DOCKETED

Docket Number:	16-AFC-01
Project Title:	Stanton Energy Reliability Center
TN #:	223281
Document Title:	Stanton Energy Reliability Center LLC's Response to PSA Workshop Queries
Description:	N/A
Filer:	Marie Fleming
Organization:	DayZen LLC
Submitter Role:	Applicant Representative
Submission Date:	4/26/2018 8:03:24 AM
Docketed Date:	4/26/2018

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STATE OF CALIFORNIA

Energy Resources
Conservation and Development Commission

In the Matter of: Application For Certification **STANTON ENERGY RELIABILITY CENTER**	**DOCKET NO. 16-AFC-01** **STANTON ENERGY RELIABILITY CENTER, LLC's RESPONSE TO PSA WORKSHOP QUERIES**

Stanton Energy Reliability Center, LLC (SERC, LLC), LLC hereby submits these Responses to Preliminary Staff Assessment (PSA) Workshop Queries to assist Staff in preparation of the Final Staff Assessment (FSA). SERC, LLC docketed a new storm water drainage design and a draft Water Quality Management Plan (WQMP) on April 11, 2018. Representatives of SERC, LLC and Staff discussed the submittal at the PSA Workshop on April 19, 2018. As a result of that discussion, Staff requested additional information be docketed. Following are responses to Staff's queries and included attachments as discussed, as prepared by WSP.

Workshop Query 1

Staff requested information relating to the 100-year hydrologic analysis to demonstrate no net increase in peak flows.

SERC, LLC is providing the 100-year Existing and Proposed Rational Method, and the Proposed and Routed Hydrographs. See Attachments A, B and C. For ease of reference, Hydrology Maps for Existing System and Proposed System are included in Attachment E.

Workshop Query 2

Staff requested the source details or formula for calculation of Time of Concentrations (TOC).

The calculations for TOC are provided in Table 4 of Attachment D.

Workshop Query 3

Staff requested an expanded discussion of Figure 2 of the WQMP in order to better understand the calculations supporting the values reported in Figure 2.

Storage volume for storm drain break down is provided in Table 1 and 2 of Attachment D. Storage volumes for the StormTech devices for DMA 2 and DMA 3 are provided in the previously docketed WQMP in the StormTech drawings.

Workshop Query 4

Staff requested additional information to provide a basis retention gravel porosity of 40 percent.

A tech sheet published by StormTech, the manufacturer of the proposed infiltration devices, is provided in Attachment F. It should be noted that a technical approach to protecting the backfill rock from soils migration is discussed in the fourth bullet-point on Page 1 of the tech sheet, i.e. “Porosity is protected from soils migration by a non-woven geotextile that surrounds the entire system.” In addition to this installation technique for the StormTech devices for DMAs 2 and 3, WSP’s storm water infiltration design also proposes placement of the non-woven geotextile for the entire area of the retention gravel bed for the DMA 1 system. As such, a 40 percent porosity for all drainage management gravel beds for the project is warranted.

Dated: April 26, 2018

Respectfully Submitted,

_____

Scott A. Galati
Counsel to SERC, LLC

Table 1. 100 Year Peak Flow Summary Table

Drainage Management Area	DMA 1	DMA 2	DMA 3
Drainage Area (Acres)	1.75	0.8	0.81
Q100 Existing (cfs)	2.81	2.48	3.35
Q100 Proposed (cfs)	2.24*	2.18*	2.43**

* Routed Hydrograph Peak

** Rational Method Peak No Hydrograph Routing Necessary

Attachment A – Q100 Existing and Proposed Rational Method

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**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
        (c) Copyright 1983-2011 Advanced Engineering Software (aes)
            Ver. 18.0  Release Date: 07/01/2011  License ID 1501

                          Analysis prepared by:



 ************************* DESCRIPTION OF STUDY *************************
* Stanton Energy Reliability Center                                      *
* Existing Condition                                                     *
* 100 Year Storm Event                                                   *
 ************************************************************************

  FILE NAME: XEAST.DAT
  TIME/DATE OF STUDY: 14:03 03/19/2018
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.5500
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.3900

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   341.00
  ELEVATION DATA: UPSTREAM(FEET) =     72.70  DOWNSTREAM(FEET) =     72.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   25.086
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 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.245
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 NATURAL FAIR COVER
 "GRASS"                    B        0.88      0.30     1.000    86   25.09
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA RUNOFF(CFS) =      1.53
 TOTAL AREA(ACRES) =      0.88   PEAK FLOW RATE(CFS) =      1.53

****************************************************************************
 FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     72.00  DOWNSTREAM(FEET) =     71.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   335.00   CHANNEL SLOPE =  0.0030
 CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.020   MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.084
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL FAIR COVER
 "GRASS"                    B        0.85      0.30     1.000    86
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.22
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.53
 AVERAGE FLOW DEPTH(FEET) =   0.26   TRAVEL TIME(MIN.) =   3.65
 Tc(MIN.) =   28.73
 SUBAREA AREA(ACRES) =     0.85       SUBAREA RUNOFF(CFS) =    1.37
 EFFECTIVE AREA(ACRES) =      1.73     AREA-AVERAGED Fm(INCH/HR) =   0.30
 AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
 TOTAL AREA(ACRES) =        1.7         PEAK FLOW RATE(CFS) =       2.77

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.30   FLOW VELOCITY(FEET/SEC.) =   1.65
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     676.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    68.50  DOWNSTREAM(FEET) =    64.50
 FLOW LENGTH(FEET) =    35.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS   3.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  11.10
 GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.77
 PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =   28.78
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =     711.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   28.78
```

```
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.082
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  B        0.02      0.30     0.100    76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =    0.02      SUBAREA RUNOFF(CFS) =    0.04
 EFFECTIVE AREA(ACRES) =      1.75   AREA-AVERAGED Fm(INCH/HR) =  0.30
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.99
 TOTAL AREA(ACRES) =        1.7       PEAK FLOW RATE(CFS) =       2.81

****************************************************************************
 FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   28.78
 RAINFALL INTENSITY(INCH/HR) =   2.08
 AREA-AVERAGED Fm(INCH/HR) =  0.30
 AREA-AVERAGED Fp(INCH/HR) =  0.30
 AREA-AVERAGED Ap =  0.99
 EFFECTIVE STREAM AREA(ACRES) =       1.75
 TOTAL STREAM AREA(ACRES) =       1.75
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.81

****************************************************************************
 FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   160.00
 ELEVATION DATA: UPSTREAM(FEET) =     70.00  DOWNSTREAM(FEET) =     68.30

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.921
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.740
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 NATURAL POOR COVER
 "BARREN"                    B        0.80      0.30     1.000    97    9.92
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA RUNOFF(CFS) =      2.48
 TOTAL AREA(ACRES) =      0.80   PEAK FLOW RATE(CFS) =      2.48

****************************************************************************
 FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    65.50  DOWNSTREAM(FEET) =    64.00
 FLOW LENGTH(FEET) =    63.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.10
 PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
 GIVEN PIPE DIAMETER(INCH) =   8.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.48
```

```
 PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =   10.07
 LONGEST FLOWPATH FROM NODE    203.00 TO NODE    205.00 =     223.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    205.00 TO NODE    206.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    64.00  DOWNSTREAM(FEET) =    63.60
 FLOW LENGTH(FEET) =   124.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS   6.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   2.92
 GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.48
 PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =   10.78
 LONGEST FLOWPATH FROM NODE    203.00 TO NODE    206.00 =     347.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    206.00 TO NODE    303.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   10.78
 RAINFALL INTENSITY(INCH/HR) =   3.57
 AREA-AVERAGED Fm(INCH/HR) =  0.30
 AREA-AVERAGED Fp(INCH/HR) =  0.30
 AREA-AVERAGED Ap =  1.00
 EFFECTIVE STREAM AREA(ACRES) =       0.80
 TOTAL STREAM AREA(ACRES) =       0.80
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.48

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        2.81   28.78    2.082  0.30( 0.30) 0.99       1.7     300.00
     2        2.48   10.78    3.574  0.30( 0.30) 1.00       0.8     203.00

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        4.41   10.78    3.574  0.30( 0.30) 1.00       1.5     203.00
     2        4.16   28.78    2.082  0.30( 0.30) 0.99       2.5     300.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       4.41    Tc(MIN.) =    10.78
 EFFECTIVE AREA(ACRES) =       1.45   AREA-AVERAGED Fm(INCH/HR) =  0.30
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  1.00
 TOTAL AREA(ACRES) =        2.5
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =     711.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
```

```
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   195.00
  ELEVATION DATA: UPSTREAM(FEET) =     69.90  DOWNSTREAM(FEET) =     68.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.725
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.632
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.81      0.30     0.100    76    6.72
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      3.35
  TOTAL AREA(ACRES) =      0.81   PEAK FLOW RATE(CFS) =      3.35

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    66.60  DOWNSTREAM(FEET) =    65.90
  FLOW LENGTH(FEET) =    81.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.61
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =   8.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.35
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =    6.87
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     276.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    206.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    65.90  DOWNSTREAM(FEET) =    63.60
  FLOW LENGTH(FEET) =   411.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   6.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.87
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.35
  PIPE TRAVEL TIME(MIN.) =   1.77    Tc(MIN.) =    8.63
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    206.00 =     687.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.8  TC(MIN.) =      8.63
  EFFECTIVE AREA(ACRES) =      0.81  AREA-AVERAGED Fm(INCH/HR)=  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       3.35
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

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**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
        (c) Copyright 1983-2011 Advanced Engineering Software (aes)
            Ver. 18.0  Release Date: 07/01/2011  License ID 1501

                          Analysis prepared by:



 ************************* DESCRIPTION OF STUDY *************************
* Stanton Energy Reliablity Center                                      *
* Proposed Condition                                                    *
* 100 Year Storm Event                                                  *
 ************************************************************************

  FILE NAME: SERC1.DAT
  TIME/DATE OF STUDY: 14:49 03/18/2018
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.5500
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.3900

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   140.00
  ELEVATION DATA: UPSTREAM(FEET) =     72.50  DOWNSTREAM(FEET) =     71.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.982
```

```
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.537
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 CONDOMINIUMS               B        0.25      0.30     0.350    76    6.98
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
 SUBAREA RUNOFF(CFS) =      1.00
 TOTAL AREA(ACRES) =      0.25   PEAK FLOW RATE(CFS) =      1.00

****************************************************************************
 FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    66.50  DOWNSTREAM(FEET) =    65.25
 FLOW LENGTH(FEET) =   156.00   MANNING'S N =  0.010
 DEPTH OF FLOW IN  36.0 INCH PIPE IS   2.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.66
 GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.00
 PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =    7.69
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     296.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =    7.69
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.302
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 RESIDENTIAL
 "3-4 DWELLINGS/ACRE"       B        0.21      0.30     0.600    76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
 SUBAREA AREA(ACRES) =    0.21      SUBAREA RUNOFF(CFS) =    0.78
 EFFECTIVE AREA(ACRES) =      0.46   AREA-AVERAGED Fm(INCH/HR) =  0.14
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.46
 TOTAL AREA(ACRES) =        0.5       PEAK FLOW RATE(CFS) =       1.72

