DRAINAGE STUDY
FOR
CLAIREMONT DRIVE

PRELIMINARY ENGINEERING

October 26, 2020
Revised: January 22, 2021

Job Number 19254-A

RICK ENGINEERING COMPANY

DRAINAGE STUDY
FOR
CLAIREMONT DRIVE

(PRELIMINARY ENGINEERING)

Job Number 19254-A

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Prepared For:

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DRAINAGE STUDY
FOR
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REVISION PAGE
January 22, 2021

This drainage study presents a revision to the October 26, 2020 report prepared by Rick Engineering Company pursuant to plan check comments (Cycle 1 LDR-Engineering Review). The following text identifies the plan check comment related to the drainage study along with the response by Rick Engineering Company in **bold**.

3. SDMC section 143.0142(f) states: Any increase in runoff resulting from the development of the site shall be directed away from any steep hillside areas and either into an existing or newly improved public storm drain system or onto a street development with a gutter system or public right-of-way designated to carry surface drainage run-off.

   Comment noted. Two (2) new storm drain outfalls with rip-rap energy dissipators are being proposed to minimize erosion along the undeveloped steep hillside.

4. All drainage calculations shall be based on the Hydromodification Management Plan (HMP) requirements. Project must be designed so that runoff rates and durations are controlled to maintain or reduce pre-project downstream erosion conditions and protect stream habitat.

   Comment noted. Supporting calculations have been provided in Attachment 3 of the Priority Development Project Storm Water Quality Management Plan (PDP SWQMP) for Clairemont Drive, dated October 26, 2020 and revised on January 22, 2021.

5. Revise the conclusion in the drainage report, to add a discussion to the drainage study stating if the proposed project is required to obtain approval from the Regional Water Quality Control Board under Federal Clean Water Act (CWA) section 401 or 404. A complete explanation must be provided. Please note, if the project is subject to regulations set forth in CWA 401/404, approval from the California Regional Water Quality Control Board must be obtained prior to permit issuance.

   Comment noted. The drainage report text has been revised to incorporate a statement at the end of the "Conclusion" section.

1.0 INTRODUCTION

This drainage report supports preliminary design of the Clairemont Drive project (herein referred to as the Project). The project site is located at 3450 Clairemont Drive, approximately 3000 feet south of the intersection of Balboa Avenue and Clairemont Drive within the City of San Diego. The vicinity map is shown in Figure 1, located at the end of this section.

The project proposes to develop the site into 40 multi-family residential units. The area within the project footprint is approximately 2.4 acres, and the parcel area is approximately 3.3 acres.

1.1 Existing Drainage Characteristics

The Project in its existing condition is comprised of a building (church and school), associated parking lot and playground. The project footprint has been delineated into five (5) basins. Basin 1 consists of runoff from the parking lot and playground and discharges across the undeveloped hillside west of the Basin 1. There is a grate which is clogged with sediment and hence, it is assumed that the runoff discharges directly to the vegetated slopes based on a preliminary site visit. Basin 2 consists of southern portion of the playground. Runoff consists of unconcentrated drainage across the undeveloped hillside. There is no existing drainage system that conveys this unconcentrated flow from the project site. Basin 3 consists of runoff from a portion of the building and parking lot. The runoff is concentrated by existing inlets and is assumed to discharge into the canyon south of the site. The presence of an outfall could not be validated during a preliminary site visit. Basin 4 consists of runoff from a portion of the building and mulched play area. Runoff consists of unconcentrated drainage which sheet flows across undeveloped hillside south of the basin. There is no existing drainage system that conveys this unconcentrated flow from Basin 4. Basin 5 consists of frontage runoff from the building which runs on to Clairemont Drive.

Ultimately, runoff from the project site confluences at the canyon south west of the site and discharges into Mission Bay

Refer to the Existing Condition Drainage Study Map located in Map Pocket 1 for more information.

