

LBM Engineering, LLC

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RECEIVED

CIVIL ENGINEERING - LAND DEVELOPMENT - SITE PLANS - STORMWATER MANAGEMENT

LAND USE DEPARTMENT

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

July 6, 2018

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 July 2018 By Dieler & 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.

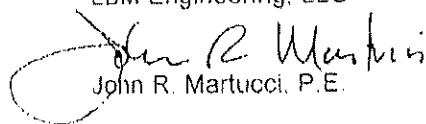
STORMWATER MANAGEMENT: The proposed development will not change the existing drainage patterns. Only 3.5 acres of the 170 acre parcel drains to the road's piped storm drain. A proposed detention/water quality basin is sized to effectively maintain the peak rates of runoff from the proposed road's drainage system for 2, 10 and 25-year rainfall events to at or below the pre-development rates. There is a slight increase in the peak rate of runoff for the 100-year event. Discharge rate from the detention/water quality basin will be further reduced as it flows over 500 feet through wetlands and underbrush. The basin is designed to drain empty after each storm. The following table provides a comparison of computed peak rates of runoff from the piped system for undeveloped land versus the developed condition:

DESIGN STORM	UNDEVELOPED	DEVELOPED
2-YEAR	3.4 CFS	0.6 CFS
10-YEAR	5.1 CFS	4.1 CFS
25-YEAR	6.0 CFS	6.0 CFS
100-YEAR	7.7 CFS	8.7 CFS

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.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.

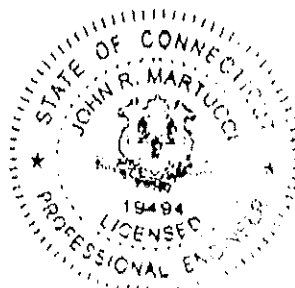


Exhibit #3

PREPARED BY JLM	DATE PREPARED 6/2018	<b>LBM Engineering, LLC</b> 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

VINEGAR HILL SUBDIVISION LEDYARD

CB1 STA 12+50 LT

ROAD  $250' \times 14' = 3500 \text{ SF} = 0,08 \text{ AC}$

ROOF & DRIVE  $3000 \text{ SF} \times 2,5 = 7500 \text{ SF} = 0,17 \text{ AC}$

OVERLAND

$0,53 \text{ AC}$

$0,78 \text{ AC TOTAL}$

WEIGHTED C =  $\left[ (0,25 \times 0,9) + (0,53 \times 0,3) \right] \div 0,78 = 0,49$

CB2 STA 12+50 RT

ROAD  $250 \times 14' = 3500 \text{ SF} = 0,08 \text{ AC}$

DRIVEWAY ALLOYS  $2 \times 15' \times 15' = 450 \text{ SF} = 0,01 \text{ AC}$

OVERLAND

WEIGHTED C =  $\left[ (0,09 \times 0,9) + (0,08 \times 0,3) \right] \div 0,17 = 0,62$

$0,08 \text{ AC}$

$0,17 \text{ AC TOTAL}$

To WETLAND ON LOT #16

ROOF & DRIVE  $(4 \times 3000) + (12 \times 160) = 0,32 \text{ AC}$

OVERLAND (FLAT) = 2,50 AC

PREPARED BY JRM	DATE PREPARED 6/2018	<b>LBM Engineering, LLC</b> P.O. BOX 44 COLCHESTER, CONNECTICUT 06415 TEL: (860)-415-9800 EMAIL: JOHN@LBMENGINEERING.COM	JOB NUMBER	PAGE NUMBER
CHECKED BY	DATE CHECKED		CLIENT NAME	DATE PAID

VILLEGAS HILL SUBDIVISION LETA/ALD

CB 3

ROAD  $450' \times 14' \div 43560$  0.14 AC

ROOF & DRIVE  $[3000 + (160 \times 12)] \div 43560$  0.11 AC

OVERLAND 0.37 AC

$$\text{WEIGHTED C} = \frac{[0.25 \times 0.9] + [0.37 \times 0.3]}{0.62} = 0.54$$

CB 4

ROAD  $450 \times 14 \div 43560$  0.14 AC

ROOF & DRIVE 3000 SF 0.07 AC

OVERLAND 0.26 AC

$$\text{WEIGHTED C} = \frac{[0.21 \times 0.9] + [0.26 \times 0.3]}{0.47} = 0.57$$

