site is a 64-acre wooded parcel located along the northern shore of Pattagansett Lake. Specifically, the site is located at 121 Upper Pattagansett Rd in the town of East Lyme, CT. The parcel was previously used as a camp for the Girl Scouts of America. The existing site is partially developed with paved/gravel roads and camp buildings. The site is wooded with mature deciduous trees. There are slopes ranging from 3% to 12% The soil type is primarily a hydraulic soil group B consisting of Canton-Charlton, Hinkley gravel and Charlton-Hollis series. The soil types were evaluated for their permeability and have a moderate to fast infiltration rate. The proposed site development is for 8 residential subdivision parcels, and one parcel to remain as-is.

The drainage areas for the proposed site development is split into two drainage areas labeled Drainage Area A (30.8 ac) and Drainage Area B (13.5 ac)(see drawing titled Drainage Areas). Drainage Area A is a 30.8 ac drainage area where water flows into a wetland settling basin on the north side of Upper Pattagansett Rd, then through a 12" re-enforced concrete culvert, then into Pattagansett Lake. Primarily, the stormwater flows are shallow concentrated flows that flow north to south across Drainage Area A, with limited channel flows for the last 250 ft before the wetland settling basin. There are some instances of intermittent channelized flows along the paved/gravel road, then the flows change back to shallow concentrated flows. Drainage Area B is a 13.5 ac drainage area that is primarily overland flow and water does not typically flow off the property due to topographic features along Upper Pattagansett Rd that contain stormwater on site.

RATIONALE FOR DESIGN:

A drainage analysis is required to evaluate stormwater run-off associated with site development A site evaluation along with a drainage analysis were conducted for estimating the storm water run-off. The site currently has 18 buildings in total with roofs, along with 45 wooden platform (tents/decks) which have a high run-off coefficient. There are packed gravel roads throughout Drainage Areas A & B, which have a high run-off coefficient. The proposed development for Drainage Area A removes 7 buildings, 10 tent platforms (8,830 sf impervious area) and gravel roads (46,472 sf). For proposed Drainage Area B, 2 buildings, 6 tent platforms (4,750 sf of impervious area) and 13,000 sf of gravel roads are to be removed.

The proposed development for Drainage Area A involves constructing 3 residential building lots and Drainage Area B involves constructing 5 residential lots, each with a 2,400 sf (roof area) home. Each home's roof drains are piped to a rain garden sized for 1" water quality volume. The paved driveways are sloped to drain down gradient through check dams to slow velocities, then into the woods.

The stormwater drainage analysis will compare the existing developed land to the proposed developed parcels which have the proposed buildings added and the old structures removed. Limits of clearing calculated for the proposed parcels will factor the change from wooded area to lawn area. Also, the extensive gravel drives and parking areas once removed will be seeded with grass to change the semi impervious area to a more pervious area. The rain gardens are very effective at retaining storm water from impervious areas and infiltrating large quantities of the roof stormwater run-off. This reduction in run-off leads to overall reduction in the amount of storm water and these BMPs increase water quality for water that flows into Pattagansett Lake.

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METHODOLOGY AND RESULTS

Drainage Analysis. The SCS TR-20 drainage analysis method is used to determine the storm water runoff flow amounts. The storm frequency values used for the calculations herein include the 2-year, 5-year 10-year, 25-year, 50-year and 100-year storm rainfall event. The storm water model software used for this analysis is *HydroCAD® 10.00-22* in which the SCS TR-20 method was used.

