

Engineering Report
For Land Use Commissions Submittals
Eagles Landing Subdivision, 79 Vinegar Hill Road, Ledyard, Connecticut

August 3, 2022

EXISTING CONDITIONS: Reference is made to the following Plan Set: "Plan Showing Eagles Landing an Open Space Subdivision Property of Mr. G 1, LLC, 79 Vinegar Hill Road, Ledyard, Connecticut" Scales as Shown June 2022 By Dieter & Gardner, Gales Ferry, CT. The property is located on the east side of Vinegar Hill Road approximately 1,500 feet south of the intersection of Vinegar Hill Road and Ash Drive. The property is wooded. Less than one acre of the property drains to Vinegar Hill Road via sheet flow. The remaining portion of the property drains to the north, east and south.

METHODOLOGY: The Rational Method was used for analyzing runoff rates per Part III of the Town of Ledyard's *Ordinance Regulating the Management of Stormwater Runoff*. The descending leg of the hydrographs are increased by a factor of 2.5 to provide additional stormwater volume. Intensity-Duration-Frequency (IDF) Curves were downloaded from the Northeast Regional Climate Center (NRCC) web site. Calculations are attached to this report.

STORMWATER MANAGEMENT: The proposed development will not change the existing drainage patterns. Only 3.5 acres of the 170 acre parcel drains to the road's piped storm drain. An additional 1.52 acres (including 3 proposed houses) drains to the detention basin via sheet flow. A proposed detention/water quality basin is sized to reduce the peak rates of runoff from the proposed road's drainage system for 2, 10, 25 and 100-year rainfall events to below the pre-development rates. The basin is designed to over-compensate for the runoff through the drainage system to make up for increases for development not associated with the road/storm drain.

Discharge rate from the detention/water quality basin will be further reduced as it flows over 1,000 feet through wetlands and underbrush. The basin is designed to slowly drain empty after each storm. The following table provides a comparison of computed peak rates of runoff from the area that flows to the basin (4.77 acres) for undeveloped land versus the developed condition:

DESIGN STORM	UNDEVELOPED	BASIN OUTFLOW	CHANGE
2-YEAR	4.95 CFS	0.0 CFS	-4.9 CFS
10-YEAR	7.35 CFS	2.44 CFS	-4.9 CFS
25-YEAR	8.85 CFS	5.21 CFS	-3.6 CFS
100-YEAR	11.17 CFS	9.08 CFS	-2.1 CFS

(*Developed Peak Flow Rates do not include the flow from the extended detention underdrain. Peak Flow Rate from a 4-inch PVC pipe will be less than 1 CFS.)

Eight of the remaining lots drain to a swale/wetland that flows off the property to the northeast. The following table provides a comparison of computed peak rates of runoff from the area of development from those lots (8.84 acres) for undeveloped land versus the developed condition:

DESIGN STORM	UNDEVELOPED	DEVELOPED	CHANGE
2-YEAR	9.17 CFS	10.1 CFS	+0.9 CFS
10-YEAR	13.6 CFS	15.0 CFS	+1.4 CFS
25-YEAR	16.4 CFS	18.0 CFS	+1.6 CFS
100-YEAR	20.7 CFS	22.8 CFS	+2.1 CFS

The reduction of peak flow rates from the detention/water quality basin exceeds the increase in peak flow rates from the remaining lots. Therefore, the basin will effectively maintain the peak rate of flow off the property to at or below the predevelopment rates.

LBM Engineering, LLC

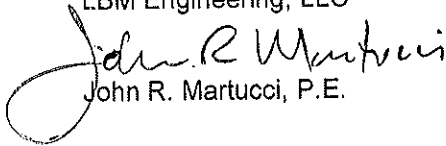
11 Hally Lane, Colchester, CT 06415-2133 Phone 860-416-9809 Email John@LBMEngineering.com

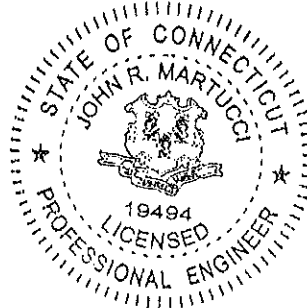
CIVIL ENGINEERING - LAND DEVELOPMENT - SITE PLANS - STORMWATER MANAGEMENT
Eagles Landing Page 2

WATER QUALITY: The proposed detention/water quality basin is to hold the Water Quality Volume (WQV) for 24 – 48 hours to settle out suspended solids from the proposed roadway's runoff. The CT D.E.E.P. 2004 Stormwater Quality Manual Paragraph 7.4.1 states: "In the northeastern U.S., the 90 percent rainfall event is equal to approximately one inch, which is consistent with the recommended WQV sizing criteria for Connecticut." Therefore, by treating one inch of runoff from the new road's drainage system, the proposal effectively improves the runoff from the property for 90 percent of all storm events.