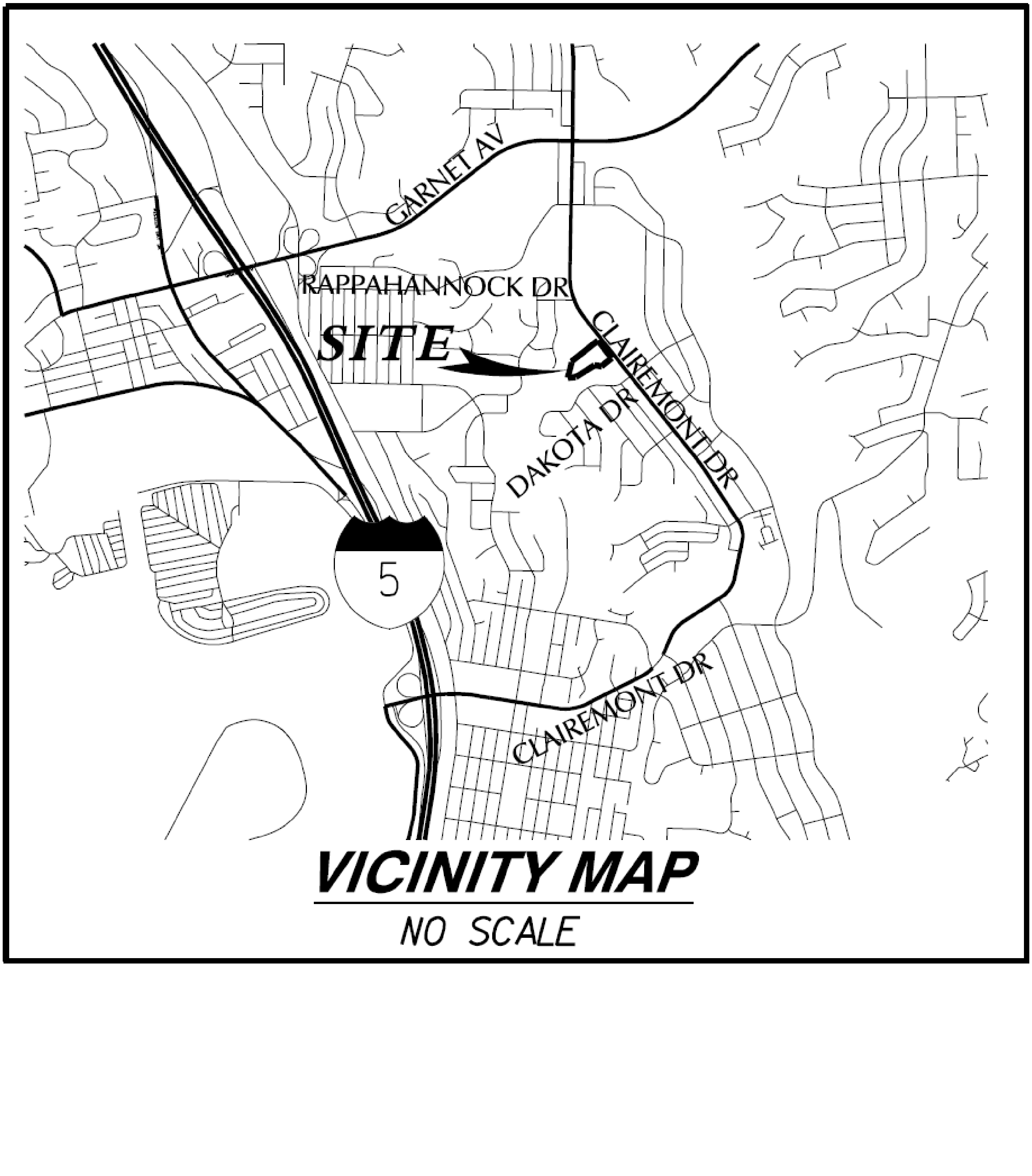
1.2 Proposed Drainage Characteristics

In the proposed condition the Project will develop the site into 40 multi-family homes and associated features like parking lots, courtyards etc.

The project site is divided into two (2) basins similar to pre-project condition. Basins 1 and 2 consist of multi -family units and associated streets and parking spaces. Runoff from the basins are intercepted by proposed inlets conveyed by proposed storm drain to an underground vault and Modular Wetland System combination to be treated for water quality and hydromodification. Ultimately, the flows outlets to the toe of slopes of westerly and southerly undeveloped hillside via 18-inch storm drain type outfalls. The proposed storm drain outfalls do not impact any jurisdictional waters or wetlands. As such it is anticipated that the project will not be subject to requirements under the Federal Clean Water Act (CWA) Section 401 or 404.

Refer to Section 2.3 and the Proposed Condition Drainage Study Map within Map Pocket 2 for more information.