The following are the tabulated results for existing and proposed storm events:

Drainage Area A

	Storm Event	Rain Fall inches	Flow CFS	Peak Flow % reduction	Volume (acre-feet)	Volume % reduction
Area A Existing	2-year	3.4	4.34		0.972	
	5 year	4.3	9.34		1.791	
	10 year	4.8	13.94		2.516	
	25 year	5.7	21.78		3.745	
	50 year	6.3	28		4.719	
	100 year	**7.1**	**35.62**		**5.919**	
Area A Proposed	2-year	3.4	3.8	**12.4%**	0.887	**8.7%**
	5 year	4.3	8.5	**9.0%**	1.67	**6.8%**
	10 year	4.8	12.91	**7.4%**	2.37	**5.8%**
	25 year	5.7	20.52	**5.8%**	3.56	**4.9%**
	50 year	6.3	26.57	**5.1%**	4.5	**4.6%**
	100 year	**7.1**	**34.03**	**4.5%**	**5.68**	**4.0%**

Drainage Area B

	Storm Event	Rain Fall inches	Flow CFS	Peak Flow % reduction	Volume (acre-feet)	Volume % reduction
Area B Existing	2-year	3.4	3.55		0.596	
	5 year	4.3	7.15		1.08	
	10 year	4.8	9.45		1.387	
	25 year	5.7	13.97		1.992	
	50 year	6.3	17.19		2.427	
	100 year	**7.1**	**21.68**		**3.039**	
Area B Proposed	2-year	3.4	3.19	**10.1%**	0.552	**7.4%**
	5 year	4.3	6.64	**7.1%**	1.018	**5.7%**
	10 year	4.8	8.88	**6.0%**	1.316	**5.1%**
	25 year	5.7	13.28	**4.9%**	1.906	**4.3%**
	50 year	6.3	16.44	**4.4%**	2.331	**4.0%**
	100 year	**7.1**	**20.86**	**3.8%**	**2.931**	**3.6%**

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SUMMARY

The proposed Nottingham Hills Subdivision Phase V development plan results in a significant reduction of both storm water peak flows and volumes for Drainage Areas A and B. The plan of development for the 8 residential homes introduces storm water BMPs such as rain gardens and check dams along driveways. Removal of impervious areas such as buildings and tent platforms, along with gravel roads and parking areas, will increase the water quality significantly.

Summary for Subcatchment A - existing: 30.8 AC

Runoff = 35.62 cfs @ 12.84 hrs, Volume= 5.919 af, Depth> 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=7.10"

Area (ac)	CN	Description
1.870	85	Gravel roads, HSG B
0.203	98	Roofs, HSG B
0.326	98	Roofs, HSG B
4.591	67	Brush, Poor, HSG B
23.810	55	Woods, Good, HSG B
30.800	59	Weighted Average
30.271		98.28% Pervious Area
0.529		1.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.2	40	0.0100	0.03		**Sheet Flow, sheet flow upper** Woods: Dense underbrush n= 0.800 P2= 3.35"
12.9	1,650	0.1810	2.13		**Shallow Concentrated Flow, sloped woodland** Woodland Kv= 5.0 fps
9.7	400	0.0750	0.68		**Shallow Concentrated Flow, woodland gental slope** Forest w/Heavy Litter Kv= 2.5 fps
12.5	348	0.0086	0.46		**Shallow Concentrated Flow, level ground** Woodland Kv= 5.0 fps
58.3	2,438	Total			

Summary for Subcatchment A - Proposed: 30.8 AC

Runoff = 34.03 cfs @ 12.84 hrs, Volume= 5.681 af, Depth> 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=7.10"

	Area (ac)	CN	Description
*	1.153	85	gravel road remaining
*	0.361	98	Remain Bldg decks - Roofs, HSG B
*	0.576	98	Paved parking Driveways, HSG B
*	0.170	98	Rev CN Rain Garden, HSG B
*	5.640	58	Lawn, HSG B
	22.900	55	Woods, Good, HSG B
	30.800	58	Weighted Average
	29.693		96.41% Pervious Area
	1.107		3.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.2	40	0.0100	0.03		**Sheet Flow, sheet flow upper** Woods: Dense underbrush n= 0.800 P2= 3.35"
12.9	1,650	0.1810	2.13		**Shallow Concentrated Flow, sloped woodland** Woodland Kv= 5.0 fps
9.7	400	0.0750	0.68		**Shallow Concentrated Flow, woodland gental slope** Forest w/Heavy Litter Kv= 2.5 fps
12.5	348	0.0086	0.46		**Shallow Concentrated Flow, level ground** Woodland Kv= 5.0 fps
58.3	2,438	Total			