CONCLUSION: The proposed development will not have adverse effects on down-gradient properties and is in keeping with the policies and goals of the Ledyard Planning and Zoning Commission.

Submitted by:
LBM Engineering, LLC


John R. Martucci, P.E.



VINEGAR HILL SUBDIVISION LEDYARD

CB1 STA 12+50 LT

ROAD $250' \times 14' = 3500 \text{ SF} = \frac{0.04}{0.08 \text{ AC}}$

ROOF & DRIVE $3000 \text{ SF} \times \frac{2.5}{1.5} = 7500 \text{ SF} = \frac{0.17 \text{ AC}}{0.10 \text{ AC}}$

OVERLAND $\frac{0.53 \text{ AC}}{0.25 \text{ AC}}$

WEIGHTED C = $\left[\frac{(0.25 \times 0.9)}{0.14} + \frac{(0.53 \times 0.3)}{0.25} \right] \div \frac{0.78 \text{ AC}}{0.39} = \frac{0.49}{0.51}$

CB2 STA 12+50 RT

ROAD $250 \times 14' = 3500 \text{ SF} = 0.08 \text{ AC}$

DRIVEWAY APPROX $2 \times 15' \times 15' = 450 \text{ SF} = 0.01 \text{ AC}$

OVERLAND WEIGHTED C = $\left[\frac{(0.09 \times 0.9)}{0.17} + \frac{(0.08 \times 0.3)}{0.17} \right] \div \frac{0.08 \text{ AC}}{0.17 \text{ AC TOTAL}} = 0.62$

TO WETLAND ON LOT #16

ROOF & DRIVE $(4 \times 3000) + (12 \times 160) = 0.32 \text{ AC}$

OVERLAND (FLAT) = 2.50 AC

PREPARED BY JEM	DATE PREPARED 11/2018	LBM Engineering, LLC P.O. BOX 44 COLCHESTER, CONNECTICUT 06415 TEL: (860)-416-9809 EMAIL: JOHN@LBMENGINEERING.COM	JOB NUMBER	PAGE NUMBER
CHECKED BY	DATE CHECKED		CLIENT NAME	TOTAL PAGES

CP51A STA 11+30 LT

ROAD $130' \times 14' = 1820 \text{ SF} = 0.04 \text{ AC}$

ROOF & DRIVE $3000 \text{ SF} = 0.07 \text{ AC}$

OVERLAND

0.28 AC

0.39 AC TOTAL

WEIGHTED C = $[(0.11 \times 0.9) + (0.28 \times 0.3)] \div 0.39 = 0.47$

CB5A STA 18+00 RT

ROAD 0.09 AC

ROOF & DRIVE $156 \times 12 = 1872 \quad 0.04 \text{ AC}$

Overland

0.30 AC

0.43 AC

WEIGHTED C = $[(0.13 \times 0.9) + (0.30 \times 0.3)] \div 0.43 \text{ AC} = 0.48$

CB5 STA 17+10 RT

ROAD $90 \times 14 \quad 0.03 \text{ AC}$

ROOF & DRIVES $[3000 + (150 \times 10)] = 4500 \quad 0.10 \text{ AC}$

OVERLAND

0.43

0.56 AC

WEIGHTED C = $[(0.13 \times 0.9) + (0.43 \times 0.3)] \div 0.56 = 0.44$

PREPARED BY JRM	DATE PREPARED 6/2018	LBM Engineering, LLC P.O. BOX 44 COLCHESTER, CONNECTICUT 06415 TEL: (860)-416-9809 EMAIL: JOHN@LBMENGINEERING.COM	JOB NUMBER	PAGE NUMBER
CHECKED BY	DATE CHECKED REV 11/2018		CLIENT NAME	TOTAL PAGES

VINEGAR HILL SUBDIVISIONS LETAIR2D

CB 3 14+60, RT

ROAD $460' \times 14' \div 43560$ 0.15 AC

ROOF & DRIVE $3000 + (150 \times 10) = 4500$ 0.10

OVERLAND 0.37
0.62

$$\text{WEIGHTED 'C'} = \left[(0.25 \times 0.9) + (0.37 \times 0.3) \right] \div 0.62 = 0.54$$

CB 4 14+60 LT

ROAD $300 \times 14 \div 43560$ 0.10 AC

4 DRIVEWAYS APPROXS $4 \text{ ea } \times 12' \times 15'$ 0.02 AC

OVERLAND 0.05 AC
0.17 AC TOTAL

$$\text{WEIGHTED C} = \left[(0.12 \times 0.9) + (0.05 \times 0.3) \right] \div 0.17 = 0.72$$

CB 5

ROAD 0.14 AC

ROOF & DRIVE $3000 + (370 \times 12) = 7440$ 0.17 AC

OVERLAND 0.69 AC

$$\text{WEIGHTED C} = \left[(0.31 \times 0.9) + (0.69 \times 0.3) \right] \div 1 = 0.49$$