****************************************************************************
 FLOW PROCESS FROM NODE    502.00 TO NODE    503.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    65.25  DOWNSTREAM(FEET) =    64.48
 FLOW LENGTH(FEET) =   111.00   MANNING'S N =  0.010
 DEPTH OF FLOW IN  36.0 INCH PIPE IS   3.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.11
 GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.72
 PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =    8.14
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    503.00 =     407.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    503.00 TO NODE    503.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
==========================================================================
  MAINLINE Tc(MIN.) =    8.14
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.169
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       B        0.15      0.30     0.500    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA AREA(ACRES) =    0.15      SUBAREA RUNOFF(CFS) =    0.54
  EFFECTIVE AREA(ACRES) =      0.61   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.47
  TOTAL AREA(ACRES) =        0.6       PEAK FLOW RATE(CFS) =       2.21

**************************************************************************
  FLOW PROCESS FROM NODE    503.00 TO NODE    504.00 IS CODE =  41
--------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    64.48  DOWNSTREAM(FEET) =    63.37
  FLOW LENGTH(FEET) =   156.00   MANNING'S N =  0.010
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   4.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.47
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.21
  PIPE TRAVEL TIME(MIN.) =   0.58    Tc(MIN.) =    8.72
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    504.00 =     563.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE    504.00 TO NODE    504.00 IS CODE =  81
--------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  MAINLINE Tc(MIN.) =    8.72
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.014
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.24      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.24      SUBAREA RUNOFF(CFS) =    0.84
  EFFECTIVE AREA(ACRES) =      0.85   AREA-AVERAGED Fm(INCH/HR) =  0.13
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.44
  TOTAL AREA(ACRES) =        0.9       PEAK FLOW RATE(CFS) =       2.97

**************************************************************************
  FLOW PROCESS FROM NODE    504.00 TO NODE    509.00 IS CODE =  41
--------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    63.37  DOWNSTREAM(FEET) =    59.50
  FLOW LENGTH(FEET) =    96.00   MANNING'S N =  0.010
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   3.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.96
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.97
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =    8.90
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    509.00 =     659.00 FEET.
```

```
**************************************************************************
  FLOW PROCESS FROM NODE    509.00 TO NODE    509.00 IS CODE =   1
--------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.90
  RAINFALL INTENSITY(INCH/HR) =   3.97
  AREA-AVERAGED Fm(INCH/HR) =  0.13
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.44
  EFFECTIVE STREAM AREA(ACRES) =       0.85
  TOTAL STREAM AREA(ACRES) =       0.85
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.97

**************************************************************************
  FLOW PROCESS FROM NODE    505.00 TO NODE    506.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   151.00
  ELEVATION DATA: UPSTREAM(FEET) =     73.00  DOWNSTREAM(FEET) =     71.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.999
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.531
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "8-10 DWELLINGS/ACRE"      B        0.23      0.30     0.400    76    7.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.400
  SUBAREA RUNOFF(CFS) =      0.91
  TOTAL AREA(ACRES) =      0.23   PEAK FLOW RATE(CFS) =      0.91

**************************************************************************
  FLOW PROCESS FROM NODE    506.00 TO NODE    507.00 IS CODE =  41
--------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    66.50  DOWNSTREAM(FEET) =    66.25
  FLOW LENGTH(FEET) =   205.00   MANNING'S N =  0.010
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   4.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   1.85
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.91
  PIPE TRAVEL TIME(MIN.) =   1.85    Tc(MIN.) =    8.85
  LONGEST FLOWPATH FROM NODE    505.00 TO NODE    507.00 =     356.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE    507.00 TO NODE    507.00 IS CODE =  81
--------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  MAINLINE Tc(MIN.) =    8.85
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.984
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
```

```
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       B        0.20      0.30     0.600    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    0.20      SUBAREA RUNOFF(CFS) =    0.68
  EFFECTIVE AREA(ACRES) =      0.43   AREA-AVERAGED Fm(INCH/HR) =  0.15
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.49
  TOTAL AREA(ACRES) =        0.4       PEAK FLOW RATE(CFS) =       1.48

****************************************************************************
  FLOW PROCESS FROM NODE    507.00 TO NODE    508.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    66.25  DOWNSTREAM(FEET) =    65.15
  FLOW LENGTH(FEET) =   175.00   MANNING'S N =  0.010
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   3.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.79
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.48
  PIPE TRAVEL TIME(MIN.) =   0.77    Tc(MIN.) =    9.61
  LONGEST FLOWPATH FROM NODE    505.00 TO NODE    508.00 =     531.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    508.00 TO NODE    508.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    9.61
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.805
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       B        0.16      0.30     0.600    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    0.16      SUBAREA RUNOFF(CFS) =    0.52
  EFFECTIVE AREA(ACRES) =      0.59   AREA-AVERAGED Fm(INCH/HR) =  0.16
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.52
  TOTAL AREA(ACRES) =        0.6       PEAK FLOW RATE(CFS) =       1.94

****************************************************************************
  FLOW PROCESS FROM NODE    508.00 TO NODE    509.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    65.15  DOWNSTREAM(FEET) =    59.50
  FLOW LENGTH(FEET) =   114.00   MANNING'S N =  0.010
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   2.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.46
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.94
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =    9.84
  LONGEST FLOWPATH FROM NODE    505.00 TO NODE    509.00 =     645.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    509.00 TO NODE    509.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
  MAINLINE Tc(MIN.) =    9.84
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.757
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS                B        0.19      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.62
  EFFECTIVE AREA(ACRES) =      0.78   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.48
  TOTAL AREA(ACRES) =        0.8       PEAK FLOW RATE(CFS) =       2.54

****************************************************************************
  FLOW PROCESS FROM NODE    509.00 TO NODE    509.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.84
  RAINFALL INTENSITY(INCH/HR) =   3.76
  AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.48
  EFFECTIVE STREAM AREA(ACRES) =       0.78
  TOTAL STREAM AREA(ACRES) =       0.78
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.54

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.97    8.90    3.970  0.30( 0.13) 0.44       0.9     500.00
      2        2.54    9.84    3.757  0.30( 0.14) 0.48       0.8     505.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        5.40    8.90    3.970  0.30( 0.14) 0.46       1.6     500.00
      2        5.34    9.84    3.757  0.30( 0.14) 0.46       1.6     505.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       5.40    Tc(MIN.) =     8.90
  EFFECTIVE AREA(ACRES) =       1.56   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.46
  TOTAL AREA(ACRES) =        1.6
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    509.00 =     659.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    509.00 TO NODE    510.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    59.50  DOWNSTREAM(FEET) =    58.50
  FLOW LENGTH(FEET) =   117.00   MANNING'S N =  0.010
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   6.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.22
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       5.40
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =    9.22
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    510.00 =     776.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    510.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    9.22
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.895
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  APARTMENTS                 B        0.12      0.30      0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.12      SUBAREA RUNOFF(CFS) =    0.41
  EFFECTIVE AREA(ACRES) =      1.68   AREA-AVERAGED Fm(INCH/HR) =  0.13
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.44
  TOTAL AREA(ACRES) =        1.8       PEAK FLOW RATE(CFS) =       5.68

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   195.00
  ELEVATION DATA: UPSTREAM(FEET) =     69.90  DOWNSTREAM(FEET) =     68.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.684
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.591
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                B        0.81      0.30      0.850    76   10.68
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      2.43
  TOTAL AREA(ACRES) =      0.81   PEAK FLOW RATE(CFS) =      2.43

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    66.60  DOWNSTREAM(FEET) =    65.90
  FLOW LENGTH(FEET) =    81.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.97
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =   8.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.43
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   10.88
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     276.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    205.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    65.90  DOWNSTREAM(FEET) =    63.97
  FLOW LENGTH(FEET) =   290.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   5.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.73
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.43
  PIPE TRAVEL TIME(MIN.) =   1.29    Tc(MIN.) =   12.17
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =     566.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.17
  RAINFALL INTENSITY(INCH/HR) =   3.34
  AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =       0.81
  TOTAL STREAM AREA(ACRES) =       0.81
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.43

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   166.00
  ELEVATION DATA: UPSTREAM(FEET) =     70.00  DOWNSTREAM(FEET) =     68.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.331
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.868
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                B        0.80      0.30     0.850    76    9.33
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      2.60
  TOTAL AREA(ACRES) =      0.80   PEAK FLOW RATE(CFS) =      2.60

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    65.53  DOWNSTREAM(FEET) =    63.97
  FLOW LENGTH(FEET) =    61.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.45
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =   8.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.60
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =    9.47
  LONGEST FLOWPATH FROM NODE    203.00 TO NODE    205.00 =     227.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.47
  RAINFALL INTENSITY(INCH/HR) =   3.84
  AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.85
  EFFECTIVE STREAM AREA(ACRES) =       0.80
  TOTAL STREAM AREA(ACRES) =       0.80
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.60

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.43   12.17    3.342  0.30( 0.26) 0.85       0.8     200.00
      2        2.60    9.47    3.838  0.30( 0.25) 0.85       0.8     203.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.80    9.47    3.838  0.30( 0.26) 0.85       1.4     203.00
      2        4.67   12.17    3.342  0.30( 0.26) 0.85       1.6     200.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.80    Tc(MIN.) =     9.47
  EFFECTIVE AREA(ACRES) =       1.43   AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.85
  TOTAL AREA(ACRES) =        1.6
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =     566.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.6  TC(MIN.) =      9.47
  EFFECTIVE AREA(ACRES) =      1.43  AREA-AVERAGED Fm(INCH/HR)=  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.850
  PEAK FLOW RATE(CFS)   =       4.80

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.80    9.47    3.838  0.30( 0.26) 0.85       1.4     203.00
      2        4.67   12.17    3.342  0.30( 0.26) 0.85       1.6     200.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

Attachment B – Q100 Proposed Hydrographs

DMA 1 - Parcel 1 - Post Construction 100 Year Storm Event - Hydrograph

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 ============================================================================
 *** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC III:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     5.83 (inches)

    SOIL-COVER     AREA      PERCENT OF    SCS CURVE    LOSS RATE
      TYPE      (Acres)   PERVIOUS AREA    NUMBER    Fp(in./hr.)    YIELD
       1         0.75        0.00       98.(AMC II)     0.300       0.959
       2         1.00      100.00       72.(AMC II)     0.300       0.784

    TOTAL AREA (Acres) =      1.75

                  _
    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.171

                  _
    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.141
 ============================================================================

