ANALYSIS OF RESULTS
FOR THE COUNTY OF SAN DIEGO
RAINFALL DISTRIBUTION STUDY PROJECT

CIP No. 1140600

Prepared For:

County of San Diego, Watershed Protection Program
Department of Public Works
5510 Overland Avenue, Suite 410
San Diego, CA 92123

January 15th, 2013
Revised March 5th, 2013

Prepared By:

Bureau Veritas North America, Inc.
10620 Treena Street, Suite 200
San Diego, CA 92131
(858) 451-6100

This page is intentionally left blank to facilitate 2-sided printing.

Engineer's Certification

This report was prepared under the supervision of Sharon L. Humphreys, a Registered Civil Engineer in the State of California. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

Sharon L. Humphreys, PE, CFM, QSD/QSP
R.C.E. Number 60946



This page is intentionally left blank to facilitate 2-sided printing.

This report has been prepared through a collaboration of the following partners:

Sharon Humphreys, P.E., CFM, QSP/QSD, Bureau Veritas North America, Inc.

Charles Mohrlock, M.S., P.E., CFM, Bureau Veritas North America, Inc.

David Cooper, P.E., Bureau Veritas North America, Inc.

Jason Paquette, P.E., Bureau Veritas North America, Inc.

Dr. R. Edward Beighley, Ph.D., Adjunct Professor in Civil, Construction, and Environmental Engineering at San Diego State University

Anthony Barry, P.E., CFM, CPESC, County of San Diego Flood Control

Special thanks to the following partners for their input via phone interview:

Dennis Bowling, M.S. P.E.

Dr. Howard Chang, Ph.D., P.E.

Martin Teal, P.E., P.H., D.WRE

Dr. Theodore Hromadka, Ph.D., Ph.D., Ph.D., P.H., P.E.

Jim Zhu, P.E., CFM

Dr. R. Edward Beighley, Ph.D.

Dr. Victor Ponce, Ph.D.

This page is intentionally left blank to facilitate 2-sided printing.

TABLE OF CONTENTS

1. PROJECT INTRODUCTION 1

1.1 Project Description 1

1.2 Project History 1

1.3 Project Outline 2

2. ANALYSIS OF RESULTS 4

2.1 Characteristics of Basins Analyzed 4

2.2 Peak Stormwater Flow Rates 4

2.3 Stormwater Volumes 7

3. CONCLUSION 7

4. APPENDICES 9

LIST OF TABLES

Table 1: Characteristics of Basins Analyzed 4

Table 2: Type B, Type 1, Nested, and Gauge Results Comparison Summary – 24-hr Event 5

Table 3: Peak Flow Rates for Type B, Type 1, and Nested Distributions Represented as a Percentage of FFD Gauge Flow Rates (100-yr, 24-hr Event) 6

Table 4: Peak Flow Rates for Type B, Type 1, and Nested Distributions Represented as a Percentage of Type B and Type 1 Flow Rates (100-yr, 24-hr Event) 6

LIST OF APPENDICES

A Research Report for the County of San Diego Rainfall Distribution Study

B Stream Gauge Data Analysis for the County of San Diego Rainfall Distribution Study

C Hydrologic Basin Modeling for the County of San Diego Rainfall Distribution Study

ABBREVIATIONS AND ACRONYMS

BVNA	Bureau Veritas North America, Inc.
FFD	Flood Frequency Distributions
HEC	Hydrologic Engineering Center
HMS	Hydrologic Modeling System
SCS	Soil Conservation Service
SDCFCD	San Diego County Flood Control District
USGS	United States Geological Survey

1. PROJECT INTRODUCTION

1.1 Project Description

The County of San Diego has retained the services of Bureau Veritas North America, Inc. (BVNA) to perform an analysis of the region's current Nested rainfall distribution methodology. This analysis involved research of existing rainfall distribution methodologies utilized in the southwestern United States, processing of available United States Geological Survey (USGS) stream gauge data for six (6) basins located in the County of San Diego, and the creation of HEC-HMS models considering SCS Type B, SCS Type 1, and Nested rainfall distributions for the same six (6) basins in which stream gauge data was analyzed. The information determined from this analysis was then interpreted in an effort to aid in the selection of a rainfall distribution methodology that is most appropriate for the County of San Diego.

1.2 Project History

The 1993 County of San Diego Hydrology Manual utilized a hypothetical Type B rainfall distribution for hydrologic computations related to basins 1 square mile and greater in size. This Type B rainfall distribution was applied to 6-hour and 24-hour duration storm events by utilizing data from the tables and figures provided within the 1993 Manual. The 24-hour duration generally produced results indicative of the maximum stormwater runoff rates and volumes; however, for certain basin conditions, the 6-hour duration produced higher peak stormwater runoff rates. Therefore, separate analyses of the 6-hour and 24-hour distributions were necessary in order to determine the appropriate peak stormwater flow rates and volumes. The peak rainfall intensity for the Type B rainfall distribution occurred prior to the halfway point of the storm event (41% of storm duration) for each duration storm. For example, the 24-hour storm produced peak rainfall intensity at hour 9.84 and the 6-hour storm produced peak rainfall intensity at hour 2.46. The Type B rainfall distribution utilized in the 1993 Manual was derived from "TR-60 Earth Dams and Reservoirs" developed by the Soil Conservation Service (SCS), dated 1985.

The 2003 County of San Diego Hydrology Manual currently utilizes a hypothetical Nested rainfall distribution for hydrologic computations related to basins 1 square mile and greater in size. This Nested distribution combines calculations for the 6-hour and 24-hour storm into a single storm distribution hydrograph via rainfall intensity formulas and a log-log distribution provided within the 2003 Manual. The peak rainfall intensity for this Nested rainfall distribution occurs at the two-thirds point of the storm event (2/3:1/3 distribution). For example, the 24-hour storm produces a peak rainfall intensity at hour 16. The 2/3:1/3 Nested rainfall distribution is a modified version of the nested distribution originally described in "TD-15 Hydrologic Analysis of Ungaged Watersheds Using HEC-1", which utilized a 1/2:1/2 distribution.

When the 2003 County of San Diego Hydrology Manual was adopted, public comments indicated that the peak flow rates and volumes calculated via the Nested distribution in the

2003 Manual were larger than those calculated utilizing the Type B distribution methodology in the 1993 Manual. Prior to implementing an update to the currently used 2003 County of San Diego Hydrology Manual, the County requested that an analysis of the Nested rainfall distribution be performed so that the rainfall distribution most appropriate for the County of San Diego can be selected.

1.3 Project Outline

The County of San Diego has retained the services of Bureau Veritas North America, Inc. (BVNA) to perform an analysis of the region's current Nested rainfall distribution methodology. Tasks performed by BVNA within the scope of this analysis included research of existing rainfall distribution methodologies used in the southwestern United States (Appendix A), processing of available United States Geological Survey (USGS) stream gauge data for six (6) basins within the County of San Diego (Appendix B), and creation of HEC-HMS models considering SCS Type B, SCS Type 1, and Nested rainfall distributions for the same six (6) basins in which stream gauge data was analyzed (Appendix C). A comparison of the results from Appendices B and C was then performed in order to determine the relationship between the available USGS peak stormwater flow rates and the peak stormwater flow rates determined by the HEC-HMS models for SCS Type B, SCS Type 1, and Nested rainfall distributions.

This report is separated into four (4) parts:

Part 1: Analysis of Results for the County of San Diego Rainfall Distribution Study Project
Part 1 of the report is intended to provide a comparative analysis of the results presented in Appendices A through C in an effort to identify the rainfall distribution methodology that is most appropriate for the County of San Diego.

Part 2: Research Report for the County of San Diego Rainfall Distribution Study Project (Appendix A)
Appendix A of this report documents research on the rainfall distributions used within fourteen (14) regions of the southwestern United States; interviews with seven (7) individuals, selected by the County of San Diego, regarding their perceptions on the use and applicability of the current Nested rainfall distribution for the County of San Diego; and relevant documents reviewed including the "Report on the Calibration Analysis for the San Diego County Hydrology Manual" prepared by Hromadka and Associates, dated May 2007.

Part 3: Stream Gauge Data Analysis for the County of San Diego Rainfall Distribution Study Project (Appendix B)
Appendix B of this report documents the analysis of data from six (6) USGS stream gauges and six (6) San Diego County Flood Control District (SDCFCD) rainfall gauges within the County of San Diego. This analysis was primarily performed by Dr. R. Edward Beighley, Ph.D., professor in Civil, Construction, and Environmental Engineering at San Diego State University.

This report provides details on the estimated peak discharges for 2-year, 5-year, 10-year and 100-year storm events developed for each stream gauge location including the assessment of variations in the measured annual peak discharges over time due to urbanization and short-term and long-term climate trends. For each of the six (6) basins analyzed, event rainfall distributions for past major storms are presented and compared to event rainfall distribution curves using representative design storms such as the Nested design storm, currently recommended in the 2003 version of the San Diego Country Hydrology Manual, as well as the previously recommended Type B distribution and the Type I distribution recommended by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), formerly the Soil Conservation service (SCS). The six (6) basins analyzed in this portion of the report are listed below.

Basin Models:

1. Guejito Creek
2. Jamul Creek
3. Las Flores Creek
4. Los Coches Creek
5. Santa Maria Creek
6. Sweetwater River

Part 4: Hydrologic Basin Modeling for the County of San Diego Rainfall Distribution Study Project (Appendix C)

Appendix C of this report provides results for the analysis of the six (6) single-basin HEC-HMS hydrologic models located within the County of San Diego for which USGS stream gauge data was available and includes basin outflow hydrographs for a series of assumed storm events and storm distributions as identified below.

Basin Models:

1. Guejito Creek
2. Jamul Creek
3. Las Flores Creek
4. Los Coches Creek
5. Santa Maria Creek
6. Sweetwater River

Storm Events and Distributions Considered for Each Model:

1. SCS Type B Rainfall Distribution
    - 100-year, 10-year, 5-year, and 2-year -- 24-hour storm events
    - 100-year, 10-year, 5-year, and 2-year -- 6-hour storm events
2. SCS Type 1 Rainfall Distribution
    - 100-year, 10-year, 5-year, and 2-year -- 24-hour storm events
    - 100-year, 10-year, 5-year, and 2-year -- 6-hour storm events
3. Nested Rainfall Distribution
    - 100-year, 10-year, 5-year, and 2-year -- 24-hour storm events
    - *Note: 6-hour storm event is not applicable to the Nested rainfall distribution.

2. ANALYSIS OF RESULTS

2.1 Characteristics of Basins Analyzed

Six basins located within the County of San Diego have been analyzed within the scope of this report. The County of San Diego Flood Control staff has selected these basins by screening all available gauges and removing all basins with constraints that made them ineligible for the analysis performed herein. Table 1 below presents the range of basin characteristics associated with the basins analyzed in this report. Table 2 on the next page presents a brief summary of all basin characteristics analyzed within this report. For more detailed information on all of the basin characteristics analyzed within this report, see Appendix C.

Table 1: Characteristics of Basins Analyzed

Basin Variables	Minimum	Maximum
Basin Area (square miles)	12.2	70.1
Lag Time (minutes)	114.4	308.4
Adjusted Rainfall Depth (inches) (100 yr - 24 hr)	4.6	11.4
Adjusted CN Values (100 yr - 24 hr)	86	92

2.2 Peak Stormwater Flow Rates

The peak stormwater flow rates determined for the Type B, Type 1, and Nested rainfall distributions, as well as the peak stormwater flow rates from the observed gauge data, are provided in Table 2 on the next page. Of particular importance in this analysis are the relationships between the calculated and observed 100-year stormwater flow rates. These relationships are presented in Tables 3, 4, and the text that follows.

Table 2: Type B, Type 1, Nested, and Gauge Results Comparison Summary – 24-hr Event

Basin Variables			Guejito Creek	Jamul Creek	Las Flores Creek	Los Coches Creek	Santa Maria Creek	Sweetwater River
Basin Information [1, 2, 3]	Area (square miles)		22.5	70.1	26.6	12.2	57.0	44.5
	Lag Time (minutes)		122.3	135.2	136.8	114.4	308.4	193.0
	Adjusted Rainfall Depth (inches)	100 yr - 24 hr	7.9	6.0	4.6	6.2	5.7	11.4
		10 yr - 24 hr	5.4	3.4	3.2	3.7	3.8	6.7
		5 yr - 24 hr	4.3	3.0	2.7	3.3	3.3	5.7
		2 yr - 24 hr	3.3	2.0	1.8	2.4	2.4	4.3
	Adjusted CN Values	100 yr	90	92	86	89	88	90
		10 yr	82	88	80	84	82	79
		5 yr	82	88	80	84	82	79
		2 yr	82	88	80	84	82	79
Peak Flowrate Data [4]	Q_{100} (cfs)	Type B - 24-hr	13,566	30,473	6,951	5,599	13,188	31,986
		Type 1 - 24-hr	15,009	33,276	7,584	6,260	13,832	33,799
		Nested	13,618	28,216	9,564	5,571	15,122	27,421
		FFD Gauge	6,610	12,600	13,200	1,350	17,400	21,800
	Q_{10} (cfs)	Type B - 24-hr	6,862	12,876	2,876	2,313	5,859	13,285
		Type 1 - 24-hr	7,571	14,055	3,110	2,566	6,208	14,178
		Nested	7,447	15,218	4,250	2,894	7,684	14,479
		FFD Gauge	1,040	2,240	1,460	572	2,410	2,580
	Q_5 (cfs)	Type B - 24-hr	4,822	10,651	2,030	1,914	4,592	10,379
		Type 1 - 24-hr	5,308	11,619	2,188	2,117	4,875	11,087
		Nested	5,756	13,899	3,344	2,459	6,058	11,788
		FFD Gauge	467	975	537	386	968	1,040
	Q_2 (cfs)	Type B - 24-hr	3,067	5,384	753	1,070	2,505	6,505
		Type 1 - 24-hr	3,359	5,844	801	1,172	2,673	6,960
		Nested	4,146	8,058	1,588	1,535	3,633	7,603
		FFD Gauge	98	166	69.4	173	146	185

1. Lag Time Calculations are included in Appendix C.5 of this report.
2. Adjusted rainfall depths as determined per calculations in Appendix C.7 of this report. These depths are applicable to Type 1 and Type B storms only, refer to Appendix C.10 for the Nested adjusted rainfall depths.
3. Adjusted CN values as determined per calculations in Appendix C.4 of this report.
4. Peak discharge flow rates (cfs) as determined per HEC-HMS Output included in Appendix C.12 of this report.

Table 3: Peak Flow Rates for Type B, Type 1, and Nested Distributions Represented as a Percentage of FFD Gauge Flow Rates (100-yr, 24-hr Event)

Distributions Compared	Guejito Creek	Jamul Creek	Las Flores Creek	Los Coches Creek	Santa Maria Creek	Sweetwater River
Type B / FFD Gauge	205%	242%	53%	415%	76%	147%
Type 1 / FFD Gauge	227%	264%	57%	464%	79%	155%
Nested / FFD Gauge	206%	224%	72%	413%	87%	126%
FFD Gauge / FFD Gauge	100%	100%	100%	100%	100%	100%

Table 3 above represents the peak flow rates calculated in HEC-HMS versus the flow rates derived from available USGS data (FFD Gauge) as a percentage value. The observed FFD Gauge flows are represented by a value of 100%, while flows for the Type B, Type 1, and Nested distributions are represented as a percentage of the FFD Gauge data. For each basin, the rainfall distribution method producing results nearest to 100% is considered the most accurate.

The HEC-HMS calculated results range from 53% to 464% of the observed FFD Gauge data. For 5 of the 6 basins analyzed, the Nested distribution produced peak flow rates that were closer to the provided FFD Gauge data than the peak flow rates calculated for the Type B and Type 1 distributions. For 1 of the 6 basins analyzed, the Type B distribution produced peak flow rates that were closest to the provided FFD Gauge data; however, even in this case the peak flow rates for the Nested distribution were within 1% of the Type B peak flow rates.

Table 4: Peak Flow Rates for Type B, Type 1, and Nested Distributions Represented as a Percentage of Type B and Type 1 Flow Rates (100-yr, 24-hr Event)

Distributions Compared	Guejito Creek	Jamul Creek	Las Flores Creek	Los Coches Creek	Santa Maria Creek	Sweetwater River
Type 1 / Type B	111%	109%	109%	112%	105%	106%
Nested / Type B	100%	93%	138%	100%	115%	86%
Nested / Type 1	91%	85%	126%	89%	109%	81%

Table 4 above illustrates the relationship of calculated peak flow rates for the Type B, Type 1, and Nested rainfall distributions.

Type 1 Compared to Type B

The Type 1 and Type B peak flow rate calculations produced results that were comparable, varying from 5% to 12% of one another. In all cases analyzed, the Type 1 distribution produced a greater peak flow rate than the Type B distribution. This can be attributed to the fact that the Type 1 distribution produces a shorter, more intense maximum rainfall period that

occurs at a later point than the Type B distribution. The consistency of the Type 1 and Type B results is logical because all of the input variables, except for the actual rainfall distribution ratios, are identical.

Nested Compared to Type 1 and Type B

The Nested distribution calculations did not produce 100-yr peak flow rates that were comparable to results from the Type 1 or Type B distributions. When compared, the calculated 100-yr Nested and Type B or Type 1 peak flow rates varied from -19% to 38% of one another. Given the range of results, it cannot be stated that the Nested distribution produces peak stormwater flow rates that are consistently higher or lower than the results obtained from the Type B or Type 1 distributions. Observation of these results indicate that for 3 out of the 6 basins analyzed, the Nested distribution produces 100-yr peak flow rates that are less than the peak flow rates calculated via Type 1 or Type B distributions. For 2 out of the 6 basins analyzed, the Nested distribution produced a 100-yr higher peak flow rate than the Type 1 or Type B distributions. For 1 out of the 6 basins, the Nested distribution produced a 100-yr peak flow rate between the Type 1 and Type B storms. The variation of results between the Nested and Type 1 or Type B distributions is logical because the Nested distribution uses different Rainfall Depth-Area Adjustment Factors, combines rainfall data from 6-hour and 24-hour storms into a single distribution, and utilizes an entirely different rainfall distribution method.

2.3 Stormwater Volumes

Stormwater runoff volumes associated with the 100-year storm events could not be determined based on the gauge data that was available for this study. The scope of this report does not analyze these events with respect to volume.

3. CONCLUSION

The County of San Diego maintains a strong commitment to the implementation of flood control policies and procedures that consistently produce results that are scientifically and historically appropriate for the San Diego region. As stated in the 2003 County of San Diego Hydrology Manual:

> *The purpose of this manual is to provide a uniform procedure for flood and stormwater analysis within San Diego County. It provides a guide for policies and procedures based upon the science and data available to attain reasonable standardization of hydrology studies throughout the county […].*
>
> *Flood management hydrology deals with estimating flow peaks, volumes, and time distributions of storm runoff. The prediction of these characteristics is fundamental to the design of stormwater management facilities. Errors in the estimates may result in a stormwater management facility that is either undersized and fails to provide public safety and flood protection or is oversized and costs more than necessary. On the other hand, the timing, distribution, and intensity of rainfall is a natural process subject to*

considerable variability. The science of hydrology attempts to make predictions based upon historical rainfall data and an understanding of the relationship between precipitation and runoff. (2003 Manual)

Given the inherent variability of natural hydrologic parameters utilized in the calculation of peak stormwater flow rates and volumes, the application of policy and procedure-based methods for hydrologic calculations may not always produce the most accurate results possible. When available, observation of local stream gauge data may be used to more accurately develop peak discharges and hydrographs. While observation of stream gauge data may be an accurate method of determining peak stormwater flow rates and volumes, incorporating this method as a standard policy of flood management hydrology is infeasible due to the number of stream gauges that would be required throughout the County.

The information presented in the Stream Gauge Data Analysis Report provided in Appendix B of this report, suggests that all three design storms generally agree with the observed rainfall patterns. The primary difference between the observed and design storm patterns is related to the fraction of rainfall occurring before the maximum 6-hour period. In general, the observed rainfall patterns received about 6-7 percent more rainfall prior to the start of the peak period relative to the Type I and Type B storms and about 8 percent less rainfall relative to the Nested storm. The observed rainfall patterns also received about 7 percent more rainfall during the peak period relative to the Nested storm and 3-4 percent more rainfall relative to the Type I and Type B storms, respectively.

The information presented in the Hydrologic Basin Modeling Report provided in Appendix C of this report, and summarized in Table 2 herein, illustrates the variability of the results that can occur between calculated and observed peak flow rates. This variability highlights the point made in the 2003 Manual that flood management hydrology is intended to allow for an estimation of pertinent flow characteristics such as peak stormwater flow rates to be made.

With respect to the scope of this report, regarding the selection of the most appropriate rainfall distribution methodology for implementation into the updated County Hydrology Manual, it is the County's duty to select a rainfall distribution that most consistently, conservatively, and accurately duplicates the peak 100-year stormwater flow rates and volumes observed within the available historic gauge data. As presented in Table 3 herein, the Nested distribution produced the most accurate, conservative, and precise results between the three rainfall distributions analyzed. The Nested distribution produced peak 100-year stormwater flow rates ranging from 76 to 413 percent of the observed gauge data, while the Type B and Type 1 distributions produced flow rates that ranging from 53 to 415 percent and 57 to 464 percent respectively. Based on this data, the Nested rainfall distribution appears to produce results that are most characteristic of the County's needs.

4. APPENDICES

A	Research Report for the County of San Diego Rainfall Distribution Study
B	Stream Gauge Data Analysis for the County of San Diego Rainfall Distribution Study
C	Hydrologic Basin Modeling for the County of San Diego Rainfall Distribution Study

This page is intentionally left blank to facilitate 2-sided printing.

APPENDIX A:
RESEARCH REPORT
FOR THE COUNTY OF SAN DIEGO
RAINFALL DISTRIBUTION STUDY PROJECT

CIP No. 1140600

Prepared For:

County of San Diego, Watershed Protection Program
Department of Public Works
5510 Overland Avenue, Suite 410
San Diego, CA 92123

January 15th, 2013

Prepared By:

Bureau Veritas North America, Inc.
10620 Treena Street, Suite 200
San Diego, CA 92131
(858) 451-6100

This page is intentionally left blank to facilitate 2-sided printing.

Engineer's Certification

This report was prepared under the supervision of Charles S. Mohrlock, a Registered Civil Engineer in the State of California. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.



Charles S. Mohrlock, M.S., P.E., CFM
R.C.E. Number 78322

This page is intentionally left blank to facilitate 2-sided printing.

TABLE OF CONTENTS

1. PROJECT INTRODUCTION 1

2. RAINFALL METHODOLOGY RESEARCH 1

2.1 Rainfall Methodology Research Locations 1

2.2 Site Specific Rainfall Methodology Research 2

2.2.1 Alameda County Rainfall Methodology Research Results 2

2.2.2 County of Sacramento Rainfall Methodology Research Results 2

2.2.3 Orange County Rainfall Methodology Research Results 4

2.2.4 County of San Bernardino Rainfall Methodology Research Results 7

2.2.5 County of Kern Rainfall Methodology Research Results 8

2.2.6 County of San Joaquin Rainfall Methodology Research Results 10

2.2.7 Imperial Irrigation District (Draft) Rainfall Methodology Research Results 11

2.2.8 Fresno County Rainfall Methodology Research Results 11

2.2.9 Los Angeles County Rainfall Methodology Research Results 12

2.2.10 City of Los Angeles Rainfall Methodology Research Results 14

2.2.11 Riverside County Flood Control and Water Conservation District Rainfall Methodology Research Results 14

2.2.12 County of Santa Clara Rainfall Methodology Research Results 14

2.2.13 Flood Control District of Maricopa County Rainfall Methodology Research Results 15

2.2.14 Pima County Regional Flood Control District Rainfall Methodology Research Results 16

3. INTERVIEWS WITH REGIONAL WATER RESOURCE EXPERTS 16

3.1 Water Resource Experts Interviewed 16

3.2 Information Collected During Interviews 16

3.2.1 Interview with Dennis Bowling, M.S., P.E. 16

3.2.2 Interview with Dr. Howard Chang, Ph.D., P.E. 17

3.2.3 Interview with Martin Teal, P.E., P.H., D.WRE 18

3.2.4 Interview with Dr. Theodore Hromadka, Ph.D., Ph.D., Ph.D., P.H., P.E. 18

3.2.5 Interview with Jim Zhu, P.E., CFM 19

3.2.6 Interview with Dr. R. Edward Beighley, Ph.D. 20

3.2.7 Interview with Dr. Victor Ponce, Ph.D. 20

4. REVIEW OF THE HROMADKA REPORT 23

4.1 Review of Hromadka Report 23

4.2 Review of Supporting Material for Hromadka Report 25

5. SUMMARY OF RAINFALL DISTRIBUTION METHODOLOGY RESEARCH CONDUCTED 26

5.1 Summary of Research Conducted 26

5.2 Summary of Interviews Conducted 28

5.3 Summary of Review of Hromadka Report 29

5.3.1 Summary of Review of Hromadka Report 29

5.3.2 Summary of Supporting Material for Hromadka Report 29

6. REFERENCES 30

7. APPENDICES 31

LIST OF TABLES

Table 1: Summary of Rainfall Distribution Methodology Research 27

Table 2: Summary of Interviews Conducted 28

LIST OF EXHIBITS

Exhibit 1: Short Duration and Long Duration Rainfall Distribution for the City and County of Sacramento 3

Exhibit 2: Rainfall Distribution for Orange County 4

Exhibit 3: Rainfall Distribution for Flow-Through Detention Basins in Orange County 5

Exhibit 4: Rainfall Distribution for Flow-By Detention Basins in Orange County 6

Exhibit 5: Rainfall Distribution for San Bernardino County 7

Exhibit 6: Rainfall Distribution for Kern County 9

Exhibit 7: Rainfall Distribution for San Diego County (Figure 4-1 of 2003 SDCHM) 21

Exhibit 8: Rainfall Depth-Area Adjustment Curves for San Diego County (Figure 4-2 of 2003 SDCHM) 22

LIST OF APPENDICES

A.1	Report on the Calibration Analysis for the San Diego County Hydrology Manual (2007)
A.2	Derivation of a Rainfall-Runoff Model to Compute N-Year Floods for Orange County Watershed (1987)
A.3	Standard Project Flood Determination, Engineer Manual No. 1110-2-1411 (1965)
A.4	Hydrologic Analysis of Ungaged Watersheds Using HEC-1, Training Document No. 15 (1982)

ABBREVIATIONS AND ACRONYMS

BVNA	Bureau Veritas North America, Inc.
CN	Curve Number
DWR	California State Department of Water Resources
HDM	Highway Design Manual
HEC	Hydrologic Engineering Center
HMS	Hydrologic Modeling System
IDF	Intensity-Duration-Frequency
LACDA	Los Angeles County Drainage Area
NEH	National Engineering Handbook
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
OCEMA	Orange County Environmental Management Agency
SCS	Soil Conservation Service
SDCHM	San Diego County Hydrology Manual
TD	Training Document
TDS	Return Period – Duration Specific
TR	Technical Release
USACE	United States Army Corps of Engineers

1. PROJECT INTRODUCTION

The County of San Diego has retained the services of Bureau Veritas North America, Inc. (BVNA) to perform an analysis of the region's current Nested rainfall distribution methodology. Tasks performed by BVNA within the scope of this analysis included research of existing rainfall distribution methodologies used in the southwestern United States (Appendix A), processing of available United States Geological Survey (USGS) stream gauge data for six (6) basins within the County of San Diego (Appendix B), and creation of HEC-HMS models considering SCS Type B, SCS Type 1, and Nested rainfall distributions for the same six (6) basins in which stream gauge data was analyzed (Appendix C). A comparison of the results from Appendices B and C was then performed in order to determine the relationship between the available USGS peak stormwater flow rates and the peak stormwater flow rates determined by the HEC-HMS models for SCS Type B, SCS Type 1, and Nested rainfall distributions.

This portion of the report, Appendix A, performed research on the rainfall distributions used within fourteen (14) regions of the southwestern United States; interviewed seven (7) individuals, selected by the County of San Diego, regarding their perceptions on the use and applicability of the current Nested rainfall distribution; and reviewed relevant documents including the "Report on the Calibration Analysis for the San Diego County Hydrology Manual" prepared by Hromadka and Associates, dated May 2007, hereinafter referred to as the Hromadka Report.

2. RAINFALL METHODOLOGY RESEARCH

2.1 Rainfall Methodology Research Locations

The rainfall distribution methodologies for the following areas have been researched within the scope of this report:

1. Alameda County, California
2. County of Sacramento, California
3. County of Orange, California
4. County of San Bernardino, California
5. County of Kern, California
6. County of San Joaquin, California
7. Imperial Irrigation District, California
8. Fresno County, California
9. Los Angeles County, California
10. City of Los Angeles, California
11. Riverside County, California
12. Santa Clara County, California
13. Maricopa County, Arizona
14. Pima County, Arizona

2.2 Site Specific Rainfall Methodology Research

Site specific rainfall methodology research was conducted by visiting websites hosted by the jurisdiction being studied and reviewing the information obtained from the search. Where appropriate, specific passages from the reviewed manuals are repeated herein without edits. All relevant manuals are referenced at the end of this report to provide clear credit for the information obtained.

2.2.1 Alameda County Rainfall Methodology Research Results

The Alameda County Hydrology and Hydraulics Manual, dated June 2003, indicates a hypothetical rainfall distribution has been adopted for use within the County. The County uses a synthetic unit hydrograph method to transform the hypothetical rainfall distribution and design rainfall depth into a design runoff hydrograph. The District has adopted a modified Snyder Unit Hydrograph method that appears to work well within the hydrologic and topographic variations found in the County. This method is used by the County to provide the engineer with peak discharge information necessary to design conveyance as well as detention facilities.

Alameda County has adopted a 6-hour design storm distribution for calculation of peak discharges from watersheds larger than one square mile and up to twenty square miles. The 6-hour distribution is used to determine design discharges for all primary facilities with drainage areas greater than one square mile. A 24-hour design storm distribution is used for calculation of peak discharges from watersheds larger than twenty square miles, and for use in detention basin design.

The adopted 6-hour and 24-hour cumulative rainfall distribution patterns are based on 15-minute time increments. The 15-minute time increment is adequate for determining peak design flow rates for the range of applicability of the synthetic unit hydrograph method. The 24-hour distribution is used for determining required design volumes for detention basins but is not used for associated peak discharge rates.

2.2.2 County of Sacramento Rainfall Methodology Research Results

The City and County of Sacramento Drainage Manual, dated December 1996, indicates design storms are obtained from a statistical analysis of local precipitation records. The use of design storms limits facility design to a narrow range of the possible precipitation patterns and durations. For the planning and design of facilities which are highly dependent on the temporal distribution and volume of precipitation, such as detention facilities, the use of historic storms may be more appropriate. The City or County may require the use of historic storms to determine runoff volumes. Additionally, the City or County may require the reconstitution of historic storms to calibrate hydrologic models. Point precipitation records at gauges have been used in the past, but radar imagery is beginning to be used as well. Continuous simulation involves the use of historical, long-term precipitation records rather than a single design storm

or historic storm. Continuous simulation can sometimes provide a better approximation of drainage facility reliability.

The Sacramento Method of development of design storms includes two types of design storms, short-duration and long-duration. The design storm selected is dependent on whether peak flow or total volume of runoff is desired. The rainfall distribution (or temporal distribution) is a single cloudburst for short-duration storms and multiple events for long-duration storms. Short-duration storms are considered to be 6-hr, 12-hr and 24-hr storms. Long-duration storms are considered to be 36-hr, 5-day and 10-day storms.

The temporal distribution of rainfall varies with respect to characteristics such as the type of storm, intensity of the storm, and the duration of the storm, all of which have an affect the calculated runoff hydrograph. There is no typical distribution that is applicable to all precipitation events. For design purposes, two different temporal distributions based on the storm duration are included in the Sacramento method.

The short-duration storm is a symmetrical precipitation distribution selected to represent the short duration storms in Sacramento County. A symmetrical precipitation distribution is constructed such that the depth specified for any duration occurs during the central part of the storm. The design storm pattern consists of critical incremental precipitation depths nested within the storm duration in an alternating pattern with the maximum value in the center and the second highest value to the right of center. With this nested pattern, the critical storm depth for all durations less than the total duration of the storm are nested within the storm. This pattern is referred to as a balanced storm. Time increments of 5 minutes are recommended for the calculation of precipitation for design storms in Sacramento County.

Long-duration storms in the Sacramento area typically consist of several precipitation events separated by periods of either low intensity precipitation or no precipitation. Precipitation patterns for long duration storms were developed from an analysis of historical storms. Example short-duration and long-duration storm rainfall distributions are illustrated in Exhibit 1 at right.

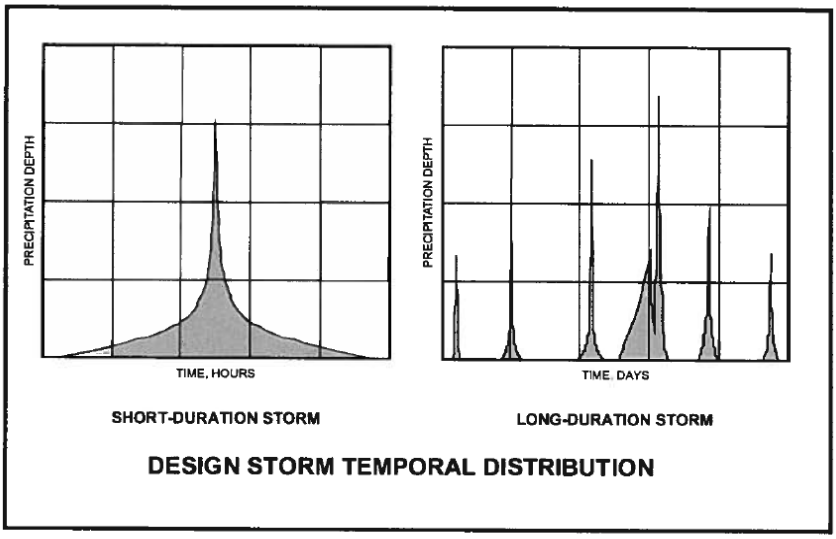


Exhibit 1: Short Duration and Long Duration Rainfall Distribution for the City and County of Sacramento

2.2.3 Orange County Rainfall Methodology Research Results

Three different design storms are used within Orange County to address watersheds without detention basins, watersheds with flow-through detention basins and watersheds with flow-by detention basins.

For watersheds that do not contain detention basins, the unit hydrograph method calculation is used with the peak storm centered around 16 hours for the 24 hour storm event as illustrated in Exhibit 2 below. After calculation of the unit time interval precipitation depths, the depths are arranged into the storm pattern shown so that the peak unit interval occurs at two-thirds of the storm duration.

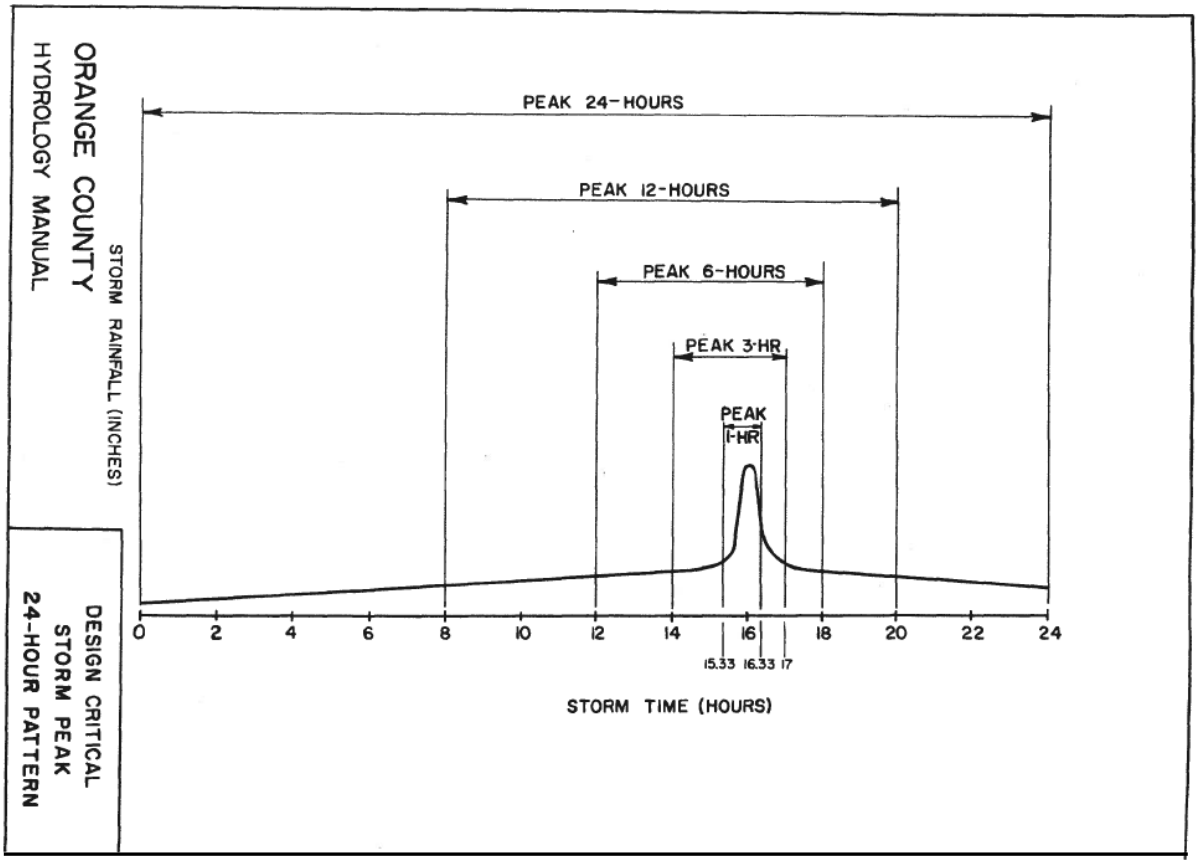


Exhibit 2: Rainfall Distribution for Orange County

For watersheds with flow-through detention basins, a multiday design storm is used and the rainfall distributed as depicted in Exhibit 3 below. Successive day storms are developed and added in the front of the previously developed design storm pattern until the detention basin system demonstrates no increase in the required basin volume due to the further extension of the design storm pattern. The extended design storm is constructed from an arrangement of rainfalls of identical T-year return frequency. Even though a two day or longer duration multiday storm is being used to test the detention basin's level of flood protection, the extended design storm still contains no more than T-year rainfall depths for the extended duration.

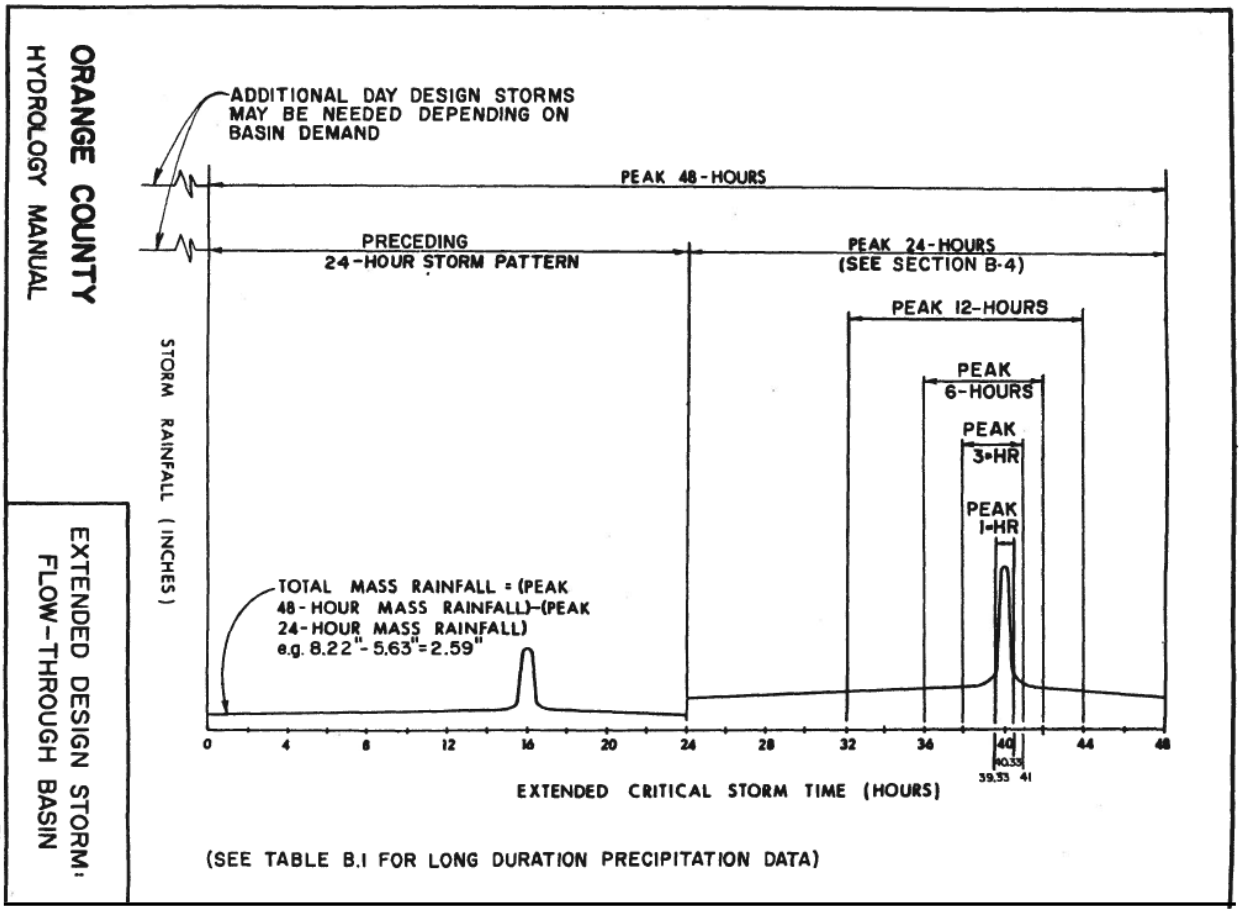


Exhibit 3: Rainfall Distribution for Flow-Through Detention Basins in Orange County

For watersheds with flow-by detention basins, a slightly revised multiday storm configuration is used as depicted in Exhibit 4 below.

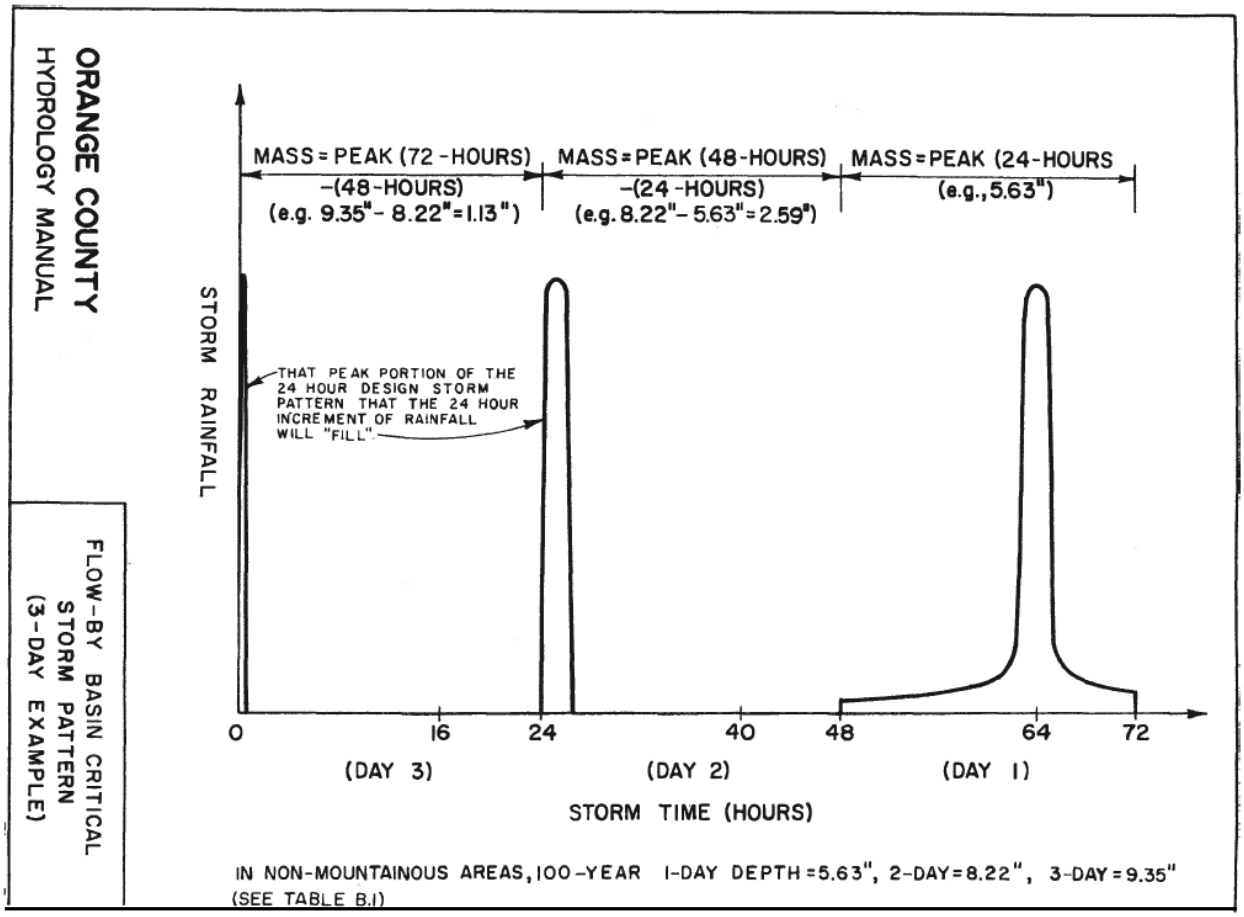


Exhibit 4: Rainfall Distribution for Flow-By Detention Basins in Orange County

2.2.4 County of San Bernardino Rainfall Methodology Research Results

The County of San Bernardino has prepared rainfall isohyetal maps in order to analyze point precipitation patterns within a watershed based on the NOAA Atlas 2. The rainfall data obtained from the NOAA Atlas 2 should be checked against current frequency analysis for all rain gauges within the study watershed and adjustments made as necessary and as approved by the County.

The peak 5-minute, 30-minute, 1-hour, 3-hour, 6-hour and 24-hour area averaged point precipitation values are required in order to develop the design storm pattern to be used to compute the watershed runoff hydrograph for the subject rainfall return frequency. Unit hydrograph studies must be submitted for review and approval by the County.

The design storm pattern is based upon a single synthetic 24-hour critical storm pattern which includes the peak rainfall intensities estimated for the 5-minutes, 30-minute, 1-hour, 3-hour, 6-hour and 24-hour durations. The storm pattern is developed from the watershed area-averaged point precipitation values and modified incrementally according to the depth-area curves published in the County's Manual. The assignment of peak values within the synthetic critical storm pattern is depicted in Exhibit 5 below.

For large watersheds (e.g. 5 square miles and larger), or for detention basin studies, the entire 24-hour synthetic storm pattern may be required for hydrologic study purposes. For smaller watershed (less than 5 square miles) where only peak runoff rates are required, the peak 3-hours of the 24-hour synthetic storm pattern can generally be used for study purposes.

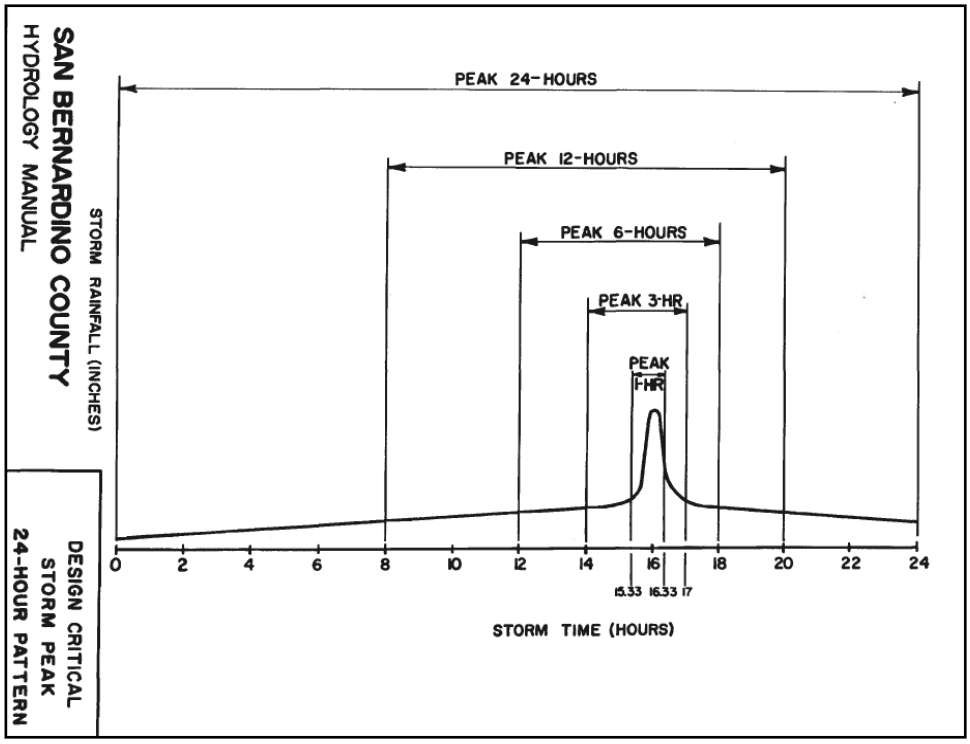


Exhibit 5: Rainfall Distribution for San Bernardino County

2.2.5 County of Kern Rainfall Methodology Research Results

The hydrologic procedures for Kern County are based on the design storm rainfall-runoff model calibration study conducted by Dr. Hromadka for the Orange County Environmental Management Agency (OCEMA) and the San Bernardino County Water Resources Division.

The Kern County Manual indicates a calibrated design storm rainfall-runoff model should satisfy three major characteristics. First, the runoff portion of the model should reproduce observed flood events with a reasonable accuracy given adequate observed rainfall for the event. Second, the calibrated design storm model should reproduce n-year peak discharge frequency curves from stream gauge data with reasonable accuracy. A Nested duration storm pattern, also referred to as a "balanced" storm in TD-15, was used to provide uniform return frequency rainfalls for all durations. The Manual further indicates that because every watershed is sensitive to a particular duration of rainfall that will produce the peak discharge, a Nested duration design storm ensures that each watershed will receive the design frequency depth of rainfall for its critical duration. In the design storm, the maximum 5 minutes of rainfall is nested within the maximum 10 minutes, the maximum 10 minutes within the maximum 15 minutes and so forth until a 24-hour storm pattern is developed. A 2/3, 1/3 time distribution with T-year frequency rainfalls nested about hour 16 of the 24-hour storm was chosen due to the sensitivity in reservoir or detention basin design with respect to storm pattern shape.

In order to calibrate the design storm for the model so that the peak flow rate estimates represent local flood frequency tendencies, an objective criterion for flood protection must be specified. Not only is the 100-year flood, for example, selected as a targeted level of flood protection, but also a level of confidence in estimating (or exceeding) the 100-year flood must be specified. This specification for a hydrologic model then becomes a policy statement for flood control. The results of the calibration are specified in terms of T-year precipitation needed to produce 50-percent and 85-percent confidence level T-year peak discharge, given all other hydrologic parameters invariant.

Third, the calibrated design storm rainfall runoff model should be transportable to ungauged watersheds with assurance that the computed peak discharges are a reasonable estimate of T-year peak discharges. This can be achieved because the parameters that vary with physical characteristics of a watershed are all deterministic: S-graph, lag and loss function. The calibrated design storm provides considerable assurance that the appropriate modification for the deterministic variables, reasonable estimates of n-year peak discharges will result.

The rainfall distribution for Kern County is depicted in Exhibit 6 on the next page.

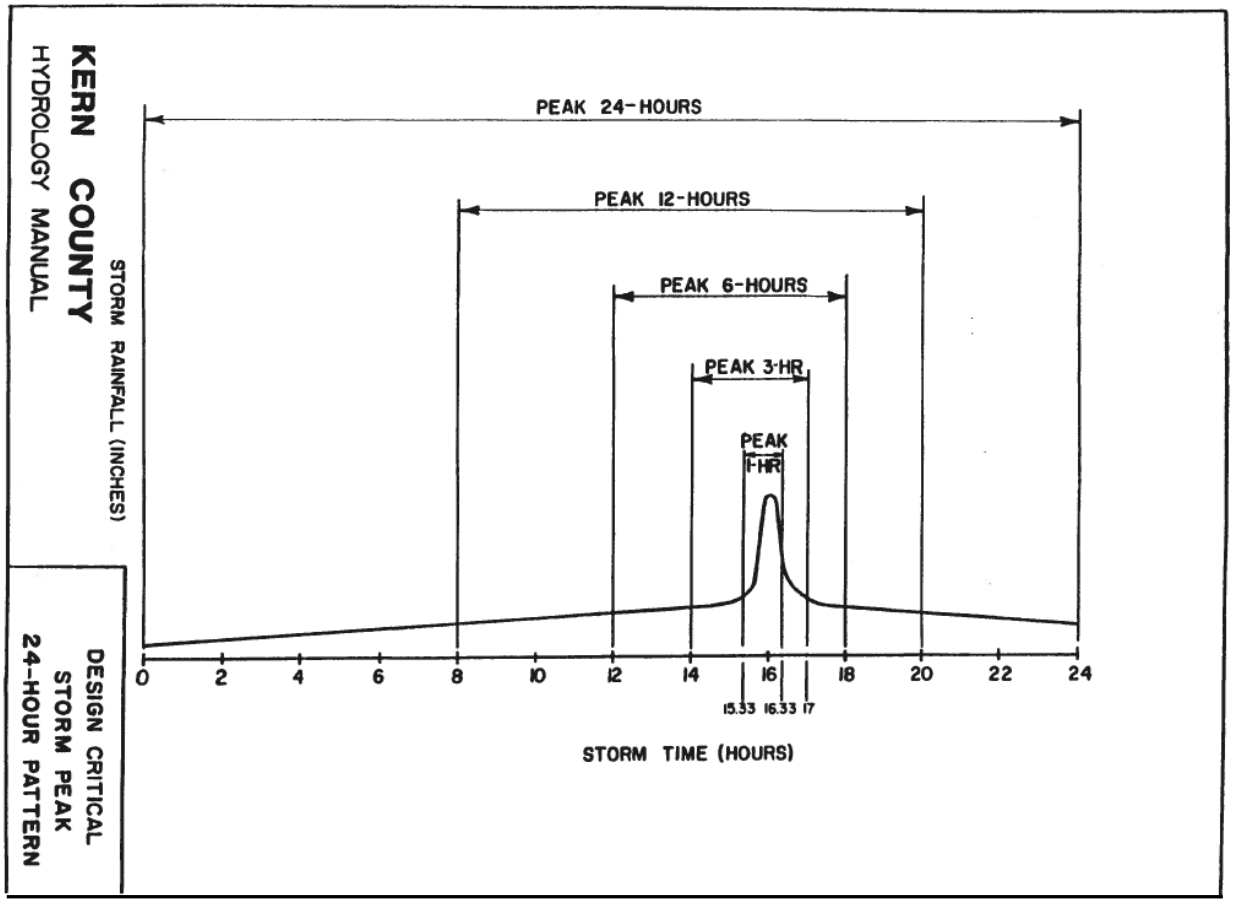


Exhibit 6: Rainfall Distribution for Kern County

2.2.6 County of San Joaquin Rainfall Methodology Research Results

The County of San Joaquin specifies the rational method for smaller watersheds and hydrograph methods of analysis for the larger, more complex watersheds. While the County indicates for the Rational Formula to be used for small watersheds, generally less than 200 acres, the model does not take into consideration such factors as available storage and varying times of travel. A hydrograph method is also required for the modeling of a proposed detention basin. The following is a summary of the three hydrologic models and associated rainfall distributions acceptable by the County for the modeling of existing and proposed watershed areas.

Technical Release No. 20 (TR-20):

The Soil Conservation Service (SCS) originally developed the TR-20 hydrologic model. The TR-20 computer program develops flood hydrographs and routes the flow through stream channels and reservoirs. It is capable of combining hydrographs and determining peak discharges, time of occurrence, and water surface elevations. The program provides for analysis of up to nine different rainfall distributions over a watershed under various combinations of land treatment, floodwater retarding structures, diversions, and channel modification. Such analysis can be performed on as many as 200 subwatersheds or reaches and 99 structures in any one continuous run.

Technical Release No. 55 (TR-55):

Technical Release No. 55 (TR-55) uses a derivation of the TR-20 Hydrograph methods to develop flood hydrographs. As a simplified version of the TR-20 model, it allows the designer to evaluate a watershed and develop comparable results without using the more complex TR-20 model. The input variables required with TR-55 include Curve Number (CN), Time of Concentration (Tc), and drainage area. The model is based on a 24-hour statistical design event. The total rainfall volume and appropriate rainfall distribution for the design storm is to be derived in accordance with the recommendations of the NRCS.

U.S. Army Corps of Engineers HEC-1:

The U.S. Army Corps of Engineers Hydrologic Engineering Center developed the hydrology program HEC-1. The model is capable of analyzing flood events for a wide range of conditions, from small urban watersheds, to large multiple watershed river basins. The basic components of the model include the development of surface runoff for each watershed, channel and reservoir routing, and the combining of hydrographs at confluences. The model also contains numerous program options such as Dam Break Analysis, flood damage modeling and many others, which in general only pertain to large scale capital improvements. The HEC-1 computer model is based on the statistical design storm required by these standards and the standard

methodologies set forth in the most recent version of the U.S. Army Corps of Engineers HEC-1 hydrologic computer model.

2.2.7 Imperial Irrigation District (Draft) Rainfall Methodology Research Results

The Imperial Irrigation District indicates their rainfall distribution is based on the dimensionless critical storm patterns using the National Weather Service (NWS) rainfall frequency atlases developed by the Natural Resources Conservation Service (NRCS, formally the Soil Conservation Service (SCS)). The rainfall frequency data for areas less than 400 square miles, for durations up to 24 hours, and for frequencies from 1 to 100 years were used.

These critical storm patterns are based on the generalized precipitation depth-duration-frequency relationships shown in technical publications of the NWS, and precipitation depths for durations from 1 minute to 24 hours were used to derive the storm patterns. Using increments of 30 minutes, incremental precipitation depths were determined. For example, the 30-minute depth was subtracted from the 1-hour depth and the 1-hour depth was subtracted from the 1.5-hour depth. The storm patterns were formed by arranging the 30-minute incremental depths such that the maximum 30-minute depth is contained within the maximum 1-hour depth, and the maximum 1-hour depth is contained within the maximum 1.5-hour depth and so forth. Because all of the critical precipitation depths are contained within the storm pattern, the critical storm patterns may be assumed appropriate for designs on both small and large watersheds.

The Imperial Irrigation District Manual's design storm pattern is based upon a modification of the SCS 24-hour storm pattern. The design storm pattern provides a representation of local precipitation depth-duration-frequency tendencies by constructing the nested intervals to fit local recorded rainfall data. Additionally, the SCS storm pattern is further modified to include the necessary adjustments (reduction in shorter duration point precipitation values) due to watershed area effects. The procedures used to construct the 24-hour storm pattern and determine the associated rainfall depths adjusted for watershed area follow the U.S. Army Corps of Engineers methods as published in the HEC Training Document No. 15.

The Imperial Irrigation District's design storm criteria extends to a multiday design storm when needed to evaluate detention basin characteristics. A tabulation provides a ratio of daily rainfalls to the peak 24-hour mass rainfall, and is used whenever rainfall gauge data is inadequate to provide the quantities directly.

2.2.8 Fresno County Rainfall Methodology Research Results

Fresno County does not appear to have a published hydrology manual. The Fresno County improvement standards indicate all drainage designs must be in accordance with the accepted principles of Civil Engineering, their improvement standards and the latest edition of the Highway Design Manual (HDM) issued by the California Department of Transportation. The latest HDM was researched to determine what rainfall distribution methodology is used by

Caltrans. The Manual indicates that rainfall is the most common factor used to predict design discharge. Unfortunately, due to the many interactive factors involved, the relationship between rainfall and runoff is not all that well defined. Intuitively, engineers know and studies confirm, that runoff increases in proportion to the rainfall on a drainage basin. Highway design engineers are cautioned about assuming that a given frequency storm always produces a flood of the same frequency. There are analytical techniques for ungauged watersheds that are based on this assumption. A statistical analysis of extensive past rainfall records should be made before such a correlation is accepted.

The HDM further indicates rainfall event characteristics that are important to highway drainage design are:

- Intensity (rate of rainfall)
- Duration (time rainfall lasts)
- Frequency (statistical probability of how often rainfall will occur)
- Time Distribution (intensity hyetograph)
- Storm Type (orographic, convective or cyclonic)
- Storm Size (localized or broad areal extent)
- Storm Movement (direction of storm)

Rainfall distribution information is collected through federal, state, local and private sources, as well as data from rain gauges that have been analyzed by specialists with the California State Department of Water Resources (DWR).

2.2.9 Los Angeles County Rainfall Methodology Research Results

The Los Angeles County Department of Public Works' design storm uses a 24-hour cumulative unit hyetograph to describe the temporal distribution of precipitation. The unit hyetograph provides the temporal distribution of one inch of rainfall occurring over a 24-hour period.

The unit hyetograph is scaled to match design rainfall depths. Design storm rainfall depths are determined from isohyets based on hydrologic design standards. Construction of the hyetograph used the normalized intensity equation solutions with an assumption about where the inflection point of the cumulative hyetograph occurs.

Development of the rainfall hyetograph used a modified alternating block method. See *Applied Hydrology* (Chow, Maidment, and Mays. page 466, McGraw-Hill, New York, 1988) for a description and example of the alternating block method. Modifications resulted from the use of the normalized intensity curve, instead of a traditional IDF curve, and the regionally specific location of the inflection point. This process produces an incremental unit rainfall distribution for a 24-hour period. The cumulative distribution is developed by summing the incremental distribution at each time step.

Developing the unit hyetograph using the IDF equation required an assumption about the timing of the most intense rainfall. The inflection point of the cumulative unit hyetograph represents the highest intensity. An analysis of the hourly distribution of large historical 24-hour events showed rainfall intensities increasing during the first 70 to 90 percent of the period and decreasing for the remaining time. Approximately 80 percent of the total 24-hour rainfall occurs within the same 70 to 90 percent time range of the period.

The unit hyetograph assumes the rainfall inflection point occurs when 80 percent of the 24-hour rainfall total has fallen and 80 percent of the 24-hour period has elapsed. Ratios of the depth at a given time relative to the total 24-hour depth were derived from the intensity equation. These ratios were then used to define the unit hyetograph curve. The depth ratios were calculated at 5-minute time steps from 5 to 60 minutes and 60-minute time steps between 60 and 1440 minutes.

The rainfall depth ratios for each intensity were placed on either side of the inflection point. The alternating blocks were placed around the inflection point. However, instead of alternating the blocks on either side with decreasing intensity, the depth ratios for each time step were split with 20 percent of depth for each time step after the inflection point and 80 percent before the inflection point. The distribution of the time steps was similarly divided using 80 percent before the time of inflection and 20 percent after.

Most major precipitation events in Los Angeles County are the result of extratropical winter storms. Significant runoff tends to occur when these storms last several days and are comprised of several individual bands of intense precipitation. In the case of a multiple day storm, the most intense rainfall tends to occur on the last day. These observations form the basis for the Department of Public Works' 4-day design storm.

The unit hyetograph is multiplied by the 24-hour rainfall depth to produce a rainfall hyetograph for the fourth day. The first through third days have respectively 10, 40, and 35 percent of the fourth day's rainfall.

Furthermore, historical data indicates that spatial distribution of precipitation across the county is not uniform during storm events. To account for this spatial variability of rainfall, Los Angeles County Department of Public Works developed rainfall isohyetal maps for the County of Los Angeles. lsohyetal maps show the 24-hour rainfall depths expected for the 50-year storm frequency. The rainfall pattern depicted on these maps shows the influence of topography on rainfall. The isohyetal maps incorporate information from Public Works' rain gauges and the National Oceanic and Atmospheric Administration's (NOAA) gridded rainfall maps of the area. The process used NOAA's Atlas 2, 2-year, 24-hour isohyetal data to provide the spatial rainfall pattern. NOAA is a widely accepted source for meteorological data, and NOAA Atlas 2 is a recognized standard for spatial rainfall distribution data.

Detailed rain gauge analysis was performed to determine the various rainfall depth and frequency relationships. Tables summarize the relationship between various frequencies as factors of the 50-year frequency depths. The factors are normalized to the 50-year event because this event is used for Capital Flood Hydrology.

2.2.10 City of Los Angeles Rainfall Methodology Research Results

The City of Los Angeles Bureau of Engineering Manual indicates the pattern storm utilized in the Los Angeles area is a 24-hour rainfall producing 6 inches of rain. This storm is preceded by 3 days of rainfall whose peak rates are 10%, 40%, and 35% of the above peak rainfall rate. The pattern storm was developed from many rainfall records by placing the 5-minute period of highest intensity at a common time: 90 minutes clock time (or 1152 minutes elapsed time). Eighty percent of the total rainfall time of the storm occurs before the period of highest intensity. (80% x 24 hrs. x 60 min. = 1152 min.).

2.2.11 Riverside County Flood Control and Water Conservation District Rainfall Methodology Research Results

The Riverside County Flood Control and Water Conservation District obtains point rainfall data from isohyetal maps and return periods for storm durations of 3-hours, 6-hours, and 24-hours, and return periods of between 2-years and 100-years. The rainfall information is based on NOAA Atlas 2.

The 3-hour and 6-hour duration storms are considered representative of local thunderstorms which usually occur in the summer months, while the 24-hour storm is considered representative of the general storms which usually occur in the winter. In general, the 3-hour and 6-hour storms will control peak discharge for small drainage areas, and the 24-hour storm will control for large watersheds. In most cases, all three durations should be analyzed. This is especially true where a reservoir or retention basin is planned, as the long duration storms may control due to the volume of runoff, even though the peak inflow may be lower than that for short duration storms.

Rainfall patterns used in development of the 3-hour and 6-hour thunderstorm flood hydrograph are based on the Indio storm of September 24, 1939. The pattern used for development of the 24-hour general storm flood hydrographs is based on the major flood producing storm of March 1938. This pattern is considered to represent a reasonable distribution of rainfall which will cause critical runoff conditions during major storm events.

2.2.12 County of Santa Clara Rainfall Methodology Research Results

The Drainage Manual for the County of Santa Clara designates a “design storm” as a term used to describe the total rainfall depth, which is determined from the combination of the return period and storm duration. For most analyses and designs in the County, rainfall events of

interest are those with 2-year, 10-year, and 100-year return periods. The standard storm duration for rainfall simulation is 24-hours. The Manual contains an adopted 24-hour incremental rainfall distribution pattern for Santa Clara County. This pattern is based upon the 3-day December 1955 rainfall event, still considered to be the storm of record for northern California.

The precipitation pattern has been adjusted to preserve the local rainfall statistics in Santa Clara County based on the District's TDS equations, which are consistent with the IDF curves provided in the Manual. Thus, the incremental precipitation pattern provided in the Manual is balanced so that the 24-hour storm distribution may be used even where shorter duration storms are more critical. The Manual provides tabulated values of precipitation as a percentage of the total 24-hour depth. The rainfall pattern (hyetograph) can be obtained for any watershed by multiplying the incremental rainfall distribution percentages by the 24-hour rainfall depth.

2.2.13 Flood Control District of Maricopa County Rainfall Methodology Research Results

Within the Flood Control District of Maricopa County, the 6-hour storm distributions are used for flood studies and design of stormwater drainage facilities of drainage area less than 20 square miles. These distributions can also be used for drainage areas larger than 20 square miles and smaller than 100 square miles by critically centering the storm over all or portions of the drainage area to estimate the peak flood discharges that could be realized on such a watershed due to the occurrence of a local storm over the watershed.

The Maricopa County 6-hour local storm distributions consist of five dimensionless storm patterns. Pattern No. 1 represents the rainfall intensities that can be expected in the "eye" of a local storm. These high, short-duration rainfall intensities would only occur over a relatively small area near the center of the storm cell. Pattern No. 1 is an offset, dimensionless form of the hypothetical distribution derived from rainfall statistics found in the NOAA Atlas for the Western United States for the Phoenix Sky Harbor Airport location. Pattern Numbers 2 through 5 are modifications of the USACE analysis of the Queen Creek storm on August 19, 1954.

Inspection of the storm patterns indicates that the peak rainfall intensities are much greater for Pattern No. 1 than for the other pattern numbers, and that peak rainfall intensity decreases as the pattern number increases. The selection of the pattern number is based on the size of the drainage area under consideration. The maximum rainfall intensities, averaged over the entire drainage area, decrease as the size of the drainage area increases. This is to account for the spatial variability of local storm rainfall wherein the maximum rainfall intensities over the storm area decrease as the storm area increases.

The Maricopa County 24-hour storm distribution, the SCS Type II distribution, is to be used for flood studies and the design of stormwater drainage facilities within the County. The 24-hour storm distribution is used for flood studies of drainage area larger than 100 square miles. This distribution is also to be used in combination with the 6-hour storm distribution for drainage

areas between 20 and 100 square miles to determine whether a local storm or a general storm will produce the greatest flood peak discharges or the maximum flood volumes.

2.2.14 Pima County Regional Flood Control District Rainfall Methodology Research Results

Hydrologic analyses are completed with PC-Hydro software for smaller watersheds and HEC-HMS software for more complicated watersheds. PC-Hydro is essentially the rational method modified to use the CN (modified regionally) to help calculate the runoff coefficient and a basin factor as an overall measure of impedance to flow on the watershed. The NOAA 14 Upper 90% rainfall was selected to be most consistent with existing discharges in Pima County.

Two different design storms were selected for use with HEC-HMS, a 3-hour SCS Type II storm, and a 24-hour SCS Type I storm. These storms were selected based on an evaluation of the types of storms in Pima County. There are primarily two rainfall seasons in the County, a summer monsoon season that produces very localized, high intensity, short duration storms, and a winter frontal storms season that produces more widespread, longer duration rainfall.

3. INTERVIEWS WITH REGIONAL WATER RESOURCE EXPERTS

3.1 Water Resource Experts Interviewed

The County identified seven (7) water resource experts to conduct a limited interview regarding their perceptions of applicability of the Nested storm rainfall distribution used in San Diego County. The following seven (7) individuals identified are as follows:

- Dennis Bowling, M.S., P.E.
- Dr. Howard Chang, Ph.D., P.E.
- Martin Teal, P.E., P.H., D.WRE
- Dr. Theodore Hromadka, Ph.D., Ph.D., Ph.D., P.H., P.E.
- Jim Zhu, P.E., CFM
- Dr. Edward Beighley, Ph.D.
- Dr. Victor Ponce, Ph.D.

3.2 Information Collected During Interviews

The following section contains information collected during interviews. The interviewees were questioned regarding their perceptions of the applicability of the Nested rainfall distribution to San Diego County.

3.2.1 Interview with Dennis Bowling, M.S., P.E.

Dennis Bowling was interviewed at the Rick Engineering facility on August 24, 2010. Mr. Bowling participated in the development of the 2003 San Diego County Hydrology Manual and was interviewed as part of this research report in order to provide some insight on the historical

development of the currently utilized rainfall distribution. Prior to the implementation of the 2003 Manual, the 1993 Manual utilized a Type B rainfall distribution. The Type B rainfall distribution was developed by Joe Hill using a log probability analysis that the County based on several severe storms in Spring Valley in the 1970's. When the hydrology manual development committee was selecting the rainfall distribution to include in the 2003 Manual, Dr. Hromadka presented a compelling argument to revise the distribution to the balanced storm rainfall distribution documented in the "Hydrologic Analysis of Ungaged Watersheds Using HEC-1" prepared by the US Army Corps of Engineers, dated April 1982 (referred to as TD-15). In addition to adopting the rainfall distribution presented in TD-15, which contains the peak for a 24-hr storm at 12 hours, or the middle of the storm (also considered a 1/2:1/2 storm distribution), Dr. Hromadka recommended that the storm peak be centered around 16 hours (also considered a 2/3:1/3 distribution). Dr. Hromadka supported revising the TD-15 report recommendation of 1/2:1/2 distribution to 2/3:1/3 distribution because detention basins sized in San Bernardino County based on the 1/2:1/2 distribution were undersized and overflowed in several major storms in San Bernardino County. As a result, the committee adopted the Nested storm rainfall distribution with the 2/3:1/3 distribution skew. Other considerations playing into the selection of the Nested storm distribution included the fact that the original Type B distribution required two analyses be completed with one for the 6-hr storm and one for the 24-hr storm, while the Nested storm rainfall distribution was applicable to all storm durations.

After adoption of the 2003 Manual, the City of Chula Vista had consultants use the new Manual to size drainage facilities. Two consultants for the City, Mike Cairns, P.E. and Eric Mosolgo, P.E., expressed concern that the drainage facilities were much larger than they would have been if designed using the Type B rainfall distribution. The City of Chula Vista shared this concern with the County of San Diego Flood Control Division. The County then retained the services of Dr. Ted Hromadka to prepare a paper documenting why the 2/3:1/3 Nested storm rainfall distribution was selected. This paper was less clear and compelling than Dr. Hromadka's initial arguments in favor of this methodology.

Mr. Bowling expressed a strong commitment to selecting a rainfall distribution that will be most appropriate for the County of San Diego and result in appropriately sized stormwater facilities.

3.2.2 Interview with Dr. Howard Chang, Ph.D., P.E.

Dr. Howard Chang was interviewed by phone on August 24, 2010. Dr. Chang reported that he is more familiar with the Type B rainfall distribution in which 6-hr and 24-hr storms are modeled and the higher flow rate from the two models is chosen for design. Dr. Chang reported that he has not used the Nested storm distribution much except for the Miller Creek project. He observed that the difference between the 100-yr and 10-yr flow rates appeared to be smaller with the Nested storm rainfall distribution. With the Type B rainfall distribution, the difference between the 100-yr and 10-yr flow rates appeared to be larger. Dr. Chang did not have an opinion on the 2/3:1/3 distribution of rainfall. In general, he noted that the Nested storm rainfall distribution tends to result in higher peak discharges.

3.2.3 Interview with Martin Teal, P.E., P.H., D.WRE

Martin Teal was interviewed at the WEST Consultants, Inc. offices on August 27, 2010. Mr. Teal reported that the Nested storm rainfall distribution is not new. It was developed by the USACE as a hypothetical design event to size infrastructure. This distribution is used extensively throughout the country and is built into the HEC-HMS software. Mr. Teal was not asserting that, because it is used extensively, it is correct. For example, curve numbers are also used extensively because they are easy to use but are known to introduce inaccuracies.

Mr. Teal noted that balanced hypothetical storms are the way people have generally modeled rainfall distributions. For his studies, he uses a 1/2:1/2 distribution which is what he considers a balanced storm. He chose not to comment on the 2/3:1/3 skewed distribution recommended by Dr. Hromadka as he infrequently uses this distribution in his studies.

Factors affecting the confidence level in resulting stormwater flow rates and volumes were discussed. Mr. Teal believes rainfall values indicated on isopluvial rainfall maps more strongly impact flow rates and volumes than the pattern in how the rainfall is distributed. As a general note, NOAA's Atlas 14 revised the isopluvial maps for the desert regions recently but this revision did not impact the San Diego coastal region.

In general, Mr. Teal indicated that the 1/2:1/2 Nested rainfall distribution is most common in his experience, which is not to say it's the best. The 2/3:1/3 Nested rainfall distribution is more conservative for detention basins.

Mr. Teal also chose not to comment on the Type B rainfall distribution as he has used it infrequently.

3.2.4 Interview with Dr. Theodore Hromadka, Ph.D., Ph.D., Ph.D., P.H., P.E.

Dr. Hromadka was interviewed by phone on August 25, 2010. Dr. Hromadka noted that a procedure to develop a Nested storm runoff hydrograph was advanced by Leo Beard around 1972. This approach used flood frequency curve estimates for various peak durations of runoff, and resulted in a runoff hydrograph construct that had similar return frequencies of runoff quantities for any peak duration of runoff. The resulting runoff hydrograph was considered to be a "balanced runoff hydrograph", and use of such a construct resulted in a drainage network having similar return frequency levels of protection even though different times of concentration were involved. The approach was later extended by Johannes J. DeVries, as published in USACE Training Document #15, dated on or about April 1982, by building a rainfall pattern of nested peak durations of rainfall of the same return frequency. Use of such a "balanced storm" produces estimates of runoff that have the same return frequency for all peak durations, and achieves the goals set forth in the approach presented by Leo Beard.

In contrast, use of a fixed storm pattern such as the SCS Type B pattern results in a storm pattern where, in general, no two peak durations have the same return frequency of rainfall. As a result, in a drainage network with various values of time of concentration, different branches with different time of concentration values will generally have different return frequencies of rainfall being used for estimating runoff. This "unbalanced" type of storm pattern may result, in general, with a mixture of return frequency runoff storm system elements depending on the relevant time of concentration value at the particular point under study. For example, use of such an unbalanced storm pattern may result in perhaps a 10-year return frequency level of storm in the upper areas of the catchment, with perhaps 150-year return frequency rainfalls in the confluence of much larger areas, all draining to perhaps a 100-year level of protection downstream.

The TD-15 study is centered about 12 hours. The County of San Diego Nested rainfall distribution is a 2/3:1/3 distribution centered around 16 hours. This skew does not change the peak flow rate but does impact the volume of stormwater accumulated which impacts proposed basin sizes. Theoretically, the rainfall distribution could be from largest rainfall to smallest or vice versa. With the 1/2:1/2 distribution, the average is obtained. With the 2/3:1/3 distribution, the result is about one standard deviation beyond the mean. The 2/3:1/3 distribution provides the right return frequencies with an 85% confidence level for the storm timing, not the maximum, within about one standard deviation of the mean.

3.2.5 Interview with Jim Zhu, P.E., CFM

Jim Zhu was interviewed by phone on August 24, 2010. Jim noted that the Type B rainfall distribution was used prior to the implementation of the 2003 San Diego County Hydrology Manual. The first draft of the 2003 Manual continued to include the Type B rainfall distribution. However, the hydrology manual update committee discussed rainfall distribution methodologies and decided to change to the Nested storm rainfall distribution. After the Manual was implemented, the engineering community started to use the Nested storm rainfall distribution and reported that, compared with the previous Manual, peak discharges increased. At this point, Dr. Hromadka was retained to complete a calibration analysis to determine if the Nested storm rainfall distribution provided an 85% confidence level that peak discharges were appropriately selected. Jim Zhu still believes the studies resulting in the selection of the Nested rainfall distribution methodology were based on limited information and may more appropriately pertain to Los Angeles County and Orange County. The County of San Diego has decided to update the 2003 San Diego County Hydrology Manual based on the results of additional study. The results of additional study will show which rainfall distribution methodology is more applicable to San Diego County.

Jim further noted that the Nested storm rainfall distribution in the 2003 Hydrology Manual is distributed 2/3:1/3 and is based on the methodology outlined in the “Hydrologic Analysis of Ungaged Watersheds Using HEC-1” prepared by the US Army Corps of Engineers dated April 1982, referred to as TD-15. This document recommends distributing the rainfall distribution

1/2:1/2. Whether to use 2/3:1/3 or 1/2:1/2 distributions for the design storm pattern needs to be discussed in the additional study for the updated hydrology Manual.

3.2.6 Interview with Dr. R. Edward Beighley, Ph.D.

Dr. R. Edward Beighley was interviewed by phone on August 30, 2010. Dr. Beighley indicated that he does not typically use the Nested rainfall distribution outlined in the San Diego County Hydrology Manual. The rainfall distribution he typically uses is the NRCS Type I rainfall distribution, which is one of the available storm distributions provided in the HEC-HMS model, which is more or less center loaded. Dr. Beighley indicated that there are no other standard rainfall distributions published for the western United States. The reports referenced in the 2003 Hydrology Manual and supporting studies specifically indicate the rainfall distributions are developed for the eastern United States and that storm patterns for the western United States should be based on local data.

Dr. Beighley further noted that timing of the highest intensity rainfall period (e.g., ±9-hours in NRCS Type 1 vs. 16-hours in County's Nested storm) is very important, especially for semiarid watersheds that have undeveloped land uses. For example, in semiarid regions where there are long periods of no rainfall, initial hydrologic conditions play an important role. The key point is when the initial conditions of a watershed transition from pre-storm to saturated (i.e., the point at which the conversion of rainfall to runoff is maximized). If the peak rainfall intensities arrive before or after this point, there can be changes in peak discharge. For example, the increase in peak discharge resulting from using the 2/3:1/3 storm distribution rather than the 1/2:1/2 storm ranges from approximately 5% to more than 25% depending on the level of development in the watershed. Thus, the selection of a rainfall distributions (1/2:1/2, 2/3:1/3 or other) is a critical decision.

3.2.7 Interview with Dr. Victor Ponce, Ph.D.

Dr. Victor Ponce was interviewed on November 4, 2010 over lunch at the SDSU Faculty Cafeteria. Dr. Ponce stated that the 1/2:1/2 nested storm distribution, as described in TD-15, is most common throughout the country, but this does not make it the most accurate.

Dr. Ponce stated that he has not used the 2/3:1/3 Nested storm distribution, but after reviewing Figure 4-1 from the 2003 County Hydrology Manual (provided as Exhibit 7 below), he concludes that the 2/3:1/3 time distribution has reduced peak flows when compared to the 1/2:1/2 time distribution. The 1/2:1/2 time distribution should provide a more conservative result except in instances where drainage structures such as detention/retention structures are being designed; then it appears that the 2/3:1/3 time distribution would produce a more conservative design for these structures.

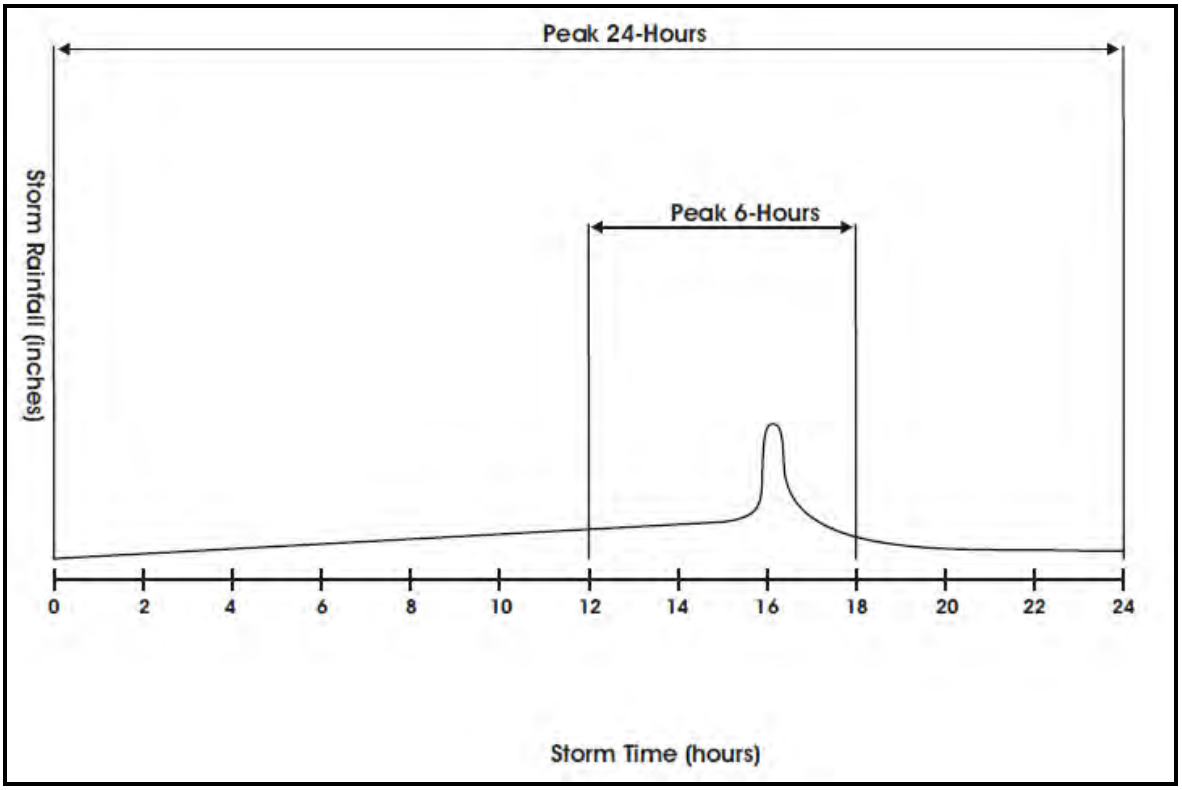


Exhibit 7: Rainfall Distribution for San Diego County (Figure 4-1 of 2003 SDCHM)

Dr. Ponce also noted that while other data such as the rainfall depth-area adjustment curves shown in Figure 4-2 of the 2003 County Hydrology Manual (provided as Exhibit 8 on the next page) have served the County well over a number of years, the technology and raw data available to the County today is such that now might be an excellent time to review and fine tune this data and make it specific to San Diego County.

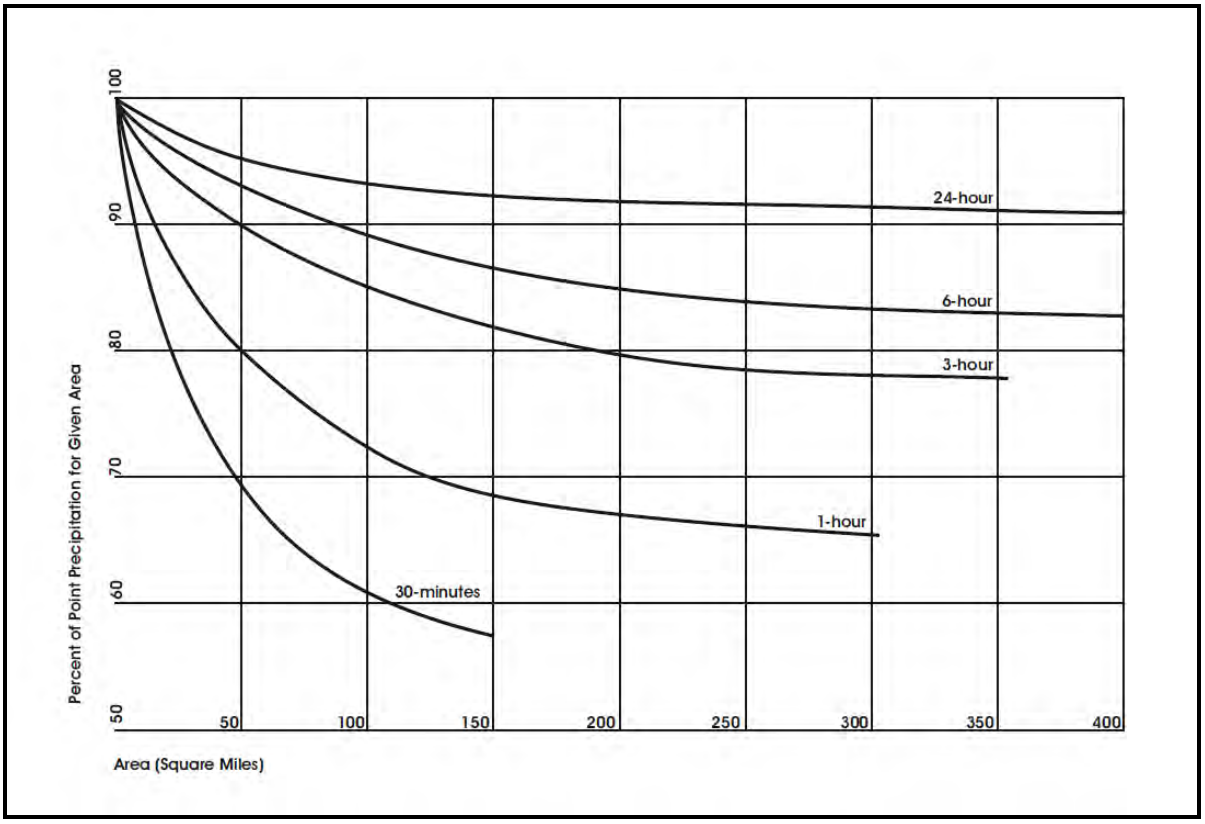


Exhibit 8: Rainfall Depth-Area Adjustment Curves for San Diego County (Figure 4-2 of 2003 SDCHM)

4. REVIEW OF THE HROMADKA REPORT

4.1 Review of Hromadka Report

The Hromadka Report was reviewed by Dr. R. Edward Beighley, Ph.D., Associate Professor, San Diego State University, Acting Civil Engineering Department Director.

This report (Hromadka, 2007) summarizes the results from an updated flood frequency analysis for the Los Angeles County Drainage Area (LACDA) and a comparison of simulated design discharges (e.g., 100-year flow) based on Orange and San Diego County design Manuals. The report builds on an early study performed by the U.S. Army Corps of Engineers (USACE) in the early 1980's by including an additional 25-years of annual peak flow data. Thus, the goal of the study is to determine if the inclusion of the recent 25-years of data alters flood frequency behavior or the performance of the previously developed flood discharge estimation methods.

The bulk of the report discusses the importance of discharge time series skew in the Bulletin 17B methods. There are three skew options: site skew, map skew or a weighted skew. For this study, site skews from the annual peak discharge series were used to remain consistent with the earlier USACE study. The study provides a thorough review and application of statistical analysis to determine the flood frequency distribution for the selected study sites.

Overall, the study finds that there are minimal changes in the flood frequency behavior from the previous period (ending in ~1980) of record and the updated period (i.e., including ~1980-2005 years). For the 5 study watersheds located in the LACDA, the change in the estimated 85% confidence level estimates for the 100-year flood ranged from 1% to 17% with a mean change of only 8%. Based on these findings, the report concludes that methods developed with the data ending in about 1980 are still valid as of the early 2000's (i.e., there are no significant changes to the updated flood frequency distributions).

The report discusses an application of the San Diego County Hydrology Manual's single area unit hydrograph method to the Los Coches Creek watershed (USGS Id 11022200; 12.2 sq mi; 1983-2005). However, due to changes in urbanization, the peak discharges were adjusted based on the ratio of the area weighted runoff coefficient in a given year relative to the runoff coefficient value for year 2005. Here the primary driver for changing the coefficient was imperviousness. This is a logical, consistent method for adjusting discharges. In this analysis, the report indicates that the use of the SCS loss method is especially sensitive to the selected design storm. However, there are no details provided for this analysis.

Due to the shape of the Los Coches Creek's flood frequency curve and the effects of skew, the watershed was dropped from the study. Rather, the 40 sq mi example watershed (Example 3.2) in the 2003 San Diego County Hydrology Manual was used. However, there are no details provided for this second analysis. Specific to San Diego County methods, only a table listing the 100-year discharges estimated from the SCS (18,544 cfs) and Urban (16,471 cfs) S-graphs are

provided. The difference in the methods is 2,073 cfs or 11%. Note, these results are due to difference in the loss model (SCS vs. 2-parameter model) and the Unit Hydrograph (i.e., S-Graph) (SCS vs. Urban). There is no analysis provided that addresses the effect of rainfall distribution.

In summary, there are three key findings from the review of the May 2007 report.

(1) The updated flood frequency distributions (i.e., the additional 25-years of data) are similar to the previously determined distributions. This finding suggests that previously developed methods should exhibit similar performance in terms of estimation of flood discharges.

(2) Although no details or results are provided, the report states that the SCS loss methods are especially sensitive to the design storm distribution. Thus, the report suggests that the County Manual, which uses the SCS loss methods, is especially sensitive to the design storm but provides no details or quantitative assessment of the design storm.

(3) The report provides no basis and/or assessment of the San Diego County Hydrology Manual's design storm. This point highlights the need for an investigation focused on the temporal distribution of design storms to be used in San Diego County.

4.2 Review of Supporting Material for Hromadka Report

The 2003 Hydrology Manual references the HEC TD-15 report as the basis for the Nested storm (2/3, 1/3) specified in the Manual. However, there appears to be some conflicting information in the Manual. For example, on page 4-5, the Manual states that the Nested storm in Figure 4-1 is the "balanced storm" from the TD-15 report. However, this is not correct. The "balanced storm" referenced in TD-15 is the storm centered on hour 12 (USACE, 1982). At the bottom of page 4-5, the Manual states that TD-15 suggests the use (1/2, 1/2) storm for the 100-year storm. This is consistent to what is discussed in TD-15 (USACE, 1982).

As support of the (2/3, 1/3) Nested storm, pages 4-5 and 4-6 of the Manual reference a sensitivity study (Hromadka, 1987) that investigated the two storm distributions (1/2, 1/2) and (2/3, 1/3) on flood discharge estimation. Although this is consistent with the statements presented in Hromadka (1987), the 1987 study provides only a relative comparison between peak discharges from the two storms. For example, Plate 1 in the report shows the variations in which is defined here as Q_r^* :

$$Q_r^* = \frac{Q_{p,r}(lag)}{Q_{p,r}(2hr - lag)}$$

where r is the either the 1/2:1/2 or 2/3:1/3 rainfall distribution, $Q_{p,r}$(lag) is the peak discharge resulting from a given lag time and loss rate, and $Q_{p,r}$(2hr-lag) is the peak discharge resulting from a 2-hr lag time and zero in/hr loss rate. As stated in the report, the comparison of Q^*_r for various lag times shows little difference between storm patterns. However, this provides no comparison to the actual magnitudes of peak discharge. For example, a hypothetical case may result in $Q^*_{(1/2,1/2)}$ = 900 cfs / 1000 cfs = 0.9. Similarly, assume $Q^*_{(2/3,1/3)}$ = 1350 cfs / 1500 cfs = 0.9. Although 0.9 is the same for both of the above Q^*_r values, the difference in peak discharge is 500 cfs (33%). In Hromadka (1987), it is not possible to compare the actual discharges. Thus, the reference in the 2003 Hydrology Manual suggesting there is minimal difference between the (1/2, 1/2) and (2/3, 1/3) rainfall distributions per Hromadka (1987) is correct only in terms of relative discharge. The statement is not substantiated in terms of impacts on estimated flood discharges. Although it may be true, this conclusion cannot be made from information presented Hromadka (1987).

Upon further review, the discrepancies surrounding the 1/2:1/2 versus the 2/3:1/3 rainfall distribution applicable to San Diego County may result from somewhat vague discussions in earlier publications. For example, TD-15 references two storms: (1) the Hypothetical Storm developed by the National Weather Service (e.g., 100-yr) and (2) the Standard Project Storm developed by the USACE. However, the report is not clear as to their differences and/or intended uses. On page A-13 of TD-15, the report states that the Standard Project Storm (SPS) distribution is sometimes applied to hypothetical-frequency storms, but it was specifically derived for events much rarer than even the 100-yr storm (USACE, 1982). Later in the report, an example is provided specifically for the U.S. east of the Rocky Mountains for areas less than

1,000 mi^2, where the Nested storm (2/3:1/3) or the SPS is used. In this example, the Engineer Manual 1110-2-1411 is referenced as the source of the SPS. However, EM-1110-2-1411 clearly states the presented SPS should not be used west of the Rocky Mountains, where rainfall patterns are different (USACE, 1965). In TD-15 (page 109, Figure 10.3), the SPS distribution results in discharges with return periods ranging from approximately 200-years to 400-years (USACE, 1982).

This issue of Standard Project Storms versus Frequency Based Storms also exists in the 1993 version of the San Diego County Hydrology Manual. For example, page II-B-1 of the Manual states that the 6-hour Type B rainfall distribution may produce larger flows than the 24-hour Type B distribution and that the larger peak flow should be used. The 6-hour Type B rainfall distribution is based on TR-60 (USDA, 1985). However, in TR-60, the 6-hour Type B distribution presented is intended for emergency spillway and freeboard design for dams, which tends to focus on less frequent, larger events nearing the Probable Maximum Precipitation (PMP) type event (e.g., Table 2-5 in USDA, 1985).

In summary, the difference between the 1/2:1/2 and 2/3:1/3 rainfall distributions as stated in the literature can be generalized as follows. The 1/2:1/2 distribution is for frequency based flood modeling (e.g., 100-yr flood), and the 2/3:1/3 distribution is for very rare ultimate design cases for critical structures like dams (not based on frequency or return period).

5. SUMMARY OF RAINFALL DISTRIBUTION METHODOLOGY RESEARCH CONDUCTED

5.1 Summary of Research Conducted

The rainfall distribution methodology was researched for the following areas:

1. Alameda County, California
2. County of Sacramento, California
3. County of Orange, California
4. County of San Bernardino, California
5. County of Kern, California
6. County of San Joaquin, California
7. Imperial Irrigation District, California
8. Fresno County, California
9. Los Angeles County, California
10. City of Los Angeles, California
11. Riverside County, California
12. Santa Clara County, California
13. Maricopa County, Arizona
14. Pima County, Arizona

Table 1: Summary of Rainfall Distribution Methodology Research

JURISDICTION	RAINFALL DISTRIBUTION METHODOLOGY USED
Alameda County, California	A hypothetical rainfall distribution calibrated for local conditions is used for the 6-hour and 24-hour storms.
County of Sacramento, California	For short duration storms (6-hour, 12-hour and 24-hour storms) a center peak balanced storm is used. For longer duration storms (36-hour, 5 and 10 day) a multiple event distribution derived from historical storm data is used.
County of Orange, California	For short duration storms, using a rainfall distribution centered around 16 hours for a 24-hour storm; for watersheds with flow through detention basins, using a multiday rainfall distribution, for flow by detention basins, using a slightly revised multiday rainfall distribution.
County of San Bernardino, California	Using a rainfall distribution centered around 16 hours for a 24-hour storm.
County of Kern, California	Using a rainfall distribution centered around 16 hours for a 24-hour storm.
County of San Joaquin, California	SCS per Technical Release TR-20, per Technical Release TR-5 or SCS rainfall distribution per HEC-1 and/or HEC-RAS.
Imperial Irrigation District, California	A modified 24-hour SCS rainfall distribution is used. The distribution has been adjusted for watershed area effects and has been constructed with several Nested storm intervals to fit local rainfall data.
Fresno County, California	Indicates rainfall distribution information is from rain gauges that have been analyzed by specialists with the California State Department of Water Resources (DWR) per Caltrans HDM.
Los Angeles County, California	Using a 24-hour unit hyetograph derived from a modified alternating block method and a regionally specific location of inflection point.
City of Los Angeles, California	The rainfall distribution method used is a 24-hour pattern storm producing 6-inches of rain that is based on many rainfall records.
Riverside County, California	Rainfall distribution based on the Indio area thunderstorm of September 24, 1939 for 3 and 6-hour patterns and the general storm of March 23, 1938 for 24-hour pattern.
Santa Clara County, California	The 24-hour rainfall distribution is based upon the three-day December 1955 rainfall event, considered the storm of record for northern California.
Maricopa County, Arizona	6-hour rainfall distributions are derived from NOAA statistical data and US Army Corps of Engineers analysis of the Queen Creek Storm of August 19, 1954. There are 5 different patterns based on area of analysis. The 24-hour rainfall distribution used is the SCS Type II distribution.
Pima County, Arizona	Uses a 3-hour SCS Type II Storm, and a 24-hour SCS Type I Storm, selected based on analysis of local rainfall patterns.

5.2 Summary of Interviews Conducted

Interviews were conducted with the following individuals:

- Dennis Bowling, M.S., P.E.
- Dr. Howard Chang, Ph.D., P.E.
- Martin Teal, P.E., P.H., D.WRE
- Dr. Theodore Hromadka, Ph.D., Ph.D., Ph.D., P.H., P.E.
- Jim Zhu, P.E., CFM
- Dr. R. Edward Beighley, Ph.D.
- Dr. Victor Ponce, Ph.D.

Table 2: Summary of Interviews Conducted

INTERVIEWEE	GENERAL OPINION ON RAINFALL DISTRIBUTION METHODOLOGY
Dennis Bowling, M.S., P.E.	Mr. Bowling expressed a commitment to get the rainfall distribution appropriate for San Diego County. He does not want stormwater facilities undersized resulting in unexpected flooding or oversized resulting in greater costs to construct.
Dr. Howard Chang, Ph.D., P.E.	Dr. Chang indicated that he is more familiar with the Type B distribution. He chose not to comment on the 2/3:1/3 distribution in the new Manual.
Martin Teal, P.E., P.H., D.WRE	Mr. Teal uses a 1/2:1/2 distribution which is what he considers a balanced storm. He chose not to comment on the 2/3:1/3 skewed distribution recommended by Dr. Hromadka as he infrequently uses this distribution in his studies.
Dr. Theodore Hromadka, Ph.D., Ph.D., Ph.D., P.H., P.E.	Dr. Hromadka is a strong supporter of the 2/3:1/3 skewed distribution as he believes this provides greater confidence in predicting storm event quantities.
Jim Zhu, P.E., CFM	Mr. Zhu indicated that the TD-15 which is referenced in the 2003 Hydrology Manual actually pertains to a 1/2:1/2 rainfall distribution pattern. Whether to use the 2/3:1/3 or 1/2:1/2 distribution for the design storm pattern needs further study
Dr. R. Edward Beighley, Ph.D.	Dr. Beighley reported that he typically uses a center balanced storm in his studies and does not use the 2/3:1/3 distribution.
Dr. Victor Ponce, Ph.D.	Dr. Ponce reported that the 1/2:1/2 distribution for hydrologic studies is the most commonly used.

5.3 Summary of Review of Hromadka Report

5.3.1 Summary of Review of Hromadka Report

In summary, there are three key findings from the review of the May 2007 report.

(1) The updated flood frequency distributions (i.e., the additional 25-years of data) are similar to the previous distributions. This finding suggests that previously developed methods should exhibit similar performance in terms of estimation of flood discharges.

(2) Although no details or results are provided, the report states that the SCS loss methods are especially sensitive to the design storm distribution. Thus, the report suggests that the County Manual, which uses the SCS loss methods, is especially sensitive to the design storm but provides no details or quantitative assessment of the design storm.

(3) The report provides no basis and/or assessment of the San Diego County Hydrology Manual's design storm. This point highlights the need for an investigation focused on the temporal distribution of design storms to be used in San Diego County.

5.3.2 Summary of Supporting Material for Hromadka Report

In summary, the difference between the 1/2:1/2 and 2/3:1/3 rainfall distributions as stated in the literature can be generalized as follows. The 1/2:1/2 distribution is for frequency based flood modeling (e.g., 100-yr flood), and the 2/3:1/3 distribution is for very rare ultimate design cases for critical structures like dams (not based on frequency or return period).

6. REFERENCES

County of San Diego, Department of Public Works, Flood Control Division, San Diego County Hydrology Manual. (April 1993).

County of San Diego, Department of Public Works, Flood Control Division, San Diego County Hydrology Manual. (June 2003).

Hromadka, T.V., Report on the Calibration Analysis for the San Diego County Hydrology Manual, Prepare for the County of San Diego. (May 2007), 43 pp.

Hromadka, T.V., Derivation of a Rainfall-Runoff Model to Compute N-Year Floods for Orange County Watersheds. U.S. Army Corps of Engineers, Los Angeles District Office. (Nov. 1987).

United States Army Corps of Engineers (USACE), Hydrologic Engineering Center. Standard Project Flood Determination, Engineer Manual No. 1110-2-1411. (March 1965).

United States Army Corps of Engineers (USACE), Hydrologic Engineering Center. Hydrologic analysis of Ungaged Watersheds Using HEC-1. Training Document No. 15. (April 1982).

United States Department of Agriculture (USDA), Soil Conservation Service (SCS). Earth Dams and Reservoirs, Technical Release 60. (October 1985).

Alameda County Hydrology and Hydraulics Manual. (June, 2003).

City and County of Sacramento Drainage Manual, Volume 2: Hydrology Standards. (December 1996).

Orange County Hydrology Manual. (October, 1986).

San Bernardino County Hydrology Manual. (August, 1986).

Kern County Hydrology Manual. (Undated).

San Joaquin County Hydrology Manual. (1997).

Imperial Irrigation District Hydrology Manual. (1995)

Improvement Standards for Fresno County. (October, 1966).

Los Angeles County Hydrology Manual. (January, 2006).

City of Los Angeles Bureau of Engineering, Storm Drain Design, Manual – Part G. (June, 1969).

Riverside County Flood Control and Water Conservation District Hydrology Manual. (1978).

County of Santa Clara, Drainage Manual. (2007).

Drainage Design Manual for Maricopa County. (November 18, 2009).

Pima County, Email Communication with Evan Canfield at Evan.Canfield@rfcd.pima.gov. (July 6, 2010).

7. APPENDICES

A.1	Report on the Calibration Analysis for the San Diego County Hydrology Manual (2007)
A.2	Derivation of a Rainfall-Runoff Model to Compute N-Year Floods for Orange County Watershed (1987)
A.3	Standard Project Flood Determination, Engineer Manual No. 1110-2-1411 (1965)
A.4	Hydrologic Analysis of Ungaged Watersheds Using HEC-1, Training Document No. 15 (1982)

Appendix A.1

Report on the Calibration Analysis for the San Diego County Hydrology Manual (2007)

This page is intentionally left blank to facilitate 2-sided printing.