REVISED SEE P. 2A

PREPARED BY JRM	DATE PREPARED 1/2018	LBM Engineering, LLC P.O. BOX 44 COLCHESTER, CONNECTICUT 06415 TEL: (860)-416-9809 EMAIL: JOHN@LBMENGINEERING.COM	JOB NUMBER	PAGE NUMBER
CHECKED BY	DATE CHECKED		CLIENT NAME	TOTAL PAGES

CB 4A 14+00 LT

ROAD 14 x 150' ÷ 43560 0.105 AC

ROOF & DRIVES 3500 SF 0.108 AC

OVERLAND 0.14 AC
0.27 TOTAL

$$\text{WEIGHTED C} = \left[(0.13 \times 0.9) + (0.14 \times 0.3) \right] \div 0.27 = 0.59$$

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CHECKED BY	DATE CHECKED REV 11-2018		CLIENT NAME	TOTAL PAGES

VINEGAR HILL SUBDIVISION LEDYARD

CP 6 16+60 LT

ROAD

0.14 AC

ROOF DRIVE APGONS

12'W x 20'L x 2EA

0.10 AC

OVERLAND

0.06 AC

0.21 AC TOTAL

$$\text{WEIGHTED 'C'} = \frac{[(0.15 \times 0.9) + (0.06 \times 0.3)]}{0.21} = 0.73$$

TOTAL AREA TO THE SYSTEM

$$Q_{25} \quad 3.25 \text{ AC} \times 0.3 (\text{UNDEVELOPED}) \times 6.2 = 6.0 \text{ CFS}$$

TOTAL AC

$$1.497 \div 3.25 \text{ AC} = 0.46 \text{ DEVELOPED 'C'}$$

PRE DEVELOPMENT FLOW FROM PIPED SYSTEM

	A	I	R	= Q
2-YR	3.25	0.3	3.5 "/HR	= 3.4 CFS
10-YR			5.2	= 5.1
25-YR			6.2	= 6.0
100-YR			7.9	= 7.7

POST DEVELOP

@ WQ BASIN

0.0

0.1

2.4

5.3

12/11/2018: ADDED 1.52 AC THAT FLOWS TO BASIN VIA SHEET FLOW.

DESIGNED BY: JRM DATE: 06/17/18
 CHECKED BY: _____ REV: 11/24/18
 DATE: _____

PROJECT: VINEGAR HILL SUBDIVISION
 PROJECT NO.: _____
 TOWN: Ledyard
 ROUTE: _____
 LOCATION: N/A

GUTTER FLOW ANALYSIS - 25 YR STORM

Inlet ID	Inlet Station and Offset	Area In Acres (A)	Runoff Coeff. (C)	Time to Inlet (min.)	Rainfall Intensity (in/hr)	AC	Total AC	Q to Inlet (cfs)	Grade of Gutter ft/ft (SL)	Cross Slope Of Shoulder ft/ft (Sx)	Depth of Flow of Gutter (ft)	Gutter Flow Width (ft)	Q Bypassing Inlet (cfs)	AC Bypassing Inlet	AC Entering Catch Basin	Inlet Type
PROPOSED ROAD LEFT GUTTER																
CB 1A	11+30, LT	0.350	0.47	10	6.20	0.183	0.183	1.250	0.010	0.043	0.194	4.511	0.248	0.040	0.143	"C"
CB 1	12+50, LT	0.350	0.51	10	6.20	0.199	0.239	1.630	0.010	0.043	0.214	4.983	0.405	0.065	0.174	"C"
CB 6	17+10, LT	0.210	0.73	10	6.20	0.153	0.153	1.046	0.010	0.043	0.181	4.219	0.174	0.028	0.125	"C"
CB 4A	14+00, LT	0.270	0.59	10	6.20	0.159	0.225	1.532	0.010	0.043	0.209	4.858	0.362	0.058	0.166	"C"
CB 4	14+60, LT	0.170	0.72	10	6.20	0.122	0.209	1.424	LOW PT	0.043						"C"
PROPOSED ROAD RIGHT GUTTER																
CB 2	12+50, RT	0.170	0.62	10	6.20	0.105	0.105	0.719	0.010	0.043	0.158	3.666	0.073	0.012	0.094	"C"
CB 5A	18+00, RT	0.430	0.48	10	6.20	0.206	0.206	1.408	0.010	0.043	0.203	4.717	0.311	0.050	0.156	"C"
CB 5	16+50, RT	0.560	0.44	10	6.20	0.246	0.246	1.680	0.010	0.043	0.217	5.041	0.427	0.069	0.178	"C"
CB 3	14+60, RT	0.620	0.54	10	6.20	0.335	0.415	2.833	LOW PT	0.043						DBL "C"
NOTES:																
LOW POINT ANALYSIS																
INLET	Q TO INLET	PERIM.	C WEIR	d WEIR	WIDTH	ORIFICE	d									
CB 4	1.424	5.020	3	0.207	4.82	0.007	0.3' DEEP - OK									
CB 3	2.833	7.330	3	0.255	5.93	0.028	0.3' DEEP - OK									

- Notes:
- Manning's n = 0.016 (asphalt).
 - Tc = 5 minutes minimum for areas with all pavement.
 - Tc = 10 minutes minimum for small areas with pavement and grass.
 - All low points operate as a weir. Depth (d) over grate is less than 0.4 feet.

