

LBM Engineering, LLC

PO Box 44, Colchester CT 06415-0044 Phone 860-416-9809 Email info@lbmengineering.com

CIVIL ENGINEERING - LAND DEVELOPMENT - SITE PLANS - STORMWATER MANAGEMENT

RECEIVED

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.

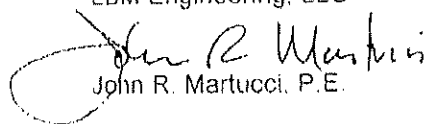
STORMWATER MANAGEMENT: The proposed development will not change the existing drainage patterns. Only 3.5 acres of the 170 acre parcel drains to the road's piped storm drain. A proposed detention/water quality basin is sized to effectively maintain the peak rates of runoff from the proposed road's drainage 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.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.

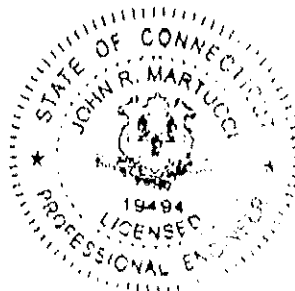


Exhibit #3

PREPARED BY JLM	DATE PREPARED 6/2018	LBM Engineering, LLC P.O. BOX 44 COLCHESTER, CONNECTICUT 06415 TEL (860)-416-9809 EMAIL: JOHN@LBMENGINEERING.COM	JOB NUMBER	PAGE 1 OF 1
CHECKED BY	DATE CHECKED		CLIENT NAME	TOTAL SHEETS

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 AC

$0.17 \text{ AC} \times 0.17 = 0.03$

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

OVERLAND

WEIGHTED C = $\left[(0.09 \times 0.9) + (0.08 \times 0.3) \right] \div 0.17 = 0.62$

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	LBM Engineering, LLC P.O. BOX 44 COLCHESTER, CONNECTICUT 06415 TEL: (860)-415-9809 EMAIL: JOHN@LBMENGINEERING.COM	JOB NUMBER	PAGE NUMBER
CHECKED BY	DATE CHECKED		CLIENT NAME	DATE

VINEGAR HILL SUBDIVISION LETAIR

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

0.62 AC

$$\text{WEIGHTED } C = [(0.25 \times 0.1) + (0.37 \times 0.3)] \div 0.62 = 0.54$$

CB 4

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

ROOF & DRIVE 3000 SF 0.07 AC

OVERLAND

0.26 AC

0.47 AC

$$\text{WEIGHTED } C = [(0.21 \times 0.1) + (0.26 \times 0.3)] \div 0.47 = 0.57$$

CB 5

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

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

OVERLAND

0.69 AC

1.00 AC

$$\text{WEIGHTED } C = [(0.21 \times 0.1) + (0.69 \times 0.3)] \div 1 = 0.49$$

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		CLIENT NAME	TOTAL PAGES

VINEGAR HILL CORPORATION LAZYBROOK

CBS

ROAD

0.14 AC

ROAD DRIVE

0.02 AC

OVERLAP

0.05 AC

0.21 AC TOTAL

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

TOTAL AREA TO THE SYSTEM

$$Q_{25} \quad 3.25 \text{ AC} \times 0.3 (\text{UNWEIGHTED}) = 0.975 \text{ CFS}$$

TOTAL AC

$$1.097 \div 3.25 \text{ AC} = 0.46 \text{ DEVELOPED 'C'}$$

PRE DEVELOPMENT FLOW FROM PIPED SYSTEM

	A	x	I	x	R	=	Q
2YR	3.25	x	0.3	x	3.5 "/hr	=	3.4 CFS
10-YR					5.2	=	5.1
25-YR					6.7	=	6.0
100-YR					7.7	=	7.7

