

LBM Engineering, LLC

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CIVIL ENGINEERING - LAND DEVELOPMENT - SITE PLANS - STORMWATER MANAGEMENT

**Engineering Report
For Land Use Commissions Submittals
Avery Brook Homes Subdivision,
Stoddards Warf Road, Ledyard, Connecticut**

November 13, 2022

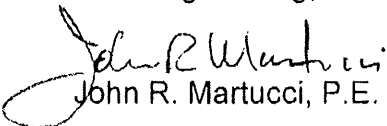
EXISTING CONDITIONS: Reference is made to the following Plan Set: "Plan Showing Resubdivision Property of Avery Brook Homes LLC 94, 96, 98 and 100 Stoddards Wharf Road, A.K.A. Connecticut Route 214 Ledyard, Connecticut" Scales as Shown July 2022, Revised October 31, 2022, By Dieter & Gardner, Gales Ferry, CT. The property is located on the north side of Stoddards Wharf Road approximately one quarter mile east of the intersection of Whalehead Road and Stoddards Wharf Road. The property is wooded. The property drains primarily to the east and north.

STORMWATER MANAGEMENT: Detention of peak flow rates is not proposed for this development. The Town of Ledyard's Ordinance Regulating the Management of Stormwater Runoff, Part I. Section 3. Paragraph C. states: "A zero percent increase in discharge characteristics is specifically not applicable in cases where the applicant can demonstrate that the runoff will discharge to the Thames River or Groton Reservoir system without increasing the potential of downstream flooding." Runoff leaves this site in the form of sheet flow discharging to the watershed of the Groton Reservoir system. The runoff is dispersed along the north and east boundary lines.

WATER QUALITY: The proposal includes a water quality basin which is designed to hold the Water Quality Volume (WQV) for 12 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, nor will it increase the potential for downstream flooding 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.

NOV 15 2022
10:30 AM
LBM ENGINEERING, LLC

COMPUTATIONS FOR:	Project
WATER QUALITY FLOW / WATER QUALITY VOLUME	Made By: JRM
AVERY BROOK HOMES SUBDIVISION	Date: 8/31/2022
LEDYARD	Rev:
	Date:

IN SYSTEM TO BASIN				
ConnDOT Drainage Manual Ch. 10 and Ch. 11, Appendix C				
Contributing Basins TO BASIN	Wooded Area (acres)	Grass Area (acres)	Paved /Roof (acres)	Total Area (acres)
	0	3.09	0.41	3.5
			0.48	0.48
Total	0	3.09	0.89	3.98
Equation 10.31: $WQV = (1")(R)(A)/12 =$ 0.083 acre-feet or 3,630 cubic-foot				
I = % of Impervious Cover = 22%				
R = volumetric runoff coeff. $0.05 + 0.009(I) =$ 0.2513				
A = site area (acres) = 3.98 acres = 0.0062 miles ²				
Q = runoff depth (in watershed inches) = $[WQV(\text{acrefeet})][12(\text{inches/foot})]/\text{drainage area (acres)}$				
Q = 0.2512563				
$CN = 1000 / [10 + 5P + 10Q - 10(Q^2 + 1.25QP)^{0.5}] =$ 87.9				
P = design precipitation (1" for water quality storm) = 1 inch				
Q = runoff depth (in watershed inches)				
$t_c =$ 10 min				
$t_c = 10 \text{ minutes} =$ 0.167 hours				
From Table 4-1, $I_a =$ 0.273 $I_a/P =$ 0.273				
From Exhibit 4-III, $q_u =$ 500				
WQF = $(q_u)(A)(Q) =$ 0.78 cfs				

PREPARED BY JRM	DATE PREPARED 10/2022	LBM Engineering, LLC 11 HALLY LANE COLCHESTER, CONNECTICUT 06415 TEL: (860)-416-9809 EMAIL: JOHN@LBMENGINEERING.COM	JOB NUMBER	PAGE NUMBER
CHECKED BY	DATE CHECKED		CLIENT NAME	TOTAL PAGES

AVERY BROOK HOMES

DRAINAGE AREA BREAKDOWN TO DETERMINE WQV

3.98 AC TOTAL

12 LOTS ROOF & DRIVEWAY 1500 SF EA X 12 =
 18,000 SF 0.41 AC

950' OF 22' WIDE ROAD = 20,900 SF = 0.48 AC

3.98 AC - 0.89 = 3.09 AC OVERLAND

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CB 1 STA 12+30 RT
 CB 2 STA 23+13 RT
 CB 3 STA 23+13 LT

CB 1

STA 10+10 - 16+20 RIGHT SIDE OF ROAD

ROAD $620' \times 11' = 6820 \text{ SF} = 0.16 \text{ ACRES}$ 'C' = 0.9

CB 2

ROAD $630' \times 11' = 6930 \text{ SF} = 0.16 \text{ AC}$

ROOF & DRIVES $1500 \text{ SF} \times 2 \text{ LOTS} = 3000 \text{ SF} = 0.07 \text{ AC}$

OVERLAND $16,200 \text{ SF} = 0.37 \text{ AC}$

TOTAL AREA 0.60 AC

$$\text{WEIGHTED 'C'} \left[(0.23 \times 0.9) + (0.37 \times 0.3) \right] \div 0.60 \text{ AC} = 0.53$$