Report on the Calibration Analysis for the San Diego County Hydrology Manual

Especially Prepared for:
County of San Diego

Prepared by:
Theodore V. Hromadka, II
Ph.D., Ph.D., Ph.D., P.E., P.H.
Licensed Geoscientist
Professor Emeritus, California State University
Professor, Dept. Mathematical Sciences,
United States Military Academy, West Point, NY

May 2007

Hromadka & Associates
Hydrologic, Earth and Atmospheric Sciences

Table of Contents

I. Introduction **1**

A. Acknowledgements **2**

II. Testing the Original LACDA Calibration Effort **3**

A. Update of 25 Years of Stream Gage Data **3**

B. Bulletin 17B Procedures **3**

C. The Flood Frequency Curve **4**

D. Analysis of Bulletin 17B Confidence Intervals **6**

E. The Confidence Levels **8**

F. Accurate Confidence Levels by Simulation **9**

G. Updating the Stream Gage Records **10**

H. Adopted Skew **10**

I. Flood Frequency Curve Results **10**

III. Test Watershed **12**

A. General Information **12**

B. Choice of Test Watershed **12**

C. Stream Gage 11022200 **12**

D. Stream Gage Data **12**

E. Lag Assumed Invariant **13**

F. Unit Hydrograph Assumed Invariant **13**

G. Percent Impervious Versus Time **13**

H. Stream Gage Data Adjustment Procedure **13**

I. Log-Pearson III Flood Frequency Curve Analysis **14**

J. Evaluation of LACDA Watershed Single Area Unit Hydrograph Design Storm Models **14**

K. Single Area Design Storm Unit Hydrograph Analysis Using Current Manual as Baseline **15**

IV. Conclusions and Recommendations **16**

V. References **19**

List of Tables

Table 1: Confidence Levels for 17B Flood Frequency Curve, N=10
Table 2: Confidence Levels for 17B Flood Frequency Curve, N=50
Table 3: Confidence Levels from 17B, N=10, *p*=0.99
Table 4: Confidence Levels from 17B, N=50, *p*=0.99
Table 5: Confidence Levels from 17B, N=10, *p*=0.01
Table 6: Confidence Levels from 17B, N=50, *p*=0.01
Table 7: Confidence Levels from Simulation, N=10, *p*=0.99
Table 8: Confidence Levels from Simulation, N=50, *p*=0.99
Table 9: Confidence Levels from Simulation, N=10, *p*=0.01
Table 10: Confidence Levels from Simulation, N=50, *p*=0.01
Table 11: Flood Frequency Curve (17B) cfs vs 50% values, N=10, skew=0.5, sample mean=3.4, sample standard deviation=0.2
Table 12: Alhambra Wash (F81D-R) Stream Gage Data
Table 13: Compton Creek (F37B-R) Stream Gage Data
Table 14: Eaton Wash (F318-R) Stream Gage Data
Table 15: Rubio Wash (F82C-R) Stream Gage Data
Table 16: Arcadia Wash (F317-R) Stream Gage Data
Table 17: Hydrologic Stream Gage Information
Table 18: Statistical Parameters
Table 19: Flow Rate Results
Table 20: Change in Confidence Level Estimates $(\alpha_{x,T,g})$ Due to Added Years of Records
Table 21: Weighted Average of $\alpha_{x,T,g}$ Values
Table 22: Relationship Between Confidence Level Estimates versus 50% Confidence Level Estimate $(\beta_{x,T,g})$
Table 23: Weighted Average of $(\beta_{x,T,g})$ Values
Table 24: Difference in Weighted Averages of Values: (Extended Record) – (Unextended Record)
Table 25: Model Results Based of the San Diego Workbook Example 3.2

I. Introduction

In this report is presented a summary of the tasks accomplished in evaluating the performance of the new Hydrology Manual for the County of San Diego. At issue are the confidence levels achieved by the new Manual's methodology and how the many components used in the modeling relate to these confidence levels. Because the Manual contains mathematical models of various components and processes of the hydrologic cycle, as well as statistical properties of the rainfall and runoff observed in the County's watersheds, the ensemble of these components form a hydrologic model that is used in predicting runoff quantities associated with target return frequencies. The model can also be used in rainfall-runoff analysis of actual storm events, and hence there is good reason to use a model that reasonably approximates such rainfall-runoff observations. Thus, there are two goals linked to the resulting hydrologic model, namely, approximating the rainfall-runoff relationships as observed locally, and approximating runoff quantities of prescribed return frequencies at specified levels of confidence.

The course of the project changed during the test watershed phase of analysis where a single test watershed was to be evaluated using the current Manual's single area unit hydrograph (UH) design storm modeling approach. Because only a single watershed was to be tested, the choice of that test watershed became the subject of scrutiny due to the limited variety of stream gage records and watershed histories. A test watershed was eventually selected, and a flood frequency analysis completed after the gage record was adjusted for the effects of urbanization. However, due to the flood frequency curve shape observed and the effects of the skew used, it was decided that better information would be obtained by examining the sensitivity of the current modeling approach versus use of alternative and readily available methods for several of the modeling components (e.g., depth-area curves, loss function construct, S-Graphs, lag estimation procedure, among other possible considerations.) As such, the project evaluated the 40-square mile test watershed problem already contained in the Manual, and modeling results were re-generated for a variety of modeling component substitutions. These modeling results are contained in this report.

From the study effort, it was concluded that the current Manual meets or exceeds the 85-percent upper confidence level goal in the estimation of runoff quantities. The current modeling procedure is found to produce runoff estimates which approximately match or exceed analogous analysis results generated by use of the County of Orange procedures. These procedures were, in turn, calibrated to the COE LACDA procedures and calibration results.

Recommendations for future research are offered in the last section of this report which may be of possible interest for future consideration.

A) Acknowledgements

Many experts collaborated in this report's preparation and provided help and assistance during the course of the project. Leading the effort were several hydrology experts from the County of San Diego including but by no means limited to: Jim Zhu (P.E., Civil Engineer), Hung Tran (P.E., Senior Civil Engineer) and Cid Tesoro (P.E., Program Manager). Other contributing experts included but were by no means limited to: Wayne Chang, Bethany Espinosa, Rene Perez, Tory Walker, and Robert Whitley.

II. Testing the Original LACDA Calibration Effort

A) Update of 25 Years of Stream Gage Data

In the early 1980's, the United States Army Corps of Engineers (COE) Los Angeles District Office prepared a rainfall and runoff unit hydrograph method calibration study for the Los Angeles County Drainage Area (LACDA), encompassing drainage areas of hundreds of square miles and dozens of stream gages and rain gages. Subsequent to that regional study, local county flood control agencies utilized those data and results to create their county flood control hydrology design criteria and documented their procedures in Hydrology Manuals. For example, the County of San Bernardino published their Hydrology Manual in 1983. In 1985, the Orange County Environmental Management Agency (OCEMA) published a calibration of the unit hydrograph procedure, and subsequently produced the Orange County Hydrology Manual in 1986. The County of San Bernardino followed in these footsteps and updated their Hydrology Manual in 1986 to incorporate the calibration. In 1989, the County of Orange extended their calibration effort by examining lower confidence levels ("Investigation of Mitigation Needs for Changes in Duration Floodflows Due to Development", Williamson and Schmid, July 1989).

The stream gage data originally used in the LACDA regional calibration included data up through the early 1980's. Now that some quarter of a century of additional data is available, a comparison of new flood frequency curves and confidence levels is appropriate in order to determine whether or not the additional data has any effect on the original results.

B) Bulletin 17B Procedures

The procedures recommended for flood-frequency analysis by U.S. federal agencies and in general use in the United States are those given in [20], a reference which is commonly referred to as (Bulletin) 17B; also see [31], [25], [21], and [13]. The confidence levels computed following the procedure in 17B are not accurate, therefore in the original LACDA calibration, simulations were used to give confidence levels using the methodology described in [32]. Because of the substantial increase in computing power now available, the simulations of [32] can be recreated with much greater accuracy.

The development of the procedures given in Bulletin 17B is described in [13]. A prior discussion was that of [30], the title of which, "A Uniform Technique for Flood-Frequency Analysis" indicates the important goal of 17B: to provide a uniform technique which would facilitate comparisons among various areas of the United States. An indispensable reference is [28]. The procedure adopted can be thought of as consisting of the following steps:

(1) Choose a distribution to represent annual maximal discharges. The distribution chosen was the Log-Pearson III distribution. This choice is discussed in Appendix 14 of 17B; see also [3], [4] and the comprehensive [13].

(2) Estimate the skew parameter for this distribution. The skew of the distribution can be estimated by combining skew data from several stations [20] [pgs 10-

15]. The variability of skew estimates based on site data alone led to a 17B recommended procedure of using a map of skew values for the United States, which is discussed in [23], [24], and [29]. Since the skew estimators specified in 17B use either a regional skew or a combination of a regional skew and a site skew, it is difficult to precisely model the variability in these estimators because that requires a joint distribution for regional skews and nearby site skews and there is scant available information about such a distribution. Because of this, the original LACDA regional calibration and this update use the adopted site skew in the calculation, ignoring the variability inherent in choosing this skew. For this simplified model it is possible to compute confidence levels with high accuracy. (There have been attempts to include the effects of the variability of the skew estimator, e.g. [9], [34], [35], and [6], [10], [11], with, as would be expected, less accuracy and with corresponding greater complexity than in the simpler situation modeled here .)

(3) Calculate remaining parameters. Various procedures have been examined for computing the remaining parameters of the distribution; for example, maximum likelihood [8], and see [6], [10], [11]. Bulletin 17B uses the usual estimates for the mean and standard deviation of logs of the yearly maximal discharges. These estimates and the value of the skew give enough information to estimate the three parameters in the Pearson III density.

(4) Use the resulting distribution to estimate various statistical aspects of the maximal flood distribution. An explicit requirement in the development of the methodology of 17B was that the calculations involved be easy to perform. This was accomplished by an estimation involving only the computation of the mean and standard deviation of the relevant discharge data, as noted above, and by looking up a tabulated constant. Specifically, a flood frequency curve for the discharge Q is obtained, for the given skew, from the basic equation (1) of [20]

$$\log Q = \hat{\mu} + \hat{\sigma} K, \qquad (1)$$

where $\hat{\mu}$ and $\hat{\sigma}$ are the usual estimators for the mean and standard deviation of the logarithms of the maximal annual discharges, and K is read from a table given in terms of exceedance probability and skew (which implicitly implies a skew value which is known exactly). [20], [16], [17]. The plot of the values of equation (1) for values of K corresponding to various exceedance probabilities gives the flood-frequency curve of 17B.

C) The Flood Frequency Curve

The underlying (mandated) hypothesis of 17B is that the series of yearly maximum discharges from a catchment at a gage have a Log-Pearson III distribution [15], [12], [2]. The density for the logarithms then has the form

$$f(t) = \frac{[(t-c)/a]^{b-1}}{|a|\Gamma(b)} e^{-[(t-c)/a]} \quad for \quad (t-c)/a > 0, \qquad (2)$$

$\Gamma(b)$ the gamma function, and $f(t) = 0$ for $(t-c)/a < 0$. The parameter b is related to the skew γ, denoted by G in 17B, by $b = 4/\gamma^2$; the parameter a has the same sign as the skew. For the important case of zero skew the distribution can, by a limiting argument, be shown to be a normal distribution.

In terms of the scaled variable $x = (t-c)/a$, the density for $x > 0$ is

$$f(x) = \frac{x^{b-1}}{\Gamma(b)} e^{-x}. \tag{3}$$

The values of K in the table in [20] are given in terms of skew and exceedance probability p'. Here the probability $p = 1 - p'$, related to the T-year flood by $p = 1 - 1/T$, will be used instead of p'. The K values given in 17B can be calculated in two steps:

(1) Given a probability p, use the distribution in equation (3) to find a value K' with the property that a random variable X with this density has $Prob(X \le K') = p$.

(2) Use the fact that X has mean b and standard deviation $b^{1/2}$ to scale K' and so obtain the value K of the 17B table,

$$K = \frac{K' - b}{\sqrt{b}}. \tag{4}$$

For the case of zero skew, K is the pth percentile for a normal random variable with mean zero and standard deviation one.

It will be useful to indicate the dependence of K on the parameters γ and p by writing:

$$K = K(\gamma, p). \tag{5}$$

By considering $K(\gamma, p)$ for negative values of skew it can be shown that:

$$K(-\gamma, p) = -K(\gamma, 1-p). \tag{6}$$

One consequence is that the 17B table values for negative skew are superfluous as they can be obtained from the values for positive skew by the use of equation (6), as was clear to the authors of 17B [16].

Suppose that an estimate of the value of the T-year flood y_p, for $p = 1 - 1/T$, is needed. Equation (1) relates $K(\gamma, p)$ to the random variable $(y_p - \hat{\mu})/\hat{\sigma}$. Let Y have the density (2) and suppose that the site has n years of yearly maximal discharge data. Let $\hat{\mu}_Y$ denote the sample mean of Y, i.e. for a sequence of independent random variables $Y_1, Y_2, \ldots Y_n$, each with the same distribution as Y,

$$\hat{\mu}_Y = \frac{1}{n}\sum_{i=1}^{n} Y_i$$

and let $\hat{\sigma}_Y$ denote the unbiased estimator

$$\hat{\sigma}_Y^2 = \frac{1}{n-1}\sum_{i=1}^{n} (Y_i - \hat{\mu}_Y)^2 \ .$$

It can be shown that:

$$\frac{y_p - \hat{\mu}_Y}{\hat{\sigma}_Y} \equiv \frac{z_p - \hat{\mu}_Z}{\hat{\sigma}_Z} \ \ for\ skew \geq 0, \qquad (7)$$

and

$$\frac{y_p - \hat{\mu}_Y}{\hat{\sigma}_Y} \equiv \frac{\hat{\mu}_Z - z_{1-p}}{\hat{\sigma}_Z} \ \ for\ skew \leq 0. \qquad (8)$$

Here $\equiv$ means that the two sides of the equivalence have the same probability distribution. The random variable Z has a gamma distribution with the density given in (3). Corresponding to y_p, z_p is the value satisfying $Prob(Z \leq z_p) = p$, and $\hat{\mu}_Z$ and $\hat{\sigma}_Z$ denote the sample estimates for the mean and standard deviation of Z, based on the same number n of data points as are in the record of the log discharge Y values. (Note the distributions in (7) and (8) are the same in the case of zero skew, where Z is normally distributed with mean zero and standard deviation one, by symmetry.)

Equations (7) and (8), given in [32], are the key to improving the values used for K, because the statistic given in these equations gives the distribution of K (as a random variable) and depends only on the skew and not on the parameters a (except for its sign), or c.

D) Analysis of Bulletin 17B Confidence Intervals

One critical question to ask of any procedure for estimating a return frequency value for maximal discharge is: What protection is obtained by the use of this procedure? If this procedure were applied over and over again to independent samples from the given distribution, how often would the true (and unknown) T-year flood value y_p be less than or equal to that estimated by use of the procedure? Which is to say how often would the use of this estimate in flood protection measures actually provide protection against an occurrence of the T-year flood? In statistical terms, one refers to the one-sided confidence interval or the confidence level given by the procedure. The numerical value for this confidence level gives a good idea of the statistical risk posed by the use of the procedure.

In order to evaluate the confidence levels obtain in using the Bulletin 17B estimator for the T-year flood, the probabilities

$$Prob(z_p \le \hat{\mu}_Z + K(\gamma, p)\hat{\sigma}_Z) \tag{9}$$

are computed for representative values of γ, p, and the number n of data points used in computing the sample mean and standard deviation.

The values for negative skew can be obtained from those for positive skew as follows: suppose $\gamma < 0$, from (8)

$$Prob\left(\frac{y_p - \hat{\mu}_Y}{\hat{\sigma}_Y} \le K(\gamma, p)\right) \tag{10}$$

$$=Prob\left(\frac{\hat{\mu}_z - z_{1-p}}{\hat{\sigma}_Z} \le K(\gamma, p)\right) \tag{11}$$

$$=Prob\left(\frac{z_{1-p} - \hat{\mu}_Z}{\hat{\sigma}_Z} \ge -K(\gamma, p)\right). \tag{12}$$

Using (6)

$$=1\text{-}Prob\left(\frac{z_{1-p} - \hat{\mu}_Z}{\hat{\sigma}_Z} \le K(-\gamma,1-p)\right). \tag{13}$$

By comparing with (7), the probability in (13) is seen to be that used to find the confidence level corresponding to $K(-\gamma,1-p)$. Numerical examples will be given below.

The $p = 1 - 1/T$ values used in the Table 1 and Table 2 correspond to those used in the table of K values in [20]. The 17B table gives K values for skews in the range -9 to 9, but an examination of the skew values on the United States maps given in [20] shows that all the skews are in the range -2 to 2 and in fact nearly all (97 %) are in the range -1 to 1, and consequently the set of values {0, 0.5, 1} was chosen for the computations here. The extension to negative skews {−0.5, −1.0} will be discussed below. The computations were done for site record lengths of $n = 10$, which 17B considers to be the smallest number of site data points to which its procedure should be applied, and $n = 50$.

The confidence levels obtained when (1) is used were computed using equation (7). For each of the skew values under consideration and each of the record lengths numbers $n = 10$ and $n = 50$, one million sites each with n values were simulated; so for $n = 50$ and one of the γ values, fifty million gamma distributed random variables were simulated. A count was kept of the number of times $z_p \le \hat{\mu}_Z + \hat{\sigma}_Z K(\gamma, p)$ and the resulting percentages are the values in the table. The simulation was run a second time and the fractions obtained differed by at most .001, i.e. 0.1%. The program was checked by comparing percentiles for the sample mean $\hat{\mu}_Z$ of equation (7) with the theoretical percentile values and was further checked by comparing a selection of K values with the output from the program HEC-FFA as well as with the tabulated K values from 17B. In

addition, selected values in the tables themselves were checked by a separate Mathematica program using a relative small (10,000) number of sites.

Example 1: For a skew of 0.5 and $n = 10$ site data points, Table 1 shows that the use of the 17B table of K values to produce the value of $\log(Q)$ of equation (1) for the $T = 100$ year flood $(p = 0.99)$ gives a value which the true 100-year flood will be less than or equal to 44% of the time, and so of course greater than 56% of the time. That the computed value does not give the desired protection 56% of the time may or may not be acceptable to the user, but as things stand in 17B this is not quantified.

Example 2: For a negative skew value of -0.5, $n = 10$ site data points, and the $T = 100$ year flood $(p = 0.99)$, the use of equation (13) and the entry for $p = 1 - 0.99 = 0.01$, shows that the true 100 year flood will be less than or equal to the computed value 100% − 55% = 45% of the time.

E) The Confidence Levels

One solution to the problem of the risk associated with the use of 17B flood frequency curves would be to adjust the constant K in equation (1) so that this equation provides a confidence level which is acceptable to the user. Appendix 9 of 17B gives formulas, for a given $0 < c < 1$, for estimators $U_{P,c}(X)$ and $L_{P,c}(X)$, applied to a sample "X" of data points at the site, which are supposed to have the property that

$$Prob\left\{U_{P,c}(X) \geq X_p^*\right\} = c \tag{14}$$

$$Prob\left\{L_{P,c}(X) \leq X_p^*\right\} = c \tag{15}$$

where X_p^* is the true but unknown value of the T-year flood, $p = 1 - 1/T$, and the probabilities are in the sense of repeated sampling.

It is known ([27], [1]) that the confidence intervals for quantiles given in 17B are not satisfactory, and [27] gives an approximate formula, using [22], which is accurate for small skew [33]. The confidence levels for 17B were also checked by [18] in the same way as they will be checked here, but, because of the limited computer power available 30 years ago, the author at that time was forced to use small sample sizes of 1000. In the calculations here, one million sites are used together with a random number generator with a period of $2^{31} - 1$. For a site with a record of length 50, this generation of 50 million gamma distributed random variables has a total running time of about 30 seconds.

From the point of view of confidence levels, the probabilities of interest are the probabilities that the actual T-year value is less than or equal to an estimator, which is the value c in (14) but is the value $1 - c$ in (15). For consistency the values reported in Tables 3, 4, 5 and 6 labeled q are for the 17B computed probabilities that the T-year flood, reported in terms of $p = 1 - 1/T$, will be less than or equal to that obtained by use of

the 17B estimators. The formulas for the estimators require that $c \le 0.5$. For $c > 0.5$, $L_{P,1-c}(X)$ supplies the confidence level c while for $c \le 0.5$, $U_{P,c}(X)$ supplies the confidence level. One further point: Bulletin 17B notes that for zero skew the Pearson III distribution is a normal distribution and therefore precise confidence levels can be computed from a table of the non-central t-distribution. (Subroutines for the non-central t-distribution are available in the IMSL software library used for the calculations given here.) The result of the tests given in Tables 3, 4, 5 and 6 for $\gamma = 0$ are actually for $\gamma = 0.001$ so as to indicate how the accuracy in the formulas for confidence levels given in Appendix 9 of 17B varies with skew.

In Tables 3, 4, 5 and 6, the confidence level is indicated by q, the number of years of record by N, the T-year flood by $p = 1 - 1/T$, and the skew by γ. The table entry is the actual percent of the time the estimator is greater than or equal to the true value of the T-year flood.

Example 3: For a site with 10 data points and a skew of 0.5, Table 3 shows that 17B 50% confidence level for the 100-year flood actually is a 43.6% confidence level, i.e. it provides a procedure which gives an estimate greater than or equal to the 100-year flood not 50% of the time but 43.6% of the time.

The 17B confidence level c for negative skew $-\gamma$ and a T-year flood, $p = 1 - 1/T$, is equal to the confidence level c which 17B provides for positive skew for $1 - p$ and γ. This follows from (6), and, using the notation of section 9 of 17B with a slight modification to indicate the skews involved, the equation $K^{U}_{p,c}(\gamma) = -K^{L}_{1-p,c}(-\gamma)$. And the fact that if X has a Pearson III distribution, scaled to have mean zero and standard deviation one, with skew γ, then $-X$ has a Pearson III distribution with mean zero, standard deviation one, and skew $-\gamma$.

Example 4: For a site with 10 data points and a skew of -0.5, Table 5 shows that the 75% confidence level provided by 17B actually is an 82.0% confidence level.

F) Accurate Confidence Levels by Simulation

Using (7) and (8), simulations can deliver accurate values for constants $K(N, \gamma, c)$ for which

$$Prob(y_p \le \hat{\mu}_Y + \hat{\sigma}_Y K(N, \gamma, c)) = c$$

is approximately true with error in the fourth decimal. That this can be done is clear in principle but was impractical at the time 17B was written. To give an idea of the change in readily available computer power, a remark made in ([32]) can be used to estimate that a program which would have taken 40 hours using the personal computers and software of 20 years ago, would now take about 10 seconds. The computer programs for this paper were compiled with a Lahey/Fujitsu FORTRAN 95 compiler using the IMSL software library. The simulations involved for a specific T-year flood take, in the case of $N = 50$

data points, approximately three minutes. An accurate value for the constant K of (1) is obtained by a simulation of the right-hand side of (7) or (8) in which an empirical histogram is used to obtain percentiles corresponding to the desired K values. After the values of K have been calculated, they are tested using a completely different random number generator from that used in the simulation.

Tables 7, 8, 9 and 10 give the results of testing the K values obtained from simulations. Each value was tested twice, and the numbers reported in the Tables are the larger of the two test errors.

Example 5: Table 7 shows that for the 100-year flood, $N = 10$ and $\gamma = 0.5$, the simulation value of K gives a confidence level of 50.05% for the 50% level.

Example 6: Table 9 shows that for $N = 10$ and a skew of -0.5 the simulation value of K gives a confidence level of 49.9% for the 50% confidence level.

Example 7: A specific case involving hypothetical data: $N = 10$, $\gamma = 0.5$, $\hat{\mu} = 3.4$ (Logarithms base 10 are used so the corresponding discharge is $10^{3.4} = 2512$ cfs), and $\hat{\sigma} = 0.2$, is given in Table 11.

G) Updating the Stream Gage Records

A key element of the new analysis is to update the LACDA flood frequency estimates by including nearly a quarter century of additional stream gage data that post-dated the LACDA study itself. Five stream gages (Alhambra Wash, Compton Creek, Eaton Wash, Rubio Wash and Arcadia Wash) are the focus of this re-analysis and are tabulated in Tables 12-16. Table 17 provides hydrologic information relevant to these five stream gages. It is noted that other stream gages, such as Dominguez Channel, were considered in this re-analysis but since there was no additional data, the stream gage records could not be extended.

H) Adopted Skew

As part of the analysis, an "adopted" skew value is assumed, as is done in the 17B procedures. The adopted skew value used in the re-analysis is the value used in the original calibration report ([19]). It is noted that had the skew value not been "adopted", then additional uncertainty would be simulated and the confidence level estimates would increase in value above what is reported by this report. That is, by "adopting" a skew value (according to the 17B procedure and as done in the original calibration), it is presupposed that skew is known, which of course is not possible. These adopted skew values are found in Table 18.

I) Flood Frequency Curve Results

Using the simulation procedure described in the previous sections of this report, each of the five stream gage data sets were extended by directly including the latest quarter century of runoff peak flow rate data. The calibration analysis of 1987 had concluded that urbanization effects stabilized some 50 years ago and so further adjustment of the runoff

data was not necessary beyond that which was done in the 1987 calibration effort. Using the adopted skew values established in the 1987 calibration effort, confidence level estimates were made for several return frequencies of storm events and for various confidence levels. A similar analysis was made for the original stream gage record data sets in order that a comparison could be made between the extended and un-extended data sets. In order to determine a generalized trend as to the effect on the prior calibration effort of 1987 by the inclusion of the extended record stream gage data, some ratios are used between the extended and un-extended data set results, and in order to develop trends across the five stream gage data sets, two types of weightings are used as discussed in the text below. The results of all of these analyses are summarized in the following tables.

Table 18 reviews the relevant statistics for the five gages for the two periods of record, extended and un-extended, and includes the adopted skew values.

In Table 19, the peak Q results are in two sets of tabulations, for the extended and un-extended records, respectively. This is a collection of smaller tables of peak Q values at each gage with the confidence levels and return frequencies listed. Table 19 is the underpinnings of the following tables.

Table 20 simply compares the peak Q estimates for the relevant confidence levels versus return frequency estimates by taking the ratio of extended/unextended record estimates. It is curious to note that the biggest change occurs at the 50% confidence.

Table 21 tries to come up with a single representative statistic to describe the overall change in estimates due to increased record length. This is done by two popular methods of weighting averages of the Table 20 ratios, using watershed area for one method, and record length for the other method. The two methods of weighting provide very similar results. Overall, adding more years of record (almost a quarter century) increases the 50% confidence results.

Table 22 compares the differences between the 50% confidence values and the other calculated confidence level values.

Table 23 tries to come up with another single representative statistic to describe the overall results of Table 22, by using the same two weighting methods used in Table 21. Again, the conclusions are very close between the two methods of weighting.

Table 24 examines whether or not the higher confidence level estimates “close in” on the 50% confidence results.

III. Test Watershed

A. General Information

The course of the project changed during the test watershed phase of analysis where a single test watershed was to be evaluated using the current Manual's single area unit hydrograph (UH) design storm modeling approach. Because only a single watershed was to be tested, the choice of that test watershed became the subject of scrutiny due to the limited variety of stream gage records and watershed histories. A test watershed was eventually selected, and a flood frequency analysis completed after the gage record was adjusted for the effects of urbanization. However, due to the flood frequency curve shape observed and the effects of the skew used, it was decided that better information would be obtained by examining the sensitivity of the current modeling approach versus use of alternative and readily available methods for several of the modeling components (e.g., depth-area curves, loss function construct, S-Graphs, lag estimation procedure, among other possible considerations.) As such, the project evaluated the 40-square mile test watershed problem already contained in the Manual, and modeling results were re-generated for a variety of modeling component substitutions.

B. Choice of Test Watershed

Working in conjunction with County personnel and following their recommendations, the test watershed was chosen. Located in San Diego County, this watershed consists of 7,817 acres with the Los Coches Creek watercourse running through the midst. Stream Gage 11022200 on Los Coches Creek provided stream gage data for the time period of 1983 to 2005. A detailed analysis of development over time within the watershed was also conducted to help determine whether certain variables needed to be adjusted over the length of record being studied.

C. Stream Gage 11022200

Stream Gage 11022200 is owned and operated by the USGS. The gage on Los Coches Creek was installed by the County of San Diego prior to 1983 and has been in continuous operation by the USGS since 11/20/83. This gage is a bubble gage which operates by pressure differential and records data continuously every 15 minutes. The data recorded from 1983 to 2005 was obtained from USGS NWIS in digital form.

D. Stream Gage Data

In order to measure the effects of urbanization on the data from Stream Gage 11022200, our test watershed characteristics were examined with respect to time. Since each annual peak flow rate would be different today if the identical storm happened now, an adjustment may be made to the data by multiplying each annual Q by a factor which is a function of time. The three key elements which were candidates for change were: lag time, unit hydrograph, and loss rates.

E. Lag Assumed Invariant

The watershed lag was assumed not to change since photo reconnaissance indicated small changes to main watercourse channelization over the time period of the stream gage record.

F. Unit Hydrograph Assumed Invariant

The unit hydrograph for this watershed was assumed to be invariant as well. This is due to the small changes in drainage patterns observed in the photo reconnaissance over the time period of the stream gage record.

G. Percent Impervious Versus Time

Of the three factors originally mentioned, only the loss rate appears to change significantly with time, which primarily is due to an increasing imperviousness. The percent of pervious area was plotted versus time and a linear regression was derived and applied to the years of record for Stream Gage 11022200 (i.e., years 1983-2005).

H. Stream Gage Data Adjustment Procedure

Using a Rational Method approach, there is a runoff coefficient, C_i, for the fraction of impervious area, and a runoff coefficient, C_p, for the remaining fraction of pervious area. The area weighted runoff coefficient is then

$$C = C_i A_i + C_p A_p , \tag{1}$$

where

$$A_i + A_p = 1. \tag{2}$$

It was assumed that C_i=1, thus

$$C = A_i + (1 - A_i) * C_p . \tag{3}$$

Three values for C_p were considered: {0.4, 0.6, 0.8}. The values of A_p and A_i were obtained by examination of the watershed and equation (2), respectively.

Next, an adjustment factor, K, was calculated as

$$K_j = \frac{A_i + (1 - A_i) * C_p}{A_{ij} + (1 - A_{ij}) * C_p}, \tag{4}$$

where K_j is the adjustment factor for year j, and the numerator of every K_j value is the latest condition, i.e. the year 2005 value.

Then, the adjusted Q for every year j is given as

$$Q_{adj(j)} = K_j * Q_j . \quad (5)$$

I. Log Pearson III Flood Frequency Curve Analysis

Since there are three values for C_p being considered, there are three synthetic stream gage records obtained. All of these were run through the FFC program to look at the sensitivity of the data with respect to the chosen C_p value. Examination of the data illustrates that there was very little sensitivity in this regard. It should be noted that for each of these FFC runs, the site skew value was used.

J. Evaluation of LACDA Watershed Single Area Unit Hydrograph Design Storm Models

Single area unit hydrograph models were prepared for the subject LACDA calibration watersheds for comparison purposes with the original modeling accomplished in the work leading up to the cited 1987 COE Calibration report. The parameters used were the same parameters used in the original calibration study and are listed in the cited COE report. The Urban S-Graph was used, which corresponds to the current Manual's S-Graph that was originally developed by the SCS some 35 years ago. The loss function used in the calibration was re-used but as a comparison, two of the watersheds were re-run using the SCS loss function as found in the current Manual. The effect of using the SCS loss function was a significant increase in peak flow rates over that obtained by using the two-parameter loss function of the COE report (1987).

The two watersheds were then re-run using the current Manual's depth-area curves. The result of using the Manual's depth-area curves instead of the 1943 Sierra-Madre event depth-area curves, as used in the cited 1987 calibration report, was a significant increase in peak flow rates. It is noted that the said 1987 COE calibration report compares the effect of using the current Manual's NOAA Atlas 2 depth-area curves versus the local severe storm Sierra-Madre event depth-area curves. It was concluded that the Sierra-Madre depth-area curve set was a significant element in modeling and that use of these curves better fit stream gage calibration efforts than using the NOAA Atlas 2 depth-area curves.

In all of these tests, the sum of travel times was used as the estimator for catchment Tc and not the COE lag regression equation. Estimates of lag using the COE lag equation resulted in decreases in catchment lag estimates which would result in an increase in peak flow rate estimates for these two test cases.

In these tests, the original rainfall T-year return frequency rainfall values were used so as to not obfuscate the sensitivity of modeling results by concurrent parameter variations.

In order to better demonstrate the sensitivity of modeling results to variations in modeling parameters, the 40 square mile example problem watershed found in the current Manual is examined with respect to the stated parameter and algorithm variations.

K. Single Area Design Storm Unit Hydrograph Analysis Using Current Manual as Baseline

The example problem presented in the Manual utilizing a 40 square mile watershed (Example 3.2 from the San Diego Workbook) was analyzed using various combinations of parameters in order to evaluate relative significance. Thus, three models were set up whose results are contained in Table 25.

IV. Conclusions and Recommendations

1. For any calibration effort, the target must be well defined. In our case, the design storm unit hydrograph procedure presented in the Manual includes several components that combine to produce a modeling response for the inputs of watershed size, runoff response factors of timing and arrival time distribution, loss rates, T-year rainfall return frequency, design storm pattern shape and characteristics, and depth-area curves. The "target" is categorized as two parts: (a) given actual storm rainfall, how well does the methodology reproduce storm runoff, and (b) estimating T-year peak flow rate and volume quantities. The first target is accommodated by the good performance that calibrated unit hydrograph models have in watersheds such as experienced in southern California. The second target requires a decision as to the confidence levels desired and the applicability of the Log-Pearson III distribution to local watersheds.

2. In the early 1980's, the U.S. Army Corps of Engineers (COE) prepared a detailed study of the Los Angeles Drainage Area (LACDA) where several stream gages were analyzed for past significant storm events and flood frequency estimates were determined for several watersheds. That COE study formed the underpinnings of the County of Orange Calibration study which was originally published by that County in 1985 and then re-published by the COE as a COE technical report in 1987. In the County of Orange calibration effort, an assumption was made that the LACDA watersheds were hydrometeorologically similar to the County of Orange watersheds, and that the rainfall-runoff relationships developed for the LACDA study were applicable to the County of Orange except where local soils and rainfall information were applicable. This assumption has also been applied to other Counties in California including San Bernardino, Kern, and San Joaquin, among others.

3. Because a quarter century of additional stream gage data are available since the conclusion of the LACDA study, the "target" was re-evaluated to see what changes would occur with the addition of the updated data. The results of this update analysis show that the rare return frequency estimates for peak flow rate increased with the addition of the latest data, but only by a few percent. Although not examined, it is plausible that rainfall return frequencies may also increase when the latest quarter century of rainfall data are included in the rainfall statistics. If the rainfall statistics were to increase as observed in the LACDA runoff data, then it is rational to assume that the original model calibration effort would apply directly. Furthermore, the new flood frequency curve values were higher than previously estimated in the LACDA study; however, the new values were still less than the original 85-percent confidence level estimates. That is, designs and plans based on the prior 85-percent confidence level estimates provided flood protection for the new flood frequency curve analysis results.

4. Because the County of Orange procedure is analogous in many ways to the new San Diego County procedures, and because it may be assumed that the County of Orange and the County of San Diego regions are hydrometeorologically similar, the basis of the County of Orange Hydrology Manual may be assumed to also be applicable to the

County of San Diego. Indeed, many features and specifics of the new Manual can be found in the County of Orange Manual. Of course, as stated before, local trends in loss rates and rainfall would be applicable in the respective Manuals.

5. Because of the relatively small increase in high frequency runoff estimates with the update of the LACDA stream gage analysis, the current County of Orange Manual still accommodates, at the 85-percent confidence level, the updated flood frequency curve values. Consequently, the departures found between the County of Orange and the County of San Diego Manuals represent departures with the LACDA information used in the original calibration. The key departures between Manuals are as follows:

a) S-graphs available: The County of Orange provides for four types of S-Graphs. The San Diego Manual provides for one S-Graph (see their Figure 4-4).

b) Lag time estimation: The County of Orange provides for a more rigorous estimation of lag time based on the sum of travel times in the main channel linkage network, whereas the San Diego Manual allows the use of the original COE lag equation. (The County of Orange calibration effort showed an increase in correlation between the use of their sum of travel times versus actual catchment lag values resolved from rainfall-runoff data). The Manual does include, however, provisions for sums of travel time (see their Section 4.3.1.2).

c) Local rainfall and loss rate trends: Of course, the local data would be used.

d) Loss rate formula: The County of Orange uses a two-parameter loss function whereas the County of San Diego uses the so-called SCS loss function (see their Section 4.3.3). The SCS loss function was not developed in tandem with the other components found in the Manual and so the applicability of that SCS loss function to the other components of the Manual are not well known. The SCS loss function exhibits a strong response to design storm timing among other effects which the County of Orange loss function does not.

e) Depth-Area curves: The County of Orange uses the 1943 Sierra-Madre thunderstorm event from the COE analysis of that event in Los Angeles. The County of San Diego uses the 1972 published NOAA depth-area curve set (see their Figure 4-2) that were not developed using southern California data.

6. The several departures mentioned above all tend to increase runoff estimates for the County of San Diego method over the values obtained from the County of Orange method. (Of course, this is setting aside the issue that loss rates and rainfall trends differ between these two Counties. Otherwise, rainfall-runoff trends should be similar because of the similarity between these two Counties.) The Depth-Area curves used by the County of San Diego produce significantly higher runoff quantities of peak flows than do the Sierra-Madre curves. Lag estimates tend to be significantly smaller than the sum of travel times, causing an increase in peak flow rate estimates. Using the single S-Graph tends to produce greater runoff estimates than the other S-Graphs found in the County of

Orange Manual which have more storage effects incorporated. The use of the SCS loss function tends to produce smaller loss rates than does the two-parameter function used by the County of Orange, resulting in higher peak flow rates. All of these departures aim in the same direction as far as being conservative in runoff estimates.

7. To demonstrate the impact of the above departures, the example problem presented in the Manual (40 square mile watershed) was analyzed using various combinations of the mentioned departures in order to evaluate relative significance. These comparisons demonstrate that all of these departures may be significant.

8. From the above analysis, it is possible to conclude that the data and analysis considered in this study show that the San Diego Manual's methodology achieves the 85-percent or higher level of confidence in estimating peak flow rates and runoff quantities.

9. Recommendations are offered as follows:

a) The County may wish to further develop their stream gage and rain gage network and appropriately handle these new data.

b) Once an appropriate record is developed, the County may wish to re-evaluate their Manual's performance and again analyze the confidence level achieved by their methodology.

c) The County may wish to study their modeling responses and relate that response set to their risk tolerance in order to further refine their Manual's goals in modeling estimates.

V. References

[1] Ashkar, F. and Bob´ee, B (1988), Confidence intervals for flood events under a Pearson 3 or Log-Pearson 3 distribution, *Water Resources Bulletin, 24* 639-650

[2] Beard, L.R.(1962), Statistical Methods in Hydrology, *U. S. Army Engineer District, Corp of Engineers,* Sacramento, California, 74 pp

[3] Bob´ee, B. (1975), The Log Pearson Type 3 Distribution and Its Application in Hydrology, *Water Resources Research, 14* 365-369

[4] Bob´ee, B. and Robitaille, R. (1977), The Use of the Pearson Type 3 Distribution and Log Pearson Type 3 Distribution Revisited, *Water Resources Research, 14* 427-443

[5] Cohn, T.A., Grifis, V.W., and Stedinger, J.R.(2004), Log-Pearson type 3 quantile estimators with regional skew information and low outlier adjustment, *Water Resources Research, 40,* W07503, doi: 1029/2003WR002697

[6] Cohn, T.A., Lane, W.L., and Baier, W.G. (1997), An algorithm for computing moment-based flood quantile estimates when historical flood information is available, *Water Resources Research, 33(9),* 2089-2096

[7] Cohn, T.A., Lane, W.L., and Stedinger, J.R. (2001), Confidence intervals for EMA flood quantile estimates, *Water Resources Research, 37(6)* 1695-1706

[8] Condie, R. (1977), The log Pearson type 3 distribution: the T-year event and its asymptotic standard error by maximum likelihood theory, *Water Resources Research, 13* 987-991

[9] Chowdhury, J.U. and Stedinger, J.D. (1991) Confidence intervals for design floods with estimated skew coefficients, *ASCE Journal of Hydraulic Engineering., 11* 811-831

[10] England, J.F., Jr., Jarrett, R.D., and Salas, J.D. (2003) Data-based comparisons of moments estimators using historical and paleoflood data, *Journal of Hydrology, 278(4),* 172-196

[11] England, J.F., Jr., Salas, J.D., and Jarrett, R.D. (2003) Comparisons of two moments-based estimators that utilize historical and paleoflood data for the log Pearson type III distribution, *Water Resources Research, 39(9),* 1243, doi: 10.1029/2002WR001791

[12] Foster, H.A. (1924), Theoretical frequency curves and their applications to engineering problems, *Transactions of the American Society of Civil Engineers, 87* 142-173; discussion 174-203

[13] Griffis, V.W., and Stedinger, J.R, Evolution of flood frequency analysis with bulletin 17, (submitted *Journal of Hydrology*, July 2005)

[14] Griffis, V.W., Stedinger, J.R., and Cohn, T.A. (2004), LP3 quantile estimators with regional skew information and low outlier adjustments, *Water Resources Research*, *40*, pp.W07503, doi: 1029/2003WR002697

[15] Hall, L.S. (1921), The probable variations in yearly run-off as determined from a study of California streams, *Transactions of the American Society of Civil Engineers*, *84* 191-231; discussion 215-257

[16] Harter, R.H. (1969), A new table of percentage points of the Pearson type III distribution, *Technometrica, 11* 177-186
10

[17] Harter, R.H. (1971), More percentage points of the Pearson type III distribution, *Technometrica*, *13* 203-204

[18] Hardison, C.H. (1976), Confidence limits for flood frequency curves computed from Pearson type III populations *Journal of Research U.S.G.S., 4* 545-547

[19] Hromadka, T.V. et.al.(November 1987), Derivation of a Rainfall-Runoff Model to Compute N-year Floods for Orange County Watersheds, *publication U.S. Army Corp of Engineers, Los Angeles Division*

[20] Interagency Committee on Water Data (1982), Guidelines for determining flood flow frequency, *Bulletin 17B*, 28pp. Hydrol. Subcomm., Washington D.C., March

[21] Committee on Techniques for Estimating Probabilities of Extreme Floods, Water Science and Technology Board, Commission on Physical Sciences, Mathematics, and Resources, Nation Research Council (1988), Estimating Probabilities of Extreme Floods, *National Academy Press*, Washington D.C

[22] Kite, G.W. (1975), Confidence limits for design events, *Water Resources Research, 11* 48-53

[23] McCuen, R.H. (1979), Map Skew, *Journal of Water Resources, Planning and Management Division, American Society of Civil Engineers (now) Journal of Water Resources, 105* 265-277 [with Closure, *107*, 582 (1981)]

[24] McCuen, R.H. (2001), Generalized flood skew: map versus watershed skew, *Journal of Hydrologic Engineering*, *64* 293-299

[25] Maidment, D.R., Editor in Chief (1993), Handbook of Hydrology, *McGraw-Hill*, New York

[26] Reis, D.S., Stedinger, J.R., and Martins, E.S. (2005) Bayesian generalized least squares regression with application to log Pearson 3 regional skew estimation, *Water Resources Research, 41, W10419, doi: 10.1029/2004WR003445*

[27] Stedinger, J.R. (1983), Confidence Intervals for Design Events, *Journal of Hydraulic Engineering, 109* 13-27

[28] Stedinger, J.R. and England, J.R., Jr., Key documents for discussion of evolution of Bulletin 17B and proposed changes (2005), *ftp://ftp.usbr.gov/jengland/HFAWG/*

[29] Tasker, G.D. and Stedinger, J.R. (1986), Estimating Generalized Skew withWeighted Least Squares Regression, *Journal of Water Resources, Planning and Management Division, 112* 225-237

[30] Thomas, W.O. (1985), A Uniform Technique for Flood-Frequency Analysis, *Journal of Water Resources, Planning and Management Division, 111* 321-337

[31] Uncertainty of Discharge-Probability Functions (1996). Chapter 4 in Manual No. 1110-2-1619, *Department of the Army, U.S. Army Corps of Engineers,* Washington D.C. (Available online as EM 1110-2-1619 from www.usace.army.mil/inet/usace-docs/eng-manuals)

[32] Whitley, R.J. and Hromadka II, T.V. (1986), Computing Confidence Intervals for Floods I, *Microsoftware for Engineers, 2*,138-150

[33] Whitley, R.J. and Hromadka II, T.V. (1986), Computing Confidence Intervals for Floods II, *Microsoftware for Engineers, 2*,151-158

[34] Whitley, R.J. and Hromadka II, T.V. (1997), Chowdhury and Stedinger's approximate confidence intervals for design floods for a single site, *Stochastic Hydrology and Hydraulics, 11* 51-63

[35] Whitley, R J. and Hromadka II, T.V. (1999), Approximate confidence intervals for design floods for a single site using a neural network, *Water Resources Research, 35* 203-209

[36] Williamson and Schmid (1989), Investigation of Mitigation Needs for Changes in Duration Floodflows Due to Development, County of Orange publication

Table 1: Confidence Levels for 17B Flood Frequency Curve, N=10

n=10	γ =0.0	γ =0.5	γ =1.0
p=0.0001	56	56	60
p=0.0005	56	56	59
p=0.001	56	56	59
p=0.002	56	56	59
p=0.005	55	56	59
p=0.01	55	55	58
p=0.05	54	54	57
p=0.25	52	52	52
p=0.50	50	49	49
p=0.75	48	47	45
p=0.95	46	44	42
p=0.99	45	44	42
p=0.995	45	43	41
p=0.998	44	43	41
p=0.999	44	43	41
p=0.9995	44	43	41
p=0.9999	44	43	41

Table 2: Confidence Levels for 17B Flood Frequency Curve, N=50

n=50	γ =0.0	γ =0.5	γ =1.0
p=0.0001	52	53	55
p=0.0005	52	53	55
p=0.001	52	53	55
p=0.002	52	53	55
p=0.005	52	53	55
p=0.01	52	53	55
p=0.05	52	52	54
p=0.25	51	51	51
p=0.50	50	50	49
p=0.75	49	49	48
p=0.95	48	48	46
p=0.99	48	47	46
p=0.995	48	47	46
p=0.998	48	47	46
p=0.999	48	47	45
p=0.9995	48	47	45
p=0.9999	48	47	45

Table 3: Confidence Levels from 17B, N=10, *p*=0.99

n=10	*q*=0.01	*q*=0.10	*q*=0.25	*q*=0.50	*q*=0.75	*q*=0.90	*q*=0.99
γ =0.0	0.9	8.6	21.6	44.9	71.0	88.5	99.3
γ =0.5	2.7	11.9	23.8	43.6	66.9	85.1	98.8
γ =1.0	4.9	14.6	25.0	41.6	61.9	79.8	97.7

Table 4: Confidence Levels from 17B, N=50, *p*=0.99

n=50	*q*=0.01	*q*=0.10	*q*=0.25	*q*=0.50	*q*=0.75	*q*=0.90	*q*=0.99
γ =0.0	1.0	9.4	23.4	47.8	73.4	89.4	99.0
γ =0.5	2.7	13.3	26.5	47.0	69.3	85.1	97.9
γ =1.0	5.6	17.1	28.9	45.9	64.6	79.7	95.3

Table 5: Confidence Levels from 17B, N=10, *p*=0.01

n=10	*q*=0.01	*q*=0.10	*q*=0.25	*q*=0.50	*q*=0.75	*q*=0.90	*q*=0.99
γ =0.0	0.7	11.5	29.0	55.1	78.4	91.4	99.1
γ =0.5	0.4	9.4	26.8	55.6	82.0	94.8	99.8
γ =1.0	0.3	8.2	26.1	58.5	86.4	97.4	100.0

Table 6: Confidence Levels from 17B, N=50, *p*=0.01

n=50	*q*=0.01	*q*=0.10	*q*=0.25	*q*=0.50	*q*=0.75	*q*=0.90	*q*=0.99
γ =0.0	1.0	10.6	26.7	52.5	76.5	90.6	99.0
γ =0.5	0.5	8.3	24.2	52.6	79.7	93.6	99.7
γ =1.0	0.3	7.4	24.0	54.6	82.4	95.2	99.8

Table 7: Confidence Levels from Simulation, N=10, *p*=0.99

n=10	*q*=0.01	*q*=0.10	*q*=0.25	*q*=0.50	*q*=0.75	*q*=0.90	*q*=0.99
γ =0.0	1.00	10.04	25.02	50.03	75.05	90.03	98.99
γ =0.5	1.01	10.05	25.05	50.05	75.08	90.09	99.02
γ =1.0	0.99	9.98	24.98	50.06	75.08	90.08	99.01

Table 8: Confidence Levels from Simulation, N=50, *p*=0.99

n=50	*q*=0.01	*q*=0.10	*q*=0.25	*q*=0.50	*q*=0.75	*q*=0.90	*q*=0.99
γ =0.0	1.01	10.04	25.04	50.04	75.04	90.01	98.99
γ =0.5	1.01	10.05	25.06	50.03	75.01	89.99	99.01
γ =1.0	0.99	9.98	24.95	50.04	75.05	89.99	98.99

Table 9: Confidence Levels from Simulation, N=10, *p*=0.01

n=10	*q*=0.01	*q*=0.10	*q*=0.25	*q*=0.50	*q*=0.75	*q*=0.90	*q*=0.99
γ =0.0	1.02	10.03	25.01	49.96	75.03	90.02	98.99
γ =0.5	0.98	9.96	24.98	50.10	75.08	90.03	98.98
γ =1.0	1.02	10.04	25.04	50.10	75.06	90.06	99.04

Table 10: Confidence Levels from Simulation, N=50, *p*=0.01

n=50	*q*=0.01	*q*=0.10	*q*=0.25	*q*=0.50	*q*=0.75	*q*=0.90	*q*=0.99
γ =0.0	1.02	10.04	25.06	50.07	75.05	89.98	99.02
γ =0.5	0.99	10.02	25.02	50.02	74.96	89.96	98.98
γ =1.0	0.99	9.94	25.05	50.08	75.05	90.04	99.02

Table 11: Flood Frequency Curve (17B) cfs vs 50% values, N=10, skew=0.5, sample mean=3.4, sample standard deviation=0.2

T-year	*T*=2	*T*=5	*T*=10	*T*=25	*T*=50	*T*=100	*T*=200	*T*=500
17B FFC	2420	3645	4620	6055	7280	8650	10190	12515
50% curve	2425	3720	4770	6335	7690	9220	10955	13600

Table 12: Alhambra Wash (F81D-R) Stream Gage Data

F81D-R ALHAMBRA WASH above Klingerman Street

Season	Daily CFS			Total Runoff	Peak Flow	
	Maximum	Minimum	Mean	(Acre-feet)	Date	CFS
1929-30	N.D.	0	N.D.	635	14-Mar	1,870
1930-31	226	0	2.1	1,480	3-Feb	1,530
1931-32	220	0	2.7	1,940	31-Jan	1,120
1932-33	418	0	2.3	1,680	19-Jan	1,850
1933-34	1,770.00	0	8	5,820	1-Jan	4,890
1934-35	219	0	3.3	2,380	5-Jan	2,280
1935-36	144	0	2	1,420	12-Feb	1,700
1936-37	309	0	5.4	3,880	15-Mar	2,470
1937-38	997	0	7.6	5,520	2-Mar	5,010
1938-39	288	0	4.1	2,990	5-Jan	2,480
1939-40	130	0	2.4	1,730	1-Feb	1,280
1940-41	219	0	7.8	5,650	3-Mar	2,080
1941-42	193	0	2.5	1,810	10-Dec	2,320
1942-43	893	0	8.4	6,070	4-Mar	4,480
1943-44	454	+	5.6	4,100	22-Feb	1,860
1944-45	199	0.1	3.1	2,250	11-Nov	2,220
1945-46	342	0.1	4.1	3,000	22-Dec	1,600
1946-47	345	0.1	5.2	3,800	13-Nov	3,810
1947-48	155	0.1	2.8	2,040	24-Mar	2,670
1948-49	95	0.2	2.8	2,020	17-Dec	758
1949-50	254	0.2	4.3	3,090	6-Feb	1,630
1950-51	106	0.2	3.3	2,360	11-Jan	1,620
1951-52	594	0.2	12.5	9,040	16-Jan	3,810
1952-53	228	0.1	4.5	3,240	15-Nov	3,140
1953-54	369	0.2	5.2	3,770	13-Feb	2,410
1954-55	185	0.2	4.2	3,020	18-Jan	1,890
1955-56	1,100.00	0.3	7.6	5,520	26-Jan	4,550
1956-57	242	0.6	6.1	4,440	23-Feb	3,090
1957-58	544	0.3	12.8	9,270	19-Feb	4,830
1958-59	279	0.2	4.2	3,020	6-Jan	3,170
1959-60	200	0.1	3.8	2,720	11-Jan	1,710
1960-61	153	0.3	2.5	1,790	5-Nov	1,480
1961-62	382	0.1	9.1	6,270	12-Feb	2,560
1962-63	359	0.1	4	2,880	16-Mar	2,210
1963-64	196	0.2	4	2,870	21-Jan	2,210
1964-65	339	0.1	6.4	4,610	9-Apr	3,730
1965-66	686	0.3	10.7	7,740	24-Nov	3,520
1966-67	662	0.4	12.2	8,820	22-Jan	3,550
1967-68	398	0.4	6.5	4,740	8-Mar	3,480
1968-69	999	0.4	17	12,300	6-Feb	3,980
1969-70	486	0.3	5.3	1,871	28-Feb	3,430
1970-71	648	0.4	7.1	2,601	29-Nov	4,040

1971-72	449	0.3	2.5	3,000	24-Dec	2,000
1972-73	555	0.3	12.6	9,110	11-Feb	4,450
1973-74	813	0.3	7.9	5,720	7-Jan	4,330
1974-75	429	0.3	5.6	4,070	4-Dec	6,000
1975-76	274	0.3	5.3	3,790	5-Feb	1,820
1976-77	252	0.3	6	4,340	22-Oct	1,770
1977-78	695	0.3	17	11,927	1-Mar	5,950
1978-79	836	0.3	10.5	7,614	27-Mar	4,484
1979-80	1,240.00	0.3	18.4	13,051	16-Feb	6,660
1980-81	196	0.1	5.1	3,720	19-Mar	2,750
1981-82	371	0.2	6	4,317	17-Mar	2,410
1982-83	1,050.00	0.1	17.8	12,941	1-Mar	7,010
1983-84	235	0.4	3.7	2,715	25-Dec	2,480
1984-85	260	0.3	4.9	3,543	19-Dec	3,050
1985-86	329	0.3	9.2	6,633	8-Mar	4,130
1986-87	177	0.6	3.6	2,579	2-Oct	5,670
1987-88	386	0.6	7	5,048	4-Dec	4,500
1988-89	226	0.9	5.2	3,570	21-Dec	1,410
1989-90	530	0.9	4.8	3,483	17-Feb	2,010
1990-91	452	0.6	7.6	5,437	1-Mar	2,700
1991-92	570	0.7	13.8	10,008	12-Feb	6,340
1992-93	796	1	20.5	14,810	7-Dec	5,880
1993-94	260	0.5	7.1	5,157	24-Mar	3,000
1994-95	875	0.2	14.3	10,380	10-Mar	8,080
1995-96	462	0.4	7	5,071	31-Jan	8,110
1996-97	279	0.3	8.7	6,260	15-Jan	2,640
1997-98	727	0.6	20.2	14,660	6-Feb	7,770
1998-99	142	0.3	6.1	4,400	28-Nov	3,500
1999-00	306	0.4	8.5	6,170	21-Feb	4,480
2000-01	404	0.6	10.2	7,380	11-Jan	3,220
2001-02	325.6	0.8	7.5	5,457.40	24-Nov	6,153
2002-03	881.7	0.5		9,652.40	15-Mar	5,980

M	Data Missing
*	Record Incomplete
E	Estimate
N.D.	Not Determined
**	Record not Computed
+	Less than 0.05 Acre Feet or Less

http://ladpw.org/wrd/report/0203/runoff/peak.cfm

Table 13: Compton Creek (F37B-R) Stream Gage Data

F 37B-R COMPTON CREEK near Greenleaf Drive

Season	Daily CFS			Total Runoff	Peak Flow	
	Maximum	Minimum	Mean	(Acre-feet)	Date	CFS
1927-28	*	0	*	1230*	5-Mar	240*
1928-29	197	0	3.1	2,270	10-Mar	924
1929-30	144	0	3.5	2,520	14-Mar	580
1930-31	137	+	3.3	2,400	26-Apr	678
1931-32	248	0	4.4	3,220	31-Jan	757
1932-33	166	0	2.4	1,780	19-Jan	740
1933-34	372	0	3.5	2,560	1-Jan	960
1934-35	301	0	5.7	4,170	8-Apr	850
1935-36	143	0	4	2,920	12-Feb	824
1936-37	559	0	*	*	6-Feb	1,220
1937-38	986.0E	*	*	*	2-Mar	N.D.
1938-39	837	0	7.1	5,150	25-Sep	2,150
1939-40	256	10	7.4	5,340	3-Feb	1,630
1940-41	544	1	22.7	16,400	23-Dec	2,660
1941-42	236	3	10.1	7,280	10-Dec	1,730
1942-43	752	0.8	11.8	8,560	22-Jan	2,050
1943-44	739	2.3	15.6	11,290	20-Feb	2,370
1944-45	363	4.4	12.7	9,210	11-Nov	3,010
1945-46	362	2.6	11	7,960	23-Dec	2,010
1946-47	474	4.1	13.9	10,080	12-Nov	2,930
1947-48	170	0.6	7.9	5,740	24-Mar	1,410
1948-49	282	0.1	5.1	3,660	17-Dec	2,710
1949-50	433	+	6.6	4,820	6-Feb	2,830
1950-51	209	+	4.9	3,550	10-Jan	1,790
1951-52	661	0.1	14.7	10,650	18-Jan	3,220E
1952-53	220	0.1	5.6	4,020	15-Nov	2,380
1953-54	797	0.1	7.5	5,410	13-Feb	3,600
1954-55	374	0.1	8.4	6,080	18-Jan	2,710
1955-56	2,090.00	0.2	12.7	9,240	26-Jan	4,910
1956-57	286	+	5.6	4,070	11-May	1,780
1957-58	1,100.00	+	16	11,610	19-Feb	4,640
1958-59	449	0	4.6	3,330	6-Jan	4,320
1959-60	463	0	6.3	4,590	11-Jan	3,220
1960-61	204	+	2.7	1,960	5-Nov	1,640
1961-62	1,060.00	0.1	14.5	10,520	19-Feb	4,550
1962-63	576	+	8.8	6,400	10-Feb	3,310
1963-64	212	+	4.7	3,440	6-Nov	2,430
1964-65	424	0	7.4	5,390	9-Apr	2,630
1965-66	809	+	10.8	7,800	29-Dec	3,250
1966-67	765	+	11.8	8,560	7-Nov	4,650
1967-68	1,120.00	+	9.4	6,850	7-Mar	3,690
1968-69	1,040.00	0	16.6	12,010	20-Jan	5,890

1969-70	275	0.2	4.4	3,150	16-Jan	1,960
1970-71	609	0.4	11.7	8,500	29-Nov	2,930
1971-72	622	0.4	6.8	4,940	27-Dec	6,000
1972-73	473	0.2	12.2	8,830	14-Nov	4,300
1973-74	810	0.3	10	7,210	4-Jan	3,140
1974-75	677	0.2	9.1	6,550	4-Dec	8,690
1975-76	285	0.1	4.6	3,270	9-Feb	2,470
1976-77	542	0	7.2	5,220	17-Aug	1,970
1977-78	688	0	20	14,471	1-Mar	3,620
1978-79	559	+	12.3	8,888	27-Mar	2,410
1979-80	*	*	*	*	16-Feb	4,780
1980-81	440	0.1	6.4	4,658	1-Mar	2,970
1981-82	237	0.3	6.3E	4,647E	1-Jan	2,720
1982-83	1,010.00	0.4	21.9	16,720	28-Jan	6,020
1983-84	277	0.3	5.4	3,893	24-Nov	2,380
1984-85	458	0.1	7.4	5,354	19-Dec	4,110
1985-86	*	*	*	*		*
1986-87	187	0.4	4	2,935	17-Nov	1,670
1987-88	443	0.3	8	5,826	4-Dec	2,980
1988-89	258	0.6	5.9	4,254	21-Dec	1,990
1989-90	755	0.2	5.4	3,887	17-Feb	2,500
1990-91	527	0.5	9.1	6,586	19-Mar	3,940
1991-92	510	0.1	15.5	11,228	20-Mar	4,640
1992-93	717	0.1	21.8	15,760	6-Jan	5,240
1993-94	290	0.2	6	4,315	30-Nov	2,680
1994-95	1,120.00	0	15.8	11,440	4-Jan	7,660
1995-96	627	0.5	8	5,792	31-Jan	3,410
1996-97	402	0.7	10.1	7,300	9-Dec	2,510
1997-98	826	0.7	26.9	19,500	6-Feb	7,040
1998-99	384	0.2	9	6,540	8-Nov	2,420
1999-00	611	0	7.6	5,480	5-Mar	6,150
2000-01	525	0	10.6	7,710	11-Jan	3,250
2001-02	402.8	0	7.1	15,512.20	24-Nov	2,519
2002-03	997.2	0		8,881	15-Mar	4,750

M	Data Missing
*	Record Incomplete
E	Estimate
N.D.	Not Determined
**	Record not Computed
+	Less than 0.05 Acre Feet or Less

http://ladpw.org/wrd/report/0203/runoff/peak.cfm

Table 14: Eaton Wash (F318-R) Stream Gage Data

F318-R EATON WASH at Lotus Drive

Season	Daily CFS			Total Runoff (Acre-feet)	Peak Flow	
	Maximum	Minimum	Mean		Date	CFS
1956-57	201	0	0	2,400	23-Feb	1,760
1957-58	368	0.1	0.1	7,460	19-Feb	2,700
1958-59	245	0.1	0.1	2,850	6-Jan	3,480
1959-60	186	+	+	2,420	12-Jan	1,090
1960-61	123	0.1	0.1	1,590	26-Nov	1,200
1961-62	598	0.1	0.1	6,880	11-Feb	1,950
1962-63	311	0.3	0.3	2,980	9-Feb	1,230
1963-64	227	0.1	0.1	3,050	20-Nov	2,360
1964-65	254	0.2	0.2	3,760	9-Apr	2,150
1965-66	605	0.3	0.3	8,990	29-Dec	2,290
1966-67	548	0.3	0.3	8,670	24-Jan	2,100
1967-68	318	0.3	0.3	4,040	8-Mar	2,390
1968-69	1,860.00	0.3	0.3	M		M
1969-70	M	M	M	M		M
1970-71	M	M	M	M		M
1971-72	M	M	M	M		M
1972-73	M	M	M	M		M
1973-74	592	0.3	0.3	4,870	7-Jan	1,530
1974-75	480	0.5	0.5	4,870	4-Dec	3,000
1975-76	275	0.4	0.4	3,980	11-Sep	2,660
1976-77	206	0.4	0.4	3,650	23-Oct	1,820
1977-78	914	0.4	0.4	21,425	10-Feb	5,810
1978-79	335	0.3	0.3	7,156	21-Feb	2,630
1979-80	1,460.00	0.1	0.1	27,991	16-Feb	5,240
1980-81	203	0.3	0.3	3,937	19-Mar	1,630
1981-82	377	0.4	0.4	5,453	17-Mar	3,060
1982-83	1,570.00	0.5	0.5	28,952		N.D.
1983-84	191	0.4	0.4	3,307	25-Dec	1,930
1984-85	199	0.4	0.4	4,258	19-Dec	2,460
1985-86	313	0.4	0.4	4,827	31-Jan	1,730
1986-87	178	0.1	0.1	1,782	2-Oct	1,400
1987-88	317	0	0	3,048	17-Jan	4,950
1988-89	172	0.1	0.1	2,134	15-Dec	1,150
1989-90	383	0.1	0.1	2,289	17-Apr	1,310
1990-91	331	0	0	3,948	28-Feb	1,850
1991-92	757	0	0	10,304	12-Feb	3,900
1992-93	664	0	0	21,580	7-Dec	5,090
1993-94	159	0	0	2,122	24-Mar	2,580
1994-95	954	0	0	14,500	11-Mar	5,330
1995-96	551	0.1	0.1	5,734	31-Jan	5,090
1996-97	236	0.1	0.1	4,630	12-Jan	1,010
1997-98	1,070.00	0.1	0.1	14,050	23-Feb	4,650

1998-99	136	0.2	0.2	1,990	28-Nov	1,430
1999-00	247	0.1	0.1	3,720	21-Feb	2,490
2000-01	352	0.2	0.2	4,680	11-Jan	1,760
2001-02	236.4	0.2	2.3	1,685.10	24-Nov	4,059
2002-03	557.8	0.1		5,352.60	15-Mar	3,030

M	Data Missing
*	Record Incomplete
E	Estimate
N.D.	Not Determined
**	Record not Computed
+	Less than 0.05 Acre Feet or Less

http://ladpw.org/wrd/report/0203/runoff/peak.cfm

Table 15: Rubio Wash (F82C-R) Stream Gage Data

F82C-R RUBIO WASH at Glendon Way

Season	Daily CFS			Total Runoff	Peak Flow	
	Maximum	Minimum	Mean	(Acre-feet)	Date	CFS
1930-31	107	0	1.5	1,110	3-Feb	1,690
1931-32	124	0	2.1	1,490	27-Nov	798
1932-33	234	0	1.5	1,110	16-Jan	1,510
1933-34	684	0	3.6	2,580	31-Dec	2,070
1934-35	134	0	2.4	1,770	17-Oct	1,680
1935-36	81	0	1.8	1,280	22-Feb	1,370
1936-37	186	0	3.9	2,800	27-Dec	1,180
1937-38	802	0	5.8	4,180	2-Mar	2,400E
1938-39	250	0	3.3	2,370	5-Jan	1,720
1939-40	122	0	2.4	1,270	7-Jan	1,000
1940-41	200	0	8.1	5,890	3-Mar	1,940
1941-42	130	0	2.1	1,530	10-Dec	1,200
1942-43	697	0	6.2	4,520	4-Mar	2,780
1943-44	393	0	4.4	3,190	22-Feb	1,930
1944-45	152	0	2.1	1,540	11-Nov	1,780
1945-46	244	0	2.5	1,840	22-Dec	1,630
1946-47	233	0	3.2	2,300	13-Nov	2,650
1947-48	91	0	1.5	1,080	24-Mar	2,090
1948-49	59	0	1.5	1,080	30-Oct	530
1949-50	161	0	2.3	1,690	6-Feb	1,060
1950-51	80	0	1.4	1,010	11-Jan	2,290
1951-52	335	0	7.3	5,300	16-Jan	3,020
1952-53	133	0	2	1,460	15-Nov	2,200
1953-54	288	+	3.4	2,490	19-Jan	2,310
1954-55	126	+	2.6	1,870	18-Jan	1,290
1955-56	639	0	4	2,880	26-Jan	1,970
1956-57	199	+	3.2	2,290	23-Feb	2,980
1957-58	286	0.1	7.7	5,610	19-Feb	2,740
1958-59	218	0.2	2.8	2,030	6-Jan	2,780
1959-60	135	0.2	2.5	1,820	11-Jan	985
1960-61	117	0.2	1.8	1,270	6-Nov	902
1961-62	281	0.1	5.7	4,120	20-Jan	1,200
1962-63	246	0.1	2.4	1,760	9-Feb	1,180
1963-64	136	0.2	2.6	1,870	21-Jan	1,570
1964-65	164	0.1	2.8	2,030	9-Apr	2,040
1965-66	466	0.1	6.4	4,650	24-Nov	2,300
1966-67	344	0.2	7.2	5,220	3-Dec	2,040
1967-68	343	0.2	4	2,930	8-Mar	2,460
1968-69	712	0.2	11.4	8,220	25-Jan	2,890
1969-70	**	**	**	**	28-Feb	2,540
1970-71	**	**	**	**	29-Nov	3,700
1971-72	**	**	**	**	24-Dec	1,240

1972-73	410	0	7.0*	5,041*	11-Feb	3,166
1973-74	460	0.2	5.5	3,950	7-Jan	1,985
1974-75	328	0.3	4.5	3,240	4-Dec	3,180
1975-76	373	0.2	4.1	2,920	10-Sep	2,070
1976-77	180	0.1	4.4	3,187	23-Oct	2,610
1977-78	531	0	12.9	9,340	10-Feb	*
1978-79	176	0	8.4	6,056	21-Feb	2,680
1979-80	781	0	11.8	8,372	29-Jan	4,594
1980-81	205	0	4.3	3,108	1-Mar	1,754
1981-82	186	0	4	2,890	17-Mar	1,650
1982-83	620	0.1	12.6	9,079	2-Mar	4,560
1983-84	165	0.1	2.8	1,976	25-Dec	1,680
1984-85	154	0.1	3.5	2,543	19-Dec	1,610
1985-86	212	0.1	6.1	4,445	8-Mar	2,090
1986-87	153	0.2	3.6	2,580	2-Oct	2,790
1987-88	246	0	4.3	3,113	4-Dec	3,620
1988-89	123	0.1	2.9	2,122	15-Dec	783
1989-90	341	0.3	4.5	3,249	16-Jan	1,560
1990-91	355	0	4.9	3,513	1-Mar	1,840
1991-92	287	0	5.7	4,115	12-Feb	2,540
1992-93	323	0	7.9	5,726	14-Jan	3,660
1993-94	105	0	2.3	1,640	24-Mar	1,970
1994-95	707	0	9.4	6,777	11-Mar	4,610
1995-96	656	0	7.5	5,464	31-Jan	5,010
1996-97	156	0	3.9	2,790	15-Jan	1,180
1997-98	438	0	9.1	6,590	6-Feb	4,030
1998-99	79	0	2.2	1,560	28-Nov	2,430
1999-00	218	0.1	5.6	4,030	21-Feb	2,710
2000-01	249	0.6	5.7	4,120	11-Jan	1,670
2001-02	186.3	0.4	3	2,187.30	24-Nov	3,553
2002-03	0	0		0	16-Mar	2,550

M	Data Missing
*	Record Incomplete
E	Estimate
N.D.	Not Determined
**	Record not Computed
+	Less than 0.05 Acre Feet or Less

http://ladpw.org/wrd/report/0203/runoff/peak.cfm

Table 16: Arcadia Wash (F317-R) Stream Gage Data

F317-R ARCADIA WASH below Grand Avenue

Season	Daily CFS			Total Runoff	Peak Flow	
	Maximum	Minimum	Mean	(Acre-feet)	Date	CFS
1956-57	108	0.1	1.8	1,340	23-Feb	1,184
1957-58	212	0.1	4.6	3,330	1-Feb	1,932
1958-59	127	0.2	1.9	1,360	6-Jan	1,270
1959-60	101	0.3	1.7	1,220	27-Apr	593
1960-61	69	+	1.1	831	5-Nov	570
1961-62	408	0.1	4.7	3,400	11-Feb	1,480
1962-63	153	0.2	2.1	1,510	9-Feb	600
1963-64	120	0.1	2.2	1,620	20-Nov	1,340
1964-65	153	0.1	3.1	2,270	9-Apr	1,460
1965-66	267	0.1	4.7	3,430	29-Dec	1,270
1966-67	283	0.3	6.3	4,560	22-Jan	1,260
1967-68	M	M	M	M		M
1968-69	M	M	M	M		M
1969-70	M	M	M	M		M
1970-71	M	M	M	M		M
1971-72	M	M	M	M		M
1972-73	M	M	M	M		M
1973-74	279	0.3	4	2,910	7-Jan	931
1974-75	207	0.3	3.2	2,290	4-Dec	2,560
1975-76	167	0.3	3.6	2,600	11-Sep	1,400
1976-77	119	0.2	2.9	2,121	23-Oct	1,320
1977-78	355	0.2	9.4	6,823	10-Feb	4,110
1978-79	128	0.2	4.5	3,263	27-Mar	1,290
1979-80	633	0	9.9	7,025	29-Jan	3,280
1980-81	104	0.4	2.8	1,991	29-Jan	1,050
1981-82	208	0.4	4.3	3,137	17-Mar	2,470
1982-83	435	0.4	10.8	7,824	1-Mar	4,110
1983-84	121	0	3.2	2,354	1-Oct	1,430
1984-85	137	0.1	4.7	3,399	19-Dec	1,420
1985-86	211	0	8.4	6,116	8-Mar	1,760
1986-87	172	0.1	3.5	2,530	2-Oct	2,410
1987-88	284	0.1	5.4	3,915	17-Jan	4,360
1988-89	114	0.1	3.7	2,521	21-Dec	507
1989-90	728	0.1	3.5	2,505	17-Apr	1,330
1990-91	228	0.1	5	3,598	28-Feb	2,120
1991-92	301	0.1	11.1	8,043	12-Feb	3,190
1992-93	586	0.3	17.3	12,560	17-Jan	2,720
1993-94	239	0	6.4	4,661	19-Mar	1,360
1994-95	480	0.1	11.1	8,032	11-Mar	2,740
1995-96	405	0.4	5.2	3,764	20-Feb	1,560
1996-97	206	0.5	6.3	4,540	26-Jan	1,430
1997-98	489	0.6	13.3	9,640	6-Feb	2,850

1998-99	151	0.5	4.2	3,020	26-Jan	1,040
1999-00	162	0.1	4.3	3,150	21-Feb	1,750
2000-01	240	0.2	6	4,320	11-Jan	1,380
2001-02	161.3	0.6	2.6	1,904.00	24-Nov	2,712
2002-03	0	0		0	15-Mar	2,120

M	Data Missing
*	Record Incomplete
E	Estimate
N.D.	Not Determined
**	Record not Computed
+	Less than 0.05 Acre Feet or Less

http://ladpw.org/wrd/report/0203/runoff/peak.cfm

Table 17: Hydrologic Stream Gage Information

	Area (sq.mi)	Length of longest watercourse (mi)	Slope (ft/mi)	Time of Concentration (hrs)	Lag (hrs)
Alhambra Wash	13.67	8.62	82.40	0.89	0.62
Compton Creek	24.76	12.69	13.80	2.22	0.94
Eaton Wash	11.02	8.14	90.90	1.05	0.54
Rubio Wash	12.20	9.47	125.70	0.68	0.63
Arcadia Wash	7.70	5.87	156.70	0.60	0.41

Table 18: Statistical Parameters

Alhambra

	1929-2003	1929-1983
N	74	54
mean	3.502	3.462
standard deviation	0.213	0.199
skew	-0.089	-0.133
adopted skew*	0.2	0.2
watershed area (square miles)	15.2	15.2

Compton

	1927-2003	1927-1984
N	74	56
mean	3.46	3.432
standard deviation	0.216	0.218
skew	-0.436	-0.522
adopted skew*	0.1	0.1
watershed area (square miles)	22.6	22.6

Eaton

	1956-2003	1956-1984
N	47	28
mean	3.386	3.375
standard deviation	0.213	0.193
skew	0.105	0.225
adopted skew*	0.2	0.2
watershed area (square miles)	22.8	22.8

Rubio

	1930-2003	1930-1983
N	74	54
mean	3.318	3.299
standard deviation	0.193	0.187
skew	-0.461	-0.599
adopted skew*	-0.2	-0.2
watershed area (square miles)	10.9	10.9

Arcadia

	1956-2003	1956-1984
N	47	28
mean	3.207	3.167
standard deviation	0.22	0.22
skew	-0.187	0.146
adopted skew*	0.1	0.1
watershed area (square miles)	8.5	8.5

*** adopted skew found in *Derivation of a Rainfall Runoff Model to Compute N-year Floods for Orange County Watersheds, November 1987***

Table 19: Flow Rate Results

Extended Record

Alhambra	50%	65%	85%	95%
T=2	3126	3196	3318	3440
T=5	4783	4917	5166	5425
T=10	6031	6234	6641	7018
T=25	7782	8097	8697	9347
T=50	9210	9629	10433	11315
T=100	10747	11288	12333	13490

Compton	50%	65%	85%	95%
T=2	2861	2925	3039	3151
T=5	4352	4471	4689	4916
T=10	5453	5629	5956	6305
T=25	6960	7228	7736	8288
T=50	8164	8515	9188	9922
T=100	9438	9885	10744	11692

Eaton	50%	65%	85%	95%
T=2	2394	2461	2581	2702
T=5	3666	3797	4045	4312
T=10	4626	4824	5206	5629
T=25	5973	6282	6890	7579
T=50	7073	7485	8301	9242
T=100	8258	8789	9855	11098

Rubio	50%	65%	85%	95%
T=2	2110	2153	2226	2298
T=5	3038	3107	3232	3362
T=10	3645	3740	3917	4103
T=25	4401	4535	4789	5059
T=50	4954	5121	5438	5781
T=100	5499	5702	6086	6503

Arcadia	50%	65%	85%	95%
T=2	1597	1644	1726	1810
T=5	2467	2556	2723	2903
T=10	3113	3245	3500	3782
T=25	4003	4207	4608	5062
T=50	4720	4989	5523	6138
T=100	5481	5824	6513	7316

Unextended Record

Alhambra	50%	65%	85%	95%
T=2	2854	2924	3048	3171
T=5	4249	4381	4627	4889
T=10	5279	5475	5847	6253
T=25	6701	7001	7581	8227
T=50	7846	8240	9012	9880
T=100	9066	9570	10562	11693

Compton	50%	65%	85%	95%
T=2	2682	2752	2877	3002
T=5	4124	4258	4507	4772
T=10	5191	5389	5768	6179
T=25	6658	6964	7555	8214
T=50	7836	8238	9026	9913
T=100	9085	9598	10611	11763

Eaton	50%	65%	85%	95%
T=2	2337	2415	2556	2702
T=5	3446	3593	3880	4204
T=10	4259	4478	4916	5427
T=25	5375	5710	6397	7222
T=50	6271	6711	7627	8750
T=100	7222	7783	8963	10436

Rubio	50%	65%	85%	95%
T=2	2019	2065	2145	2223
T=5	2869	2943	3078	3221
T=10	3421	3522	3713	3917
T=25	4104	4246	4518	4815
T=50	4601	4777	5116	5491
T=100	5089	5301	5711	6169

Arcadia	50%	65%	85%	95%
T=2	1457	1512	1613	1717
T=5	2255	2361	2570	2809
T=10	2848	3008	3331	3714
T=25	3668	3917	4433	5060
T=50	4328	4658	5349	6209
T=100	5030	5453	6350	7486

Table 20: Change in Confidence Level Estimates ($\alpha_{x,T,g}$) Due to Added Years of Records

Alhambra

	50%	65%	85%	95%
T=2	1.10	1.09	1.09	1.08
T=5	1.13	1.12	1.12	1.11
T=10	1.14	1.14	1.14	1.12
T=25	1.16	1.16	1.15	1.14
T=50	1.17	1.17	1.16	1.15
T=100	1.19	1.18	1.17	1.15

Compton

	50%	65%	85%	95%
T=2	1.07	1.06	1.06	1.05
T=5	1.06	1.05	1.04	1.03
T=10	1.05	1.04	1.03	1.02
T=25	1.05	1.04	1.02	1.01
T=50	1.04	1.03	1.02	1.00
T=100	1.04	1.03	1.01	0.99

Eaton

	50%	65%	85%	95%
T=2	1.02	1.02	1.01	1.00
T=5	1.06	1.06	1.04	1.03
T=10	1.09	1.08	1.06	1.04
T=25	1.11	1.10	1.08	1.05
T=50	1.13	1.12	1.09	1.06
T=100	1.14	1.13	1.10	1.06

Rubio

	50%	65%	85%	95%
T=2	1.05	1.04	1.04	1.03
T=5	1.06	1.06	1.05	1.04
T=10	1.07	1.06	1.06	1.05
T=25	1.07	1.07	1.06	1.05
T=50	1.08	1.07	1.06	1.05
T=100	1.08	1.08	1.07	1.05

Arcadia

	50%	65%	85%	95%
T=2	1.10	1.09	1.07	1.05
T=5	1.09	1.08	1.06	1.03
T=10	1.09	1.08	1.05	1.02
T=25	1.09	1.07	1.04	1.00
T=50	1.09	1.07	1.03	0.99
T=100	1.09	1.07	1.03	0.98

Note: $\alpha_{x,T,g}$ = Ratio of Peak Flow Rate estimate at confidence level *x*, return frequency *T*, gage *g* for the extended record versus the unextended record

Table 21: Weighted Average of $\alpha_{x,T,g}$ Values

Weighted Average (watershed size)

	50%	65%	85%	95%
T=2	1.06	1.06	1.05	1.04
T=5	1.08	1.07	1.06	1.05
T=10	1.08	1.08	1.06	1.05
T=25	1.09	1.09	1.07	1.05
T=50	1.10	1.09	1.07	1.05
T=100	1.11	1.10	1.08	1.05

$$\frac{\sum_g \alpha_{x,T,g} A_g}{\sum_g A_g}$$

Weighted Average (years of record)

	50%	65%	85%	95%
T=2	1.07	1.06	1.05	1.05
T=5	1.08	1.07	1.06	1.05
T=10	1.09	1.08	1.07	1.05
T=25	1.10	1.09	1.07	1.05
T=50	1.10	1.09	1.07	1.05
T=100	1.11	1.10	1.08	1.05

$$\frac{\sum_g \alpha_{x,T,g} N_g}{\sum_g N_g}$$

Notes:

1. A_g **=area of watershed, *g***
2. N_g **=number of years of record for gage, *g***

Table 22: Relationship Between Confidence Level Estimates versus 50% Confidence Level Estimate ($\beta_{x,T,g}$)

Extended Record ($\beta_{x,T,g}$) Values

Alhambra	50%	65%	85%	95%
T=2	1.00	1.02	1.06	1.10
T=5	1.00	1.03	1.08	1.13
T=10	1.00	1.03	1.10	1.16
T=25	1.00	1.04	1.12	1.20
T=50	1.00	1.05	1.13	1.23
T=100	1.00	1.05	1.15	1.26

Compton	50%	65%	85%	95%
T=2	1.00	1.02	1.06	1.10
T=5	1.00	1.03	1.08	1.13
T=10	1.00	1.03	1.09	1.16
T=25	1.00	1.04	1.11	1.19
T=50	1.00	1.04	1.13	1.22
T=100	1.00	1.05	1.14	1.24

Eaton	50%	65%	85%	95%
T=2	1.00	1.03	1.08	1.13
T=5	1.00	1.04	1.10	1.18
T=10	1.00	1.04	1.13	1.22
T=25	1.00	1.05	1.15	1.27
T=50	1.00	1.06	1.17	1.31
T=100	1.00	1.06	1.19	1.34

Rubio	50%	65%	85%	95%
T=2	1.00	1.02	1.05	1.09
T=5	1.00	1.02	1.06	1.11
T=10	1.00	1.03	1.07	1.13
T=25	1.00	1.03	1.09	1.15
T=50	1.00	1.03	1.10	1.17
T=100	1.00	1.04	1.11	1.18

Arcadia	50%	65%	85%	95%
T=2	1.00	1.03	1.08	1.13
T=5	1.00	1.04	1.10	1.18
T=10	1.00	1.04	1.12	1.21
T=25	1.00	1.05	1.15	1.26
T=50	1.00	1.06	1.17	1.30
T=100	1.00	1.06	1.19	1.33

Unextended Record ($\beta_{x,T,g}$) Values

Alhambra	50%	65%	85%	95%
T=2	1.00	1.02	1.07	1.11
T=5	1.00	1.03	1.09	1.15
T=10	1.00	1.04	1.11	1.18
T=25	1.00	1.04	1.13	1.23
T=50	1.00	1.05	1.15	1.26
T=100	1.00	1.06	1.17	1.29

Compton	50%	65%	85%	95%
T=2	1.00	1.03	1.07	1.12
T=5	1.00	1.03	1.09	1.16
T=10	1.00	1.04	1.11	1.19
T=25	1.00	1.05	1.13	1.23
T=50	1.00	1.05	1.15	1.26
T=100	1.00	1.06	1.17	1.29

Eaton	50%	65%	85%	95%
T=2	1.00	1.03	1.09	1.16
T=5	1.00	1.04	1.13	1.22
T=10	1.00	1.05	1.15	1.27
T=25	1.00	1.06	1.19	1.34
T=50	1.00	1.07	1.22	1.40
T=100	1.00	1.08	1.24	1.44

Rubio	50%	65%	85%	95%
T=2	1.00	1.02	1.06	1.10
T=5	1.00	1.03	1.07	1.12
T=10	1.00	1.03	1.09	1.14
T=25	1.00	1.03	1.10	1.17
T=50	1.00	1.04	1.11	1.19
T=100	1.00	1.04	1.12	1.21

Arcadia	50%	65%	85%	95%
T=2	1.00	1.04	1.11	1.18
T=5	1.00	1.05	1.14	1.25
T=10	1.00	1.06	1.17	1.30
T=25	1.00	1.07	1.21	1.38
T=50	1.00	1.08	1.24	1.43
T=100	1.00	1.08	1.26	1.49

Note: ($\beta_{x,T,g}$) = (*x* confidence level estimate / 50% confidence level estimate) at return frequency *T*, for gage *g*

Table 23: Weighted Average of $(\beta_{x,T,g})$ Values

Extended Record

Weighted Average (watershed size)

	50%	65%	85%	95%
T=2	1.0000	1.0245	1.0677	1.1107
T=5	1.0000	1.0301	1.0862	1.1456
T=10	1.0000	1.0358	1.1044	1.1769
T=25	1.0000	1.0429	1.1257	1.2173
T=50	1.0000	1.0480	1.1415	1.2463
T=100	1.0000	1.0529	1.1568	1.2744

$$\frac{\sum_g \beta_{x,T,g} A_g}{\sum_g A_g}$$

Weighted Average (years of record)

	50%	65%	85%	95%
T=2	1.0000	1.0237	1.0655	1.1070
T=5	1.0000	1.0289	1.0826	1.1393
T=10	1.0000	1.0342	1.0999	1.1685
T=25	1.0000	1.0409	1.1196	1.2062
T=50	1.0000	1.0458	1.1345	1.2333
T=100	1.0000	1.0504	1.1487	1.2594

$$\frac{\sum_g \beta_{x,T,g} N_g}{\sum_g N_g}$$

Unextended Record

Weighted Average (watershed size)

	50%	65%	85%	95%
T=2	1.0000	1.0287	1.0800	1.1321
T=5	1.0000	1.0357	1.1039	1.1785
T=10	1.0000	1.0425	1.1254	1.2190
T=25	1.0000	1.0511	1.1531	1.2711
T=50	1.0000	1.0573	1.1731	1.3093
T=100	1.0000	1.0632	1.1920	1.3459

$$\frac{\sum_g \beta_{x,T,g} A_g}{\sum_g A_g}$$

Weighted Average (years of record)

	50%	65%	85%	95%
T=2	1.0000	1.0278	1.0773	1.1274
T=5	1.0000	1.0342	1.0992	1.1700
T=10	1.0000	1.0406	1.1193	1.2077
T=25	1.0000	1.0487	1.1452	1.2562
T=50	1.0000	1.0545	1.1638	1.2915
T=100	1.0000	1.0600	1.1815	1.3254

$$\frac{\sum_g \beta_{x,T,g} N_g}{\sum_g N_g}$$

Notes:

1. A_g**=area of watershed,** g
2. N_g**=number of years of record for gage,** g

Table 24: Difference in Weighted Averages of Values: (Extended Record) – (Unextended Record)

Weighting by Watershed Area

	50%	65%	85%	95%
T=2	0.0000	-0.0043	-0.0123	-0.0214
T=5	0.0000	-0.0056	-0.0177	-0.0329
T=10	0.0000	-0.0067	-0.0210	-0.0421
T=25	0.0000	-0.0082	-0.0274	-0.0539
T=50	0.0000	-0.0093	-0.0315	-0.0630
T=100	0.0000	-0.0103	-0.0353	-0.0715

Weighting by Years of Record

	50%	65%	85%	95%
T=2	0.0000	-0.0041	-0.0118	-0.0204
T=5	0.0000	-0.0053	-0.0166	-0.0308
T=10	0.0000	-0.0063	-0.0195	-0.0392
T=25	0.0000	-0.0078	-0.0256	-0.0500
T=50	0.0000	-0.0087	-0.0293	-0.0581
T=100	0.0000	-0.0096	-0.0328	-0.0660

Table 25: Model Results Based of the San Diego Workbook Example 3.2

Model	**A**	**B**	**C**
Area (sq mi)	40	40	40
SCS CN	85		
Fp (in/hr)		***0.29***	***0.29***
Low loss fraction		***0.303***	***0.303***
Return Frequency	100-year	100-year	100-year
P_6 (in)	3.0	3.0	3.0
P_{24} (in)	5.5	5.5	5.5
Lag (hr)	1.74	1.74	1.74
S-graph	SCS	***Urban***	***Urban***
	SD	SD	Sierra
Depth-Area Factor	Manual	Manual	Madre
5-m	0.730	0.730	***0.475***
30-m	0.730	0.730	***0.510***
1-hr	0.830	0.830	***0.053***
3-hr	0.915	0.915	***0.865***
6-hr	0.940	0.940	***0.940***
24-hr	0.958	0.958	***0.963***
Peak Runoff (cfs)	18,544	16,471	13,027
Total Volume (af)	7,726	8,121	7,983

Note: Values are different from Model A

Appendix A.2

Derivation of a Rainfall-Runoff Model to Compute N-Year Floods for Orange County Watershed (1987)

This page is intentionally left blank to facilitate 2-sided printing.

DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

NOVEMBER 1987

DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE
N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

TABLE OF CONTENTS

		Page
1.	INTRODUCTION	1
	a. PURPOSE AND SCOPE	1
	b. CONTRIBUTORS	2
2.	MODEL COMPONENTS	3
	a. STORM	3
	(1) Pattern	3
	(2) Time Distribution	3
	(3) Precipitation	3
	(4) Depth Area Adjustment	4
	b. PRECIPITATION LOSS RATE FUNCTION	4
	(1) Maximum Loss Rate (Fm)	5
	(2) Low Loss Rate Fraction (Y)	5
	(3) Antecedent Moisture Conditions	6
	c. UNIT HYDROGRAPH	6
	(1) S-Graph	7
	(2) Lag Relationships	7
3.	DEVELOPMENT OF MODEL PARAMETERS	9
	a. FLOOD RECONSTITUTIONS	9
	(1) Reconstitution Process	9
	(2) Los Angeles County Flood Reconstitutions	9
	(a) Precipitation	9
	(b) Runoff hydrograph parameters	10
	(c) Unit hydrograph and loss rate parameters	10
	(3) Orange County Flood Reconsitutions	11
	(a) Precipitation	11
	(b) Runoff hydrograph parameters	11
	(c) Unit hydrograph and loss rate parameters	11
	b. REGIONALIZATION OF MODEL PARAMETERS	12
	(1) Loss Rate	12
	(2) S-Graph	13
	(3) Lag Relationships	13
	c. VERIFICATION OF REGIONALIZED MODEL PARAMETERS	14
4.	MODEL CALIBRATION	16
	a. ANALYTICAL DISCHARGE FREQUENCY ANALYSIS	16
	(1) Adjustment for Effects of Urbanization	16
	(a) Physical description of drainage basins	17
	(b) Impacts of urbanization	17
	(c) Hydrologic method for adjusting streamflow data	18
	(2) Analytic Analysis of Adjusted Streamflow Records	21
	(3) Results of Analytic Discharge Frequency Analysis	22
	b. CALIBRATION OF RAINFALL-RUNOFF MODEL TO COMPUTED ANALYTIC RESULTS	22
	c. VERIFICATION OF CALIBRATED RAINFALL-RUNOFF MODEL	24
	d. EXPECTED PROBABILITY ADJUSTMENT	24
	e. OCEMA PROCEDURE - 85 PERCENT CONFIDENCE LEVEL	24

CONTENTS (Continued)

Page

5. MODEL APPLICATION..... 26
   a. GENERAL DESCRIPTION OF MODEL..... 26
      (1) Single Area Runoff Hydrograph Development..... 26
      (2) Complex Watershed Runoff Hydrograph Development..... 26
   b. COMPUTER PROGRAM..... 27
   c. INPUT REQUIREMENTS..... 27
   d. MODELING PROCEDURE, STEP-BY-STEP GUIDE..... 27
      (1) Physical Characteristics..... 27
      (2) Precipitation..... 27
      (3) Loss Rate Function..... 28
         (a) Impervious cover..... 28
         (b) Low loss fraction, Y..... 29
         (c) Maximum loss rate, Fm..... 33
      (4) S-Graph..... 33
      (5) Lag Relationships..... 33
      (6) N-Year Flood Hydrographs..... 33

REFERENCES

LIST OF TABLES

1. N-YEAR MEAN POINT RAINFALL VALUES FOR NON-MOUNTAINOUS ORANGE COUNTY.
2. STREAM GAUGES AND STORM EVENT RECONSTITUTIONS USED IN DEVELOPMENT OF REGIONAL MODEL PARAMETERS.
3. BASIN CHARACTERISTICS OF WATERSHEDS USED IN FLOOD RECONSTITUTIONS.
4. PRECIPITATION GAUGES USED IN LOS ANGELES COUNTY FLOOD RECONSTITUTIONS.
5. RESULTS OF FLOOD RECONSTITUTIONS FOR LOS ANGELES COUNTY WATERSHEDS.
6. PRECIPTIATION GAUGES USED IN ORANGE COUNTY FLOOD RECONSTITUTIONS.
7. RESULTS OF FLOOD RECONSTITUTIONS FOR ORANGE COUNTY WATERSHEDS.
8. PEAK LOSS RATES FROM RECONSTITUTION STUDIES USED FOR REGIONALIZATION OF Fp.
9. LAG AND tc ESTIMATES.
10. DATA USED FOR VERIFICATION OF REGIONAL PARAMETER MODEL, MARCH 1, 1983 STORM EVENT.
11. COMPARISON OF REGIONAL PARAMETER MODEL RESULTS WITH OBSERVED PEAK FLOWS, MARCH 1, 1983 STORM EVENT.
12. STREAMGAUGING DATA USED IN ANALYTIC DISCHARGE FREQUENCY ANALYSIS.
13. IMPERVIOUS AREA FOR LAND-USE CLASSIFICATIONS, ANALYTIC DISCHARGE FREQUENCY ANALYSIS.
14. SUMMARY OF TABLE AND PLATE NUMBERS FOR FLOOD RECORDS AND FREQUENCY CURVES FOR GAUGES ANALYSED ANALYTICALLY.
15. FLOOD RECORD FOR ALHAMBRA WASH NEAR KLINGERMAN STREET.
16. FLOOD RECORD FOR COMPTON CREEK NEAR GREENLEAF DRIVE.
17. FLOOD RECORD FOR EATON WASH AT LOFTUS DRIVE.
18. FLOOD RECORD FOR RUBIO WASH AT GLENDON WAY.
19. FLOOD RECORD FOR ARCADIA WASH BELOW GRAND AVENUE
20. FLOOD RECORD FOR COMPTON CREEK AT 120TH STREET.
21. FLOOD RECORD FOR DOMINGUEZ CHANNEL AT VERMONT AVENUE.
22. FLOOD RECORD FOR VERDUGO WASH AT ESTELLE AVENUE.

TABLES (Continued)

23. FLOOD RECORD FOR EL MODENA-IRVINE CHANNEL AT MYFORD ROAD.
24. FLOOD RECORD FOR SANTA ANA-DELHI CHANNEL AT IRVINE AVENUE.
25. FLOOD RECORD FOR ARROYO TRABUCO CHANNEL AT CAMINO CAPISTRANO.
26. FLOOD RECORD FOR EAST GARDEN GROVE-WINTERSBURG CHANNEL.
27. FLOOD RECORD FOR SAN DIEGO CREEK AT CULVER DRIVE.
28. SUMMARY OF STATISTICS FOR GAUGE RECORDS AND ADJUSTED GAUGE RECORDS (HYDROLOGIC METHOD).
29. N-YEAR POINT RAINFALL VALUES FOR ALHAMBRA WASH NEAR KLINGERMAN STREET.
30. N-YEAR POINT RAINFALL VALUES FOR COMPTON CREEK NEAR GREENLEAF DRIVE.
31. N-YEAR POINT RAINFALL VALUES FOR EATON WASH AT LOFTUS DRIVE.
32. N-YEAR POINT RAINFALL VALUES FOR RUBIO WASH AT GLENDON WAY.
33. N-YEAR POINT RAINFALL VALUES FOR ARCADIA WASH BELOW GRAND AVENUE.
34. N-YEAR POINT RAINFALL VALUES FOR COMPTON CREEK NEAR 120TH STREET.
35. N-YEAR POINT RAINFALL VALUES FOR DOMINGUEZ CHANNEL AT VERMONT AVENUE
36. PARAMETER VALUES FOR CALIBRATION OF REGIONAL N-YEAR AND RAINFALL-RUNOFF MODEL.
37. CALIBRATION RESULTS FOR COMPUTED, EXPECTED PROBABILITY AND 85% CONFIDENCE LEVEL N-YEAR FREQUENCY RUNOFF.

LIST OF PLATES

1. COMPARISON OF RUNOFF RESULTS (2/3, 1/3 DISTRIBUTION OF STORM OF STORM PATTERN NESTED UNIT RAINFALL COMPARED TO 1/2, 1/2 DISTIRUBTION).
2. COMPARISON OF NOAA ATLAS 2 AND STATE OF CALIFORNIA DWR POINT RAINFALL DATA, 2 YR, 6 HR.
3. COMPARISON OF NOAA ATLAS 2 AND STATE OF CALIFORNIA DWR POINT RAINFALL DATA, 2 YR, 24 HR.
4. COMPARISON OF NOAA ATLAS 2 AND STATE OF CALIFORNIA DWR POINT RAINFALL DATA, 10 YR, 6 HR.
5. COMPARISON OF NOAA ATLAS 2 AND STATE OF CALIFORNIA DWR POINT RAINFALL DATA, 10 YR, 24 HR.
6. COMPARISON OF NOAA ATLAS 2 AND STATE OF CALIFORNIA DWR POINT RAINFALL DATA, 100 YR, 6 HR.
7. COMPARISON OF NOAA ATLAS 2 AND STATE OF CALIFORNIA DWR POINT RAINFALL DATA, 100 YR, 24 HR.
8. MEAN DEPTH-DURATION RELATIONSHIPS FOR ORANGE COUNTY NON-MOUNTAINOUS AREAS, (DWR DATA).
9. COMPARISON OF DEPTH-AREA CURVES.
10. CALIBRATION LOSS FUNCTION.
11. LOCATION OF STREAM GAUGES USED IN FLOOD RECONSTITUTIONS.
12. RECONSTITUTION, ALHAMBRA WASH NEAR KLINGERMAN STREET, MARCH 3-5, 1978.
13. RECONSTITUTION, COMPTON CREEK NEAR GREENLEAF DRIVE, FEB. 16, 1980.
14. RECONSTITUTION, SEPULVEDA DAM, FEBRUARY 16, 1980.
15. S-GRAPHS FROM LOS ANGELES COUNTY FLOOD RECONSTITUTIONS.
16. RECONSTITUTION, WESTMINSTER CHANNEL AT BEACH BLVD., MARCH 4, 1978.
17. RECONSTITUTION, WESTMINSTER CHANNEL AT BEACH BLVD., FEBRUARY 13, 1980.
18. RECONSTITUTION, SANTA ANA-DELHI CHANNEL AT IRVINE AVENUE, MARCH 1, 1978.
19. RECONSTITUTION, SANTA ANA-DELHI CHANNEL AT IRVINE AVENUE, MARCH 28, 1979.
20. RECONSTITUTION, SANTA ANA-DELHI CHANNEL AT IRVINE AVENUE, FEBRUARY 1980.

PLATES (Continued)

21. RECONSTITUTION, EL MODENA-IRVINE CHANNEL AT MYFORD ROAD, FEBRUARY 25-26, 1969.
22. S-GRAPHS FROM ORANGE COUNTY FLOOD RECONSTITUTIONS.
23. PERVIOUS LOSS RATE, Fp, OCCURANCE DISTRIBUTION.
24. URBAN S-GRAPH.
25. RELATIONSHIP BETWEEN WATERSHED LAG AND COMPUTED tc.
26. VERIFICATION OF REGIONAL MODEL, ALHAMBRA WASH NEAR KLINGERMAN STREET.
27. VERIFICATION OF REGIONAL MODEL, COMPTON CREEK NEAR GREENLEAF DRIVE.
28. VERIFICATION OF REGIONAL MODEL, EATON WASH AT LOFTUS DRIVE.
29. VERIFICATION OF REGIONAL MODEL, RUBIO WASH AT GLENDON WAY.
30. VERIFICATION OF REGIONAL MODEL, ARCADIA WASH BELOW GRAND AVENUE.
31. VERIFICATION OF REGIONAL MODEL, DOMINGUEZ CHANNEL AT VERMONT AVENUE.
32. LOCATION OF STREAM GAUGES USED IN ANALYTIC DISCHARGE FREQUENCY ANALYSIS.
33. ANNUAL PEAK DISCHARGES FOR COMPTON CREEK NEAR GREENLEAF DRIVE.
34. ANNUAL PEAK DISCHARGES FOR RUBIO WASH AT GLENDON WAY.
35. CHANGES IN IMPERVIOUS AREA FOR ALHAMBRA WASH DRAINAGE BASIN.
36. CHANGES IN IMPERVIOUS AREA FOR COMPTON CREEK NEAR GREENLEAF DRIVE.
37. CHANGES IN IMPERVIOUS AREA FOR EATON WASH DRAINAGE BASIN.
38. CHANGES IN IMPERVIOUS AREA FOR RUBIO WASH DRAINAGE BASIN.
39. CHANGES IN IMPERVIOUS AREA FOR ARCADIA WASH DRAINAGE BASIN.
40. CHANGES IN IMPERVIOUS AREA FOR DOMINGUEZ CHANNEL DRAINAGE BASIN.
41. CHANGES IN IMPERVIOUS AREA FOR VERDUGO WASH DRAINAGE BASIN.
42. CHANGES IN IMPERVIOUS AREA FOR EL MODENA-IRVINE CHANNEL DRAINAGE BASIN.
43. CHANGES IN IMPERVIOUS AREA FOR SANTA ANA-DELHI CHANNEL DRAINAGE BASIN.
44. CHANGES IN IMPERVIOUS AREA FOR ARROYO TRABUCO CHANNEL DRAINAGE BASIN.
45. CHANGES IN IMPERVIOUS AREA FOR EAST GARDEN GROVE-WINTERSBURG CHANNEL DRAINAGE BASIN.
46. CHANGES IN IMPERVIOUS AREA FOR SAN DIEGO CREEK DRAINAGE BASIN.
47. PEAK ADJUSTMENT FACTOR FOR URBANIZING WATERSHEDS.
48. FLOOD FREQUENCY CURVES FOR ALHAMBRA WASH NEAR KLINGERMAN STREET, HYDROLOGIC METHOD.
49. FLOOD FREQUENCY CURVES FOR COMPTON CREEK NEAR GREENLEAF DRIVE, HYDROLOGIC METHOD.
50. FLOOD FREQUENCY CURVES FOR EATON WASH AT LOFTUS DRIVE, HYDROLOGIC METHOD.
51. FLOOD FREQUENCY CURVES FOR RUBIO WASH AT GLENDON WAY, HYDROLOGIC METHOD.
52. FLOOD FREQUENCY CURVES FOR ARCADIA WASH BELOW GRAND AVENUE, HYDROLOGIC METHOD
53. FLOOD FREQUENCY CURVES FOR COMPTON CREEK AT 120TH STREET, HYDROLOGIC METHOD.
54. FLOOD FREQUENCY CURVES FOR DOMINGUEZ CHANNEL AT VERMONT AVENUE, HYDROLOGIC METHOD.
55. FLOOD FREQUENCY CURVES FOR VERDUGO WASH AT ESTELLE AVENUE, HYDROLOGIC METHOD.
56. FLOOD FREQUENCY CURVES FOR El MODENA-IRVINE CHANNEL AT MYFORD ROAD, HYDROLOGIC METHOD.
57. FLOOD FREQUENCY CURVES FOR SANTA ANA-DELHI CHANNEL AT IRVINE AVENUE, HYDROLOGIC METHOD.
58. FLOOD FREQUENCY CURVES FOR ARROYO TRABUCO CHANNEL AT CAMINO CAPISTRANO, HYDROLOGIC METHOD.
59. FLOOD FREQUENCY CURVES FOR EAST GARDEN GROVE-WINTERSBURG CHANNEL, HYDROLOGIC METHOD.
60. FLOOD FREQUENCY CURVES FOR SAN DIEGO CREEK AT CULVER DRIVE, HYDROLOGIC METHOD.

PLATES (continued)

61. VARIATION IN Xn(t) AS A FUNCTION OF (t) FOR COMPUTED PEAK DISCHARGES.
62. VARIATION IN Xn(t) AS A FUNCTION OF (t) FOR EXPECTED PROBABILITY PEAK DISCHARGES.
63. VARIATION IN Xn(t) AS A FUNCTION OF (t) FOR 85 PERCENT CONFIDENCE LEVEL PEAK DISCHARGES.

REFERENCES

1. U.S. Army Corps of Engineers, The Hydrologic Engineering Center, Hydrologic Analysis of Ungaged Watersheds Using HEC-1, Training Document No. 15, April 1982.

2. State of California, Department of Water Resources, Rainfall Analysis for Drainage Design, Vol. 1, Short Duration Precipitation Frequency Data, Bulletin #195, October 1976.

3. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NOAA Atlas-2, Precipitation-Frequency of the Western United States, Volume XI-California, Silver Spring, Maryland, 1973.

4. U.S. Department of Agriculture, Soil Conservation Service, Urban Hydrology for Small Watersheds, Technical Release No. 55, 1975.

5. U.S. Army Corps of Engineers, The Hydrologic Engineering Center, Optimization Techniques for the Hydrologic Engineer, Technical Paper No. 2, 1966.

6. U.S. Army Corps of Engineers, The Hydrologic Engineering Center, Corps of Engineers Experience with Automatic Calibration of a Precipitation - Runoff Model, Technical Paper No. 70, May 1980.

7. U.S. Army Corps of Engineers, The Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package Users Manual, September 1981.

8. Viessman Jr., W., J. Knapp, and G. Lewis, T. Harbaush, Introduction to Hydrology, 2nd. Ed, Harper and Row Publishers, 1917. p.343.

9. U.S. Army Corps of Engineers, Los Angeles District, Unit Graph to S-Graph (UGTOSG) Computer Program.

10. U.S. Army Corps of Engineers, Los Angeles District, Hydrology, San Gabriel River and the Rio Hondo Above Whittier Narrows Flood Control Basin with Addendum on the Hydrologic Effect of Diverting Outflow from Whittier Narrows Flood Control Basin to Los Angeles River via the Rio Hondo, dated 20 December 1944 and revised 10 July 1946.

11. U.S. Army Corps of Engineers, Hydrologic Engineering Center, Generalized Standard Project Rainflood Criteria, Southern California Coastal Streams, March 1967.

12. U.S. Army Corps of Engineers, Los Angeles District, Los Angeles County Drainage Area, California, Review, Hydrology Report, 1986.

13. McCuen R., et.al., Estimating Urban Time of Concentration, Journal of Hydraulic Engineering, Vol. 110, No. 3, March 1984.

14. McCuen, Richard H., A Guide to Hyrologic Analyses Using SCS Methods, Prentice Hall Inc., Englewood Cliffs, New Jersey, 1982.

REFERENCES (Continued)

15. San Diego County Hydrology Manual, San Diego County Department of Public Works, Flood Control Division, September 16, 1985.

16. Hromadka, T.V., McCuen, R.H., Whitley, R.J., and Nestlinger, A.J., Development of a Policy for Flood Control Design and Planning, June 1986.

17. Sarma, P.G.S., Delleur, J.W., and Rav, A.R., 1969, A program in urban hydrology: Purdue University, Water Resources Center, Technical Report No. 9.

18. Carter, R.W., 1961, Magnitude and frequency of floods in suburban areas: U.S. Geological Survey Professional Paper 424-B, pp. B9-B11.

19. Anderson, D.G., 1970, Effects of urban development on floods in northern Virginia: U.S. Geological Survey Water Supply Paper 2001-C, 30 p.

20. Dunne, T., and Leopold, L.B., 1978, Water in environmental planning: San Francisco, W.H. Freeman and Co., 818 p.

21. Sauer, Vernon B., Thomas Jr., Wilbur O., Strickler, Virginia A. and Wilson, K.V., Flood Characteristics of Urban Watersheds in the United States - Techniques for Estimating Magnitude and Frequencies of Urban Floods: Federal Highway Administration, FHWA-RD-81-178, 1981.