GRATES	PERIM	AREA
C	5.02	3.13
C DOUB	7.33	6.26
CL	7.33	3.13
CL DOUB	11.96	6.26

**STORM SEWER SYSTEM DESIGN
DRAINAGE SYSTEM**

Sheet No. 1 of 1

Client: VINEGAR HILL SUBDIVISION
 Project: VINEGAR HILL SUBDIVISION
 Proj. No.: 25-YR
 Return Period for Design:

Prepared By: JRM Date: 06/17/18 Revised: 12/09/18

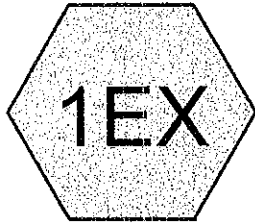
Line Segment From To	Time to Inlet (min.)	Time in Pipe (min.)	Accumul. Time (min.)	A x C Entering System	Sum of A x C in System	Rainfall Intensity, R (in./hr.)	Q in System (c.f.s.)	Size (in.)	Length (ft.)	Slope (ft./ft.)	Pipe Data			
											Avg. Vel. (f.p.s.)	Full Cap. (c.f.s.)	Headwater (ft.)	Manning "n"
CB 1A 11+30.LT CB 2 12+50.LT	10	0.40	10.0	0.143	0.143	6.2	0.89	15	120	0.010	5.0	6.99	0.40	0.012
CB 2 12+50.LT CB 3 12+50.RT	10	0.07	10.0	0.174	0.317	6.2	1.97	15	22	0.010	5.0	6.99	0.40	0.012
CB 5A 18+00.RT CB 5 17+10.RT	10	0.64	10.1	0.094	0.411	6.2	2.55	15	192	0.010	5.0	6.99	0.60	0.012
CB 5 17+10.RT CB 3 17+10.LT	10	0.09	10.0	0.156	0.156	6.2	0.97	15	22	0.010	4.0	6.99	0.40	0.012
CB 3 17+10.RT CB 4 14+60.RT	10	0.09	10.0	0.125	0.125	6.2	0.78	15	22	0.010	4.0	6.99	0.40	0.012
CB 4 14+60.RT CB 4 14+60.IT	10	0.69	10.1	0.178	0.459	6.2	2.85	15	250	0.010	6.0	6.99	0.50	0.012
CB 4 14+60.IT OUTLET	10	0.05	10.8	0.415	1.285	6.2	7.97	18	22	0.010	7.0	11.37	1.00	0.012
	10	0.50	10.8	0.209	1.494	6.2	9.26	18	300	0.026	10.0	18.34	2.00	0.012

Manning's "n" for HDPE and RC pipe = 0.012

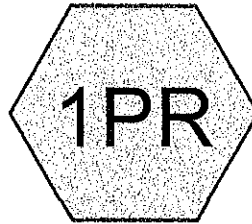
NOTE: ALL PIPES ARE BELOW FULL CAPACITY.

COMPUTATIONS FOR:	Project
WATER QUALITY FLOW / WATER QUALITY VOLUME	Made By: JRM
VINEGAR HILL RD SUBDIVISION	Date: 8/3/2022
LEDYARD	Rev:
	Date:

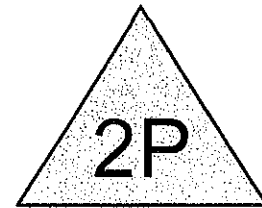
IN SYSTEM TO BASIN				
ConnDOT Drainage Manual Ch. 10 and Ch. 11, Appendix C				
Contributing Basins	Wooded Area (acres)	Grass Area (acres)	Paved Area (acres)	Total Area (acres)
TO BASIN	0	4.8	1.4	6.2
Total	0	4.8	1.4	6.2
Equation 10.31: $WQV = (1")(R)(A)/12 =$ 0.131 acre-feet or 5,699 cubic-feet				
I = % of Impervious Cover = 23%				
R = volumetric runoff coeff. $0.05 + 0.009(I) =$ 0.2532				
A = site area (acres) = 6.2 acres = 0.0097 miles ²				
Q = runoff depth (in watershed inches) = $[WQV(\text{acrefeet}) * [12(\text{Inches/foot})] / \text{drainage area (acres)}$				
Q = 0.2532258				
CN = $1000 / [10 + 5P + 10Q - 10(Q^2 + 1.25QP)^{0.5}] =$ 88.0				
P = design precipitation (1" for water quality storm) = 1 inch				
Q = runoff depth (in watershed inches)				
t_c 10 min				
t_c 10 minutes = 0.167 hours				
From Table 4-1, $ia =$ 0.273; $ia/P =$ 0.273				
From Exhibit 4-III, $q_u =$ 500				
WQF = $(q_u)(A)(Q) =$ 1.23 cfs				



