**MOUNTAIN SHADE SUBDIVISION**
**STORMWATER MANAGEMENT AND BMP**
**CALCULATIONS AND INFORMATION**

COMMONWEALTH OF VIRGINIA
J. WAYNE STEPHENS
No. 025845
9/11/98
PROFESSIONAL ENGINEER

# Mountain Shade Subdivision

# Stormwater Management and BMP

# Calculations and Information

Prepared By:
J. Wayne Stephens, P.E.
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**Carson, Harris and Associates**
**39 Garrett Street**
**Warrenton, VA 20186**
(540) 347-9191

# Mountain Shade Subdivision Stormwater Management and Best Management Practice Calculations and Information

Mountain Shade Subdivision consists of 10.75 acres of moderately sloped land bounded by existing subdivisions on two sides, and by farmland and a road on the other two sides. The entire property drains to the Goose Creek Watershed by means of a small stream which crosses the parcel. A total of 36.80 acres of off-site developed property (single family subdivisions) also drains across the site. This off-site property was included in all SWM calculations, while BMP computations show that BMP requirements can be met without taking off-site credit. Stormwater Management and BMP requirements were met using a small wet pond with bottom elevation 632.0 feet and top of berm at elevation 643.5 feet.

The required BMP volume, (3)(8768) = 26,304 CF (0.6039 AC-FT), is contained between elevations 632.0 feet and 639.0 feet, which is the design water surface elevation for the wet pond.

The SWM Pond principal outlet structure consists of a standard DI-7 grate inlet on a standard precast manhole /standpipe. Elevation of the DI-7 inlet shall be set at elevation 639.0 feet. A grass-lined, trapezoidal spillway with 16 foot bottom width at elevation 641.5 feet, allows discharge of the 100-Year storm runoff while maintaining at least one foot of freeboard in the pond. The pond is designed so that the sum of the 2-year, Post-Development discharge from the SWM Pond and the discharge from the 2-year Post-Development Bypass areas, does not exceed the total Pre-Development flows. Offsite areas are included as part of the total drainage area. Detailed information on times of concentration, runoff, and pond routing are provided in a binder submitted with these plans. All run-off calculations and pond routings were performed using Haestad Methods' Pond Pack 6.0 Software and the Modified Rational Method. The available I-D-F Curves for Fauquier County were used throughout. SWM Routing information is summarized below:

## Pre-Development Stormwater Runoff Summary -

| | | | | |
|---|---|---|---|---|
| ON-SITE + OFF-SITE AREAS | 47.55 AC | C=0.42 | Tc = 15 MIN | $Q_2$ = 69.83 CFS |

## Post-Development Stormwater Runoff Summary -

| Drainage Area | Area | C | Tc | 2-Year Flow |
|---|---|---|---|---|
| BYPASS AREA | 1.97 AC | 0.47 | 5 min | **4.40 CFS** |
| POST-DEV AREA TO SWM | 45.58 AC | 0.41 | 11 min | 89.81 CFS |
| POND DISCHARGE | ---------- | --- | ---------- | **57.67 CFS** |
| TOTALS | 47.55 AC | ---- | ---------- | **62.07 CFS** |

* POST-DEV areas flow to the pond and are routed through it. Peak flows TO the pond are not included in the total site flow.

## Conclusion -

The total 2-Year Post-Development Peak Flow (62.07 CFS) is less than the total 2-Year Pre-Development Peak Flow (69.83 CFS). The 10-Year and 100-Year return period flows are also totally contained within the pond, while maintaining 1 foot of free-board during a 100-Year event. Stormwater Management and BMP detention requirements are met for Mountain Shade Subdivision.

# BMP Facility Design Worksheet

Step 1. Determine the required BMP storage Volume For the Site

A) Site are draining into the Occoquan Watershed 10.75 acres

B) Impervious of area in Step 1A:

Impervious = 26.1 %

or, C Value = _____

(show computations for obtaining weighted values)

C) Chart A Value = 815.6 cf/acre

D) Total required BMP storage for the site ( A x C ) = 8768 cf

(x3) = 26,304 cf

,Step 2. Determine the required BMP storage for the proposed facility.

A) Onsite area ( and offsite area if credit is to be taken)

Draining to the proposed facility 8.78 acres

B) Impervious of area in step 2A

Impervious = 26.1 %

or, C Value = _____

(show computations for obtaining weighted values)

C) Chart A Value = 815.6 cf/acre

D) Total required BMP storage for the site ( A x C ) = 7161 cf

(x3) = 21,483 cf

Note: Repeat Step 2 for each proposed BMP facility.