CB 5

ROAD 0.14 AC

ROOF & DRIVE  $3000 + (370 \times 12) \div 43560$  0.17 AC

OVERLAND 0.69 AC

$$\text{WEIGHTED C} = \frac{[0.31 \times 0.9] + [0.69 \times 0.3]}{1.00} = 0.49$$

PREPARED BY JRM	DATE PREPARED 6/2018	<b>LBM Engineering, LLC</b> 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	DATE PAVED

VINEGAR HILL SUBDIVISION LEAD/PAVED

CBS 6

ROAD	0.14 AC
ROCKY DRIVE	0.02 AC
OVERLAP	0.05 AC
	0.21 AC TOTAL

WEIGHTED 'C' =  $[(0.16 \times 0.9) + (0.05 \times 0.3)] \div 0.21 = 0.75$

TOTAL AREA TO THE SYSTEM

$3.25 \text{ AC} \times 0.3 (\text{UNPAVED AREA}) = 0.975 \text{ AC}$

TOTAL AC

$1.027 \div 3.25 \text{ AC} = 0.46 \text{ DEVELOPED 'C'}$

PRE DEVELOPMENT FLOW FROM PAVED SYSTEM	Post Dev. @ 100 YR
$A \times I \times R = Q$ 2YR $3.25 \times 0.3 \times 3.5 \text{ "/math> $	2.6
10-YR $5.2 = 5.1$	4.1
25-YR $6.7 = 6.0$	6.0
100-YR $7.9 = 7.7$	8.1

DESIGNED BY JRM DATE 06/17/18  
 CHECKED BY \_\_\_\_\_ REV \_\_\_\_\_  
 DATE \_\_\_\_\_

PROJECT VINEGAR HILL SUBDIVISION  
 PROJECT NO \_\_\_\_\_  
 TOWN Leeward  
 ROUTE \_\_\_\_\_  
 LOCATION N/A

GUTTER FLOW ANALYSIS - 25 YR STORM

Inlet ID	Inlet Shoulder and Orifice	Area (sq ft)	Depth (ft)	Time to inlet (min)	Runoff (cfs)	AC	Total AC	Q to inlet (cfs)	Grade % (ft/ft)	Cross Slope (ft/ft)	Length of Run (ft)	Number of Gutter Inlets	Gutter Width (ft)	Gutter Depth (ft)	AC Bypassing Inlet	AC Bypassing Collector Basin	Inlet Type
<b>PROPOSED ROAD LEFT GUTTER</b>																	
CB 1	12+50 LT	5.00	0.49	10	6.20	0.382	0.382	2.507	0.015	0.343	0.276	0.276	6.424	0.273	0.157	0.225	"C"
CB 5	17+10 LT	5.00	0.75	10	6.20	0.158	0.158	1.074	0.015	0.343	0.198	0.198	4.607	0.225	0.036	0.121	"C"
CB 4	14+50 LT	5.00	0.57	10	6.20	0.263	0.451	3.144	0.015	0.343							"C"
<b>PROPOSED ROAD RIGHT GUTTER</b>																	
CB 2	12+50 RT	5.00	0.62	10	6.20	0.105	0.105	0.719	0.015	0.343	0.170	0.170	3.963	0.098	0.016	0.093	"C"
CB 5	17+10 RT	5.00	0.49	10	6.20	0.490	0.490	3.342	0.015	0.343	0.303	0.303	7.051	1.392	0.235	0.265	"C"
CB 3	14+50 RT	5.00	0.54	10	6.20	0.335	0.335	2.283	0.015	0.343							"C"
NOTES																	
<b>LOW POINT ANALYSIS</b>																	
INLET	C TO INLET	PERIM	C WEIR	d WEIR	WIDTH	C	ORIFICE										
CB 4	3.144	5.020	3	0.352	5.18	0.140		0.3 DEEP - OK									
CB 3	2.283	5.020	3	0.284	5.61	0.078		0.3 DEEP - OK									

- Notes:
1. Manning's n = 0.015 - asphalt
  2. To a 5 minutes minimum for design of all basins
  3. To a 10 minutes minimum for small areas with pavement and grass
  4. To a 15 minutes minimum for areas with grass and less than 2.5 ft deep

