



707 17<sup>th</sup> Street, Suite 3150  
Denver, Colorado 80202  
Phone (303) 572-0200  
[www.matrixdesigngroup.com](http://www.matrixdesigngroup.com)

# MEMORANDUM

**To:** David Van Dellen  
**From:** Garrett Anderson, Matrix Design Group  
**Date:** April 3, 2026  
**RE:** World Compass Academy & Plum Creek Church Parking Lot Expansion Drainage Memorandum

---

## Introduction and Background Information

This memorandum has been prepared by Matrix Design Group, Inc. to support the engineering analysis and design methodology for the *World Compass Academy & Plum Creek Church Parking Lot Expansion* project. This memorandum supplements the previously approved Phase III Drainage Report (SDP14-0024, CD14-0032, CD14-0033, CD18-0004) to support the proposed improvements by World Compass Academy and Plum Creek Church. The project includes modifications to the existing parking lot, consisting of removal of 22 parking spaces and addition of 63 parking spaces to the western portion of the site.

The existing water quality/detention pond is being utilized for the project. It was originally designed to accommodate flows from the overall project site in accordance with the Phase III Drainage Report for Plum Creek Investment Group LLC, World Compass Academy Site, and Burt at Castle Rock Infrastructure (approved March 15, 2015).

## Historic Drainage System

The majority of the site slopes to the northeast at an average grade of 2%, with the southwest corner sloping at approximately 25% slope. The existing school site basins (S1 through S11) include roof, parking lots and open spaces, which are conveyed in a series of sump inlets and storm sewer system located south of Perry Street. The existing storm sewer system discharges developed flows from west to east/northeast towards the existing water quality / detention pond in the northeast corner of the site.

## Existing Water Quality / Detention Pond

The existing full-spectrum detention pond was originally designed assuming approximately 60% imperviousness over a 24.90-acre tributary area, documented in the previously approved Phase III Drainage Report (SDP14-0024, CD14-0032, CD14-0033). This assumption is considered conservative and likely intended to allow flexibility in future tributary developments.

## Proposed Drainage System

Expanded parking areas west of the school will drain to the existing CDOT Type-D sump inlets (S1\* and S2\*) located in the parking lot on the west and northwest sides of the school. All existing storm infrastructure will remain the same; however, inlets S1\* and S2\* have been re-analyzed to account for new runoff from the expanded impervious areas.

The existing storm sewer system for the school site conveys flows to the storm sewer along Perry Street, then east of the Perry Street cul-de-sac, ultimately discharging to the existing water quality/detention pond in the northeast corner of the site.

Impervious calculations and proposed drainage map are provided in Appendix A.

**The proposed site has been divided into two sub-basins, as described below.**

**Sub-basin S1\***

Sub-basin S1\* consists of 0.86 acres of the proposed parking lot expansion and adjacent open space located west of World Compass Academy. A conservative impervious estimate of 81% has been assumed for this sub-basin, reflecting approximately 0.70 acres of paved parking and streets, and 0.16 acres of undisturbed/pervious areas.

Runoff from this sub-basin will generally sheet flow to the existing CDOT Type-D sump inlet (S1\*). Based on the calculations performed in the MHFD inlet design spreadsheet, the existing inlet has sufficient capacity to convey the proposed flows. Inlet calculations have been provided in Appendix B.

**Sub-basin S2\***

Sub-basin S2\* consists of 0.89 acres of the proposed parking lot expansion and adjacent open space located northwest of World Compass Academy. A conservative impervious estimate of 60.4% has been assumed for this sub-basin, reflecting approximately 0.48 acres of paved parking and streets, and 0.41 acres of undisturbed/pervious areas.

Runoff from this sub-basin will generally sheet flow to the existing CDOT Type-D sump inlet (S2\*). Based on the calculations performed in the MHFD inlet design spreadsheet, the existing inlet has sufficient capacity to convey the proposed flows. Inlet calculations have been provided in Appendix B.

**Conclusion**

As previously stated, the existing full-spectrum detention pond was designed with an assumed 60% impervious land-use. The proposed condition results in approximately 34% imperviousness over a tributary area of 24.79 acres. As the proposed condition is less impervious than the original design assumption, the resulting runoff rates and volumes are anticipated to be less than those previously analyzed. Therefore, the existing pond will have sufficient capacity to accommodate runoff from the proposed parking lot expansion without any necessary pond modifications.

## Engineer's Statement

This letter for the drainage design for the *World Compass Academy & Plum Creek Church Parking Lot Expansion* project was prepared by me (or under my supervision) in accordance with the provisions of the Town of Castle Rock Drainage Design and Technical Criteria for the owners thereof. I understand that the Town of Castle Rock does not and will not assume liability for drainage facilities designed by others.



By: \_\_\_\_\_

Garrett Anderson

Licensed Professional Engineer

State of Colorado

No. 62557

# **APPENDIX A**

## **Hydrologic Calculations**

Includes:

1. Proposed Drainage Map
2. Proposed Impervious Calculations
3. Proposed Basin Summary Table
4. MHFD Peak Runoff Prediction by Rational Method Spreadsheet

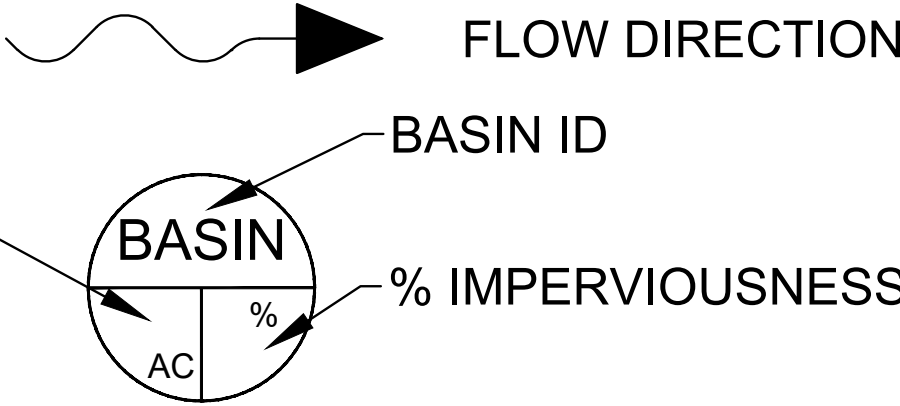


SITE DEVELOPMENT PLAN

LOT 1, BURT AT CASTLE ROCK  
AMENDMENT NO. 2

A PORTION OF THE SOUTHEAST QUARTER OF SECTION 15, TOWNSHIP 8 SOUTH, RANGE  
67 WEST OF THE 6TH P.M., TOWN OF CASTLE ROCK, DOUGLAS COUNTY, COLORADO  
LOCATED AT: 2490 S. PERRY STREET

LEGEND

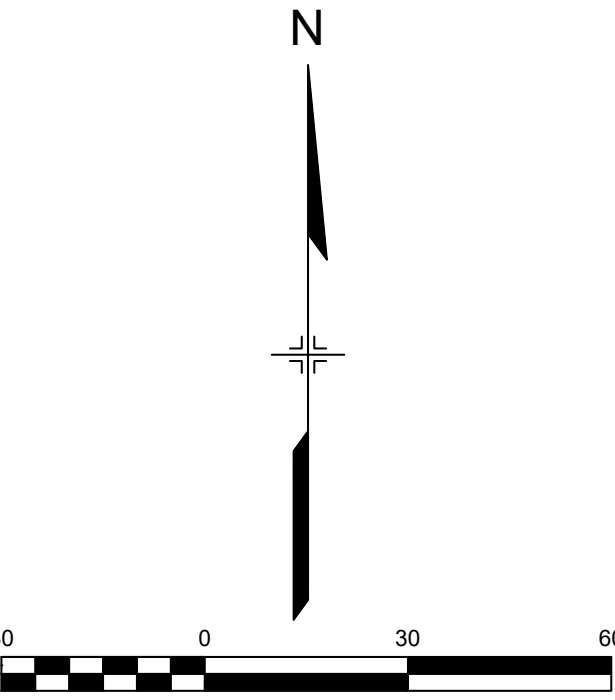


| BASIN SUMMARY TABLE |           |                  |
|---------------------|-----------|------------------|
| BASIN ID            | AREA (AC) | % IMPERVIOUSNESS |
| S1*                 | 0.86      | 81%              |
| S2*                 | 0.89      | 60%              |
| S3                  | 0.42      | 97%              |
| S4                  | 0.15      | 84%              |
| S5                  | 0.23      | 96%              |
| S6                  | 0.47      | 79%              |
| S7                  | 0.74      | 83%              |
| S8                  | 0.90      | 100%             |
| S9                  | 0.68      | 99%              |
| S10                 | 0.48      | 98%              |
| S11                 | 2.00      | 0%               |
| I1                  | 0.35      | 93%              |
| I2                  | 0.44      | 93%              |
| I3                  | 0.55      | 94%              |
| I4                  | 0.18      | 93%              |
| I5                  | 0.11      | 94%              |
| I6                  | 0.83      | 94%              |
| I7                  | 0.16      | 94%              |
| I8                  | 0.24      | 97%              |
| F1                  | 12.41     | 0%               |
| OS3                 | 1.70      | 46%              |
| TOTAL               | 24.79     | 34%              |

NOTES:

POND BASINS: S1-S11, I1-18, F1, OS3  
(PHASE III DRAINAGE REPORT CD18-0004)

S1 AND S2 BASINS HAVE BEEN REVISED FOR  
THIS PROJECT DUE TO WCC PARKING LOT  
EXPANSION.



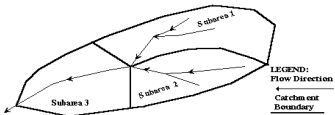


Determination of Runoff Coefficients for Rational Method

Designer: EJK  
Company: Matrix Design Group  
Date: 4/2/2026  
Project: WCC Parking Lot  
Location: Castle Rock, Colorado

MHFD-Rational, Version 3.00 (August 2025)

Cells of this color are for required user-input  
Cells of this color are for optional override values



| Provide subcatchment names on the Rational Calcs worksheet to open up the table below. |               |           |                            |                        |                            |                           |                                    |                       |      |       |       |       |        |        |            |                                           |       |       |       |        |        |               |  |          |
|----------------------------------------------------------------------------------------|---------------|-----------|----------------------------|------------------------|----------------------------|---------------------------|------------------------------------|-----------------------|------|-------|-------|-------|--------|--------|------------|-------------------------------------------|-------|-------|-------|--------|--------|---------------|--|----------|
| Subcatchment Name                                                                      | # of Subareas | Area (ac) | NRCS Hydrologic Soil Group | Percent Imperviousness |                            |                           |                                    | Runoff Coefficient, C |      |       |       |       |        |        |            | (Optional) Override Runoff Coefficient, C |       |       |       |        |        |               |  | Comments |
|                                                                                        |               |           |                            | Imperviousness Source  | Imperviousness Category    | Calculated Imperviousness | (Optional) Override Imperviousness | WQE & 2-yr            | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr | WQE & 2-yr | 5-yr                                      | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr |               |  |          |
| S1                                                                                     | 2             | 0.86      | C/D                        |                        |                            | 81.0%                     | 81.0%                              | 0.67                  | 0.70 | 0.73  | 0.77  | 0.79  | 0.82   | 0.84   | 0.67       | 0.70                                      | 0.73  | 0.77  | 0.79  | 0.82   | 0.84   | Curb inlet S1 |  |          |
|                                                                                        |               | 0.70      | C/D                        | Surface Type           | Roadways and Paved Streets | 95%                       |                                    | 0.79                  | 0.81 | 0.83  | 0.85  | 0.86  | 0.87   | 0.89   |            |                                           |       |       |       |        |        |               |  |          |
|                                                                                        |               | 0.16      | C/D                        | Surface Type           | Disturbed Soil             | 20%                       |                                    | 0.14                  | 0.20 | 0.28  | 0.43  | 0.49  | 0.57   | 0.65   |            |                                           |       |       |       |        |        |               |  |          |
| S2                                                                                     | 2             | 0.89      | C/D                        |                        |                            | 60.4%                     | 60.4%                              | 0.49                  | 0.53 | 0.58  | 0.66  | 0.69  | 0.73   | 0.78   | 0.49       | 0.53                                      | 0.58  | 0.66  | 0.69  | 0.73   | 0.78   |               |  |          |
|                                                                                        |               | 0.48      | C/D                        | Surface Type           | Roadways and Paved Streets | 95%                       |                                    | 0.79                  | 0.81 | 0.83  | 0.85  | 0.86  | 0.87   | 0.89   |            |                                           |       |       |       |        |        |               |  |          |
|                                                                                        |               | 0.41      | C/D                        | Surface Type           | Disturbed Soil             | 20%                       |                                    | 0.14                  | 0.20 | 0.28  | 0.43  | 0.49  | 0.57   | 0.65   |            |                                           |       |       |       |        |        |               |  |          |

**Basin Summary Table**

| <b>Basin ID</b> | <b>Area (acres)</b> | <b>% Imperviousness</b> |
|-----------------|---------------------|-------------------------|
| S1*             | 0.86                | 81%                     |
| S2*             | 0.89                | 60%                     |
| S3              | 0.42                | 97%                     |
| S4              | 0.15                | 84%                     |
| S5              | 0.23                | 96%                     |
| S6              | 0.47                | 79%                     |
| S7              | 0.74                | 83%                     |
| S8              | 0.9                 | 100%                    |
| S9              | 0.68                | 99%                     |
| S10             | 0.48                | 98%                     |
| S11             | 2                   | 0%                      |
| I1              | 0.35                | 93%                     |
| I2              | 0.44                | 93%                     |
| I3              | 0.55                | 94%                     |
| I4              | 0.18                | 93%                     |
| I5              | 0.11                | 94%                     |
| I6              | 0.83                | 94%                     |
| I7              | 0.16                | 94%                     |
| I8              | 0.24                | 97%                     |
| F1              | 12.41               | 0%                      |
| OS3             | 1.7                 | 46%                     |
| <b>TOTAL</b>    | <b>24.79</b>        | <b>34%</b>              |

\*=                      Revised Basin due to WCC Parking Lot Expansion

POND =>    OS3, I1-I8, S1-S11, F1

Calculation of Peak Runoff using Rational Method

Designer: EJK  
Company: Matrix Design Group  
Date: 4/2/2026  
Project: WCC Parking Lot  
Location: Castle Rock, Colorado

MHFD-Rational, Version 3.00 (August 2025)

Cells of this color are for required user-input  
Cells of this color are for optional override values

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L_i}}{S^{0.33}}$$
$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

Computed  $t_c = t_i + t_t$   
Regional  $t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$

$t_c \text{ minimum} = 5 \text{ (urban)}$   
 $t_c \text{ minimum} = 10 \text{ (non-urban)}$   
Selected  $t_c = \max\{t_{\text{minimum}}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$

| Provide input for area, soil type, and imperviousness on the Runoff Coeffs worksheet. |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|---------------------------------------------------------------------------------------|-----------|-------------------------------|----------------|-----------------------|------|-------|-------|-------|--------|--------|------------------------------------------|-------------------------------|-------------------------------|--------------------------------------------|-----------------------------------------|---------------------------------------------|-------------------------------|-------------------------------|-----------------------------------------------|--------------------------|---------------------------------------------------|--------------------------------------------|
| Subcatchment Name                                                                     | Area (ac) | NRCS Hydrologic Soil Group(s) | Imperviousness | Runoff Coefficient, C |      |       |       |       |        |        | Overland (Initial) Flow Time             |                               |                               |                                            |                                         | Channelized (Travel) Flow Time              |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                | WQE & 2-yr            | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr | Overland Flow Length L <sub>i</sub> (ft) | U/S Elevation (ft) (Optional) | D/S Elevation (ft) (Optional) | Overland Flow Slope S <sub>i</sub> (ft/ft) | Overland Flow Time t <sub>i</sub> (min) | Channelized Flow Length L <sub>t</sub> (ft) | U/S Elevation (ft) (Optional) | D/S Elevation (ft) (Optional) | Channelized Flow Slope S <sub>t</sub> (ft/ft) | NRCS Conveyance Factor K | Channelized Flow Velocity V <sub>t</sub> (ft/sec) | Channelized Flow Time t <sub>t</sub> (min) |
| S1                                                                                    | 0.86      | C/D                           | 81.0%          | 0.67                  | 0.70 | 0.73  | 0.77  | 0.79  | 0.82   | 0.84   | 67.00                                    |                               |                               | 0.200                                      | 2.22                                    | 285.00                                      |                               |                               | 0.040                                         | 20                       | 4.00                                              | 1.19                                       |
| S2                                                                                    | 0.89      | C/D                           | 60.4%          | 0.49                  | 0.53 | 0.58  | 0.66  | 0.69  | 0.73   | 0.78   | 35.00                                    |                               |                               | 0.300                                      | 1.99                                    | 235.00                                      |                               |                               | 0.038                                         | 20                       | 3.90                                              | 1.00                                       |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         |                                             |                               |                               |                                               |                          |                                                   |                                            |
|                                                                                       |           |                               |                |                       |      |       |       |       |        |        |                                          |                               |                               |                                            |                                         | </                                          |                               |                               |                                               |                          |                                                   |                                            |



Calculation of Peak Runoff using Rational Method

Designer:

Company:

Date:

Project:

Location:

Select MHFD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

1-hour rainfall depth, P1 (in) =

|       |      |       |       |       |       |        |        |
|-------|------|-------|-------|-------|-------|--------|--------|
| WQE   | 2-yr | 5-yr  | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr |
| 0.60  | 1.06 | 1.43  | 1.66  |       | 2.26  | 2.60   |        |
| a     |      | b     |       | c     |       |        |        |
| 28.50 |      | 10.00 |       | 0.786 |       |        |        |

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

| Subcatchment Name | Time of Concentration         |                               |                               |                                          | Rainfall Intensity, I (in/hr) |      |      |       |       |       |        |        | Peak Flow, Q (cfs) |      |      |       |       |       |        |        |
|-------------------|-------------------------------|-------------------------------|-------------------------------|------------------------------------------|-------------------------------|------|------|-------|-------|-------|--------|--------|--------------------|------|------|-------|-------|-------|--------|--------|
|                   | Computed t <sub>c</sub> (min) | Regional t <sub>c</sub> (min) | Selected t <sub>c</sub> (min) | (Optional) Override t <sub>c</sub> (min) | WQE                           | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr | WQE                | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr |
| S1                | 3.41                          | 13.39                         | 5.00                          |                                          | 2.04                          | 3.60 | 4.85 | 5.63  |       | 7.67  | 8.82   |        | 1.17               | 2.06 | 2.90 | 3.52  |       | 5.23  | 6.18   |        |
| S2                | 2.99                          | 16.87                         | 5.00                          |                                          | 2.04                          | 3.60 | 4.85 | 5.63  |       | 7.67  | 8.82   |        | 0.88               | 1.56 | 2.28 | 2.89  |       | 4.72  | 5.74   |        |
|                   |                               |                               |                               |                                          |                               |      |      |       |       |       |        |        |                    |      |      |       |       |       |        |        |
|                   |                               |                               |                               |                                          |                               |      |      |       |       |       |        |        |                    |      |      |       |       |       |        |        |
|                   |                               |                               |                               |                                          |                               |      |      |       |       |       |        |        |                    |      |      |       |       |       |        |        |
|                   |                               |                               |                               |                                          |                               |      |      |       |       |       |        |        |                    |      |      |       |       |       |        |        |
|                   |                               |                               |                               |                                          |                               |      |      |       |       |       |        |        |                    |      |      |       |       |       |        |        |
|                   |                               |                               |                               |                                          |                               |      |      |       |       |       |        |        |                    |      |      |       |       |       |        |        |
|                   |                               |                               |                               |                                          |                               |      |      |       |       |       |        |        |                    |      |      |       |       |       |        |        |
|                   |                               |                               |                               |                                          |                               |      |      |       |       |       |        |        |                    |      |      |       |       |       |        |        |
|                   |                               |                               |                               |                                          |                               |      |      |       |       |       |        |        |                    |      |      |       |       |       |        |        |

## **APPENDIX B**

### **Hydraulic Calculations**

Includes:

1. Inlet Calculations

# INLET MANAGEMENT

**Project:** WCC Parking Lot Expansion

**Minor:** 5-year

**Major:** 100-year

Worksheet Protected

| INLET NAME                         | <a href="#">S1</a>       | <a href="#">S2</a>       |
|------------------------------------|--------------------------|--------------------------|
| Inlet Application (Street or Area) | STREET                   | STREET                   |
| Hydraulic Condition                | In Sump                  | In Sump                  |
| Inlet Type                         | CDOT Type R Curb Opening | CDOT Type R Curb Opening |
| Number of Inlet Units              | 2                        | 2                        |

## USER-DEFINED INPUT

### User-Defined Peak Flows

|                          |      |      |
|--------------------------|------|------|
| Minor Peak Flow, Q (cfs) | 2.90 | 2.28 |
| Major Peak Flow, Q (cfs) | 6.18 | 5.74 |

### Bypass (Carry-Over) Flow from Upstream

Inlets must be organized from upstream (left) to downstream (right) in order for bypass

|                                         |  |  |
|-----------------------------------------|--|--|
| Receive Bypass Flow from:               |  |  |
| Bypass Flow Description (Optional):     |  |  |
| Minor Bypass Flow Received, $Q_b$ (cfs) |  |  |
| Major Bypass Flow Received, $Q_b$ (cfs) |  |  |

## CALCULATED OUTPUT

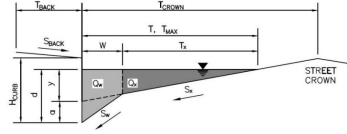
|                                                |      |      |
|------------------------------------------------|------|------|
| Minor Total Design Peak Flow, Q (cfs)          | 2.90 | 2.28 |
| Major Total Design Peak Flow, Q (cfs)          | 6.18 | 5.74 |
| Minor Inlet Interception Capacity, $Q_a$ (cfs) | 6.18 | 6.18 |
| Major Inlet Interception Capacity, $Q_a$ (cfs) | 6.18 | 6.18 |
| Minor Flow Bypassed Downstream, $Q_b$ (cfs)    | N/A  | N/A  |
| Major Flow Bypassed Downstream, $Q_b$ (cfs)    | N/A  | N/A  |
| Minor Flow Capture Percentage, C%              | 100% | 100% |
| Major Flow Capture Percentage, C%              | 100% | 100% |

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: WCC Parking Lot Expansion

Inlet ID: S1

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

$T_{BACK} = 0.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.013$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 1.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_W = 0.083$  ft/ft  
 $S_0 = 0.000$  ft/ft  
 $n_{STREET} = 0.013$

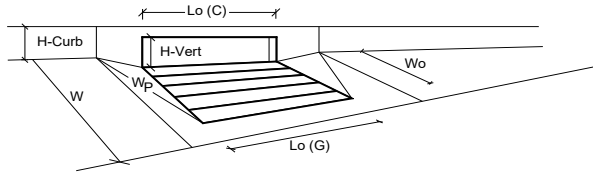
|             | Minor Storm              | Major Storm              |        |
|-------------|--------------------------|--------------------------|--------|
| $T_{MAX} =$ | 17.0                     | 17.0                     | ft     |
| $d_{MAX} =$ | 6.0                      | 6.0                      | inches |
|             | <input type="checkbox"/> | <input type="checkbox"/> |        |

$Q_{allow} =$ 

| Minor Storm | Major Storm |     |
|-------------|-------------|-----|
| SUMP        | SUMP        | cfs |

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



## Design Information (Input)

Type of Inlet CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a' from above)

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

### Grate Information

Length of a Unit Grate

Width of a Unit Grate

Open Area Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

### Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

### Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth

Depth for Curb Opening Weir Equation

Grated Inlet Performance Reduction Factor for Long Inlets

Curb Opening Performance Reduction Factor for Long Inlets

Combination Inlet Performance Reduction Factor for Long Inlets

Total Inlet Interception Capacity (assumes clogged condition)

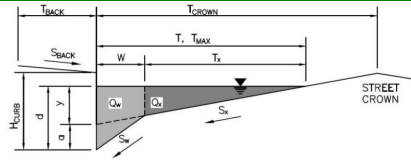
**Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)**

|                       | MINOR                    | MAJOR |         |
|-----------------------|--------------------------|-------|---------|
| Type =                | CDOT Type R Curb Opening |       |         |
| $a_{local}$ =         | 3.00                     | 3.00  | inches  |
| No =                  | 2                        | 2     |         |
| Ponding Depth =       | 4.8                      | 4.8   | inches  |
|                       | MINOR                    | MAJOR |         |
| $L_o$ (G) =           | N/A                      | N/A   | feet    |
| $W_o$ =               | N/A                      | N/A   | feet    |
| $A_{ratio}$ =         | N/A                      | N/A   |         |
| $C_r$ (G) =           | N/A                      | N/A   |         |
| $C_{w_r}$ (G) =       | N/A                      | N/A   |         |
| $C_o$ (G) =           | N/A                      | N/A   |         |
|                       | MINOR                    | MAJOR |         |
| $L_o$ (C) =           | 5.00                     | 5.00  | feet    |
| $H_{vert}$ =          | 6.00                     | 6.00  | inches  |
| $H_{throat}$ =        | 6.00                     | 6.00  | inches  |
| Theta =               | 63.40                    | 63.40 | degrees |
| $W_p$ =               | 1.00                     | 1.00  | feet    |
| $C_r$ (C) =           | 0.10                     | 0.10  |         |
| $C_{w_r}$ (C) =       | 3.60                     | 3.60  |         |
| $C_o$ (C) =           | 0.67                     | 0.67  |         |
|                       | MINOR                    | MAJOR |         |
| $d_{Grate}$ =         | N/A                      | N/A   | ft      |
| $d_{Curb}$ =          | 0.32                     | 0.32  | ft      |
| $RF_{Grate}$ =        | N/A                      | N/A   |         |
| $RF_{Curb}$ =         | 0.86                     | 0.86  |         |
| $RF_{Combination}$ =  | N/A                      | N/A   |         |
|                       | MINOR                    | MAJOR |         |
| $Q_a$ =               | 6.2                      | 6.2   | cfs     |
| $Q_{PEAK REQUIRED}$ = | 2.9                      | 6.2   | cfs     |



