

STORMWATER MANAGEMENT COMPUTATIONS

FROM THE STORMWATER MANAGEMENT COMPUTATIONS ON THIS SHEET THE PRE-DEVELOPMENT PEAK RUNOFF RELEASE RATES FROM THE SITE ARE 9.84 CFS AND 13.13 CFS FOR THE 2 AND 10 YEAR STORMS RESPECTIVELY. DUE TO THE PROPOSED IMPROVEMENTS, THE SITE C FACTOR WILL INCREASE FROM 0.81 TO 0.87. THE POST DEVELOPMENT RELEASE RATE WILL INCREASE FROM 9.84 CFS FOR THE 2 YEAR STORM AND 13.13 CFS FOR THE 10 YEAR STORM TO 10.57 CFS AND 14.10 CFS FOR 2 YEAR AND 10 YEAR STORMS RESPECTIVELY BEFORE DETENTION. WHILE NOT A CODE REQUIREMENT, THE APPLICANT PROPOSES TO REDUCE THE PEAK RATES OF RUNOFF FOR THE 2 AND 10-YEAR STORMS TO 10 PERCENT LESS THAN PRE-DEVELOPMENT LEVELS. THIS WILL BE ACHIEVED BY PROVIDING STORMWATER DETENTION IN AN UNDERGROUND DETENTION FACILITY TO BE LOCATED ON SITE UNDER THE STREETScape.

I. SITE PRE-DEVELOPMENT

SITE AREA = 97,182 SF OR 2.23 AC

A. CONTRIBUTING AREAS:

0.35 AC @ 0.30 GREEN AREA
1.88 AC @ 0.90 ROOFS, DRIVEWAYS, SIDEWALKS, ETC.
2.23 AC

B. WEIGHTED "C" FACTOR:

$$\frac{(0.35)(0.30) + (1.88)(0.90)}{2.23} = 0.81$$

C. TIME OF CONCENTRATION:

5 MINUTES

D. RUNOFF:

$$Q2 = (0.81)(5.45)(2.23) = 9.84 \text{ CFS}$$

$$Q10 = (0.81)(7.27)(2.23) = 13.13 \text{ CFS}$$

II. SITE POST-DEVELOPMENT

A. CONTRIBUTING AREAS:

0.10 AC. @ 0.30 GREEN AREA
2.13 AC. @ 0.90 ROOFS, DRIVEWAYS, SIDEWALKS, ETC.
2.23 AC.

B. WEIGHTED "C" FACTOR:

$$\frac{(0.10)(0.30) + (2.13)(0.90)}{2.23} = 0.87$$

C. TIME OF CONCENTRATION:

5 MINUTES

D. RUNOFF:

$$Q2 = (0.87)(5.45)(2.23) = 10.57 \text{ CFS}$$

$$Q10 = (0.87)(7.27)(2.23) = 14.10 \text{ CFS}$$

III. UNDETAINED SITE POST-DEVELOPMENT

A. CONTRIBUTING AREAS:

0.10 AC. @ 0.30 GREEN AREA
1.08 AC. @ 0.90 ROOFS, DRIVEWAYS, SIDEWALKS, ETC.
1.18 AC.

B. WEIGHTED "C" FACTOR:

$$\frac{(0.10)(0.30) + (1.08)(0.90)}{1.18} = 0.85$$

C. TIME OF CONCENTRATION:

5 MINUTES

D. RUNOFF:

$$Q2 = (0.85)(5.45)(1.18) = 5.47 \text{ CFS}$$

$$Q10 = (0.85)(7.27)(1.18) = 7.29 \text{ CFS}$$

IV. STORM RUNOFF SUMMARY

A. MAXIMUM PEAK SITE RUNOFF:

$$Q2 = (0.90)(9.84) = 8.86 \text{ CFS}$$

$$Q10 = (0.90)(13.13) = 11.82 \text{ CFS}$$

* 10% REDUCTION FROM EXISTING CONDITIONS

B. MAXIMUM PEAK RELEASE RATE FROM DETENTION:

(1.05 AC OF ROOF AREA TO DETENTION SYSTEM)