22. Rantz, S.E., 1971, Suggested criteria for hydrologic design of storm-drainage facilities in the San Francisco Bay region, California: U.S. Geological Survey open-file report, 89 p.

23. James, L.D., 1965, Using a computer to estimate the effects of urban development on flood peaks: Water Resources Research, Vol. 1, pp. 223-234.

24. U.S. Department of the Interior, Geological Survey, Office of Water Data Coordination, Guidelines for Determining Flood Flows Frequency, Bulletin #17 B of the Hydrology Subcommittee, revised September 1981.

25. Stedinger, J., Confidence Intervals for Design Events, Journal of Hydraulic Engineering, Vol. 109, January 1983.

26. Kite, G., Confidence Limits for Design Events, Water Resources Research, Vol. 11, No. 1, February 1975.

27. U.S. Army Corps of Engineers, Los Angeles District, LAPRE1 Input Description, November 1984.

28. U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Orange County and Western Part of Riverside County, California, September 1978.

29. Orange County Environmental Management Agency, Orange County Hydrology Manual, June 1986.

1. INTRODUCTION

a. PURPOSE AND SCOPE

The purpose of this report is to document the data and methods used in the calibration of a regionalized rainfall-runoff model to compute n-year floods for Orange County, California watersheds.

The need for a calibration study in Orange County was realized when ongoing hydrologic studies by the Orange County Environmental Management Agency (OCEMA) and U.S. Army Corps of Engineers, Los Angeles District (LAD) resulted in significantly different peak discharges for the same gauged and ungauged basins. Although the same basic procedure was being used by both agencies (S-graph, unit hydrograph procedure) to compute flood hydrographs, the results varied greatly. These differences were attributed mainly to the highly subjective selection process of basin "n" factors and lack of actual calibrated data to justify these selections. Therefore, an objective procedure calibrated to test basins was desired to determine basin "n" values. In addition, other calibrated rainfall-runoff relationships were desired, such as a new S-graph for the flat urbanized coastal regions of Orange County where the old Valley S-graph seemed to inadequately describe hydrograph timing. Finally, calibrated discharge-frequency relationships were desired for ungauged and inadequately gauged watersheds within the county.

A calibrated rainfall-runoff model should have three major attributes:

(1) The runoff portion of the model should reproduce observed flood events with adequate accuracy, given adequate observed rainfall for the event. This attribute was assured by using unit hydrograph parameters - S-graphs and lags and loss rate derived from reconstitutions of observed storm and flood events to develop regional unit hydrograph and loss rate relationships. The regional relationships were then verified using a storm and flood event not included in the reconstitution studies (Section 3c, p. 14).

(2) The rainfall-runoff model should reproduce n-year peak discharge frequency curves derived from stream gauge data with adequate accuracy. To develop a model with this attribute, a storm pattern, time distribution, depth-area relationship, and source of n-year, t-hour precipitation data was adopted (Section 2a, p. 3). A loss rate function-maximum loss rate, Fm, and low loss fraction Y - was adopted from the reconstitution results and fixed (Section 3b, p. 12). The loss function would be considered a deterministic function and not a probabilistic function; i.e., it would not vary with frequency. The unit hydrograph parameters - S-graph and lag-derived from the reconstitutions (Sections 3b(2) and 3b(3), p. 12) would also be deterministic variables. The remaining variables, n-year preciptitation, would be the only probabilistic variable; frequency of precipitation would be varied until adequate reproduction of n-year peak discharges from stream gauge frequency curves was obtained (Section 4b, p. 22). The adopted relationships were then verified (Section 4c, p. 24).

(3) The rainfall-runoff model should be transportable to ungauged watersheds with assurance that the computed peak discharges are reasonable estimates of n-year peak discharges. This attribute can be achieved because the parameters

that vary with physical characteristics of watershed are all deterministics - S-graph, lag, and loss function. The calibrated probabilistic storm, provides considerable assurance that, with appropriate modification of the deterministic variables, reasonable estimates of n-year peak discharge will result. Model application is discussed in Section 5, p. 26.

b. CONTRIBUTORS

The following list provides an outline of the main contributors to the calibration study along with a brief description of their roles in this effort:

T.V. Hromadka II, PhD, PhD, RCE (Director of Water Resources, Williamson & Schmid, Irvine, CA), under contract to OCEMA, conducted the entire calibration effort utilizing those listed below for additional data and support work, as stated.

R.H. McCuen, PhD (Professor, Department of Civil Engineering, University of Maryland, College Park, MD) - Hydrologic Method for adjusting streamgauge records.

Tim J. Durbin, MS, RCE (Project Engineer, Hydrotech Division, Williamson & Schmid, Irvine, CA) - Simulation Method for adjusting streamgauge records, statistical analysis of adjusted streamgauge records.

R.J. Whitley, PhD (Professor of Mathematics, University of California, Irvine, CA) - Statistical evaluation of the streamgauge data confidence limits.

A.J. Nestlinger, RCE (Orange County Environmental Management Agency, Santa Ana, California). Orange County data, general support through review and comment.

U.S. Army Corp of Engineers, Los Angeles District Hydrologic Engineering Section, - Los Angeles County and Orange County flood reconstitutions, and general support through review and comment.

2. MODEL COMPONENTS

a. STORM

(1) Pattern. The storm pattern used to compute n-year frequency floods is a synthetic storm composed of t-year rainfalls (2-year, 5-year, etc.) with the maximum rainfall intensities nested for duration between 5 minutes and 24 hours. The maximum 5 minutes of rainfall is nested within the maximum 10 minutes; the maximum 10 minutes is nested within the maximum 15 minutes; and so forth until the 24-hour storm pattern is developed. This hypothetical storm pattern is referred to in HEC TD-15 (reference 1) as a "balanced storm", because of the consistent depth-frequency relation used for each peak duration interval. This nested duration storm pattern is compared to the March 1, 1983 storm that occurred over western Orange County during which several recording rain gauges showed near 100-year rainfall intensities (State of California, DWR data, reference 2) for all durations between 15 minutes and 6 hours. Every watershed is sensitive to a particular duration of rainfall that will produce the peak discharge, usually a duration approximating the time of concentration of the watershed. A nested duration design storm, analogous to a "balanced hydrograph", ensures that each watershed will receive the design frequency depth of rainfall for its critical duration. Durations longer or shorter than the critical duration have little effect on peak discharge, although longer durations have considerable effect on total volume of runoff.

(2) Time Distribution. A (2/3, 1/3) rainfall distribution is used with t-year frequency rainfalls nested about hour 16 of the 24-hour storm. HEC TD-15 (reference 1) suggests a (1/2, 1/2) distribution in which the peak rainfall intensity is placed at the center of the storm; however, other distributions are not ruled out. A sensitivity analysis was performed to determine the effect of these two storm distributions on peak flow rates. The test watershed parameters used for comparison purposes along with the results of the analysis are shown on plate 1.

It is clear from the plots on plate 1 that there are negligible differences between peak flow rates determined by the two considered design storm pattern distributions of rainfall when using the unit hydrograph and loss rate function models, as discussed in later sections. Consequently, it was concluded that a reasonable variation of the design storm pattern shape would have a negligible effect on the modeling output of peak flow rate. However, the distribution of runoff volume varies within the runoff hydrograph depending upon the design storm pattern rainfall distribution. In reservoir or detention basin design the impacts on total storm required would be significant. This is the main reason the (2/3, 1/3) distribution was chosen.

(3) Precipitation. Sources of precipitation data include the NWS NOAA Atlas 2 (reference 3) and the State of California DWR data (reference 2). The NOAA Atlas 2 data provides point rainfall isopluvials for the 6- and 24-hour durations only, and includes regression relationships for other durations. In comparison, the longer record DWR data provides 10-minute through 24-hour duration data, and at a few stations 5-minute data is available. A comparison of these two data sources indicated that the 6- and 24-hour values were

comparable, but the smaller duration rainfalls (less than 3-hours) differed significantly in coastal Orange County with the DWR data being about 30 to 50 percent higher than the NOAA data.

Point rainfall isopluvial plots obtained from NOAA Atlas 2 and corresponding raingauge data obtained from DWR for Orange County are shown on plates 2-7. These figures show the comparison of 6- and 24-hour duration point rainfalls for various return frequenies, and the overall variation in precipitation for Orange County.

Although a little harder to apply then NOAA Atlas 2 data, the DWR data was considered to be reasonable and more up-to-date than the NOAA Atlas 2 data. Precipitation data, developed for each station from this data source, can be used with either a basin average or Theisson Polygon method, to obtain frequency duration precipitation depths for a watershed under study.

OCEMA uses a single set of mean values of 2-, 5-, 10-, 25-, 50- and 100-year point rainfall from the DWR data, due to a claimed near homogeneous point rainfall distribution throughout the county, except for the high mountain regions. These means values were obtained from DWR data from 25 rain gauge stations and are plotted on plate 8. Lines of best fit were drawn and the lines were then extended to obtain 5-minute values for each frequency. The adopted means values are given in table 1. These values were used in this calibration study and have been adopted by OCEMA to be used for all non-mountainous Orange County watersheds. However, LAD will use the DWR data with a basin average or the Theisson Polygon method as described above and not use the mean values.

(4) Depth-Area Adjustment. Depth-area adjustment factors are used to adjust point rainfall values to correspond to a proper rainfall mass distribution over the watershed, based on storm size and other factors. Two sets of depth-area relationships were considered in this study: the NOAA Atlas 2 relationships, which provides depth area adjustment factors for the 30 minute to 24 hour durations; and 30 minute to 3 hour duration factors from the March 1943 Sierra Madre storm in southern California. The 30-minute, 1- and 3-hour NOAA Atlas 2 and Sierra Madre depth-area curves are shown for comparison on plate 9. It can been seen that the Sierra Madre depth-area adjustments provide a significant reduction in design storm rainfalls over that given by the NOAA Atlas values.

Because the Sierra Madre event actually occurred locally and is well documented, it is considered to be more representative of southern California storms than the NOAA Atlas curves, which are based on a national average of storms. Therefore, the Sierra Madre relationships for 30 minute to 3 hour durations and the NOAA Atlas 2 relationships for the remaining durations (6 hour and 24 hour) were used in this study.

b. PRECIPITATION LOSS RATE FUNCTION

The precipitation loss rate function used in this calibration study is based on the Soil Conservation Service (SCS) curve number (CN) approach, (reference 4) but modified to have a upper and lower bound. The loss rate f(t) in in/hr is defined by:

$f(t) = \bar{Y}\ I(t)$ for $\bar{Y}\ I(t)$ less than Fm

Fm, otherwise

where,

$\bar{Y}$ = the low loss fraction

Fm = the maximum loss rate (in/hr), and

I(t) = the design storm rainfall intensity (in/hr) at storm time (t).

The low loss fraction $\bar{Y}$, acts as a lower bound fixed loss rate fraction, whereas Fm serves as an upper bound to the possible values of $f(t) = \bar{Y}\ I(t)$. This loss accounting procedure is a hybridization of the SCS CN approach. The low loss rate fraction is used to develop runoff hydrograph yields that are comparable to SCS 24-hr storm yields, and the peak rainfall loss rates are representative of values developed from the rainfall-runoff reconstitution studies. A graphical illustration of this loss function is presented on plate 10.

(1) Maximum Loss Rate (Fm). The maximum loss rate Fm is defined by:

Fm = Ap Fp

where,

Ap = the actual* pervious area fraction of a subarea with corresponding maximum loss rate of Fp; and

Fp = the maximum loss rate for the pervious area fraction Ap for appropriate CN and antecedent moisture condition (AMC).

*Note - Actual pervious/impervious area is defined as the map measured value. In many instances it is necessary to distinguish between actual impervious area and hydraulically connected (or effective) impervious area because these values may differ significantly. For the watersheds used in this study and those for which the model will apply it was determined that these values do not differ significantly. The map measured values are therefore reasonable for use in this model)

The maximum infiltration rate for impervious areas is set at zero. Values for Fp can be calibrated to values obtained from rainfall-runoff reconstitution studies. The development of maximum loss rate values, Fp, for this study is discussed in Section 5d(3)(c) p. 33.

(2) Low Loss Rate Fraction ($\bar{Y}$). The low loss rate fraction is estimated from the SCS loss rate equation by:

$$\bar{Y} = 1 - Y$$

where Y is the catchment yield (percent of 24-hour rain that runs off) computed by:

$$Y = A\ Y$$

with,

A = catchment area fraction with corresponding Y,

Y = catchment yield in percent for catchment area fraction A.

Y, for pervious areas, is estimated using the SCS CN by:

$$Y = \frac{(P_{24} - Ia)^2}{(P_{24} - Ia + S)\ P_{24}}$$

where,

P_{24} = the 24 hour n-year precipitation depth

Ia = initial abstraction (0.2S)

S = (1000/CN) - 10

(NOTE: For P_{24} less than Ia, Y = 0)

The catchment yield for impervious areas is computed using a CN of 98. A CN of 98 is used rather than 100 to account for some depression storage.

(3) Antecedent Moisture Conditions (AMC). The AMC I, II, and III conditions represent adjustments for antecedent soil moisture conditions of dry, average, and wet, respectively. The designation of a particular AMC condition of a specific storm is usually determined by the evaluation of prior rainfall. The effect of AMC is built into the runoff curve number determination by providing adjusted CNs for AMC I and III, with the CN table (reference 4) based on AMC II. The prior rainfall criteria used to adjust the CN is based on the data used in the original estimation of the CN table. The AMC I and III CNs represent the extremes on the graphs of rainfall versus runoff volume. In this calibration study, however, the designation of a particular AMC condition for use with the design storm is used only as an approximate estimate of the effect of AMC. The AMC adjustment is therefore a probabilistic variable for evaluation during calibration. Once the model is calibrated, the AMC variable becomes a constant and the value is not free to vary. This is discussed further in Section 4., MODEL CALIBRATION.

c. UNIT HYDROGRAPH

A unit hydrograph is a flood hydograph resulting from one inch of effective rainfall occurring uniformly over a watershed in a specified time duration. The unit hydrograph concept is a useful tool in that it provides a

linear description of runoff from a watershed and facilities the generation of synthetic flood hydrographs for watershed which are ungaged. The unit hydrograph procedure used in this calibration study has its basis in an S-graph which is a summation graph of discharge in percent of ultimate discharge versus time in percent of lag time. Lag time is defined as the time in hours from the beginning of effective rainfall for 50 percent of the total volume of runoff of the unit hydrograph to occur. It is important to remember this particular definition of lag so as not to be confused with definitions of lag used in other procedures. The S-graph and lag time are discussed in more detail below.

(1) S-graph. The S-graph representation of the unit hydrograph as defined above can be used to develop unit hydrographs corresponding to various watershed lag estimates. The S-graph can be developed by rainfall-runoff reconstitution studies of several storms for one particular watershed or for several watersheds, if a regional S-graph is desired. The development of a representative S-graph applicable to Orange County watersheds is discussed in Section 3a(3), p. 11.

(2) Lag Relationships. The main parameter used to developp a synethic unit hydrograph from an S-graph is the watershed lag time. A generalized relationship for estimating basin lag values when stream gauge data is inadequate for rainfall-runoff reconstitution studies has been developed for the southern California area, and has been widely used by LAD OCEMA, and others. The generalized equation for lag relating both estimated and measured characteristics of a watershed, is

$$\text{Lag} = 24n \left[\frac{L \times L_{ca}}{S^{1/2}} \right]^{0.38}$$

where:

L = length of longest watercourse in the subarea (miles)

L_{ca} = length along longest watercourse from the subarea concentration point to a point on the longest watercourse perpendicular to the centroid of the subarea (miles)

S = average slope of basin in feet/mile

n = basin factor

This equation was developed from data from several southern California watersheds. The uncertainty in using this equation to estimate basin lag lies in the choice or estimation of basin n. In addition, this relationship may give unreasonable results for small areas, of less than about 2 square miles, often resulting in very low lag estimates yielding excessively high ratios of ft^3/s per acre.

In this study, a correlation of watershed lag to rational method time of concentration (tc) was developed using several stream gage records and current watershed development conditions. This correlation, in the form of:

$$Lag = k\ (tc)$$

reduces the uncertainty and arbitrary selection errors associated with estimating lag based on a chart of generalized basin "n" factor descriptions. However, methods used to determine tc can differ, so the correlation relationship does not completely eliminate all of the uncertainty in determining lag. N-valves should be back calculated from the tc determined lag and if the back calculated n-valves seem unreasonable, physical reasons should be determined before accepting the tc determined lag values. The development of the k value in the above equation is described in Section 3b(3), p. 13.

3. DEVELOPMENT OF MODEL PARAMETERS

This section describes how the parameter values for the loss rate function and unit hydrograph components of the model were determined and verified. Calibration of the storm component of the model is discussed in Section 4, MODEL CALIBRATION.

a. FLOOD RECONSTITUTIONS

Data from the reconstitution of 42 flood hydrographs of 26 observed flood events in 9 watersheds of Los Angeles and Orange counties were used in the development of regional model parameters for use in computing hypothetical flood hydrographs for Orange County watersheds. Table 2 outlines the streamgauge locations and storm events used in the reconstitutions. Some events were separated into several peaks in order to more accurately describe the runoff processes. The locations of these stream gages are shown on plate 11. Basin characteristics of the watersheds are listed in table 3. The following paragraphs describe the reconstitution process and the results of the flood reconstitutions.

(1) Reconstitution Process. The HEC-1 Flood Hydrograph Package was used to perform all flood reconstitutions. HEC-1 has the capability to automatically determine a set of unit hydrographs and loss rate parameters that "best" reconstitutes an observed runoff event for a gauged basin, given the observed hydrograph, average observed rainfall, the drainage area, and runoff hydrograph parameter values for the starting flow and base flow recession computations. The "best" reconstitution is considered to be that which minimizes the square root of the weighted square difference between the observed hydrograph and a computed (reconstituted) hydrograph. The parameter estimation procedure is the unit variate gradient search procedure. A detailed description of this procedure is contained in reference 5. The Corps of Engineers experience with automatic parameter estimation is discussed in reference 6.

Runoff hydrograph parameters that are not automatically derived by HEC-1 and that must be determined by evaluating the characteristics of observed flood hydrographs and watershed characteristics in the region are QRCSN, STRTQ, RTIOR, RTIMP and time-area curves. Clark unit hydrograph parameters derived automatically by HEC-1 are TC and R. Rainfall loss rate parameters that can be derived automatically by HEC-1 are DLTKR, STRKR RTIOL, ERAIN, ALOSS, AK PRCP, and DLTK. Parameter descriptions are given in the HEC-1 Users Manual (reference 7).

The Los Angeles and Orange County flood reconstitutions are discussed below individually by county, because the reconstitution studies for these two groups were done separately, and slight procedural differences occurred.

(2) Los Angeles County Flood Reconstitutions.

(a) Precipitation. Basin total rainfall amounts for the Los Angeles County watersheds were determined from an isohyetal analysis of the February 1978, March 1978, and February 1980 storms. The precipitation gauges used in this analysis are listed in table 4 and their locations are shown on plate 11.

Representative basin hyetographs were determined from a polygonal analysis of these three storms using relative weights of 15-minute digitized hyetographs. Theisson polygon weighting of the gauge data for these watersheds did not give reasonable results apparently because of changes in topgraphy and the actual storm tracks and travel time. The gauge data was therefore analysed subjectively to determine the appropriate weightings for each reconstitution. From two to five gauges were utilized in any event.

(b) Runoff Hydrograph Parameters. The runoff hydrograph parameters not automatically derived fall into three categories: base flow, impervious cover, and time area curves. For Los Angeles County reconstitutions, the base flow parameters STRTQ, QRCSN, and RTIOR were selected to provide a "best fit" for the base flow portions of the observed hydrographs. Starting flows (STRTQ) ranged from a low of zero percent of peak discharge to a high of three percent of peak discharge for the watersheds. QRCSN ranged from a low of zero percent of peak discharge to a high of 26 percent.

Values for effective impervious cover RTIMP were selected to provide a "best-fit" of the computed hydrograph to those portions of the observed hydrographs that appeared to be principally from the result of runoff from impervious areas. RTIMP was first varied on an event by event basis, then final values were selected on a watershed by watershed basis. The final runoff hydrograph parameters selected for each reconstitution are listed in table 5.

Time area curves were developed for each watershed by developing streamflow isochromes using the equation time = $0.0078\left[L/S^{0.5}\right]^{0.77}$ (reference 8), where L = horizontal projection of channel length and S = slope of channel reach, to determine the time of concentration for each drainage channel increment. (Note, this time of concentration is different from the rational method tc and the Clark unit hydrograph TC). Percent of total drainage area contributing to the runoff at each point at specified times were then measured. The time area curves developed for each watershed were then compared to the default time area curve of HEC-1. The computed curves were similar in shape to the default curve.

(c) Unit Hydrograph and Loss Rate Parameters. The parameters automatically derived by HEC-1 are the unit hydrograph and loss rate parameters using a sequential successive approximation [redacted] as described in reference 5. The sequential successive approximation approach for each variable is necessary because virtually all variables to be optimized are interdependent to some degree. An optimization was initially performed on each event, letting HEC-1 select values for STRKR, DLTKR, TC, and R and using predetermined values for STRTQ, QTCSN and RTIOR. The HEC-1 selected parameters were then varied to determine their effect on the reproduced hydrograph. RTIOL was first set for all watersheds. Then the other parameters were varied, STRTQ, QRCSN, RTIOR, STRKR, and KLTKR on an event by event basis and TC and R on a watershed by watershed basis. ERAIN was fixed at zero in all reconstitutions. The parameter to be fixed next was determined by an assessment of which parameter would best improve the fit. In this manner the parameters were fixed until a best fit was determined. Table 5 presents a summary of "best-fit" unit

hydrograph and rainfall loss parameters determined for each Los Angeles County reconstitution. Selected flood reconstitutions are presented graphically on plates 12-14.

The unit hydrographs determined by adopting the average parameters for each watershed (shown on table 5) were converted to S-graphs by the Los Angeles District computer program UGTOSG (reference 9). Basin "n" values were also determined by the UGTOSG program. The average "n" value and S-graph for each basin was determined by averaging the "n" values (mathematically) and S-graphs (the ordinates were averaged) from the reconstitutions for each stream. The average "n" values are also listed in table 5. The average S-graphs are shown graphically on plate 18. The S-graphs are shown along with the previously developed average Valley S-graph (references 10 and 11) for comparison.

(3) Orange County Flood Reconstitutions.

(a) Precipitation. Precipitation data from the gauges listed on table 6 were used in the Orange County reconstitutions. The locations of these gauges are shown on plate 11. For each reconstitution, data from two gauges were used. Judgement was used to determine weighting for each gauge to determine basin average precipitation for each watershed. Precipitation depths were then distributed according to the recording gauge data.

(b) Runoff Hydrograph Parameters. Baseflow parameters were not developed for Orange County reconstitutions because no baseflow was observed. Hydraulically connected impervious cover (effective) was estimated for all three watersheds to be about 40 percent.

All reconstitutions were performed using the synthetic time-area curve provided by HEC-1. To check the validity of using the synethtic time-area curve, a time-area curve was derived from isochrones of distance that runoff travels, assuming a velocity of 5 feet per second. This time-area curve was then used in place of the synthetic time-area curve. Optimization results when using the derived time-area curve were comparable to the results using the synthetic time-area curve.

(c) Unit Hydrograph and Loss Rate Parameters. Again, HEC-1 was utilized to determined estimated loss rate and Clark unit hydrograph parameters for the Orange County watersheds, based on rainfall for each storm denoted. These reconstitutions were performed with many different iterations in order to determine senstitivity of various parameters, and to achieve results which best exemplify conditions in the basins. All reconstitutions were set up and run simultaneously in order to analyze the various loss rate and unit hydrograph variables. On each successive computer run of all reconstitutions, the following steps or modifications were made:

ERAIN	-	fixed to zero
RTIOL	-	fixed
STRKR	-	fixed
DLTKR	-	fixed

From the results of this analysis, average loss rate and unit hydrograph parameters were derived. To determine the effect, if any, on the magnitude of optimized loss rate parameters, another iteration of optimizing loss rates was performed in a similiar manner as above using the derived average unit hydrograph parameters. These results were comparable to the previously derived average loss rate parameters.

Table 7 presents a summary of "best fit" loss rate and unit hydrograph parameters determined for each reconstitution. Six of the better reconstitutions are presented graphically on plates 16-21. Using the adopted unit hydrographs from each reconstitution, "n" values and S-graphs were determined by the UGTOSG program. The average "n" value and S-graph for each basin was determined by averaging the individual "n" values (mathematically) and S-graphs (graphically) from the reconstitutions for each stream. The average "n" values are listed also in table 7. The average S-graphs are presented graphically on plate 22.

b. REGIONALIZATION OF MODEL PARAMETERS

(1) Loss Rates. The loss rate function used in the flood reconstitutions was a variable loss rate for pervious areas, that decreases with time. However, the reconstitutions resulted in near constant loss rate values during each storm's peak rainfalls. For this calibration study the loss rate function consists of a low loss rate fraction, ($\bar{Y}$), which is a function of the total storm depth, the soil group, and the antecedent moisture conditions of pervious areas; and a maximum loss rate (Fp), which is a function of the soil group of the pervious areas, as discussed in Section 2b. p. 4. The low loss fraction conforms to SCS 24-hour storm yields, and is not calibrated in this study. The maximum loss rate, Fp, however, conforms to the range of loss rates estimated by the reconstitutions during the peak periods of the storms. The peak loss rate was regionalized based upon these results. The values of peak loss rates from the reconstitution studies used to regionalize the maximum loss (Fp) are listed in table 8.

The range of values for peak loss, Fp, lie between 0.20 and 0.65 in/hr, with the highest value occurring in Verdugo Wash (which has substantial open space in foothill areas). Except for Verdugo Wash, $0.20 \leq Fp \leq 0.60$, which is a variation in values of the order noted for Alhambra Wash alone. These results, where the peak loss rate varied from storm to storm, and from watershed to watershed, makes the use of the maximum loss Fp, as defined in Section 2b, appear reasonable.

Fp varies from watershed to watershed depending upon soil cover, and also varies for different antecedent moisture conditions. In the actual calibration, the AMC variable is made a constant and the value is not free to vary, as discussed in Section 4b., p. 22. A histogram of Fp values obtained from the reconstitutions is shown on plate 23. Eighty-eight percent of the Fp values lie between 0.20 and 0.45 inches per hour with 77 percent of the values falling between 0.20 and 0.40 inches per hour. A mean regional peak loss rate, Fp, of 0.30 inches per hour was selected to use for verification of the regionalized model and for calibration purposes. This representative loss

rate is assumed to be stationary in a probabilistic sense in that both prior to storm rainfall and available initital abstraction probabilities are lumped into this single constant parameter.

(2) S-Graph. The average watershed S-graphs developed from the reconstitutions are shown on plates 15 and 22. It can be seen on plate 15 that the S-graphs developed from Sepulveda, Alhambra, Limekiln, and Compton reconstitutions are very similar in shape. The S-graphs developed from the Orange County reconstitutions, shown on plate 22 are also very similar to the L.A. S-graphs. These new S-graphs have steeper slopes and shorter tails than the average Valley S-graph, which is also shown on plates 15 and 22, indicating that runoff occurs more rapidly and with higher peaks. This change in behavior is attributed to improved drainage that is caused by urbanization. The ordinates of the new S-graphs developed from the Sepulveda, Alhambra, Limekiln and Compton reconstitutions were averaged to obtain a regional S-graph for the LACDA study (reference 12).

This regional S-graph called the "Urban" S-graph was adopted as the S-graph for this calibration study, and is presented on plate 24, along with the SCS equivalent S-graph, and the previous Valley S-graph for comparison. This "urban" S-graph, seems reasonable due to the somewhat high degree of urbanization that has occurred since development of the original average Valley S-graph (reference 10), and due to the larger number of reconstitutions this new "Urban" S-graph is based upon.

(3) Lag Relationships. The Urban S-graph is a near duplicate of the SCS S-graph (plate 24), and therefore it was assumed that watershed lag was related to the watershed time of concentration, tc, as is typically assumed in the SCS approach. Although the SCS definition of lag is different from the definition of lag being used here, the SCS definition of tc is the same as the rational method tc. Lag in this study is defined as the time in hours from the beginning of effective rainfall for 50 percent of the total volume of runoff of the unit hydrograph to occur (Sec. 2c., p. 6). SCS lag is defined as the time in hours from the center of the mass of rainfall excess to the peak discharge. The SCS S-graph resulted from an average dimensionless unit hydrograph that was developed from the evaluation of a large number of actual watersheds. The SCS recommends this S-graph for use in average gently sloping watersheds, a more steep rising S-graph for mountain areas and a less steep rising S-graph for flat marshy areas. The average conditions of the watersheds used to develop the urban S-graph explains the similarity between the urban and the SCS S-graphs. LA and Orange County watershed tc values, where lag estimates were available, were estimated by the rational method of determining tc. The watersheds were divided into subareas with the initial subarea less than 10 acres and a flow length of less than 1000 feet. An initial subarea tc was estimated by the Kirpich method and a Q was calculated. By subsequent routing downstream of the peak flow rate (Q), through the various conveyances (using normal depth flow velocities), and adding estimated successive subarea contributions, a catchment tc was estimated as sum of travel times. This is essentially a mixed velocity method of determining a tc. The watersheds along with their computed tc and associated lag values are listed in table 9. The lag values were either obtained from the flood reconstitutions or estimated using a similar basin "n"

as developed for a neighboring similar watershed where flood reconstitutions were performed. Lag was computed using the lag equation presented in Section 2c., p. 6. The computed values of tc were plotted against lag for each watershed and is shown on plate 25. A least squares best fit for the local data resulted in a relationship of:

$$\text{Lag} = 0.72\ tc$$

Additional measured lag values and mixed velocity tc estimates were obtained from reference 13. The lag values from this report were modified according to the definition used in this study and were plotted versus their associated tc values, along with the local data also shown on plate 25. (A constant of 1.31 was used to convert the SCS lag values to this study's defined lag. This constant was developed by geometric considerations of the SCS dimensionless unit hydrograph, relating each definition of lag to tp.) A least squares best fit of the combined data resulted in a relationship of:

$$\text{Lag} = 0.80\ tc$$

In Reference 14, SCS time to peak, tp, is related to Tc by:

$$tp = 0.67\ tc$$

whereby the definition of lag (reference 15)

$$\text{Lag} = 1.16\ tp$$

When these relationships are combined, the result is:

$$\text{Lag} = 1.16\ (0.67)\ tc = 0.77\ tc$$

The relationship of lag = 0.80 tc was therefore adopted for this calibration study.

c. VERIFICATION OF REGIONALIZED MODEL PARAMETERS

The regional model was verified by reconstituting the March 1, 1983 flood event for six southern California watersheds, applying the regional parameters of loss rate, S-graph, and lag. The March 1, 1983 event was not used in development of these parameters.

A mean regional peak loss rate of 0.30 in/hr, as discussed in Section 3b., REGIONALIZATION OF MODEL PARAMETERS, was used for all watersheds along with actual percent of pervious cover. The Urban S-graph was used and the rational method time of concentration (tc) for all watersheds was computed, and lag set equal to 0.80 tc. Measured gauge rainfall and storm pattern were used. Two sets of values for the low loss rate fraction ($\bar{Y}$), were used:

(1) $\bar{Y}$ estimated from equation presented in Section 2b..

(2) $\bar{Y}$ calibrated by taking:

$$\bar{Y} = 1 - \frac{\text{measured storm runoff volume}}{\text{measured storm rainfall}}$$

The watersheds modeled for verification of the regional parameters, their recorded peak discharges and runoff volumes for the March 1, 1983 event; watershed physical characteristics; and the regional parameter values used for each are listed in table 10. Table 11 presents a comparison of measured peak discharges and those obtained from the model verification. Plates 26-31 provide a comparison between measured and modeled runoff hydrographs.

The measured and computed peak discharges compare reasonably well, with the calibrated $\bar{Y}$ reconstitutions producing, generally, a better fit of the computed value. However, using the regional model equation for $\bar{Y}$ also provides reasonable results.

4. MODEL CALIBRATION

This section describes the calibration of the storm component, using the verified loss rate function and unit hydrograph components discussed in Section 3, DEVELOPMENT OF MODEL PARAMETERS. Application of the calibrated rainfall-runoff model is described in Section 5, MODEL APPLICATION.

a. ANALYTICAL DISCHARGE FREQUENCY ANALYSIS

The regional rainfall runoff model developed to compute n-year floods needed to be calibrated to discharge frequency estimates for gauged drainage basins. Streamflow records for five drainage basins in Orange County and eight basins in Los Angeles County were analysed. The Orange County basins, which range in drainage area from 13 mi^2 to 40 mi^2 included the following stream gauging stations: Arroyo Trabuco at Camino Capistrano, East Garden Grove-Wintersburg Channel, Santa Ana-Delhi Channel at Irvine Avenue, El Modena-Irvine Channel at Myford Road, and San Diego Creek at Culver Drive. The Los Angeles County basins, which range in area from 8 mi^2 to 37 mi^2, included the following stream gauging stations: Dominquez Channel at Vermont Avenue, Alhambra Wash near Klingerman Street, Rubio Wash at Glendon Way, Eaton Wash at Loftus Drive, Arcadia Wash below Grand Avenue, Compton Creek at 120th Street, Compton Creek near Greenleaf Drive, and Verdugo Wash at Estelle Avenue. The period of record, drainage area size and operating agency for each gauge is listed in table 12. The location of these basins is shown on plate 32. The annual series of peak discharges for these streams were analysed, as described below, to obtain estimates of n-year peak discharges. The regional rainfall-runoff model was then calibrated to reproduce these estimates of n-year peak discharges as discussed in Section, 4b., p. 22.

(1) Adjustment for Effects of Urbanization.

The streamflow records for nearly all the analysed drainage basins have been impacted by continuing urbanization. Over time, the impervious area of the drainage basins and the hydraulic efficiency of the channel systems has increased. Consequently, the peak discharge annual series is not homogeneous, as indicated on plates 33 and 34, which show increasing peak discharge with time for Compton Creek near Greenleaf Drive and Rubio Wash at Glendon Way, respectively. Peak discharges from different periods represent different conditions of urbanization, and the annual series cannot be analysed directly for the n-year discharges. Before a flood frequency analysis could be performed, the peak discharge annual series had to be adjusted so that it represented a single specified condition of urbanization. Then, a flood frequency analysis of the adjusted annual series was performed to provide estimates of the n-year flood for that condition of urbanization.

Two independent methods were used to adjust the peak-discharge annual series in order to remove the impacts of continuing urbanization. These methods are referred to as the "hydrologic method" and the "simulation method." The hydrologic method involves adjusting individual peak discharges on the basis of empirical relations derived from published information on the effect of urbanization on streamflow characteristics. The development and application of the hydrologic method are discussed in detail below. The

simulation method involves creating a synthetic annual series using a rainfall-runoff model and observations of historic precipitation. The rainfall-runoff model of the simulation method is developed by calibration to the drainage basin for the specified condition of urbanization. Once the rainfall-runoff model is calibrated a synthetic annual series of peak discharge is created using historical precipitation for the drainage basins as input to the model. For each year of the annual series, the precipitation during the year that will produce the maximum peak discharge is used as input. With that input the model is used to estimate the discharges for the flood hydrograph, from which the peak discharge can be abstracted. The resulting annual series will represent the condition of urbanization that the model has been calibrated to.

The simulation method was used to develop a synthetic record of annual peak discharges for three Orange County drainage basins. The standard error of prediction in the analysis ranged between -40 to +60% and -90 to +700% which indicated that the model was at best only a fair preditor of annual discahrge. It was felt that the hydrologic method to adjust an annual series of discharges was more reliable than the simulation method and was therefore chosen to be used in the study. The hydrologic method is discussed below. Details of the simulation method analysis may be found in reference 16.

(a) Physical Description of Drainage Basins. The Los Angeles County and Orange County drainage basins are similar to their general character. Basins in the two groups are similar in that their urbanized parts generally occur on broad alluvial fans that slope toward the south or southwest from the mountains and hills that border the Los Angeles and Orange County coastal plain. Some of the basins are only partly urbanized, and the undeveloped parts generally occur on mountains or hilly terrains. The drainage systems within the basins consist of engineered open channels for the higher order channels and pipes for the lower ordered channels. In Los Angeles County most main channels are concrete lined, while in Orange County many main channels are earth lined.

Within the Los Angeles County and Orange County groups, drainage basins with differing characteristics occur. Nevertheless, about the same range of characteristics occurs within each group, and basins with similar characteristics occur between groups. For example, Compton Creek and Dominquez Channel basins in Los Angeles County are similar to East Garden Grove-Wintersburg Channel and Santa Ana-Delhi Channel basins in Orange County. Arcadia Wash, Rubio Wash, and Eaton Wash basins in Los Angeles County are similar to El Modena-Irvine and San Diego Creek basins in Orange County. However, Arroyo Trabuco Basin in Orange County has no counterpart among the Los Angeles County basins.

Nevertheless, the Los Angeles County and Orange County groups are sufficiently similar that each is hydrologically representative of the other. Therefore, the Los Angeles County basins can be used to provide additional samples of drainage basins that are typical of Orange County.

(b) Impacts of Urbanization. Except for the Arcadia Wash and Eaton Wash drainage basins, both the Orange County and Los Angeles drainage basin have been impacted by continuing urbanization over the period of record. This is

illustrated on plates 33 and 34, which show the time trend of annual peak discharge for Compton Creek near Greenleaf Drive and Rubio Wash, respectively. For these drainage basins, peak discharge tends to increase with time. While part of the trend can be attributed to a possible trend in precipitation, most can be attributed to an increase with time in the urbanized area of the drainage basins and to improvement of the channels.

To describe changes in impervious area, the relationship of impervious area as a function of time was developed for each watershed and shown for each on plates 35-46. (A separate relationship for Compton Creek at 120th Street was not developed). For the Los Angeles County drainage basins, the relations were obtained from the LACDA study (reference 10). For the Orange County drainage basins, the relations were developed from information on historical land use. The principal source of information was U.S. Geological Survey topographic maps. A map indicates the street pattern and other features on a particular date, and that information can be used to delineate areas of different land use. Land use was then converted to impervious area by assigning a fractional impervious area to each land-use classification. The land-use classifications and their associated fractional impervious area are listed in table 13, where the fractional impervious area was estimated by analysis of areal photographs for selected small areas in each drainage basin.

Examination of the relationships shown on plates 35-46 indicated that the Los Angeles County drainage basins have changed less during their periods of streamflow record than the Orange County drainage basins. Typically, the Los Angeles County basins experienced rapid urbanization in the period prior to the mid 1950's. After that time, however, the drainage basins experienced little additional urbanization. The Orange County drainage basins show a different pattern of urbanization. The period of urbanization continues through about 1980 for most basins, and it is continuing through the present for the remaining basins. Therefore, the streamflow records for the Orange County basins are impacted more by urbanization than those for the Los Angeles County basins.

(c) Hydrologic Method for Adjusting Streamflow Records.

A number of hydrologic methods and specific models have been proposed and are used to represent the effect of urbanization on peak discharges. In some cases, methods provide a basis for accounting for urbanization, but it is difficult to develop a general statement of the effect of urbanization. For example, with the Rational Method, urban development would have an effect on both the runoff coefficient and the time of concentration. Thus it is not possible to make a general statement that a 5 percent increase in imperviousness will cause an "x" percent increase in the peak discharge for a specific return period. Other models are not so constrained. Five different models for determining the effect of urbanization are discussed below. An analysis of these models along with the available data led to the development of a method to adjust the Los Angeles County and Orange County annual peak discharges for the effects of urbanization. The method as developed for this study is then discussed and applied.

1. A number of regression equations are available that include percent imperviousness as a predictor variable. With such models, it is possible to develop a general statement on the effect of urbanization. One such example, found in reference 17, is

$$Q_p = 4.84.1\ A^{0.723}\ (1+U)^{1.516} P_E^{1.112} T_R^{-0.403} \qquad \text{(Equation 1)}$$

in which A is the drainage area in (square miles), U is the impervious area (in percent), P_E is the volume of excess rainfall excess (in hours), and Q_p is the peak discharge (in cubic feet per second). Since the model has the power model form, the specific effect of urbanization depends on the values of the other predictor variables (A, P_E, and T_R). However, the relative sensitivity of Equation 1 can be used as a measure of the effect of urbanization. The relative sensitivity is given by:

$$S_R = \left(\frac{Q_p}{U}\right)\left(\frac{U}{Q^P}\right) \qquad \text{(Equation 2)}$$

Evaluation of Equation 2 yields a relative sensitivity of 1.516. Thus, a one percent change in U will cause a change of 1.516 percent in the peak discharge. This estimate is an average effect since it is independent of both the value of U and the return period.

2. Based on the work of Carter (reference 18) and Anderson (reference 19), Dunne and Leopold (reference 20) provided the following equation for estimating the effect of urbanization:

$$f = 1 + 0.015U \qquad \text{(Equation 3)}$$

in which f is a factor that gives the relative increase in peak discharge for a percent imperviousness of U. The following is a summary of the effect of urbanization based on the model of Equation 3:

U	0	10	20	30	40	50	100
f	1	1.15	1.3	1.45	1.6	1.75	2.5

Thus, a one percent increase in U will increase the peak discharge by 1.5 percent, which is the same effect shown by the model of Equation 2.

3. The Soil Conservation Service (SCS) provided an adjustment for urbanization for the TR-55 (reference 4) Chart method. The adjustment depends on the percentages of imperviousness and the hydraulic length modified, as well as the runoff curve number. Although the adjustment does not specifically include the return period as a factor, the Chart method incorporates the return period through the rainfall input. The relative sensitivities of the SCS Chart method suggest a change in peak discharge of 2.3 to 2.6 percent for a 1 percent change in urbanization, which here is the combined effect of changes in imperviousness and modification of the hydraulic length.

4. The U.S. Geological Survey (USGS) urban peak discharge equations provide another alternative for assessing the effect of urbanization (reference 21). For the 2-year event the ratio of urban to rural peak discharge ranges

from 1 to 4.5, with the latter value for complete development. For the 100-year event the ratio has a maximum value of 2.7. For purposes of illustration and assuming that basin development occurs in direct proportion to changes in imperviousness, the average change in peak discharge due to a one percent change in urbanization is 1.75 and 0.9 percent for the 2-year and 100-year events, respectively. While the methods discussed previously provided an effect of about 1.5 percent, the USGS equations suggest that the effect is slightly higher for the more frequent storm events and slightly lower for the less frequent storm events.

5. Rantz (reference 22) provided a method for assessing the effect of urbanization on peak discharges using simulated data from James (reference 23) for the San Francisco Bay area. With this method, urbanization is characterized by two variables, the percentages of channels sewered and basin developed with the percentage of basin developed being approximately twice the percentage of imperviousness. For urbanization as measured by the percentage change in imperviousness, the mean relative sensitivities are 2.6, 1.7, and 1.2 percent for the 2-year, 10-year, and 100-year events, respectively. These values are slightly larger (30 to 50 percent) than the values computed from the USGS urban equations. When both the percentages of channel sewered and basin developed are used as indices of development, the relative sensitivities are considerably higher. The mean relative sensitivities are 7.1, 5.1 and 3.5 percent for the 2-year, 10-year, and 100-year events, respectively. These values are much larger than the values suggested by the other methods discussed in the preceding paragraphs.

The literature does not identify a single method that is considered to be the best method. Each method depends on the data used to calibrate the prediction process and the data bases used to calibrate the methods is very sparse. However, the sensitivities suggest that a 1 percent increase in urbanization causes an increase in peak discharge of about 1 to 2.5 percent, with the former value for the 100-year event and the latter for the 2-year event. However, there are considerable variations at any return period.

Based on the general trends of the methods described above and the available data, a method of adjusting a flood record was developed. Plate 47 shows the peak adjustment factor as a function of the exceedence probability for percentages of urbanization up to 70 percent. The greatest effect is for the more frequent events and the highest percentage of urbanization. Given the return period of a flood peak for a non-urbanized watershed, the effect of an increase in urbanization can be assessed by multiplying the discharge by the peak adjustment factor for the return period and percentage of urbanization. Where it is necessary to adjust a discharge from a partially urbanized watershed to a discharge for another watershed condition, the discharge can be divided by the peak adjustment factor for the existing condition and then multiply the resulting "rural" discharge by the peak adjustment factor for the second watershed condition. The first operation (division) adjusts the discharge to a magnitude representative of the nonurbanized condition. The second operation (multiplication) adjusts the discharge to a magnitude that is representative of the watershed for the second watershed condition.

The adjustment method shown on plate 47 requires an exceedence probability. For a flood record, the best estimate of the probability is obtained from a plotting position formula. The following procedure was developed to adjust a flood record for which the individual flood events have occurred on a watershed that is undergoing a continuous change of the level of urbanization:

1. Identify both the percentage of urbanization for each event in the flood record and the percentage of urbanization for which an adjusted flood record is needed.

2. Compute the rank (i) and exceedence probability (p) for each event in the flood record (the median plotting position formula can be used to compute the probability).

3. Using the exceedence probability and the actual percentage of urbanization find from plate 75 the peak adjustment factor (f_1) to transform the measured peak from the actual level of urbanization to a non-urbanized condition.

4. Using the exceedence probability and the percentage of urbanization for which a flood series is needed, find from plate 47 the peak adjustment factor (f_2) that is necessary to transform the non-urbanized peak to a discharge for the desired level of urbanization.

5. Compute the adjusted discharge (Q_a) by:
$$Q_a = (f_2/f_1)Q$$
in which Q is the measured discharge.

6. Repeat steps 3, 7, and 5 for each event in the flood record and rank the adjusted series.

7. If there are significant changes in the ranks of the measured (Q) and adjusted (Q_a) flood series, then repeat steps 2 through 6 until the changes are not significant.

The developed hydrologic method for adjustment of streamflow records was applied to eleven watersheds, six in Los Angeles County and five in Orange County. Flood frequency curves were then computed for the recorded flood record and the existing conditions record obtained by making the appropriate adjustments using plate 47. For two watersheds, Arcadia Wash and Eaton Wash, the two conditions were the same and so the method was not applied. For each watershed, tables are provided that show the recorded flood record and the adjusted (existing conditions) flood record. Table 14 summarizes the table numbers where the annual maximum flood series for each watershed can be found.

(2) Analytical Analysis of Adjusted Streamflow Records. An analytical discharge frequency analysis, using the guidelines from WRC Bulletin #17B (reference 24), was performed for each gauge and both watershed conditions.

The complete recorded and adjusted gauge records are given for each gauge in tables 15-27. The computed statistics for each watershed for the recorded flood record and existing conditions are summarized in table 28. The generalized skew for the unadjusted record was obtained from the map on Bulletin 17B. For the adjusted data, a generalized skew, was obtained by averaging the computed skews for the original data. These generalized skews were weighted with the computed values to obtain the final values. The resultant frequency curves of the adjusted records along with the median plotting positions are shown on plates 48-60; the plate number for each gauge is also shown in table 14.

The adjustment of the recorded data had a minimal effect on most of the frequency curves, with no significant effect on the following watersheds: Alhambra, Compton Creek at 120th Street, El Modena-Irvine, and Santa Ana-Delhi. The minimial effect on these watersheds is the result of small changes in urbanization over a short period, with most of the recorded data at existing conditions. Two watersheds, Compton Creek near Greenleaf and Verdugo Wash showed a change for the minor events but no change for the larger events (50-, 100-year and larger). This pattern resulted because the urbanization occurred in the latter part of the record when urbanization had little or no change. Only Arroyo Trabuco and San Diego Creek showed change over the entire frequency curve. Both of these watersheds were subject to large changes in urbanization, so the change in the frequency curve was expected.

(3) Results of Analytic Discharge Frequency Analysis.

The hydrologic method was used to adjust streamgauging records for 13 Los Angeles and Orange County drainage basins. The reliability of this method appears much better than that of the simulation method, especially for the Los Angeles County drainage basins. Few factors need to be described by the hydrologic method because many factors are naturally embedded in the observed discharge. Therefore, the hydrologic method need only describe the incremental effects of urbanization. For much of the period of record for the drainage basins, the incremental effects are small especially for the L.A. County drainage basins.

On the basis of these results, it was decided that the regional rainfall-runoff model would be calibrated to the estimated n-year peak discharges with the gauge records adjusted by the hydrologic method. In addition, only the discharge frequency data for the Los Angeles County gauges, with one exclusion, are used for calibration. Data from the Verdugo Wash gauge were considered to be unrepresentative of the actual hydrologic response of the watershed for higher return frequency storms due to the significant foothill area that is controlled by debris dams. The actual calibration of the n-year rainfall-runoff model to the analytic results is discussed in the next section.

b. CALIBRATION OF RAINFALL-RUNOFF MODEL TO COMPUTED ANALYTIC RESULTS

The regional n-year rainfall-runoff model was calibrated to the computed n-year peak discharges obtained in the analytic discharge frequency analysis. This was accomplished by modeling the gauged drainage basins with the regional

rainfall-runoff model. Only one model parameter was varied in the calibration process; the design storm return frequency. Several simulations were made for each watershed using the regional model, varying the precipitation frequency each time. Tables 29-35 show the n-year point precipitation values used for each watershed. These values were obtained from the State of California DWR precipitation data. Each table notes the gauge or gauges that the data were obtained from. The other model parameters are discussed in the following paragraphs:

The maximum loss rate for each watershed was set equal to the regionalized value of F_p=0.30 inches/hour. Y was computed for each drainage basin using the 24-hour storm precipitation according to the selected return frequency of rainfall and the AMC II soil cover CN. Lag was set equal to 0.8tc, with tc computed for the urbanized area of each drainage basin as discussed in Section 3a(3), p. 11. Because tc varied only slightly for n-year storm estimates, a constant lag was used for each catchment. The Urban S-graph was used for all watersheds, along with the Sierra-Madre depth area curves for 15-minute through 3-hour durations and the NOAA Atlas depth area curves for the 6- and 24-hour durations. The actual pervious area, a_p, of each watershed was determined from USGS maps and Fm ($=a_pF_p$) was computed. Table 36 summarizes the model parameters developed for each watershed for the calibration process.

An objective function X, was used to calibrate the design storm frequency to the runoff frequency.

$$Xn(t) = \sum_{i=1}^{m} \frac{(Qi^t - Qi^n)}{Ai} Ai/Qi^n$$ where,

$Xn(t)$ = objective function considered at the n-year flood, and t-year design storm rainfall.

Q^t_i = rainfall-runoff model peak flow estimate for drainage basin i using t-year precipitation.

Q^n_i = drainage basin i, computed* n-year flood peak discharge from the adjusted stream gauge data.

A_i = area of drainage basin i.

* computed - unbiased, 50 percent confidence level flood low estimate using the log Pearson type-III distribution.

The design storm of the model is calibrated to the n-year flood by finding the t-year precipitation that satisfies:

$$Xn(t) = 0$$

Plate 63 shows the variation in Xn(t) as a function of t, for n=2-, 5-, 10-, 25-, 50-, and 100-year events (for computed n-year peak discharges).

The results of the calibration are shown in table 37 relating the t-year frequency precipitation required in the regional model to give the desired computed n-year frequency runoff. Two more calibrations were performed; one relating t-year frequency precipitation to n-year frequency runoff adjusted for expected probability; and the second relating t-year frequency precipitation to 85 percent confidence level n-year frequency runoff. These are discussed in Section 4d., p. 24, and Section 4e., p. 24, respectively.

c. VERIFICATION OF CALIBRATED RAINFALL-RUNOFF MODEL

The calibrated rainfall-runoff model was then verified by using the calibrated rainfall frequencies of table 37 in the regional rainfall-runoff model of each gauged watershed. These discharges are plotted on their respective analytical frequency curves shown on plates 48-54. These figures show that the calibrated rainfall-runoff model provides reasonable estimates of unbiased, 50 percent confidence level n-year peak discharges.

d. EXPECTED PROBABILITY ADJUSTMENT

Expected probability is defined (reference 24) as the average of the true probabilities of all magnitude estimates for any specified flood frequency that might be made from successive samples of a specified size. The development and computation of the expected probability adjustment are described in detail in reference 24. This type of adjustment is made in an attempt to incorporate the effects of uncertainty in application of the frequency curve.

The use of the expected probability adjustment is a policy decision. The U.S. Army Corps of Engineers uses this adjustment in estimates of annual flood damages an in establishing design flood criteria.

The regional rainfall-runoff model for Orange County watersheds was calibrated to n-year discharge frequency values, adjusted for expected probability, developed from the adjusted stream gauge data. The expected probability discharges were used in the objective function and calibration was performed as described in Section 4b., p. 22. Plate 62 shows the variation in Xn(t) as a function of t, for n= 2-, 5-, 10-, 25-, 50-, and 100-year events adjusted for expected probability.

The results of this calibration are also shown in table 37 relating the t-year precipitation required in the regional model to give the desired n-year frequency discharge, adjusted for expected probability. The calibrated model was then verified by using the calibrated rainfall frequencies of table 37 in the regional model of each gauged watershed. These discharges were also plotted on their corresponding analytic frequency curves, adjusted for expected probability, and are shown on plates 48-54.

e. OCEMA PROCEDURE - 85 PERCENT CONFIDENCE LEVEL

The computed flood frequency curve is only an approximation to the true frequency curve of the total population of annual flood peaks. Confidence intervals gauge the accuracy of this approximation by providing a range of hypothetical frequency curves that with a high degree of confidence, contains

the population frequency curve. Confidence limits (or levels) are the end points of this interval and provide a measure of the uncertainty of the discharge at a selected exceedence probability.

Bulletin #17B (reference 24) provides (in the case of a flood distribution whose logarithm is normally distributed) confidence intervals for the n-year flood by the use of the non-central student's t-distribution. The more general case, following the guidelines of Bulletin #17B, is when the logarithm of the flood distribution has a Pearson III distribution with a non-zero skew parameter. This case of non-zero skew is more complicated than the case of log-normally distributed floods, which is the case of zero skew. Stedinger (reference 25), shows that the confidence intervals, for quantiles, which are given in Bulletin #17B are not satisfactory. (Discussion with the personnel indicates the Bulletin #17B will be updated in due course to correct this deficiency). Stedinger uses a formula due to Kite (reference 26) and derives an expression for confidence intervals for the quantiles that he shows is satisfactory in several simulations. Following these developments, confidence intervals for the flood design values can be determined by a Monte Carlo simulation. This simulation gives an approximate sampling distribution and so can be used to obtain confidence intervals of various levels and can also be used to quantify the magnitudes and probabilities of various possible errors due to sampling.

This simulation process is described in more detail by Hromadka et. al. in reference 16.

The Orange County Environmental Management Agency (OCEMA), has adopted a policy of flood control within the county that has the objective of providing 100-year flood protection with an 85 percent level of confidence in estimating that value. Using the simulation process for developing confidence limits, 85 percent confidence n-year discharge frequency values were computed for each adjusted gauge record. The regional rainfall-runoff model was then calibrated to these values.

The calibration and verification processes for 85 percent confidence level discharge were performed in the same manner as the computed and expected probability discharges described in the previous sections. The variation in the objective function, Xn(t), as a function of t, for n = 2-, 5-, 10-, 25-, 50-, and 100-year 85 percent confidence level peak discharges is shown on plate 63. Table 37 shows the calibration results relating t-year precipitation frequency required in the regional model to give the desired 85 percent confidence level n-year frequency discharges. The verified n-year peak discharges are plotted on the adjusted stream gauge data frequency curves on plates 48-54.

5. MODEL APPLICATION

a. GENERAL DESCRIPTION OF MODEL

The previous sections describe the development and calibration of a rainfall-runoff model to compute n-year floods for Orange County watersheds. This model is directly applicable to all Orange County watersheds that are hydrometerologically similar to the several watersheds used in the regionalization and calibration of model parameters. It can also be used with considerable confidence of determining reasonable n-year peak discharges in other coastal southern California watersheds where appropriate unit hydrograph and loss function adjustments are made.

(1) Single Area Runoff Hydrograph Development. Single area runoff hydrographs can be developed using the n-year, rainfall-runoff model when the watershed being studied involves a free flowing drainage system such as where storm runoff is collected by major storm drains or street systems and is carried from the watershed by means of a main channel. These watersheds would typically have minor storage or detention effects due to detention basins, channel constrictions or channel capacity. In addition, the watershed time of concentration should be comparable to those of the watersheds from which the s-graphs were derived.

(2) Complex Watershed Runoff Hydrograph Development. Watersheds that are characterized by significant detention or storage effects, large areas of different development types or soil loss conditions, or areas of complex drainage patterns may have to be divided into subareas and linked together by routing processes. The procedures available for channel or detention routing include Modified Puls and Muskingum routing. These and other procedures for routing floodflows are described in reference 7 HEC-1 Flood Hydrograph Package Users Manual.

Because all watershed modeling results differ based on the number and selection of subareas linked together to represent the total watershed, arbitrary subdivision of the watershed should be avoided. An increase in the watershed subdivisions does not necessarily increase the modeling accuracy but rather transfers the model's reliability from the calibrated unit hydrograph and lag relationships to the unknown reliability of the several flow routing submodels used to link together the several subareas. Reference 13 indicates that discretization actually increases model uncertainty.

Each subarea is subject to the design storm under consideration and the calibrated rainfall-runoff model is used to compute a hydrograph for each. It is important to keep in mind that as the watershed area increases, depth-area adjustment is needed based upon the entire contributing area. For example, suppose n-year peak discharges were desired at the outlet for each subarea of a watershed that had four subareas. Each of the subareas must be reanalysed for the design storm condition with depth area factors based upon the total area above the concentration point of interest. All routing procedures are also reevaluated based upon the new subarea runoff hydrographs. In this fashion, each point of concentration has the appropriate depth-area adjustment applied to the design storm.

Generally, subareas are defined which are tributary to detention basins or major channels whose storage routing effects are considered significant. Additionally, subareas should be determined such that the corresponding lag values are between 20 minutes and 2.5 hours (preferably between 25 minutes and 1.5 hours - the range of lag values used in the calibration effort).

b. COMPUTER PROGRAM

LAPRE1 (reference 27) is a preprocessor which converts input for s-graph and Los Angeles District design storms to standard input for HEC-1. At the present time a preliminary revised version of LAPRE1 has been developed that includes the 24-hour Orange County design storm and the calibrated loss function as described in this report. This revised version of LAPRE1, called LAPRE2, is currently available on the district Harris and can be run in a batch mode using the following command:

RUNPRE2, input filename, output filename, DSS filename.

c. INPUT REQUIREMENTS

The input to LAPRE2 is the same as for LAPRE1 (which is the same as for HEC1) with the addition of a $Q card, Orange County Special Storm Card. The Orange County storm is selected on the $P card as #15 in field 1 and $Q card is then required. When this storm is selected a 5-minute computation interval is necessary.

The $Q card requires rainfall depths for 5-min, 30-min, 1-hr, 3hr, 6-hr and 24-hr durations (in inches), a low loss fraction, Y (decimal), and a maximum loss rate, Fm (in inches per hour). In addition, the Urban s-graph can be specified by selecting #23 in field 5 of the $U card. For detailed descriptions of input requirements for LAPRE1 and HEC1, see references 27 and 7, respectively.

d. MODELING PROCEDURE, STEP-BY-STEP GUIDE

(1) Physical Characteristics. The drainage boundary for the particular basin under study should first be drawn on a topographic map (USGS 7.5 minute topographic maps are available for all of Orange County) and subareas delineated where necessary. (See section 5.a(2), p. 26,) The physical characteristics of each subarea can then be measured from the map. These include the area of the subbasin, A, in square miles; the length of longest watercourse, L, in miles; length along the longest watercourse to a point opposite the centroid, Lca, in miles; and the average slope of the basin, S, in feet per mile.

(2) Precipitation. Precipitation data for the area under study can be obtained from the State of California DWR data (reference 2). Precipitation depth-duration frequency data are provided for each gauge. A single set of depth-duration frequency data can be developed for the study area either by using an arithmetic average of values obtained from gauges in or near the study area; or the Thiessen Polygon Method may be used. The model requires

values for 5-min, 30-min, 1-hr, 3-hr, 6-hr and 24-hr durations for each frequency. Most of the gauges have no data for the 5-minute duration. Therefore, the average values developed for the other durations from all the gauges being used for particular study area can be plotted on log-log paper, a line of best fit drawn through the points and the line extrapolated to the 5-minute duration. This extrapolated 5-minute value along with the average values for the other durations are then used directly in the model. The depth area reduction factors have been pre-programmed into the computer model.

The following chart provides the required precipitiation frequency to obtain a desired frequency runoff for the three cases as shown:

N-Year Runoff	Computed *	Expected Probability *	85% Confidence**
	t-year precipitation required		
2	2	2	2 (AMC I)
5	4	4	5 (AMC I)
10	5	5	10 (AMC II)
25	10	10	25 (AMC II)
50	15	20	50 (AMC II)
100	25	40	100 (AMC III)

* AMC for Computed and Expected Probability is AMC II.

** as adopted by OCEMA

For most Corps flood control projects, the expected probability adjustment is used. Flood insurance studies generally utilize the computed values and the 85% confidence level is being used for design purposes by OCEMA.

(3) Loss Rate Function. The model loss rate function consists of two parameters, namely, the low loss fraction, Y, and the maximum loss rate, Fm. Both parameters are determined for each subarea.

Soil maps and current land use maps are required to determine these parameters. The SCS has a published soil survey of Orange County and the western part of Riverside County (reference 28). These maps are used to determine the hydrologic soil groups of the subareas for computation of Y. Current land use maps for a watershed can usually be obtained from local city or town engineering departments. These maps aid in the determination of impervious cover of the subareas, which is needed for determination of both Y and Fm.

(a) Impervious Cover. Using a land use map for the study area determine the area fraction of each type of development for each subareas. For each type of development assign a value of percent impervious cover. The chart below gives values recommended by OCEMA.

IMPERVIOUS COVER (1)

Land Use	Range - Percent	Recommended Value for Average Conditions-Percent (2)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential(3)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2 dwellings/acre	20 - 40	30
3-4 dwelling/acre	30 - 50	40
5-7 dwellings/acre	35 - 55	50
8-10 dwellings/acre	50 - 70	60
More than 10 dwellings/acre	65 - 90	80
Multiple Family Residential		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

(1) From the Orange County Hydrology Manual, reference 29.
(2) Recommended values are based on average conditions and may not apply to a particular study area. The percentage impervious may vary greatly even on comparable size lots due to differences in dwelling size, improvements, etc.
(3) For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the chart above.

Compute the composite percent impervious cover for each subarea using the following equation:

$$(D)\ (A) = D_1A_1 + D_2A_2 + \ldots + D_nA_n$$

where,

$(D)\ (A)$ = composite percent impervious cover for a particular subarea.
D_n = % impervious value for development type n.
A_n = area fraction of development type n.

(b) Low Loss Fraction, Y. Using the soil map of the study area, the area fraction of each type of hydrologic soil group is determined for each subarea. A watershed curve number, from the chart provided below, is then selected for each area fraction according to its soil group and cover type. The calibration procedure fixed the AMC condition at AMC II for all frequency flood events. However, OCEMA is recommending the following: AMC I for the 2- and 5-year flood events, AMC II for the 10-, 25-, and 50-year flood events and AMC III for the 100-year event. Curve numbers obtained from the chart below for AMC II can be converted to AMC I or II curve numbers using the conversion table following. This departure from the calibrated AMC II values does not affect the peak flow rates of computed hydrographs as Y affects only the volume, as long as the rainfall intensity is greater than Fm (maximum loss rate).

CURVE NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES
FOR PERVIOUS AREA - AMC II (1).

Cover Type	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzanita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf	Poor	71	82	88	91
	Fair	55	72	81	78
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs-buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland (Coniferous or broadleaf trees with canopy density from 20 to 50 percent.)	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS					
Residential or Commercial Landscaping (Lawns, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVER					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avacados, etc.)	Poor	57	78	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80

CURVE NUMBERS (Continued)

Cover Type	Quality of Cover (2)	Soil Group A	B	C	D
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small Grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

(1) From Orange County Hydrology Manual, reference 26.
(2) Quality of cover definitions:
Poor - Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50% of the ground surface is protected by plant cover or brush and tree canopy.
Fair - Moderate cover with 50% to 75% of the ground surface protected.
Good - Heavy or dense cover with more than 75% of the ground surface protected.

CURVE NUMBER RELATIONSHIPS

AMC II - CN	Corresponding CN for AMC I	AMC III
100	100	100
95	87	99
90	78	98
85	70	97
80	63	94
75	57	91
70	51	87
65	45	83
60	40	79
55	35	75
50	31	70
45	27	65
40	23	60
35	19	55
30	15	50
25	12	45
20	9	39
15	7	33
10	4	26
5	2	17
0	0	0

The following equations are then used to calculate Y:

$$\bar{Y} = 1 - Y$$

$$Y = \frac{(P_{24} - Ia)^2}{(P_{24} - Ia + S)P_{24}}$$

$$S = \frac{1000}{CN} - 10$$

$$Ia = 0.2S$$

where,

$\bar{Y}$ = low loss fraction
Y = 24-hour storm runoff yield
P_{24} = 24-hour storm rainfall
Ia = initial abstraction
S = estimate of total soil capacity
CN = watershed curve number

If the subarea contains several CN designations then the yield, Y, for the total subarea must represent the net effect of the several curve numbers. This is done by weighting each of the area fraction yields according to their respective area fraction. The effect of the impervious cover fraction is lumped together and a CN of 98 should be used. The following is an example of the computation of $\bar{Y}$ for a subarea.

EXAMPLE COMPUTATION OF $\bar{Y}$

Subarea A - drainage area = 5 sq. mi.
% impervious cover = 45%
urban cover, residential landscaping, good cover quality
P_{24} = 5.0 inches

Hydrologic Soil Group	Area Fraction	AMC II-CN	S	Ia	Y(per)
A	0.30	32	21.3	4.3	.005
B	0.20	56	7.9	1.6	0.21
C	0.25	69	4.5	0.9	0.39
D	0.25	75	3.3	0.7	0.49

$Y(per) = 0.30(.005)+0.20(0.21)+0.25(0.39)+0.25(0.49) = 0.26$

$$Y(imp) = \frac{(5-0.041)^2}{(5-0.041+0.204)5} = 0.95$$

$Y(composite) = 0.55(0.26) + 0.45(0.95) = 0.57$

$\bar{Y}(composite) = 1 - Y(composite) = 1 - 0.57 = 0.43$

Therefore, $\bar{Y}$ for subarea A = 0.43.

(c) Maximum Loss Rate, Fm. The soils of the watersheds used in the calibration were generally soil Group B, therefore, a value of Fp = 0.30 inches/hour, where Fp was the pervious area maximum loss rate was assumed in the calibration procedure. When using the model the following values of Fp should be assigned to the corresponding soil groups.

Soil Group:	A	B	C	D
Fp	0.40	0.30	0.25	0.20

The loss rate for the impervious area is zero, therefore, Fm is computed for each subarea by Fm = FpAp, where Ap is the pervious area fraction.

(4) S-Graph. The urban s-graph is used for watersheds that are hydrometeorologically similar to the basins used in the regionalization and calibration of this model. (The urban s-graph is also described as the "valley, developed" s-graph).

(5) Lag relationships. Lag is computed for each subarea using the equation

Lag = 0.8 tc where,

tc is the rational method computed time of concentration. Tc's can be computed using the guidelines provided in the Orange County Hydrology Manual (reference 29).

The present versions of LAPRE1 and LAPRE2 use the equation

$$\text{Lag} = 24n\left[\frac{L \times L_{ca}}{S^{1/2}}\right]^{0.38}$$

to compute lag, where

n = basin "n" factor
L = length of longest watercourse (mi)
Lca = length along longest watercourse to a point opposite the centroid (mi)
S = average slope of basin (ft/mi)

L, Lca and S are measured and "n" is selected based on visual inspection of the subarea and a generalized chart description. Until the computer programs are modified to accept a value for lag directly, n-value has to be back computed using Lag = 0.8tc and the lag equation above. It is strongly suggested that unusual variations in n-value determined from tc computations be examined carefully for a physically reasonable explanation for the variation. Otherwise estimated n-values should probably be used.

(6) N-Year Flood Hydrographs. Once the subarea hydrograph parameters are defined, the stream network can be set up linking subarea runoff hydrographs together by the appropriate routing processes. N-year flood hydrographs can then be determined at a concentration point of interest.

TABLE 1. N-YEAR MEAN POINT RAINFALL VALUES FOR NON-MOUNTAINOUS ORANGE COUNTY (IN INCHES).

Frequency	DURATION					
	5-min*	30 min	1 hr	3 hr	6 hr	24 hr
2-yr	0.19	0.40	0.53	0.89	1.22	2.05
5-yr	0.27	0.59	0.78	1.31	1.81	3.03
10-yr	0.33	0.72	0.95	1.59	2.20	3.68
25-yr	0.40	0.87	1.15	1.94	2.71	4.49
50-yr	0.45	0.98	1.30	2.19	3.02	5.07
100-yr	0.52	1.09	1.45	2.43	3.36	5.63

* extrapolated values, see plate 8.

(Caution should be exercised in using these mean values. Some point rainfall values for Orange County areas very close to the coast are noticeably lower).

TABLE 2. STREAM GAGES AND STORM EVENT RECONSTITUTIONS USED IN DEVELOPMENT OF REGIONAL MODEL PARAMETERS.

Stream Gage Name	Gage No.*	County	Drainage Area (mi^2)	Storm Date	Peak No.	Observed Peak (ft^3/s)
Alhambra Wash near Klingerman Street	F81DR	LA	15.2	Feb78		5110
				Mar78		2940
				Feb80		6660
Compton Creek near Greenleaf	F37BR	LA	22.6	Feb78		2850
				Mar78		2336
				Feb80		4780
Limekiln Creek above Aliso Creek	F350R	LA	10.30	Feb78		11500
				Feb80		3270
San Jose Channel above Workman Mill Rd.	F312R (USGS) 11092450	LA	83.40	Feb78		7070
				Feb80		1150
Sepulveda Dam (inflow)	(USGS) 11092400	LA	152.00	Feb78		12846
				Mar78		25671
				Feb80		62636
Verdugo Wash at Estelle Ave.	F252R	LA	26.8	Feb78		9820
El Modena-Irvine Channel at Myford Rd.	OC-216	Orange	11.9	Feb69		770
Santa Ana-Delhi Channel at Irvine Ave.	OC-220	Orange	17.6	Mar78	1	592
					2	1775
					3	220
					4	565
					5	205
					6	820
					7	1363
					8	475
				Nov78		1160
				Jan79	1	416
					2	251
					3	1348
				Mar79	1	1563
					2	830
				Jan80		2000
				Feb80		1820
				Mar80		1315
				Nov82	1	1750
					2	659
Westminster Channel at Beach Blvd.	OC-207	Orange	6.7	Dec74		1040
				Mar78	all	---
					1	118
					2	264
					3	694
				Feb80	1	311
					2	924
					3	645

* County gauge unless otherwise indicated.

TABLE 3. BASIN CHARACTERISTICS OF WATERSHEDS USED IN FLOOD RECONSTITUTIONS.

	Drainage Area (sq. mi.)	L (mi)	Lca (mi)	S (ft/mi)	Percent impervious	
					total	effective
LOS ANGELES COUNTY WATERSHEDS						
Alhambra Wash near Kingerman	15.2	8.20	4.60	79	60	32
Compton Creek near Greenleaf Drive	22.6	11.0	4.00	11.0	65	45
Limekiln Creek above Aliso Creek	10.3	7.4	3.6	294.0	25	25
San Jose Channel above Workman Mill Road	83.4	23.0	8.5	60.0	18	18
Sepulveda Dam (inflow)	152.0	19.0	9.0	143.0	35	24
Verdugo Wash at Estelle Ave.	26.8	11.4	5.70	310.0	25	20
ORANGE COUNTY WATERSHEDS						
El Modena-Irvine Channel at Myford Road	11.9	6.34	2.69	52	40	40
Santa Ana-Delhi Channel at Irvine Ave.	17.6	8.71	4.17	16.0	40	40
Westminster Channel at Beach Blvd.	6.7	5.65	1.39	13	40	40

TABLE 4. PRECIPITATION GAUGES USED IN LOS ANGELES COUNTY FLOOD RECONSTITUTIONS.

Streamgauge Location	Storm Reconstitution	LACFCD Raingauge No.*
Alhambra Wash near Klingerman Street	Feb 78	191, 303, 1114B
	Mar 78	191, 303, 1114
	Feb 80	191B, 235, 280C, 1014
Compton Creek near Greenleaf Drive	Feb 78	116, 291
	Mar 78	116, 291
	Feb 80	116, 291, 716
Limekiln Creek above Aliso Creek	Feb 78	57A, 446
	Feb 80	259, 446
San Jose Creek Channel above Workman Mill Rd.	Feb 78	92, 1078, 1088X
	Feb 80	96CE, 347E, 1088
Sepulveda Dam (inflow)	Feb 78	57A, 292DE, 446, 735H
	Mar 78	57A, 435, 762
	Feb 80	292, 446, 735
Verdugo Wash at Estelle Ave.	Feb 78	280C, 373C, 498, 758

*No.	Station Name	Lat.	Long.	Elev	Type
L057A	Camp Hi Hill (OPIDS)	34-15-18	118-05-41	4240	SR
L0092	Claremont-Pomona College	34-05-48	117-42-33	1185	SR
L0096CE	Puddingstone Dam	34-05-31	117-48-24	1030	SR
L0116	Inglewood Fire Station	33-47-53	118-21-22	153	SR
L0191(B)	Los Angeles-Alcazar	34-03-46	118-11-54	400	SR
L0235	Henninger Flats	43-11-38	118-05-17	2550	SR
L0259	Chatsworth-Twin Lakes	34-16-43	118-35-41	1275	SR
L0280C	Sacred Heart Academy	34-10-54	118-11-08	1600	R
L0291	Los Angeles-96th & Central	33-56-56	118-15-17	121	R
L0292(DE)	Encino Reservoir	34-08-56	118-30-57	1075	SR
L0303	Pasadena-Cal Tech	34-08-14	118-07-25	800	SR
L0347E	Baldwin Park-Exp. Station	34-05-56	117-57-40	384	SR
L0373C	Briggs Terrace	34-14-17	118-13-27	2200	SR
L0435	Monte Nido	34-04-41	118-41-35	600	SR
L0446	Aliso Canyon-Oat Canyon	34-18-53	118-33-25	2367	SR
L0498	Angeles Crest Hwy-Drk Cny Tr	34-15-21	118-11-45	2800	R
L0716	Los Angeles-Ducommun Street	34-03-09	118-14-13	306	SR
L0735(H)	Bell Canyon	34-11-40	118-39-23	895	R
L0758	Griffith Park-Lower Spr Cyn	34-08-02	118-17-27	600	R
L0762	Upperstone Canyon	34-07-27	118-27-15	943	R
L1014	Rio Hondo Spreading	33-59-57	118-06-04	170	SR
L1078	Covina-Griffith	34-04-10	117-50-47	975	SR
L1088(X)	La Habra Hgts-Mut Water Co	33-56-55	117-57-51	445	SR
L1114(B)	Whittier Narrows Dam	34-01-29	118-05-02	239	SR

S = Standard 8" raingauge (non-recording).
R = Recording raingauge.

Basin	Drainage Area (mi^2)	Even	Average Watershed TC	R	"n"	Effective Impervious Cover (%)
Alhambra Wash near Klingerman	15.2	Feb 7 Mar 7 Feb 8	0.65	0.30	0.015	32
Compton Creek near Greenleaf Drive	22.6	Feb 7 Mar 7 Feb 8	0.90	0.48	0.015	45
Limekiln Creek above Aliso Creek	10.3	Feb 7 Mar 7 Feb 8	0.70	0.37	0.026	25
San Jose Channel above Workman Mill Rd.	83.4	Feb 78 Feb 8	0.37	2.10	0.020	18
Sepulveda Dam (inflow)	152.0	Feb 78 Mar 78 Feb 80 Mar 83	1.56	0.30	.017	24
Verdugo Wash at Estelle Ave.	26.8	Feb 78	0.33	0.65	.016	20

Hydrologic Engineering Center Base Fl

STRTQ	Flow (cfs) at start of fl
QRCSN	Flow (cfs) below which ba
RTIOR	Ratio of recession flow,

Hydrologic Engineering Center Loss-Ra

STRKR	Starting value (inches/ho
ERAIN	Exponent of precipitation
DLTKR	Amount (inches) of initia
RTIOL	Ratio of rain-loss coeffi

Clark Unit Hydrograph of Parameters:

TC	Time of concentration in
R	Storage coefficient in ho

TABLE 6. PRECIPITATION GAUGES USED IN ORANGE COUNTY FLOOD RECONSTITUTIONS.

Streamgauge Location	Storm Reconstitution		OCEMA Raingauge No.*
El Modena-Irvine Channel at Myford Rd.	Feb 69		61,121
Santa Ana-Delhi Channel at Irvine Ave.	Mar 79	Jan 80	121,165
	Nov 78	Feb 80	
	Jan 79	Mar 80	
	Mar 79	Nov 82	
Westminster Channel at Beach Blvd.	Dec 74		162,184
	Mar 78		
	Feb 80		

*No.	Station Name	Lat.	Long.	Elev.	Type
OC-61	Tustin-Irvine Ranch	33-43-46	117-46-58	118	S
OC-121	OCEMA-Santa Ana	33-45-94	117-52-11	180	R
OC-162	Westminster	33-45-08	117-59-17	39	SR
OC-165	Costa Mesa	33-40-07	117-53-35	56	SR
OC-184	Garden Grove City Hall	34-46-35	117-55-49	121	S

S = Standard 8" raingauge (non-recording).
R = Recording raingauge.

Basin	Drainage Area (mi^2)	Event	lume cror %)	Average Watershed TC	R	"n"	Effective Impervious Cover (%)
El Modena-Irvine Channel at Myford Road	11.9	Feb 6	7.6	0.80	0.73	0.028	40
Santa Ana-Delhi Channel at Irvine Ave.	17.6	Mar 7	5.4	3.04	1.89	0.053	40
			4.9				
			0.7				
			3.8				
			5.5				
			4.4				
			7.2				
		Jan 7	.00				
			3.1				
			0.4				
		Mar 7	0.1				
			0.5				
		Jan 8	0.0				
		Feb 8	0.1				
		Mar 8	0.3				
		Nov 8	0.0				
			0.6				
			.3				
Westminster Channel at Beach Blvd.	6.7	Dec 7	.9	2.20	1.90	0.077	40
		Mar 7	0.0				
			.4				
			0.0				
			.2				
		Feb 8	.8				
			.5				
			.1				

Hydrologic Engineering Center Base F

STRTQ Flow (ft^3/s) at start of
QRCSN Flow (cfs) below which b
RTIOR Ratio of recession flow,

Hydrologic Engineering Center Loss-R

STRKR Starting value (inches/h
ERAIN Exponent of precipitatio
DLTKR Amount (inches) of initi
RTIOL Ratio of rain-loss coffi

Clark Unit Hydrograph of Parameters:

TC Time of concentration in
R Storage cofficient in ho

TABLE 8. PEAK LOSS RATES FROM RECONSTITUTIONS STUDIES USED FOR REGIONALIZATION OF F_p.

Watershed Name	Event	Peak Loss (in/hr)*
Alhambra Wash near Klingerman Street	Feb. 78	0.59, 0.24
	Mar. 78	0.35, 0.29
	Feb. 80	0.24
Compton Creek near Greenleaf Drive	Feb. 78	0.36
	Mar. 78	0.29
	Feb. 80	0.44
Limekiln Creek above Aliso Creek	Feb. 78	0.27
	Feb. 80	0.27
San Jose Channel above Workman Mill Road	Feb. 78	0.20
	Feb. 80	0.39
Sepulveda Dam (inflow)	Feb. 78	0.22, 0.21
	Mar. 78	0.32
	Feb. 80	0.42
Verdugo Wash at Estelle Ave.	Feb. 78	0.65

* Two values indicate a double peaked storm.

TABLE 9. LAG AND tc ESTIMATES.

Watershed Name	Area (sq.mi.)	L[1] (mi.)	L_{ca}[2] (mi.)	S (ft./mi.)	tc (hrs)	Lag (hrs)	Basin n
Alhambra Wash near Klingerman St.[3]	13.67	8.62	4.17	82.4	0.89	0.62[11]	0.015[10]
Compton Crk near Greenleaf Drive[3]	24.76	12.69	6.63	13.8	2.22	0.94[11]	0.015[10]
Limekiln Creek above Aliso Creek[3]	10.3	7.77	3.41	295.7	0.8	0.73[11]	0.026[10]
Eaton Wash at Loftus Drive[3]	11.02	8.14	3.41	90.9	1.05	0.54[12]	0.015[8]
Rubio Wash at Glendon Way[3]	12.20	9.47	5.11	125.7	0.68	0.63[12]	0.015[8]
Arcadia Wash below Grand Ave.[3]	7.70	5.87	3.03	156.7	0.60	0.41[12]	0.015[8]
Compton Crk at 120th Street[3]	15.08	9.47	3.79	14.3	1.92	0.85[12]	0.015[9]
Dominguez Channel at Vermont Ave.[3]	37.30	11.36	4.92	7.9	2.08	1.12[12]	0.015[9]
Santa Ana-Delhi Channel at Irvine Ave.[4]	17.6	8.71	4.17	16.0	1.73	2.0[11]	0.053[10]
Westminster Ch at Beach Blvd.[4]	6.7	5.65	1.39	13	1.3	1.3[11]	0.077[10]

1 L = length of longest watercourse.
2 Lca = length along longest watercourse to a point opposite the centroid.
3 Watershed geometry based on review of quad maps and LACFCD storm drain maps.
4 Watershed geometry based on reconstitution study.
5 Area reduced 57% due to several debris basins and Eaton Wash Dam reservoir and groundwater recharge ponds.
6 Area reduced 3% due to debris basin.
7 Area reduced 14% due to several debris basins.
8 0.015 basin "n" due to similarity to Alhambra Wash watershed.
9 0.015 basin "n" due to similarity to Compton Creek near Greenleaf watershed.
10 Average basin factor from flood reconstitution.
11 Average lag from flood reconstitution.
12 Lag determined from estimated basin "n".

Watershed Name	RECORDED DATA Drainage Area (mi^2)	Peak Discharge (cfs)	Tc Vc (	ONAL PARAMETERS F_m (in/hr)	$\bar{Y}$ calculated	$\bar{Y}$ calibrated
Alhambra Wash near Klingerman Street[1]	13.67	7010	2C	0.165	0.46	0.43
Compton Creek nr Greenleaf Drive[1]	24.76	4620	19	0.135	0.45	0.51
Eaton Wash at Loftus Drive	11.02[2]	5430	23	0.180	0.48	0.26
Rubio Wash at Glendon Way	12.20[3]	3760	12	0.180	0.47	0.66
Arcadia Wash below Grand Ave.	7.70[4]	4110	9	0.165	0.43	0.61
Dominguez Channel at Vermont Ave.	37.30	9830	49	0.120	0.39	0.20

(1) Physical characteristics slightly di

(2) Area reduced 57% due to several debr

(3) Area reduced 3% due to debris basins

(4) Area reduced 14% due to several debr

(5) Raingauge #235, Henninger Flats.

(6) Raingauge #291, Los Angeles - 96th E

TABLE 11. COMPARISON OF REGIONAL PARAMETER MODEL RESULTS WITH OBSERVED PEAK FLOWS, MARCH 1, 1983 STORM EVENT.

Watershed	Time (hrs)	Recorded Q(cfs)	Regional Model Std. Time	Regional Model Modeled Q(cfs)	Regional Model Relative Error	Calibrated to Low Loss Fraction, Y Std. Time	Calibrated to Low Loss Fraction, Y Modeled Q(cfs)	Calibrated to Low Loss Fraction, Y Relative Error
Alhambra Wash nr Klingerman Street	0615	2290	0710	2870	+25	0710	2450	+7
	0830	7010	0915	6580	-6	0915	6460	-8
	1200	5300	1255	2970	-44	1255	2550	-52
	1900	5250	1940	5500	+5	1940	5320	+1
Compton Creek nr Greenleaf Drive	0645	3380	0645	1760	-48	0645	1237	-63
	0815	4620	0940	5550	+20	0940	4100	-11
	1200	2430	1200	3730	+53	1200	2320	-5
	1845	847	1955	1500	+77	2010	920	+9
Eaton Wash at Loftus Drive[1,4]	0619	1780	0720	2360(+150)	+32	0715	2320(+150)	+30
	0904	4300	0925	5580(+150)	+30	0925	5510(+150)	+28
	1219	5430	1300	2900(+600)	-47	1300	2830(+600)	-48
	1934	3080	1950	5330(+750)	+73	1950	5310(+750)	+72
Rubio Wash at Glendon Way[2]	0630	1500	0700	2970	+98	0700	2450	+63
	0900	3760	0905	6050	+61	0905	5990	+59
	1215	2520	1245	2680	+6	1245	2110	-16
	1930	3520	1930	6090	+73	1930	5900	+68
Arcadia Wash below Grand Ave.[3]	0615	1460	0655	1990	+36	0655	1740	+19
	0845	3660	0900	3510	-4	0900	3500	-4
	1215	4110	1215	1550	-62	1250	1260	-69
	2000	1340	1925	3580	+167	1925	3530	+163
Dominguez Channel at Vermont Ave.	0910	9830	0925	8100	-18	0925	7600	-23
	1206	6180	1240	5450	-12	1240	5000	-19
	1900	2400	1955	2300	-4	1955	2090	-13
	2400	1700	2440	2600	+53	2440	2370	+39

Notes:
1 - Area reduced 57% due to Eaton Dam.
2 - Area reduced 3% due to Debris Basin.
3 - Area reduced 14% due to Debris Basins.
4 - ( ) added to modeled Q's to account for Eaton Wash Dam outflow (per LACFCD 1983 Storm Report).

TABLE 12. STREAMGAUGING DATA USED IN ANALYTIC DISCHARGE FREQUENCY ANALYSIS.

Station Number	Station Name	Agency	Period of Record	Drainage area (mi^2)
F81D-R	Alhambra Wash near Klingerman Street	LACFCD	1930-83	15.2
F37B-R	Compton Creek near Greenleaf Drive	LACFCD	1928-83	22.6
F318-R	Eaton Wash at Loftus Drive	LACFCD	1957-84	22.8
F82C-R	Rubio Wash at Glendon Way	LACFCD	1930-83	10.9
F317-R	Aracdia Wash below Grand Ave.	LACFCD	1957-84	8.5
F302-R	Compton Creek at 120th Street	LACFCD	1952-78	14.5
F378-R	Dominguez Channel at Vermont Ave.	LACFCD	1967-82	37.1
F252-R	Verdugo Wash at Estelle Ave.	LACFCD	1929-83	26.8
216	El Modena-Irvine Channel at Myford Rd.	OCEMA	1967-83	12.8
220	Santa Ana-Delhi Channel at Irvine Ave.	OCEMA	1970-83	17.6
5	Arroyo Trabuco Channel at Camino Capistrano	OCEMA	1932-84	35.7
217	East Garden Grove-Wintersburg Channel	OCEMA	1968-84	20.7
4850	San Diego Creek at Culver Drive	USGS	1950-84	40.5

TABLE 13. IMPERVIOUS AREA FOR LAND-USE CLASSIFICATIONS, ANALYTIC DISCHARGE FREQUENCY ANALYSIS.

Classification	Impervious Area (percent)
Residential	35
Commercial	83
Industrial	95
Undeveloped	0

TABLE 14. SUMMARY OF TABLE AND PLATE NUMBERS FOR FLOOD RECORDS AND FREQUENCY CURVES OF GAUGES ANALYSED ANALYTICALLY.

Stream Gauge	Table with flood record	Plate showing frequency curves
Alhambra Wash near Klingerman Street	15	50
Compton Creek near Greenleaf Drive	16	51
Eaton Wash at Loftus Drive	17	52
Rubio Wash at Glendon Way	18	53
Arcadia Wash below Grand Ave.	19	54
Compton Creek at 120th Street	20	55
Dominguez Channel at Vermont Ave.	21	56
Verdugo Wash at Estelle Ave.	22	57
El Modena-Irvine Channel at Myford Rd.	23	58
Santa Ana-Delhi Channel at Irvine Ave.	24	59
Arroyo Trabuco at Camino Capistrano	25	60
East Garden Grove-Wintersburg Channel	26	61
San Diego Creek at Culver Drive	27	62

TABLE 15. FLOOD RECORD FOR ALHAMBRA WASH NEAR KLINGERMAN STREET.

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
3	14	1930	1870.	2387.
2	3	1931	1530.	1962.
1	31	1932	1250.	1462.
1	19	1933	2280.	2343.
1	1	1934	4890.	5925.
1	5	1935	2280.	2827.
2	12	1936	1700.	2155.
3	15	1937	2470.	3026.
3	2	1938	5010.	5961.
1	5	1939	2480.	2979.
2	1	1940	1280.	1578.
3	3	1941	2080.	2514.
12	10	1941	2320.	2781.
3	4	1943	4480.	5191.
2	22	1944	1860.	2194.
11	11	1944	2220.	2556.
12	12	1945	1600.	1793.
11	13	1946	3810.	4141.
3	24	1948	2670.	2789.
12	17	1948	758.	783.
2	6	1950	1630.	1647.
1	11	1951	1620.	1620.
1	16	1952	3810.	3810.
11	15	1952	3140.	3140.
2	13	1954	2410.	2410.
1	18	1955	1890.	1890.
1	26	1956	4550.	4550.
2	23	1957	3090.	3090.
2	19	1958	4830.	4830.
1	6	1959	3170.	3170.
1	11	1960	1710.	1710.
11	5	1960	1480.	1480.
2	12	1962	2560.	2560.
3	16	1963	2210.	2210.
1	21	1964	2210.	2210.
4	9	1965	3730.	3730.
11	24	1965	3520.	3520.
1	22	1967	3550.	3550.
3	8	1968	3480.	3480.
2	6	1969	3980.	3980.

* Hydrologic method.

TABLE 15. Continued

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
2	28	1970	3430.	3430.
11	29	1970	4040.	4040.
12	24	1971	2000.	2000.
2	11	1973	4450.	4450.
1	7	1974	4330.	4330.
12	4	1974	6000.	6000.
2	5	1976	1820.	1820.
10	22	1976	1770.	1770.
3	1	1978	5950.	5950.
3	27	1979	4484.	4484.
2	16	1980	6660.	6660.
3	19	1981	2750.	2750.
3	17	1982	2410.	2410.
3	1	1983	7010.	7010.

* Hydrologic method.

TABLE 16. FLOOD RECORD FOR COMPTON CREEK NEAR GREENLEAF DRIVE,

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
3	5	1928	240.	505.
3	10	1929	924.	1730.
3	14	1930	580.	1136.
4	26	1931	678.	1265.
1	31	1932	757.	1339.
1	19	1933	740.	1291.
1	1	1934	960.	1605.
4	8	1935	850.	1386.
2	12	1936	824.	1355.
2	6	1937	1220.	1918.
9	25	1939	2150.	3092.
2	3	1940	1630.	2361.
12	23	1940	2660.	3617.
12	10	1941	1730.	2332.
1	22	1943	2050.	2656.
2	20	1944	2370.	2955.
11	11	1944	3010.	3586.
12	23	1945	2010.	2383.
11	23	1946	2930.	3363.
3	24	1948	1410.	1639.
12	17	1948	2710.	3047.
2	6	1950	2830.	3148.
1	10	1951	1790.	1963.
1	18	1952	3220.	3472.
11	15	1952	2380.	2553.
2	13	1954	3600.	3803.
1	18	1955	2710.	2821.
1	26	1956	4910.	5024.
5	11	1957	1780.	1822.
2	19	1958	4640.	4719.
1	6	1959	4320.	4367.
1	11	1960	3220.	3237.
11	5	1960	1640.	1647.
2	19	1962	4550.	4575.
2	10	1963	3310.	3310.
11	6	1963	2430.	2430.
4	9	1965	2630.	2630.
12	29	1965	3250.	3250.
11	7	1966	4650.	4650.

* Hydrologic method.

TABLE 16. Continued

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
3	7	1968	3690.	3690.
1	20	1969	5890.	5890.
1	16	1970	1960.	1960.
11	29	1970	2930.	2930.
12	27	1971	6000.	6000.
11	14	1972	4300.	4300.
1	4	1974	3140.	3140.
12	4	1974	8690.	8690.
2	9	1976	2470.	2470.
8	17	1977	1970.	1970.
3	1	1978	3620.	3620.
3	27	1979	1420.	2410.
1	16	1980	4780.	4780.
3		1981	2970.	2970.
1	1	1982	2720.	2720.
1	28	1983	6020.	6020.
11	24	1983	2380.	2380.

* Hydrologic method.

TABLE 17. FLOOD RECORD FOR EATON WASH AT LOFTUS DRIVE.

Mon	Day	Year	Unadjusted Flow (ft^3/s)
0	0	1957	1760.
0	0	1958	2700.
0	0	1959	3480.
0	0	1960	1090.
0	0	1961	1200.
0	0	1962	1950.
0	0	1963	1230.
0	0	1964	2360.
0	0	1965	2150.
0	0	1966	2290.
0	0	1967	2100.
0	0	1968	2390.
0	0	1969	2930.
0	0	1970	2570.
0	0	1971	3770.
0	0	1972	1240.
0	0	1973	3200.
0	0	1974	1530.
0	0	1975	3000.
0	0	1976	2660.
0	0	1977	1820.
0	0	1978	5810.
0	0	1979	2630.
0	0	1980	5240.
0	0	1981	1630.
0	0	1982	3060.
0	0	1983	5510.
0	0	1984	1930.

TABLE 18. FLOOD RECORD FOR RUBIO WASH AT GLENDON WAY.

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
3	14	1930	661.	878.
2	3	1931	1690.	2152.
11	27	1931	798.	1038.
1	16	1933	1510.	1875.
12	31	1933	2070.	2514.
10	17	1934	1680.	2030.
2	22	1936	1370.	1664.
12	27	1936	1180.	1431.
3	2	1938	2400.	2789.
1	5	1939	1720.	2031.
1	7	1940	1000.	1175.
3	3	1941	1940.	2190.
12	10	1941	1200.	1357.
3	4	1943	2780.	3026.
2	22	1944	1930.	2095.
11	11	1944	1780.	1893.
12	22	1945	1630.	1723.
11	13	1946	2650.	2783.
3	24	1948	2090.	2189.
10	30	1948	530.	556.
2	6	1950	1060.	1088.
1	11	1951	2290.	2358.
1	16	1952	3020.	3059.
11	15	1952	2200.	2238.
1	19	1954	2310.	2337.
1	18	1955	1290.	1304.
1	26	1956	1970.	1992.
2	23	1957	2980.	3018.
2	19	1958	2740.	2773.
1	6	1959	2780.	2814.
1	11	1960	985.	995.
11	6	1960	902.	911.
1	20	1962	1200.	1213.
2	9	1963	1180.	1192.
1	21	1964	1570.	1587.
4	9	1965	2040.	2040.
11	24	1965	2300.	2300.
12	3	1966	2040.	2040.
3	8	1968	2460.	2460.
1	25	1969	2890.	2890.

* Hydrologic method.

TABLE 18. Continued

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
2	28	1970	2540.	2540.
11	29	1970	3700.	3700.
12	24	1971	1240.	1240.
2	11	1973	3166.	3166.
1	7	1974	1985.	1985.
12	4	1974	3180.	3180.
9	10	1975	2070.	2070.
10	23	1976	2610.	2610.
3	10	1978	3170.	3170.
2	21	1979	2680.	2680.
1	29	1980	4594.	4594.
3	1	1981	1754.	1754.
3	17	1982	1650.	1650.
3	2	1983	4560.	4560.

* Hydrologic method.

TABLE 19. FLOOD RECORD FOR ARCADIA WASH BELOW GRAND AVENUE.

Mon	Day	Year	Unadjusted Flow, ft^3/s
0	0	1957	1184.
0	0	1958	1932.
0	0	1959	1270.
0	0	1960	593.
0	0	1961	570.
0	0	1962	1480.
0	0	1963	600.
0	0	1964	1340.
0	0	1965	1460.
0	0	1966	1270.
0	0	1967	1260.
0	0	1968	1570.
0	0	1969	1870.
0	0	1970	1550.
0	0	1971	1840.
0	0	1972	850.
0	0	1973	2040.
0	0	1974	931.
0	0	1975	2580.
0	0	1976	1400.
0	0	1977	1320.
0	0	1978	4110.
0	0	1979	1290.
0	0	1980	3280.
0	0	1981	1090.
0	0	1982	2470.
0	0	1983	4110.
0	0	1984	1430.

TABLE 20. FLOOD RECORD FOR COMPTON CREEK AT 120TH STREET.

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
0	0	1952	1730.	1882.
0	0	1953	1240.	1323.
0	0	1954	2050.	2174.
0	0	1955	1220.	1276.
0	0	1956	2040.	2103.
0	0	1957	1550.	1580.
0	0	1958	2900.	2948.
0	0	1959	1760.	1785.
0	0	1960	1950.	1969.
0	0	1961	1140.	1150.
0	0	1962	3510.	3529.
0	0	1963	1900.	1900.
0	0	1964	1506.	1506.
0	0	1965	2082.	2082.
0	0	1966	2170.	2170.
0	0	1967	3740.	3740.
0	0	1968	792.	792.
0	0	1969	4610.	4610.
0	0	1970	1335.	1335.
0	0	1971	2126.	2126.
0	0	1972	4120.	4120.
0	0	1973	2676.	2676.
0	0	1974	2040.	2040.
0	0	1975	5970.	5970.
0	0	1976	2010.	2010.
0	0	1977	1540.	1540.
0	0	1978	2620.	2620.

* Hydrologic method.

TABLE 21. FLOOD RECORD FOR DOMINQUEZ CHANNEL AT VERMONT AVENUE.

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
0	0	1967	4550.	4655.
0	0	1968	10300.	10771.
0	0	1969	12320.	12592.
0	0	1970	3762.	3848.
0	0	1971	6540.	6634.
0	0	1972	11585.	11771.
0	0	1973	5060.	5131.
0	0	1974	6560.	6656.
0	0	1975	12700.	12847.
0	0	1976	8810.	8810.
0	0	1977	3514.	3514.
0	0	1978	11350.	11350.
0	0	1979	5211.	5211.
0	0	1980	9068.	9068.
0	0	1981	2587.	2587.
0	0	1982	3430.	3430.

* Hydrologic method.

TABLE 22. FLOOD RECORD FOR VERDUGO WASH AT ESTELLE AVENUE.

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
0	0	1929	56.	89.
0	0	1930	80.	126.
0	0	1931	46.	72.
0	0	1932	145.	226.
0	0	1933	391.	601.
0	0	1934	3690.	4955.
0	0	1935	1020.	1465.
0	0	1936	1100.	1560.
0	0	1937	768.	1117.
0	0	1938	4400.	5728.
0	0	1939	520.	774.
0	0	1940	533.	764.
0	0	1941	1120.	1560.
0	0	1942	440.	626.
0	0	1943	3570.	4609.
0	0	1944	3160.	4034.
0	0	1945	1520.	2022.
0	0	1946	816.	1088.
0	0	1947	1860.	2405.
0	0	1948	573.	753.
0	0	1949	202.	271.
0	0	1950	467.	602.
0	0	1951	960.	1202.
0	0	1952	2920.	3438.
0	0	1953	1520.	1812.
0	0	1954	1300.	1546.
0	0	1955	784.	915.
0	0	1956	1940.	2170.
0	0	1957	2960.	3319.
0	0	1958	1700.	1896.
0	0	1959	2080.	2327.
0	0	1960	333.	597.
0	0	1961	676.	750.
0	0	1962	1880.	2040.
0	0	1963	2180.	2353.
0	0	1964	1640.	1740.
0	0	1965	1480.	1559.
0	0	1966	3480.	3604.
0	0	1967	3230.	3320.
0	0	1968	3460.	3533.
0	0	1969	5050.	5086.

* Hydrologic method.

TABLE 22. Continued

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
0	0	1970	2500.	2500.
0	0	1971	5330.	5330.
0	0	1972	1960.	1960.
0	0	1973	4010.	4010.
0	0	1974	2390.	2390.
0	0	1975	3390.	3390.
0	0	1976	1190.	1190.
0	0	1977	2100.	2100.
0	0	1978	9820.	9820.
0	0	1979	2870.	2870.
0	0	1980	6420.	6420.
0	0	1981	2870.	2870.
0	0	1982	1960.	1960.
0	0	1983	6714.	6714.

* Hydrologic method.

TABLE 23. FLOOD RECORD FOR EL MODENA-IRVINE CHANNEL AT MYFORD ROAD.

EVENTS ANALYZED Mon	Day	Year	Unadjusted Flow ft^3/s	Adjusted* Flow (ft^3/s)
4	1	1967	202.	245.
11	21	1967	883.	1050.
2	23	1969	1293.	1498.
11	7	1969	682.	790.
12	19	1970	792.	904.
12	24	1971	378.	426.
11	14	1972	820.	903.
1	7	1974	558.	597.
12	4	1974	1000.	1047.
3	2	1976	357.	362.
11	12	1976	1071.	1082.
3	4	1978	2431.	2460.
3	27	1979	2329.	2329.
2	16	1980	2961.	2961.
1	29	1981	2293.	2293.
3	14	1982	1650.	1650.
3	1	1983	5018.	5018.
10	1	1983	1601.	1601.

* Hydrologic method.

TABLE 24. FLOOD RECORD FOR SANTA ANA-DELHI CHANNEL AT IRVINE AVENUE.

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
12	19	1970	1300.	1417.
12	24	1971	820.	875.
1	16	1972	1099.	1160.
10	14	1973	1251.	1316.
12	4	1974	2569.	2666.
4	12	1975	799.	825.
11	12	1976	989.	1016.
3	1	1977	1767.	1811.
3	27	1978	1562.	1576.
1	30	1979	2011.	2041.
1	29	1980	2300.	2324.
11	28	1981	1781.	1781.
3	10	1982	4346.	4346.
10	1	1983	1710.	1710.

* Hydrologic method.

TABLE 25. FLOOD RECORD FOR ARROYO TRABUCO AT CAMINO CAPISTRANO.

Mon	Day	Year	Unadjusted Flow (ft^3/s)
0	0	1932	382.
0	0	1933	4.
0	0	1934	6.
0	0	1935	198.
0	0	1936	160.
0	0	1937	8551.
0	0	1938	4417.
0	0	1939	188.
0	0	1940	357.
0	0	1941	876.
0	0	1942	8.
0	0	1943	2848.
0	0	1944	898.
0	0	1945	218.
0	0	1946	133.
0	0	1947	127.
0	0	1948	7.
0	0	1949	4.
0	0	1950	4.
0	0	1951	0.
0	0	1952	852.
0	0	1953	4.
0	0	1954	66.
0	0	1955	4.
0	0	1956	753.
0	0	1957	3.
0	0	1958	1929.
0	0	1959	2.
0	0	1960	182.
0	0	1961	2.
0	0	1962	93.
0	0	1963	9.
0	0	1964	11.
0	0	1965	31.
0	0	1966	1000.
0	0	1967	3201.
0	0	1968	16.
0	0	1969	7986.
0	0	1970	27.
0	0	1971	44.

TABLE 25. Continued

Mon	Day	Year	Unadjusted Flow (ft^3/s)
0	0	1972	54.
0	0	1973	640.
0	0	1974	59.
0	0	1975	51.
0	0	1976	16.
0	0	1977	27.
0	0	1978	951.
0	0	1979	399.
0	0	1980	3240.
0	0	1981	565.
0	0	1982	420.
0	0	1983	2449.
0	0	1984	189.

TABLE 26. FLOOD RECORD FOR EAST GARDEN GROVE-WINTERSBURG CHANNEL.

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
0	0	1968	535.	607.
0	0	1969	1025.	1130.
0	0	1970	1095.	1192.
0	0	1971	1459.	1563.
0	0	1972	1187.	1233.
0	0	1973	954.	1023.
0	0	1974	1212.	1264.
0	0	1975	2601.	2266.
0	0	1976	636.	644.
0	0	1977	896.	876.
0	0	1978	1410.	1417.
0	0	1979	1025.	1035.
0	0	1980	3993.	3993.
0	0	1981	3523.	3523.
0	0	1982	3201.	3201.
0	0	1983	3399.	3399.
0	0	1984	2141.	2141.

* Hydrologic method.

TABLE 27. FLOOD RECORD FOR SAN DIEGO CREEK AT CULVER DRIVE.

Mon	Day	Year	Unadjusted Flow (ft^3/s)	Adjusted* Flow (ft^3/s)
0	0	1950	244.	333.
0	0	1951	0.	0.
0	0	1952	4040.	4890.
0	0	1953	1740.	2202.
0	0	1954	722.	948.
0	0	1955	900.	1170.
0	0	1956	914.	1190.
0	0	1957	370.	498.
0	0	1958	1880.	2360.
0	0	1959	835.	1060.
0	0	1960	991.	1260.
0	0	1961	1140.	1445.
0	0	1962	734.	948.
0	0	1963	439.	559.
0	0	1964	2210.	2680.
0	0	1965	410.	526.
0	0	1966	2550.	3050.
0	0	1967	1620.	1922.
0	0	1968	1880.	2237.
0	0	1969	6700.	7515.
0	0	1970	1060.	1210.
0	0	1971	914.	1050.
0	0	1972	448.	512.
0	0	1973	1840.	2030.
0	0	1974	665.	720.
0	0	1975	2000.	2120.
0	0	1976	1220.	1300.
0	0	1977	840.	882.
0	0	1978	6300.	6500.
0	0	1979	5550.	5723.
0	0	1980	7720.	7910.
0	0	1981	3470.	3520.
0	0	1982	2220.	2250.
0	0	1983	10400.	10570.
0	0	1984	3120.	3120.

* Hydrologic method.

TABLE 28. SUMMARY OF STATISTICS[1] FOR GAUGE RECORDS AND FOR ADJUSTED[2] GAUGE RECORDS.