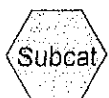
UNDEV



TO BASIN



WQ BASIN



Routing Diagram for VINEGAR HILL BASIN 08-03-2022
Prepared by LBM Engineering LLC, Printed 8/4/2022
HydroCAD® 10.10-3a s/n 09192 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment 1EX: UNDEV

Runoff = 4.95 cfs @ 0.17 hrs, Volume= 5,235 cf, Depth= 0.30"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 2-yr Duration=10 min, Inten=3.46 in/hr

Area (ac)	C	Description	Land Use
4.770	0.30	EXISTING UNDEVELOPED	
4.770		100.00% Pervious Area	

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

Summary for Subcatchment 1PR: TO BASIN

Runoff = 7.26 cfs @ 0.17 hrs, Volume= 7,678 cf, Depth= 0.44"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 2-yr Duration=10 min, Inten=3.46 in/hr

Area (ac)	C	Description	Land Use
3.250	0.46	SYSTEM TO BASIN	
1.290	0.30	OLAND DIRECT TO BASIN	
0.230	0.95	ROOF DRIVE 3 LOTS	
4.770	0.44	Weighted Average	
4.540		95.18% Pervious Area	
0.230		4.82% Impervious Area	

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

Summary for Pond 2P: WQ BASIN

Inflow Area = 207,781 sf, 4.82% Impervious, Inflow Depth = 0.44" for 2-yr event
 Inflow = 7.26 cfs @ 0.17 hrs, Volume= 7,678 cf
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 Peak Elev= 268.28' @ 0.59 hrs Surf.Area= 4,118 sf Storage= 7,678 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

VINEGAR HILL BASIN 08-03-2022

CT-Ledyard 2-yr Duration=10 min, Inten=3.46 in/hr

Prepared by LBM Engineering LLC

Printed 8/4/2022

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Volume	Invert	Avail.Storage	Storage Description
#1	266.00'	21,700 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
266.00	2,650	0	0
268.00	3,900	6,550	6,550
270.00	5,450	9,350	15,900
271.00	6,150	5,800	21,700

Device	Routing	Invert	Outlet Devices
#1	Primary	268.75'	15.0' long x 6.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65
			2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=266.00' (Free Discharge)

↑1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Subcatchment 1EX: UNDEV

Runoff = 7.35 cfs @ 0.17 hrs, Volume= 7,780 cf, Depth= 0.45"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 10-yr Duration=10 min, Inten=5.14 in/hr

Area (ac)	C	Description	Land Use
4.770	0.30	EXISTING UNDEVELOPED	
4.770		100.00% Pervious Area	

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

Summary for Subcatchment 1PR: TO BASIN

Runoff = 10.78 cfs @ 0.17 hrs, Volume= 11,410 cf, Depth= 0.66"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 10-yr Duration=10 min, Inten=5.14 in/hr

Area (ac)	C	Description	Land Use
3.250	0.46	SYSTEM TO BASIN	
1.290	0.30	OLAND DIRECT TO BASIN	
0.230	0.95	ROOF DRIVE 3 LOTS	
4.770	0.44	Weighted Average	
4.540		95.18% Pervious Area	
0.230		4.82% Impervious Area	

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

Summary for Pond 2P: WQ BASIN

Inflow Area = 207,781 sf, 4.82% Impervious, Inflow Depth = 0.66" for 10-yr event
 Inflow = 10.78 cfs @ 0.17 hrs, Volume= 11,410 cf
 Outflow = 2.44 cfs @ 0.49 hrs, Volume= 1,714 cf, Atten= 77%, Lag= 19.2 min
 Primary = 2.44 cfs @ 0.49 hrs, Volume= 1,714 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 Peak Elev= 268.92' @ 0.49 hrs Surf.Area= 4,611 sf Storage= 10,456 cf

Plug-Flow detention time= 29.3 min calculated for 1,708 cf (15% of inflow)
 Center-of-Mass det. time= 19.5 min (34.5 - 15.0)

VINEGAR HILL BASIN 08-03-2022

CT-Ledyard 10-yr Duration=10 min, Inten=5.14 in/hr

Prepared by LBM Engineering LLC

Printed 8/4/2022

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Page 5

Volume	Invert	Avail.Storage	Storage Description
#1	266.00'	21,700 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
266.00	2,650	0	0
268.00	3,900	6,550	6,550
270.00	5,450	9,350	15,900
271.00	6,150	5,800	21,700