Events for Subcatchment A - existing: 30.8 AC

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	3.40	4.34	0.972	0.38
5-year	4.20	9.34	1.791	0.70
10 year	4.80	13.94	2.516	0.98
25 year	5.70	21.78	3.745	1.46
50-year	6.35	28.00	4.719	1.84
100 year	**7.10**	**35.62**	**5.919**	**2.31**

Events for Subcatchment A - Proposed: 30.8 AC

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	3.40	3.80	0.887	0.35
5-year	4.20	8.50	1.670	0.65
10 year	4.80	12.91	2.369	0.92
25 year	5.70	20.52	3.560	1.39
50-year	6.35	26.57	4.509	1.76
100 year	**7.10**	**34.03**	**5.681**	**2.21**

Summary for Subcatchment B - existing: 13.5 AC

Runoff = 21.68 cfs @ 12.63 hrs, Volume= 3.039 af, Depth> 2.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=7.10"

	Area (ac)	CN	Description
*	0.203	98	Roofs tent decks , HSG B
	1.067	85	Gravel roads, HSG B
	12.230	60	Woods, Fair, HSG B
	13.500	63	Weighted Average
	13.297		98.50% Pervious Area
	0.203		1.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	30	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.35"
3.1	326	0.1200	1.73		**Shallow Concentrated Flow, sloped woodland** Woodland Kv= 5.0 fps
22.4	600	0.0080	0.45		**Shallow Concentrated Flow, level ground** Woodland Kv= 5.0 fps
43.9	956	Total			

Summary for Subcatchment B - Proposed: 13.5 AC

Runoff = 20.86 cfs @ 12.63 hrs, Volume= 2.931 af, Depth> 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=7.10"

	Area (ac)	CN	Description
*	0.275	98	REV roof to Rain gardens
*	0.264	98	Driveways Paved, HSG B
*	1.200	60	Lawns grass, HSG B
	11.761	60	Woods, Fair, HSG B
	13.500	62	Weighted Average
	12.961		96.01% Pervious Area
	0.539		3.99% Impervious Area