**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **WCC Parking Lot Expansion**Inlet ID: **S2****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

|              |       |       |
|--------------|-------|-------|
| $T_{BACK}$ = | 15.0  | ft    |
| $S_{BACK}$ = | 0.110 | ft/ft |
| $n_{BACK}$ = | 0.013 |       |

|                |       |        |
|----------------|-------|--------|
| $H_{CURB}$ =   | 6.00  | inches |
| $T_{CROWN}$ =  | 17.0  | ft     |
| $W$ =          | 1.00  | ft     |
| $S_x$ =        | 0.020 | ft/ft  |
| $S_w$ =        | 0.083 | ft/ft  |
| $S_o$ =        | 0.000 | ft/ft  |
| $n_{STREET}$ = | 0.013 |        |

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

|             | Minor Storm              | Major Storm              |        |
|-------------|--------------------------|--------------------------|--------|
| $T_{MAX}$ = | 17.0                     | 17.0                     | ft     |
| $d_{MAX}$ = | 6.0                      | 6.0                      | inches |
|             | <input type="checkbox"/> | <input type="checkbox"/> |        |

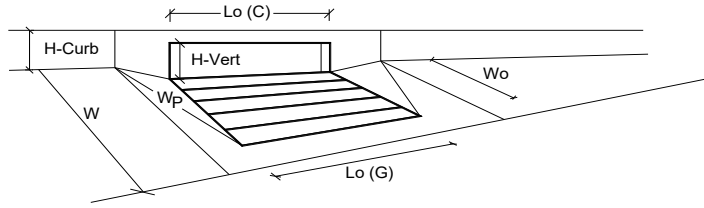
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

|               | Minor Storm | Major Storm |     |
|---------------|-------------|-------------|-----|
| $Q_{allow}$ = | SUMP        | SUMP        | cfs |

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



| Design Information (Input)                                                   |                          | MINOR                 |                          | MAJOR |                                          |
|------------------------------------------------------------------------------|--------------------------|-----------------------|--------------------------|-------|------------------------------------------|
| Type of Inlet                                                                | CDOT Type R Curb Opening | Type =                | CDOT Type R Curb Opening |       |                                          |
| Local Depression (additional to continuous gutter depression 'a' from above) |                          | $a_{local}$ =         | 3.00                     | 3.00  | inches                                   |
| Number of Unit Inlets (Grate or Curb Opening)                                |                          | No =                  | 2                        | 2     |                                          |
| Water Depth at Flowline (outside of local depression)                        |                          | Ponding Depth =       | 4.8                      | 4.8   | inches                                   |
| <b>Grate Information</b>                                                     |                          |                       | MINOR                    | MAJOR | <input type="checkbox"/> Override Depths |
| Length of a Unit Grate                                                       |                          | $L_o (G)$ =           | N/A                      | N/A   | feet                                     |
| Width of a Unit Grate                                                        |                          | $W_o$ =               | N/A                      | N/A   | feet                                     |
| Open Area Ratio for a Grate (typical values 0.15-0.90)                       |                          | $A_{ratio}$ =         | N/A                      | N/A   |                                          |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70)               |                          | $C_f (G)$ =           | N/A                      | N/A   |                                          |
| Grate Weir Coefficient (typical value 2.15 - 3.60)                           |                          | $C_w (G)$ =           | N/A                      | N/A   |                                          |
| Grate Orifice Coefficient (typical value 0.60 - 0.80)                        |                          | $C_o (G)$ =           | N/A                      | N/A   |                                          |
| <b>Curb Opening Information</b>                                              |                          |                       | MINOR                    | MAJOR |                                          |
| Length of a Unit Curb Opening                                                |                          | $L_o (C)$ =           | 5.00                     | 5.00  | feet                                     |
| Height of Vertical Curb Opening in Inches                                    |                          | $H_{vert}$ =          | 6.00                     | 6.00  | inches                                   |
| Height of Curb Orifice Throat in Inches                                      |                          | $H_{throat}$ =        | 6.00                     | 6.00  | inches                                   |
| Angle of Throat                                                              |                          | Theta =               | 63.40                    | 63.40 | degrees                                  |
| Side Width for Depression Pan (typically the gutter width of 2 feet)         |                          | $W_p$ =               | 1.00                     | 1.00  | feet                                     |
| Clogging Factor for a Single Curb Opening (typical value 0.10)               |                          | $C_f (C)$ =           | 0.10                     | 0.10  |                                          |
| Curb Opening Weir Coefficient (typical value 2.3-3.7)                        |                          | $C_w (C)$ =           | 3.60                     | 3.60  |                                          |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)                 |                          | $C_o (C)$ =           | 0.67                     | 0.67  |                                          |
| <b>Low Head Performance Reduction (Calculated)</b>                           |                          |                       | MINOR                    | MAJOR |                                          |
| Depth for Grate Midwidth                                                     |                          | $d_{Grate}$ =         | N/A                      | N/A   | ft                                       |
| Depth for Curb Opening Weir Equation                                         |                          | $d_{Curb}$ =          | 0.32                     | 0.32  | ft                                       |
| Grated Inlet Performance Reduction Factor for Long Inlets                    |                          | $RF_{Grate}$ =        | N/A                      | N/A   |                                          |
| Curb Opening Performance Reduction Factor for Long Inlets                    |                          | $RF_{Curb}$ =         | 0.86                     | 0.86  |                                          |
| Combination Inlet Performance Reduction Factor for Long Inlets               |                          | $RF_{Combination}$ =  | N/A                      | N/A   |                                          |
| Total Inlet Interception Capacity (assumes clogged condition)                |                          | $Q_a$ =               | 6.2                      | 6.2   | cfs                                      |
| Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)                  |                          | $Q_{PEAK REQUIRED}$ = | 2.3                      | 5.7   | cfs                                      |

## **APPENDIX C**

### **Supporting Documentation**

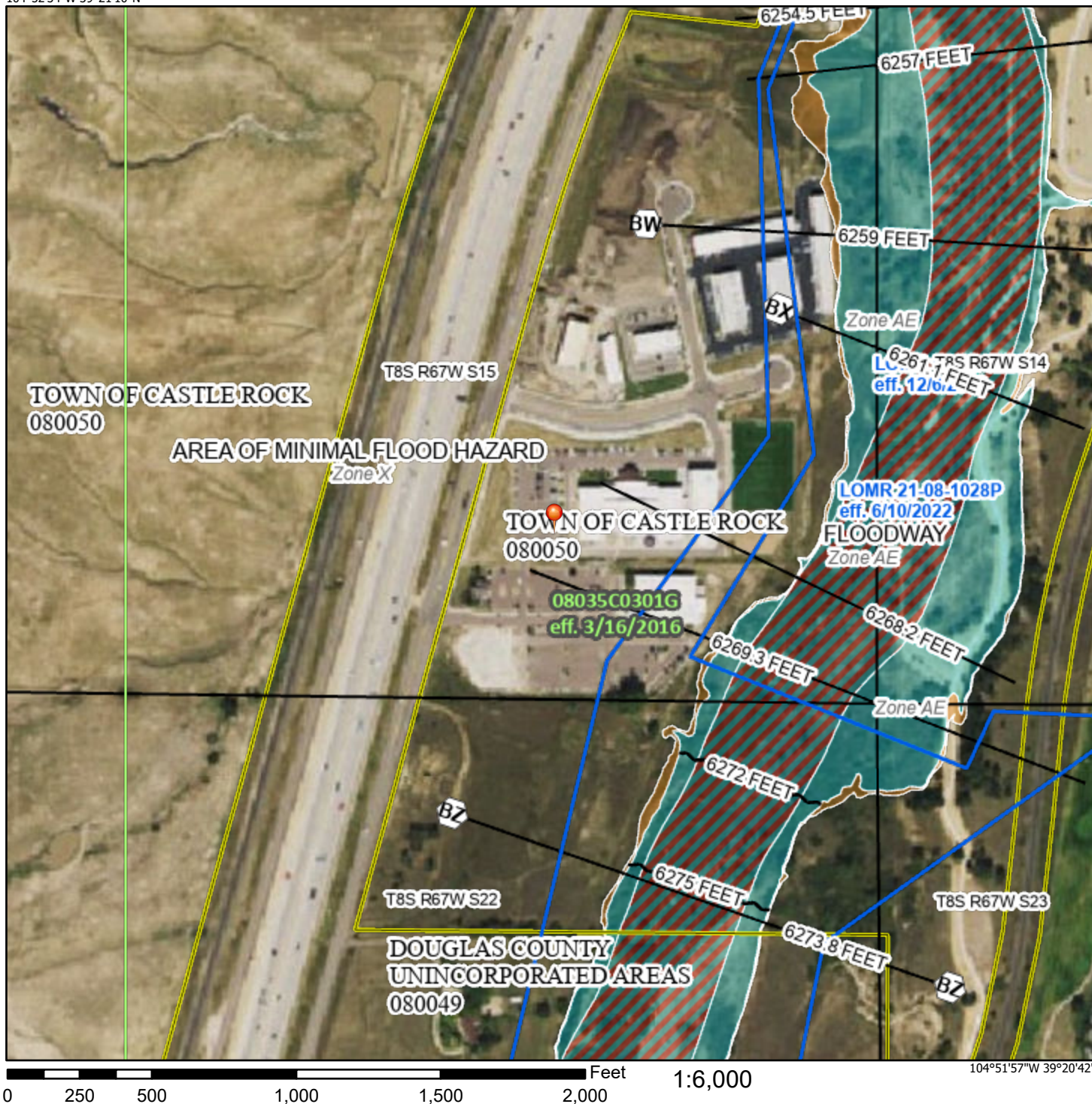
Includes:

1. FEMA Map
2. Phase III Drainage Map (CD18-0004)
3. Phase III Drainage Report (SDP14-0024, CD14-0032, CD14-0033)

# National Flood Hazard Layer FIRMette



104°52'34"W 39°21'10"N



## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

|                             |  |                                                                                                                                                                   |
|-----------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SPECIAL FLOOD HAZARD AREAS  |  | Without Base Flood Elevation (BFE)<br>Zone A, V, A99                                                                                                              |
|                             |  | With BFE or Depth Zone AE, AO, AH, VE, AR                                                                                                                         |
|                             |  | Regulatory Floodway                                                                                                                                               |
| OTHER AREAS OF FLOOD HAZARD |  | 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X |
|                             |  | Future Conditions 1% Annual Chance Flood Hazard Zone X                                                                                                            |
|                             |  | Area with Reduced Flood Risk due to Levee. See Notes. Zone X                                                                                                      |
|                             |  | Area with Flood Risk due to Levee Zone D                                                                                                                          |
| OTHER AREAS                 |  | NO SCREEN Area of Minimal Flood Hazard Zone X                                                                                                                     |
|                             |  | Effective LOMRs                                                                                                                                                   |
| GENERAL STRUCTURES          |  | Area of Undetermined Flood Hazard Zone D                                                                                                                          |
|                             |  | Channel, Culvert, or Storm Sewer                                                                                                                                  |
| OTHER FEATURES              |  | Levee, Dike, or Floodwall                                                                                                                                         |
|                             |  | Coastal Transect Baseline                                                                                                                                         |
| MAP PANELS                  |  | Digital Data Available                                                                                                                                            |
|                             |  | No Digital Data Available                                                                                                                                         |
|                             |  | Unmapped                                                                                                                                                          |

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/31/2026 at 10:07 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

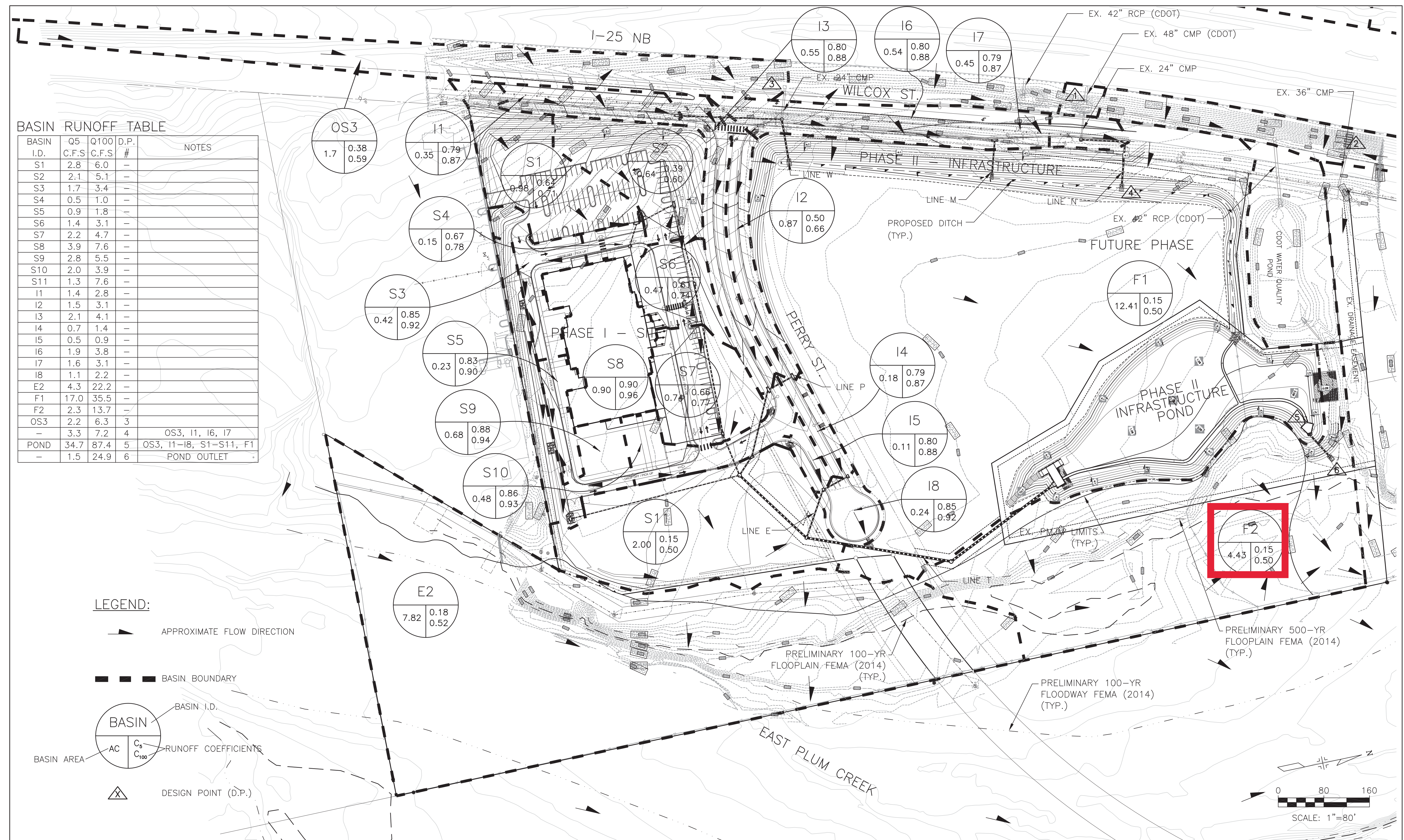
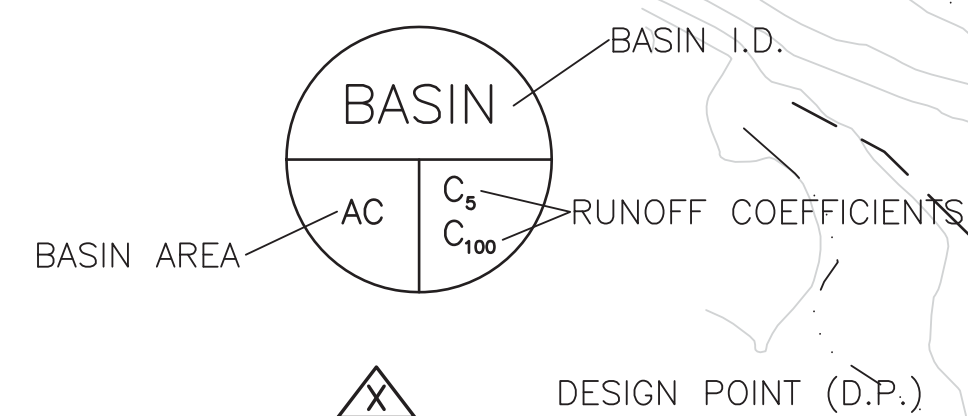
Basemap Imagery Source: USGS National Map 2023



| BASIN<br>I.D. | Q5<br>C.F.S | Q100<br>C.F.S | D.P.<br># | NOTES                  |
|---------------|-------------|---------------|-----------|------------------------|
| S1            | 2.8         | 6.0           | —         |                        |
| S2            | 2.1         | 5.1           | —         |                        |
| S3            | 1.7         | 3.4           | —         |                        |
| S4            | 0.5         | 1.0           | —         |                        |
| S5            | 0.9         | 1.8           | —         |                        |
| S6            | 1.4         | 3.1           | —         |                        |
| S7            | 2.2         | 4.7           | —         |                        |
| S8            | 3.9         | 7.6           | —         |                        |
| S9            | 2.8         | 5.5           | —         |                        |
| S10           | 2.0         | 3.9           | —         |                        |
| S11           | 1.3         | 7.6           | —         |                        |
| I1            | 1.4         | 2.8           | —         |                        |
| I2            | 1.5         | 3.1           | —         |                        |
| I3            | 2.1         | 4.1           | —         |                        |
| I4            | 0.7         | 1.4           | —         |                        |
| I5            | 0.5         | 0.9           | —         |                        |
| I6            | 1.9         | 3.8           | —         |                        |
| I7            | 1.6         | 3.1           | —         |                        |
| I8            | 1.1         | 2.2           | —         |                        |
| E2            | 4.3         | 22.2          | —         |                        |
| F1            | 17.0        | 35.5          | —         |                        |
| F2            | 2.3         | 13.7          | —         |                        |
| OS3           | 2.2         | 6.3           | 3         |                        |
| —             | 3.3         | 7.2           | 4         | OS3, I1, I6, I7        |
| POND          | 34.7        | 87.4          | 5         | OS3, I1—I8, S1—S11, F1 |
| —             | 1.5         | 24.9          | 6         | POND OUTLET            |

 APPROXIMATE FLOW DIRECTION

■ ■ ■ BASIN BOUNDARY



|                           |                             |                |                          |  |  |                                                                                       |                                                                                                                                                                       |                |  |                                                                  |                        |                |                  |  |              |
|---------------------------|-----------------------------|----------------|--------------------------|--|--|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--|------------------------------------------------------------------|------------------------|----------------|------------------|--|--------------|
| Computer File Information |                             |                | Index of Revisions       |  |  |  | <br>740 Pearl Street, Suite 703<br>Denver, Colorado 80203<br>Phone: 303.861.9331 | As Constructed |  | HIER DEVELOPMENT<br>BURT AT CASTLE ROCK<br>PROPOSED DRAINAGE MAP |                        |                | Project No./Code |  |              |
| Creation Date:            | 11/30/14                    | Initials: DRK  | <input type="checkbox"/> |  |  |                                                                                       |                                                                                                                                                                       | No Revisions:  |  |                                                                  | Designer: DRK          | Structure      |                  |  |              |
| Last Modification Date:   | 01/10/15                    | Initials: DRK  | <input type="checkbox"/> |  |  |                                                                                       |                                                                                                                                                                       | Revised:       |  |                                                                  | Detailer: DRK          | Numbers        |                  |  |              |
| Full Path:                | C:\INCLINE\Hier\SHEET 24x36 |                | <input type="checkbox"/> |  |  |                                                                                       |                                                                                                                                                                       | Void:          |  |                                                                  | Sheet Subset: DRAINAGE | Subset Sheets: | BM-3 of 3        |  | Sheet Number |
| Drawing File Name:        | BASIN?AP3?4X36.dwg          |                | <input type="checkbox"/> |  |  |                                                                                       |                                                                                                                                                                       |                |  |                                                                  |                        |                |                  |  |              |
| Acad Ver. 2010            | Scale: 1"=80'               | Units: ENGLISH | <input type="checkbox"/> |  |  |                                                                                       |                                                                                                                                                                       |                |  |                                                                  |                        |                |                  |  |              |



**PHASE III DRAINAGE REPORT  
FOR THE PLUM CREEK INVESTMENT GROUP, LLC  
WORLD COMPASS ACADEMY SITE & BURT AT CASTLE ROCK INFRASTRUCTURE  
CASTLE ROCK, COLORADO  
SDP14-0024,  
CD14-0032 AND  
CD14-0033**

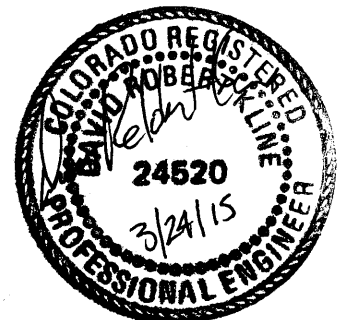
A Part of the SE ¼ of Section 15,  
Township 8 South, Range 67 West,  
of the 6<sup>th</sup> P.M., Douglas County, Colorado

December 8, 2014  
Revised January 14, 2015  
Revised February 12, 2015

***Prepared for:***  
Plum Creek Investment Group, LLC  
801 S. Perry St.  
Castle Rock, CO 80104

***Prepared by:***  
Incline Associates  
David R. Kline, P.E., PTOE  
Incline Associates  
740 Pearl Street, Suite 703  
Denver, CO 80203  
(303) 861-9331

 **INCLINE ASSOCIATES**



### Engineers Certification

"I affirm that this report and plan for the Phase III drainage design of the World Compass Academy Site & Burt at Castle Rock Infrastructure was prepared by me (or under my direct supervision) in accordance with the provisions of the Town of Castle Rock Drainage Design and Technical Criteria for the owners thereof. I understand that the Town of Castle Rock does not and will not assume liability for drainage facilities designed by others."



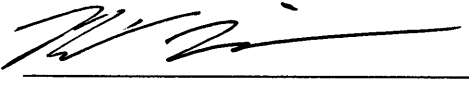
David R. Kline, P.E., PTOE  
P.E. No. 24520

3/24/15

Date

"Plum Creek Investment Group, LLC. hereby certifies that the drainage facilities for the World Compass Academy Site & Burt at Castle Rock Infrastructure shall be constructed according to the design presented in this report. I understand that the Town of Castle Rock does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the Town of Castle Rock reviews drainage plans pursuant to the Municipal Code; but cannot, on behalf of the World Compass Academy Site & Burt at Castle Rock Infrastructure, guarantee that final drainage design review will absolve Plum Creek Investment Group, LLC. and/or their successors and/or assigns of future liability for improper design."