Gauging Station	Drainage Area (mi^2)	n	Recorded Data M	Recorded Data S	Recorded Data G_c	Recorded Data G_g[3]	Recorded Data G_a	Adjusted Data M	Adjusted Data S	Adjusted Data G_c	Adjusted Data G_g[4]	Adjusted Data G_a
1. Alhambra Wash	15.2	54	3.434	0.210	-0.10	-0.45	-0.20	3.469	0.185	0.25	0.05	0.20
2. Compton Creek nr Greenleaf Dr.	22.6	56	3.376	0.265	-0.50	-0.45	-0.50	3.442	0.195	-0.08	0.05	0.10
3 Eaton Wash	22.8	28	3.375	0.193	0.23	-0.45	0.00	3.375	0.193	0.23	0.05	0.20
4 Rubio Wash	10.9	54	3.274	0.200	-0.53	-0.45	-0.50	3.306	0.171	-0.27	0.05	-0.20
5 Arcadia Wash	8.5	28	3.167	0.220	0.15	-0.45	-0.10	3.167	0.220	0.15	0.05	0.10
6 Compton Creek nr 120th St.	14.5	27	3.317	0.199	0.36	-0.45	0.00	3.323	0.196	0.33	0.05	0.20
7. Dominguez Ch.	37.1	16	3.814	0.227	-0.23	-0.45	-0.30	3.818	0.228	-0.23	0.05	0.10
Verdugo Wash	26.8	55	3.148	0.478	~~-1.0~~	-0.45	-0.80	3.222	0.430	-1.00	0.05	-0.6
El Modena-Irvine Channel	12.8	18	3.035	0.350	-0.18	-0.29	-0.20	3.062	0.339	-0.20	0.05	-0.1
Santa Ana-Delhi Channel	17.6	14	3.193	0.203	0.50	-0.29	0.10	3.206	0.196	0.51	0.05	0.3
Arroyo Trabuco	35.7	53	1.909	1.10	-0.19	-0.29	-0.20	2.009	1.04	0.02	0.05	0.0

TABLE 28. SUMMARY OF STATISTICS[1] FOR GAUGE RECORDS AND FOR ADJUSTED[2] GAUGE RECORDS. (Continued)

Gauging Station	Drainage Area (mi^2)	Recorded Data n	M	S	G_c	G_g[3]	G_a	Adjusted Data M	S	G_c	G_g[4]	G_a
East Garden Grove Wintersburg	20.8	17	3.171	0.269	0.24	-0.29	0.00	3.177	0.258	0.30	0.05	0.2
San Diego Creek	40.5	35	3.159	0.409	0.26	-0.29	0.10	3.227	0.382	0.26	0.05	0.2

(1) n = number of years of record
N = mean
S = standard deviation
G_c = computed skew
G_g = generalized skew
G_a = adopted skew

(2) Adjusted by the hydrologic method

(3) G_g for recorded data was obtained from the generalized skew map of Bulletin #17B, ref. no. ___.

(4) G_g for adjusted data was obtained by averaging the computed skews of the adjusted records of Los Angeles County gauges, excluding Verdugo Wash.

TABLE 29. N-YEAR POINT RAINFALL VALUES FOR ALHAMBRA WASH*, IN INCHES.

Frequency	Duration					
	5 min	30 min	1 hr	3 hr	6 hr	24 hr
2-yr	0.18	0.46	0.68	1.29	1.85	3.18
5-yr	0.27	0.70	1.02	1.93	2.79	4.80
10-yr	0.33	0.86	1.24	2.36	3.40	5.86
25-yr	0.41	1.05	1.52	2.88	4.19	7.16
50-yr	0.46	1.18	1.72	3.26	4.70	8.09
100-yr	0.52	1.31	1.91	3.62	5.26	9.00

* Data from El Monte Fire Station (#108) and Pasadena - Cal Tech (#303) 0.25 (#108) + .75 (#303).

TABLE 30. N-YEAR POINT RAINFALL VALUES FOR COMPTON CREEK NEAR GREENLEAF DRIVE*, IN INCHES.

Frequency	Duration					
	5 min	30 min	1 hr	3 hr	6 hr	24 hr
2-yr	0.18	0.46	0.66	1.27	1.85	3.41
5-yr	0.27	0.69	1.01	1.93	2.83	5.21
10-yr	0.34	0.84	1.23	2.36	3.44	6.36
25-yr	0.41	1.03	1.50	2.88	4.23	7.65
50-yr	0.46	1.16	1.70	3.26	4.70	8.79
100-yr	0.52	1.30	1.89	3.63	5.26	9.78

* Data from Los Angeles - 96th E. Central.

TABLE 31. N-YEAR POINT RAINFALL VALUES FOR EATON WASH*, IN INCHES.

Frequency	Duration					
	5 min	30 min	1 hr	3 hr	6 hr	24 hr
2-yr	0.18	0.46	0.67	1.26	1.83	3.21
5-yr	0.27	0.69	1.00	1.89	2.74	4.84
10-yr	0.33	0.84	1.22	2.30	3.34	5.91
25-yr	0.41	1.03	1.49	2.82	4.10	7.22
50-yr	0.46	1.17	1.69	3.19	4.58	8.17
100-yr	0.52	1.30	1.87	3.54	5.13	9.09

* Data from El Monte Fire Station (#108), Bailey Debris Dam (#179) and Pasadena Cal Tech (#303) 0.35 (#108) + 0.30 (#179) + 0.35 (#303).

TABLE 32. N-YEAR POINT RAINFALL VALUES FOR RUBIO WASH*, IN INCHES.

Frequency	Duration					
	5 min	30 min	1 hr	3 hr	6 hr	24 hr
2-yr	0.18	0.47	0.69	1.34	1.96	3.47
5-yr	0.27	0.70	1.04	2.02	2.96	5.23
10-yr	0.33	0.86	1.27	2.46	3.61	6.38
25-yr	0.41	1.05	1.55	3.01	4.40	7.80
50-yr	0.46	1.19	1.75	3.41	4.97	8.82
100-yr	0.51	1.32	1.95	3.79	5.55	9.81

* Data from El Monte Fire Station (#108), Pasadena - Cal Tech (#303), Henninger Flates (#235) and Sacred Heart Academy (#280)
0.10 (#108) + 0.65 (#303) + 0.20 (#235) + 0.05 (#280).

TABLE 33. N-POINT RAINFALL VALUES FOR ARCADIA WASH*, IN INCHES.

Frequency	Duration					
	5 min	30 min	1 hr	3 hr	6 hr	24 hr
2-yr	0.18	0.46	0.66	1.27	1.85	3.41
5-yr	0.27	0.69	1.01	1.93	2.83	5.21
10-yr	0.34	0.84	1.23	2.36	3.44	6.36
25-yr	0.41	1.03	1.50	2.88	4.23	7.65
50-yr	0.46	1.16	1.70	3.26	4.70	8.79
100-yr	0.52	1.30	1.89	3.63	5.26	9.78

* Data from El Monte Fire Station (#108) and Bailey Debris Dam (#179) 0.25 (#108) + 0.75 (#179).

TABLE 34. N-YEAR POINT RAINFALL VALUES FOR COMPTON CREEK AT 120TH STREET*, IN INCHES.

Frequency	Duration					
	5 min	30 min	1 hr	3 hr	6 hr	24 hr
2-yr	0.16	0.37	0.55	1.01	1.40	2.37
5-yr	0.24	0.55	0.82	1.52	2.20	3.56
10-yr	0.29	0.67	1.01	1.85	2.60	4.35
25-yr	0.35	0.82	1.23	2.26	3.20	5.32
50-yr	0.40	0.93	1.39	2.56	3.55	6.01
100-yr	0.44	1.04	1.55	2.84	4.00	6.69

* Data from Los Angeles – 96th/Central (#291).

TABLE 35. N-YEAR POINT RAINFALL VALUES FOR DOMINQUEZ CHANNEL*, IN INCHES.

Frequency	Duration					
	5 min	30 min	1 hr	3 hr	6 hr	24 hr
2-yr	0.16	0.37	0.55	1.01	1.40	2.37
5-yr	0.24	0.55	0.82	1.52	2.20	3.56
10-yr	0.29	0.67	1.01	1.85	2.60	4.35
25-yr	0.35	0.82	1.23	2.26	3.20	5.32
50-yr	0.40	0.93	1.39	2.56	3.55	6.01
100-yr	0.44	1.04	1.55	2.84	4.00	6.69

* Data from Los Angeles - 96th & Central (#291).

TABLE 36. PARAMETER VALUES FOR CALIBRATION OF REGIONAL N-YEAR RAINFALL-RUNOFF MODEL.

Watershed	a_p[1]	F_p (in/hr)	F_m (in/hr)	CN[2]	Low Loss Fraction (Y)						LAG(hrs)[3]
					2yr	5 yr	10 yr	25 yr	50 yr	100 yr	
Alhambra Wash	0.55	0.30	0.165	56	0.53	0.46	0.43	0.39	0.36	0.34	0.71
Compton Creek near Greenleaf	0.45	0.30	0.135	56	0.47	0.44	0.40	0.37	0.35	0.33	1.78
Eaton Wash	0.60	0.30	0.180	56	0.57	0.50	0.46	0.41	0.39	0.37	0.84
Rubio Wash	0.60	0.30	0.180	56	0.56	0.49	0.44	0.40	0.38	0.35	0.54
Arcadia Wash	0.55	0.30	0.165	56	0.53	0.45	0.41	0.37	0.35	0.32	0.48
Compton Creek at 120th Street	0.45	0.30	0.135	56	0.47	0.44	0.40	0.37	0.35	0.33	1.54
Dominguez Channel	0.40	0.29	0.112	61	0.43	0.37	0.34	0.31	0.29	0.27	1.66

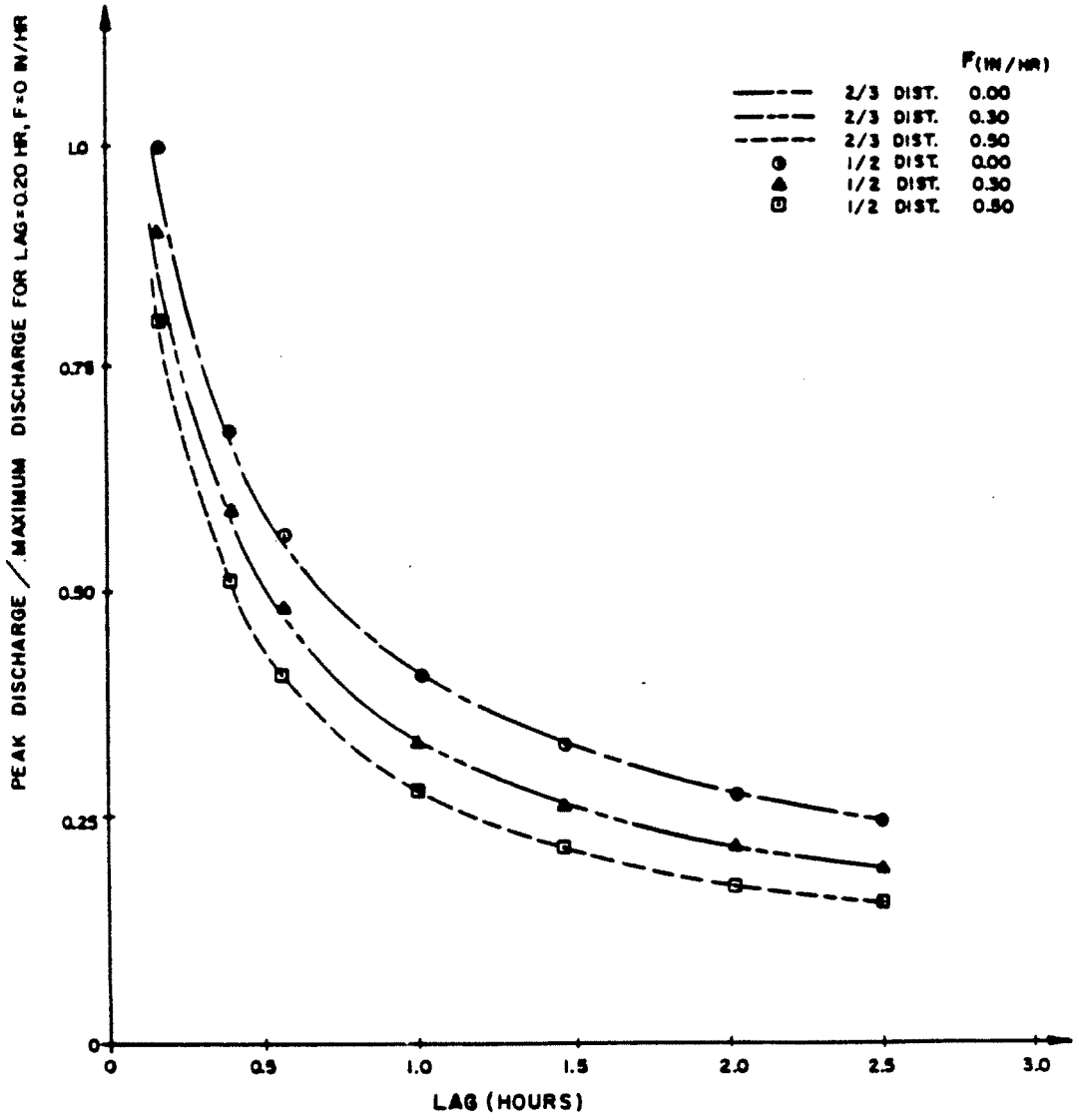
[1] Map measured.

[2] AMC II.

[3] LAG = 0.8Tc

TABLE 37. CALIBRATION RESULTS FOR COMPUTED, EXPECTED PROBABILITY AND 85% CONFIDENCE LEVEL N-YEAR FREQUENCY RUNOFF.

Frequency Runoff (yrs)	Frequency Rainfall (yrs)		
	Computed	Expected Probability	85% Confidence Level
2	2	2	2
5	4	4	5
10	5	5	10
25	10	10	25
50	15	20	50
100	25	40	100



TEST WATERSHED PARAMETERS

L	=	7500 ft
Lca	=	3750 ft
Slope	=	0.01
Lag	=	0.2 to 2.5 hr
Fm*	=	0.0 to 0.5 in/hr

Valley S-graph used.

R5min	=	0.51 in.
R30min	=	1.13 in.
R1hr	=	1.53 in.
R3hr	=	2.48 in.
R6hr	=	3.37 in.
R24hr	=	6.19 in.

* Fm = maximum rainfall loss rate; discussed in section 2b., Precipitation Loss Rate Function.

DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

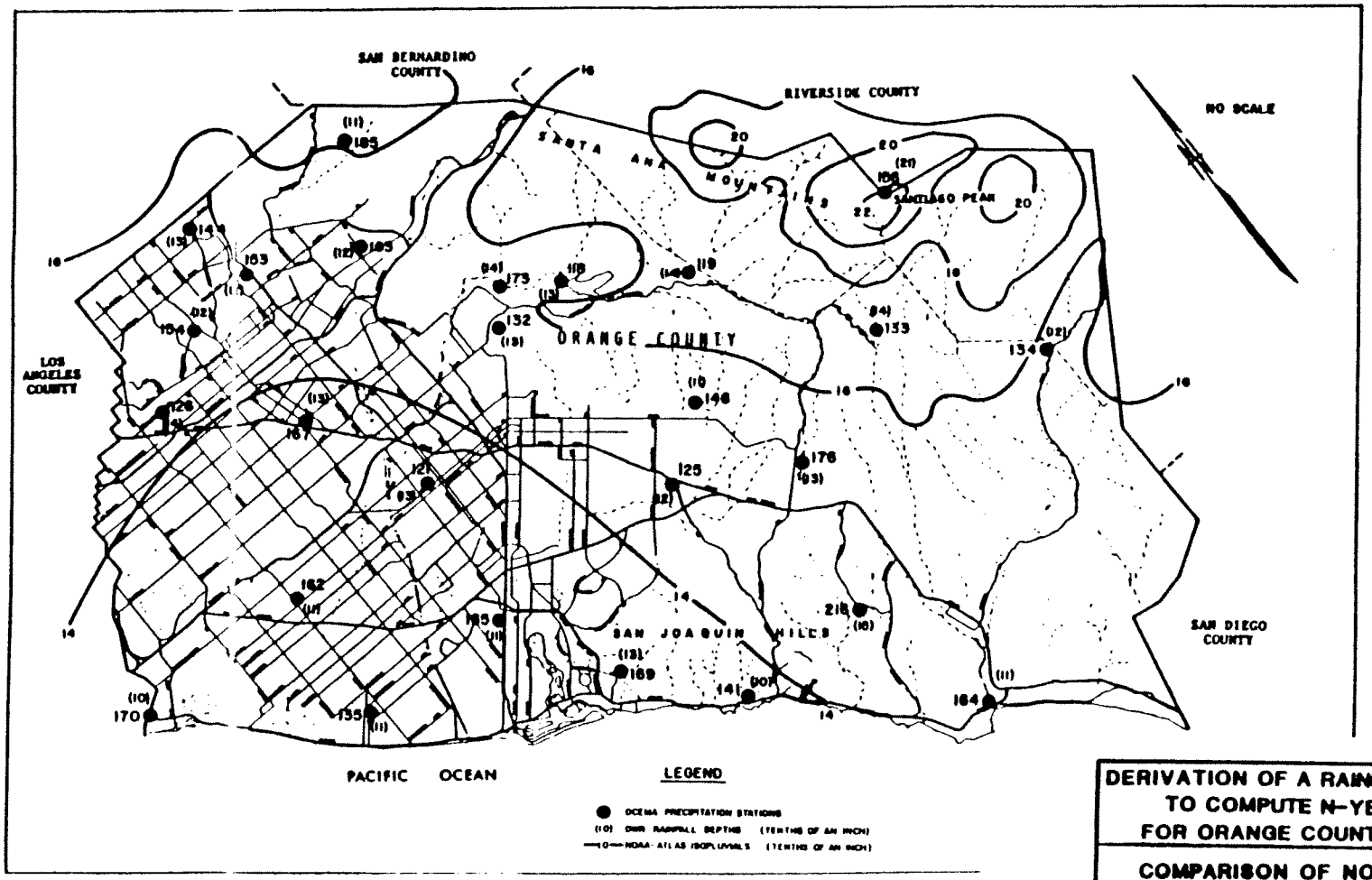
COMPARISON OF RUNOFF RESULTS (2/3,1/3 DISTRIBUTION OF STORM PATTERN NESTED UNIT RAINFALL COMPARED TO 1/2,1/2 DISTRIBUTION).

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 1

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

COMPARISON OF NOAA ATLAS 2 AND STATE OF CALIFORNIA DWR POINT RAINFALL DATA

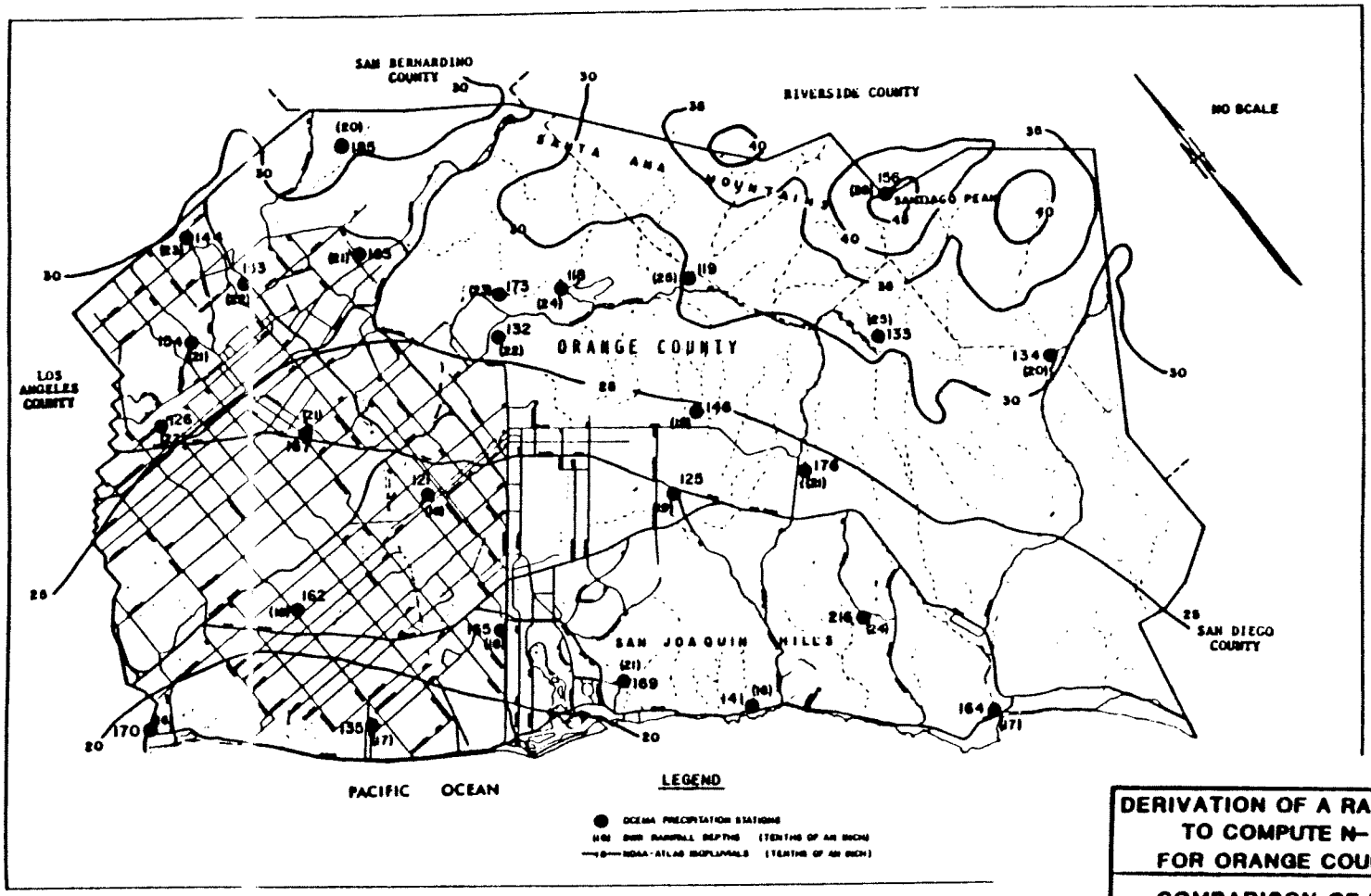
2 YR, 6 HR

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 2

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

COMPARISON OF NOAA ATLAS 2 AND STATE OF CALIFORNIA DWR POINT RAINFALL DATA

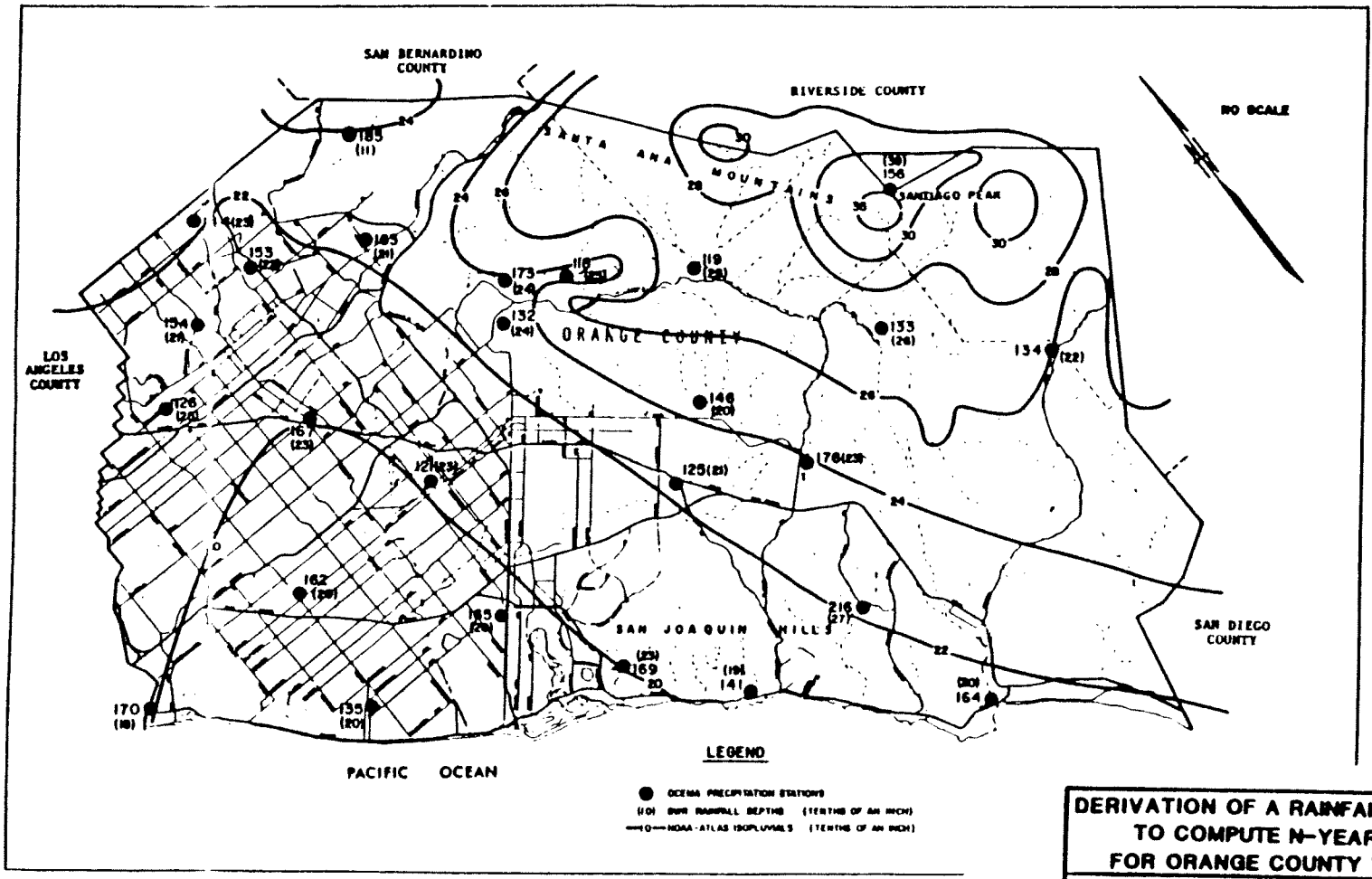
2 YR, 24 HR

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 3

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS

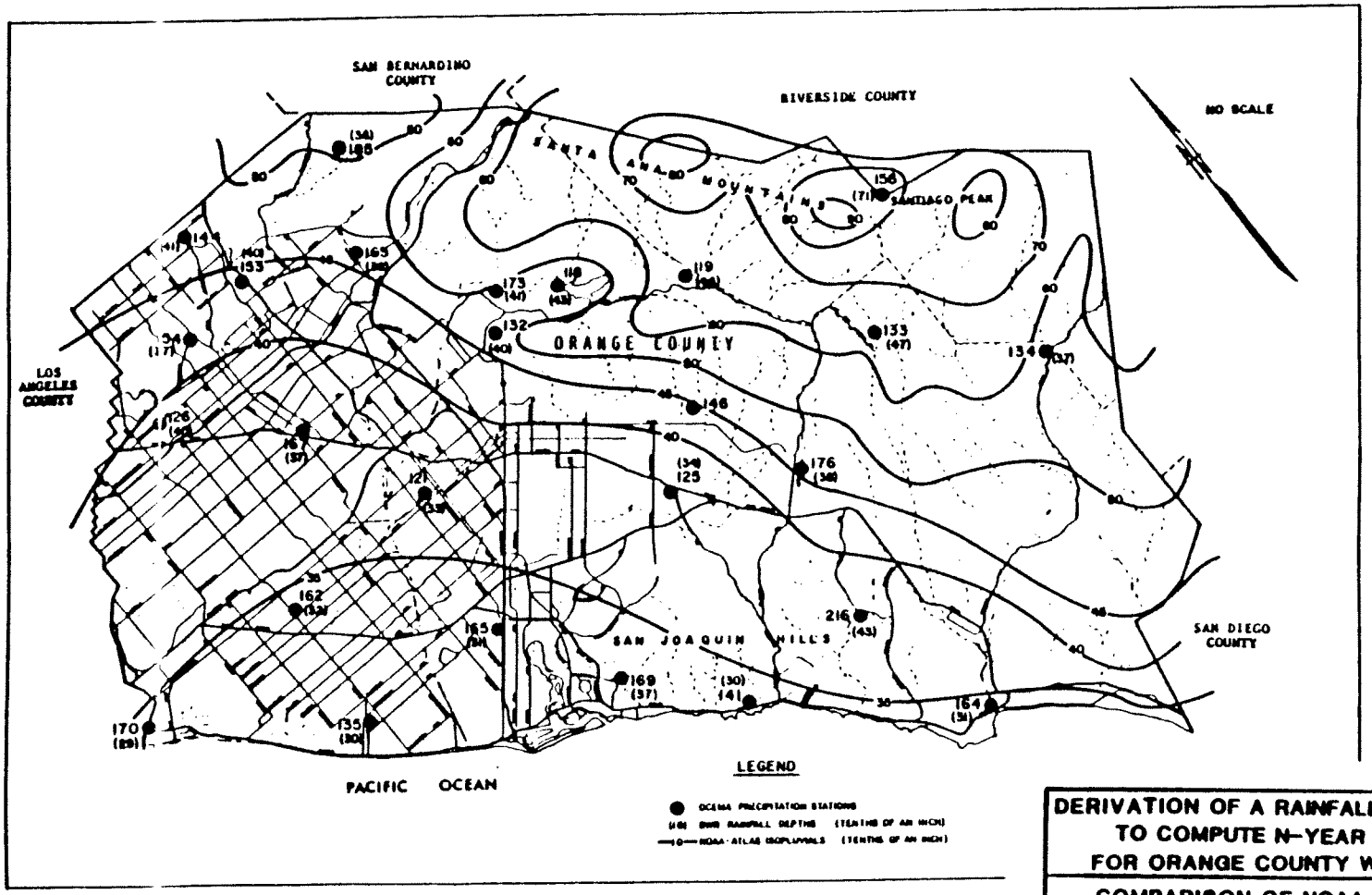


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS
COMPARISON OF NOAA ATLAS 2 AND STATE OF CALIFORNIA DWR POINT RAINFALL DATA 10 YR, 6 HR
U. S. ARMY ENGINEER DISTRICT LOS ANGELES, CORPS OF ENGINEERS TO ACCOMPANY REPORT DATED:

PLATE 4

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

COMPARISON OF NOAA ATLAS 2 AND STATE OF CALIFORNIA DWR POINT RAINFALL DATA

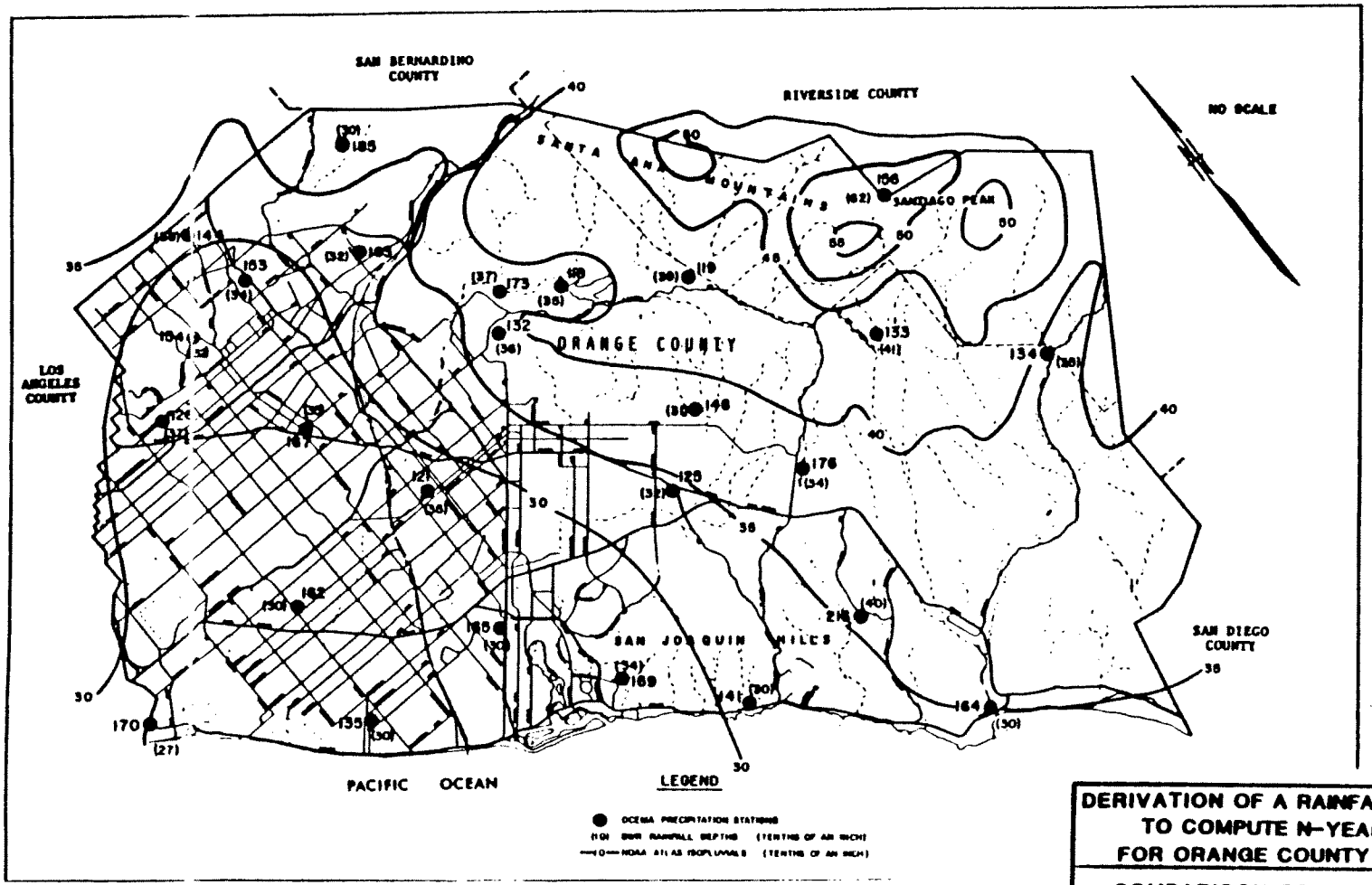
10 YR,24 HR

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 6

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

COMPARISON OF NOAA ATLAS 2 AND STATE OF CALIFORNIA DWR POINT RAINFALL DATA

100 YR,6 HR

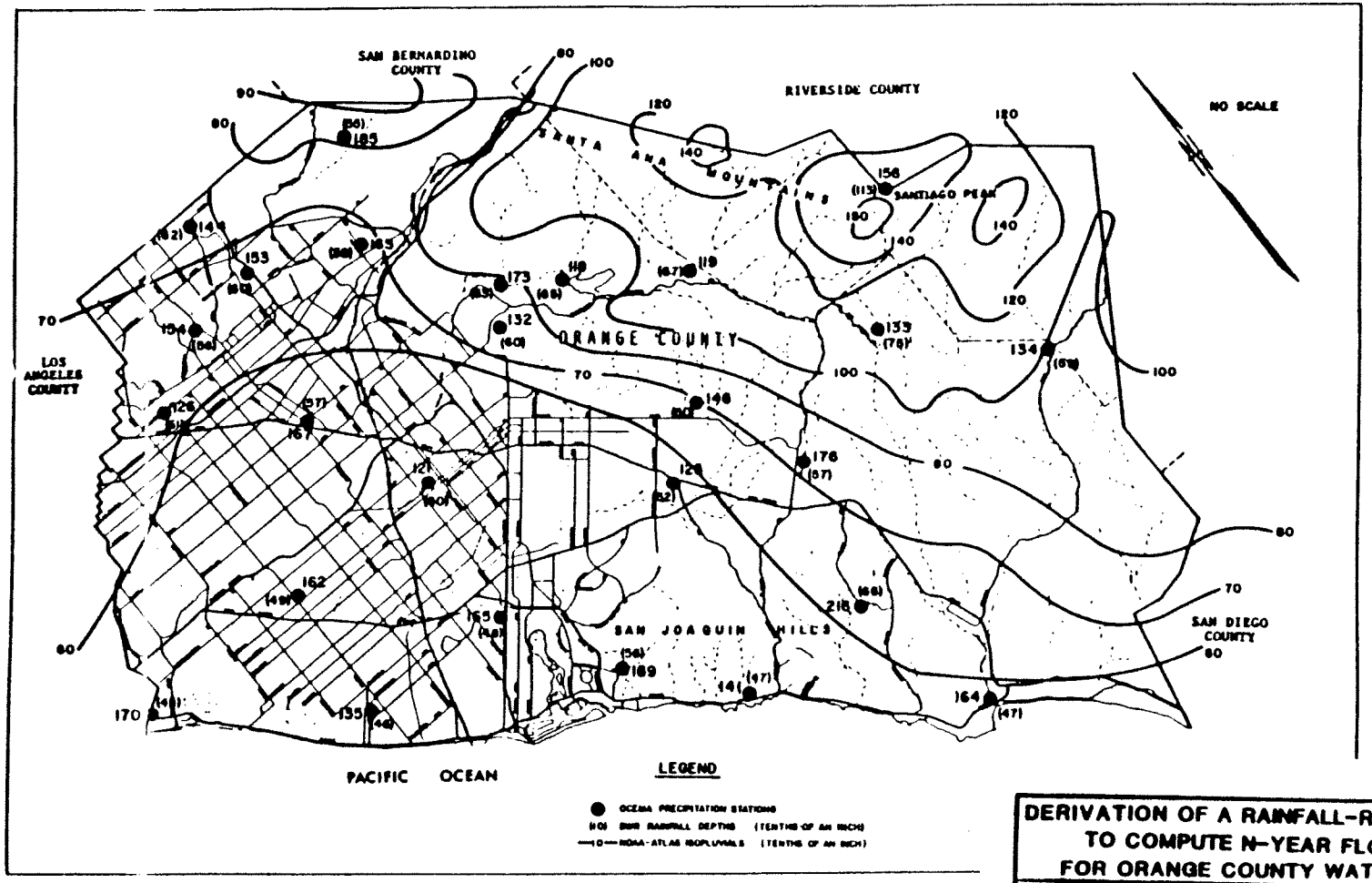
U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS

TO ACCOMPANY REPORT DATED:

PLATE 6

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



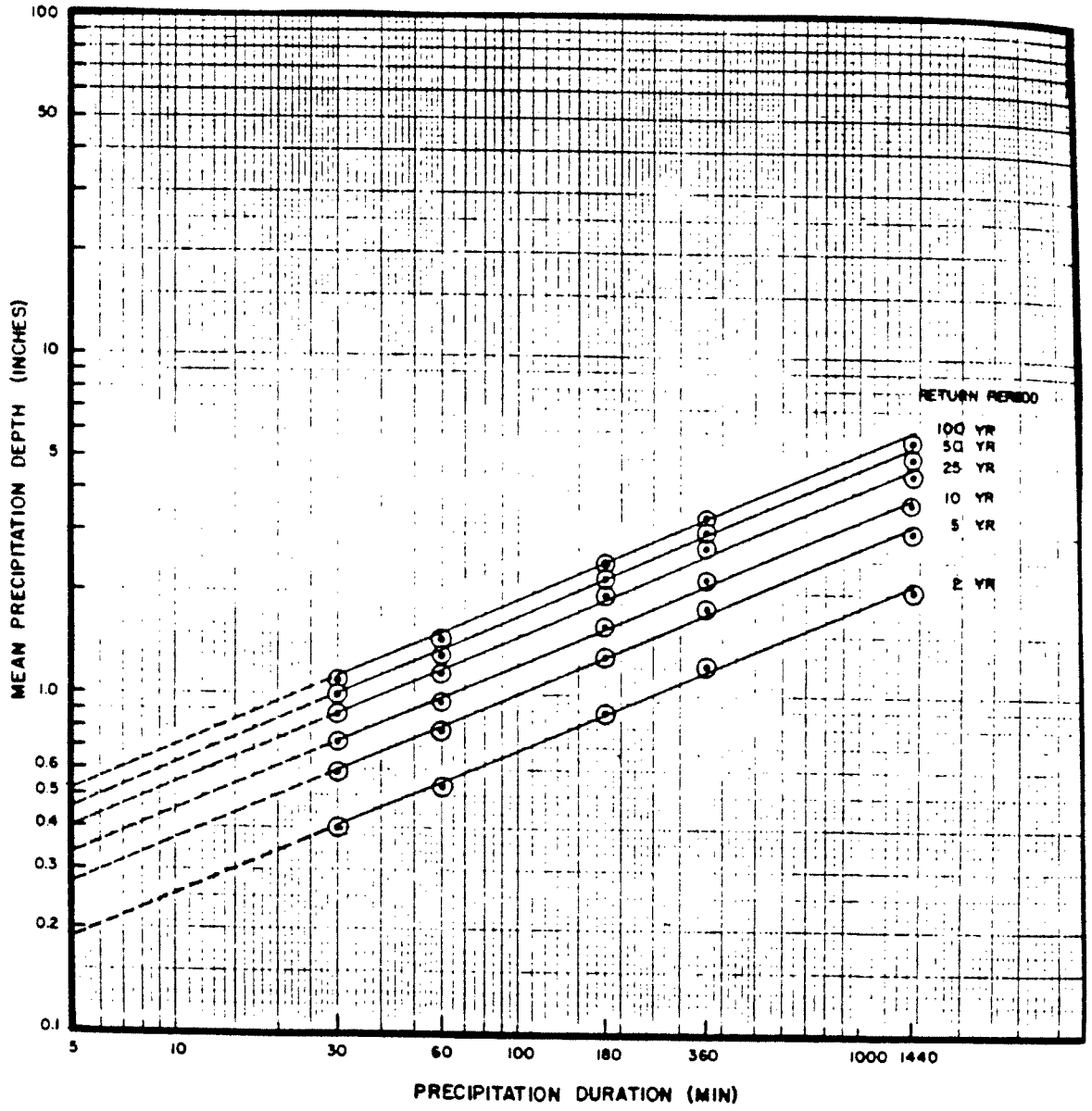
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

COMPARISON OF NOAA ATLAS 2 AND STATE OF CALIFORNIA DWR POINT RAINFALL DATA

100 YR, 24 HR

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 7

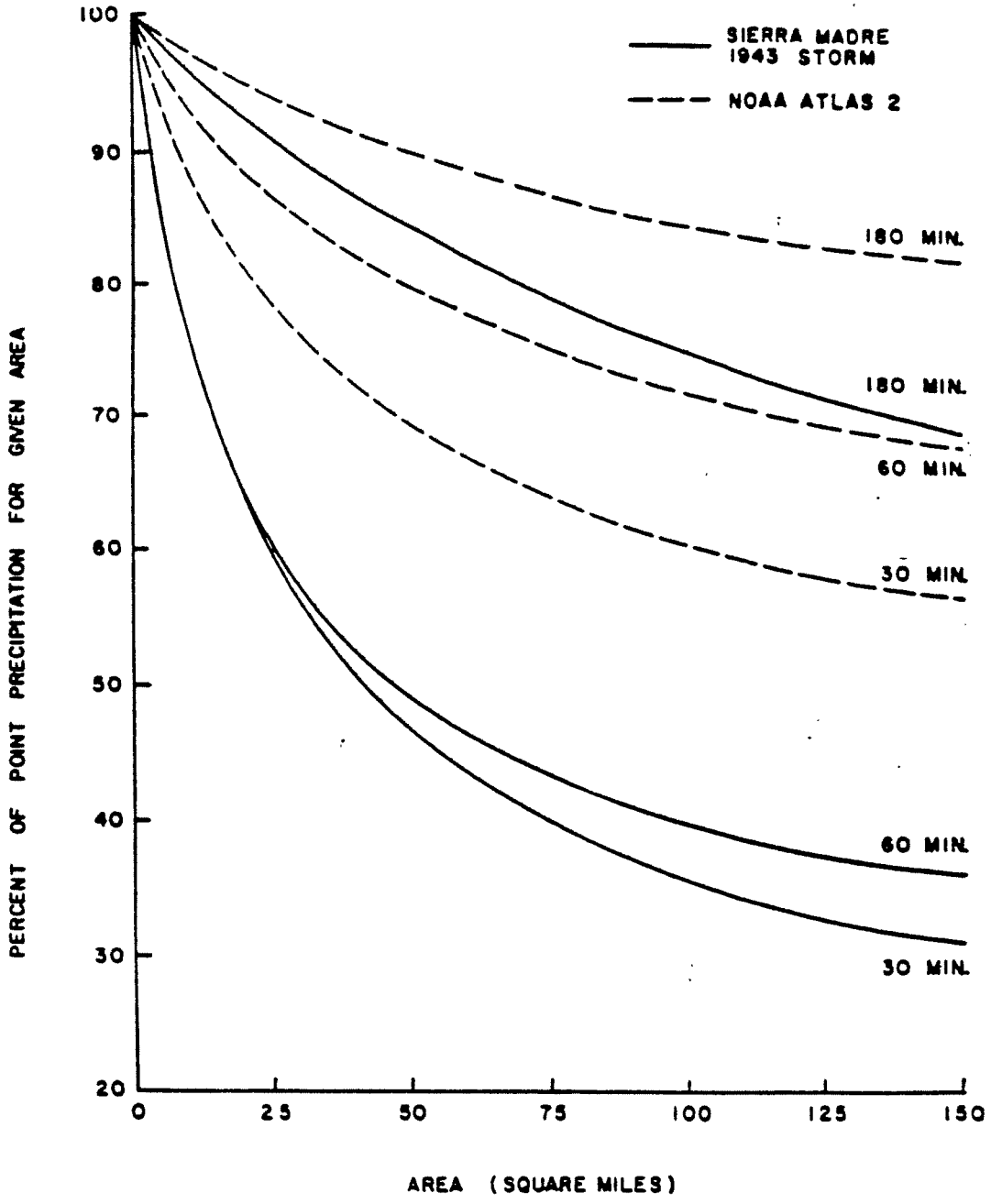


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

MEAN DEPTH-DURATION RELATIONSHIPS FOR ORANGE COUNTY NON-MOUNTAINOUS AREAS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 8

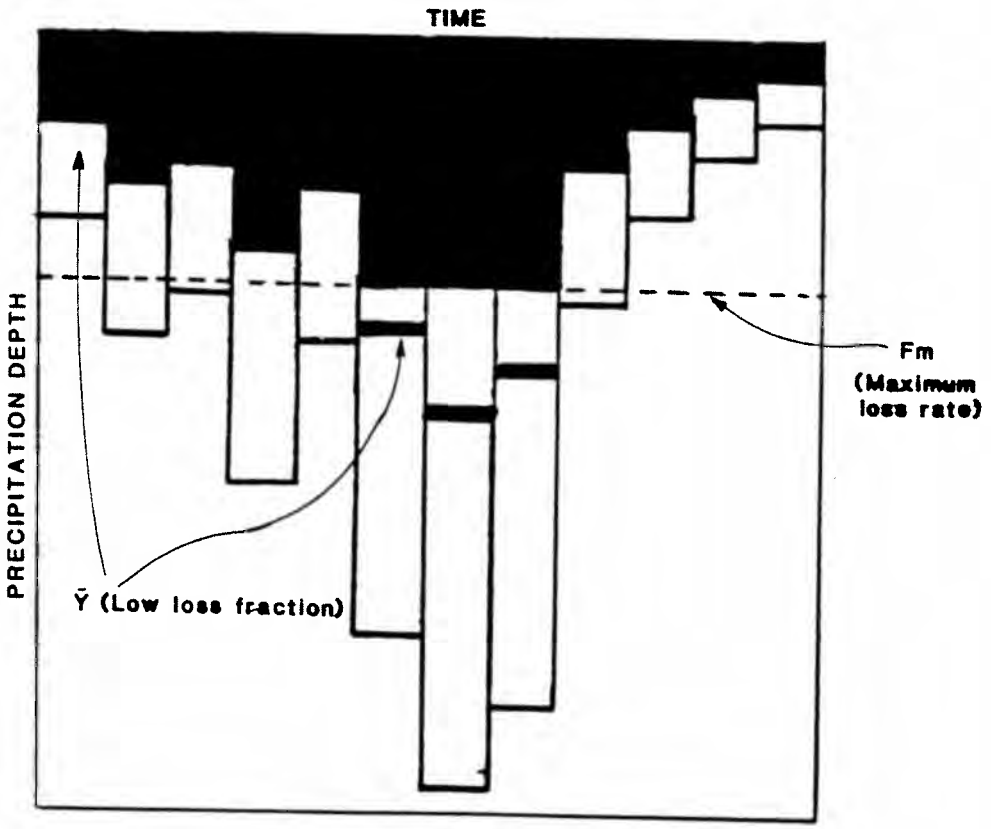


DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

COMPARISON OF DEPTH-AREA CURVES

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 9



PRECIPITATION LOSS

EFFECTIVE PRECIPITATION

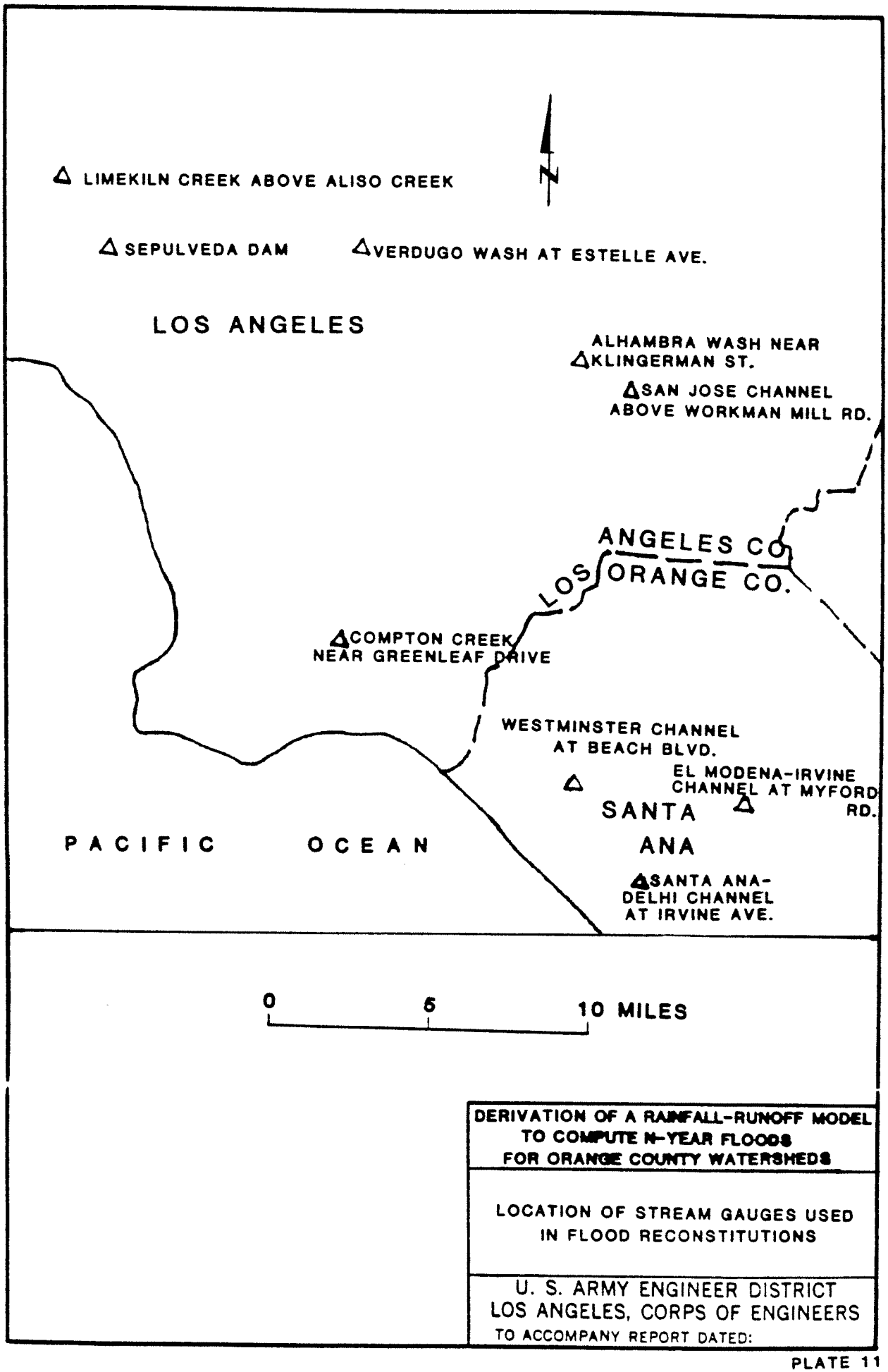
DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

CALIBRATION LOSS FUNCTION

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 10

U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS

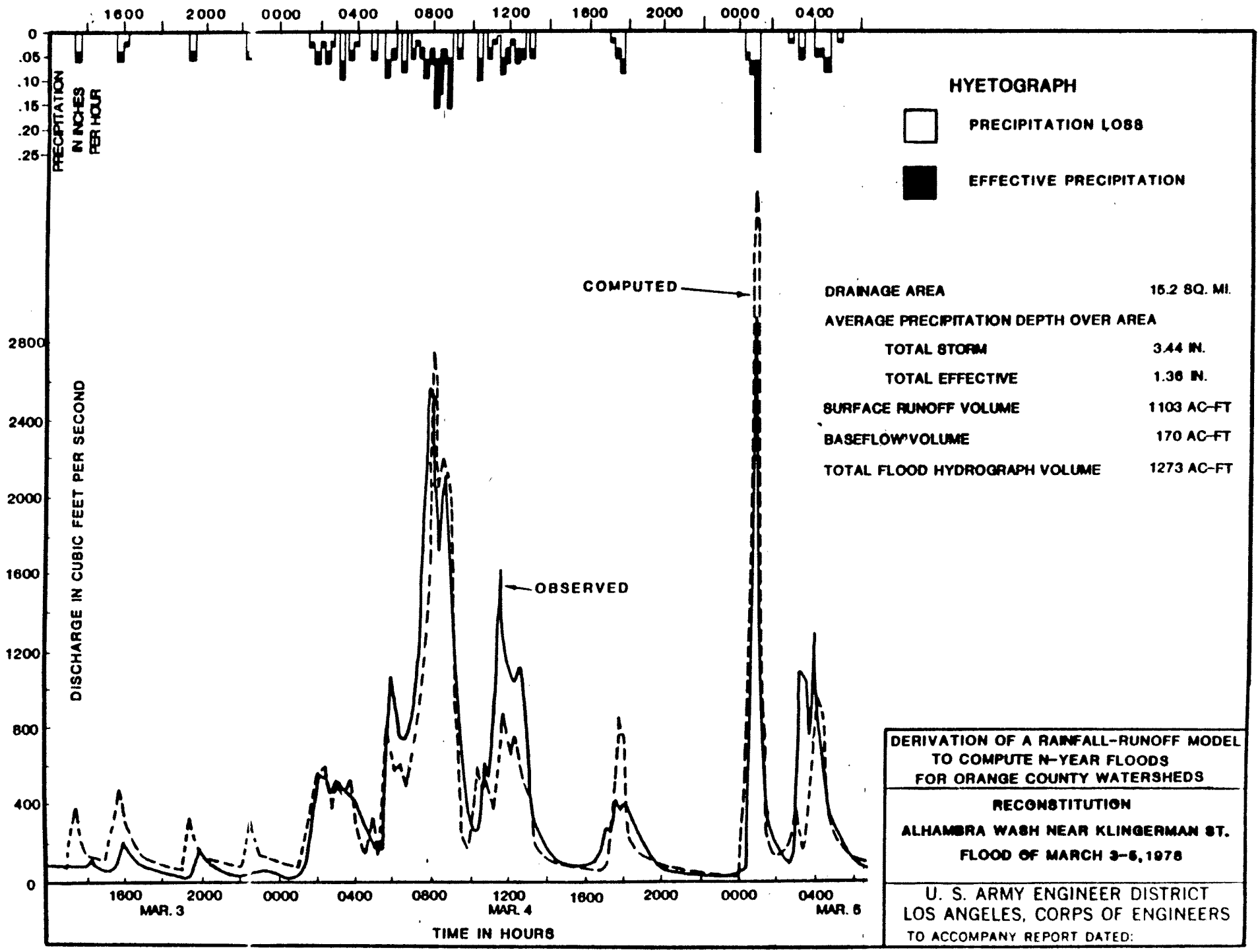


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

LOCATION OF STREAM GAUGES USED IN FLOOD RECONSTITUTIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 11



DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

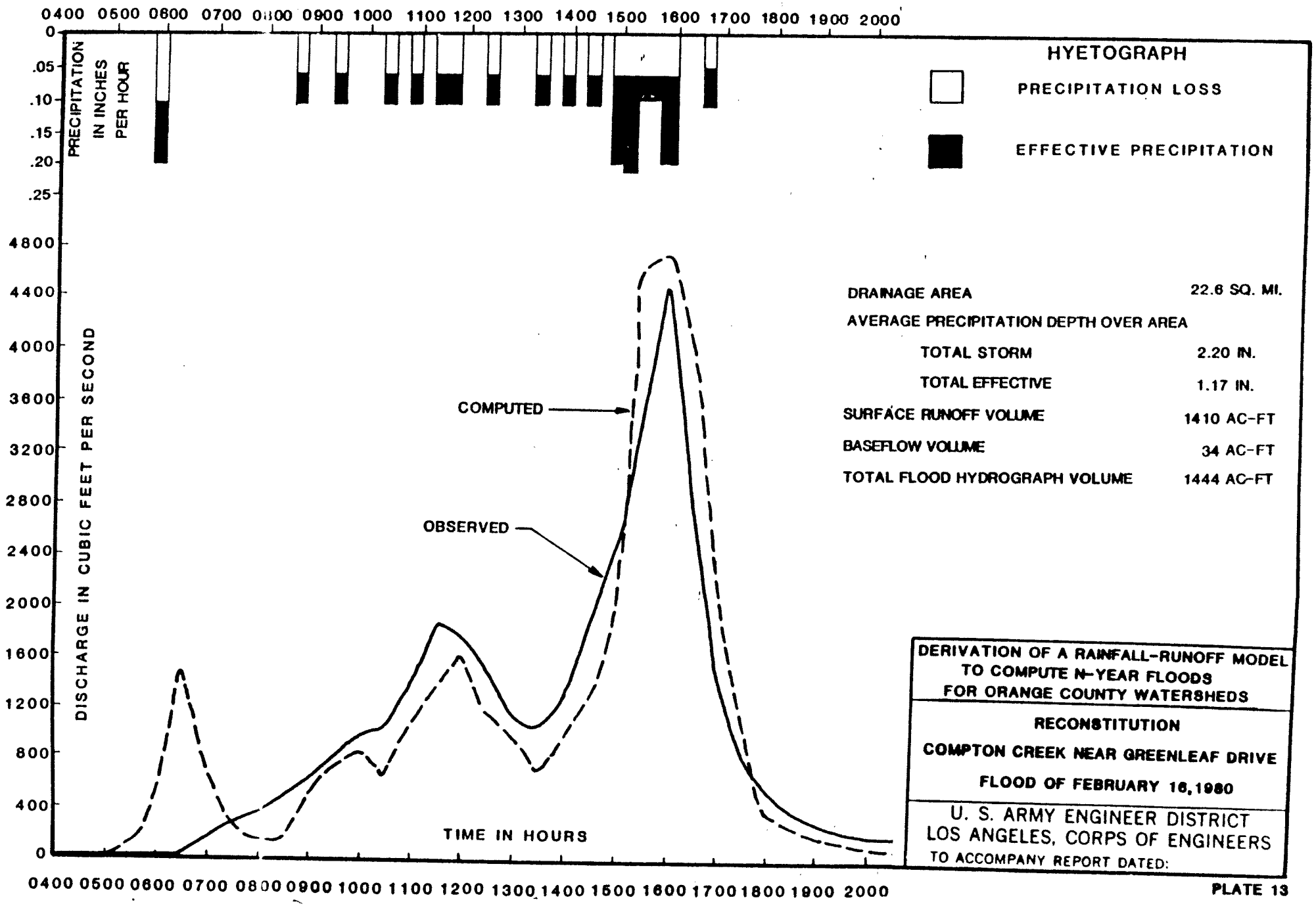
RECONSTITUTION

ALHAMBRA WASH NEAR KLINGERMAN ST.

FLOOD OF MARCH 3-5, 1978

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 12


0400 0500 0600 0700 0800 0900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000
PRECIPITATION IN INCHES PER HOUR
0
.05
.10
.15
.20
.25
HYETOGRAPH
PRECIPITATION LOSS
EFFECTIVE PRECIPITATION
4800
4400
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
DISCHARGE IN CUBIC FEET PER SECOND
COMPUTED
OBSERVED
TIME IN HOURS
DRAINAGE AREA 22.6 SQ. MI.
AVERAGE PRECIPITATION DEPTH OVER AREA
TOTAL STORM 2.20 IN.
TOTAL EFFECTIVE 1.17 IN.
SURFACE RUNOFF VOLUME 1410 AC-FT
BASEFLOW VOLUME 34 AC-FT
TOTAL FLOOD HYDROGRAPH VOLUME 1444 AC-FT
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS
RECONSTITUTION
COMPTON CREEK NEAR GREENLEAF DRIVE
FLOOD OF FEBRUARY 16,1980
U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:
0400 0500 0600 0700 0800 0900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000
PLATE 13

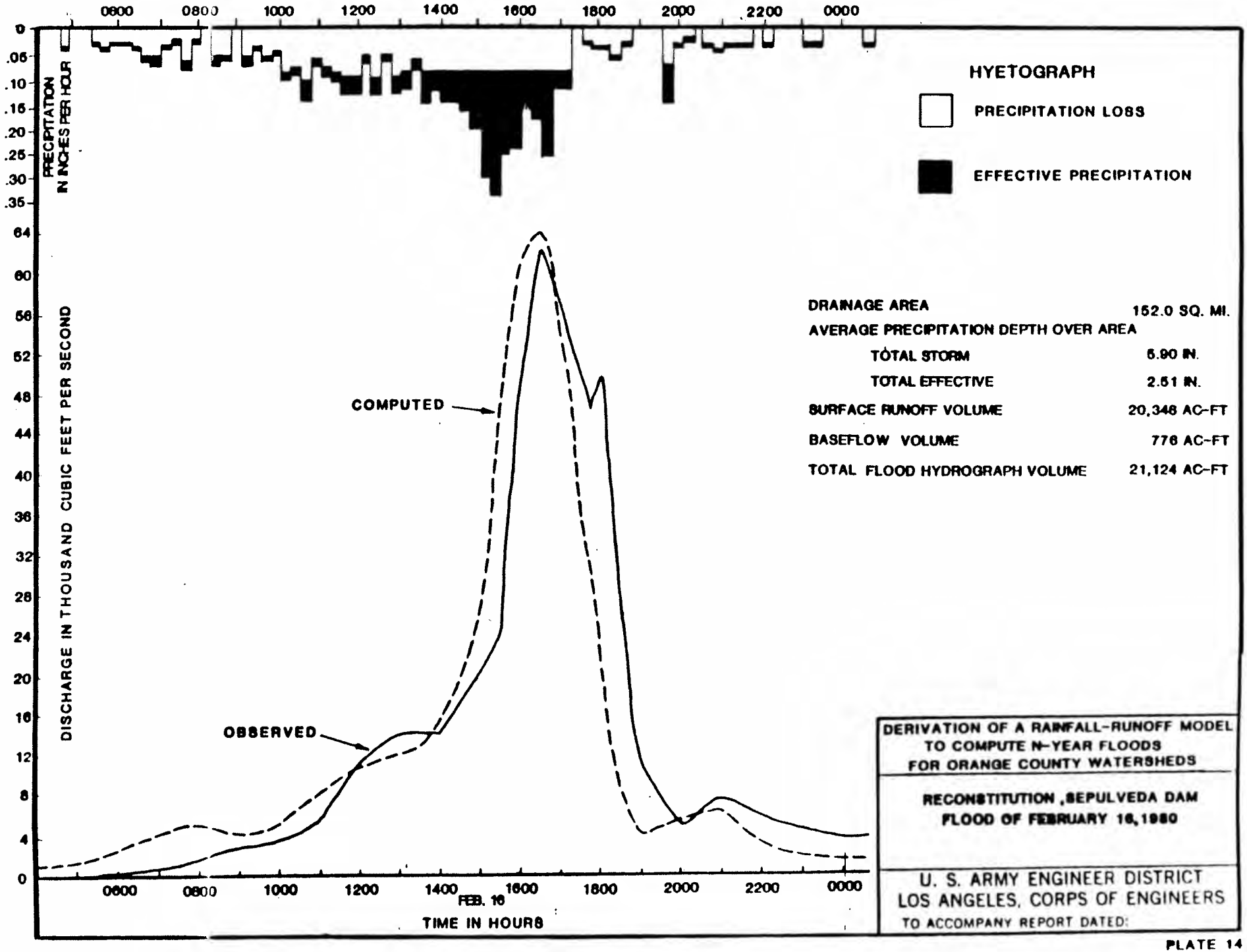
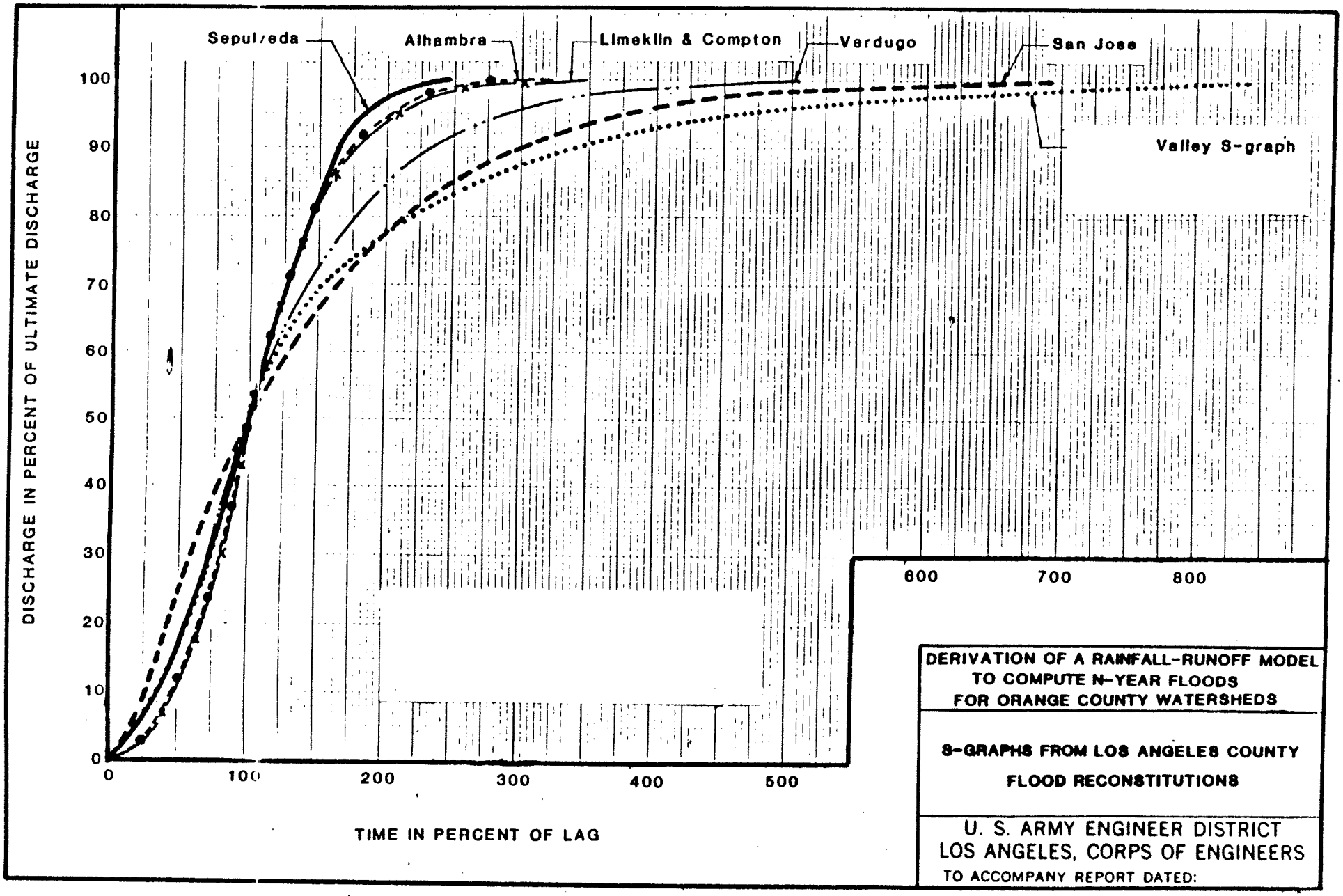

0600
0800
1000
1200
1400
1600
1800
2000
2200
0000
PRECIPITATION IN INCHES PER HOUR
0
.05
.10
.15
.20
.25
.30
.35
HYETOGRAPH
PRECIPITATION LOSS
EFFECTIVE PRECIPITATION
DISCHARGE IN THOUSAND CUBIC FEET PER SECOND
64
60
56
52
48
44
40
36
32
28
24
20
16
12
8
4
0
COMPUTED
OBSERVED
DRAINAGE AREA 152.0 SQ. MI.
AVERAGE PRECIPITATION DEPTH OVER AREA
TOTAL STORM 5.90 IN.
TOTAL EFFECTIVE 2.51 IN.
SURFACE RUNOFF VOLUME 20,348 AC-FT
BASEFLOW VOLUME 776 AC-FT
TOTAL FLOOD HYDROGRAPH VOLUME 21,124 AC-FT
FEB. 16
TIME IN HOURS
DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS
RECONSTITUTION, SEPULVEDA DAM
FLOOD OF FEBRUARY 16, 1980
U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 14



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

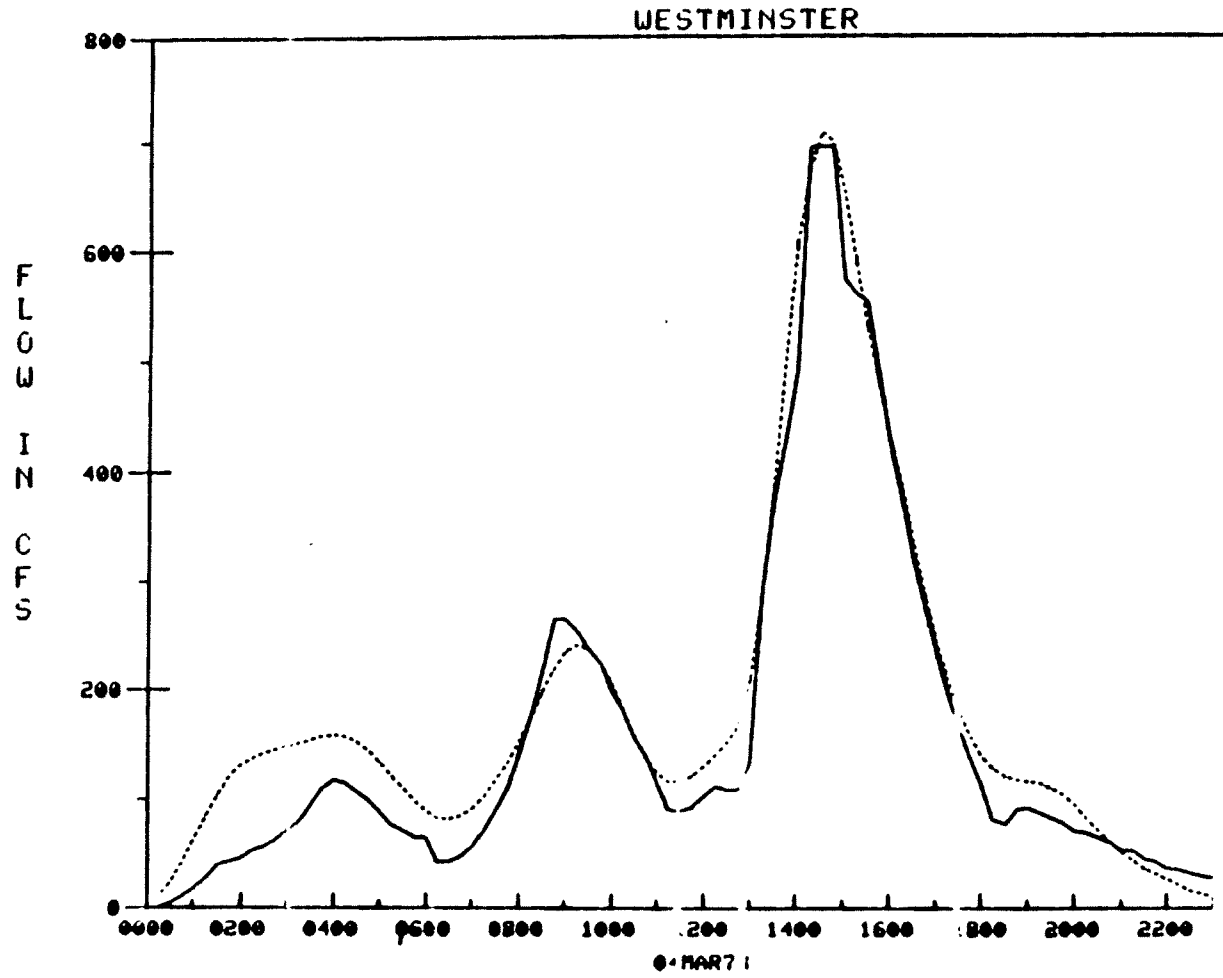
S-GRAPHS FROM LOS ANGELES COUNTY FLOOD RECONSTITUTIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 15

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

RECONSTITUTION

WESTMINSTER CHANNEL AT BEACH BLVD.

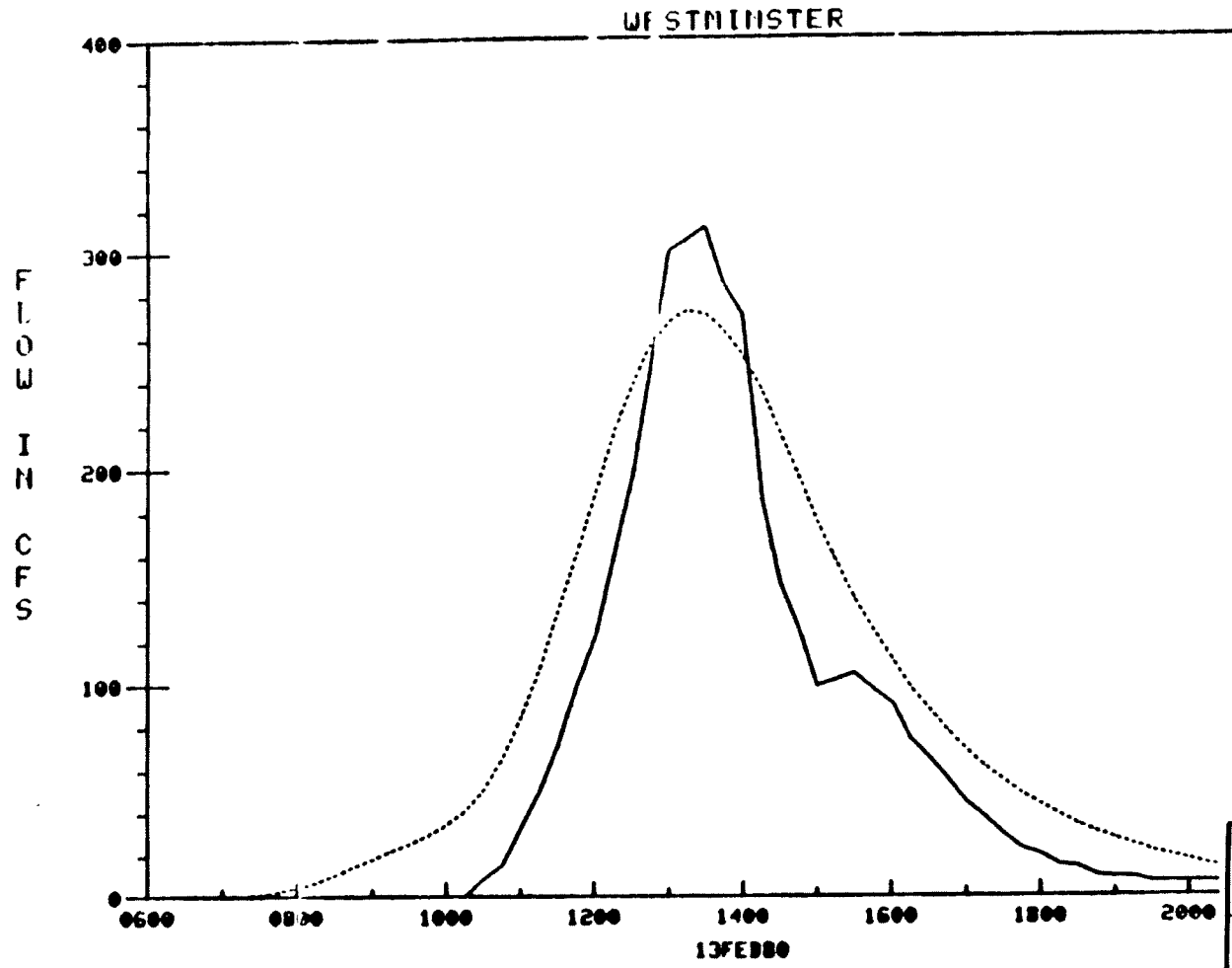
FLOOD OF MARCH 4, 1978

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 16

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

RECONSTITUTION

WESTMINSTER CHANNEL AT BEACH BLVD.

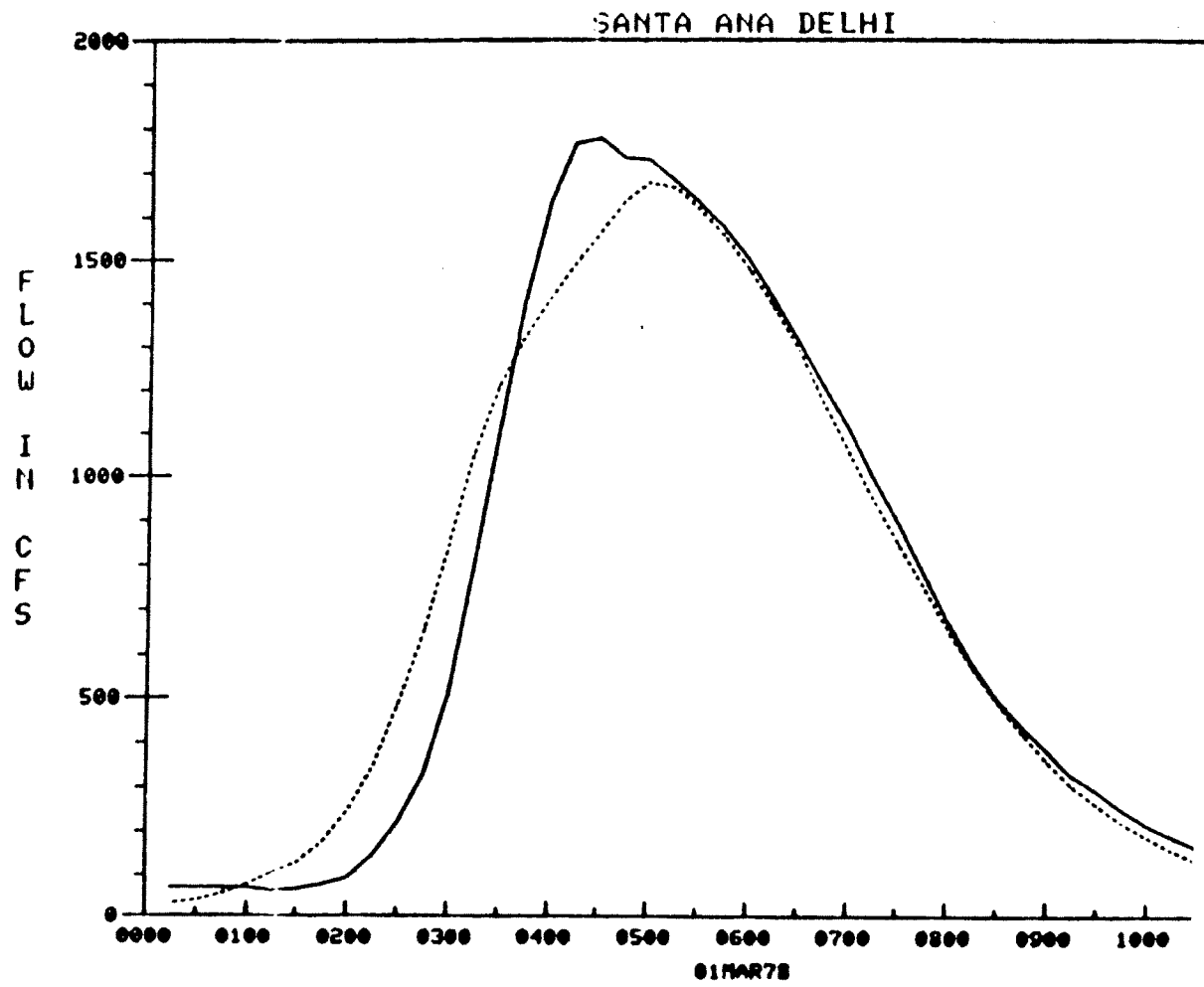
FLOOD OF FEBRUARY 13, 1980

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 17

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

RECONSTITUTION

SANTA ANA-DELHI CHANNEL AT IRVINE AVE.

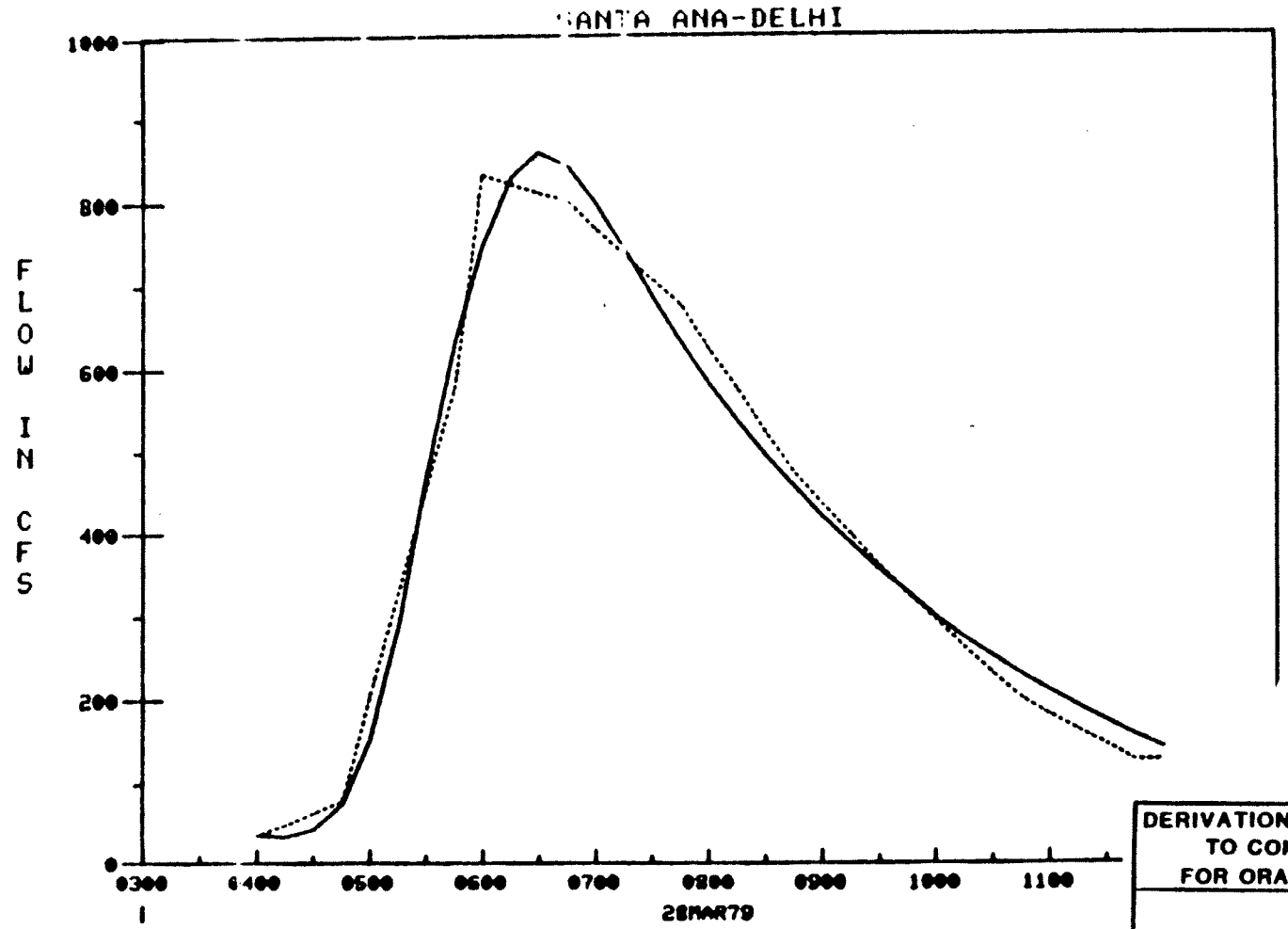
FLOOD OF MARCH 1, 1978

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 18

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

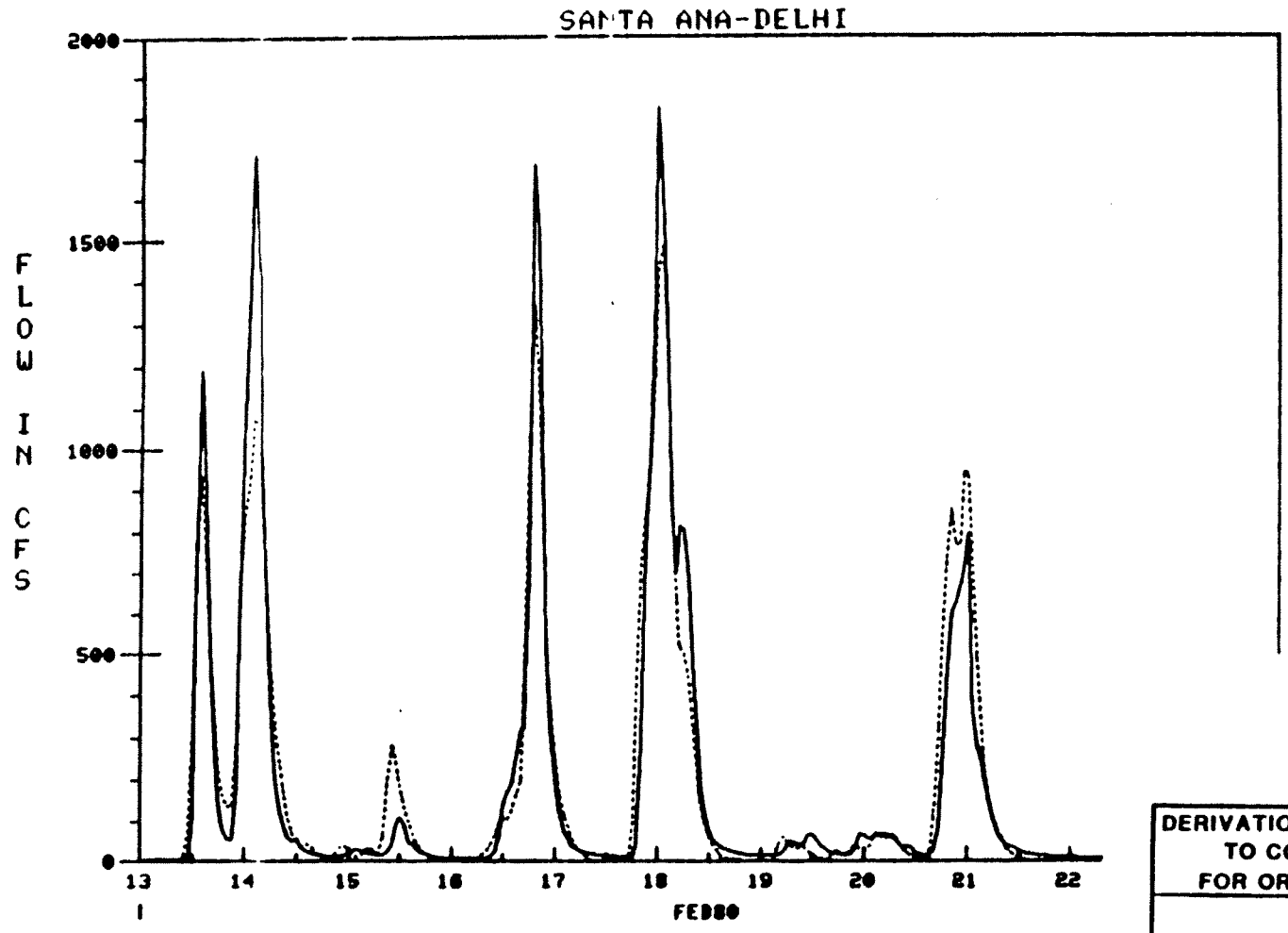
RECONSTITUTION

SANTA ANA-DELHI CHANNEL AT IRVINE AVE.

FLOOD OF MARCH 28,1979

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 19



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

RECONSTITUTION

SANTA ANA-DELHI CHANNEL AT IRVINE AVE.

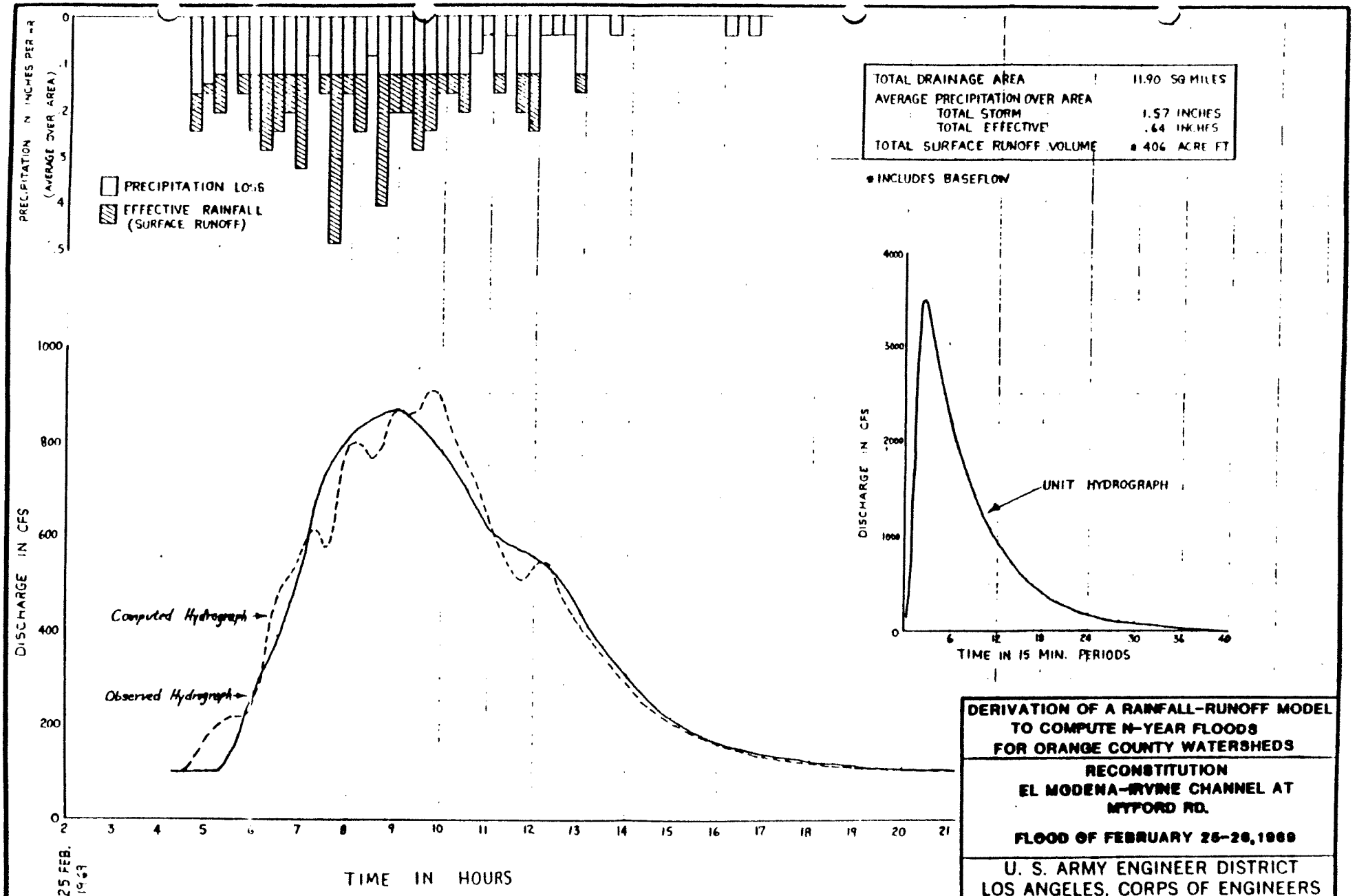
FLOOD OF FEBRUARY 1980

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 20

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



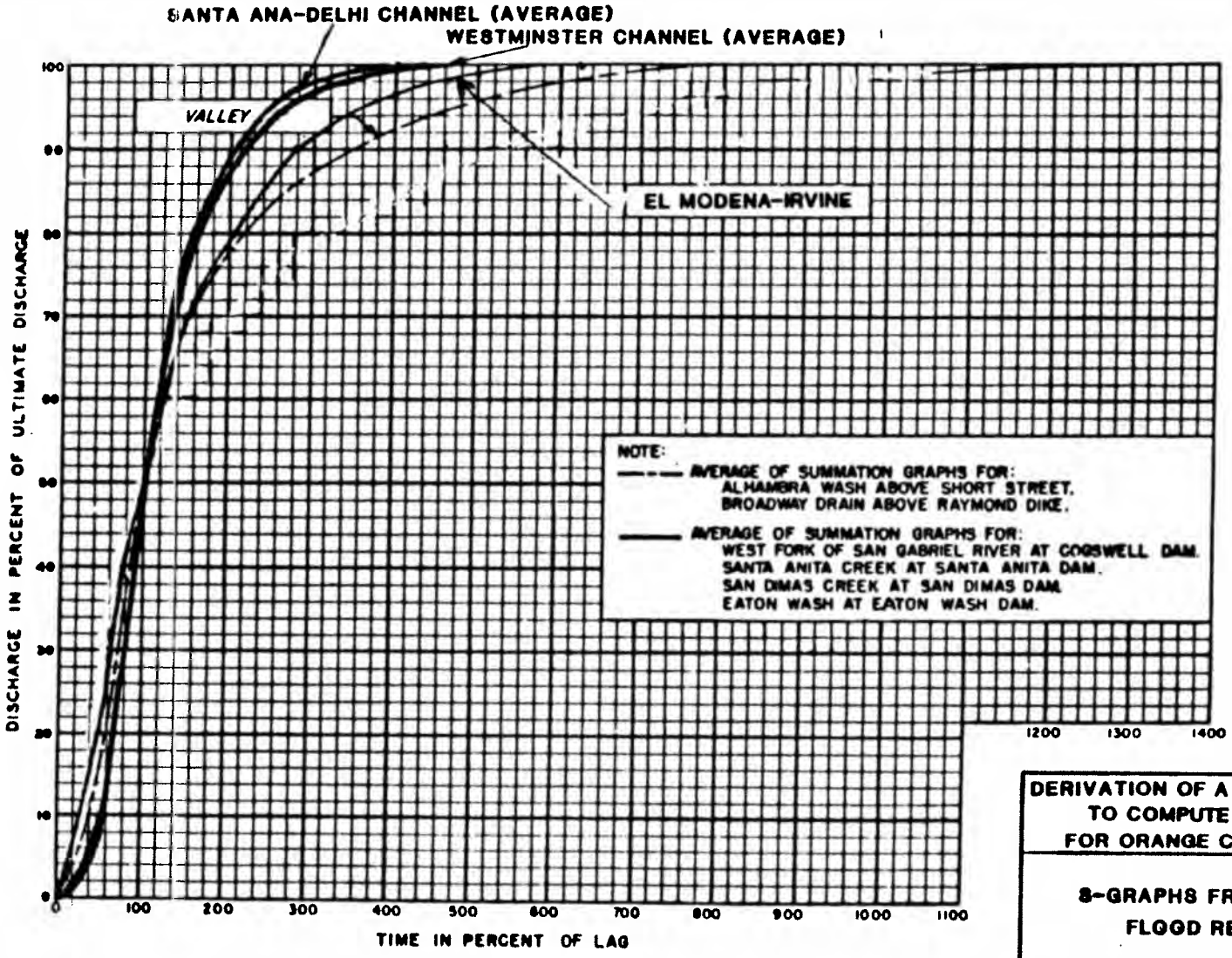
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

RECONSTITUTION
EL MODENA-IRVINE CHANNEL AT MYFORD RD.

