BMP Facility Design Calculations

Plan Name: METRO PLACE- PARCEL C-1 Date: Feb. 29, 2000
Plan Number: 5169JADE Engineer: CEH/MP

I. Water Quality Narrative

The site consists of 2.65 acre residential development which includes parcel C-1. BMP requirements for the development of this site will be satisfied through the construction of a Delaware Sand Filter, located in the street at the southwest section of the site.

The facility will be privately owned and maintained.

II. Watershed Information

Part 1: List all of the Subareas and "C" Factors used in the BMP Computations

Subarea Designation and Description (1)	"C" (2)	Acres (3)
A1 ON-SITE TREATED	0.84	1.65
A2 OFF-SITE TREATED	0.90	0.21
A3 ON-SITE NOT TREATED	0.63	1.00

NOTE: Rational formula "C" factors are taken from the general zoning values listed in Appendix 4-1 or 4-2 depending on the location of the BMP facility (Fairfax County Public Facilities Manual Chart A6-19 or Prince William County Design and Construction Standards Manual, Exhibit 1).

Part 2: Compute the Weighted Average "C" Factor for the Site

(A) Area of the site (a) 2.65 acres

(B)

Subarea Designation (1)	"C" (2)		Acres (3)		Product (4)
A1 ON-SITE TREATED	0.84	x	1.65	=	1.39
A3 ON-SITE NOT TREATED	0.63	x	1.00	=	0.63

(b) Total = 2.02

(C) Weighted average "C" factor (b) / (a) = (c) 0.76

Part 3: Compute the Total Phosphorus Removal for the Site

Subarea Designation (1)	BMP Type (2)	Removal Eff. (%) (3)		Area Ratio (4)		"C" Factor Ratio (5)		Product (6)
A1	SANDFILTER	60	x	1.65/2.65	x	0.84/0.76	=	41.29
A2	SANDFILTER	60	x	0.21/2.65	x	0.90/0.76	=	5.63

(a) Total = 46.92 %

Part 4: Determine Compliance with Phosphorus Removal Requirement

(A) Select Requirement (a) 40

- Water Supply Overlay District (Occoquan Watershed) = 50% (Fairfax County and Prince William County)
- Chesapeake Bay Preservation Area (New Development) = 40% (Fairfax County) 50% (Prince William County)
- Chesapeake Bay Preservation Area (Redevelopment) = [1-0.9 x ("I"pre / "I"post)] x 100 = ___%

(B) If Line 3(a) 48.26 ≥ Line 4(a) 40 then Phosphorus removal requirement is satisfied.

Worksheet 1
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FAIRFAX COUNTY, VIRGINIA
SAND FILTER BMP COMPUTATIONS

WORKSHEET 1: COMPUTATIONS COMMON TO ALL SAND FILTER BMPS
Part 1: Compute Post-Development Site Impervious Acreage (I_a):

structures = 56,375 ft²
parking lot = 1,464 ft²
roadway = 11,438 ft²
sidewalk = 7,440 ft²
other = 13,887 ft²

Total = 90,604 ft²/43,560 = I_a = 2.08 acres

Part 2: Compute Water Quality Volume to be Treated:

WQV = 1816I_a = 1816 x 2.08 = 3,777 ft³

Part 3: Identify Critical Site Parameters:

Storm sewer invert at proposed connection point = ___ ft
Length of outflow line (BMP - storm sewer) = ___ ft
Minimum BMP outflow invert @ minimum 0.5% grade = ___ ft
Site Plan surface elevation at BMP location = ___ ft
Inflow invert to BMP from drainage system plan = ___ ft
Flow splitter weir or bypass pipe invert = ___ ft
(usually set at maximum BMP ponding depth)
BMP outflow possible by gravity ___;

Worksheet 4
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FAIRFAX COUNTY, VIRGINIA
SAND FILTER BMP COMPUTATIONS

WORKSHEET 4: COMPUTATIONS FOR DELAWARE SAND FILTER

Part 4: Considering data on Worksheet 1, select maximum ponding depth over filter:

2h = 7.82 ft;
h = 3.91 ft

From WORKSHEET 1;
I_a = 2.08 acres
WQV = 3,777 ft³

Part 5: Compute Minimum Area of Filter (A_{fm}) and Sediment Pool (A_{sm}):

a) If 2h ≥ 2.67 ft, use the formula:

$A_{sm} = A_{fm} = \frac{545 I_a d_f}{(d_f + h)}$

= [545 x 2.08 x 1.5] / [1.5 + 3.91]
= 314.31 ft²

b) If 2h ≤ 2.67 ft, use the formula:

$A_{sm} = A_{fm} = \frac{1816 I_a}{(4.1h + 0.9)} = \frac{WQV}{(4.1h + 0.9)}$

= ___ / [(4.1 x ___) + 0.9]
= ___ ft²

Worksheet 4
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Part 6: Considering Site Constraints, Select Filter Width (W_f) and Sediment Pool Width (W_s) and Compute Filter Length (L_f) and Adjusted Filter Area (A_f) and Sediment Chamber Area (A_s):

$W_s = W_f$ = 5.67 ft;
$L_s = L_f = A_{fm} / W_f$
= 314.31 / 5.67
= 55.43 , say 55 ft(69.83' IS ACTUALLY PROVIDED FOR BMP VAULT)
$A_s = A_f = W_f \times L_f$ = 5.67 x 69.83
= 395.94 ft²

Part 7: Compute Storage in Filter Voids (V_v):
(Assume 40% voids in filter media)

$V_v = A_f \times d_f \times 0.4$ = 395.94 x 1.5 x 0.4
= 237.56 ft³

Part 8: Compute Flow Through Filter During Filling Period (V_Q):
(Assume 1-hour to fill per D.C. practice)

$V_Q = \frac{kA_f(d_f + h)}{d_f}$; use k = 2 ft/day = 0.0833 ft/hr

= [0.0833 x 395.94 x (1.5 + 3.91)]/ 1.5
= 119.00 ft³

Part 9: Compute Net Volume to be Stored Awaiting Filtration (V_{st}):

$V_{st} = WQV - V_v - V_Q$ = 3,777 - 237.56 - 119.00
= 3,420 ft³

Part 10: Compute Storage Above Filter and Sediment Pool (V_{fs}):

$V_{fs} = 2h(A_f + A_s)$ = 7.82 (395.94 + 395.94)
= 6,193 ft

Worksheet 4
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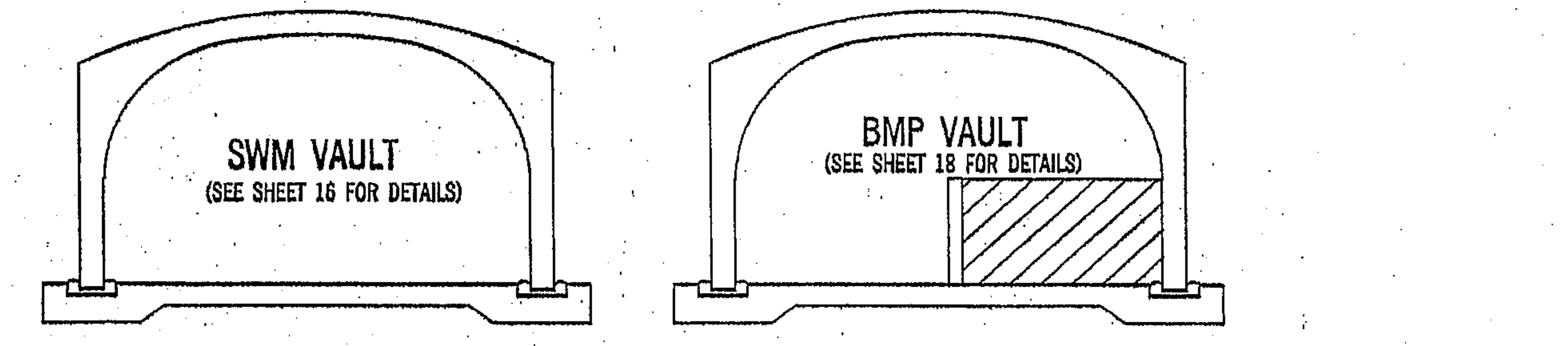
Part 11: Compute Storage Deficit (V_D):