Plum Creek Investment Group, LLC 3/25/15  
Name of Developer Date

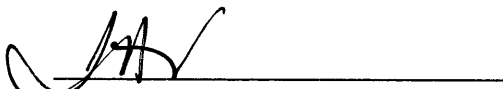


Authorized Signature

3/25/15

Date

### Town of Castle Rock (Permittee) Approvals

  
Utilities Department

3/25/15 Approved  
Date Development Services

MAR 25 2015

  
Development Services

3/25/15 Town of Castle Rock  
Date

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S1

### I. Catchment Hydrologic Data

Catchment ID = S1  
 Area = 0.98 Acres  
 Percent Imperviousness = 79.00 %  
 NRCS Soil Type = C A, B, C, or D

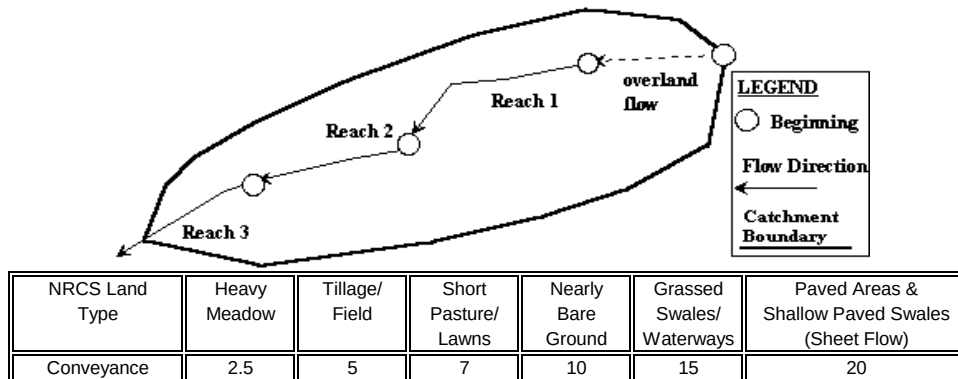
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.61  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.61  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 50                      | 0.61                               | N/A                      | 0.17                             | 4.93                                          |
| 1                             | 0.0640                    | 344                     |                                    | 20.00                    | 5.06                             | 1.13                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 394                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 6.06                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 12.19                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 6.06                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 4.60 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.57 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.60 inch/hr

Peak Flowrate,  $Q_p$  = 2.77 cfs  
 Peak Flowrate,  $Q_p$  = 2.15 cfs  
 Peak Flowrate,  $Q_p$  = 2.77 cfs



## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S1

### I. Catchment Hydrologic Data

Catchment ID = S1  
 Area = 0.98 Acres  
 Percent Imperviousness = 79.00 %  
 NRCS Soil Type = C A, B, C, or D

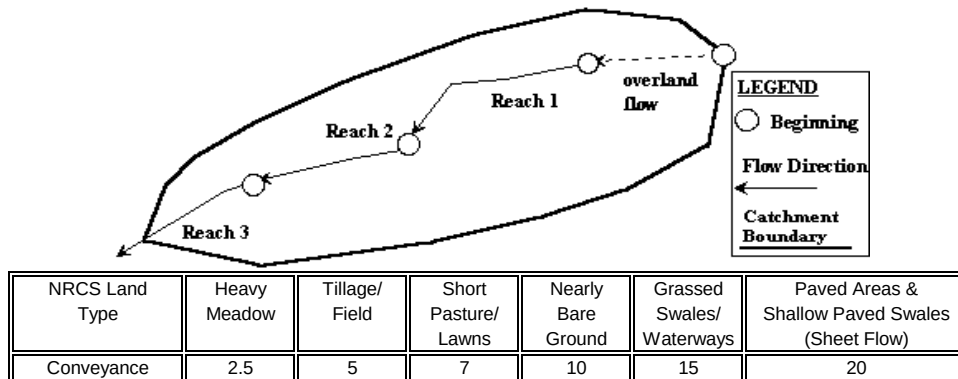
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.74  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.61  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 50                      | 0.61                               | N/A                      | 0.17                             | 4.93                                          |
| 1                             | 0.0640                    | 344                     |                                    | 20.00                    | 5.06                             | 1.13                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 394                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 6.06                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 12.19                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 6.06                                          |

### IV. Peak Runoff Prediction

|                                                                               |                                        |
|-------------------------------------------------------------------------------|----------------------------------------|
| Rainfall Intensity at Computed T <sub>c</sub> , $I$ = <u>8.36</u> inch/hr     | Peak Flowrate, $Q_p$ = <u>6.03</u> cfs |
| Rainfall Intensity at Regional T <sub>c</sub> , $I$ = <u>6.48</u> inch/hr     | Peak Flowrate, $Q_p$ = <u>4.67</u> cfs |
| Rainfall Intensity at User-Defined T <sub>c</sub> , $I$ = <u>8.36</u> inch/hr | Peak Flowrate, $Q_p$ = <u>6.03</u> cfs |

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **S2**

### I. Catchment Hydrologic Data

Catchment ID = **S2**  
 Area = **0.87** Acres  
 Percent Imperviousness = **66.00** %  
 NRCS Soil Type = **C A, B, C, or D**

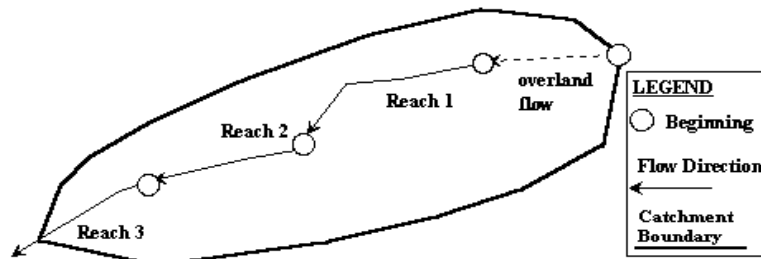
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **5** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **1.43** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.50**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.50**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



| NRCS Land Type | Heavy Meadow | Tillage/Field | Short Pasture/Lawns | Nearly Bare Ground | Grassed Swales/Waterways | Paved Areas & Shallow Paved Swales (Sheet Flow) |
|----------------|--------------|---------------|---------------------|--------------------|--------------------------|-------------------------------------------------|
| Conveyance     | 2.5          | 5             | 7                   | 10                 | 15                       | 20                                              |

Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.1887                    | 53                      | 0.50                               | N/A                      | 0.29                             | 3.00                                          |
| 1                             | 0.0396                    | 227                     |                                    | 20.00                    | 3.98                             | 0.95                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 280                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 3.95                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.56                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **5.14** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **3.65** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **4.85** inch/hr

Peak Flowrate,  $Q_p$  = **2.23** cfs  
 Peak Flowrate,  $Q_p$  = **1.58** cfs  
 Peak Flowrate,  $Q_p$  = **2.11** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **S2**

### I. Catchment Hydrologic Data

Catchment ID = **S2**  
 Area = **0.87** Acres  
 Percent Imperviousness = **66.00** %  
 NRCS Soil Type = **C A, B, C, or D**

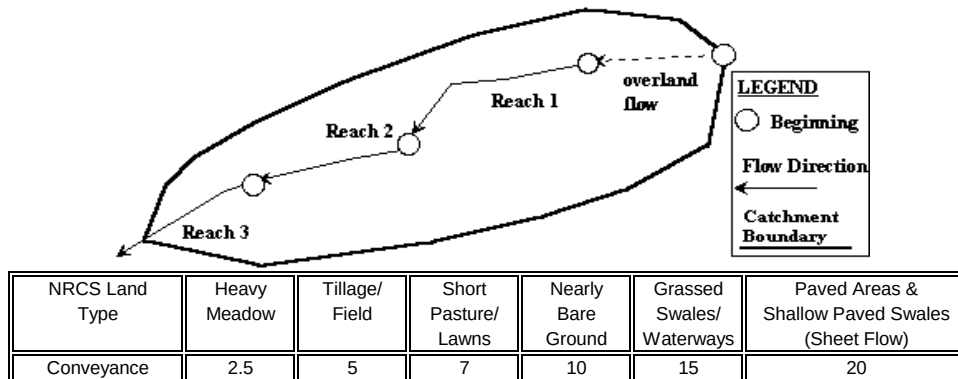
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **100** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **2.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.66**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.50**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.1887                    | 53                      | 0.50                               | N/A                      | 0.29                             | 3.00                                          |
| 1                             | 0.0396                    | 227                     |                                    | 20.00                    | 3.98                             | 0.95                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 280                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 3.95                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.56                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **9.34** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **6.63** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **8.82** inch/hr

Peak Flowrate,  $Q_p$  = **5.34** cfs  
 Peak Flowrate,  $Q_p$  = **3.79** cfs  
 Peak Flowrate,  $Q_p$  = **5.05** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S3

### I. Catchment Hydrologic Data

Catchment ID = S3  
 Area = 0.42 Acres  
 Percent Imperviousness = 97.00 %  
 NRCS Soil Type = C A, B, C, or D

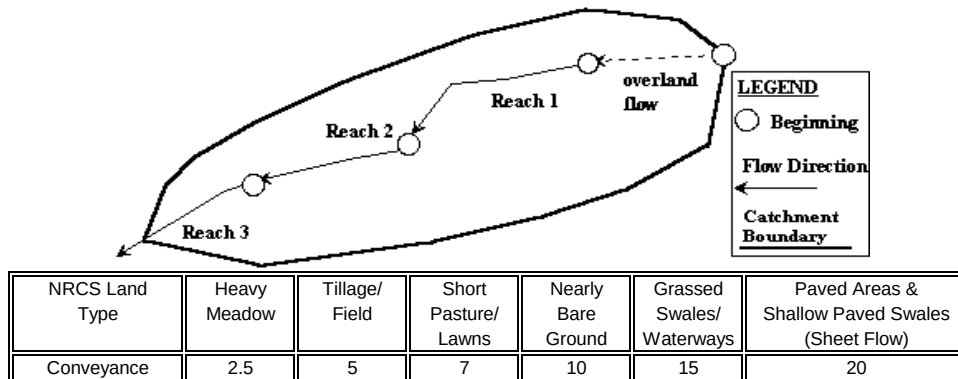
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.85  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.85  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 44                      | 0.85                               | N/A                      | 0.30                             | 2.41                                          |
| 1                             | 0.0105                    | 168                     |                                    | 20.00                    | 2.05                             | 1.37                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 212                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 3.77                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.18                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 5.19 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.70 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.85 inch/hr

Peak Flowrate,  $Q_p$  = 1.85 cfs  
 Peak Flowrate,  $Q_p$  = 1.32 cfs  
 Peak Flowrate,  $Q_p$  = 1.73 cfs



## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S3

### I. Catchment Hydrologic Data

Catchment ID = S3  
 Area = 0.42 Acres  
 Percent Imperviousness = 97.00 %  
 NRCS Soil Type = C A, B, C, or D

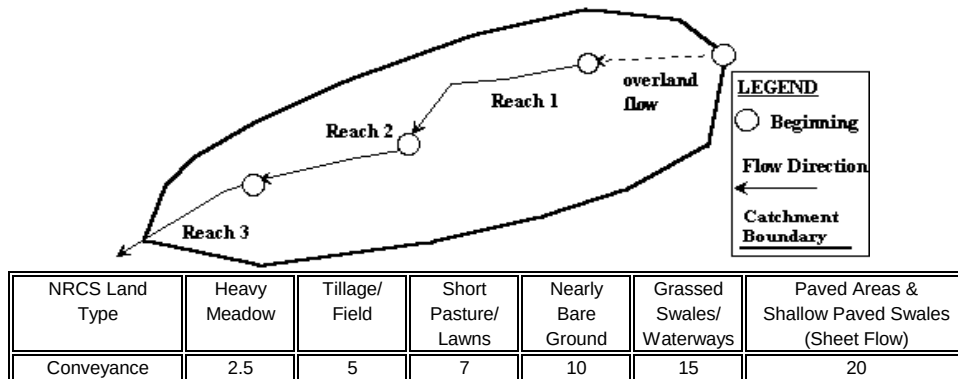
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.92  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.85  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 44                      | 0.85                               | N/A                      | 0.30                             | 2.41                                          |
| 1                             | 0.0105                    | 168                     |                                    | 20.00                    | 2.05                             | 1.37                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 212                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 3.77                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.18                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 9.43 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 6.72 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 8.82 inch/hr

Peak Flowrate,  $Q_p$  = 3.63 cfs  
 Peak Flowrate,  $Q_p$  = 2.59 cfs  
 Peak Flowrate,  $Q_p$  = 3.39 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S4

### I. Catchment Hydrologic Data

Catchment ID = S4  
 Area = 0.15 Acres  
 Percent Imperviousness = 84.00 %  
 NRCS Soil Type = C A, B, C, or D

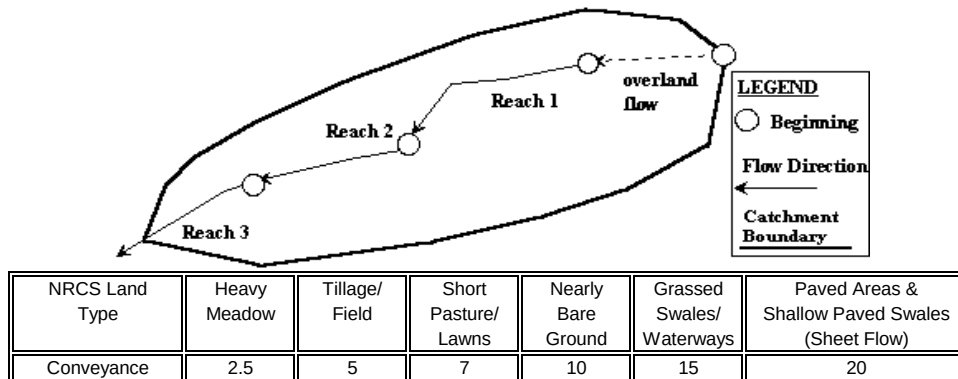
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.67  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.67  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 41                      | 0.67                               | N/A                      | 0.17                             | 3.95                                          |
| 1                             | 0.0105                    | 105                     |                                    | 20.00                    | 2.05                             | 0.85                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 146                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 4.81                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 10.81                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 4.90 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.75 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.85 inch/hr

Peak Flowrate,  $Q_p$  = 0.49 cfs  
 Peak Flowrate,  $Q_p$  = 0.38 cfs  
 Peak Flowrate,  $Q_p$  = 0.49 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S4

### I. Catchment Hydrologic Data

Catchment ID = S4  
 Area = 0.15 Acres  
 Percent Imperviousness = 84.00 %  
 NRCS Soil Type = C A, B, C, or D

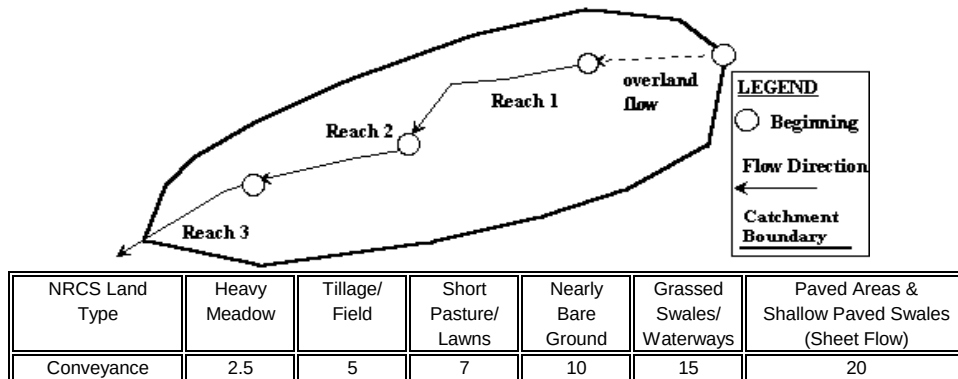
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.78  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.67  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 41                      | 0.67                               | N/A                      | 0.17                             | 3.95                                          |
| 1                             | 0.0105                    | 105                     |                                    | 20.00                    | 2.05                             | 0.85                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 146                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 4.81                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 10.81                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 8.91 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 6.82 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 8.82 inch/hr

Peak Flowrate,  $Q_p$  = 1.04 cfs  
 Peak Flowrate,  $Q_p$  = 0.79 cfs  
 Peak Flowrate,  $Q_p$  = 1.03 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S5

### I. Catchment Hydrologic Data

Catchment ID = S5  
 Area = 0.23 Acres  
 Percent Imperviousness = 96.00 %  
 NRCS Soil Type = C A, B, C, or D

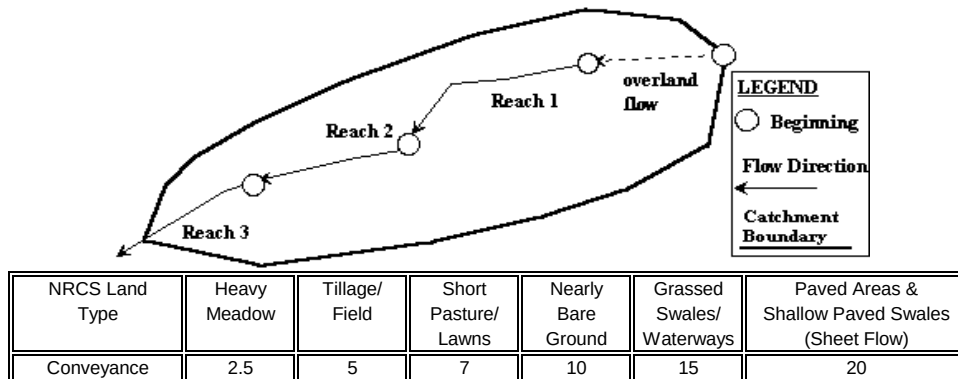
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.83  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.83  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0100                    | 53                      | 0.83                               | N/A                      | 0.25                             | 3.53                                          |
| 1                             | 0.0089                    | 144                     |                                    | 20.00                    | 1.89                             | 1.27                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 197                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 4.80                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.09                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 4.90 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.71 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.85 inch/hr

Peak Flowrate,  $Q_p$  = 0.94 cfs  
 Peak Flowrate,  $Q_p$  = 0.71 cfs  
 Peak Flowrate,  $Q_p$  = 0.93 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S5

### I. Catchment Hydrologic Data

Catchment ID = S5  
 Area = 0.23 Acres  
 Percent Imperviousness = 96.00 %  
 NRCS Soil Type = C A, B, C, or D

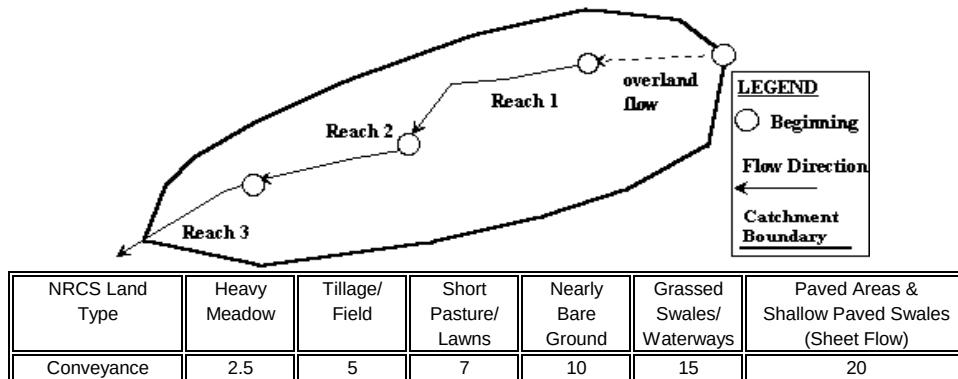
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.90  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.83  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0100                    | 53                      | 0.83                               | N/A                      | 0.25                             | 3.53                                          |
| 1                             | 0.0089                    | 144                     |                                    | 20.00                    | 1.89                             | 1.27                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 197                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 4.80                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.09                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 8.91 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 6.75 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 8.82 inch/hr

Peak Flowrate,  $Q_p$  = 1.85 cfs  
 Peak Flowrate,  $Q_p$  = 1.40 cfs  
 Peak Flowrate,  $Q_p$  = 1.83 cfs



## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S6

### I. Catchment Hydrologic Data

Catchment ID = S6  
 Area = 0.47 Acres  
 Percent Imperviousness = 79.00 %  
 NRCS Soil Type = C A, B, C, or D

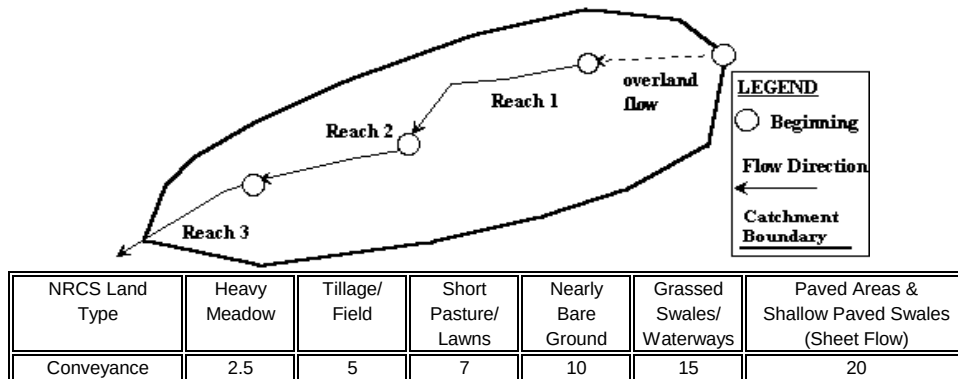
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.61  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.61  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0668                    | 38                      | 0.61                               | N/A                      | 0.22                             | 2.88                                          |
| 1                             | 0.0275                    | 82                      |                                    | 20.00                    | 3.32                             | 0.41                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 120                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 3.30                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 10.67                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 5.33 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.77 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.85 inch/hr

Peak Flowrate,  $Q_p$  = 1.54 cfs  
 Peak Flowrate,  $Q_p$  = 1.09 cfs  
 Peak Flowrate,  $Q_p$  = 1.40 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **S6**

### I. Catchment Hydrologic Data

Catchment ID = **S6**  
 Area = **0.47** Acres  
 Percent Imperviousness = **79.00** %  
 NRCS Soil Type = **C** A, B, C, or D

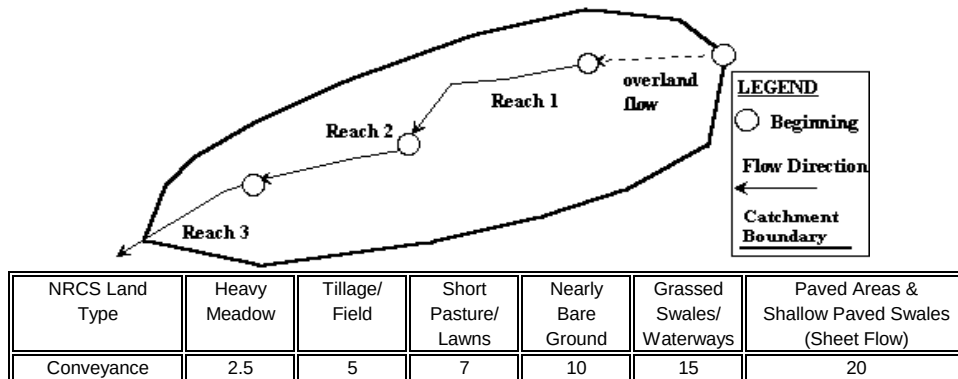
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **100** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **2.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.74**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.61**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0668                    | 38                      | 0.61                               | N/A                      | 0.22                             | 2.88                                          |
| 1                             | 0.0275                    | 82                      |                                    | 20.00                    | 3.32                             | 0.41                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 120                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 3.30                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 10.67                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **9.69** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **6.85** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **8.82** inch/hr

Peak Flowrate,  $Q_p$  = **3.35** cfs  
 Peak Flowrate,  $Q_p$  = **2.37** cfs  
 Peak Flowrate,  $Q_p$  = **3.05** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S7

### I. Catchment Hydrologic Data

Catchment ID = S7  
 Area = 0.74 Acres  
 Percent Imperviousness = 83.00 %  
 NRCS Soil Type = C A, B, C, or D

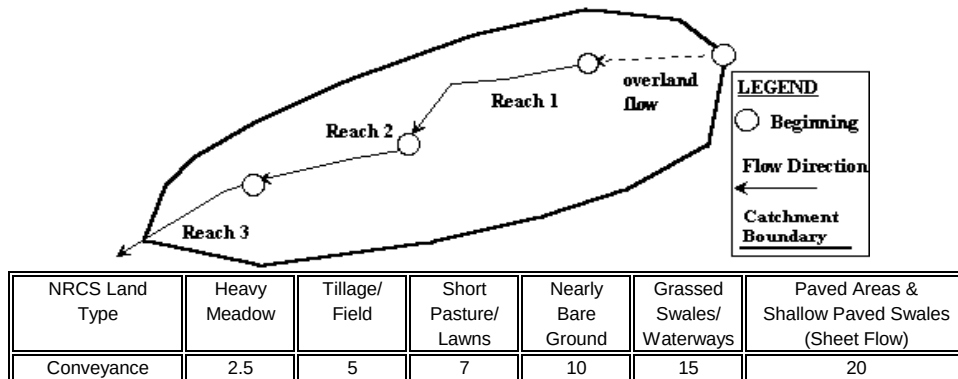
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.66  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.66  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 31                      | 0.66                               | N/A                      | 0.15                             | 3.53                                          |
| 1                             | 0.0061                    | 243                     |                                    | 20.00                    | 1.56                             | 2.59                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 274                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 6.12                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.52                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 6.12                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 4.58 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.65 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.58 inch/hr

Peak Flowrate,  $Q_p$  = 2.23 cfs  
 Peak Flowrate,  $Q_p$  = 1.78 cfs  
 Peak Flowrate,  $Q_p$  = 2.23 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S7

### I. Catchment Hydrologic Data

Catchment ID = S7  
 Area = 0.74 Acres  
 Percent Imperviousness = 83.00 %  
 NRCS Soil Type = C A, B, C, or D

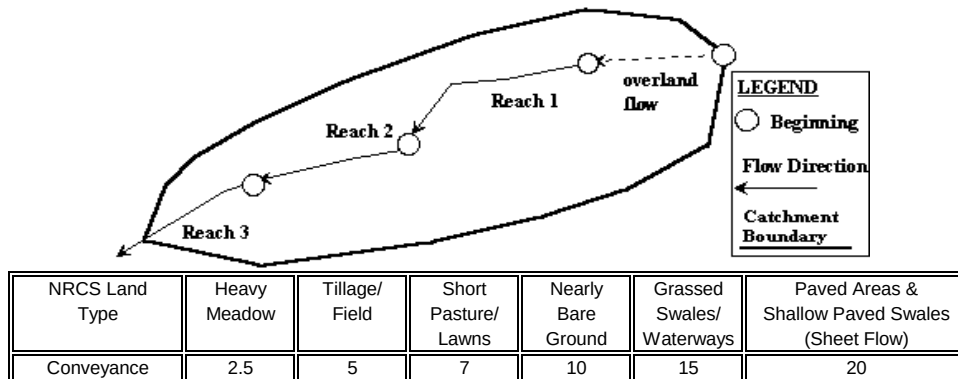
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.77  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.66  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 31                      | 0.66                               | N/A                      | 0.15                             | 3.53                                          |
| 1                             | 0.0061                    | 243                     |                                    | 20.00                    | 1.56                             | 2.59                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 274                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 6.12                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.52                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 6.12                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 8.33 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 6.64 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 8.33 inch/hr

Peak Flowrate,  $Q_p$  = 4.74 cfs  
 Peak Flowrate,  $Q_p$  = 3.77 cfs  
 Peak Flowrate,  $Q_p$  = 4.74 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S8

### I. Catchment Hydrologic Data

Catchment ID = S8  
 Area = 0.90 Acres  
 Percent Imperviousness = 100.00 %  
 NRCS Soil Type = C A, B, C, or D

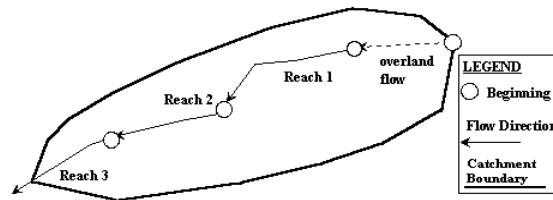
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.90  
 Override Runoff Coefficient,  $C$  =          (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.90  
 Override 5-yr. Runoff Coefficient,  $C$  =          (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



| NRCS Land Type | Heavy Meadow | Tillage/ Field | Short Pasture/ Lawns | Nearly Bare Ground | Grassed Swales/ Waterways | Paved Areas & Shallow Paved Swales (Sheet Flow) |
|----------------|--------------|----------------|----------------------|--------------------|---------------------------|-------------------------------------------------|
| Conveyance     | 2.5          | 5              | 7                    | 10                 | 15                        | 20                                              |

Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|---------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0050                    | 20                      | 0.90                            | N/A                      | 0.16                             | 2.07                                          |
| 1                             | 0.0050                    | 175                     |                                 | 20.00                    | 1.41                             | 2.06                                          |
| 2                             |                           |                         |                                 |                          |                                  |                                               |
| 3                             |                           |                         |                                 |                          |                                  |                                               |
| 4                             |                           |                         |                                 |                          |                                  |                                               |
| 5                             |                           |                         |                                 |                          |                                  |                                               |
| Sum                           |                           | 195                     |                                 |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 4.13                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 11.08                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                 |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 5.08 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.71 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.85 inch/hr

Peak Flowrate,  $Q_p$  = 4.10 cfs  
 Peak Flowrate,  $Q_p$  = 2.99 cfs  
 Peak Flowrate,  $Q_p$  = 3.91 cfs



## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **S8**

### I. Catchment Hydrologic Data

Catchment ID = **S8**  
 Area = **0.90** Acres  
 Percent Imperviousness = **100.00** %  
 NRCS Soil Type = **C** A, B, C, or D

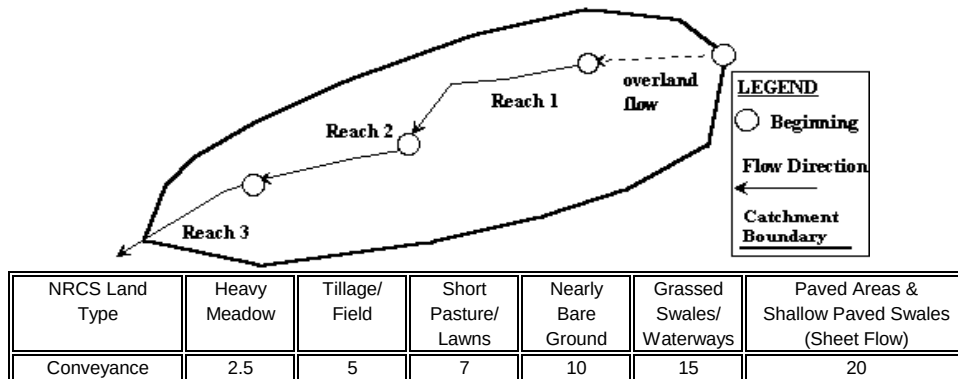
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **100** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **2.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.96**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.90**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0050                    | 20                      | 0.90                               | N/A                      | 0.16                             | 2.07                                          |
| 1                             | 0.0050                    | 175                     |                                    | 20.00                    | 1.41                             | 2.06                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 195                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 4.13                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.08                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **9.24** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **6.75** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **8.82** inch/hr

Peak Flowrate,  $Q_p$  = **7.95** cfs  
 Peak Flowrate,  $Q_p$  = **5.81** cfs  
 Peak Flowrate,  $Q_p$  = **7.59** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S9

### I. Catchment Hydrologic Data

Catchment ID = S9  
 Area = 0.68 Acres  
 Percent Imperviousness = 99.00 %  
 NRCS Soil Type = C A, B, C, or D

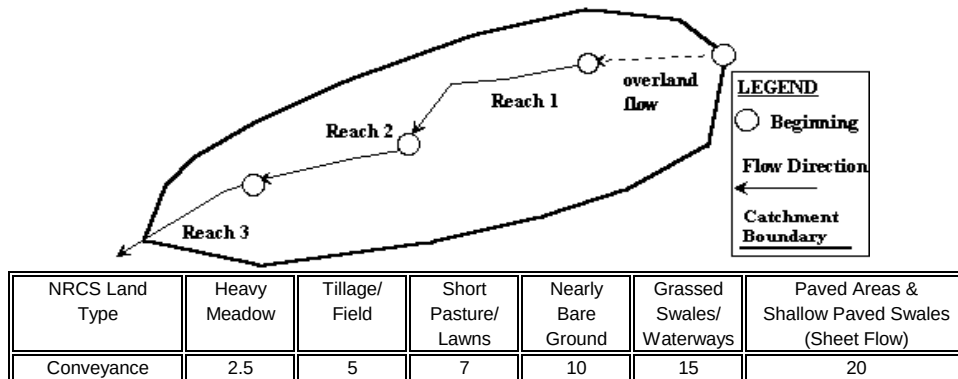
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.88  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.88  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.1310                    | 42                      | 0.88                               | N/A                      | 0.63                             | 1.10                                          |
| 1                             | 0.0084                    | 477                     |                                    | 20.00                    | 1.83                             | 4.34                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 519                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 5.44                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 12.88                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.44                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 4.74 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.48 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.74 inch/hr

Peak Flowrate,  $Q_p$  = 2.84 cfs  
 Peak Flowrate,  $Q_p$  = 2.08 cfs  
 Peak Flowrate,  $Q_p$  = 2.84 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S9

### I. Catchment Hydrologic Data

Catchment ID = S9  
 Area = 0.68 Acres  
 Percent Imperviousness = 99.00 %  
 NRCS Soil Type = C A, B, C, or D

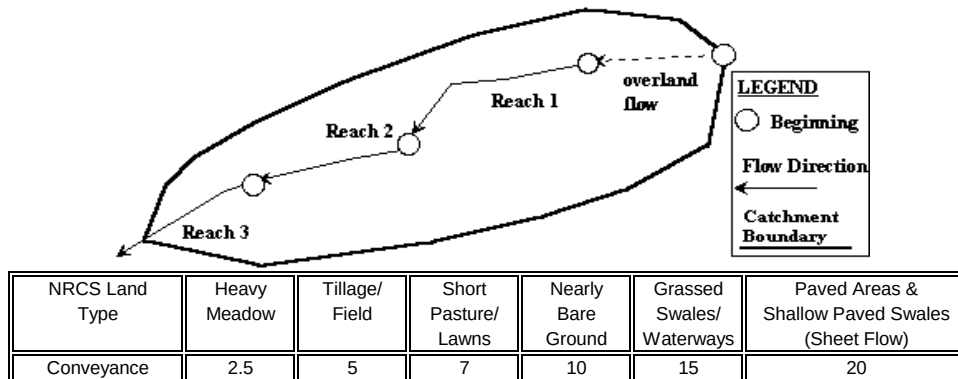
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.94  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.88  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.1310                    | 42                      | 0.88                               | N/A                      | 0.63                             | 1.10                                          |
| 1                             | 0.0084                    | 477                     |                                    | 20.00                    | 1.83                             | 4.34                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 519                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 5.44                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 12.88                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.44                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 8.62 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 6.33 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 8.62 inch/hr

Peak Flowrate,  $Q_p$  = 5.52 cfs  
 Peak Flowrate,  $Q_p$  = 4.06 cfs  
 Peak Flowrate,  $Q_p$  = 5.52 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **S10**

### I. Catchment Hydrologic Data

Catchment ID = **S10**  
 Area = **0.48** Acres  
 Percent Imperviousness = **98.00** %  
 NRCS Soil Type = **C** A, B, C, or D

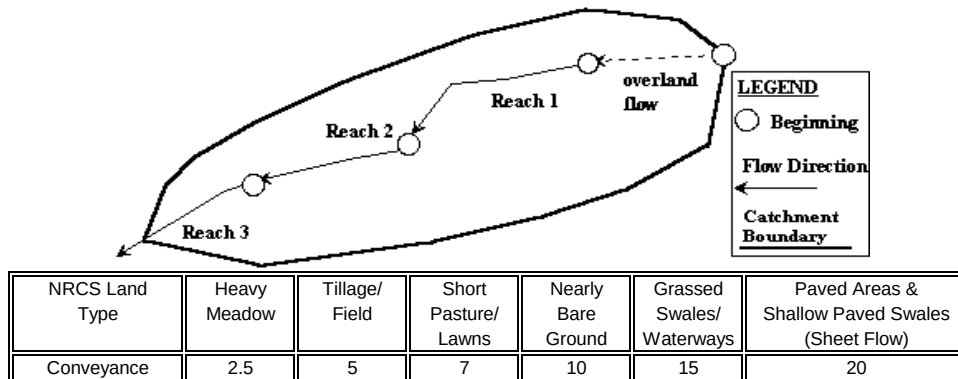
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **5** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **1.43** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.86**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.86**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0240                    | 54                      | 0.86                               | N/A                      | 0.38                             | 2.35                                          |
| 1                             | 0.0086                    | 154                     |                                    | 20.00                    | 1.85                             | 1.38                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 208                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 3.74                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.16                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

|                                                                               |                                        |
|-------------------------------------------------------------------------------|----------------------------------------|
| Rainfall Intensity at Computed T <sub>c</sub> , $I$ = <b>5.20</b> inch/hr     | Peak Flowrate, $Q_p$ = <b>2.15</b> cfs |
| Rainfall Intensity at Regional T <sub>c</sub> , $I$ = <b>3.70</b> inch/hr     | Peak Flowrate, $Q_p$ = <b>1.53</b> cfs |
| Rainfall Intensity at User-Defined T <sub>c</sub> , $I$ = <b>4.85</b> inch/hr | Peak Flowrate, $Q_p$ = <b>2.01</b> cfs |

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **S10**

### I. Catchment Hydrologic Data

Catchment ID = **S10**  
 Area = **0.48** Acres  
 Percent Imperviousness = **98.00** %  
 NRCS Soil Type = **C** A, B, C, or D

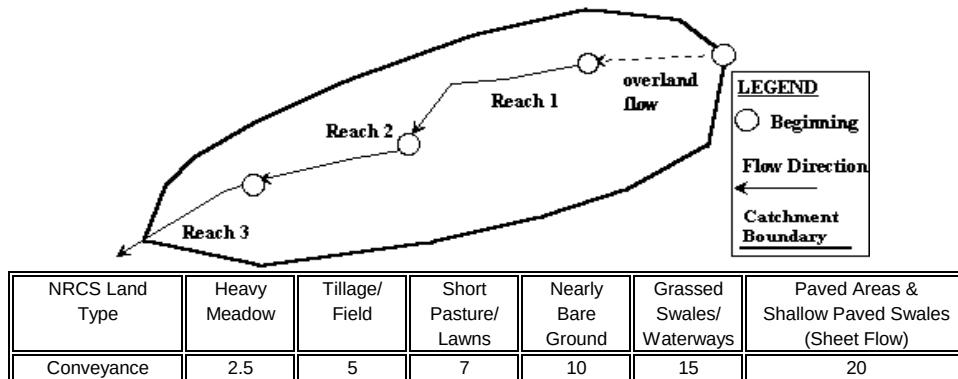
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **100** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **2.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.93**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.86**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0240                    | 54                      | 0.86                               | N/A                      | 0.38                             | 2.35                                          |
| 1                             | 0.0086                    | 154                     |                                    | 20.00                    | 1.85                             | 1.38                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 208                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 3.74                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.16                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **9.45** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **6.73** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **8.82** inch/hr

Peak Flowrate,  $Q_p$  = **4.21** cfs  
 Peak Flowrate,  $Q_p$  = **3.00** cfs  
 Peak Flowrate,  $Q_p$  = **3.93** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: S11

### I. Catchment Hydrologic Data

Catchment ID = S11  
 Area = 2.00 Acres  
 Percent Imperviousness = 0.00 %  
 NRCS Soil Type = C A, B, C, or D

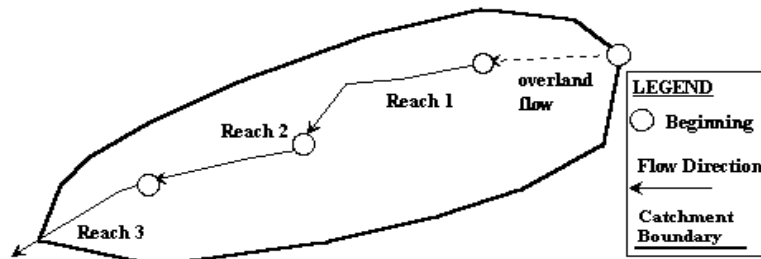
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.15  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.15  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



| NRCS Land Type | Heavy Meadow | Tillage/Field | Short Pasture/Lawns | Nearly Bare Ground | Grassed Swales/Waterways | Paved Areas & Shallow Paved Swales (Sheet Flow) |
|----------------|--------------|---------------|---------------------|--------------------|--------------------------|-------------------------------------------------|
| Conveyance     | 2.5          | 5             | 7                   | 10                 | 15                       | 20                                              |

Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.1154                    | 13                      | 0.15                               | N/A                      | 0.08                             | 2.76                                          |
| 1                             | 0.0060                    | 500                     |                                    | 20.00                    | 1.55                             | 5.38                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 513                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 8.14                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 12.85                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 8.14                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 4.18 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.48 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.18 inch/hr

Peak Flowrate,  $Q_p$  = 1.25 cfs  
 Peak Flowrate,  $Q_p$  = 1.05 cfs  
 Peak Flowrate,  $Q_p$  = 1.25 cfs



## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **S11**

### I. Catchment Hydrologic Data

Catchment ID = **S11**  
 Area = **2.00** Acres  
 Percent Imperviousness = **0.00** %  
 NRCS Soil Type = **C** A, B, C, or D

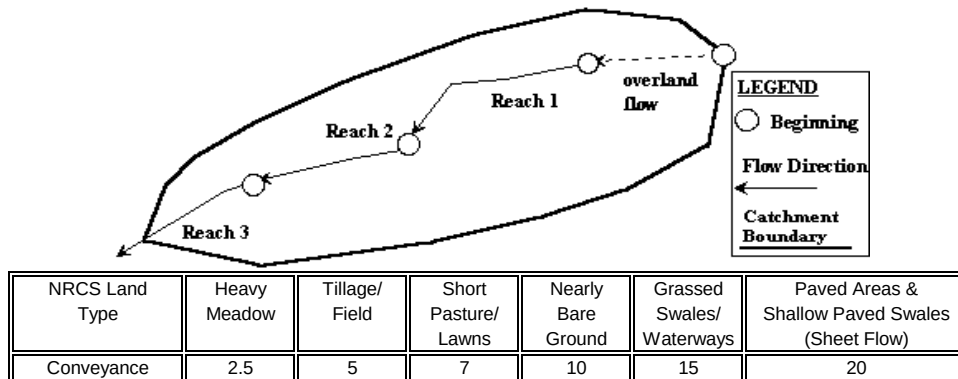
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **100** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **2.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.50**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.15**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.1154                    | 13                      | 0.15                               | N/A                      | 0.08                             | 2.76                                          |
| 1                             | 0.0060                    | 500                     |                                    | 20.00                    | 1.55                             | 5.38                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 513                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 8.14                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 12.85                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 8.14                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **7.60** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **6.33** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **7.60** inch/hr

Peak Flowrate,  $Q_p$  = **7.60** cfs  
 Peak Flowrate,  $Q_p$  = **6.33** cfs  
 Peak Flowrate,  $Q_p$  = **7.60** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I1

### I. Catchment Hydrologic Data

Catchment ID = I1  
 Area = 0.35 Acres  
 Percent Imperviousness = 93.00 %  
 NRCS Soil Type = C A, B, C, or D

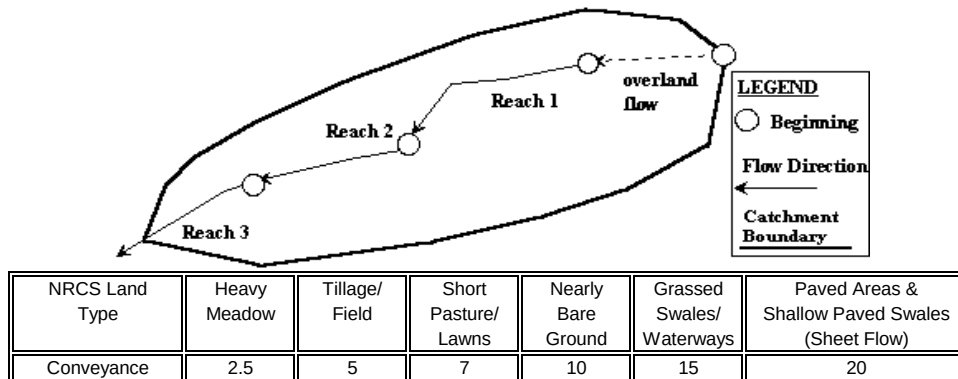
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.79  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.79  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 34                      | 0.79                               | N/A                      | 0.22                             | 2.62                                          |
| 1                             | 0.0341                    | 293                     |                                    | 20.00                    | 3.69                             | 1.32                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 327                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 3.94                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.82                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 5.14 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.61 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.85 inch/hr

Peak Flowrate,  $Q_p$  = 1.42 cfs  
 Peak Flowrate,  $Q_p$  = 1.00 cfs  
 Peak Flowrate,  $Q_p$  = 1.34 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I1

### I. Catchment Hydrologic Data

Catchment ID = I1  
 Area = 0.35 Acres  
 Percent Imperviousness = 93.00 %  
 NRCS Soil Type = C A, B, C, or D

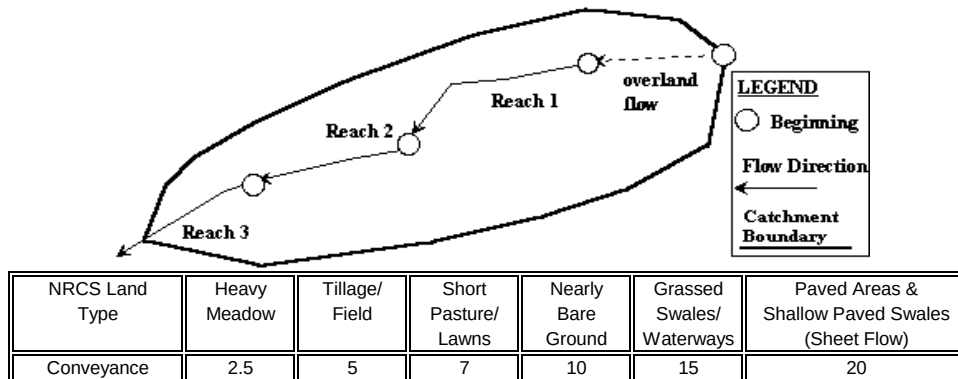
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.87  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.79  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 34                      | 0.79                               | N/A                      | 0.22                             | 2.62                                          |
| 1                             | 0.0341                    | 293                     |                                    | 20.00                    | 3.69                             | 1.32                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 327                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 3.94                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.82                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 9.34 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 6.57 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 8.82 inch/hr

Peak Flowrate,  $Q_p$  = 2.84 cfs  
 Peak Flowrate,  $Q_p$  = 1.99 cfs  
 Peak Flowrate,  $Q_p$  = 2.68 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I2

### I. Catchment Hydrologic Data

Catchment ID = I2  
 Area = 0.44 Acres  
 Percent Imperviousness = 93.00 %  
 NRCS Soil Type = C A, B, C, or D

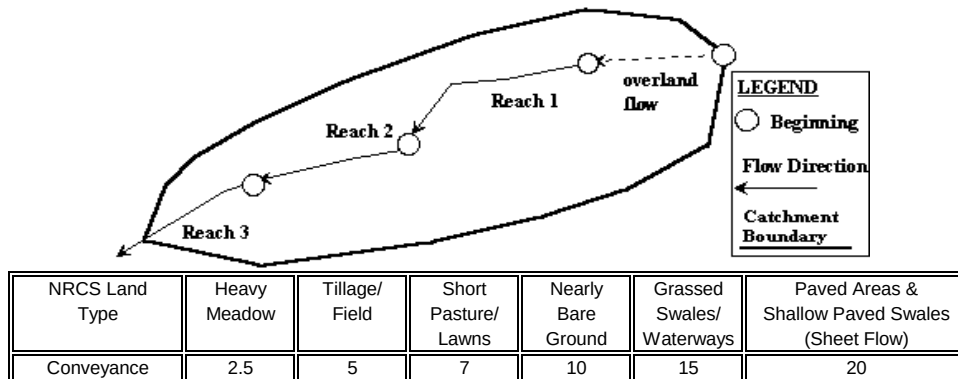
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.79  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.79  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 96                      | 0.79                               | N/A                      | 0.36                             | 4.40                                          |
| 1                             | 0.0231                    | 455                     |                                    | 20.00                    | 3.04                             | 2.49                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 551                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 6.90                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 13.06                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 6.90                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 4.42 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.46 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.42 inch/hr

Peak Flowrate,  $Q_p$  = 1.53 cfs  
 Peak Flowrate,  $Q_p$  = 1.20 cfs  
 Peak Flowrate,  $Q_p$  = 1.53 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I2

### I. Catchment Hydrologic Data

Catchment ID = I2  
 Area = 0.44 Acres  
 Percent Imperviousness = 93.00 %  
 NRCS Soil Type = C A, B, C, or D

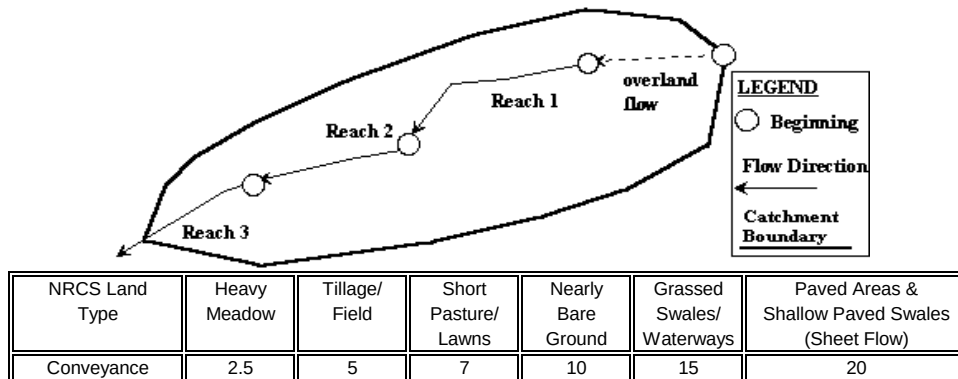
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.87  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.79  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 96                      | 0.79                               | N/A                      | 0.36                             | 4.40                                          |
| 1                             | 0.0231                    | 455                     |                                    | 20.00                    | 3.04                             | 2.49                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 551                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 6.90                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 13.06                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 6.90                                          |

### IV. Peak Runoff Prediction

|                                                                               |                                        |
|-------------------------------------------------------------------------------|----------------------------------------|
| Rainfall Intensity at Computed T <sub>c</sub> , $I$ = <u>8.03</u> inch/hr     | Peak Flowrate, $Q_p$ = <u>3.06</u> cfs |
| Rainfall Intensity at Regional T <sub>c</sub> , $I$ = <u>6.29</u> inch/hr     | Peak Flowrate, $Q_p$ = <u>2.40</u> cfs |
| Rainfall Intensity at User-Defined T <sub>c</sub> , $I$ = <u>8.03</u> inch/hr | Peak Flowrate, $Q_p$ = <u>3.06</u> cfs |

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I3

### I. Catchment Hydrologic Data

Catchment ID = I3  
 Area = 0.55 Acres  
 Percent Imperviousness = 94.00 %  
 NRCS Soil Type = C A, B, C, or D

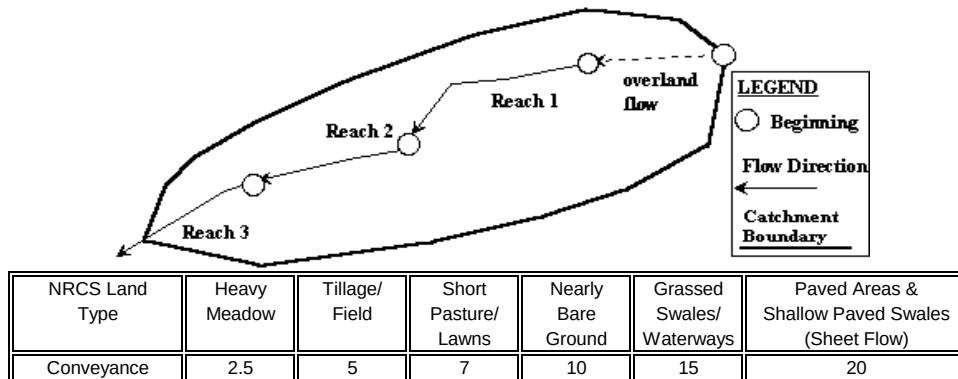
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.80  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.80  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 49                      | 0.80                               | N/A                      | 0.27                             | 3.00                                          |
| 1                             | 0.0257                    | 545                     |                                    | 20.00                    | 3.21                             | 2.83                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 594                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 5.83                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 13.30                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.83                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 4.65 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.43 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.65 inch/hr

Peak Flowrate,  $Q_p$  = 2.05 cfs  
 Peak Flowrate,  $Q_p$  = 1.51 cfs  
 Peak Flowrate,  $Q_p$  = 2.05 cfs



## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **I3**

### I. Catchment Hydrologic Data

Catchment ID = **I3**  
 Area = **0.55** Acres  
 Percent Imperviousness = **94.00** %  
 NRCS Soil Type = **C** A, B, C, or D

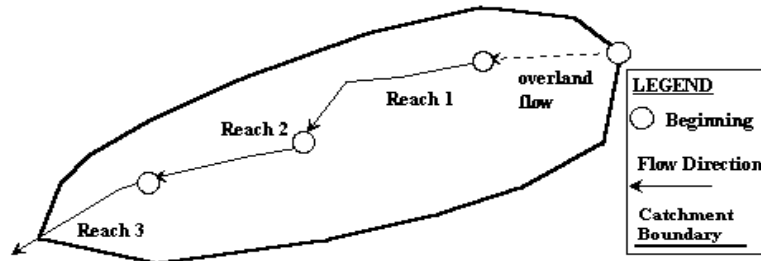
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **100** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **2.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.88**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.80**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



| NRCS Land Type | Heavy Meadow | Tillage/Field | Short Pasture/Lawns | Nearly Bare Ground | Grassed Swales/Waterways | Paved Areas & Shallow Paved Swales (Sheet Flow) |
|----------------|--------------|---------------|---------------------|--------------------|--------------------------|-------------------------------------------------|
| Conveyance     | 2.5          | 5             | 7                   | 10                 | 15                       | 20                                              |

Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 49                      | 0.80                               | N/A                      | 0.27                             | 3.00                                          |
| 1                             | 0.0257                    | 545                     |                                    | 20.00                    | 3.21                             | 2.83                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 594                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 5.83                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 13.30                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.83                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **8.45** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **6.24** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **8.45** inch/hr

Peak Flowrate,  $Q_p$  = **4.09** cfs  
 Peak Flowrate,  $Q_p$  = **3.02** cfs  
 Peak Flowrate,  $Q_p$  = **4.09** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I4

### I. Catchment Hydrologic Data

Catchment ID = I4  
 Area = 0.18 Acres  
 Percent Imperviousness = 93.00 %  
 NRCS Soil Type = C A, B, C, or D