GRADES	PERIM	AREA
1	4.00	3.10
2	5.00	5.28
3	7.00	7.33
4	11.00	9.28

**STORM SEWER SYSTEM DESIGN  
DRAINAGE SYSTEM**

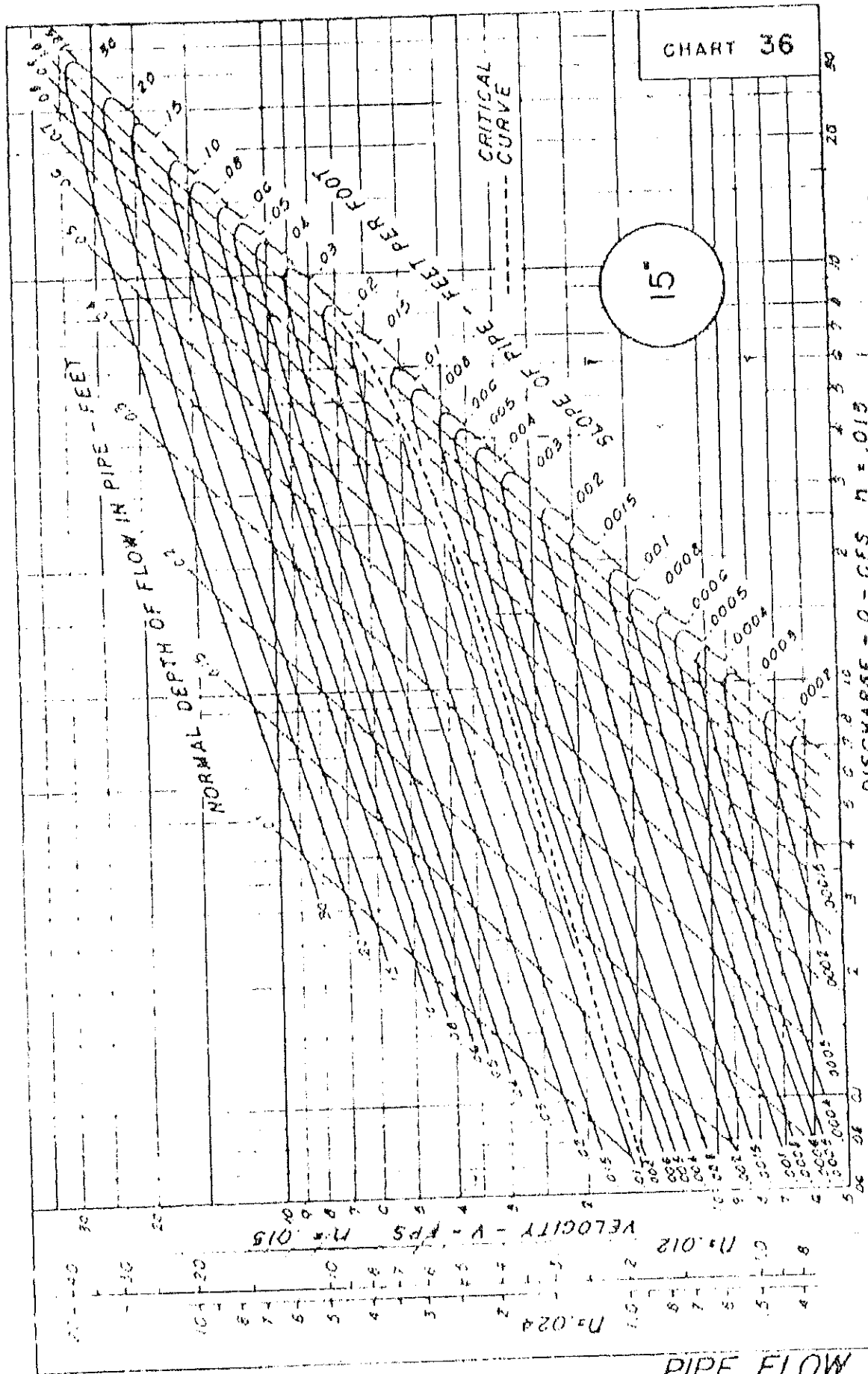
Sheet No 1 of 1

Client: VINEGAR HILL SUBDIVISION  
 Project: VINEGAR HILL SUBDIVISION  
 Proj No: 25-YR  
 Return Period for Design: 25-YR  
 Prepared By: JRM  
 Date: 06/17/18  
 Revised:

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.)	Pipe Data				Manning "n"		
								Size (in.)	Length (ft)	Slope (ft./ft.)	Avg Vel (f.p.s.)		Full Cap. (c.f.s.)	Headwater (ft.)
CB 1 12-50.LI CB 2 12-50.RI	10	0.07	10.0	0.225	0.225	6.2	1.40	15	22	0.010	5.0	6.99	0.40	0.012
CB 2 12-50.RI CB 3 14-60.RI	10	0.64	10.1	0.09	0.315	6.2	1.95	15	192	0.010	5.0	6.99	0.60	0.012
CB 6 17-10.LI CB 5 17-10.RI	10	0.09	10.0	0.121	0.121	6.2	0.75	15	22	0.010	4.0	6.99	0.40	0.012
CB 3 17-10.RI CB 4 14-60.RI	10	0.89	10.1	0.265	0.366	6.2	2.39	15	250	0.010	6.0	6.99	0.50	0.012
CB 4 14-60.RI CB 4 14-60.LI	10	0.05	10.8	0.335	1.036	6.2	6.42	15	22	0.010	7.0	6.99	1.00	0.012
OUTLET 14-60.LI	10	0.50	10.8	0.461	1.467	6.2	9.28	18	300	0.026	10.0	18.34	2.00	0.012

NOTE ALL PIPES ARE BELOW FULL CAPACITY

Manning's n for HUPP and H-C pipe = 0.012



PIPE FLOW CHART  
15-INCH DIAMETER

0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	1.5	2.0	3.0	4.0
0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	1.5	2.0	3.0	4.0
0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	1.5	2.0	3.0	4.0



NOAA Atlas 14, Volume 10, Version 2  
 Location name: Ledyard, Connecticut, USA\*  
 Latitude: 41.4443°, Longitude: -72.0175°  
 Elevation: 304.37 ft\*\*  
\*Source: FSR Maps  
 \*\*Source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sungu Ferrara, Sotha Pavlovic, Michael St. Laurent, Carl Trzaska, Dan Ulrich, Odan Zaitsev

NOAA National Weather Service, Silver Spring, Maryland

PF\_tabular | PF\_graphical | Maps & records

1.04" / 10 years = 6.24"

