Appendix J Preliminary Drainage Report

Appendix

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Coyote Canyon Landfill Project:
Preliminary Drainage Report

December 14, 2023

Submitted to:

City of Newport Beach
100 Civic Center Drive
Newport Beach, CA 92660

OC Public Works
Orange County Public Works
601 N. Ross Street
Santa Ana, CA 92701

Prepared for:

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1. Introduction

1.1 Overview

The following Preliminary Drainage Report is being prepared for the Coyote Canyon Landfill (CCL) Project ("Project"). This Report will summarize the pre-project and post-project peak flowrates and present a proposed drainage concept. This report will include analyses and modeling to compare the 10-year and 25-year pre- and post- flowrates.

1.2 Location

The Project is a 1.88-acre site located at Coyote Canyon Landfill (CCL), which is at 20662 Newport Coast Drive in the City of Newport Beach, Orange County, California. The Project is a new Renewable Natural Gas (RNG) Plant at CCL which will convert landfill gas into a pipeline quality natural gas equivalent. The RNG Plant will occupy about 1.07 acres of the Project site.

A project vicinity map is shown on **Exhibit 1**.

1.3 Drainage

Pre-Project

The pre-project condition site overland flows to two discharge locations. About 75% of the Project site (1.4-acres), on the eastern side discharges to a concrete ditch (*Discharge Point #1*). The concrete ditch is tributary to an offsite City-owned 24-inch RCP. The remaining 25% of the Project site (0.5-acres), on the western side, drains to the entrance road (*Discharge Point #2*). These road flows drain offsite along the road's v-gutter and are intercepted by catch basins which also discharge to the 24-inch RCP.

Refer to the pre-project condition drainage map shown on **Exhibit 2**.

Post-Project

The post-project condition site drainage preserves the pre-project drainage patterns and flow distribution to the two discharge locations. The eastern 1.4-acres of the site drains northerly to the proposed perimeter access road along the northern and eastern Project boundary. The access road gutter directs flows and captures them with inlets to a subsurface gravel layer under the access road. The gravel layer will provide storage and is for hydromodification compliance. Within the gravel layer, a perforated pipe directs flows to a treatment BMP unit at the northwest Project boundary, located at *Discharge Point #1*. The BMP unit's outflows are piped offsite to the 24-inch RCP. The western 0.5-acres does not change in post-project condition, as the tributary area and flow paths to *Discharge Point #2* are the same as pre-project condition.

Refer to the post-project condition drainage map shown on **Exhibit 3**.

For focus of this drainage report, the analyses present hydrology assuming surface flows and are not based on subsurface flows. Additionally, hydraulic analyses are beyond the scope of this report and will be evaluated under a separate cover.

2. Methodology

2-1. Overview

The 10-year and 25-year hydrologic calculations for the pre-project and post-project conditions are prepared using the Advanced Engineering Software (AES) software. The AES software includes *Rational Method* (RM) calculations to determine peak flowrates.

2-2. Rational Method

The *Rational Method* (RM) calculations with the *Advanced Engineering Software* (AES) software are completed for the Projects drainage areas. These RM calculations follow the *Orange County Hydrology Manual* (OCHM). The software requires input for drainage area characteristics, which includes area, landuse, flowpath length, and flowpath slope.

The RM correlates rainfall intensity, runoff coefficient, and drainage area to peak runoff. The software computes runoff from the following relationship:

$Q = 0.90 \times (I - F_m) \times A$ for I greater than F_p
$Q = 0.90 \times a_i \times I \times A$ for I less than or equal to F_p

Where:
Q = runoff (cfs)
0.90 = calibration constant determined by an average fit between Rational Method and design storm unit hydrograph
$F_m = a_p \times F_p$ = loss rate of total watershed (in/hr)
I = rainfall intensity (in/hr)
F_p = infiltration rate for pervious areas (in/hr)
a_i = ratio of impervious area to total area (decimal fraction)
a_p = ratio of pervious area to total area (decimal fraction)

A summary of the modeling parameters for the RM calculations are presented:

- *Subareas*: The Project's subarea boundaries are shown on **Exhibit 2** and **Exhibit 3** for pre-project and post-project conditions. Boundaries are delineated using 2022 topographic survey by D. Woolley & Associates and 2023 preliminary proposed grading by BKF.
- *Landuse*: The Project landuse is designated as *commercial* (90% impervious) for impervious areas and *urban turf* in poor condition for pervious areas. Given 100% impervious landuse category is not allowed in AES, the commercial area was scaled up to equate to a subarea's actual impervious percentage.
- *Soils*: The Project was assigned Soil Group D and applied an Antecedent Moisture Condition (AMC) II for 10-year and 25-year storms, which represent moderate runoff potential.
- *Loss Rate*: The loss rates for pervious areas (F_p) is based on Soil Group, which is 0.2 inches per hour for Soil Group D.
- *Time of Concentration (T_c)*: The initial time of concentration (T_c) is calculated with the Kirpich formula, and requires subarea length, slope, and development type. For model routing, initial subareas for commercial/industrial landuses should be subdivided to have flowpath lengths less than 330 feet, as recommended in the OCHM Addendum No. 1. The Project subareas have flow paths lengths not exceeding the 330 feet criteria.

A summary of the *Rational Method* (RM) calculations for the 10-year and 25-year storms for each of the sub-area is shown in **Table 1** and **Table 2** for pre-project and post-project conditions.

Table 1. Pre-Project AES RM Subarea Flow Summary

Area ID	Area (ac)	Imper %	Q_{10} (cfs)	Q_{25} (cfs)
101	0.41	0.0%	0.75	0.91
102	0.96	19.8%	2.86	3.43
103	0.51	49.0%	1.36	1.63

Table 2. Post-Project AES RM Subarea Flow Summary

Area ID	Area (ac)	Imper %	Q_{10} (cfs)	Q_{25} (cfs)
201	0.38	73.7%	1.04	1.25
202	0.99	58.6%	3.11	3.71
203	0.51	49.0%	1.36	1.63

For comparison assessment, post-project versus pre-project flows are determined at the two discharge locations. For the post-project condition, flows tributary to *Discharge Point #1* increase by 1.2 and 1.4 cfs during the 10-year and 25-year storms, respectively.

Table 3. Post-Project vs. Pre-Project AES RM 10-Year Flows at Discharge Points

Discharge Point	Area (ac)	Pre-Proj. Q_{10} (cfs)	Post-Proj. Q_{10} (cfs)	[Post] – [Pre] ΔQ_{10}
#1	1.37	2.40	3.61	1.21
#2	0.51	1.36	1.36	0.00

Table 4. Post-Project vs. Pre-Project AES RM 25-Year Flows at Discharge Points

Discharge Point	Area (ac)	Pre-Proj. Q_{25} (cfs)	Post-Proj. Q_{25} (cfs)	[Post] – [Pre] ΔQ_{25}
#1	1.37	2.93	4.33	1.40
#2	0.51	1.63	1.63	0.00

The results of the RM modeling are included in **Appendix A** for pre-project and **Appendix B** for post-project.

3. Conclusion

This Preliminary Drainage Report for the Coyote Canyon Landfill (CCL) Project has determined preliminary hydrology calculations to determine pre-project and post-project design flowrates. This Report has also presented the Project's proposed drainage concept.

The analyses in this Report show post-project discharge rates for the 10-year and 25-year event exceed the pre-project rates at *Discharge Point #1. h*owever, the site was previously occupied with structures associated with a landfill gas-to-energy facility that was operated from 1988 to December 2015. The facility received landfill gas from the Coyote Landfill and converted it to electricity. The facility had five buildings as well as numerous other supporting structures on-site. In addition to the five buildings on the project site, the major features of the facility include the following: a boiler and dilution fan structure, five pad-mounted transformers, a generator breaker, a cooling tower structure, landfill gas blowers, four flares for burning excess landfill gas, a storage area and an exhaust stack associated with the steam plant. In addition, there are several above ground storage tanks located on the project site. The site was completely paved. See Figure 1 below. In December 2015, the pervious operator, Fortistar, closed the facility since the landfill was no longer producing enough landfill gas for the facility to remain economically viable. The site was subsequently demolished and prepared for a new facility by a new operator. It is our opinion that the pre-project condition should be the condition before the removal and demolition of the previous facility. Since the proposed project site consists of pervious areas, the post-project condition flow rate for the 10- and 25-year flows are less than pre-project condition when it is 100% impervious. Therefore, the proposed project does not have an impact to the drainage condition.

FIGURE 1

4. References

Orange County Hydrology Manual, Williamson and Schmid, Oct. 1986.

Orange County Flood Control District Design Manual, 2nd Ed., Jan. 2023.

Exhibit 1. Project Vicinity Map

PRELIMINARY DRAINAGE REPORT

CONFIDENTIAL

NOT FOR CONSTRUCTION

ISSUED FOR REVIEW

REV	DATE	DESCRIPTION	DRN BY	CHK BY	APRV BY
0	11/15/23	ISSUE FOR BID	DMM	VL	RTC

CIVIL ENGINEER:
BKF ENGINEERS
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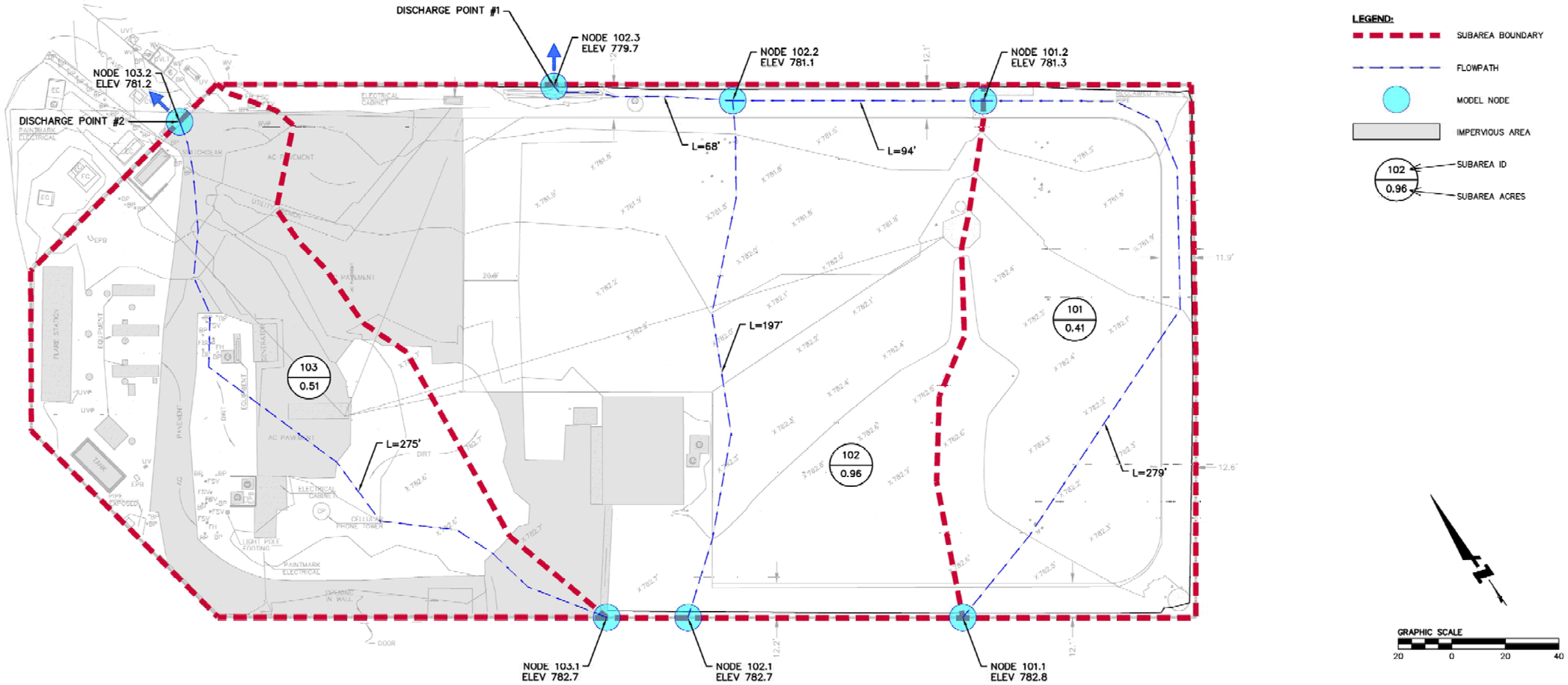
PROJECT VICINITY MAP

COYOTE CANYON LANDFILL
RNG PROJECT
20662 NEWPORT COAST DRIVE
NEWPORT BEACH, CA 92657

EXH 01

Exhibit 2. Pre-Project Drainage Map



Pre-Project Hydrology

Area ID	Area (ac)	Imper %	Q_{10} (cfs)	Q_{25} (cfs)
101	0.41	0.0%	0.75	0.91
102	0.96	19.8%	2.86	3.43
103	0.51	49.0%	1.36	1.63

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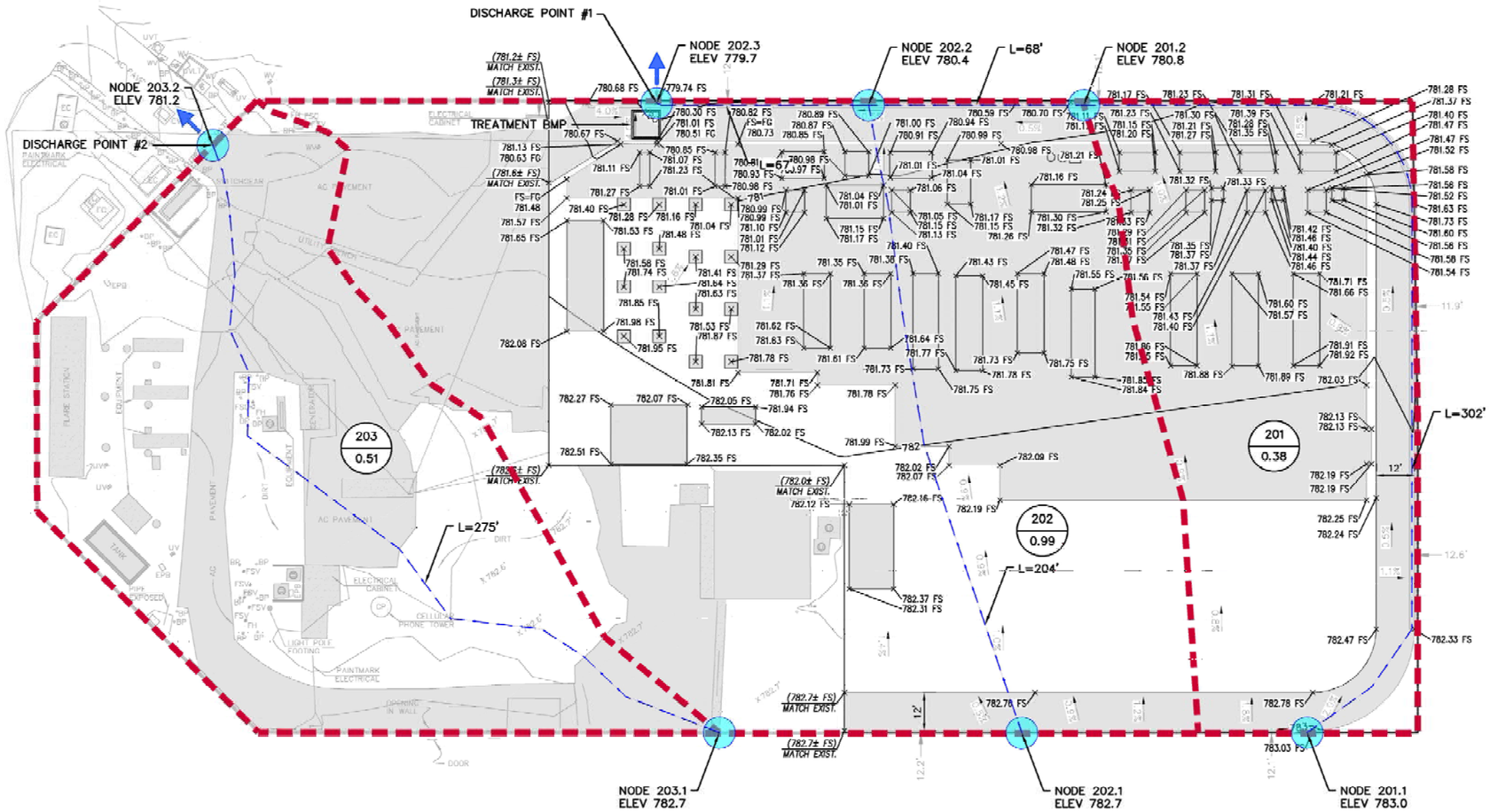
PRE-PROJECT DRAINAGE MAP

COYOTE CANYON LANDFILL
RNG PROJECT
20662 NEWPORT COAST DRIVE
NEWPORT BEACH, CA 92657

EXH 02

Exhibit 3. Post-Project Drainage Map



Post-Project Hydrology

Area ID	Area (ac)	Imper %	Q_{10} (cfs)	Q_{25} (cfs)
201	0.38	73.7%	1.04	1.25
202	0.99	58.6%	3.11	3.71
203	0.51	49.0%	1.36	1.63

PRELIMINARY DRAINAGE REPORT

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POST-PROJECT DRAINAGE MAP

COYOTE CANYON LANDFILL
RNG PROJECT
20662 NEWPORT COAST DRIVE
NEWPORT BEACH, CA 92657

EXH 03

Appendix A. AES Pre-Project RM Calculations

10-Year

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
         (c) Copyright 1983-2016 Advanced Engineering Software (aes)
             Ver. 23.0  Release Date: 07/01/2016  License ID 1676

                          Analysis prepared by:




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  FILE NAME: CLPRE10.DAT
  TIME/DATE OF STUDY: 12:59 12/14/2023
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  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
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  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.85
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II 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    101.10 TO NODE    101.20 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   279.00
  ELEVATION DATA: UPSTREAM(FEET) =    782.80  DOWNSTREAM(FEET) =    781.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.200
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.232
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  URBAN POOR COVER
  "TURF"                     D        0.41      0.20     1.000    87   14.20
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      0.75
  TOTAL AREA(ACRES) =      0.41   PEAK FLOW RATE(CFS) =      0.75

**************************************************************************
  FLOW PROCESS FROM NODE    101.20 TO NODE    102.20 IS CODE =  51
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  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    781.30  DOWNSTREAM(FEET) =    781.10
  CHANNEL LENGTH THRU SUBAREA(FEET) =    94.00   CHANNEL SLOPE =  0.0021
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.020   MAXIMUM DEPTH(FEET) =   1.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.75
  FLOW VELOCITY(FEET/SEC.) =   1.17   FLOW DEPTH(FEET) =   0.25
```

```
  TRAVEL TIME(MIN.) =   1.33   Tc(MIN.) =   15.54
  LONGEST FLOWPATH FROM NODE    101.10 TO NODE    102.20 =     373.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.10 TO NODE    102.20 IS CODE =  82
----------------------------------------------------------------------------
  >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
  >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   197.00
  ELEVATION DATA: UPSTREAM(FEET) =    782.70  DOWNSTREAM(FEET) =    781.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.588
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.466
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  URBAN POOR COVER
  "TURF"                     D        0.75      0.20     1.000    87   11.38
  COMMERCIAL                 D        0.21      0.20     0.100    75    6.59
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.802
  SUBAREA AREA(ACRES) =    0.96   INITIAL SUBAREA RUNOFF(CFS) =    2.86

  ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
  MAINLINE Tc(MIN.) =   15.54
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.120
  SUBAREA AREA(ACRES) =    0.96      SUBAREA RUNOFF(CFS) =    1.69
  EFFECTIVE AREA(ACRES) =      1.37   AREA-AVERAGED Fm(INCH/HR) =  0.17
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.86
  TOTAL AREA(ACRES) =        1.4       PEAK FLOW RATE(CFS) =       2.40

****************************************************************************
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----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
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  CHANNEL LENGTH THRU SUBAREA(FEET) =    68.00   CHANNEL SLOPE =  0.0206
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =    2.000
  MANNING'S FACTOR = 0.020   MAXIMUM DEPTH(FEET) =   1.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       2.40
  FLOW VELOCITY(FEET/SEC.) =   3.73   FLOW DEPTH(FEET) =   0.26
  TRAVEL TIME(MIN.) =   0.30   Tc(MIN.) =   15.84
  LONGEST FLOWPATH FROM NODE    101.10 TO NODE    102.30 =     441.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.10 TO NODE    103.20 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   275.00
  ELEVATION DATA: UPSTREAM(FEET) =    782.70  DOWNSTREAM(FEET) =    781.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.152
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.068
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  URBAN POOR COVER
  "TURF"                     D        0.23      0.20     1.000    87   14.08
  COMMERCIAL                 D        0.28      0.20     0.100    75    8.15
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.509
  SUBAREA RUNOFF(CFS) =      1.36
  TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      1.36
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.5  TC(MIN.) =      8.15
  EFFECTIVE AREA(ACRES) =      0.51  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap = 0.509
  PEAK FLOW RATE(CFS)   =       1.36
============================================================================
```

```
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

25-Year

```
**************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
         (c) Copyright 1983-2016 Advanced Engineering Software (aes)
             Ver. 23.0  Release Date: 07/01/2016  License ID 1676

                           Analysis prepared by:




--------------------------------------------------------------------------
  FILE NAME: CLPRE25.DAT
  TIME/DATE OF STUDY: 13:06 12/14/2023
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  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.85
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II 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    101.10 TO NODE    101.20 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   279.00
  ELEVATION DATA: UPSTREAM(FEET) =    782.80  DOWNSTREAM(FEET) =    781.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.200
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.672
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  URBAN POOR COVER
  "TURF"                     D        0.41      0.20     1.000    87   14.20
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      0.91
  TOTAL AREA(ACRES) =      0.41   PEAK FLOW RATE(CFS) =      0.91

**************************************************************************
  FLOW PROCESS FROM NODE    101.20 TO NODE    102.20 IS CODE =  51
--------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    781.30  DOWNSTREAM(FEET) =    781.10
  CHANNEL LENGTH THRU SUBAREA(FEET) =    94.00   CHANNEL SLOPE =  0.0021
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.020   MAXIMUM DEPTH(FEET) =   1.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.91
  FLOW VELOCITY(FEET/SEC.) =   1.24   FLOW DEPTH(FEET) =   0.29
```

```
  TRAVEL TIME(MIN.) =   1.26   Tc(MIN.) =   15.46
  LONGEST FLOWPATH FROM NODE    101.10 TO NODE    102.20 =     373.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.10 TO NODE    102.20 IS CODE =  82
----------------------------------------------------------------------------
  >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
  >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   197.00
  ELEVATION DATA: UPSTREAM(FEET) =    782.70  DOWNSTREAM(FEET) =    781.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.588
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.127
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  URBAN POOR COVER
  "TURF"                     D        0.75      0.20     1.000    87   11.38
  COMMERCIAL                 D        0.21      0.20     0.100    75    6.59
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.802
  SUBAREA AREA(ACRES) =    0.96   INITIAL SUBAREA RUNOFF(CFS) =    3.43

  ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
  MAINLINE Tc(MIN.) =   15.46
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.546
  SUBAREA AREA(ACRES) =    0.96      SUBAREA RUNOFF(CFS) =    2.06
  EFFECTIVE AREA(ACRES) =      1.37   AREA-AVERAGED Fm(INCH/HR) =  0.17
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.86
  TOTAL AREA(ACRES) =        1.4       PEAK FLOW RATE(CFS) =       2.93

****************************************************************************
  FLOW PROCESS FROM NODE    102.20 TO NODE    102.30 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    781.10  DOWNSTREAM(FEET) =    779.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =    68.00   CHANNEL SLOPE =  0.0206
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =    2.000
  MANNING'S FACTOR = 0.020   MAXIMUM DEPTH(FEET) =   1.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       2.93
  FLOW VELOCITY(FEET/SEC.) =   3.96   FLOW DEPTH(FEET) =   0.29
  TRAVEL TIME(MIN.) =   0.29   Tc(MIN.) =   15.75
  LONGEST FLOWPATH FROM NODE    101.10 TO NODE    102.30 =     441.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.10 TO NODE    103.20 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   275.00
  ELEVATION DATA: UPSTREAM(FEET) =    782.70  DOWNSTREAM(FEET) =    781.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.152
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.658
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  URBAN POOR COVER
  "TURF"                     D        0.23      0.20     1.000    87   14.08
  COMMERCIAL                 D        0.28      0.20     0.100    75    8.15
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.509
  SUBAREA RUNOFF(CFS) =      1.63
  TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      1.63
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.5  TC(MIN.) =      8.15
  EFFECTIVE AREA(ACRES) =      0.51  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap = 0.509
  PEAK FLOW RATE(CFS)   =       1.63
============================================================================
```

```
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Appendix B. AES Post-Project RM Calculations

10-Year

```
**************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1676

                           Analysis prepared by:




--------------------------------------------------------------------------
  FILE NAME: CLPST10.DAT
  TIME/DATE OF STUDY: 16:16 12/14/2023
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.85
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II 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    201.10 TO NODE    201.20 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   302.00
  ELEVATION DATA: UPSTREAM(FEET) =    783.00  DOWNSTREAM(FEET) =    780.80

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.987
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.104
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  URBAN POOR COVER
  "TURF"                     D        0.07      0.20     1.000    87   13.79
  COMMERCIAL                 D        0.31      0.20     0.100    75    7.99
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.263
  SUBAREA RUNOFF(CFS) =      1.04
  TOTAL AREA(ACRES) =      0.38   PEAK FLOW RATE(CFS) =      1.04

**************************************************************************
  FLOW PROCESS FROM NODE    201.20 TO NODE    202.20 IS CODE =  51
--------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    780.80  DOWNSTREAM(FEET) =    780.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =    68.00   CHANNEL SLOPE =  0.0059
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.014   MAXIMUM DEPTH(FEET) =   1.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       1.04
```

```
 FLOW VELOCITY(FEET/SEC.) =   2.37   FLOW DEPTH(FEET) =   0.19
 TRAVEL TIME(MIN.) =   0.48   Tc(MIN.) =    8.47
 LONGEST FLOWPATH FROM NODE    201.10 TO NODE    202.20 =     370.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    202.10 TO NODE    202.20 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   204.00
 ELEVATION DATA: UPSTREAM(FEET) =    782.70  DOWNSTREAM(FEET) =    780.40

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.256
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.570
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 URBAN POOR COVER
 "TURF"                     D        0.35      0.20     1.000    87   10.80
 COMMERCIAL                 D        0.64      0.20     0.100    75    6.26
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.415
 SUBAREA AREA(ACRES) =    0.99   INITIAL SUBAREA RUNOFF(CFS) =    3.11

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =    8.47
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.002
 SUBAREA AREA(ACRES) =    0.99      SUBAREA RUNOFF(CFS) =    2.60
 EFFECTIVE AREA(ACRES) =      1.37   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.37
 TOTAL AREA(ACRES) =        1.4       PEAK FLOW RATE(CFS) =       3.61

****************************************************************************
 FLOW PROCESS FROM NODE    202.20 TO NODE    202.30 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    780.40  DOWNSTREAM(FEET) =    779.70
 CHANNEL LENGTH THRU SUBAREA(FEET) =    67.00   CHANNEL SLOPE =  0.0104
 CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.014   MAXIMUM DEPTH(FEET) =   1.00
 CHANNEL FLOW THRU SUBAREA(CFS) =       3.61
 FLOW VELOCITY(FEET/SEC.) =   4.22   FLOW DEPTH(FEET) =   0.32
 TRAVEL TIME(MIN.) =   0.26   Tc(MIN.) =    8.73
 LONGEST FLOWPATH FROM NODE    201.10 TO NODE    202.30 =     437.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    203.10 TO NODE    203.20 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   275.00
 ELEVATION DATA: UPSTREAM(FEET) =    782.70  DOWNSTREAM(FEET) =    781.20

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.152
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.068
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 URBAN POOR COVER
 "TURF"                     D        0.23      0.20     1.000    87   14.08
 COMMERCIAL                 D        0.28      0.20     0.100    75    8.15
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.509
 SUBAREA RUNOFF(CFS) =      1.36
 TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      1.36
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =        0.5  TC(MIN.) =      8.15
 EFFECTIVE AREA(ACRES) =      0.51  AREA-AVERAGED Fm(INCH/HR)=  0.10
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap = 0.509
 PEAK FLOW RATE(CFS)   =       1.36
```

```
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

25-Year

```
**************************************************************************
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                          Analysis prepared by:




--------------------------------------------------------------------------
  FILE NAME: CLPST25.DAT
  TIME/DATE OF STUDY: 16:16 12/14/2023
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.85
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II 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 0.0312 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    201.10 TO NODE    201.20 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   302.00
  ELEVATION DATA: UPSTREAM(FEET) =    783.00  DOWNSTREAM(FEET) =    780.80

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.987
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.700
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  URBAN POOR COVER
  "TURF"                     D        0.07      0.20     1.000    87   13.79
  COMMERCIAL                 D        0.31      0.20     0.100    75    7.99
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.263
  SUBAREA RUNOFF(CFS) =      1.25
  TOTAL AREA(ACRES) =      0.38   PEAK FLOW RATE(CFS) =      1.25

**************************************************************************
  FLOW PROCESS FROM NODE    201.20 TO NODE    202.20 IS CODE =  51
--------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    780.80  DOWNSTREAM(FEET) =    780.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =    68.00   CHANNEL SLOPE =  0.0059
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.014   MAXIMUM DEPTH(FEET) =   1.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       1.25
```

```
 FLOW VELOCITY(FEET/SEC.) =   2.47   FLOW DEPTH(FEET) =   0.21
 TRAVEL TIME(MIN.) =   0.46   Tc(MIN.) =    8.45
 LONGEST FLOWPATH FROM NODE    201.10 TO NODE    202.20 =     370.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    202.10 TO NODE    202.20 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   204.00
 ELEVATION DATA: UPSTREAM(FEET) =    782.70  DOWNSTREAM(FEET) =    780.40

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.256
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.249
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 URBAN POOR COVER
 "TURF"                     D        0.35      0.20     1.000    87   10.80
 COMMERCIAL                 D        0.64      0.20     0.100    75    6.26
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.415
 SUBAREA AREA(ACRES) =    0.99   INITIAL SUBAREA RUNOFF(CFS) =    3.71

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =    8.45
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.585
 SUBAREA AREA(ACRES) =    0.99      SUBAREA RUNOFF(CFS) =    3.12
 EFFECTIVE AREA(ACRES) =      1.37   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.37
 TOTAL AREA(ACRES) =        1.4       PEAK FLOW RATE(CFS) =       4.33

****************************************************************************
 FLOW PROCESS FROM NODE    202.20 TO NODE    202.30 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    780.40  DOWNSTREAM(FEET) =    779.70
 CHANNEL LENGTH THRU SUBAREA(FEET) =    67.00   CHANNEL SLOPE =  0.0104
 CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.014   MAXIMUM DEPTH(FEET) =   1.00
 CHANNEL FLOW THRU SUBAREA(CFS) =       4.33
 FLOW VELOCITY(FEET/SEC.) =   4.52   FLOW DEPTH(FEET) =   0.35
 TRAVEL TIME(MIN.) =   0.25   Tc(MIN.) =    8.69
 LONGEST FLOWPATH FROM NODE    201.10 TO NODE    202.30 =     437.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    203.10 TO NODE    203.20 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   275.00
 ELEVATION DATA: UPSTREAM(FEET) =    782.70  DOWNSTREAM(FEET) =    781.20

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.152
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.658
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 URBAN POOR COVER
 "TURF"                     D        0.23      0.20     1.000    87   14.08
 COMMERCIAL                 D        0.28      0.20     0.100    75    8.15
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.509
 SUBAREA RUNOFF(CFS) =      1.63
 TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      1.63
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =        0.5  TC(MIN.) =      8.15
 EFFECTIVE AREA(ACRES) =      0.51  AREA-AVERAGED Fm(INCH/HR)=  0.10
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap = 0.509
 PEAK FLOW RATE(CFS)   =       1.63
```

```
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```