

December 22,2019

Drainage Calculations
For
302-304 Whiting Street

Prepared for;
South Shore Habitat for Humanity
156 East Street
Weymouth, MA 02043

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Purpose

The purpose of this report is to review the proposed development at 302-304 Whiting Street and determine the impact of the proposed development on the abutting lot and treat the runoff from the proposed impervious surfaces on the lot in accordance with the stormwater standards.

Method

The calculation will be based upon the SCS TR-20 Model using HYDRO-CAD 10.0 software to conduct the calculations.

Assumptions

Minimum Tc 6 minutes	
CN Assumptions	A
Impervious	98
Gravel Driveway	96
Lawn-poor	42
Woodland	30
Lawn/shoulder	39

Project Description

The proposed development of the lot at 302-304 Whiting Street will be 2 single-family dwellings. The existing dwelling at 302 Whiting will be removed in conjunction with this development and replaced further back from the wetlands at the rear of the parcel. The 2 dwellings will share a common driveway that will follow the existing gravel driveway. Overall, the proposed development will be:

- 1,344 sq. ft. dwelling
- 160 sq. ft. sheds
- 3,822 sq. ft. driveway, and
- 80 sq. ft. walkways

The primary goal of the design will be to reduce the peak rates and volume of runoff from the site in all directions.

The lot is 41,287± square feet in size and will be subdivided into 2 separate parcels with each individual dwelling being located on its own lot. Overall, the parcel has 152.0' of frontage along Whiting Street. The site currently is a single family 2-bedroom dwelling that is located at the rear of the parcel. The wetlands and a perennial stream are located at the rear of the parcel. Approximately 153 square feet of the parcel is located within the limits of the flagged wetlands. The 200' riverfront area extends up to within 80'+ of the front property line. The existing dwelling is currently only 59' from the wetlands and 84' from the top of bank for the stream. The land slopes dramatically from the existing house down to the wetlands and there is a series of stepped masonry walls along back northwest corner of the lot. The abutter to the north and west is the Derby Brook Condominiums. The entrance driveway into this complex is parallel with the northerly property line. There are 2 stormwater features between the entrance roadway into the condominiums and the northerly property line. From Whiting Street west there is a rain garden approximately 120' long along the southerly edge of the driveway. The parcel currently slopes at

a 5+hor:1vert slope down from elevation 52.0 at the top of the lot to elevation 135.0 at the edge of the rain garden. This slope is currently lightly grass covered. The flow from the rain garden is split and flows either directly across the driveway towards the stream with extremely larger flows being directed into a detention basin located just west of the northwest corner of our lot. At the top of the lot in front of the existing dwelling, the lot is primarily a bare gravel surface that allows vehicular access to the dwelling.

The proposed development will be 2 3-bedroom single-family dwellings which will be accessed from Whiting Street by a common drive that will come into the site at the southerly edge of the parcel where the existing gravel driveway is located. The common driveway will be paved and will be sloped back towards Whiting Street. The driveway will be 110'± long, with a 20' wide travel lane and a 12" cape cod berm along the northerly edge. A catch basin will be located at station 0+21 which will collect the runoff from most of the common driveway and the individual parking areas for each lot and direct it into an infiltration trench. The catch basin will be equipped with an insert that will treat the runoff prior to discharge into the infiltration chambers.

The first dwelling will be located 29.7' off of the Whiting Street right of way and completely out of the riverfront area. The 2nd house will be located 140.3' off of the Whiting Street layout and will be 133' from the top of bank outside of the inner riparian zone and outside of the 100' buffer to the vegetated wetlands. A drywell will be provided for the roof runoff.

Existing Conditions

The limits of the watershed analysis will extend to the property line for both existing and proposed conditions. Runoff from the site will flow in 4 directions.

- Towards Route 53
- Towards the derby brook upper rain garden
- Towards the derby brook lower rain garden
- Towards the stream away from the derby brook improvements.

Ultimately, all of the runoff from the site will flow into the stream behind the site. We will look at the total runoff from the site to ensure that peak flow rates are not increased off site and we will also look at the flows directed into the derby brook stormwater improvements to ensure that they are not impacted by the development.