29,242 cf provided

Step 3. Check uncontrolled areas

A) In the uncontrolled portions if the site, measures the open areas and any impervious areas that drain by sheet flow over an open area. 1.97 acres

B) Divide (A) by 2 0.98 acres

C) Multiply (B) by the answer from 1 ( C ) 803 cf

Step 4. Check Site Coverage

A) Total BMP volumes provided:

Sum all of steps 2 (D) and add to 3 ( C ). 7964 cf

B) Percentage of storage volume provided:

Divided 4 (A) by 1(D). 90.9 %

C) Compare 4 (B) to 70 %

Design is acceptable if 4 (B) 90.8 % > 70 %

Design is unacceptable if 4 (B) _____ % < 70 %

If offsite credit is not to be taken:

D) Total equivalent controlled area:
add sum steps 2 (A) to 3 (B) 9.76 acres

E) Percentage of site that is controlled:
Divide 4 (D) by 1 (A) 90.8 %

F) Compare 4 (E) to 70 %
Design is acceptable if 4 (E) 90.8 % > 70 %
Design is unacceptable if 4 (E) _____ % < 70 %

Step 5. Impervious Acres Served

A) Measure total impervious area
( including offsite area if credit is to be taken) 2.81 acres

B) Measure controlled impervious area
( including offsite area if credit is to be taken) 2.30 acres

C) Measure onsite uncontrolled impervious areas
that drain over open space. 0.51 acres

D) Divide ( C ) by 2 0.26 acres

E) Add (B) to (D) then divide by (A) 91.4 %

F) Compare 5 (E) to 70 %
Design is acceptable if 5 (E) 91.4 % > 90 %
Uncontrolled impervious area should be reduced if:
5 (E) _____ % < 90 %

Job File: C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Rain Dir: .\util\

==========
JOB TITLE
==========

MOUNTAIN SHADE SUBDIVISION

S/N: H0M0L0120355 Carson, Harris, & Associates
Pond Pack Ver: 5-12-98 (57) Compute Time: 14:46:43 Date: 09-04-1998

# Pre-Development Drainage Area

On-Site Area = 10.75 Acres
Off-Site Area = 36.8 Acres
C = 0.42
$T_C$ = 15 minutes

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********** TC CALCULATIONS **********

PRE-DEVELOPMENT Tc Calcs ..... 1.01

********** RATIONAL METHOD CALCS **********

PRE-DEVELOPMENT C and Area ..... 2.01

PRE-DEVELOPMENT 100yr
Mod. Rational Hyg ..... 2.02

PRE-DEVELOPMENT 10yr
Mod. Rational Hyg ..... 2.03

PRE-DEVELOPMENT 2yr
Mod. Rational Hyg ..... 2.04

Type.... Tc Calcs
Name.... PRE-DEVELOPMENT

File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK

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File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Title... PRE-DEVELOPMENT CONDITIONS

RATIONAL C COEFFICIENT DATA

PRE-DEVELOPMENT CONDITIONS

| Soil/Surface Description | C | Area acres | C x Area acres |
|---|---|---|---|
| PRE-DEVELOPMENT SITE AREA | .3000 | 10.750 | 3.225 |
| OFF-SITE AREA DRAINING TO SITE | .4500 | 36.800 | 16.560 |
| WEIGHTED C & TOTAL AREA ---> | .4161 | 47.550 | 19.785 |

File.... C:\HAESTAD\PPK6\PROJECTS\

MODIFIED RATIONAL METHOD HYDROGRAPH

Q = CiA * Units Conversion;  Where Conversion = 43560 / (12 * 3600)

Rational Storms: KSLGREEN.IDQ KslGreen

| Tag | Freq | File | IDF Curve |
|---|---|---|---|
| 100yr | 100 | FAUQUIER.IDF | 100YR |

Td = 15.00 min

| Tag | Freq (years) | C | C adj factor | C final | I in/hr | Area acres | Peak Q cfs |
|---|---|---|---|---|---|---|---|
| 100yr | 100 | .416 | 1.000 | .416 | 7.0000 | 47.550 | 139.65 |

HYG file =
HYG ID  = Computed Hyd
HYG Tag  = 100yr

Peak Discharge =  139.65 cfs
Time to Peak  =  15.00 min
HYG Volume  =  125688 cu.ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = 1.00 min
Time on left represents time for first value in each row.

| Time min | | | | | |
|---|---|---|---|---|---|
| .00 | .00 | 9.31 | 18.62 | 27.93 | 37.24 |
| 5.00 | 46.55 | 55.86 | 65.17 | 74.48 | 83.79 |
| 10.00 | 93.10 | 102.41 | 111.72 | 121.03 | 130.34 |
| 15.00 | 139.65 | 130.34 | 121.03 | 111.72 | 102.41 |
| 20.00 | 93.10 | 83.79 | 74.48 | 65.17 | 55.86 |
| 25.00 | 46.55 | 37.24 | 27.93 | 18.62 | 9.31 |
| 30.00 | .00 | | | | |

Type.... Mod. Rational Hyg
Name.... PRE-DEVELOPMENT  Tag: 10yr

File.... C:\HAESTAD\PPK6\PROJECTS\

## MODIFIED RATIONAL METHOD HYDROGRAPH

Q = CiA * Units Conversion;  Where Conversion = 43560 / (12 * 3600)