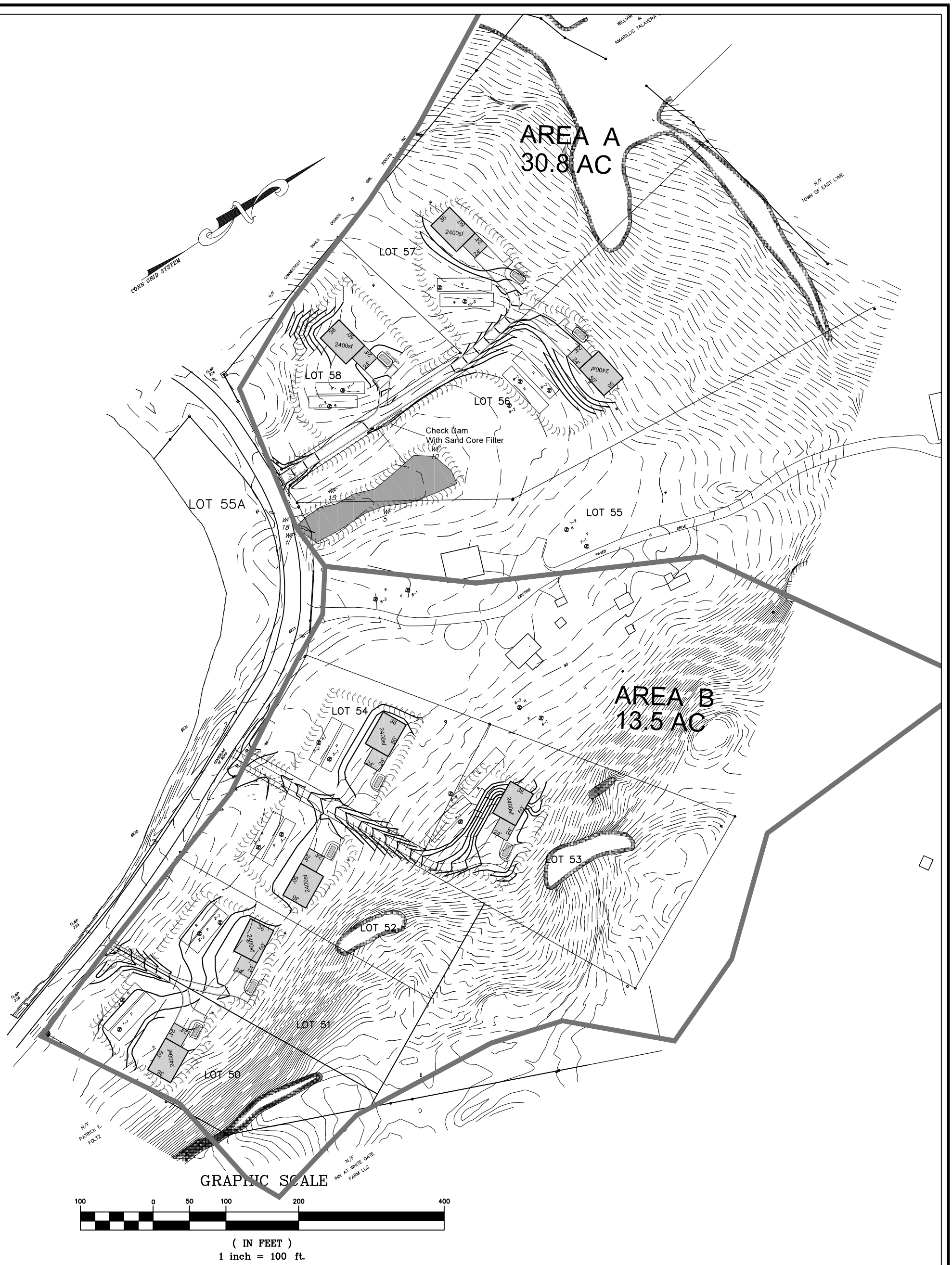
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	30	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.35"
3.1	326	0.1200	1.73		**Shallow Concentrated Flow, sloped woodland** Woodland Kv= 5.0 fps
22.4	600	0.0080	0.45		**Shallow Concentrated Flow, level ground** Woodland Kv= 5.0 fps
43.9	956	Total			

Events for Subcatchment B - existing: 13.5 AC

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	3.40	3.55	0.596	0.53
5 year	4.30	7.15	1.080	0.96
10 year	4.80	9.45	1.387	1.23
25 year	5.70	13.97	1.992	1.77
50 year	6.30	17.19	2.427	2.16
100 year	**7.10**	**21.68**	**3.039**	**2.70**

Events for Subcatchment B - Proposed: 13.5 AC

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	3.40	3.19	0.552	0.49
5 year	4.30	6.64	1.018	0.91
10 year	4.80	8.88	1.316	1.17
25 year	5.70	13.28	1.906	1.69
50 year	6.30	16.44	2.331	2.07
100 year	**7.10**	**20.86**	**2.931**	**2.61**



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Project
Nottingham Hills Subdivision Phase V
121 Upper Pattagansett Rd.
East Lyme, CT. 06333

DESCRIPTION: Building Lot Development and Grading
Rain Garden Location and Drainage

PROPOSED BUILDING

SCALE: as noted

DATE: 10 OCT 2021

JOB NUMBER	SHEET
	1 of 1

Existing Buildings Impervious Areas & Gravel Roads

Drainage Area A - 30.8 ac -(Parcels 56, 57 & 58)

2 Building to be removed roof area	1,750 sf
6 Deck/Tent Platforms to be removed	3,000 sf
Impervious Area	**4,750 sf**
Gravel Roads to be removed	13,000 sf