Device	Routing	Invert	Outlet Devices
#1	Primary	268.75'	15.0' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=2.44 cfs @ 0.49 hrs HW=268.92' (Free Discharge)

↑1=Broad-Crested Rectangular Weir (Weir Controls 2.44 cfs @ 0.97 fps)

Summary for Subcatchment 1EX: UNDEV

Runoff = 8.85 cfs @ 0.17 hrs, Volume= 9,361 cf, Depth= 0.54"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 25-yr Duration=10 min, Inten=6.18 in/hr

Area (ac)	C	Description	Land Use
4.770	0.30	EXISTING UNDEVELOPED	
4.770		100.00% Pervious Area	

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

Summary for Subcatchment 1PR: TO BASIN

Runoff = 12.98 cfs @ 0.17 hrs, Volume= 13,729 cf, Depth= 0.79"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 25-yr Duration=10 min, Inten=6.18 in/hr

Area (ac)	C	Description	Land Use
3.250	0.46	SYSTEM TO BASIN	
1.290	0.30	OLAND DIRECT TO BASIN	
0.230	0.95	ROOF DRIVE 3 LOTS	
4.770	0.44	Weighted Average	
4.540		95.18% Pervious Area	
0.230		4.82% Impervious Area	

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

Summary for Pond 2P: WQ BASIN

Inflow Area = 207,781 sf, 4.82% Impervious, Inflow Depth = 0.79" for 25-yr event
 Inflow = 12.98 cfs @ 0.17 hrs, Volume= 13,729 cf
 Outflow = 5.21 cfs @ 0.42 hrs, Volume= 4,033 cf, Atten= 60%, Lag= 14.8 min
 Primary = 5.21 cfs @ 0.42 hrs, Volume= 4,033 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 Peak Elev= 269.02' @ 0.42 hrs Surf.Area= 4,694 sf Storage= 10,950 cf

Plug-Flow detention time= 22.5 min calculated for 4,020 cf (29% of inflow)
 Center-of-Mass det. time= 14.6 min (29.6 - 15.0)

VINEGAR HILL BASIN 08-03-2022

CT-Ledyard 25-yr Duration=10 min, Inten=6.18 in/hr

Prepared by LBM Engineering LLC

Printed 8/4/2022

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Volume	Invert	Avail.Storage	Storage Description
#1	266.00'	21,700 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
266.00	2,650	0	0
268.00	3,900	6,550	6,550
270.00	5,450	9,350	15,900
271.00	6,150	5,800	21,700

Device	Routing	Invert	Outlet Devices
#1	Primary	268.75'	15.0' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=5.21 cfs @ 0.42 hrs HW=269.02' (Free Discharge)

↳ 1=Broad-Crested Rectangular Weir (Weir Controls 5.21 cfs @ 1.27 fps)

Summary for Subcatchment 1EX: UNDEV

Runoff = 11.17 cfs @ 0.17 hrs, Volume= 11,815 cf, Depth= 0.68"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 100-yr Duration=10 min, Inten=7.80 in/hr

Area (ac)	C	Description	Land Use
4.770	0.30	EXISTING UNDEVELOPED	
4.770		100.00% Pervious Area	

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

Summary for Subcatchment 1PR: TO BASIN

Runoff = 16.38 cfs @ 0.17 hrs, Volume= 17,328 cf, Depth= 1.00"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 100-yr Duration=10 min, Inten=7.80 in/hr

Area (ac)	C	Description	Land Use
3.250	0.46	SYSTEM TO BASIN	
1.290	0.30	OLAND DIRECT TO BASIN	
0.230	0.95	ROOF DRIVE 3 LOTS	
4.770	0.44	Weighted Average	
4.540		95.18% Pervious Area	
0.230		4.82% Impervious Area	

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

Summary for Pond 2P: WQ BASIN

Inflow Area = 207,781 sf, 4.82% Impervious, Inflow Depth = 1.00" for 100-yr event
 Inflow = 16.38 cfs @ 0.17 hrs, Volume= 17,328 cf
 Outflow = 9.08 cfs @ 0.35 hrs, Volume= 7,632 cf, Atten= 45%, Lag= 11.0 min
 Primary = 9.08 cfs @ 0.35 hrs, Volume= 7,632 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 Peak Elev= 269.14' @ 0.35 hrs Surf.Area= 4,782 sf Storage= 11,492 cf

Plug-Flow detention time= 17.9 min calculated for 7,632 cf (44% of inflow)
 Center-of-Mass det. time= 11.2 min (26.2 - 15.0)