Rational Storms: KSLGREEN.IDQ KslGreen

| Tag | Freq | File | IDF Curve |
|---|---|---|---|
| 10yr | 10 | FAUQUIER.IDF | .10YR |

Td = 15.00 min

| Tag | Freq (years) | C | C adj factor | C final | I in/hr | Area acres | Peak Q cfs |
|---|---|---|---|---|---|---|---|
| 10yr | 10 | .416 | 1.000 | .416 | 4.9000 | 47.550 | 97.76 |

HYG file =
HYG ID  = Computed Hyd
HYG Tag  = 10yr

| | | |
|---|---|---|
| Peak Discharge | = | 97.76 cfs |
| Time to Peak | = | 15.00 min |
| HYG Volume | = | 87981 cu.ft |

HYDROGRAPH ORDINATES (cfs)
Output Time increment = 1.00 min
Time on left represents time for first value in each row.

| Time min | | | | | |
|---|---|---|---|---|---|
| .00 | .00 | 6.52 | 13.03 | 19.55 | 26.07 |
| 5.00 | 32.59 | 39.10 | 45.62 | 52.14 | 58.65 |
| 10.00 | 65.17 | 71.69 | 78.21 | 84.72 | 91.24 |
| 15.00 | 97.76 | 91.24 | 84.72 | 78.21 | 71.69 |
| 20.00 | 65.17 | 58.65 | 52.14 | 45.62 | 39.10 |
| 25.00 | 32.59 | 26.07 | 19.55 | 13.03 | 6.52 |
| 30.00 | .00 | | | | |

File.... C:\HAESTAD\PPK6\PROJECTS\

MODIFIED RATIONAL METHOD HYDROGRAPH

Q = CiA * Units Conversion; Where Conversion = 43560 / (12 * 3600)

Rational Storms: KSLGREEN.IDQ KslGreen

| Tag | Freq | File | IDF Curve |
|---|---|---|---|
| 2yr | 2 | FAUQUIER.IDF | ..2YR |

Td = 15.00 min

| Tag | Freq (years) | C | C adj factor | C final | I in/hr | Area acres | Peak Q cfs |
|---|---|---|---|---|---|---|---|
| 2yr | 2 | .416 | 1.000 | .416 | 3.5000 | 47.550 | 69.83 |

HYG file =
HYG ID = Computed Hyd
HYG Tag = 2yr

| | | |
|---|---|---|
| Peak Discharge | = | 69.83 cfs |
| Time to Peak | = | 15.00 min |
| HYG Volume | = | 62844 cu.ft |

HYDROGRAPH ORDINATES (cfs)
Output Time increment = 1.00 min
Time on left represents time for first value in each row.

| Time min | | | | | |
|---|---|---|---|---|---|
| .00 | .00 | 4.66 | 9.31 | 13.97 | 18.62 |
| 5.00 | 23.28 | 27.93 | 32.59 | 37.24 | 41.90 |
| 10.00 | 46.55 | 51.21 | 55.86 | 60.52 | 65.17 |
| 15.00 | 69.83 | 65.17 | 60.52 | 55.86 | 51.21 |
| 20.00 | 46.55 | 41.90 | 37.24 | 32.59 | 27.93 |
| 25.00 | 23.28 | 18.62 | 13.97 | 9.31 | 4.65 |
| 30.00 | .00 | | | | |

# Post-Development Bypass Area

Area = 1.97 Acres
CN = 0.41
$T_C$ = 5 minutes

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********** TC CALCULATIONS **********

POST-DEV BYPASS Tc Calcs ..... 1.01

********** RATIONAL METHOD CALCS **********

POST-DEV BYPASS C and Area ..... 2.01

POST-DEV BYPASS 100yr
Mod. Rational Hyg ..... 2.02

POST-DEV BYPASS 10yr
Mod. Rational Hyg ..... 2.03

POST-DEV BYPASS 2yr
Mod. Rational Hyg ..... 2.04

File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Title... TIME OF CONCENTRATION FOR AREA BYPASSING SWM POND

::::::

Type.... C and Area
Name.... POST-DEV BYPASS

File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Title... ON-SITE AREA WHICH BYPASSES SWM POND

RATIONAL C COEFFICIENT DATA
::::::

Type.... Mod. Rational Hyg
Name.... POST-DEV BYPASS  Tag: 100yr

File.... C:\HAESTAD\PPK6\PROJECTS\

MODIFIED RATIONAL METHOD HYDROGRAPH

Q = CiA * Units Conversion;  Where Conversion = 43560 / (12 * 3600)

Rational Storms: KSLGREEN.IDQ KslGreen

| Tag | Freq | File | IDF Curve |
|---|---|---|---|
| 100yr | 100 | FAUQUIER.IDF | 100YR |

Td = 5.00 min

| Tag | Freq (years) | C | C adj factor | C final | I in/hr | Area acres | Peak Q cfs |
|---|---|---|---|---|---|---|---|
| 100yr | 100 | .410 | 1.000 | .410 | 9.4995 | 1.970 | 7.74 |