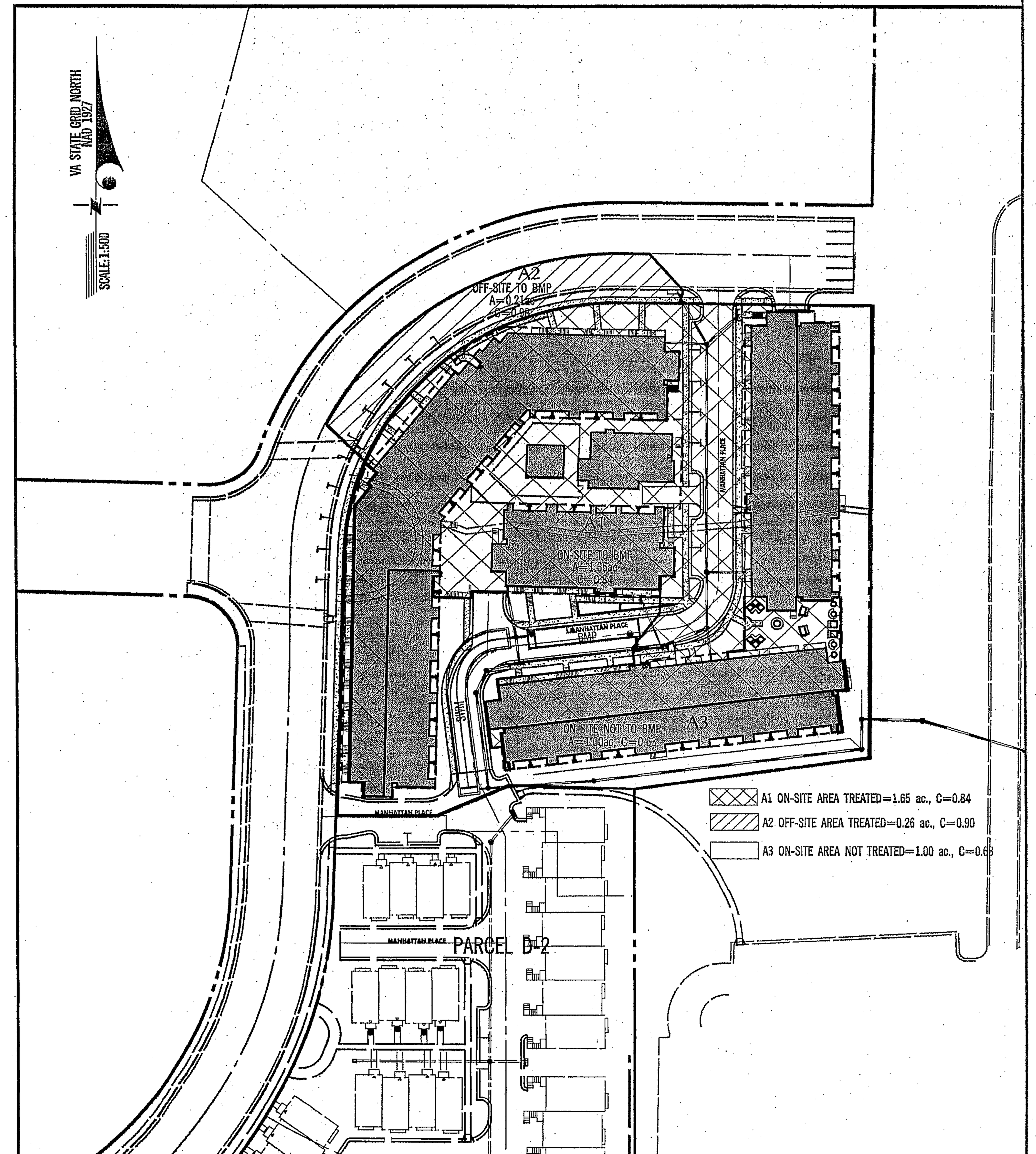
$V_D = V_{st} - V_{fs}$ = 3,420 - 6,193
= -2,773 ft³

If V_D ≤ 0, SKIP TO PART 13. If V_D ≥ 0, ADJUST DESIGN TO PROVIDE ADDITIONAL STORAGE.



TYPICAL SWM/BMP CHAMBER ILLUSTRATION

BMP DRAINAGE DIVIDES



COMMONWEALTH OF VIRGINIA
EDWARD G. VENDITTI
No. 16395
PROFESSIONAL ENGINEER
5/22/00

No.	REVISION	DATE	BY

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FAIRFAX, VIRGINIA 22030
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BEST MANAGEMENT PRACTICES CALCULATIONS

METRO PLACE AT DUNN LORING

PARCEL L (PREVIOUSLY PARCEL C-1)

PROVIDENCE DISTRICT
FAIRFAX COUNTY, VIRGINIA

DESIGN	CEH	SCALE	1:600
DRAWN	CEH	SHEET	17 OF 35
CHECKED	MP		
DATE	2/00	PROJ No. 5168JADE	FILE No. PP-805