FLOOD OF FEBRUARY 25-26, 1969

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 21

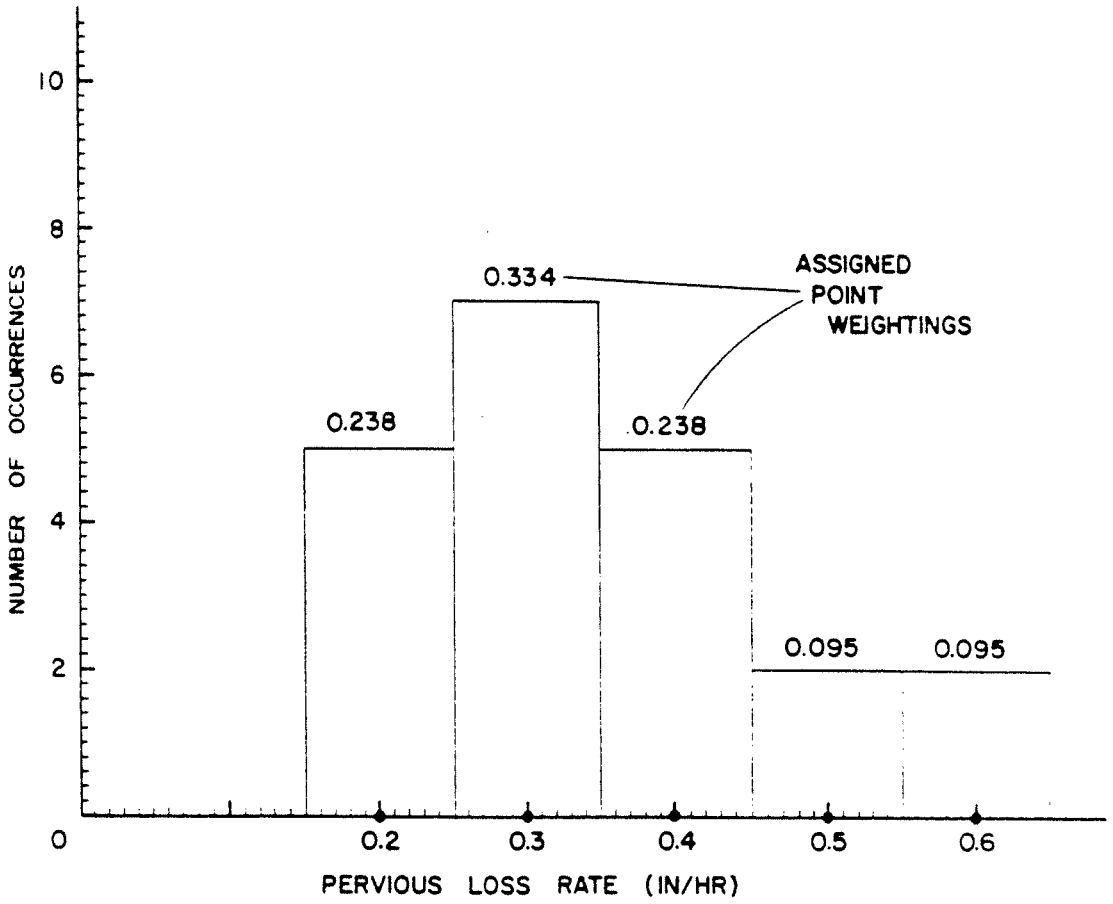


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

S-GRAPHS FROM ORANGE COUNTY FLOOD RECONSTITUTIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 22

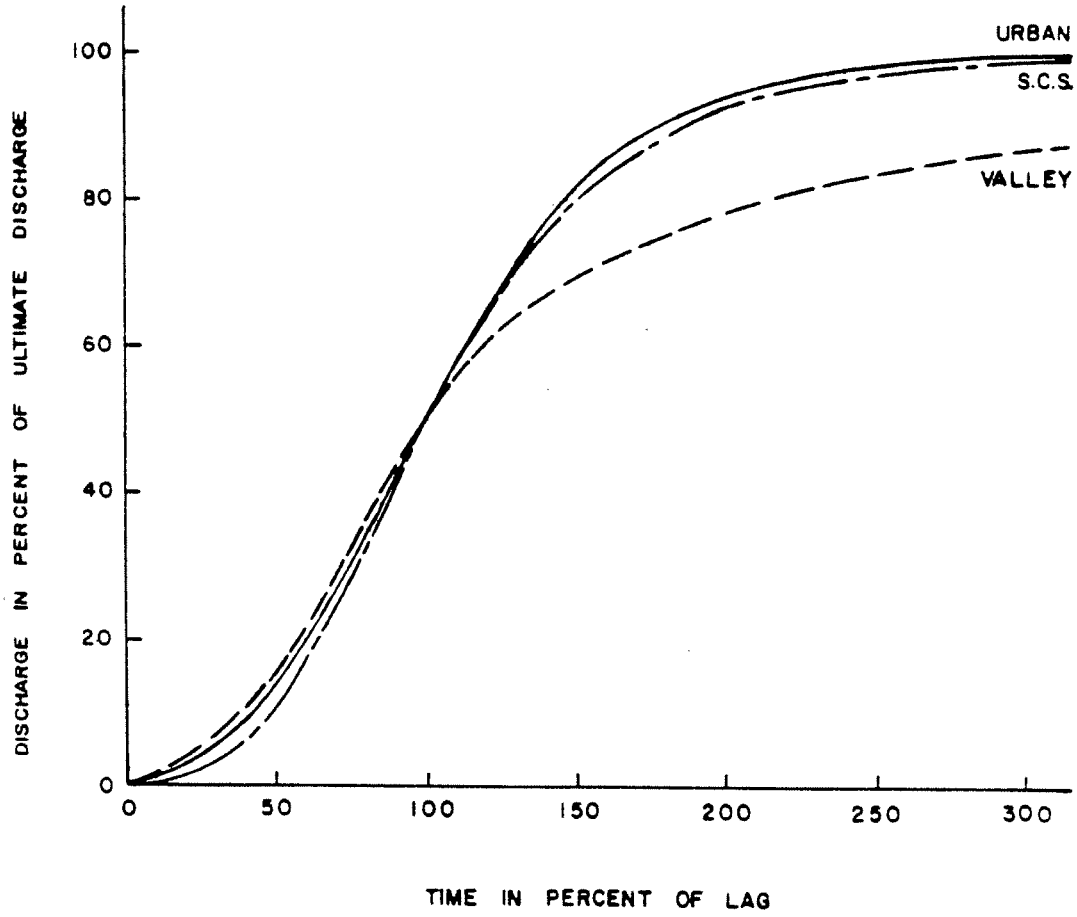


DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

PERVIOUS LOSS RATE, Fp,
OCCURANCE DISTRIBUTION

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 23

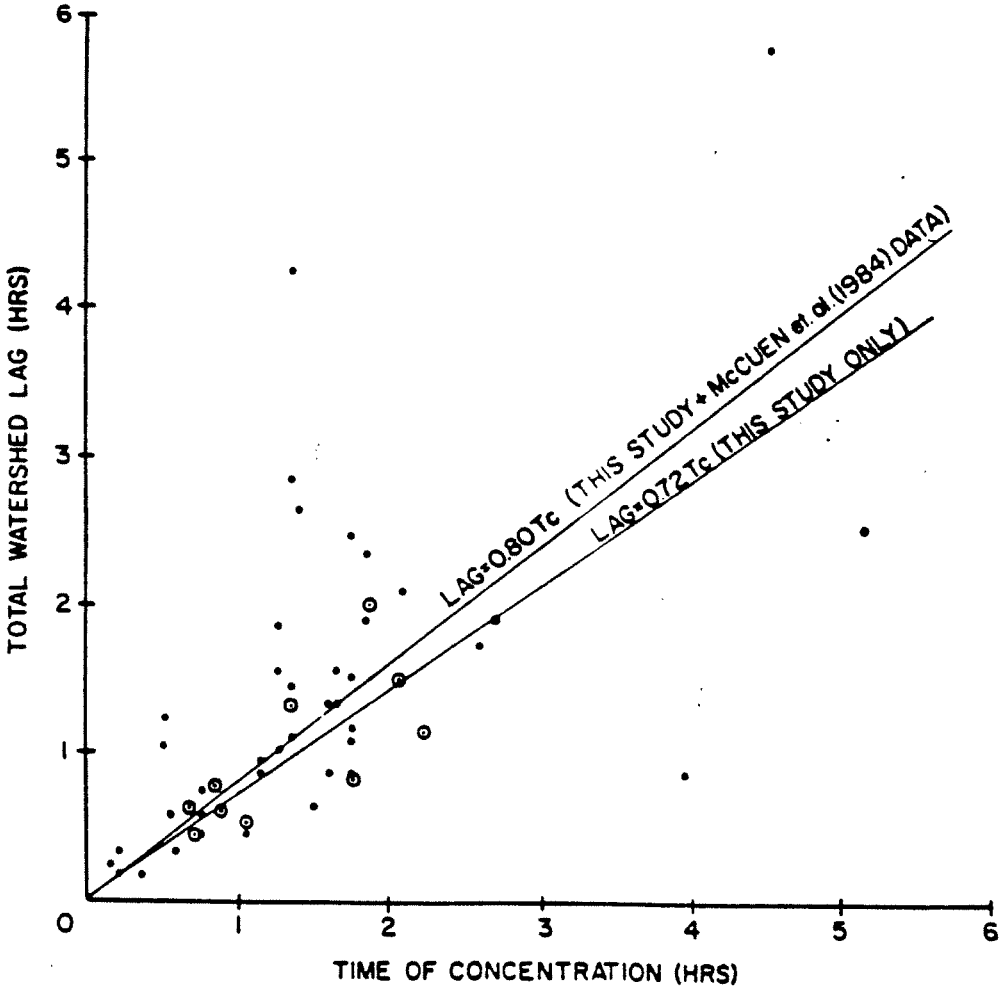


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

URBAN S-GRAPH

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

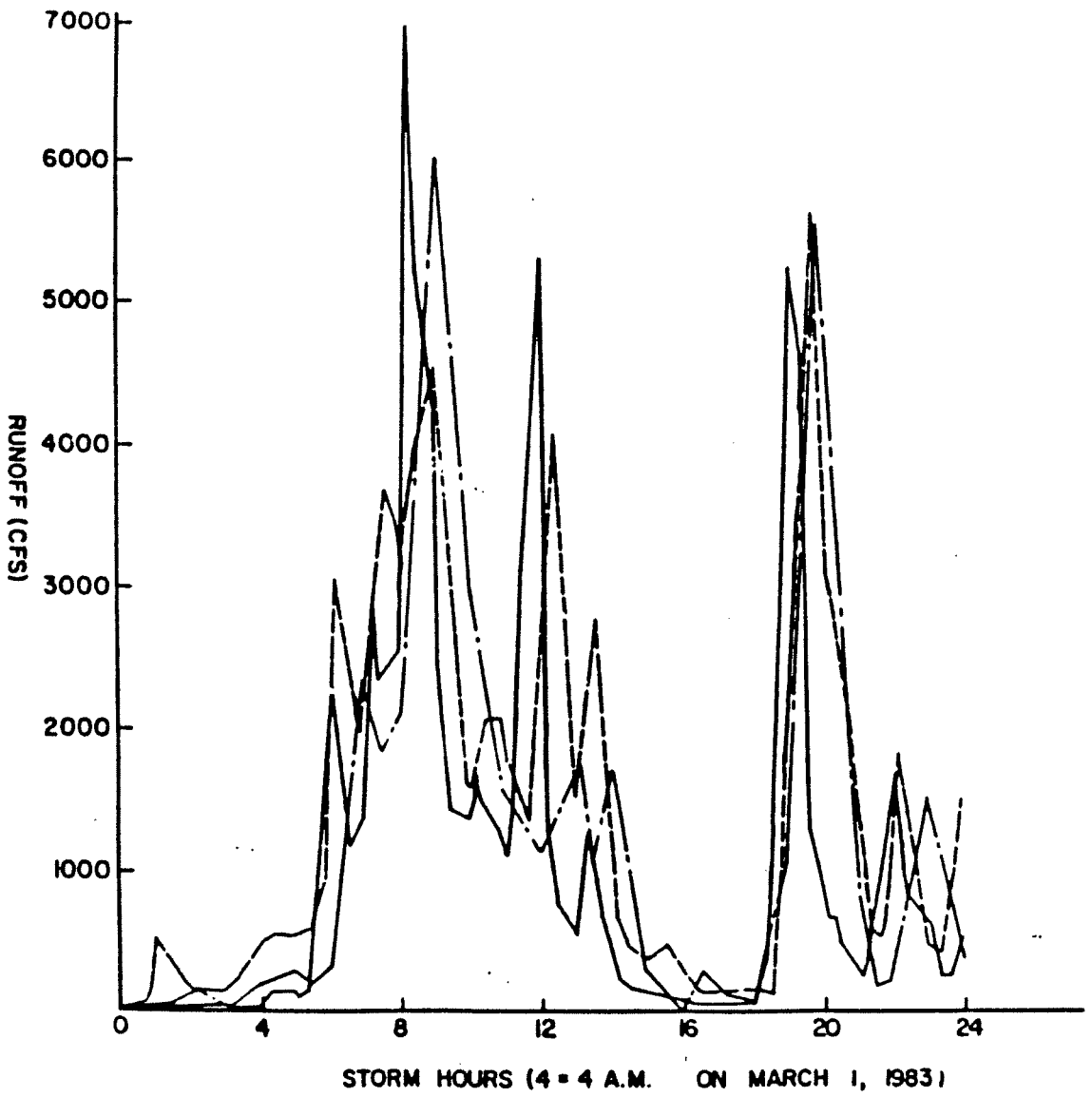
PLATE 24



• = REFERENCE 13
⊙ = THIS STUDY DATA

DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS
RELATIONSHIP BETWEEN WATERSHED LAG AND COMPUTED tc
U. S. ARMY ENGINEER DISTRICT LOS ANGELES, CORPS OF ENGINEERS TO ACCOMPANY REPORT DATED:

PLATE 25



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

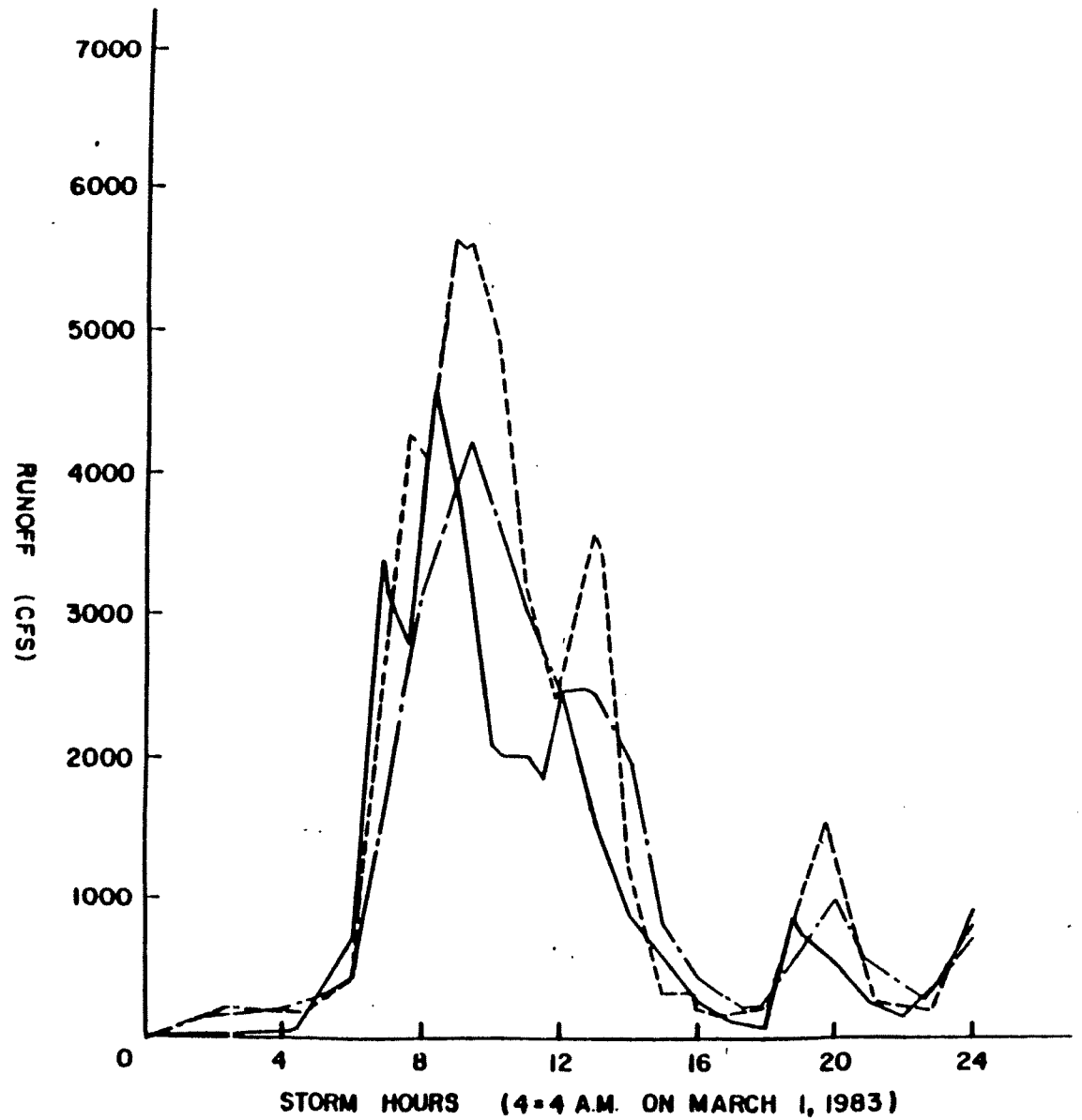
VERIFICATION OF REGIONAL MODEL
ALHAMBRA WASH NEAR KLINGERMAN ST.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 26

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

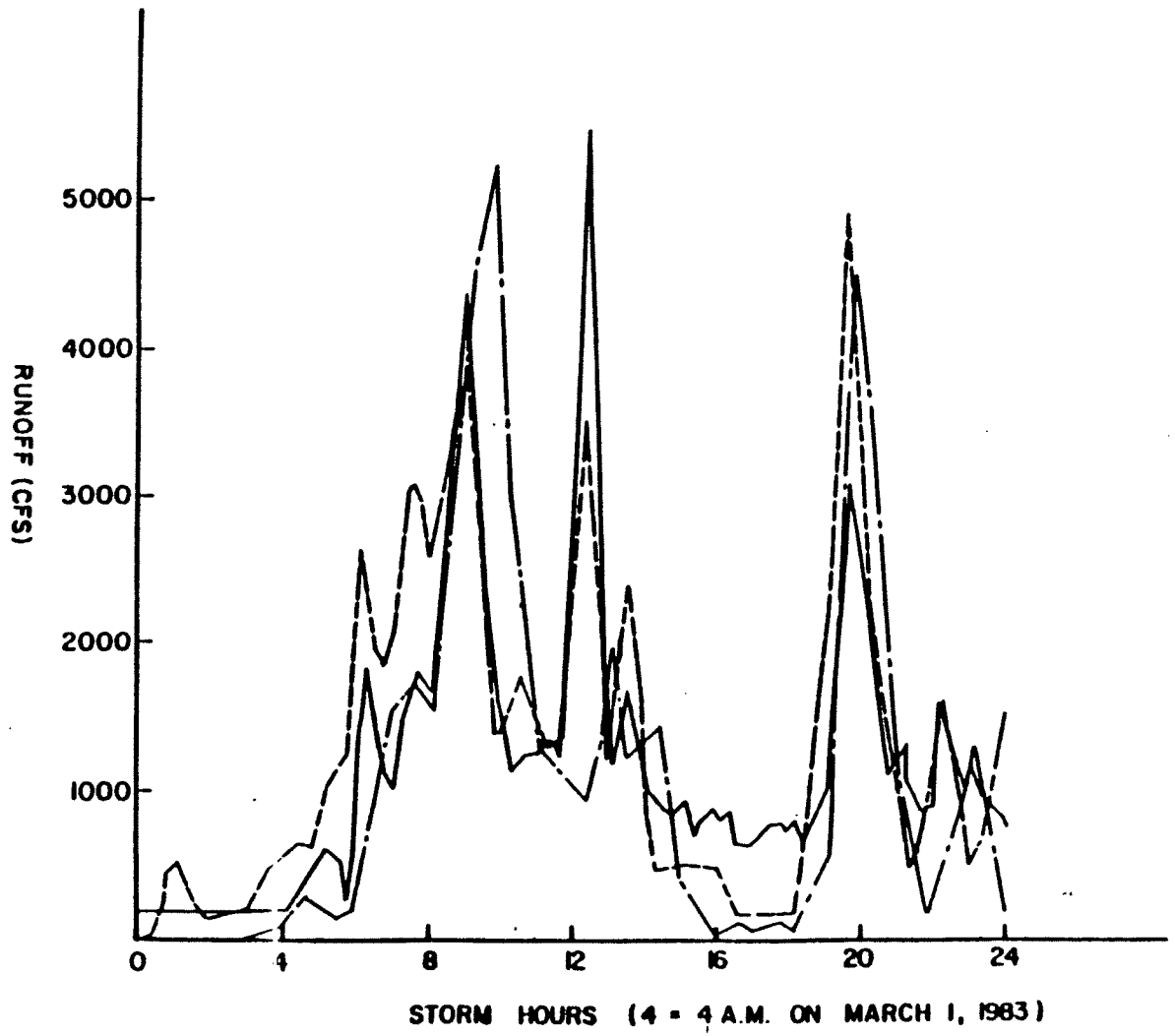
VERIFICATION OF REGIONAL MODEL
COMPTON CREEK NEAR GREENLEAF DR.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 27

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS

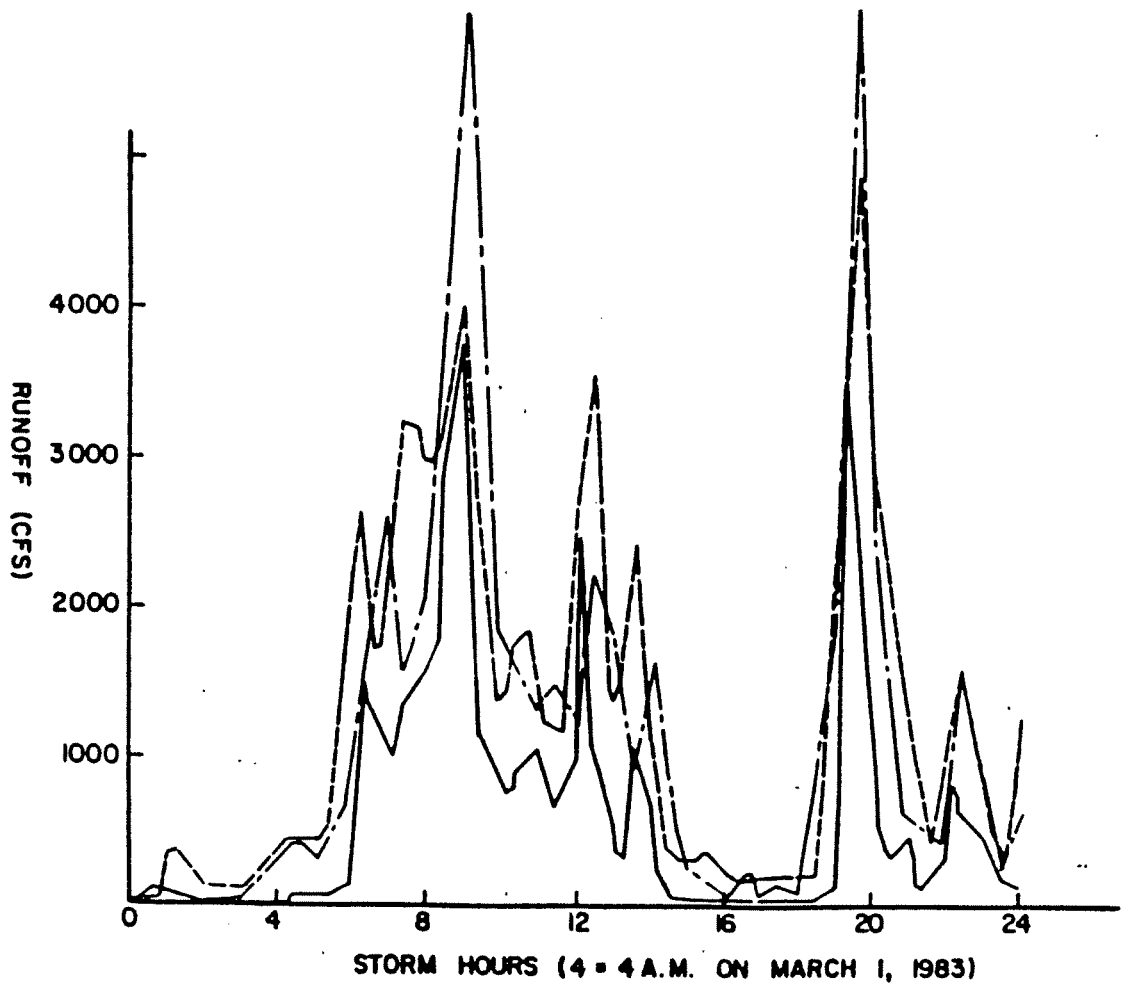


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

VERIFICATION OF REGIONAL MODEL
EATON WASH AT LOFTUS AVE.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 28



——— STREAM GAUGE DATA

– – – – – – REGIONAL MODEL ($\bar{Y}$,CALIBRATED)

——·——·—— REGIONAL MODEL ($\bar{Y}$,CALCULATED)

DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

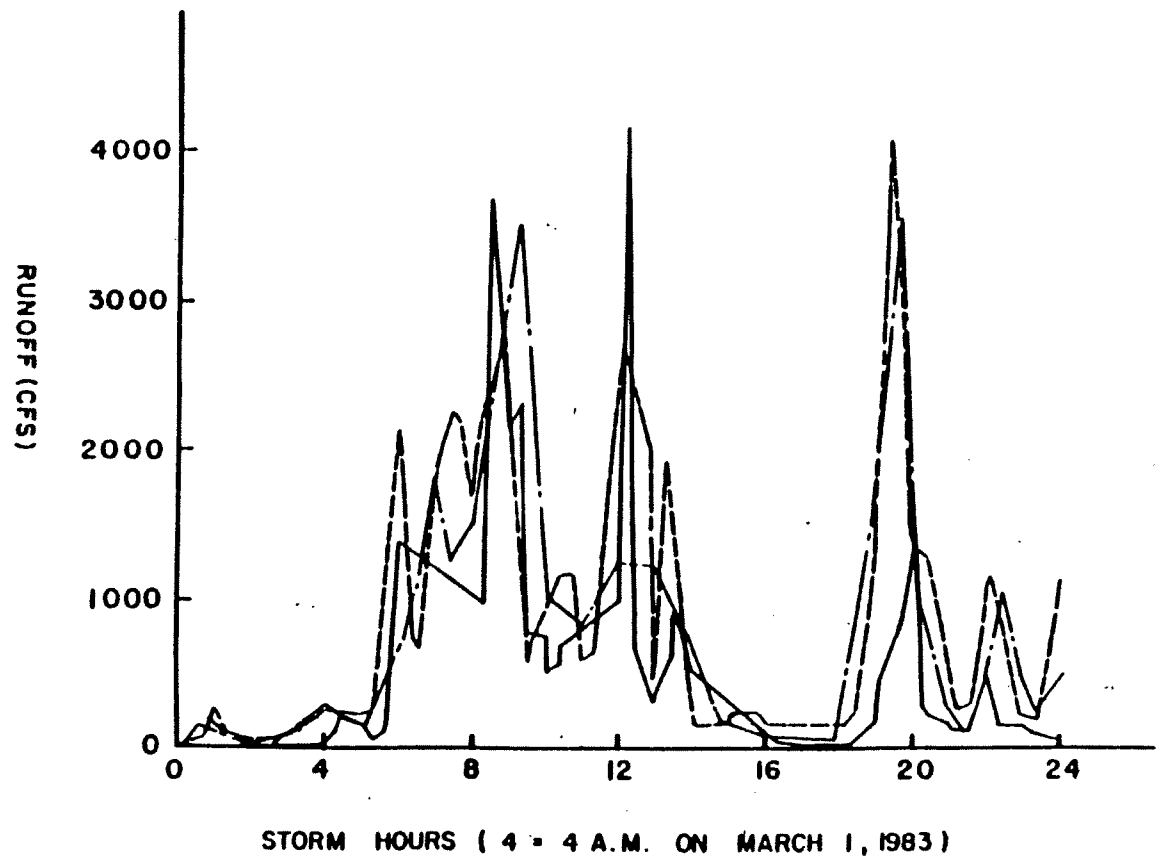
VERIFICATION OF REGIONAL MODEL RUBIO WASH AT GLENDON WAY

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 29

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS

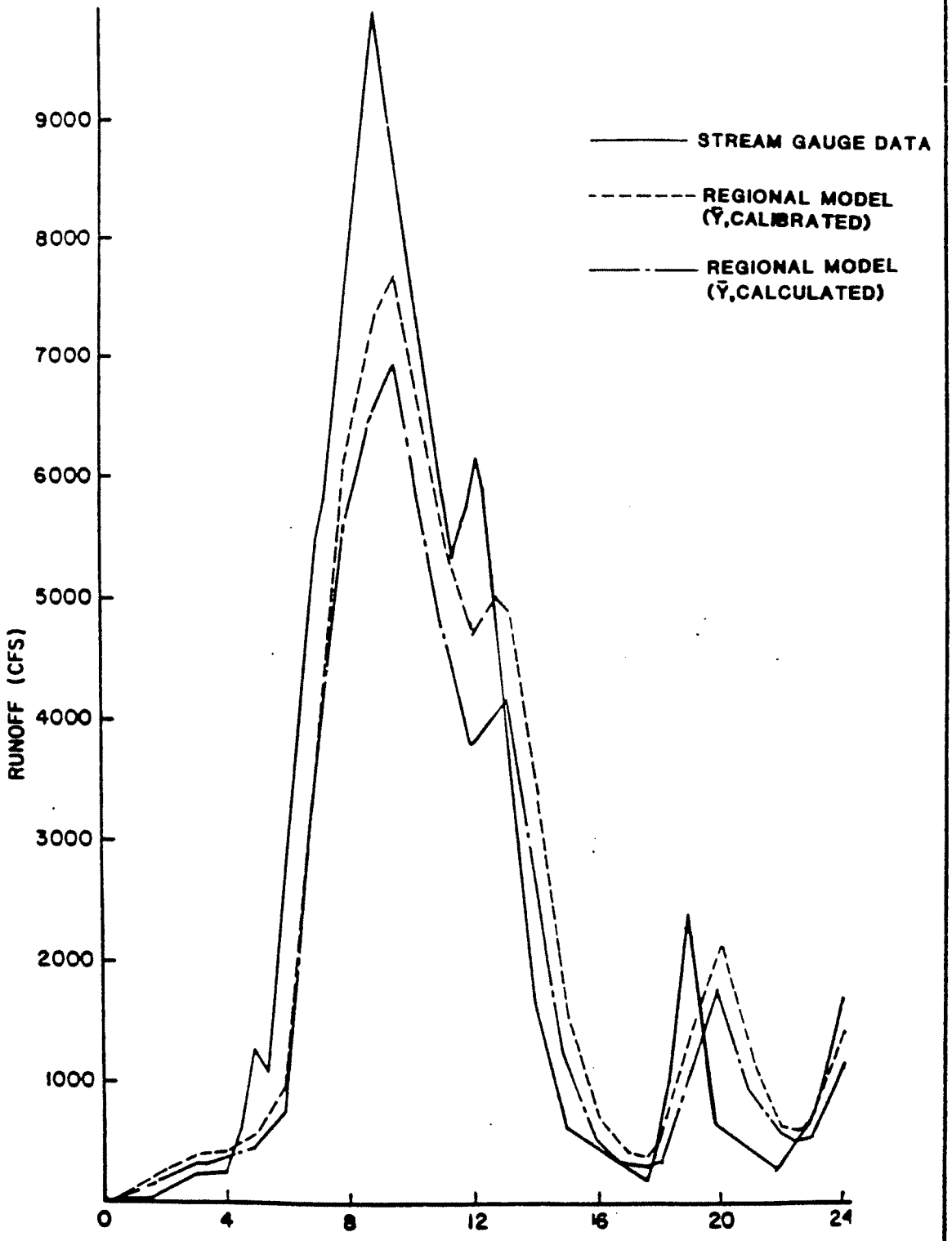


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

VERIFICATION OF REGIONAL MODEL ARCADIA WASH BELOW GRAND AVE.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 30



DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

VERIFICATION OF REGIONAL MODEL
DOMINGUEZ CHANNEL AT VERMONT AVE.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 31



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

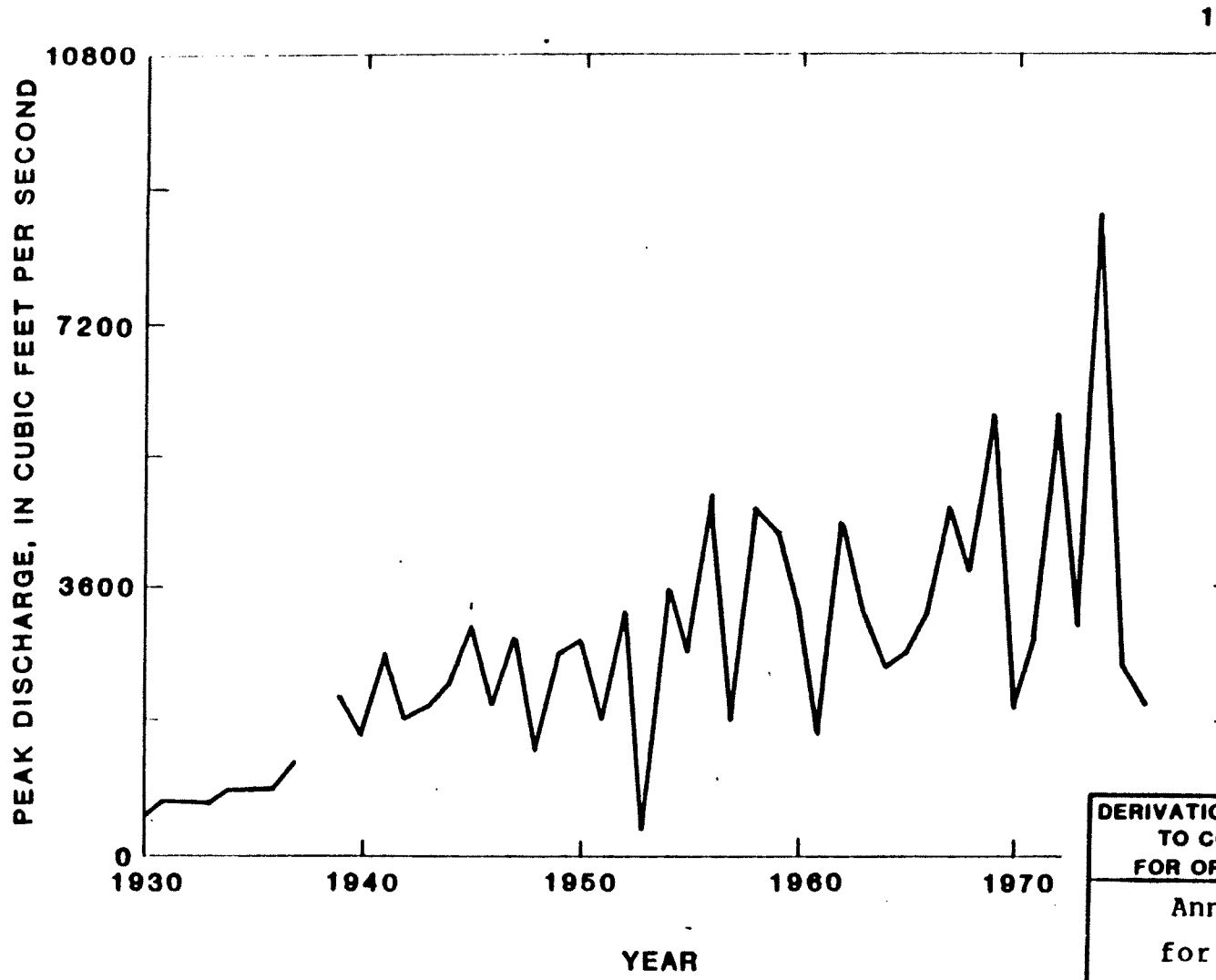
LOCATION OF STREAM GAUGES USED IN ANALYTICAL DISCHARGE FREQUENCY ANALYSIS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 32

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

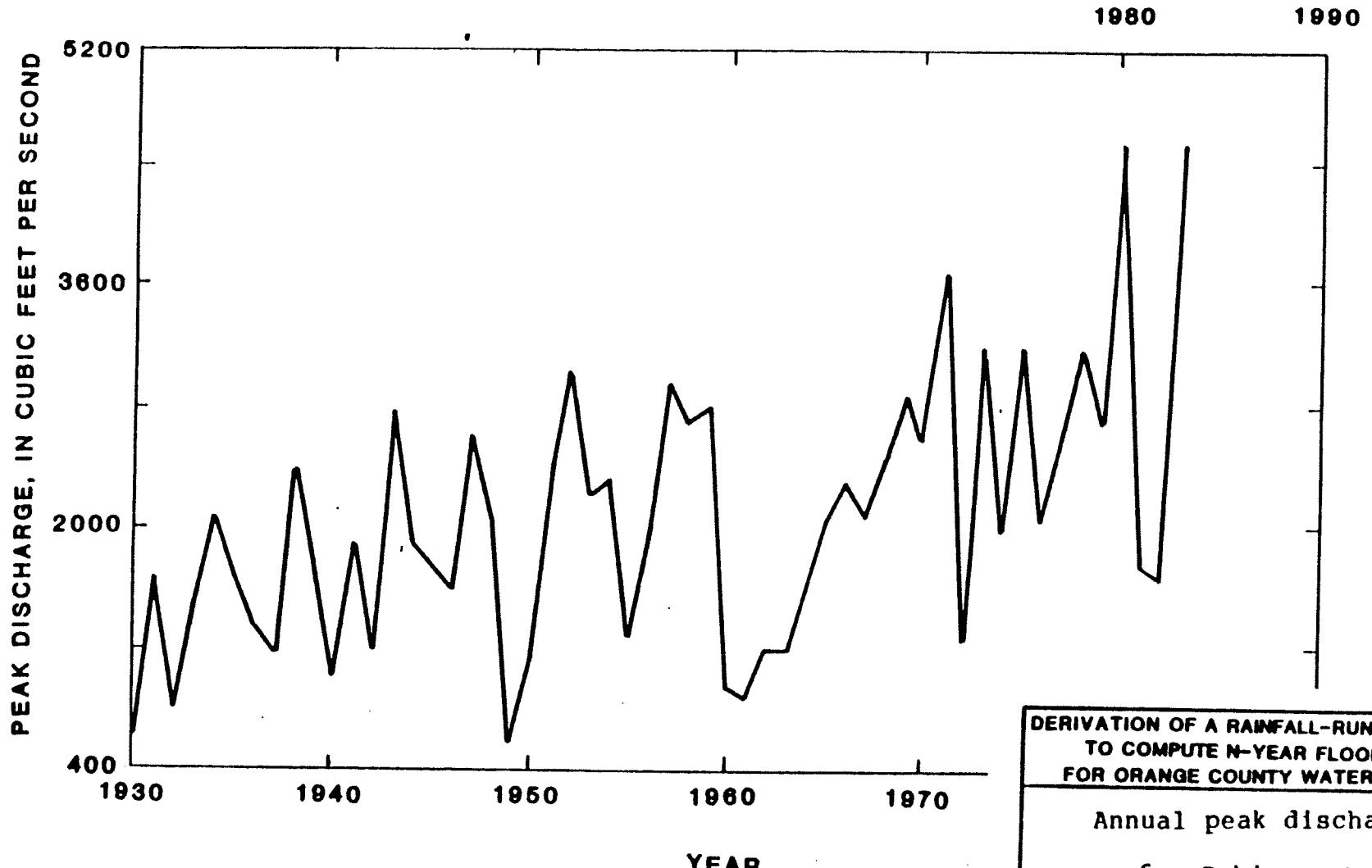
Annual peak discharges
for Compton Creek near
Greenleaf Drive.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 33

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



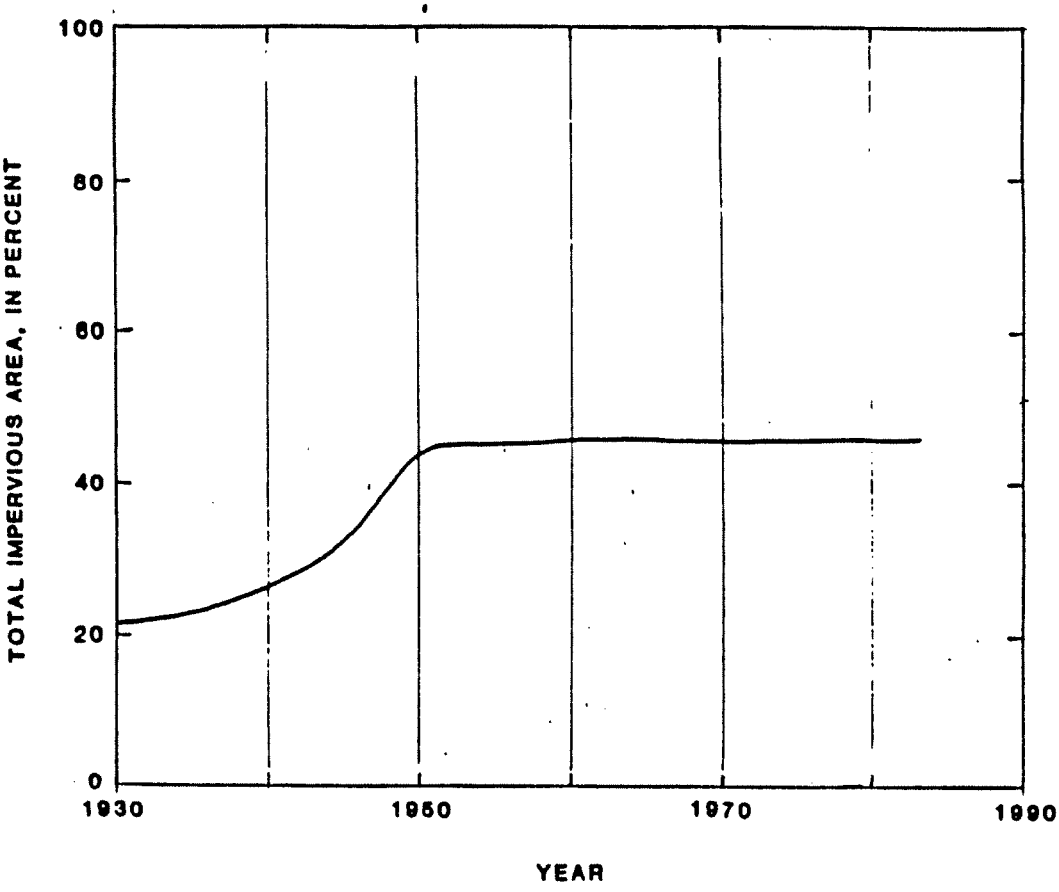
DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

Annual peak discharges

for Rubio Wash.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 34

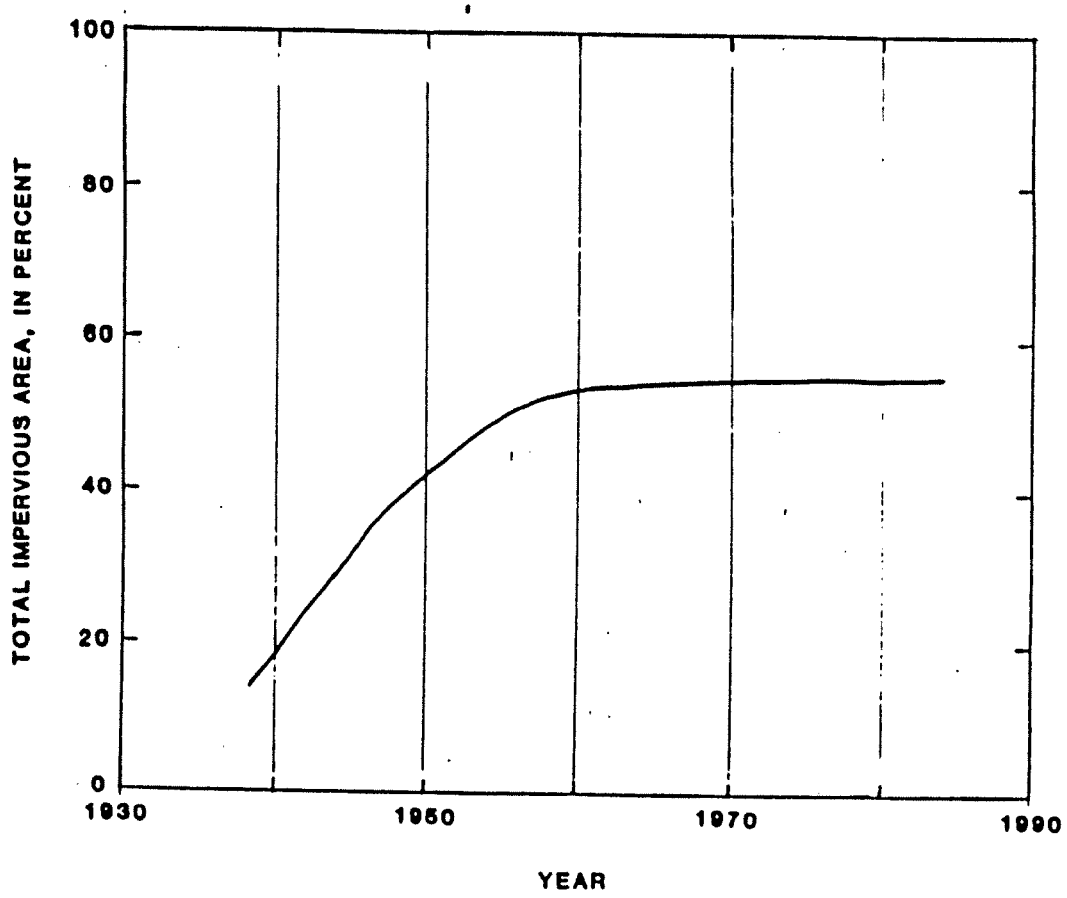


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

CHANGES IN IMPERVIOUS AREA FOR ALHAMBRA WASH DRAINAGE BASIN

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 35

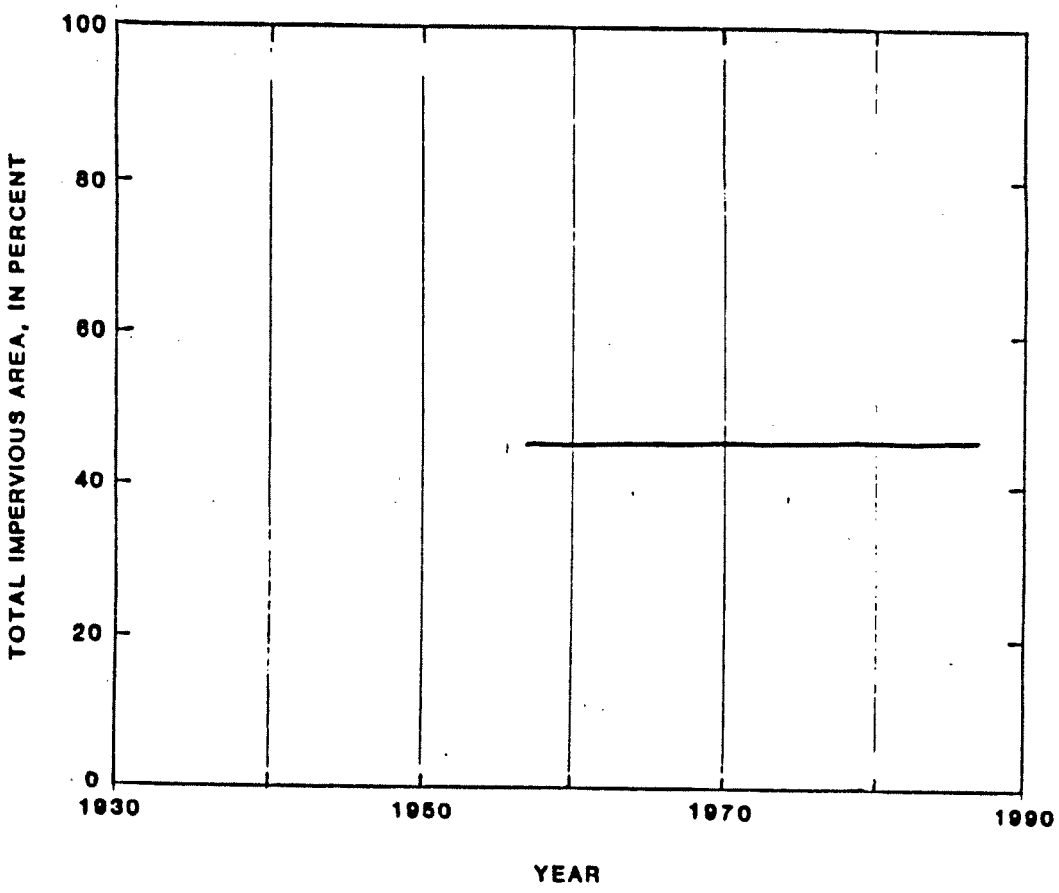


DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

CHANGES IN IMPERVIOUS AREA FOR
COMPTON CREEK DRAINAGE BASIN

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 36

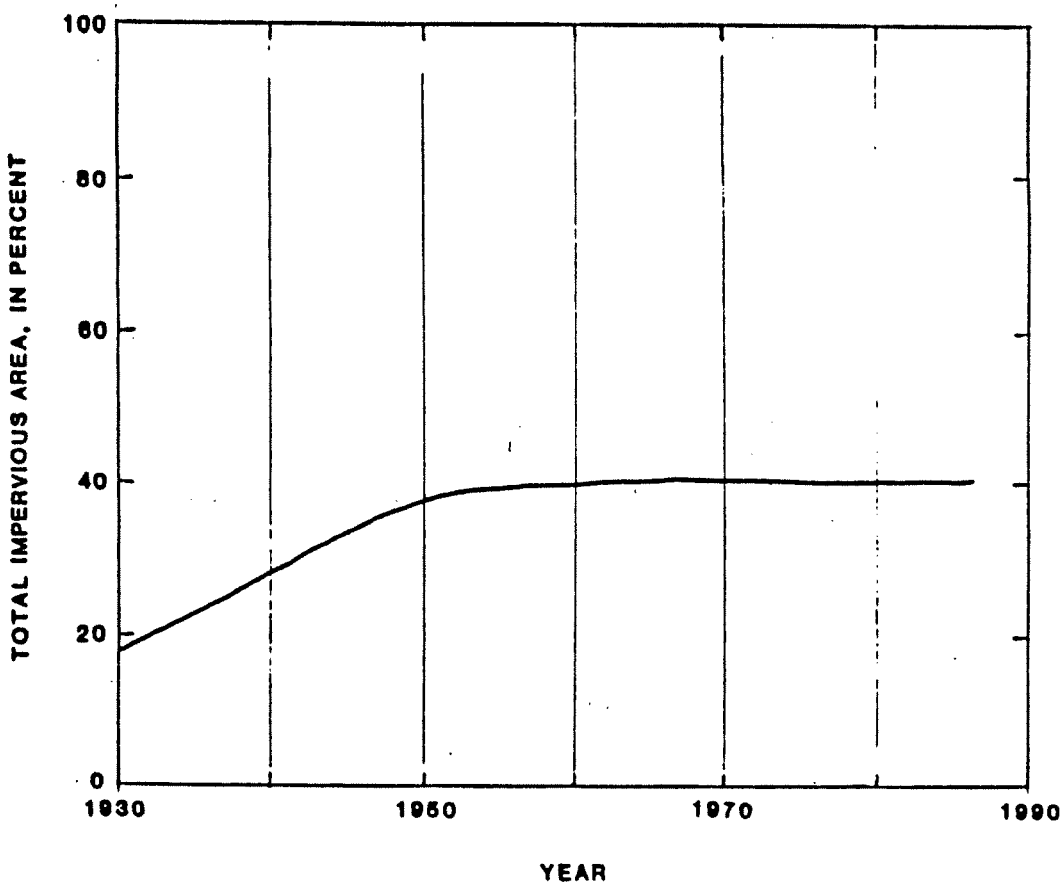


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

CHANGES IN IMPERVIOUS AREA FOR EATON WASH DRAINAGE BASIN

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 37

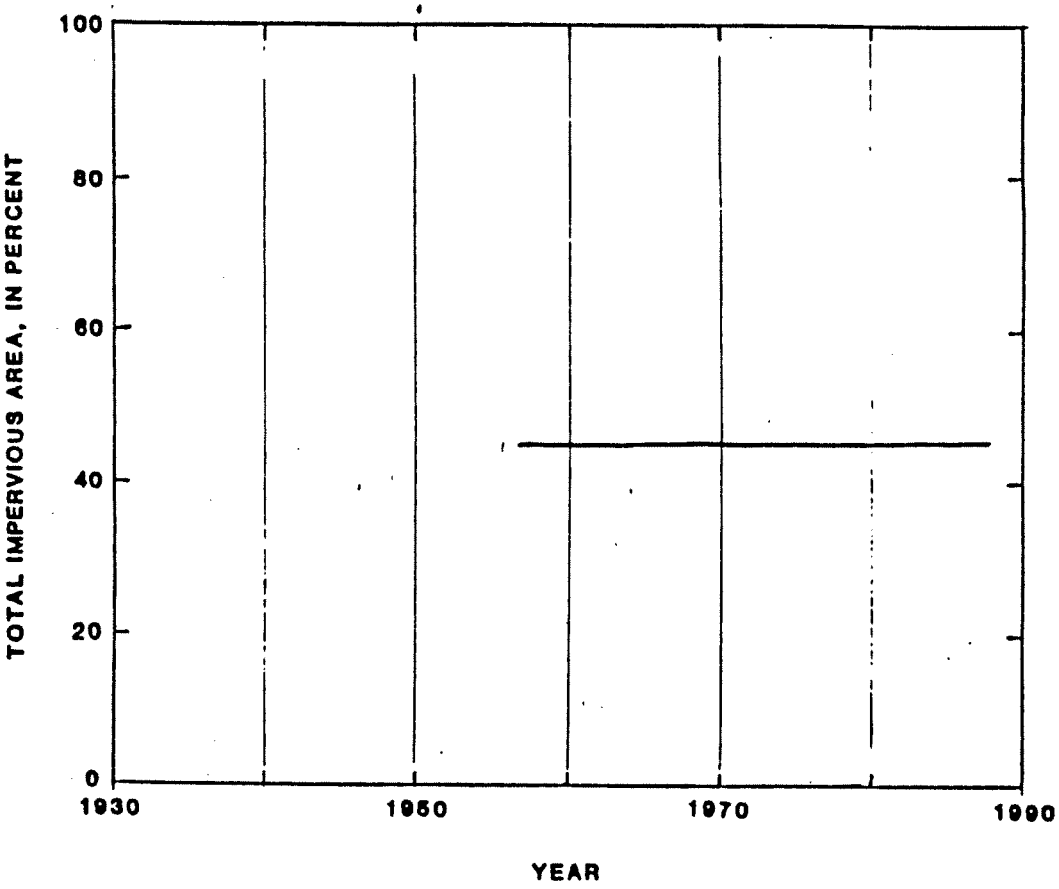


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

CHANGES IN IMPERVIOUS AREA FOR RUBIO WASH DRAINAGE BASIN

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

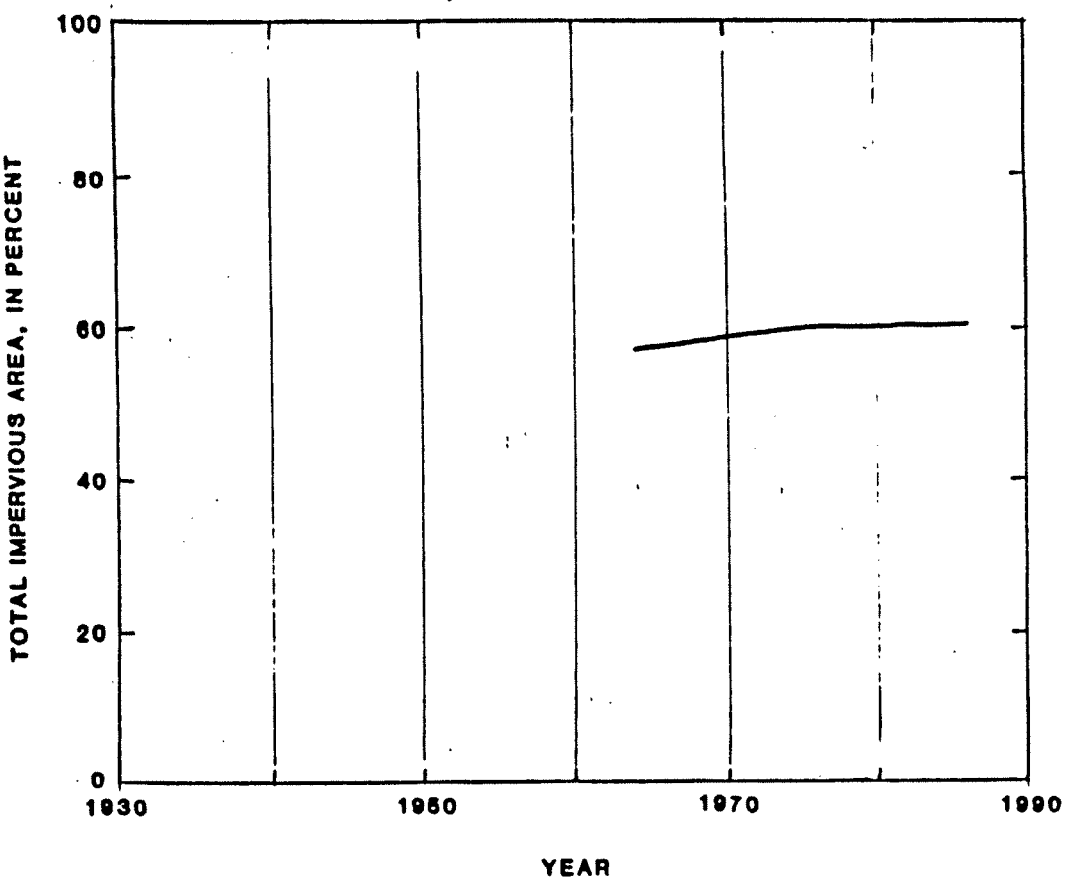
PLATE 38



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

CHANGES IN IMPERVIOUS AREA FOR ARCADIA WASH DRAINAGE BASIN

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

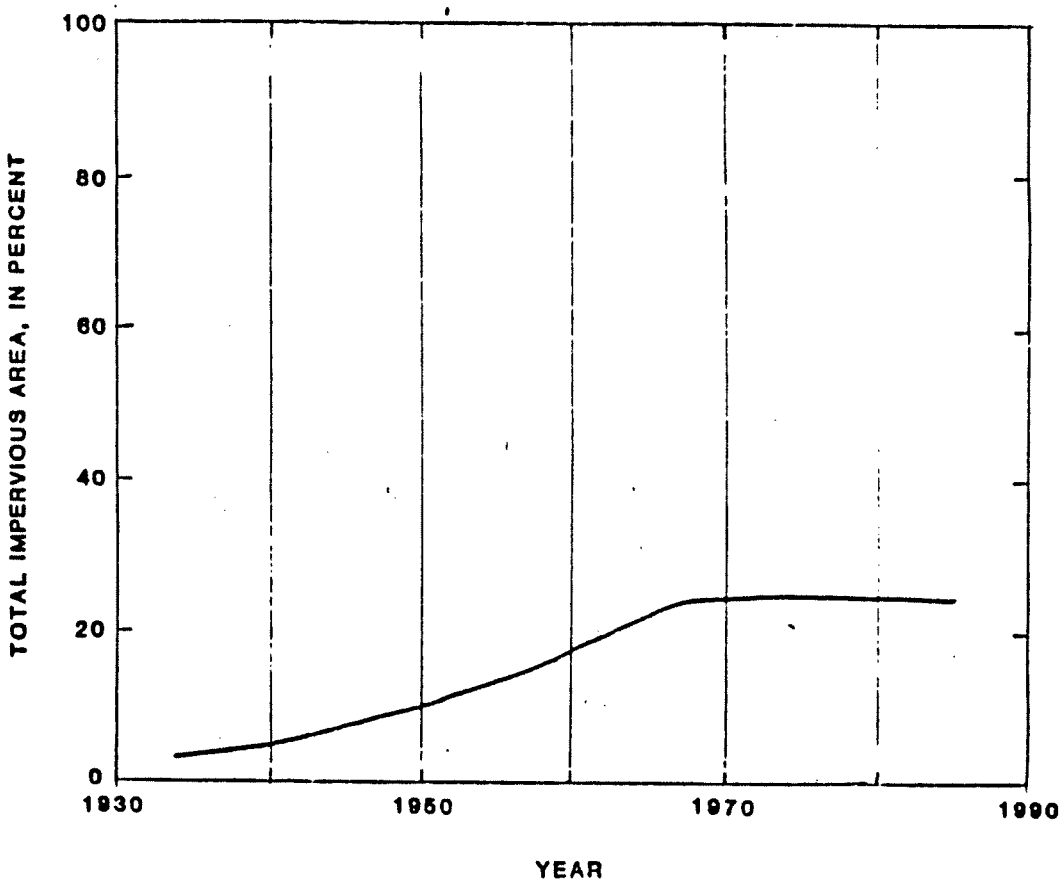


DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

CHANGES IN IMPERVIOUS AREA FOR
DOMINGUEZ CHANNEL DRAINAGE BASIN

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 49

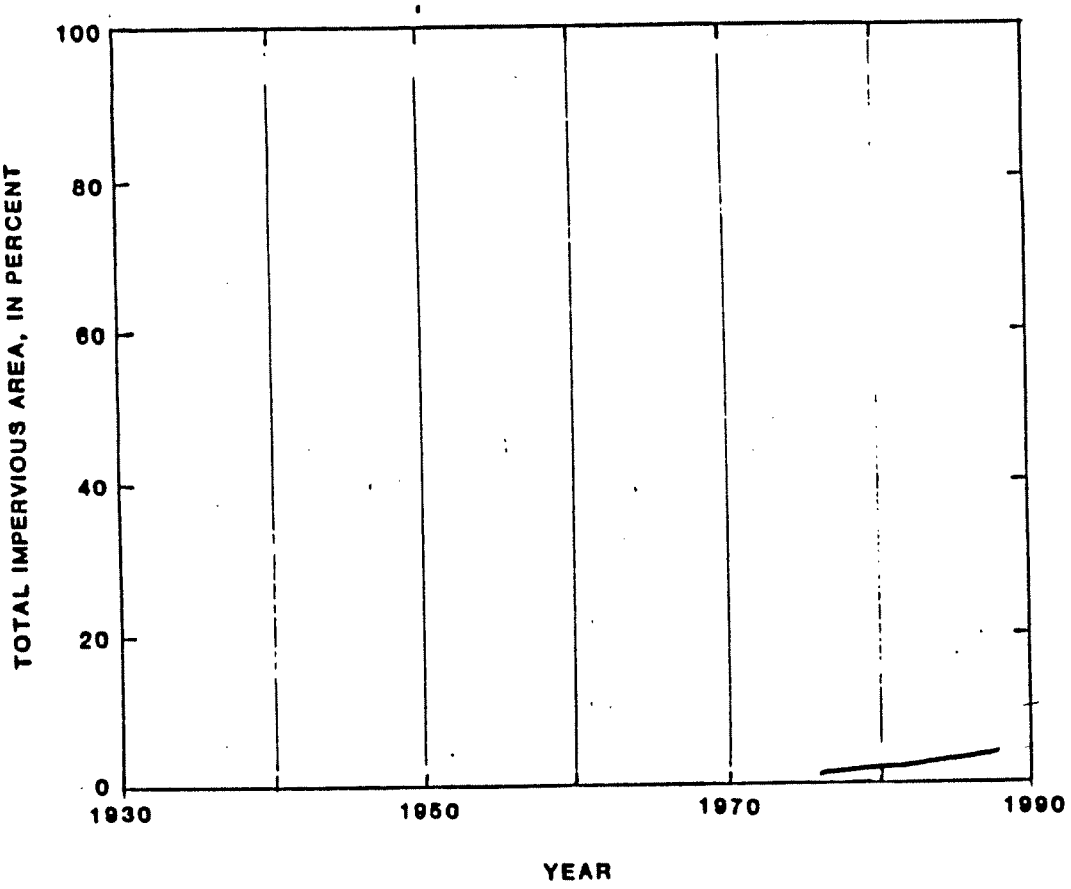


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

CHANGES IN IMPERVIOUS AREA FOR VERDUGO WASH DRAINAGE BASIN

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 41

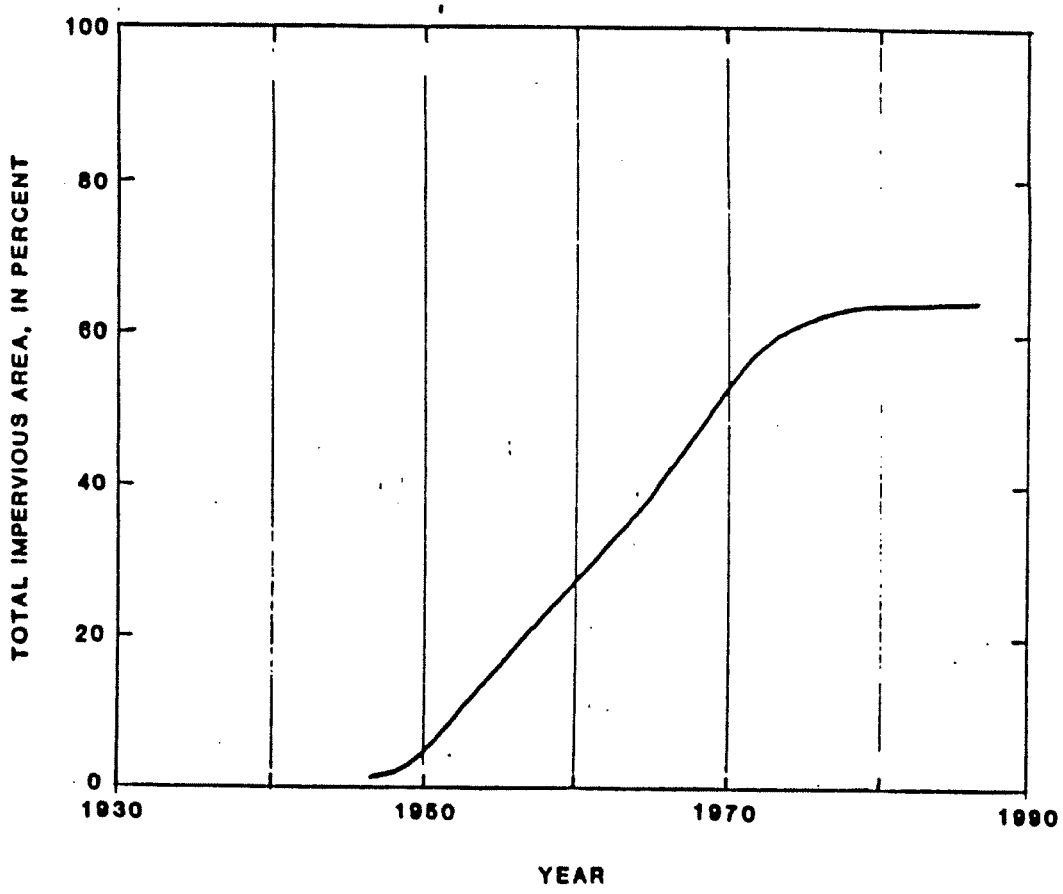


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

CHANGES IN IMPERVIOUS AREA FOR ARROYO TRABUCO CHANNEL DRAINAGE BASIN

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 44

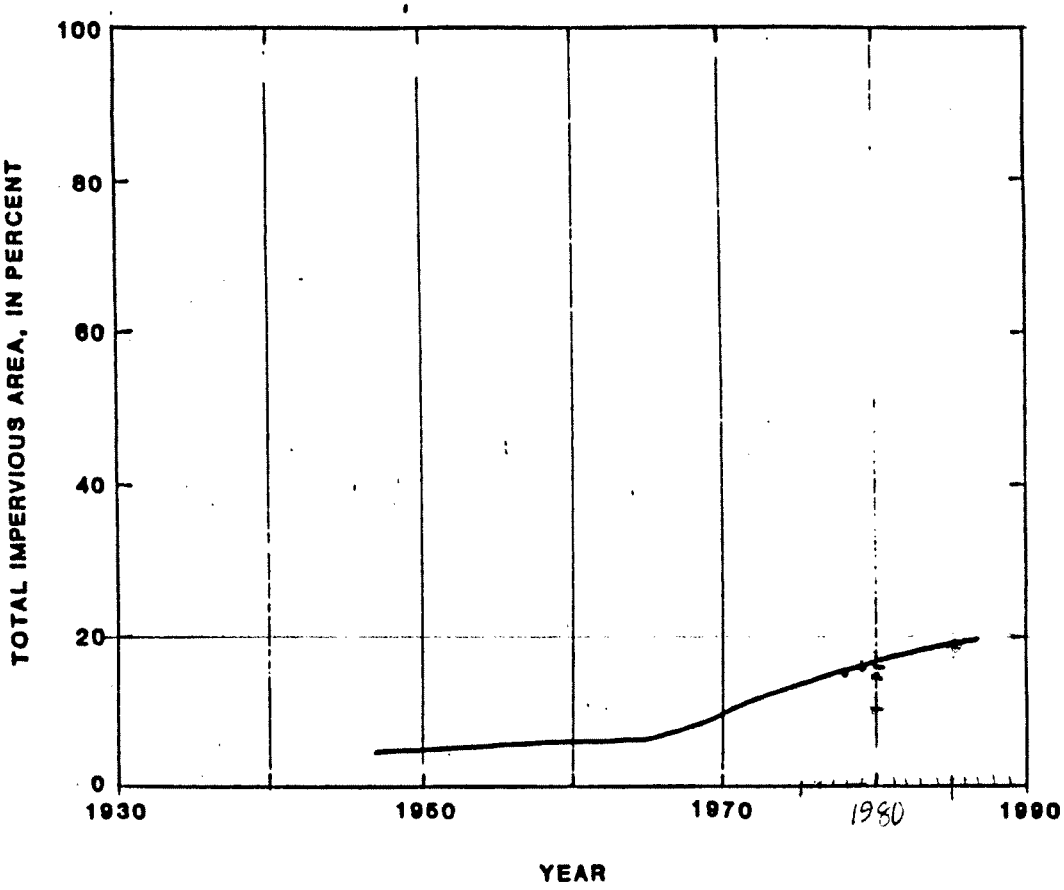


DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

CHANGES IN IMPERVIOUS AREA FOR EAST GARDEN GROVE-WINTERSBURG CHANNEL DRAINAGE BASIN

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 45

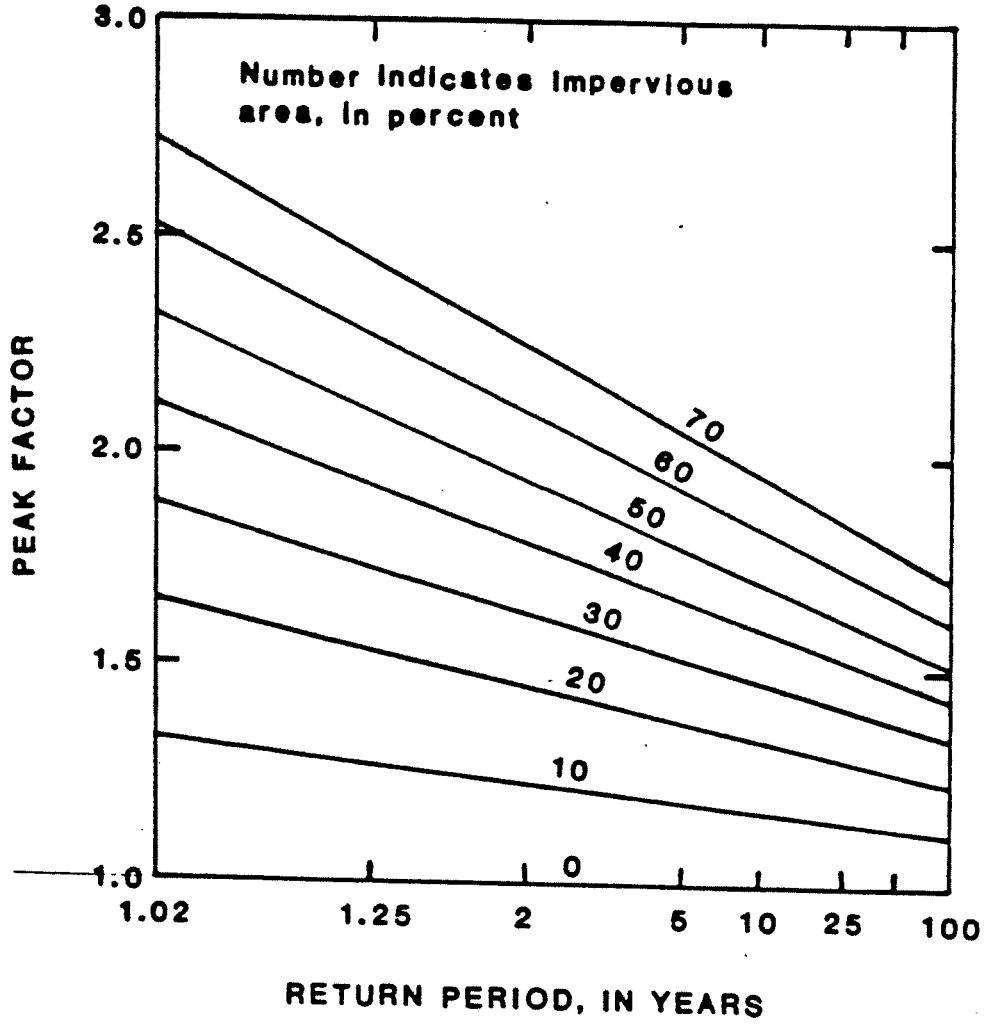


DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

CHANGES IN IMPERVIOUS AREA FOR
SAN DIEGO CREEK DRAINAGE BASIN

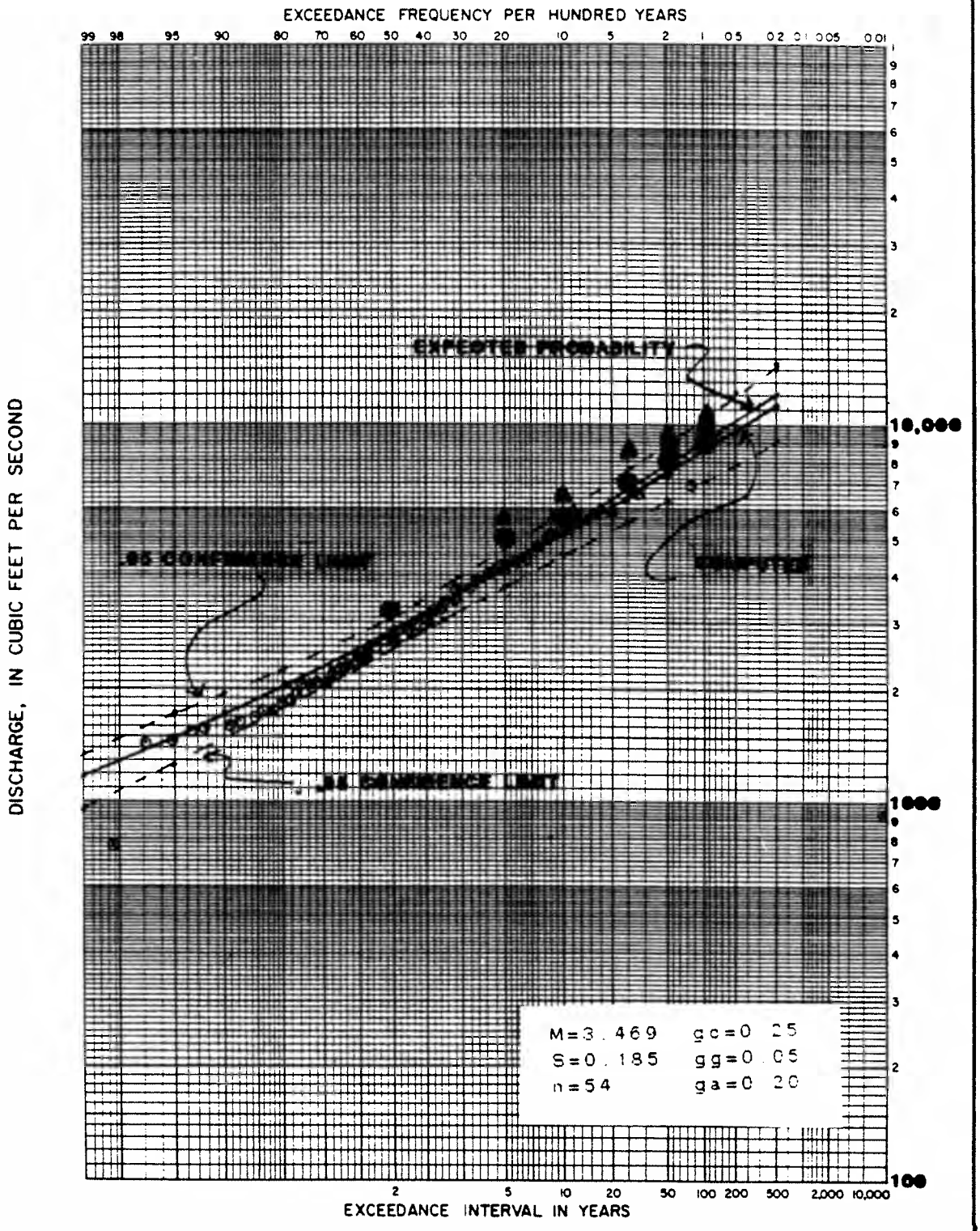
U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 46



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS
PEAK ADJUSTMENT FACTORS FOR URBANIZING WATERSHEDS
U. S. ARMY ENGINEER DISTRICT LOS ANGELES, CORPS OF ENGINEERS TO ACCOMPANY REPORT DATED:

PLATE 47



LEGEND

⊙ median plotting positon

Calibration Results

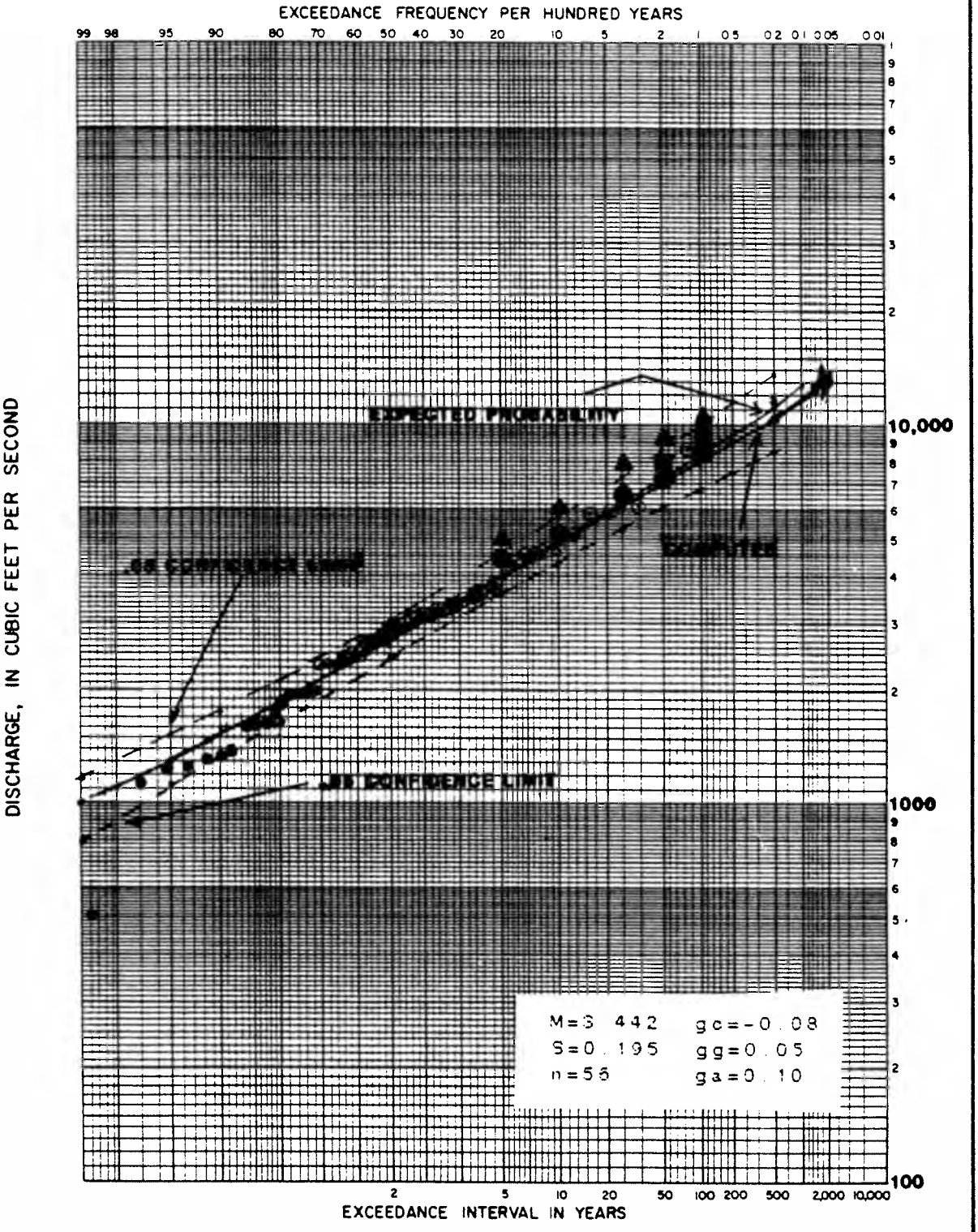
● computed
■ expected probability
▲ 85% confidence level

DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

ALHAMBRA WASH
NEAR KLINGERMAN STREET

D.A.=15.2 MI^2

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:



LEGEND

⊙ median plotting positon

Calibration Results

● computed
■ expected probability
▲ 85% confidence level

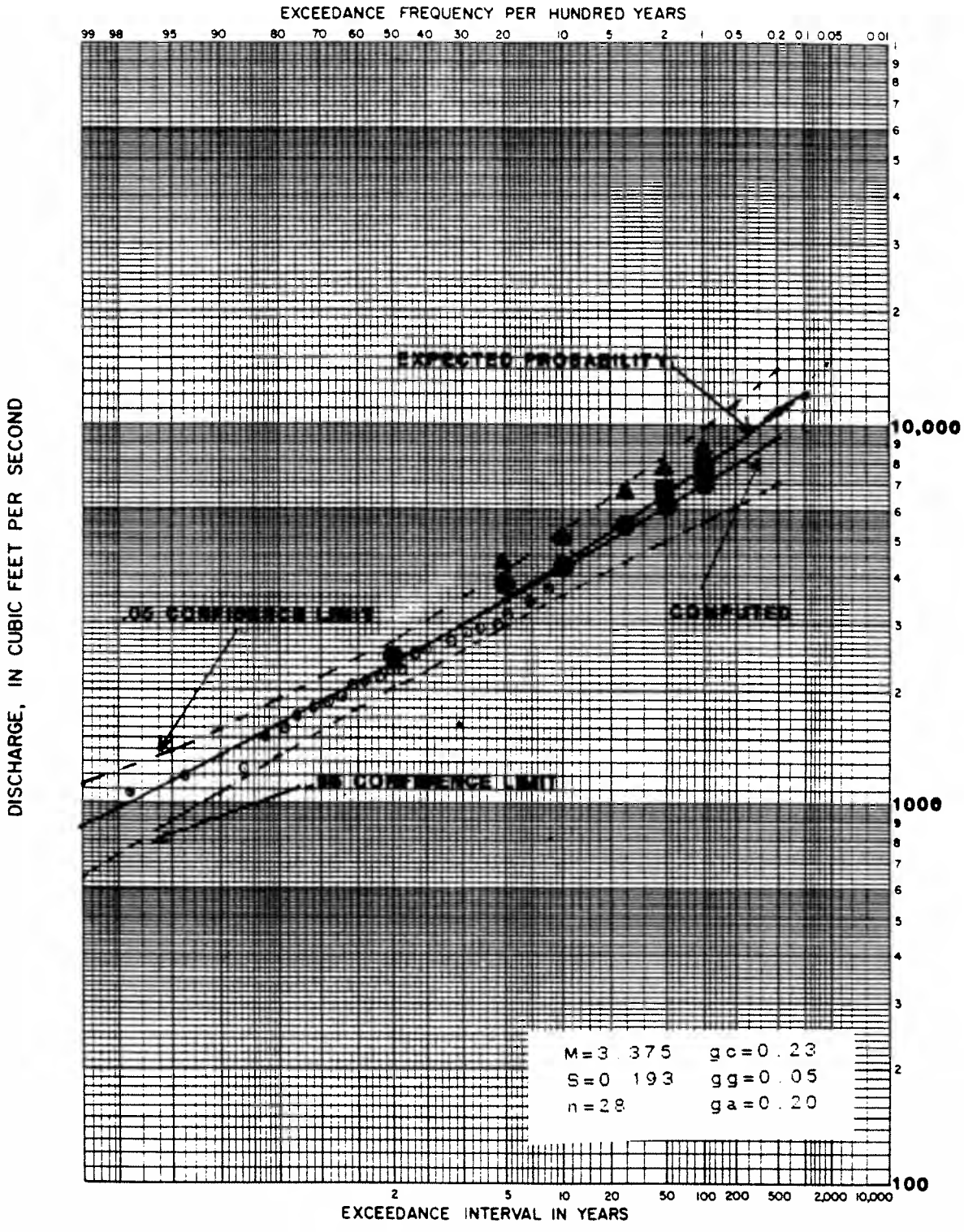
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

COMPTON CREEK NEAR GREENLEAF DRIVE

DA = 22.6 sq.mi.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 49



LEGEND

⊙ median plotting positon

Calibration Results

● computed
■ expected probability
▲ 85% confidence level

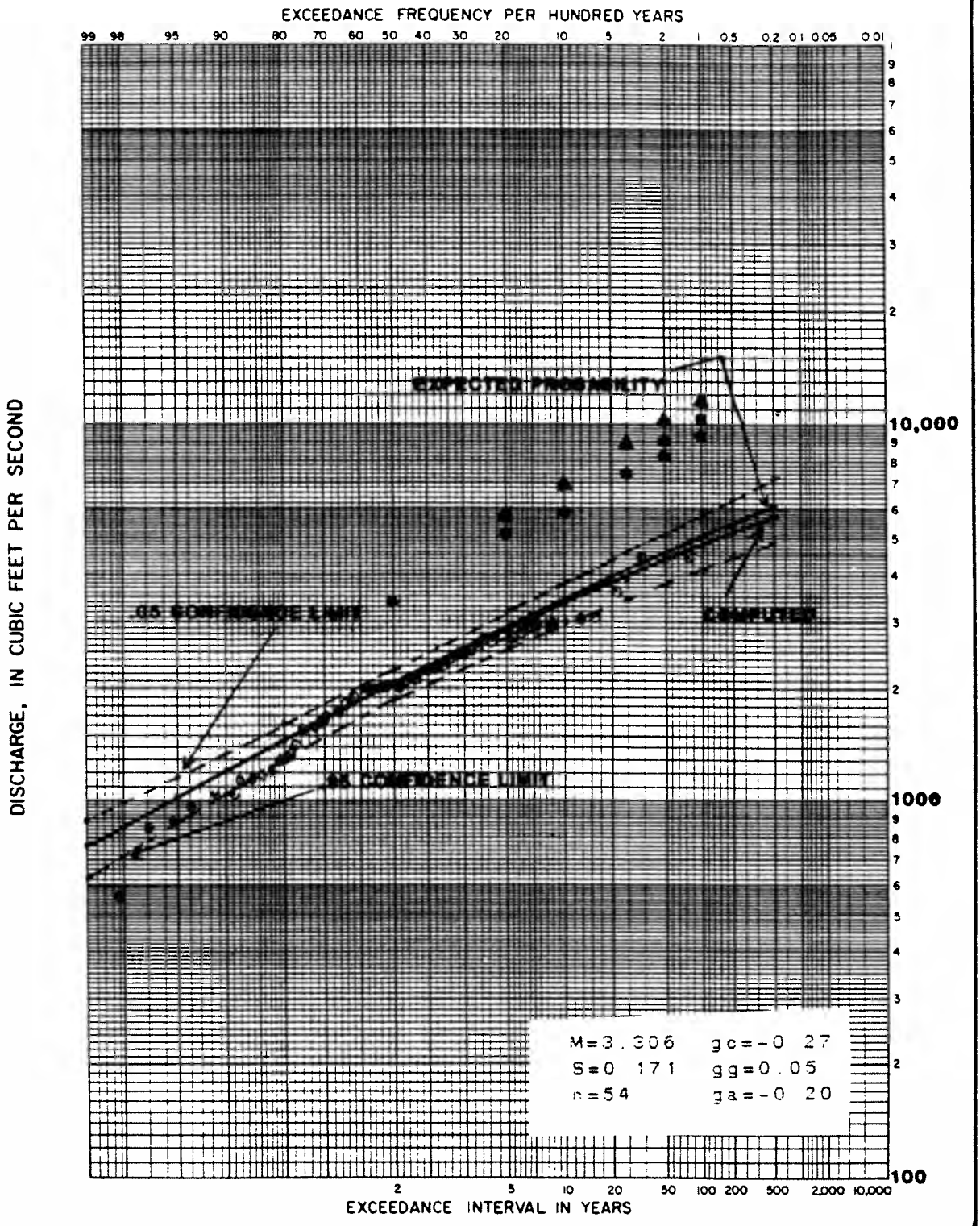
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

EATON WASH AT LOFTUS DRIVE

DA = 22.8 sq.mi.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 50



LEGEND

⊙ median plotting positon

Calibration Results

● computed
■ expected probability
▲ 85% confidence level

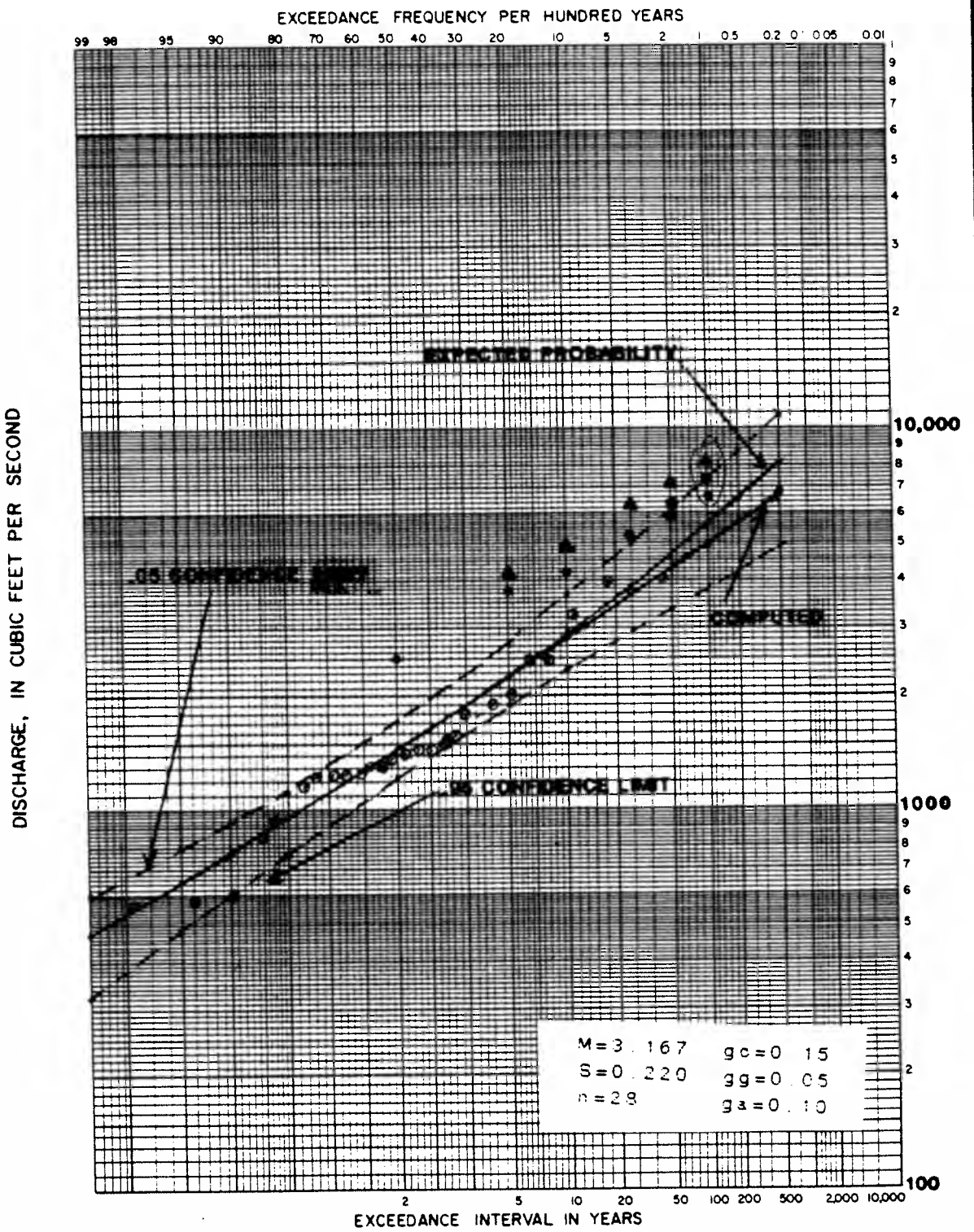
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

RUBIO WASH AT GLENDON WAY

DA = 10.9 sq.mi.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 51



LEGEND

⊙ median plotting positon

Calibration Results

● computed
■ expected probability
▲ 85% confidence level

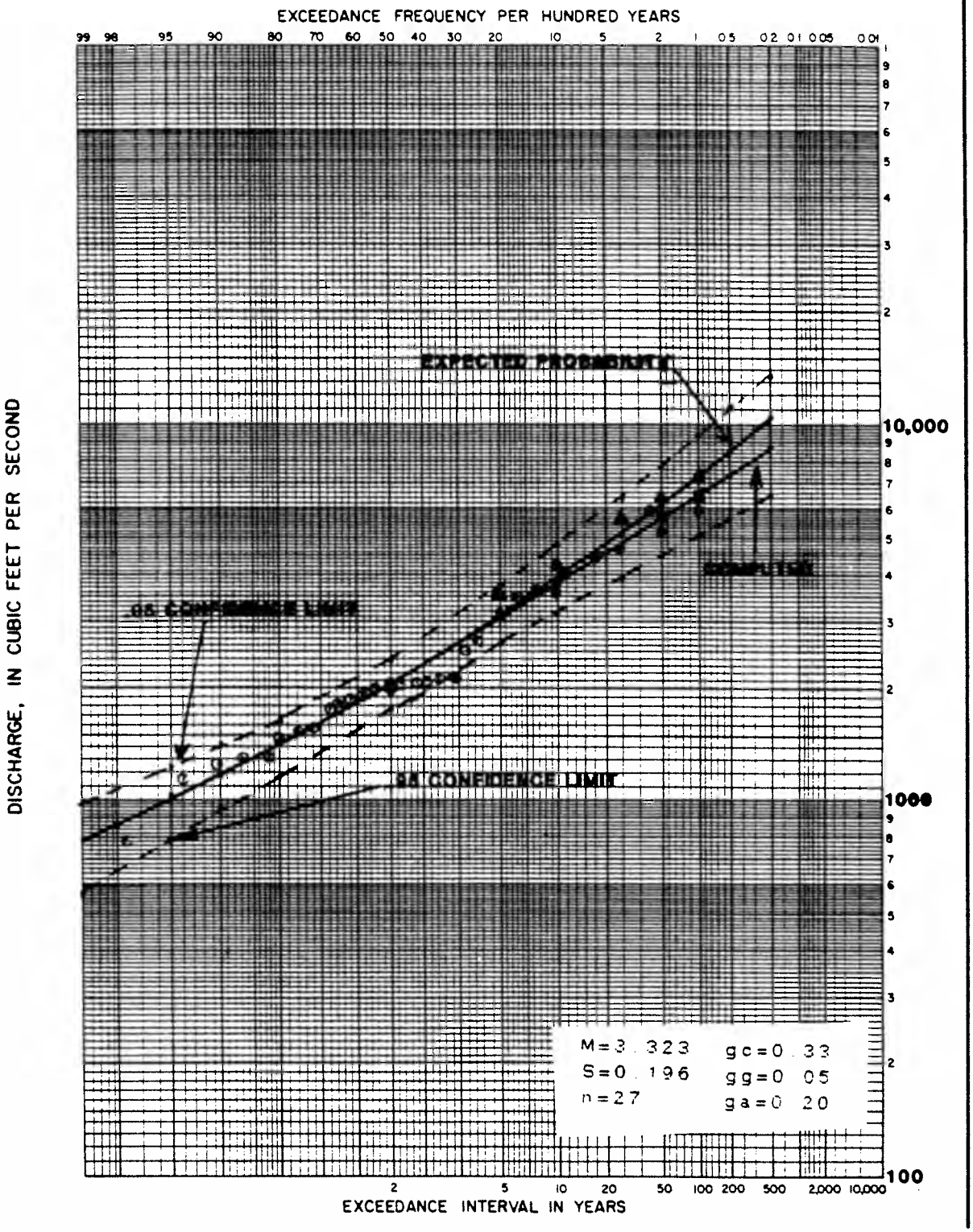
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

ARCADIA WASH BELOW GRANDE AVE.

DA = 8.5 sq.mi.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 52



LEGEND

⊙ median plotting positon

Calibration Results

● computed
■ expected probability
▲ 85% confidence level

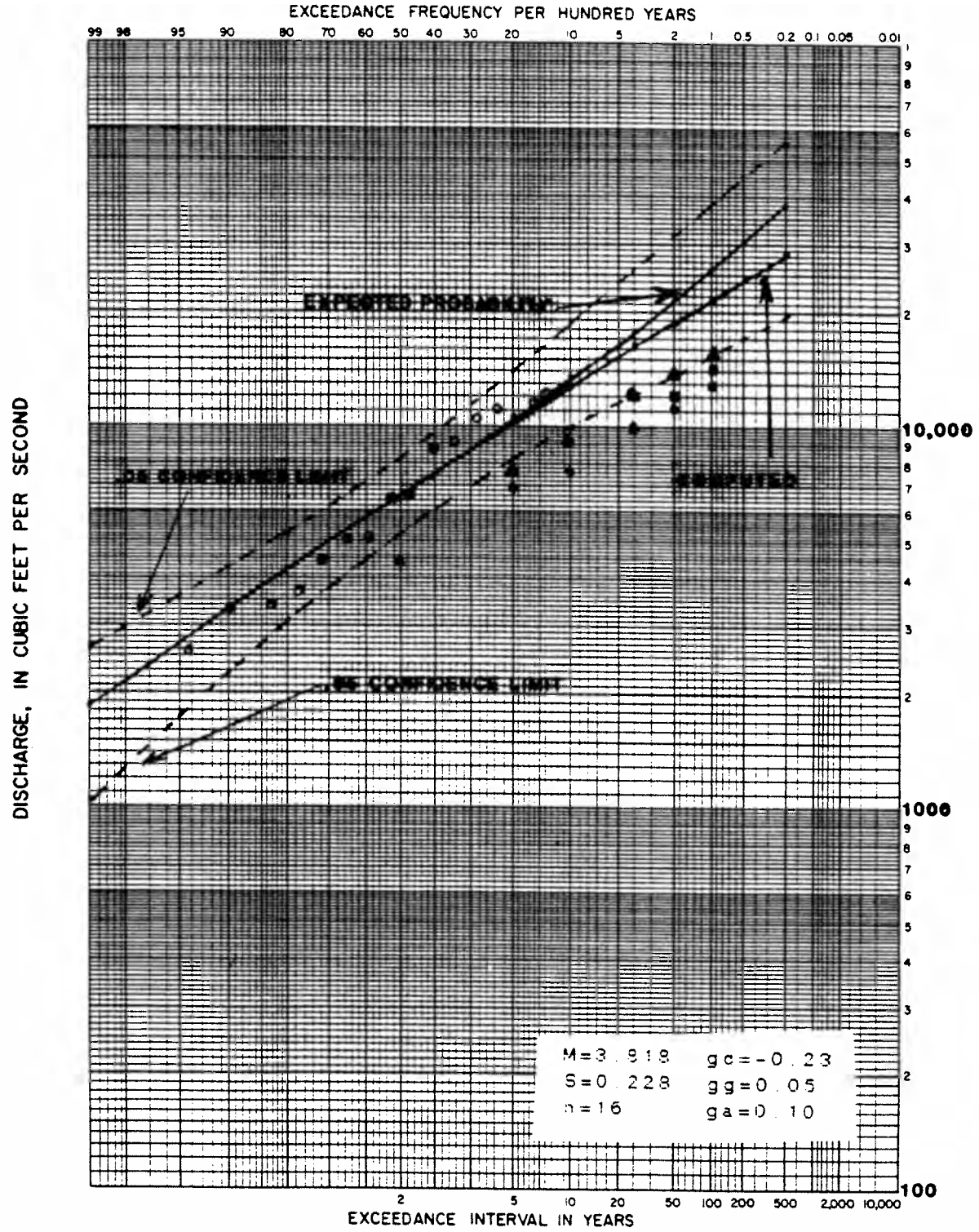
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

COMPTON CREEK NEAR 120th STREET

DA = 14.5 sq.mi.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 53



LEGEND

⊙ median plotting positon

Calibration Results

● computed
■ expected probability
▲ 85% confidence level

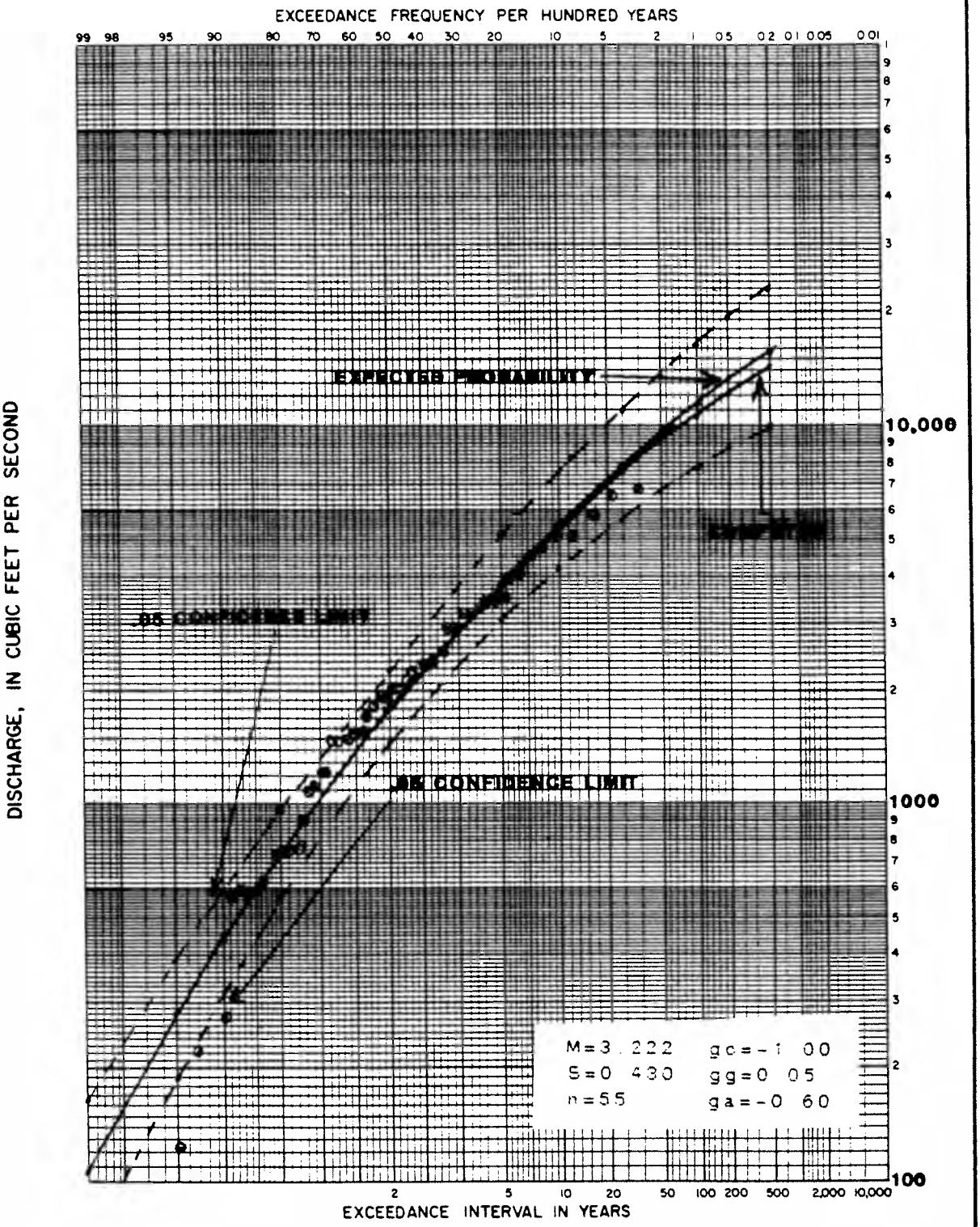
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

DOMINGUEZ CHANNEL AT VERMONT AVE.

DA = 37.1 sq.mi.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 54



LEGEND

⊙ median plotting positon

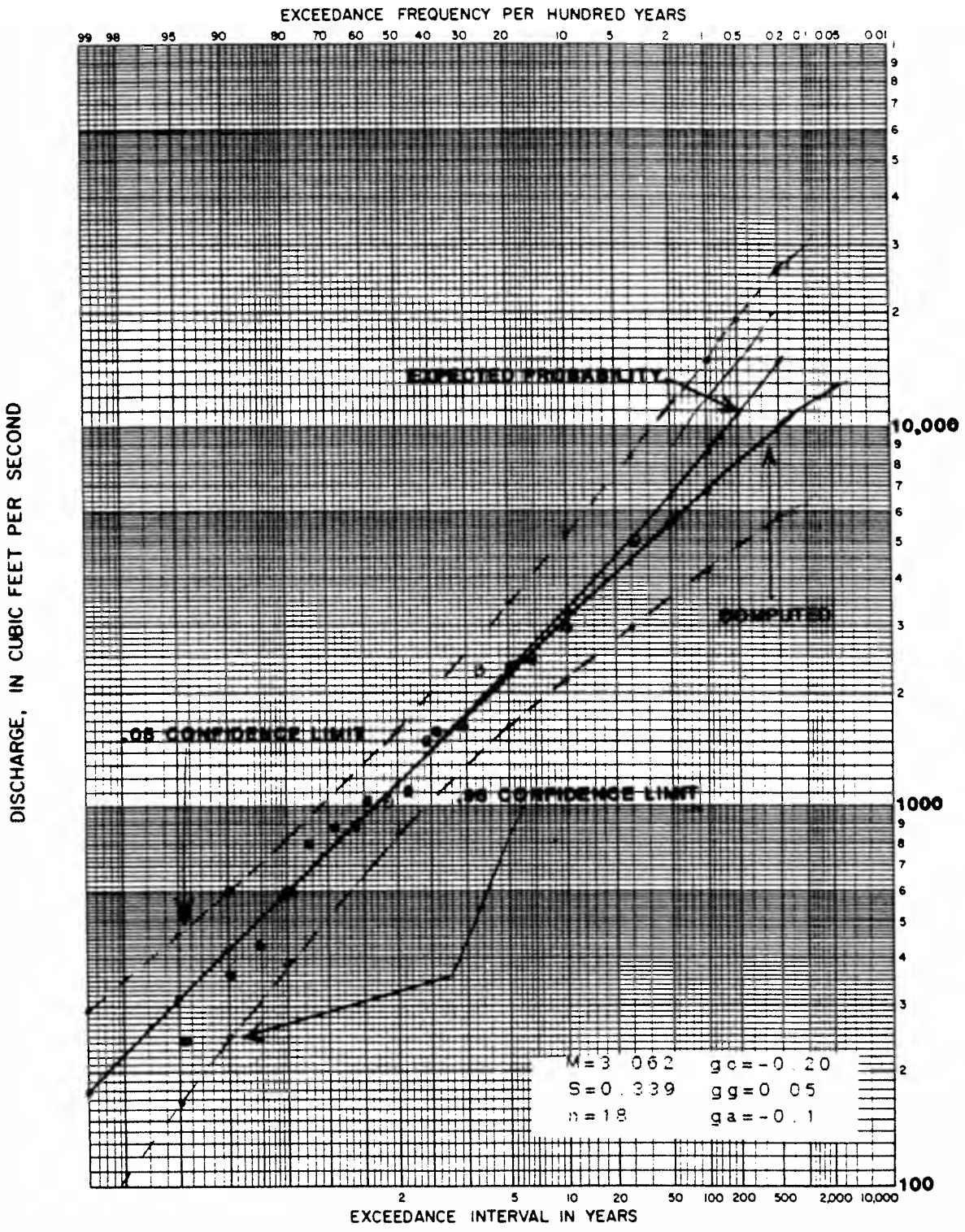
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

VERDUGO WASH AT ESTELLE AVE.

DA = 26.8 sq.mi.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 56



LEGEND

o median plotting positon

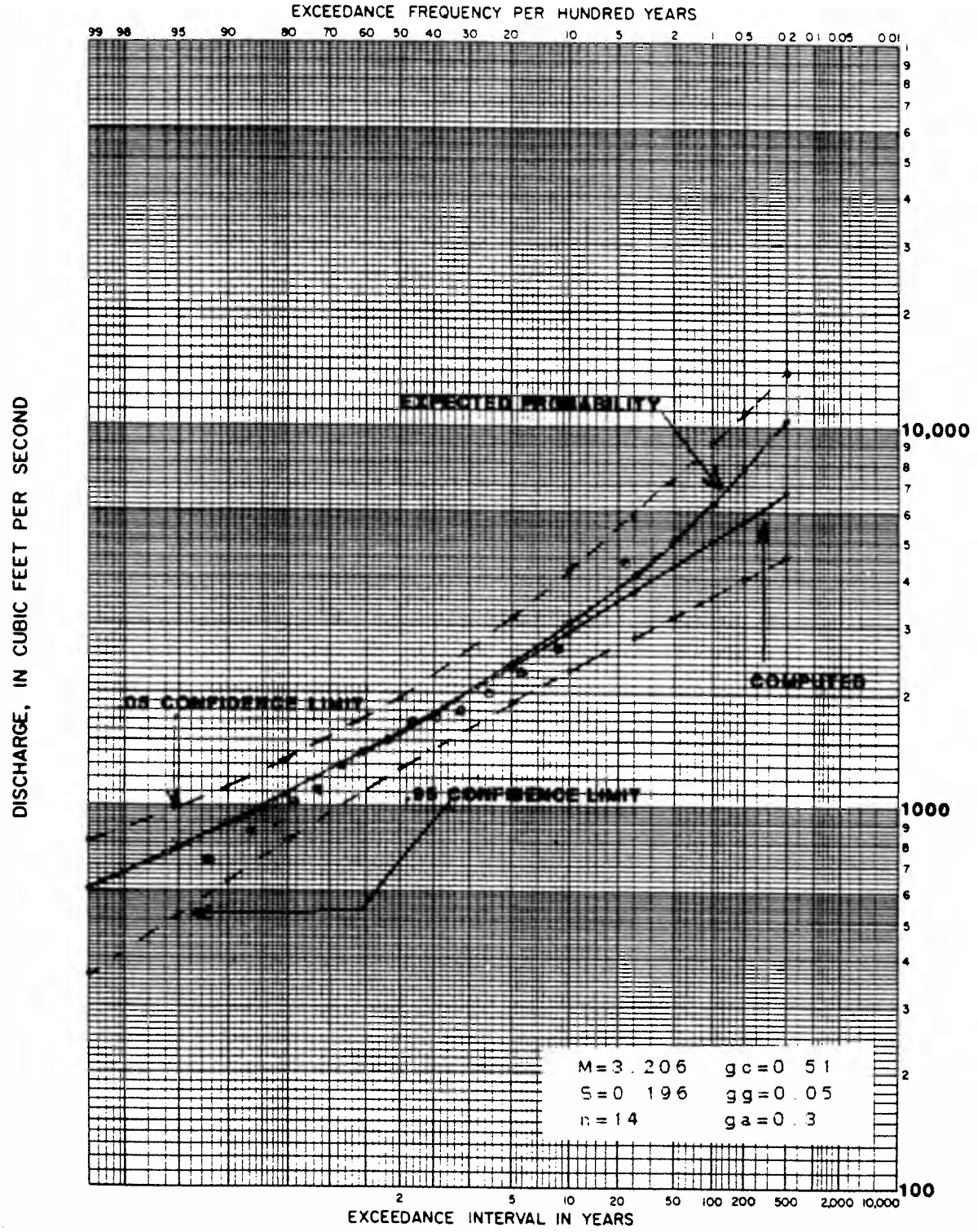
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

EL MODENA-IRVINE CHANNEL AT MYFORD RD.

DA = 12.8 sq.mi.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 56



LEGEND

o median plotting positon

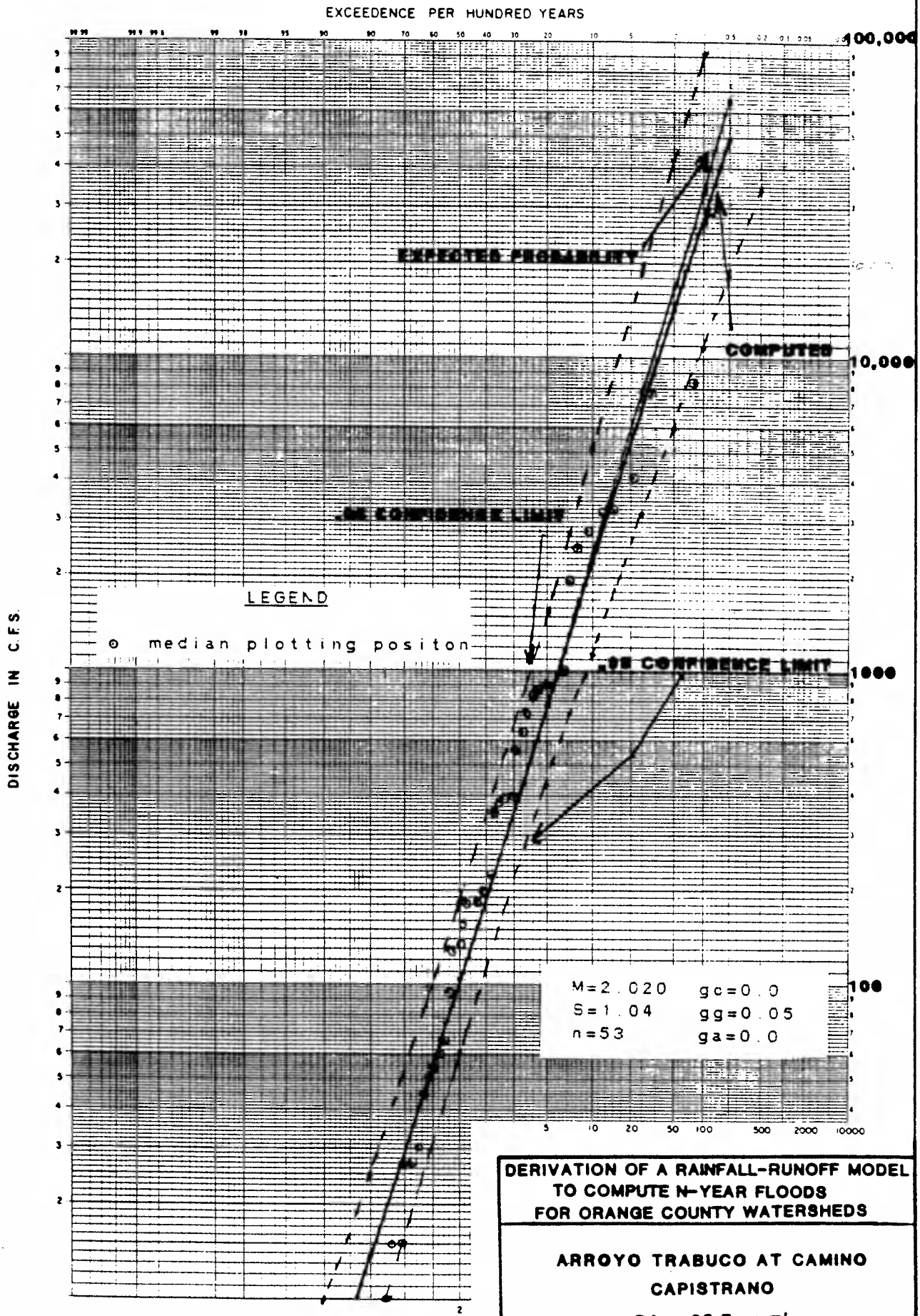
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

SANTA ANA-DELHI CHANNEL AT IRVINE AVE.