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup>

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.341 (0.265-0.437)	0.408 (0.316-0.523)	0.517 (0.399-0.664)	0.608 (0.447-0.783)	0.732 (0.545-0.973)	0.828 (0.605-1.12)	0.924 (0.656-1.28)	1.05 (0.704-1.46)	1.21 (0.792-1.74)	1.33 (0.841-1.92)
10-min	0.483 (0.375-0.619)	0.578 (0.448-0.740)	0.732 (0.566-0.941)	0.861 (0.681-1.11)	1.04 (0.772-1.38)	1.17 (0.856-1.58)	1.31 (0.930-1.82)	1.48 (0.997-2.08)	1.71 (1.17-2.35)	1.88 (1.19-2.74)
15-min	0.589 (0.441-0.725)	0.680 (0.527-0.871)	0.862 (0.685-1.11)	1.01 (0.778-1.31)	1.22 (0.909-1.62)	1.38 (1.01-1.88)	1.54 (1.09-2.13)	1.74 (1.12-2.44)	2.01 (1.30-2.88)	2.27 (1.49-3.27)
30-min	0.802 (0.622-1.0)	0.959 (0.743-1.23)	1.21 (0.937-1.58)	1.43 (1.09-1.81)	1.72 (1.26-2.28)	1.94 (1.47-2.62)	2.17 (1.54-3.06)	2.45 (1.65-3.43)	2.83 (1.85-4.25)	3.12 (2.07-4.53)
60-min	1.04 (0.804-1.33)	1.24 (0.958-1.59)	1.57 (1.21-2.01)	1.84 (1.41-2.37)	2.21 (1.65-2.94)	2.50 (1.83-3.30)	2.79 (1.98-3.87)	3.16 (2.13-4.42)	3.65 (2.36-5.23)	4.02 (2.7-5.84)
2-hr	1.36 (1.07-1.73)	1.62 (1.27-2.06)	2.08 (1.60-2.62)	2.41 (1.87-3.08)	2.90 (2.18-3.83)	3.28 (2.45-4.39)	3.66 (2.62-5.04)	4.15 (2.80-5.76)	4.79 (3.12-6.81)	5.27 (3.57-7.53)
3-hr	1.58 (1.24-2.00)	1.88 (1.46-2.39)	2.38 (1.86-3.02)	2.79 (2.17-3.56)	3.36 (2.53-4.41)	3.80 (2.85-5.06)	4.24 (3.04-5.80)	4.80 (3.26-6.69)	5.54 (3.62-7.84)	6.10 (4.07-8.63)
6-hr	2.01 (1.59-2.54)	2.38 (1.89-2.99)	3.01 (2.37-3.77)	3.52 (2.76-4.43)	4.23 (3.21-5.50)	4.77 (3.56-6.30)	5.32 (3.84-7.22)	6.02 (4.18-8.25)	6.95 (4.56-9.75)	7.65 (5.08-10.8)
12-hr	2.48 (1.98-3.07)	2.94 (2.35-3.65)	3.69 (2.94-4.59)	4.32 (3.42-5.35)	5.18 (4.07-6.68)	5.84 (4.58-7.65)	6.51 (4.74-9.17)	7.37 (5.00-10.0)	8.50 (5.51-11.9)	9.36 (6.17-12.8)
24-hr	2.90 (2.34-3.57)	3.46 (2.79-4.25)	4.36 (3.51-5.38)	5.11 (4.09-6.33)	6.15 (4.75-7.87)	6.95 (5.26-9.03)	7.75 (5.69-10.4)	8.81 (6.09-11.9)	10.2 (6.78-14.2)	11.3 (7.59-15.6)
2-day	3.25 (2.64-3.95)	3.90 (3.18-4.75)	4.97 (4.03-6.07)	5.87 (4.73-7.19)	7.09 (5.54-9.01)	8.04 (6.15-10.4)	8.98 (6.66-12.0)	10.3 (7.15-13.8)	12.0 (8.02-16.5)	13.4 (8.87-19.0)
3-day	3.52 (2.88-4.26)	4.22 (3.46-5.12)	5.38 (4.39-6.54)	6.34 (5.14-7.73)	7.66 (6.00-9.68)	8.68 (6.66-11.2)	9.70 (7.23-12.9)	11.1 (7.76-13.3)	13.0 (8.79-17.8)	14.4 (9.41-20.1)
4-day	3.77 (3.10-4.55)	4.51 (3.71-5.45)	5.73 (4.69-6.93)	6.73 (5.48-8.19)	8.12 (6.49-10.2)	9.19 (7.07-11.8)	10.3 (7.68-13.5)	11.7 (8.21-15.6)	13.7 (9.59-18.7)	15.2 (10.27-20.7)
7-day	4.49 (3.72-5.38)	5.30 (4.39-6.35)	6.63 (5.46-7.95)	7.72 (6.33-9.31)	9.23 (7.30-11.5)	10.4 (8.04-13.2)	11.6 (8.66-15.1)	13.1 (9.22-17.3)	15.2 (10.2-20.6)	16.8 (11.2-22.7)
10-day	5.21 (4.33-6.20)	6.05 (5.03-7.21)	7.44 (6.16-8.86)	8.59 (7.07-10.3)	10.2 (8.07-12.6)	11.4 (8.83-14.3)	12.6 (9.45-16.3)	14.2 (9.99-18.6)	16.2 (11.3-21.9)	17.8 (12.2-23.7)
20-day	7.39 (6.22-8.72)	8.30 (6.97-9.80)	9.78 (8.18-11.6)	11.0 (9.15-13.1)	12.7 (10.1-15.5)	14.0 (10.9-17.4)	15.3 (11.5-19.4)	16.7 (11.9-21.7)	18.5 (12.6-24.7)	19.9 (13.7-27.1)
30-day	9.21 (7.79-10.8)	10.2 (8.58-11.9)	11.7 (9.85-13.8)	13.0 (10.9-15.4)	14.8 (11.8-17.9)	16.1 (12.6-19.8)	17.5 (13.1-21.9)	18.7 (13.4-24.2)	20.4 (13.9-27.2)	21.6 (14.5-29.2)
45-day	11.5 (9.74-13.4)	12.5 (10.6-14.5)	14.1 (11.9-16.5)	15.5 (13.0-18.2)	17.4 (14.0-20.9)	18.8 (14.7-23.9)	20.3 (15.2-26.1)	21.4 (15.3-27.5)	22.8 (15.6-30.1)	23.9 (16.3-31.5)
60-day	13.3 (11.1-15.5)	14.4 (12.3-16.7)	16.1 (13.7-18.8)	17.6 (14.8-20.6)	19.6 (15.8-23.4)	21.1 (16.6-25.5)	22.6 (17.6-27.9)	23.7 (17.5-30.3)	25.0 (17.2-33.0)	26.1 (17.9-34.7)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates of upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical



COMPUTATIONS FOR  
 WATER QUALITY FLOW / WATER QUALITY VOLUME  
 VINEGAR HILL RD SUBDIVISION  
 LEDYARD

Project

Made By:

Date:

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)
				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

$I = \% \text{ of Impervious Cover} =$  23%

$R = \text{volumetric runoff coeff } 0.05 + 0.009(I) =$  0.2532

$A = \text{site area (acres)} =$  6.2 acres = 0.0097 miles<sup>2</sup>

$Q = \text{runoff depth (in watershed inches)} = [WQV(\text{acrefeet}) * [12(\text{inches/foot})] / \text{drainage area (acres)}$   
 $Q =$  0.2532258

$CN = 1000 / [10 + 5P + 10Q - 10(Q^2 + 1.25QP)^{0.5}] =$  88.0

$P = \text{design precipitation (1" for water quality storm)} =$  1 inch

$Q = \text{runoff depth (in watershed inches)}$

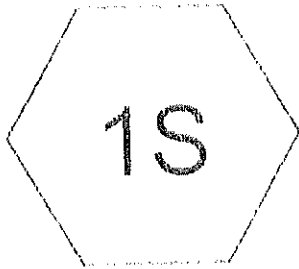
$t_c =$  10 min

hours

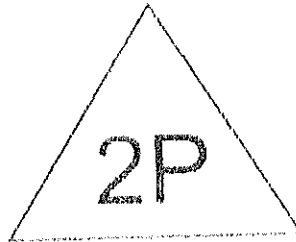
From Table 4-1,  $I_a =$   $I_a/P =$  0.273

From Exhibit 4-III,  $q_w =$

$WQF = (q_w)(A)(Q) =$  1.23 cfs



TO BASIN



WQ BASIN

Subcat

Reach

Pond

Link

Routing Diagram for VINEGAR HILL BASIN  
Prepared by IBA Engineering LLC - Project 00112-1  
HydroCAD v. 10.00.02 - 2010 IBA Engineering Software - 6/10

**VINEGAR HILL BASIN**

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

Prepared by LBM Engineering LLC

Printed 7/6/2018

HydroCAD® 10.00-22 s/n 09192 © 2018 HydroCAD Software Solutions LLC

Page 1

**Summary for Subcatchment 1S: TO BASIN**

Runoff = 5.17 cfs @ 0.17 hrs. Volume= 5.469 cf Depth= 0.46"

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	
3.250		100.00% Pervious 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 = 141,570 sf, 0.00% Impervious. Inflow Depth = 0.46" for 2-yr event  
 Inflow = 5.17 cfs @ 0.17 hrs. Volume= 5.469 cf  
 Outflow = 0.59 cfs @ 0.54 hrs. Volume= 284 cf. Atten= 89%. Lag= 21.9 min  
 Primary = 0.59 cfs @ 0.54 hrs. Volume= 284 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs  
 Peak Elev= 277.07' @ 0.54 hrs Surf.Area= 2.287 sf Storage= 5.332 cf

Plug-Flow detention time= 33.6 min calculated for 284 cf (5% of inflow)  
 Center-of-Mass det. time= 21.5 min ( 36.5 - 15.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	274.00'	7.823 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
274.00	1,120	0	0
276.00	1,965	3,085	3,085
277.00	2,234	2,100	5,185
278.00	3,042	2,638	7,823

