# PRELIMINARY DRAINAGE STUDY

## HOME2 HOTEL

## 381 TOWN CENTER PARKWAY SANTEE, CA 92071

PREPARED FOR:

EXCEL HOTEL GROUP

10174 Old Grove Road, Suite 200
San Diego, CA 92131
(858) 621-4908

PREPARED BY:

LANDMARK CONSULTING

9555 Genesee Avenue, Suite 200
San Diego, CA 92121
Phone: (858) 587-8070

REGISTERED PROFESSIONAL ENGINEER
DAVID H. YEH
NO. 62717
EXP. 6/30/24
CIVIL
STATE OF CALIFORNIA

Date Prepared: July 8, 2022

David H. Yeh | RCE 62717 | Exp 6/30/2024

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# 1.0 INTRODUCTION

The purpose of this study is to determine the anticipated runoff generated from the project site in pre-project and post-project conditions for the Home2 Hotel project located near the intersection of Riverview Parkway and Town Center Parkway, in the City of Santee. This report provides calculations to support the proposed development and conditional-use permit and to demonstrate no noticeable adverse impacts are anticipated to downstream receiving bodies or storm drain facilities as a result of the proposed development.

## 1.1 Location

The project site is located northwest of the intersection of Riverview Parkway and Town Center Parkway, on the south side of Town Center Parkway adjacent to the existing shopping center development in the City of Santee, County of San Diego, State of California. Project address is 381 Town Center Parkway.

### 1.1.1 Vicinity Map

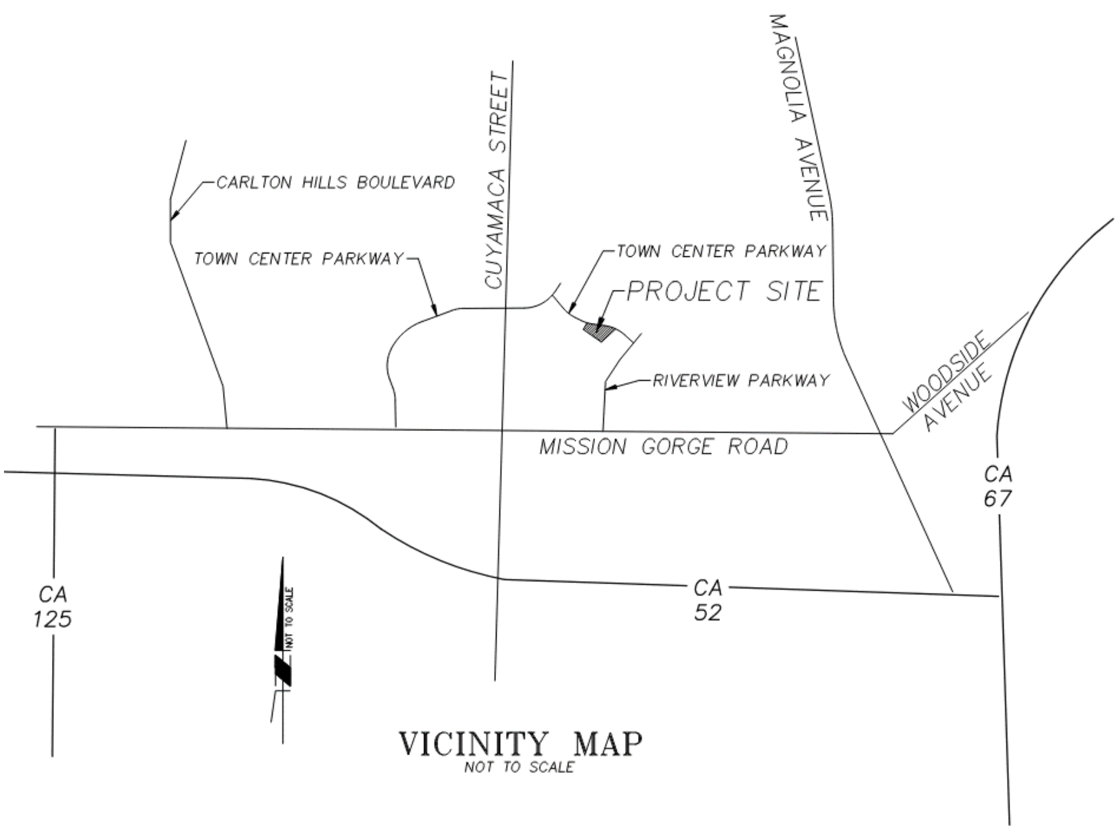


Figure 1-1: Vicinity map

# 2.0 PROJECT DESCRIPTION

## 2.1 Pre-Project Site Conditions

Under the existing conditions, the site is an existing asphalt-concrete parling lot, with raised planters dispersed throughout. The existing project site parcel is approximately 1.6 acres and largely falls within an overall drainage basin encompassing 2.7 acres. Runoff generally flows from north east to south west, via sheet flow across the existing parking area, and collected within a 3-foot-wide concrete ribbon gutter. The existing drainage basin is split into two subbasins, the east portion from Node 101 to Node 110 and the west basin from Node 121 to Node 130 (see pre-project hydrology map in Attachment 1).

Runoff from the eastern basin sheet flows from the southwest corner of the intersection of Town Center Parkway and Riverview Parkway, into the concrete ribbon gutter to the south. The ribbon gutter conveys runoff westerly, eventually discharging into an existing curb inlet located within the project site, near the eastern property line. The flow then enters an existing storm drain system that collects runoff from the overall shopping center area.

Runoff from the western subbasin follows a similar drainage pattern, draining from the northeast to the southwest and collecting within the existing ribbon gutter. The ribbon gutter conveys runoff westerly and then northerly until it is collected within the existing grated catch basin. The flow then enters the existing storm drain system.

## 2.2 Post-Project Site Conditions

The proposed development consists of the redevelopment of a portion of the overall parcel with a mid-rise hotel building and adjacent site improvements. Under the proposed conditions, the overall runoff pattern will not significantly change from pre-project conditions. Off-site run-on from the easter subbasin will continue to sheet flow from the existing parking areas, and collect within the existing ribbon gutter. The runoff will then collect within a proposed inlet within the project boundary, designed to isolate offsite runoff and drain into the same existing storm drain facility as pre-project conditions.

Prior to collecting within the existing storm drain, runoff generated from the proposed improvements within the eastern subbasin will be collected within water quality facilities proposed in the raised medians to treat the anticipated runoff.

Runoff from the western subbasin will also follow the general runoff pattern of pre-project conditions, draining from northeast to west. Runoff from the proposed improvements will be collected within water quality treatment facilities located within the proposed raised planters and collect into a proposed subgrade storm water system, eventually tying into the existing storm water system.

# 3.0 DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the Civil Engineer of Work for this project, that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with current standards.

I understand that the check of the project design reports and calculations by the City of Santee is confined to review only and does not relieve me, as Engineer of Work, of my responsibilities for project design.

11-30-2022

David Yeh, P.E. 62717, Exp. 6-30-2024 Date

REGISTERED PROFESSIONAL ENGINEER
DAVID H. YEH
NO. 62717
EXP. 6/30/24
CIVIL
STATE OF CALIFORNIA

# 4.0 METHOD OF ANALYSIS

Since the project area is less than 1 square mile, the study utilized the rational method, in accordance with the County of San Diego Hydrology Manual (County of San Diego, 2003). The following provides excerpts from the Hydrology Manual.

# SECTION 3
## RATIONAL METHOD AND MODIFIED RATIONAL METHOD

### 3.1 THE RATIONAL METHOD

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage, where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and small drainage structures. The RM is recommended for analyzing the runoff response from drainage areas up to approximately 1 square mile in size. It should not be used in instances where there is a junction of independent drainage systems or for drainage areas greater than approximately 1 square mile in size. In these instances, the Modified Rational Method (MRM) should be used for junctions of independent drainage systems in watersheds up to approximately 1 square mile in size (see Section 3.4); or the NRCS Hydrologic Method should be used for watersheds greater than approximately 1 square mile in size (see Section 4).

The RM can be applied using any design storm frequency (e.g., 100-year, 50-year, 10-year, etc.). The local agency determines the design storm frequency that must be used based on the type of project and specific local requirements. A discussion of design storm frequency is provided in Section 2.3 of this manual. A procedure has been developed that converts the 6-hour and 24-hour precipitation isopluvial map data to an Intensity-Duration curve that can be used for the rainfall intensity in the RM formula as shown in Figure 3-1. The RM is applicable to a 6-hour storm duration because the procedure uses Intensity-Duration Design Charts that are based on a 6-hour storm duration.

#### 3.1.1 Rational Method Formula

The RM formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration ($T_c$), which is the time required for water to flow from the most remote point of the basin to the location being analyzed. The RM formula is expressed as follows:

$$Q = C\ I\ A$$

Where: Q = peak discharge, in cubic feet per second (cfs)

C = runoff coefficient, proportion of the rainfall that runs off the surface (no units)

I = average rainfall intensity for a duration equal to the $T_C$ for the area, in inches per hour (Note: If the computed $T_C$ is less than 5 minutes, use 5 minutes for computing the peak discharge, Q)

A = drainage area contributing to the design location, in acres Combining the units

for the expression CIA yields:

$$\left(\frac{1\,\text{acre} \times \text{inch}}{\text{hour}}\right)\left(\frac{43{,}560\ \text{ft}^2}{\text{acre}}\right)\left(\frac{1\,\text{foot}}{12\,\text{inches}}\right)\left(\frac{1\,\text{hour}}{3{,}600\,\text{seconds}}\right) \Rightarrow 1.008\ \text{cfs}$$

For practical purposes the unit conversion coefficient difference of 0.8% can be ignored.

The RM formula is based on the assumption that for constant rainfall intensity, the peak discharge rate at a point will occur when the raindrop that falls at the most upstream point in the tributary drainage basin arrives at the point of interest.

Unlike the MRM (discussed in Section 3.4) or the NRCS hydrologic method (discussed in Section 4), the RM does not create hydrographs and therefore does not add separate subarea hydrographs at collection points. Instead, the RM develops peak discharges in the main line by increasing the $T_C$ as flow travels downstream.

Characteristics of, or assumptions inherent to, the RM are listed below:

The discharge flow rate resulting from any I is maximum when the I lasts as long as or longer than the $T_C$.

1. The storm frequency of peak discharges is the same as that of I for the given $T_c$.

2. The fraction of rainfall that becomes runoff (or the runoff coefficient, C) is independent of I or precipitation zone number (PZN) condition (PZN Condition is discussed in Section 4.1.2.4).

3. The peak rate of runoff is the only information produced by using the RM.

### 3.1.2 Runoff Coefficient

Table 3-1 lists the estimated runoff coefficients for urban areas. The concepts related to the runoff coefficient were evaluated in a report entitled *Evaluation, Rational Method "C" Values* (Hill, 2002) that was reviewed by the Hydrology Manual Committee. The Report is available at San Diego County Department of Public Works, Flood Control Section and on the San Diego County Department of Public Works web page.

The runoff coefficients are based on land use and soil type. Soil type can be determined from the soil type map provided in Appendix A. An appropriate runoff coefficient (C) for each type of land use in the subarea should be selected from this table and multiplied by the percentage of the total area (A) included in that class. The sum of the products for all land uses is the weighted runoff coefficient (Σ[CA]). Good engineering judgment should be used when applying the values presented in Table 3-1, as adjustments to these values may be appropriate based on site-specific characteristics. In any event, the impervious percentage (% Impervious) as given in the table, for any area, shall govern the selected value for C. The runoff coefficient can also be calculated for an area based on soil type and impervious percentage using the following formula:

$$C = 0.90 \times (\% \text{ Impervious}) + C_p \times (1 - \% \text{ Impervious})$$

Where: $C_p$ = Pervious Coefficient Runoff Value for the soil type (shown in Table 3-1 as Undisturbed Natural Terrain/Permanent Open Space, 0% Impervious). Soil type can be determined from the soil type map provided in Appendix A.

The values in Table 3-1 are typical for most urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the local agency.

### 3.1.3 Rainfall Intensity

The rainfall intensity (I) is the rainfall in inches per hour (in/hr) for a duration equal to the $T_c$ for a selected storm frequency. Once a particular storm frequency has been selected for design and a $T_c$ calculated for the drainage area, the rainfall intensity can be determined from the Intensity-Duration Design Chart (Figure 3-1). The 6-hour storm rainfall amount ($P_6$) and the 24-hour storm rainfall amount ($P_{24}$) for the selected storm frequency are also needed for calculation of I. $P_6$ and $P_{24}$ can be read from the isopluvial maps provided in Appendix B. An Intensity-Duration Design Chart applicable to all areas within San Diego County is provided as Figure 3-1. Figure 3-2 provides an example of use of the Intensity-Duration Design Chart. Intensity can also be calculated using the following equation:

$$I = 7.44\ P_6\ D^{-0.645}$$

Where: $P_6$ = adjusted 6-hour storm rainfall amount (see discussion below) D = duration in minutes (use $T_c$)

Note: This equation applies only to the 6-hour storm rainfall amount (i.e., $P_6$ cannot be changed to $P_{24}$ to calculate a 24-hour intensity using this equation).

The Intensity-Duration Design Chart and the equation are for the 6-hour storm rainfall amount. In general, $P_6$ for the selected frequency should be between 45% and 65% of $P_{24}$ for the selected frequency. If $P_6$ is not within 45% to 65% of $P_{24}$, $P_6$ should be increased or decreased as necessary to meet this criteria. The isopluvial lines are based on precipitation gauge data. At the time that the isopluvial lines were created, the majority of precipitation gauges in San Diego County were read daily, and these readings yielded 24-hour precipitation data. Some 6-hour data were available from the few recording gauges distributed throughout the County at that time; however, some 6-hour data were extrapolated. Therefore, the 24-hour precipitation data for San Diego County are considered to be more reliable.

### 3.1.4 Time of Concentration

The Time of Concentration ($T_c$) is the time required for runoff to flow from the most remote part of the drainage area to the point of interest. The $T_c$ is composed of two components: initial time of concentration ($T_i$) and travel time ($T_t$). Methods of computation for $T_i$ and $T_t$ are discussed below. The $T_i$ is the time required for runoff to travel across the surface of the most remote subarea in the study, or "initial subarea." Guidelines for designating the initial subarea are provided within the discussion of computation of $T_i$. The $T_t$ is the time required for the runoff to flow in a watercourse (e.g., swale, channel, gutter, pipe) or series of watercourses from the initial subarea to the point of interest. For the RM, the $T_c$ at any point within the drainage area is given by:

$$T_c = T_i + T_t$$

Methods of calculation differ for natural watersheds (nonurbanized) and for urban drainage systems. When analyzing storm drain systems, the designer must consider the possibility that an existing natural watershed may become urbanized during the useful life of the storm drain system. Future land uses must be used for $T_c$ and runoff calculations, and can be determined from the local Community General Plan.

#### 3.1.4.1 Initial Time of Concentration

The initial time of concentration is typically based on sheet flow at the upstream end of a drainage basin. The Overland Time of Flow (Figure 3-3) is approximated by an equation developed by the Federal Aviation Agency (FAA) for analyzing flow on runaways (FAA, 1970). The usual runway configuration consists of a crown, like most freeways, with sloping pavement that directs flow to either side of the runway. This type of flow is uniform in the direction perpendicular to the velocity and is very shallow. Since these depths are ¼ of an inch (more or less) in magnitude, the relative roughness is high. Some higher relative roughness values for overland flow are presented in Table 3.5 of the HEC-1 Flood Hydrograph Package User's Manual (USACE, 1990). a Tc calculated for the drainage area, the rainfall intensity can be determined from the Intensity-Duration-Frequency Design Chart (Figure A-1).

# 5.0 HYDROLOGIC ANALYSIS CALCULATIONS AND RESULTS

## 5.1 Calculation Methods

Per the attached hydrological soil group map and the enlarged area encompassing the project site, the project site is situated on Type B soil as defined by the current County of San Diego Hydrology Manual and further supplemented with information from USDA's NRCS Web Soil Survey, found in Attachments 3 and 4.

Per the County of San Diego Hydrology Manual's table 3-1, based on soil type B and the site being fully developed with parking lots with minimal planters (approximately 90% impervious), the runoff coefficient used in all hydraulic calculations is **0.84** for all area in pre project conditions. Under post-project conditions, the existing AC parking area is to be redeveloped with a mid-rise hotel building and surrounding parking areas and other associated improvements. Overall, the percentage of impervious areas will decrease slightly in post project conditions, however a conservative estimate of 90% impervious was used. Therefore, under post-project conditions a runoff coefficient of **0.84** was used for all areas. This was then correlated to the proper land-use type based on the percent impervious listed in the Hydrology Manual.

The analysis was performed using Advanced Engineering Software, which has built-in capabilities to perform Modified Rational Method Calculations. The inputs included the subarea acreage, land-use, flow length, and representative elevations of the site. The program calculates the time of concentration and corresponding intensity to determine the peak flow rates. The user must also input a "code" value which signifies what type of hydrologic/hydraulic computation is to be performed. A summary of the specific codes is provided below in Table 5-1.

Table 5-1: AES Code Summary Table

| Code Number | Function |
|---|---|
| 0 | Enter Comment |
| 1 | Confluence Analysis at Node |
| 2 | Initial Subarea Analysis |
| 3 | Pipe/Box/Culvert Traveltime (Computer Sized) |
| 4 | Pipe/Box/Culvert Traveltime (User Sized) |
| 5 | Open Channel Traveltime |

| | |
|---|---|
| 6 | Streetflow Analysis Through Subarea |
| 7 | User-Specified Hydrology Data at Node |
| 8 | Addition of Subarea Runoff To Main Stream |
| 9 | V-Gutter Flow Through Subarea |
| 10 | Copy Main-Stream Data onto A Memory Bank |
| 11 | Confluence A Memory Bank with The Main-Stream Memory |
| 12 | Clear A Memory Bank |
| 13 | Clear The Main Stream |
| 14 | Copy A Memory Bank onto The Main-Stream Memory |
| 15 | Hydrologic Data Bank Storage Functions |
| 16 | User-Specified Source Flow at A Node |

## 5.2 Pre-Project Runoff Summary

The complete output files from the AES modified rational method analyses are provided in the attached appendices. A summary for the pre-project peak flow rate calculations is provided in Table 5-2.

Table 5-2: Pre-project hydrologic analysis summary

| Node | Area (ac) | Flow Length (ft) | Tc (mins) | Intensity (in/hr) | Q (cfs) |
|---|---|---|---|---|---|
| 110 (within ex 24" RCP) | 1.3 | 375 | 4.6 (use 5) | 6.6 | 7.2 |
| 115 (within ex A4 CO) | 0.1 | 220 | 3.0 (use 5) | 6.6 | 0.6 |
| 130 | 1.4 | 475 | 6.3 | 5.7 | 6.4 |

The pre-project hydrologic analysis was divided into two subbasins that drain into two catch basins. The eastern basin is collected within an existing curb inlet in the raised island near the eastern property line of the site. Runoff sheet flows from the existing parking lot, and is collected within the existing ribbon gutter, that drains into the curb inlet at Node 110.

The western basin also sheet flows from the northeast to south west, collecting within the concrete ribbon gutter. The ribbon gutter conveys runoff westerly, and then north to the existing grate inlet at Node 130. See Attachment 5 for the full AES analysis output.

## 5.3 Post-Project Runoff Summary

The complete output from the AES modified rational method analysis for the post-project hydrologic analysis is provided as an appendix to this report. A summary of the post-project calculated peak flow rates are provided in Table 5-3.

Table 5-3: Post-project hydrologic analysis summary

| Node | Area (ac) | Flow Length (ft) | Tc (mins) | Intensity (in/hr) | Q (cfs) |
|---|---|---|---|---|---|
| 110 | 1.8 | 615 | 8.8 | 4.6 | 7.4 |
| 108 (within ex. 24" RCP) | 2.8 | 695 | 9.0 | 4.5 | 11.0 |
| 115 (within ex A4 CO) | 0.1 | 220 | 3.0 (use 5) | 6.6 | 0.6 |
| 119 (Curb inlet to MWS) | 0.8 | 385 | 7.5 | 4.7 | 3.2 |
| 125 (Curb inlet to MWS) | 0.5 | 188 | 4.6 (use 5) | 6.6 | 3.0 |
| 133 (Curb cut to biofiltration) | 0.4 | 155 | 4.5 (use 5) | 6.6 | 2.3 |

For the post-project hydrologic analysis, the entire site drains into the existing 24-inch RCP storm drain running easterly, from the project through the existing shopping center. Off-site run on (5.3 cfs) from the area east of the project boundary, is collected within a proposed inlet to prevent co-mingling of on-site and offsite flows.

The remainder of the on-site runoff is directed into water quality BMPs prior to collecting within an underground storm drain system that ties into the exiting 24-inch RCP storm drain. The general flow pattern is retained, with runoff flowing in a westerly direction.

## 5.4 Peak Flow Comparison

The comparison of pre-project and post-project peak flow rates are provided in Table 5-4. The proposed project is anticipated to result in an overall decrease in peak flow rate for the entire project site due to increased flow routing, increased pervious area, and the conveyance of storm water into proposed water quality BMPs. The on-site routing into the existing storm drain system, at the east of the project, is necessary to accommodate depths required for structural BMPs for storm water quality. This routing temporarily increases area draining to this system, but ultimately the drainage basin area does not increase.

| Table 5-4: Peak Flow Comparison Summary | | | |
|---|---|---|---|
| Node | Pre-Project Flow (cfs) | Post-Project Flow (cfs) | Increase in Flow (cfs) |
| 110 (108 Post Flow in ex 24" RCP) | 7.2 | 11.0 | 3.8 |
| 130 | 6.4 | N/A | -6.4 |
| 115 | 0.6 | 0.6 | 0 |

# 6.0 HYDRAULIC ANALYSIS

Hydraulic analyses were performed on the existing and proposed storm drain facilities in order to determine the adequacy to handle the anticipated peak flows from the 100-year storm event.

## 6.1 Existing 24-inch RCP SD

For this preliminary drainage study, normal depth Manning's equation calculations were performed to show the system has adequate capacity to convey anticipated flow rates. The Hydraulic Toolbox v5.1, developed by the FHWA, was utilized to perform these calculations.

Under pre-project conditions the anticipated flow depth for the peak flow rates associated with the 100-year storm event is 0.95 feet (d/D=0.48).

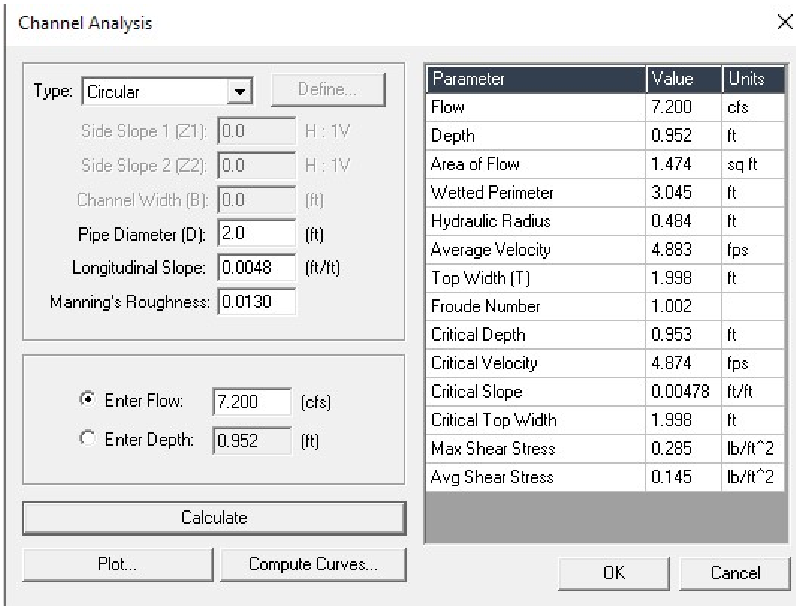


Figure 6-1: Pre-project hydraulic analysis existing 24" RCP SD

Under post-project conditions, a temporary increase in flow is anticipated in the existing 24" RCP storm drain.

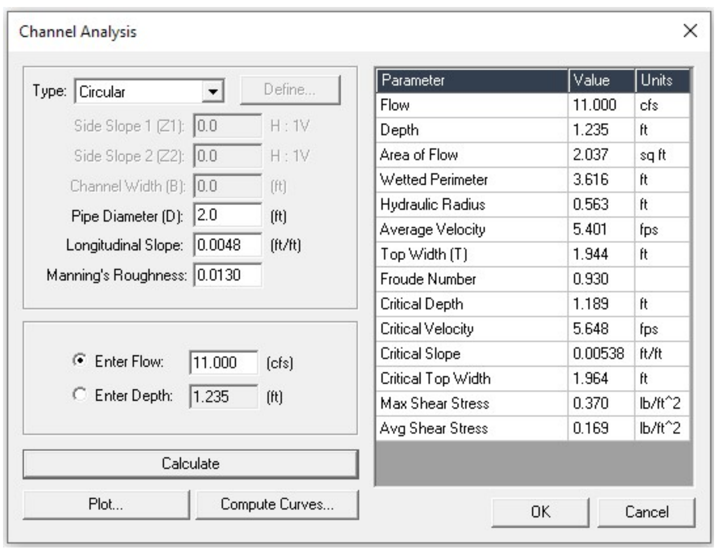


Figure 6-2: Post-project hydraulic analysis existing 24" RCP SD

Based on the hydraulic analysis, the existing system has adequate capacity to convey the post-project flow rates with a depth of flow of 1.2 feet (d/D=0.6).

## 6.2 Proposed 18" Storm Drain

The analysis on the proposed 18-inch storm drain reflects the maximum flow rate experienced by the system, at node 110.

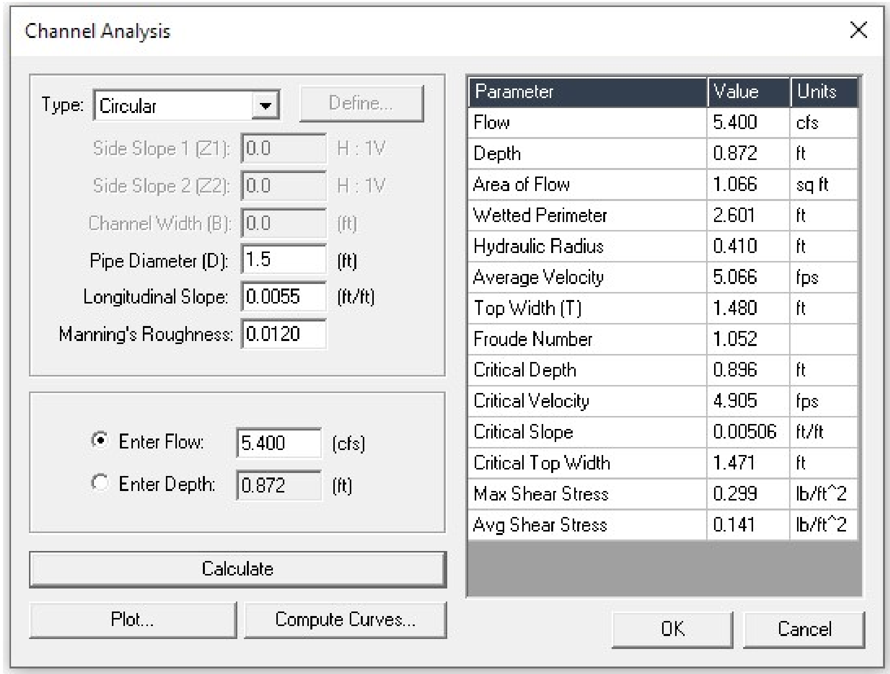


Figure 6-3: Post-project hydraulic analysis proposed 18" SD

# 7.0 CONCLUSIONS

The preliminary hydrologic and hydraulic analyses outlined in this report demonstrate no negative impacts to downstream facilities are anticipated as a result of the proposed development. The existing and proposed storm water facilities are adequately sized to convey runoff.

Additionally, the overall peak flow rates anticipated in post-project conditions are below pre-project due to the flow routing, increased pervious areas, and water quality BMPs.

# Attachment 1: Pre-Project Hydrology Map

## DRAINAGE BASIN SUMMARY TABLE

| US Node | DS Node | US Elev | DS Elev | Flow Length (ft) | Slope (%) | Area (AC) | C-Value |
|---|---|---|---|---|---|---|---|
| 101 | 102 | 349 | 347 | 60 | 3.33% | 0.08 | 0.84 |
| 102 | 105 | 347 | 344 | 165 | 1.82% | 0.6 | 0.84 |
| 105 | 110 | 344 | 341.6 | 150 | 1.60% | 0.62 | 0.84 |
| 110 | 110 | | | | | | |
| 110 | 110 | | | | | | |
| 111 | 112 | 342.5 | 340.5 | 55 | 3.64% | 0.04 | 0.84 |
| 112 | 115 | 336.9 | 336.3 | 165 | 0.36% | | |
| 115 | 115 | | | | | | |
| | | | | | | | |
| 113 | 114 | 343.5 | 341 | 95 | 2.63% | 0.07 | 0.84 |
| 114 | 115 | 337.5 | 336.5 | 28 | 3.57% | | |
| 115 | 115 | | | | | | |
| | | | | | | | |
| 115 | 110 | 336.5 | 336.3 | 66 | 0.30% | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| 121 | 122 | 346.3 | 345.2 | 70 | 1.57% | 0.06 | 0.84 |
| 122 | 125 | 345.2 | 341.8 | 200 | 1.70% | 0.54 | 0.84 |
| 125 | 130 | 341.8 | 340.3 | 205 | 0.73% | 0.75 | 0.84 |


PREPARED BY:

LANDMARK CONSULTING
Planning Engineering Surveying
9555 Genesee Avenue, Suite 200
San Diego, CA 92121, (858) 587-8070

CITY OF SANTEE
# HOME2 HOTEL
TOWN CENTER PARKWAY

## PRE-PROJECT HYDROLOGY
ATTACHMENT 1

SHEET NO. 1 OF 1

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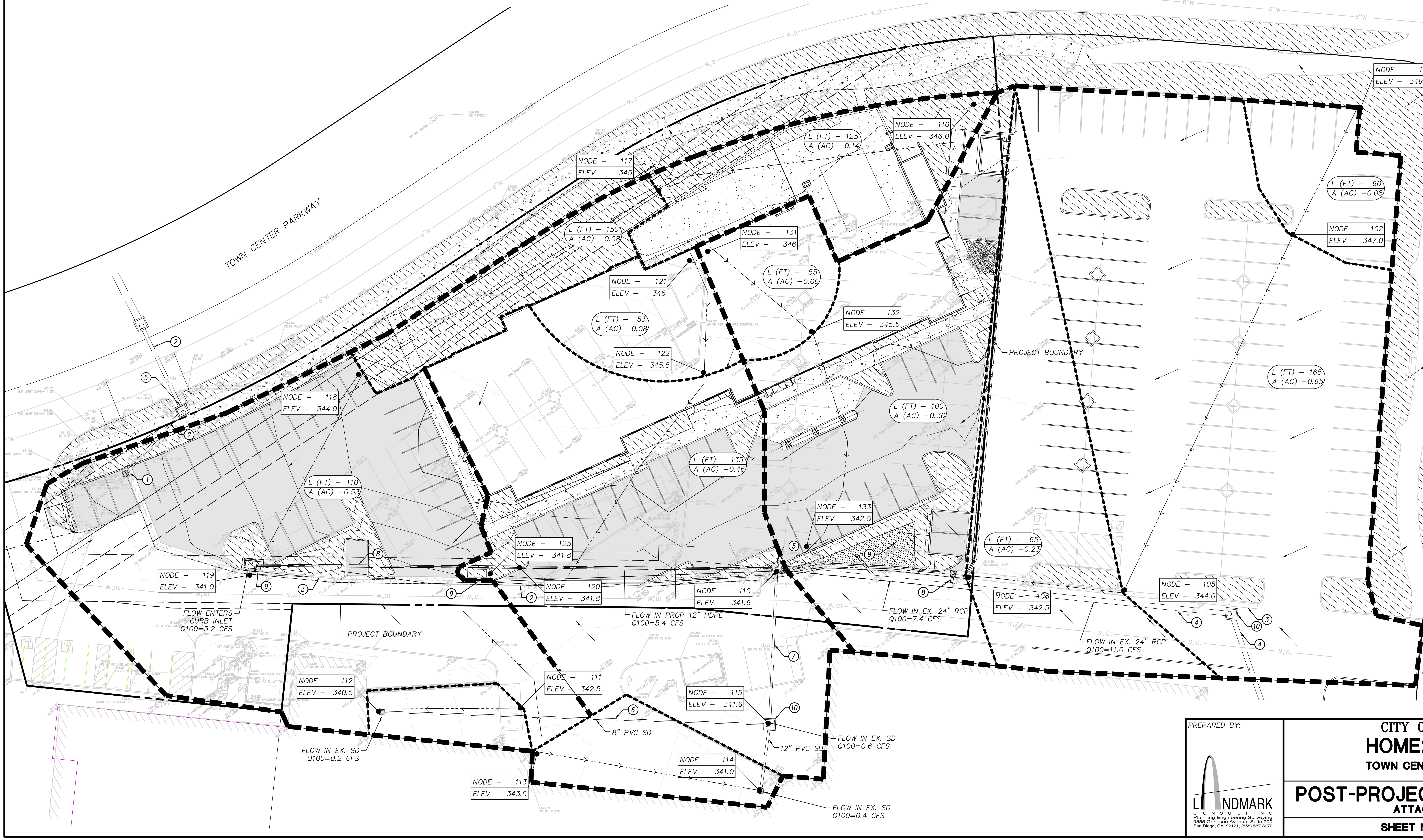
# Attachment 2: Post-project Hydrology Map

# DRAINAGE BASIN SUMMARY TABLE

| US Node | DS Node | US Elev | DS Elev | Flow Length (ft) | Slope (%) | Area (AC) | C-Value |
|---|---|---|---|---|---|---|---|
| 101 | 102 | 349 | 347 | 60 | 3.33% | 0.08 | 0.84 |
| 102 | 105 | 347 | 344 | 165 | 1.82% | 0.65 | 0.84 |
| 105 | 108 | 344 | 342.5 | 65 | 2.31% | 0.23 | 0.84 |
| 108 | 108 | | | | | | |
| | | | | | | | |
| 111 | 112 | 342.5 | 340.5 | 55 | 3.64% | 0.04 | 0.84 |
| 112 | 115 | 336.9 | 336.3 | 165 | 0.36% | | |
| 115 | 115 | | | | | | |
| | | | | | | | |
| 113 | 114 | 343.5 | 341 | 95 | 2.63% | 0.07 | 0.84 |
| 114 | 115 | 337.5 | 336.5 | 28 | 3.57% | | |
| 115 | 115 | | | | | | |
| | | | | | | | |
| 115 | 110 | 336.5 | 336.3 | 66 | 0.30% | | |
| 110 | 110 | | | | | | |
| | | | | | | | |
| 116 | 117 | 346 | 345 | 125 | 0.80% | 0.14 | 0.84 |
| 117 | 118 | 345 | 344 | 150 | 0.67% | 0.08 | 0.84 |
| 118 | 119 | 344 | 341 | 110 | 2.73% | 0.53 | 0.84 |
| 119 | 120 | 337.5 | 336.88 | 120 | 0.52% | | |
| 120 | 120 | | | | | | |
| | | | | | | | |
| 121 | 122 | 346 | 345.5 | 53 | 0.94% | 0.08 | 0.84 |
| 122 | 125 | 345.5 | 342 | 135 | 2.59% | 0.46 | 0.84 |
| 125 | 120 | 337 | 336.88 | 10 | 1.20% | | |
| 120 | 120 | | | | | | |
| | | | | | | | |
| 120 | 110 | 336.88 | 336.3 | 110 | 0.53% | | |
| 110 | 110 | | | | | | |
| | | | | | | | |
| 131 | 132 | 346 | 345.5 | 55 | 0.91% | 0.06 | 0.84 |
| 132 | 133 | 345.5 | 342.5 | 100 | 3.00% | 0.36 | 0.84 |
| 133 | 110 | 338 | 336.3 | 20 | 8.50% | | |
| 110 | 110 | | | | | | |
| 110 | 110 | | | | | | |
| | | | | | | | |
| 110 | 108 | 336.3 | 335.9 | 80 | 0.50% | | |




## NOTES

1. EX GRATE INLET TO BE REMOVED
2. EX RIBBON GUTTER TO BE REPLACED
3. EX CURB AND GUTTER
4. EX 24" RCP STORM DRAIN
5. EX CURB INLET
6. EX 8" PVC SD
7. EX 12" PVC SD
8. PROP 12" HDPE SD
9. PROP WATER QUALITY BMP
10. EX CLEANOUT

## LEGEND

- OVERALL DRAINAGE BOUNDARY
- SUBBASIN
- NODE — NODE – XXX / ELEV – XXX.X
- LENGTH/AREA — L (FT) – XXX / A (AC) –XXX.X
- FLOW PATH
- FLOW DIRECTION

PREPARED BY:

LANDMARK CONSULTING
Planning Engineering Surveying
9555 Genesee Avenue, Suite 200
San Diego, CA 92121, (858) 587-8070

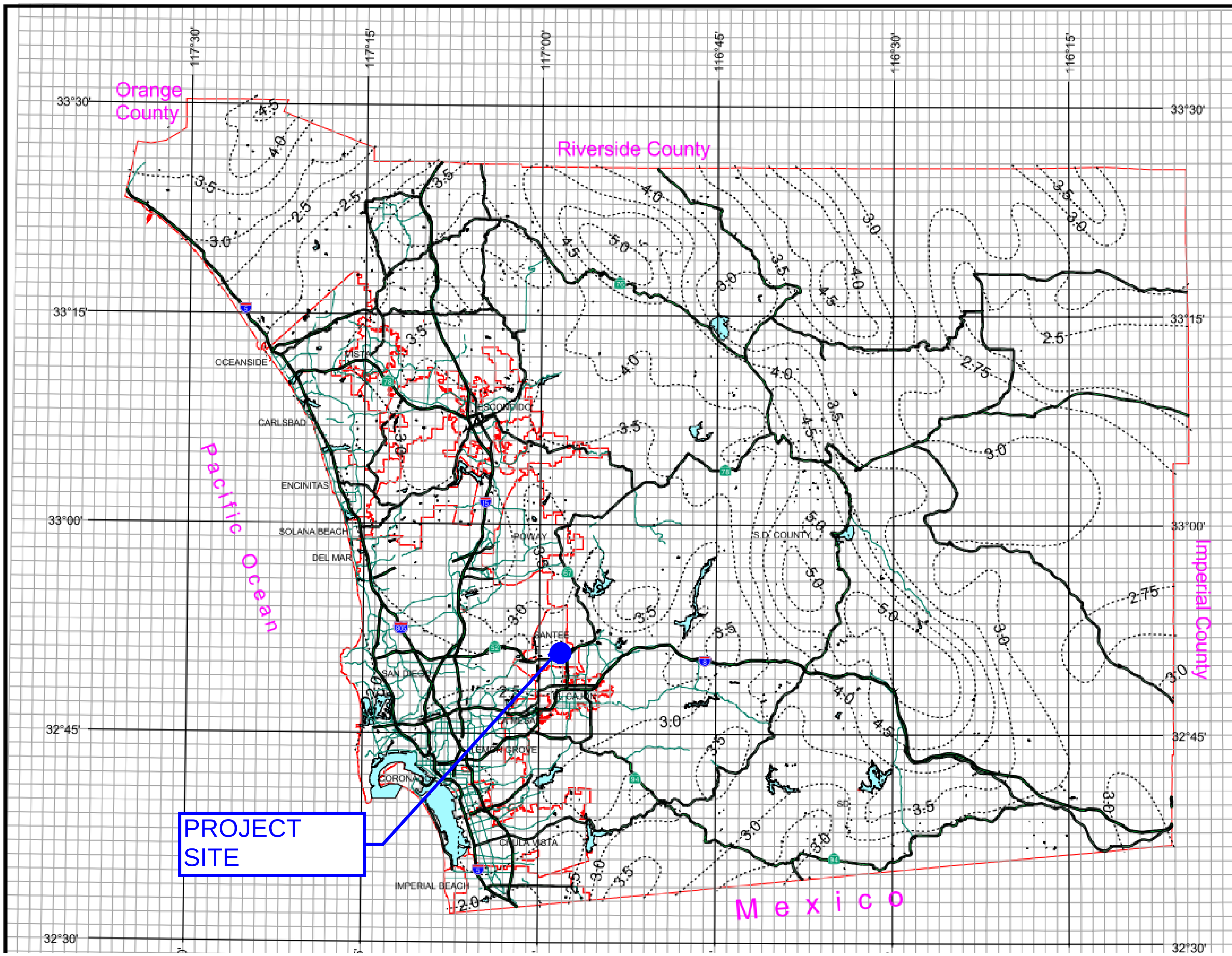
CITY OF SANTEE
**HOME2 HOTEL**
**TOWN CENTER PARKWAY**

**POST-PROJECT HYDROLOGY**
**ATTACHMENT 2**

**SHEET NO. 1 OF 1**

FILE: C:\USERS\JKMCK\DROPBOX (LANDMARK CONSULTING)\0348-1 SANTEE HOME2 HOTEL\E REPORTS AND ANALYSIS\DRAINAGE\CAD\348-1 HYDRO POST.DWG PLOTTED: 7/8/2022 9:54:09 AM

# Attachment 3: Hydrology Manual Excerpts




# County of San Diego Hydrology Manual

*Rainfall Isopluvials*

**100 Year Rainfall Event - 6 Hours**

-------- Isopluvial (inches)

I = 2.5 IN



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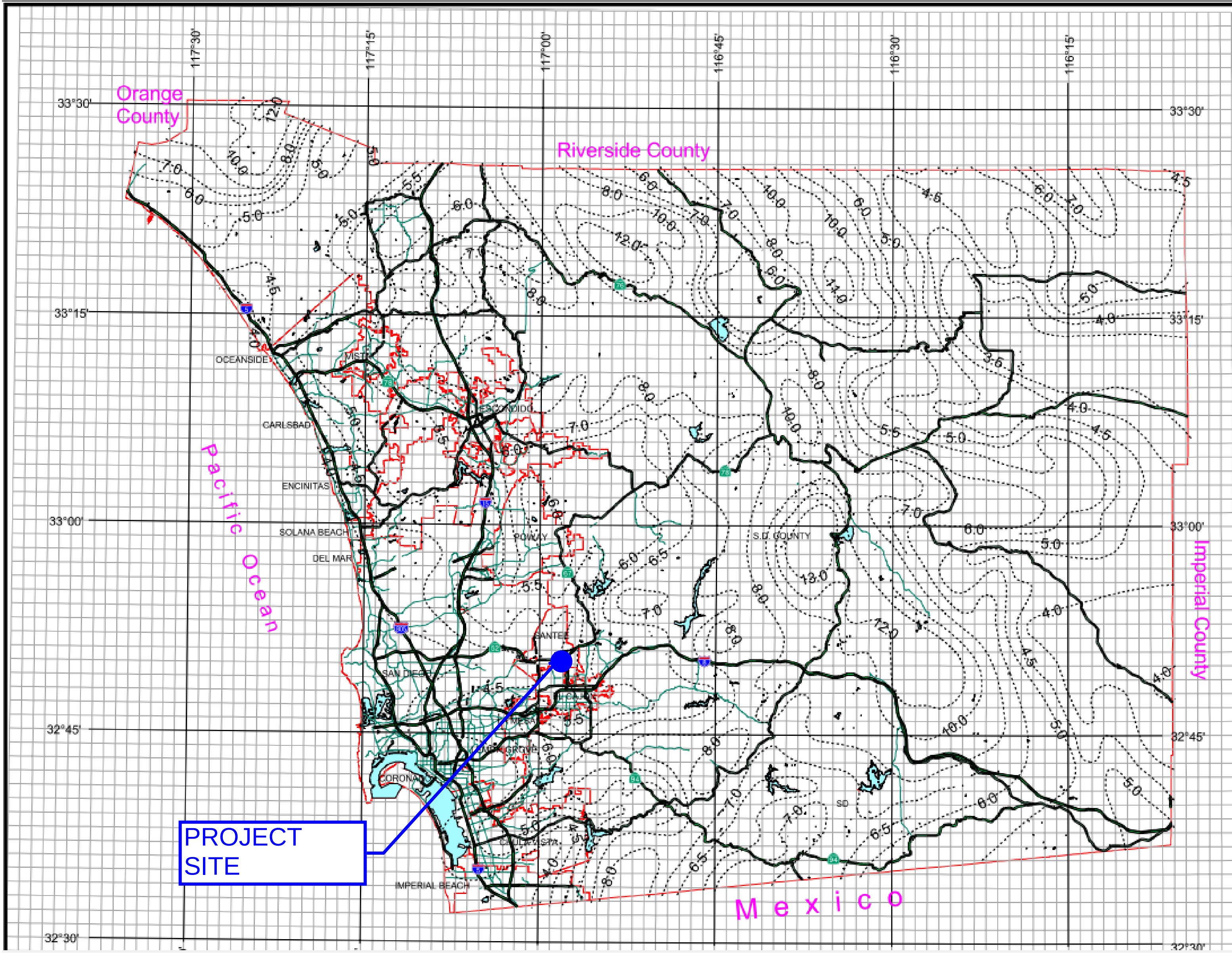
SANTEE, CA

100-YEAR 6-HOUR PRECIPITATION




# County of San Diego Hydrology Manual

*Rainfall Isopluvials*

**100 Year Rainfall Event - 24 Hours**

| | |
|---|---|
| -------- | Isopluvial (inches) |

I = 5.0 IN

DPW GIS
Department of Public Works Geographic Information Services

SanGIS
We Have San Diego Covered!

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SANTEE, CA

100-YEAR 24-HOUR PRECIPITATION

# Table 3-1
## RUNOFF COEFFICIENTS FOR URBAN AREAS

| Land Use | | Runoff Coefficient "C" | | | | |
|---|---|---|---|---|---|---|
| | | | Soil Type | | | |
| NRCS Elements | County Elements | % IMPER. | A | B | C | D |
| Undisturbed Natural Terrain (Natural) | Permanent Open Space | 0* | 0.20 | 0.25 | 0.30 | 0.35 |
| Low Density Residential (LDR) | Residential, 1.0 DU/A or less | 10 | 0.27 | 0.32 | 0.36 | 0.41 |
| Low Density Residential (LDR) | Residential, 2.0 DU/A or less | 20 | 0.34 | 0.38 | 0.42 | 0.46 |
| Low Density Residential (LDR) | Residential, 2.9 DU/A or less | 25 | 0.38 | 0.41 | 0.45 | 0.49 |
| Medium Density Residential (MDR) | Residential, 4.3 DU/A or less | 30 | 0.41 | 0.45 | 0.48 | 0.52 |
| Medium Density Residential (MDR) | Residential, 7.3 DU/A or less | 40 | 0.48 | 0.51 | 0.54 | 0.57 |
| Medium Density Residential (MDR) | Residential, 10.9 DU/A or less | 45 | 0.52 | 0.54 | 0.57 | 0.60 |
| Medium Density Residential (MDR) | Residential, 14.5 DU/A or less | 50 | 0.55 | 0.58 | 0.60 | 0.63 |
| High Density Residential (HDR) | Residential, 24.0 DU/A or less | 65 | 0.66 | 0.67 | 0.69 | 0.71 |
| High Density Residential (HDR) | Residential, 43.0 DU/A or less | 80 | 0.76 | 0.77 | 0.78 | 0.79 |
| Commercial/Industrial (N. Com) | Neighborhood Commercial | 80 | 0.76 | 0.77 | 0.78 | 0.79 |
| Commercial/Industrial (G. Com) | General Commercial | 85 | 0.80 | 0.80 | 0.81 | 0.82 |
| Commercial/Industrial (O.P. Com) | Office Professional/Commercial | 90 | 0.83 | 0.84 | 0.84 | 0.85 |
| Commercial/Industrial (Limited I.) | Limited Industrial | 90 | 0.83 | 0.84 | 0.84 | 0.85 |
| Commercial/Industrial (General I.) | General Industrial | 95 | 0.87 | 0.87 | 0.87 | 0.87 |

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

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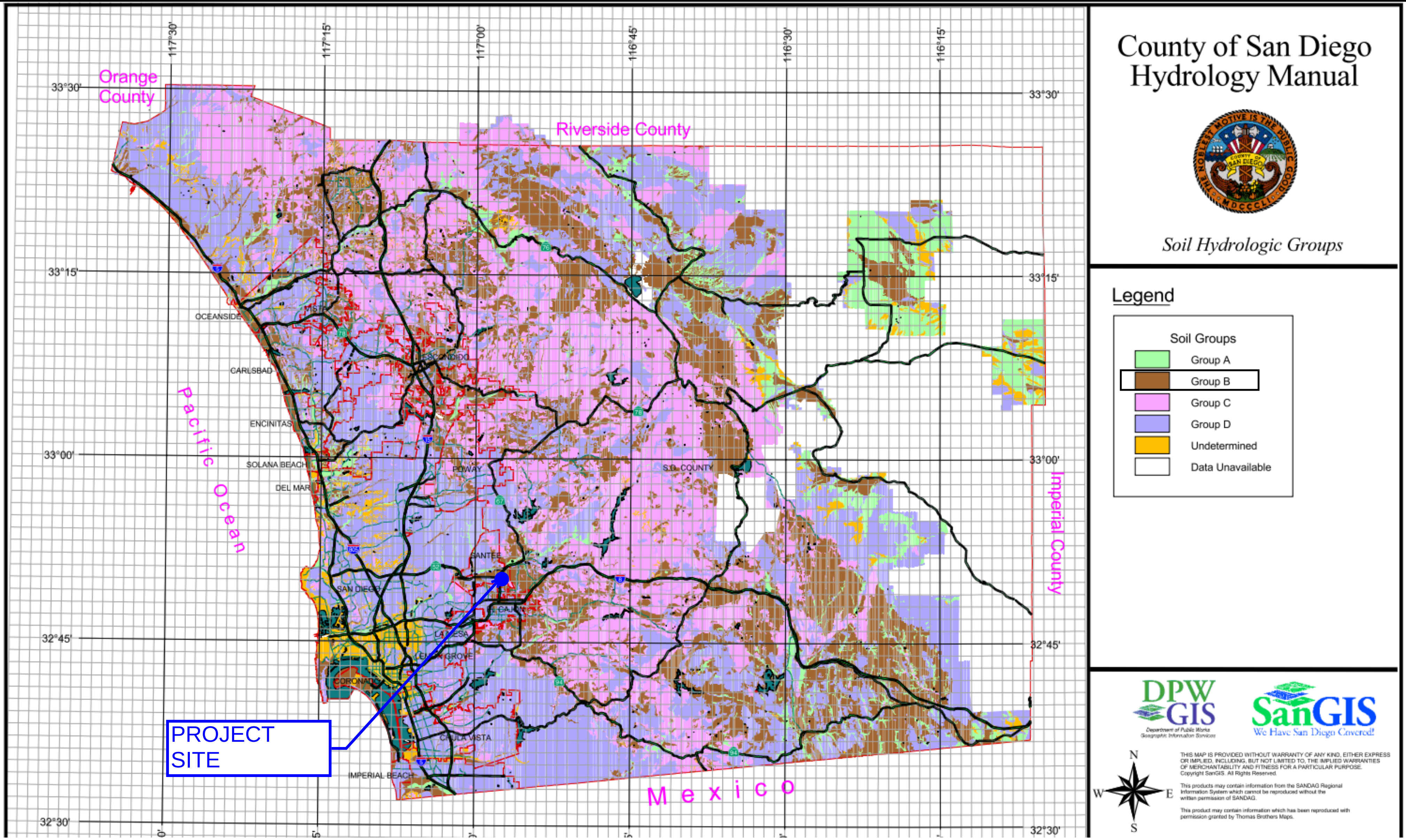
COUNTY OF SAN DIEGO RUNOFF COEFFICIENT




TYPE 'B' SOILS

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COUNTY OF SAN DIEGO SOIL GROUP MAP

# Attachment 4: Web Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

# Custom Soil Resource Report for

# San Diego County Area, California


June 29, 2022

# Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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# Contents

# How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


116° 58' 49" W
116° 58' 43" W
32° 50' 33" N
32° 50' 29" N
501840
501850
501860
501870
501880
501890
501900
501910
501920
501930
501940
501950
501960
501970
501980
501990
3633830
3633820
3633810
3633800
3633790
3633780
3633770
3633760
3633750
3633740
3633730
Transit Way
GoA
Soil Map may not be valid at this scale.
Map Scale: 1:742 if printed on A landscape (11" x 8.5") sheet.
Meters
0 10 20 40 60
Feet
0 35 70 140 210
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

**Special Point Features**

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 16, Sep 13, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 18, 2018—Aug 22, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| GoA | Grangeville fine sandy loam, 0 to 2 percent slopes | 1.4 | 100.0% |
| **Totals for Area of Interest** | | **1.4** | **100.0%** |

# Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

# San Diego County Area, California

## GoA—Grangeville fine sandy loam, 0 to 2 percent slopes

### Map Unit Setting

*National map unit symbol:* hbc8
*Elevation:* 10 to 1,800 feet
*Mean annual precipitation:* 8 to 16 inches
*Mean annual air temperature:* 61 to 64 degrees F
*Frost-free period:* 260 to 300 days
*Farmland classification:* Prime farmland if irrigated and drained

### Map Unit Composition

*Grangeville and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Grangeville

#### Setting

*Landform:* Alluvial fans
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Base slope, rise
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Parent material:* Alluvium derived from granite

#### Typical profile

*H1 - 0 to 11 inches:* fine sandy loam
*H2 - 11 to 60 inches:* sandy loam

#### Properties and qualities

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Somewhat poorly drained
*Runoff class:* Very low
*Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)
*Depth to water table:* About 24 to 48 inches
*Frequency of flooding:* Rare
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 5 percent
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* Moderate (about 8.3 inches)

#### Interpretive groups

*Land capability classification (irrigated):* 2w
*Land capability classification (nonirrigated):* 3w
*Hydrologic Soil Group:* B
*Ecological site:* R019XG911CA - Loamy Fan
*Hydric soil rating:* No

### Minor Components

#### Tujunga

*Percent of map unit:* 5 percent

*Hydric soil rating:* No

**Chino**

*Percent of map unit:* 5 percent
*Hydric soil rating:* No

**Visalia**

*Percent of map unit:* 3 percent
*Hydric soil rating:* No

**Unnamed**

*Percent of map unit:* 2 percent
*Landform:* Alluvial fans
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Base slope, rise
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Hydric soil rating:* Yes

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# Attachment 5: Pre-Project AES Analysis

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2012 Advanced Engineering Software (aes)
             Ver. 18.2 Release Date: 05/08/2012  License ID 1503

                           Analysis prepared by:

                            LANDMARK CONSULTING
                         9555 GENESEE AVE, STE 200
                            SAN DIEGO, CA 92121
                               (858) 587-8070

 ************************** DESCRIPTION OF STUDY **************************
* HOME2 HOTEL SANTEE PRE-PROJECT HYDROLOGY                                 *
* 100-YEAR STORM EVENT                                                     *
* JUNE, 2022                                                               *
 **************************************************************************

  FILE NAME: 3481E00.DAT
  TIME/DATE OF STUDY: 15:05 07/06/2022
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.500
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *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    101.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    349.00
  DOWNSTREAM ELEVATION(FEET) =    347.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.427
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.44
  TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.44

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    105.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    347.00  DOWNSTREAM(FEET) =    344.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   165.00   CHANNEL SLOPE =  0.0182
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.016   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.10
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.82
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   1.51
  Tc(MIN.) =    3.94
  SUBAREA AREA(ACRES) =     0.60       SUBAREA RUNOFF(CFS) =    3.32
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.840
  TOTAL AREA(ACRES) =        0.7         PEAK FLOW RATE(CFS) =       3.76

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   2.29
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    105.00 =     225.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    110.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    344.00  DOWNSTREAM(FEET) =    341.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   150.00   CHANNEL SLOPE =  0.0160
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.48
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.02
  AVERAGE FLOW DEPTH(FEET) =   0.37   TRAVEL TIME(MIN.) =   0.62
  Tc(MIN.) =    4.56
  SUBAREA AREA(ACRES) =     0.62       SUBAREA RUNOFF(CFS) =    3.43
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.840
  TOTAL AREA(ACRES) =        1.3         PEAK FLOW RATE(CFS) =       7.19

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.41   FLOW VELOCITY(FEET/SEC.) =   4.34
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    110.00 =     375.00 FEET.

+--------------------------------------------------------------------------+
| FLOW ENTERS EXISTING CURB INLET                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    55.00
  UPSTREAM ELEVATION(FEET) =    342.50
  DOWNSTREAM ELEVATION(FEET) =    340.50
  ELEVATION DIFFERENCE(FEET) =      2.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.257
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.22
  TOTAL AREA(ACRES) =      0.04   TOTAL RUNOFF(CFS) =      0.22
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    115.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   336.90  DOWNSTREAM(FEET) =   336.30
  FLOW LENGTH(FEET) =   165.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   8.0 INCH PIPE IS   3.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   1.77
  GIVEN PIPE DIAMETER(INCH) =   8.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.22
  PIPE TRAVEL TIME(MIN.) =   1.55    Tc(MIN.) =    3.81
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    115.00 =     220.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    115.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.81
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.04
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.22

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    114.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    95.00
  UPSTREAM ELEVATION(FEET) =    343.50
  DOWNSTREAM ELEVATION(FEET) =    341.00
  ELEVATION DIFFERENCE(FEET) =      2.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.961
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    76.32
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.39
  TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.39
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    115.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   337.50  DOWNSTREAM(FEET) =   336.50
  FLOW LENGTH(FEET) =    28.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   2.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.51
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.39
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    3.06
  LONGEST FLOWPATH FROM NODE    113.00 TO NODE    115.00 =     123.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    115.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.06
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.07
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.39

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        0.22     3.81        6.587          0.04
      2        0.39     3.06        6.587          0.07

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        0.57     3.06       6.587
      2        0.61     3.81       6.587

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       0.61   Tc(MIN.) =    3.81
  TOTAL AREA(ACRES) =        0.1
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    115.00 =     220.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    110.00 IS CODE =  41
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   336.50  DOWNSTREAM(FEET) =   336.30
  FLOW LENGTH(FEET) =    66.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   4.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.13
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.61
  PIPE TRAVEL TIME(MIN.) =   0.52    Tc(MIN.) =    4.33
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    110.00 =     286.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        0.61     4.33       6.587        0.11
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    110.00 =     286.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        7.19     4.56       6.587        1.30
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    110.00 =     375.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1       7.43       4.33        6.587
     2       7.80       4.56        6.587

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.80   Tc(MIN.) =    4.56
  TOTAL AREA(ACRES) =        1.4

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    346.30
  DOWNSTREAM ELEVATION(FEET) =    345.20
  ELEVATION DIFFERENCE(FEET) =      1.10
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.263
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.71
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.33
  TOTAL AREA(ACRES) =      0.06   TOTAL RUNOFF(CFS) =      0.33

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    125.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    345.20  DOWNSTREAM(FEET) =    341.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0170
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.016   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.433
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.80
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.73
  AVERAGE FLOW DEPTH(FEET) =   0.05   TRAVEL TIME(MIN.) =   1.92
  Tc(MIN.) =    5.19
  SUBAREA AREA(ACRES) =     0.54       SUBAREA RUNOFF(CFS) =    2.92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.840
  TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       3.24

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.07   FLOW VELOCITY(FEET/SEC.) =   2.13
  LONGEST FLOWPATH FROM NODE    121.00 TO NODE    125.00 =     270.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    130.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    341.80  DOWNSTREAM(FEET) =    340.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =   205.00   CHANNEL SLOPE =  0.0073
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.642
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.02
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.92
  AVERAGE FLOW DEPTH(FEET) =   0.41   TRAVEL TIME(MIN.) =   1.17
  Tc(MIN.) =    6.36
  SUBAREA AREA(ACRES) =     0.75       SUBAREA RUNOFF(CFS) =    3.55
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.840
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       6.40

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.45   FLOW VELOCITY(FEET/SEC.) =   3.12
  LONGEST FLOWPATH FROM NODE    121.00 TO NODE    130.00 =     475.00 FEET.

+--------------------------------------------------------------------------+
| FLOW ENTERS EXISTING GRATE INLET                                         |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.4  TC(MIN.) =      6.36
  PEAK FLOW RATE(CFS)   =       6.40
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

# Attachment 6: Post-Project AES Analysis

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

             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                          2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2012 Advanced Engineering Software (aes)
              Ver. 18.2 Release Date: 05/08/2012  License ID 1503

                            Analysis prepared by:

                             LANDMARK CONSULTING
                          9555 GENESEE AVE, STE 200
                             SAN DIEGO, CA 92121
                                (858) 587-8070

 ************************** DESCRIPTION OF STUDY **************************
* HOME2 HOTEL SANTEE POST-PROJECT HYDROLOGY                                *
* 100-YEAR STORM EVENT                                                     *
* JUNE, 2022                                                               *
 **************************************************************************

  FILE NAME: 3481P00.DAT
  TIME/DATE OF STUDY: 08:53 07/08/2022
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.500
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *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    101.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    349.00
  DOWNSTREAM ELEVATION(FEET) =    347.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.427
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.44
  TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.44

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    105.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    347.00  DOWNSTREAM(FEET) =    344.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   165.00   CHANNEL SLOPE =  0.0182
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.016   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.24
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.87
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   1.47
  Tc(MIN.) =    3.90
  SUBAREA AREA(ACRES) =     0.65       SUBAREA RUNOFF(CFS) =    3.60
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.840
  TOTAL AREA(ACRES) =       0.7         PEAK FLOW RATE(CFS) =       4.04

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   2.39
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    105.00 =     225.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    108.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    344.00  DOWNSTREAM(FEET) =    342.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =    65.00   CHANNEL SLOPE =  0.0231
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.68
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.47
  AVERAGE FLOW DEPTH(FEET) =   0.32   TRAVEL TIME(MIN.) =   0.24
  Tc(MIN.) =    4.14
  SUBAREA AREA(ACRES) =     0.23       SUBAREA RUNOFF(CFS) =    1.27
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.840
  TOTAL AREA(ACRES) =        1.0         PEAK FLOW RATE(CFS) =       5.31

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.34   FLOW VELOCITY(FEET/SEC.) =   4.58
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    108.00 =     290.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    55.00
  UPSTREAM ELEVATION(FEET) =    342.50
  DOWNSTREAM ELEVATION(FEET) =    340.50
  ELEVATION DIFFERENCE(FEET) =      2.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.257
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.22
  TOTAL AREA(ACRES) =      0.04   TOTAL RUNOFF(CFS) =      0.22

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    115.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
```

```
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   336.90  DOWNSTREAM(FEET) =   336.30
  FLOW LENGTH(FEET) =   165.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   8.0 INCH PIPE IS   3.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   1.77
  GIVEN PIPE DIAMETER(INCH) =   8.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.22
  PIPE TRAVEL TIME(MIN.) =   1.55    Tc(MIN.) =    3.81
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    115.00 =     220.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    115.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.81
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.04
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.22

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    114.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
================================================================================
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    95.00
  UPSTREAM ELEVATION(FEET) =    343.50
  DOWNSTREAM ELEVATION(FEET) =    341.00
  ELEVATION DIFFERENCE(FEET) =      2.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.961
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    76.32
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.39
  TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.39

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    115.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   337.50  DOWNSTREAM(FEET) =   336.50
  FLOW LENGTH(FEET) =    28.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   2.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.51
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.39
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    3.06
  LONGEST FLOWPATH FROM NODE    113.00 TO NODE    115.00 =     123.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    115.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.06
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.07
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.39

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        0.22     3.81        6.587         0.04
      2        0.39     3.06        6.587         0.07

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        0.57     3.06       6.587
      2        0.61     3.81       6.587

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      0.61   Tc(MIN.) =    3.81
  TOTAL AREA(ACRES) =        0.1
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    115.00 =     220.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    110.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   336.50  DOWNSTREAM(FEET) =   336.30
  FLOW LENGTH(FEET) =    66.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   4.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.13
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.61
  PIPE TRAVEL TIME(MIN.) =   0.52    Tc(MIN.) =    4.33
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    110.00 =     286.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    117.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   125.00
  UPSTREAM ELEVATION(FEET) =    346.00
  DOWNSTREAM ELEVATION(FEET) =    345.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.773
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    56.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.77
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.77

****************************************************************************
  FLOW PROCESS FROM NODE    117.00 TO NODE    118.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    345.00  DOWNSTREAM(FEET) =    344.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   150.00   CHANNEL SLOPE =  0.0067
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.483
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.96
```

```
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.87
  AVERAGE FLOW DEPTH(FEET) =   0.19   TRAVEL TIME(MIN.) =   2.87
  Tc(MIN.) =    6.64
  SUBAREA AREA(ACRES) =     0.08       SUBAREA RUNOFF(CFS) =    0.37
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.840
  TOTAL AREA(ACRES) =        0.2         PEAK FLOW RATE(CFS) =       1.01

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.19   FLOW VELOCITY(FEET/SEC.) =   0.91
  LONGEST FLOWPATH FROM NODE    116.00 TO NODE    118.00 =     275.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    119.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    344.00  DOWNSTREAM(FEET) =    341.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   110.00   CHANNEL SLOPE =  0.0273
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.016   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.058
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.14
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.07
  AVERAGE FLOW DEPTH(FEET) =   0.05   TRAVEL TIME(MIN.) =   0.89
  Tc(MIN.) =    7.53
  SUBAREA AREA(ACRES) =     0.53       SUBAREA RUNOFF(CFS) =    2.25
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.840
  TOTAL AREA(ACRES) =        0.8         PEAK FLOW RATE(CFS) =       3.19

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   2.42
  LONGEST FLOWPATH FROM NODE    116.00 TO NODE    119.00 =     385.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    119.00 TO NODE    120.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   337.50  DOWNSTREAM(FEET) =   336.88
  FLOW LENGTH(FEET) =   120.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.09
  (PIPE FLOW VELOCITY CORRESPONDING TO FULL PIPE CAPACITY FLOW)
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.19
```

```
  PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =    8.18
  LONGEST FLOWPATH FROM NODE    116.00 TO NODE    120.00 =     505.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.18
  RAINFALL INTENSITY(INCH/HR) =   4.80
  TOTAL STREAM AREA(ACRES) =     0.75
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.19

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    53.00
  UPSTREAM ELEVATION(FEET) =    346.00
  DOWNSTREAM ELEVATION(FEET) =    345.50
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.474
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.44
  TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.44

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    125.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    345.50  DOWNSTREAM(FEET) =    342.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   135.00   CHANNEL SLOPE =  0.0259
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.016   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.72
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.96
```

```
  AVERAGE FLOW DEPTH(FEET) =   0.04   TRAVEL TIME(MIN.) =   1.15
  Tc(MIN.) =    4.62
  SUBAREA AREA(ACRES) =     0.46       SUBAREA RUNOFF(CFS) =    2.55
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.840
  TOTAL AREA(ACRES) =        0.5         PEAK FLOW RATE(CFS) =       2.99

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   2.27
  LONGEST FLOWPATH FROM NODE    121.00 TO NODE    125.00 =     188.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    120.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   337.00  DOWNSTREAM(FEET) =   336.88
  FLOW LENGTH(FEET) =    10.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.24
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.99
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    4.66
  LONGEST FLOWPATH FROM NODE    121.00 TO NODE    120.00 =     198.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.66
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.54
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.99

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        3.19     8.18        4.796          0.75
      2        2.99     4.66        6.587          0.54

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
```

```
     1         4.80     4.66       6.587
     2         5.36     8.18       4.796

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       5.36   Tc(MIN.) =    8.18
 TOTAL AREA(ACRES) =        1.3
 LONGEST FLOWPATH FROM NODE    116.00 TO NODE    120.00 =     505.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    110.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   336.88  DOWNSTREAM(FEET) =   336.30
 FLOW LENGTH(FEET) =   110.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.12
 (PIPE FLOW VELOCITY CORRESPONDING TO FULL PIPE CAPACITY FLOW)
 GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       5.36
 PIPE TRAVEL TIME(MIN.) =   0.59    Tc(MIN.) =    8.76
 LONGEST FLOWPATH FROM NODE    116.00 TO NODE    110.00 =     615.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        5.36     8.76       4.586       1.29
 LONGEST FLOWPATH FROM NODE    116.00 TO NODE    110.00 =     615.00 FEET.

 ** MEMORY BANK #  2 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        0.61     4.33       6.587       0.11
 LONGEST FLOWPATH FROM NODE    111.00 TO NODE    110.00 =     286.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF      Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1       3.26       4.33        6.587
     2       5.79       8.76        4.586

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       5.79   Tc(MIN.) =    8.76
```

```
  TOTAL AREA(ACRES) =        1.4

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    131.00 TO NODE    132.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    55.00
  UPSTREAM ELEVATION(FEET) =    346.00
  DOWNSTREAM ELEVATION(FEET) =    345.50
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.583
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.33
  TOTAL AREA(ACRES) =      0.06   TOTAL RUNOFF(CFS) =      0.33

****************************************************************************
  FLOW PROCESS FROM NODE    132.00 TO NODE    133.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    345.50  DOWNSTREAM(FEET) =    342.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   100.00   CHANNEL SLOPE =  0.0300
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.016   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  OFFICE PROFESSIONAL/COMMERCIAL RUNOFF COEFFICIENT = .8400
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.33
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.85
  AVERAGE FLOW DEPTH(FEET) =   0.04   TRAVEL TIME(MIN.) =   0.90
  Tc(MIN.) =    4.48
  SUBAREA AREA(ACRES) =     0.36       SUBAREA RUNOFF(CFS) =    1.99
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.840
  TOTAL AREA(ACRES) =        0.4         PEAK FLOW RATE(CFS) =       2.32

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
  DEPTH(FEET) =  0.05   FLOW VELOCITY(FEET/SEC.) =   2.24
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    133.00 =     155.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    133.00 TO NODE    110.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   338.00  DOWNSTREAM(FEET) =   336.30
  FLOW LENGTH(FEET) =    20.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.26
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.32
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    4.52
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    110.00 =     175.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        2.32     4.52       6.587        0.42
  LONGEST FLOWPATH FROM NODE    131.00 TO NODE    110.00 =     175.00 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        5.79     8.76       4.586        1.40
  LONGEST FLOWPATH FROM NODE    116.00 TO NODE    110.00 =     615.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1       5.31       4.52        6.587
     2       7.40       8.76        4.586

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.40   Tc(MIN.) =    8.76
  TOTAL AREA(ACRES) =        1.8

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
```

```
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    108.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   336.30  DOWNSTREAM(FEET) =   335.90
  FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  11.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.80
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.40
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =    9.04
  LONGEST FLOWPATH FROM NODE    116.00 TO NODE    108.00 =     695.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        7.40     9.04       4.495        1.82
  LONGEST FLOWPATH FROM NODE    116.00 TO NODE    108.00 =     695.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        5.31     4.14       6.587        0.96
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    108.00 =     290.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1       8.70       4.14        6.587
      2      11.03       9.04        4.495

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      11.03   Tc(MIN.) =    9.04
  TOTAL AREA(ACRES) =        2.8

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================
```

```
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.8  TC(MIN.) =      9.04
  PEAK FLOW RATE(CFS)   =      11.03
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```