DA = 17.6 sq.mi.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 57



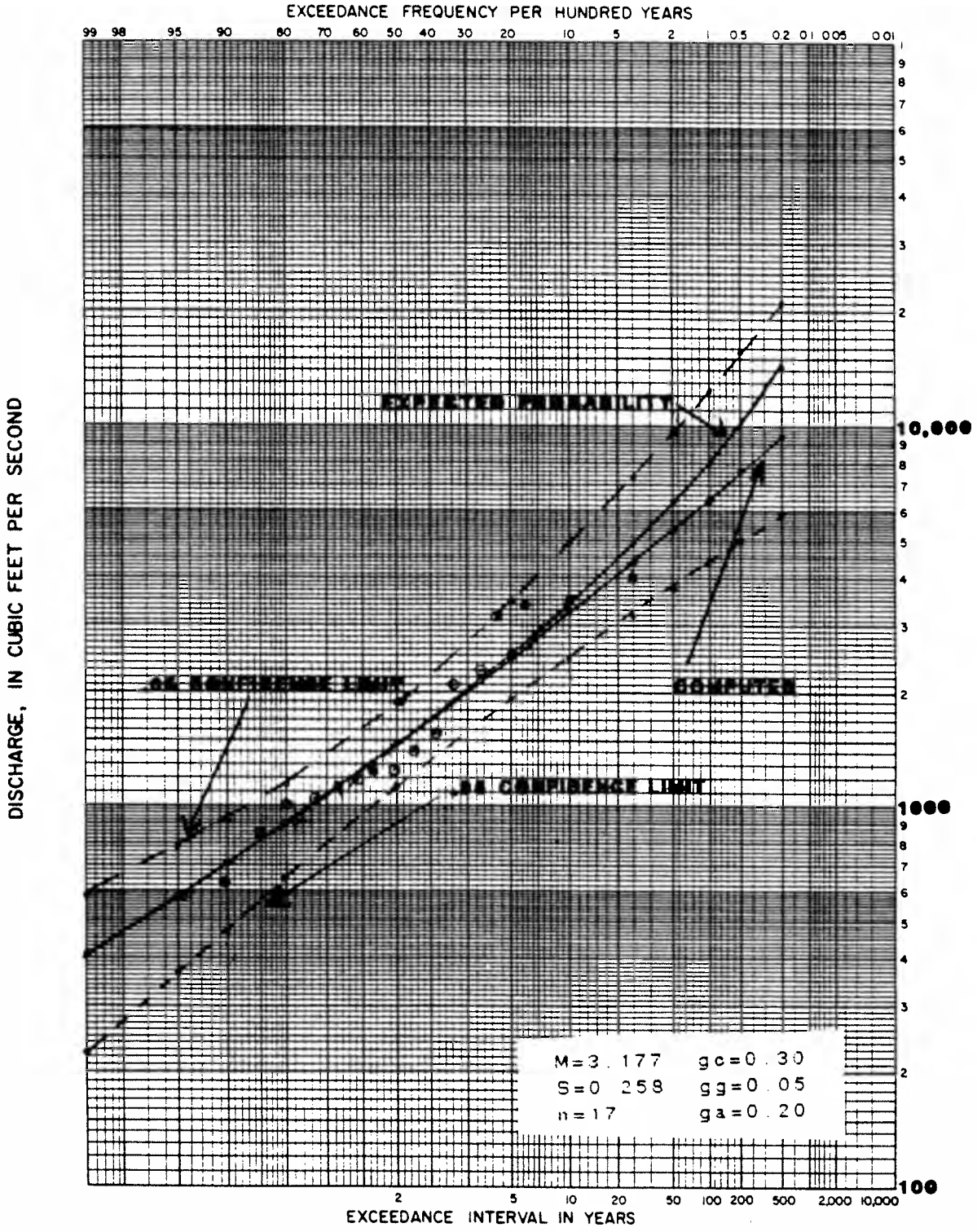
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

ARROYO TRABUCO AT CAMINO CAPISTRANO

DA = 35.7 sq.mi.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 58



LEGEND

⊙ median plotting positon

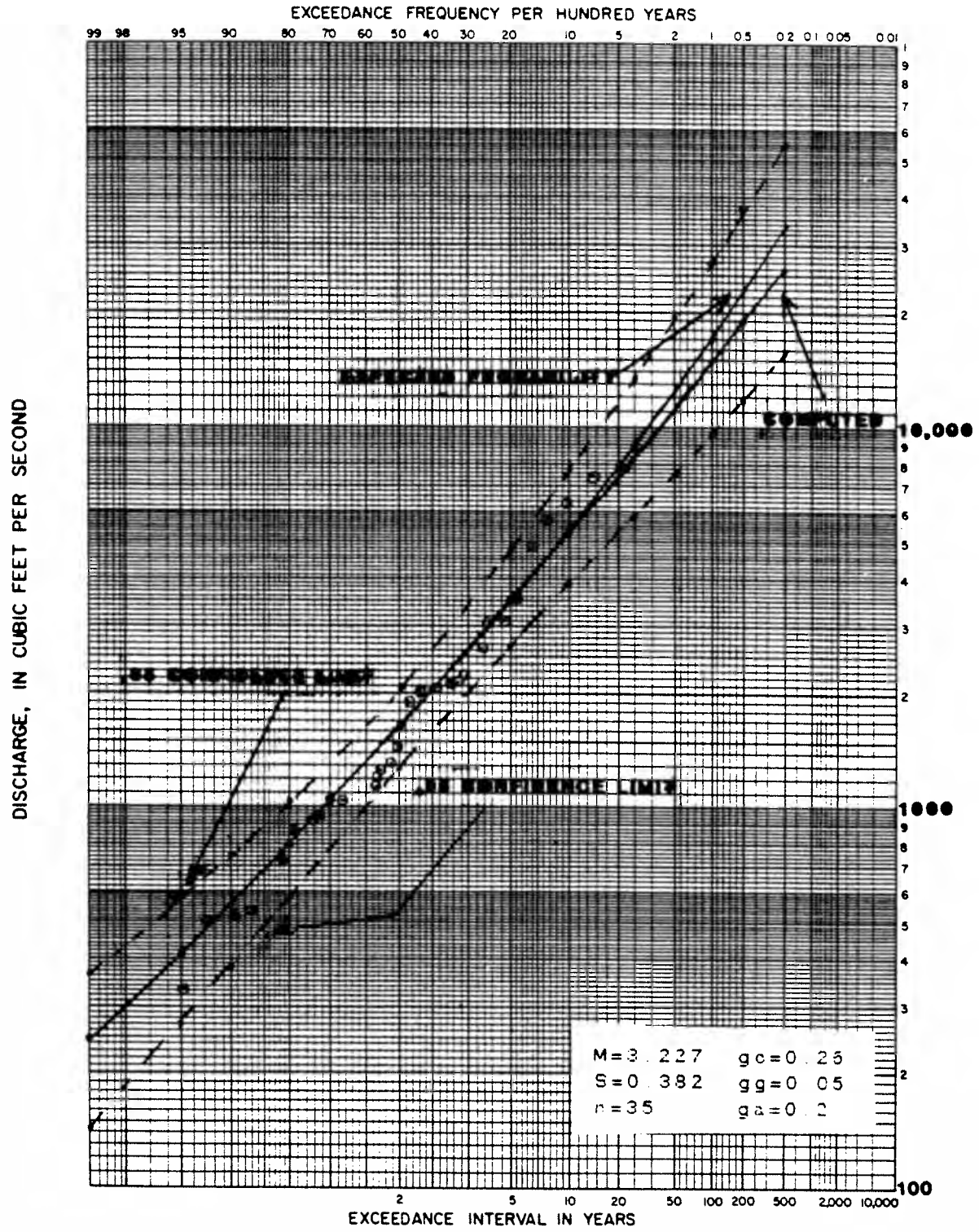
DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

EAST GARDEN GROVE WINTERSBURG CHANNEL

DA = 20.8 sq.mi.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 59



LEGEND

o median plotting positon

DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

SAN DIEGO CREEK AT CULVER DRIVE

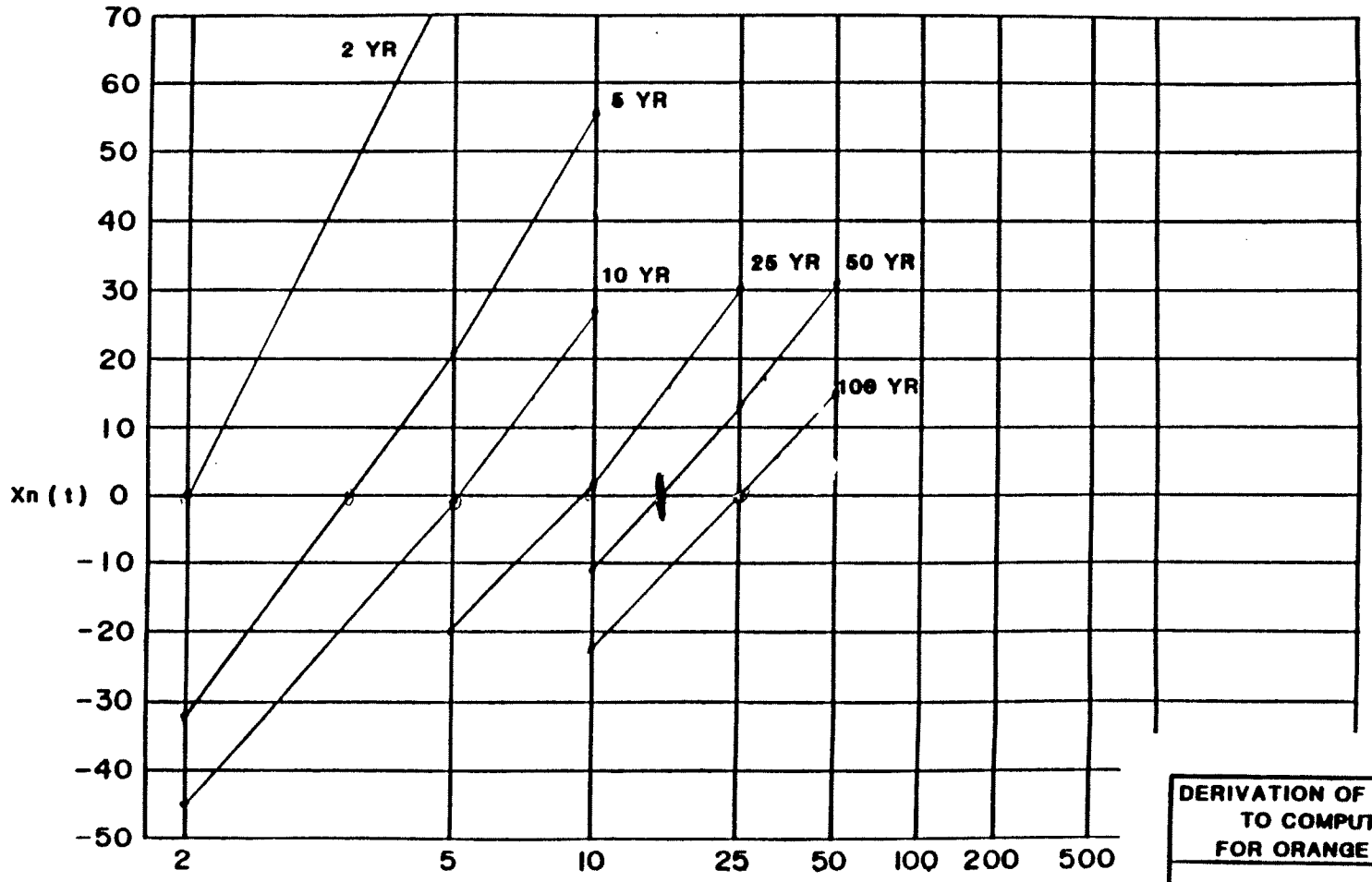
DA = 40.5 sq.mi.

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 60

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL
TO COMPUTE N-YEAR FLOODS
FOR ORANGE COUNTY WATERSHEDS

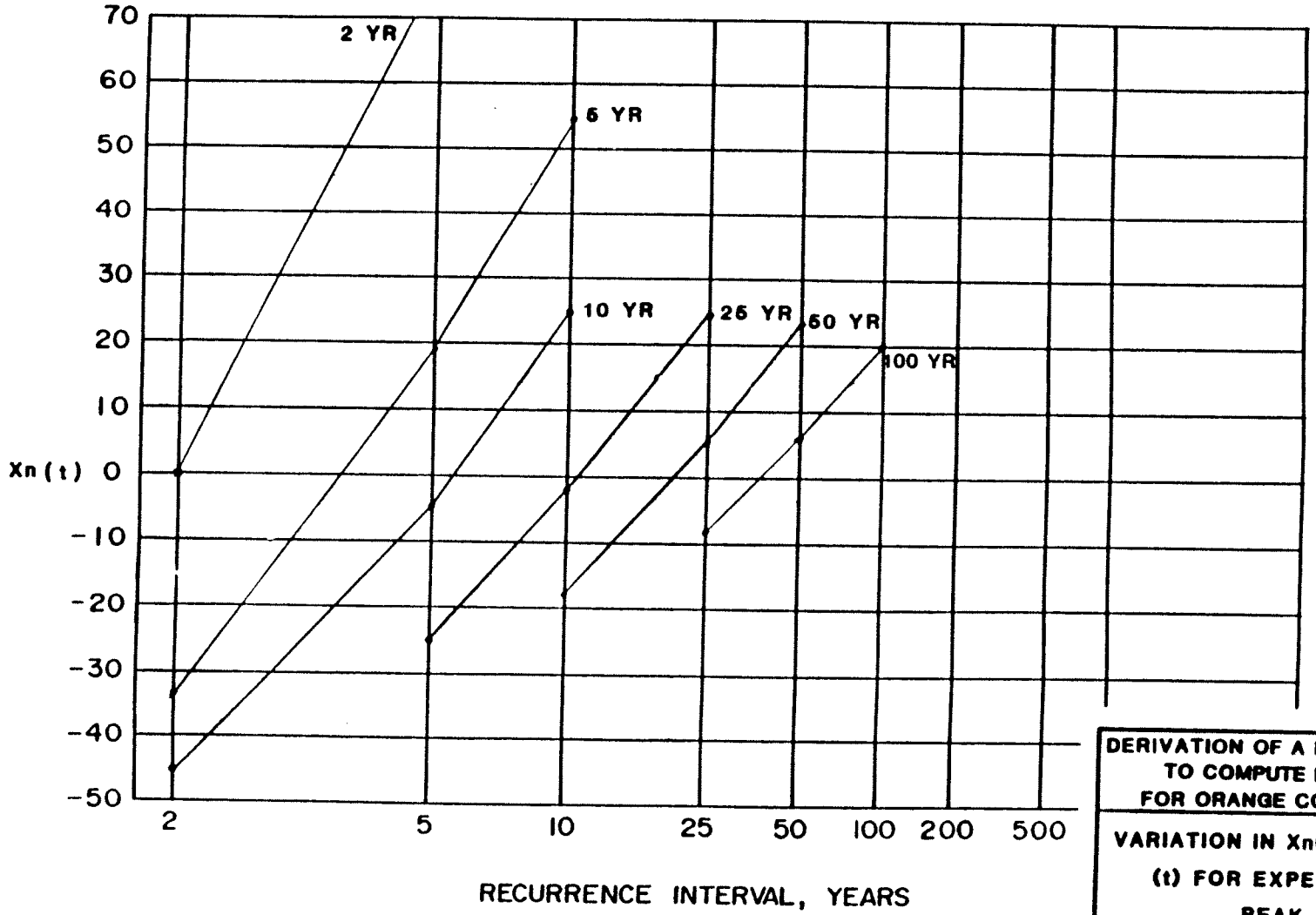
VARIATION IN Xn(t) AS A FUNCTION OF (t)
FOR COMPUTED PEAK DISCHARGES

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 61

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

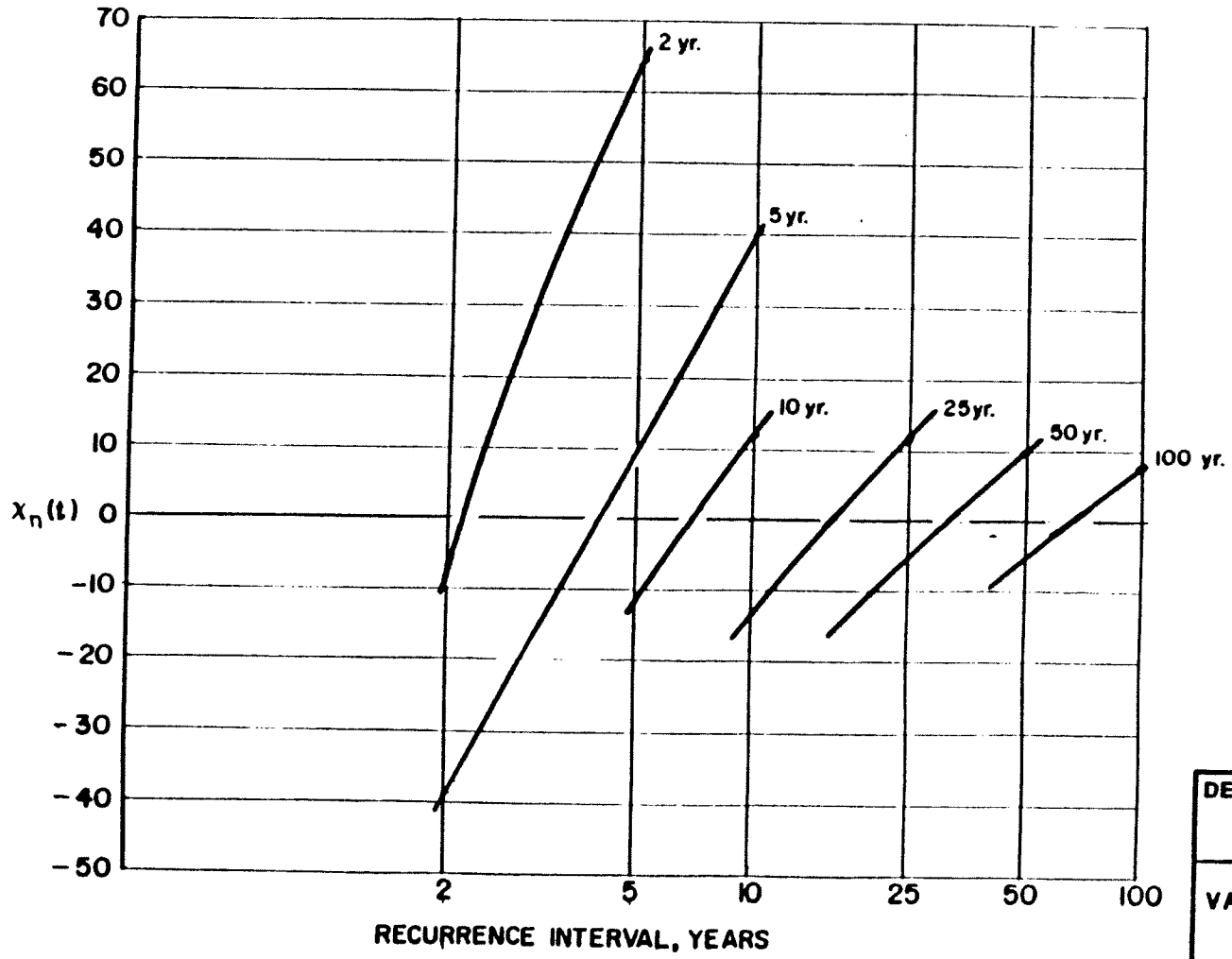
VARIATION IN Xn(t) AS A FUNCTION OF (t) FOR EXPECTED PROBABILITY PEAK DISCHARGES

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 62

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DERIVATION OF A RAINFALL-RUNOFF MODEL TO COMPUTE N-YEAR FLOODS FOR ORANGE COUNTY WATERSHEDS

VARIATION IN Xn(t) AS A FUNCTION OF (t) FOR 85% CONFIDENCE LEVEL PEAK DISCHARGES

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
TO ACCOMPANY REPORT DATED:

PLATE 63

This page is intentionally left blank to facilitate 2-sided printing.

Appendix A.3

Standard Project Flood Determination,
Engineer Manual No. 1110-2-1411 (1965)

This page is intentionally left blank to facilitate 2-sided printing.

CECW Engineer Manual 1110-2-1411	Department of the Army U.S. Army Corps of Engineers Washington, DC 20314-1000	EM 1110-2-1411 1 March 1965
	STANDARD PROJECT FLOOD DETERMINATION	
	Distribution Restriction Statement Approved for public release; distribution is unlimited.	

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, DC 20315

EM 1110-2-1411

ENGCW

26 March 1952

Civil Engineer Bulletin No. 52-8

(Revised March 1965)

STANDARD PROJECT FLOOD DETERMINATIONS

I. INTRODUCTION

1-01. REFERENCES.

a. Circular Letter No. 4262 (Civil Works No. 65), dated 20 November 1946, subject, Standard Project Flood Estimates, wherein original instructions concerning the preparation of standard project flood estimates were issued.

b. Orders & Regulations, paragraph 4208.11 (Revised Mar. 1951) wherein the preparation of standard project flood estimates for certain classes of projects is directed, and instructions are presented regarding the submission of certain estimates for approval of the Chief of Engineers prior to incorporation in project reports. (See quotation in para 4-02 herein).

c. Engineering Manual, Civil Works, Part CXIV, Chapter 5, subject, Flood-Hydrograph Analyses and Computations.

1-02. PURPOSE AND SCOPE OF THIS BULLETIN.

a. This bulletin reviews briefly principal classes of flood analyses and estimates involved in the planning and design of flood control and multiple-purpose projects, with the primary objective of indicating the general application and purposes of Standard Project Flood Estimates.

b. Generalized rainfall criteria and recommended procedures for the computation of standard project storm rainfall and rainfall-excess quantities for small drainage basins (classified herein as approximately 1,000 square miles and less) located east of 105° longitude, are presented, with a concise explanation of their derivation.

c. Procedures for derivation of SPS and SPF estimates for large drainage basins (exceeding approximately 1000 sq.mi.) are discussed and illustrated.

d. This bulletin is sub-divided into four Sections, as follows:

I. Introduction
II. Generalized SPS Estimates for Small Drainage Basins
III. SPS Estimates for Large Drainage Basins
IV. Projects for which SPF Estimates are Required.

1-03. SPECIFICATIONS OF A STANDARD PROJECT STORM (Abbrev. "SPS).

a. The "standard project storm" estimate for a particular drainage area and season of year in which snow-melt is not a major consideration should represent the most severe flood-producing rainfall depth-area-duration relationship and isohyetal pattern of any storm that is considered reasonably characteristic of the region in which the drainage basin is located, giving consideration to the runoff characteristics and existence of water regulation structures in the basin. In deriving standard project storm rainfall estimates applicable to seasons and areas in which melting snow may contribute a substantial volume of runoff to the standard project flood hydrograph, appropriate allowances for snow melt are included with and considered as a part of the standard project storm rainfall quantities in computing the SPF hydrograph. Where floods are predominatly the result of melting snow, the SPF estimate is based on estimates of the most critical combinations of snow, temperature and water losses considered reasonably characteristic of the region.

b. The term "storm" is used in a broad sense to mean any period or sequence of rainfall events that may contribute to critical flood events in the particular drainage basin under study.

c. The term "region" as used above is construed to include the area surrounding the given basin in which storm producing factors are substantially comparable; i.e., the general area within which meteorological influences and topography are sufficiently alike to permit adjustment of storm data to a common basis of comparison with practical degree of reliability. Such a "region" includes a very large area in the eastern half of the United States where relief is generally moderate, and relatively small areas in certain sections of the western United States where extreme topography is encountered.

d. A general comparison of maximum storms of record in the region, supplemented my meteorological investigations, serve as a basis in selecting rainfall criteria to represent the most severe storm that is considered "reasonably characteristic" of a region. Certain storms of extraordinary severity may be eliminated as too unusual and extreme to warrant adoption as the standard project storm.

1-04. STANDARD PROJECT FLOOD (Abbrev. "SPF")

a. In general terms, the standard project flood may be defined as a hydrograph representing runoff from the standard project storm (and/or snow melt) as defined in paragraph 1-03 a. The SPF may have more than a single peak if these are the result of runoff from the SPS.

b. Infiltration losses assumed in computing runoff from the SPS should correspond to those considered reasonably likely to occur during storms of such magnitude, estimated on the basis of data obtained from the analys s of rainfall-runoff relations in major floods of record.

c. The same principles referred to above should be followed in the selection of unit hydrographs, in flood routing computations, and in other calculations related to the development of the SPF hydrographs.

d. Appropriate allowances should be made for variations in the areal distribution and sequence of rainfall over the basin during the SPS. The SPS rainfall estimate should be prepared in suitable form to permit significant variations in areal distribution, sequence, and intensities to be taken into consideration in computing runoff hydrographs.

e. In some cases, particularly with respect to very large drainage basins, the Standard Project Flood hydrograph estimate may, of necessity, be based on a study of actual hydrographs or stages of record, or on other procedures not involving directly a SPS estimate. In such cases, the general principles and objectives presented for the development of SPF estimates from rainfall and run-off criteria should serve as a guide.

f. It is apparent from a study of depth-area-duration data for major storms, and general consideration of the relative opportunities for drainage basins of various sizes, shapes and locations to be subjected to rainfall occurrences of SPS category, that the statistical probability of SPF occurrence would vary with size of drainage area and other hydrometeorological factors. For these, and a number of other reasons that might be listed, it is not considered feasible to assign specific frequency estimates to SPF determinations in general.

g. Where only the highest peak discharge of a SPF hydrograph is pertinent to specific project studies, the SPF may be referred to by that peak discharge as a matter of convenience.

1-05. STANDARD PROJECT FLOOD SERIES

Practically all detailed studies of unusual storms completed to date have been limited to durations of 120 hours or less. In the development of standard project flood criteria for very large drainage basins or those in which reservoirs serve to modulate runoff rates to a substantial extent, it is necessary to consider runoff resulting from rainfall over a substantially longer period than 120 hours. In some cases, runoff for a period of weeks or months prior to the occurrence of an extraordinary 120-hour storm must be taken into account in studies related to specific projects. It is apparent that the computation of hypothetical hydrographs covering such an extended length of time, following procedures involving storm rainfall data and application of the unit hydrograph technique, would be very laborious and subject to many uncertainties as to proper basic assumptions and criteria. These difficulties can be circumvented satisfactorily in most cases by developing a "standard project flood series" in

which hydrographs for periods antecedent to and subsequent to a standard project storm of 120-hours duration are represented by flows actually observed in the basin, with such adjustments as may be deemed appropriate after a general study of flood and storm characteristics in the region involved.

1-06. BASIC FLOOD ESTIMATES IN PLANNING AND DESIGN OF PROJECTS.

a. General. Flood magnitudes in a particular drainage basin are governed by combinations of many variable factors, the most important being the quantity, intensity, sequence and areal distribution of precipitation, the infiltration capacity of the soil, and natural and artificial storage effects during floods. Compensating variations in these several factors usually serve to reduce flood runoff rates and volumes to values far below those that would result from critical combinations of such factors. Where relatively long-period records of stream flow are available, statistical analyses of the record provide a valuable means of estimating the magnitude of flood flows that may be expected with frequencies bearing a reasonable relationship to the period of observation. Statistical studies involving consideration of flow records of numerous streams in a region of reasonably comparable hydrologic and meteorological influences provide more reliable estimates of maximum flood potentialities and average frequencies of commonly observed flood magnitudes than can be obtained from studies of individual station records. However, because of the number and range of variation in independent variables involved and the wide range between flood magnitudes that would result from optimum combinations of critical flood-producing factors as compared with combinations generally observed, statistical analyses of actual stream flow records seldom, if ever, provide a reliable indication of extraordinary flood potentialities of a specific drainage basin. Accordingly, in the planning and design of major engineering projects for the regulation of stream flow, statistical analyses of stream flow records must be supplemented by hypothetical flood estimates based on scientific studies of principal flood-producing factors individually and in various combinations.

b. In accordance with the preceding discussion, three classes of basic flood estimates are required in general flood control planning and design investigations:

(1) Statistical Analyses of Stream Flow Records, including flood-frequency estimates (preferably on a regionalized basis) and various correlations of flood characteristics and hydrologic features of the drainage basin.

(2) Standard Project Flood (Abbrev. SPF) Estimates representing flood discharges that may be expected from the most severe combination of meteorologic and hydrologic conditions that are considered reasonably characteristic of the geographical region involved, excluding extremely rare combinations.

(3) Maximum Probable (or "Maximum Possible)" Flood Estimates representing flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

c. Statistical Flood Studies of several types have proven useful in engineering investigations, the most prevalent consisting of flood-frequency estimates. Flood-frequency determinations are used primarily as a basis for estimating the mean annual benefits that may be expected from the control or reduction of floods of relatively common occurrence.

d. Standard Project Flood estimate serves the following primary purposes:

(1) Represents a "standard" against which the degree of protection finally selected for a project may be judged and compared with protection provided at similar projects in other localities. The SPF estimate must reflect a generalized analysis of flood potentialities in a region, as contrasted to an analysis of flood records at the specific locality that may be misleading because of the inadequacies of records or abnormal sequences of hydrologic events during the period of stream flow observation.

(2) Represent the flood discharge that should be selected as the design flood for the project, or approached as nearly as practicable in consideration of economic or other governing limitations, where some small degree of risk can be accepted but an unusually high degree of protection is justified by hazards to life and high property values within the area to be protected. Estimates completed to date indicate that SPF flood discharges are generally equal to 40 to 60 percent of "maximum probable" floods for the same basins.

e. Maximum Probable (or Maximum Possible) Flood estimates are applicable to projects where consideration is to be given to virtually complete security against potential floods. Applications of such estimates are usually confined to the determination of spillway requirements for high dams, but in unusual cases may constitute the design flood for local protection works where an exceptionally high degree of protection is advisable and economically obtainable.

1-07. DESIGN FLOOD

a. The term "design flood" refers to the flood hydrograph or peak discharge value finally adopted as the basis for design of a particular project or section thereof after full consideration has been given to flood characteristics, frequencies, and potentialities, and the economic and other practical considerations entering into selection of the design discharge criteria. The term "design flood" is synonymous with "project design flood", although use of the latter term has been generally discontinued in order to avoid possible confusion with the term "standard project flood". For convenience in reference, such terms as "spillway design flood", "levee design flood", "channel design flood", etc., are used where appropriate.

b. The term "design flood" or "reservoir design flood" may be applied to the most severe flood that a particular reservoir may be capable of controlling under an adopted plan of operation but such usage has little value except where the reservoir is provided primarily for protection of damage centers near the dam. Usually selection of the flood control allocation in a reservoir is governed by consideration of flood control effects at several locations downstream, involving the analysis of a number of flood situations. Accordingly, application of the term "design flood" or "reservoir design flood" should be limited to those cases in which the term is actually indicative of the basis for a flood control storage allocation, more detailed criteria being specified for other cases.

1-08. RELATION OF SPF TO DESIGN FLOOD

a. In the design of flood control projects it would of course be desirable to provide protection against the maximum probable flood, if this were feasible within acceptable limits of cost. However, it is seldom practicable to provide absolute flood protection by means of local protection projects or reservoirs: - usually the costs are too high, and in many cases the acquisition of adequate rights-of-way for the purpose would involve unreasonably destruction or modifications of properties along the floodway. As a rule, some risk must be accepted in the selection of design flood discharges. A decision as to how much risk should be accepted in each case is of utmost importance and should be based on careful consideration of flood characteristics and potentialities in the basin, the class of area to be protected, and economic limitations.

b. The "design flood" for a particular project may be either greater or less than the standard project flood, depending to an important extent upon economic factors and other practical considerations governing the selection of design capacity in a specific case. However, selections should not be governed by estimates of average annual benefits of a tangible nature alone, nor should construction difficulties that may prove troublesome but not insurmountable be allowed to dictate the design flood selection, particularly where protection of high class urban or agricultural areas is involved. Intangible benefits, resulting from provision of a high degree of security against floods of a disastrous magnitude, including the protection of human life, must be considered in addition to tangible benefits that may be estimated in monetary terms.

c. The Standard Project Flood is intended as a practicable expression of the degree of protection that should be sought as a general rule in the design of flood control works for communities where protection of human life and unusually high-valued property is involved. Inasmuch as SPF estimates are to be based on generalized studies of meteorologic and hydrologic conditions in a region, the SPF estimates provides a basis for comparing the degree of protection provided by flood control projects in different localities, thus promoting a more consistent policy with respect to selection of design flood giving a comparable degree of protection for similar classes of property.

II. GENERALIZED SPS ESTIMATES FOR SMALL DRAINAGE BASINS

2-01. GENERAL

a. The criteria presented in this section apply specifically to drainage areas east of 105° longitude and primarily to basins less than approximately 1000 square miles in area. The rainfall criteria are basined primarily on analysis of major storms of record that have occurred in the spring, summer and fall seasons, during which convective activity is prominent. The criteria are not generally applicable to snow seasons without special adjustments. Inasmuch as records indicate that the most severe (but not necessarily the most frequent) floods in drainage areas of less than a few thousand square miles, within the area covered by the generalized charts, usually result from intense rainfall during the non-snow season, the criteria presented hereinafter are considered applicable in the computation of SPF estimates for most basins. Where this conclusion is not considered applicable by the reporting engineer, development of the SPS estimate should be based on a special study of flood producing factors affecting the particular basin. It is anticipated that such exceptions will apply only where runoff from snow melt, with or without coincident rainfall, is a major factor in the production of unusual floods.

b. Various approaches to the standardization of methods and criteria related to the computation of SPS and SPF estimates have been studied during the past two years. Because of the variability of factors involved, limitations in basic data, and th nature of the problem, certain arbitrary assumptions and simplifications of criteria have been necessary to obtain results suitable for practical use. Although any standardization of criteria must involve certain approximations, it has been concluded that adoption of generalized rainfall criteria substantially as presented herein is advisable for the purpose of assuring consistency between SPF estimates prepared by various offices, as well as to minimize work required in the preparation of estimates.

c. The development of generalized SPS rainfall criteria for drainage areas less than approximately 1000 square miles, located east of 105° longitude, is revealed generally by the explanation of plates in the following paragraph.

2-02. EXPLANATION OF PLATES

a. Plate 1. Generalized Estimates, Maximum Possible Precipitation. The isohyets on this chart represent the maximum probable 24-hour rainfall over 200 square miles area, as estimated by the Hydrometeorological Section of the U. S. Weather Bureau and explained in HMS Report No. 23.

b. Plate 2. SPS Index Rainfall. The isohyetes on Plate 2 represent the maximum average depth of rainfall in 24 hours over 200 square miles during the standard project storm, which is equal to approximately 40 to 60 percent of the maximum possible rainfall indicated on Plate 1, with a general average of about 50 percent. Plate 2 was prepared by reducing isohyets on Plate 1 to 50 percent of original values and reshaping the isohyets in certain regions by moderate amounts to conform with supplementary studies of rainfall characteristics in those regions During development studies similar charts were prepared for selected areas ranging from 10 to 20,000 square miles and storm durations from 6 to 96 hours. It was found that depth-area-duration values for these several charts bore a reasonably consistent relationship to values shown on Plate 2. Accordingly, Plate 2 was adopted as the "SPS Index Rainfall" chart, the use of which is explained hereinafter.

c. Plate 3. SPS Index Rainfall Isohyets vs Actual Storm Values. This chart shows graphically a comparison between the selected SPS Index Rainfall isohyets and rainfall values recorded during actual storms in various geographical locations for comparable durations and areas. Data from all storm studies completed to date (approx, 400) are shown on the chart.

d. Plate 4. Ratio of Actual Storm Values to SPS Index Rainfall. In Figure (a) of Plate 4 the rainfall values recorded in actual storms, as shown on Plate 3, are plotted against values indicated by SPS Index Rainfall isohyets for corresponding geographical locations. The number of actual storm values exceeding various percentages of the SPS Index Rainfall are shown graphically in Figure (a) and the percentages of actual storm values that equalled or exceeded various SPS Index Rainfall ratios are indicated in Figure (b). To demonstrate the relative consistency of relationships in different geographical areas, separate curves are plotted in Figure (b) for four areas, delineated by SPS Index Rainfall isohyets as indicated on Plate 4, as well as for the total area east of 105° longitude. It may be observed that on the average approximately 10 percent of the storms studied to date have equalled or exceeded the SPS Index Rainfall. This percentage will of course vary as additional storm studies are completed, but serves to illustrate that the standard project storm is not of unprecedented magnitude regionally, although it is definitely of a major category.

e. Plate 5. Tabulation, Precipitation During Major Storms of Record, Expressed in Percent of SPS Index Rainfall. In preparing this table the geographical location of maximum rainfall during each storm of record was determined by 2-degree latitude-longitude quadrangles, and the corresponding SPS Index Rainfall value was scaled from Plate 2; the average depths of rainfall over selected areas in various periods of time were obtained for the Corps of Engineers publications entitled "Storm Rainfall in the Eastern United States", and converted to percent of SPS Index Rainfall, as shown in Plate 5. For study purposes, the data were tabulated by geographical zones as delineated on Plate 2. Plate 5 includes 105 of the more outstanding storms of the 400 investigated in detail.

f. Plate 6. Generalized Depth-Area-Curves, 24-Hour Rainfall. Considering all storms tabulated in Plate 5, the 24-hour values of Index Rainfall Ratios (i.e. Percent of Index Rainfall) were arranged in order of diminishing magnitude for each of the areas designated in the column headings of Plate 5. The number of Index Rainfall Ratios exceeding various values was determined and converted to percent of the total number of storms studies (approx. 400). The curve on Plate 6 designated as "Maximum Observed" was obtained by plotting the highest value of Index Rainfall Ratio for each area and drawing a smooth curve to envelope the plotted points. The set of curves number 1E, 5E, and 10E was obtained by plotting for each selected area the values of Index Rainfall Ratio equalled or exceeded by 1 percent, 5 percent, and 10 percent, respectively, of the total number of values. For purpose of comparison, the set of curves designated as 1A, 5A, 10A, 25A and 50A were obtained by plotting the mean of the highest 1 percent, 5 percent, 10 percent, etc., of the Index Rainfall Ratios for the selected areas.

g. Plates 7 and 8. These Plates were prepared in the same manner as Plate 6, using data applicable to 48-hour and 96-hour storm periods, respectively.

h. Plates 9. SPS Depth-Area-Duration Relationships by 24-Hour Storm Increments. Following a general review of the problem and data analyzed, Curves Nos. 25A on Plates 6, 7, and 8 were selected as indices to the volume of precipitation that should be assumed as occuring in 24, 48, and 96-hour periods of Standard Project Storms. Plate 9 represents a replotting of Curves 25A from Plates 6, 7, and 8, with an interpolated curve for the 72-hour duration, for convenience in use. Applications of the cures in preparing SPS estimates for basins of various sizes are discussed hereinafter.

i. Plate 10. Time-Distribution of 24-Hour SPS Rainfall. In developing Plate 10, charts similar to Plate 2 were prepared from data recorded in actual storms to represent the maximum rainfall in 6 and 12 hours, respectively, over selected areas of less than 1000 sq.miles Correlations of maximum 6-hour and 12-hour rainfall values with the SPS Index Rainfall values for various geographical locations resulted in curves substantially as indicated in Fig (a) of Plate 10. Supplementary studies using different methods of approach substantiated the results obtained by the first method within acceptable limits of variation. A relatively extensive study of hydrographs of actual storms showed that the maximum 6-hour rainfall may occur near the beginning, middle or end of the maximum 24-hour rainfall period of a storm. Accordingly, the sequence of 6-hour rainfall increments indicated in Fig (b) of Plate 10 was selected for SPS estimates applicable to drainage areas of approximetely 1000 sq.mi. and less, on the basis that such a sequence would produce critical runoff from most basins. Procedures for estimating time-distribution of rainfall in SPS estimates for drainage basins larger than approximately 1000 sq.mi. are outlined hereinafter.

j. Plate 11. Time-Distribution of Maximum 6-Hour SPS Rainfall Analyses of major storms approaching SPS intensities over areas of a few hundred square miles or larger show that the rate of rainfall is usually fairly uniform during the maximum 6-hour period of the storm, with exception of intermittent short-period variations which usually produce only small variations in stream-flow rates at downstream points after valley storage has modulated local variations in surface runoff. Rainfall rates during less intense 6-hour periods of the storm are generally more erratic, and may follow many different sequences and rate changes in different storms. However, studies indicate that assumption of uniform rainfall intensities during successive 6-hour periods of the SPS, with exception of the maximum 6-hr. period of SPS estimates applicable to small drainage basins, would give satisfactory flood discharge estimates if reasonable conservatism is exercised in estimating infiltration losses and unit hydrographs. In order to assure safe estimates of peak discharges to be expected from SPS rainfall over drainage areas less than approximately 300 square miles on the average, the maximum 6-hour rainfall of the SPS should be broken down into shorter unit periods and higher intensities assumed for the shorter intervals according to criteria presented on Plate 11.

k. Plate 12, SPS Isohyetal Pattern. Studies of isohyetal patterns resulting from storms in which the maximum 6 or 12-hour rainfall is generally comparable to SPS values reveal that the patterns over a few thousand square miles or less are usually elliptical in shape and that the longer axis may be oriented in any direction, unless topographical influences are pronounced. Within these general limits, a wide variety of patterns might be selected with equal validity. To simplify SPS computations in which areal distribution of precipitation has an important influence on run-off rates and volumes, a typical isohyetal pattern is presented on Plate 12. The application of this isohyetal pattern is explained later.

l. Plates 13, 14 and 15. These relate to illustrative examples, as discussed hereinafter.

2-03. PREPARATION OF SPS ESTIMATES FOR SMALL DRAINAGE BASINS (LESS THAN 1000 SQ. MI.)

a. General. The preparation of a SPS estimate for a small drainage basin utilizing generalized criteria presented on Plates 2 and 9 to 12 involves the following steps:

(1) Interpolate from generalized isohyets on Plate 2 the SPS index rainfall corresponding to the location of the drainage basin under study (referred to hereinafter as "project basin").

(2) Enter Plate 9 with the SPS Index Rainfall value determined in step (1) to obtain the SPS Index Rainfall Ratios corresponding to 24, 48, 72 and 96-hour periods and an area equal to the total area of the project basin. Multiply these ratios by the SPS Index Rainfall to obtain average depths of rainfall within an isohyetal area equal to the drainage area of the project basin, and determine incremental 24-hour values by subtraction.

(3) Arrange the 24-hour SPS rainfall values determined in step (2) in a sequence favorable to production of critical runoff at project locations under consideration, based on a general appraisal of hydrologic conditions in the project basin.

(4) Prepare an overlay of the isohyetal map shown on Plate 12, converting the isohyet values to inches of 96-hour SPS rainfall by multiplying the percentage values on Plate 12 by the SPS index Rainfall value determined in step (1).

(5) Superimpose the project basin outline over the total-storm isohyetal map obtained in step (4), and planimeter to determine the average depth of total-storm rainfall over the basin and each sub-division thereof that is to be considered in estimating the SPS rainfall-excess and runoff rates.

(6) Subdivide the total-storm SPS rainfall values obtained in step (5) into 6-hour values in accordance with criteria presented on Plate 10. The same sequence and 6-hourly percentage distribution of rainfall is assumed for each day of the SPS.

(7) If the computed value of "t_p" for the drainage are under study, or important subdivisions thereof for which SPF discharges are desired, is less than 16 hours, subdivide the maximum 6-hour SPS rainfall value of the maximum 24-hour rainfall into shorter unit durations in accordance with criteria presented on Plate 11. (See p. 11 of reference cited in paragraph 1-01 for explanation of "t_p" and method of computation).

(8) Subtract estimated infiltration losses from SPS Rainfall values obtained in steps (6) and (7) to obtain rainfall-excess quantities to be used with unit hydrographs in computing SPF discharges.

b. Simplification of Procedure in Special Cases. If analyses of rainfall and runoff records in the project basin or comparable watersheds indicate that infiltration capacities over the basin are relatively uniform, and subdivision of the drainage basin for hydrologic reasons is not otherwise required for project study purposes, the general procedure outlined above may be simplified by omitting preparation of the isohyetal pattern referred to in step (4), simply using the depth-area curve values obtained in step (3), without correction for basin shape.

c. Illustrative Example: Computation of SPS rainfall for a sample drainage basin following the steps outlined in subparagraph a above is demonstrated on Plate 14. The drainage basin and isohyetal overlay (step 4) are shown on Plate 13. In this case, the existence of a flood-control reservoir in the area is assumed in order to demonstrate the centering of the storm over the uncontrolled area and the computation of rainfall for the controlled and uncontrolled areas separately. Explanation of the computation is as follows:

(1) Lines 1 to 5 establish the index rainfall and the magnitude and time arrangement of 24-hour rainfall amounts that would be obtained for the entire basin without reduction for the fact that the storm isohyets do not conform to the shape of the basin.

(2) Lines 6 to 12 incorporate the adjustment required for basin shape and the subdivision of rainfall among sub-basins. These lines can be eliminated where these refinements are not required. Values given in lines 6 to 8 were obtained by planimetering isohyets on Plate 13. Values of line 9 are those of line 5 divided by the total-storm rainfall (15.7 inches). Values of lines 10 to 12 are obtained by multiplying values of line 5 by those of lines 6 to 8 respectively.

(3) Lines 13 to 21 establish the hyetographs for each area. Six-hour percentage of maximum 24-hour rainfall obtained from Plate 10, are applied to each successive 24-hour period of rainfall. These are multiplied by respective values in lines 10-12 to obtain 6-hour rainfall amounts in lines 14 to 16. The tabulation on Plate 13 indicates that t_R is 3 hours in this case (see Plate 11). Appropriate percentages of maximum 6-hour rainfall in 3-hour intervals shown on Plate 11 are entered in line 18, Plate 14. These are multiplied by the respective values of the 66-hour column, lines 14 to 16, to obtain 3-hour amounts on lines 19 to 21.

(4) Lines 22 to 29 establish rainfall excess amounts. Infiltration losses (lines 22 and 23) are subtracted from rainfall amounts for the sub-areas A and B to obtain rainfall excess amounts for those sub-areas (lines 24 and 25). These are converted to volumes (lines 26 and 27, and are added to obtain rainfall-excess volumes for the total area (line 28). These volumes divided by the total area yield average rainfall-excess depths for the total area (line 29). Values of line 24 and 25 would be used in conjunction with unit hydrographs for the subareas in this case because of the existence of a flood-control reservoir at the lower end of area A. In cases where subdivision of the area is made only to account for areal differences in loss rates, values of line 29 can be used in conjunction with a unit hydrograph for the entire area.

2-04. APPROXIMATION OF SPF AS PERCENTAGE OF MAXIMUM PROBABLE FLOOD. As stated in sub-paragraph 1-06 d (2), estimates completed to date indicate that SPF discharges based on detailed studies usually equal 40 to 60 percent of the maximum probable (or "maximum possible") flood for the same basin; a ratio of 50 percent is considered representative of average conditions. Inasmuch as computation of maximum probable flood estimates are normally required as the basis of design of spillways for high dams, it is convenient to estimate the SPF for reservoir projects as equal to 50 percent of the maximum probable flood hydrograph to avoid the preparation of a separate SPF estimate (see paragraph 1-05 and 3-02 d regarding SPF series). Accordingly, this convention is acceptable for reservoir projects in general. The rule may also be applied in estimating SPF hydrographs for basins outside of the region and range of areas covered by generalized charts presented herein where maximum probable flood estimates based on detailed hydrometeorological investigations have been completed. Where snow melt or extreme

ranges in topography are major factors to be taken into consideration, it is appropriate to estimate the maximum probable flood hydrograph for the basin by considering optimum combinations of critical flood-producing factors and assuming the SPF hydrographs is equal to 90 percent of the maximum probable discharges. This approximation is based on the conclusion that critical conditions can be determined from analyses of meteorological and topographic influences, whereas a substantial period of hydrometeorological records are required to determine appropriate combinations of flood producing factors meeting SPF specifications.

III. SPS ESTIMATES FOR LARGE DRAINAGE BASINS

3-01. GENERAL. The basic principles involved in the preparation of SPS and SPF estimates for large drainage basins are the same as those applicable to basins less than 1000 square miles in area, which have been discussed in Section II. However, generalizations of criteria become more difficult as the size of area increases. Whereas SPF discharge estimates for small areas are usually governed largely by the maximum 6 or 12-hour rainfall associated with a severe thunderstorm situation, floods of SPF category on large drainage basins are generally the result of a succession of relatively distinct rainfall events. Although the intensity and quantities of rainfall are important factors in the production of a flood in a large drainage basin, the location of successive increments of rainfall in the basin, and the syncronization of intense bursts of rainfall with progression of runoff, are of equal or greater importance in many cases than quantity of total precipitation. For example, the total rainfall over the Kansas River basin during the period 25-31 May 1903, which produced an estimated peak discharge of 260,000 cfs on the Kansas River at Kansas City, was almost identical with the total precipitation that occurred over the basin 9-12 July 1951 to produce a peak discharge of 510,000 cfs. Other examples of a similar nature might be cited. Accordingly, selection of a SPS for a large basin cannot be predicated on a statistical analysis of precepitation quantities alone, but must be based on a review of hydrometeorological data for several outstanding storms of record in the basin and adjacent regions in relation to hydrologic characteristics of the basin under study. Consideration of major floods of record and historical account should also play an important part in the selection of SPF criteria and final estimate.

3-02. EXAMPLE: SPS ESTIMATE FOR CUMBERLAND RIVER ABOVE OLD HICKORY DAM SITE (11,700 SQ. MI.).

a. Selection of Model Storm for SPS Estimate. Following is a chronological outline of the procedure used:

(1) Using the Corps of Engineers publication "Storm Rainfall in the United States, Depth-Area-Duration Data", approximately 30 storms of record within a few hundred miles of the Cumberland basin were tentatively listed for transposition. To limit the number, only those storms that produced rainfall exceeding an average of 6 inches over 5,000 sq. mi. were included. The average depth of rainfall over 5,000 and 10,000 sq. mi. was listed for purpose of comparison.

(2) Following a preliminary inspection of data referred to above, it was evident that winter-season storms were predominantly the most severe for the area involved, and that ground conditions would be most favorable for flood runoff during the winter. Accordingly, the list of storms cited in sub-paragraph a was reduced by eliminating the less important Summer and Fall Storms, and also certain winter storms that did not show isohyetal patters oriented favorably for transposition to the Cumberland basin. The final list of 19 storms considered for transposition is shown in table A of Plate 15.

(3) The list of 19 storms was referred to the Hydrometeorological Section of the Weather Bureau for an opinion regarding transposibility and for an estimate of adjustment required. Two transpositions of the 5,000 sq. mi. center area of each storm were considered, one transposition being made to the lower Cumberland basin (center at Clarksville, Tenn.) and the other to the Upper basin (center at Burnside, Ky.) The transposition adjustment factors furnished by the Weather Bureau are listed in the 5th and 6th columns of Table A, Plate 15.

(4) In order to facilitate a comparison of the relative magnitudes of rainfall quantities that might be expected over various size areas and in selected periods of time, the tabulation shown in Table A, Plate 15, was completed by multiplying the rainfall values observed in the respective storms by the average of the Clarksville and Burnside transposition factors.

(5) Inasmuch as rainfall values listed in Table A of Plate 15 represent average depths within isohyets that differ from the shape of the Cumberland watershed, adjustment for such differences is necessary to determine the quantity of rainfall that would fall on the watershed during the transposed storm. To minimize work, "basin shape" factors were computed only for the seven most important storms, as listed in Table B of Plate 15. The basin shape factor for each storm was determined by superimposing the basin outline over the total-storm isohyetal map prepared in the Part II Storm Study, planimetering to determine the average depth of rainfall within the basin outline, and dividing this value by the average rainfall depth for a corresponding size area as read from the maximum depth-area-curve for the storm. Results are listed in the 5th, 6th, and 7th columns of Table B, Plate 15.

(6) Depth-area-duration data for the seven most important storms included in the study, including adjustments for transposition and basin shape, are tabulated in Table B, Plate 15. Following a general comparison of data shown on Table B, consideration of seasonal characteristics of floods in the basin and the probable effects of reservoir operations on the regulation of runoff, the transposed and adjusted storm of 23-27 March 1913 (OR 1-15) was selected as the 120 hour SPS for the Cumberland basin above Old Hickory, Tenn.

(7) Average rainfall and rainfall-excess quantities for 7 sub-divisions of the drainage area were computed by 6-hour time intervals during the 120-hour SPS, as explained in paragraph 3-02 b.

(8) Criteria for the preparation of the SPF Series for the drainage area above Old Hickory, Tenn., were established in the manner explained in paragraph 3-02 d.

Footnote: Permissible rotation of isohyetal pattern was assumed as 20 degrees, but was less in the seven storms listed in Table B of Plate 15.

b. Example: Computation of SPS Rainfall and Rainfall Excess for Cumberland River Basin above Old Hickory Dam Site.

(1) The outline of the Cumberland basin was superimposed over the total-storm isohyetal map of the 23-27 March 1913 (OR 1-15 storm in the same position assumed in computing the "basin shape" factor referred to in sub-paragraph 3-02 a (5). Portions of the isohyetal map within each of seven sub-divisions of the basin were planimetered to determine the average depth of total-storm rainfall before adjustment for tranposition.

(2) The transposition adjustment factor for each of the seven sub-areas of the basin were interpolated on a straight line basis from values determined by the Hydrometeorological Section of the Weather Bureau, for Clarksville, Tenn., and Burnside, Ky. The total storm rainfall values computed for each of seven sub-areas were multiplied by the appropriate transposition factors to obtain the total-storm SPS precipitation for the area.

(3) Precipitation stations within the outline of the Cumberland basin as superimposed on the isohyetal map in step (1), and stations immediately adjacent thereto, were listed on Storm Study Form S-10, grouping the stations as they appeared in the sub-areas. The accumulative precipitation at each of these stations was then copied from the Form S-10 tabulations of the Part II Storm Study data.

(4) Average mass curves of unadjusted rainfall for the 23-27 March 1913 storm (OR 1-15) were computed by 6 hour intervals for each of the seven sub-areas of the basin, using data compiled in steps (1) and (3), following the same procedure used in computing average mass curves for "zones" in Part II Storm Studies (See Supplement C to Engineer Bulletin R&H No. 10, 1938 Form S-12). These average mass curve values were then adjusted to correspond to the SPS rainfall values for the respective sub-areas, and 6-hour increments of rainfall during the SPS were reduced from this curve.

(5) Rainfall-excess during successive 6-hour periods of the SPS were computed by subtracting losses corresponding to an infiltration index of 0.02 inch per hour, which conforms to values deduced from an analysis of a number of actual winter floods in the area.

c. Variation in Procedure in Computing Rainfall-Excess. In computing rainfall-excess values for the 120-hour SPS discussed in paragraph 3-02 b, 6-hour average losses over each sub-area were subtracted from 6-hour average rainfall values for the same composite area. Treatment of each sub-area as a unit was satisfactory in the particular study because of the very low infiltration index involved. However, in studies applicable to drainage basins of similar size in which infiltration losses are relatively high, rainfall-excess quantities should be computed for area sub-division corresponding to Thiessen polygons surrounding each precipitation station, in order that appropriate allowances may be made for areas not covered by rainfall exceeding losses during each period of the storm.

d. Example: SPF Series. The derivation of a "SPF Series" for the 11,700 sq. mi. drainage of the Cumberland River basin above Old Hickory, Tenn., covering a 4 ½ month period from 23 Dec to 7 May is outlined below:

(1) Flows for a three-month period antecedent to the SPF flood were assumed as equal to daily discharges recorded during the period from 23 Dec 1932 to 22 Mar 1933. The purpose of including the "antecedent" flows was to provide a concrete basis of determining the status in existing and anticipated reservoirs in the basin corresponding to runoff conditions considered reasonably likely to prevail prior to the SPF. Runoff during the three-month period selected was approximately 25 percent above the average observed for the months of January, February and March over a 29-year period of record from 1919 to 1947. The flows by months were also distributed fairly uniformly and variations were fairly representative of flood sequence observed during the period of record, excluding a few years of extraordinary flood occurrences. Although the general criteria adopted for selection of the "antecedent" flow data are in this case arbitrary and subject to appreciable variations on the basis of personal judgment, the procedure was adopted as an expedient in view of the necessity of taking into account the effects of antecedent conditions on routing of the SPF. It is apparent that the criteria followed will require variations in other circumstances, but it is believed that reasonable results may be obtained by exercise of judgment on the part of hydraulic engineers responsible for such studies.

(2) Flows for the 15-day period from 23 Mar to 7 Apr were computed from rainfall-excess estimates derived from the selected 120-hour standard project storm which was based on a transposition of the 23-27 Mar 1913 storm (OR 1-15) as discussed in paragraph 3-02 b.

(3) Flows for a 30-day period subsequent to the SPF were assumed as equal to daily discharge recorded during the period from 8 Apr to 7 May 1933. The 30-day period of flows "subsequent" to the SPF was included to permit a calculation of the time required to draw down the reservoirs if runoff should equal approximately the average observed for corresponding period over the period of record. In general, the derivation of a SPF Series is required only when runoff before or after the SPF is likely to influence conclusions reached by routing the SPF hydrograph thru storage.

3-03. USE OF SPS GENERALIZED DEPTH-AREA CURVES IN SELECTION OF STORMS FOR COMPARISON. The generalized curves and data shown on Plates 5 to 9, may be used in the selection of storms for detailed comparison in preparing SPS estimates for drainage basins up to 20,000 square miles, in lieu of the procedure outlined in sub-paragraph 3-02 a. In this manner the number of storms requiring detailed study to determine critical flood producing capabilities may be reduced to a small number. The remainder of the procedure should be substantially as outlined in paragraphs 3-02 b to 3-02 d.

IV. PROJECTS FOR WHICH SPF ESTIMATES ARE REQUIRED

4-01. GENERAL. The purpose to be served by SPF estimates are discussed briefly in paragraphs 1-06 and 1-08. In some cases the SPF estimate may have a major bearing on selection of the design flood for a particular project, whereas in other cases the estimate may serve only as an indication of the partial degree of protection proposed for the project. SPF estimates are useful in connection with practically all flood control investigations but to reduce the work required in project studies, preparation of SPF estimates is required only for those projects in which the proposed design flood is more than one of estimated 25-year frequency. To further reduce the work involved, approximate estimates are acceptable where it is apparent that the design flood is strictly limited by economic considerations and is substantially less than the SPF. The basis of SPF estimates should be clearly stated in each case.

4-02. ORDERS & REGULATIONS. For convenience in reference paragraph 4208.11 (Revised March 1951) is quoted below:

"Describe any "standard project flood" estimate established as a criterion in analyzing flood possibilities and flood control requirements, give the basis for its derivation and compare it with floods of record and the "design flood" finally selected as a basis for the project design. Standard project flood determinations will be prepared for local flood protection projects intended to protect against floods (greater than those) having an average frequency of exceedence in the order of once in 25 years, and such estimates will be submitted to the Chief of Engineers for approval prior to incorporation into the survey report. Standard project flood estimates will be prepared for flood control and multiple-purpose reservoirs, but such estimates need not be submitted to the Chief of Engineers for advance approval unless considered advisable by the reporting officer. Estimates will be prepared substantially in accordance with technical instructions issued by the Chief of Engineers".

4-03. MAJOR DRAINAGE PROJECTS. In accordance with the O&R cited above, SPF estimates will not be required for "major drainage" projects unless such projects serve also to provide protection against floods greater than those having average frequency of approximately once in 25 years.

4-04. LOCAL PROTECTION PROJECTS. SPF determinations are required for local protection projects included in survey reports that are intended to provide protection against floods greater than those having an average frequency of occurrence of approximately one in 25 years. SPF estimates should also be included in Definite Project Reports, design memoranda, and other special reports pertaining to the selection of design flood criteria for local protection projects; in the event estimates have been submitted to OCE in reports bearing specifically on SPF determinations, inclusion of appropriate references and summaries of results will suffice for report purposes, although inclusion of details pertaining to prior SPF estimates as a matter of record is desirable where this can be accomplished without undue expense.

4-05. RESERVOIR PROJECTS. In some instances SPF estimates serve as the primary basis for selecting the storage capacity of flood control reservoirs, and in such cases the estimate should be prepared with substantially the same care and detailed study observed in connection with determinations for local protection projects of comparable importance. However, in most cases selection of storage and outlet capacities for reservoirs are governed by considerations other than the SPF estimate, in which case the SPF estimate is of secondary importance and may be approximated satisfactorily by assuming that the SPF equals 50 percent of the spillway design flood for the project. (See para 2-04.).

4-06. SUBMISSION OF SPF ESTIMATES TO OCE FOR APPROVAL PRIOR TO INCORPORATION IN REPORTS.

a. All SPF estimates required for inclusion in survey reports under instructions discussed above should be submitted to OCE for approval prior to incorporation in the survey reports, with the following exceptions:

(1) SPF estimates for small drainage areas (less than approximately 1000 sq.miles) based on generalized rainfall criteria and procedures presented herein need not be submitted to OCE for advance approval unless the reporting officer considers advance approval advisable in specific cases.

(2) SPF estimates prepared for individual reservoirs need not be submitted to OCE for advance approval unless the estimate constitutes the primary basis for selection of the reservoir storage and outlet capacities.

b. With reference to SPF estimates related to Definite Project Reports and special studies, attention is invited to O&R, paragraph 4214.10 h, in which submission of appendices or portions of reports covering hydrologic features for advance approval by OCE is outlined. SPF estimates required under instructions presented above should be included in such advance submissions. In special cases, conferences should be arranged to permit review of SPF estimates and related hydrologic determinations that have a major bearing on the selection of design floods for important projects.

c. SPF estimates submitted for approval of OCE should be accompanied by supporting information, and a statement indicating the purpose of the particular estimate and the probable influence that the estimate will have on selection of the design flood for the project involved (See paragraph 4-01).

BY THE ORDER OF THE CHIEF OF ENGINEERS:

/s/ Stanley G. Reiff

/t/ STANLEY G. REIFF
Colonel, Corps of Engineers
Executive
Civil Works

2 Incls
1 List of Plates
2 Plates 1 - 15 incl.
Distribution: (C/L No. 4358)
P-1,2,3 and 5
O

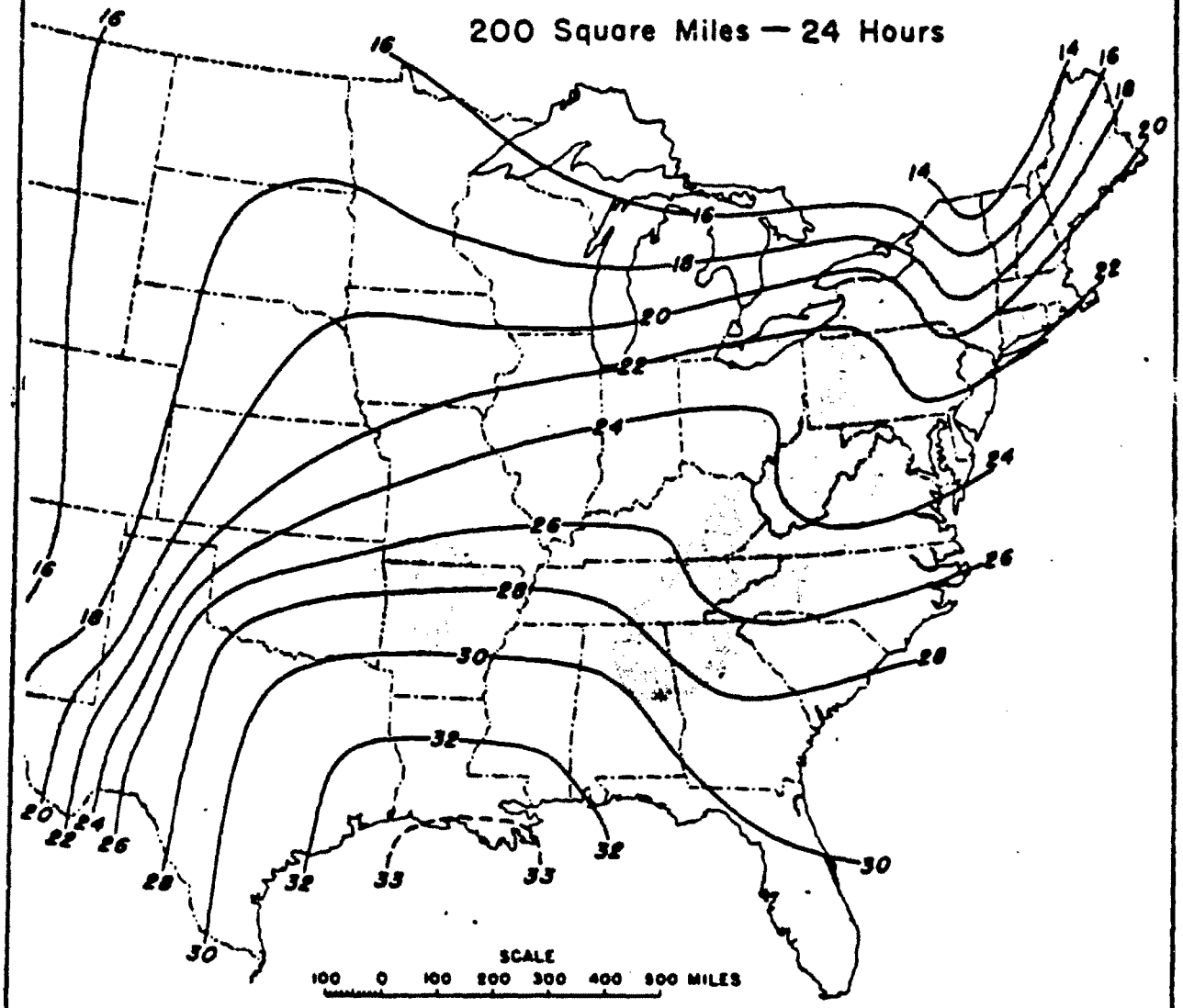
Civil Works Engineer Bulletin No. 52-8

STANDARD PROJECT FLOOD DETERMINATIONS

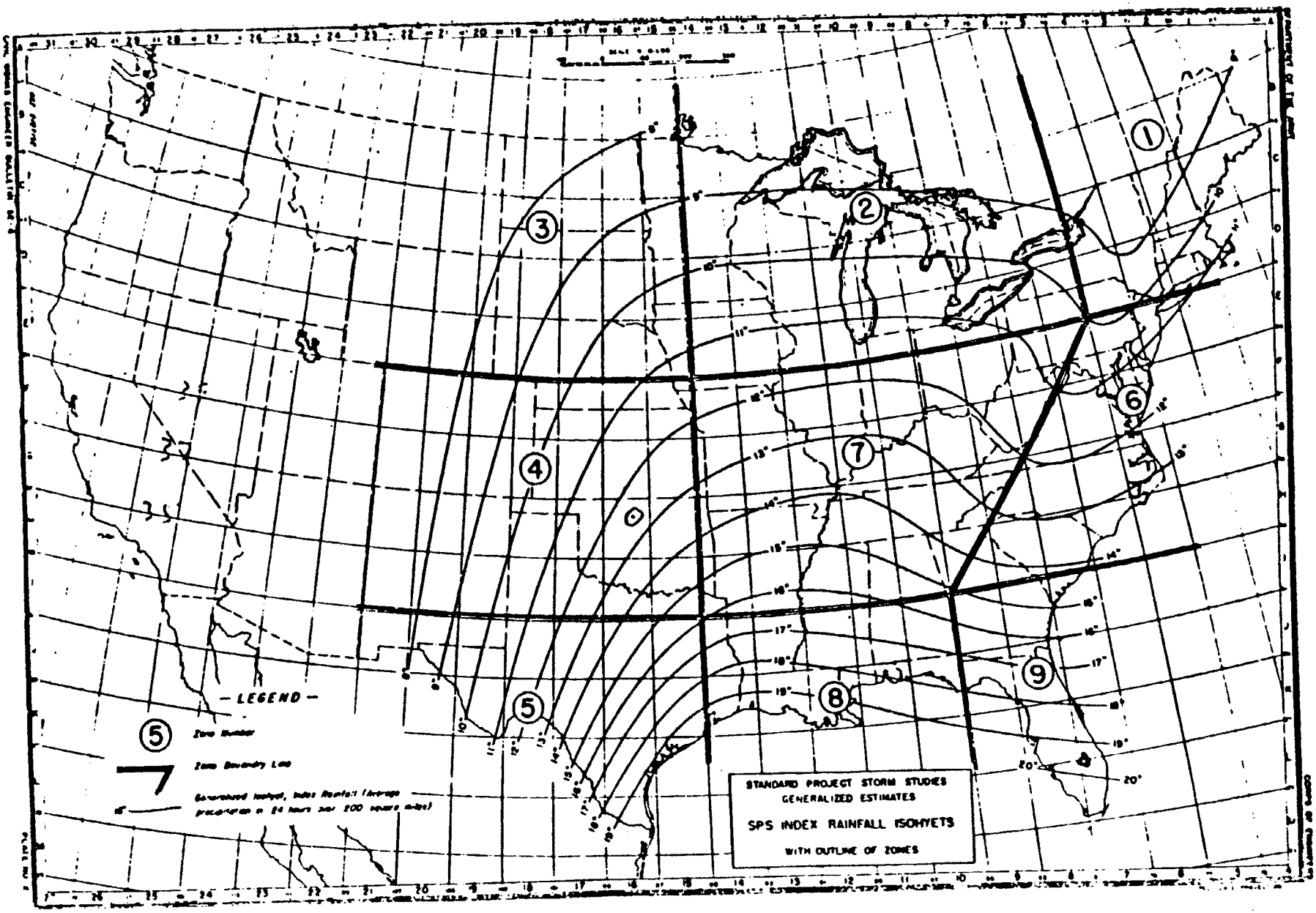
List of Plates

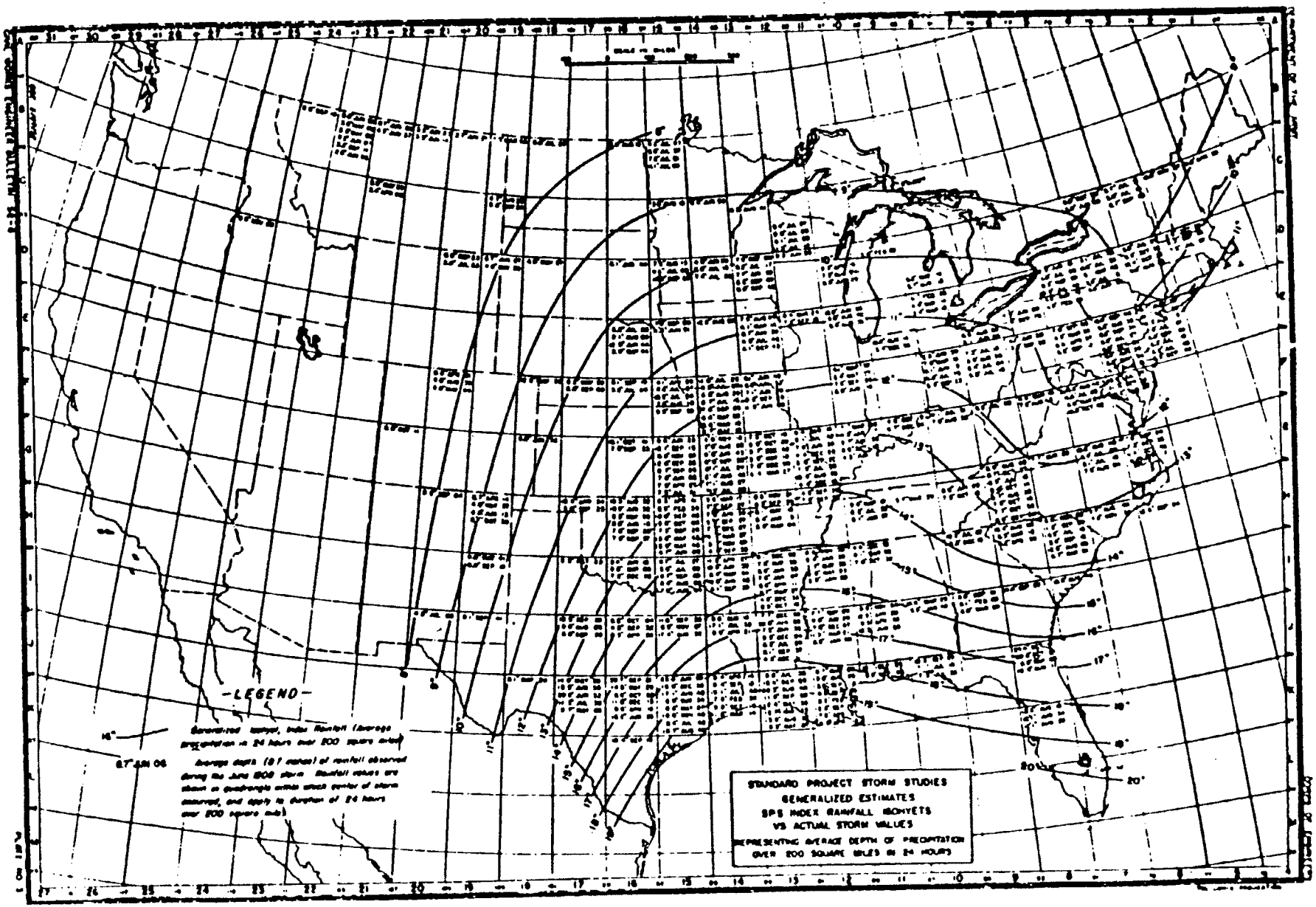
Plate No.	Subject
1	Chart from U. S. Weather Bureau's HMS Report No. 23, Generalized Estimates, Maximum Possible Precipitation, (Average Precipitation in 24 hours over 200 sq. mi.)
2	SPS Index Rainfall, with outline of Zones (Average Precipitation in 24 hours over 200 sq. mi.)
3	SPS Index Rainfall Isohyets vs Actual Storm Values (Representing Average Depth of Precipitation over 200 Square Miles in 24 Hours)
4	Ratio of Actual Storm Values to SPS Index Rainfall
5	Tabulation, Precipitation During Major Storms of Record in Percent of SPS Index Rainfall (In 2 sheets)
6	Generalized Depth-Area Curves, 24-Hour Rainfall
7	Generalized Depth-Area Curves 48-Hour Rainfall
8	Generalized Depth-Area Curves 96-Hour Rainfall
9	SPS Depth-Area-Duration Relationships by 24-Hour Storm Increments
10	Time Distribution of 24-Hour SPS Rainfall
11	Time Distribution of Maximum 6-Hour SPS Rainfall
12	SPS Isohyetal Pattern
13	Illustrative Example: Application of Isohyetal Pattern (Maximum 96-Hour Period of SPS)
14	Tabulation, Computation of Rainfall and Rainfall-Excess During SPS over Sample Drainage Basin.
15	Tabulation re Cumberland River Basin: Standard Project Storm Determination.

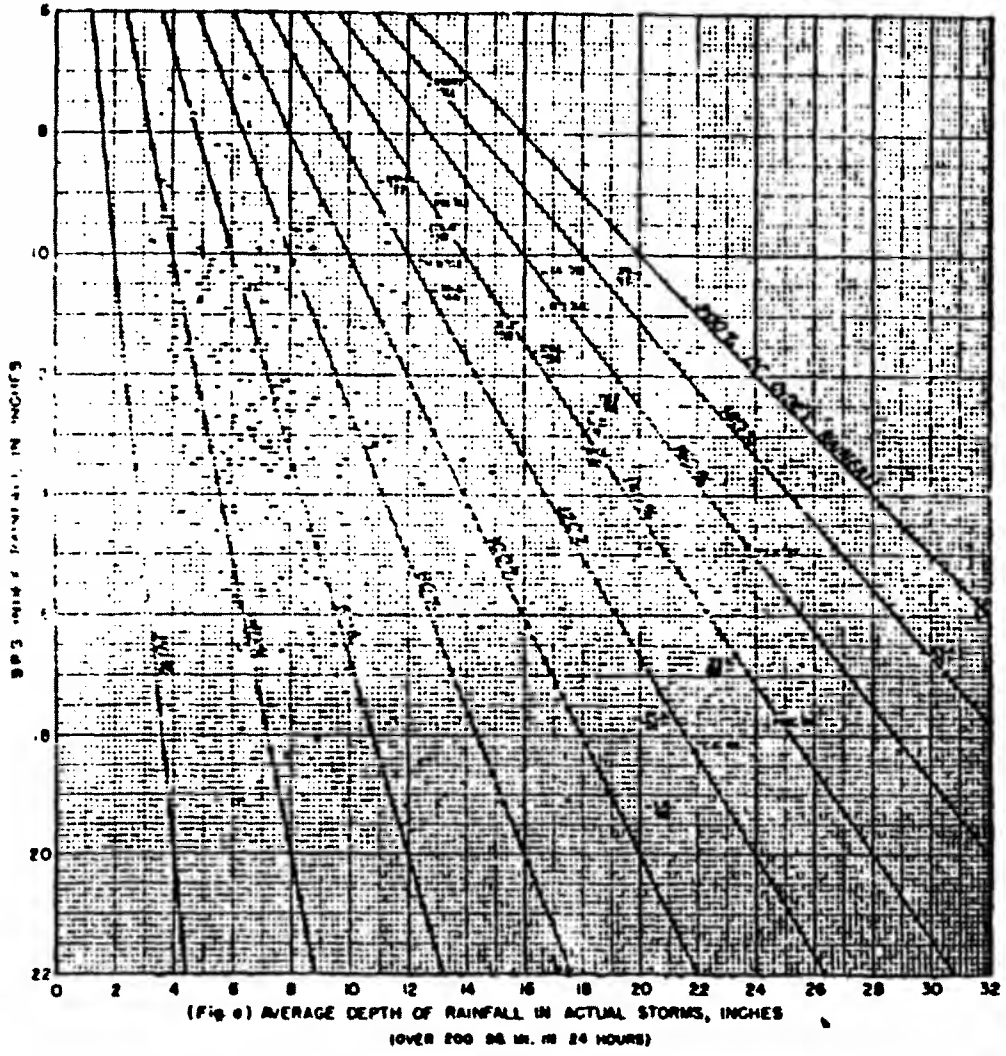
GENERALIZED ESTIMATES
MAXIMUM POSSIBLE PRECIPITATION

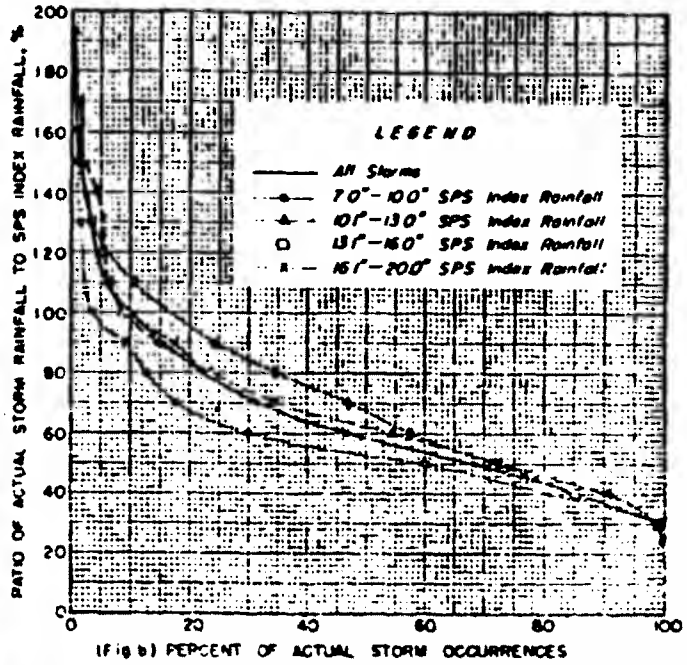


This plate is reproduced from H.M.S. Report No. 23 prepared by the Hydrometeorological Section of the U.S. Weather Bureau.


— LEGEND —
Zone Number
Zone Boundary Line
Generalized Isohyet, Index Rainfall (Average precipitation in 24 hours over 200 square miles)
STANDARD PROJECT STORM STUDIES
GENERALIZED ESTIMATES
SPS INDEX RAINFALL ISOHYETS
WITH OUTLINE OF ZONES


-LEGEND-
STANDARD PROJECT STORM STUDIES
GENERALIZED ESTIMATES
SPS INDEX RAINFALL ISOHYETS
VS ACTUAL STORM VALUES
REPRESENTING AVERAGE DEPTH OF PRECIPITATION
OVER 200 SQUARE MILES IN 24 HOURS





STANDARD PROJECT STORM STUDIES
GENERALIZED ESTIMATES

RATIO ACTUAL STORM VALUES
TO SPS INDEX RAINFALL

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS

STANDARD PROJECT STORM STUDIES

PRECIPITATION DURING MAJOR STORMS OF RECORD IN PERCENT OF SPS INDEX RAINFALL

LINE	LOCATION	BASIN ASSESSMENT SQ. MI.	ZONE	DATE OF STORM	TOTAL RAIN-FALL	PERCENT OF INDEX RAINFALL																	
						10 SQUARE MILES			200 SQUARE MILES				1,000 SQUARE MILES				5,000 SQ. MILES				10,000 SQ. MILES		
						6 hr	12 hr	24 hr	6 hr	12 hr	24 hr	48 hr	6 hr	12 hr	24 hr	48 hr	12 hr	24 hr	48 hr	72 hr	24 hr	48 hr	96 hr
											ZONE 1												
1	Mass.	24 1-4	E-1	12-14 July 1897	10.5"	58	79	97	56	69	78	93	51	63	73	88	58	68	78	93	68	78	93
2	N.H. Vt. Me	24 1-17	E-1	2-4 Nov 1927	9.6"	58	100	133	58	91	118	158	53	84	109	146	84	109	146	194	109	146	194
3	N.Y.	24 1-21	E-1	3-4 Oct 1903	9.4"	71	97	124	58	80	102	131	49	67	86	111	67	86	111	143	86	111	143
4	N.Y. & Pa.	24 1-24a	E-1	20-24 Aug 1933	9.4"	71	-	-	58	-	-	-	49	-	-	-	-	-	-	-	-	-	-
5	N.Y.	24 1-24 (a)	E-1	20-24 Aug. 1933	9.6"	71	97	117	58	80	96	115	49	67	80	96	67	80	96	115	80	96	115
6	N.Y. & Pa.	24 1-27	E-1	8-10 July 1935	9.7"	71	100	122	58	82	100	125	49	69	84	105	69	84	105	129	84	105	129
7	Mass.	24 2-4	E-1	27-28 Sept 1938	10.5"	63	79	100	52	65	82	104	44	55	69	88	55	69	88	110	69	88	110
8	N.J. N.Y.	24 1-9	E-1	7-11 Oct 1903	10.1"	55	79	96	47	68	82	100	37	53	65	80	53	65	80	98	65	80	98
											ZONE 2												
9	N.J. N.Y. Pa.	61 1-9	E-2	7-11 Oct 1903	10.1"	55	79	96	47	68	82	100	37	53	65	80	53	65	80	98	65	80	98
10	Pa.	24 1-1	E-2	30 Sept-1 Oct 1903	10.0"	58	84	104	52	73	90	110	44	63	78	94	63	78	94	114	78	94	114
11	Md. Va. Pa.	1247 1-11	E-2	16-17 July 1909	8.8"	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	Md.	1247 1-11(b)	E-2	16-17 July 1909	9.2"	57	82	104	48	69	88	110	39	56	71	90	56	71	90	110	71	90	110
13	Md.	1247 1-12	E-2	30-31 Aug 1933	9.5"	68	101	121	58	86	103	124	49	72	88	106	72	88	106	129	88	106	129
14	Miss.	1247 2-1	E-2	14-15 Sept 1903	10.2"	55	78	93	47	66	80	95	39	55	68	82	55	68	82	98	68	82	98
15	Miss.	61 2-12	E-2	5-6 June 1905	9.5"	75	95	98	64	81	84	84	55	70	72	72	70	72	72	72	72	72	72
16	N.Y.	61 2-16	E-2	31 Aug-1 Sept 1938	10.4"	117	117	117	99	99	99	99	84	84	84	84	84	84	84	84	84	84	84
17	Miss.	61 2-8	E-2	15-16 July 1912	9.4"	96	96	117	81	81	99	115	69	69	84	103	69	84	103	115	84	103	115
18	Miss.	61 1-5	E-2	15-17 July 1877	9.5"	94	94	105	80	80	89	103	68	68	76	90	68	76	90	103	76	90	103
19	Ohio	61 2-19	E-2	10-11 Sept 1878	10.8"	95	105	115	81	100	110	120	69	85	94	103	85	94	103	115	94	103	115
20	Pa.	61 2-13	E-2	17-18 July 1942	10.5"	80	80	80	68	68	68	68	58	58	58	58	58	58	58	58	58	58	58
21	Iowa	24 1-20	E-2	26-28 Aug 1909	11.5"	88	100	100	75	86	86	86	64	73	73	73	73	73	73	73	73	73	73
											ZONE 3												
22	Miss. Ala.	247 1-8	A-15	16-18 July 1897	8.5"	78	88	97	66	75	82	88	56	64	70	75	64	70	75	82	70	75	82
23	Ala.	247 1-6	B-15	7-11 Sept 1900	10.5"	78	88	98	66	75	84	94	56	64	72	80	64	72	80	90	72	80	90
24	Miss.	247 1-14(a)	A-15	16-18 July 1899	8.8"	135	135	135	115	115	115	115	98	98	98	98	98	98	98	98	98	98	98
25	Ia. Mo.	24 1-5	C-15	16-17 July 1900	10.5"	95	98	117	58	78	106	113	50	67	90	96	67	90	96	113	90	96	113
26	Iowa	24 1-6	B-15	23-27 June 1891	10.6"	95	105	125	66	90	108	128	58	77	93	110	77	93	110	132	93	110	132
27	Kans.	24 1-21	A-20	17-21 June 1921	7.8"	122	142	165	115	150	176	201	103	133	157	184	133	157	184	214	157	184	214
28	Nebr.	24 1-23	C-20	27 Sept-1 Oct 1903	7.5"	79	138	165	66	115	138	165	58	97	115	138	97	115	138	165	115	138	165
29	Iowa	24 1-24b	C-15	27-29 Sept 1916	10.5"	167	181	210	116	153	161	161	74	95	88	88	95	88	88	88	88	88	88
30	Nebr.	24 1-15	B-15	14-15 June 1914	10.0"	186	186	186	109	138	138	138	74	95	95	95	95	95	95	95	95	95	95
											ZONE 4												
30	Ia. Neb.	24 1-24	B-15	6-7 July 1938	11.8"	89	106	106	67	85	88	88	54	73	73	73	73	73	73	73	73	73	73
31	Okla.	24 2-12	B-16	4-6 June 1916	12.7"	89	89	89	70	70	70	70	57	57	57	57	57	57	57	57	57	57	57
32	Kans.	24 2-23	B-16	14-19 Sept 1938	11.1"	89	89	89	73	73	73	73	59	59	59	59	59	59	59	59	59	59	59
33	Kans.	24 2-20	B-15	15-17 Nov 1928	12.5"	89	95	98	73	80	80	80	59	65	65	65	65	65	65	65	65	65	65
34	Colo.	24 1-24a	B-15	30-31 May 1935	9.4"	89	89	89	73	73	73	73	59	59	59	59	59	59	59	59	59	59	59
35	Okla.	24 2-5	B-15	1-3 June 1908	11.4"	89	89	89	73	73	73	73	59	59	59	59	59	59	59	59	59	59	59
36	N. Mex.	24 1-6	B-20	28-30 Sept 1904	8.3"	56	81	81	46	67	67	67	37	55	55	55	55	55	55	55	55	55	55
37	Okla.	24 1-10(a)	B-16	21-25 May 1908	12.9"	78	86	86	64	71	71	71	53	59	59	59	59	59	59	59	59	59	59
38	Okla.	24 1-11	B-15	29-31 Oct 1908	13.1"	78	95	95	64	78	78	78	53	65	65	65	65	65	65	65	65	65	65
39	N. Mex.	24 1-16	B-19	28 Apr - 4 May 1914	9.4"	95	95	95	78	78	78	78	65	65	65	65	65	65	65	65	65	65	65
40	Iowa	24 2-1	B-15	11-16 Sept 1926	12.4"	104	104	104	91	91	91	91	75	75	75	75	75	75	75	75	75	75	75
41	Okla.	24 2-11	B-17	3-4 April 1934	11.6"	158	178	186	134	155	161	161	78	98	98	98	98	98	98	98	98	98	98
42	Okla. Kans.	24 2-18	B-15	2-4 Sept 1940	13.4"	158	177	179	134	153	154	154	98	103	103	103	103	103	103	103	103	103	103
43	Okla.	24 2-20	B-15	9-12 May 1943	14.1"	78	87	138	58	67	98	116	51	59	80	95	59	80	95	111	80	95	111
44	Okla. Kans.	247 2-21	B-15	12-20 Mar 1945	13.4"	118	125	125	77	101	101	101	65	85	85	85	85	85	85	85	85	85	85
45	N. Mex. Tex.	24 1-15(a)	B-19	15-17 Sept. 1919	9.4"	111	111	111	77	77	77	77	65	65	65	65	65	65	65	65	65	65	65
46	Kans.	24 1-4	B-20	9-13 July 1951	20.8"	--	--	--	38	38	61	109	36	36	36	36	36	36	36	36	36	36	36
											ZONE 5												
47	Tex.	24 1-4	J-15	27 June-1 July 1899	16.9"	31	74	88	37	78	136	178	33	68	120	160	78	120	160	178	120	160	178
48	Tex.	24 1-19	E-20	21-25 July 1909	8.6"	58	58	88	58	58	63	71	36	36	56	71	56	71	91	91	71	91	91
49	Tex.	24 1-16	J-17	4-6 Aug 1906	12.8"	58	95	95	58	63	63	63	36	56	56	56	56	56	56	56	56	56	56
50	Tex.	24 1-12	J-16	8-10 Sept 1921	16.8"	135	179	180	100	146	175	185	81	113	142	151	113	142	151	151	142	151	151
51	Tex.	24 5-1	J-17	30 Jun - 2 Jul 1935	15.0"	89	130	211	69	97	157	171	51	78	117	139	78	117	139	139	117	139	139
52	Tex.	24 5-6	J-16	27 June - 1 Jul 1935	17.3"	81	92	184	77	89	89	185	55	77	77	77	77	77	77	77	77	77	77
53	Tex.	24 5-10	J-17	19-25 July 1938	13.0"	89	105	132	65	89	89	132	55	75	75	75	75	75	75	75	75	75	75
54	Tex.	24 5-13	J-15	28-30 Jun 1940	18.1"	61	95	152	58	89	89	152	55	89	89	89	89	89	89	89	89	89	89
55	Tex.	24 5-14a	J-15	30 Aug-5 Sep 1952	14.4"	88	95	113	67	77	87	113	59	65	77	77	65	77	77	77	77	77	77
56	N.Mex.	24 5-9	J-19	20-23 Sept 1941	9.6"	105	117	126	86	96	96	118	59	59	59	59	59	59	59	59	59	59	59
57	Tex.	24 5-21	J-15	11 May 1955	15.8"	155	155	155	98	98	98	98	57	57	57	57	57	57	57	57	57	57	57

STANDARD PROJECT STORM STUDIES

PRECIPITATION DURING MAJOR STORMS OF RECORD IN PERCENT OF SPS INDEX RAINFALL

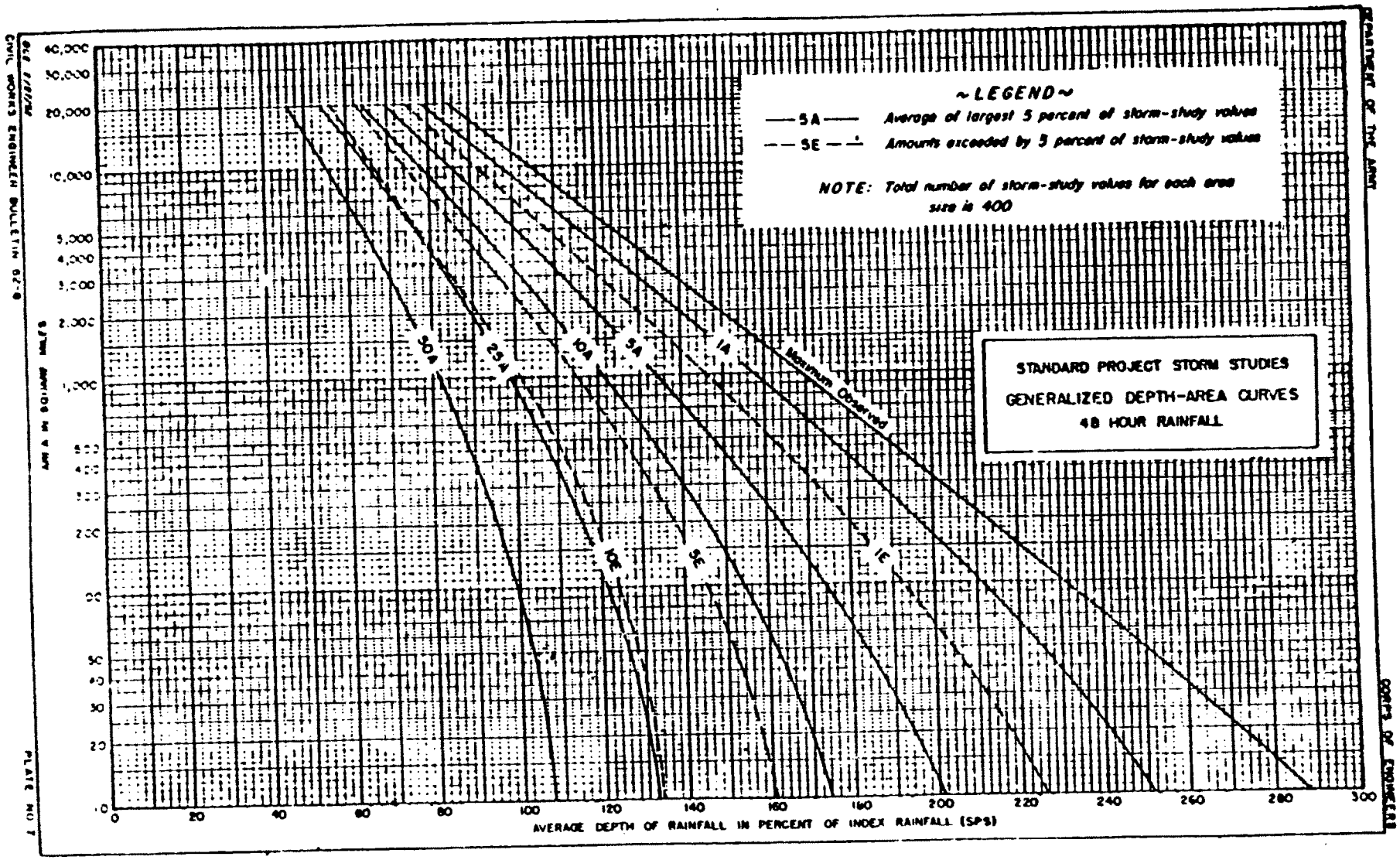
ITEM	LOCATION	BASIC ASSIGNMENT NO.	QUAD	DATE OF STORM	STORM RAINFALL	AVERAGE OF STORM RAINFALL															
						10 SQUARE MILES			200 SQUARE MILES				1,000 SQUARE MILES				5,000 Sq. MILES			20,000 Sq. MI.	
						6 hr	12 hr	24 hr	6 hr	12 hr	24 hr	48 hr	6 hr	12 hr	24 hr	48 hr	12 hr	24 hr	96 hr	24 hr	96 hr
												ZONE 6									
52	N.J.,Pa.	1-1	7-4	28-29 Sept. 1882	16.5	15	15	15	14	14	14	14	13	13	13	13	12	12	12	11	11
53	Md.	1-7(a)	7-5	23-24 July 1897	11.1	10	10	10	9	9	9	9	9	9	9	9	8	8	8	8	8
54	N.J.	1-15	7-4	15-16 Aug 1933	11.5	10	10	10	10	10	10	10	9	9	9	9	9	9	9	8	8
55	Md. Va.	1-18	7-5	15-17 Aug 1938	11.5	10	10	10	10	10	10	10	9	9	9	9	9	9	9	8	8
56	Pa.,N.J.,Md.	1-4(b)	7-5	29 Aug-1 Sept 1953	10.5	9	9	9	9	9	9	9	8	8	8	8	8	8	8	7	7
57	N. J.	1-4	7-4	29 Aug 1959	11.1	10	10	10	10	10	10	10	9	9	9	9	9	9	9	8	8
58	N.J.	1-4	7-4	31 Aug-1 Sept 1960	10.5	9	9	9	9	9	9	9	8	8	8	8	8	8	8	7	7
59	N.Va.	1-19	7-5	27-30 Sept 1896	10.8	10	10	10	9	9	9	9	8	8	8	8	8	8	8	7	7
60	Md.	1-16	7-5	2-6 Sept 1955	11.3	10	10	10	10	10	10	10	9	9	9	9	9	9	9	8	8
61	Va.	1-20 (a)	7-6	11-17 Oct 1942	11.9	11	11	11	10	10	10	10	10	10	10	10	9	9	9	8	8
62	N.C.	2-1	8-7	30-31 Aug 1893	13.4	12	12	12	12	12	12	12	11	11	11	11	11	11	11	10	10
63	N.C.Va.	2-4	8-8	23-24 Aug 1908	13.4	12	12	12	12	12	12	12	11	11	11	11	11	11	11	10	10
70	N.C. S.C.	2-9	8-8	15-17 July 1916	15.5	14	14	14	14	14	14	14	13	13	13	13	13	13	13	12	12
71	N.C.	2-8(a)	8-7	15-17 July 1916	15.5	14	14	14	14	14	14	14	13	13	13	13	13	13	13	12	12
72	N.C. Va.	2-15	8-7	16-19 Sept 1928	13.4	12	12	12	12	12	12	12	11	11	11	11	11	11	11	10	10
73	Ga.	3-1	8-8	29-31 July 1897	11.9	11	11	11	10	10	10	10	10	10	10	10	9	9	9	8	8
74	S.C.Ala.Ga.	3-16	8-5	15-17 Sept 1824	13.4	12	12	12	12	12	12	12	11	11	11	11	11	11	11	10	10
75	Va.	3-22(a)	8-6	15-17 Aug 1940	11.8	11	11	11	10	10	10	10	10	10	10	10	9	9	9	8	8
76	N.C.	3-22(b)	8-8	16-17 Aug 1940	12.4	12	12	12	11	11	11	11	11	11	11	11	10	10	10	9	9
												ZONE 7									
77	Miss. Tenn.	1W7 1-4	8-12	17-21 Nov 1906	15.5	14	14	14	14	14	14	14	13	13	13	13	13	13	13	12	12
78	Tenn. Miss.	1W7 1-12	8-11	15-17 Mar. 1929	14.9	14	14	14	13	13	13	13	13	13	13	13	12	12	12	11	11
79	Ia. Ill.	1W7 2-5	8-13	9-10 June 1905	11.7	11	11	11	10	10	10	10	10	10	10	10	9	9	9	8	8
80	Ohio, Mass.	1E 1-15	8-8	29-30 Nov. 1913	13.4	12	12	12	12	12	12	12	11	11	11	11	11	11	11	10	10
81	Ill. Ark.	1E 1-8	7-11	3-4 Oct 1910	13.7	13	13	13	12	12	12	12	12	12	12	12	11	11	11	10	10
82	Tenn.	1W 7-15	8-10	21-23 Mar 1929	13.7	13	13	13	12	12	12	12	12	12	12	12	11	11	11	10	10
83	Ohio	1E 9-11	8-8	6-7 Aug 1935	11.5	11	11	11	10	10	10	10	10	10	10	10	9	9	9	8	8
84	Tenn.	1W 3-4	8-11	5-15 Jan 1937	14.9	14	14	14	13	13	13	13	13	13	13	13	12	12	12	11	11
85	Ga.	2W 1-1	7-13	14-20 Dec 1955	13.4	12	12	12	12	12	12	12	11	11	11	11	11	11	11	10	10
86	Ga. Miss.	2W 3-8	8-12	9-12 July 1916	11.8	11	11	11	10	10	10	10	10	10	10	10	9	9	9	8	8
87	Ga.	2W 7-4(a)	7-14	15-15 Aug 1916	13.7	13	13	13	12	12	12	12	12	12	12	12	11	11	11	10	10
88	Ill.	2W 7-4(b)	7-12	15-16 Aug. 1916	12.0	12	12	12	11	11	11	11	11	11	11	11	10	10	10	9	9
89	Ga. Miss.	2W 1-18	8-12	6-10 Dec. 1919	13.9	13	13	13	13	13	13	13	12	12	12	12	12	12	12	11	11
												ZONE 8									
90	Ala. Fla.	2E 1-5	8-11	17-21 Sept 1906	17.7	17	17	17	16	16	16	16	15	15	15	15	14	14	14	13	13
91	Ala. Miss.	2W 2-5	8-11	15-18 Apr 1908	16.1	15	15	15	15	15	15	15	14	14	14	14	13	13	13	12	12
92	La.	2W 2-13	8-12	28-30 Sept 1915	18.1	17	17	17	17	17	17	17	16	16	16	16	15	15	15	14	14
93	Ala. Miss.	2W 2-16	8-11	1-5 June 1920	16.7	16	16	16	15	15	15	15	15	15	15	15	14	14	14	13	13
94	Ala.	2W 2-18	8-10	11-16 Mar. 1929	17.6	17	17	17	16	16	16	16	16	16	16	16	15	15	15	14	14
95	La.	2W 2-18	8-12	26-27 July 1933	17.6	17	17	17	16	16	16	16	16	16	16	16	15	15	15	14	14
96	La.	2W 2-18	8-12	12-14 Apr 1937	19.1	18	18	18	18	18	18	18	17	17	17	17	16	16	16	15	15
97	La.	2W 2-18	8-13	8-9 Aug 1940	19.1	18	18	18	18	18	18	18	17	17	17	17	16	16	16	15	15
98	Tenn.	1W 1-10	8-11	14-21 Aug 1915	17.5	17	17	17	16	16	16	16	16	16	16	16	15	15	15	14	14
99	Fla. Ala.	2E 1-19	8-10	9-10 July 1916	17.6	17	17	17	16	16	16	16	16	16	16	16	15	15	15	14	14
100	La.	2W 2-7	8-15	15-17 June 1886	18.1	18	18	18	17	17	17	17	17	17	17	17	16	16	16	15	15
101	Tenn.	1W 2-21	8-11	27-29 July 1940	20.1	19	19	19	19	19	19	19	18	18	18	18	17	17	17	16	16
												ZONE 9									
102	Ga.	2E 1-20	8-9	15-18 Sept 1940	19.1	18	18	18	18	18	18	18	17	17	17	17	16	16	16	15	15
103	Fla.	2E 1-20	8-9	9-11 Oct 1941	17.6	17	17	17	16	16	16	16	16	16	16	16	15	15	15	14	14
104	Fla.	2E 1-4	8-9	17-20 Oct 1941	17.6	17	17	17	16	16	16	16	16	16	16	16	15	15	15	14	14
105	Ga.	2E 1-11	8-9	28-31 Aug.1911	17.6	17	17	17	16	16	16	16	16	16	16	16	15	15	15	14	14

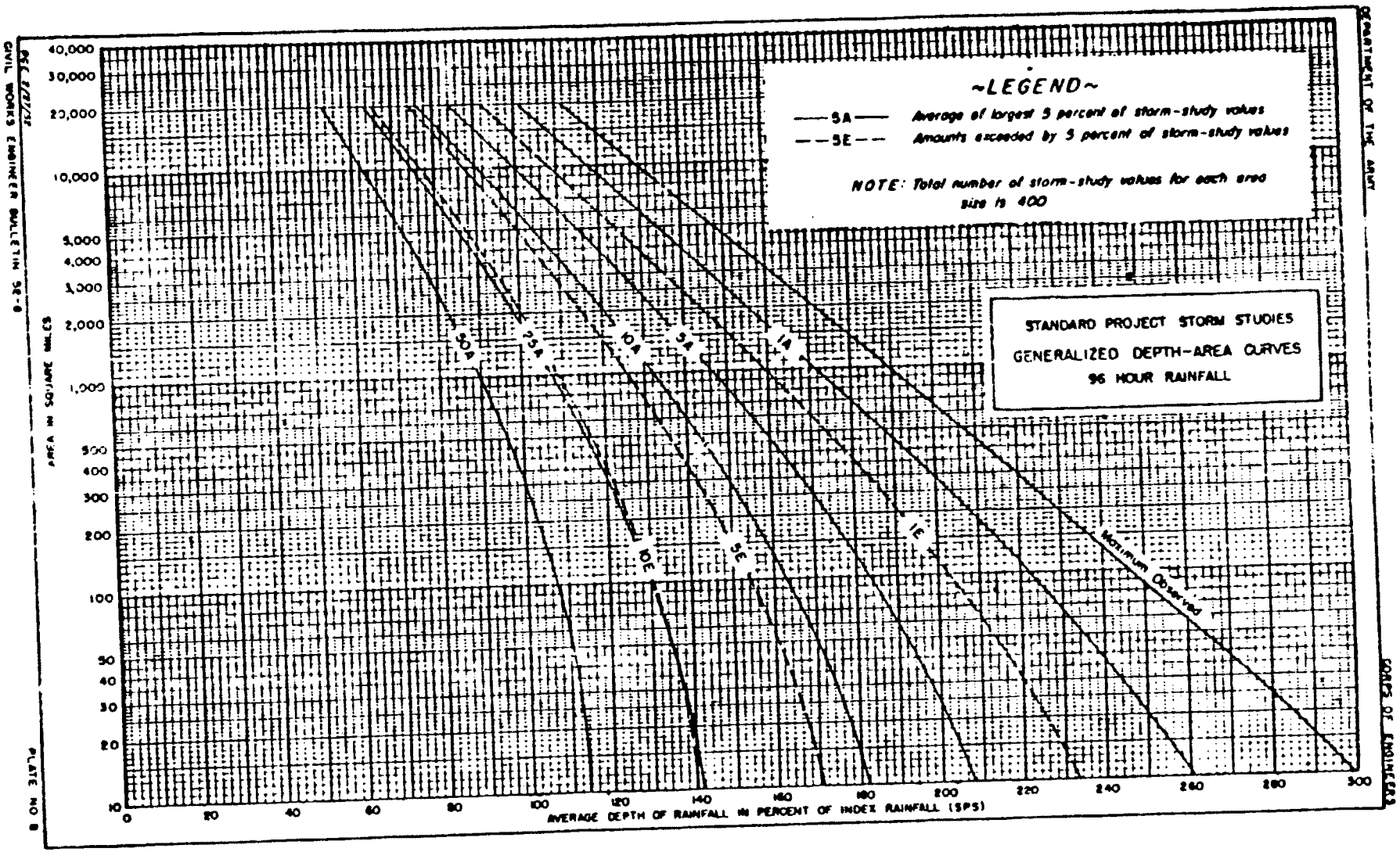
DEPARTMENT OF THE ARMY

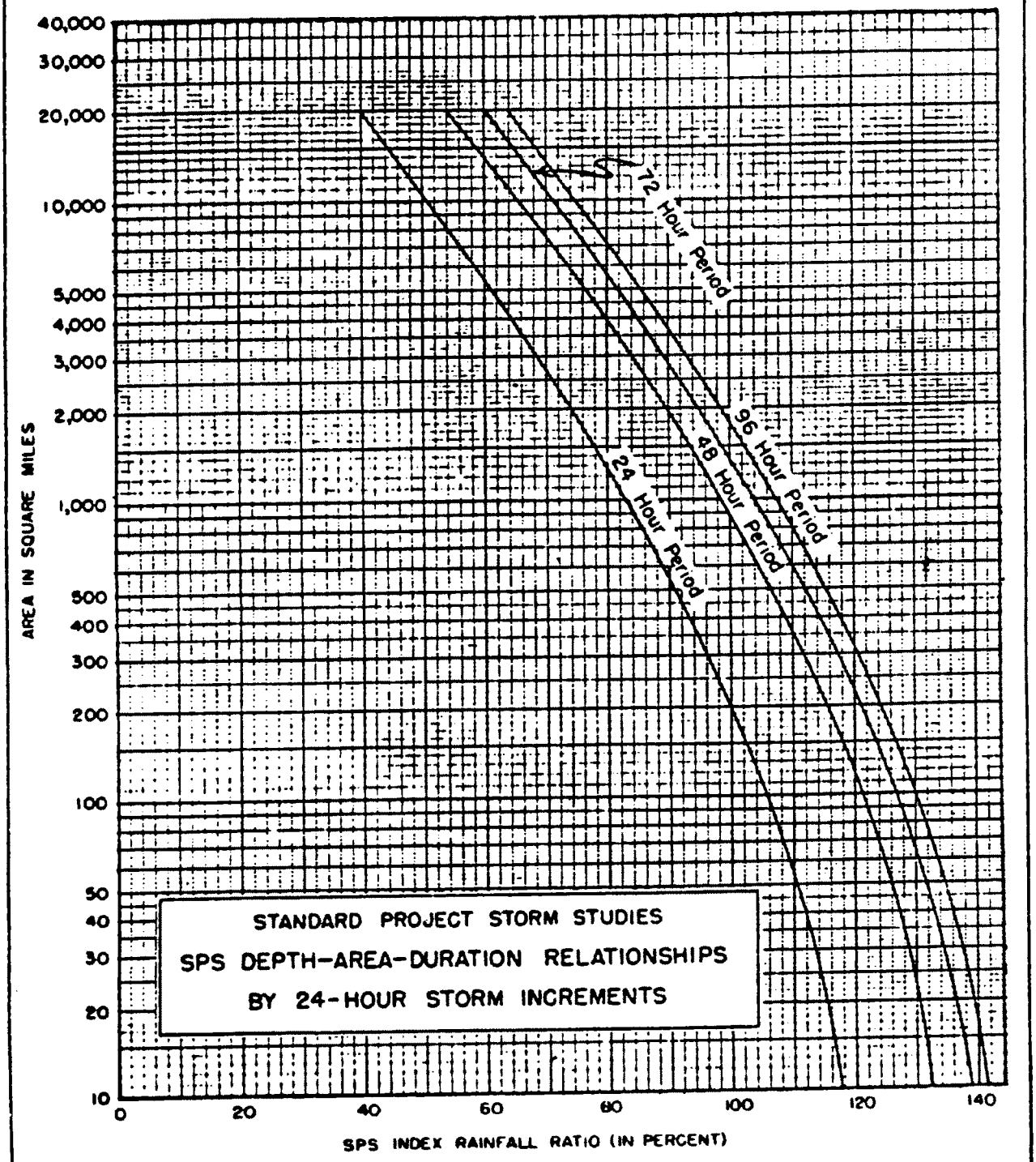
CORPS OF ENGINEERS

PLATE NO. 6

CIVIL WORKS ENGINEER BULLETIN 52-8


~LEGEND~
—5A— Average of largest 5 percent of storm-study values
--5E-- Amounts exceeded by 5 percent of storm-study values
NOTE: Total number of storm-study values for each area size is 400
STANDARD PROJECT STORM STUDIES
GENERALIZED DEPTH-AREA CURVES
48 HOUR RAINFALL
Maximum Observed
50A
25A
10A
5A
1A
50E
25E
10E
5E
1E
AREA IN SQUARE MILES
40,000
30,000
20,000
10,000
5,000
4,000
3,000
2,000
1,000
500
400
300
200
100
50
40
30
20
10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
AVERAGE DEPTH OF RAINFALL IN PERCENT OF INDEX RAINFALL (SPS)