Device	Routing	Invert	Outlet Devices
#1	Primary	277.00'	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=0.59 cfs @ 0.54 hrs HW=277.06' (Free Discharge)  
 ←1=Broad-Crested Rectangular Weir (Weir Controls 0.59 cfs @ 0.60 fps)

VINEGAR HILL BASIN

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

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Summary for Subcatchment 1S: TO BASIN

Runoff = 7.68 cfs @ 0.17 hrs. Volume= 3.128 cf. Depth= 0.69"

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	
3.250		100.00% Pervious 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 = 141,570 sf, 0.00% Impervious, Inflow Depth = 0.69" for 10-yr event  
 Inflow = 7.68 cfs @ 0.17 hrs. Volume= 8.128 cf  
 Outflow = 4.14 cfs @ 0.36 hrs. Volume= 2.943 cf. Atten= 46%. Lag= 11.5 min  
 Primary = 4.14 cfs @ 0.36 hrs. Volume= 2.943 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs. dt= 0.01 hrs  
 Peak Elev= 277.24' @ 0.36 hrs Surf.Area= 2.425 sf Storage= 5.736 cf

Plug-Flow detention time= 18.5 min calculated for 2,943 cf (36% of inflow)  
 Center-of-Mass det. time= 10.9 min ( 25.9 - 15.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	274.00'	7.823 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum Store (cubic-feet)
274.00	1,120	0	0
276.00	1,965	3,085	3,085
277.00	2,234	2,100	5,185
278.00	3,042	2,638	7,823

Device	Routing	Invert	Outlet Devices
#1	Primary	277.00'	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=4.13 cfs @ 0.36 hrs HW=277.24' (Free Discharge)  
 t=1=Broad-Crested Rectangular Weir (Weir Controls 4.13 cfs @ 1.16 fps)

**VINEGAR HILL BASIN**

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

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**Summary for Subcatchment 1S: TO BASIN**

Runoff = 9.24 cfs @ 0.17 hrs, Volume= 9,780 cf, Depth= 0.83"

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	
3.250		100.00% Pervious 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 = 141,570 sf, 0.00% Impervious. Inflow Depth = 0.83" for 25-yr event  
 Inflow = 9.24 cfs @ 0.17 hrs, Volume= 9,780 cf  
 Outflow = 5.96 cfs @ 0.32 hrs, Volume= 4,595 cf, Atten= 36%, Lag= 8.8 min  
 Primary = 5.96 cfs @ 0.32 hrs, Volume= 4,595 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs. dt= 0.01 hrs  
 Peak Elev= 277.30' @ 0.32 hrs Surf.Area= 2,475 sf Storage= 5,887 cf

Plug-Flow detention time= 15.4 min calculated for 4,595 cf (47% of inflow)  
 Center-of-Mass det. time= 8.9 min ( 23.9 - 15.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	274.00'	7,823 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
274.00	1,120	0	0
276.00	1,965	3,085	3,085
277.00	2,234	2,100	5,185
278.00	3,042	2,638	7,823

Device	Routing	Invert	Outlet Devices
#1	Primary	277.00'	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=5.95 cfs @ 0.32 hrs HW=277.30' (Free Discharge)  
 1=Broad-Crested Rectangular Weir (Weir Controls 5.95 cfs @ 1.33 fps)

**VINEGAR HILL BASIN**

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

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**Summary for Subcatchment 1S: TO BASIN**

Runoff = 11.67 cfs @ 0.17 hrs, Volume= 12,343 cf, Depth= 1.05"

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	
3.250		100.00% Pervious 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 = 141,570 sf, 0.00% Impervious, Inflow Depth = 1.05" for 100-yr event  
 Inflow = 11.67 cfs @ 0.17 hrs, Volume= 12,343 cf  
 Outflow = 8.69 cfs @ 0.28 hrs, Volume= 7,158 cf, Atten= 25%, Lag= 6.3 min  
 Primary = 8.69 cfs @ 0.28 hrs, Volume= 7,158 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs  
 Peak Elev= 277.38' @ 0.28 hrs Surf.Area= 2,539 sf Storage= 6,087 cf

Plug-Flow detention time= 12.5 min calculated for 7,158 cf (58% of inflow)  
 Center-of-Mass det. time= 7.1 min ( 22.1 - 15.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	274.00'	7,823 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
274.00	1,120	0	0
276.00	1,965	3,085	3,085
277.00	2,234	2,100	5,185
278.00	3,042	2,638	7,823

