BMP/Water Quality Narrative for the Leesburg Central Maintenance Facility Fuel Island Renovation

The proposed improvements for the Fuel Island at the Leesburg Central Maintenance Facility will not change the overall runoff, flow conditions or discharges leaving the site. The reason for this negligible impact is that the existing project area is completely impervious and the proposed project will remain impervious. However, due to the project's close proximity to Tuscarora Creek, the sensitive use of the site, and the designation as a potential BMP "hot spot," the Town of Leesburg plans to install a BMP device to provide water quality enhancement and pollutant removal for portions of this high impervious site.

The location of the water quality inlet was chosen to maximize the amount of stormwater runoff that could be captured before flowing over the new fuel island concrete pad while minimizing the need for additional storm sewer infrastructure. Slotted trench drain inlets will be placed around the outside edge of the concrete fuel island pad. These drains will feed into a small ductile iron pipe which immediately discharges into the BMP. The proposed BMP structure will be placed in approximately the same location as an existing grate inlet that previously captured storm water runoff from the parking lot, such that the existing pipe of the storm sewer system can be used as the outlet pipe for the proposed BMP. Please refer to drawing C006 for a plan view location of the trench drains and BMP structure.

BMP computations were performed assuming the "site" for this project as the footprint of the disturbed impervious area that is being replaced with the new fuel island and appurtenances. The amount of area to be replaced with the new construction totals 3,917 square feet (0.090 acres). This 0.090 acres is considered the "site area." The drainage area to the BMP is 0.20 acres, and includes flow over the existing asphalt parking lot and the direct runoff from the new canopy, which covers the new concrete pad at the fuel island.

The State Stormwater Management Handbook (Blue Book) was used to calculate the effectiveness of the BMP structure and the amount of pollutant reduction using performance based techniques. The spreadsheets used were developed by VDOT and are identical to the worksheets shown in Appendix 5D from the Blue Book. Given the sensitive nature, proximity to Tuscarora Creek and the high impervious area of the project site, the BMP calculations were developed assuming the existing "site" area is considered to be undeveloped or comprising of a "greenfield" condition (16% allowable impervious coverage).

Based on the calculations, the required amount of pollutant load removed is required to be equal to or greater than 0.16 pounds/year. Using trial and error techniques and given the drainage area of 0.20 acres, the removal efficiency of the proposed BMP structure will need to be 40% or greater in order to remove more than 0.16 pound/year. Given the site constraints, a structural BMP was chosen as the most suitable method for pollutant removal. The high removal efficiency required to meet the site conditions required the selection of the Contech StormFilter system, with has a pollutant removal efficient rate of 65%. This Contech device, used in conjunction with the slotted trench drains, has been used successfully at other Northern Virginia fueling sites and effectively meets the demands for this project. The total pollutant load removed with the Contech StormFilter system at this site is 0.28 pounds/year, which is greater than the required 0.16 pounds/year.

Performance Based Water Quality
Leesburg Fuel Island

Project No. Leesburg Fuel Island | Date: 05/12/11
Calc. By: BMF | Check By: WSS
County Number: 53 | County: Loudoun

PERFORMANCE-BASED WATER QUALITY CALCULATIONS

WORKSHEET 1

STEP 1: Determine the applicable area (A) and the post-developed impervious cover (I_{post}).

Applicable area (A) = 0.09 acres

Post-development impervious cover:

structures = 0.04 acres
parking lot = 0.05 acres
roadway = 0.00 acres
other:
(input description) = acres
(input description) = acres
Total = 0.09 acres

I_{post} = (total post-development impervious cover ÷ A) x 100 = 100.00 %

STEP 2: Determine the avg. land cover condition ($I_{watershed}$) or the exist. impervious cover (I_{exist})

1. Average land cover condition ($I_{watershed}$):
If the locality has determined land cover conditions for individual watersheds within its jurisdiction, use the watershed specific value determined by the locality as $I_{watershed}$.

$I_{watershed}$= % (input locality value or leave blank if one does not apply)

Otherwise, use the Chesapeake Bay default value:

$I_{watershed}$= 16.00 %

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PERFORMANCE-BASED WATER QUALITY CALCULATIONS

WORKSHEET 1

X **Situation 2:** Use Worksheet 2
This consists of land development where the existing percent impervious cover ($I_{existing}$) is less than or equal to the average land cover condition ($I_{watershed}$) and the proposed improvements will create a total percent impervious cover (I_{post}) which is greater than the average land cover condition ($I_{watershed}$).

$I_{existing}$ 0.00 % <= $I_{watershed}$ 16.00 % ;and
I_{post} 100.00 % > $I_{watershed}$ 16.00 %

Situation 3: Worksheet 3 Not Applicable
This consists of land development where the existing percent impervious cover (existing) is greater than the average land cover condition ($I_{watershed}$).

$I_{existing}$ 0.00 % > $I_{watershed}$ 16.00 %

Situation 4: Worksheet 4 Not Applicable
This consists of land development where the existing percent impervious cover (existing) is served by an existing stormwater management BMP (s) that addresses water quality.