Figure 1 Vicinity Map



2.0 HYDROLOGY

2.1 Criteria

The hydrologic conditions were analyzed in accordance with the County of San Diego's design criteria.

Design Storm:	100-year

January 2017 City of San Diego *Drainage Design Manual* criteria

Soil Type:	D (See Appendix A)
Rainfall Intensity:	January 2017 City of San Diego *Drainage Design Manual* (inches per hour)

2.2 Modified Rational Method

To calculate the flow rates for Basin 1 and 2 in pre-project and post-project condition, a Modified Rational Method analysis was performed in accordance with the methodology presented in the June 2003 County of San Diego *Hydrology Manual* to determine pre- and post-project 100-year peak discharge rates for watersheds less than 1 square-mile. The Advanced Engineering Software (AES) Rational Method computer program was used to perform these calculations. The hydrologic model is developed by creating independent node-link models of each interior drainage basin and linking these sub-models together at confluence points. The program has the capability to perform calculations for 15 hydrologic processes. These processes are assigned code numbers that appear in the results. The code numbers and their significance are as follows:

Code 1:	Confluence analysis at a node
Code 2:	Initial subarea analysis
Code 3:	Pipe flow travel time (computer-estimated pipe sizes)
Code 4:	Pipe flow travel time (user-specified pipe size)
Code 5:	Trapezoidal channel travel time
Code 6:	Street flow analysis through a subarea
Code 7:	User-specified information at a node
Code 8:	Addition of the subarea runoff to mainline
Code 9:	V-Gutter flow thru subarea
Code 10:	Copy main-stream data onto a memory bank

Code 11: Confluence a memory bank with the main-stream memory
Code 12: Clear a memory bank
Code 13: Clear the main-stream memory
Code 14: Copy a memory bank onto the main-stream memory
Code 15: Hydrologic data bank storage functions

In order for the program to perform the hydrologic analysis; base information for the study area is required. This information includes the land uses, drainage facility locations, flow patterns, drainage basin boundaries, and topographic elevations. The rainfall data, runoff coefficients, and soils information were obtained from the January 2017 City of San Diego *Drainage Design Manual*.

2.3 RATIONAL METHOD

To calculate the flow rates for post-project Basins 3,4 and 5, the Rational Method equation was used. It should be noted that The Modified Rational Method was used to calculate an accurate Time of Concentration for Basin 1 and 2. For each of the other basins, a 5 minute time of concentration was assumed because the areas are significantly smaller compared to Basin 1 and 2. The Rational Method equation is defined by the following equation.

$$Q_{\text{peak, x-year event}} = C * I_{\text{x-year event}} * A$$

Where:

$Q_{\text{peak, x-year event}}$ = peak flow rate for a design storm event (i.e. 10-year, 50-year, etc.) (cfs)
C = the area-weighted runoff coefficient (see runoff coefficient criteria in section 2.1)
$I_{\text{x-year event}}$ = rainfall intensity (see intensity criteria in section 2.1)
A = tributary area to a point of interest (acres)

Weighted runoff coefficients are calculated, where appropriate, based on a percentage of the runoff coefficients for 100% Impervious Area (0.90) and 0% Impervious area (0.35) for Type D Soils, which is calculated based on the following equation:

$$C_{\text{weighted}} = 0.95 * (\text{\% Impervious Area}) + 0.45 * (1 - \text{\% Impervious Area})$$

2.4 Hydrologic Results

The 100-year Modified Rational Method and Rational Method calculations for pre- and post-project conditions are provided in Appendix A and Appendix B, respectively, and the associated hydrologic drainage exhibits are located in Map Pockets 1 and 2. Detention analysis will be provided as a part of next submittal. A summary of the results for contributing areas are listed in the following table:

Table 1 – Hydrologic Summary Table (Pre-project)

Basin	Watershed Area (acres)	Time of Concentration (min)	100-Year Peak Flow Rate (cfs)
1[1]	1.10	7.4	3.5
2[1]	0.6	8.0	1.0
3[2]	0.4	5.0	1.5
4[2]	0.3	5.0	0.8
5[2]	0.05	5.0	0.2
Total	**2.5**		**7.0**

Table 2- Hydrologic Summary Table (Post-project)

Basin	Watershed Area (acres)	Time of Concentration (min)	Undetained 100-Year Peak Flow Rate (cfs)
1[1]	1.1	8.7	3.1
2[1]	1.4	8.7	3.6
Total	**2.5**		**6.7**

([1]): Flow Rate calculated using the Modified Rational Method
([2]): Flow Rate calculated using the Rational Method
(3): Basin F assumes a 10 min time of concentration and includes the same off-site post-project area in pre-project condition to compare Q100.