POST DEVELOPMENT

@ VINEGAR HILL

0.6

4.1

6.0

8.1

DESIGNED BY _____ DATE 06/17/18
 JRM
 REV _____
 CHECKED BY _____ DATE _____

PROJECT VINEGAR HILL SUBDIVISION
 PROJECT NO _____
 TOWN Leeward
 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 Peak (min)	Runoff Intensity (in/hr)	A/C	Total A/C	Q to Inlet (cfs)	Grade % (G)	Grade % (G) (ft/100)	Cross Slope (ft/ft)	Length of Run (ft)	Flow Width (ft)	Bypassing Inlet (cfs)	A/C Bypassing Inlet	A/C Bypassing Inlet (ft)	Inlet Type
PROPOSED ROAD LEFT GUTTER																	
CB 1	12+50.0 LT	0.49	0.49	10	6.20	0.382	0.382	2.607	0.343	0.343	0.343	0.276	6.424	0.973	0.157	0.225	"C"
CB 5	17+10.0 LT	0.75	0.75	10	6.20	0.158	0.158	1.074	0.343	0.343	0.343	0.198	4.607	0.225	0.036	0.121	"C"
CB 4	14+60.0 LT	0.57	0.57	10	6.20	0.263	0.263	3.144	0.343	0.343	0.343						"C"
PROPOSED ROAD RIGHT GUTTER																	
CB 2	12+50.0 RT	0.62	0.62	10	6.20	0.105	0.105	0.719	0.343	0.343	0.343	0.170	3.963	0.098	0.016	0.093	"C"
CB 5	17+10.0 RT	0.49	0.49	10	6.20	0.490	0.490	3.342	0.343	0.343	0.343	0.303	7.051	1.392	0.235	0.265	"C"
CB 3	14+60.0 RT	0.54	0.54	10	6.20	0.335	0.335	2.283	0.343	0.343	0.343						"C"
NOTES																	
LOW POINT ANALYSIS																	
INLET	Q TO INLET	PERIM	C WEIR	d WEIR	WIDTH	d	ORIFICE										
CB 4	3.144	5.020	3	0.352	9.18	0.140	0.3 DEEP - OK										
CB 3	2.283	5.020	3	0.284	6.61	0.018	0.3 DEEP - OK										

Notes:
 1. Manning's n = 0.015 - asphalt
 2. The 5 minutes minimum for design rainfall duration
 3. The 5 to 10 minutes minimum for small areas with pavement and grass
 4. The 10 minutes minimum for areas with grass and pavement and trees

GRADES	PERIM	AREA
0.343	4.00	3.12
0.343	1.00	0.38
0.343	7.00	0.13
0.343	11.00	0.20

STORM SEWER SYSTEM DESIGN DRAINAGE SYSTEM

Sheet No 1 of 1

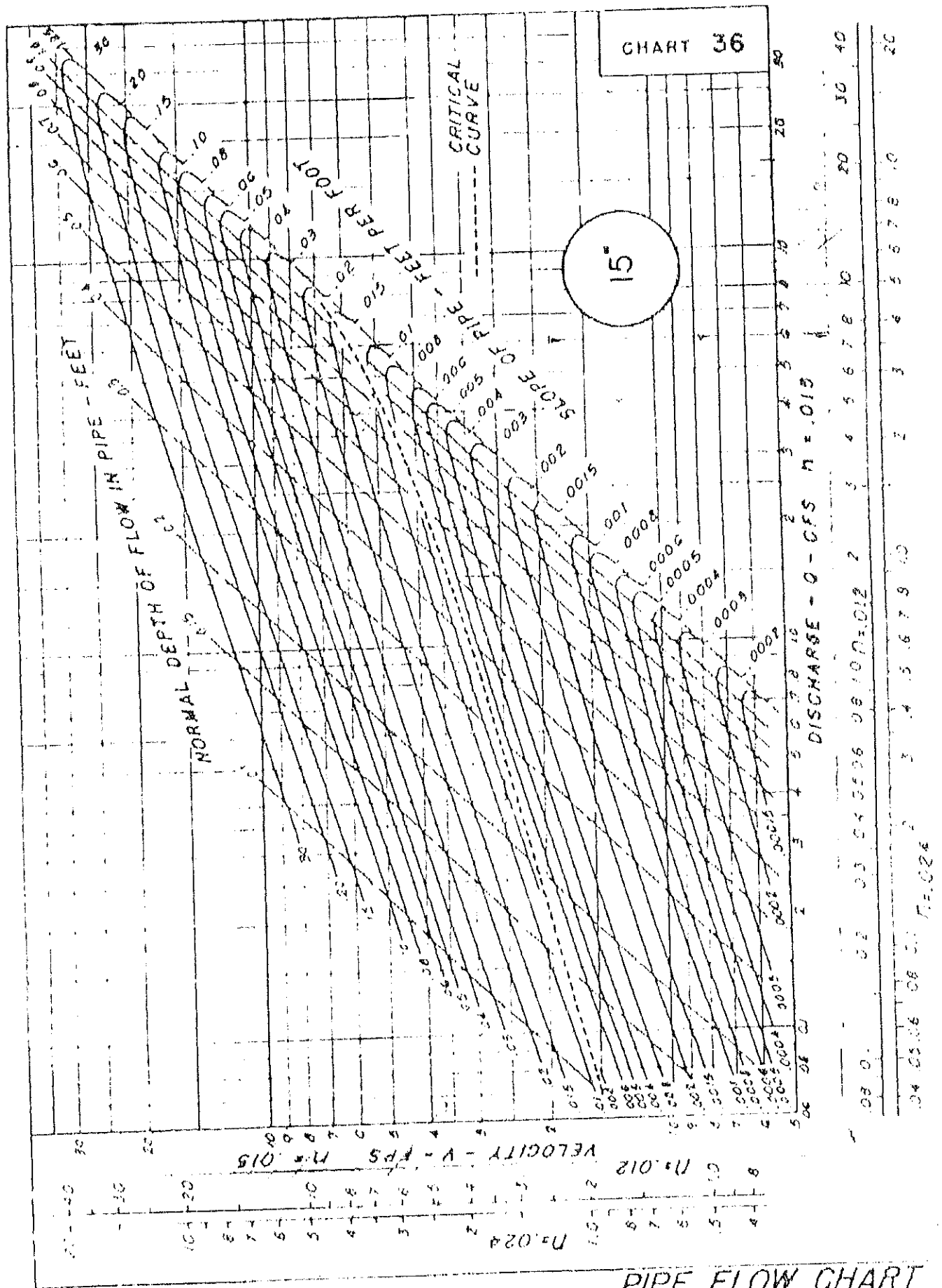
Client: VINEGAR HILL SUBDIVISION
Project: 25-YR
Proj No:
Return Period for Design