~LEGEND~
—5A— Average of largest 5 percent of storm-study values
--5E-- Amounts exceeded by 5 percent of storm-study values
NOTE: Total number of storm-study values for each area size is 400
STANDARD PROJECT STORM STUDIES
GENERALIZED DEPTH-AREA CURVES
96 HOUR RAINFALL
AREA IN SQUARE MILES
AVERAGE DEPTH OF RAINFALL IN PERCENT OF INDEX RAINFALL (SPS)
50A
75A
10A
5A
1A
10E
5E
1E
MAXIMUM OBSERVED
40,000
30,000
20,000
10,000
5,000
4,000
3,000
2,000
1,000
500
400
300
200
100
50
40
30
20
10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300


AREA IN SQUARE MILES
40,000
30,000
20,000
10,000
5,000
4,000
3,000
2,000
1,000
500
400
300
200
100
50
40
30
20
10
72 Hour Period
96 Hour Period
48 Hour Period
24 Hour Period
STANDARD PROJECT STORM STUDIES
SPS DEPTH-AREA-DURATION RELATIONSHIPS
BY 24-HOUR STORM INCREMENTS
0
20
40
60
80
100
120
140
SPS INDEX RAINFALL RATIO (IN PERCENT)

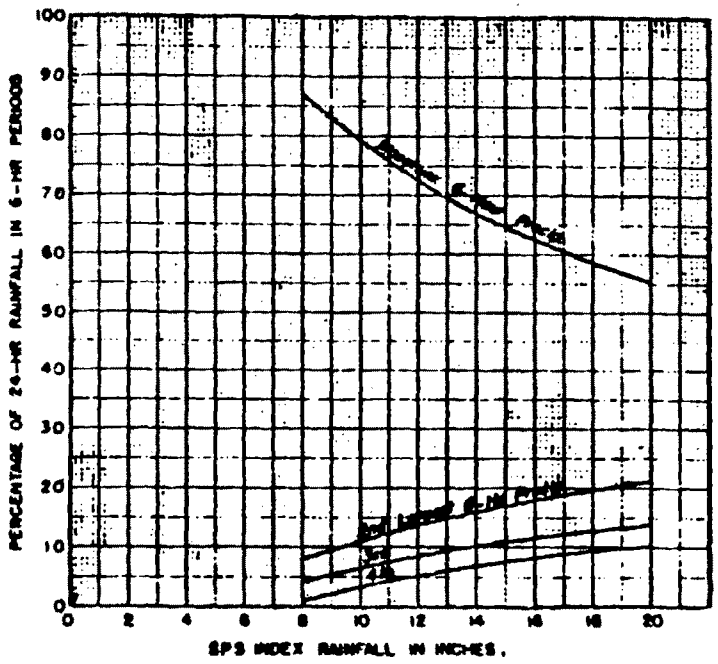


FIG. (a) SPS 24-HOUR PRECIPITATION OVER 200 SQ. MI. vs. PERCENT IN 6-HOUR PERIODS

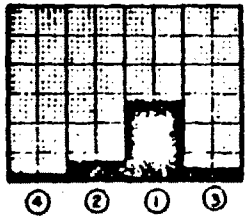


FIG. (b) TYPICAL ARRANGEMENT OF 6-HOUR RAINFALL QUANTITIES IN SPS

INDEX RAINFALL IN INCHES	PERCENTAGE OF 24-HOUR SPS RAINFALL IN DESIGNATED 6-HR PERIOD			
	④	②	①	③
1	2	3	4	5
8	10	8 0	87 0	4 0
9	2 1	9 5	83 0	5 4
10	3 2	11 0	79 2	6 6
11	4 3	12 3	75 9	7 9
12	5 3	13 8	72 5	8 4
13	6 1	14 9	69 6	9 4
14	7 0	16 0	66 9	10 1
15	7 8	17 0	64 5	10 9
16	8 1	17 9	62 4	11 6
17	8 8	18 9	60 3	12 0
18	9 1	19 7	58 5	12 7
19	9 8	20 3	56 8	13 1
20	10 1	21 0	55 1	13 8

FIG. (c) TABULATION OF DATA FROM FIG. (a)

STANDARD PROJECT STORM STUDIES
GENERALIZED ESTIMATES

TIME DISTRIBUTION OF 24-HOUR SPS RAINFALL

TIME DISTRIBUTION OF MAXIMUM 6-HOUR SPS RAINFALL

Rainfall Period (Sub-Division of 6-Hour Period)	Time Distribution of Maximum 6-Hour SPS Rainfall, Expressed in Percent of Total 6-Hour Rainfall			
	*Selected Unit Rainfall Duration, t_R			
	6-Hours	3-Hours	2-Hours	1-Hour
#1	#2	#3	#4	#5
1st	100	33	26	10
2nd		67	53	12
3rd			21	15
4th				38
5th				14
6th				11
TOTAL	100	100	100	100

*NOTE: The "selected unit rainfall duration," t_R is determined approximately from the synthetic unit hydrograph equation, $t_r = t_p / 5.5$ in which "t_p" is the lag time from midpoint of unit rainfall duration, t_r, to peak of unit hydrograph, in hours, (See page 11, Engineering Manual for Civil Works, Part CXIV - Hydrologic and Hydraulic Analyses, Chapter 5 - Flood-Hydrograph Analyses and Computations). The following rounded-off values are to be used in the above table:

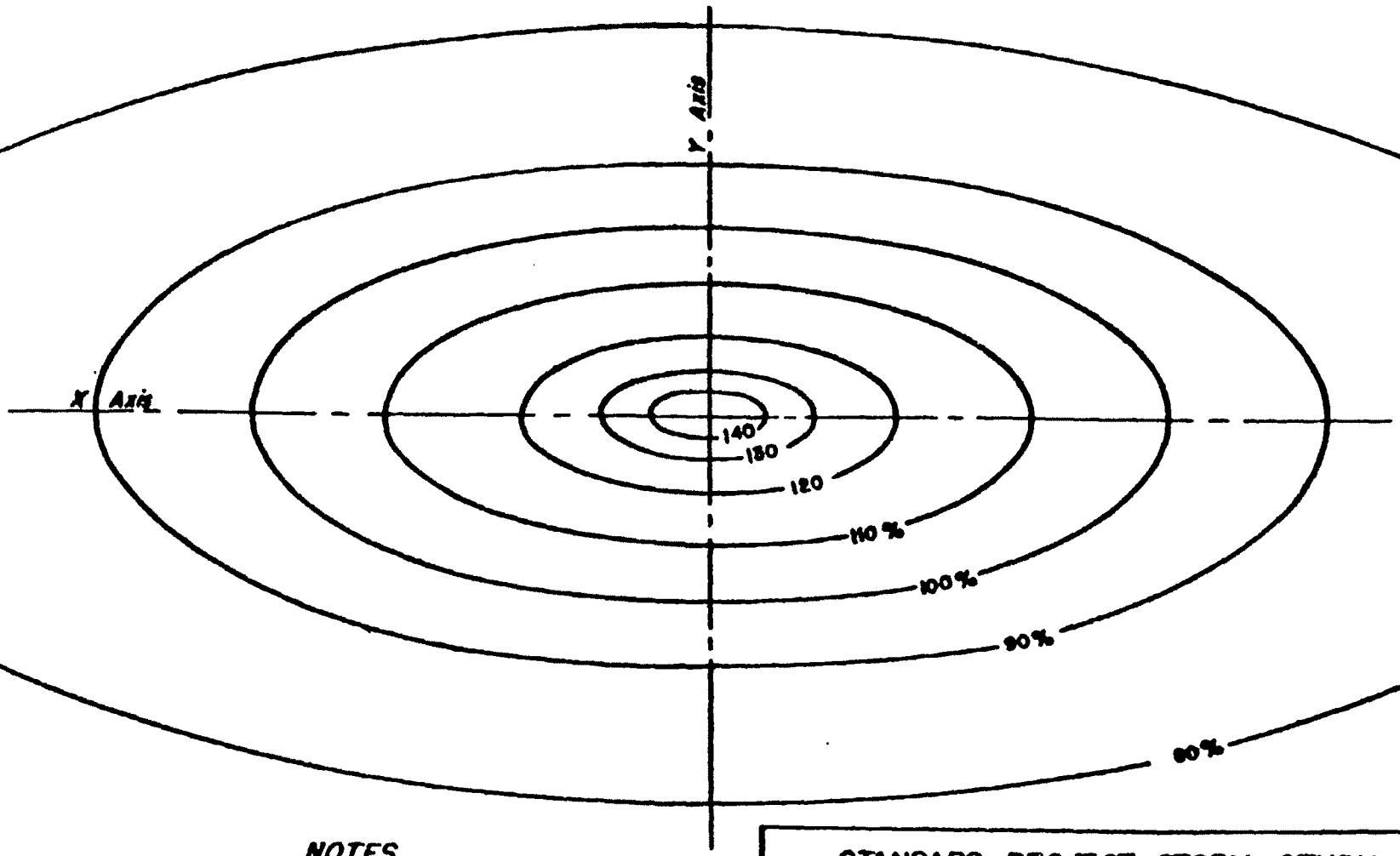
If t_p exceeds 16, use $t_R = 6$

If t_p is between 12 and 16, use $t_R = 3$

If t_p is between 6 and 12, use $t_R = 2$

If t_p is between 4 and 6, use $t_R = 1$

Rev. 1-3-65



NOTES

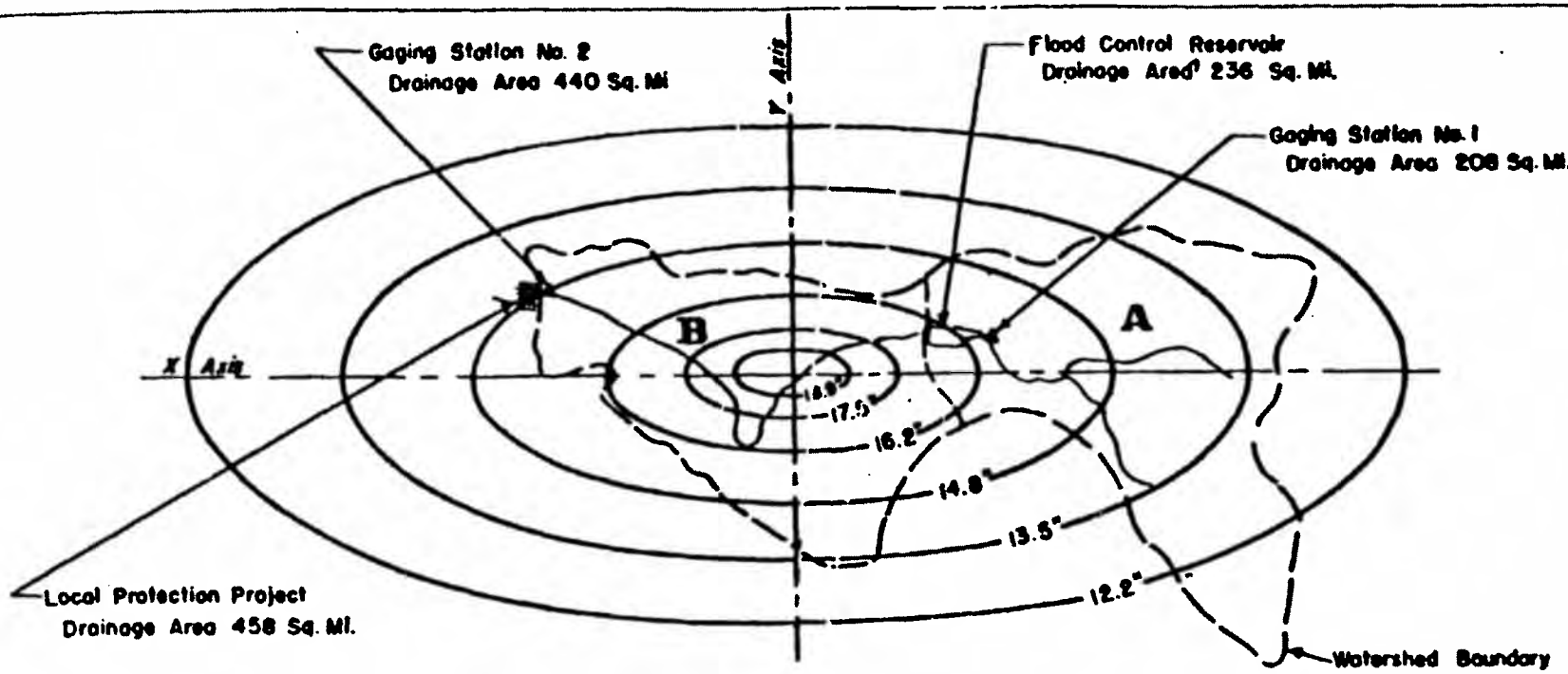
1. Pattern may be oriented in any direction.
2. Pattern corresponds to depth-area relation represented by 96-hour curve of Plate No. 9. expressed in % of index rainfall.

STANDARD PROJECT STORM STUDY

SPS ISOHYETAL PATTERN

SCALE • 1/500,000

10 5 0 MILES 10 20



UNIT HYDROGRAPH DATA

LOCATION	DRAINAGE AREA	L	L_{ca}	$(L \cdot L_{ca})^{0.3}$	C_t	t_p	t_r	t_R	t_{pR}	$640C_p$	Q_p
Dam A	236	37	20	7.3	1.8	13.1	2.4	3.0	13.2	380	6,800
LPP B	222	35	18	6.9	2.3	15.9	2.9	3.0	15.9	420	5,900

NOTES

1. *Project location: Lat. 37°, Long. 94° (Index rainfall = 13.5").*
2. *Isohyets correspond to those of Plate No. 12 with percentages multiplied by index rainfall of 13.5 inches.*
3. *For definition and application of unit-hydrograph symbols see Engineering Manual for Civil Works, Part CXIV, Chapter 5.*
4. *C_t and C_p based on floods observed at gaging stations 1 & 2.*
5. *t_R based on criteria on Plate No. 11.*

STANDARD PROJECT STORM STUDIES
ILLUSTRATIVE EXAMPLE
APPLICATION OF ISOHYETAL PATTERN
(MAXIMUM 96-HOUR PERIOD OF SPS)

10 5 0 10 20
MILES

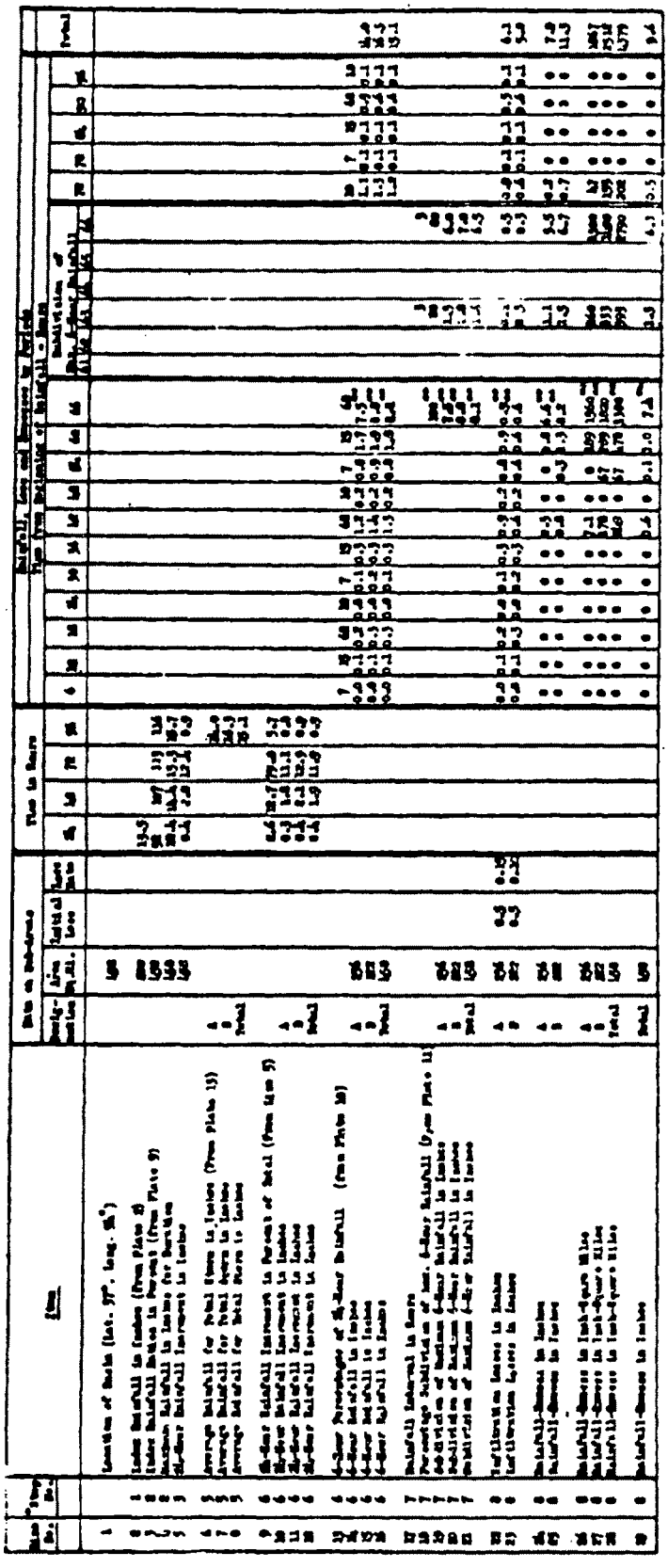


PLATE 14

PAGE NO. 15

[illegible]

TABLE 6

[illegible]

[illegible]

Line Number	Storm Number	Date of Storm	Approximate Location of Storm Center considered (5000 sq. mi. area)	Transposition factor for 5000 sq.mi. area		Adjusted average for Basin	Basin Average Depth of Rainfall over Specified Areas, Adjusted for Transposition and Basin Shape													
				Station Value	Basin Value		200 Square Miles				1,000 Square Miles				5,000 Square Miles				10,000 Square Miles			
							12 Hrs.	24 Hrs.	48 Hrs.	120 Hrs.	12 Hrs.	24 Hrs.	48 Hrs.	120 Hrs.	12 Hrs.	24 Hrs.	48 Hrs.	120 Hrs.	12 Hrs.	24 Hrs.	48 Hrs.	120 Hrs.
1	[illegible]	30-31 Aug 1878	Pittsburg, Ohio	1.19	1.18	1.18	13.6	15.9	17.4	(18.1)	12.2	13.6	14.1	(14.8)	10.0	11.5	12.2	(12.1)	8.8	10.1	10.1	(10.5)
2	[illegible]	11-12 Mar 1929	Crossville, Tenn.	1.10	0.97	1.06	8.2	10.1	10.4	-	6.8	9.1	9.8	-	6.8	7.8	8.4	-	5.6	6.9	7.6	-
3	[illegible]	12-13 Mar 1964	Aurora, Minn.	0.88	0.88	0.88	6.9	7.8	8.1	(8.8)	6.1	6.9	7.4	(8.2)	5.7	6.8	6.4	(6.8)	5.4	5.8	6.2	(6.4)
4	[illegible]	3-4 Oct 1950	Cairo, Ill.	1.01	.98	0.97	6.8	8.5	10.8	(11.8)	5.8	7.8	11.8	10.6	5.8	6.9	9.8	10.1	5.4	6.1	8.2	8.8
5	[illegible]	16-18 Dec 1955	Springfield, Mo.	1.12	.99	1.06	6.8	7.4	12.1	(12.1)	5.9	6.9	11.5	(11.8)	5.8	6.9	10.1	(10.7)	5.8	6.8	9.1	(9.8)
6	[illegible]	15-17 Mar 1913	Richmond, Ind.	1.05	1.18	1.18	6.5	8.2	11.8	12.2	5.8	7.8	10.2	10.8	5.8	6.8	9.4	10.1	5.8	6.8	8.8	8.8
7	[illegible]	3-15 Jan 1937	Denver, Tenn.	1.00	.88	0.88	5.8	5.4	8.8	10.1	5.7	5.8	8.8	10.8	5.1	5.8	7.8	10.7	4.7	5.8	8.8	8.8
8	[illegible]	15-17 Mar 1913	Dubo, Ohio	1.11	1.06	1.06	5.2	7.1	10.8	(11.8)	5.8	7.8	10.8	(10.4)	5.8	6.8	9.8	(9.8)	5.1	6.7	(9.8)	(9.8)
9	[illegible]	15-17 Mar 1913	Smokemont, Tenn.	0.85	0.88	0.88	7.1	8.8	(9.8)	-	6.6	8.4	(8.8)	-	5.7	7.4	(7.8)	-	5.1	6.7	(8.8)	-
10	[illegible]	15-16 Jan 1925	Dalton, Tenn.	.95	.88	0.88	6.8	7.4	10.8	(11.7)	5.8	7.8	10.8	(11.5)	5.8	6.8	8.8	(9.8)	5.8	6.8	7.4	(8.8)
11	[illegible]	1-2 Dec 1945	Smokehill Mt., Ky.	1.05	.98	0.88	5.6	6.8	8.8	9.8	5.8	6.1	7.8	8.7	5.8	5.8	6.8	7.8	5.8	5.1	6.8	7.8
12	[illegible]	3-13 May 1915	Avon, Ill.	1.05	.97	1.00	5.4	6.8	7.8	(7.8)	5.2	5.8	7.8	(7.5)	5.1	5.8	6.8	(6.8)	5.8	5.8	6.8	(6.8)
13	[illegible]	15-17 Jan 1946	Farmington, Mo.	1.11	1.06	1.06	5.8	6.8	7.8	9.8	5.8	6.1	7.8	9.8	5.8	5.8	6.8	8.8	5.8	5.8	6.8	8.8
14	[illegible]	30-31 Jan 1918	Conway, Ark.	.88	.88	0.88	5.2	5.4	6.8	-	5.8	5.8	6.8	-	5.6	5.7	5.8	-	5.8	5.8	5.8	-
15	[illegible]	6-11 Jan 1959	Hospital, Penn.	.95	.88	0.88	5.4	5.8	6.8	9.8	5.4	5.8	7.8	8.8	5.8	5.8	7.1	8.8	5.8	5.8	6.8	7.8
16	[illegible]	15 Jul-6 Aug 1943	Delaware, Ind.	1.12	1.06	1.18	5.8	6.8	7.8	10.8	5.6	5.7	6.8	9.8	5.8	5.8	5.7	8.1	5.8	5.8	6.1	7.8
17	[illegible]	20-21 Mar 1959	Pikeville, Ky.	1.05	.98	0.88	5.8	6.8	7.8	(7.8)	5.7	5.8	6.8	(7.8)	5.8	5.1	5.7	(6.8)	5.1	5.8	5.8	(5.7)
18	[illegible]	15-16 Dec 1959	Dodson, Ark.	.95	.88	0.88	5.7	5.8	5.8	7.8	5.8	5.7	5.8	7.8	5.8	5.8	5.8	6.8	5.8	5.1	5.8	6.8
19	[illegible]	3-13 Nov 1919	Hot Springs, Ark.	.89	.88	0.88	5.8	7.6	7.7	8.8	5.6	6.4	6.4	8.2	5.8	5.8	5.8	7.8	5.4	5.8	5.8	6.8

[illegible]

TABLE 7

[illegible]

[illegible]

Line Number	Storm Number	Date of Storm	Approximate Location of Storm Center considered (5000 sq. mi. Area)	Adjustment for Basin Shape Factor			Basin Average Depth of Rainfall over Specified Areas, Adjusted for Transposition and Basin Shape															
				Total Storm Precip. Zone No. Basin	Storm Precip. Within Basin Outline	Basin Shape Factor	200 Square Miles				1,000 Square Miles				5,000 Square Miles				10,000 Square Miles			
							12 Hrs.	24 Hrs.	48 Hrs.	120 Hrs.	12 Hrs.	24 Hrs.	48 Hrs.	120 Hrs.	12 Hrs.	24 Hrs.	48 Hrs.	120 Hrs.	12 Hrs.	24 Hrs.	48 Hrs.	120 Hrs.
1	[illegible]	30-31 Aug 1878	Pittsburg, Ohio	9.6	9.7	.91	10.3	13.6	15.8	16.8	11.8	12.6	14.7	(15.8)	9.8	10.3	12.6	(12.8)	7.7	9.8	10.8	(11.6)
2	[illegible]	11-12 Mar 1929	Crossville, Tenn.	7.6	6.8	.86	7.8	8.8	9.7	-	6.7	7.8	8.8	-	5.8	6.6	7.1	-	5.7	5.8	6.8	-
3	[illegible]	12-13 Mar 1964	Aurora, Minn.	15.8	11.8	.95	6.5	6.8	7.8	(8.2)	5.8	6.3	6.7	(7.8)	5.6	5.8	6.8	(7.1)	5.1	5.8	5.7	(6.8)
4	[illegible]	3-4 Oct 1950	Cairo, Ill.	12.8	10.6	.90	5.6	7.7	11.5	12.8	5.8	6.8	10.3	12.8	5.5	5.7	8.9	10.9	5.8	5.5	8.3	10.1
5	[illegible]	16-18 Dec 1955	Springfield, Mo.	9.1	8.8	.90	5.6	6.7	10.8	(11.8)	5.8	6.8	10.1	(10.8)	5.8	5.6	9.1	(9.8)	5.6	5.8	8.3	(8.8)
6	[illegible]	15-17 Mar 1913	Richmond, Ind.	9.8	9.1	.88	6.1	7.8	10.3	10.5	5.5	7.5	9.8	10.8	5.7	6.8	8.8	11.8	5.8	6.1	8.8	10.8
7	[illegible]	3-15 Jan 1937	Denver, Tenn.	20.1	18.6	.98	5.8	5.2	7.8	12.8	5.6	5.8	7.6	11.5	8.9	5.8	6.7	10.8	5.8	5.6	6.3	10.8

* Note: The total storm values correspond to those represented by isohyetal maps for durations exceeded longer than 120 hours in some cases.

This page is intentionally left blank to facilitate 2-sided printing.

Appendix A.4

Hydrologic Analysis of Ungaged Watersheds Using HEC-1, Training Document No. 15 (1982)

This page is intentionally left blank to facilitate 2-sided printing.

US Army Corps
of Engineers
Hydrologic Engineering Center

Hydrologic Analysis of Ungaged Watersheds Using HEC-1

April 1982

Approved for Public Release. Distribution Unlimited.

TD-15

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Department of Defense, Executive Services and Communications Directorate (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.
PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ORGANIZATION.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
April 1982	Training Document	

4. TITLE AND SUBTITLE
Hydrologic Analysis of Ungaged Watershed Using HEC-1

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Johannes J. DeVries

5d. PROJECT NUMBER

5e. TASK NUMBER

5F. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
US Army Corps of Engineers
Institute for Water Resources
Hydrologic Engineering Center (HEC)
609 Second Street
Davis, CA 95616-4687

8. PERFORMING ORGANIZATION REPORT NUMBER
TD-15

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/ MONITOR'S ACRONYM(S)

11. SPONSOR/ MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

This report discusses general approaches to frequency analyses for ungaged watersheds, effects of the extent of data availability on choice of approach, and regionalization of hydrologic parameters. Hypothetical rainfall data are often the only rainfall data available for s study, so methods for use of this type of data are presented. The use of HEC-1 for watershed modeling is described and techniques are given in detail for the estimation and calibration of HEC-1 model parameters.

15. SUBJECT TERMS
floods, flood hydrology, flood frequency, simulation, mathematical models, hydrologic models, watersheds, runoff

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER
U	U	U	UU	178	

Hydrologic Analysis of Ungaged Watersheds Using HEC-1

April 1982

US Army Corps of Engineers
Institute for Water Resources
Hydrologic Engineering Center
609 Second Street
Davis, CA 95616

(530) 756-1104
(530) 756-8250 FAX
www.hec.usace.army.mil

TD-15

HYDROLOGIC ANALYSIS OF UNGAGED WATERSHEDS
WITH HEC-1

CONTENTS

CHAPTER		PAGE
	PREFACE	xiii
	ACKNOWLEDGMENTS	xv
1.	INTRODUCTION	
	1.1 Scope of Report	1
	1.2 Need for Guidelines	3
2.	GENERAL APPROACHES TO FREQUENCY ANALYSIS FOR UNGAGED BASINS	
	2.1 Generalized Rainfall - Runoff Relations	5
	2.2 Regional Analysis of Watershed Characteristics	7
	2.3 Continuous Simulation with Historical Precipitation Data	8
	2.4 Single Event Simulation with Hypothetical Precipitation Data	9
	2.5 Selection of a Particular Method	10
3.	EFFECT OF DATA AVAILABILITY ON CHOICE OF APPROACH	
	3.1 Degrees of Data Availability	11
	3.2 General HEC-1 Study Approach with Limited Data	11
	3.3 Influence of Data Availability on Study Procedure	12

CONTENTS (Cont'd)

CHAPTER		PAGE
4.	HYPOTHETICAL PRECIPITATION DATA	
	4.1 Introduction	17
	4.2 Types of Hypothetical Storms	18
	4.3 Applications for Hypothetical Storms	20
	4.4 Construction of Hypothetical Storms	21
	4.5 Consistant Depth-Area Relationships	25
	4.6 Other Considerations	25
5.	CALIBRATION OF MODEL PARAMETERS	
	5.1 Need for Model Calibration	27
	5.2 Unit Hydrograph Specification	27
	5.3 Loss Rate Analyses	31
	5.4 Parameter Estimation Technique	33
	5.5 Application of Automatic Calibration Capability to the Rainfall-Runoff Process	38
	5.6 Stream Flow Routing Optimization	40
39		
	5.7 Typical Values of Model Parameters	43
6.	REGIONALIZATION OF UNIT HYDROGRAPH AND LOSS-RATE PARAMETERS	
	6.1 Introduction	44
	6.2 Basic Steps in a Regional Study	44
	6.3 Definition and Description of Regionalization Parameters	45
	6.4 Basic Techniques for Regression Analysis	48
	6.5 Criteria for Accepting Results of Regression Analysis	51

CONTENTS (Cont'd)

CHAPTER		PAGE
7.	HEC-1 KINEMATIC WAVE ROUTING TECHNIQUES FOR UNGAGED BASIN MODELING	
	7.1 Introduction	53
	7.2 Basin Modeling	54
	7.3 Kinematic Wave Equations	56
	7.4 Elements Used in Kinematic Wave Equations	56
	7.5 Overland Flow Elements	57
	7.6 Collector Channel	59
	7.7 Main Channel	60
	7.8 Example Application of Kinematic Wave Methods	61
	7.9 Summary	66
8.	CASE STUDY I - ANALYSIS WITH SOME DISCHARGE-FREQUENCY DATA	
	8.1 General Study Program	67
	8.2 Basin Description	69
	8.3 Frequency Analysis	72
	8.4 Unit Hydrograph Analysis	72
	8.5 Hypothetical Storms	78
	8.6 Basin Hydrologic Model for Hypothetical Storms	80
	8.7 Results of Hydrologic Analysis	81
9.	CASE STUDY II - ANALYSIS WITH SOME STREAMFLOW DATA AVAILABLE	
	9.1 Basin Description	83
	9.2 Observed Frequency (Observed Data)	85
	9.3 Unit Hydrograph Studies	87
	9.4 Basin Subdivision and Model Calibration	91
	9.5 Channel Routing Criteria	94

CONTENTS (Cont'd)

CHAPTER		PAGE
9.	CASE STUDY II - ANALYSIS WITH SOME STREAMFLOW DATA AVAILABLE (Cont'd)	
	9.6 Hypothetical Storm Runoff Estimates	94
	9.7 Regional Discharge-Frequency Comparisons	95
	9.8 Conclusions	99
10.	CASE STUDY III - ANALYSIS WITH NO AVAILABLE DATA	
	10.1 Study Outline	100
	10.2 Basin Description	101
	10.3 Unit Hydrograph Analysis	101
	10.4 Frequency Analysis	102
	10.5 Hypothetical Storms	104
	10.6 Hydrologic Basin Model	105
	10.7 Regional Discharge-Frequency Analysis	108
11.	REFERENCES	117
APPENDIX - PROCEDURES FOR DEVELOPING SYNTHETIC PRECIPITATION DATA		
	A.1 Introduction	A-1
	A.2 Sources of Storm Data	A-1
	A.3 Hypothetical Frequency Storm Derivation	A-5
	A.4 Example Application	A-14
	A.5 Standard Project Storm	A-21
	A.6 Probable Maximum Storm	A-30
	A.7 Supplemental Information	A-36
	A.8 References	A-38

LIST OF FIGURES

FIGURE		PAGE
3.1	Development of a Runoff Hydrograph for a Simple Ungaged Basin Using HEC-1	13
4.1	Typical Isopluvial Map	19
4.2	Adjustment of Rainfall Data for Area	23
4.3	Typical Time Distribution of Storm Rainfall	24
5.1	Illustration of Clark Coefficients	28
5.2	Division of Basin on Basis of Travel of Travel Time to Outlet	29
5.3	Typical Watershed Time-Area Relationship	30
5.4	Loss Rate Function Used in HEC-1	31
5.5	Sequence of Events in Evaluation of Objective Function	35
6.1	Graphical Correlation - t_p as a Function LL_{ca}	49
7.1	Typical Urban Drainage Pattern	55
7.2	Elements Used in Kinematic Wave Calculations	58
7.3	Basin for Example Problem	61
7.4	Computed Hydrographs for Example Problem	64
7.5	Effect of Urbanization on Basin Outflow	65
8.1	Watershed Map - Rahway River Basin	68
8.2	Annual Flood Peak Frequency Data and HEC-1 Results	70
8.3	Recommended Discharge-Frequency Curve	71
8.4	Optimized 1-Hour Unit Hydrograph for Rahway River Near Springfield	75
8.5	Optimized 1-Hour Unit Hydrograph for Rahway River at Rahway	76
9.1	Shellpot Creek Study Area	84
9.2	Discharge-Frequency Curve for Shellpot Creek	86

LIST OF FIGURES (CON'T)

FIGURE		PAGE
9.3	Typical Isohyetal Map	88
9.4	Simulated and Observed Hydrographs	90
9.5	Basin Subdivision	92
9.6	Regional Parameters	93
9.7	Drainage Area-Discharge Relationships	97
10.1	Red Lion Creek Basin Study Area	102
10.2	Annual Flood Peak Frequency Data	103
10.3	Discharge-Frequency Data	109
10.4	Peak Discharge for Hypothetical Events	110
10.5	Peak Discharge vs Drainage Area	111
10.6	Mean Log Coefficient C_m for Annual Flood Peaks	115
10.7	Standard Deviation Coefficient C_s for Annual Flood Peaks	116
A.1	Distribution of Rainfall Stations for NWS Storm Data	A-3
A.2	Typical Isopluvial Map	A-4
A.3	Adjustment of Point Rainfall for Watershed Area	A-10
A.4	Partial and Annual Rainfall Series	A-12
A.5	Example of Arrangement of Hourly Rainfall Over a 24-Hour Period	A-13
A.6	Rainfall Value for the Study Area (Northeast Corner of Texas Panhandle)	A-15
A.7	Depth-Duration Relationship for Study Area (Northeast Corner of Texas Panhandle)	A-16
A.8	Rainfall Depth for 2-yr Return Interval, 6-hr Duration for Example (Davis, California)	A-18
A.9	Rainfall Depth-Duration Relationship for Example (Davis, California)	A-20
A.10	Index Rainfall for Standard Project Storm	A-22

LIST OF FIGURES (CON'T)

FIGURE		PAGE
A.11	Adjustment of Standard Project Storm Rainfall for Watershed Area	A-24
A.12	Isohyetal Pattern for Standard Project Storms	A-25
A.13	Distribution of Standard Project Storm Rainfall in Time (6-hr Periods)	A-26
A.14	Hourly Distribution of SPS Rainfall in Maximum Six-Hour Period	A-27
A.15	Example of Probable Maximum Precipitation Intensities	A-32
A.16	Depth-Area-Duration Curves for Example Probable Maximum Storm	A-34
A.17	Rainfall Depth vs Duration for Probable Maximum Storm Example	A-35

LIST OF TABLES

TABLE		PAGE
5.1	Constraints on HEC-1 Unit Hydrograph and Loss-Rate Parameters	36
5.2	Program HEC-1 Default Initial Unit Hydrograph and Loss-Rate Parameter Estimates	38
5.3	Program HEC-1 Default Initial Routing Parameter Estimates	42
5.4	Bounds on HEC-1 Parameters Unit Hydrograph and Loss-Rate Parameters	43
6.1	Typical Results of Multiple Regression Analysis for Regionalization of Model Parameters (Rahway River Basin, New Jersey)	52
7.1	Parameters for Kinematic Wave Example Problem	63
8.1	Regional Analysis, Selected Data Used in the Multiple Regression Analysis Relating t_c and R to Various Physiographic Characteristics of the Rahway River	74
8.2	Results of Multiple Regression Analysis on a Regional Basis	77
8.3	Point Rainfall for Hypothetical Storm Events	78
8.4	Point Rainfall Distributions for Hypothetical Storm Events	79
8.5	24-Hour Depth-Area Rainfall Data for Hypothetical Storms	80
8.6	Recommended Peak Discharges at Various Stream Locations for Hypothetical Floods	82
9.1	Data for Historical Events	87
9.2	Rainfall and Runoff for Storm Events	89
9.3	Shellpot Creek Basin Physical Characteristics and Unit Hydrograph Data for Subbasins	89
9.4	Recommended Peak Discharges at Selected Index Points (Shellpot Creek Basin)	98
10.1	Average Point Rainfall Depths for Durations from 1 Hour to 24 Hours and Return Periods from 2 to 100 Years	106
10.2	24-Hour Depth-Area Rainfall Data for Hypothetical Storms	106
10.3	Selected Data in the Vicinity of Red Lion Creek Used in the Analysis Relating t_p and Physiographic Characteristics of a Drainage Basin	107

LIST OF TABLE (CON'T)

TABLE		PAGE
10.4	Discharge-Frequency Statistics for Streams in the Vicinity of Red Lion Creek	114
A.1	100-Year Rainfall with TP-40, Hydro-35	A-17
A.2	Synthetic 2-Year Rainfall at Davis, California	A-19
A.3	3-Hour Duration 10-Minute-Interval 2-Year-Return-Period Storm at Davis, California	A-20
A.4	Subdivision of Maximum 1-Hour SPS Rainfall	A-28
A.5	Final 1-Hour SPS Rainfall Distribution	A-30
A.6	Hop Brook Adjustment Factors	A-33

PREFACE

This report presents guidelines and procedures for hydrologic investigations of "ungaged" watersheds, that is, watersheds for which available streamflow data are insufficient for making dependable discharge-frequency estimates by statistical procedures. Data availability may vary from the extreme of none at all to situations where some discharge-frequency data can be used with a hydrologic model to extend the discharge-frequency curve to estimate less-frequent events. The hydrologic model can also be used to develop discharge-frequency relationships at ungaged locations in the basin.

The procedures presented center on computer program HEC-1, a general-purpose watershed-modeling program package developed at the Hydrologic Engineering Center (HEC) of the U.S. Army Corps of Engineers. The analysis techniques, developed at HEC, have been used in a number of studies of ungaged watersheds. Examples from three studies are used herein to illustrate use of the procedures.

This report discusses general approaches to frequency analyses for ungaged watersheds, effects of the extent of data availability on choice of approach, and regionalization of hydrologic parameters. Hypothetical rainfall data are often the only rainfall data available for a study, so methods for use of this type of data are presented. The use of HEC-1 for watershed modeling is described, and techniques are given in detail for the estimation and calibration of HEC-1 model parameters.

ACKNOWLEDGMENTS

This report is the result of efforts of a number of people at the Hydrologic Engineering Center (HEC). Johannes J. DeVries prepared the report. The basic outline was developed by David Ford, with contributions from a number of the Center's staff. The chapter on Calibration of Model Parameters (Chapter 5) was written by Dr. Ford. Gary Dyhouse, Chief of the Hydrologic Engineering Section of the St. Louis District, Corps of Engineers, prepared the material in the Appendix while on assignment at HEC in 1979.

The major portion of the material in this report is based on notes, procedures, and special-assistance reports prepared by the Special Assistance Branch of the Hydrologic Engineering Center, much of which was the work of Dale Burnett, past Branch Chief. The review comments of Bill Eichert, Dale Burnett, Arlen Feldman, John Peters, and David Ford were very helpful. William Johnson offered a number of valuable suggestions on both content and organization. Also greatly appreciated is the help of the Training and Methods Branch clerical staff, Eileen Tomita, Diane Harris, and Penni Baker. Ms. Baker provided a great deal of help with the report figures, besides typing drafts. The final typing was done by the Word Processing Center of the Sacramento District, Corps of Engineers.

Director of the Hydrologic Engineering Center during the study period was Bill S. Eichert. Funding for the report was provided by the Office of the Chief of Engineers, U.S. Army Corps of Engineers under the Analytical Techniques Research Subarea of the Corps of Engineers Research and Development Appropriations.

CHAPTER I

INTRODUCTION

1.1 Scope of Report

This report presents guidelines and methods for determining discharge-frequency relationships for ungaged watersheds. It considers the following topics:

- General approaches to frequency analysis
- Effect of data availability on choice of approach
- Use of hypothetical precipitation data for ungaged watersheds
- Basin modeling with HEC-1 and calibration of model parameters
- Regionalization of model parameters
- Case studies to illustrate use of the methods

Emphasis is placed on the use of computer program HEC-1 for the hydrologic calculations. Computer program HEC-1 is a comprehensive, single-event precipitation-runoff model (Hydrologic Engineering Center, 1981, 1980). The program was developed by the Hydrologic Engineering Center (HEC) of the U. S. Army Corps of Engineers in Davis, California. HEC-1 is maintained and supported by the Hydrologic Engineering Center and is widely available throughout the United States at commercial computer facilities, as well as on Corps of Engineer and other federal computer systems.

In HEC-1, the transformation from rainfall excess to streamflow is accomplished either through unit hydrograph or kinematic wave routing procedures. A variety of techniques can be used for calculation of watershed interception and infiltration (refered to as loss rates). The loss rate determination is an important part of the hydrologic analysis; the accuracy of the loss calculations greatly affects the accuracy of the final results of the modeling effort.

The hydrograph parameters and loss rates must usually be determined by calibration, from rainfall and flow data. When no data are available for a

watershed, they must be estimated by using data from similar watersheds. If the watersheds are hydrologically similar, direct transfer of the data may be done with minor adjustments. More generally, regionalization techniques are used to develop runoff transformation and loss rate parameters.

Information on some common methods for the development of hypothetical storms is presented in detail (See Chapter 4 and the Appendix), with examples of the development of storm rainfall distributions. In many studies, hypothetical rainfall data are the only rainfall data available for the study. The approaches presented for storm development use the rainfall intensity-duration-frequency criteria developed by the National Weather Service, as presented in the NOAA Atlases (NOAA, 1973) and in Technical Paper 40 (U.S. National Weather Service, 1961). Corps of Engineers procedures for configuring the hypothetical storms are used. It should be noted that not all areas of the country can use the methods described here, however.

Because the methods presented in this report rely on the features available in computer program HEC-1, detailed techniques are given for the estimation and calibration of HEC-1 model parameters. Included are discussions of the runoff transformation and loss-rate parameters as well as streamflow routing parameters. Typical values of parameters are given for comparison, and the sensitivity of results to parameter estimation errors is discussed.

Three case studies are presented to illustrate the practical application of the material in this report. An example is given for each of three degrees of data availability: (1) for the case where some discharge-frequency data are available; (2) where some rainfall and streamflow data are available, but where streamflow data are insufficient to determine discharge-frequency curves by statistical analysis; and (3) where no streamflow data exist for the watershed.

The primary objective of this report is to describe how HEC-1 can be used to develop peak-discharge-frequency estimates for ungaged areas. The hydrologist can use the material presented here to help choose the

appropriate level and detail of a study, basing this decision on the availability of the data, time and funds available, and the accuracy requirements of the study results. It should be kept in mind that any data for the basin which are available should be used in the calibration of the hydrologic model of the basin and in the development of discharge-frequency curves at gaged locations. By using all the resources available, including data from regional sources, in conjunction with the analytical techniques described here, the hydrologist can usually make reasonable determinations of discharge-frequency relations for ungaged basins.

1.2 Need for Guidelines

A lack of meteorological and hydrological data is one of the greatest obstacles to accurate discharge-frequency analysis (Burnham, 1980). The hydrologist is usually faced with the problem of having few rainfall measuring sites and even fewer streamflow measuring stations in the basin under study. Techniques are therefore required for predicting or forecasting the peak flow rate and/or volume of runoff for events or situations of interest that do not rely on historical records as a check.

Accurate prediction of streamflows is essential in the planning and design of all types of water resource systems. Of major concern is the prediction of the magnitude of flood peaks and their frequency of occurrence. Information on peak flow is needed for the sizing of channels, bridge waterways, storm drainage systems, reservoir spillways, and other hydraulic structures. The frequency associated with a given flood flow permits the selection of the appropriate level of probability for design. General areas for which this information is used include: Design of urban drainage systems, flood plain mapping, and design of structural and nonstructural measures for reduction of flood damages.

Hydrologic studies to provide data for flood insurance studies require flow and frequency estimates for a wide range of recurrence intervals. In these studies, the 10-, 50-, 100-, 500-year (the 10-, 2-, 1-, 0.2- percent events), and the Standard Project Flood are frequently determined. For reservoir and spillway design the largest expected floods are of greatest concern, and the 100-year, 500-year, Standard Project Flood, plus the Probable Maximum Flood magnitudes are required.

CHAPTER 2

GENERAL APPROACHES TO FREQUENCY ANALYSIS FOR UNGAGED BASINS

The method used for hydrologic analysis of an ungaged basin depends upon many factors. These include:

(A) Type of information required:

(1) Peak flow. Only the maximum discharge at some point in the basin is needed in many cases.
(2) Volume of flow. The total storm runoff is required in some circumstances.
(3) Rate of runoff over an extended period of time. A complete hydrograph for a given frequency flood must be specified in many cases.

(B) Type of data available:

(1) Precipitation. Data may be available only for adjacent basins.
(2) Basin characteristics. Required for basin modeling or for regionalization analysis.
(3) Observed or computed peaks for major events. Although no gage exists for long term records, some data may be available for isolated events.
(4) High water marks of major historical events. These can be used for calibration of a basin model.

(C) Resources.

(1) Experience of the hydrologist, familiarity with alternative methods, and access to computer facilities.
(2) Study time-frame and manpower available.
(3) Funds available for the study. This may be the most important factor in influencing how the study is done.

The approaches used include regional frequency analysis, continuous precipitation-runoff analysis with historical precipitation data, and single-event precipitation-runoff analysis using synthetic precipitation data. These three general approaches are discussed in this chapter. There are other widely used procedures, such as USGS nomographs, empirical equations, and others. The reader is referred to McQuen, et al. (1977) for a list of references on other methods.

2.1 Generalized Rainfall-Runoff Relations

Hydrograph analysis concepts may be applied to ungaged watersheds through the development and application of generalized functions for estimating the amount of precipitation lost due to interception and infiltration (loss rates), unit hydrographs, and base flow. The unit hydrograph is usually assumed to give a unique relationship between rainfall excess and surface runoff for a basin regardless of storm size, losses, or other factors (Hydrologic Engineering Center, 1973b). Because of its ease of use, the unit hydrograph has received the most attention by hydrologists. However, other methods of hydrograph generation are also becoming widely used (Feldman, 1979), such as the kinematic wave approach to basin modeling, also a feature of HEC-1. Both the unit hydrograph and the kinematic wave analyses will be discussed in this report.

The determination of loss rates is a major problem because loss rates are extremely variable and are dependent on both precipitation patterns and basin characteristics. Loss rates should correspond to those considered reasonably likely to occur during the given magnitude storm and should be estimated on the basis of observed loss rates for floods that have occurred in the study basin or in similar areas (USCE, 1965; HEC, 1975b). A "criteria" approach where loss rates are chosen to give conservatively low values has also been used. The criteria approach is most appropriate for computing large floods (from synthetic rainfall), such as floods for spillway design, since losses tend to be small relative to rainfall for large and rare events. This is especially true when the ground is frozen at the beginning of the flood. This approach is less appropriate when it is used to compute runoff for a range of flood events for system performance evaluations, due in

part to the fact that different combinations of rainfall intensities and loss rates can yield similar runoff quantities.

Relating loss rates and analytical loss-rate functions to soil type, land use and cover, antecedent precipitation, and rainfall intensity can be done; however, good results have not always been obtained. A commonly used procedure is that of the U.S. Soil Conservation Service (SCS) which permits generalizing loss-rate functions through the SCS curve number technique. The curve number reflects land use, cover, and soil types with allowances for antecedent moisture conditions (U.S. Department of Agriculture, SCS, 1957).

Unit hydrographs for ungaged basins (also known as synthetic unit hydrographs) are usually developed in two steps. First, an equation or procedure is devised that will allow a unit hydrograph to be computed. Second, the procedure (or equation) must be related to definable basin characteristics. The simplest and most direct method is to transfer a unit hydrograph from an adjacent gaged basin of similar hydrological and meteorological characteristics with simple adjustments. This technique is fairly common; however, it is usually difficult to locate "similar" basins. More complicated and more general procedures include deriving parameters that describe the unit hydrograph, and then transferring these parameters with some adjustments. The two most common synthetic unit hydrograph methods used in the Corps of Engineers are the procedures of Clark (1945) and Snyder (1938).

An alternative to the unit hydrograph approach is the simulation of the most significant watershed processes, such as interception and infiltration, overland flow, and channel flow, using small elements of the watershed to trace the movement of water through the basin. The various watershed elements are linked together to produce a model of a complete watershed. The Stanford Watershed Model and the MITCAT Model (MIT Catchment Model) are two well-known examples of this type of model. Models of this type have been designated as "distributed-parameter" models in contrast to "lumped-parameter" models such as the unit hydrograph.

The distributed-parameter approach is very attractive for modeling ungaged basins, because it is based in principle on the use of physically-based parameters for describing the response of the basin to rainfall. The required data include lengths of overland flow paths and overland flow resistance coefficients, channel geometry and roughness, channel lengths, and loss-rate parameters. The channel parameters can be obtained quite readily; however, it is somewhat more difficult to estimate the overland flow parameters. In general, the model should be calibrated using measured flows to ensure its proper formulation.

To permit basin modeling by a distributed-parameter approach, computer program HEC-1 contains kinematic-wave procedures for computing subbasin outflow hydrographs (Hydrologic Engineering Center, 1981). These kinematic wave options provide an alternative to the unit hydrograph method for determining direct runoff.

A description of the kinematic-wave techniques available in HEC-1 is given in Chapter 7. Procedures for computing flow hydrographs are presented. The development of frequency estimates for this approach is in general the same as when the unit hydrograph approach is used, once the hydrographs have been determined for various rainfall frequencies.

2.2 Regional Analysis of Watershed Characteristics

It is sometimes possible to transfer information from watersheds for which data are available to nearby ungaged watersheds within a given region, if they have very similar hydrological characteristics. If unit hydrograph and loss rate parameters can be related to basin characteristics, then a rainfall-runoff model such as HEC-1 can be used to estimate discharge information.

If a regional approach is used, care should be taken to select basins that are indeed similar in hydrological characteristics. Thus, the basins should have similar geological characteristics, topography, land uses, vegetative cover, and agricultural practices. The basins should be of the same general size, and the rainfall distribution and magnitude, as well as the factors affecting loss rates, should be generally the same.

Basic Steps in a Regional Study Using the Unit Hydrograph Procedures of HEC-1:

1. Collect precipitation and runoff information for a range of major flood events in the region. Identify the watershed and subbasin boundaries on a topographic map. Index points where discharge-frequency estimates are desired should be located. The subbasins are chosen to include these index points, desired hydrological components, and stream gage locations. Basins adjacent are also used if they are hydrologically and meteorologically similar.

2. Perform an HEC-1 rainfall-runoff analysis to optimize the unit hydrograph and loss-rate parameters for the gaged drainage areas.

3. Correlate the unit hydrograph and loss-rate parameters with basin characteristics and develop generalized relationships for these parameters.

4. Divide region into subbasins corresponding to their hydrologic characteristics and to the index points at which discharge-frequency estimates are needed, and also to capture the spatial variations in precipitation.

5. The generalized relationships developed in Step 3 are used to compute parameters for the ungaged subbasins using measurable subbasin characteristics.

6. A watershed simulation using HEC-1 is next performed for several historical storm events. If the reconstituted runoff peaks and volumes at downstream gages are significantly different from observed hydrographs, the unit hydrograph, loss-rate, and/or routing parameters must be adjusted and the analysis repeated.

2.3 Continuous Simulation with Historical Precipitation Data

An alternative method to the single event modeling approach is continuous simulation with long term precipitation data after calibrating the model with several years of continuous data. This approach could be used

with any continuous simulation model, such as the HSP model (Hydrocomp, Inc., 1976; Crawford, 1971).

In many cases, the length of record for streamgage data is only a few years. Rainfall data are often available for much longer periods for the same watershed, and hourly data in the U.S. are frequently available for a period of 35 to 70 years. By simulating a streamflow record with these data, sufficient data for a discharge-frequency relationship can be obtained. This relationship is based on the response of the basin during the calibration period, and thus no correction for changes in basin characteristics over the period of record need to be made unless it is known that the discharge-frequency relationship has changed due to urbanization or other effects, such as channelization or water storage projects (Cermak, 1979).

This method has also been used on completely ungaged basins when data are available from adjacent basins with known characteristics to establish the modeling parameters. This type of model requires a similar subdivision of the basin into small subbasins to properly account for the various soil and land use characteristics within the basin. The chief disadvantage of models of this type is the high cost associated with their use. Several factors contribute to these costs: a great amount of data is needed; the personnel time required for setting up the model is significantly greater than for other models; and more computer time is also needed.

2.4 Single Event Simulation with Hypothetical Precipitation Data

In many cases, neither streamflow nor precipitation data records are long enough to determine flood-flow return periods that are less frequent than a few years. If it is assumed that the frequency of a given flood is the same as the frequency of the storm producing the flood then hypothetical storms can be developed on the basis of meteorological analyses to give rainfall data for a particular frequency of occurance.

Analysis of total storm rainfall data on a regional basis permits the development of generalized rainfall-frequency curves for relatively large areas. These are usually based on point rainfall-frequency analyses which are adjusted to account for the areal extent of the storms. These generalized storms are usually refered to as "design storms."

The total storm rainfall can then be distributed in time and used as precipitation input to a hydrologic model (such as HEC-1) to determine the runoff associated with a storm of a given frequency. If the discharge for a particular frequency storm is known, the model loss rates can be adjusted so that the computed discharge matches the observed. A similar adjustment procedure can be used for storms of other frequencies. A number of storms, each of a different frequency, are used to produce a discharge-frequency curve. This is done by either assuming that the rainfall and runoff frequency relationships are the same or by using an adjustment procedure to relate rainfall and discharge frequency. If no adjustment is used, it is assumed, for example, that the 1 percent frequency storm produces the 1 percent frequency flood flow.

The major assumption of this method is that rainfall of a given frequency will produce a flood of the same frequency. It should be recognized, however, that different combinations of rainfall intensities and loss rates can give rise to the same peak discharge. However, when no rainfall or flow data are available, this may be the most acceptable approach. Because of the wide use of this method, the development of hypothetical storms will be described in some detail in Chapter 4.

2.5 Selection of A Particular Method

The particular approach used for the hydrological analysis of a watershed depends on a number of factors (Burnham, 1980). The type of study being performed and the information that is needed from it are important, as well as the amount of time and the personnel available. The characteristics and location of the watershed will influence the method used. Often the experience of the hydrologist and his familiarity with a particular technique will influence him to select a given method over others, even though a less familiar method may give superior results. However, if one assumes comparable expertise, the most important factors in determining the method used for the analysis of an ungaged watershed are the type and amount of data available and the funds available. The following chapter discusses in detail the effect of data availability and will serve as a guide for establishing the methodology to be used in a given study.

CHAPTER 3

EFFECT OF DATA AVAILABILITY ON CHOICE OF APPROACH

It is the rule, rather than the exception, that the data available for a particular hydrologic study are not sufficient to give a complete solution to the problem. The available methods of hydrologic analysis are frequently more precise than the data to support them, even though many hydrologic processes are not fully understood and completely defined. As a consequence, the hydrologist is often constrained to adopt procedures that are not as complete or as rigorous as desired, but that must be used as a result of the type of data that are available. This chapter discusses the degrees of data availability, the general approach to basin analysis using HEC-1, and the influence of data availability on the study procedure.

3.1 Degrees of Data Availability

Three levels of data availability are considered here: (1) Sufficient data to calculate discharge-frequency curves at some locations, but not at others; (2) Sufficient rainfall and streamflow data to calibrate precipitation-runoff parameters at some locations, but insufficient streamflow data to derive discharge- frequency curves by statistical methods; and (3) No streamflow data available within the basin.

3.2 General HEC-1 Study Approach with Limited Data

HEC-1 is a generalized precipitation runoff model for single event simulation (Hydrologic Engineering Center, 1981). Either a unit hydrograph or kinematic wave approach is used to transform rainfall values to runoff. The unit hydrograph is most commonly used, and it is assumed that a single unit hydrograph is appropriate for all magnitudes of rainfall excess. Clark, Snyder, or the Soil Conservation Service unit hydrograph methods can be used. Snowmelt can be included, and several loss rate functions are available. A large basin can be subdivided into subbasins, and stream routing from subbasin to subbasin can be performed with any of several hydrologic routing methods.

The basic sequence followed in the situation where no streamflow is available for the basin is shown in Figure 3.1. The basin average rainfall associated with a particular frequency of occurrence is determined, either from historical records or using methods for developing hypothetical-frequency events (see Chapter 4). Basin average loss rates are set. These may be calculated from regional values; they may be estimated through direct transfer from historical events; or other methods may be used.

The computed time distribution of basin-average rainfall excess (i.e., the rainfall minus losses) is then used with a unit hydrograph and the general basin routing model to compute the runoff hydrograph at the basin outlet. The Clark, Snyder, or SCS unit hydrographs may be used with the hydrograph parameters determined by calibration using measured events (see Chapter 5) or by using parameters determined with regionalization techniques (see Chapter 6). Alternatively, the kinematic wave options of HEC-1 can be used to develop a basin model.

This process is repeated for several storms of different frequencies. The computed flow for each event can be associated with the frequency of occurrence of the rainfall, and a discharge-frequency relationship can be established. This discharge-frequency relationship is adjusted to match events of known frequency by adjusting the loss rates.

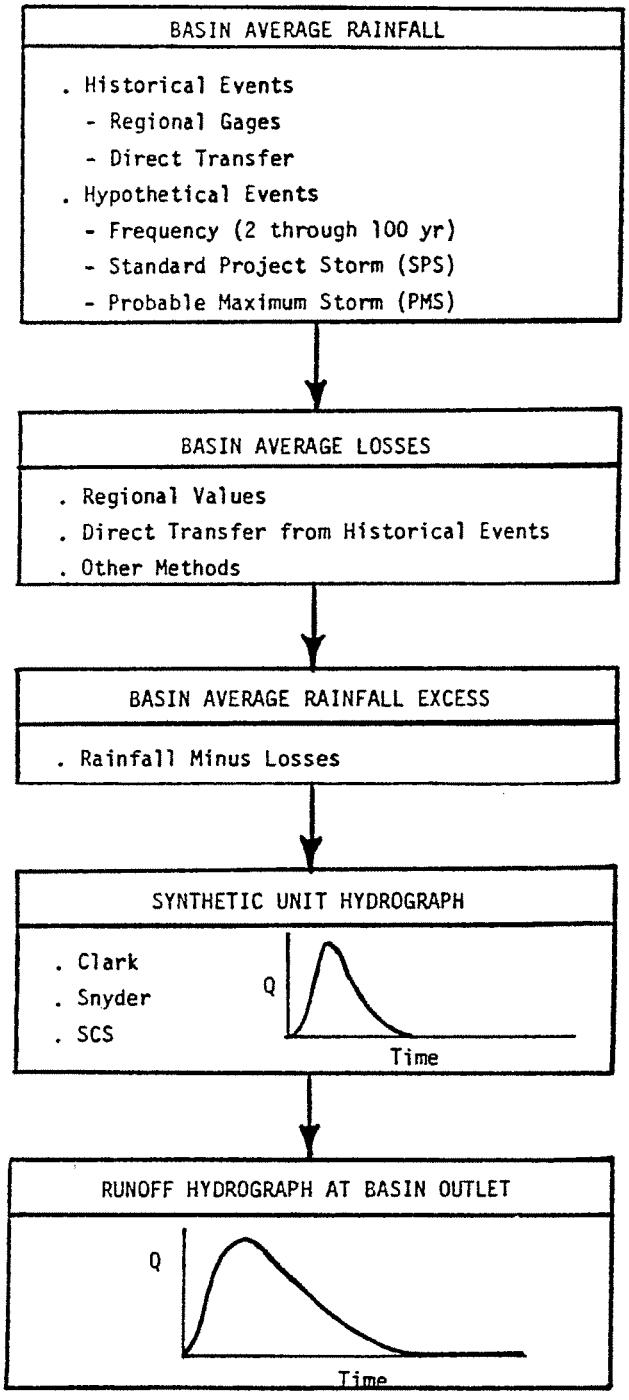
3.3 Influence of Data Availability on Study Procedure

The type and amount of data that are available for the study strongly influence how the study is conducted. This is illustrated here for the case where little or no streamflow data are available. Three possible levels of study procedure are discussed, starting with the most extensive investigation effort.

Procedure A - Complete Study

(1) Obtain Basin Parameters

Determine locations in a hydrologic region similar to the study basin where discharge has been measured during several (usually 5 to 10) major storm events. Collect streamflow and rainfall data for these events at as



3.1. Development of a Runoff Hydrograph for a Simple Ungaged Basin Using HEC-1.

many locations as possible. Determine unit hydrograph or kinematic wave parameters, loss-rate parameters, beginning flow rates, and recession characteristics which do the "best" job of reproducing the observed hydrographs. Adopt representative values of these parameters. Optimization features of the HEC-1 model are normally used for this step.

(2) Regionalize Basin Parameters

Perform regression studies on unit hydrograph parameters and basin physical characteristics using the procedures given in Chapter 6.

(3) Develop Streamflow Frequency Curves for Gaged Sites

If any of the stream gages studied are near the basin of interest, perform discharge-frequency analyses on the annual series of observed maximum discharges.

(4) Model the Study Area

a. Subdivide the study basin into as many subbasins as are necessary to establish index points for each stream reach where discharge-frequency estimates are required. Determine the drainage area and other physical characteristics of each subbasin and adopt unit hydrograph or kinematic wave parameters for each, based on the regional studies of Step (2).

b. Determine channel length between index and/or combining points and estimate channel routing characteristics either by detailed field surveys, stream cross-section and multiple-discharge water surface profile studies, or any acceptable approximate means commensurate with the scope of the study. Adopt channel routing parameters.

c. Assemble subarea data decks for the HEC-1 runoff model for several historical storms and adjust loss parameters and routing parameters to best reproduce the observed hydrographs at gaged points, if gaged points are present.

(5) Develop Hypothetical Events

Develop rainfall frequency curves using the National Weather Service procedures described in Chapter 4, for various rainfall durations (say

durations of 1, 3, 6, 12, and 24 hours). For a selected storm frequency, determine rainfall depths for each duration at desired time intervals, compute incremental depths, and arrange in appropriate order around the maximum value. This is repeated for each of several storm frequencies such as the 50-percent, 10-percent, 2-percent, 1-percent events (i.e., the 2-year, 10-year, 50-year, 100-year recurrance intervals). These become the hypothetical storm inputs. Point rainfall values should be adjusted to the appropriate areal size using the guidelines given in Chapter 4.

(6) Assign Frequency to Hypothetical Events at Gaged Sites (If Available)

If there is a gage at some location either in the basin or on a nearby watershed the data from this gage can be used to develop a better estimate of the discharge-frequency relationships at the locations which have no gages. If there is no suitable gage, this step is skipped.

Use the hypothetical storm data of Step (5) as input to the calibrated model of Step (4) and generate peak discharges at whatever gaged locations may be available for selected rainfall frequencies. Compare the results with discharge-frequency curves at the gaged locations. Adopt indicated frequencies for hypothetical events or adjust loss rates in a logical manner until reasonable agreement is obtained between the two frequency curves.

(7) Determine Point Runoff and Frequency for Desired Locations

Use HEC-1 to generate peak discharges for each subbasin and combining point throughout the basin. If they are available, the loss rates established in Step (6) are used with the hypothetical precipitation data. Separate HEC-1 runs are required for each frequency and rainfall distribution pattern, but the jobs can be stacked so that they are all processed at one time. Plot the peak discharge values vs exceedence frequency on a log-normal probability paper and interpolate to get other discharge frequencies, if they are desired. Compare results with those available from other methods and adopt final values.

Procedure B - Regional Unit Hydrograph Parameters Available

If regression equations for regional unit hydrograph parameters are already available, Procedure A can be modified by omitting Steps (1) and (2).

When there are no observed data within the basin under study, streamflow-frequency curves should be developed for near-by basins by treating the area above each gage as a single subbasin (Step (3)). Step (4c) will also be omitted in this procedure.

Procedure C - Data Available from Previous Studies

If a discharge-frequency curve is desired at only one location and no observed data are available, but regional unit hydrograph and loss rate parameters are available from previous studies, only Steps (5) and (6) are needed. In this situation the basin would not be subdivided. Appropriate loss rates would be subject to considerable judgment, however, and could vary widely, depending on the criteria used by the individual selecting the value.

CHAPTER 4

HYPOTHETICAL PRECIPITATION DATA

4.1 Introduction

Hypothetical rainfall data are used when rain gage data are not available or when records are too short to develop rainfall-frequency relationships. Hypothetical storms are also used as a basis of design for projects which pose a threat to property or would result in loss of life. General use of these data is discussed in this chapter. Detailed guidelines for hypothetical storm development are given in the Appendix.

Sources of Storm Data. The primary sources of hypothetical storm information for the United States are various technical publications (TP) of the National Weather Service (NWS) and the hydrometeorological reports (HR) of the National Oceanic and Atmospheric Administration (NOAA) (NOAA, 1973; NWS, 1961; for example). The development of hypothetical-frequency storms from data given in these publications is based on generalized rainfall maps and regression equations. Other methods, such as statistical analysis of nearby long-record rain gages to derive the hypothetical storms of particular frequencies, are used extensively in some parts of the United States but are not discussed here.

The United States is divided into two major geographical areas based on type of precipitation. The 35 states east of the Rocky Mountain area are essentially free of significant orographic effects and thus are included in one region. The 13 mountain states (those containing the Rocky Mountains and states to the west) are covered on a state-by-state basis as well as in site-specific publications. Similar data are available for Alaska and Hawaii. The NWS procedures are based on statistical evaluations of long-term rainfall-gage records in a region. These evaluations include estimates of the frequency of accumulated rainfall-depth versus storm duration at each rain gage. Rainfall maps made from these depth-duration values were used to define lines on the maps of equal total rainfall within a specific period. These permit consistant rainfall-depth relationships through a region for

specific storm durations to be defined. These lines of equal rainfall depth are termed "isopluvial" lines; a typical isopluvial map is shown in Figure 4.1. Derivation of the rainfall-frequency depth-duration relationships is detailed in each of the publications.

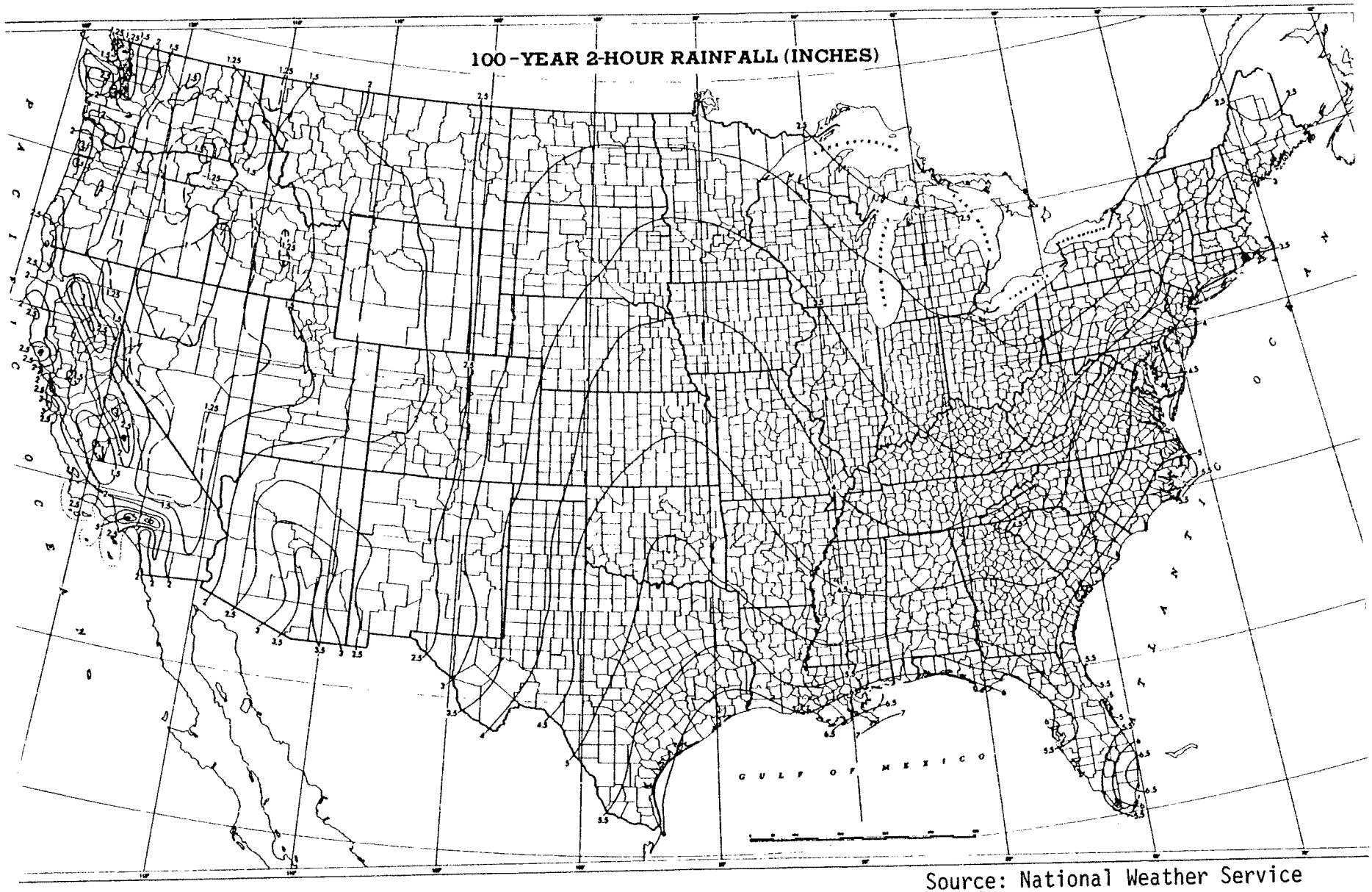
The precipitation-frequency maps given in the NWS and NOAA publications show point-precipitation values that can be assumed to apply to areas up to 10 sq mi. For larger areas, the average precipitation over the area is less than the maximum value at a point, and thus adjustments are required. In general, depth-area-duration relations vary with storm type and intensity and can also vary with the region.

A hypothetical storm developed from NWS data is sometimes called a "balanced" storm, because a consistent depth-frequency relation is used for each duration interval of the total storm. For example, for the 100-year return period, 48-hour duration storm, rainfall depths for a given period (say the 30-minute, 1-hour, 6-hour, or 24-hour periods) would each be equal to the 100-year rainfall depth for that duration interval. This consistent frequency-depth-duration relationship throughout a storm does not occur in nature, of course, because of the random nature of rainfall events. Use of a balanced storm, however, permits the construction and arrangement of a storm event such that an average precipitation intensity of a specified frequency is provided for all durations -- including one that matches the time-response characteristics of the particular watershed being analyzed.

4.2 Types of Hypothetical Storms

The storms determined from National Weather Service criteria as described above give hypothetical storm data for specific frequencies. For example, a storm with an X-year return period has a 100/X percent probability of being equaled or exceeded in any given year. Thus, a 50-year storm has a 2 percent chance of being equaled or exceeded in any given year and would be equaled or exceeded, on the average, once every 50 years.

The other types of storms that are frequently used are the Standard Project Storm (SPS) and the Probable Maximum Storm (PMS). The SPS represents the most severe meteorologic conditions considered reasonably characteristic



Source: National Weather Service

4.1. Typical Isopluvial Map

of the geographic region involved, excluding extremely rare events. The flood resulting from the SPS gives a "standard" against which the performance of a system can be compared with similar systems in other locations.

The Standard Project Storm is used widely within the Corps of Engineers (USCE, 1965). Development of the SPS is described in detail in the Appendix, and example calculations are given. However, because development of the SPS for the Western states requires site-specific criteria, procedures for the Western states are not covered in this report.

The Probable Maximum Storm (PMS) is considered the maximum storm that can be reasonably expected to occur in a given region. Accepted meteorological procedures are used to determine the upper limits of rainfall amounts, which are then assembled into critical chronological sequences. PMS data are usually developed by using depth-area-duration relationships for precipitation from major storms that were measured in the region or could have occured. Precipitation amounts for the storms are adjusted to correspond to maximum moisture conditions and maximum rate of moisture inflow to the storm location. Envelope curves based on the adjusted values for all storms are then used to develop the PMS depth-area-duration curves.

Generalized charts for PMS rainfall are available for the United States from National Weather Service publications. Two publications covering the U.S. in general are NWS (1956) for areas east of the 105th Meridian and NWS (1960) for western areas. Procedures for distributing the probable maximum precipitation estimates in time and space for the United States east of the 105th Meridian are given in NWS (1981). The Appendix gives an extensive list of publications with PMS data for specific areas.

4.3 Applications for Hypothetical Storms

The various types of hypothetical storms are commonly used in planning investigations of flood control components, design analyses, and in flood plain management studies. The types of storms used and their applications depend on the requirements of the study.

Hypothetical storms for various recurrance intervals are used in planning investigations to develop frequency curves for existing and modified conditions as input into economic evaluations. In design analyses a design storm is used to generate the runoff that is selected as the standard against which the performance of a facility can be evaluated. The design flood is simply the runoff from the design storm. Hypothetical frequency storms are used to design channels, storm sewers, agricultural levees, detention areas, and other features.

Hypothetical storms are frequently used in flood plain management studies to develop flood hazard information. Usually, these hypothetical frequency storms are used to generate the flood events of various return periods, such as the 100-yr event for flood insurance studies. The Standard Project Storm is often also included for flood hazard information in flood plain management studies.

Standard Project Storms are used in planning investigations as an upper boundary in determining flood control storage requirements. For project design work the Standard Project Storm is the design storm to be used where some small degree of risk can be accepted but an unusually high degree of protection is required (due to loss of life, high property values, etc.). It is typically used for determination of storage in flood control reservoirs and studies for main river levees in urban areas. The projects for which Standard Project Flood estimates are required are specified in EM-1110-2-1411 (USCE, 1965).

The Probable Maximum Storm is used as a design storm where virtually no risk of failure can be tolerated, such as for most dam spillways. In planning investigations Probable Maximum Storms are generally used in determining spillway size and top of dam elevation.

4.4 Construction of Hypothetical Storms

When constructing a hypothetical storm, it is necessary to establish the appropriate storm duration and the time interval for subdividing the storm rainfall. One can then take rainfall values from the appropriate NWS publication, make adjustments to compensate for size of drainage area, adjust

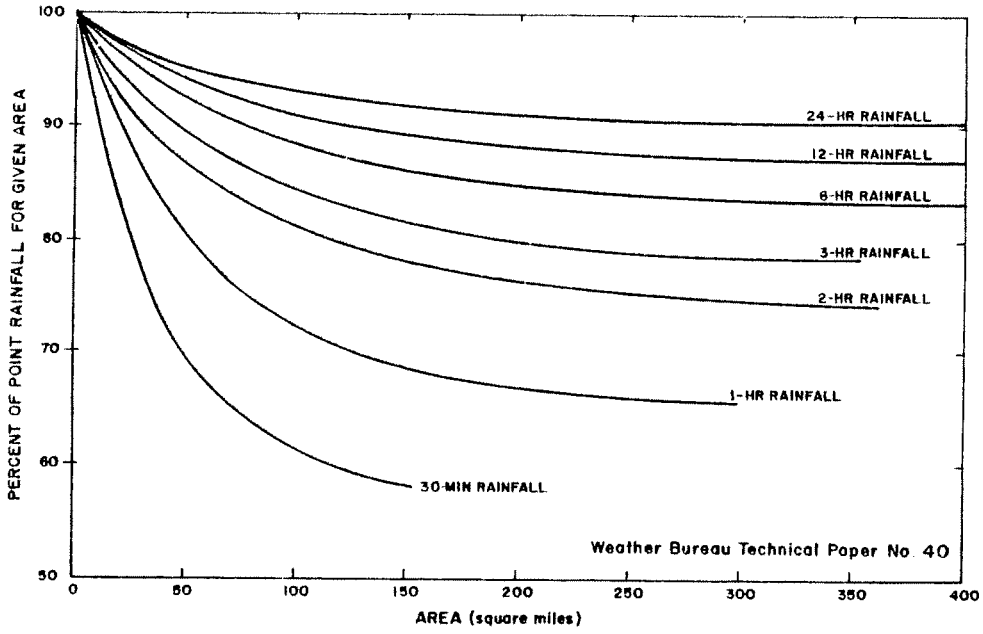
from partial to annual series (if required), and finally increment and arrange the storm rainfall for later use with the hydrologic model of the watershed. Each of these steps is described in detail with examples in the Appendix.

The storm duration and the time increment for calculations are functions of the type and size of the drainage area. The appropriate duration of the storm depends on the basin time of concentration, i.e., the travel time from the upper portions of the basin to the point of interest farthest downstream. The overall duration is dictated by the purpose of the estimate and the importance of total runoff volume in the use of the design flood.

Rainfall frequency curves are derived from TP 40 (NWS, 1961), or other appropriate source, for durations of 2, 3, 6, 12, and 24 hours. The 30-minute and 1-hour maps in TP-40 have been superceded by data given in HYDRO-35 (NWS, 1977) for 15- and 60-minute rainfall depths. The value of the 30-minute rainfall depth is obtained from the 15- and 60-minute values using an equation given in HYDRO-35. The values must be adjusted for annual series, since the TP 40 and HYDRO-35 charts are for partial duration series. For a selected storm frequency, rainfall depths are determined for each duration at desired time intervals and incremental depths computed. If durations greater than 24 hours are needed TP 49 (NWS, 1964) can be used.

The rainfall values from the maps represent point rainfall. However, the average rainfall over a given area will be less than the maximum point value in the area. Figure 4.2, which is taken from TP40, gives the reduction in the point value for various precipitation durations as a function of area size.

The rainfall time-intensity pattern is determined next. Rainfall depth can be plotted as a function of duration on log-log graph paper. If a line is drawn through the points, the plot can then be used to determine accumulated rainfall depths for any desired interval. The accumulated rainfall is divided into increments to determine the amount in each period.

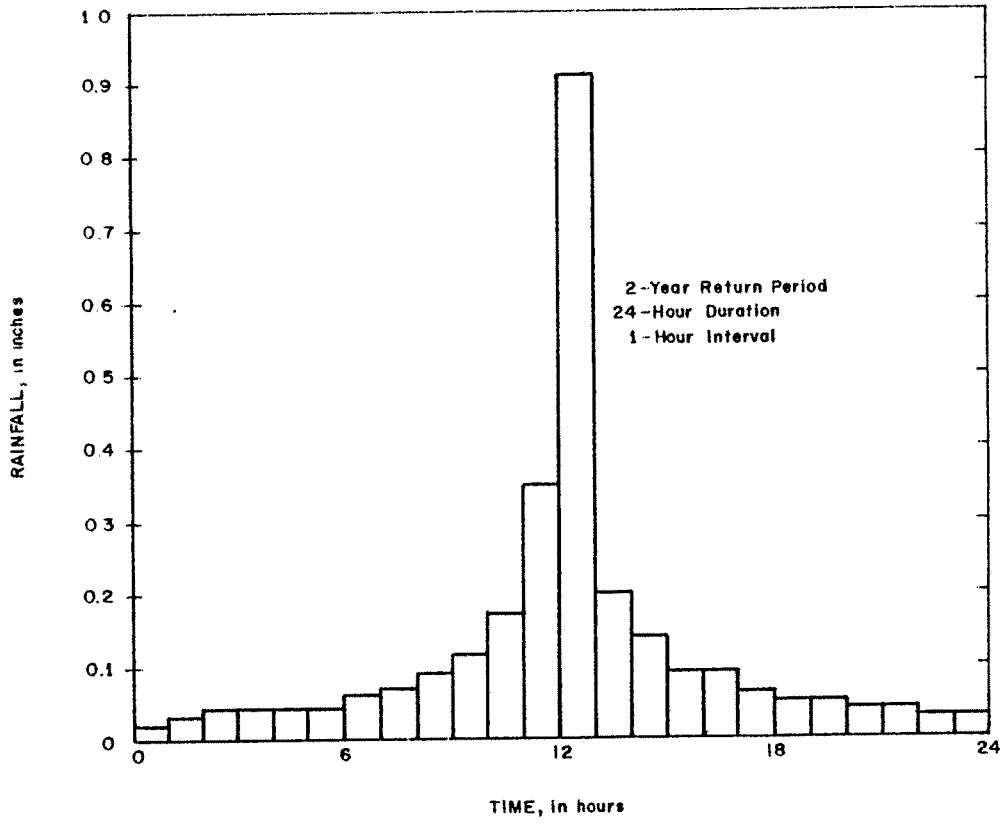


4.2. Adjustment of Rainfall Data for Area

The rainfall values are then ranked by magnitude to produce a rainfall distribution. The following order is most commonly used (USCE, 1965): the greatest rainfall increment is usually placed in the center of the distribution, the next largest is placed in the time increment before it, and the next after. For succeeding values, the next largest is placed before, the next after, and so forth. A storm distribution of this type is shown in Figure 4.3. Other distributions can also be employed. It may be desirable in some cases to analyze actual storm distributions to develop a representative storm pattern for a given region.

If the precipitation time-intensity pattern for a storm with a duration longer than 24 hours is needed, all 24-hour periods outside of the peak 24-hour period can be represented by an average value for each period, because the effects of rainfall variations away from the peak are small (Linsley, Kohler, and Paulhus, 1975).

The Standard Project Storm distribution (USCE, 1965) has been used to develop an alternative arrangement of rainfall in time. However, although the SPS arrangement is sometimes applied to hypothetical storms, it was



4.3. Typical Time Distribution of Storm Rainfall

specifically derived for events that are rarer than the 100-year return-period event. Its application will produce a more severe distribution of rainfall intensity in time than may be reasonable for a hypothetical storm, so excessively high estimates of peak discharge may result when the SPS arrangement is used.

4.5 Consistent Depth-Area Relationships.

It is assumed here that rainfall depths for hypothetical storms are directly related to a particular drainage area size. However, because it is necessary with HEC-1 watershed models to apply rainfall to different subarea sizes to compute runoff from each, different rainfall totals should be applied to each watershed (based on subarea size) to obtain runoff consistent with the particular event under study. This can be done with HEC-1 by employing the Precipitation Depth-Area Relationship. Section 7 of the HEC-1 Users Manual (HEC, 1981) describes this feature in detail. In brief, this option of the program uses a total-storm-depth-versus-area relationship for each runoff, routing, and combining operation of the watershed modeling process to develop at each computation point a hydrograph that is based on a rainfall depth that is consistent with the actual drainage area. A key feature not covered in the manual is that the appropriate rainfall distribution for the subarea under study must be used. The point rainfall total may not differ greatly from that for a 50-square-mile area for the total storm duration, but the distribution will give significantly different incremental values for the short-duration peak periods. The peak periods are greatly reduced as the drainage area increases, as shown in Figure 4.2. One should use several distributions (based on representive drainage areas) for the consistent depth-area option. An appropriate application would be the development of three to five distribution patterns for areas ranging from the smallest subarea to the area of the entire watershed model. The distribution for the area nearest in size to the subarea under analysis should then be specified for each runoff hydrograph calculation.

4.6 Other Considerations

The hypothetical-storm data are used as input to a calibrated hydrologic model of the basin to generate peak discharges at gaged locations for selected rainfall frequencies. The model results are then compared with computed (adopted) discharge-frequency curves at gaged locations. The standard procedure is then to adjust the losses until reasonable agreement is obtained between the two frequency curves. The procedure is based on the assumption that the frequency of a particular storm and loss rate combination

can be directly related to the frequency of the flood produced. This usually gives a reasonable estimate of the relative frequency of various discharges at ungaged locations within a basin.

CHAPTER 5

CALIBRATION OF MODEL PARAMETERS

5.1 Need for Model Calibration

Application of HEC-1 to a study of the precipitation-runoff process in a basin requires calibration of the model; that is, values of the parameters of the numerical model of the physical system must be established. For a strictly physically-based model, these parameters can theoretically be determined by measurement. Practically, however, the parameters are determined most often by using observed precipitation and runoff data to solve the inverse problem. That is, given the system input (precipitation) and the system output (runoff), the inverse problem (and hence the calibration problem) is to define the characteristics of a system that produces the transformation from input to output. With a specific numerical model such as HEC-1, the functions that define the transformation are preselected; calibration requires only selection of the parameters of these transformation functions.

This chapter presents a discussion of the loss rate and unit hydrograph precipitation-to-runoff transformation functions of HEC-1, and it defines the parameters of those functions that are adjusted to model characteristics of a particular basin. HEC-1 has the capability to estimate optimal values of the unit hydrograph and loss-rate parameters automatically; this capability is described here, and a procedure for its use is presented. The program also has the capability to estimate parameters of the routing functions that simulate the motion of water in the streams and channels of a basin, and this is described as well. Determination of the routing parameters is possible only if the shape of the local inflow hydrograph is known or assumed, however. Finally, typical values of the model parameters are suggested.

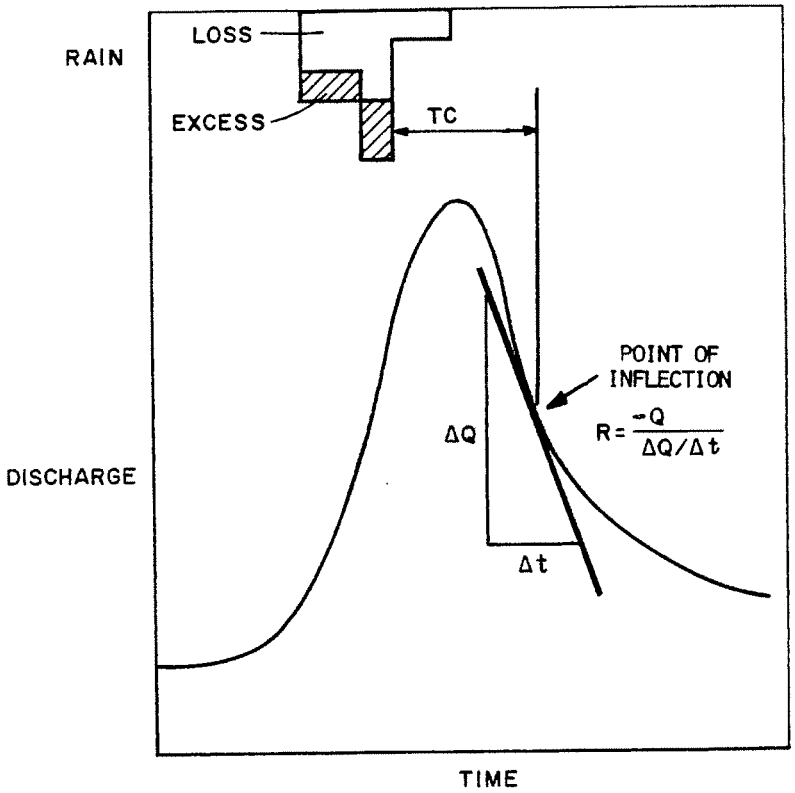
5.2 Unit Hydrograph Specification

HEC-1 is most commonly used to model the precipitation-runoff process by application of the unit hydrograph technique proposed by Clark (1945). This technique defines the ordinates of a unit hydrograph with only two

parameters: t_c, the time of concentration (in the program the designation "TC" is used for t_c), and R, a storage constant. Use of this technique is attractive because it avoids problems inherent in defining, through calibration, individual ordinates of the unit hydrograph. The general shape of the hydrograph is fixed, and problems with negative ordinates and infeasible fluctuations of the unit graph ordinates are eliminated.

In addition to the two parameters, the Clark method uses a time-area relation to define an instantaneous unit hydrograph. The first parameter (t_c) theoretically is the travel time of a water particle from the most upstream point in the basin to the outflow location. An estimate of this lag time is the time from the end of the runoff producing rainfall to the inflection point on the recession limb of the surface runoff hydrograph (Figure 5.1).

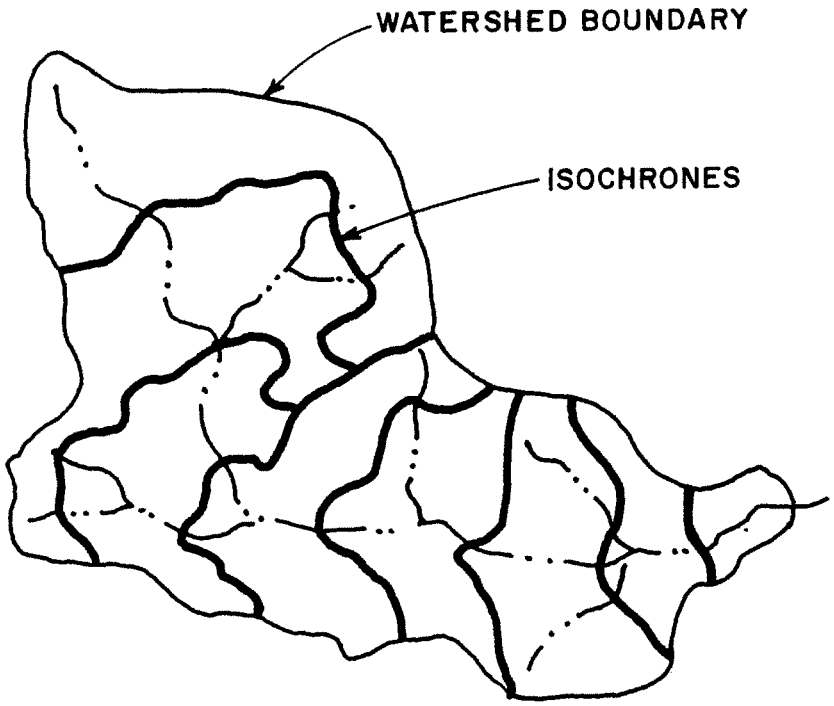
The parameter R also has the dimension of time and is used to account for the effect of basin storage on the hydrograph. This parameter can theoretically be estimated by dividing the flow at the point of inflection of the surface runoff hydrograph by the rate of change of discharge (slope) at this same time (Figure 5.1). Another method for estimating R is



5.1. Illustration of Clark Coefficients

by computing the volume remaining under the recession limb of the surface runoff hydrograph following the point of inflection and dividing this volume by the flow at the point of inflection.

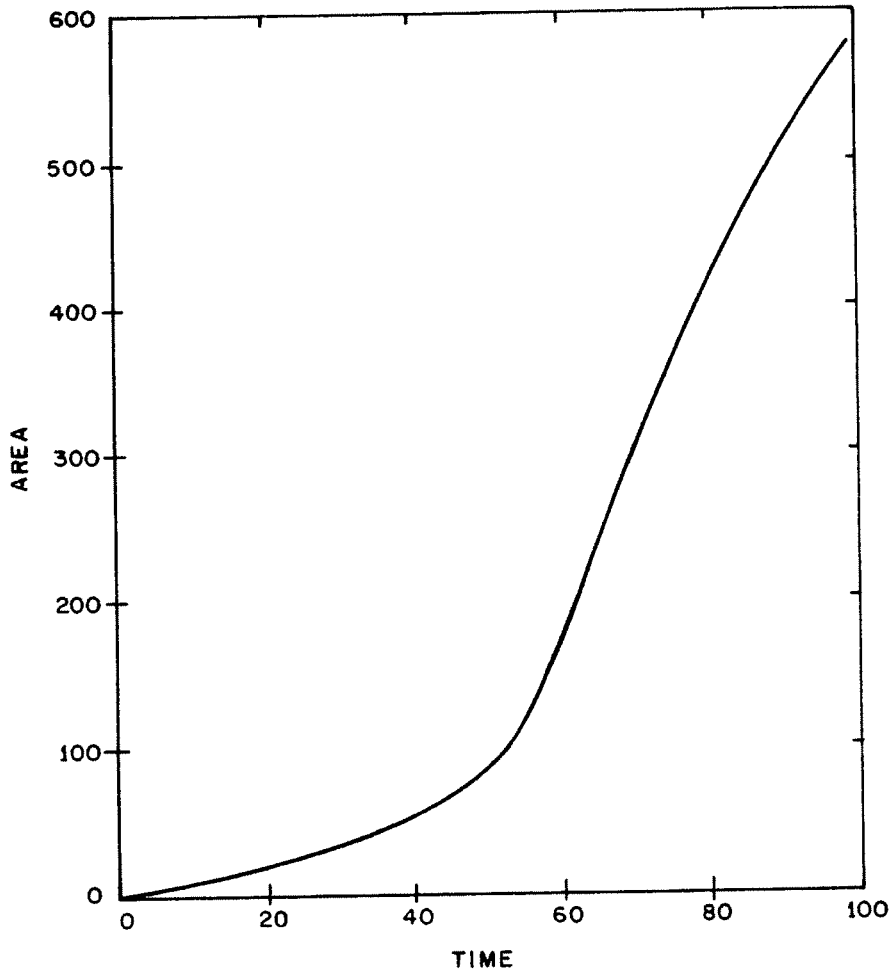
The other item necessary to compute a unit hydrograph with the Clark technique is a time-area relation. If a synthetic time-area curve is not used, the time-area relation is developed by dividing the basin into incremental runoff-producing areas that have equal incremental travel times to the outflow location (Figure 5.2). The distance from the most upstream point in the basin is usually measured along the principal watercourse to the outflow location. Dividing this distance by an assumed value of t_c gives an estimate of the rate of travel. The value of t_c should be for that point in the basin that is furthest from the outlet based on travel time. In some cases this may not be a point that is reached by extending the principal watercourse. Isochrones representing equal travel time to the outflow location are laid out using the rate of travel to establish the location of the lines. The areas between the isochrones are then measured and tabulated in upstream sequence along with the corresponding incremental travel time for



5.2. Division of Basin on Basis of Travel of Travel Time to Outlet

each incremental area. The increment of time used to subdivide the basin need only be small enough to define adequately the areal distribution of runoff, while the time period selected as the computation interval must be equal to or less than the unit duration of precipitation excess. Because the former may be larger than the latter, a plot of percent of time of concentration versus accumulative area is useful in determining time-area relationships for model calibration (Figure 5.3). Such a curve facilitates rapid development of unit hydrographs for various values of the still undetermined parameter, t_c, without requiring development of a new time-area relation. This development is based on an assumption that the percent of time versus accumulated-area relation will remain constant for all values of t_c.

A detailed description of implementation of the Clark unit hydrograph technique in computer program HEC-1 is presented in the HEC-1 Users Manual (HEC, 1981) and in Volume 4 of the Hydrologic Engineering Methods for Water Resources Development Series (HEC, 1973b).

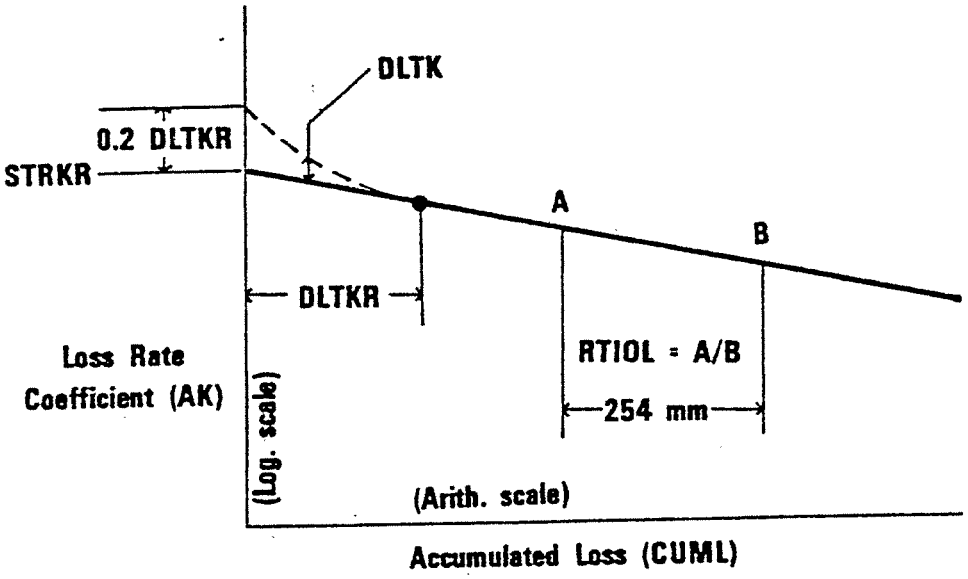


5.3. Typical Watershed Time-Area Relationship

The parameters t_c and R, as proposed by Clark are related in that R is determined at the point of inflection on the recession side of the hydrograph. This point also defines t_c (Figure 5.1). In practice, variability from storm to storm and uncertainties in timing of recorded data may preclude reliable determination of t_c and R by direct measurement of the inflection point and the slope of the curve. In HEC-1 the interrelationship can be implicitly accounted for by estimating the parameters $(t_c + R)$ and $R/(t_c + R)$, rather than seeking to estimate t_c and R directly. Of course, when the "best" estimates of $(t_c + R)$ and $R / (t_c + R)$ are determined, values of t_c and R can be found by simple arithmetic.

5.3 Loss Rate Analysis

HEC-1 models the precipitation loss or infiltration process with 1) functions that compute loss rates using initial and uniform losses, or 2) functions that relate loss rates to rainfall and snowmelt intensity and to accumulated loss. The second category includes the exponential loss-rate (shown in Figure 5.4), the Soil Conservation Service (SCS), and the Holtan loss rate functions.



5.4. Loss Rate Function Used in HEC-1

In most cases the initial and uniform loss rate function or the SCS Curve Number procedure are used for basin loss computations. The more complicated exponential loss rate function is difficult to relate to basin characteristics, making it hard to establish regional relationships for the terms in the function. This is especially true when many subbasins are used in the watershed model.

The parameters for the initial and uniform loss rate function, the SCS Curve Number procedure, the Holton loss rate function, and the exponential loss rate function can be estimated from measured rainfall events using the optimization procedures of HEC-1 as described in the HEC-1 Users Manual (HEC, 1981). The following paragraphs cover the parameter estimation process using the exponential loss rate function; this function was used in the case studies described later in this report. Similar procedures can be used to estimate parameters for the other loss rate functions.

The function is expressed mathematically as follows:

5.4. Exponential Loss Rate Function Used in HEC-1

$$ALOSS = (AK + DLTK)\ (RAIN)^{ERAIN} \quad (5.1)$$

$$AK = STRKR/RTIOL)^{0.1\ CUML} \quad (5.2)$$

$$DLTK = 0.2\ DLTKR\ \ (1-(CUML/DLTKR))^2 \quad (5.3)$$

where:

ALOSS = loss rate in inches (mm) per hour
AK = basic loss coefficient
DLTK = incremental loss coefficient
RAIN = rainfall intensity in inches (mm) per hour
ERAIN = exponential of the rainfall intensity
STRKR = basic loss index for start of storm in inches (mm) per hour
RTIOL = ratio of the loss coefficient (AK) to that after 10 inches (254 mm) of additional accumulated loss occurs
CUML = accumulated loss in inches (mm)
DLTKR = incremental loss index

When snow is melting, initial losses are set to zero, and the loss rate function becomes:

$$ALOSS = AK\ (RAIN + SNWMT)^{ERAIN} \quad (5.4)$$

$$AK = STRKS/(RTIOK)^{0.1\ CUML} \quad (5.5)$$

where

SNWMT = snowmelt in inches (mm) per hour
STRKS = basic loss coefficient for snowmelt in inches (mm) per hour
RTIOK = similar to RTIOL for snowmelt conditions

Snowmelt is determined using the following equation:

$$SNWMT = COEF\ (TMPR - FRZTP) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5.6)$$

where

SNWMT = melt in inches (mm) per day in the elevation zone
TMPR = air temperature in ^{o}F or ^{o}C lapsed to the midpoint of the elevation zone
FRZTP = temperature in ^{o}F or ^{o}C at which snow melts
COEF = melt coefficient in inches (mm) per degree-day (^{o}F or ^{o}C)

Energy budget equations can be employed to compute melt during rain or melt during rainfree periods. Alternative versions of these functions are used for computation of losses during long-duration storms. In the loss-rate and snowmelt equations, the following parameters must be determined by calibration: STRKR, RTIOL, DLTKR, ERAIN, COEF, STRKS, RTIOK, FRZTP.

5.4 Parameter Estimation Technique

If HEC-1 were a perfect model of watershed hydrology, and if total precipitation and total direct runoff could be measured accurately, the parameters of the precipitation-runoff transformation functions for a particular storm event could be determined directly by inverse solution of the transformation equations. These conditions are not satisfied in reality, and the inverse solution of the equations is difficult. Thus the parameters cannot be determined directly. Instead, the parameters are found by selection of those values that yield the "best" reproduction of some measured runoff event with the available measured precipitation data and the available model. This parameter selection could be accomplished by a systematic trial-and-error procedure: first, parameter values can be selected; next, the model can be exercised with these values; and then, the resulting runoff hydrograph can be compared with the observed hydrograph. If the "fit" is less than satisfactory, different parameter values can be selected, and the entire process can be repeated.

An alternative to the trial-and-error approach to parameter selection is the automatic calibration approach, in which the tasks necessary for calibration are automated. Automatic calibration requires selection of an explicit index of the acceptability of alternative parameter estimates, definition of the range of feasible values of the parameters, and development of some technique for correcting the parameter estimates until the "best" estimates are determined. Thus the parameter estimation problem can be classified as an optimization problem: there is an objective function for which an optimal value is sought, subject to certain constraints on the decision variables (the parameters). Program HEC-1 includes the capability to solve this optimization problem, thereby automatically determining parameter estimates that are optimal from the standpoint of the program procedures. The optimization calculations are made for a single basin only by HEC-1.