$$Q2 = 8.86 \text{ SITE} - 5.47 \text{ UNDETAINED} = 3.39 \text{ CFS}$$

$$Q10 = 11.82 \text{ SITE} - 7.29 \text{ UNDETAINED} = 4.53 \text{ CFS}$$

V. ACTUAL POST-DEVELOPMENT RUNOFF

A. DETENTION SYSTEM RELEASE RATES:

$$Q2 = 3.00 \text{ CFS}^{**}$$

$$Q10 = 3.69 \text{ CFS}^{**}$$

** SEE ROUTING COMPUTATIONS SHEET C-0704

B. TOTAL SITE RUNOFF:

$$Q(\text{RUNOFF}) = Q(\text{DETAINED}) + Q(\text{UNDETAINED})$$

$$Q2 = 3.00 \text{ DETAINED} + 5.47 \text{ UNDETAINED} = 8.47 \text{ CFS}$$

$$Q10 = 3.69 \text{ DETAINED} + 7.29 \text{ UNDETAINED} = 10.98 \text{ CFS}$$

C. COMPARE TO MAXIMUM PEAK SITE RUNOFF:

$$[Q2(\text{RUNOFF}) = 8.47 \text{ CFS}] < [Q2(\text{MAX}) = 8.86]$$

$$[Q10(\text{RUNOFF}) = 10.98 \text{ CFS}] < [Q10(\text{MAX}) = 11.82]$$

ONSITE BMP COMPUTATIONS

THE PROPOSED CONSTRUCTION IS CONSIDERED REDEVELOPMENT DUE TO THE FACT THAT THERE IS LESS THAN 20% INCREASE IN IMPERVIOUS AREA. THE PHOSPHOROUS REMOVAL REQUIREMENT FOR THIS REDEVELOPMENT IS 20.0%. THE PHOSPHOROUS REMOVAL REQUIREMENT IS PROPOSED TO BE MET THROUGH THE USE OF A STORMFILTER OR EQUIVALENT WHICH HAVE A PHOSPHOROUS REMOVAL EFFICIENCY OF 50%. THE TOTAL PHOSPHOROUS REMOVAL PROVIDED FROM THESE MEASURES IS 23.6%. THE BMP FACILITIES WILL BE PRIVATELY OWNED AND MAINTAINED. SEE SHEET C-0706 FOR DETAILS. SEE SHEET C-0702 FOR PROPOSED DRAINAGE DIVIDES.

BMP COMPUTATIONS - CHESAPEAKE BAY METHOD

PHOSPHORUS REMOVAL CALCULATIONS

$$L = \{P * Pj * [0.05 + 0.009(I)] * C * A * 2.72\} / 12$$

WHERE:

- L = PHOSPHORUS LOADING (lbs/yr)
- P = AVERAGE RAINFALL DEPTH (INCHES) = 40 IN/YR FOR NORTHERN VIRGINIA
- Pj = UNITLESS CORRECTION FACTOR FOR STORMS THAT PRODUCE NO RUNOFF
- Pj = 0.9
- I = PERCENT OF SITE IMPERVIOUSNESS IN WHOLE NUMBERS
- C = FLOW-WEIGHTED MEAN POLLUTANT CONCENTRATION (mg/L)
- C = 0.26 mg/L WHEN I < 20%
- C = 1.08 mg/L WHEN I > 20%
- A = AREA OF DEVELOPMENT SITE (ACRES)

1. SITE NAME:

THE RESERVE AT TINNER HILL - REDEVELOPMENT

2. EXISTING SITE IMPERVIOUSNESS

#	SUBAREA DESIGNATION AND DESCRIPTION	AREA
A.	PAVEMENT, SIDEWALKS AND STRUCTURES	1.88 AC.
B.	LANDSCAPED AREA	0.35 AC.
TOTAL AREA (E) =		2.23 ACRES

$$\text{SITE IMPERVIOUSNESS (A/E) * 100} = (1.88/2.23) \times 100 = 84.3\%$$

3. PROPOSED SITE IMPERVIOUSNESS

#	SUBAREA DESIGNATION AND DESCRIPTION	AREA
A.	PAVEMENT, SIDEWALKS AND STRUCTURES	2.13 AC
B.	LANDSCAPED AREAS	0.10 AC
TOTAL AREA (E) =		2.23 ACRES

$$\text{SITE IMPERVIOUSNESS (A/E) x 100} = (2.13/2.23) \times 100 = 95.5\% \text{ IMPERVIOUS}$$

4. SITE CONDITIONS

- (A) NAME OF WATERSHED: CAMERON RUN
- (B) WATERSHED IMPERVIOUSNESS AS A PERCENTAGE: 50%
- (C) DETERMINE WHETHER PROPOSAL IS CONSIDERED NEW DEVELOPMENT OR REDEVELOPMENT: REDEVELOPMENT

5. PHOSPHORUS LOADINGS

(A) EXISTING PHOSPHORUS LOADING:

$$L = \{P * Pj * [0.05 + 0.009(I)] * C * A * 2.72\} / 12$$

$$L(\text{pre}) = \{40 * 0.9 * [0.05 + 0.009(\text{site-pre } 84.3)] * (C) 1.08 * (A) 2.23 * 2.72\} / 12$$

$$L(\text{pre}) = 15.89 \text{ Lbs/Year}$$

(B) PROPOSED PHOSPHORUS LOADING:

$$L(\text{post}) = \{40 * 0.9 * [0.05 + 0.009(\text{site-post } 95.5)] * (C) 1.08 * (A) 2.23 * 2.72\} / 12$$

$$L(\text{post}) = 17.87 \text{ Lbs/Year}$$

6. PHOSPHORUS REMOVAL REQUIRED

(A) PHOSPHORUS REMOVAL REQUIRED:

$$\text{REMOVAL REQUIRED} = L(\text{post } 17.87) - 0.9(L(\text{pre } 15.89)) = 3.57 \text{ Lbs/Year}$$