Prepared By JRM Date 06/17/18 Revised

Line Segment		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.)	Avg Vel (f.p.s.)	Full Cap. (c.f.s.)	Headwater (ft.)	Manning "n"
From	To														
CB 1	CB 2	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
12-50.II	12-50.RT														
CB 2	CB 3	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
12-50.RT	14-60.RT														
CB 6	CB 5	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
17-10.II	17-10.RT														
CB 5	CB 3	10	0.59	10.1	0.265	0.366	6.2	2.39	15	250	0.010	6.0	6.99	0.50	0.012
17-10.RT	14-50.RT														
CB 3	CB 4	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
14-60.RT	14-60.II														
CB 4	OUTLET	10	0.50	10.8	0.461	1.457	5.2	9.28	18	300	0.026	10.0	18.34	2.00	0.012
14-60.II															

Manning's "n" for RUPP and P-C pipe = 0.012

NOTE ALL PIPES ARE BELOW FULL CAPACITY





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



POINT PRECIPITATION FREQUENCY ESTIMATES

Salary/Payroll: See that Payroll: Includes St. Vincent and the Grenadines. Date: 11/03/2010. Order Number:

NOAA National Weather Service Silver Spring Maryland

[PE_tutorial](#) | [PE_architectural](#) | [Maps & agents](#)