It can be observed that there is a minimal increase in the peak discharge rate for the site as a whole due to the increase in imperviousness. It is anticipated that the minimal increase in peak discharge would not affect the downstream systems. Hence, detention is not being provided for the project. The 100-year modified rational method calculations for pre- and post-project conditions are provided in Appendix A, while the associated hydrologic drainage exhibits are located in Map Pockets 1 and 2.

3.0 HYDRAULICS

Hydraulic Methodology and Criteria

The 100-year post-project peak flow rates determined using the Modified Rational Method were used to size the on-site storm drain system. Additional hydraulic analyses such as open channel sizing proposed inlet sizing, dry lane calculations, and energy dissipaters will be prepared for the subsequent submittals.

3.1 Inlet / Dry Lane Design

<u>Inlet Sizing</u>

An inlet design calculation was completed using a computer program based on Equation 1 for inlets on grade:

Type B Inlets on a Grade

$$Q = 0.7\ L\ (a + y)^{3/2} \qquad \text{(Equation 1)}$$

Where:

y = depth of flow approaching the curb inlet, in feet (ft)

a = depth of depression of curb at inlet, in feet (ft)

L = length of clear opening of inlet for total interception, in feet (ft)

Q = interception capacity of the curb inlet, in cubic feet per second (cfs)

<u>Results</u>

Please refer to Appendix B for the preliminary inlet sizes.

3.3 Hydraulic Analysis

Storm drain sizes were determined based on a normal depth calculation to verify storm drain capacity based on Manning's equation.

$$Q = (1.486/n)\ A\ R^{2/3}\ S^{1/2}$$

Where:

Q = Discharge (cfs)

n = Manning's roughness coefficient

A = Cross-sectional Area of flow (sq. ft.)

R = Hydraulic radius (ft.) (where hydraulic radius is defined as the cross-section area of flow divide by the wetted perimeter, R= A/P)

S = Slope of pipe (ft./ft.)

The Manning's roughness coefficient "n" of 0.013 was used for the hydraulic calculations. This value is typically used for reinforced concrete pipe (RCP), polyvinyl chloride (PVC) and high-density polyethylene pipe (HDPE). The pipe sizes were evaluated based on the Rational Method flow rates with a 30% "bump up" sizing factor to account for hydraulic losses within the system. Please refer to Appendix C for the preliminary storm drain sizes.

3.4 Energy Dissipater Design

As mentioned in the existing drainage conditions, runoff from the site in pre-project condition discharges from the site mostly through sheet flow to hillside vegetated area. To minimize the risk of erosion along the slope, in the post-project condition two (2) storm drain outfalls with rip-rap (SDD-104) energy dissipators are proposed.

Detailed energy dissipator sizing calculations will be provided as a part of final engineering.

4.0 SUMMARY/CONCLUSION

This drainage study presents the hydrologic and hydraulic analyses for the Clairemont Drive in support of preliminary engineering. The pre-project and post-project condition peak discharge rates were determined using the Modified Rational Method based on the hydrologic methodology and criteria described in the City of San Diego Drainage Design Manual, January 2017.

The overall drainage characteristics in the post-project condition will remain similar as compared to the pre-project conditions. It is currently anticipated that the project will result in a slight increase to impervious surfaces. However, the project as a whole will not result in an increase in storm water runoff. At this stage, it is not anticipated that the project will adversely impact the hydraulics of existing drainage systems located downstream of the project. The project will also include LID BMPs and Pollutant Control BMPs that will further reduce/slow runoff for post-project conditions.

The 100-year, 6-hour post-project peak flow rates were utilized to size the proposed drainage system, including preliminary sizing for proposed storm drain and inlets. Inlets locations have been identified and the detailed inlet sizing will be provided during final engineering. Storm drain outfalls proposed for all the basins to outlet to the toe of slope in the post-project condition to minimize the effect of erosion along the undeveloped slope. The proposed storm drain outfalls do not impact any jurisdictional waters or wetlands. As such it is anticipated that the project will not be subject to requirements under the Federal Clean Water Act (CWA) Section 401 or 404.