VINEGAR HILL BASIN 08-03-2022

CT-Ledyard 100-yr Duration=10 min, Inten=7.80 in/hr

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Volume	Invert	Avail.Storage	Storage Description
#1	266.00'	21,700 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
266.00	2,650	0	0
268.00	3,900	6,550	6,550
270.00	5,450	9,350	15,900
271.00	6,150	5,800	21,700

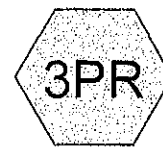
Device	Routing	Invert	Outlet Devices
#1	Primary	268.75'	15.0' long x 6.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65
			2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=9.07 cfs @ 0.35 hrs HW=269.14' (Free Discharge)

↳1=Broad-Crested Rectangular Weir (Weir Controls 9.07 cfs @ 1.56 fps)



UNDEV 13 15 17 19 21
23 25 28



POST DEV 13 15 17 19
21 23 25 28



Routing Diagram for VINEGAR HILL 8 LOTS 12-2018
Prepared by LBM Engineering LLC, Printed 12/11/2018
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Summary for Subcatchment 1EX: UNDEV 13 15 17 19 21 23 25 28

Runoff = 9.17 cfs @ 0.17 hrs, Volume= 9,702 cf, Depth= 0.30"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 2-yr Duration=10 min, Inten=3.46 in/hr

Area (ac)	C	Description	Land Use
8.840	0.30	LOTS NOT IN SYSTEM	
8.840		100.00% Pervious Area	

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

Summary for Subcatchment 3PR: POST DEV 13 15 17 19 21 23 25 28

Runoff = 10.09 cfs @ 0.17 hrs, Volume= 10,672 cf, Depth= 0.33"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 2-yr Duration=10 min, Inten=3.46 in/hr

Area (ac)	C	Description	Land Use
8.380	0.30		
0.460	0.95		
8.840	0.33	Weighted Average	
8.380		94.80% Pervious Area	
0.460		5.20% Impervious Area	

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

Summary for Subcatchment 1EX: UNDEV 13 15 17 19 21 23 25 28

Runoff = 13.63 cfs @ 0.17 hrs, Volume= 14,418 cf, Depth= 0.45"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 10-yr Duration=10 min, Inten=5.14 in/hr

Area (ac)	C	Description	Land Use
8.840	0.30	LOTS NOT IN SYSTEM	
8.840		100.00% Pervious Area	

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

Summary for Subcatchment 3PR: POST DEV 13 15 17 19 21 23 25 28

Runoff = 14.99 cfs @ 0.17 hrs, Volume= 15,859 cf, Depth= 0.49"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 10-yr Duration=10 min, Inten=5.14 in/hr

Area (ac)	C	Description	Land Use
8.380	0.30		
0.460	0.95		
8.840	0.33	Weighted Average	
8.380		94.80% Pervious Area	
0.460		5.20% Impervious Area	

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

Summary for Subcatchment 1EX: UNDEV 13 15 17 19 21 23 25 28

Runoff = 16.40 cfs @ 0.17 hrs, Volume= 17,348 cf, Depth= 0.54"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 25-yr Duration=10 min, Inten=6.18 in/hr

Area (ac)	C	Description	Land Use
8.840	0.30	LOTS NOT IN SYSTEM	
8.840		100.00% Pervious Area	

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

Summary for Subcatchment 3PR: POST DEV 13 15 17 19 21 23 25 28

Runoff = 18.04 cfs @ 0.17 hrs, Volume= 19,083 cf, Depth= 0.59"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 25-yr Duration=10 min, Inten=6.18 in/hr

Area (ac)	C	Description	Land Use
8.380	0.30		
0.460	0.95		
8.840	0.33	Weighted Average	
8.380		94.80% Pervious Area	
0.460		5.20% Impervious Area	

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

Summary for Subcatchment 1EX: UNDEV 13 15 17 19 21 23 25 28

Runoff = 20.69 cfs @ 0.17 hrs, Volume= 21,896 cf, Depth= 0.68"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 100-yr Duration=10 min, Inten=7.80 in/hr

Area (ac)	C	Description	Land Use
8.840	0.30	LOTS NOT IN SYSTEM	
8.840		100.00% Pervious Area	