CB 3

ROAD $750' \times 11' = 8250 \text{ SF} = 0.19 \text{ AC}$

ROOF & DRIVES $1500 \times 6 \text{ LOTS} = 9,000 \text{ SF} = 0.21 \text{ AC}$

OVERLAND $50,095 \text{ SF} = 1.15 \text{ AC}$ (1.55 TOTAL)

$$\text{WEIGHTED 'C'} \left[(0.40 \times 0.9) + (1.15 \times 0.3) \right] \div 1.55 = 0.45$$

DESIGNED BY: JRM DATE: 11/12/22
 CHECKED BY: _____ REV: _____
 DATE: _____

PROJECT: AVERY BROOK 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 (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 RIGHT GUTTER																
CB 1	12+30, RT	0.180	0.9	10	6.20	0.144	0.144	0.982	LOWPT	0.043	SEE LOW POINT ANALYSIS	SEE LOW POINT ANALYSIS	0.144	0.144	0.144	"C"
CB 2	23+13, RT	0.600	0.53	10	6.20	0.318	0.318	2.169	LOWPT	0.043	SEE LOW POINT ANALYSIS	SEE LOW POINT ANALYSIS	0.318	0.318	0.318	"C"
PROPOSED ROAD LEFT GUTTER																
CB 3	23+13, LT	1.660	0.45	10	6.20	0.698	0.698	4.757	LOWPT	0.043	SEE LOW POINT ANALYSIS	SEE LOW POINT ANALYSIS	0.698	0.698	0.698	"C"
LOW POINT ANALYSIS																
INLET	Q TO INLET	PERIM.	C WEIR	d WEIR	WIDTH OF FLOW	d ORIFICE										
CB 1	0.982	5.020	3	0.162	3.24	0.014										
CB 2	2.169	5.020	3	0.275	5.49	0.066										
CB 3	4.757	7.330	3	0.360	7.20	0.320										

NOTES:

- Notes:
 1.) Manning's n = 0.016 (asphalt)
 2.) Tc = 5 minutes minimum for areas with all pavement
 3.) Tc = 10 minutes minimum for small areas with pavement and grass
 4.) 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	6.25
CL	7.33	3.13
CL DOUB	11.96	6.25

STORM SEWER SYSTEM DESIGN

Sheet No. 1 of 1

Client: AVERY BROOK SUBDIVISION
 Project: AVERY BROOK SUBDIVISION
 Proj. No.:
 Return Period for Design: 25-YR

Prepared By: JRM Date: 11/12/22 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.)	Pipe Data				
From	To											Avg. Vel. (f.p.s.)	Full Cap. (c.f.s.)	Headwater (ft.)	Manning "n"	
CB 3	CB 2	10	0.11	10.0	0.698	0.698	6.2	4.33	15	32	0.020	5.0	9.89	0.50	0.012	
23+13.LT	23+13.RT															
CB 2	CB 1	10	0.08	10.1	0.318	1.016	6.2	6.30	15	24	0.017	5.0	9.12	0.50	0.012	
23+13.RT	12+30.RT															
CB 1	BASIN	10	0.16	10.2	0.144	1.16	6.2	7.19	15	48	0.170	5.0	28.84	0.60	0.012	
12+30.RT																

NOTE: ALL PIPES ARE BELOW FULL CAPACITY.

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

COMPUTATIONS FOR:	Project
ORIFICE SIZING WORKSHEET	Made By: JRM
AVERY BROOK HOMES	Date: 11/13/2022
LEDYARD, CT	Rev:
	Date:

ORIFICE SIZING FOR EXTENDED DETENTION UNDERDRAIN

BASIN VOLUME AT SPILLWAY = 3,600 CUBIC FT
 TARGET VOLUME (HALF EMPTY)

ConnDOT Drainage Manual Equation 10.32

Qav = VOL./T
 VOLUME (FT³) 3600
 T (SEC.)= 12 Hrs = 43,200
 Qav (CFS) = 0.0833 Target Q at Half Volume

ConnDOT Drainage Manual Equation 10.18

Q = Kor D² Ho^{0.50} Kor = 3.78 Q = Flow in CFS
 Kor= Oriface Coefficient = 3.78
 D= Oriface
 H= Head in Feet

HEAD AT FULL = 2.5'

D (inch)	D (FT.)	H	Q (CFS)	
1.75	0.146	2.50	0.1271	USE 1-3/4" ORIFICE
2.00	0.167	2.50	0.1660	
2.50	0.208	2.50	0.2594	
3.00	0.250	2.50	0.3735	

HEAD AT HALF EMPTY = 1.25'

D (inch)	D (FT.)	H	Q (CFS)	
1.75	0.146	1.25	0.0899	USE 1-3/4" ORIFICE
2.00	0.167	1.25	0.1174	
2.50	0.208	1.25	0.1834	
3.00	0.250	1.25	0.2641	

HEAD AT 0.5'

D (inch)	D	H	Q (CFS)	
1.75	0.146	0.50	0.0568	USE 1-3/4" ORIFICE
2.00	0.167	0.50	0.0742	
2.50	0.208	0.50	0.1160	
3.00	0.250	0.50	0.1671	