Post-project flows will be treated per the City of San Diego's Storm Water Standards Manual, dated October 2019. For more information on water quality and HMP sizing, please refer to a separate report titled, "Priority Development Project Storm Water Quality Management Plan (PDP SWQMP) for Clairemont Drive," dated October 26, 2020 and prepared by Rick Engineering Company (Job No. 19254-A).

APPENDIX A

Hydrology

Existing Condition AES Output

[100-Year]

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2003 Advanced Engineering Software (aes)
             Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* 3450 CLAIREMONT DRIVE                                                    *
* 100-YEAR PRE-PROJECT HYDROLOGY                                           *
* BASIN1                                                                   *
 **************************************************************************

  FILE NAME: CB100PRE.RAT
  TIME/DATE OF STUDY: 00:31 10/23/2020
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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.*

****************************************************************************
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============================================================================
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  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    92.00
  UPSTREAM ELEVATION(FEET) =    294.00
  DOWNSTREAM ELEVATION(FEET) =    290.00
  ELEVATION DIFFERENCE(FEET) =      4.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.587
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    110.00 IS CODE =  51
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  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    290.00  DOWNSTREAM(FEET) =    285.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   205.00   CHANNEL SLOPE =  0.0244
  CHANNEL BASE(FEET) =    1.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.085
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.79
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.18
  AVERAGE FLOW DEPTH(FEET) =   0.27   TRAVEL TIME(MIN.) =   0.66
  Tc(MIN.) =   6.66
  SUBAREA AREA(ACRES) =     0.80       SUBAREA RUNOFF(CFS) =    2.78
  TOTAL AREA(ACRES) =      0.90         PEAK FLOW RATE(CFS) =       3.18

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
  DEPTH(FEET) =  0.38   FLOW VELOCITY(FEET/SEC.) =   6.13
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****************************************************************************
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----------------------------------------------------------------------------
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  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
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  CHANNEL LENGTH THRU SUBAREA(FEET) =   183.00   CHANNEL SLOPE =  0.3115
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.944
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.33
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.11
  AVERAGE FLOW DEPTH(FEET) =   0.08   TRAVEL TIME(MIN.) =   0.74
  Tc(MIN.) =   7.40
  SUBAREA AREA(ACRES) =     0.22       SUBAREA RUNOFF(CFS) =    0.30
  TOTAL AREA(ACRES) =      1.12         PEAK FLOW RATE(CFS) =       3.48

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   4.30
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    115.00 =   480.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      1.12  TC(MIN.) =      7.40
  PEAK FLOW RATE(CFS)   =      3.48
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2003 Advanced Engineering Software (aes)
             Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* 3450 CLAIREMONT DRIVE                                                    *
* 100-YEAR PRE-PROJECT HYDROLOGY                                           *
* BASIN 2                                                                  *
 **************************************************************************

  FILE NAME: CB200PRE.RAT
  TIME/DATE OF STUDY: 00:37 10/23/2020
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  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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.*

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    205.00 IS CODE =  21
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  *USER SPECIFIED(SUBAREA):
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  UPSTREAM ELEVATION(FEET) =    288.00
  DOWNSTREAM ELEVATION(FEET) =    285.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.903
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.37
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.37

****************************************************************************
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============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    285.00  DOWNSTREAM(FEET) =    232.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   207.00   CHANNEL SLOPE =  0.2560
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.823
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      0.68
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.70
  AVERAGE FLOW DEPTH(FEET) =   0.02   TRAVEL TIME(MIN.) =   2.04
  Tc(MIN.) =   8.04
  SUBAREA AREA(ACRES) =     0.46       SUBAREA RUNOFF(CFS) =    0.62
  TOTAL AREA(ACRES) =      0.60         PEAK FLOW RATE(CFS) =       0.99

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
  DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   1.90
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    210.00 =   250.00 FEET.
================================================================================
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  TOTAL AREA(ACRES)     =      0.60  TC(MIN.) =      8.04
  PEAK FLOW RATE(CFS)   =      0.99
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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Date 10/20/2020
Job No. 19254 A
Page
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Checked By

Pre-Project Hydrology

Basin - 3

Area = 0.41 AC.