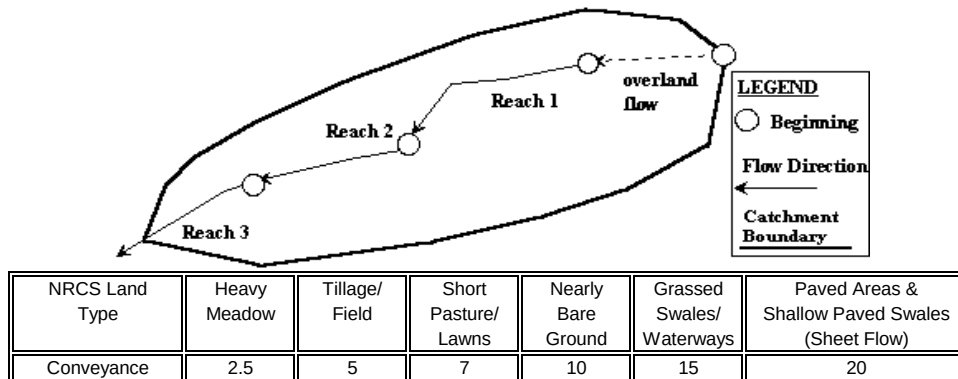
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.79  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.79  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 36                      | 0.79                               | N/A                      | 0.22                             | 2.70                                          |
| 1                             | 0.0101                    | 191                     |                                    | 20.00                    | 2.01                             | 1.58                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 227                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 4.28                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.26                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 5.04 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.69 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.85 inch/hr

Peak Flowrate,  $Q_p$  = 0.71 cfs  
 Peak Flowrate,  $Q_p$  = 0.52 cfs  
 Peak Flowrate,  $Q_p$  = 0.69 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I4

### I. Catchment Hydrologic Data

Catchment ID = I4  
 Area = 0.18 Acres  
 Percent Imperviousness = 93.00 %  
 NRCS Soil Type = C A, B, C, or D

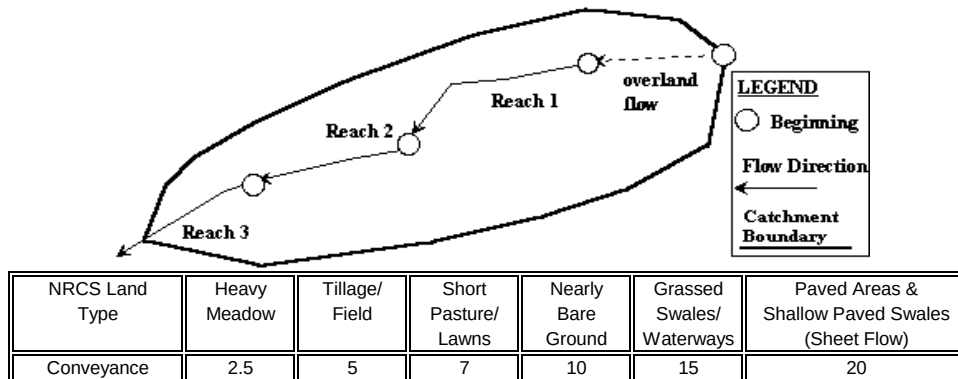
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.87  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.79  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 36                      | 0.79                               | N/A                      | 0.22                             | 2.70                                          |
| 1                             | 0.0101                    | 191                     |                                    | 20.00                    | 2.01                             | 1.58                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 227                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 4.28                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 11.26                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 9.17 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 6.70 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 8.82 inch/hr

Peak Flowrate,  $Q_p$  = 1.43 cfs  
 Peak Flowrate,  $Q_p$  = 1.05 cfs  
 Peak Flowrate,  $Q_p$  = 1.38 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I5

### I. Catchment Hydrologic Data

Catchment ID = I5  
 Area = 0.11 Acres  
 Percent Imperviousness = 94.00 %  
 NRCS Soil Type = C A, B, C, or D

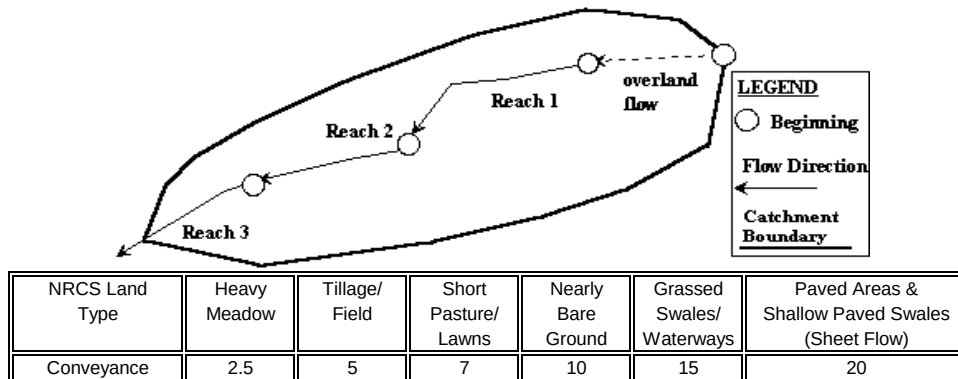
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.80  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.80  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 36                      | 0.80                               | N/A                      | 0.23                             | 2.57                                          |
| 1                             | 0.0101                    | 120                     |                                    | 20.00                    | 2.01                             | 1.00                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 156                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 3.57                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 10.87                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 5.25 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.74 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.85 inch/hr

Peak Flowrate,  $Q_p$  = 0.46 cfs  
 Peak Flowrate,  $Q_p$  = 0.33 cfs  
 Peak Flowrate,  $Q_p$  = 0.43 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **I5**

### I. Catchment Hydrologic Data

Catchment ID = **I5**  
 Area = **0.11** Acres  
 Percent Imperviousness = **94.00** %  
 NRCS Soil Type = **C** A, B, C, or D

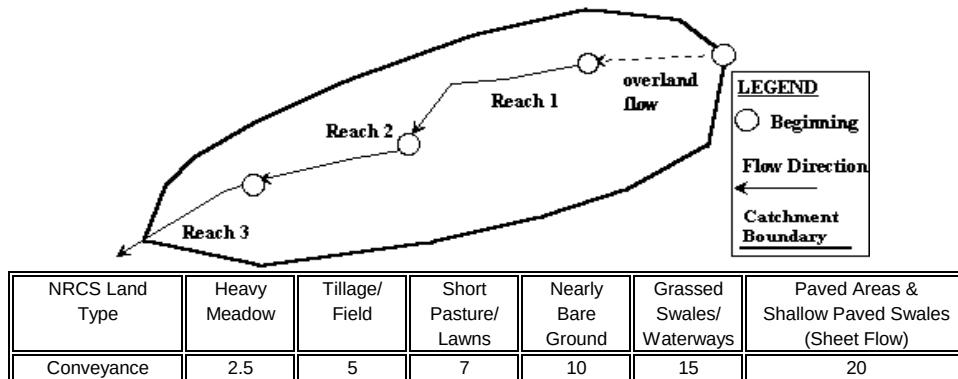
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **100** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **2.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.88**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.80**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 36                      | 0.80                               | N/A                      | 0.23                             | 2.57                                          |
| 1                             | 0.0101                    | 120                     |                                    | 20.00                    | 2.01                             | 1.00                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 156                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 3.57                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 10.87                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **9.54** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **6.80** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **8.82** inch/hr

Peak Flowrate,  $Q_p$  = **0.92** cfs  
 Peak Flowrate,  $Q_p$  = **0.66** cfs  
 Peak Flowrate,  $Q_p$  = **0.85** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I6

### I. Catchment Hydrologic Data

Catchment ID = I6  
 Area = 0.83 Acres  
 Percent Imperviousness = 94.00 %  
 NRCS Soil Type = C A, B, C, or D

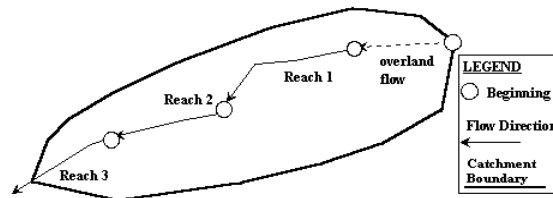
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.80  
 Override Runoff Coefficient,  $C$  =          (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.80  
 Override 5-yr. Runoff Coefficient,  $C$  =          (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



| NRCS Land Type | Heavy Meadow | Tillage/ Field | Short Pasture/ Lawns | Nearly Bare Ground | Grassed Swales/ Waterways | Paved Areas & Shallow Paved Swales (Sheet Flow) |
|----------------|--------------|----------------|----------------------|--------------------|---------------------------|-------------------------------------------------|
| Conveyance     | 2.5          | 5              | 7                    | 10                 | 15                        | 20                                              |

Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|---------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 97                      | 0.80                            | N/A                      | 0.38                             | 4.22                                          |
| 1                             | 0.0097                    | 413                     |                                 | 20.00                    | 1.97                             | 3.49                                          |
| 2                             |                           |                         |                                 |                          |                                  |                                               |
| 3                             |                           |                         |                                 |                          |                                  |                                               |
| 4                             |                           |                         |                                 |                          |                                  |                                               |
| 5                             |                           |                         |                                 |                          |                                  |                                               |
| Sum                           |                           | 510                     |                                 |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 7.71                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 12.83                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                 |                          |                                  | 7.71                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 4.26 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.49 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.26 inch/hr  
 Peak Flowrate,  $Q_p$  = 2.83 cfs  
 Peak Flowrate,  $Q_p$  = 2.32 cfs  
 Peak Flowrate,  $Q_p$  = 2.83 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I6

### I. Catchment Hydrologic Data

Catchment ID = I6  
 Area = 0.83 Acres  
 Percent Imperviousness = 94.00 %  
 NRCS Soil Type = C A, B, C, or D

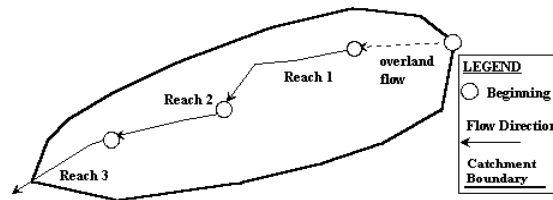
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.88  
 Override Runoff Coefficient,  $C$  =          (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.80  
 Override 5-yr. Runoff Coefficient,  $C$  =          (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



| NRCS Land Type | Heavy Meadow | Tillage/Field | Short Pasture/Lawns | Nearly Bare Ground | Grassed Swales/Waterways | Paved Areas & Shallow Paved Swales (Sheet Flow) |
|----------------|--------------|---------------|---------------------|--------------------|--------------------------|-------------------------------------------------|
| Conveyance     | 2.5          | 5             | 7                   | 10                 | 15                       | 20                                              |

Calculations:

| Reach ID                      | Slope S<br>ft/ft | Length L<br>ft | 5-yr Runoff Coeff C-5 | NRCS Conveyance | Flow Velocity V<br>fps | Flow Time T <sub>f</sub><br>minutes |
|-------------------------------|------------------|----------------|-----------------------|-----------------|------------------------|-------------------------------------|
| Overland                      | input            | input          | output                | input           | output                 | output                              |
| 1                             | 0.0200           | 97             | 0.80                  | N/A             | 0.38                   | 4.22                                |
| 2                             | 0.0097           | 413            |                       | 20.00           | 1.97                   | 3.49                                |
| 3                             |                  |                |                       |                 |                        |                                     |
| 4                             |                  |                |                       |                 |                        |                                     |
| 5                             |                  |                |                       |                 |                        |                                     |
| Sum                           |                  | 510            |                       |                 |                        |                                     |
| Computed T <sub>c</sub> =     |                  |                |                       |                 |                        | 7.71                                |
| Regional T <sub>c</sub> =     |                  |                |                       |                 |                        | 12.83                               |
| User-Entered T <sub>c</sub> = |                  |                |                       |                 |                        | 7.71                                |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 7.74 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 6.34 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 7.74 inch/hr

Peak Flowrate,  $Q_p$  = 5.65 cfs  
 Peak Flowrate,  $Q_p$  = 4.63 cfs  
 Peak Flowrate,  $Q_p$  = 5.65 cfs



## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I7

### I. Catchment Hydrologic Data

Catchment ID = I7  
 Area = 0.16 Acres  
 Percent Imperviousness = 94.00 %  
 NRCS Soil Type = C A, B, C, or D

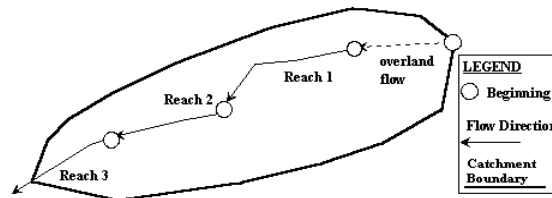
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.80  
 Override Runoff Coefficient,  $C$  =          (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.80  
 Override 5-yr. Runoff Coefficient,  $C$  =          (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



| NRCS Land Type | Heavy Meadow | Tillage/Field | Short Pasture/Lawns | Nearly Bare Ground | Grassed Swales/Waterways | Paved Areas & Shallow Paved Swales (Sheet Flow) |
|----------------|--------------|---------------|---------------------|--------------------|--------------------------|-------------------------------------------------|
| Conveyance     | 2.5          | 5             | 7                   | 10                 | 15                       | 20                                              |

Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|---------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 46                      | 0.80                            | N/A                      | 0.26                             | 2.91                                          |
| 1                             | 0.0077                    | 130                     |                                 | 20.00                    | 1.75                             | 1.23                                          |
| 2                             |                           |                         |                                 |                          |                                  |                                               |
| 3                             |                           |                         |                                 |                          |                                  |                                               |
| 4                             |                           |                         |                                 |                          |                                  |                                               |
| 5                             |                           |                         |                                 |                          |                                  |                                               |
| Sum                           |                           | 176                     |                                 |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 4.14                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 10.98                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                 |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 5.08 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.73 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.85 inch/hr

Peak Flowrate,  $Q_p$  = 0.65 cfs  
 Peak Flowrate,  $Q_p$  = 0.48 cfs  
 Peak Flowrate,  $Q_p$  = 0.62 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I7

### I. Catchment Hydrologic Data

Catchment ID = I7  
 Area = 0.16 Acres  
 Percent Imperviousness = 94.00 %  
 NRCS Soil Type = C A, B, C, or D

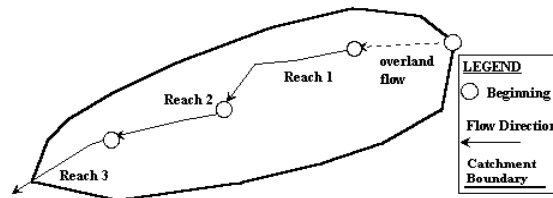
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.88  
 Override Runoff Coefficient,  $C$  =            (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.80  
 Override 5-yr. Runoff Coefficient,  $C$  =            (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



| NRCS Land Type | Heavy Meadow | Tillage/Field | Short Pasture/Lawns | Nearly Bare Ground | Grassed Swales/Waterways | Paved Areas & Shallow Paved Swales (Sheet Flow) |
|----------------|--------------|---------------|---------------------|--------------------|--------------------------|-------------------------------------------------|
| Conveyance     | 2.5          | 5             | 7                   | 10                 | 15                       | 20                                              |

Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 46                      | 0.80                               | N/A                      | 0.26                             | 2.91                                          |
| 1                             | 0.0077                    | 130                     |                                    | 20.00                    | 1.75                             | 1.23                                          |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 176                     |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 4.14                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 10.98                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 9.24 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 6.77 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 8.82 inch/hr

Peak Flowrate,  $Q_p$  = 1.30 cfs  
 Peak Flowrate,  $Q_p$  = 0.95 cfs  
 Peak Flowrate,  $Q_p$  = 1.24 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I8

### I. Catchment Hydrologic Data

Catchment ID = I8  
 Area = 0.24 Acres  
 Percent Imperviousness = 97.00 %  
 NRCS Soil Type = C A, B, C, or D

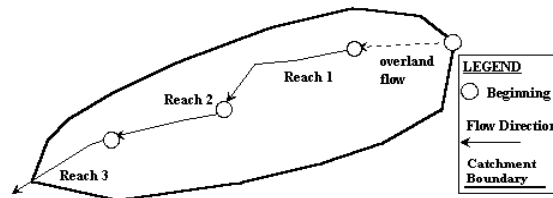
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.85  
 Override Runoff Coefficient,  $C$  =          (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.85  
 Override 5-yr. Runoff Coefficient,  $C$  =          (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



| NRCS Land Type | Heavy Meadow | Tillage/ Field | Short Pasture/ Lawns | Nearly Bare Ground | Grassed Swales/ Waterways | Paved Areas & Shallow Paved Swales (Sheet Flow) |
|----------------|--------------|----------------|----------------------|--------------------|---------------------------|-------------------------------------------------|
| Conveyance     | 2.5          | 5              | 7                    | 10                 | 15                        | 20                                              |

Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|---------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 20                      | 0.85                            | N/A                      | 0.21                             | 1.62                                          |
| 1                             | 0.0095                    | 148                     |                                 | 20.00                    | 1.95                             | 1.27                                          |
| 2                             |                           |                         |                                 |                          |                                  |                                               |
| 3                             |                           |                         |                                 |                          |                                  |                                               |
| 4                             |                           |                         |                                 |                          |                                  |                                               |
| 5                             |                           |                         |                                 |                          |                                  |                                               |
| Sum                           |                           | 168                     |                                 |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 2.89                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 10.93                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                 |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 5.46 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.73 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 4.85 inch/hr

Peak Flowrate,  $Q_p$  = 1.11 cfs  
 Peak Flowrate,  $Q_p$  = 0.76 cfs  
 Peak Flowrate,  $Q_p$  = 0.99 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Phase I - Site & Phase II - Infrastructure  
 Catchment ID: I8

### I. Catchment Hydrologic Data

Catchment ID = I8  
 Area = 0.24 Acres  
 Percent Imperviousness = 97.00 %  
 NRCS Soil Type = C A, B, C, or D

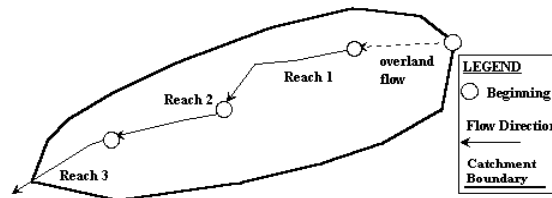
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.92  
 Override Runoff Coefficient,  $C$  =          (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.85  
 Override 5-yr. Runoff Coefficient,  $C$  =          (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



| NRCS Land Type | Heavy Meadow | Tillage/ Field | Short Pasture/ Lawns | Nearly Bare Ground | Grassed Swales/ Waterways | Paved Areas & Shallow Paved Swales (Sheet Flow) |
|----------------|--------------|----------------|----------------------|--------------------|---------------------------|-------------------------------------------------|
| Conveyance     | 2.5          | 5              | 7                    | 10                 | 15                        | 20                                              |

Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|---------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.0200                    | 20                      | 0.85                            | N/A                      | 0.21                             | 1.62                                          |
| 1                             | 0.0095                    | 148                     |                                 | 20.00                    | 1.95                             | 1.27                                          |
| 2                             |                           |                         |                                 |                          |                                  |                                               |
| 3                             |                           |                         |                                 |                          |                                  |                                               |
| 4                             |                           |                         |                                 |                          |                                  |                                               |
| 5                             |                           |                         |                                 |                          |                                  |                                               |
| Sum                           |                           | 168                     |                                 |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 2.89                                          |
| Regional T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 10.93                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                 |                          |                                  | 5.00                                          |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 9.93 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 6.79 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 8.82 inch/hr

Peak Flowrate,  $Q_p$  = 2.18 cfs  
 Peak Flowrate,  $Q_p$  = 1.49 cfs  
 Peak Flowrate,  $Q_p$  = 1.94 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **F1**

### I. Catchment Hydrologic Data

Catchment ID = **F1**  
 Area = **12.41** Acres  
 Percent Imperviousness = **0.00** %  
 NRCS Soil Type = **C** A, B, C, or D

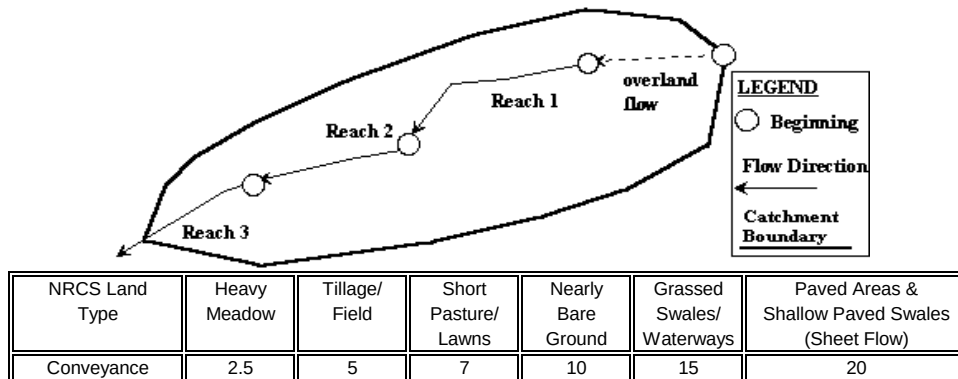
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **5** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **1.43** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.15**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.15**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.1121                    | 107                     | 0.15                               | N/A                      | 0.22                             | 7.99                                          |
| 1                             | 0.0148                    | 1,168                   |                                    | 15.00                    | 1.82                             | 10.67                                         |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 1,275                   |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 18.66                                         |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 17.08                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 17.08                                         |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **2.92** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **3.05** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **3.05** inch/hr

Peak Flowrate,  $Q_p$  = **5.43** cfs  
 Peak Flowrate,  $Q_p$  = **5.68** cfs  
 Peak Flowrate,  $Q_p$  = **5.68** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **F1**

### I. Catchment Hydrologic Data

Catchment ID = **F1**  
 Area = **12.41** Acres  
 Percent Imperviousness = **0.00** %  
 NRCS Soil Type = **C** A, B, C, or D

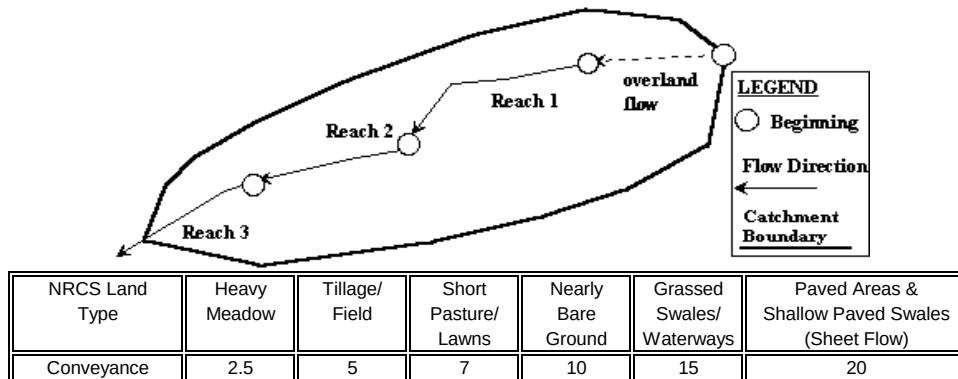
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **100** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **2.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.50**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.15**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.1121                    | 107                     | 0.15                               | N/A                      | 0.22                             | 7.99                                          |
| 1                             | 0.0148                    | 1,168                   |                                    | 15.00                    | 1.82                             | 10.67                                         |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 1,275                   |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 18.66                                         |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 17.08                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 17.08                                         |

### IV. Peak Runoff Prediction

|                                                                               |                                         |
|-------------------------------------------------------------------------------|-----------------------------------------|
| Rainfall Intensity at Computed T <sub>c</sub> , $I$ = <b>5.30</b> inch/hr     | Peak Flowrate, $Q_p$ = <b>32.90</b> cfs |
| Rainfall Intensity at Regional T <sub>c</sub> , $I$ = <b>5.54</b> inch/hr     | Peak Flowrate, $Q_p$ = <b>34.40</b> cfs |
| Rainfall Intensity at User-Defined T <sub>c</sub> , $I$ = <b>5.54</b> inch/hr | Peak Flowrate, $Q_p$ = <b>34.40</b> cfs |

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title:   
 Catchment ID: OS3

### I. Catchment Hydrologic Data

Catchment ID = OS3  
 Area = 1.70 Acres  
 Percent Imperviousness = 46.00 %  
 NRCS Soil Type = C A, B, C, or D

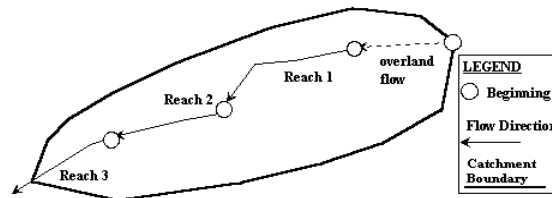
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 5 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.38  
 Override Runoff Coefficient,  $C$  =  (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.38  
 Override 5-yr. Runoff Coefficient,  $C$  =  (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



| NRCS Land Type | Heavy Meadow | Tillage/ Field | Short Pasture/ Lawns | Nearly Bare Ground | Grassed Swales/ Waterways | Paved Areas & Shallow Paved Swales (Sheet Flow) |
|----------------|--------------|----------------|----------------------|--------------------|---------------------------|-------------------------------------------------|
| Conveyance     | 2.5          | 5              | 7                    | 10                 | 15                        | 20                                              |

Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|---------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.1100                    | 88                      | 0.38                            | N/A                      | 0.26                             | 5.55                                          |
| 1                             | 0.0200                    | 988                     |                                 | 15.00                    | 2.12                             | 7.76                                          |
| 2                             |                           |                         |                                 |                          |                                  |                                               |
| 3                             |                           |                         |                                 |                          |                                  |                                               |
| 4                             |                           |                         |                                 |                          |                                  |                                               |
| 5                             |                           |                         |                                 |                          |                                  |                                               |
| Sum                           |                           | 1,076                   |                                 |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 13.31                                         |
| Regional T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 15.98                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                 |                          |                                  | 13.31                                         |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 3.43 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 3.15 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 3.43 inch/hr

Peak Flowrate,  $Q_p$  = 2.20 cfs  
 Peak Flowrate,  $Q_p$  = 2.02 cfs  
 Peak Flowrate,  $Q_p$  = 2.20 cfs



## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title:   
 Catchment ID: OS3