 ----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.93
    TOTAL CATCHMENT AREA(ACRES) =    1.75
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.171
    LOW LOSS FRACTION = 0.141
    TIME OF CONCENTRATION(MIN.) =  9.22
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
      5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.42
     30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.99
      1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.39
      3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.40
      6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.32
     24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.83

 ----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.68
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.17

 ****************************************************************************
  TIME    VOLUME      Q   0.       2.5       5.0       7.5       10.0
 (HOURS)   (AF)     (CFS)
 ----------------------------------------------------------------------------
  0.02     0.0000     0.00  Q        .         .         .         .
```

0.17	0.0009	0.14	Q	.	.	.	.
0.33	0.0026	0.14	Q	.	.	.	.
0.48	0.0044	0.14	Q	.	.	.	.
0.63	0.0062	0.14	Q	.	.	.	.
0.79	0.0080	0.14	Q	.	.	.	.
0.94	0.0098	0.14	Q	.	.	.	.
1.09	0.0116	0.14	Q	.	.	.	.
1.25	0.0134	0.14	Q	.	.	.	.
1.40	0.0152	0.14	Q	.	.	.	.
1.56	0.0171	0.15	Q	.	.	.	.
1.71	0.0189	0.15	Q	.	.	.	.
1.86	0.0208	0.15	Q	.	.	.	.
2.02	0.0227	0.15	Q	.	.	.	.
2.17	0.0246	0.15	Q	.	.	.	.
2.32	0.0265	0.15	Q	.	.	.	.
2.48	0.0284	0.15	Q	.	.	.	.
2.63	0.0303	0.15	Q	.	.	.	.
2.78	0.0323	0.15	Q	.	.	.	.
2.94	0.0342	0.15	Q	.	.	.	.
3.09	0.0362	0.16	Q	.	.	.	.
3.25	0.0382	0.16	Q	.	.	.	.
3.40	0.0402	0.16	Q	.	.	.	.
3.55	0.0422	0.16	Q	.	.	.	.
3.71	0.0442	0.16	Q	.	.	.	.
3.86	0.0463	0.16	Q	.	.	.	.
4.01	0.0483	0.16	Q	.	.	.	.
4.17	0.0504	0.16	Q	.	.	.	.
4.32	0.0525	0.16	Q	.	.	.	.
4.47	0.0546	0.17	Q	.	.	.	.
4.63	0.0567	0.17	Q	.	.	.	.
4.78	0.0589	0.17	Q	.	.	.	.
4.94	0.0610	0.17	Q	.	.	.	.
5.09	0.0632	0.17	Q	.	.	.	.
5.24	0.0654	0.17	Q	.	.	.	.
5.40	0.0676	0.18	Q	.	.	.	.
5.55	0.0698	0.18	Q	.	.	.	.
5.70	0.0721	0.18	Q	.	.	.	.
5.86	0.0743	0.18	Q	.	.	.	.
6.01	0.0766	0.18	Q	.	.	.	.
6.17	0.0789	0.18	Q	.	.	.	.
6.32	0.0813	0.18	Q	.	.	.	.
6.47	0.0836	0.19	Q	.	.	.	.
6.63	0.0860	0.19	Q	.	.	.	.
6.78	0.0884	0.19	Q	.	.	.	.
6.93	0.0908	0.19	Q	.	.	.	.
7.09	0.0933	0.19	Q	.	.	.	.
7.24	0.0957	0.20	Q	.	.	.	.

7.39	0.0982	0.20	Q	.	.	.	.
7.55	0.1008	0.20	Q	.	.	.	.
7.70	0.1033	0.20	Q	.	.	.	.
7.86	0.1059	0.20	Q	.	.	.	.
8.01	0.1085	0.21	Q	.	.	.	.
8.16	0.1111	0.21	Q	.	.	.	.
8.32	0.1138	0.21	Q	.	.	.	.
8.47	0.1165	0.21	Q	.	.	.	.
8.62	0.1192	0.22	Q	.	.	.	.
8.78	0.1220	0.22	Q	.	.	.	.
8.93	0.1248	0.22	Q	.	.	.	.
9.09	0.1276	0.22	Q	.	.	.	.
9.24	0.1305	0.23	Q	.	.	.	.
9.39	0.1334	0.23	Q	.	.	.	.
9.55	0.1363	0.23	Q	.	.	.	.
9.70	0.1393	0.24	Q	.	.	.	.
9.85	0.1423	0.24	Q	.	.	.	.
10.01	0.1454	0.24	Q	.	.	.	.
10.16	0.1485	0.25	Q	.	.	.	.
10.31	0.1517	0.25	.Q	.	.	.	.
10.47	0.1549	0.25	.Q	.	.	.	.
10.62	0.1582	0.26	.Q	.	.	.	.
10.78	0.1615	0.26	.Q	.	.	.	.
10.93	0.1649	0.27	.Q	.	.	.	.
11.08	0.1684	0.27	.Q	.	.	.	.
11.24	0.1719	0.28	.Q	.	.	.	.
11.39	0.1754	0.28	.Q	.	.	.	.
11.54	0.1791	0.29	.Q	.	.	.	.
11.70	0.1828	0.29	.Q	.	.	.	.
11.85	0.1866	0.30	.Q	.	.	.	.
12.00	0.1905	0.31	.Q	.	.	.	.
12.16	0.1947	0.36	.Q	.	.	.	.
12.31	0.1994	0.37	.Q	.	.	.	.
12.47	0.2042	0.38	.Q	.	.	.	.
12.62	0.2090	0.39	.Q	.	.	.	.
12.77	0.2140	0.40	.Q	.	.	.	.
12.93	0.2191	0.41	.Q	.	.	.	.
13.08	0.2244	0.42	.Q	.	.	.	.
13.23	0.2298	0.43	.Q	.	.	.	.
13.39	0.2353	0.44	.Q	.	.	.	.
13.54	0.2410	0.45	.Q	.	.	.	.
13.70	0.2469	0.47	.Q	.	.	.	.
13.85	0.2530	0.49	.Q	.	.	.	.
14.00	0.2593	0.51	. Q	.	.	.	.
14.16	0.2660	0.54	. Q	.	.	.	.
14.31	0.2732	0.59	. Q	.	.	.	.
14.46	0.2807	0.60	. Q	.	.	.	.

14.62	0.2887	0.65	.	Q	.	.	.	.
14.77	0.2970	0.67	.	Q	.	.	.	.
14.92	0.3059	0.73	.	Q	.	.	.	.
15.08	0.3153	0.76	.	Q	.	.	.	.
15.23	0.3255	0.84	.	Q	.	.	.	.
15.39	0.3366	0.90	.	Q	.	.	.	.
15.54	0.3489	1.04	.	Q	.	.	.	.
15.69	0.3628	1.15	.	Q	.	.	.	.
15.85	0.3798	1.53	.	Q	.	.	.	.
16.00	0.4026	2.07	.	Q	.	.	.	.
16.15	0.4518	5.68	.	.	.	Q	.	.
16.31	0.4961	1.30	.	Q	.	.	.	.
16.46	0.5105	0.96	.	Q	.	.	.	.
16.61	0.5216	0.80	.	Q	.	.	.	.
16.77	0.5311	0.70	.	Q	.	.	.	.
16.92	0.5395	0.62	.	Q	.	.	.	.
17.08	0.5471	0.57	.	Q	.	.	.	.
17.23	0.5539	0.50	.	Q	.	.	.	.
17.38	0.5600	0.46	.	Q	.	.	.	.
17.54	0.5657	0.44	.	Q	.	.	.	.
17.69	0.5711	0.41	.	Q	.	.	.	.
17.84	0.5762	0.39	.	Q	.	.	.	.
18.00	0.5811	0.38	.	Q	.	.	.	.
18.15	0.5854	0.31	.	Q	.	.	.	.
18.31	0.5893	0.30	.	Q	.	.	.	.
18.46	0.5930	0.29	.	Q	.	.	.	.
18.61	0.5966	0.28	.	Q	.	.	.	.
18.77	0.6001	0.27	.	Q	.	.	.	.
18.92	0.6034	0.26	.	Q	.	.	.	.
19.07	0.6066	0.25	Q	.	.	.	.	.
19.23	0.6097	0.24	Q	.	.	.	.	.
19.38	0.6128	0.24	Q	.	.	.	.	.
19.53	0.6157	0.23	Q	.	.	.	.	.
19.69	0.6186	0.22	Q	.	.	.	.	.
19.84	0.6214	0.22	Q	.	.	.	.	.
20.00	0.6241	0.21	Q	.	.	.	.	.
20.15	0.6268	0.21	Q	.	.	.	.	.
20.30	0.6294	0.20	Q	.	.	.	.	.
20.46	0.6319	0.20	Q	.	.	.	.	.
20.61	0.6344	0.19	Q	.	.	.	.	.
20.76	0.6369	0.19	Q	.	.	.	.	.
20.92	0.6393	0.19	Q	.	.	.	.	.
21.07	0.6416	0.18	Q	.	.	.	.	.
21.22	0.6439	0.18	Q	.	.	.	.	.
21.38	0.6462	0.18	Q	.	.	.	.	.
21.53	0.6484	0.17	Q	.	.	.	.	.
21.69	0.6506	0.17	Q	.	.	.	.	.

21.84	0.6528	0.17	Q	.	.	.	.
21.99	0.6549	0.17	Q	.	.	.	.
22.15	0.6570	0.16	Q	.	.	.	.
22.30	0.6590	0.16	Q	.	.	.	.
22.45	0.6611	0.16	Q	.	.	.	.
22.61	0.6631	0.16	Q	.	.	.	.
22.76	0.6650	0.15	Q	.	.	.	.
22.92	0.6670	0.15	Q	.	.	.	.
23.07	0.6689	0.15	Q	.	.	.	.
23.22	0.6708	0.15	Q	.	.	.	.
23.38	0.6727	0.15	Q	.	.	.	.
23.53	0.6745	0.14	Q	.	.	.	.
23.68	0.6763	0.14	Q	.	.	.	.
23.84	0.6781	0.14	Q	.	.	.	.
23.99	0.6799	0.14	Q	.	.	.	.
24.14	0.6817	0.14	Q	.	.	.	.
24.30	0.6826	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1447.5
10%	175.2
20%	46.1
30%	18.4
40%	9.2
50%	9.2
60%	9.2
70%	9.2
80%	9.2
90%	9.2

DMA 2 - Parcel 2 - Post Construction 100 Year Storm Event - Hydrograph

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================================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
   AND LOW LOSS FRACTION ESTIMATIONS FOR AMC III:

   TOTAL 24-HOUR DURATION RAINFALL DEPTH =     5.83 (inches)

   SOIL-COVER     AREA      PERCENT OF    SCS CURVE    LOSS RATE
     TYPE      (Acres)   PERVIOUS AREA    NUMBER    Fp(in./hr.)    YIELD
      1         0.13        0.00       98.(AMC II)     0.300       0.959
      2         0.67      100.00       72.(AMC II)     0.300       0.784

   TOTAL AREA (Acres) =      0.80

                 _
   AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.251

                 _
   AREA-AVERAGED LOW LOSS FRACTION, Y = 0.188
================================================================================

--------------------------------------------------------------------------------


   RATIONAL METHOD CALIBRATION COEFFICIENT = 0.96
   TOTAL CATCHMENT AREA(ACRES) =    0.80
   SOIL-LOSS RATE, Fm,(INCH/HR) =  0.251
   LOW LOSS FRACTION = 0.188
   TIME OF CONCENTRATION(MIN.) =  9.33
   SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
   USER SPECIFIED RAINFALL VALUES ARE USED
   RETURN FREQUENCY(YEARS) = 100
     5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.42
    30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.99
     1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.39
     3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.40
     6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.32
    24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.83

--------------------------------------------------------------------------------

   TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.31
   TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.08

********************************************************************************
 TIME    VOLUME      Q   0.       2.5      5.0      7.5      10.0
(HOURS)   (AF)     (CFS)
--------------------------------------------------------------------------------
 0.14     0.0004     0.06  Q       .        .        .        .
```