% Impervious = 80%

C = 0.85 [Per Table A-1 of City of SD DDM]

Time of concentration of 5-min is assumed

Intensity I = 4.4 in/hr

Q_{100} = CIA

= 0.85 x 4.4 x 0.41

Q_{100} = 1.53 cfs

Basin-4

Area = 0.29 AC.

% Impervious = 40%.

Runoff Co-efficient C = (0.95 x 0.4) + (0.45 x 0.6) = 0.65

Time of concentration of 5-min is assumed

Intensity I = 4.4 in/hr

Q_{100} = CIA = 0.65 x 4.4 x 0.29 = 0.83 cfs

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Page
Done By BV
Checked By

Basin 5

Area = 0.05 AC.

C = 0.85 [% imp = 80%, per Table A-1 of City of SD DDM]

Time of concentration of 5-min assumed

I = 4.4 in/hr

Q_{100} = CIA = 0.85 X 4.4 X 0.05 = 0.2 cfs

Proposed Condition AES Output

[100-Year]

```
****************************************************************************

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                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* 3450 CLAIREMONT DRIVE                                                    *
* 100-YEAR POST-PROJECT HYDROLOGY                                          *
* BASIN1                                                                   *
 **************************************************************************

  FILE NAME: CB100PST.RAT
  TIME/DATE OF STUDY: 03:28 10/23/2020
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    105.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    72.00
  UPSTREAM ELEVATION(FEET) =    295.00
  DOWNSTREAM ELEVATION(FEET) =    293.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.934
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    110.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  293.00  DOWNSTREAM ELEVATION(FEET) =  289.00
  STREET LENGTH(FEET) =   241.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.63
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    7.97
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.16
```

```
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.62
  STREET FLOW TRAVEL TIME(MIN.) =   1.86   Tc(MIN.) =   7.86
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.857
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.80      SUBAREA RUNOFF(CFS) =    2.56
  TOTAL AREA(ACRES) =      0.90        PEAK FLOW RATE(CFS) =       2.91

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.36
  FLOW VELOCITY(FEET/SEC.) =  2.44   DEPTH*VELOCITY(FT*FT/SEC.) =   0.81
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    110.00 =   313.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    115.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    289.00  DOWNSTREAM(FEET) =    228.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.3050
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.699
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.01
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.01
  AVERAGE FLOW DEPTH(FEET) =   0.07   TRAVEL TIME(MIN.) =   0.83
  Tc(MIN.) =   8.69
  SUBAREA AREA(ACRES) =     0.15       SUBAREA RUNOFF(CFS) =    0.19
  TOTAL AREA(ACRES) =      1.05         PEAK FLOW RATE(CFS) =       3.11

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.07   FLOW VELOCITY(FEET/SEC.) =   4.14
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    115.00 =   513.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      1.05  TC(MIN.) =      8.69
  PEAK FLOW RATE(CFS)   =      3.11
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* 3450 CLAIREMONT DRIVE                                                    *
* 100-YEAR POST-PROJECT HYDROLOGY                                          *
* BASIN 2                                                                  *
 **************************************************************************

  FILE NAME: CB200PST.RAT
  TIME/DATE OF STUDY: 18:00 01/18/2021
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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.*

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    205.00 IS CODE =  22
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  USER SPECIFIED Tc(MIN.) =    6.000
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    210.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
```

```
  UPSTREAM ELEVATION(FEET) =  292.07  DOWNSTREAM ELEVATION(FEET) =  289.22
  STREET LENGTH(FEET) =   232.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.62
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.52
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.92
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.57
  STREET FLOW TRAVEL TIME(MIN.) =   2.01   Tc(MIN.) =    8.01
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.828
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.830
  SUBAREA AREA(ACRES) =    0.80      SUBAREA RUNOFF(CFS) =    2.54
  TOTAL AREA(ACRES) =       0.9       PEAK FLOW RATE(CFS) =       2.86

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.91
  FLOW VELOCITY(FEET/SEC.) =  2.19   DEPTH*VELOCITY(FT*FT/SEC.) =   0.75
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    210.00 =     271.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.828
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8300
  SUBAREA AREA(ACRES) =    0.10   SUBAREA RUNOFF(CFS) =    0.32
  TOTAL AREA(ACRES) =       1.0   TOTAL RUNOFF(CFS) =       3.18
  TC(MIN.) =    8.01

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    215.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    289.22  DOWNSTREAM(FEET) =    232.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   140.00   CHANNEL SLOPE =  0.4087
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.701
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.44
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.50
  AVERAGE FLOW DEPTH(FEET) =   0.05   TRAVEL TIME(MIN.) =   0.67
  Tc(MIN.) =    8.68
  SUBAREA AREA(ACRES) =     0.41       SUBAREA RUNOFF(CFS) =    0.53
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.690
  TOTAL AREA(ACRES) =       1.4        PEAK FLOW RATE(CFS) =       3.60

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.05   FLOW VELOCITY(FEET/SEC.) =   3.66
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    215.00 =     411.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       1.4  TC(MIN.) =      8.68
  PEAK FLOW RATE(CFS)   =       3.60
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX B

Inlet Sizing

Hydraulic Analysis Report

Project Data

Project Title: 19254-A CLAIREMONT DRIVE

Designer:

Project Date: Monday, January 18, 2021

Project Units: U.S. Customary Units

Notes: INLET SIZING

Curb and Gutter Analysis: BASIN1_SIS_4ft

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0200 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 2.0000 ft

Design Flow: 2.9000 cfs

Per Q100 at Node 110 of Post-project rational method.

Gutter Result Parameters

Width of Spread: 7.9167 ft

Gutter Depression: 1.5120 in

Area of Flow: 0.7527 ft^2

Eo (Gutter Flow to Total Flow): 0.6934

Gutter Depth at Curb: 3.4120 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Curb Opening

Length of Inlet: 4.0000 ft

Curb opening height: 6.0000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 7.6000 ft

Effective Perimeter: 7.6000 ft

Area: 3.3333 ft^2

Effective Area: 3.3333 ft^2

Depth at curb face (upstream of local depression): 0.3019 ft

Computed Width of Spread at Sag: 8.7964 ft

Flow type: Weir Flow

Efficiency: 1.0000

J-19254A Clairemont Drive
01/19/2021

Grate Inlet on Grade - Basin 2

Based on the January 2017 City of San Diego Drainage Design Manual

$Q_{approach}$ - total flow approaching the grate (cfs)	2.9	
T - total spread of water in the roadway (ft)	8.1	
W_e - effective width of the grate (ft) (Actual width less the width of bars or vanes with a clogging factor (0.5) applied)[1]	0.800	
L_e - effective length of the grate (ft) (Actual length less the width of bars or vanes with a clogging factor (0.5) applied)	1.542	
V_o - splash-over velocity; 2.0 ft/s for a standard D-15 (ft/s)	2.0	
V - velocity of flow approaching inlet (ft/s)	4.5	
S_x - street cross slope, not the longitudinal slope of gutter (ft/ft)	0.02	
Q_w - portion of approaching flow within the width of the grate inlet (cfs)	0.703	