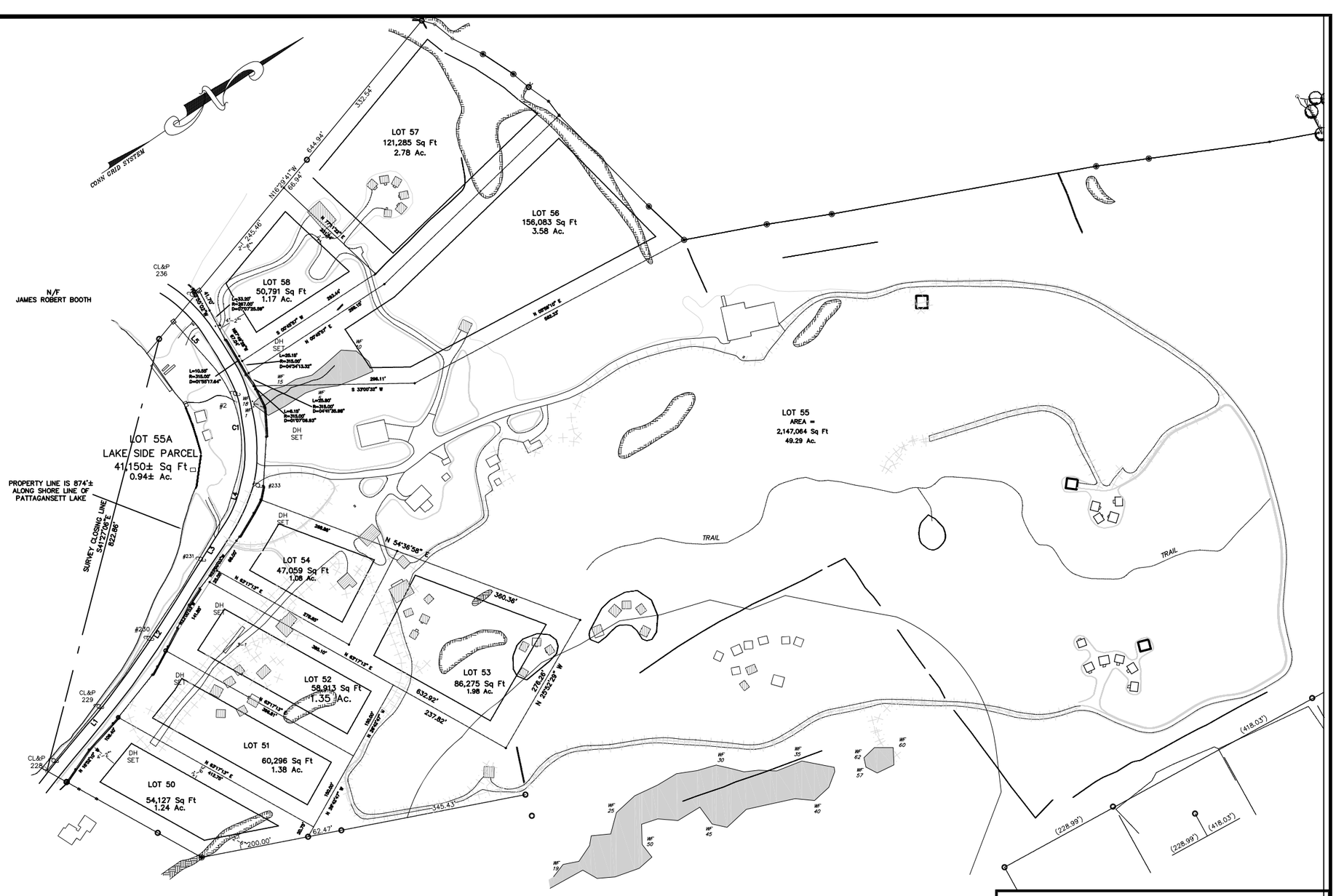
Buildings to remain Parcel 55

7 building Roof Area	9,654 sf
19 Deck/Tent Platforms Area	4,550 sf

Drainage Area B 13.5 ac -(Parcels 50, 51, 52, 53, & 54)