If the proposed development meets the criteria for development situation 1, then the low density development is considered to be the BMP and no pollutant removal is required. The calculation procedure for situation 1 stops here. If the proposed development meets the criteria for development situations 2,3, or 4, then proceed to STEP 4 on the appropriate worksheet.

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new sheet added

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PERFORMANCE-BASED WATER QUALITY CALCULATIONS

WORKSHEET 2 : SITUATION 2

SUMMARY OF SITUATION 2 CRITERIA: FROM CALCULATION PROCEDURE STEP 1 THRU STEP 3, WORKSHEET 1:

Applicable area (A)*= 0.09 acres

I_{post} = (total post-development impervious cover / A) x 100 = 100.00 %

$I_{watershed}$ = 16.00 %

$I_{existing}$ 0.00 % <= $I_{watershed}$ 16.00 % ;and

I_{post} 100.00 % > $I_{watershed}$ 16.00 %

STEP 4: Determine the relative pre-development pollutant load (L_{pre}).

$L_{pre(watershed)}$ = [0.05 + (0.009 x $I_{watershed}$)] x A x 2.28 (Equation 5-16)

$L_{pre(watershed)}$ = relative pre-development total phosphorous load (pounds per year)

$I_{watershed}$ = average land cover condition for specific watershed or locality or the Chesapeake Bay default value of 16% (percent expressed in whole numbers)
A = applicable area (acres)

$I_{watershed}$ = 16.00 %

A = 0.09 acres

$L_{pre(watershed)}$ = 0.04 lbs/year

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PERFORMANCE-BASED WATER QUALITY CALCULATIONS

WORKSHEET 2 : SITUATION 2

STEP 5: Determine the relative post-development pollutant load (L_{post}).

L_{post} = [0.05 + (0.009 x I_{post})] x A x 2.28 (Equation 5-21)

L_{post} = relative post-development total phosphorous load (pounds per year)

$I_{watershed}$ = post-development percent impervious cover (percent expressed in whole numbers)
A = applicable area (acres)

L_{post} = 0.19 pounds per year

STEP 6: Determine the relative pollutant removal requirement (RR).

RR = Lpost - Lpre(watershed)

RR= 0.16 **pounds per year**

STEP 7: Identify best management practice (BMP) for site.

1. Determine the required pollutant removal efficiency for site:

EFF = (RR ÷ L_{post}) x 100 (Equation 5-22)

L_{post} = relative post-development total phosphorous load (pounds per year)

EFF = required pollutant removal efficiency (percent in whole numbers)

RR = pollutant removal requirement (pounds per year)

EFF = 79.58 **%**

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PERFORMANCE-BASED WATER QUALITY CALCULATIONS

WORKSHEET 2 : SITUATION 2

2. Select BMP(s) from Table 5-14 and locate on the site:

BMP 1: [redacted] CONTECH Storm Filter
Sta: / offset
BMP 2:
Sta: / offset
BMP 3:
Sta: / offset
BMP 4:
Sta: / offset
BMP 5:
Sta: / offset

L_{BMP} = [0.05 + (0.0090x I_{bmp})] x A x 2.28 (Equation 5-23)
$L_{removed}$ = EFF_{BMP} x L_{BMP} (Equation 5-24)

L_{BMP} = relative post-development total phosphorous load entering proposed BMP (pounds per year)
I_{BMP} = Post-development percent impervious cover of BMP drainage area (percent expressed in whole numbers
A = drainage area of proposed BMP (acres)
$L_{removed}$ = Post-development pollutant removed by proposed BMP (pounds per year)
EFF_{BMP} = pollutant removal efficiency of BMP (expressed in decimal form)

3. and 4. Determine the pollutant load entering the proposed BMP (s) and Calculate the pollutant load removed by the proposed BMP(s):

BMP Str.#	BMP "A" (acres)	BMP Imp. Area (ac.)	I_{BMP} (%)	L_{BMP}	EFF_{BMP}	Lremoved (Lbs/YR)	Comments
1.00	0.20	0.20	100.00	0.43	0.65	0.28	
						0.00	
						0.00	
						0.00	
						0.00	

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WORKSHEET 2 : SITUATION 2

5. Calculate the total pollutant load removed by the BMP (s):

$L_{removed/total}$ = $L_{removed/BMP1}$ + $L_{removed/BMP2}$ + Etc.... (equation 5-25)

where: $L_{removed/total}$ = Total pollutant load removed by proposed BMP's
$L_{removed/BMP1}$ = pollutant load removed by BMP1
$L_{removed/BMP2}$ = pollutant load removed by BMP2

See chart on sheet 3 of 4 for individual BMP removal

$L_{removed/total}$ = 0.28 Pounds/year

6. Verify compliance:

$L_{removed/total}$ ≥ RR

0.28 ≥ 0.16 OK

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Typical engineering principals would ignore time of concentration values less than 5 minutes. However, given the sensitive nature and the high imperviousness of the site, actual time of concentration values were used to calculate flow rates and hydraulic capacity of the drains and BMP device. Please note that if the slower time of concentration of 5 minutes were used in the calculations, the sizes of the 12-inch trench drains, 12-inch DIP pipe and BMP structure would not have changed. The size of these structures already meets the minimum desirable size.

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