$$1.04''/10 \text{ mm} = 6.24 \times 10^{-4}$$

PF tabular

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

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)	0.820 (0.605-1.12)	0.924 (0.656-1.26)	1.05 (0.704-1.46)	1.21 (0.742-1.74)	1.33 (0.841-2.0)
10-min	0.483 (0.375-0.619)	0.578 (0.448-0.740)	0.732 (0.506-0.941)	0.861 (0.661-1.11)	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 (1.11-2.45)	1.88 (1.19-2.74)
15-min	0.589 (0.441-0.725)	0.680 (0.527-0.871)	0.862 (0.605-1.11)	1.01 (0.778-1.31)	1.22 (0.909-1.62)	1.38 (0.91-1.86)	1.54 (1.09-2.13)	1.74 (1.12-2.44)	2.01 (1.30-2.88)	2.27 (1.49-3.2)
30-min	0.802 (0.622-1.03)	0.959 (0.743-1.23)	1.21 (0.942-1.56)	1.43 (1.09-1.81)	1.72 (1.26-2.28)	1.94 (1.42-2.67)	2.17 (1.54-3.06)	2.45 (1.65-3.43)	2.83 (1.83-4.29)	3.12 (2.04-4.5)
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 (1.83-3.36)	2.79 (1.98-3.87)	3.16 (2.13-4.42)	3.65 (2.38-5.27)	4.02 (2.6-5.83)
2-hr	1.36 (1.07-1.73)	1.62 (1.27-2.06)	2.00 (1.60-2.62)	2.41 (1.87-3.08)	2.90 (2.18-3.83)	3.28 (2.43-4.39)	3.66 (2.62-5.04)	4.15 (2.80-5.76)	4.79 (3.12-6.81)	5.27 (3.45-7.6)
3-hr	1.58 (1.24-2.00)	1.88 (1.46-2.48)	2.38 (1.86-3.02)	2.79 (2.17-3.55)	3.36 (2.53-4.41)	3.80 (2.83-5.06)	4.24 (3.04-5.80)	4.80 (3.26-6.63)	5.54 (3.62-7.85)	6.10 (4.03-8.5)
6-hr	2.01 (1.59-2.54)	2.38 (1.89-2.99)	3.01 (2.37-3.77)	3.52 (2.66-4.43)	4.23 (3.23-5.50)	4.77 (3.56-6.30)	5.32 (3.84-7.27)	6.02 (4.31-8.26)	6.95 (4.86-9.26)	7.65 (5.08-10.6)
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 (4.38-7.65)	6.51 (4.74-8.77)	7.37 (5.06-10.0)	8.50 (5.61-11.9)	9.36 (6.2-12.7)
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 (7.49-15.5)
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 (5.53-9.01)	8.04 (6.13-10.4)	8.98 (6.66-12.0)	10.3 (7.15-13.8)	12.0 (8.02-16.9)	13.4 (8.84-18.6)
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 (7.22-12.9)	11.1 (7.66-14.3)	13.0 (8.79-17.8)	14.4 (9.47-19.7)
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 (6.48-10.2)	9.19 (7.12-11.8)	10.3 (7.68-13.5)	11.7 (8.21-15.6)	13.7 (9.56-18.3)	15.2 (10.3-20.2)
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 (11.3-22.3)
10-day	5.21 (4.33-6.20)	6.05 (5.03-7.21)	7.44 (6.16-8.86)	8.50 (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 (11.9-21.9)	17.8 (12.7-23.4)
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 (13.7-26.7)
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 (13.4-25.2)	20.4 (13.9-27.3)	21.6 (14.3-28.9)
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 (14.7-22.9)	20.3 (15.2-25.3)	21.4 (15.3-27.5)	22.8 (15.6-30.1)	23.9 (16.9-31.5)
60-day	13.3 (11.15-15.5)	14.4 (12.3-16.7)	16.4 (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 (17.9-29.3)	25.0 (17.2-33.5)	26.1 (18.5-34.5)

Precession 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 at upper and lower bounds represent extreme correlation (PMP) estimates and may be higher than extremely rare PMP values.

¹ Please refer to NOAA Atlas 14 document for more information.

Penetration

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)
	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

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

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

$A = \text{site area (acres)} =$ 6.2 acres = 0.0097 miles²

$Q = \text{runoff depth (in watershed inches)} = [WQV(\text{acre-feet})] \cdot [12(\text{inches/foot})] / \text{drainage area (acres)}$
 $Q =$ 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

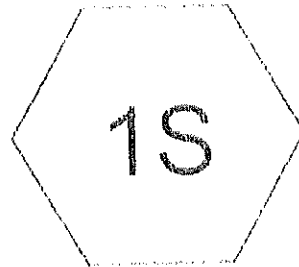
From Table 4-1, $I_a =$

$I_a/P =$ 0.273

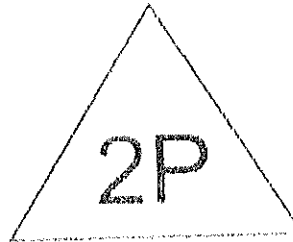
From Exhibit 4-III, $q_u =$

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

TO POND 1



TO BASIN



WQ BASIN

Subcat

Reach

Pond

Link

Routing Diagram for VINEGAR HILL BASIN
Prepared by EBA Engineering LLC - Project 001110-01
HydroCAD v10.00.02 - 2010 HydroCAD Software v10.0

VINEGAR HILL BASIN

Prepared by LBM Engineering LLC

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

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

Printed 7/6/2018

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 del. 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)
↑=Broad-Crested Rectangular Weir (Weir Controls 0.59 cfs @ 0.60 fps)

VINEGAR HILL BASIN

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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)

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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)

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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)
↑=Broad-Crested Rectangular Weir (Weir Controls 8.68 cfs @ 1.53 fps)