(B) BMP REMOVAL REQUIRED:

PERCENT OF PHOSPHORUS REQUIRED TO BE REMOVED

$$\frac{3.57 * 100}{17.87} = 20.0\%$$

7. PHOSPHORUS REMOVAL PROVIDED

(A) BMP FACILITY	REMOVAL EFF.	IMP. SITE COVERAGE (ONSITE)	COVERAGE (OFFSITE)	Lpost (lbs/yr)	LOAD REMOVED (lbs/yr)
STORMFILTER	0.50*	x [1.05/2.23	+ 0.00]	x 17.87	= 4.21
TOTAL					= 4.21
4.21 * 100/17.87 =					23.6%

(B) 7(A) 23.6% > 6(B) 20.0% , THE PHOSPHORUS REMOVAL PROVIDED IS SATISFIED.

OFFSITE BMP COMPUTATIONS

AS PART OF THIS DEVELOPMENT, THE APPLICANT IS PROPOSING TO TREAT 0.60 ACRES OF OFFSITE STORMWATER WITH A REMOVAL EFFICIENCY OF 15%.

OUTFALL NARRATIVE

THE EXISTING SITE OUTFALLS TO TRIPPS RUN VIA OVERLAND SHEET FLOW AND AN EXISTING CLOSED CONDUIT SYSTEM IN SOUTH WASHINGTON STREET AND SOUTH MAPLE AVENUE.

THIS SITE CURRENTLY HAS A 10 YEAR RUNOFF OF 13.13 CFS OF WHICH THE MAJORITY IS COLLECTED BY AN EXISTING ONSITE CLOSED CONDUIT STORM SYSTEM AND IS DISCHARGED INTO STRUCTURE 1900 IN SOUTH MAPLE AVENUE. FROM THIS POINT, THE EXISTING PUBLIC CLOSED CONDUIT SYSTEM RUNS ALONG THE SOUTH SIDE OF THE STREET AND OUTFALLS INTO THE EXISTING CULVERT AT TRIPPS RUN. THE REMAINING PORTION OF THE SITE FLOWS OVERLAND TO INLETS IN SOUTH WASHINGTON STREET AND SOUTH MAPLE AVENUE WHICH OUTFALL TO TRIPPS RUN AS WELL.

THE REDEVELOPMENT OF THIS SITE WILL RESULT IN AN INCREASE OF IMPERVIOUS AREA RAISING THE "C" FACTOR FROM 0.81 TO 0.87. BUT WITH THE USE OF AN ONSITE DETENTION SYSTEM, THE PROPOSED 10 YEAR SITE RUNOFF WILL BE REDUCED TO 10.98, WHICH IS 10% LESS THAN THE EXISTING RUNOFF. THE PROPOSED DRAINAGE PATTERN WILL BE SIMILAR TO EXISTING WITH ONSITE RUNOFF BEING CAPTURED AND CONVEYED IN A CLOSED CONDUIT SYSTEM TO TRIPPS RUN. ADDITIONAL STORM DRAIN INLETS WILL BE ADDED ON TINNER HILL STREET AND ALONG SOUTH MAPLE AVENUE TO CAPTURE OFFSITE AND ONSITE UNDETAINED RUNOFF.

THE STORM SEWER COMPUTATIONS ON SHEET C-0801 SHOW THAT THE EXISTING 24" RCP PIPE IN SOUTH MAPLE AVENUE WILL ADEQUATELY CONVEY THE ONSITE AND OFFSITE RUNOFF FROM THE 10 YEAR STORM. DUE TO THE RESULTS OF THIS ANALYSIS AND THE FACT THAT THE PROJECT WILL RESULT IN THE REDUCTION OF THE EXISTING RUNOFF RATE, IT IS THE OPINION OF THE SUBMITTING ENGINEER THAT THIS OUTFALL IS ADEQUATE.

STORMWATER MANAGEMENT AND BMP CALCULATIONS

THE RESERVE AT TINNER HILL CITY OF FALLS CHURCH, VIRGINIA

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 ESTABLISHED 1945
 IN CORP. ORATED
 DATE: 02/20/13
 SCALE: 1" = 20'



NO.	DESCRIPTION	DATE		APPROVED	
		DATE	REV. BY	DATE	BY

CHECKED: KVM
 DRAWN: MM