1S To Whiting Street

Drainage Area- 10,790.0 sq. ft.
0.25 acres

<u>Land Use</u>	<u>Area (s.f.)</u>	<u>CN</u>
Grass-fair	4,890	49
Driveway	5,900	96

Tc
Use 6 minutes as a minimum

2S To Derby Brook Rain Garden

Drainage Area- 14,854.3 sq. ft.
0.34 acres

<u>Land Use</u>	<u>Area (s.f.)</u>	<u>CN</u>
Gravel drive	1,754	96
Meadow	13,100	49

Tc
Sheet flow 48' s=0.01 grass, short
Shallow concentrated flow 70' s=0.25 short grass

3S To Derby Brook Rain Garden 2

Drainage Area- 7,006.6 sq. ft.
034 acres

Land Use		
<u>Use</u>	<u>Area (s.f.)</u>	<u>CN</u>
Wooded	1,457	30
Grass-fair	5,550	49

Tc		
Sheet flow		35' s=0.01 grass, short
Sheet flow		15' s=0.066 grass, short
Shallow concentrated flow		39' s=0.3 grass

4S To the stream

Drainage Area- 8,636.1 sq. ft.
0.20 acres

Land Use		
<u>Use</u>	<u>Area (s.f.)</u>	<u>CN</u>
Roof	720	98
Gravel drive	880	92
Woods	5,185	30
Lawn	1,851	39

Tc		
Sheet flow		50' s=0.01 grass, short
Shallow concentrated flow		100' s=0.20 wooded

Total watershed area

1S	10,790.0
2S	14,854.3
3S	7,006.6
4S	<u>8,636.1</u>
Total	41,287.0 sq. ft.

Proposed Conditions

1S-To the catch basin

Drainage Area- 10,106.4 sq. ft.
0.23 acres

Weighted CN		
<u>Use</u>	<u>Area (s.f.)</u>	<u>CN</u>
Roof	672	98
shed	160	98
walkways	100	98
Pavement	3,333	98
Lawn	5,841	39

Tc
Use 6 minutes as minimum

Water Quality Volume
Total Impervious 4,162 sq. ft.
 $\frac{1}{2}$ " of runoff = 173.4 cu. ft.

1P-Infiltration Chambers

System will be one row of 3-precast concrete chambers
Size = 8.0'w x 4.0' deep x 33.5'long
Bottom elevation = 139.25
Total Volume =
Chambers - 387 cu. ft.
Stone - 160 cu. ft.
Total 547 cu. ft.
Outlet is 6" aADS @ Inv. El. 142.25

Water Quality Volume
Total Impervious 4,162 sq. ft.
 $\frac{1}{2}$ " of runoff = 173.4 cu. ft.

Static storage provided = 358 cu. ft. (1.03")

2S-To Route 53

Drainage Area- 3,928.4 sq. ft.
0.09acres

Weighted CN		
<u>Use</u>	<u>Area (s.f.)</u>	<u>CN</u>
Pavement	725	98
Lawn	3,203	39

Tc
Use 6 minutes as a minimum

3S-House 2

Drainage Area- 672 sq. ft.
0.015 acres

Weighted CN 98

Tc
Use 6 minutes as a minimum

2P-Roof Infiltration Chamber

System will be one precast concrete chambers
Size = 8.0'w x 4.0' deep x 12.5'long
Bottom elevation = 142.0

Total Volume =
Chambers - 120 cu. ft.
Stone - 100 cu. ft.
Total 220 cu. ft.

Water Quality Volume
Total Impervious 672 sq. ft.
½" of runoff = 28 cu. ft.

Static storage provided = 220 cu. ft. (3.93")

4S-Derby Brook Rain Garden 2

Drainage Area- 9,012.6 sq. ft.
0.21 acres

Weighted CN

<u>Use</u>	<u>Area (s.f.)</u>	<u>CN</u>
Woods	1,457	30
Lawn	7,556	39

Tc

Sheet flow 50' s=0.03 grass, dense
Shallow concentrated flow 80', s=0.25 grass short

5S-Derby Brook Rain Garden 1

Drainage Area- 9,363.7 sq. ft.
0.21 acres

Weighted CN

<u>Use</u>	<u>Area (s.f.)</u>	<u>CN</u>
Lawn	9,364	39

Tc

Sheet flow 50' s=0.02 grass, dense
Shallow concentrated flow 50', s=0.20 grass short