HYG file =
HYG ID  = Computed Hyd
HYG Tag  = 100yr

| | | |
|---|---|---|
| Peak Discharge | = | 7.73 cfs |
| Time to Peak | = | 5.00 min |
| HYG Volume | = | 2320 cu.ft |

HYDROGRAPH ORDINATES (cfs)
Output Time increment = 1.00 min
Time on left represents time for first value in each row.

| Time min | | | | | |
|---|---|---|---|---|---|
| .00 | .00 | 1.55 | 3.10 | 4.64 | 6.19 |
| 5.00 | 7.73 | 6.19 | 4.64 | 3.09 | 1.54 |
| 10.00 | .00 | | | | |

File.... C:\HAESTAD\PPK6\PROJECTS\

MODIFIED RATIONAL METHOD HYDROGRAPH

Q = CiA * Units Conversion;  Where Conversion = 43560 / (12 * 3600)

Rational Storms: KSLGREEN.IDQ KslGreen

| Tag | Freq | File | IDF Curve |
|---|---|---|---|
| 10yr | 10 | FAUQUIER.IDF | .10YR |

Td = 5.00 min

| Tag | Freq (years) | C | C adj factor | C final | I in/hr | Area acres | Peak Q cfs |
|---|---|---|---|---|---|---|---|
| 10yr | 10 | .410 | 1.000 | .410 | 7.0995 | 1.970 | 5.78 |

HYG file =
HYG ID = Computed Hyd
HYG Tag = 10yr

Peak Discharge = 5.78 cfs
Time to Peak = 5.00 min
HYG Volume = 1734 cu.ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = 1.00 min
Time on left represents time for first value in each row.

| Time min | | | | | |
|---|---|---|---|---|---|
| .00 | .00 | 1.16 | 2.31 | 3.47 | 4.63 |
| 5.00 | 5.78 | 4.62 | 3.47 | 2.31 | 1.15 |
| 10.00 | .00 | | | | |

Type.... Mod. Rational Hyg
Name.... POST-DEV BYPASS  Tag: 2yr

File.... C:\HAESTAD\PPK6\PROJECTS\

MODIFIED RATIONAL METHOD HYDROGRAPH

Q = CiA * Units Conversion;  Where Conversion = 43560 / (12 * 3600)

Rational Storms: KSLGREEN.IDQ KslGreen

| Tag | Freq | File | IDF Curve |
|---|---|---|---|
| 2yr | 2 | FAUQUIER.IDF | ..2YR |

Td = 5.00 min

| Tag | Freq (years) | C | C adj factor | C final | I in/hr | Area acres | Peak Q cfs |
|---|---|---|---|---|---|---|---|
| 2yr | 2 | .410 | 1.000 | .410 | 5.3996 | 1.970 | 4.40 |

HYG file =
HYG ID  = Computed Hyd
HYG Tag  = 2yr

Peak Discharge =  4.40 cfs
Time to Peak  =  5.00 min
HYG Volume  =  1319 cu.ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = 1.00 min
Time on left represents time for first value in each row.

| Time min | | | | | |
|---|---|---|---|---|---|
| .00 | .00 | .88 | 1.76 | 2.64 | 3.52 |
| 5.00 | 4.40 | 3.52 | 2.64 | 1.76 | .88 |
| 10.00 | .00 | | | | |

# Post-Development Area
# Draining to BMP/SWM Facility

On-Site Area = 8.78 Acres
Off-Site Area = 36.80 Acres
C = 0.47
$T_C$ = 11 minutes

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********** TC CALCULATIONS **********

MTNSHADE..... Tc Calcs ..... 1.01

********** RATIONAL METHOD CALCS **********

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POST-DEV TO SWM 100yr
Mod. Rational Hyg ..... 2.02

POST-DEV TO SWM 10yr
Mod. Rational Hyg ..... 2.03

POST-DEV TO SWM 2yr
Mod. Rational Hyg ..... 2.04

File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK

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File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Title... AREAS DRAINING TO SWM POND

RATIONAL C COEFFICIENT DATA

AREAS DRAINING TO SWM POND

| Soil/Surface Description | C | Area acres | C x Area acres |
|---|---|---|---|
| DA 1 | .4000 | 2.500 | 1.000 |
| DA 2 | .9000 | .190 | .171 |
| DA 3 | .4600 | 1.000 | .460 |
| DA 4 | .7000 | .650 | .455 |
| DA 5 | .6100 | .480 | .293 |
| DA 6 | .7000 | .360 | .252 |
| DA 7 | .7200 | .190 | .137 |
| DA 10 | .9000 | .160 | .144 |
| DA 11 | .8200 | 1.040 | .853 |
| DA 12A | .4500 | 1.780 | .801 |
| DA 12B OFFSITE AREAS | .4500 | 36.800 | 16.560 |
| DA 14 | .9000 | .150 | .135 |
| DA 15 | .9000 | .280 | .252 |
| WEIGHTED C & TOTAL AREA ---> | .4720 | 45.580 | 21.512 |

File.... C:\HAESTAD\PPK6\PROJECTS\

MODIFIED RATIONAL METHOD HYDROGRAPH

Q = CiA * Units Conversion;  Where Conversion = 43560 / (12 * 3600)

Rational Storms: KSLGREEN.IDQ KslGreen

| Tag | Freq | File | IDF Curve |
|---|---|---|---|
| 100yr | 100 | FAUQUIER.IDF | 100YR |

Td = 11.00 min

| Tag | Freq (years) | C | C adj factor | C final | I in/hr | Area acres | Peak Q cfs |
|---|---|---|---|---|---|---|---|
| 100yr | 100 | .472 | 1.000 | .472 | 7.9604 | 45.580 | 172.68 |

HYG file = C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.HYG
HYG ID = MTNSHADE
HYG Tag = 100yr

Peak Discharge = 172.68 cfs
Time to Peak = 11.00 min
HYG Volume = 113972 cu.ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = 1.00 min
Time on left represents time for first value in each row.

| Time min | | | | | |
|---|---|---|---|---|---|
| .00 | .00 | 15.70 | 31.40 | 47.10 | 62.79 |
| 5.00 | 78.49 | 94.19 | 109.89 | 125.59 | 141.29 |
| 10.00 | 156.99 | 172.68 | 156.99 | 141.29 | 125.59 |
| 15.00 | 109.89 | 94.19 | 78.49 | 62.79 | 47.10 |
| 20.00 | 31.40 | 15.70 | .00 | | |

File.... C:\HAESTAD\PPK6\PROJECTS\

MODIFIED RATIONAL METHOD HYDROGRAPH

Q = CiA * Units Conversion;  Where Conversion = 43560 / (12 * 3600)

Rational Storms: KSLGREEN.IDQ KslGreen

| Tag | Freq | File | IDF Curve |
|---|---|---|---|
| 10yr | 10 | FAUQUIER.IDF | .10YR |

Td = 11.00 min

| Tag | Freq (years) | C | C adj factor | C final | I in/hr | Area acres | Peak Q cfs |
|---|---|---|---|---|---|---|---|
| 10yr | 10 | .472 | 1.000 | .472 | 5.5803 | 45.580 | 121.05 |

HYG file = C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.HYG
HYG ID = MTNSHADE
HYG Tag = 10yr

Peak Discharge = 121.05 cfs
Time to Peak = 11.00 min
HYG Volume = 79895 cu.ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = 1.00 min
Time on left represents time for first value in each row.

| Time min | | | | | |
|---|---|---|---|---|---|
| .00 | .00 | 11.00 | 22.01 | 33.01 | 44.02 |
| 5.00 | 55.02 | 66.03 | 77.03 | 88.04 | 99.04 |
| 10.00 | 110.05 | 121.05 | 110.05 | 99.04 | 88.04 |
| 15.00 | 77.03 | 66.03 | 55.02 | 44.02 | 33.01 |
| 20.00 | 22.01 | 11.00 | .00 | | |

File.... C:\HAESTAD\PPK6\PROJECTS\

MODIFIED RATIONAL METHOD HYDROGRAPH

Q = CiA * Units Conversion;  Where Conversion = 43560 / (12 * 3600)

Rational Storms: KSLGREEN.IDQ KslGreen

| Tag | Freq | File | IDF Curve |
|---|---|---|---|
| 2yr | 2 | FAUQUIER.IDF | ..2YR |

Td = 11.00 min

| Tag | Freq (years) | C | C adj factor | C final | I in/hr | Area acres | Peak Q cfs |
|---|---|---|---|---|---|---|---|
| 2yr | 2 | .472 | 1.000 | .472 | 4.1403 | 45.580 | 89.81 |

HYG file = C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.HYG
HYG ID = MTNSHADE
HYG Tag = 2yr

Peak Discharge = 89.81 cfs
Time to Peak = 11.00 min
HYG Volume = 59278 cu.ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = 1.00 min
Time on left represents time for first value in each row.

| Time min | | | | | |
|---|---|---|---|---|---|
| .00 | .00 | 8.16 | 16.33 | 24.49 | 32.66 |
| 5.00 | 40.82 | 48.99 | 57.15 | 65.32 | 73.48 |
| 10.00 | 81.65 | 89.81 | 81.65 | 73.48 | 65.32 |
| 15.00 | 57.15 | 48.99 | 40.82 | 32.66 | 24.49 |
| 20.00 | 16.33 | 8.16 | .00 | | |

# Stormwater Management Pond

## Pond Information
## Outlet Information
## Storm Routings

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********** POND VOLUMES **********

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********** OUTLET STRUCTURES **********

DI7 BOX CULVERT Individual Outlet Curves ..... 2.01
Composite Rating Curve ..... 2.03

********** POND ROUTING **********

MTNSHADE..... 100yr
Pond Routing Summary ..... 3.01

MTNSHADE..... 10yr
Pond Routing Summary ..... 3.02

MTNSHADE..... 2yr
Pond Routing Summary ..... 3.03

Type.... Vol: Elev-Area
Name.... MTNSHADE

File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Title... SWM POND VOLUMES

| Elevation (ft) | Planimeter (sq.in) | Area (sq.ft) | A1+A2+sqr(A1*A2) (sq.ft) | Volume (cu.ft) | Volume Sum (cu.ft) |
|---|---|---|---|---|---|
| 632.00 | ----- | 520 | 0 | 0 | 0 |
| 633.00 | ----- | 1066 | 2331 | 777 | 777 |
| 634.00 | ----- | 2083 | 4639 | 1546 | 2323 |
| 635.00 | ----- | 3050 | 7654 | 2551 | 4874 |
| 636.00 | ----- | 4637 | 11448 | 3816 | 8690 |
| 637.00 | ----- | 5952 | 15843 | 5281 | 13971 |
| 638.00 | ----- | 7688 | 20405 | 6802 | 20773 |
| 639.00 | ----- | 9275 | 25407 | 8469 | 29242 |
| 640.00 | ----- | 11730 | 31436 | 10479 | 39720 |
| 642.00 | ----- | 16293 | 41848 | 27898 | 67619 |
| 643.00 | ----- | 19567 | 53715 | 17905 | 85524 |

Elevations With Areas Interpolated From
The Closest Two Planimeter Readings

| Elevation (ft) | Planimeter (sq.in) | Area (sq.ft) | A1+A2+sqr(A1*A2) (sq.ft) | Volume (cu.ft) | Volume Sum (cu.ft) |
|---|---|---|---|---|---|
| 632.25 | ----- | 638 | 1734 | 145 | 145 |
| 632.50 | ----- | 769 | 1921 | 320 | 320 |
| 632.75 | ----- | 911 | 2120 | 530 | 530 |
| 633.25 | ----- | 1289 | 3527 | 294 | 1071 |
| 633.50 | ----- | 1532 | 3876 | 646 | 1423 |
| 633.75 | ----- | 1797 | 4247 | 1062 | 1839 |
| 634.25 | ----- | 2308 | 6583 | 549 | 2872 |
| 634.50 | ----- | 2544 | 6928 | 1155 | 3478 |
| 634.75 | ----- | 2791 | 7285 | 1821 | 4145 |
| 635.25 | ----- | 3416 | 9693 | 808 | 5682 |
| 635.50 | ----- | 3802 | 10257 | 1710 | 6584 |
| 635.75 | ----- | 4209 | 10842 | 2711 | 7585 |
| 636.25 | ----- | 4950 | 14379 | 1198 | 9889 |
| 636.50 | ----- | 5274 | 14856 | 2476 | 11166 |
| 636.75 | ----- | 5608 | 15344 | 3836 | 12526 |
| 637.25 | ----- | 6365 | 18472 | 1539 | 15510 |
| 637.50 | ----- | 6792 | 19103 | 3184 | 17155 |
| 637.75 | ----- | 7233 | 19747 | 4937 | 18908 |
| 638.25 | ----- | 8071 | 23636 | 1970 | 22742 |
| 638.50 | ----- | 8463 | 24217 | 4036 | 24809 |

File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Title... SWM POND VOLUMES

Elevations With Areas Interpolated From
The Closest Two Planimeter Readings

| Elevation (ft) | Planimeter (sq.in) | Area (sq.ft) | A1+A2+sqr(A1*A2) (sq.ft) | Volume (cu.ft) | Volume Sum (cu.ft) |
|---|---|---|---|---|---|
| 638.75 | ----- | 8864 | 24808 | 6202 | 26975 |
| 639.25 | ----- | 9862 | 28701 | 2392 | 31633 |
| 639.25 | ----- | 9862 | 28701 | 2392 | 31633 |
| 639.50 | ----- | 10467 | 29594 | 4932 | 34174 |
| 639.75 | ----- | 11089 | 30506 | 7626 | 36868 |
| 640.25 | ----- | 12259 | 35981 | 2998 | 42719 |
| 640.50 | ----- | 12801 | 36784 | 6131 | 45851 |
| 640.75 | ----- | 13353 | 37599 | 9400 | 49120 |
| 641.00 | ----- | 13918 | 38425 | 12808 | 52529 |
| 641.25 | ----- | 14494 | 39263 | 16360 | 56080 |
| 641.50 | ----- | 15082 | 40113 | 20057 | 59777 |
| 641.75 | ----- | 15682 | 40974 | 23902 | 63622 |
| 642.25 | ----- | 17083 | 50060 | 4172 | 71790 |
| 642.50 | ----- | 17893 | 51260 | 8543 | 76162 |
| 642.75 | ----- | 18720 | 52478 | 13120 | 80738 |

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Interpolated area from closest two given contour areas
is computed using the relationship:

IA = (sq.rt(Area1) + ((Ei-E1)/(E2-E1))*(sq.rt(Area2)-sq.rt(Area1)))**2

where: E1, E2 = Closest two elevations with planimeter data
Ei = Elevation at which to interpolate area
Area1,Area2 = Areas computed for E1, E2, respectively
IA = Interpolated area for Ei

File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Title... CONCRETE STANDPIPE

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = BX (Inlet Box)

Upstream ID = (Pond Water Surface)
DNstream ID = TW (Pond Outfall)

| WS Elev,Device Q | | Tail Water | | Notes |
|---|---|---|---|---|
| WS Elev. ft | Q cfs | TW Elev ft | Converge +/-ft | Computation Messages |
| 639.00 | .00 | Free Outfall | | Weir: H =.00 |
| 639.25 | 4.65 | Free Outfall | | Weir: H =.25 |
| 639.50 | 13.15 | Free Outfall | | Weir: H =.50 |
| 639.75 | 24.16 | Free Outfall | | Weir: H =.75 |
| 640.00 | 37.20 | Free Outfall | | Weir: H =1.00 |
| 640.25 | 48.43 | Free Outfall | | |
| Orifice: H =1.25 | | | | |
| 640.50 | 53.05 | Free Outfall | | |
| Orifice: H =1.50 | | | | |
| 640.75 | 57.30 | Free Outfall | | |
| Orifice: H =1.75 | | | | |
| 641.00 | 61.26 | Free Outfall | | |
| Orifice: H =2.00 | | | | |
| 641.25 | 64.98 | Free Outfall | | |
| Orifice: H =2.25 | | | | |
| 641.50 | 68.49 | Free Outfall | | |
| Orifice: H =2.50 | | | | |
| 641.75 | 71.83 | Free Outfall | | |
| Orifice: H =2.75 | | | | |
| 642.00 | 75.03 | Free Outfall | | |
| Orifice: H =3.00 | | | | |
| 642.25 | 78.09 | Free Outfall | | |
| Orifice: H =3.25 | | | | |
| 642.50 | 81.04 | Free Outfall | | |
| Orifice: H =3.50 | | | | |
| 642.75 | 83.88 | Free Outfall | | |
| Orifice: H =3.75 | | | | |
| 643.00 | 86.63 | Free Outfall | | |
| Orifice: H =4.00 | | | | |

File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Title... CONCRETE STANDPIPE

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = EM (Weir-XY Points)

Upstream ID = (Pond Water Surface)
DNstream ID = TW (Pond Outfall)

| WS Elev,Device Q | | Tail Water | | Notes |
|---|---|---|---|---|
| WS Elev. ft | Q cfs | TW Elev ft | Converge +/-ft | Computation Messages |
| 639.00 | .00 | Free Outfall | | |
| | E < Y min=641.50 | | | |
| 639.25 | .00 | Free Outfall | | |
| | E < Y min=641.50 | | | |
| 639.50 | .00 | Free Outfall | | |
| | E < Y min=641.50 | | | |
| 639.75 | .00 | Free Outfall | | |
| | E < Y min=641.50 | | | |
| 640.00 | .00 | Free Outfall | | |
| | E < Y min=641.50 | | | |
| 640.25 | .00 | Free Outfall | | |
| | E < Y min=641.50 | | | |
| 640.50 | .00 | Free Outfall | | |
| | E < Y min=641.50 | | | |
| 640.75 | .00 | Free Outfall | | |
| | E < Y min=641.50 | | | |
| 641.00 | .00 | Free Outfall | | |
| | E < Y min=641.50 | | | |
| 641.25 | .00 | Free Outfall | | |
| | E < Y min=641.50 | | | |
| 641.50 | .00 | Free Outfall | | |
| | E = Y min=641.50 | | | |
| 641.75 | 6.82 | Free Outfall | | |
| | Max.H=.25; Max.Htw=free out;; W(ft)=17.50 | | | |
| 642.00 | 19.91 | Free Outfall | | |
| | Max.H=.50; Max.Htw=free out;; W(ft)=19.00 | | | |
| 642.25 | 37.70 | Free Outfall | | |
| | Max.H=.75; Max.Htw=free out;; W(ft)=20.50 | | | |
| 642.50 | 59.80 | Free Outfall | | |
| | Max.H=1.00; Max.Htw=free out;; W(ft)=22.00 | | | |
| 642.75 | 86.02 | Free Outfall | | |
| | Max.H=1.25; Max.Htw=free out;; W(ft)=23.50 | | | |
| 643.00 | 116.29 | Free Outfall | | |
| | Max.H=1.50; Max.Htw=free out;; W(ft)=25.00 | | | |

Type.... Composite Rating Curve
Name.... DI7 BOX CULVERT

File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Title... CONCRETE STANDPIPE

***** COMPOSITE OUTFLOW SUMMARY ****

| WS Elev, Total Q | | Converge | | Notes |
|---|---|---|---|---|
| Elev. ft | Q cfs | TW Elev ft | Error +/-ft | Contributing Structures |
| 639.00 | .00 | Free Outfall | | BX |
| 639.25 | 4.65 | Free Outfall | | BX |
| 639.50 | 13.15 | Free Outfall | | BX |
| 639.75 | 24.16 | Free Outfall | | BX |
| 640.00 | 37.20 | Free Outfall | | BX |
| 640.25 | 48.43 | Free Outfall | | BX |
| 640.50 | 53.05 | Free Outfall | | BX |
| 640.75 | 57.30 | Free Outfall | | BX |
| 641.00 | 61.26 | Free Outfall | | BX |
| 641.25 | 64.98 | Free Outfall | | BX |
| 641.50 | 68.49 | Free Outfall | | BX +EM |
| 641.75 | 78.65 | Free Outfall | | BX +EM |
| 642.00 | 94.93 | Free Outfall | | BX +EM |
| 642.25 | 115.80 | Free Outfall | | BX +EM |
| 642.50 | 140.84 | Free Outfall | | BX +EM |
| 642.75 | 169.90 | Free Outfall | | BX +EM |
| 643.00 | 202.93 | Free Outfall | | BX +EM |

Name.... MTNSHADE Tag: 100yr

File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Title... MOUNTAIN SHADE SWM POND

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = C:\HAESTAD\PPK6\PROJECTS\
Inflow  HYG file = MTNSHADE.HYG - MTNSHADE        100yr
Outflow HYG file = PONDOUT.HYG - PONDOUT         100yr

Pond Node   Data = MTNSHADE
Pond Volume Data = MTNSHADE
Pond Outlet Data = DI7 BOX CULVERT

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =  639.00 ft
Starting Volume    =   29242 cu.ft
Starting Outflow   =     .00 cfs
Starting Infiltr.  =     .00 cfs
Starting Total Qout=     .00 cfs
Time Increment     =    1.00 min


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =   172.68 cfs    at     11.00 min
Peak Outflow      =   117.10 cfs    at     15.00 min
-----------------------------------------------------
Peak Elevation    =   642.26 ft
Peak Storage =         72012 cu.ft
=====================================================


MASS BALANCE (cu.ft)
--------------------------
+ Initial Vol  =      29242
+ HYG Vol IN   =     113972
- Infiltration =          0
- HYG Vol OUT  =     113971
- Retained Vol =      29243
                  ----------
Unrouted Vol =-            cu.ft  (.000% of Inflow Volume)
```

Name.... MTNSHADE Tag: 10yr

File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Title... MOUNTAIN SHADE SWM POND

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = C:\HAESTAD\PPK6\PROJECTS\
Inflow  HYG file = MTNSHADE.HYG - MTNSHADE        10yr
Outflow HYG file = PONDOUT.HYG - PONDOUT         10yr

Pond Node   Data = MTNSHADE
Pond Volume Data = MTNSHADE
Pond Outlet Data = DI7 BOX CULVERT

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =  639.00 ft
Starting Volume    =   29242 cu.ft
Starting Outflow   =     .00 cfs
Starting Infiltr.  =     .00 cfs
Starting Total Qout=     .00 cfs
Time Increment     =    1.00 min


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =   121.05 cfs    at     11.00 min
Peak Outflow      =    68.73 cfs    at     16.00 min
-----------------------------------------------------
Peak Elevation    =   641.51 ft
Peak Storage =         59865 cu.ft
=====================================================


MASS BALANCE (cu.ft)
--------------------------
+ Initial Vol  =      29242
+ HYG Vol IN   =      79895
- Infiltration =          0
- HYG Vol OUT  =      79894
- Retained Vol =      29243
                 ----------
Unrouted Vol =-            cu.ft  (.000% of Inflow Volume)
```

File.... C:\HAESTAD\PPK6\PROJECTS\MTNSHADE.PPK
Title... MOUNTAIN SHADE SWM POND

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = C:\HAESTAD\PPK6\PROJECTS\
Inflow  HYG file = MTNSHADE.HYG - MTNSHADE        2yr
Outflow HYG file = PONDOUT.HYG - PONDOUT         2yr

Pond Node   Data = MTNSHADE
Pond Volume Data = MTNSHADE
Pond Outlet Data = DI7 BOX CULVERT
```

No Infiltration

INITIAL CONDITIONS

```
Starting WS Elev   =  639.00 ft
Starting Volume    =   29242 cu.ft
Starting Outflow   =     .00 cfs
Starting Infiltr.  =     .00 cfs
Starting Total Qout=     .00 cfs
Time Increment     =    1.00 min
```

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

```
Peak Inflow       =    89.81 cfs    at     11.00 min
Peak Outflow      =    57.67 cfs    at     15.00 min
Peak Elevation    =   640.77 ft
Peak Storage =         49431 cu.ft
```

MASS BALANCE (cu.ft)

```
+ Initial Vol  =      29242
+ HYG Vol IN   =      59278
- Infiltration =          0
- HYG Vol OUT  =      59276
- Retained Vol =      29243
                  ----------
Unrouted Vol =-            cu.ft  (.000% of Inflow Volume)
```