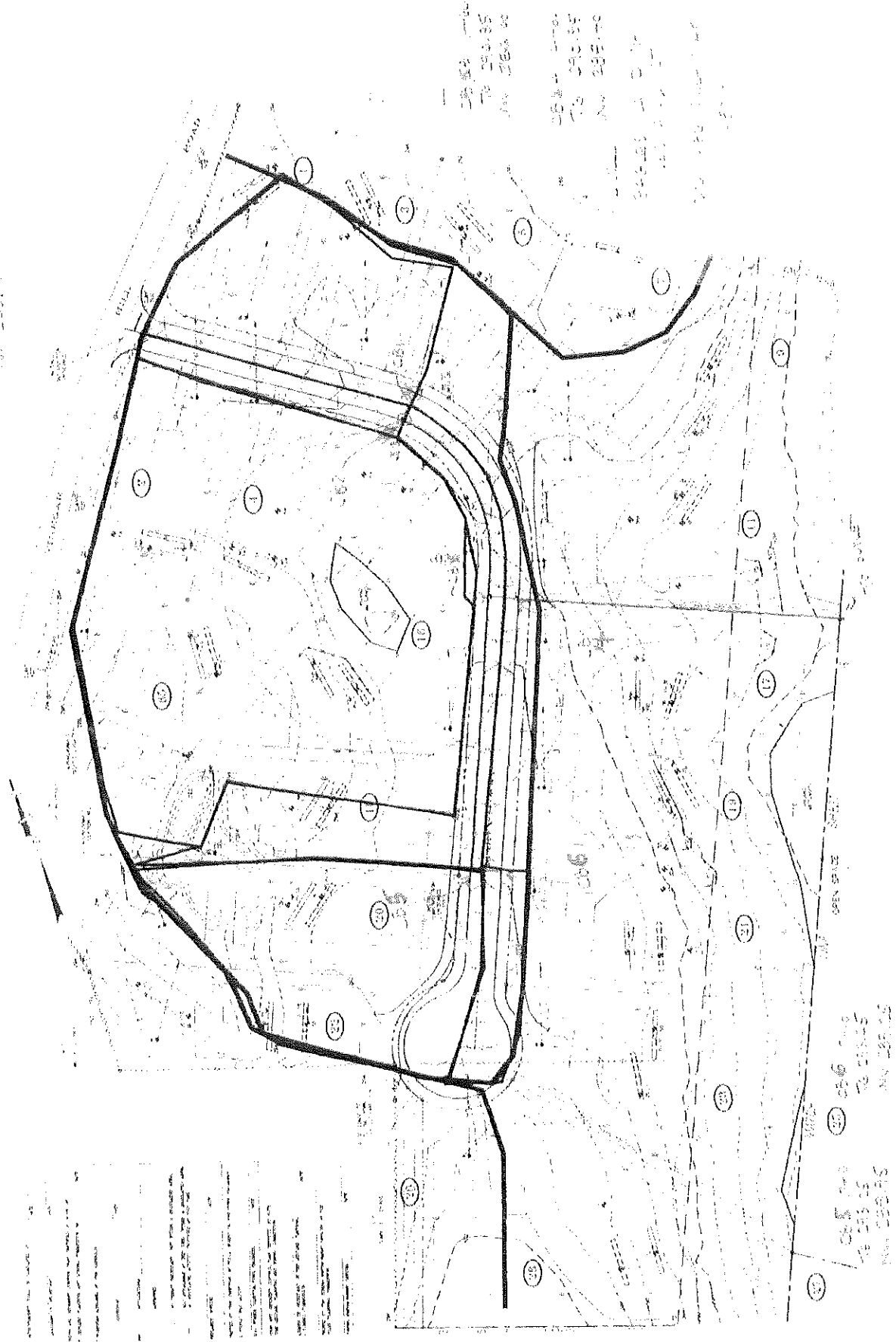
Device	Routing	Invert	Outlet Devices
#1	Primary	277.00'	15.0' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=8.68 cfs @ 0.28 hrs HW=277.38' (Free Discharge)  
 ↑-1=Broad-Crested Rectangular Weir (Weir Controls 8.68 cfs @ 1.53 fps)

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