7 Building to be removed roof area	3,681 sf
10 Deck/Tent Platforms to be removed	5,144 sf
Impervious Area	**8,830 sf**
Gravel Road area to be removed	46,472 sf

NOTE Shaded Building are planned to be removed



LEGEND

STONE WALL	
PROPERTY LINE	
STREET LINE	
DRILL HOLE SET	DH SET
DRILL HOLE FOUND	DH FND
MONUMENT FOUND	MON FND
IRON PIPE FOUND	IP FND
EDGE OF WETLANDS & FLAG	WF 57
UTILITY POLE	
EXPOSED LEDGE	

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

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Project
Nottingham Hills Subdivision Phase V
121 Upper Pattagansett Rd.
East Lyme, CT. 06333

DESCRIPTION:

Plan of Subdivsion Showing Existing Buildings and Roads

SCALE: as noted

DATE: 11 October 2021

JOB NUMBER	SHEET
	1 of 1

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Project
Nottingham Hills Subdivision Phase V
121 Upper Pattagansett Rd.
East Lyme, CT. 06333

DESCRIPTION:

DRAINAGE AREAS

SCALE: 1"=400' & as noted

DATE: 16 AUG 2021

JOB NUMBER	SHEET
	1 of 1

Soil Map—State of Connecticut
(121 Upper Pattagansett Rd East Lyme CT)

Map Scale: 1:6,180 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 300 600 1200 1800

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.

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 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Mar 20, 2019—Mar 27, 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
12	Raypol silt loam	2.5	1.3%
29B	Agawam fine sandy loam, 3 to 8 percent slopes	3.6	2.0%
38C	Hinckley loamy sand, 3 to 15 percent slopes	6.6	3.6%
46B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	0.0	0.0%
51B	Sutton fine sandy loam, 0 to 8 percent slopes, very stony	1.2	0.6%
61B	Canton and Charlton fine sandy loams, 0 to 8 percent slopes, very stony	18.1	9.9%
62D	Canton and Charlton fine sandy loams, 15 to 35 percent slopes, extremely stony	0.2	0.1%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	51.6	28.2%
73E	Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky	36.5	20.0%
75C	Hollis-Chatfield-Rock outcrop complex, 3 to 15 percent slopes	24.9	13.6%
75E	Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes	29.5	16.2%
76E	Rock outcrop-Hollis complex, 3 to 45 percent slopes	3.8	2.1%
86D	Paxton and Montauk fine sandy loams, 15 to 35 percent slopes, extremely stony	1.2	0.6%
701B	Ninigret fine sandy loam, 3 to 8 percent slopes	0.1	0.0%
W	Water	3.2	1.7%
Totals for Area of Interest		**182.8**	**100.0%**

Rain Gardens

Water Quality Volume rainfall event 1” WQV rainfall

where:

P = design precipitation, inches (1” for water quality storm)
A = drainage area (*acres*) roof area 2,400 sf >> 0.055 ac
V = runoff volume CF
V= (1”/12)ft x 2400 sf = ***200 CF***

Rain Garden size 10-feet wide X 20 -feet long x 1-foot deep= 200CF

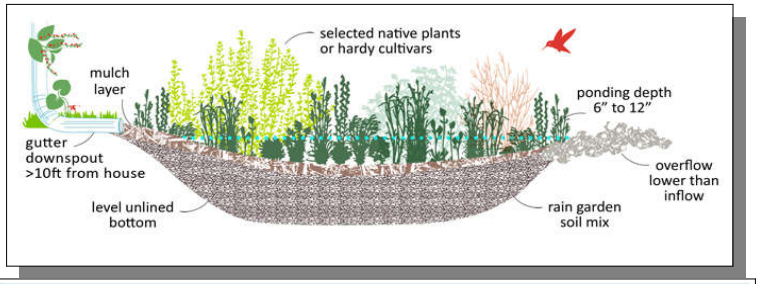

Figure 4-6 Residential Rain Gardens