6S To the stream

Drainage Area- 8,203.8 sq. ft.
0.20 acres

Land Use

<u>Use</u>	<u>Area (s.f.)</u>	<u>CN</u>
Woods	5,185	30
Lawn	3,019	39

Tc

Sheet flow 50' s=0.03 grass, dense
Shallow concentrated flow 24', s=0.02 grass short
Shallow concentrated flow 85' s=0.25 wooded

Total watershed area

1S	10,106.4
2S	3,928.4
3S	672.0
4S	9,012.6
5S	9,363.7
6S	<u>8,203.8</u>
Total	41,286.9 sq. ft. ok within 0.01' of existing

Storm Water Standards

Standard No. 1, Untreated Discharges

The proposed storm water system will collect and treat the runoff from nearly all the proposed impervious surfaces in the development. Approximately 600 square feet of the driveway pavement is too close to the existing pavement in Whiting Street to be collected and routed to the infiltration chamber system. This area will be partially treated by the new catch basin. 150 square feet of the new driveway pavement to this catch basin is in the right of way. I consider the remaining 600 square feet of pavement on the lot not treated to the full extent of the standards de minimus in comparison with the remainder of the impervious surfaces in the watershed.

Standard No. 2, Peak Discharge Rates

The development of the lot did not modify the land use of the lot significantly. Most of the area used in the development had already been altered by prior development. Final development of the lot will actually heal some of the scars of the prior use and maintenance. Accordingly, all of the flows in each direction have been reduced significantly.

To Derby Brook

Site Total	Existing	Proposed	Difference
2 Year Storm	0.04cfs	0.0 cfs	-99.9%
10 Year Storm	0.25 cfs	0.01 cfs	-96.0%
25 Year Storm	0.41 cfs	0.04 cfs	-90.0%
100 Year Storm	0.78 cfs	0.15 cfs	-80.7%

To Whiting Street

	Existing	Proposed	Difference
2 Year Storm	0.32 cfs	0.0	-99.9%
10 Year Storm	0.65 cfs	0.04 cfs	-93.8%
25 Year Storm	0.84 cfs	0.22 cfs	-73.8%
100 Year Storm	1.20 cfs	0.73 cfs	-39.1%

To Stream

	Existing	Proposed	Difference
2 Year Storm	0.0 cfs	0.0 cfs	-99.9%
10 Year Storm	0.02 cfs	0.002 cfs	-90.0%
25 Year Storm	0.06 cfs	0.006 cfs	-90.0%
100 Year Storm	0.18 cfs	0.02 cfs	-88.9%

Standard No. 3, Recharge

The proposed infiltration chambers and the roof system for 302 whiting will provide all of the infiltration capacity required. This volume is:

Static Storage Provided	Chamber system	358 cu. ft.
	Roof system	220 cu. ft.
Required infiltration	0.65”	
Impervious area	5,406 sq. ft.	
Infiltration volume required		292.8 cu. ft.

Standard No. 4, Water Quality

There are only 2 treatment trains. The driveway system and the roof drywell for 302 Whiting. The pretreatment for the chamber system will be provided by the fabco filter.

Driveway

Item Description	Removal rate	Actual removal	Remaining	Total Removal
Chamber system	80%	80%	20 %	80 %

Roof runoff

Item Description	Removal rate	Actual removal	Remaining	Total Removal
Drywell	80%	80%	20%	80%

Standard No. 5, Land Use with Higher Potential Pollution Loads

This standard is not applicable to a residential lot

Standard No. 6, Critical Areas

This standard is not applicable to this site

Standard No. 7, Redevelopment

This standard is partially applicable to this site; however, no credits have been taken

Standard No. 8, Construction Period Pollution Control

The site does not qualify under the NPDES CGP. Accordingly, a Storm Water Pollution Prevention Plan is not required. 12" mulch logs will be placed along the lower edge of the development area to prevent sediment transport on to the abutting lot and the wetland resources. The existing gravel driveway will be used as primary access onto the site and will provide the track pad required. Once disturbed for installation of the utilities, a 50' long pad of 1-1/2" aggregate will be placed on the construction access.

Standard No. 9, Operation and Maintenance

The O & M manual for the lot is attached hereto

Standard No. 10, Illicit Discharge statement

I do hereby certify that there are no illicit discharges proposed on site.

Gary D. James, P.E.

Existing Conditions Hydro-Cad Printout

Proposed Conditions Hydro-CAD printout

Watershed Plans

Operations & Maintenance