0.29	0.0012	0.06	Q	.	.	.	.
0.45	0.0020	0.06	Q	.	.	.	.
0.61	0.0028	0.06	Q	.	.	.	.
0.76	0.0036	0.06	Q	.	.	.	.
0.92	0.0044	0.06	Q	.	.	.	.
1.07	0.0052	0.06	Q	.	.	.	.
1.23	0.0060	0.06	Q	.	.	.	.
1.38	0.0069	0.06	Q	.	.	.	.
1.54	0.0077	0.07	Q	.	.	.	.
1.69	0.0085	0.07	Q	.	.	.	.
1.85	0.0094	0.07	Q	.	.	.	.
2.01	0.0102	0.07	Q	.	.	.	.
2.16	0.0111	0.07	Q	.	.	.	.
2.32	0.0119	0.07	Q	.	.	.	.
2.47	0.0128	0.07	Q	.	.	.	.
2.63	0.0137	0.07	Q	.	.	.	.
2.78	0.0146	0.07	Q	.	.	.	.
2.94	0.0154	0.07	Q	.	.	.	.
3.09	0.0163	0.07	Q	.	.	.	.
3.25	0.0172	0.07	Q	.	.	.	.
3.40	0.0181	0.07	Q	.	.	.	.
3.56	0.0190	0.07	Q	.	.	.	.
3.72	0.0200	0.07	Q	.	.	.	.
3.87	0.0209	0.07	Q	.	.	.	.
4.03	0.0218	0.07	Q	.	.	.	.
4.18	0.0227	0.07	Q	.	.	.	.
4.34	0.0237	0.07	Q	.	.	.	.
4.49	0.0246	0.07	Q	.	.	.	.
4.65	0.0256	0.07	Q	.	.	.	.
4.80	0.0266	0.08	Q	.	.	.	.
4.96	0.0275	0.08	Q	.	.	.	.
5.11	0.0285	0.08	Q	.	.	.	.
5.27	0.0295	0.08	Q	.	.	.	.
5.43	0.0305	0.08	Q	.	.	.	.
5.58	0.0315	0.08	Q	.	.	.	.
5.74	0.0325	0.08	Q	.	.	.	.
5.89	0.0336	0.08	Q	.	.	.	.
6.05	0.0346	0.08	Q	.	.	.	.
6.20	0.0356	0.08	Q	.	.	.	.
6.36	0.0367	0.08	Q	.	.	.	.
6.51	0.0378	0.08	Q	.	.	.	.
6.67	0.0388	0.08	Q	.	.	.	.
6.83	0.0399	0.08	Q	.	.	.	.
6.98	0.0410	0.09	Q	.	.	.	.
7.14	0.0421	0.09	Q	.	.	.	.
7.29	0.0432	0.09	Q	.	.	.	.
7.45	0.0444	0.09	Q	.	.	.	.

7.60	0.0455	0.09	Q	.	.	.	.
7.76	0.0467	0.09	Q	.	.	.	.
7.91	0.0478	0.09	Q	.	.	.	.
8.07	0.0490	0.09	Q	.	.	.	.
8.23	0.0502	0.09	Q	.	.	.	.
8.38	0.0514	0.09	Q	.	.	.	.
8.54	0.0526	0.10	Q	.	.	.	.
8.69	0.0539	0.10	Q	.	.	.	.
8.85	0.0551	0.10	Q	.	.	.	.
9.00	0.0564	0.10	Q	.	.	.	.
9.16	0.0577	0.10	Q	.	.	.	.
9.31	0.0590	0.10	Q	.	.	.	.
9.47	0.0603	0.10	Q	.	.	.	.
9.62	0.0616	0.11	Q	.	.	.	.
9.78	0.0630	0.11	Q	.	.	.	.
9.94	0.0644	0.11	Q	.	.	.	.
10.09	0.0658	0.11	Q	.	.	.	.
10.25	0.0672	0.11	Q	.	.	.	.
10.40	0.0686	0.11	Q	.	.	.	.
10.56	0.0701	0.12	Q	.	.	.	.
10.71	0.0716	0.12	Q	.	.	.	.
10.87	0.0731	0.12	Q	.	.	.	.
11.02	0.0747	0.12	Q	.	.	.	.
11.18	0.0762	0.12	Q	.	.	.	.
11.34	0.0778	0.13	Q	.	.	.	.
11.49	0.0795	0.13	Q	.	.	.	.
11.65	0.0811	0.13	Q	.	.	.	.
11.80	0.0828	0.13	Q	.	.	.	.
11.96	0.0846	0.14	Q	.	.	.	.
12.11	0.0864	0.15	Q	.	.	.	.
12.27	0.0885	0.16	Q	.	.	.	.
12.42	0.0906	0.17	Q	.	.	.	.
12.58	0.0928	0.17	Q	.	.	.	.
12.73	0.0950	0.18	Q	.	.	.	.
12.89	0.0973	0.18	Q	.	.	.	.
13.05	0.0997	0.19	Q	.	.	.	.
13.20	0.1021	0.19	Q	.	.	.	.
13.36	0.1046	0.20	Q	.	.	.	.
13.51	0.1071	0.20	Q	.	.	.	.
13.67	0.1098	0.21	Q	.	.	.	.
13.82	0.1125	0.22	Q	.	.	.	.
13.98	0.1153	0.23	Q	.	.	.	.
14.13	0.1183	0.24	Q	.	.	.	.
14.29	0.1215	0.26	.Q	.	.	.	.
14.45	0.1249	0.27	.Q	.	.	.	.
14.60	0.1285	0.29	.Q	.	.	.	.
14.76	0.1322	0.30	.Q	.	.	.	.

14.91	0.1362	0.32	.Q	.	.	.	.
15.07	0.1404	0.34	.Q	.	.	.	.
15.22	0.1450	0.37	.Q	.	.	.	.
15.38	0.1499	0.40	.Q	.	.	.	.
15.53	0.1555	0.46	.Q	.	.	.	.
15.69	0.1617	0.51	. Q	.	.	.	.
15.84	0.1693	0.68	. Q	.	.	.	.
16.00	0.1795	0.91	. Q	.	.	.	.
16.16	0.2020	2.60	.	Q	.	.	.
16.31	0.2225	0.58	. Q	.	.	.	.
16.47	0.2289	0.43	.Q	.	.	.	.
16.62	0.2339	0.35	.Q	.	.	.	.
16.78	0.2382	0.31	.Q	.	.	.	.
16.93	0.2419	0.28	.Q	.	.	.	.
17.09	0.2453	0.25	.Q	.	.	.	.
17.24	0.2484	0.22	Q	.	.	.	.
17.40	0.2511	0.21	Q	.	.	.	.
17.56	0.2537	0.19	Q	.	.	.	.
17.71	0.2561	0.18	Q	.	.	.	.
17.87	0.2584	0.17	Q	.	.	.	.
18.02	0.2606	0.17	Q	.	.	.	.
18.18	0.2625	0.14	Q	.	.	.	.
18.33	0.2643	0.13	Q	.	.	.	.
18.49	0.2659	0.13	Q	.	.	.	.
18.64	0.2675	0.12	Q	.	.	.	.
18.80	0.2691	0.12	Q	.	.	.	.
18.95	0.2706	0.11	Q	.	.	.	.
19.11	0.2720	0.11	Q	.	.	.	.
19.27	0.2734	0.11	Q	.	.	.	.
19.42	0.2748	0.10	Q	.	.	.	.
19.58	0.2761	0.10	Q	.	.	.	.
19.73	0.2774	0.10	Q	.	.	.	.
19.89	0.2786	0.10	Q	.	.	.	.
20.04	0.2799	0.09	Q	.	.	.	.
20.20	0.2810	0.09	Q	.	.	.	.
20.35	0.2822	0.09	Q	.	.	.	.
20.51	0.2834	0.09	Q	.	.	.	.
20.67	0.2845	0.09	Q	.	.	.	.
20.82	0.2856	0.08	Q	.	.	.	.
20.98	0.2866	0.08	Q	.	.	.	.
21.13	0.2877	0.08	Q	.	.	.	.
21.29	0.2887	0.08	Q	.	.	.	.
21.44	0.2898	0.08	Q	.	.	.	.
21.60	0.2908	0.08	Q	.	.	.	.
21.75	0.2917	0.08	Q	.	.	.	.
21.91	0.2927	0.07	Q	.	.	.	.
22.06	0.2937	0.07	Q	.	.	.	.