### I. Catchment Hydrologic Data

Catchment ID = OS3  
 Area = 1.70 Acres  
 Percent Imperviousness = 46.00 %  
 NRCS Soil Type = C A, B, C, or D

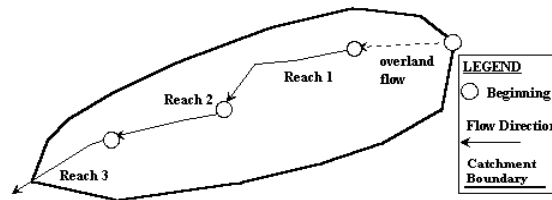
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = 100 years (input return period for design storm)  
 $C1$  = 28.50 (input the value of  $C1$ )  
 $C2$  = 10.00 (input the value of  $C2$ )  
 $C3$  = 0.786 (input the value of  $C3$ )  
 $P1$  = 2.60 inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = 0.59  
 Override Runoff Coefficient,  $C$  =  (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = 0.38  
 Override 5-yr. Runoff Coefficient,  $C$  =  (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



| NRCS Land Type | Heavy Meadow | Tillage/ Field | Short Pasture/ Lawns | Nearly Bare Ground | Grassed Swales/ Waterways | Paved Areas & Shallow Paved Swales (Sheet Flow) |
|----------------|--------------|----------------|----------------------|--------------------|---------------------------|-------------------------------------------------|
| Conveyance     | 2.5          | 5              | 7                    | 10                 | 15                        | 20                                              |

Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|---------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.1100                    | 88                      | 0.38                            | N/A                      | 0.26                             | 5.55                                          |
| 1                             | 0.0200                    | 988                     |                                 | 15.00                    | 2.12                             | 7.76                                          |
| 2                             |                           |                         |                                 |                          |                                  |                                               |
| 3                             |                           |                         |                                 |                          |                                  |                                               |
| 4                             |                           |                         |                                 |                          |                                  |                                               |
| 5                             |                           |                         |                                 |                          |                                  |                                               |
| Sum                           |                           | 1,076                   |                                 |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 13.31                                         |
| Regional T <sub>c</sub> =     |                           |                         |                                 |                          |                                  | 15.98                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                 |                          |                                  | 13.31                                         |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = 6.24 inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = 5.73 inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = 6.24 inch/hr

Peak Flowrate,  $Q_p$  = 6.30 cfs  
 Peak Flowrate,  $Q_p$  = 5.78 cfs  
 Peak Flowrate,  $Q_p$  = 6.30 cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **Pond - Site & Infrastructure**

### I. Catchment Hydrologic Data

Catchment ID = **SITE**  
 Area = **24.90** Acres  
 Percent Imperviousness = **60.00** %  
 NRCS Soil Type = **C** A, B, C, or D

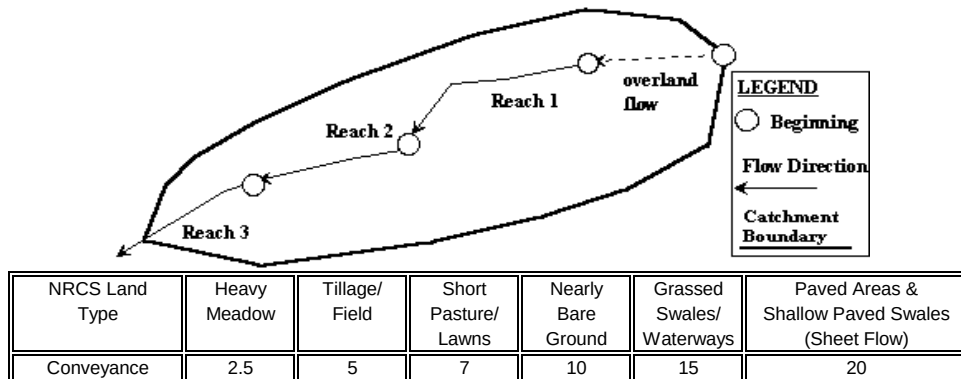
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **5** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **1.43** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.46**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.46**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.1100                    | 88                      | 0.46                               | N/A                      | 0.30                             | 4.94                                          |
| 1                             | 0.0213                    | 2,125                   |                                    | 20.00                    | 2.92                             | 12.13                                         |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 2,213                   |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 17.07                                         |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 22.29                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 17.07                                         |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **3.05** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **2.65** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **3.05** inch/hr

Peak Flowrate,  $Q_p$  = **34.68** cfs  
 Peak Flowrate,  $Q_p$  = **30.20** cfs  
 Peak Flowrate,  $Q_p$  = **34.68** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **Phase I - Site & Phase II - Infrastructure**  
 Catchment ID: **Pond - Site & Infrastructure**

### I. Catchment Hydrologic Data

Catchment ID = **SITE**  
 Area = **24.90** Acres  
 Percent Imperviousness = **60.00** %  
 NRCS Soil Type = **C** A, B, C, or D

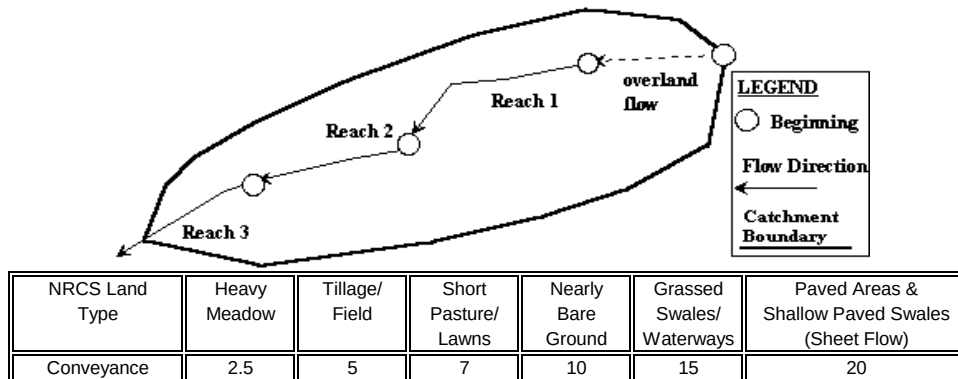
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **100** years (input return period for design storm)  
 $C1$  = **28.50** (input the value of  $C1$ )  
 $C2$  = **10.00** (input the value of  $C2$ )  
 $C3$  = **0.786** (input the value of  $C3$ )  
 $P1$  = **2.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.63**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.46**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



Calculations:

| Reach ID                      | Slope S<br>ft/ft<br>input | Length L<br>ft<br>input | 5-yr Runoff Coeff<br>C-5<br>output | NRCS Conveyance<br>input | Flow Velocity V<br>fps<br>output | Flow Time T <sub>f</sub><br>minutes<br>output |
|-------------------------------|---------------------------|-------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------------------|
| Overland                      | 0.1100                    | 88                      | 0.46                               | N/A                      | 0.30                             | 4.94                                          |
| 1                             | 0.0213                    | 2,125                   |                                    | 20.00                    | 2.92                             | 12.13                                         |
| 2                             |                           |                         |                                    |                          |                                  |                                               |
| 3                             |                           |                         |                                    |                          |                                  |                                               |
| 4                             |                           |                         |                                    |                          |                                  |                                               |
| 5                             |                           |                         |                                    |                          |                                  |                                               |
| Sum                           |                           | 2,213                   |                                    |                          |                                  |                                               |
| Computed T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 17.07                                         |
| Regional T <sub>c</sub> =     |                           |                         |                                    |                          |                                  | 22.29                                         |
| User-Entered T <sub>c</sub> = |                           |                         |                                    |                          |                                  | 17.07                                         |

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **5.54** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **4.83** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **5.54** inch/hr

Peak Flowrate,  $Q_p$  = **87.36** cfs  
 Peak Flowrate,  $Q_p$  = **76.06** cfs  
 Peak Flowrate,  $Q_p$  = **87.36** cfs

# DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: World Compass Academy Site & Burt At Castle Rock Infrastructure  
Basin ID: Pond

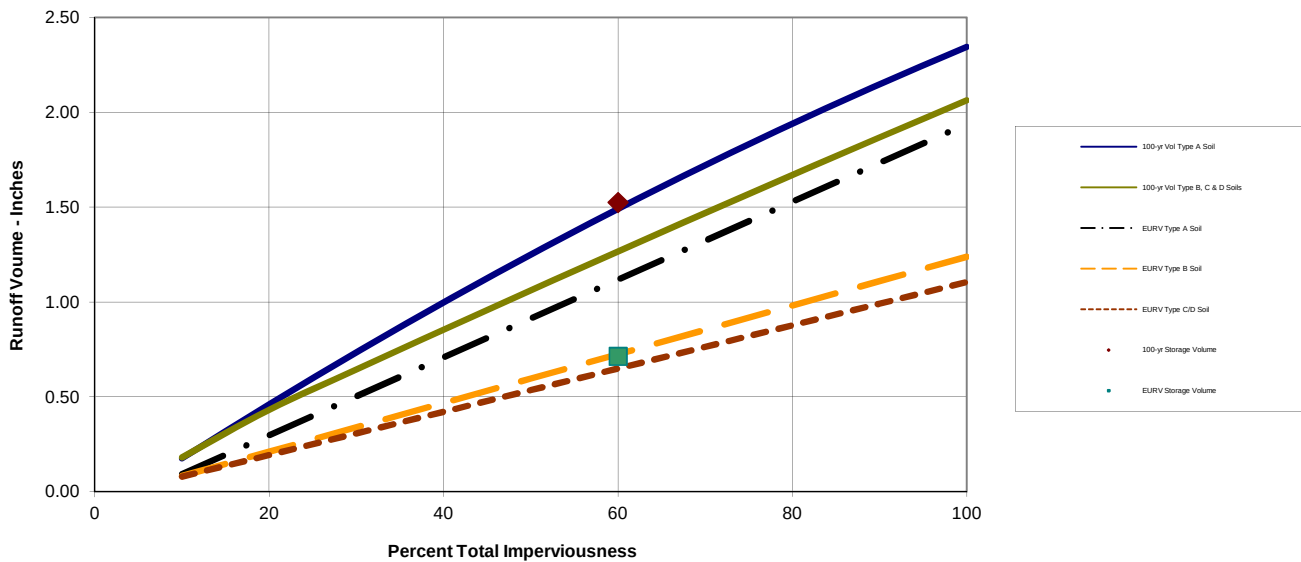
\* User input data  
shown in blue.

|                                                                |                    |               |
|----------------------------------------------------------------|--------------------|---------------|
| Area of Watershed (acres)                                      | 24.90              |               |
| Subwatershed Imperviousness                                    | 60.0%              |               |
| Level of Minimizing Directly Connected Impervious Area (MDCIA) | 0                  | <div>0▼</div> |
| Effective Imperviousness <sup>1</sup>                          | 60.0%              |               |
| Hydrologic Soil Type                                           | Percentage of Area | Area (acres)  |
| Type A                                                         |                    | 0.0           |
| Type B                                                         |                    | 0.0           |
| Type C or D                                                    | 100.0%             | 24.9          |

| Recommended Horton's Equation Parameters for CUHP |               |                                                  |
|---------------------------------------------------|---------------|--------------------------------------------------|
| Infiltration (inches per hour)                    |               | Decay Coefficient-- $\alpha$                     |
| Initial-- $f_i$                                   | Final-- $f_o$ |                                                  |
| 3                                                 | 0.5           | 0.0018                                           |
| Detention Volumes <sup>2,5</sup>                  |               | Maximum Allowable Release Rate, cfs <sup>3</sup> |
| (watershed inches)                                | (acre-feet)   |                                                  |
| 0.71                                              | 1.48          | Design Outlet to Empty EURV in 72 Hours          |
| 1.53                                              | 3.16          | 24.90                                            |

Excess Urban Runoff Volume<sup>4</sup>

100-year Detention Volume plus WQCV<sup>5</sup>

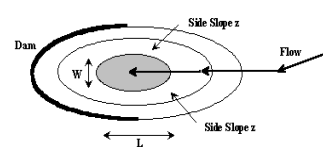
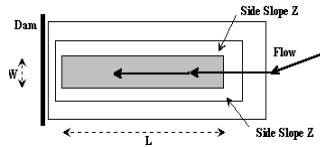
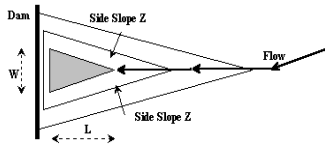


## Notes:

- 1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).
- 2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.
- 3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.
- 4) EURV approximates the difference between developed and pre-developed runoff volume.
- 5) User has opted to add the WQCV to the 100-year detention volume to satisfy local regulations. This is not required per the USDCM.

## STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: World Compass Academy Site & Burt At Castle Rock Infrastructure  
 Basin ID: Pond



### Design Information (Input):

Width of Basin Bottom, W =  ft  
 Length of Basin Bottom, L =  ft  
 Dam Side-slope (H:V), Z<sub>d</sub> =  ft/ft

### Check Basin Shape

Right Triangle  OR...  
 Isosceles Triangle  OR...  
 Rectangle  OR...  
 Circle / Ellipse  OR...  
 Irregular  (Use Override values in cells G32:G52)

### Stage-Storage Relationship:

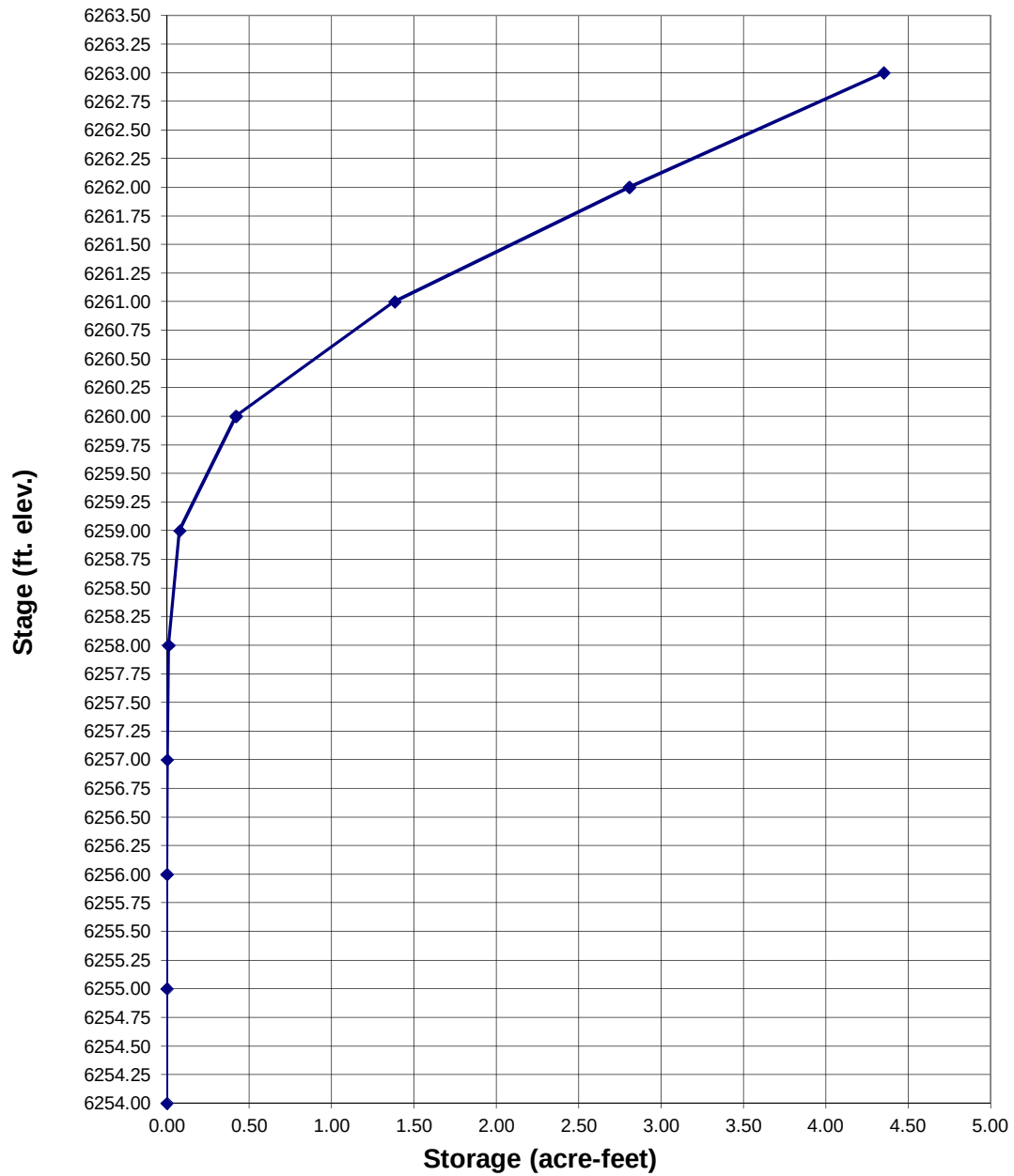
Storage Requirement from Sheet 'Modified FAA':  MINOR  MAJOR acre-ft.  
 Storage Requirement from Sheet 'Hydrograph':  acre-ft.  
 Storage Requirement from Sheet 'Full-Spectrum':  1.48  3.16 acre-ft.

| Labels<br>for WQCV, Minor,<br>& Major Storage<br>Stages<br>(input) | Water<br>Surface<br>Elevation<br>ft<br>(input) | Side<br>Slope<br>(H:V)<br>ft/ft<br>Below El.<br>(input) | Basin<br>Width at<br>Stage<br>ft<br>(output) | Basin<br>Length at<br>Stage<br>ft<br>(output) | Surface<br>Area at<br>Stage<br>ft <sup>2</sup><br>(output) | Surface<br>Area at<br>Stage<br>ft <sup>2</sup> User<br>Override | Volume<br>Below<br>Stage<br>ft <sup>3</sup><br>(output) | Surface<br>Area at<br>Stage<br>acres<br>(output) | Volume<br>Below<br>Stage<br>acre-ft<br>(output) | Target Volumes<br>for WQCV, Minor,<br>& Major Storage<br>Volumes<br>(for goal seek) |
|--------------------------------------------------------------------|------------------------------------------------|---------------------------------------------------------|----------------------------------------------|-----------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------|--------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------|
|                                                                    | 6254.00                                        |                                                         |                                              |                                               |                                                            | 0                                                               |                                                         | 0.000                                            | 0.000                                           |                                                                                     |
|                                                                    | 6255.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            | 0                                                               | 0                                                       | 0.000                                            | 0.000                                           |                                                                                     |
|                                                                    | 6256.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            | 0                                                               | 0                                                       | 0.000                                            | 0.000                                           |                                                                                     |
|                                                                    | 6257.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            | 100                                                             | 50                                                      | 0.002                                            | 0.001                                           |                                                                                     |
|                                                                    | 6258.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            | 610                                                             | 405                                                     | 0.014                                            | 0.009                                           |                                                                                     |
|                                                                    | 6259.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            | 5,316                                                           | 3,368                                                   | 0.122                                            | 0.077                                           |                                                                                     |
|                                                                    | 6260.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            | 24,465                                                          | 18,259                                                  | 0.562                                            | 0.419                                           |                                                                                     |
|                                                                    | 6261.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            | 59,448                                                          | 60,215                                                  | 1.365                                            | 1.382                                           | EURV @ 61.17'                                                                       |
|                                                                    | 6262.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            | 64,591                                                          | 122,235                                                 | 1.483                                            | 2.806                                           | 100yr+WQ @ 62.33'                                                                   |
|                                                                    | 6263.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            | 69,940                                                          | 189,500                                                 | 1.606                                            | 4.350                                           | Top Pond @ 63.33'                                                                   |
|                                                                    | 6264.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6265.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6266.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6267.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6268.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6269.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6270.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6271.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6272.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6273.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6274.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6275.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6276.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6277.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6278.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6279.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6280.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6281.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6282.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6283.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6284.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6285.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6286.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6287.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6288.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6289.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6290.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6291.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6292.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6293.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6294.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6295.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6296.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |
|                                                                    | 6297.00                                        |                                                         | 0.00                                         | 0.00                                          |                                                            |                                                                 | #N/A                                                    |                                                  | 0.000                                           |                                                                                     |

## STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: World Compass Academy Site & Burt At Castle Rock Infrastructure  
Basin ID: Pond

### STAGE-STORAGE CURVE FOR THE POND



|                                                                          |
|--------------------------------------------------------------------------|
| STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET |
|--------------------------------------------------------------------------|

Project: World Compass Academy Site & Burt At Castle Rock Infrastructure

Basin ID: Pond

**WQCV Design Volume (Input):**  

OR

**Watershed Design Information (Input):**

### Perforated Plate Examples

**Outlet Design Information (Output):**

|                                                                |                    |
|----------------------------------------------------------------|--------------------|
| Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')        | 1.481 acre-feet    |
| Outlet area per row, Ao =                                      | 1.38 square inches |
| Total opening area at each row based on user-input above, Ao = | 1.47 square inches |
| Total opening area at each row based on user-input above, Ao = | 0.010 square feet  |