Q_s - side discharge; flow exceeding the width of the grate inlet (cfs)	2.197	
$Q_{intercept,front}$ - frontal discharge intercepted by grate inlet (cfs)	0.545	(If $V < V_o$ it can be assumed that the grate intercepts all of the approaching frontal discharge)
$Q_{intercept,side}$ - side discharge intercepted by grate inlet (cfs)	0.052	
$Q_{intercept,total}$ - total flow intercepted by the grate inlet (cfs)	0.60	
Q_{bypass} - bypass flow (cfs)	2.30	
Efficiency (%)	20.6%	

Will be intercepted by the southern inlet in sump of Basin 2

Note:
Refer to the Federal Highway Administration's Urban Drainage Design Manual (HEC-22) for guidance for other grate types and configurations, including splash-over velocity.
1. Value taken from Jan 2017 City of SD DDM Section 3.2.2.3 Grate Inlets on Grade

Curb and Gutter Analysis: BASIN2_SIS_4ft

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0100 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 2.0000 ft

Width of Spread: 8.9001 ft

Gutter Result Parameters

Design Flow: 2.6000 cfs

Includes bypass flow of 2.3 cfs and Q100 at Node 210 of Post-project rational method

Gutter Depression: 1.5120 in

Area of Flow: 0.9181 ft^2

Eo (Gutter Flow to Total Flow): 0.6356

Gutter Depth at Curb: 3.6480 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Curb Opening

Length of Inlet: 4.0000 ft

Curb opening height: 6.0000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 7.6000 ft

Effective Perimeter: 7.6000 ft

Area: 3.3333 ft^2

Effective Area: 3.3333 ft^2

Depth at curb face (upstream of local depression): 0.2807 ft

Computed Width of Spread at Sag: 7.7365 ft

Flow type: Weir Flow

Efficiency: 1.0000

APPENDIX C

Hydraulic Analysis

Normal Depth Storm Drain Sizing Table

The purpose of this table is to provide an estimated pipe size to convey the 100-year flow rates with a sizing factor.

Manning's n: 0.013

Sizing Factor (%): 30

	Slope at:	0.5%		1.0%		2.0%		3.0%	
Q_{100} (cfs[1])	**Q_{100} with Sizing Factor (cfs[1])**	**Minimum Pipe Size[2] (feet)**	**Recommended Pipe Size (inches)**	**Minimum Pipe Size[2] (feet)**	**Recommended Pipe Size (inches)**	**Minimum Pipe Size [2] (feet)**	**Recommended Pipe Size (inches)**	**Minimum Pipe Size[2] (feet)**	**Recommended Pipe Size (inches)**
1.2	1.6	0.83	10"	0.73	10"	0.64	8"	0.60	8"
1.3	1.7	0.86	12"	0.76	10"	0.66	8"	0.61	8"
3.0	3.9	1.18	18"	1.03	18"	0.91	12"	0.84	10"
10.0	13.0	1.85	24"	1.62	24"	1.43	18"	1.32	18"
15.0	19.5	2.15	30"	1.89	24"	1.66	24"	1.54	24"
20.0	26.0	2.40	30"	2.11	30"	1.85	24"	1.71	24"
25.0	32.5	2.61	36"	2.29	30"	2.01	24"	1.86	24"
30.0	39.0	2.79	36"	2.45	30"	2.15	30"	1.99	24"
35.0	45.5	2.96	36"	2.60	36"	2.28	30"	2.11	30"
40.0	52.0	3.11	42"	2.73	36"	2.40	30"	2.22	30"
50.0	65.0	3.38	42"	2.97	36"	2.61	36"	2.42	30"
60.0	78.0	3.62	48"	3.18	42"	2.79	36"	2.59	36"
70.0	91.0	3.83	48"	3.37	42"	2.96	36"	2.74	36"
80.0	104.0	4.03	54"	3.54	48"	3.11	42"	2.88	36"
90.0	117.0	4.21	54"	3.70	48"	3.25	42"	3.01	42"
100.0	130.0	4.38	54"	3.85	48"	3.38	42"	3.13	42"
150.0	195.0	5.10	72"	4.48	54"	3.94	48"	3.65	48"
200.0	260.0	5.68	72"	4.99	60"	4.38	54"	4.06	54"
250.0	325.0	6.18	84"	5.43	72"	4.77	60"	4.42	54"
300.0	390.0	6.62	84"	5.81	72"	5.10	72"	4.73	60"

Note:

1. "cfs" = cubic feet per second.
2. Minimum pipe sizes are calculated using the Manning's equation and are based on the flow rates with 30% factor.

APPENDIX D

Energy Dissipater Sizing

MAP POCKET 1

Drainage Study Map

for

Clairemont Drive

[Pre-project]

LEGEND

- POI
- BASIN 1 — BASIN ID
- XX.X AC. — BASIN AREA
- DRAINAGE BASIN BOUNDARY
- DRAINAGE SUB-BASIN BOUNDARY
- EXISTING STORM DRAIN SYSTEM
- FLOW PATH

30 15 0 30 60 90

GRAPHIC SCALE 1" = 30'

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J-13284-NNN

DRAINAGE STUDY EXHIBIT FOR 3450 CLAIREMONT DRIVE (PRE PROJECT)

J-19524-A

October 26, 2020

NOT FOR CONSTRUCTION - EXHIBIT FOR DRAINAGE STUDY ONLY

MAP POCKET 2

Drainage Study Map

for

Clairemont Drive

[Post-project]

DRAINAGE STUDY EXHIBIT FOR CLAIREMONT WARMINGTON (POST PROJECT)

Date: Ocotber 26, 2020
Revised: January 22, 2021

J-19524-A

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