22.22	0.2946	0.07	Q	.	.	.	.
22.38	0.2955	0.07	Q	.	.	.	.
22.53	0.2964	0.07	Q	.	.	.	.
22.69	0.2973	0.07	Q	.	.	.	.
22.84	0.2982	0.07	Q	.	.	.	.
23.00	0.2991	0.07	Q	.	.	.	.
23.15	0.2999	0.07	Q	.	.	.	.
23.31	0.3008	0.07	Q	.	.	.	.
23.46	0.3016	0.06	Q	.	.	.	.
23.62	0.3024	0.06	Q	.	.	.	.
23.77	0.3033	0.06	Q	.	.	.	.
23.93	0.3041	0.06	Q	.	.	.	.
24.09	0.3049	0.06	Q	.	.	.	.
24.24	0.3053	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

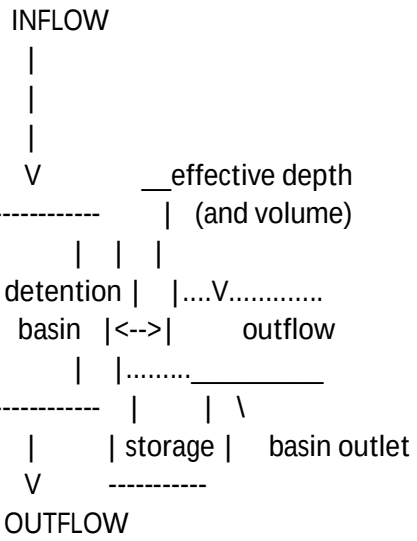
Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1446.2
10%	167.9
20%	37.3
30%	18.7
40%	9.3
50%	9.3
60%	9.3
70%	9.3
80%	9.3
90%	9.3

Attachment C – Q100 Routed Hydrograph

DMA 1 - Parcel 1 - Post Construction 100 Year Storm Event - Routed Hydrograph

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 9.220
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00



DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 5

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) **	BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
* 0.000	0.000	0.000**	1.000	0.040	0.000*
* 1.600	0.070	0.600**	3.250	0.166	2.700*
* 4.000	0.200	9.550**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	1.00	0.04000	0.04000
3	1.60	0.06619	0.07381
4	3.25	0.14886	0.18314
5	4.00	0.13936	0.26064

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES

OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE
AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.019	0.000	0.00	0.00	0.00	0.000
0.172	0.000	0.14	0.04	0.00	0.002
0.326	0.000	0.14	0.09	0.00	0.004
0.480	0.000	0.14	0.13	0.00	0.005
0.633	0.000	0.14	0.18	0.00	0.007
0.787	0.000	0.14	0.22	0.00	0.009
0.941	0.000	0.14	0.27	0.00	0.011
1.094	0.000	0.14	0.31	0.00	0.013
1.248	0.000	0.14	0.36	0.00	0.014
1.402	0.000	0.15	0.40	0.00	0.016
1.555	0.000	0.15	0.45	0.00	0.018
1.709	0.000	0.15	0.50	0.00	0.020
1.863	0.000	0.15	0.54	0.00	0.022
2.016	0.000	0.15	0.59	0.00	0.024
2.170	0.000	0.15	0.64	0.00	0.026
2.324	0.000	0.15	0.69	0.00	0.027
2.477	0.000	0.15	0.73	0.00	0.029
2.631	0.000	0.15	0.78	0.00	0.031
2.785	0.000	0.15	0.83	0.00	0.033
2.938	0.000	0.15	0.88	0.00	0.035
3.092	0.000	0.16	0.93	0.00	0.037
3.246	0.000	0.16	0.98	0.00	0.039
3.399	0.000	0.16	1.02	0.01	0.041
3.553	0.000	0.16	1.05	0.04	0.043
3.707	0.000	0.16	1.08	0.06	0.044
3.860	0.000	0.16	1.10	0.09	0.045
4.014	0.000	0.16	1.11	0.10	0.046
4.168	0.000	0.16	1.12	0.12	0.046
4.321	0.000	0.16	1.13	0.13	0.047
4.475	0.000	0.17	1.14	0.14	0.047
4.629	0.000	0.17	1.15	0.14	0.047
4.782	0.000	0.17	1.15	0.15	0.048
4.936	0.000	0.17	1.16	0.15	0.048
5.090	0.000	0.17	1.16	0.16	0.048
5.243	0.000	0.17	1.16	0.16	0.048
5.397	0.000	0.18	1.17	0.16	0.048
5.551	0.000	0.18	1.17	0.17	0.048
5.704	0.000	0.18	1.17	0.17	0.049
5.858	0.000	0.18	1.17	0.17	0.049
6.012	0.000	0.18	1.17	0.17	0.049
6.165	0.000	0.18	1.18	0.18	0.049

6.319	0.000	0.18	1.18	0.18	0.049
6.473	0.000	0.19	1.18	0.18	0.049
6.626	0.000	0.19	1.18	0.18	0.049
6.780	0.000	0.19	1.18	0.18	0.049
6.934	0.000	0.19	1.19	0.18	0.049
7.087	0.000	0.19	1.19	0.19	0.049
7.241	0.000	0.20	1.19	0.19	0.049
7.395	0.000	0.20	1.19	0.19	0.050
7.548	0.000	0.20	1.19	0.19	0.050
7.702	0.000	0.20	1.19	0.19	0.050
7.856	0.000	0.20	1.20	0.20	0.050
8.009	0.000	0.21	1.20	0.20	0.050
8.163	0.000	0.21	1.20	0.20	0.050
8.317	0.000	0.21	1.20	0.20	0.050
8.470	0.000	0.21	1.21	0.20	0.050
8.624	0.000	0.22	1.21	0.21	0.050
8.778	0.000	0.22	1.21	0.21	0.051
8.931	0.000	0.22	1.21	0.21	0.051
9.085	0.000	0.23	1.22	0.21	0.051
9.239	0.000	0.23	1.22	0.22	0.051
9.392	0.000	0.23	1.22	0.22	0.051
9.546	0.000	0.23	1.22	0.22	0.051
9.700	0.000	0.24	1.23	0.23	0.051
9.853	0.000	0.24	1.23	0.23	0.051
10.007	0.000	0.24	1.23	0.23	0.052
10.161	0.000	0.25	1.24	0.23	0.052
10.314	0.000	0.25	1.24	0.24	0.052
10.468	0.000	0.25	1.24	0.24	0.052
10.622	0.000	0.26	1.25	0.25	0.052
10.775	0.000	0.26	1.25	0.25	0.053
10.929	0.000	0.27	1.26	0.25	0.053
11.083	0.000	0.27	1.26	0.26	0.053
11.236	0.000	0.28	1.26	0.26	0.053
11.390	0.000	0.28	1.27	0.27	0.053
11.544	0.000	0.29	1.27	0.27	0.054
11.697	0.000	0.29	1.28	0.28	0.054
11.851	0.000	0.30	1.28	0.28	0.054
12.005	0.000	0.31	1.29	0.29	0.054
12.158	0.000	0.36	1.31	0.30	0.055
12.312	0.000	0.37	1.32	0.31	0.056
12.466	0.000	0.38	1.33	0.33	0.057
12.619	0.000	0.39	1.35	0.34	0.057
12.773	0.000	0.40	1.36	0.35	0.058
12.927	0.000	0.41	1.37	0.36	0.058
13.080	0.000	0.42	1.38	0.37	0.059
13.234	0.000	0.43	1.39	0.39	0.060
13.388	0.000	0.45	1.40	0.40	0.060

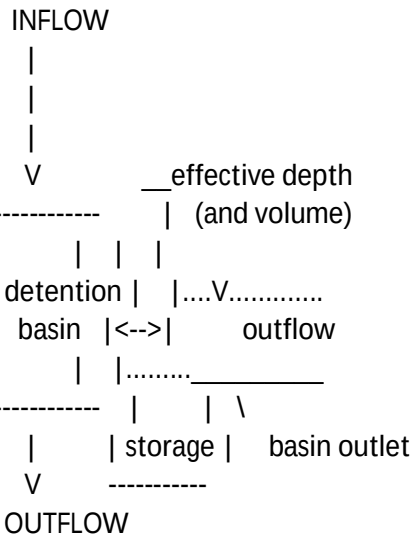
13.541	0.000	0.45	1.41	0.41	0.061
13.695	0.000	0.47	1.43	0.42	0.061
13.849	0.000	0.49	1.44	0.43	0.062
14.002	0.000	0.51	1.46	0.45	0.063
14.156	0.000	0.54	1.48	0.47	0.064
14.310	0.000	0.59	1.50	0.49	0.065
14.463	0.000	0.61	1.52	0.51	0.066
14.617	0.000	0.65	1.55	0.54	0.068
14.771	0.000	0.67	1.58	0.57	0.069
14.924	0.000	0.73	1.61	0.60	0.071
15.078	0.000	0.76	1.64	0.63	0.072
15.232	0.000	0.85	1.68	0.67	0.074
15.385	0.000	0.90	1.71	0.72	0.077
15.539	0.000	1.04	1.77	0.78	0.080
15.693	0.000	1.15	1.83	0.86	0.084
15.846	0.000	1.53	1.96	0.98	0.091
16.000	0.000	2.07	2.15	1.18	0.102
16.154	0.000	5.68	2.99	1.83	0.151
16.307	0.000	1.30	2.79	2.24	0.139
16.461	0.000	0.96	2.57	1.97	0.126
16.615	0.000	0.80	2.37	1.70	0.115
16.768	0.000	0.70	2.20	1.47	0.105
16.922	0.000	0.62	2.06	1.27	0.097
17.076	0.000	0.57	1.94	1.11	0.090
17.229	0.000	0.50	1.84	0.97	0.084
17.383	0.000	0.46	1.75	0.85	0.079
17.537	0.000	0.44	1.68	0.75	0.075
17.690	0.000	0.41	1.63	0.67	0.072
17.844	0.000	0.39	1.58	0.61	0.069
17.998	0.000	0.38	1.53	0.56	0.067
18.151	0.000	0.31	1.48	0.51	0.064
18.305	0.000	0.30	1.44	0.46	0.062
18.459	0.000	0.29	1.41	0.42	0.060
18.612	0.000	0.28	1.38	0.39	0.059
18.766	0.000	0.27	1.35	0.36	0.058
18.920	0.000	0.26	1.33	0.34	0.057
19.073	0.000	0.25	1.31	0.32	0.056
19.227	0.000	0.24	1.30	0.30	0.055
19.381	0.000	0.24	1.28	0.29	0.054
19.534	0.000	0.23	1.27	0.28	0.054
19.688	0.000	0.22	1.26	0.27	0.053
19.842	0.000	0.22	1.25	0.26	0.053
19.995	0.000	0.21	1.24	0.25	0.052
20.149	0.000	0.21	1.23	0.24	0.052
20.303	0.000	0.20	1.23	0.23	0.051
20.456	0.000	0.20	1.22	0.22	0.051
20.610	0.000	0.19	1.21	0.22	0.051

20.764	0.000	0.19	1.21	0.21	0.050
20.917	0.000	0.19	1.20	0.21	0.050
21.071	0.000	0.18	1.20	0.20	0.050
21.225	0.000	0.18	1.20	0.20	0.050
21.378	0.000	0.18	1.19	0.19	0.050
21.532	0.000	0.17	1.19	0.19	0.049
21.686	0.000	0.17	1.18	0.19	0.049
21.839	0.000	0.17	1.18	0.18	0.049
21.993	0.000	0.17	1.18	0.18	0.049
22.147	0.000	0.16	1.17	0.18	0.049
22.300	0.000	0.16	1.17	0.17	0.049
22.454	0.000	0.16	1.17	0.17	0.048
22.608	0.000	0.16	1.17	0.17	0.048
22.761	0.000	0.15	1.16	0.16	0.048
22.915	0.000	0.15	1.16	0.16	0.048
23.069	0.000	0.15	1.16	0.16	0.048
23.222	0.000	0.15	1.16	0.16	0.048
23.376	0.000	0.15	1.15	0.15	0.048
23.530	0.000	0.14	1.15	0.15	0.048
23.683	0.000	0.14	1.15	0.15	0.047
23.837	0.000	0.14	1.15	0.15	0.047
23.991	0.000	0.14	1.15	0.15	0.047
24.144	0.000	0.14	1.14	0.14	0.047
24.298	0.000	0.00	1.11	0.13	0.046

DMA 2 - Parcel 2 - Post Construction 100 Year Storm Event - Routed Hydrograph

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 9.330
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00



DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 4

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)	**	BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
* 0.000	0.000	0.000**		0.750	0.007	0.000*
* 5.500	0.092	0.000**		5.900	0.100	3.500*

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.75	0.00700	0.00700
3	5.50	0.09200	0.09200
4	5.90	0.07751	0.12249

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES
OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE
AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.139	0.000	0.06	0.08	0.00	0.001
0.295	0.000	0.06	0.17	0.00	0.002
0.450	0.000	0.06	0.26	0.00	0.002
0.606	0.000	0.06	0.34	0.00	0.003
0.761	0.000	0.06	0.43	0.00	0.004
0.917	0.000	0.06	0.52	0.00	0.005
1.072	0.000	0.06	0.60	0.00	0.006
1.228	0.000	0.06	0.69	0.00	0.006
1.383	0.000	0.06	0.77	0.00	0.007
1.539	0.000	0.07	0.81	0.00	0.008
1.694	0.000	0.07	0.86	0.00	0.009
1.850	0.000	0.07	0.91	0.00	0.010
2.005	0.000	0.07	0.95	0.00	0.011
2.161	0.000	0.07	1.00	0.00	0.012
2.316	0.000	0.07	1.05	0.00	0.012
2.472	0.000	0.07	1.10	0.00	0.013
2.627	0.000	0.07	1.15	0.00	0.014
2.783	0.000	0.07	1.20	0.00	0.015
2.938	0.000	0.07	1.25	0.00	0.016
3.093	0.000	0.07	1.30	0.00	0.017
3.249	0.000	0.07	1.35	0.00	0.018
3.405	0.000	0.07	1.40	0.00	0.019
3.560	0.000	0.07	1.45	0.00	0.019
3.716	0.000	0.07	1.50	0.00	0.020
3.871	0.000	0.07	1.55	0.00	0.021
4.027	0.000	0.07	1.60	0.00	0.022
4.182	0.000	0.07	1.66	0.00	0.023
4.338	0.000	0.07	1.71	0.00	0.024
4.493	0.000	0.07	1.76	0.00	0.025
4.648	0.000	0.07	1.82	0.00	0.026
4.804	0.000	0.08	1.87	0.00	0.027
4.960	0.000	0.08	1.92	0.00	0.028
5.115	0.000	0.08	1.98	0.00	0.029
5.271	0.000	0.08	2.04	0.00	0.030
5.426	0.000	0.08	2.09	0.00	0.031
5.582	0.000	0.08	2.15	0.00	0.032
5.737	0.000	0.08	2.21	0.00	0.033
5.893	0.000	0.08	2.26	0.00	0.034
6.048	0.000	0.08	2.32	0.00	0.035
6.203	0.000	0.08	2.38	0.00	0.036
6.359	0.000	0.08	2.44	0.00	0.037
6.515	0.000	0.08	2.50	0.00	0.038
6.670	0.000	0.08	2.56	0.00	0.039

6.826	0.000	0.08	2.62	0.00	0.040
6.981	0.000	0.09	2.68	0.00	0.042
7.136	0.000	0.09	2.74	0.00	0.043
7.292	0.000	0.09	2.81	0.00	0.044
7.448	0.000	0.09	2.87	0.00	0.045
7.603	0.000	0.09	2.93	0.00	0.046
7.759	0.000	0.09	3.00	0.00	0.047
7.914	0.000	0.09	3.06	0.00	0.048
8.069	0.000	0.09	3.13	0.00	0.050
8.225	0.000	0.09	3.20	0.00	0.051
8.380	0.000	0.09	3.27	0.00	0.052
8.536	0.000	0.10	3.33	0.00	0.053
8.691	0.000	0.10	3.40	0.00	0.054
8.847	0.000	0.10	3.47	0.00	0.056
9.003	0.000	0.10	3.55	0.00	0.057
9.158	0.000	0.10	3.62	0.00	0.058
9.314	0.000	0.10	3.69	0.00	0.060
9.469	0.000	0.10	3.77	0.00	0.061
9.625	0.000	0.11	3.84	0.00	0.062
9.780	0.000	0.11	3.92	0.00	0.064
9.936	0.000	0.11	4.00	0.00	0.065
10.091	0.000	0.11	4.07	0.00	0.066
10.247	0.000	0.11	4.15	0.00	0.068
10.402	0.000	0.11	4.24	0.00	0.069
10.557	0.000	0.12	4.32	0.00	0.071
10.713	0.000	0.12	4.40	0.00	0.072
10.868	0.000	0.12	4.49	0.00	0.074
11.024	0.000	0.12	4.57	0.00	0.075
11.180	0.000	0.12	4.66	0.00	0.077
11.335	0.000	0.13	4.75	0.00	0.079
11.490	0.000	0.13	4.85	0.00	0.080
11.646	0.000	0.13	4.94	0.00	0.082
11.802	0.000	0.13	5.04	0.00	0.084
11.957	0.000	0.14	5.13	0.00	0.085
12.113	0.000	0.15	5.24	0.00	0.087
12.268	0.000	0.16	5.36	0.00	0.090
12.423	0.000	0.17	5.48	0.00	0.092
12.579	0.000	0.17	5.52	0.11	0.092
12.734	0.000	0.18	5.52	0.19	0.092
12.890	0.000	0.18	5.52	0.17	0.092
13.045	0.000	0.19	5.52	0.19	0.092
13.201	0.000	0.19	5.52	0.19	0.092
13.357	0.000	0.20	5.52	0.20	0.092
13.512	0.000	0.20	5.52	0.20	0.092
13.667	0.000	0.21	5.52	0.21	0.092
13.823	0.000	0.22	5.52	0.21	0.092
13.979	0.000	0.23	5.53	0.22	0.093

14.134	0.000	0.24	5.53	0.23	0.093
14.290	0.000	0.26	5.53	0.25	0.093
14.445	0.000	0.27	5.53	0.27	0.093
14.601	0.000	0.29	5.53	0.28	0.093
14.756	0.000	0.30	5.53	0.30	0.093
14.911	0.000	0.32	5.54	0.32	0.093
15.067	0.000	0.34	5.54	0.34	0.093
15.222	0.000	0.37	5.54	0.36	0.093
15.378	0.000	0.40	5.55	0.40	0.093
15.533	0.000	0.46	5.56	0.44	0.093
15.689	0.000	0.51	5.56	0.50	0.093
15.844	0.000	0.68	5.59	0.64	0.094
16.000	0.000	0.91	5.61	0.87	0.094
16.156	0.000	2.60	5.89	2.18	0.100
16.311	0.000	0.58	5.13	1.69	0.085
16.466	0.000	0.43	5.44	0.00	0.091
16.622	0.000	0.35	5.55	0.20	0.093
16.778	0.000	0.31	5.53	0.33	0.093
16.933	0.000	0.28	5.53	0.27	0.093
17.089	0.000	0.25	5.53	0.26	0.093
17.244	0.000	0.22	5.52	0.23	0.092
17.399	0.000	0.21	5.52	0.21	0.092
17.555	0.000	0.19	5.52	0.20	0.092
17.711	0.000	0.18	5.52	0.18	0.092
17.866	0.000	0.17	5.52	0.18	0.092
18.022	0.000	0.17	5.52	0.17	0.092
18.177	0.000	0.14	5.51	0.14	0.092
18.332	0.000	0.13	5.52	0.13	0.092
18.488	0.000	0.13	5.51	0.13	0.092
18.643	0.000	0.12	5.51	0.12	0.092
18.799	0.000	0.12	5.51	0.12	0.092
18.955	0.000	0.11	5.51	0.11	0.092
19.110	0.000	0.11	5.51	0.11	0.092
19.266	0.000	0.11	5.51	0.11	0.092
19.421	0.000	0.10	5.51	0.10	0.092
19.576	0.000	0.10	5.51	0.10	0.092
19.732	0.000	0.10	5.51	0.10	0.092
19.888	0.000	0.10	5.51	0.10	0.092
20.043	0.000	0.09	5.51	0.09	0.092
20.198	0.000	0.09	5.51	0.09	0.092
20.354	0.000	0.09	5.51	0.09	0.092
20.509	0.000	0.09	5.51	0.09	0.092
20.665	0.000	0.09	5.51	0.09	0.092
20.820	0.000	0.08	5.51	0.08	0.092
20.976	0.000	0.08	5.51	0.08	0.092
21.132	0.000	0.08	5.51	0.08	0.092
21.287	0.000	0.08	5.51	0.08	0.092

21.443	0.000	0.08	5.51	0.08	0.092
21.598	0.000	0.08	5.51	0.08	0.092
21.753	0.000	0.08	5.51	0.08	0.092
21.909	0.000	0.07	5.51	0.07	0.092
22.065	0.000	0.07	5.51	0.07	0.092
22.220	0.000	0.07	5.51	0.07	0.092
22.375	0.000	0.07	5.51	0.07	0.092
22.531	0.000	0.07	5.51	0.07	0.092
22.686	0.000	0.07	5.51	0.07	0.092
22.842	0.000	0.07	5.51	0.07	0.092
22.997	0.000	0.07	5.51	0.07	0.092
23.153	0.000	0.07	5.51	0.07	0.092
23.309	0.000	0.07	5.51	0.07	0.092
23.464	0.000	0.06	5.51	0.06	0.092
23.620	0.000	0.06	5.51	0.06	0.092
23.775	0.000	0.06	5.51	0.06	0.092
23.931	0.000	0.06	5.51	0.06	0.092
24.086	0.000	0.06	5.51	0.06	0.092
24.241	0.000	0.00	5.49	0.03	0.092

Attachment D – Calculation Summary Tables

Table 1. - Perforated Piping Storage Break Down Summary

Retention Pipe Length (ft)	Detention Pipe Length (ft)	Diameter (ft)	Pipe Area (ft2)	Gravel Depth (ft)	Gravel Bed Width (ft)
150	150	3	7.065	1	4
105	105	3	7.065	1	4
152	152	3	7.065	1	4
91	91	3	7.065	1	4
200	200	3	7.065	1	4
170	170	3	7.065	1	4
109	109	3	7.065	1	4
-	70	3	7.065	1	4
977	1047	3	7.065	1	4
Total Length					

Table 2. - Perforated Piping Storage Break Down Summary based on Table 1

Gravel Retention (ft3) *	1675	Length x Depth x Bed Width x Porosity (0.4)
Pipe Detention (ft3)	7397	Total Length x Area
Pipe Retention (ft3)	5177	Total Length x Area x 0.75
Total Storage at Top of Weir (ft3)	6852	Pipe Retention + Gravel Retention
2.25 ft Weir Retention (ft3)	5176.88	Total Length x Area

* Gravel Bed underlies entire Detention Pipe Length of 1047 ft.

Table 3. Perforated Storm Drain Storage Table for Hydrograph Routing based on Table 2

Depth (ft)	Storage (ft3)	Storage (ac/ft)	Description
0	0	0.00	
1	1675	0.04	Gravel Retention
1.6	3154	0.07	1675 + (Pipe Detention x 0.2)
3.25	6852	0.16	1675 + (Pipe Detention x 0.75)
4	9072	0.21	Gravel Retention + Pipe Detention
	Within Gravel Substrate		

Table 4. 2 Year Storm Event Time of Concentration

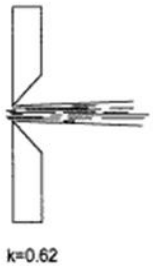
	DMA 1	DMA 2	DMA 3	Description
Rational Method TC (minutes)	9.99	9.52	11.08	Referenced in Rational Method Calculations
Rational Method Peak (cfs)	2.03	0.93	0.86	Referenced in Rational Method Calculations
Available Storage Volume (ft3)	6852	4002	695	From Table 2 for DMA 1, From Stormtech Ref for DMA 2&3
Time to fill storage (seconds)	3375.4	4303.2	808.1	Available storage/Rational Method Peak
Time to fill storage (minutes)	56.3	71.7	13.5	Time to Fill Storage Seconds/60
Total TC = Rat M TC + Time to fill	66.2	81.2	24.5	

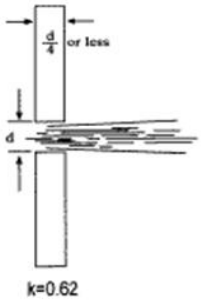
Table 5. 2 Year Storm Event Runoff Volume

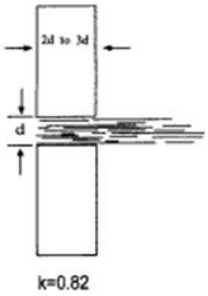
	DMA 1	DMA 2	DMA 3	Description
2 Year Hydrograph Runoff Volume (ac/ft)	0.1677	0.0424	0.0472	From Hydrograph output
2 Year Hydrograph Runoff Volume (ft3)	7305	1847	2056	ac/ft x 43560 ft2/ac
Retention Storage (ft3)	6852	4002	695	From Table 2 for DMA 1, From Stormtech Ref for DMA 2&3
Volume Discharged (ft3)	453	0	1361	2 year Hydrograph Runoff Volume - Volume Discharged

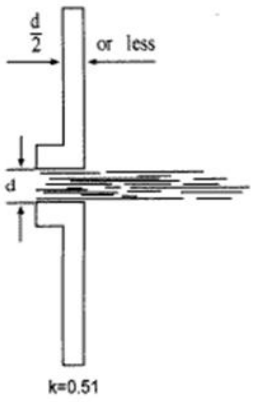
Orifice Calculations -Outflow DMA 1

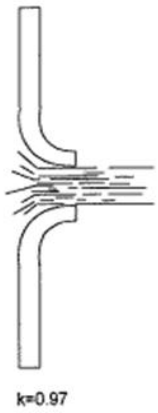
$$Q = \frac{A \times 8.02 \times 448.8 \times K \times \sqrt{h}}{144} = 25 \times A \times K \times \sqrt{h}$$











Orifice Dimensions

Height	ft	0.5	0.5	0.5
Width	ft	0.2	0.2	0.2
Area	ft	0.1	0.1	0.1
Head	ft	0.1	1.75	2.5
K	unitless	0.82	0.82	0.82
Q (cfs) =		0.6	2.7	3.2

Weir Calculation - Outflow DMA 1

Purpose - to determine maximum Q flowing over weir

H=((Q^2)/(CL^2))^(1/3)

H = depth of water flowing over spillway

C	3.4
Active Wier Length (ft)	2.9

Q (cfs)	H = depth (ft)
6.35	**0.746**

Weir Calculation Outflow DMA 2

Purpose - to determine maximum water surface flowing over weir

H=((Q^2)/(CL^2))^(1/3)

H = depth of water flowing over spillway

C	3.4
Active Wier Length	4

Q (cfs)	H = depth (ft)
3.5	**0.4**

DMA 1 Outflow Summary

Depth (ft)	Orifice (cfs)	Weir (cfs)	Total Outflow (cfs)
0	0	-	0
1	0	-	0
1.6	0.6	-	0.6
3.25	2.7	-	2.7
4	3.2	6.35	9.55

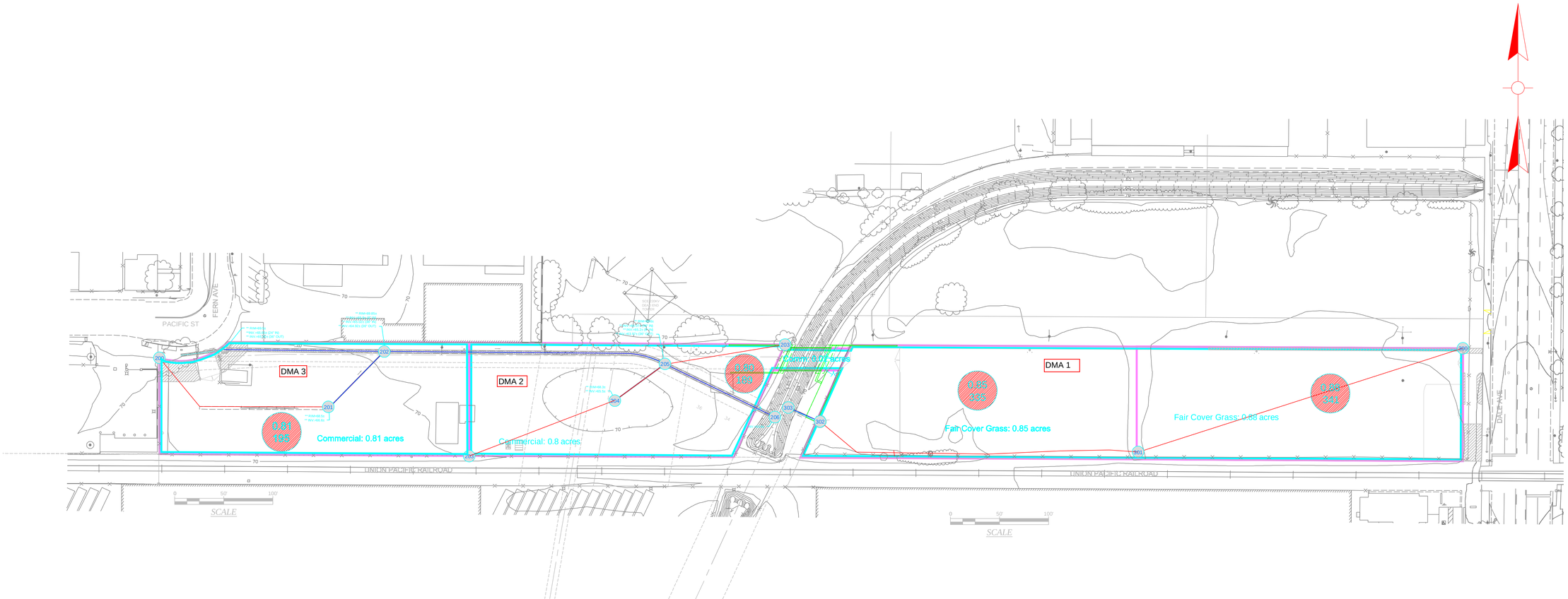
Gravel Storage

DMA 2 Outflow Summary Table

Depth (ft)	Storage (ft3)	Storage (ac/ft	Outflow (cfs)
0	0	0	0
0.75	309	0.007	0
5.5	4005	0.092	0
5.9	4549	0.10	3.5

Gravel Storage

Attachment E – Exhibits



Subcatchment Boundaries

Existing Drainage Pipe Flowpaths

Drainage Management Area Boundary

Surface Flowpaths

AES Software Model Node Number

Subcatchment Area (ac) and Surface Flowpath Length (ft)

0 100 200 Feet

WSP | PARSONS BRINCKERHOFF

NOTES:

REV	DATE	DESCRIPTION	DRAWN	REV	DATE	DESCRIPTION	DRAWN

Stanton Energy Reliability Center, LLC
650 Bercut Dr, Suite A - Sacramento, CA 95811
Phone: 916-492-9486 Fax: 916-880-5318

DRAWING TITLE: Hydrology Map of Existing System Figure 1

DRAWN	DATE	SIZE	FSCM NO.	DWG NO.	REV
–	–	D		C-201	B
ENG. APPROVAL	DATE	SCALE 1"=50	PROJECT STANTON	SHEET 1/1	
–	–				

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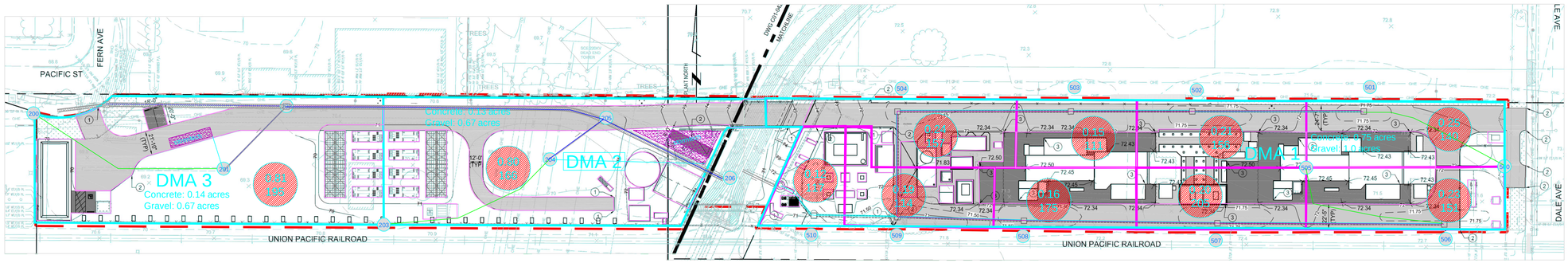


Storm Drain Inlet/Weir/Orifice Typical Section

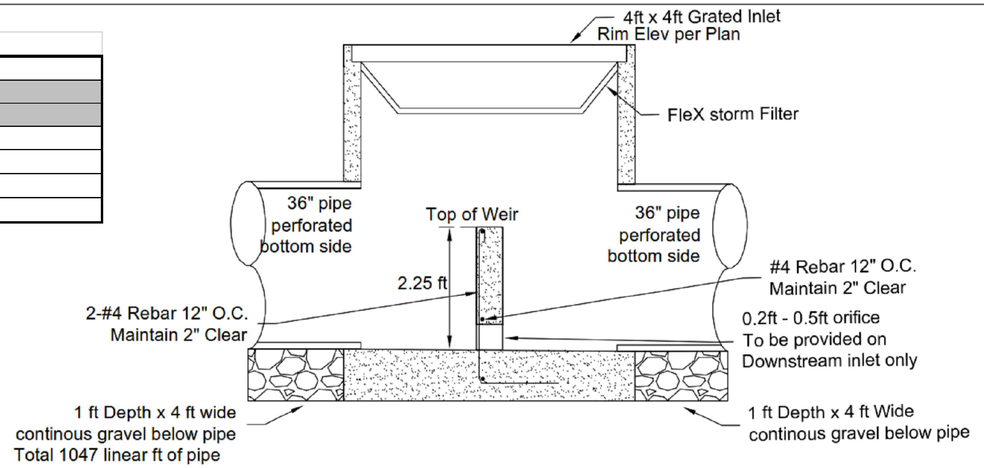
Water Quality Volume Summary Table

	DMA 1	DMA 2	DMA 3
Runoff Coefficient (unitless)	0.43	0.16	0.17
85% Storm Depth (inch)	0.85	0.85	0.85
Area (acres)	1.75	0.80	0.81
WQV (ft3)	2328.6	394.3	424.0
Retention provided (ft3)	6852	4002	695

WQV = C x d x A x 43560sf/ac x 1/12 in/ft

Perforated Storm Drain Storage Table

Depth (ft)	Storage (ft3)	Storage (ac/ft)
0	0	0.00
1	1675	0.04
1.6	3154	0.07
3.25	6852	0.16
4	9072	0.21
	Within Gravel Substrate	



Subcatchment Boundaries

Perforated Storm Drain

Existing Storm Drain

Proposed Surface Flowpaths

AES Software Model Node Number

Drainage Management Area Boundary

Subcatchment Area (ac) and Surface Flowpath Length (ft)

Proposed Storm Tech (for Storage See Design Drawings)

0 100 200 Feet

NOTES:

REV	DATE	DESCRIPTION	DRAWN

REV	DATE	DESCRIPTION	DRAWN

Stanton Energy Reliability Center, LLC
650 Bercut Dr, Suite A - Sacramento, CA 95811
Phone: 916-492-9486 Fax: 916-880-5318

DRAWING TITLE: Hydrology Map of Proposed System Figure 2

DRAWN – DATE –

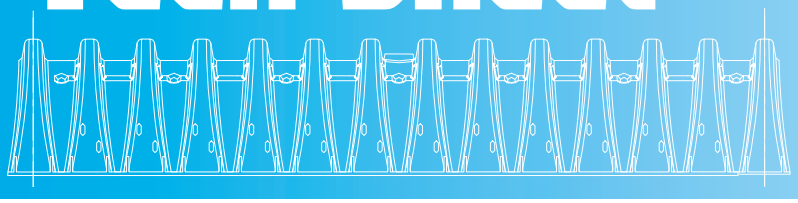
ENG. APPROVAL – DATE –

SIZE D | FSCM NO. | DWG NO. C-201 | REV B

SCALE 1"=50 | PROJECT STANTON | SHEET 1/1

Attachment F – Tech Sheet #1

Tech Sheet



StormTech®
Detention • Retention • Water Quality
A division of ADS®

Porosity of Structural Backfill

Tech Sheet # 1
November 2012

General:
StormTech advises that a porosity of 40% is appropriate to use for the storage capacity of structural aggregate used in the bedding and embedment zones around StormTech chambers. This memo provides technical support for the use of a porosity of 40%. The major points of the memo are:

- 40% porosity is appropriate for the clean, open graded, angular aggregate material StormTech recommends for foundation and embedment.
- Most of the porosity data available is based on a compacted condition. StormTech requires compaction of the foundation (bedding) and allows dumped aggregate embedment around the chambers.
- Test data indicates that the average porosity of all gradations of the *compacted* foundation is approximately 40%. The porosity of the *dumped* backfill in the embedment zone is typically greater than 40% and the calculated weighted average porosity therefore exceeds 40% for typical StormTech systems.
- Porosity is protected from soils migration by a non-woven geotextile that surrounds the entire system. For some exfiltration systems, a drainage net is substituted for the geotextile on the bottom of the bed.

Terms:
Porosity (n) is defined as the volume voids over the total volume expressed as a percent: $n = (V_v / V_t) \times 100\%$. Other terms commonly used to describe porosity include; "voids" and "void space". A related term that should not be confused with porosity is *void ratio* (e) which is the volume of voids over the volume of solids expressed as a decimal: $e = V_v / V_s$.

Compilation of Known Test Data:

Sample	Data Source	Porosity	Bulk Density	Test / Description
AASHTO # 4	StormTech lab	39.9%	94.3 lbs/ft^3	dumped, corrected[1]
AASHTO # 57	StormTech lab	45.4%	87.2 lbs/ft^3	dumped, corrected[1]
AASHTO # 4	StormTech lab	37.4%	103.0 lbs/ft^3	jigged & tamped, corrected[1]
AASHTO # 57	StormTech lab	38.7%	97.7 lbs/ft^3	jigged & tamped, corrected[1]
AASHTO # 57	NTH lab	50 - 51%		tapped & agitated, dried[2]
AASHTO # 57	NTH lab	50 - 52 %		tapped & agitated, dried[2]
AASHTO # 3	NTH lab	53 - 54%		tapped & agitated, dried[2]
-1 ½"	Anderson Eng. Cons.	41.9%	96.8 lbs/ft^3	dry rodded, C29[3]
-1 ½"	Anderson Eng. Cons.	35.3%	101.7 lbs/ft^3	dry rodded, C29[3]
-1 ½"	Anderson Eng. Cons.	37.8%	98.6 lbs/ft^3	dry rodded, C29[3]
-1 ½"	Anderson Eng. Cons.	41.3%	93.6 lbs/ft^3	dry rodded, C29[3]
-1 ½"	Anderson Eng. Cons.	38.2%	98.7 lbs/ft^3	dry rodded, C29[3]
-3/4"	Anderson Eng. Cons.	38.5%	100.3 lbs/ft^3	dry rodded, C29[3]
-3/4"	Anderson Eng. Cons.	38.9%	97.9 bs/ft^3	dry rodded, C29[3]

Compilation of Known Test Data:

Sample	Data Source	Porosity	Bulk Density	Test / Description
AASHTO # 4	Universal Eng. Serv.	44.3%	78.6 lbs/ft^3	rodded C29[4]
AASHTO # 57	Universal Eng. Serv.	43.2%	79.8 lbs/ft^3	rodded C29[4]
AASHTO # 4	Universal Eng. Serv.	46.1%	70.8 lbs/ft^3	rodded C29[5]
AASHTO # 57	Universal Eng. Serv.	42.8%	74.8 lbs/ft^3	rodded C29[5]
-1 ½" Crushed Rock	CTL Thompson TX	46%	90.5 lbs/ft^3	rodded C29[6]
-1" Crushed Rock	CTL Thompson TX	45%	91.6 lbs/ft^3	rodded C29[6]
-1 ½" Crushed Conc	CTL Thompson TX	48%	77.1 lbs/ft^3	rodded C29[6]

[1]Testing was conducted by StormTech in October, 2003 using aggregate from Connecticut. Water was used to fill voids and a correction factor that reduced porosities by 3 to 16% was calculated and applied to correct for wall effects of the test container.

[2]Testing was conducted by NTH Consultants,Ltd. Exton, PA in December, 2002 for ADS. This was dry testing in accordance with the "Civil Engineering Reference Manual, Sixth Edition" by Michael R. Lindburg, PE.

[3]Testing was conducted by Anderson Engineering Consultants, Inc., Little Rock, AR in February, 2000 for 7 different aggregate samples from four suppliers in Arkansas.

[4]The material tested was lime rock from central Florida. Testing was conducted by Universal Engineering Sciences in Orlando, FL in November, 2005.

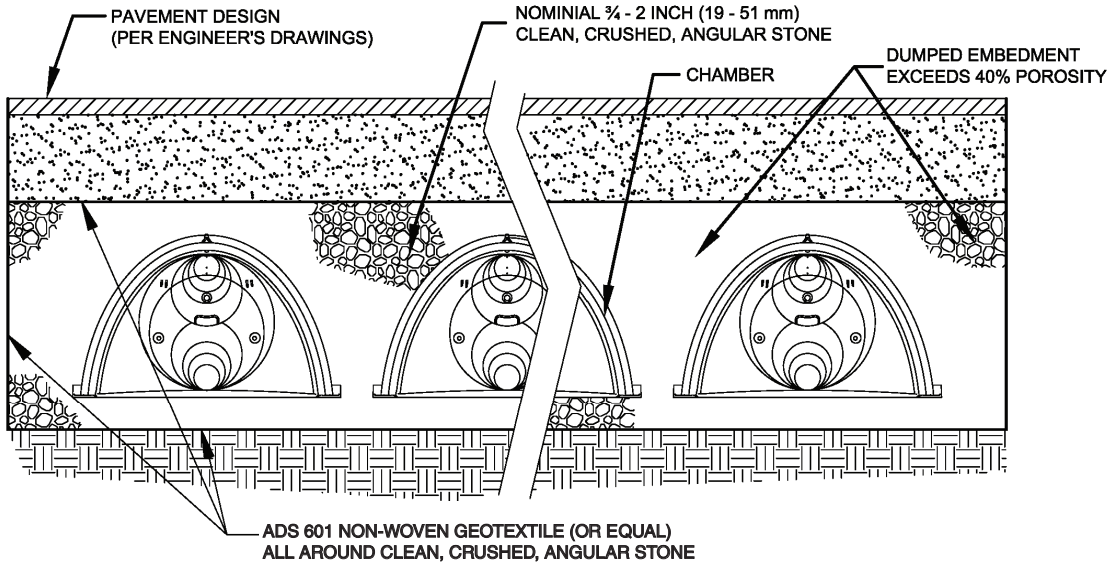
[5]The material tested was recycled, crushed concrete from central Florida. Testing was conducted by Universal Engineering Sciences in Orlando, FL in November, 2005.

[6]Testing was conducted by CTL | Thompson Texas, LLC in August, 2006.

ASTM C29 is the "Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate".

Porosity References:

- "Urban Runoff Quality Management" WEF MOP 23 / ASCE MOP 87. Table 5.12 lists uniform sized gravel at 40%.
- "Controlling Urban Runoff:" by Thomas R. Schueler, July 1987 describes storage volume of the void space in the trench at 40% of the excavated trench volume.
- "On-site Stormwater Management: Applications for Landscape and Engineering" Second Edition by Bruce Ferguson and Thomas Debo states that open graded crushed stone has 40% void space.



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