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

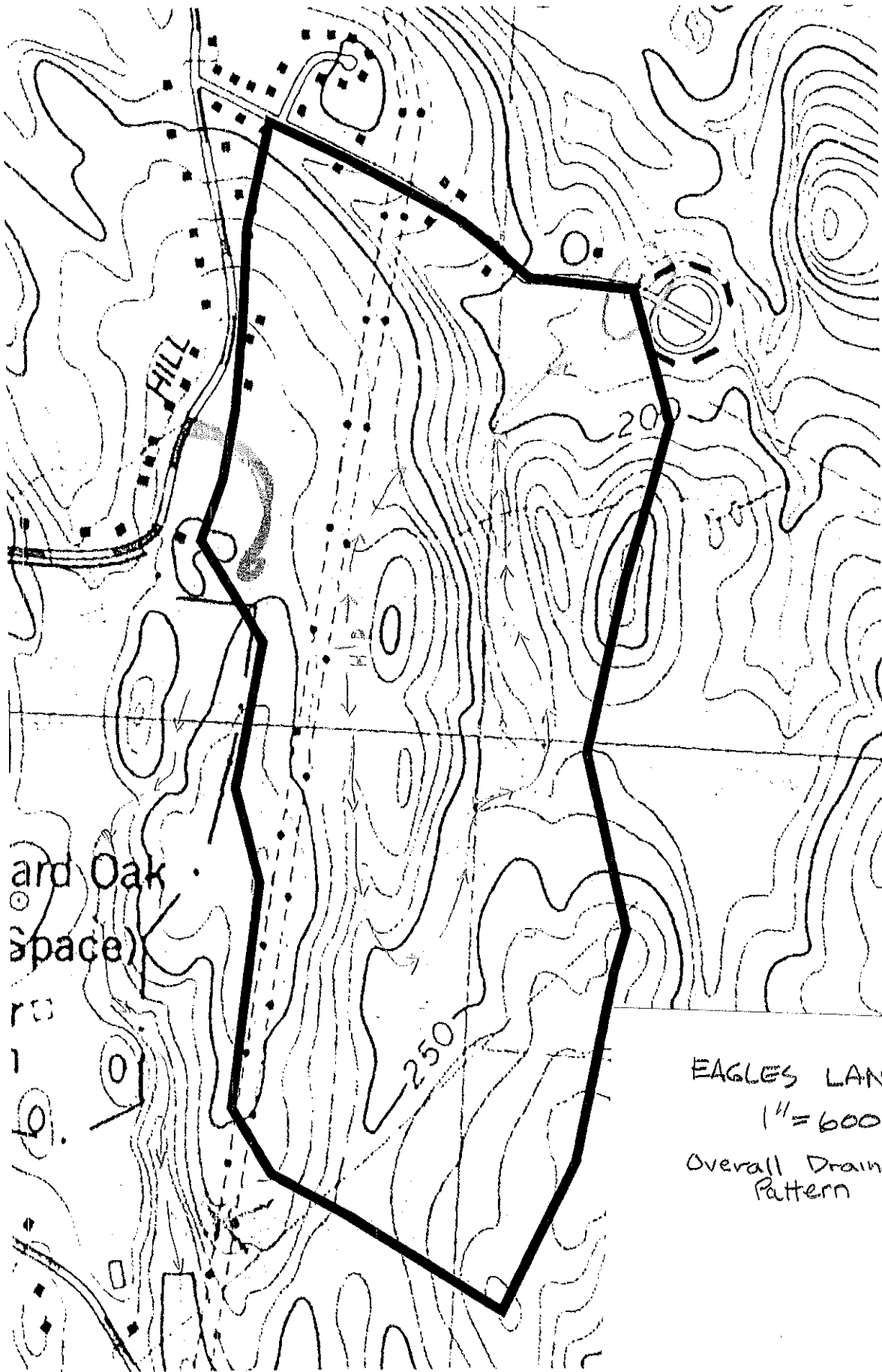
Summary for Subcatchment 3PR: POST DEV 13 15 17 19 21 23 25 28

Runoff = 22.76 cfs @ 0.17 hrs, Volume= 24,085 cf, Depth= 0.75"

Runoff by Rational method, Rise/Fall=1.0/2.5 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 CT-Ledyard 100-yr Duration=10 min, Inten=7.80 in/hr

Area (ac)	C	Description	Land Use
8.380	0.30		
0.460	0.95		
8.840	0.33	Weighted Average	
8.380		94.80% Pervious Area	
0.460		5.20% Impervious Area	

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



EAGLES LANDING
1" = 600'
Overall Drainage
Pattern

1. DRAINAGE AREA SHALL BE DETERMINED BY THE
 2. THE DRAINAGE AREA SHALL BE DETERMINED BY THE
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 9. THE DRAINAGE AREA SHALL BE DETERMINED BY THE
 10. THE DRAINAGE AREA SHALL BE DETERMINED BY THE

CB2 12+50 RT
 TG 292.77
 INV 288.45

CB1 12+50 LT
 TG 292.77
 INV OUT 288.5075

CB1A 14+30 LT
 TG 294.00
 INV. 290.00

CB5A 18+00 RT
 TG 295.19
 INV 290.00

LIMIT OF DRAINAGE AREA

CB3 14+60
 TG 290.85
 INV 286.00

CB4 14+60
 TG 290.85
 INV 285.40

EAGLES LANDING
 LEYARD CT

DRAINAGE AREA MAP

CB4A 14+00 LT
 TG 291.29
 INV 286.00

CB5 17+10
 TG 293.25
 INV 288.95

CB6 17+10
 TG 293.25
 INV 288.95