|         | Central Elevations of Rows of Holes in feet      |                     |                     |                     |                     |                     |                     |                     |                     |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | Σ<br>Flow |
|---------|--------------------------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------|
|         | Row 1                                            | Row 2               | Row 3               | Row 4               | Row 5               | Row 6               | Row 7               | Row 8               | Row 9               | Row 10               | Row 11               | Row 12               | Row 13               | Row 14               | Row 15               | Row 16               | Row 17               | Row 18               | Row 19               | Row 20               | Row 21               | Row 22               | Row 23               | Row 23               |           |
|         | 6257.17                                          | 6257.50             | 6257.84             | 6258.17             | 6258.50             | 6258.84             | 6259.17             | 6259.50             | 6259.84             | 6260.17              | 6260.50              |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |           |
|         | Collection Capacity for Each Row of Holes in cfs |                     |                     |                     |                     |                     |                     |                     |                     |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |           |
| 6257.17 | 0.0000                                           | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.0000               | 0.0000               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 0.00      |
| 6258.17 | 0.0532                                           | 0.0435              | 0.0306              | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.0000              | 0.0000               | 0.0000               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 0.13      |
| 6259.17 | 0.0752                                           | 0.0688              | 0.0614              | 0.0532              | 0.0435              | 0.0306              | 0.0000              | 0.0000              | 0.0000              | 0.0000               | 0.0000               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 0.33      |
| 6260.17 | 0.0922                                           | 0.0869              | 0.0812              | 0.0752              | 0.0688              | 0.0614              | 0.0532              | 0.0435              | 0.0306              | 0.0000               | 0.0000               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 0.59      |
| 6261.17 | 0.1064                                           | 0.1019              | 0.0971              | 0.0922              | 0.0869              | 0.0812              | 0.0752              | 0.0688              | 0.0614              | 0.0532               | 0.0435               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 0.87      |
| 6262.17 | 0.1190                                           | 0.1150              | 0.1107              | 0.1064              | 0.1019              | 0.0971              | 0.0922              | 0.0869              | 0.0812              | 0.0752               | 0.0688               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 1.05      |
| 6263.17 | 0.1303                                           | 0.1267              | 0.1228              | 0.1190              | 0.1150              | 0.1107              | 0.1064              | 0.1019              | 0.0971              | 0.0922               | 0.0869               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 1.21      |
| 6264.17 | 0.1408                                           | 0.1374              | 0.1339              | 0.1303              | 0.1267              | 0.1228              | 0.1190              | 0.1150              | 0.1107              | 0.1064               | 0.1019               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 1.34      |
| 6265.17 | 0.1505                                           | 0.1473              | 0.1440              | 0.1408              | 0.1374              | 0.1339              | 0.1303              | 0.1267              | 0.1228              | 0.1190               | 0.1150               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 1.47      |
| 6266.17 | 0.1596                                           | 0.1567              | 0.1536              | 0.1505              | 0.1473              | 0.1440              | 0.1408              | 0.1374              | 0.1339              | 0.1303               | 0.1267               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 1.58      |
| 6267.17 | 0.1682                                           | 0.1654              | 0.1625              | 0.1596              | 0.1567              | 0.1536              | 0.1505              | 0.1473              | 0.1440              | 0.1408               | 0.1374               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 1.69      |
| 6268.17 | 0.1765                                           | 0.1738              | 0.1710              | 0.1682              | 0.1654              | 0.1625              | 0.1596              | 0.1567              | 0.1536              | 0.1505               | 0.1473               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 1.79      |
| 6269.17 | 0.1843                                           | 0.1818              | 0.1791              | 0.1765              | 0.1738              | 0.1710              | 0.1682              | 0.1654              | 0.1625              | 0.1596               | 0.1567               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 1.88      |
| 6270.17 | 0.1918                                           | 0.1894              | 0.1868              | 0.1843              | 0.1818              | 0.1791              | 0.1765              | 0.1738              | 0.1710              | 0.1682               | 0.1654               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 1.97      |
| 6271.17 | 0.1991                                           | 0.1967              | 0.1943              | 0.1918              | 0.1894              | 0.1868              | 0.1843              | 0.1818              | 0.1791              | 0.1765               | 0.1738               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.05      |
| 6272.17 | 0.2061                                           | 0.2038              | 0.2014              | 0.1991              | 0.1967              | 0.1943              | 0.1918              | 0.1894              | 0.1868              | 0.1843               | 0.1818               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.14      |
| 6273.17 | 0.2128                                           | 0.2106              | 0.2083              | 0.2061              | 0.2038              | 0.2014              | 0.1991              | 0.1967              | 0.1943              | 0.1918               | 0.1894               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.21      |
| 6274.17 | 0.2194                                           | 0.2172              | 0.2150              | 0.2128              | 0.2106              | 0.2083              | 0.2061              | 0.2038              | 0.2014              | 0.1991               | 0.1967               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.29      |
| 6275.17 | 0.2257                                           | 0.2236              | 0.2215              | 0.2194              | 0.2172              | 0.2150              | 0.2128              | 0.2106              | 0.2083              | 0.2061               | 0.2038               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.36      |
| 6276.17 | 0.2319                                           | 0.2299              | 0.2278              | 0.2257              | 0.2236              | 0.2215              | 0.2194              | 0.2172              | 0.2150              | 0.2128               | 0.2106               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.44      |
| 6277.17 | 0.2379                                           | 0.2360              | 0.2339              | 0.2319              | 0.2299              | 0.2278              | 0.2257              | 0.2236              | 0.2215              | 0.2194               | 0.2172               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.50      |
| 6278.17 | 0.2438                                           | 0.2419              | 0.2399              | 0.2379              | 0.2360              | 0.2339              | 0.2319              | 0.2299              | 0.2278              | 0.2257               | 0.2236               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.57      |
| 6279.17 | 0.2496                                           | 0.2477              | 0.2457              | 0.2438              | 0.2419              | 0.2399              | 0.2379              | 0.2360              | 0.2339              | 0.2319               | 0.2299               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.64      |
| 6280.17 | 0.2552                                           | 0.2533              | 0.2514              | 0.2496              | 0.2477              | 0.2457              | 0.2438              | 0.2419              | 0.2399              | 0.2379               | 0.2360               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.70      |
| 6281.17 | 0.2606                                           | 0.2588              | 0.2570              | 0.2552              | 0.2533              | 0.2514              | 0.2496              | 0.2477              | 0.2457              | 0.2438               | 0.2419               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.77      |
| 6282.17 | 0.2660                                           | 0.2643              | 0.2624              | 0.2606              | 0.2588              | 0.2570              | 0.2552              | 0.2533              | 0.2514              | 0.2496               | 0.2477               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.83      |
| 6283.17 | 0.2713                                           | 0.2696              | 0.2678              | 0.2660              | 0.2643              | 0.2624              | 0.2606              | 0.2588              | 0.2570              | 0.2552               | 0.2533               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.89      |
| 6284.17 | 0.2765                                           | 0.2748              | 0.2730              | 0.2713              | 0.2696              | 0.2678              | 0.2660              | 0.2643              | 0.2624              | 0.2606               | 0.2588               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 2.95      |
| 6285.17 | 0.2815                                           | 0.2799              | 0.2781              | 0.2765              | 0.2748              | 0.2730              | 0.2713              | 0.2696              | 0.2678              | 0.2660               | 0.2643               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.00      |
| 6286.17 | 0.2865                                           | 0.2849              | 0.2832              | 0.2815              | 0.2799              | 0.2781              | 0.2765              | 0.2748              | 0.2730              | 0.2713               | 0.2696               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.06      |
| 6287.17 | 0.2914                                           | 0.2898              | 0.2881              | 0.2865              | 0.2849              | 0.2832              | 0.2815              | 0.2799              | 0.2781              | 0.2765               | 0.2748               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.11      |
| 6288.17 | 0.2962                                           | 0.2946              | 0.2930              | 0.2914              | 0.2898              | 0.2881              | 0.2865              | 0.2849              | 0.2832              | 0.2815               | 0.2799               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.17      |
| 6289.17 | 0.3010                                           | 0.2994              | 0.2978              | 0.2962              | 0.2946              | 0.2930              | 0.2914              | 0.2898              | 0.2881              | 0.2865               | 0.2849               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.22      |
| 6290.17 | 0.3056                                           | 0.3041              | 0.3025              | 0.3010              | 0.2994              | 0.2978              | 0.2962              | 0.2946              | 0.2930              | 0.2914               | 0.2898               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.28      |
| 6291.17 | 0.3102                                           | 0.3087              | 0.3072              | 0.3056              | 0.3041              | 0.3025              | 0.3010              | 0.2994              | 0.2978              | 0.2962               | 0.2946               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.33      |
| 6292.17 | 0.3148                                           | 0.3133              | 0.3117              | 0.3102              | 0.3087              | 0.3072              | 0.3056              | 0.3041              | 0.3025              | 0.3010               | 0.2994               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.38      |
| 6293.17 | 0.3192                                           | 0.3178              | 0.3162              | 0.3148              | 0.3133              | 0.3117              | 0.3102              | 0.3087              | 0.3072              | 0.3056               | 0.3041               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.43      |
| 6294.17 | 0.3236                                           | 0.3222              | 0.3207              | 0.3192              | 0.3178              | 0.3162              | 0.3148              | 0.3133              | 0.3117              | 0.3102               | 0.3087               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.48      |
| 6295.17 | 0.3280                                           | 0.3265              | 0.3251              | 0.3236              | 0.3222              | 0.3207              | 0.3192              | 0.3178              | 0.3162              | 0.3148               | 0.3133               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.53      |
| 6296.17 | 0.3323                                           | 0.3309              | 0.3294              | 0.3280              | 0.3265              | 0.3251              | 0.3236              | 0.3222              | 0.3207              | 0.3192               | 0.3178               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.58      |
| 6297.17 | 0.3365                                           | 0.3351              | 0.3337              | 0.3323              | 0.3309              | 0.3294              | 0.3280              | 0.3265              | 0.3251              | 0.3236               | 0.3222               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.62      |
| 6298.17 | 0.3407                                           | 0.3393              | 0.3379              | 0.3365              | 0.3351              | 0.3337              | 0.3323              | 0.3309              | 0.3294              | 0.3280               | 0.3265               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.67      |
| 6299.17 | 0.3448                                           | 0.3434              | 0.3420              | 0.3407              | 0.3393              | 0.3379              | 0.3365              | 0.3351              | 0.3337              | 0.3323               | 0.3309               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.72      |
| 6300.17 | 0.3489                                           | 0.3475              | 0.3462              | 0.3448              | 0.3434              | 0.3420              | 0.3407              | 0.3393              | 0.3379              | 0.3365               | 0.3351               |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      | 3.76      |
|         | Override Area Row 1                              | Override Area Row 2 | Override Area Row 3 | Override Area Row 4 | Override Area Row 5 | Override Area Row 6 | Override Area Row 7 | Override Area Row 8 | Override Area Row 9 | Override Area Row 10 | Override Area Row 11 | Override Area Row 12 | Override Area Row 13 | Override Area Row 14 | Override Area Row 15 | Override Area Row 16 | Override Area Row 17 | Override Area Row 18 | Override Area Row 19 | Override Area Row 20 | Override Area Row 21 | Override Area Row 22 | Override Area Row 23 | Override Area Row 24 |           |

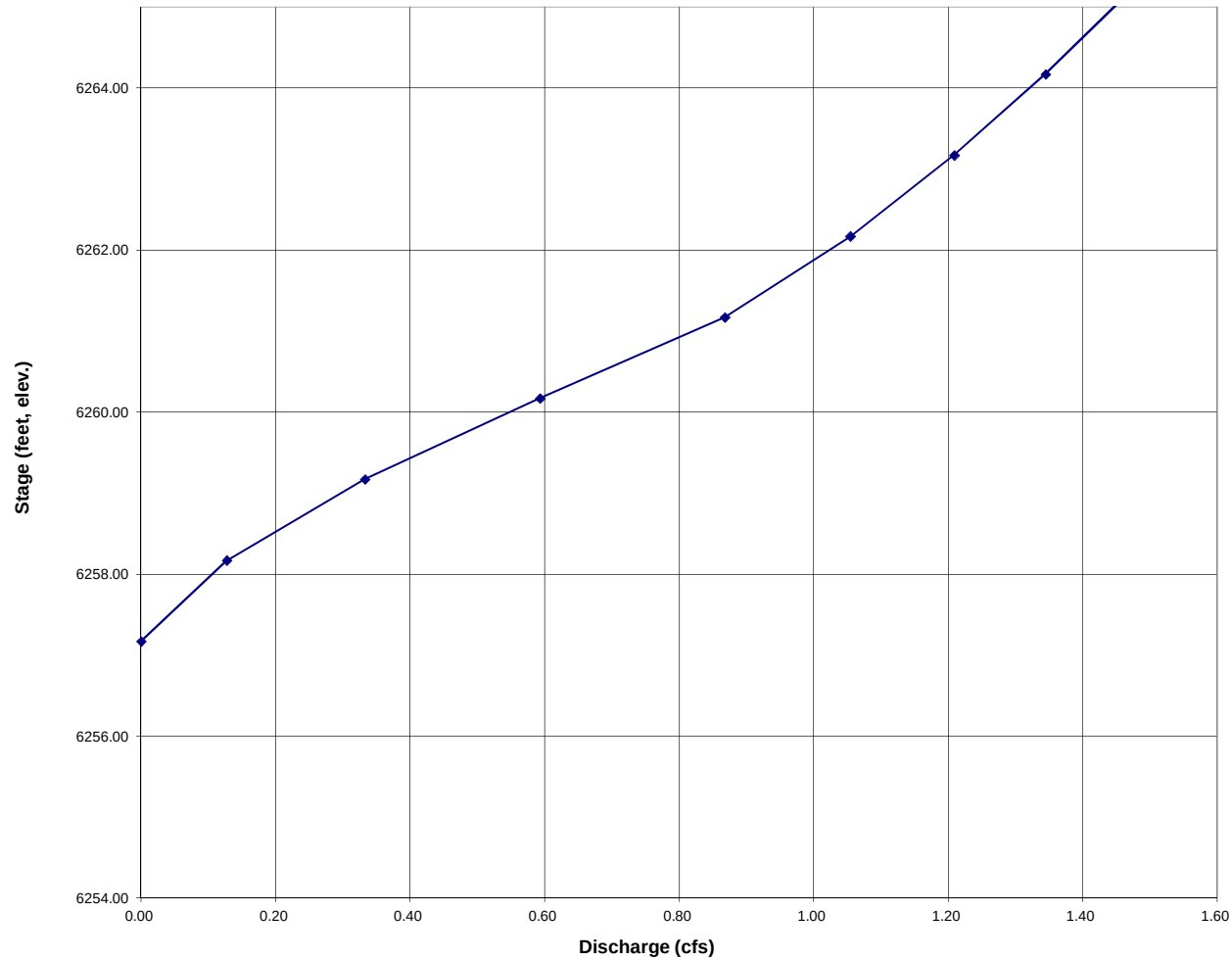
## STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

Project: **World Compass Academy Site & Burt At Castle Rock Infrastructure**

Basin ID: **Pond**

STAGE-DISCHARGE CURVE FOR THE WQCV OUTLET STRUCTURE

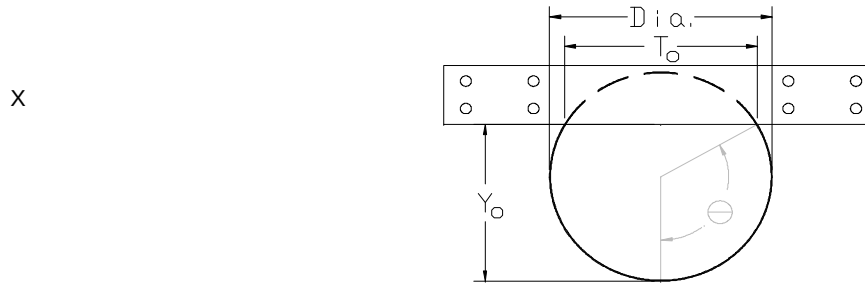




# RESTRICTOR PLATE SIZING FOR CIRCULAR VERTICAL ORIFICES

Project: **World Compass Academy Site & Burt At Castle Rock Infrastructure**

Basin ID: **Pond**



## Sizing the Restrictor Plate for Circular Vertical Orifices or Pipes (Input)

Water Surface Elevation at Design Depth  
 Pipe/Vertical Orifice Entrance Invert Elevation  
 Required Peak Flow through Orifice at Design Depth  
 Pipe/Vertical Orifice Diameter (inches)  
 Orifice Coefficient

|                  | #1 Vertical Orifice | #2 Vertical Orifice |        |
|------------------|---------------------|---------------------|--------|
| Elev: WS =       | 6,262.33            |                     | feet   |
| Elev: Invert =   | 6,257.17            |                     | feet   |
| Q =              | 24.90               |                     | cfs    |
| Dia =            | 24.0                |                     | inches |
| C <sub>o</sub> = | 0.65                |                     |        |

## Full-flow Capacity (Calculated)

Full-flow area  
 Half Central Angle in Radians  
 Full-flow capacity

|                          |      |  |       |
|--------------------------|------|--|-------|
| Af =                     | 3.14 |  | sq ft |
| Theta =                  | 3.14 |  | rad   |
| Qf =                     | 33.4 |  | cfs   |
| Percent of Design Flow = | 134% |  |       |

## Calculation of Orifice Flow Condition

Half Central Angle (0<Theta<3.1416)  
 Flow area  
 Top width of Orifice (inches)  
 Height from Invert of Orifice to Bottom of Plate (feet)  
 Elevation of Bottom of Plate  
 Resultant Peak Flow Through Orifice at Design Depth

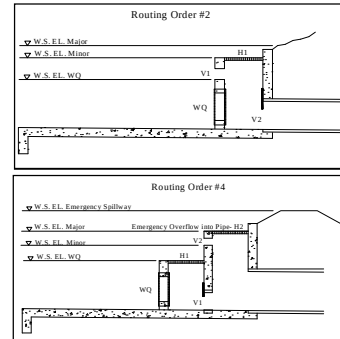
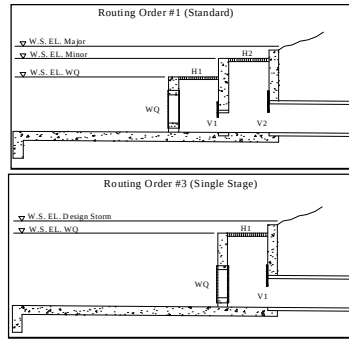
|                          |          |  |        |
|--------------------------|----------|--|--------|
| Theta =                  | 1.93     |  | rad    |
| A <sub>o</sub> =         | 2.26     |  | sq ft  |
| T <sub>o</sub> =         | 22.49    |  | inches |
| Y <sub>o</sub> =         | 1.35     |  | feet   |
| Elev Plate Bottom Edge = | 6,258.52 |  | feet   |
| Q <sub>o</sub> =         | 24.9     |  | cfs    |

Width of Equivalent Rectangular Vertical Orifice  
 Centroid Elevation of Equivalent Rectangular Vertical Orifice

|                       |          |  |      |
|-----------------------|----------|--|------|
| Equivalent Width =    | 1.67     |  | feet |
| Equiv. Centroid El. = | 6,257.85 |  | feet |

# STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: World Compass Academy Site & Burt At Castle Rock Infrastructure  
Basin ID: Pond



Current Routing Order is #3

## Design Information (Input):

Circular Opening: Diameter in Inches  
OR  
Rectangular Opening: Width in Feet  
Length (Height for Vertical)  
Percentage of Open Area After Trash Rack Reduction  
Orifice Coefficient  
Weir Coefficient  
Orifice Elevation (Bottom for Vertical)

|                  | #1 Horiz. | #2 Horiz. | #1 Vert. | #2 Vert. |        |
|------------------|-----------|-----------|----------|----------|--------|
| Dia. =           |           |           |          |          | inches |
| W =              | 5.83      |           | 1.67     |          | ft.    |
| L or H =         | 2.92      |           | 1.35     |          | ft.    |
| % open =         | 50        |           | 100      |          | %      |
| C <sub>o</sub> = | 0.65      |           | 0.65     |          |        |
| C <sub>w</sub> = | 3.00      |           |          |          |        |
| E <sub>o</sub> = | 6261.17   |           | 6,257.17 |          | ft.    |

## Calculation of Collection Capacity:

Net Opening Area (after Trash Rack Reduction)  
OPTIONAL: User-Override Net Opening Area  
Perimeter as Weir Length  
OPTIONAL: User-Override Weir Length

|                                                     |         |      |         |
|-----------------------------------------------------|---------|------|---------|
| A <sub>o</sub> =                                    | 8.51    | 2.26 | sq. ft. |
| A <sub>o</sub> =                                    |         |      | sq. ft. |
| L <sub>w</sub> =                                    | 11.67   |      | ft.     |
| L <sub>w</sub> =                                    |         |      | ft.     |
| Top Elevation of Vertical Orifice Opening, Top =    | 6258.52 |      | ft.     |
| Center Elevation of Vertical Orifice Opening, Cen = | 6257.85 |      | ft.     |

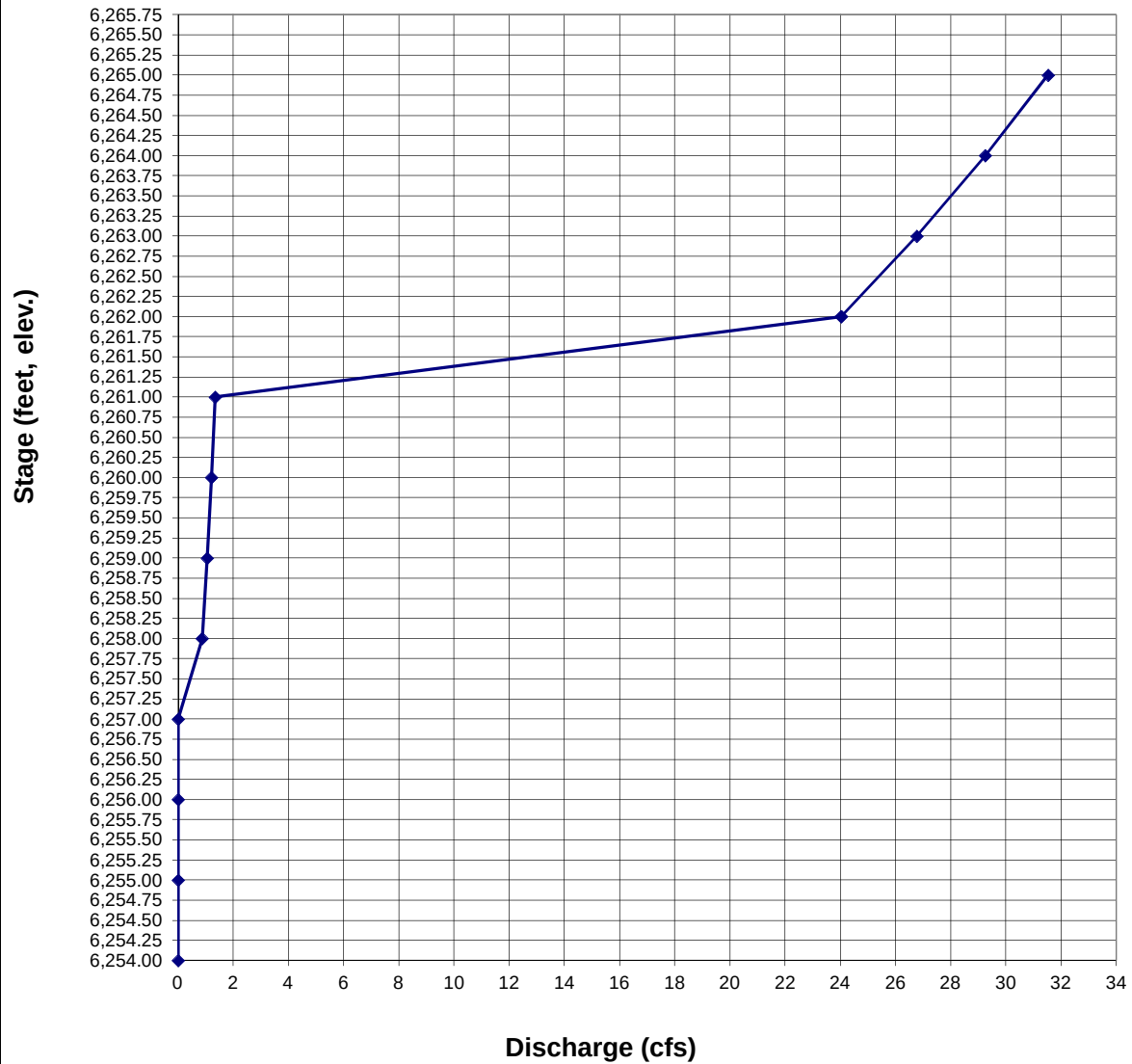
**Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).**

|                                                                             |                                                 |                                                     | Horizontal Orifices                          |                                                 |                                              |                                                 | Vertical Orifices                                     |                                                       |                                                    |                                                                                          |
|-----------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------|----------------------------------------------|-------------------------------------------------|----------------------------------------------|-------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------------|
| Labels<br>for WQCV, Minor,<br>& Major Storage<br>W.S. Elevations<br>(input) | Water<br>Surface<br>Elevation<br>ft<br>(linked) | WQCV<br>Plate/Riser<br>Flow<br>cfs<br>(User-linked) | #1 Horiz.<br>Weir<br>Flow<br>cfs<br>(output) | #1 Horiz.<br>Orifice<br>Flow<br>cfs<br>(output) | #2 Horiz.<br>Weir<br>Flow<br>cfs<br>(output) | #2 Horiz.<br>Orifice<br>Flow<br>cfs<br>(output) | #1 Vert.<br>Collection<br>Capacity<br>cfs<br>(output) | #2 Vert.<br>Collection<br>Capacity<br>cfs<br>(output) | Total<br>Collection<br>Capacity<br>cfs<br>(output) | Target Volumes<br>for WQCV, Minor,<br>& Major Storage<br>Volumes<br>(link for goal seek) |
|                                                                             | 6254.00                                         | 0.00                                                | 0.00                                         | 0.00                                            | 0.00                                         | 0.00                                            | 0.00                                                  | 0.00                                                  | 0.00                                               |                                                                                          |
|                                                                             | 6255.00                                         | 0.13                                                | 0.00                                         | 0.00                                            | 0.00                                         | 0.00                                            | 0.00                                                  | 0.00                                                  | 0.00                                               |                                                                                          |
|                                                                             | 6256.00                                         | 0.33                                                | 0.00                                         | 0.00                                            | 0.00                                         | 0.00                                            | 0.00                                                  | 0.00                                                  | 0.00                                               |                                                                                          |
|                                                                             | 6257.00                                         | 0.59                                                | 0.00                                         | 0.00                                            | 0.00                                         | 0.00                                            | 0.00                                                  | 0.00                                                  | 0.00                                               |                                                                                          |
|                                                                             | 6258.00                                         | 0.87                                                | 0.00                                         | 0.00                                            | 0.00                                         | 0.00                                            | 4.67                                                  | 0.00                                                  | 0.87                                               |                                                                                          |
|                                                                             | 6259.00                                         | 1.05                                                | 0.00                                         | 0.00                                            | 0.00                                         | 0.00                                            | 12.67                                                 | 0.00                                                  | 1.05                                               |                                                                                          |
|                                                                             | 6260.00                                         | 1.21                                                | 0.00                                         | 0.00                                            | 0.00                                         | 0.00                                            | 17.31                                                 | 0.00                                                  | 1.21                                               |                                                                                          |
|                                                                             | 6261.00                                         | 1.34                                                | 0.00                                         | 0.00                                            | 0.00                                         | 0.00                                            | 20.94                                                 | 0.00                                                  | 1.34                                               |                                                                                          |
|                                                                             | 6262.00                                         | 1.47                                                | 26.47                                        | 40.45                                           | 0.00                                         | 0.00                                            | 24.03                                                 | 0.00                                                  | 24.03                                              |                                                                                          |
|                                                                             | 6263.00                                         | 1.58                                                | 86.67                                        | 60.06                                           | 0.00                                         | 0.00                                            | 26.77                                                 | 0.00                                                  | 26.77                                              |                                                                                          |
|                                                                             | 6264.00                                         | 1.69                                                | 166.68                                       | 74.69                                           | 0.00                                         | 0.00                                            | 29.25                                                 | 0.00                                                  | 29.25                                              |                                                                                          |
|                                                                             | 6265.00                                         | 1.79                                                | 262.42                                       | 86.89                                           | 0.00                                         | 0.00                                            | 31.53                                                 | 0.00                                                  | 31.53                                              |                                                                                          |
|                                                                             | 6266.00                                         | 1.88                                                | 371.63                                       | 97.58                                           | 0.00                                         | 0.00                                            | 33.66                                                 | 0.00                                                  | 33.66                                              |                                                                                          |
|                                                                             | 6267.00                                         | 1.97                                                | 492.83                                       | 107.20                                          | 0.00                                         | 0.00                                            | 35.67                                                 | 0.00                                                  | 35.67                                              |                                                                                          |
|                                                                             | 6268.00                                         | 2.05                                                | 624.92                                       | 116.03                                          | 0.00                                         | 0.00                                            | 37.57                                                 | 0.00                                                  | 37.57                                              |                                                                                          |
|                                                                             | 6269.00                                         | 2.14                                                | 767.07                                       | 124.24                                          | 0.00                                         | 0.00                                            | 39.37                                                 | 0.00                                                  | 39.37                                              |                                                                                          |
|                                                                             | 6270.00                                         | 2.21                                                | 918.61                                       | 131.93                                          | 0.00                                         | 0.00                                            | 41.10                                                 | 0.00                                                  | 41.10                                              |                                                                                          |
|                                                                             | 6271.00                                         | 2.29                                                | 1079.00                                      | 139.20                                          | 0.00                                         | 0.00                                            | 42.76                                                 | 0.00                                                  | 42.76                                              |                                                                                          |
|                                                                             | 6272.00                                         | 2.36                                                | 1247.77                                      | 146.11                                          | 0.00                                         | 0.00                                            | 44.35                                                 | 0.00                                                  | 44.35                                              |                                                                                          |
|                                                                             | 6273.00                                         | 2.44                                                | 1424.52                                      | 152.71                                          | 0.00                                         | 0.00                                            | 45.89                                                 | 0.00                                                  | 45.89                                              |                                                                                          |
|                                                                             | 6274.00                                         | 2.50                                                | 1608.91                                      | 159.03                                          | 0.00                                         | 0.00                                            | 47.38                                                 | 0.00                                                  | 47.38                                              |                                                                                          |
|                                                                             | 6275.00                                         | 2.57                                                | 1800.63                                      | 165.12                                          | 0.00                                         | 0.00                                            | 48.83                                                 | 0.00                                                  | 48.83                                              |                                                                                          |
|                                                                             | 6276.00                                         | 2.64                                                | 1999.42                                      | 170.98                                          | 0.00                                         | 0.00                                            | 50.23                                                 | 0.00                                                  | 50.23                                              |                                                                                          |
|                                                                             | 6277.00                                         | 2.70                                                | 2205.02                                      | 176.65                                          | 0.00                                         | 0.00                                            | 51.59                                                 | 0.00                                                  | 51.59                                              |                                                                                          |
|                                                                             | 6278.00                                         | 2.77                                                | 2417.23                                      | 182.15                                          | 0.00                                         | 0.00                                            | 52.92                                                 | 0.00                                                  | 52.92                                              |                                                                                          |
|                                                                             | 6279.00                                         | 2.83                                                | 2635.84                                      | 187.48                                          | 0.00                                         | 0.00                                            | 54.22                                                 | 0.00                                                  | 54.22                                              |                                                                                          |
|                                                                             | 6280.00                                         | 2.89                                                | 2860.67                                      | 192.67                                          | 0.00                                         | 0.00                                            | 55.49                                                 | 0.00                                                  | 55.49                                              |                                                                                          |
|                                                                             | 6281.00                                         | 2.95                                                | 3091.55                                      | 197.71                                          | 0.00                                         | 0.00                                            | 56.73                                                 | 0.00                                                  | 56.73                                              |                                                                                          |
|                                                                             | 6282.00                                         | 3.00                                                | 3328.33                                      | 202.64                                          | 0.00                                         | 0.00                                            | 57.94                                                 | 0.00                                                  | 57.94                                              |                                                                                          |
|                                                                             | 6283.00                                         | 3.06                                                | 3570.86                                      | 207.45                                          | 0.00                                         | 0.00                                            | 59.13                                                 | 0.00                                                  | 59.13                                              |                                                                                          |
|                                                                             | 6284.00                                         | 3.11                                                | 3819.01                                      | 212.14                                          | 0.00                                         | 0.00                                            | 60.29                                                 | 0.00                                                  | 60.29                                              |                                                                                          |
|                                                                             | 6285.00                                         | 3.17                                                | 4072.66                                      | 216.74                                          | 0.00                                         | 0.00                                            | 61.43                                                 | 0.00                                                  | 61.43                                              |                                                                                          |
|                                                                             | 6286.00                                         | 3.22                                                | 4331.69                                      | 221.24                                          | 0.00                                         | 0.00                                            | 62.55                                                 | 0.00                                                  | 62.55                                              |                                                                                          |
|                                                                             | 6287.00                                         | 3.28                                                | 4595.99                                      | 225.65                                          | 0.00                                         | 0.00                                            | 63.65                                                 | 0.00                                                  | 63.65                                              |                                                                                          |
|                                                                             | 6288.00                                         | 3.33                                                | 4865.45                                      | 229.98                                          | 0.00                                         | 0.00                                            | 64.74                                                 | 0.00                                                  | 64.74                                              |                                                                                          |
|                                                                             | 6289.00                                         | 3.38                                                | 5139.99                                      | 234.23                                          | 0.00                                         | 0.00                                            | 65.80                                                 | 0.00                                                  | 65.80                                              |                                                                                          |
|                                                                             | 6290.00                                         | 3.43                                                | 5419.50                                      | 238.40                                          | 0.00                                         | 0.00                                            | 66.85                                                 | 0.00                                                  | 66.85                                              |                                                                                          |
|                                                                             | 6291.00                                         | 3.48                                                | 5703.90                                      | 242.50                                          | 0.00                                         | 0.00                                            | 67.88                                                 | 0.00                                                  | 67.88                                              |                                                                                          |
|                                                                             | 6292.00                                         | 3.53                                                | 5993.11                                      | 246.53                                          | 0.00                                         | 0.00                                            | 68.90                                                 | 0.00                                                  | 68.90                                              |                                                                                          |
|                                                                             | 6293.00                                         | 3.58                                                | 6287.05                                      | 250.49                                          | 0.00                                         | 0.00                                            | 69.90                                                 | 0.00                                                  | 69.90                                              |                                                                                          |
|                                                                             | 6294.00                                         | 3.62                                                | 6585.65                                      | 254.40                                          | 0.00                                         | 0.00                                            | 70.88                                                 | 0.00                                                  | 70.88                                              |                                                                                          |
|                                                                             | 6295.00                                         | 3.67                                                | 6888.82                                      | 258.24                                          | 0.00                                         | 0.00                                            | 71.86                                                 | 0.00                                                  | 71.86                                              |                                                                                          |
|                                                                             | 6296.00                                         | 3.72                                                | 7196.52                                      | 262.03                                          | 0.00                                         | 0.00                                            | 72.82                                                 | 0.00                                                  | 72.82                                              |                                                                                          |
|                                                                             | 6297.00                                         | 3.76                                                | 7508.66                                      | 265.77                                          | 0.00                                         | 0.00                                            | 73.77                                                 | 0.00                                                  | 73.77                                              |                                                                                          |

# STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: World Compass Academy Site & Burt At Castle Rock Infrastructure  
Basin ID: Pond

## STAGE-DISCHARGE CURVE FOR THE OUTLET STRUCTURE

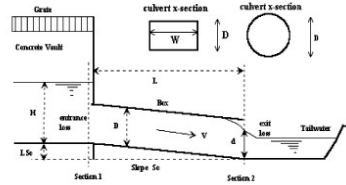


# STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: World Compass Academy Site & Burt At Castle Rock Infrastructure

Basin ID: Pond

Status: Sheet Contains Warnings. See Culvert\_ErrorList Range



## Design Information (Input):

Circular Culvert: Barrel Diameter in Inches  
Circular Culvert: Inlet Edge Type (choose from pull-down list)

OR:

Box Culvert: Barrel Height (Rise) in Feet  
Box Culvert: Barrel Width (Span) in Feet  
Box Culvert: Inlet Edge Type (choose from pull-down list)

D = 24 in.

Grooved End with Headwall

Height (Rise) =

Width (Span) =

Square Edge w/ 90-15 deg. Flared Wingwall

Number of Barrels  
Inlet Elevation at Culvert Invert  
Outlet Elevation at Culvert Invert  
Culvert Length in Feet  
Manning's Roughness  
Bend Loss Coefficient  
Exit Loss Coefficient

No = 1  
I<sub>elev</sub> = 6257.17 ft. elev.  
O<sub>elev</sub> = 6256.90 ft. elev.  
L = 47.0 ft.  
n = 0.0130  
K<sub>0</sub> =  
K<sub>e</sub> = 1.00

## Design Information (calculated):

Entrance Loss Coefficient  
Friction Loss Coefficient  
Sum of All Loss Coefficients  
Orifice Inlet Condition Coefficient  
Minimum Energy Condition Coefficient

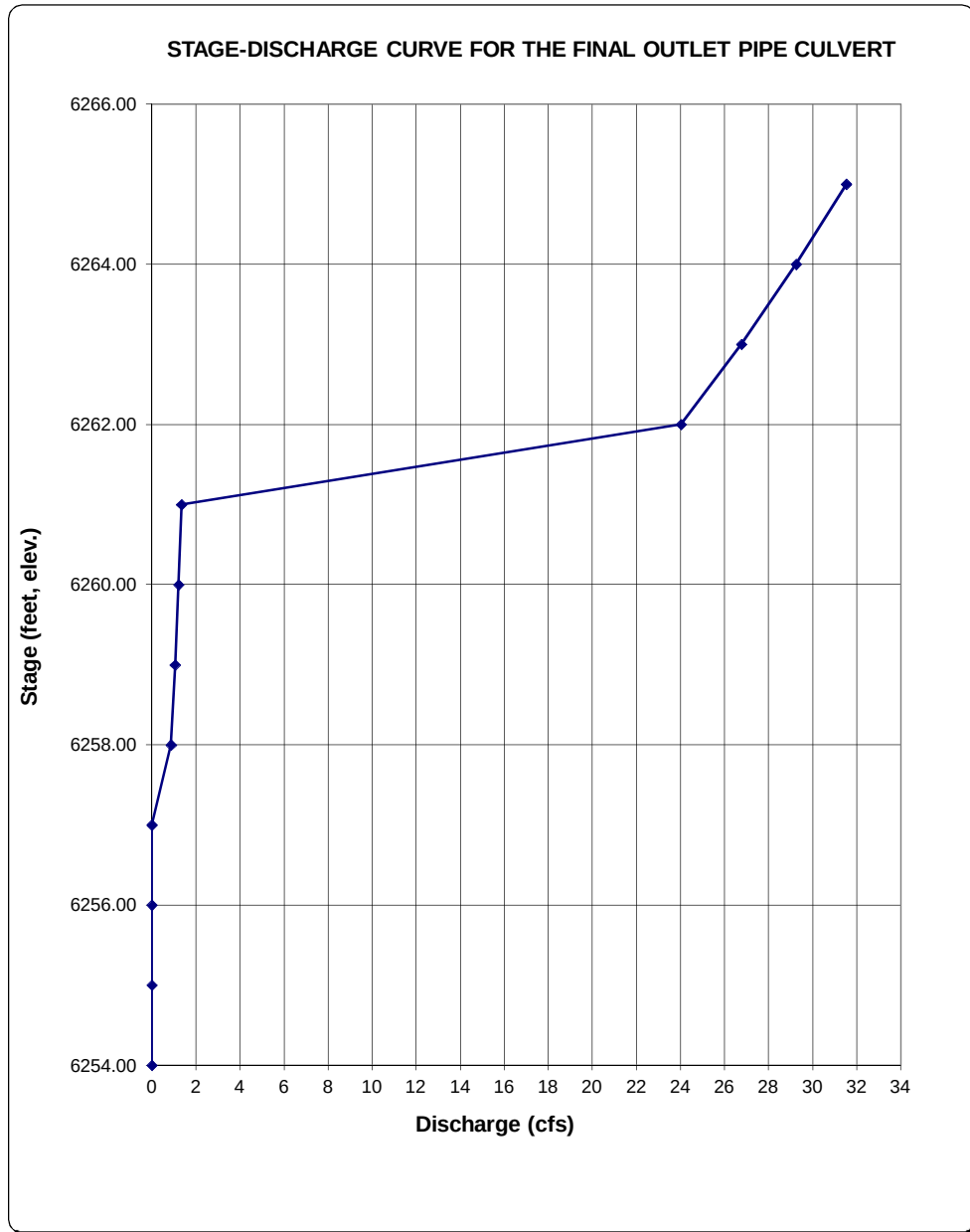
K<sub>e</sub> = 0.20  
K<sub>f</sub> = 0.58  
K<sub>0</sub> = 1.78  
C<sub>d</sub> = 0.99  
KE<sub>min</sub> = -0.03

## Calculations of Culvert Capacity (output):

| Water Surface<br>Elevation<br>From Sheet<br>"Basin"<br>(ft., linked) | Tailwater<br>Surface<br>Elevation<br>ft<br>(input if known) | Culvert<br>Inlet-Control<br>Flowrate<br>cfs<br>(output) | Culvert<br>Outlet-Control<br>Flowrate<br>cfs<br>(output) | Flowrate<br>Into Culvert<br>From Sheet<br>"Outlet"<br>(cfs, linked) | Controlling<br>Culvert<br>Flowrate<br>cfs<br>(output) | Inlet<br>Equation<br>Used<br>(output) |
|----------------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------|---------------------------------------|
| 6254.00                                                              | 0.00                                                        | 0.00                                                    | 0.00                                                     | 0.00                                                                | 0.00                                                  | No Flow (WS < inlet)                  |
| 6255.00                                                              | 0.00                                                        | 0.00                                                    | 0.00                                                     | 0.00                                                                | 0.00                                                  | No Flow (WS < inlet)                  |
| 6256.00                                                              | 0.00                                                        | 0.00                                                    | 0.00                                                     | 0.00                                                                | 0.00                                                  | No Flow (WS < inlet)                  |
| 6257.00                                                              | 0.00                                                        | 0.00                                                    | 0.00                                                     | 0.00                                                                | 0.00                                                  | No Flow (WS < inlet)                  |
| 6258.00                                                              | 0.00                                                        | 3.20                                                    | 7.03                                                     | 0.87                                                                | 0.87                                                  | Min. Energy. Eqn.                     |
| 6259.00                                                              | 0.00                                                        | 12.30                                                   | 9.09                                                     | 1.05                                                                | 1.05                                                  | Regression Eqn.                       |
| 6260.00                                                              | 0.00                                                        | 21.60                                                   | 15.86                                                    | 1.21                                                                | 1.21                                                  | Regression Eqn.                       |
| 6261.00                                                              | 0.00                                                        | 28.30                                                   | 21.95                                                    | 1.34                                                                | 1.34                                                  | Regression Eqn.                       |
| 6262.00                                                              | 0.00                                                        | 33.80                                                   | 26.66                                                    | 24.03                                                               | 24.03                                                 | Regression Eqn.                       |
| 6263.00                                                              | 0.00                                                        | 38.70                                                   | 30.69                                                    | 26.77                                                               | 26.77                                                 | Regression Eqn.                       |
| 6264.00                                                              | 0.00                                                        | 42.60                                                   | 34.21                                                    | 29.25                                                               | 29.25                                                 | Orifice Eqn.                          |
| 6265.00                                                              | 0.00                                                        | 46.10                                                   | 37.38                                                    | 31.53                                                               | 31.53                                                 | Orifice Eqn.                          |
| 6266.00                                                              | 0.00                                                        | 49.40                                                   | 40.29                                                    | 33.66                                                               | 33.66                                                 | Orifice Eqn.                          |
| 6267.00                                                              | 0.00                                                        | 52.40                                                   | 43.04                                                    | 35.67                                                               | 35.67                                                 | Orifice Eqn.                          |
| 6268.00                                                              | 0.00                                                        | 55.30                                                   | 45.70                                                    | 37.57                                                               | 37.57                                                 | Orifice Eqn.                          |
| 6269.00                                                              | 0.00                                                        | 58.00                                                   | 48.10                                                    | 39.37                                                               | 39.37                                                 | Orifice Eqn.                          |
| 6270.00                                                              | 0.00                                                        | 60.70                                                   | 50.41                                                    | 41.10                                                               | 41.10                                                 | Orifice Eqn.                          |
| 6271.00                                                              | 0.00                                                        | 63.20                                                   | 52.64                                                    | 42.76                                                               | 42.76                                                 | Orifice Eqn.                          |
| 6272.00                                                              | 0.00                                                        | 65.60                                                   | 54.78                                                    | 44.35                                                               | 44.35                                                 | Orifice Eqn.                          |
| 6273.00                                                              | 0.00                                                        | 67.90                                                   | 56.84                                                    | 45.89                                                               | 45.89                                                 | Orifice Eqn.                          |
| 6274.00                                                              | 0.00                                                        | 70.20                                                   | 58.81                                                    | 47.38                                                               | 47.38                                                 | Orifice Eqn.                          |
| 6275.00                                                              | 0.00                                                        | 72.30                                                   | 60.70                                                    | 48.83                                                               | 48.83                                                 | Orifice Eqn.                          |
| 6276.00                                                              | 0.00                                                        | 74.50                                                   | 62.58                                                    | 50.23                                                               | 50.23                                                 | Orifice Eqn.                          |
| 6277.00                                                              | 0.00                                                        | 76.50                                                   | 64.38                                                    | 51.59                                                               | 51.59                                                 | Orifice Eqn.                          |
| 6278.00                                                              | 0.00                                                        | 78.50                                                   | 66.10                                                    | 52.92                                                               | 52.92                                                 | Orifice Eqn.                          |
| 6279.00                                                              | 0.00                                                        | 80.50                                                   | 67.81                                                    | 54.22                                                               | 54.22                                                 | Orifice Eqn.                          |
| 6280.00                                                              | 0.00                                                        | 82.40                                                   | 69.53                                                    | 55.49                                                               | 55.49                                                 | Orifice Eqn.                          |
| 6281.00                                                              | 0.00                                                        | 84.20                                                   | 71.16                                                    | 56.73                                                               | 56.73                                                 | Orifice Eqn.                          |
| 6282.00                                                              | 0.00                                                        | 86.10                                                   | 72.70                                                    | 57.94                                                               | 57.94                                                 | Orifice Eqn.                          |
| 6283.00                                                              | 0.00                                                        | 87.90                                                   | 74.24                                                    | 59.13                                                               | 59.13                                                 | Orifice Eqn.                          |
| 6284.00                                                              | 0.00                                                        | 89.60                                                   | 75.79                                                    | 60.29                                                               | 60.29                                                 | Orifice Eqn.                          |
| 6285.00                                                              | 0.00                                                        | 91.30                                                   | 77.24                                                    | 61.43                                                               | 61.43                                                 | Orifice Eqn.                          |
| 6286.00                                                              | 0.00                                                        | 93.00                                                   | 78.79                                                    | 62.55                                                               | 62.55                                                 | Orifice Eqn.                          |
| 6287.00                                                              | 0.00                                                        | 94.70                                                   | 80.16                                                    | 63.65                                                               | 63.65                                                 | Orifice Eqn.                          |
| 6288.00                                                              | 0.00                                                        | 96.30                                                   | 81.62                                                    | 64.74                                                               | 64.74                                                 | Orifice Eqn.                          |
| 6289.00                                                              | 0.00                                                        | 97.90                                                   | 82.99                                                    | 65.80                                                               | 65.80                                                 | Orifice Eqn.                          |
| 6290.00                                                              | 0.00                                                        | 99.50                                                   | 84.36                                                    | 66.85                                                               | 66.85                                                 | Orifice Eqn.                          |
| 6291.00                                                              | 0.00                                                        | 101.00                                                  | 85.73                                                    | 67.88                                                               | 67.88                                                 | Orifice Eqn.                          |
| 6292.00                                                              | 0.00                                                        | 102.50                                                  | 87.02                                                    | 68.90                                                               | 68.90                                                 | Orifice Eqn.                          |
| 6293.00                                                              | 0.00                                                        | 104.00                                                  | 88.30                                                    | 69.90                                                               | 69.90                                                 | Orifice Eqn.                          |
| 6294.00                                                              | 0.00                                                        | 105.50                                                  | 89.59                                                    | 70.88                                                               | 70.88                                                 | Orifice Eqn.                          |
| 6295.00                                                              | 0.00                                                        | 107.00                                                  | 90.88                                                    | 71.86                                                               | 71.86                                                 | Orifice Eqn.                          |
| 6296.00                                                              | 0.00                                                        | 108.40                                                  | 92.16                                                    | 72.82                                                               | 72.82                                                 | Orifice Eqn.                          |
| 6297.00                                                              | 0.00                                                        | 109.90                                                  | 93.36                                                    | 73.77                                                               | 73.77                                                 | Orifice Eqn.                          |

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: World Compass Academy Site & Burt At Castle Rock Infrastructure  
Basin ID: Pond



# Design Procedure Form: Extended Detention Basin (EDB)

Sheet 1 of 4

**Designer:** Incline Associates  
**Company:** Plum Creek Investment Group, LLC  
**Date:** January 13, 2015  
**Project:** World Compass Academy Site & Burt At Castle Rock Infrastructure  
**Location:** Pond

## 1. Basin Storage Volume

- A) Effective Imperviousness of Tributary Area,  $I_a$
- B) Tributary Area's Imperviousness Ratio ( $i = I_a / 100$ )
- C) Contributing Watershed Area
- D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm
- E) Design Concept  
(Select EURV when also designing for flood control)
- F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time  
( $V_{DESIGN} = (1.0 * (0.91 * i^2 - 1.19 * i^2 + 0.78 * i) / 12 * Area * 1.2)$ )
- G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume  
( $V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43))$ )
- H) User Input of Water Quality Capture Volume (WQCV) Design Volume  
(Only if a different WQCV Design Volume is desired)
- I) Predominant Watershed NRCS Soil Group
- J) Excess Urban Runoff Volume (EURV) Design Volume  
 For HSG A:  $EURV_A = (0.1878i - 0.0104) * Area$   
 For HSG B:  $EURV_B = (0.1178i - 0.0042) * Area$   
 For HSG C/D:  $EURV_{C/D} = (0.1043i - 0.0031) * Area$

$I_a = 60.0$  %

$i = 0.600$

Area = 24.900 ac

$d_6 =$  in

Choose One

- ☐ Water Quality Capture Volume (WQCV)  
☒ Excess Urban Runoff Volume (EURV)

$V_{DESIGN} = 0.588$  ac-ft

$V_{DESIGN\ OTHER} =$  ac-ft

$V_{DESIGN\ USER} =$  ac-ft

Choose One

- ☐ A  
☐ B  
☒ C / D

EURV = 1.481 ac-ft

## 2. Basin Shape: Length to Width Ratio

(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

$L : W = 2.0 : 1$

## 3. Basin Side Slopes

- A) Basin Maximum Side Slopes  
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

$Z = 4.00$  ft / ft

## 4. Inlet

- A) Describe means of providing energy dissipation at concentrated inflow locations:

Concrete forebays included for all concentrated inflow locations.

# Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

**Designer:** Incline Associates  
**Company:** Plum Creek Investment Group, LLC  
**Date:** January 13, 2015  
**Project:** World Compass Academy Site & Burt At Castle Rock Infrastructure  
**Location:** Pond

## 5. Forebay

A) Minimum Forebay Volume  
( $V_{FMIN} = 3\%$  of the WQCV)

$V_{FMIN} = 0.015$  ac-ft

B) Actual Forebay Volume

$V_F = 0.017$  ac-ft

C) Forebay Depth  
( $D_F = 18$  inch maximum)

$D_F = 18.0$  in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge

$Q_{100} = 87.40$  cfs

ii) Forebay Discharge Design Flow  
( $Q_F = 0.02 * Q_{100}$ )

$Q_F = 1.75$  cfs

E) Forebay Discharge Design

Choose One

- ☐ Berm With Pipe  
☒ Wall with Rect. Notch  
☐ Wall with V-Notch Weir

(flow too small for berm w/ pipe)

F) Discharge Pipe Size (minimum 8-inches)

Calculated  $D_p =$  in

G) Rectangular Notch Width

Calculated  $W_N = 7.0$  in

## 6. Trickle Channel

A) Type of Trickle Channel

Choose One

- ☒ Concrete  
☐ Soft Bottom

F) Slope of Trickle Channel

$S = 0.0050$  ft / ft

## 7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum)

$D_M = 2.5$  ft

B) Surface Area of Micropool (10 ft<sup>2</sup> minimum)

$A_M = 225$  sq ft

C) Outlet Type

Choose One

- ☒ Orifice Plate  
☐ Other (Describe):

D) Depth of Design Volume (EURV or 1.2 WQCV) Based on the Design Concept Chosen Under 1.E.

$H = 3.67$  feet

E) Volume to Drain Over Prescribed Time

EURV = 1.481 ac-ft

F) Drain Time  
(Min  $T_D$  for WQCV= 40 hours; Max  $T_D$  for EURV= 72 hours)

$T_D = 72$  hours

G) Recommended Maximum Outlet Area per Row, ( $A_o$ )

$A_o = 1.38$  square inches

H) Orifice Dimensions:

i) Circular Orifice Diameter or

ii) Width of 2" High Rectangular Orifice

$D_{orifice} = 1 - 5 / 16$  inches

$W_{orifice} =$  inches

I) Number of Columns

$n_c = 1$  number

J) Actual Design Outlet Area per Row ( $A_o$ )

$A_o = 1.35$  square inches

K) Number of Rows ( $n_r$ )

$n_r = 11$  number

L) Total Outlet Area ( $A_{ot}$ )

$A_{ot} = 14.9$  square inches

M) Depth of WQCV ( $H_{WQCV}$ )  
(Estimate using actual stage-area-volume relationship and  $V_{WQCV}$ )

$H_{WQCV} =$  feet

N) Ensure Minimum 40 Hour Drain Time for WQCV

$T_{D WQCV} =$  hours

# Design Procedure Form: Extended Detention Basin (EDB)

Sheet 3 of 4

**Designer:** Incline Associates  
**Company:** Plum Creek Investment Group, LLC  
**Date:** January 13, 2015  
**Project:** World Compass Academy Site & Burt At Castle Rock Infrastructure  
**Location:** Pond

## 8. Initial Surcharge Volume

- A) Depth of Initial Surcharge Volume  
(Minimum recommended depth is 4 inches)
- B) Minimum Initial Surcharge Volume  
(Minimum volume of 0.3% of the WQCV)
- C) Initial Surcharge Provided Above Micropool

$D_{IS} = 4.0$  in

$V_{IS} = 64.0$  cu ft

$V_s = 75.0$  cu ft

## 9. Trash Rack

- A) Type of Water Quality Orifice Used

Choose One

- ☐ Circular (up to 1-1/4" diame  
☒ Circular (greater than 1-1/4" diameter) OR Rectangular (2" high)

$A_t = 506$  square inches

- B) Water Quality Screen Open Area:  $A_s = A_{ot} * 38.5 * (e^{-0.095D})$

- C) For 1-1/4", or Smaller, Circular Opening (See Fact Sheet T-12):

i) Width of Water Quality Screen and Concrete Opening ( $W_{opening}$ )

$W_{opening} =$  inches

ii) Height of Water Quality Screen ( $H_{TR}$ )

$H_{TR} =$  inches

iii) Type of Screen, Describe if "Other"

Choose One

- ☐ S.S. Well Screen with 60% Open Area\*  
☐ Other (Describe)

- D) For Circular Opening (greater than 1-1/4" diameter)  
OR 2" High Rectangular Opening (See Fact Sheet T-12):

i) Width of Water Quality Screen Opening ( $W_{opening}$ )

$W_{opening} = 1.0$  ft

ii) Height of Water Quality Screen ( $H_{TR}$ )

$H_{TR} = 6.0$  ft

iii) Type of Screen, Describe if "Other"

Choose One

- ☒ Aluminum Amico-Klemp SR Series (or equal)  
☐ Other (Describe):

v) Cross-bar Spacing

$2.0$  inches

vi) Minimum Bearing Bar Size

1-3/4 inch x 3/16 inch



# Design Procedure Form: Extended Detention Basin (EDB)

Sheet 4 of 4

**Designer:** Incline Associates  
**Company:** Plum Creek Investment Group, LLC  
**Date:** January 13, 2015  
**Project:** World Compass Academy Site & Burt At Castle Rock Infrastructure  
**Location:** Pond

## 10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping:

Soil riprap placed along spillway along with concrete cutoff wall.

B) Slope of Overflow Embankment  
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

$Z_E =$  4.00 ft / ft

## 11. Vegetation

Choose One

☐ Irrigated

☒ Not Irrigated

## 12. Access

A) Describe Sediment Removal Procedures

Maintenance access provided to forebays and outlet structure.

Notes: