



PRELIMINARY DRAINAGE STUDY FOR ST. KATHERINE ORTHODOX CHURCH

RICK Job No. 20292

August 7, 2026



**PRELIMINARY
DRAINAGE STUDY
FOR
ST. KATHERINE ORTHODOX CHURCH
Job Number 20292**

Shavger Rekani, P.E.
R.C.E. #90893, Exp. 03/28

Prepared for:
St. Katherine Orthodox Church
2720 Loker Ave W C/D, Carlsbad, CA 92010

Prepared by:
RICK
Water Resources Division
5620 Friars Road
San Diego, California 92110-2596
(619) 291-0707

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1.0 INTRODUCTION

1.1 Project Description

This drainage study presents hydrologic and hydraulic analyses for the proposed St. Katherine Orthodox Church project (herein referred to as “the project”) to support the Conditional Use Permit (CUP) for the project area. The project is located in the City of San Marcos and is bounded by Via Cancion to the east, South Rancho Santa Fe Road to the south and Brighton Glen Road to the west. The proposed project encompasses approximately 3 acres (APN: 2220411100) and involves the development of a new church and its associated temple, parish hall, amphitheater, parking lot and landscape features. See Figure 1, Vicinity Map, located at the end of Section 1.0 for the approximate project location.

1.2 Drainage Characteristics

Pre-Project Condition

In existing conditions, the site consists of one major drainage area, identified as Basin 1. The drainage basin includes both impervious surfaces, such as residential homes and streets, and pervious areas located within and around the project site, with the onsite area acting as a plant nursery. Run-on flows from offsite areas discharge into the Basin 1 outfall. Considerable offsite run-on from residential areas flow between node 100 to 150 and convey to a brow ditch that runs along the northern perimeter of the site from node 106 to 150. At node 150 the offsite flows will confluence with onsite runoff. Additionally, a golf course south of the project site contributes run-on flows through an existing 60-inch corrugated steel storm drain that eventually confluent with the onsite runoff by outfalling to an existing riprap/headwall shown at node 150. It is important to note that the existing 60-inch storm drain lacks any records, as-builts and an easement. The project shall utilize the latest City of San Marcos Drainage Master Plan to determine the 100-year peak flow for this 60-inch storm drain. The combined runoff from the 60-inch storm drain and node 150 is conveyed along an existing channel to node 190 where an existing culvert beneath the Brighton Glen Road conveys the flows to an unnamed creek that is tributary to San Marcos Creek. Refer to Pre-Project Drainage Study Map for St. Katherine Orthodox Church in Map Pocket 1 for node references.

Post-Project Condition

In the post-project condition, the proposed development will increase the impervious area of the project site which increases the overall peak runoff value. To mitigate this runoff, the project proposes a storm drain system that conveys on-site flows from node 110 to a biofiltration basin located at node 140. This basin is designed to provide water quality treatment, hydromodification management, and detention for the 100-year storm event. The existing 60-inch storm drain will be realigned under the parking lot and shall be designed to bypass the biofiltration basin and outfall directly to the existing channel on-site. Runoff from the biofiltration basin will also be conveyed by a proposed storm drain to the existing channel.

Run-on from the off-site area between nodes 100 to 150, located north of the project site, will remain as-is and will continue to drain the same pattern to the confluence point at node 150, consistent with pre-project conditions. Refer to Post-Project Drainage Study Map for St. Katherine Orthodox Church in Map Pocket 2 for node references.

In the post-project condition, the overall drainage pattern shall remain similar between pre-project and post-project condition. The off-site drainage characteristics will remain similar to the pre-project condition. In contrast, on-site drainage will be modified due to site grading required for the proposed development, as well as the addition of a biofiltration basin to mitigate the increased runoff. The runoff for both Pre- and Post-Project conditions in a 100-year, 6-hour storm was calculated using AES Rational Method, in accordance with the San Diego County Hydrology Manual (SDCHM), dated June 2003, and are summarized in Section 2.0 of this report. The rational method results are summarized in Table 2.1.

1.3 Hydrology and Hydraulics

Hydrology and hydraulics are discussed in detail in Sections 2.0 and 3.0 of this report.

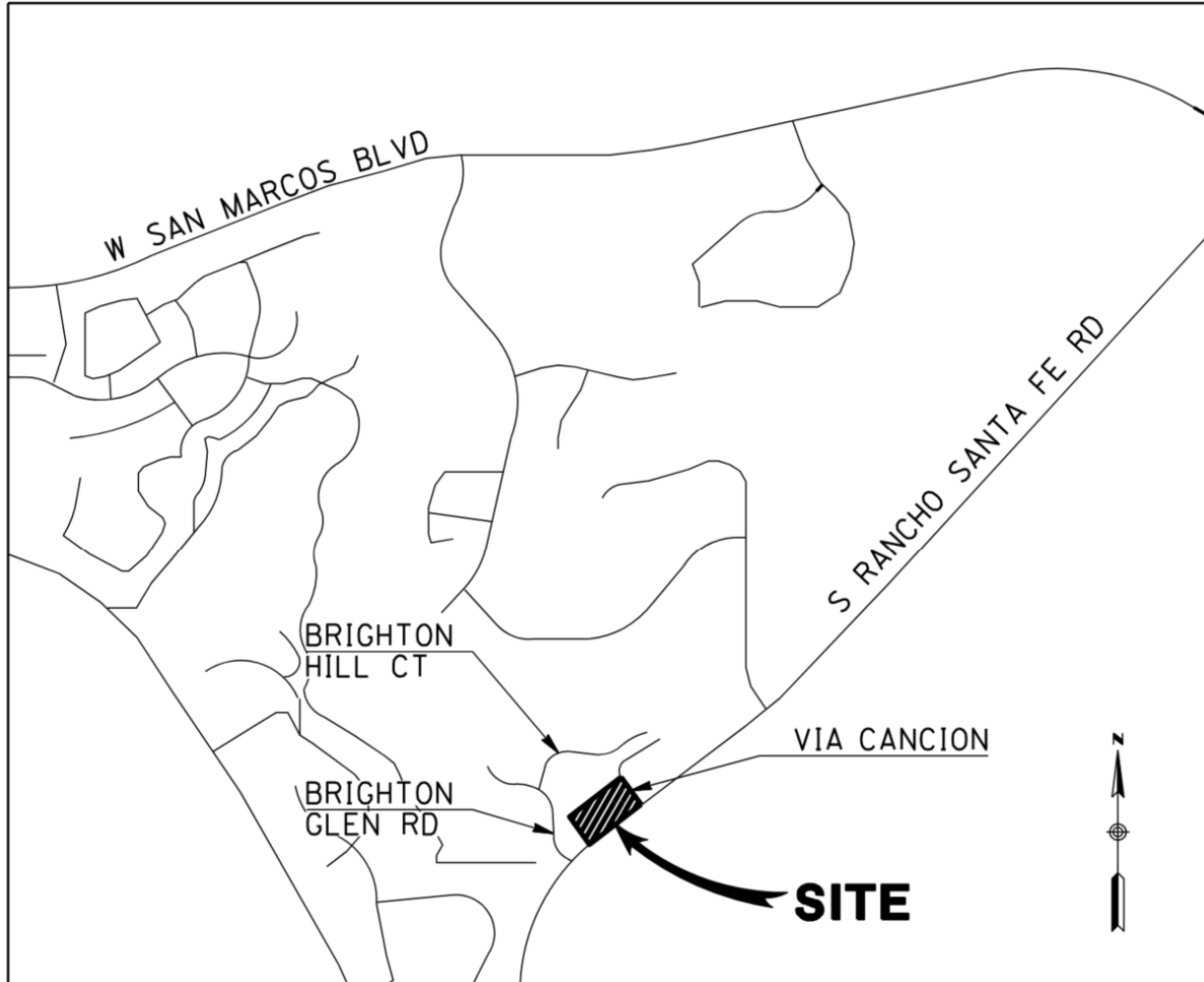
1.4 Water Quality

Post-project storm water runoff will be treated per the City of San Marcos BMP Design Manual, dated February 2023, and will be discussed in the report titled, "Priority Development Project Storm Water Quality Management Plan (PDP SWQMP) for St. Katherine Orthodox Church," dated August 7, 2026 (or any revision thereafter) and prepared by RICK (Job No. 20292).

1.5 Hydromodification Management Requirements

According to the BMP Design Manual, Priority Development Projects must be designed so that runoff rates and durations are controlled to pre-development rates in order to reduce hydromodification potential and protect stream habitat. To comply with the BMP Design Manual, a Hydromodification Management Plan (HMP) has been prepared and included within the PDP SWQMP for the project.

Figure 1: Vicinity Map



VICINITY MAP

NO SCALE

2.0 HYDROLOGY

2.1 Methodology

The San Diego County Hydrology Manual, dated June 2003, requires that the Modified Rational Method be used for the hydrologic analysis of a watershed up to but not exceeding 1.0 square-mile (640 acres). The Rational Method computer program developed by Advanced Engineering Software (AES 2014) was used for this study because it satisfies the County of San Diego's design criteria.

2.1.1 Modified Rational Method

The AES hydrologic model is developed by creating independent node-link models of each interior drainage basin and linking these sub-models together at confluence points. The program has the capability to perform calculations for 15 hydrologic processes. These processes are assigned code numbers that appear in the results. The code numbers and their significance are as follows:

Code 1:	Confluence analysis at a node
Code 2:	Initial subarea analysis
Code 3:	Pipe flow travel time (computer-estimated pipe sizes)
Code 4:	Pipe flow travel time (user-specified pipe size)
Code 5:	Trapezoidal channel travel time
Code 6:	Street flow analysis through a subarea
Code 7:	User-specified information at a node
Code 8:	Addition of the subarea runoff to mainline
Code 9:	V-Gutter flow thru subarea
Code 10:	Copy main-stream data onto a memory bank
Code 11:	Confluence a memory bank with the main-stream memory
Code 12:	Clear a memory bank
Code 13:	Clear the main-stream memory
Code 14:	Copy a memory bank onto the main-stream memory
Code 15:	Hydrologic data bank storage functions

In order to perform the hydrologic analysis, base information for the study area is required. This information includes the existing drainage facility locations and sizes, existing land uses, flow patterns, drainage basin boundaries, and topographic elevations. Drainage basin boundaries,

flow patterns, and topographic elevations are shown on the drainage exhibits located in the map pockets.

2.2 Design Criteria

The runoff coefficients were calculated using both Table 3-1 and Table 3-2 from the SDCHM. 100% impervious was assumed for the parking lot and building development.

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

Design Storm: 100-year

Soil Type: D

Rainfall Intensity: Based on time-intensity criteria per County of San Diego

2.3 Hydrologic Results

Rational Method computer outputs for the pre- and post-project can be found in Appendices A and B, respectively. Watershed boundaries, Rational Method node numbers, flow patterns, and areas can be found on the exhibits titled, "Drainage Study Map for St. Katherine Orthodox Church [Pre-project]," and "Drainage Study Map for St. Katherine Orthodox Church [Post-project]," located in Map Pockets 1 and 2, respectively. A summary of the hydrologic results for the pre- and post-project conditions at points of interest can be found in Table 2.1 below. Based on the summary, the post-project condition would maintain similar drainage patterns compared to pre-project conditions and result in an increase in post-project peak flow rates as compared to the pre-project condition due to the increase in impervious area.

Table 2.1: Summary of Hydrologic Results

Storm Event Frequency	Pre-Project Condition			Post-Project Condition (Undetained)			
	Area (acres)	Tc (min.)	Peak Flow Rate (cfs)	Area (acres)	Tc (min.)	Peak Flow Rate (cfs)	ΔQ (cfs)
100-Year	14.4	22.6	23.3	14.4	22.2	26.0	+2.7

As a result of the increase in peak flow, the project proposes to detain and attenuate post-project runoff rates back to the pre-development for the 100-year storm event discussed in Section 4.0 of this report.

3.0 HYDRAULICS

3.1 Hydraulic Methodology and Criteria

The 100-year post-project peak flow rates determined using the Modified Rational Method will be used to size the on-site storm drain system. The hydraulic analyses will be performed in accordance with the San Diego County Hydraulic Design Manual, dated September 2014.

3.1.2 Storm Drain Sizing

The proposed onsite storm drains conveying the onsite runoff will be sized using normal depth method for the 100-year storm event.

Normal Depth Sizing

Pipe sizes were evaluated using Manning's equation:

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

Where:

Q = discharge (cfs)

n = Manning coefficient of roughness

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

R = Hydraulic radius (ft.) = A/WP (WP = Wetted Perimeter)

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

The Manning's roughness coefficient "n" used for the hydraulic calculations for RCP and PVC pipes is 0.013. The pipe sizes were evaluated based on the AES rational method flow rates with a 30% bump up sizing factor (for hydraulic losses) assuming normal depth. A minimum slope of 0.5% has also been maintained. A summary of the performed normal depth hydraulic analyses is provided in Appendix C in the form of a sizing matrix table.

4.0 DETENTION ANALYSIS

For the post-project condition, the project proposes to provide a biofiltration basin designed to include enough volume to comply with hydromodification management criteria, in addition to treating the required water quality volume. Detention volume is also provided in order to mitigate the increase in peak flows between post-project and pre-project condition.

For the design of detention facilities, the 100-year flow rates for both the pre-project condition and the post-project condition from the modified rational method hydrologic analysis shall be used. Detention analyses will be completed using the Hydrologic Modeling System (HEC-HMS) software, Version 4.1.

4.1 Hydrograph Development

The sizing of a detention facility requires an inflow hydrograph to obtain the necessary storage volume. The modified rational method only yields a peak discharge and time of concentration and does not yield a hydrograph. In order to convert the peak discharge and time of concentration into a hydrograph, Rick Engineering's program, RatHydro was used. RatHydro generates a hydrograph from the following inputs: Time of concentration, 6-Hour Precipitation depth, basin area, rational method runoff coefficient, and peak discharge rate. The generated hydrograph can then be used as the inflow hydrograph for basin sizing within HEC-HMS.

4.2 HEC-HMS Methodology and Criteria

100-year hydrographs and elevation-storage-outflow rating curves were used in the HEC-HMS hydrologic model to perform routing calculations for the detention basin, and to determine the preliminary 100-year detention volumes required for the basin to reduce the post-project peak discharge rate back to the pre-project peak discharge rate. Detailed outlet-works design for the BMP was calculated as well.

4.3 Detention Results

Preliminary detention analysis results have been included in Appendix D. A summary of the post-detention hydrologic result is provided below in Table 4-1.

Table 4-1: Summary of Detention Analysis

Storm Event Frequency	Pre-Project Condition			Post-Project Condition (Undetained)			Post-Project Condition (Detained)		
	Area (acres)	Tc (min.)	Peak Flow Rate (cfs)	Area (acres)	Tc (min.)	Peak Flow Rate (cfs)	Area (acres)	Tc (min.)	Peak Flow Rate (cfs)
100-Year	14.4	22.6	23.3	14.4	22.2	26.0	14.4	22.2	21.3

5.0 CONCLUSION

This drainage study presents the hydrologic and hydraulic analyses for the St. Katherine Orthodox Church project. The pre-project and post-project condition peak discharge rates were determined using the Modified Rational Method based on the hydrologic methodology and criteria described in the San Diego County Hydrology Manual, dated June 2003.

The overall drainage characteristics in the post-project condition will remain similar compared to the pre-project conditions. Due to the overall increase in impervious area, the project proposes detention for the 100-year, 6-hour storm event so that post-project peak discharge rates are reduced back to pre-project conditions using the HEC-HMS hydrologic model. Storage and rating curves will be provided during Final Engineering along with a detailed outlet-works design for the proposed detention basin.

The 100-year, 6-hour post-project peak flow rates have been used to size the proposed drainage system, including preliminary sizing for proposed storm drain and inlets. Inlet locations have been identified, and detailed inlet sizing will be provided during final engineering.

Post-project storm water runoff will be treated per the City of San Marcos BMP Design Manual, dated February 2023, and will be discussed in the report titled, "Priority Development Project Storm Water Quality Management Plan (PDP SWQMP) for St. Katherine Orthodox Church," dated August 7, 2026 (or any revision thereafter) and prepared by RICK (Job No. 20292).

APPENDIX A

Modified Rational Method Output [Pre-project]

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE

Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT

2003,1985,1981 HYDROLOGY MANUAL

(c) Copyright 1982-2014 Advanced Engineering Software (aes)

Ver. 21.0 Release Date: 06/01/2014 License ID 1261

Analysis prepared by:

RICK ENGINEERING COMPANY

5620 Friars Road

San Diego, California 92110

619-291-0707 Fax 619-291-4165

***** DESCRIPTION OF STUDY *****

* ST. KATHERINES ORTHODOX CHURCH *

* EXISTING CONDITION 100-YR STORM EVENT - BASIN 1 *

* JN-20292 *

FILE NAME: SK100EX.DAT

TIME/DATE OF STUDY: 11:51 06/30/2026

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00

6-HOUR DURATION PRECIPITATION (INCHES) = 3.000

SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00

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

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / PARK- SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH LIP HIKE (FT) (FT) (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00 0.0312 0.167	0.0150
2	24.0	19.0	0.020/0.020/0.020	0.50	1.50 0.0312 0.125	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = -0.10 FEET

as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN

OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

FLOW PROCESS FROM NODE 100.00 TO NODE 102.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .3600

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 116.00

UPSTREAM ELEVATION(FEET) = 606.00

DOWNSTREAM ELEVATION(FEET) = 600.00

ELEVATION DIFFERENCE(FEET) = 6.00

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 7.702

WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN

THE MAXIMUM OVERLAND FLOW LENGTH = 100.00

(Reference: Table 3-1B of Hydrology Manual)

THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.982

SUBAREA RUNOFF(CFS) = 0.22

TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.22

FLOW PROCESS FROM NODE 102.00 TO NODE 104.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<

>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 600.00 DOWNSTREAM(FEET) = 565.00

CHANNEL LENGTH THRU SUBAREA(FEET) = 849.00 CHANNEL SLOPE = 0.0412

CHANNEL BASE(FEET) = 80.00 "Z" FACTOR = 20.000

MANNING'S FACTOR = 0.025 MAXIMUM DEPTH(FEET) = 10.00

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.350

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .6000

S.C.S. CURVE NUMBER (AMC II) = 0

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.59

TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.26

AVERAGE FLOW DEPTH(FEET) = 0.04 TRAVEL TIME(MIN.) = 11.22

Tc(MIN.) = 18.92

SUBAREA AREA(ACRES) = 3.30 SUBAREA RUNOFF(CFS) = 6.63

AREA-AVERAGE RUNOFF COEFFICIENT = 0.593

TOTAL AREA(ACRES) = 3.4 PEAK FLOW RATE(CFS) = 6.75

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.05 FLOW VELOCITY(FEET/SEC.) = 1.65

LONGEST FLOWPATH FROM NODE 100.00 TO NODE 104.00 = 965.00 FEET.

FLOW PROCESS FROM NODE 104.00 TO NODE 106.00 IS CODE = 62

>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION # 2 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 565.00 DOWNSTREAM ELEVATION(FEET) = 506.00
 STREET LENGTH(FEET) = 624.00 CURB HEIGHT(INCHES) = 6.0
 STREET HALFWIDTH(FEET) = 24.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 19.00
 INSIDE STREET CROSSFALL(DECIMAL) = 0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
 STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
 Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 9.44
 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
 STREET FLOW DEPTH(FEET) = 0.34
 HALFSTREET FLOOD WIDTH(FEET) = 10.90
 AVERAGE FLOW VELOCITY(FEET/SEC.) = 7.23
 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 2.49
 STREET FLOW TRAVEL TIME(MIN.) = 1.44 Tc(MIN.) = 20.36
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.196
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6000
 S.C.S. CURVE NUMBER (AMC II) = 0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.596
 SUBAREA AREA(ACRES) = 2.80 SUBAREA RUNOFF(CFS) = 5.37
 TOTAL AREA(ACRES) = 6.2 PEAK FLOW RATE(CFS) = 11.81

END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.37 HALFSTREET FLOOD WIDTH(FEET) = 11.94
 FLOW VELOCITY(FEET/SEC.) = 7.65 DEPTH*VELOCITY(FT*FT/SEC.) = 2.79
 LONGEST FLOWPATH FROM NODE 100.00 TO NODE 106.00 = 1589.00 FEET.

FLOW PROCESS FROM NODE 106.00 TO NODE 106.00 IS CODE = 81

>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.196
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7800
 S.C.S. CURVE NUMBER (AMC II) = 0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6280
 SUBAREA AREA(ACRES) = 1.30 SUBAREA RUNOFF(CFS) = 3.24
 TOTAL AREA(ACRES) = 7.5 TOTAL RUNOFF(CFS) = 15.05
 TC(MIN.) = 20.36

FLOW PROCESS FROM NODE 106.00 TO NODE 150.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<

>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 544.00 DOWNSTREAM(FEET) = 456.00

CHANNEL LENGTH THRU SUBAREA(FEET) = 621.00 CHANNEL SLOPE = 0.1417

CHANNEL BASE(FEET) = 6.00 "Z" FACTOR = 2.000

MANNING'S FACTOR = 0.020 MAXIMUM DEPTH(FEET) = 10.00

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.099

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .6000

S.C.S. CURVE NUMBER (AMC II) = 0

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 16.26

TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 10.40

AVERAGE FLOW DEPTH(FEET) = 0.24 TRAVEL TIME(MIN.) = 1.00

Tc(MIN.) = 21.35

SUBAREA AREA(ACRES) = 1.30 SUBAREA RUNOFF(CFS) = 2.42

AREA-AVERAGE RUNOFF COEFFICIENT = 0.624

TOTAL AREA(ACRES) = 8.8 PEAK FLOW RATE(CFS) = 17.01

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.25 FLOW VELOCITY(FEET/SEC.) = 10.52

LONGEST FLOWPATH FROM NODE 100.00 TO NODE 150.00 = 2210.00 FEET.

FLOW PROCESS FROM NODE 150.00 TO NODE 150.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.099

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .4800

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.5994

SUBAREA AREA(ACRES) = 1.80 SUBAREA RUNOFF(CFS) = 2.68

TOTAL AREA(ACRES) = 10.6 TOTAL RUNOFF(CFS) = 19.69

TC(MIN.) = 21.35

FLOW PROCESS FROM NODE 150.00 TO NODE 150.00 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.) = 21.35

RAINFALL INTENSITY(INCH/HR) = 3.10

TOTAL STREAM AREA(ACRES) = 10.60

PEAK FLOW RATE(CFS) AT CONFLUENCE = 19.69

FLOW PROCESS FROM NODE 110.00 TO NODE 112.00 IS CODE = 21

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .3300

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 90.00

UPSTREAM ELEVATION(FEET) = 509.00

DOWNSTREAM ELEVATION(FEET) = 506.00

ELEVATION DIFFERENCE(FEET) = 3.00

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 8.803

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.488

SUBAREA RUNOFF(CFS) = 0.18

TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.18

FLOW PROCESS FROM NODE 112.00 TO NODE 150.00 IS CODE = 51

>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<

>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 506.00 DOWNSTREAM(FEET) = 456.00

CHANNEL LENGTH THRU SUBAREA(FEET) = 380.00 CHANNEL SLOPE = 0.1316

CHANNEL BASE(FEET) = 65.00 "Z" FACTOR = 4.000

MANNING'S FACTOR = 0.025 MAXIMUM DEPTH(FEET) = 10.00

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.362

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .4200

S.C.S. CURVE NUMBER (AMC II) = 0

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.19

TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.68

AVERAGE FLOW DEPTH(FEET) = 0.02 TRAVEL TIME(MIN.) = 3.76

Tc(MIN.) = 12.57

SUBAREA AREA(ACRES) = 2.20 SUBAREA RUNOFF(CFS) = 4.03

AREA-AVERAGE RUNOFF COEFFICIENT = 0.416

TOTAL AREA(ACRES) = 2.3 PEAK FLOW RATE(CFS) = 4.17

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.03 FLOW VELOCITY(FEET/SEC.) = 2.32

LONGEST FLOWPATH FROM NODE 110.00 TO NODE 150.00 = 470.00 FEET.

FLOW PROCESS FROM NODE 150.00 TO NODE 150.00 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.) = 12.57
RAINFALL INTENSITY(INCH/HR) = 4.36
TOTAL STREAM AREA(ACRES) = 2.30
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.17
```

** CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	19.69	21.35	3.099	10.60
2	4.17	12.57	4.362	2.30

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

** PEAK FLOW RATE TABLE **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	15.76	12.57	4.362
2	22.66	21.35	3.099

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 22.66 Tc(MIN.) = 21.35
TOTAL AREA(ACRES) = 12.9
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 150.00 = 2210.00 FEET.

FLOW PROCESS FROM NODE 150.00 TO NODE 190.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

```
=====
ELEVATION DATA: UPSTREAM(FEET) = 456.00 DOWNSTREAM(FEET) = 448.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 436.00 CHANNEL SLOPE = 0.0183
CHANNEL BASE(FEET) = 5.00 "Z" FACTOR = 3.000
MANNING'S FACTOR = 0.020 MAXIMUM DEPTH(FEET) = 10.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.989
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3300
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 23.05
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 5.94
AVERAGE FLOW DEPTH(FEET) = 0.58 TRAVEL TIME(MIN.) = 1.22
Tc(MIN.) = 22.58
SUBAREA AREA(ACRES) = 0.80 SUBAREA RUNOFF(CFS) = 0.79
AREA-AVERAGE RUNOFF COEFFICIENT = 0.553
TOTAL AREA(ACRES) = 13.7 PEAK FLOW RATE(CFS) = 22.66
```

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.58 FLOW VELOCITY(FEET/SEC.) = 5.86

LONGEST FLOWPATH FROM NODE 100.00 TO NODE 190.00 = 2646.00 FEET.

FLOW PROCESS FROM NODE 190.00 TO NODE 190.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.989

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .3300

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.5421

SUBAREA AREA(ACRES) = 0.70 SUBAREA RUNOFF(CFS) = 0.69

TOTAL AREA(ACRES) = 14.4 TOTAL RUNOFF(CFS) = 23.33

TC(MIN.) = 22.58

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 14.4 TC(MIN.) = 22.58

PEAK FLOW RATE(CFS) = 23.33

=====

END OF RATIONAL METHOD ANALYSIS

↑

APPENDIX B

Modified Rational Method Output [Post-project Un-detained]

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
 Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
 2003,1985,1981 HYDROLOGY MANUAL
 (c) Copyright 1982-2014 Advanced Engineering Software (aes)
 Ver. 21.0 Release Date: 06/01/2014 License ID 1261

Analysis prepared by:

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

***** DESCRIPTION OF STUDY *****
 * ST. KATHERINES ORTHODOX CHURCH *
 * POST-PROJECT CONDITION 100-YR STORM EVENT - BASIN 1 (UNDETAINED) *
 * JN-20292 *

FILE NAME: SK100PR.DAT
 TIME/DATE OF STUDY: 07:47 07/30/2026

 USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00
 6-HOUR DURATION PRECIPITATION (INCHES) = 3.000
 SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00
 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

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH LIP HIKE (FT) (FT) (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00 0.0312 0.167	0.0150
2	24.0	19.0	0.020/0.020/0.020	0.50	1.50 0.0312 0.125	0.0150
3	22.0	17.0	0.020/0.020/0.020	0.50	1.50 0.0313 0.125	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = -0.10 FEET
 as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
 OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

```
*****
FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
-----
```

```
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=====
```

```
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3600
S.C.S. CURVE NUMBER (AMC II) =  0
INITIAL SUBAREA FLOW-LENGTH(FEET) =  116.00
UPSTREAM ELEVATION(FEET) =  606.00
DOWNSTREAM ELEVATION(FEET) =  600.00
ELEVATION DIFFERENCE(FEET) =    6.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) =  7.702
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =  100.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.982
SUBAREA RUNOFF(CFS) =    0.22
TOTAL AREA(ACRES) =    0.10    TOTAL RUNOFF(CFS) =    0.22
```

```
*****
FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  51
-----
```

```
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
=====
```

```
ELEVATION DATA: UPSTREAM(FEET) =  600.00 DOWNSTREAM(FEET) =  565.00
CHANNEL LENGTH THRU SUBAREA(FEET) =  849.00 CHANNEL SLOPE =  0.0412
CHANNEL BASE(FEET) =  80.00 "Z" FACTOR =  20.000
MANNING'S FACTOR = 0.025 MAXIMUM DEPTH(FEET) =  10.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.296
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .5400
S.C.S. CURVE NUMBER (AMC II) =  0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =  3.26
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  1.21
AVERAGE FLOW DEPTH(FEET) =  0.03 TRAVEL TIME(MIN.) =  11.70
Tc(MIN.) =  19.41
SUBAREA AREA(ACRES) =  3.30 SUBAREA RUNOFF(CFS) =  5.87
AREA-AVERAGE RUNOFF COEFFICIENT =  0.535
TOTAL AREA(ACRES) =  3.4 PEAK FLOW RATE(CFS) =  5.99
```

```
END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.05 FLOW VELOCITY(FEET/SEC.) =  1.52
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =  965.00 FEET.
```

```
*****
FLOW PROCESS FROM NODE    104.00 TO NODE    106.00 IS CODE =  62
```

 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>(STREET TABLE SECTION # 2 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 565.00 DOWNSTREAM ELEVATION(FEET) = 506.00
 STREET LENGTH(FEET) = 624.00 CURB HEIGHT(INCHES) = 6.0
 STREET HALFWIDTH(FEET) = 24.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 19.00
 INSIDE STREET CROSSFALL(DECIMAL) = 0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
 STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 8.63
 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
 STREET FLOW DEPTH(FEET) = 0.34
 HALFSTREET FLOOD WIDTH(FEET) = 10.46
 AVERAGE FLOW VELOCITY(FEET/SEC.) = 7.13
 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 2.39
 STREET FLOW TRAVEL TIME(MIN.) = 1.46 Tc(MIN.) = 20.87
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.145

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .6000
 S.C.S. CURVE NUMBER (AMC II) = 0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.564
 SUBAREA AREA(ACRES) = 2.80 SUBAREA RUNOFF(CFS) = 5.28
 TOTAL AREA(ACRES) = 6.2 PEAK FLOW RATE(CFS) = 11.00

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FEET) = 0.36 HALFSTREET FLOOD WIDTH(FEET) = 11.64
 FLOW VELOCITY(FEET/SEC.) = 7.47 DEPTH*VELOCITY(FT*FT/SEC.) = 2.68
 LONGEST FLOWPATH FROM NODE 100.00 TO NODE 106.00 = 1589.00 FEET.

FLOW PROCESS FROM NODE 106.00 TO NODE 106.00 IS CODE = 81

 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.145
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7800
 S.C.S. CURVE NUMBER (AMC II) = 0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6039
 SUBAREA AREA(ACRES) = 1.40 SUBAREA RUNOFF(CFS) = 3.43
 TOTAL AREA(ACRES) = 7.6 TOTAL RUNOFF(CFS) = 14.44
 TC(MIN.) = 20.87

```
*****
FLOW PROCESS FROM NODE    106.00 TO NODE    150.00 IS CODE =  51
-----
```

```
>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<
=====
```

```
ELEVATION DATA: UPSTREAM(FEET) =   544.00  DOWNSTREAM(FEET) =   456.00
CHANNEL LENGTH THRU SUBAREA(FEET) =   621.00  CHANNEL SLOPE =   0.1417
CHANNEL BASE(FEET) =    6.00  "Z" FACTOR =    2.000
MANNING'S FACTOR = 0.020  MAXIMUM DEPTH(FEET) =   10.00
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =   3.049
```

```
*USER SPECIFIED(SUBAREA):
```

```
USER-SPECIFIED RUNOFF COEFFICIENT = .6000
S.C.S. CURVE NUMBER (AMC II) =    0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    15.63
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  10.08
AVERAGE FLOW DEPTH(FEET) =    0.24  TRAVEL TIME(MIN.) =    1.03
Tc(MIN.) =    21.89
SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    2.38
AREA-AVERAGE RUNOFF COEFFICIENT =  0.603
TOTAL AREA(ACRES) =    8.9      PEAK FLOW RATE(CFS) =    16.37
```

```
END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
DEPTH(FEET) = 0.25  FLOW VELOCITY(FEET/SEC.) =  10.21
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    150.00 =   2210.00 FEET.
```

```
*****
FLOW PROCESS FROM NODE    150.00 TO NODE    150.00 IS CODE =  81
-----
```

```
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =   3.049
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4800
S.C.S. CURVE NUMBER (AMC II) =    0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.5826
SUBAREA AREA(ACRES) =    1.80  SUBAREA RUNOFF(CFS) =    2.63
TOTAL AREA(ACRES) =    10.7  TOTAL RUNOFF(CFS) =    19.01
TC(MIN.) =    21.89
```

```
*****
FLOW PROCESS FROM NODE    150.00 TO NODE    150.00 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.) =    21.89
RAINFALL INTENSITY(INCH/HR) =    3.05
```

TOTAL STREAM AREA(ACRES) = 10.70
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 19.01

FLOW PROCESS FROM NODE 110.00 TO NODE 112.00 IS CODE = 21

 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .9000

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 59.00

UPSTREAM ELEVATION(FEET) = 506.50

DOWNSTREAM ELEVATION(FEET) = 506.00

ELEVATION DIFFERENCE(FEET) = 0.50

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 2.871

WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN

THE MAXIMUM OVERLAND FLOW LENGTH = 56.95

(Reference: Table 3-1B of Hydrology Manual)

THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN T_c CALCULATION!

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.904

NOTE: RAINFALL INTENSITY IS BASED ON T_c = 5-MINUTE.

SUBAREA RUNOFF(CFS) = 0.71

TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.71

FLOW PROCESS FROM NODE 112.00 TO NODE 114.00 IS CODE = 51

 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<

>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 506.00 DOWNSTREAM(FEET) = 504.00

CHANNEL LENGTH THRU SUBAREA(FEET) = 507.00 CHANNEL SLOPE = 0.0039

CHANNEL BASE(FEET) = 20.00 "Z" FACTOR = 20.000

MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 0.50

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.929

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .9000

S.C.S. CURVE NUMBER (AMC II) = 0

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.12

TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.12

AVERAGE FLOW DEPTH(FEET) = 0.09 TRAVEL TIME(MIN.) = 7.53

T_c(MIN.) = 10.40

SUBAREA AREA(ACRES) = 0.60 SUBAREA RUNOFF(CFS) = 2.66

AREA-AVERAGE RUNOFF COEFFICIENT = 0.900

TOTAL AREA(ACRES) = 0.7 PEAK FLOW RATE(CFS) = 3.11

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.10 FLOW VELOCITY(FEET/SEC.) = 1.35

LONGEST FLOWPATH FROM NODE 110.00 TO NODE 114.00 = 566.00 FEET.

```
*****
FLOW PROCESS FROM NODE    114.00 TO NODE    114.00 IS CODE =  81
-----
```

```
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
```

```
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.929
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .9000
S.C.S. CURVE NUMBER (AMC II) =  0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.9000
SUBAREA AREA(ACRES) =    0.60  SUBAREA RUNOFF(CFS) =    2.66
TOTAL AREA(ACRES) =    1.3  TOTAL RUNOFF(CFS) =    5.77
TC(MIN.) =  10.40
```

```
*****
FLOW PROCESS FROM NODE    114.00 TO NODE    114.20 IS CODE =  31
-----
```

```
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
```

```
ELEVATION DATA: UPSTREAM(FEET) =  501.00  DOWNSTREAM(FEET) =  500.80
FLOW LENGTH(FEET) =   20.00  MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS  9.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  5.84
ESTIMATED PIPE DIAMETER(INCH) =  18.00  NUMBER OF PIPES =  1
PIPE-FLOW(CFS) =    5.77
PIPE TRAVEL TIME(MIN.) =  0.06  Tc(MIN.) =  10.46
LONGEST FLOWPATH FROM NODE    110.00 TO NODE    114.20 =    586.00 FEET.
```

```
*****
FLOW PROCESS FROM NODE    114.20 TO NODE    114.20 IS CODE =  81
-----
```

```
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
```

```
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.911
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .9000
S.C.S. CURVE NUMBER (AMC II) =  0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.9000
SUBAREA AREA(ACRES) =    0.20  SUBAREA RUNOFF(CFS) =    0.88
TOTAL AREA(ACRES) =    1.5  TOTAL RUNOFF(CFS) =    6.63
TC(MIN.) =  10.46
```

```
*****
FLOW PROCESS FROM NODE    114.20 TO NODE    114.60 IS CODE =  31
-----
```

```
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```

=====
ELEVATION DATA: UPSTREAM(FEET) = 500.80 DOWNSTREAM(FEET) = 499.50
FLOW LENGTH(FEET) = 128.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.07
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 6.63
PIPE TRAVEL TIME(MIN.) = 0.35 Tc(MIN.) = 10.81
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 114.60 = 714.00 FEET.

```

```

*****
FLOW PROCESS FROM NODE 114.60 TO NODE 114.60 IS CODE = 81
-----

```

```

>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====

```

```

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.808
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .9000
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.9000
SUBAREA AREA(ACRES) = 0.20 SUBAREA RUNOFF(CFS) = 0.87
TOTAL AREA(ACRES) = 1.7 TOTAL RUNOFF(CFS) = 7.36
TC(MIN.) = 10.81

```

```

*****
FLOW PROCESS FROM NODE 114.60 TO NODE 114.80 IS CODE = 31
-----

```

```

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====

```

```

ELEVATION DATA: UPSTREAM(FEET) = 499.50 DOWNSTREAM(FEET) = 498.50
FLOW LENGTH(FEET) = 90.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 11.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.43
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 7.36
PIPE TRAVEL TIME(MIN.) = 0.23 Tc(MIN.) = 11.04
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 114.80 = 804.00 FEET.

```

```

*****
FLOW PROCESS FROM NODE 114.80 TO NODE 114.80 IS CODE = 81
-----

```

```

>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====

```

```

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.742
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .9000
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.9000
SUBAREA AREA(ACRES) = 0.30 SUBAREA RUNOFF(CFS) = 1.28

```

TOTAL AREA(ACRES) = 2.0 TOTAL RUNOFF(CFS) = 8.54
 TC(MIN.) = 11.04

FLOW PROCESS FROM NODE 114.80 TO NODE 140.00 IS CODE = 31

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 498.50 DOWNSTREAM(FEET) = 470.00
 FLOW LENGTH(FEET) = 51.00 MANNING'S N = 0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 4.1 INCHES
 PIPE-FLOW VELOCITY(Feet/Sec.) = 28.04
 ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 8.54
 PIPE TRAVEL TIME(MIN.) = 0.03 Tc(MIN.) = 11.07
 LONGEST FLOWPATH FROM NODE 110.00 TO NODE 140.00 = 855.00 FEET.

FLOW PROCESS FROM NODE 140.00 TO NODE 140.00 IS CODE = 81

>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.734
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3300
 S.C.S. CURVE NUMBER (AMC II) = 0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.8050
 SUBAREA AREA(ACRES) = 0.40 SUBAREA RUNOFF(CFS) = 0.62
 TOTAL AREA(ACRES) = 2.4 TOTAL RUNOFF(CFS) = 9.15
 TC(MIN.) = 11.07

FLOW PROCESS FROM NODE 140.00 TO NODE 150.00 IS CODE = 31

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(Feet) = 470.00 DOWNSTREAM(Feet) = 456.00
 FLOW LENGTH(Feet) = 50.00 MANNING'S N = 0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 5.1 INCHES
 PIPE-FLOW VELOCITY(Feet/Sec.) = 22.36
 ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 9.15
 PIPE TRAVEL TIME(MIN.) = 0.04 Tc(MIN.) = 11.11
 LONGEST FLOWPATH FROM NODE 110.00 TO NODE 150.00 = 905.00 FEET.

FLOW PROCESS FROM NODE 150.00 TO NODE 150.00 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.) = 11.11
RAINFALL INTENSITY(INCH/HR) = 4.72
TOTAL STREAM AREA(ACRES) = 2.40
PEAK FLOW RATE(CFS) AT CONFLUENCE = 9.15

** CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	T _c (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	19.01	21.89	3.049	10.70
2	9.15	11.11	4.723	2.40

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

** PEAK FLOW RATE TABLE **

STREAM NUMBER	RUNOFF (CFS)	T _c (MIN.)	INTENSITY (INCH/HOUR)
1	18.79	11.11	4.723
2	24.91	21.89	3.049

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 24.91 T_c(MIN.) = 21.89
TOTAL AREA(ACRES) = 13.1
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 150.00 = 2210.00 FEET.

FLOW PROCESS FROM NODE 150.00 TO NODE 190.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 456.00 DOWNSTREAM(FEET) = 448.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 136.00 CHANNEL SLOPE = 0.0588
CHANNEL BASE(FEET) = 5.00 "Z" FACTOR = 3.000
MANNING'S FACTOR = 0.025 MAXIMUM DEPTH(FEET) = 10.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.023
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3300
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 25.21
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 7.78
AVERAGE FLOW DEPTH(FEET) = 0.50 TRAVEL TIME(MIN.) = 0.29
T_c(MIN.) = 22.19

SUBAREA AREA(ACRES) = 0.60 SUBAREA RUNOFF(CFS) = 0.60
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.611
 TOTAL AREA(ACRES) = 13.7 PEAK FLOW RATE(CFS) = 25.29

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.50 FLOW VELOCITY(FEET/SEC.) = 7.80
 LONGEST FLOWPATH FROM NODE 100.00 TO NODE 190.00 = 2346.00 FEET.

FLOW PROCESS FROM NODE 190.00 TO NODE 190.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.023

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .3300

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.5969

SUBAREA AREA(ACRES) = 0.70 SUBAREA RUNOFF(CFS) = 0.70

TOTAL AREA(ACRES) = 14.4 TOTAL RUNOFF(CFS) = 25.99

TC(MIN.) = 22.19

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 14.4 TC(MIN.) = 22.19

PEAK FLOW RATE(CFS) = 25.99

=====

END OF RATIONAL METHOD ANALYSIS

↑

Modified Rational Method Output
[Post-project Detained]

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
 Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
 2003,1985,1981 HYDROLOGY MANUAL
 (c) Copyright 1982-2014 Advanced Engineering Software (aes)
 Ver. 21.0 Release Date: 06/01/2014 License ID 1261

Analysis prepared by:

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

***** DESCRIPTION OF STUDY *****
 * ST. KATHERINES ORTHODOX CHURCH *
 * POST-PROJECT CONDITION 100-YR STORM EVNET - BASIN 1 (DETAINED) *
 * JN-20292 *

FILE NAME: SK100D.DAT
 TIME/DATE OF STUDY: 15:12 07/30/2026

 USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00
 6-HOUR DURATION PRECIPITATION (INCHES) = 3.000
 SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00
 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

NO.	HALF- WIDTH	CROWN TO CROSSFALL	STREET-CROSSFALL: IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT	GUTTER-GEOMETRIES: WIDTH LIP HIKE	MANNING FACTOR
	(FT)	(FT)		(FT)	(FT) (FT) (FT)	(n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00 0.0312 0.167	0.0150
2	24.0	19.0	0.020/0.020/0.020	0.50	1.50 0.0312 0.125	0.0150
3	22.0	17.0	0.020/0.020/0.020	0.50	1.50 0.0313 0.125	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = -0.10 FEET
 as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
 OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

```
*****
FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
-----
```

```
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=====
```

```
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3600
S.C.S. CURVE NUMBER (AMC II) =  0
INITIAL SUBAREA FLOW-LENGTH(FEET) =  116.00
UPSTREAM ELEVATION(FEET) =  606.00
DOWNSTREAM ELEVATION(FEET) =  600.00
ELEVATION DIFFERENCE(FEET) =  6.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) =  7.702
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =  100.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.982
SUBAREA RUNOFF(CFS) =  0.22
TOTAL AREA(ACRES) =  0.10    TOTAL RUNOFF(CFS) =  0.22
```

```
*****
FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  51
-----
```

```
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
=====
```

```
ELEVATION DATA: UPSTREAM(FEET) =  600.00  DOWNSTREAM(FEET) =  565.00
CHANNEL LENGTH THRU SUBAREA(FEET) =  849.00  CHANNEL SLOPE =  0.0412
CHANNEL BASE(FEET) =  80.00  "Z" FACTOR =  20.000
MANNING'S FACTOR = 0.025  MAXIMUM DEPTH(FEET) =  10.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.296
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .5400
S.C.S. CURVE NUMBER (AMC II) =  0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =  3.26
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  1.21
AVERAGE FLOW DEPTH(FEET) =  0.03  TRAVEL TIME(MIN.) =  11.70
Tc(MIN.) =  19.41
SUBAREA AREA(ACRES) =  3.30    SUBAREA RUNOFF(CFS) =  5.87
AREA-AVERAGE RUNOFF COEFFICIENT =  0.535
TOTAL AREA(ACRES) =  3.4    PEAK FLOW RATE(CFS) =  5.99
```

```
END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  0.05  FLOW VELOCITY(FEET/SEC.) =  1.52
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =  965.00 FEET.
```

```
*****
FLOW PROCESS FROM NODE    104.00 TO NODE    106.00 IS CODE =  62
```

```
-----
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION # 2 USED)<<<<<
=====
```

```
UPSTREAM ELEVATION(FEET) = 565.00 DOWNSTREAM ELEVATION(FEET) = 506.00
STREET LENGTH(FEET) = 624.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 24.00
```

```
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 19.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020
```

```
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150
```

```
**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 8.63
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.34
HALFSTREET FLOOD WIDTH(FEET) = 10.46
AVERAGE FLOW VELOCITY(FEET/SEC.) = 7.13
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 2.39
STREET FLOW TRAVEL TIME(MIN.) = 1.46 Tc(MIN.) = 20.87
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.145
```

```
*USER SPECIFIED(SUBAREA):
```

```
USER-SPECIFIED RUNOFF COEFFICIENT = .6000
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.564
SUBAREA AREA(ACRES) = 2.80 SUBAREA RUNOFF(CFS) = 5.28
TOTAL AREA(ACRES) = 6.2 PEAK FLOW RATE(CFS) = 11.00
```

```
END OF SUBAREA STREET FLOW HYDRAULICS:
```

```
DEPTH(FEET) = 0.36 HALFSTREET FLOOD WIDTH(FEET) = 11.64
FLOW VELOCITY(FEET/SEC.) = 7.47 DEPTH*VELOCITY(FT*FT/SEC.) = 2.68
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 106.00 = 1589.00 FEET.
```

```
*****
```

```
FLOW PROCESS FROM NODE 106.00 TO NODE 106.00 IS CODE = 81
```

```
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
```

```
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.145
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7800
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.6039
SUBAREA AREA(ACRES) = 1.40 SUBAREA RUNOFF(CFS) = 3.43
TOTAL AREA(ACRES) = 7.6 TOTAL RUNOFF(CFS) = 14.44
TC(MIN.) = 20.87
```

```
*****
FLOW PROCESS FROM NODE    106.00 TO NODE    150.00 IS CODE =  51
-----
```

```
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
=====
```

```
ELEVATION DATA: UPSTREAM(FEET) =   544.00  DOWNSTREAM(FEET) =   456.00
CHANNEL LENGTH THRU SUBAREA(FEET) =   621.00  CHANNEL SLOPE =   0.1417
CHANNEL BASE(FEET) =    6.00  "Z" FACTOR =   2.000
MANNING'S FACTOR = 0.020  MAXIMUM DEPTH(FEET) =  10.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =   3.049
```

```
*USER SPECIFIED(SUBAREA):
```

```
USER-SPECIFIED RUNOFF COEFFICIENT = .6000
```

```
S.C.S. CURVE NUMBER (AMC II) =  0
```

```
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    15.63
```

```
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  10.08
```

```
AVERAGE FLOW DEPTH(FEET) =   0.24  TRAVEL TIME(MIN.) =   1.03
```

```
Tc(MIN.) =   21.89
```

```
SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    2.38
```

```
AREA-AVERAGE RUNOFF COEFFICIENT =  0.603
```

```
TOTAL AREA(ACRES) =    8.9      PEAK FLOW RATE(CFS) =    16.37
```

```
END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
DEPTH(FEET) =  0.25  FLOW VELOCITY(FEET/SEC.) =  10.21
```

```
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    150.00 =    2210.00 FEET.
```

```
*****
FLOW PROCESS FROM NODE    150.00 TO NODE    150.00 IS CODE =  81
-----
```

```
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
```

```
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =   3.049
```

```
*USER SPECIFIED(SUBAREA):
```

```
USER-SPECIFIED RUNOFF COEFFICIENT = .4800
```

```
S.C.S. CURVE NUMBER (AMC II) =  0
```

```
AREA-AVERAGE RUNOFF COEFFICIENT = 0.5826
```

```
SUBAREA AREA(ACRES) =    1.80  SUBAREA RUNOFF(CFS) =    2.63
```

```
TOTAL AREA(ACRES) =    10.7  TOTAL RUNOFF(CFS) =    19.01
```

```
TC(MIN.) =   21.89
```

```
*****
FLOW PROCESS FROM NODE    150.00 TO NODE    150.00 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.) =   21.89
```

```
RAINFALL INTENSITY(INCH/HR) =   3.05
```

TOTAL STREAM AREA(ACRES) = 10.70
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 19.01

FLOW PROCESS FROM NODE 110.00 TO NODE 112.00 IS CODE = 21

 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .9000

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 59.00

UPSTREAM ELEVATION(FEET) = 506.50

DOWNSTREAM ELEVATION(FEET) = 506.00

ELEVATION DIFFERENCE(FEET) = 0.50

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 2.871

WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN

THE MAXIMUM OVERLAND FLOW LENGTH = 56.95

(Reference: Table 3-1B of Hydrology Manual)

THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN T_c CALCULATION!

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.904

NOTE: RAINFALL INTENSITY IS BASED ON T_c = 5-MINUTE.

SUBAREA RUNOFF(CFS) = 0.71

TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.71

FLOW PROCESS FROM NODE 112.00 TO NODE 114.00 IS CODE = 51

 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<

>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 506.00 DOWNSTREAM(FEET) = 504.00

CHANNEL LENGTH THRU SUBAREA(FEET) = 507.00 CHANNEL SLOPE = 0.0039

CHANNEL BASE(FEET) = 20.00 "Z" FACTOR = 20.000

MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 0.50

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.929

*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .9000

S.C.S. CURVE NUMBER (AMC II) = 0

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.12

TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.12

AVERAGE FLOW DEPTH(FEET) = 0.09 TRAVEL TIME(MIN.) = 7.53

T_c(MIN.) = 10.40

SUBAREA AREA(ACRES) = 0.60 SUBAREA RUNOFF(CFS) = 2.66

AREA-AVERAGE RUNOFF COEFFICIENT = 0.900

TOTAL AREA(ACRES) = 0.7 PEAK FLOW RATE(CFS) = 3.11

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.10 FLOW VELOCITY(FEET/SEC.) = 1.35

LONGEST FLOWPATH FROM NODE 110.00 TO NODE 114.00 = 566.00 FEET.

```
*****
FLOW PROCESS FROM NODE    114.00 TO NODE    114.00 IS CODE =  81
-----
```

```
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
```

```
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.929
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .9000
S.C.S. CURVE NUMBER (AMC II) =  0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.9000
SUBAREA AREA(ACRES) =    0.60  SUBAREA RUNOFF(CFS) =    2.66
TOTAL AREA(ACRES) =    1.3  TOTAL RUNOFF(CFS) =    5.77
TC(MIN.) =  10.40
```

```
*****
FLOW PROCESS FROM NODE    114.00 TO NODE    114.20 IS CODE =  31
-----
```

```
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
```

```
ELEVATION DATA: UPSTREAM(FEET) =  501.00  DOWNSTREAM(FEET) =  500.80
FLOW LENGTH(FEET) =   20.00  MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS  9.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  5.84
ESTIMATED PIPE DIAMETER(INCH) =  18.00  NUMBER OF PIPES =  1
PIPE-FLOW(CFS) =    5.77
PIPE TRAVEL TIME(MIN.) =  0.06  Tc(MIN.) =  10.46
LONGEST FLOWPATH FROM NODE    110.00 TO NODE    114.20 =    586.00 FEET.
```

```
*****
FLOW PROCESS FROM NODE    114.20 TO NODE    114.20 IS CODE =  81
-----
```

```
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
```

```
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.911
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .9000
S.C.S. CURVE NUMBER (AMC II) =  0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.9000
SUBAREA AREA(ACRES) =    0.20  SUBAREA RUNOFF(CFS) =    0.88
TOTAL AREA(ACRES) =    1.5  TOTAL RUNOFF(CFS) =    6.63
TC(MIN.) =  10.46
```

```
*****
FLOW PROCESS FROM NODE    114.20 TO NODE    114.60 IS CODE =  31
-----
```

```
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
=====
ELEVATION DATA: UPSTREAM(FEET) = 500.80 DOWNSTREAM(FEET) = 499.50
FLOW LENGTH(FEET) = 128.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.07
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 6.63
PIPE TRAVEL TIME(MIN.) = 0.35 Tc(MIN.) = 10.81
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 114.60 = 714.00 FEET.
```

```
*****
FLOW PROCESS FROM NODE 114.60 TO NODE 114.60 IS CODE = 81
```

```
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
```

```
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.808
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .9000
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.9000
SUBAREA AREA(ACRES) = 0.20 SUBAREA RUNOFF(CFS) = 0.87
TOTAL AREA(ACRES) = 1.7 TOTAL RUNOFF(CFS) = 7.36
TC(MIN.) = 10.81
```

```
*****
FLOW PROCESS FROM NODE 114.60 TO NODE 114.80 IS CODE = 31
```

```
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
```

```
ELEVATION DATA: UPSTREAM(FEET) = 499.50 DOWNSTREAM(FEET) = 498.50
FLOW LENGTH(FEET) = 90.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 11.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.43
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 7.36
PIPE TRAVEL TIME(MIN.) = 0.23 Tc(MIN.) = 11.04
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 114.80 = 804.00 FEET.
```

```
*****
FLOW PROCESS FROM NODE 114.80 TO NODE 114.80 IS CODE = 81
```

```
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
```

```
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.742
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .9000
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.9000
SUBAREA AREA(ACRES) = 0.30 SUBAREA RUNOFF(CFS) = 1.28
```

TOTAL AREA(ACRES) = 2.0 TOTAL RUNOFF(CFS) = 8.54
 TC(MIN.) = 11.04

FLOW PROCESS FROM NODE 114.80 TO NODE 140.00 IS CODE = 31

 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 498.50 DOWNSTREAM(FEET) = 470.00
 FLOW LENGTH(FEET) = 51.00 MANNING'S N = 0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 4.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 28.04
 ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 8.54
 PIPE TRAVEL TIME(MIN.) = 0.03 Tc(MIN.) = 11.07
 LONGEST FLOWPATH FROM NODE 110.00 TO NODE 140.00 = 855.00 FEET.

FLOW PROCESS FROM NODE 140.00 TO NODE 140.00 IS CODE = 81

 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.734
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3300
 S.C.S. CURVE NUMBER (AMC II) = 0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.8050
 SUBAREA AREA(ACRES) = 0.40 SUBAREA RUNOFF(CFS) = 0.62
 TOTAL AREA(ACRES) = 2.4 TOTAL RUNOFF(CFS) = 9.15
 TC(MIN.) = 11.07

FLOW PROCESS FROM NODE 140.00 TO NODE 140.00 IS CODE = 7

 >>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<

=====

USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) = 13.00 RAIN INTENSITY(INCH/HOUR) = 4.27
 TOTAL AREA(ACRES) = 2.40 TOTAL RUNOFF(CFS) = 1.60

FLOW PROCESS FROM NODE 140.00 TO NODE 150.00 IS CODE = 31

 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 470.00 DOWNSTREAM(FEET) = 456.00
 FLOW LENGTH(FEET) = 50.00 MANNING'S N = 0.013

ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 2.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 13.37
 ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 1.60
 PIPE TRAVEL TIME(MIN.) = 0.06 Tc(MIN.) = 13.06
 LONGEST FLOWPATH FROM NODE 110.00 TO NODE 150.00 = 905.00 FEET.

FLOW PROCESS FROM NODE 150.00 TO NODE 150.00 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.) = 13.06
 RAINFALL INTENSITY(INCH/HR) = 4.25
 TOTAL STREAM AREA(ACRES) = 2.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.60

** CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	19.01	21.89	3.049	10.70
2	1.60	13.06	4.255	2.40

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

** PEAK FLOW RATE TABLE **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	12.94	13.06	4.255
2	20.16	21.89	3.049

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 20.16 Tc(MIN.) = 21.89
 TOTAL AREA(ACRES) = 13.1
 LONGEST FLOWPATH FROM NODE 100.00 TO NODE 150.00 = 2210.00 FEET.

FLOW PROCESS FROM NODE 150.00 TO NODE 190.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
 >>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 456.00 DOWNSTREAM(FEET) = 448.00
 CHANNEL LENGTH THRU SUBAREA(FEET) = 136.00 CHANNEL SLOPE = 0.0588
 CHANNEL BASE(FEET) = 5.00 "Z" FACTOR = 3.000

MANNING'S FACTOR = 0.025 MAXIMUM DEPTH(FEET) = 10.00
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.021
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3300
 S.C.S. CURVE NUMBER (AMC II) = 0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 20.45
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 7.25
 AVERAGE FLOW DEPTH(FEET) = 0.45 TRAVEL TIME(MIN.) = 0.31
 Tc(MIN.) = 22.21
 SUBAREA AREA(ACRES) = 0.60 SUBAREA RUNOFF(CFS) = 0.60
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.497
 TOTAL AREA(ACRES) = 13.7 PEAK FLOW RATE(CFS) = 20.57

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) = 0.45 FLOW VELOCITY(FEET/SEC.) = 7.29
 LONGEST FLOWPATH FROM NODE 100.00 TO NODE 190.00 = 2346.00 FEET.

FLOW PROCESS FROM NODE 190.00 TO NODE 190.00 IS CODE = 81

 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.021
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3300
 S.C.S. CURVE NUMBER (AMC II) = 0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.4887
 SUBAREA AREA(ACRES) = 0.70 SUBAREA RUNOFF(CFS) = 0.70
 TOTAL AREA(ACRES) = 14.4 TOTAL RUNOFF(CFS) = 21.26
 TC(MIN.) = 22.21
 =====

END OF STUDY SUMMARY:
 TOTAL AREA(ACRES) = 14.4 TC(MIN.) = 22.21
 PEAK FLOW RATE(CFS) = 21.26
 =====

=====
 END OF RATIONAL METHOD ANALYSIS



APPENDIX C

Normal Depth Storm Drain Sizing Matrix

Preliminary Storm Drain Size

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

Manning's n: 0.013

Sizing Factor (%): 30

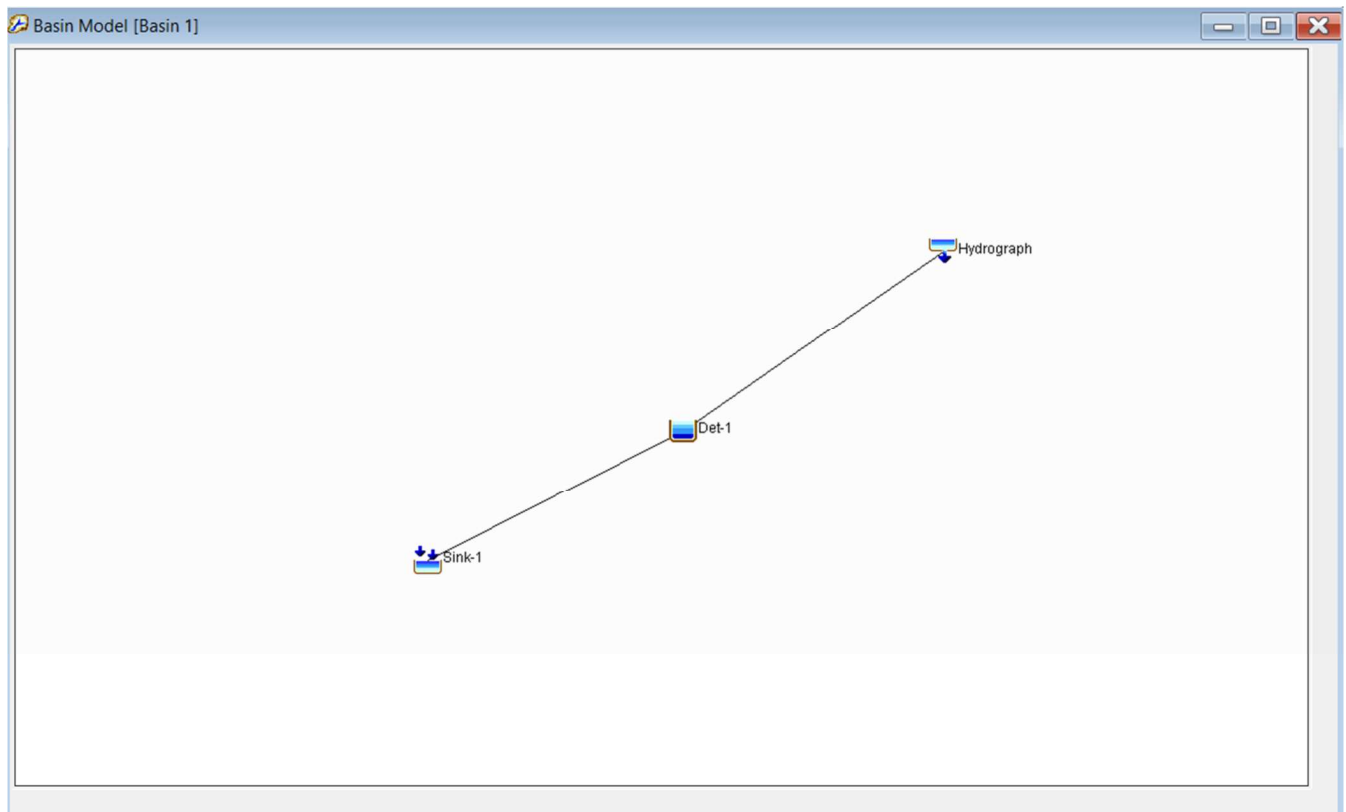
Slope at:		0.5%		1.0%		2.0%		3.0%	
Q ₁₀₀ (cfs ¹)	Q ₁₀₀ with Sizing Factor (cfs ¹)	Minimum Pipe Size ² (feet)	Recommended Pipe Size (inches)	Minimum Pipe Size ² (feet)	Recommended Pipe Size (inches)	Minimum Pipe Size ² (feet)	Recommended Pipe Size (inches)	Minimum Pipe Size ² (feet)	Recommended Pipe Size (inches)
1.0	1.3	0.78	10"	0.68	10"	0.60	8"	0.56	8"
2.0	2.6	1.01	12"	0.89	12"	0.78	10"	0.72	10"
5.0	6.5	1.43	18"	1.25	18"	1.10	18"	1.02	18"
10.0	13.0	1.85	24"	1.62	24"	1.43	18"	1.32	18"
15.0	19.5	2.15	30"	1.89	24"	1.66	24"	1.54	24"
20.0	26.0	2.40	30"	2.11	30"	1.85	24"	1.71	24"
24.6	31.9	2.59	36"	2.27	30"	2.00	24"	1.85	24"
30.0	39.0	2.79	36"	2.45	30"	2.15	30"	1.99	24"
35.0	45.5	2.96	36"	2.60	36"	2.28	30"	2.11	30"
40.0	52.0	3.11	42"	2.73	36"	2.40	30"	2.22	30"
50.0	65.0	3.38	42"	2.97	36"	2.61	36"	2.42	30"
60.0	78.0	3.62	48"	3.18	42"	2.79	36"	2.59	36"
70.0	91.0	3.83	48"	3.37	42"	2.96	36"	2.74	36"
80.0	104.0	4.03	54"	3.54	48"	3.11	42"	2.88	36"
90.0	117.0	4.21	54"	3.70	48"	3.25	42"	3.01	42"
110.0	143.0	4.54	60"	3.99	48"	3.50	42"	3.25	42"
145.0	188.5	5.04	72"	4.42	54"	3.89	48"	3.60	48"
170.0	221.0	5.35	72"	4.70	60"	4.12	54"	3.82	48"
240.0	312.0	6.09	84"	5.35	72"	4.69	60"	4.35	54"
350.0	455.0	7.01	96"	6.16	84"	5.41	72"	5.01	72"

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

APPENDIX D

Detention Analysis

St. Katherine Orthodox Church
JN-20292
HEC-HMS (Version 4.1) Modeling for BF-1 (Detention Vault)



St. Katherine Orthodox Church
JN-20292
HEC-HMS (Version 4.1) Modeling for BF-1 (Detention Vault)

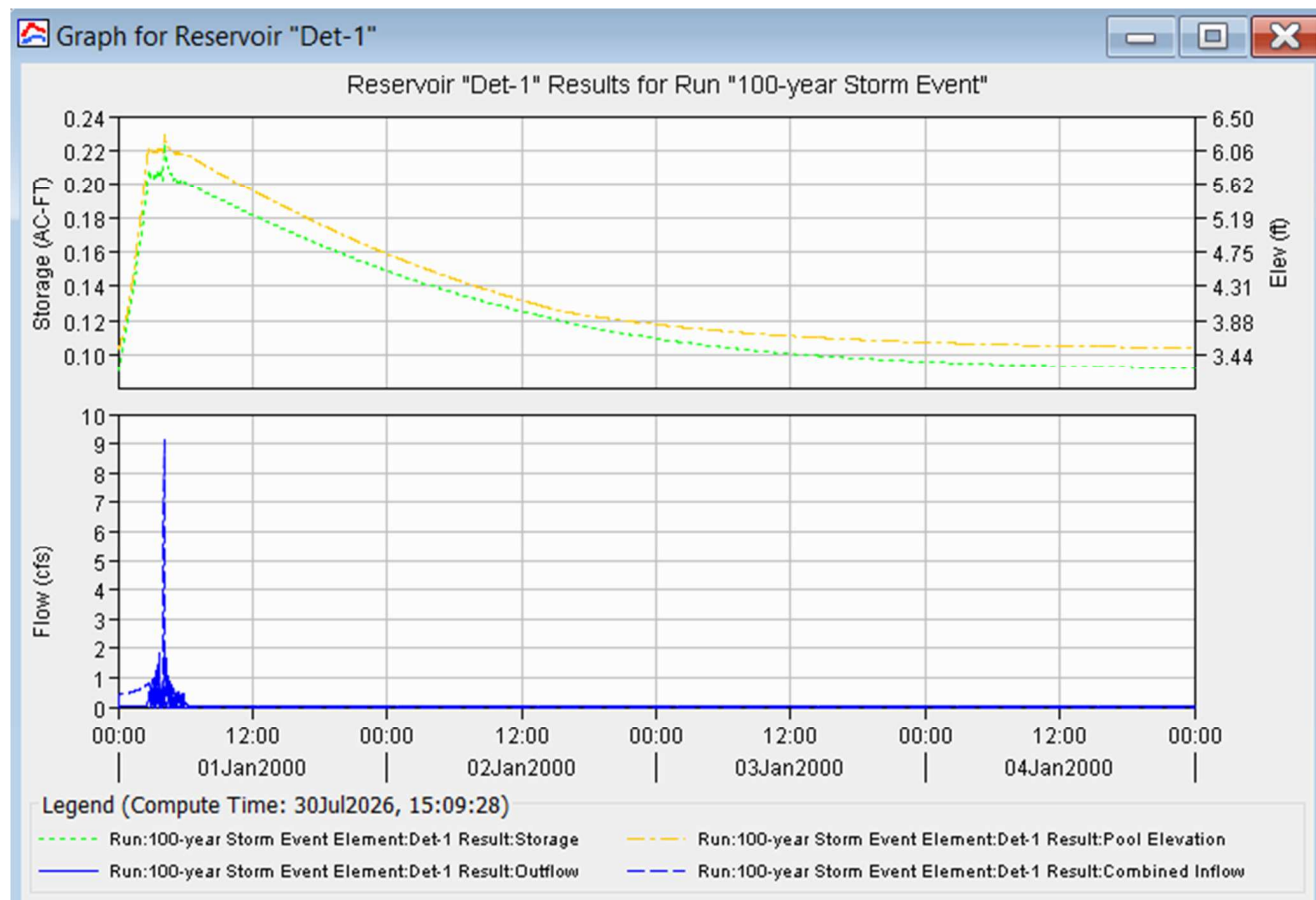
Global Summary Results for Run "100-year Storm Event"				
Project: 20292_StKatherineOC Simulation Run: 100-year Storm Event				
Start of Run: 01Jan2000, 00:00		Basin Model: Basin 1		
End of Run: 05Jan2000, 00:00		Meteorologic Model: 100-yr		
Compute Time:30Jul2026, 15:09:28		Control Specifications:Control 1		
Show Elements:	All Elements	Volume Units:	☐ IN ☒ AC-FT	Sorting: Hydrologic
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Hydrograph	0.00375	9.15	01Jan2000, 04:06	0.22
Det-1	0.00375	1.63	01Jan2000, 04:08	0.22
Sink-1	0.00375	1.63	01Jan2000, 04:08	0.22

Summary Results for Reservoir "Det-1"	
Project: 20292_StKatherineOC Simulation Run: 100-year Storm Event	
Reservoir: Det-1	
Start of Run: 01Jan2000, 00:00 Basin Model: Basin 1	
End of Run: 05Jan2000, 00:00 Meteorologic Model: 100-yr	
Compute Time:30Jul2026, 15:09:28 Control Specifications:Control 1	
Volume Units: ☐ IN ☒ AC-FT	
Computed Results	
Peak Inflow: 9.15 (CFS)	Date/Time of Peak Inflow: 01Jan2000, 04:06
Peak Discharge: 1.63 (CFS)	Date/Time of Peak Discharge:01Jan2000, 04:08
Inflow Volume: 0.22 (AC-FT)	Peak Storage: 0.23 (AC-FT)
Discharge Volume:0.22 (AC-FT)	Peak Elevation: 6.27 (FT)

Detained Q100 flow
for AES input

Lag time for AES
input

St. Katherine Orthodox Church
JN-20292
HEC-HMS (Version 4.1) Modeling for BF-1 (Detention Vault)



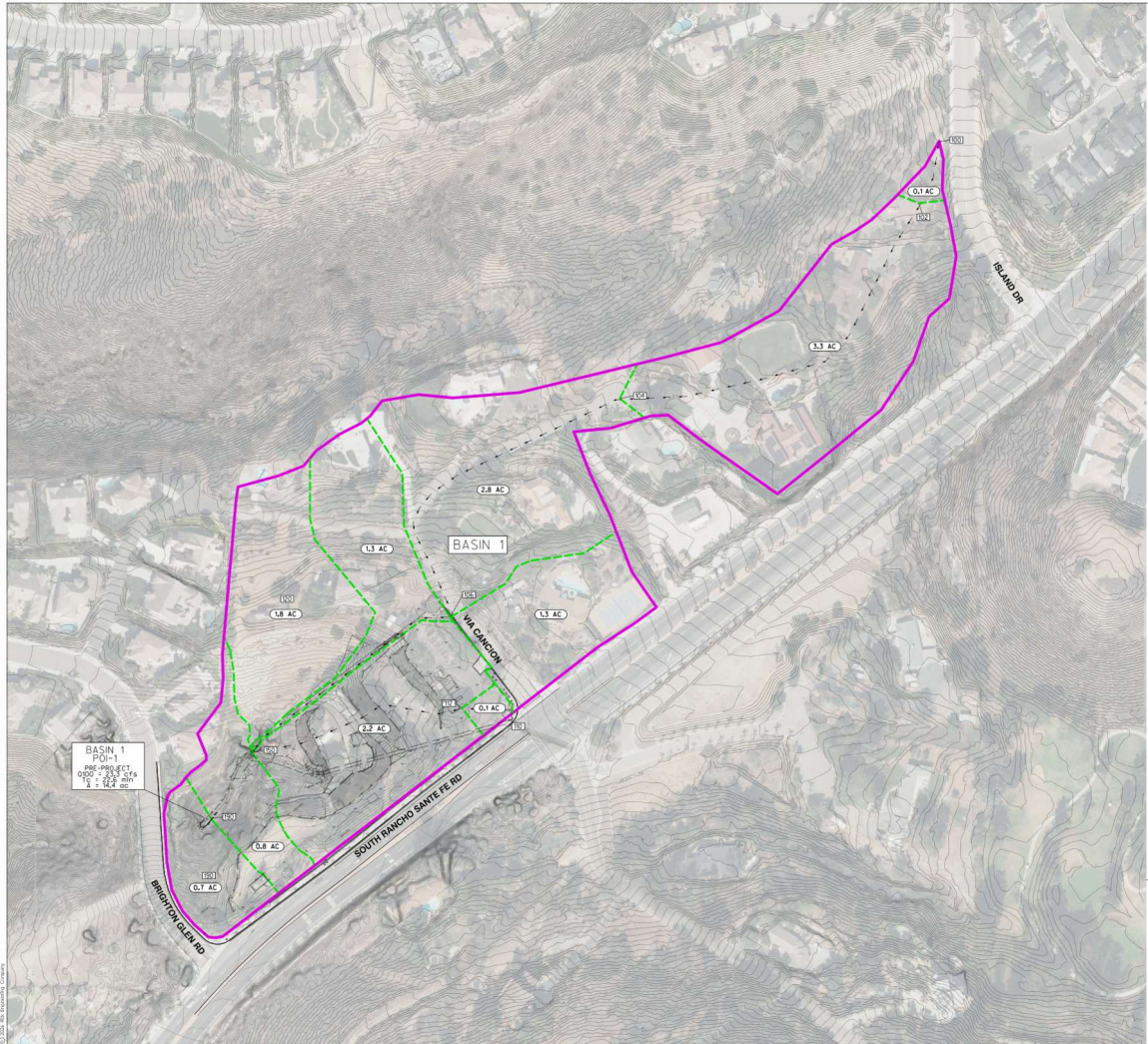
St. Katherine Orthodox Church
 JN-20292
 HEC-HMS (Version 4.1) Modeling for BF-1 (Detention Vault)

Time-Series Results for Reservoir "Det-1"					
Project: 20292_StKatherineOC Simulation Run: 100-year Storm Event Reservoir: Det-1					
Start of Run: 01Jan2000, 00:00		Basin Model: Basin 1			
End of Run: 05Jan2000, 00:00		Meteorologic Model: 100-yr			
Compute Time: 30Jul2026, 15:09:28		Control Specifications: Control 1			
Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	04:00	0.00	0.20	6.03	0.20
01Jan2000	04:01	0.00	0.20	6.03	0.19
01Jan2000	04:02	0.00	0.20	6.02	0.17
01Jan2000	04:03	0.00	0.20	6.02	0.16
01Jan2000	04:04	3.05	0.20	6.04	0.26
01Jan2000	04:05	6.10	0.21	6.10	0.59
01Jan2000	04:06	9.15	0.22	6.19	1.13
01Jan2000	04:07	4.58	0.23	6.26	1.57
01Jan2000	04:08	0.00	0.23	6.27	1.63
01Jan2000	04:09	0.00	0.23	6.25	1.50
01Jan2000	04:10	0.00	0.22	6.23	1.39
01Jan2000	04:11	0.00	0.22	6.21	1.28
01Jan2000	04:12	0.00	0.22	6.20	1.18
01Jan2000	04:13	0.00	0.22	6.18	1.09
01Jan2000	04:14	0.42	0.22	6.17	1.02
01Jan2000	04:15	0.84	0.22	6.16	0.99
01Jan2000	04:16	1.26	0.22	6.17	1.00
01Jan2000	04:17	1.68	0.22	6.17	1.03
01Jan2000	04:18	0.00	0.22	6.17	1.02
01Jan2000	04:19	0.00	0.22	6.16	0.94
01Jan2000	04:20	0.00	0.21	6.14	0.87
01Jan2000	04:21	0.00	0.21	6.13	0.80
01Jan2000	04:22	0.00	0.21	6.12	0.74
01Jan2000	04:23	0.00	0.21	6.11	0.68
01Jan2000	04:24	0.21	0.21	6.10	0.64
01Jan2000	04:25	0.42	0.21	6.10	0.62
01Jan2000	04:26	0.64	0.21	6.10	0.61
01Jan2000	04:27	0.85	0.21	6.10	0.62
01Jan2000	04:28	1.06	0.21	6.10	0.65
01Jan2000	04:29	0.85	0.21	6.11	0.67
01Jan2000	04:30	0.64	0.21	6.11	0.68
01Jan2000	04:31	0.42	0.21	6.11	0.66
01Jan2000	04:32	0.21	0.21	6.10	0.64
01Jan2000	04:33	0.00	0.21	6.10	0.60

45.0	3.750	0.051	0.003	0.000	0.000	0.000	0.000	0.000	0.0631	0.013
46.0	3.833	0.051	0.004	0.000	0.000	0.000	0.000	0.000	0.0658	0.015
47.0	3.917	0.052	0.004	0.000	0.000	0.000	0.000	0.000	0.0682	0.017
48.0	4.000	0.052	0.005	0.000	0.000	0.000	0.000	0.000	0.0704	0.018
49.0	4.083	0.053	0.005	0.000	0.000	0.000	0.000	0.000	0.0725	0.020
50.0	4.167	0.053	0.005	0.000	0.000	0.000	0.000	0.000	0.0744	0.021
51.0	4.250	0.054	0.006	0.000	0.000	0.000	0.000	0.000	0.0763	0.022
52.0	4.333	0.054	0.006	0.000	0.000	0.000	0.000	0.000	0.0781	0.024
53.0	4.417	0.055	0.006	0.000	0.000	0.000	0.000	0.000	0.0798	0.025
54.0	4.500	0.055	0.006	0.000	0.000	0.000	0.000	0.000	0.0814	0.026
55.0	4.583	0.056	0.007	0.000	0.000	0.000	0.000	0.000	0.0830	0.027
56.0	4.667	0.056	0.007	0.000	0.000	0.000	0.000	0.000	0.0846	0.028
57.0	4.750	0.057	0.007	0.000	0.000	0.000	0.000	0.000	0.0861	0.029
58.0	4.833	0.057	0.008	0.000	0.000	0.000	0.000	0.000	0.0876	0.030
59.0	4.917	0.058	0.008	0.000	0.000	0.000	0.000	0.000	0.0890	0.031
60.0	5.000	0.058	0.008	0.000	0.000	0.000	0.000	0.000	0.0904	0.032
61.0	5.083	0.059	0.008	0.000	0.000	0.000	0.000	0.000	0.0918	0.033
62.0	5.167	0.059	0.008	0.000	0.000	0.000	0.000	0.000	0.0931	0.034
63.0	5.250	0.060	0.009	0.000	0.000	0.000	0.000	0.000	0.0945	0.035
64.0	5.333	0.060	0.009	0.000	0.000	0.000	0.000	0.000	0.0958	0.035
65.0	5.417	0.061	0.009	0.000	0.000	0.000	0.000	0.000	0.0970	0.036
66.0	5.500	0.061	0.009	0.000	0.000	0.000	0.000	0.000	0.0983	0.037
67.0	5.583	0.062	0.009	0.000	0.000	0.000	0.000	0.000	0.0995	0.038
68.0	5.667	0.062	0.010	0.000	0.000	0.000	0.000	0.000	0.1008	0.038
69.0	5.750	0.063	0.010	0.000	0.000	0.000	0.000	0.000	0.1020	0.039
70.0	5.833	0.063	0.010	0.000	0.000	0.000	0.000	0.000	0.1031	0.040
71.0	5.917	0.064	0.010	0.000	0.000	0.000	0.000	0.000	0.1043	0.041
72.0	6.000	0.064	0.010	0.000	0.000	0.000	0.000	0.000	0.1055	0.041
73.0	6.083	0.065	0.011	0.043	0.000	0.000	0.000	0.000	0.2798	0.215
74.0	6.167	0.065	0.011	0.122	0.000	0.000	0.000	0.000	0.5976	0.533
75.0	6.250	0.065	0.011	0.225	0.000	0.000	0.000	0.000	1.0088	0.943
76.0	6.333	0.066	0.011	0.346	0.000	0.000	0.000	0.000	1.4955	1.430
77.0	6.417	0.066	0.011	0.484	0.000	0.000	0.000	0.000	2.0475	1.981
78.0	6.500	0.067	0.011	0.000	0.722	0.000	0.000	0.000	3.0011	2.934
79.0	6.583	0.067	0.011	0.000	0.834	0.000	0.000	0.000	3.4490	3.382
80.0	6.667	0.068	0.012	0.000	0.932	0.000	0.000	0.000	3.8439	3.776
81.0	6.750	0.068	0.012	0.000	1.021	0.000	0.000	0.000	4.2009	4.133
82.0	6.833	0.068	0.012	0.000	1.103	0.000	0.000	0.000	4.5292	4.461
83.0	6.917	0.069	0.012	0.000	1.179	0.000	0.000	0.000	4.8350	4.766
84.0	7.000	0.069	0.012	0.000	1.251	0.000	0.000	0.000	5.1221	5.053
85.0	7.083	0.070	0.012	0.000	1.319	0.000	0.758	0.000	6.1515	6.082
86.0	7.167	0.070	0.013	0.000	1.383	0.000	2.143	0.000	7.7956	7.716
87.0	7.250	0.071	0.013	0.000	1.444	0.000	3.938	0.000	9.8367	9.766
88.0	7.333	0.071	0.013	0.000	1.503	0.000	6.062	0.000	12.1982	12.127
89.0	7.417	0.071	0.013	0.000	1.560	0.000	8.472	0.000	14.8363	14.765
90.0	7.500	0.072	0.013	0.000	1.615	0.000	11.137	0.000	17.7210	17.649
91.0	7.583	0.072	0.013	0.000	1.668	0.000	14.034	0.000	20.8309	20.759
92.0	7.667	0.073	0.013	0.000	1.719	0.000	17.147	0.000	24.1497	24.077
93.0	7.750	0.073	0.014	0.000	1.769	0.000	20.460	0.000	27.6633	27.590
94.0	7.833	0.073	0.014	0.000	1.818	0.000	23.963	0.000	31.3610	31.288
95.0	7.917	0.074	0.014	0.000	1.865	0.000	27.646	0.000	35.2340	35.160
96.0	8.000	0.074	0.014	0.000	1.911	0.000	31.500	0.000	39.2732	39.199
97.0	8.083	0.074	0.014	0.000	1.956	0.000	33.177	0.000	41.1306	41.056
98.0	8.167	0.075	0.014	0.000	2.000	0.000	34.429	0.000	42.5599	42.485
99.0	8.250	0.075	0.014	0.000	2.043	0.000	35.637	0.000	43.9411	43.866
100.0	8.333	0.076	0.014	0.000	2.085	0.000	36.806	0.000	45.2792	45.204
101.0	8.417	0.076	0.015	0.000	2.126	0.000	37.939	0.000	46.5781	46.502
102.0	8.500	0.076	0.015	0.000	2.167	0.000	39.039	0.000	47.8409	47.764
103.0	8.583	0.077	0.015	0.000	2.206	0.000	40.109	0.000	49.0705	48.994
104.0	8.667	0.077	0.015	0.000	2.246	0.000	41.151	0.000	50.2696	50.192
105.0	8.750	0.077	0.015	0.000	2.284	0.000	42.167	0.000	51.4402	51.363
106.0	8.833	0.078	0.015	0.000	2.322	0.000	43.159	0.000	52.5843	52.506
107.0	8.917	0.078	0.015	0.000	2.359	0.000	44.129	0.000	53.7038	53.626
108.0	9.000	0.079	0.015	0.000	2.395	0.000	45.078	0.000	54.8000	54.721
109.0	9.083	0.079	0.015	0.000	2.431	0.000	46.008	0.000	55.8744	55.795
110.0	9.167	0.079	0.016	0.000	2.467	0.000	46.919	0.000	56.9285	56.849
111.0	9.250	0.080	0.016	0.000	2.502	0.000	47.813	0.000	57.9630	57.883
112.0	9.333	0.080	0.016	0.000	2.536	0.000	48.690	0.000	58.9792	58.899
113.0	9.417	0.080	0.016	0.000	2.570	0.000	49.552	0.000	59.9781	59.898
114.0	9.500	0.081	0.016	0.000	2.604	0.000	50.399	0.000	60.9604	60.880
115.0	9.583	0.081	0.016	0.000	2.637	0.000	51.232	0.000	61.9270	61.846
116.0	9.667	0.081	0.016	0.000	2.670	0.000	52.052	0.000	62.8786	62.797
117.0	9.750	0.082	0.016	0.000	2.702	0.000	52.859	0.000	63.8159	63.734
118.0	9.833	0.082	0.016	0.000	2.734	0.000	53.654	0.000	64.7395	64.657
119.0	9.917	0.083	0.017	0.000	2.766	0.000	54.437	0.000	65.6501	65.568
120.0	10.000	0.083	0.017	0.000	2.797	0.000	55.209	0.000	66.5481	66.465
121.0	10.083	0.083	0.017	0.000	2.828	0.000	55.971	0.000	67.4340	67.351
122.0	10.167	0.084	0.017	0.000	2.859	0.000	56.722	0.000	68.3085	68.225
123.0	10.250	0.084	0.017	0.000	2.889	0.000	57.464	0.000	69.1717	69.088
124.0	10.333	0.084	0.017	0.000	2.919	0.000	58.196	0.000	70.0242	69.940
125.0	10.417	0.085	0.017	0.000	2.949	0.000	58.919	0.000	70.8666	70.782
126.0	10.500	0.085	0.017	0.000	2.978	0.000	59.633	0.000	71.6988	71.614

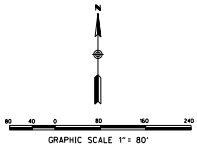
MAP POCKET 1

**Drainage Study Map
for
St. Katherine Orthodox Church
[Pre-project]**



- LEGEND:**
- BASIN BOUNDARY
 - SUB BASIN BOUNDARY
 - SUB BASIN AREA
 - NODE NUMBER
 - BASIN ID
 - FLOW PATH

RICK 5620 FRIARS ROAD
SAN DIEGO, CA 92110
619-291-0707
rickengineering.com



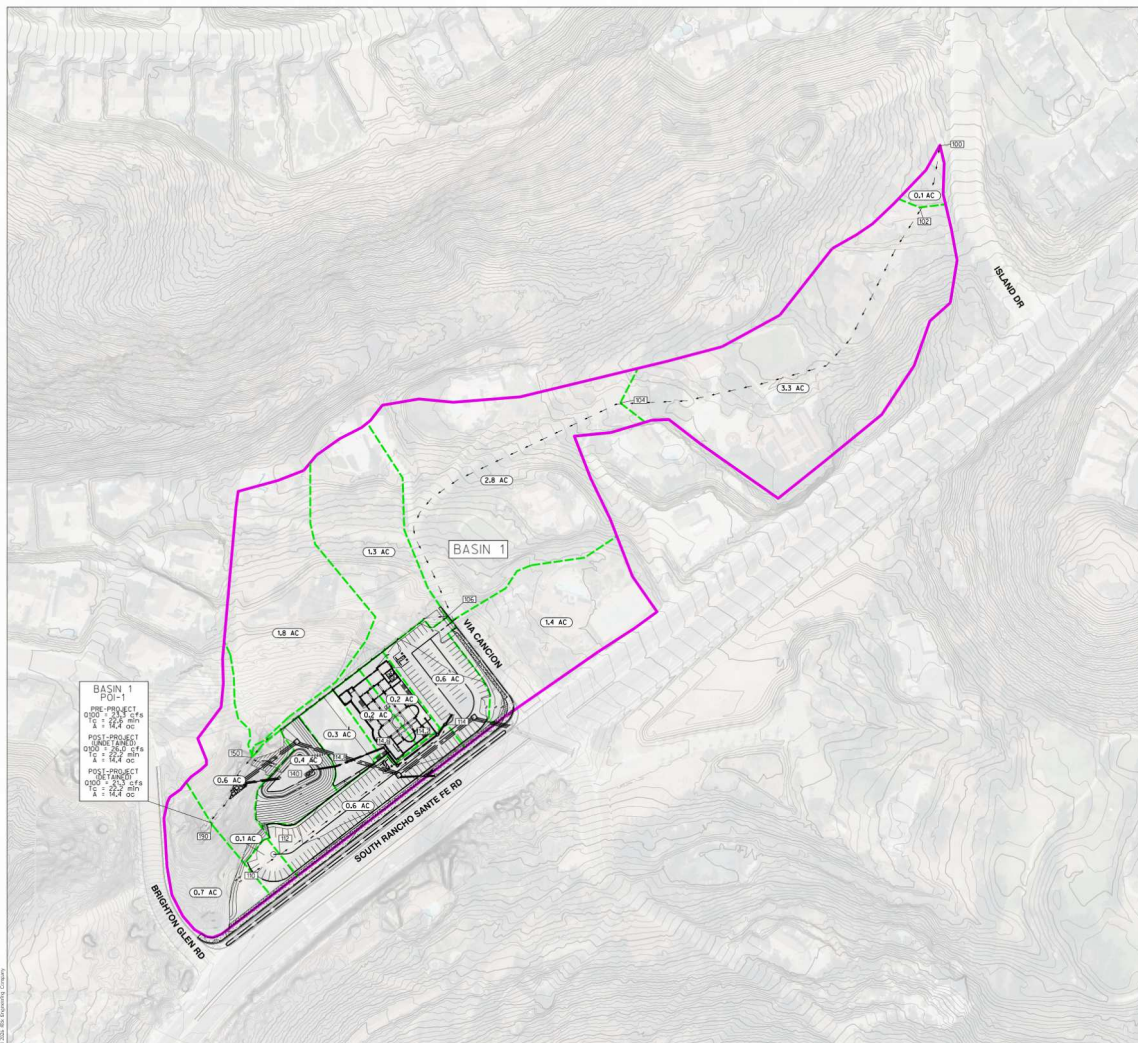
**PRE-PROJECT DRAINAGE MAP
FOR
ST KATHERINE ORTHODOX CHURCH**

J-20292 Date: July 28, 2026

NOT FOR CONSTRUCTION - EXHIBIT FOR DRAINAGE STUDY ONLY

MAP POCKET 2

**Drainage Study Map
for
St. Katherine Orthodox Church
[Post-project]**



BASIN 1
POI-1

PRE-PROJECT
Q100 = 23.3 cfs
Tc = 22.8 min
A = 14.4 ac

POST-PROJECT
(UNDETAILED)
Q100 = 26.0 cfs
Tc = 22.2 min
A = 14.4 ac

POST-PROJECT
(DETAILED)
Q100 = 21.3 cfs
Tc = 22.2 min
A = 14.4 ac

LEGEND:

BASIN BOUNDARY
SUB BASIN BOUNDARY
SUB BASIN AREA
NODE NUMBER
BASIN ID
FLOW PATH

R
RICK

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SAN DIEGO, CA 92110
619-291-0707
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POST-PROJECT DRAINAGE MAP FOR ST KATHERINE ORTHODOX CHURCH

J-20292

Date: July 28, 2026

NOT FOR CONSTRUCTION - EXHIBIT FOR DRAINAGE STUDY ONLY