Objective Function. The objective function of the parameter estimation optimization problem must define the differences between the runoff hydrograph (computed with any parameter estimates) and the recorded runoff hydrograph. This difference will presumably be at a minimum for the optimal parameter estimates. HEC-1 employs the following function as an index of the errors:

$$STDER = \sqrt{\sum_{i=1}^{N} [(QOBS_i - QCOMP_i)^2 * WT_i]} \quad \ldots\ldots\ldots\ldots\ldots (5.7)$$

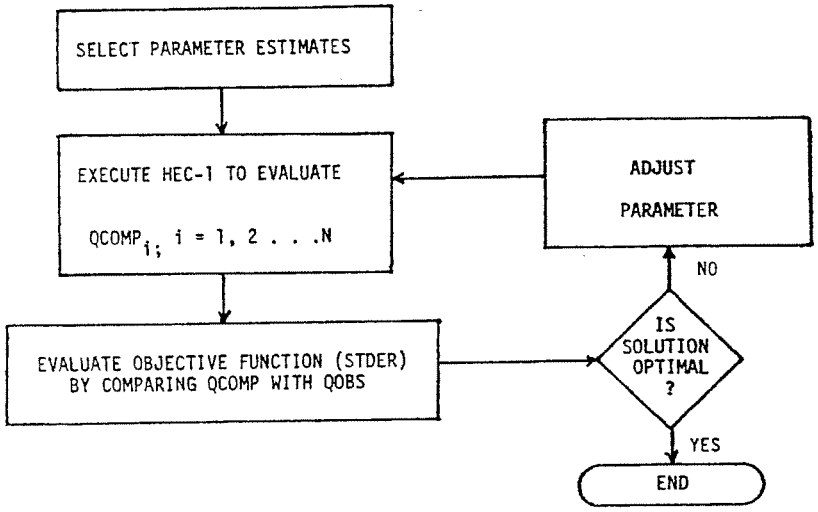
where STDER = the error index; $QOBS_i$ = observed runoff hydrograph ordinate for period i; $QCOMP_i$ = the computed runoff hydrograph ordinate for period i, computed by HEC-1 with the current parameter estimates; N = total number of hydrograph ordinates; WT_i = a weight for the hydrograph ordinate. The weight, WT_i, is defined as follows:

$$WT_i = \frac{QOBS_i + QAVE}{2 * QAVE} \quad \ldots\ldots\ldots\ldots\ldots (5.8)$$

where QAVE = the average computed discharge. By biasing the objective function, this weighting function emphasizes accurate reproduction of peak flows rather than low flow. Since any errors for discharge ordinates that exceed the average discharge will be weighted more heavily, the optimization scheme should focus on reduction of these errors.

The sequence of events followed for evaluation of the objective function is illustrated conceptually in Figure 5.5. The goal of the automatic calibration exercise is to select those parameter values that will yield the minimum value of STDER.

Constraints. The range of feasible values of the parameters is bounded because of physical limitations on the values that the various unit hydrograph, loss-rate, snowmelt, and streamflow routing parameters may have. Also, numerical limitations are imposed by the mathematical functions employed in modeling watershed behavior. In addition to bounds on the maximum and minimum values of certain parameters, the interaction of certain parameters is also restricted because of physical or numerical limitations. These constraints are summarized in Table 5.1. The constraints shown here are limited to those imposed explicitly in the program. Additional constraints may be appropriate in certain circumstances; however, these must be imposed externally to the program, and the user must decide whether to accept or to reject a given parameter set on the basis of engineering judgement.



5.5. Sequence of Events in Evaluation of Objective Function

TABLE 5.1

CONSTRAINTS ON HEC-1 UNIT HYDROGRAPH AND LOSS-RATE PARAMETERS

Clark Unit Graph Parameters:

$TC+R \geq 1.03\ \Delta t/(1-R/(TC+R))$

$R \geq .52\ \Delta t$

Δt = Computation Interval

Loss Rate Parameters

Exponential	Uniform
$ERAIN \leq 1.0$	$STRTL \geq 0$
$RTIOL \geq 1.0$	$CNSTL \geq 0$

Snowmelt

$RTIOK \geq 1.0$

$-1.11°C \leq FRZTP \leq 3.33°C$

Optimization Technique. Addition of constraints to the parameter estimation optimization problem has a significant impact on the ease with which the problem can be solved. Whereas an unconstrained optimization problem can frequently be solved adequately with relatively unsophisticated techniques, efficient solution of the constrained optimization problem requires application of techniques that can locate an optimum while simultaneously satisfying all constraints.

The constrained optimization technique employed in HEC-1 is a univariate search technique. Application of such a technique permits use of the simulation capabilities of HEC-1 in a traditional manner and does not require development of analytical derivatives. Steps used by HEC-1 in application of this technique, shown in Figure 5.5, are as follows:

1. Initial values for parameters not assigned by the program user, are given program-assigned default values. The default parameter values are shown in Table 5.2. The parameter definitions are given in Section 5.3, with the exception of STRTL, initial loss, and CNSTL, constant loss rate, which are used with the initial and uniform loss rate method.

2. The response of the watershed is simulated with the initial parameter estimates, and the value of the objective function is computed by comparison of the ordinates of the computed and observed runoff hydrographs.

3. The parameter that is to be estimated is decreased by one percent and then by two percent, and the system response is evaluated for each change. The objective function is evaluated in each case. This gives three separate system evaluations at equally-spaced values of one parameter with all other parameters held constant.

4. The "best" value of each parameter is estimated independently by a Newton-Raphson procedure*.

5. Steps 3 and 4 are repeated for each of the other parameters to be estimated following the order in which they are listed in Table 5.2. This yields a second approximation of all parameters.

6. Step 4 is repeated for the parameter that most reduced the value of the objective function in its last change until no single change in any parameter yields a reduction of the objective function of more than one percent.

---

* This procedure, which is also known as Newton's method, is described in detail in the text by Himmelblau (1972), p. 73ff. The Newton-Raphson scheme employed for estimating the "best" value of each parameter in Step 4 is based on the concept that the optimum of the objective function occurs at a root of the first partial derivative of the function with respect to each of the parameters.

TABLE 5.2

PROGRAM HEC-1 DEFAULT INITIAL UNIT HYDROGRAPH AND LOSS-RATE PARAMETER ESTIMATES

Parameter Name	Initial Value
TC+R	$(TAREA)^{1/2}$
R/(TC+R)	0.5
COEF	0.07
STRKR	0.2
STRKS	0.2
RTIOK	2.00
ERAIN	0.5
FRZTP	$32.00^{o}F$
DLTKR	0.5
RTIOL	2.00
STRTL	1.00
CNSTL	0.1

*TAREA = Drainage area, in square miles

7. One more complete search of all parameters is made.

8. Step 6 is repeated, and the final parameter estimates are designated as optimal.

5.5 Application of Automatic Calibration Capability to the Rainfall-Runoff Process

Because the data available for precipitation-runoff analysis vary in quantity and form, the exact sequence of steps in application of the automatic calibration capability of HEC-1 will vary from study to study. Other sections of this report propose techniques for selecting stream gages in the study region that are representative of conditions for the basin and for developing precipitation and runoff data for use in model calibration. A proposed sequence of steps for the engineer or hydrologist to use in

determining the unit hydrograph and loss-rate parameters for the representative gaged areas is as follows:

1. Determine, for each selected storm for each gage, the recession flow for antecedent runoff (STRTQ), the discharge at which recession flow begins (QRCSN), and the recession coefficient (RTIOR) that is the ratio of flow at some selected time to the flow one hour later. The HEC-1 Users Manual (HEC, 1981) suggests techniques for estimating these parameters.

2. For each storm at each gage, determine the optimal estimates of all unknown unit hydrograph and loss-rate parameters using the automatic calibration feature of HEC-1. If the temporal and spatial distribution of precipitation is not well defined, an initial loss followed by a uniform loss rate can be used. Omit steps 3 to 7 if the initial and uniform loss rate function is used.

3. If ERAIN is to be estimated, select a regional value based on analysis of the results of Step 2 for all storms for the representative gages.

4. Repeat Step 2 with ERAIN fixed at the selected value. Select next an appropriate regional value of RTIOL, if RTIOL is unknown.

5. Repeat Step 2 with ERAIN and RTIOL fixed. Select a value of STRKR for each storm, and if desired, determine a regional value. If values for adjacent basins have been determined, check the selected value for regional consistency.

6. With ERAIN, RTIOL, and STRKR fixed, repeat Step 2 to compute TC, R, and DLTKR. DLTKR and STRKR can be generalized if desired, although the parameter DLTKR is considered event-dependent.

7. With DLTKR fixed, optimize the values of TC+R and R/(TC+R). Select appropriate values of TC+R for each gage. In order to determine TC and R, an average value of R/(TC+R) is typically selected for the

region. This value may also be appropriate for use in the ungaged basin.

8. Once all parameters have been selected, these should be verified by simulating the response of the gaged basins to other events for which precipitation and runoff records are available. If the simulated runoff hydrographs do not "match" the observed hydrograph, the calibration procedure must be repeated. The parameters should not be arbitrarily adjusted to yield satisfactory reproduction of hydrographs at this step.

9. When a satisfactory set of parameters is selected the regionalization procedures described in Chapter 6 of this report can be used to transfer the necessary information to the ungaged basin.

5.6 Streamflow Routing Optimization

In addition to the capability for modeling the precipitation-runoff processes in a basin, HEC-1 also includes the capability for modeling the movement of water through the streams and channels of the basin. So-called "hydrologic" routing techniques are used. These techniques include the modified-Puls method, the Muskingum method, the Working R and D method, the Straddle-Stagger method, the Tatum method, the Multiple Storage method, and the Kinematic Wave method. Each of these techniques is described in detail in the HEC-1 Users Manual (HEC, 1981). The kinematic wave method is also described in Chapter 7 of this report. As with the model of the rainfall-runoff process, the routing parameters must be determined from calibration; that is, appropriate values must be determined for the parameters of the equations used to model the process.

The automatic calibration capability of HEC-1 can be used to determine optimal estimates of certain parameters of the streamflow routing equations. These parameters include the following:

1. Number of routing steps to be used for routing by Tatum method, Muskingum method, or modified-Puls method (NSTPS).

2. Number of ordinates to be averaged in the Straddle-Stagger routing (NSTDL), and number of intervals the hydrograph is to be lagged (LAG) in the Straddle-Stagger routing.

3. K coefficient (AMSKK) and X coefficient (X) of Muskingum routing function.

Any additional parameters for the routing functions must be supplied by the user. This may require use of calibration techniques external to the HEC-1 optimization. For example, a storage-discharge relationship is required for application of the modified-Puls technique. This relationship cannot be determined by the automatic calibration procedure of HEC-1, but methods of developing such a relationship are discussed later in this section.

The technique used by HEC-1 for estimating the parameters of the various streamflow routing methods is similar to the technique used for estimating the parameters of the unit hydrograph and of the loss-rate functions. The steps of this calibration technique are as follows:

1. Initial parameter estimates are assigned, either by the user or by the program. The parameter values assigned by the program are shown in Table 5.3. The variable TRHR is the computation interval in hours.

2. The movement through the stream system of a specified inflow hydrograph is simulated with the parameter estimates.

3. The simulated outflow hydrograph is compared with a specified outflow hydrograph, using the same objective function that is used for determining optimal estimates of the unit hydrograph and loss-rate parameters.*

* This optimization process may not produce useful results because knowledge of local inflows is also required. The program requires a time pattern which is used to distribute the intervening-area runoff calculated by the program. The intervening-area runoff is added to the routed hydrograph flows prior to evaluation of the objective function. The required knowledge of the time distribution of intervening-area runoff may make it impossible to get good results from the optimization procedure, especially if intervening-area runoff is a significant percentage of the total runoff. "Optimal" estimates are usually very sensitive to the assumptions made regarding intervening-area runoff.

TABLE 5.3
PROGRAM HEC-1 DEFAULT INITIAL ROUTING PARAMETER ESTIMATES

Parameter Name	Initial Value
NSTPS	1
NSTDL	1
LAG	1
AMSKK	TRHR
X	0.2

4. Each parameter is optimized in the same manner as the unit hydrograph and loss rate parameters. Derivatives are estimated with finite difference approximations.

5. The optimal estimates of integer parameters, such as the number of routing steps to be used in the Tatum method, are determined by testing successive values and selecting as optimal the value preceding the first one that causes the objective function to increase.

Alternatives to the above procedures for estimating routing parameters are:

1) A storage-outflow relationship for the modified-Puls routing technique can be developed from steady-flow water surface profile computations. These computations can be done with the HEC-1 normal depth option or with computer program HEC-2 (HEC, 1979). This approach requires collection (or estimation) of stream cross section data, channel roughness characteristics, and streambed slopes necessary for computation of the water surface profiles.

2) The techniques developed for HEC by Slocum and Dandekar (1975)provide an alternative procedure for optimization of routing parameters for the modified Puls and Muskingum routing methods. A computer program - OPROUT (HEC, 1982) - is available to permit the parameter estimates to be developed outside of HEC-1. In this procedure the local inflows are computed by subtracting the ordinates of the routed hydrograph from the observed

downstream hydrograph. In nearly all cases local inflows are not known. However, it is reasonable in nearly all situations to assume that none of the local flow values will be negative. The procedure used by OPROUT employs an objective function which minimizes the sum of negative local flow in a given routing reach through definition of the storage-outflow relationship. The routing parameters which meet this objective are considered optimum.

5.7 Typical Values of Model Parameters

Table 5.4 gives values considered to be approximately the upper and lower bounds expected in practice for the various parameters used by HEC-1. In certain regions, stricter bounds may be appropriate; these can be established on the basis of experience with application of HEC-1.

TABLE 5.4

BOUNDS ON HEC-1 PARAMETERS

UNIT HYDROGRAPH AND LOSS-RATE PARAMETERS

Parameter	Lower Bound	Upper Bound
TC+R	1.5*TRHR	100
R/(TC+R)	1/3	1
STRKR	0	5
ERAIN	0	1
FRZTP	32	38
DLTKR	0	5
RTIOL	1	10

STREAMFLOW ROUTING PARAMETERS

Parameter	Lower Bound	Upper Bound
NSTPS	1	10
NSTDL	1	10
LAG	1	10
AMSKK	0	TRHR
X	0	0.5

CHAPTER 6

REGIONALIZATION OF UNIT HYDROGRAPH AND LOSS RATE PARAMETERS

6.1 Introduction

The purpose of a regional study is to develop unit hydrograph coefficients and loss rate data for basins for which no gaged hydrograph data are available. The study area must be large enough to obtain a good sampling of gaged basins. Gaged basins do not have to be within the same watershed as the ungaged sites, but all basins must be in a region that is hydrologically and meteorologically similar.

As discussed earlier, unit hydrographs are usually developed for ungaged basins in two steps. First, an equation or procedure is devised that will allow a unit hydrograph to be computed. Second, parameters of the equation or procedure are related to definable basin characteristics. The procedure used most generally involves deriving parameters that describe the unit hydrograph, and then transferring these parameters with adjustments to compensate for the geographic differences between the gaged and ungaged basins.

6.2 Basic Steps in a Regional Study

The following steps are generally followed in executing a regional study to develop loss rate and unit hydrograph relationships for a basin.

(1) Collect precipitation and runoff information in region. Data requirements for each gaged area are:

a. Precipitation data for each flood.
b. Hydrograph records for each flood.
c. Type of unit hydrograph coefficients to be derived.
d. Type of loss rate to be derived.
e. Base flow characteristics.

(2) Perform an HEC-1 rainfall-runoff analysis using subbasins above gaged locations. HEC-1 is used to estimate the unit hydrograph and loss rate parameters for the gaged drainage areas. A basin model is developed for each gaged basin for this analysis. As mentioned above, only a single subbasin can be used for optimization using HEC-1, however.

(3) Correlate unit hydrograph and loss-rate parameters with basin characteristics and develop generalized relationships. HEC-1 model results for each gaged basin are analyzed by tabulating the unit hydrograph and loss-rate data. The data are then reviewed for consistency, and an average value is chosen for each unit hydrograph and loss-rate parameter.

(4) Divide basin into subbasins. By knowing basin characteristics in the ungaged subbasins, solve for parameters using relationships developed in Step 3 above.

(5) Perform HEC-1 analysis using gaged and ungaged subbasins. If the reconstituted runoff volumes at downstream gages are significantly different from observed hydrographs, adjust the unit hydrograph, loss-rate, and routing parameters.

6.3 Definition and Description of Regionalization Parameters

The basin parameters considered most important in affecting basin hydrologic response are: drainage area, stream slope, channel length, and percent of impervious area. The following definitions of these parameters are used to provide standardized terminology in the discussions that follow:

DA = drainage area

S = equivalent stream slope of the longest watercourse

L = length along the longest watercourse from the outflow point of the designated subbasin to the upper limit to the watershed boundary.

L_{ca} = watercourse length from the outflow point to a point on the stream nearest the centroid of the basin.

I = index of impervious cover in percent of total land area.

These basin characteristics (and any others that may be influential in affecting basin behavior) are used with the unit hydrograph parameters discussed in Chapter 5 (Clark's TC and R, or Snyder's TP and CP), or the parameters describing the loss-rate function and runoff hydrograph (QRSCN, STRTQ, RTIOR, DLTKR, STRKR, RTIOL, ERAIN), either individually or in combination.

Example. If Clark's unit hydrograph method is being used, the above parameters can be correlated with TC and R either graphically or numerically (using multiple regression techniques in the latter case). The following are examples of parameters which could be used (some of which are combinations of the individual parameters):

(1) DA
(2) S
(3) $L/\sqrt{S}$
(4) $L\,L_{ca}/\sqrt{S}$
(5) $L\sqrt{DA/S}$

In the graphical procedure TC+R is plotted against drainage area, slope, channel length, or some combination of these parameters, and a best-fit line is drawn through the points. If a multiple regression analysis is used to obtain an equation for TC+R, the same parameters or parameter groups can be used. Residuals, which are the differences between the filtered or calculated values and the observed values, can be obtained from the multiple regression results. (Residuals are also known as remainders, discrepancies, and differences.) These residuals can be plotted on a study area map and lines of equal residual can be drawn. TC+R determined from the regression equation can be adjusted by using the residual shown on the map for the ungaged basin(s) being analyzed.

Recession and Base Flow Parameters. The next step is to define the input variables that describe the base flow and recession portion of the hydrograph: STRTQ, QRSCN, and RTIOR. The initial and base flow parameters can be related to basin characteristics in the following ways:

(1) STRTQ can be related to characteristics that are indicative of antecedent moisture conditions and size of the basin. Drainage area is often used.

(2) QRSCN can be related to peak discharge (Q_{peak}), precipitation intensity, drainage area, or other parameters. It should in general be no greater than 25 percent of the peak and is typically between 3 and 10 percent.

(3) RTIOR can be related to Q_{peak}, precipitation intensity, drainage area, etc. RTIOR is often assumed to be constant throughout a region.

The loss-rate function is often selected at this point. If the temporal and spatial distributions of precipitation are not well defined, an initial loss followed by a uniform loss rate is frequently used. The next step is to run the HEC-1 model with the runoff parameters developed. HEC-1 will estimate values of TC+R, R/(TC+R), STRKR, and DLTKR, if observed hydrographs are available with representative rainfall data. (Values of TC, R, TP, and CP based on calibration results are also given as program output).

Analysis of Loss Rate Parameters DLTKR and STRKR. When QRSCN, STRTQ, RTIOR, RTIOL, ERAIN, TC and R, or TP and CP were fixed in earlier steps, errors associated with estimating basin average precipitation, the losses, or other parameters were lumped together in the terms DLTKR and STRKR. As a consequence of this lumping, it is very difficult to relate STRKR to basin characteristics. The values of DLTKR and STRKR, which are determined for a particular storm event at a gage, are often used without modification at the ungaged sites. If estimates of historical peak discharges exist at ungaged sites, then STRKR and DLTKR can be adjusted so the reconstituted peak equals the historical peak. As a check of the method, a HEC-1 simulation should be made for gaged and ungaged regions using the parameters developed in the above steps. Adjustments can be made if calculated and observed downstream hydrograph volumes are different.

6.4 Basic Techniques for Regression Analysis

Correlation techniques available for regional analysis include the following: (1) graphical correlation, (2) simple linear regression, and (3) multiple linear regression. A nonlinear relationship can sometimes be transformed into a linear relationship (for example, by a logarithmic transformation), and linear regression can be applied to the transformed values.

Graphical Correlation. The various regionalization parameters are plotted as a function of each other. Usually logarithmic graph paper is used, and a best fit line is drawn by eye. Other information, such as knowledge of the approximate slope of the curve or limits on some of the parameters, can often be used to aid in positioning the curves. An example is shown in Figure 6.1, where values of t_p computed by optimization runs of HEC-1 are plotted as a function of LL_{ca}. It was assumed that the slope of these curves should be the same as those established in other studies (i.e., the slope is equal to 0.30).

Linear Regression. As in the graphical correlation case, it is assumed that the variables (or their logarithms) are related to each other by the equation for a straight line. The regression equation is:

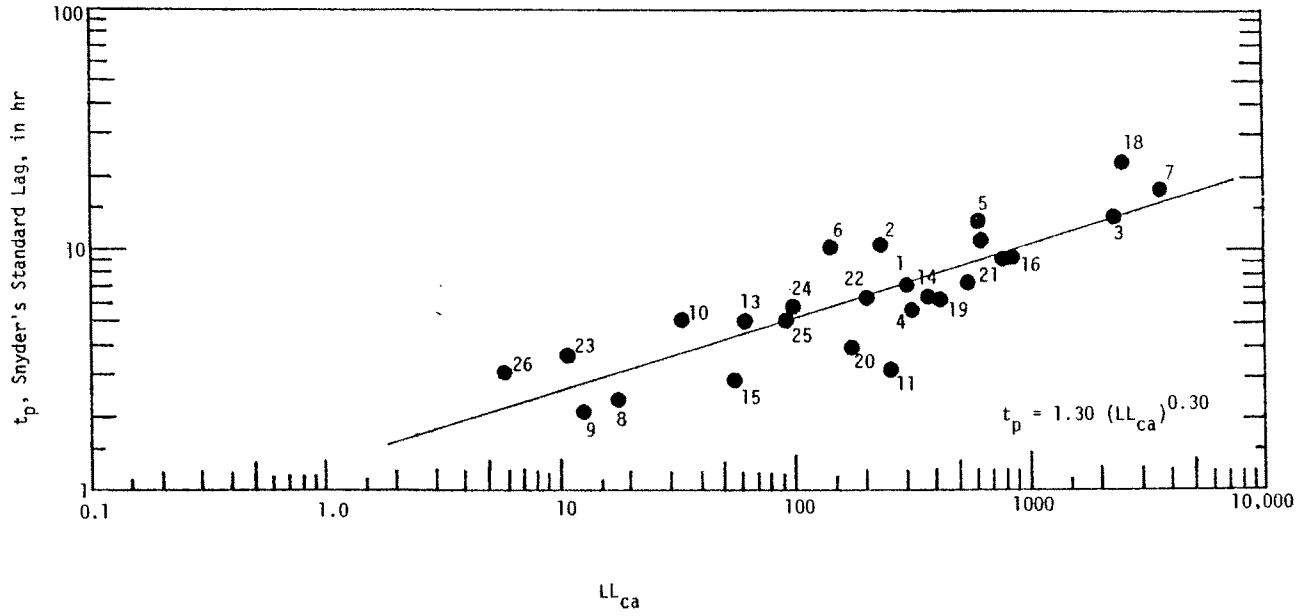
$$Y = a + b X \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (6.1)$$

where Y = the dependent variable, or its logarithm
a = regression constant,
b = regression coefficient, and
X = the independent variable, or its logarithm

Many programs are available for determining values of a and b that give a least-squares best-fit to a given set of data. These include programs for hand-held or desk-top calculators. Hand calculations can be made also if the data sets are not large.

	Gage Location	t_p (hours)	DA (sq mi)
1	Pohopoco Creek near Parryville	7.1	109.0
2	Aquashicola Creek at Palmerton	10.2	76.7
3	Lehigh River at Walnutport	13.4	889.0
4	Little Lehigh River near Allentown	5.5	80.8
5	Jordan Creek at Allentown	12.3	75.8
6	Monocacy Creek at Bethlehem	10.2	44.5
7	Lehigh River at Bethlehem	17.0	1,279.0
8	Saucon Creek at Lanark	2.4	12.0
9	So. Branch Saucon Cr. at Friedensville	2.0	10.6
10	Saucon Creek at Friedensville	5.0	26.6
11	Tohickon Creek near Pipersville	3.1	97.4
12	Neshaminy Creek near Langhorne	10.2	210.0
13	Schuylkill River at Pottsville	5.0	53.4

	Gage Location	t_p (hours)	DA (sq mi)
14	Schuylkill River at Landingville	6.0	133.0
15	Little Schuylkill River at Tamaqua	2.9	42.9
16	Schuylkill River at Berne	9.2	355.0
17	Tulpehocken Creek at Reading	7.1	211.0
18	Schuylkill River at Pottstown	22.8	1,147.0
19	Perkiomen Creek at Graterford	6.0	279.0
20	Ridley Creek at Moylan	3.9	31.9
21	Brandywine Creek at Chadds Ford	9.2	287.0
22	Chester Creek at U.S.G.S. gage	6.4	61.1
23	Maiden Creek Tributary at Lenhartsville	3.7	7.5
24	French Creek near Phoenixville	5.7	59.1
25	Skippack Creek near Collegeville	5.1	53.7
26	Pickering Creek near Chester Springs	3.1	6.0



6.1. Graphical Correlation - t_p as a Function of LL_{ca}

Multiple Linear Regression. In general, watershed response is dependent on several watershed parameters. An equation of the following form can be used to provide a mathematical expression that involves several independent variables:

$$Y = a + b_1X_1 + b_2X_2 + \ldots + b_nX_n \quad (6.2)$$

where Y = the dependent variable,
a = regression constant,
$b_1, b_2 \ldots$ = regression coefficients, and
$X_1, X_2 \ldots$ = independent variables

This type of analysis generally requires a computer program, and most computer systems have multiple regression program packages. For example, HEC has a step-wise multiple regression program (702-G1-L2020) available in FORTRAN IV (HEC, 1970). Other multiple regression programs, such as the Statistical Package for Social Sciences (Nie et al., 1975), are available on most large computing systems.

When several watershed parameters are being considered, some of the proposed parameters may have little effect on the dependent variable. These parameters, of course, should be dropped from consideration, and the final expression should include only those parameters which significantly affect the result. The general rule is: the fewer variables the better. To determine which parameters should be dropped, a "step-wise regression" procedure is used.

In step-wise regression the analysis is first made with all the specified independent variables; the least significant variable is then deleted, and the analysis is repeated. In the HEC multiple regression program (HEC, 1970) the independent variables are deleted, in turn, on the basis of the adjusted partial determination coefficient (r^2), which gives the increase in unexplained variance caused by deleting that variable from the regression equation.

The HEC program also permits combining and transforming variables. New variables can be computed by combining individual input variables; for

example, a parameter DA $\sqrt{S}$ (basin area DA times the square root of the channel slope S) can be computed if the area and slope have been specified as program input. Individual variables may be transformed (by taking the square root, reciprocal, or logarithm) to make the relationships more nearly linear.

Logarithmic Transformation of Nonlinear Relationships. If the relationship is nonlinear, it can often be transformed into a linear relation; for example, the equation $Z = cX^dY^e$ is equivalent to $\log Z = \log c + d \log X + e \log Y$ through a logarithmic transformation. After such a transformation is made, linear regression can be used to determine the coefficients that best fit the data.

6.5 Criteria for Accepting Results of Regression Analysis

The results of the regression analysis are evaluated by looking at the statistics describing the "goodness-of-fit" of the regression equation to the data. The statistical parameters used are the coefficients of determination (both the adjusted coefficient and the unadjusted coefficient), the partial determination coefficient, and the standard error of estimate. A detailed discussion of these statistical measures is provided by Beard (1962).

The unadjusted multiple-determination coefficient (R^2), and the adjusted multiple-determination coefficient (R^2), provide a measure of the percent of variance in the dependent variable explained by the independent variable. The magnitude of these coefficients varies from 0 to 1. The closer the value is to unity, the greater the reliability of the estimate.

The partial-determination coefficient (r^2) gives a measure of the importance of an independent variable by determining the reduction in variance in the dependent variable when the variable is included with the other independent variables.

The standard error of estimate (S_e) is the standard deviation of the differences between the observed dependent values and the values computed from the regression equation in the units of the dependent variable; therefore, it must be compared with the mean and the standard deviation of that variable.

When regression analysis is used to determine equations relating the various model parameters, the standard error of estimate and the coefficient of determination are computed for each equation. Typical results of such an analysis are tabulated in Table 6.1, where values of S_e and R^2 are given for each equation. The general rule is to use R^2 and S_e as a guide and select the equation with the fewest independent variables and the best values of R^2 and S_e.

TABLE 6.1

TYPICAL RESULTS OF MULTIPLE REGRESSION ANALYSIS
FOR REGIONALIZATION OF MODEL PARAMETERS
(RAHWAY RIVER BASIN, NEW JERSEY)

	Standard Error of Estimate S_e	Correlation Coefficient R	Coefficient of Determination R^2
$TC = 26.19\ I^{-0.53} S^{-0.29}\ (DA)^{0.23}$	0.0495	0.9710	0.9428
$TC = 19.84\ I^{-0.50}\ (DA/S)^{0.26}$	0.0358	0.9849	0.9701
$TC = 8.29\ K^{-1.28}\ (DA/S)^{0.28}$ *	0.0269	0.9915	0.9831
$TC = 4.14\ (DA/S)^{0.39}$	0.1296	0.7800	0.6084
$(TC + R) = 122.64\ I^{0.42}\ S^{-0.55} (DA)^{0.09}$	0.1442	0.6844	0.4684
$(TC + R) = 15.69\ I^{-0.21} (DA/S)^{0.34}$	0.1161	0.8094	0.6552
$(TC + R) = 11.52\ K^{-0.67}\ (DA/S)^{0.33}$ *	0.1054	0.8461	0.7159
$(TC + R) = 7.98\ (DA/S)^{0.39}$	0.1093	0.8333	0.6944

* $K = 1.0 + 0.03I$

CHAPTER 7

HEC-1 KINEMATIC WAVE ROUTING TECHNIQUES FOR UNGAGED BASIN MODELING

7.1 Introduction

The purpose of this chapter is to describe in general terms how the HEC-1 kinematic-wave modeling prodedures may be applied. A discussion of kinematic wave theory as it relates to the HEC-1 procedures are given by DeVries and MacArthur (1979). The papers by Lighthill and Whitman (1955), Harley et al. (1972), and Woolhiser (1975) are recommended for general background on the kinematic wave method. The kinematic wave approach to rainfall-runoff modeling uses a very detailed analysis of the physical processes occuring on the watershed. This is in constrast to the equally valid, but less detailed, "lumped-parameter" approach used in the unit hydrograph method. In the kinematic wave approach the various physical processes of water movement over the basin surface (with attendant infiltration), flow into stream channels, and flow through the channel network are modeled using the equations of physics. Parameters such as roughness, slope, catchment lengths and areas, and stream channel dimensions are used to define the processes.

The various features of the irregular surface geometry of the basin are approximated by two types of basic elements: (1) an overland flow element, and (2) a stream or channel flow element. In the modeling process described here, one or two overland flow elements (designated as overland flow strips) are combined with one or two channel flow elements to represent a subbasin. An entire basin is modeled by linking the various subbasins together.

Because the various elements comprising the model are defined in terms of physical parameters, the model can be easily modified, and changes which represent changes in land use in the basin can be made using parameters which describe these new uses. This makes kinematic- wave-type models very useful for urban studies because the effects of increasing urbanization can be accounted for by changing the parameters describing the basin.

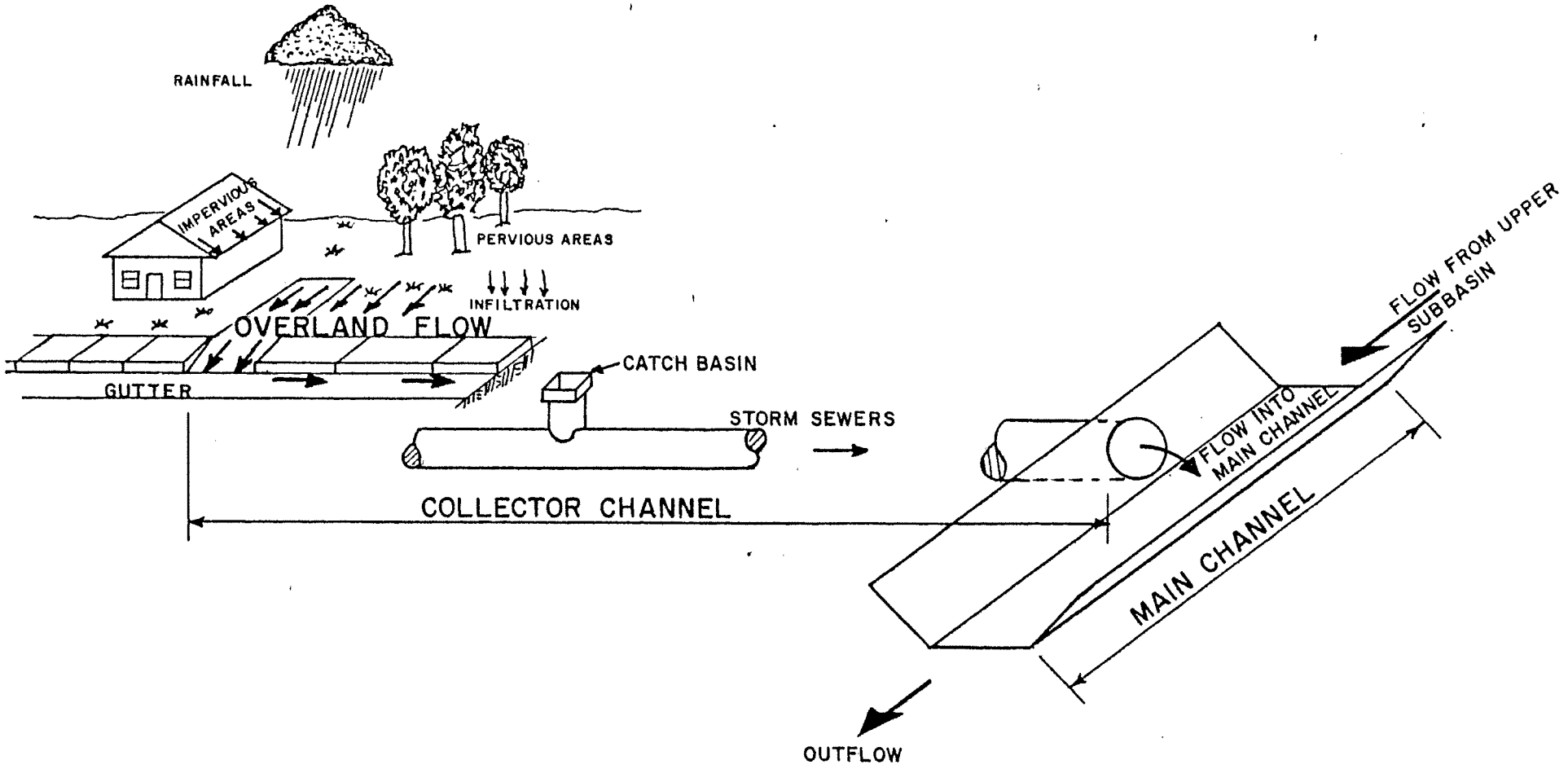
The various topics which are covered here include basin modeling procedures, a description of the elements used in kinematic wave calculations, and procedures for selecting the parameters. An example problem is presented to illustrate HEC-1 input and output data, and effects of changes to numerical values of the parameters are discussed.

7.2 Basin Modeling

The modeling process starts with a description of the topologic structure of the basin: drainage basin boundaries, stream and drainage channels, and the logical relationships between the drainage areas and the channels. The definition of the drainage boundary will depend on the objective of the study being conducted, as well as the topological character of the basin. Studies dealing with urban hydrology usually require delineation of subbasins that are smaller than 2 mi^2 in extent (about 5 km^2). Studies dealing with the effects of channel modifications may permit use of large areas; however, as the area is increased the assumptions required to apply the kinematic wave method become more tenuous.

Typical elements of an urban drainage system are shown in Figure 7.1. Rain falls on two general types of surfaces: (1) those that are essentially impervious, such as roofs, driveways, parking lots and other paved areas; and (2) pervious areas, most of which are covered with vegetation and have numerous small depressions which produce local storage of rainfall. It is assumed in the model that water initially travels over these surfaces as sheet flow; however, in a relatively short distance the water begins to collect in small streams or rivulets and the process of stream or channel flow begins. For impervious areas, the distance to the first channel (say a gutter) is typically thirty to one hundred feet, while for pervious surfaces the longest distance a drop of water must travel to reach a channel is on the order of one hundred to several hundred feet.

Water collected by the gutters usually travels no more than a few hundred feet until it enters catch basins which are connected to sewers. These sewers are typically 1.5 to 2 feet in diameter for local drains. Local drains are connected in turn to larger and larger drains which feed the main storm drain. In many areas the main storm drains are open channels or



7.1. Typical Urban Drainage Pattern

streams. In major urban areas the main storm drains are often large closed-conduit sections, but these storm drains are usually designed to flow only partially full, and therefore, the kinematic wave routing approach (which assumes open channel flow) is appropriate.

7.3 Kinematic Wave Equations

The kinematic wave equations (DeVries and MacArthur, 1979) are the continuity equation for unsteady open channel flow with lateral inflow, and Manning's equation. The continuity equation is:

$$\frac{\partial A}{\partial t} + \frac{\partial Q}{\partial x} = q_o \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (7.1)$$

where Q is the channel flow in cfs, A is the flow cross-sectional area in ft^2, q_o is the lateral inflow in cfs/ft, x is the distance along the flow path in ft, and t is time in seconds. Manning's equation is written in the form:

$$Q = \alpha A^m \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (7.2)$$

where the kinematic wave routing coefficients, α and m, are functions of the channel or flow surface geometry. The general expression for α is:

$$\alpha = \frac{KS^{1/2}}{n} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (7.3)$$

where K is a constant that depends on the geometry, S is the slope, and n is a roughness coefficient. A change in either n or S will change the value of α used in the calculations. The same equations are used for both sheet flow computations (for overland flows) and for channel flow computations.

7.4 Elements Used in Kinematic Wave Calculations

The runoff process described above is idealized in HEC-1 through the use of the following flow elements: (1) one or two overland flow elements, (2) one or two collector channel elements, and (3) a main channel element. These

generally provide the necessary detail for modeling the runoff process in urban basins. Schematic drawings of these elements are shown in Figure 7.2. The elements are specified to represent typical features of the basin, and thus the parameters chosen for the individual elements should be representative of the entire subbasin. Because land use and development practices are usually very similar within a selected hydrologic unit, assigning a single value to a given parameter (such as an overland flow length for impervious areas, for example) usually gives good results.

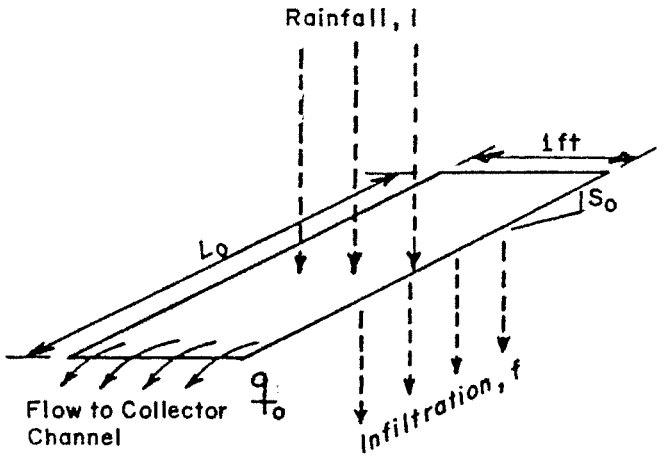
7.5 Overland Flow Elements

The basic overland flow element is simply a sloping rectangular plane upon which the rain falls. In HEC-1 it is treated as a strip of unit width (one foot or one meter wide). Some of the rainfall is lost by infiltration; the remainder runs off the lower edge of the plane into a channel. Infiltration losses may be described as varying with time or constant, and any of the previously described loss rates can be specified for each flow strip. The fraction of the element that is impervious can also be specified. The losses are computed first, and then the overland flow computations are made.

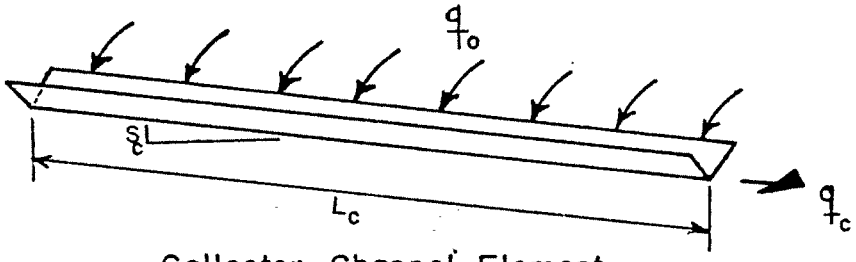
The basic kinematic-wave-analysis concept used in HEC-1 allows the use of either one or two overland flow surfaces, each discharging into a collector channel. For example, one element could represent all areas that are essentially impervious, with short lengths of flow (L_o) to the point where the flow becomes channel flow. Thus the element would represent driveways, roofs, street surfaces, etc.

The other overland flow element could then represent areas that are pervious and have higher resistance to flow, such as lawns, fields, and wooded areas. In general, the catchment flow lengths and roughness coefficients will be much greater for these areas. Again, the value of L_o to be used is the representative maximum distance for water to travel as overland flow for this type of land surface.

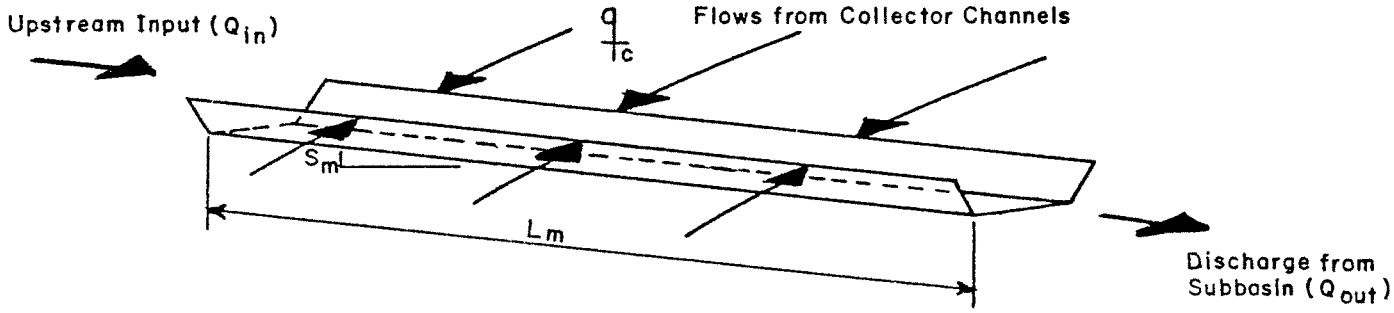
The user of this method should think of the overland flow strips as representing typical flow surfaces rather than actual planar surfaces, except



Overland Flow Element



Collector Channel Element



Main Channel Element

7.2. Elements Used in Kinematic Wave Calculations

when very small areas (such as one city lot) are being considered. It is only at these very small scales that the mean surface slope and actual area and length come close to fitting the basic theoretical concept.

Fortunately, in many natural basins and urban catchments, close examination of the full drainage system reveals that the small-scale drainage patterns are quite similar throughout the entire basin. The value of L_o appropriate for such a situation will not vary greatly over the basin. The actual values of L_o which give the correct runoff response for the basin must be verified through comparison of model output with measured data, however.

The following data are needed as input to HEC-1 to describe each overland flow strip:

1. L_o - typical overland flow length
2. S_o - representative slope
3. N - roughness coefficient
4. A_o^1 , A_o^2 - the percentages of the subbasin area which the overland flow surface represents (two possible types for each subbasin)
5. Infiltration and loss-rate parameters

7.6 Collector Channel

The collector channel element is used to model the flow in its path from the point where it first becomes channel flow to the point where it enters the main channel. The inflow to the collector channel is taken as a uniformly distributed flow along the entire length of the channel. This correctly represents the situation where overland flow runs directly into the gutter, and also provides a reasonable approximation of the flow inputs into the storm drain system from individual catch basins and tributary collector pipes which are distributed along the collector channel.

The value of the exponent m in Equation 7.2 for trapezoidal channels ranges from 4/3 when the trapezoid has a base width of zero (triangular shape) to 5/3 for a very wide rectangular shape. For a channel with a circular cross section, m is taken as 1.25.

The following data are needed as input to describe the collector channel system:

1. A_c - surface area drained by a single representative collector channel (e.g., gutter plus storm drain)
2. L_c - collector channel length (total length of gutter plus length of storm drain)
3. S_c - channel slope
4. n - Manning's roughness coefficient
5. Channel shape (either a circular section or some variant of a trapezoid can be used)
6. Pipe diameter or the trapezoid bottom width and side slope, if appropriate

7.7 Main Channel

The main channel can carry both inflows from upstream subbasins as well as flows supplied by the collector channels within the subbasin. The inflow from the collector channel is taken to be uniformly distributed along the length of the main channel. This is assumed to reasonably approximate the actual situation where the flow enters the channel from the various collectors at a number of discrete points at various spacings.

The channel routing element can also be used independently for routing a hydrograph through a channel reach. If desired, the subbasin flow can be computed separately and combined with routed flow at the subbasin outlet. Any of the routing methods available in HEC-1 can be used for channel routing (Muskingum, modified-Puls, Tatum, etc.) if desired.

The channel routing procedure requires the following data:

1. $A_{subbasin}$ - Area of subbasin
2. L_m - Channel or stream length
3. S_m - Slope
4. n - Manning's roughness coefficient
5. Channel shape (trapezoidal or circular)

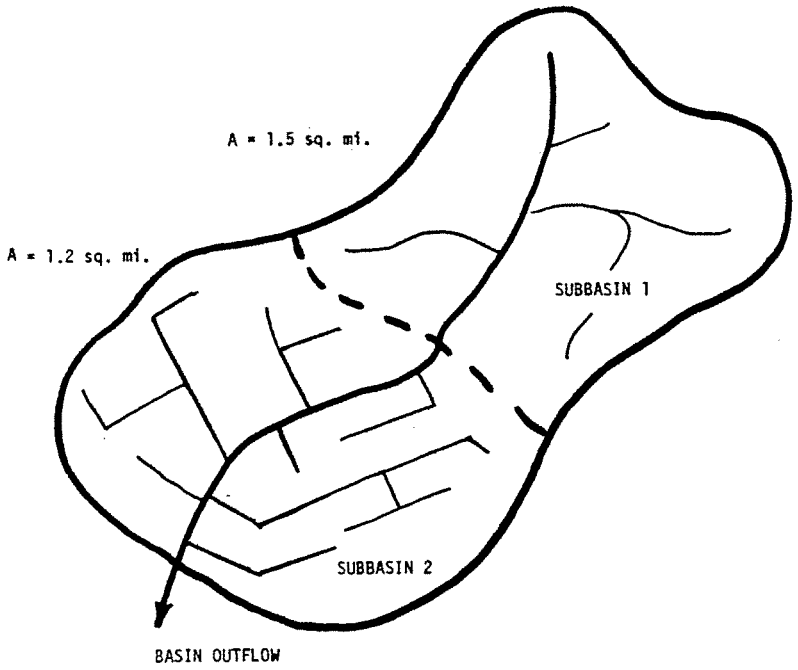
6. Channel dimensions (e.g., width, w, or diameter, D, if required, and side slopes, z)
7. The upstream hydrograph to be routed through the reach, if desired.

7.8 Example Application of Kinematic Wave Methods

The small partially-urban basin shown in Figure 7.3 is to be modeled using kinematic wave runoff and routing options of HEC-1. The hydrologic characteristics of this basin (obtained either by previous calibration or by comparison with other basins) are as follows:

Subbasin 1. The upper of the two subbasins is presently not urbanized and is primarily rolling pasture with few trees. The typical distance L_o for flow to travel to tributary stream channels is 500 feet. The overland flow roughness coefficient N is 0.4. The representative ground slope, S_o, is 0.04. The amount of impervious area is assumed to be negligible. The subbasin area A_o^1 is 1.5 square miles.

The collector or tributary channels have a slope, S_c of 0.025, and an 'n' value of 0.10, with a typical channel length, L_c, of 1,500 feet. The most representative section is a triangle. The area, A_c, contributing to a typical collector stream is 0.4 square mile.



7.3. Basin for Example Problem

The main channel is approximately triangular in cross section with side slopes, z, of 1 in 4. The mean channel slope, S_m, is 0.01 and Manning's 'n' is 0.05. Its length, L_m, is 3,500 feet.

Subbasin 2. The lower subbasin is completely urbanized, and twenty percent of the subbasin surface is impervious. In this subbasin the impervious runoff areas have the following characteristics: L_{o_1} = 50 ft, S_{o_1} = 0.06, N = 0.15. The pervious areas can be represented by the following parameters: L_{o_2} = 130 ft, S_{o_2} = 0.01, N = 0.3. the subbasin area, A_{o_2}, is 1.2 sq mi. The total basin area is 2.7 sq mi.

The collector channel system involves 1,800 ft of pipe storm drain ranging up to four feet in diameter, plus an additional three hundred feet of gutter between catch basins. A triangular section is used to represent these various channel components (the program default value which gives one to one side slopes is used). The average slope, S is 0.008, and the Manning's 'n' (which is used here to account for friction and other channel head losses) is 0.020. The area, A, contributing to the collector channel system is 0.35 sq mi.

The parameters describing this basin are given in Table 7.1, and hydrographs from the HEC-1 output are shown in Figure 7.4.

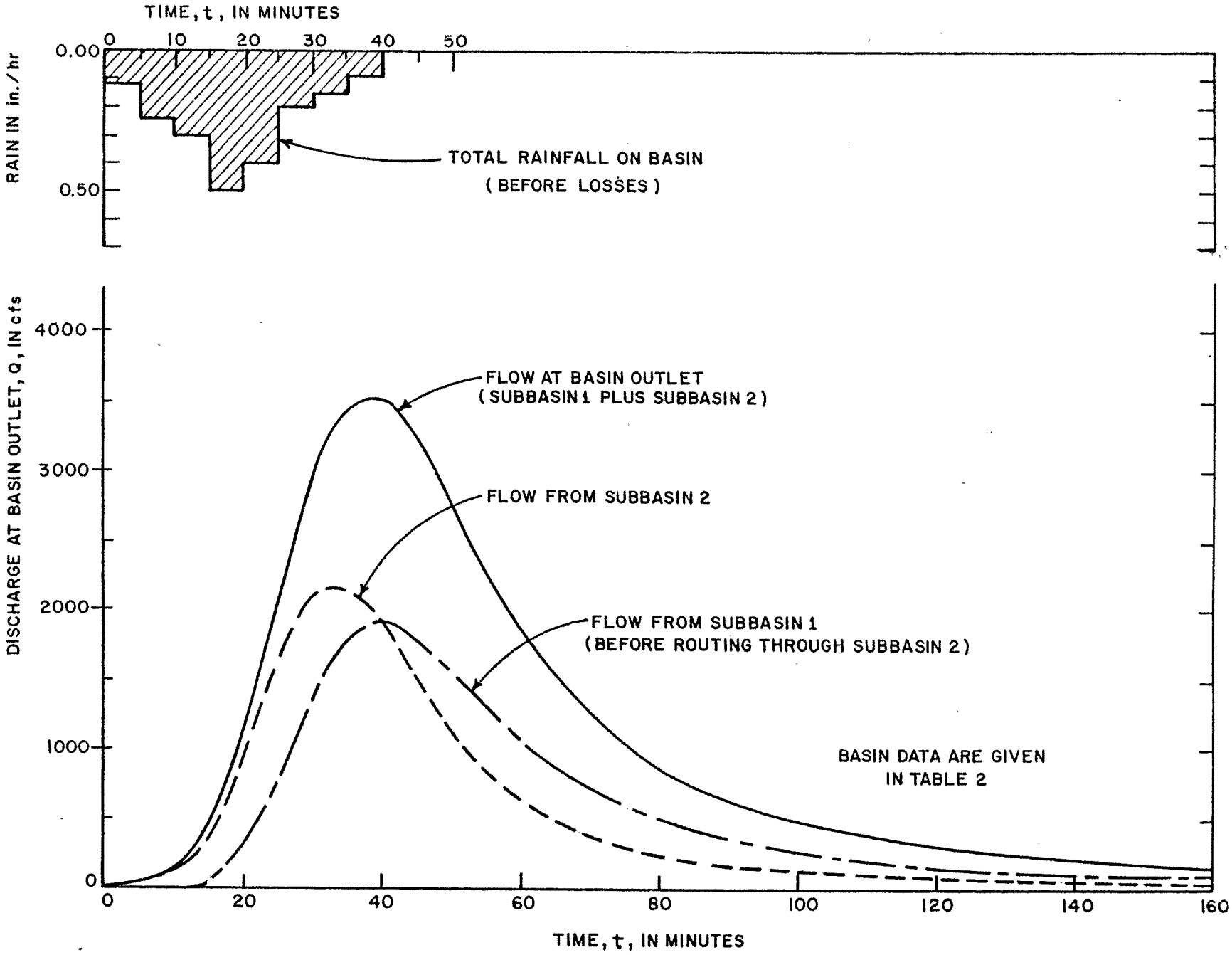
As an example of the way the program can be used to evaluate the effects of future urbanization, the following changes were made to the parameters describing Subbasin 1. Two overland flow strips were used instead of one; an impervious overland flow element with L_{o_1} = 50 feet, N = 0.3, and representing twenty percent of the subbasin area; and a pervious element with the representative flow lengths reduced to four hundred feet and with the other parameters as before.

The results from this analysis are plotted in Figure 7.5. The peak flow at the basin outlet increased from 3,514 cfs for the initial basin condition to 4,275 cfs after the urbanization changes. The peak flow occurred five minutes earlier in the fully urbanized basin.

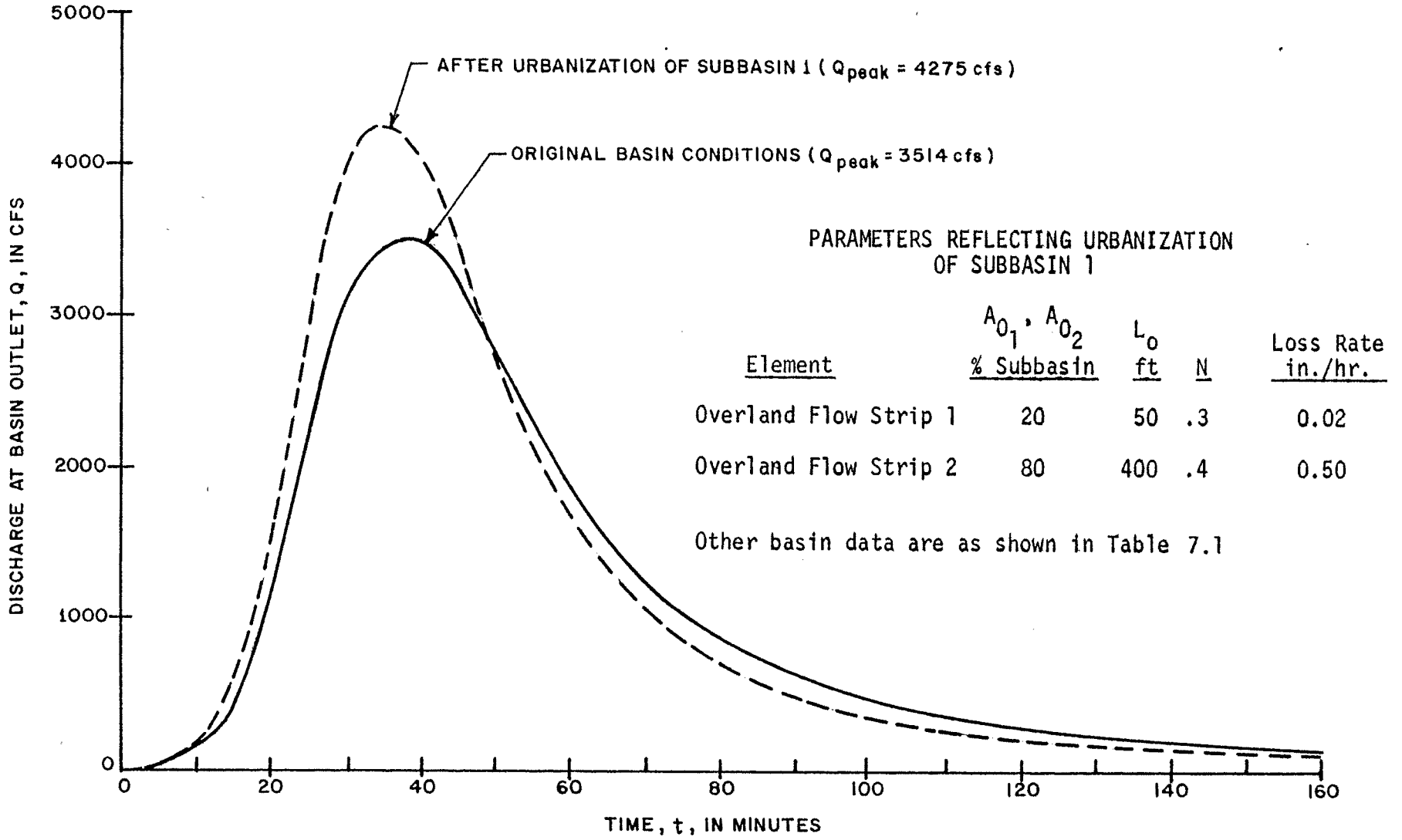
TABLE 7.1

Parameters for Kinematic Wave Example Problem

		Percent Total Subbasin Area	L ft	S	Roughness	Channel Shape	Channel Size ft	Z	Collector System Area mi^2	Loss Rate in/hr
Subbasin 1 (1.5 mi^2)										
1.	Overland Flow Strip	100	500	0.04	0.40	--	--	-	--	0.50
2.	Collector Channel	--	1,500	0.025	0.10	Triangle	--	1	0.40	--
3.	Main Channel	--	3,500	0.010	0.05	Triangle	--	4	--	--
Subbasin 2 (1.2 mi^2)										
1.	Overland Flow Strip 1	20	50	0.06	0.30	--	--	-	--	0.02
2.	Overland Flow Strip 2	80	180	0.01	0.40	--	--	-	--	0.20
3.	Collector Channel	--	2,100	0.008	0.020	Triangle	--	1	0.35	--
4.	Main Channel	--	4,000	0.003	0.025	Trapezoid	2	2	--	--



7.4. Computed Hydrographs for Example Problem



PARAMETERS REFLECTING URBANIZATION OF SUBBASIN 1

Element	A_{O_1}, A_{O_2} % Subbasin	L_o ft	N	Loss Rate in./hr.
Overland Flow Strip 1	20	50	.3	0.02
Overland Flow Strip 2	80	400	.4	0.50

Other basin data are as shown in Table 7.1

7.5. Effect of Urbanization on Basin Outflow

7.9 Summary

The material presented here provides background information for modeling hydrologic basins using kinematic wave routing with HEC-1. The example problem gives an illustration of the use of the method and shows how it can be applied to studies of the effects of urbanization on hydrologic basins. Because the kinematic wave parameters are directly related to physical properties of the watershed, the method can readily be used to develop models for ungaged basins. The major uncertainties in its use lie with the determination of roughness coefficients and flow surface slopes. It is important that the modeler have experience with similar watersheds before making estimates of parameters for ungaged areas.

The user of this method should verify the model using measured rainfall-runoff events to allow the assessment of the performance of the model with the selected parameters. Without such a check, the results should be interpreted with a great deal of caution. However, kinematic wave models have been used successfully in a large number of applications for ungaged watersheds, especially in urban settings, and when the models are properly formulated, good simulations result.

CHAPTER 8

CASE STUDY I - ANALYSIS WITH SOME DISCHARGE-FREQUENCY DATA

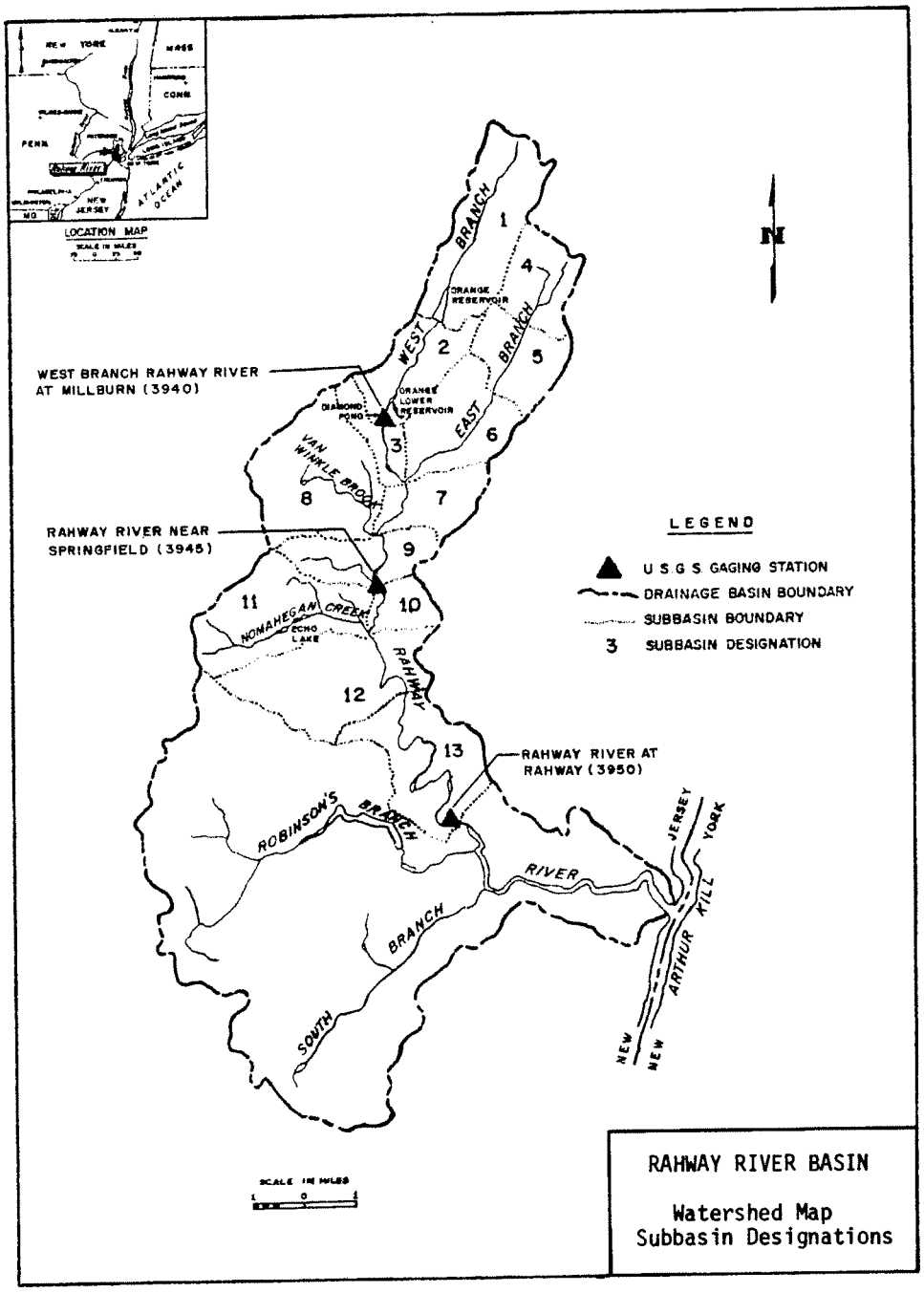
Three case studies are presented in this report to illustrate how the methods previously described are actually applied. Each provides an example dealing with a different degree of data availability. This first example discusses a study made to determine discharge-frequency relationships for the Rahway River Basin in New Jersey (HEC, 1976a). The basin is shown in Figure 8.1. There are three stream gages within the basin. At only one gage, however, was the length of record sufficient to provide an adequate discharge-frequency relationship. Discharge-frequency curves were needed at a total of 13 locations in the basin.

8.1 General Study Program

To provide the needed discharge-frequency relationships, an HEC-1 model for the basin was set up and calibrated using data from several storms. The optimization features of HEC-1 were used to develop unit hydrographs and loss rate parameters to reconstitute the observed runoff hydrographs at the gaging stations.

The basin was then subdivided into 13 subbasins related to the locations at which discharge-frequency curves are needed (index points). These are locations of existing and proposed flood control structures, major confluences, and points where there is significant change in land use, stage-damage relations, or stream-routing characteristics. Unit hydrograph parameters (t_c and R) were computed by regional techniques. The three gage locations in the Rahway basin were used to define drainage basin characteristics, and data from three nearby basins were also used.

Precipitation loss rates were estimated for the ungaged subbasins by a combination of techniques: (1) using results of the optimization runs for the gaged areas of the basin, (2) using data from hydrologically similar basins in the area, and (3) reproducing estimated peak flows at various locations in the basin using high water marks. Storage-outflow relationships for streamflow routing were determined using preliminary runs of computer program HEC-2. The full basin model was then calibrated with three storms of record.



8.1. Watershed Map - Rahway River Basin

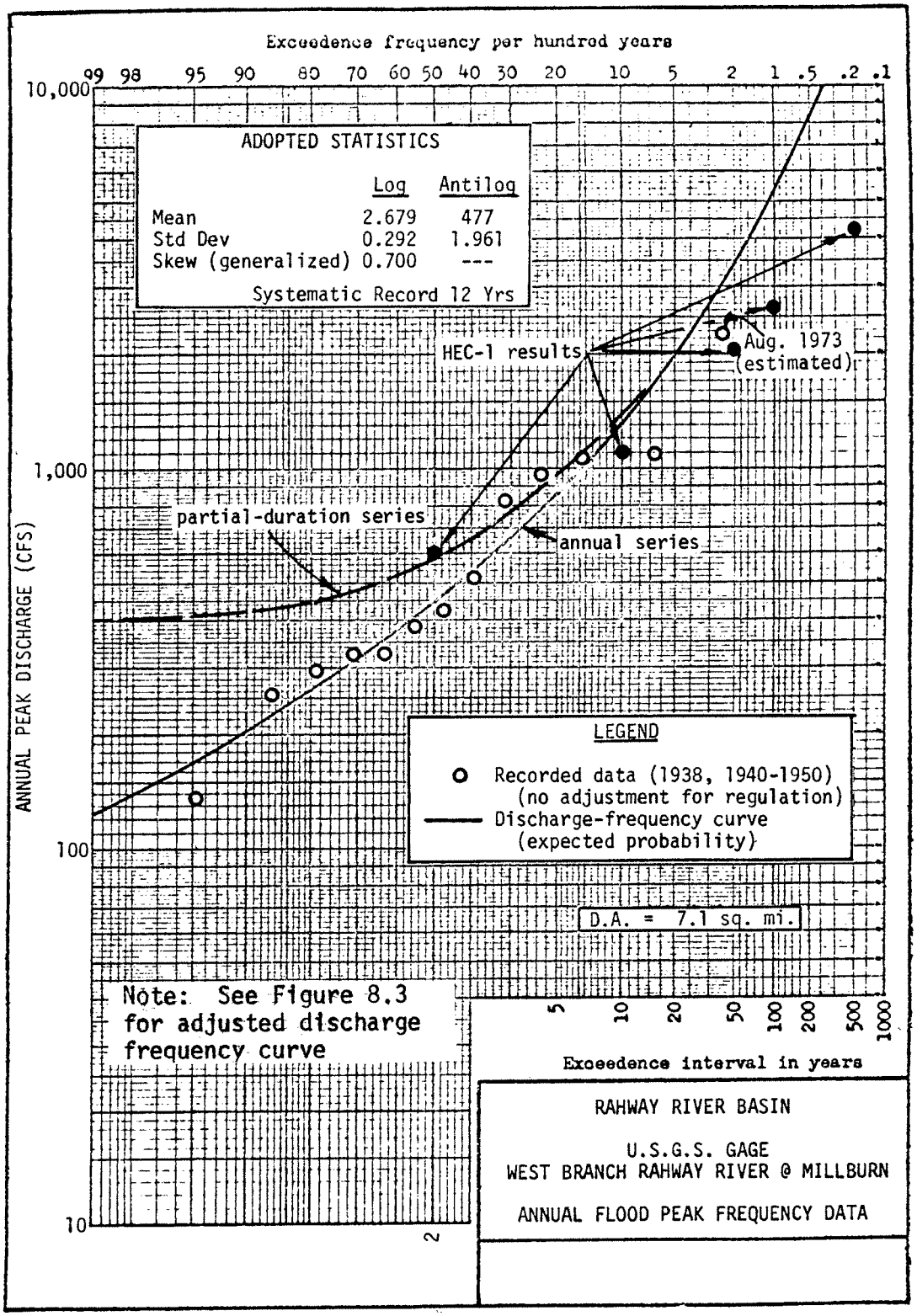
The next step in the study was to develop hypothetical rainfall data. These data were used as input to the HEC-1 model, and a discharge for each storm frequency was computed at the gage locations. The resulting discharge-frequency curve was compared with the curve computed from gage records. Next the loss rates were adjusted to make the computed results match the curve. Figure 8.2 shows the HEC-1 results as well as a plot of the recorded gage data. The recommended discharge-frequency curve is shown in Figure 8.3. The frequency curve based on HEC-1 results was compared for closeness of fit with the recommended curve, and where necessary, adjustments were made. These adjustments were then used to modify tributary curves to represent consistant runoff frequencies.

A basin model was calibrated for the area under investigation using computer program HEC-1 for selected storms of record. Using discharges computed by the HEC-1 model, river stages were computed throughout the study area for the various storm events, giving the final results desired for the study. The work performed in the study is discussed in more detail in the following paragraphs.

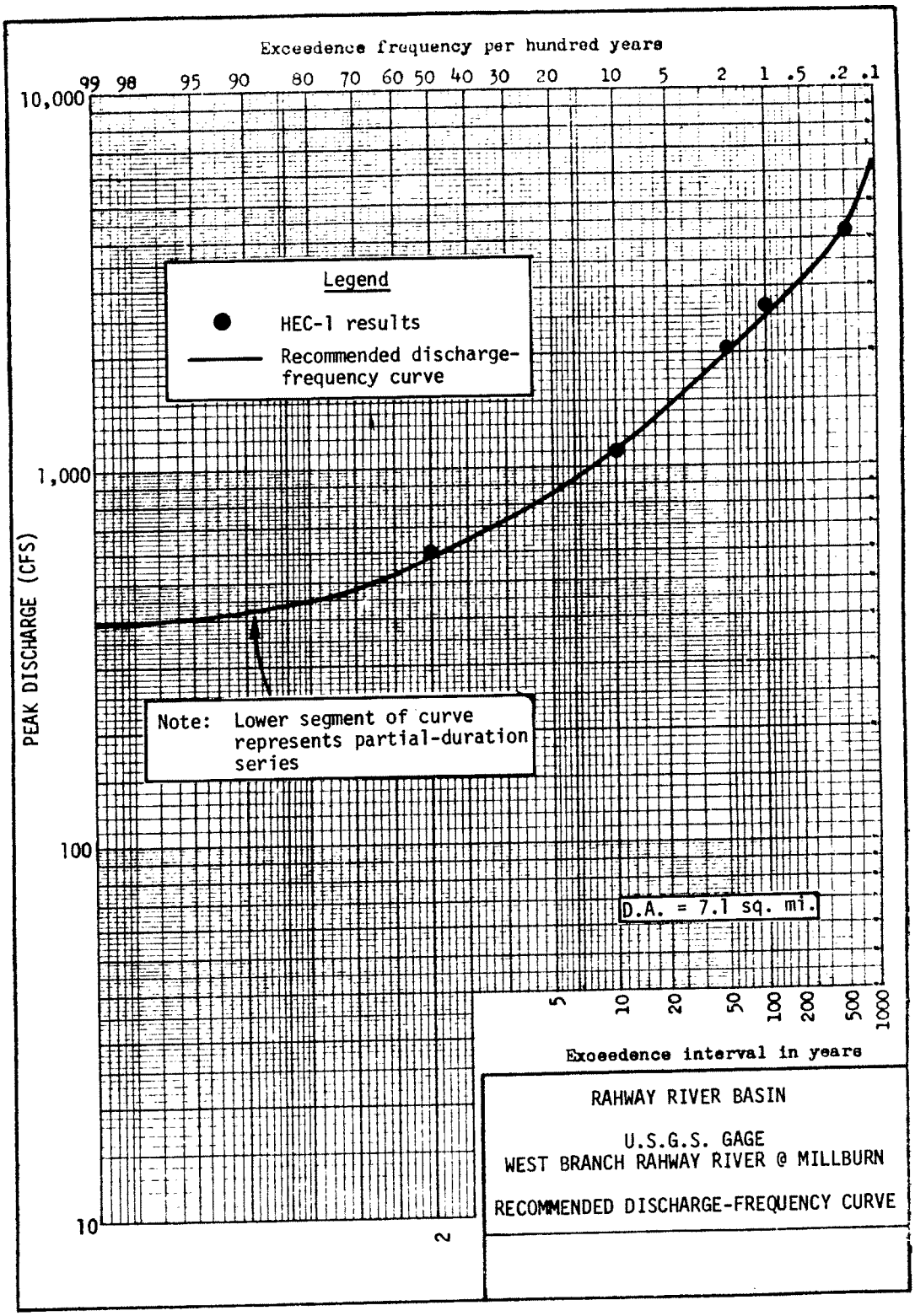
8.2 Basin Description

The Rahway River Basin is located in northeastern New Jersey within the metropolitan area of Greater New York. The basin has a total area of 81.9 square miles. The Rahway River is a tributary to the Arthur Kill, an estuary of New York Harbor. Elevations range from sea level at the confluence with the Arthur Kill to 600 ft at its most northern source. The total length of the longest watercourse is about 25 mi. Stream slopes are very small in the lower reaches and range from about 10 ft per mi in the middle reaches to 300 ft per mi in the uppermost reaches.

The East and West Branches of the Rahway River (see Figure 8.1) are in valleys with steep side slopes producing high rates of runoff. The area contributing runoff to the West Branch, 8.3 sq mi, is relatively undeveloped, whereas the area contributing runoff to the East Branch, 7.5 sq mi, is highly developed. Channel slopes of the East Branch are also significantly flatter than those of the West Branch. The contrasting physical differences in slope and urbanization for the separate watersheds have counteracting effects on



8.2. Annual Flood Peak Frequency Data and HEC-1 Results



8.3. Recommended Discharge-Frequency Curve

travel time. As a result, flood peaks nearly coincide at the confluence of the two branches.

8.3 Frequency Analysis

Data and procedures contained in Guidelines for Determining Flood Flow Frequency, (Water Resources Council, 1976) were used to compute flood flow frequency curves at the USGS recording streamflow gages: West Branch Rahway River at Millburn, Rahway River near Springfield, and Rahway River at Rahway. The Pearson Type III distribution with log transformation of the flood data was used as the basic distribution for defining the annual flood series. Plotting positions were computed according to Weibull's formula, and an expected probability adjustment was applied to each computed frequency curve.

8.4 Unit Hydrograph Analysis

A unit hydrograph study was made for the gaged basins (Rahway River near Springfield and Rahway River at Rahway) to derive t_c and R, the Clark unit hydrograph parameters. The values obtained were used to develop a regional relationship for t_c and R based on the physiographic characteristics of the basins.

The optimization feature of HEC-1 was used to compute the best-fit loss rate and unit hydrograph parameters. Program input data for each storm event consisted of: (1) mean storm rainfall for the gaged basin under investigation, (2) hourly precipitation data from the recording stations which provided a distribution pattern for the mean rainfall, (3) basin drainage area, (4) percent of impervious area, and (5) the observed runoff hydrograph.

Multiple runs were made according to the procedures outlined in Addendum 1 of the HEC-1 manual, until the observed hydrographs were approximated by the computed hydrographs in shape, timing, and volume. The exponential loss rate function was used for these runs, and regional values of ERAIN and RTIOL (see Chapter 5 for definitions) were based on the optimization results of this study and on optimization runs for hydrologically similar basins in the vicinity of the study area.

The derived 1-hour unit hydrographs and unit hydrograph parameters are shown in Figures 8.4 and 8.5. The adopted values of t_c and R for the two gages, Rahway River near Springfield and Rahway River at Rahway, were taken as the average of the derived parameters. The significant difference in timing and peak flow rate between the optimized 1-hour unit hydrographs of Figure 8.4 is probably due to (1) movement of the storm of August 1971 up the basin such that the time of concentration was greater, and (2) channelization, specifically in the East Branch, which tends to increase the peak discharge rate and reduce the time of concentration.

The adopted unit hydrograph parameters are tabulated in Table 8.1 with data from other gaged basins considered hydrologically similar to the study area. The variables of Table 8.1 are defined in Chapter 6. The values of I and S were taken from reports by the U. S. Geological Survey (1974) and the U. S. Army Corps of Engineers (1976).

A multiple regression routine (HEC, 1970) was used to correlate t_c and R with various physiographic characteristics of a drainage basin. Imperviousness was included as one of the parameters because of the high degree of development in parts of the basin and because of the significant difference in development in the areas contributing runoff to the East and West Branches of the Rahway River. In the regression analysis, imperviousness was shown to be a significant physical parameter. Results are given in Table 8.2 together with each of the equations considered.

Equation 8.3 was adopted as the best relationship for determining t_c as a function of the other parameters, based on the partial determination coefficients for the individual parameters and a comparison of the standard errors of estimate for the various expressions evaluated in the analysis. The Clark parameter t_c for ungaged basins is therefore computed as

$$t_c = 8.29\ (1.0 + 0.03I)^{-1.28}\ (DA/S)^{0.28} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (8.3)$$

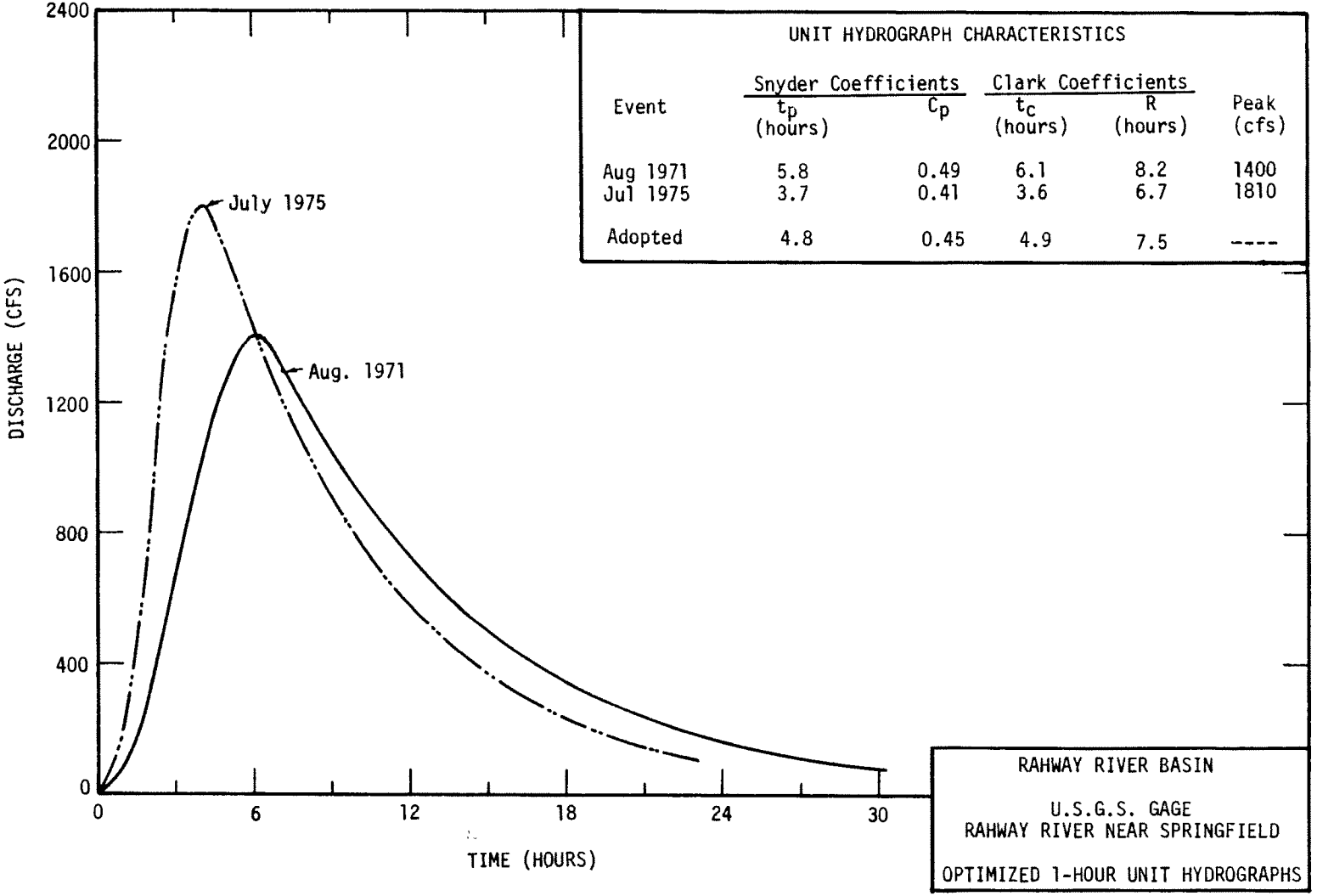
where t_c, I, DA, and S are as defined above. The transformation K = 1.0 + 0.03I was necessary to keep t_c from approaching infinity as I approached zero. It should also be noted that the slope characteristic, S, used for a given ungaged basin is the slope of that particular watercourse that yields

TABLE 8.1

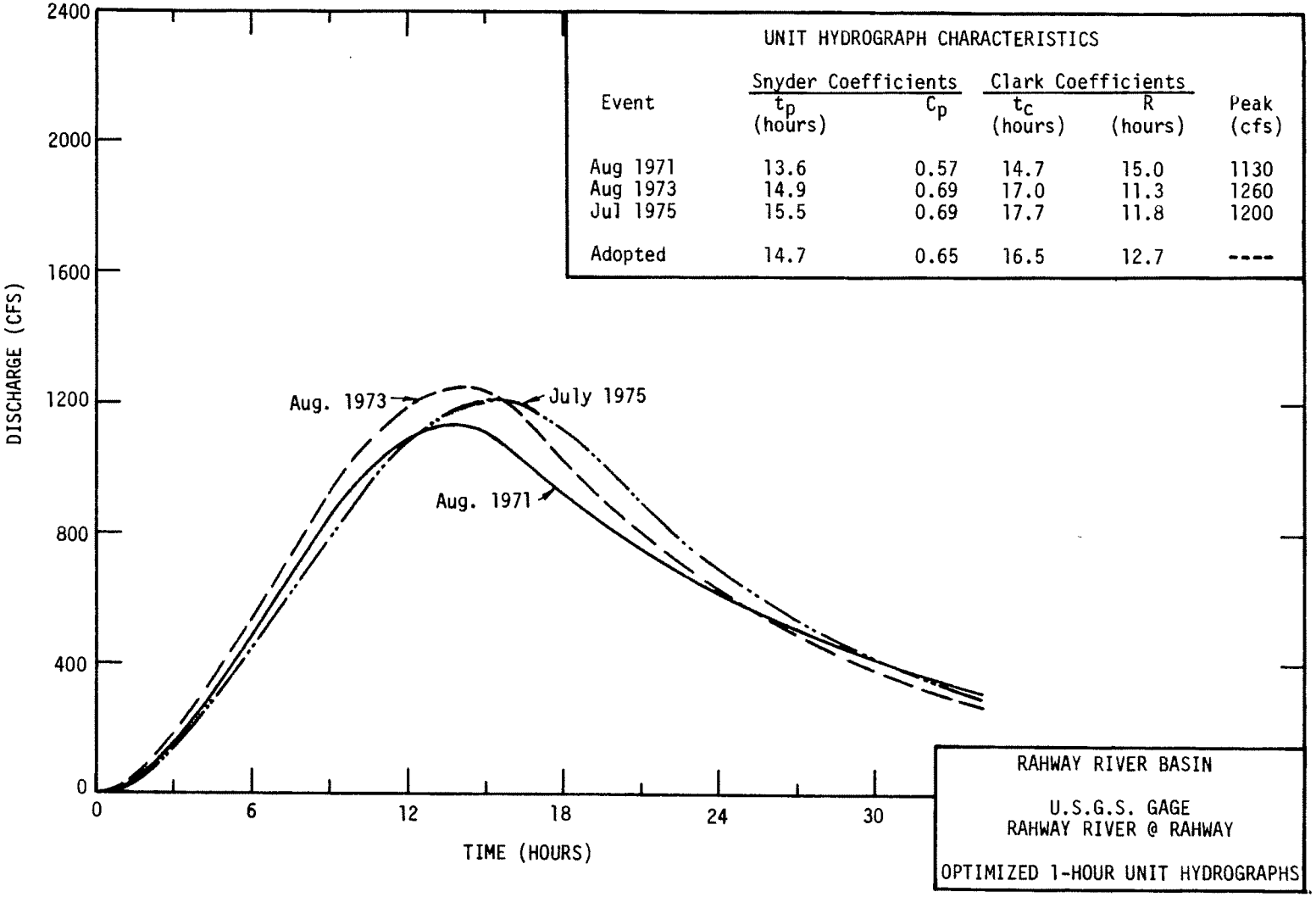
REGIONAL ANALYSIS

SELECTED DATA USED IN THE MULTIPLE REGRESSION ANALYSIS RELATING t_c and R TO VARIOUS PHYSIOGRAPHIC CHARACTERISTICS OF THE RAHWAY RIVER

	Gage Location	D A (sq mi)	S (ft/mi)	I (%)	t_c+R (hours)	t_c (hours)
1	Rahway River near Springfield, N.J.	25.5	14.6	26.0	12.4	4.9
2	Rahway River at Rahway, N.J.	40.9	8.8	24.0	29.2	16.5
3	Chester Creek near Chester, Pa.	61.1	22.6	9.5	11.9	8.1
4	Green Brook at Plainfield, N.J.	9.75	49.2	25.0	4.7	2.6
5	Robinsons Branch, Rahway R. at Rahway, N. J.	21.6	13.3	19.0	9.9	5.0
6	Elizabeth River at Elizabeth, N. J.	18.0	19.5	45.0	5.4	2.7



8.4. Optimized 1-Hour Unit Hydrograph for Rahway River Near Springfield



8.5. Optimized 1-Hour Unit Hydrograph for Rahway River at Rahway

the longest time of travel. It is not necessarily the slope of the longest watercourse.

The relationships of Table 8.2 containing R did not give reasonable results; therefore, the ratio

$$R/(t_c + R) = 0.65 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (8.9)$$

was adopted. This ratio was used in the preliminary optimization work for the gaged basin (Rahway River near Springfield) before specific values of t_c and R were selected. Equation 8.9 reduces to

$$R = 1.85\ t_c \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (8.10)$$

TABLE 8.2

RESULTS OF MULTIPLE REGRESSION ANALYSIS ON A REGIONAL BASIS

Equation	Equation No.	Standard Error of Estimate	Correlation Coefficient $\overline{R}$	Coefficient of Determination $\overline{R}^2$
$t_c = 26.19\ I^{-0.53}\ S^{-0.29}\ (DA)^{0.23}$	(8.1)	0.0495	0.9710	0.9428
$t_c = 19.84\ I^{-0.50}\ (\frac{DA}{S})^{0.26}$	(8.2)	0.0358	0.9849	0.9701
* $t_c = 8.29\ K^{-1.28}\ (\frac{DA}{S})^{0.28}$	(8.3)	0.0269	0.9915	0.9831
$t_c = 4.14\ (\frac{DA}{S})^{0.39}$	(8.4)	0.1296	0.7800	0.6084
$(t_c + R) = 122.64\ I^{-0.42}\ S^{-0.55}\ (DA)^{0.09}$	(8.5)	0.1442	0.6844	0.4684
$(t_c + R) = 15.69\ I^{-0.21}\ (\frac{DA}{S})^{0.34}$	(8.6)	0.1161	0.8094	0.6552
* $(t_c + R) = 11.52\ K^{-0.67}\ (\frac{DA}{S})^{0.33}$	(8.7)	0.1054	0.8461	0.7159
$(t_c + R) = 7.98\ \frac{DA}{S}^{0.39}$	(8.8)	0.1093	0.8333	0.6944

* $K = 1.0 + 0.03I$

Optimization results for the USGS gage, Rahway River at Rahway, were not used in the preliminary determination of R or t_c for the ungaged basins because the channel storage in this basin is generally not representative of the ungaged areas.

8.5 Hypothetical Storms

Storms of various frequencies were developed for the area under investigation. The storms selected were those with exceedance intervals of 500, 100, 50, 25, 10 and 2 years, plus the Standard Project Storm (SPS).

The 500-, 100-, 50-, 25-, 10-, and 2-year storms were developed by procedures described in the Appendix. Average point rainfall depths were taken from the isopluvial maps for the study area location. The depths are tabulated in Table 8.3 for each storm for durations from 1 to 24 hours. The point rainfall depths were converted to 40-square-mile rainfall depths using the area-depth curves of the Appendix. A rainfall distribution similar to

TABLE 8.3

POINT RAINFALL FOR HYPOTHETICAL STORM EVENTS[1]

Duration (hours)	2-Year	10-Year	25-Year	50-Year	100-Year	500-Year[2]
	(inches)					
1	1.45	2.15	2.45	2.75	3.10	3.75
2	1.75	2.70	3.15	3.40	3.80	4.75
3	2.00	2.90	3.35	3.80	4.30	5.30
6	2.40	3.60	4.10	4.60	5.20	6.45
12	2.85	4.30	5.10	5.50	6.30	7.85
24	3.35	5.10	5.85	6.50	7.35	9.10

[1]Data taken from isopluvial maps contained in Technical Paper No. 40, Rainfall Frequency Atlas of the United States, U. S. Dept. of Commerce, Washington, D. C., 1961.

[2]Determined by extrapolation according to procedures contained in Technical Paper No. 40 for return periods longer than 100 years.

that for the SPS was used where the hour of largest precipitation is preceded by the second largest and followed by the third largest (see Table 8.4).

The rainfall-depth versus area data developed for the stream system procedure of HEC-1 are given in Table 8.5. This procedure automatically accounts for decreasing amounts of basin-average precipitation with increased basin size and is discussed in Addendum 2 of the HEC-1 Users Manual (HEC, 1973).

The Standard Project Storm rainfall for the study area was developed with procedures from EM 1110-2-1411 (U.S. Army Corps of Engineers, 1965). The 200-square mile, 24-hour precipitation index for the basin is 10.4 inches. Using a transposition coefficient of 1.0, the SPS rainfall distribution was developed for a tabulation interval of 1 hour. The 24-hour depth-area rainfall data were determined by using the 24-hour curve of Plate 9 of EM 1110-1-1411.

TABLE 8.4

POINT RAINFALL DISTRIBUTIONS FOR HYPOTHETICAL STORM EVENTS

Hours	2-Year	10-Year	25-Year	50-Year	100-Year	500-Year
	(inches)					
1	0.02	0.04	0.04	0.05	0.05	0.06
2	0.02	0.04	0.04	0.05	0.05	0.06
3	0.03	0.05	0.04	0.06	0.06	0.06
4	0.04	0.06	0.05	0.07	0.06	0.07
5	0.04	0.06	0.06	0.08	0.09	0.10
6	0.05	0.07	0.07	0.09	0.11	0.15
7	0.06	0.11	0.15	0.13	0.16	0.21
8	0.07	0.11	0.15	0.14	0.17	0.22
9	0.07	0.11	0.16	0.14	0.18	0.23
10	0.08	0.12	0.17	0.15	0.18	0.23
11	0.08	0.12	0.18	0.16	0.19	0.24
12	0.09	0.13	0.19	0.18	0.22	0.27
13	0.12	0.20	0.20	0.24	0.27	0.35
14	0.14	0.23	0.25	0.29	0.32	0.42
15	0.30	0.55	0.70	0.65	0.70	1.00
16	1.45	2.15	2.45	2.75	3.10	3.75
17	0.25	0.25	0.27	0.40	0.50	0.55
18	0.14	0.22	0.23	0.27	0.31	0.38
19	0.07	0.10	0.11	0.13	0.14	0.18
20	0.06	0.09	0.09	0.12	0.13	0.15
21	0.05	0.08	0.07	0.11	0.12	0.14
22	0.04	0.08	0.07	0.09	0.09	0.11
23	0.04	0.07	0.06	0.08	0.08	0.09
24	0.04	0.06	0.05	0.07	0.07	0.08
TOTAL	3.35	5.10	5.85	6.50	7.35	9.10

TABLE 8.5

24-HOUR DEPTH-AREA RAINFALL DATA
FOR HYPOTHETICAL STORMS

Drainage Area (sq mi)	Rainfall in inches					
	2-Year	10-Year	25-Year	50-Year	100-Year	500-Year
0[1]	3.35	5.10	5.85	6.50	7.35	9.10
5	3.33	5.07	5.82	6.47	7.31	9.05
10	3.32	5.05	5.79	6.44	7.28	9.01
20	3.28	4.99	5.72	6.36	7.19	8.90
30	3.24	4.93	5.66	6.29	7.11	8.80
40	3.21	4.88	5.60	6.22	7.03	8.71
50	3.18	4.85	5.56	6.18	6.98	8.65

[1]Point rainfall for hypothetical storm events.

8.6 Basin Hydrologic Model for Hypothetical Storms

The starting discharge (STRTQ) adopted for each subbasin was 1.00 cfs/sq mi. Recession discharges began at a value of 5 percent of the peak discharge(QRCSN) with RTIOR set equal to 2.00. These parameters are averages of the STRTQ-, QRCSN- and RTIOR-values used in the calibration analysis. Regional values of ERAIN and RTIOL of 0.70 and 2.00, respectively, were used in the precipitation loss rate function. Values of STRKR and DLTKR were initially estimated for each hypothetical storm event.

The basin model was run using the stream system procedure of HEC-1 (described in Addendum 2 of the HEC-1 Users Manual) for each hypothetical storm event. The stream system computation procedure greatly simplifies the computation of multiple flood events in a basin through the use of "index hydrographs." The peak flows as computed at each USGS streamflow gage location were compared with those obtained from the discharge-frequency curves obtained by statistical analysis. The values of the loss rates (STRKR and DLTKR) were adjusted until the computed peak flows approximated the respective flows obtained in the frequency analysis.

In the stream-system subroutine of HEC-1, only one rainfall distribution at a time can be entered as input. Since the distribution patterns for the 500-, 100-, 50-, 25-, 10-, and 2-year hypothetical storms are functions of drainage-area size, distributions were determined for point rainfall and 40-square-mile rainfall. HEC-1 runs were made with each distribution for a particular hypothetical storm. A logarithmic interpolation was then made between the two results to determine the discharge for a specified drainage area size.

8.7 Results of the Hydrologic Analysis

The recommended peak discharges at various stream locations are tabulated in Table 8.6. If discharges are needed for exceedance intervals which are not given on the table, they can be obtained by plotting the discharges at a particular location on log-probability paper as in Figure 8.3.

TABLE 8.6

RECOMMENDED PEAK DISCHARGES AT VARIOUS STREAM LOCATIONS
FOR HYPOTHETICAL FLOODS

Description of Stream Location	Drainage Area (sq mi)	SPF	500-Year	100-Year	50-Year	10-Year	2-Year
		(cfs)					
West Branch Rahway River at Diamond Mill Pond (subareas 1 and 2)	7.13	5,500	4,150	2,650	2,050	1,100	600
immediately upstream of confluence (subareas 1, 2 and 3)	8.28	5,800	4,300	2,800	2,100	1,150	650
Rahway River immediately downstream of confluence	15.81	11,500	8,600	4,950	3,900	2,200	1,050
immediately upstream of confluence (subareas 1 thru 7)	17.85	11,100	8,350	4,800	3,700	2,000	1,000
Rahway River immediately downstream of confluence with Van Winkle Brook (subareas 1 thru 8)	23.22	14,500	10,900	6,050	4,050	2,400	1,800
Rahway River at Springfield gage (subareas 1 thru 9)	25.49	14,900	11,200	6,050	4,600	2,400	1,300
immediately upstream of confluence with Namahegan Brook (subareas 1 thru 10)	26.51	12,850	9,700	5,000	3,750	2,000	1,000
Rahway River immediately downstream of confluence with Nomahegan Brook (subareas 1 thru 11)	31.00	15,100	11,500	6,100	4,700	2,700	1,400
at Central Railroad (subareas 1 thru 12)	36.49	14,800	11,400	6,300	4,850	2,700	1,450
at Rahway gage (subareas 1 thru 13)	40.93	14,900	11,700	6,600	5,100	2,700	1,450

CHAPTER 9

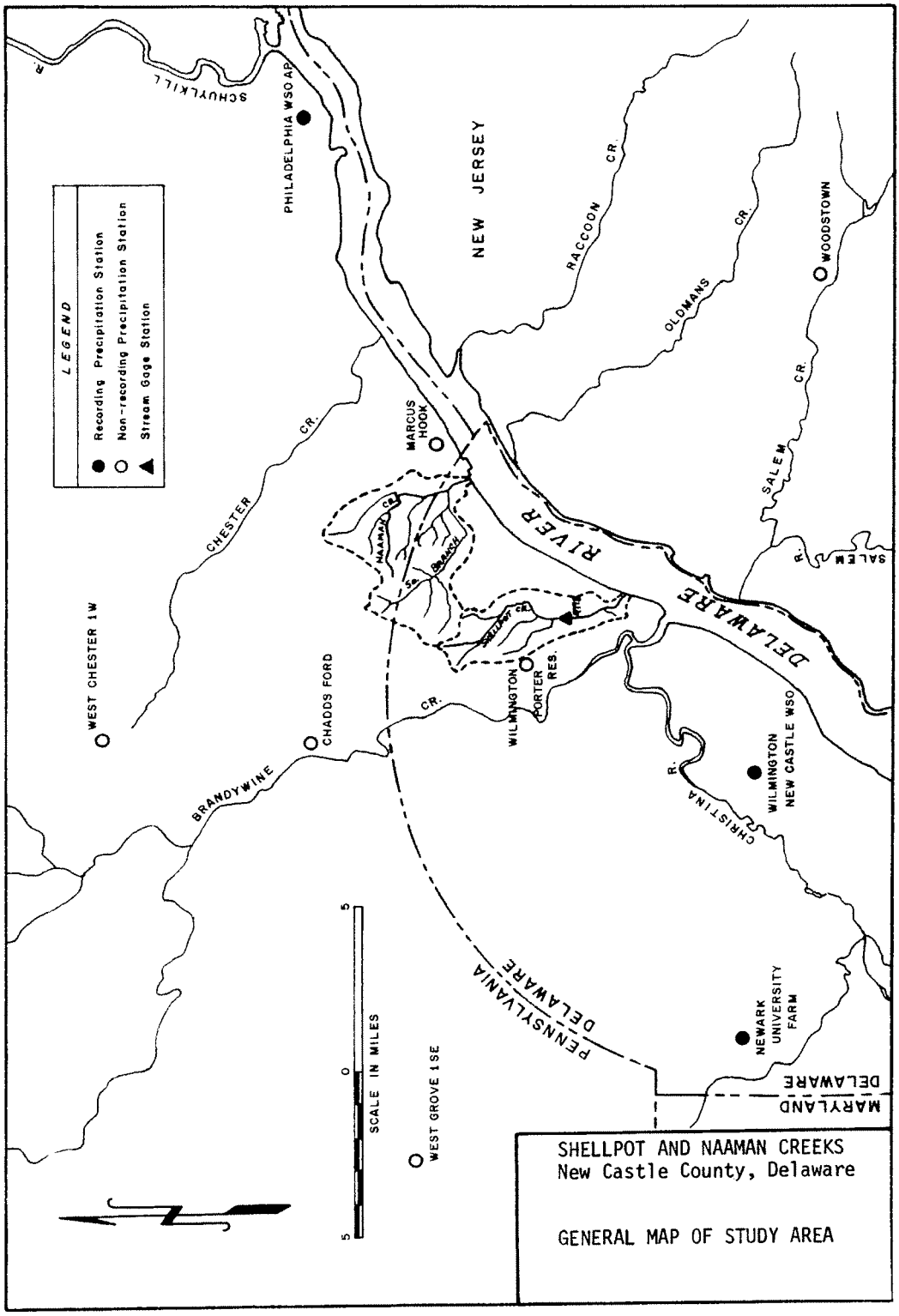
STUDY II - ANALYSIS WITH SOME STREAMFLOW DATA AVAILABLE

Some data (such as flow data from a single stream gage) are available for the watershed in many cases. Usually, however, the gage is not at the location at which the discharge-frequency relationship is needed. An example of such a situation is Shellpot Creek, a 9.43-sq mi basin near Wilmington, Delaware. The study on which this example is based is described in a Special Projects Memorandum by the Hydrologic Engineering Center (1976b). The hydrological data were developed for use in Special Flood Hazard Information reports. Basic rainfall and runoff data were analyzed, and the HEC-1 model was calibrated on several observed events and applied to specific hypothetical events. The following paragraphs describe the procedures and assumptions which were used to develop recommended discharges at selected exceedance frequencies for this basin.

9.1 Basin Description

Shellpot Creek is located in the northeastern corner of the state of Delaware. Figure 9.1 is a general map of the study area. Shellpot Creek enters the Delaware River at Wilmington, Delaware. It drains an area of 9.43 square miles, all within New Castle County, Delaware. The basin is nearly completely urbanized, and the predominant type of land use is single-family residential, with industrial and commercial development concentrated primarily in the lower portions of the basin near the Delaware River.

Channel slopes vary from less than 25 ft per mi in the lower reaches of the stream to over 200 ft per mi in the steeper slopes near the watershed boundary. The main channel slope of Shellpot Creek (between points 10 and 85 percent of the distance along the longest watercourse) is 40 ft per mi. Land surface slopes average about 3 to 5 percent, and soils are predominantly of the moderate-infiltration soils group. Mean annual precipitation is about 43 in, and average annual runoff for Shellpot Creek during the 29-year period 1946-74 was 17.5 in. Streamflow data are available at one location on Shellpot Creek (at Wilmington, Delaware). The drainage area at this point is 7.46 sq mi. Continuous records are available from December 1945 to the present.



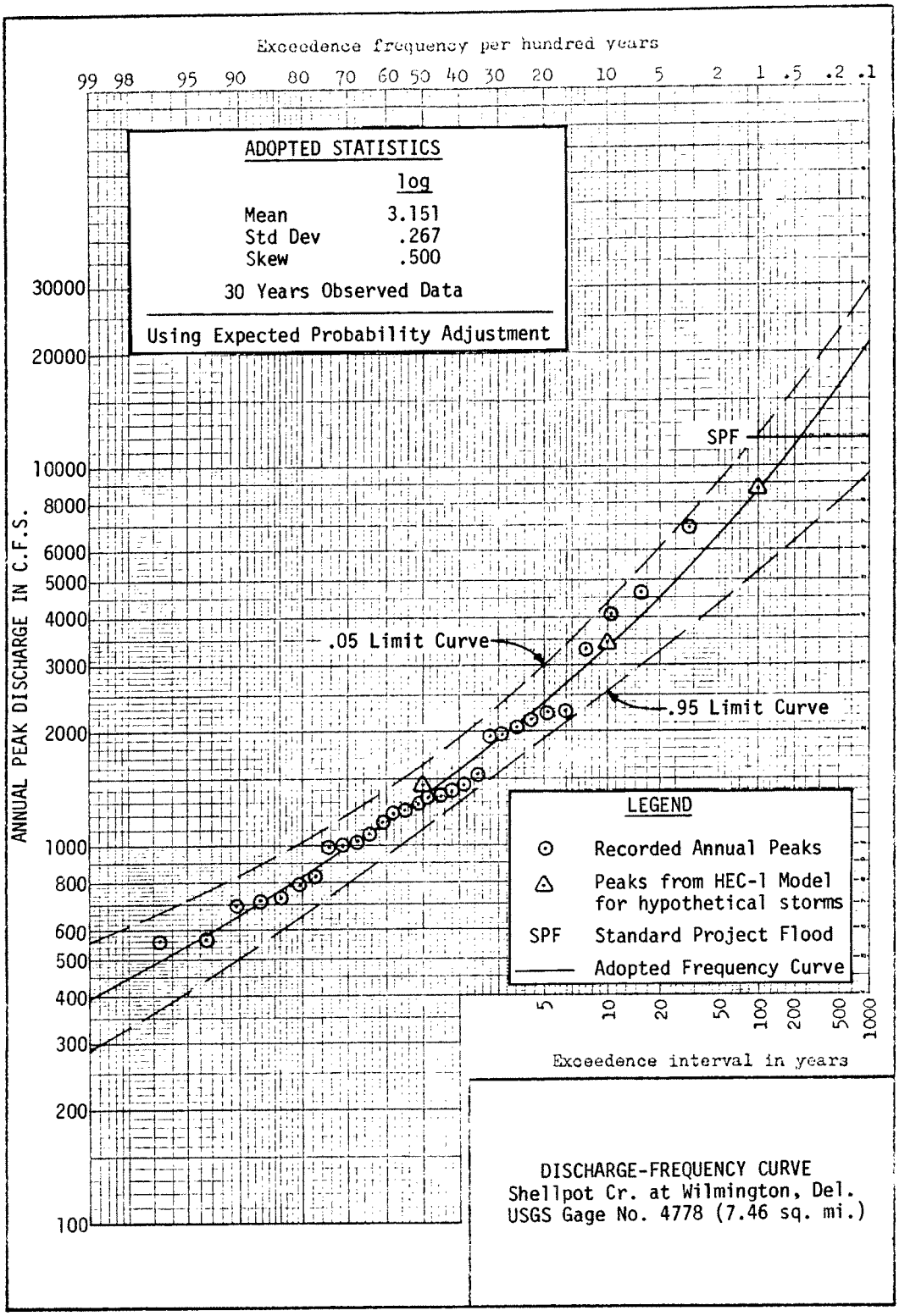
9.1. Shellpot Creek Study Area

9.2 Observed Frequency (Observed Data)

A discharge-frequency analysis was made on the 30-year period 1946-75 based on annual maxima. Water Resources Council Guidelines procedures (WRC, 1976) were applied using a weighted skew value of 0.5. Figure 9.2 shows a plot of these data based on the Weibull plotting position equation. The computed mean, based on the log transformation of the data, is 3.151 (or 1,400 cfs), and the standard deviation is 0.267. Nearby basins having streamflow records with longer periods of record are almost nonexistent. Chester Creek, about 10 miles northeast, has continuous records from 1932, but has a much larger drainage area (61.1 sq mi) and very little urbanization. Correlation of annual peak discharges for Shellpot and Chester Creeks resulted in a correlation coefficient of 0.428. If the Water Resources Council Guidelines are followed, the correlation coefficient would need to be equal to or greater than 0.93 in order to justify adjustment of the gaged annual-series discharge statistics of Shellpot Creek.

The only other nearby station with a longer term of record is Brandywine Creek at Chadds Ford, Pennsylvania, with records from 1911 to 1953 and from 1962 to the present. The area associated with this station is 287 square miles, and there is essentially no urbanization. Because of the great difference in basin size, no correlation studies were made. The curve in Figure 9.2 is considered to be the best estimate of the discharge-frequency characteristics for Shellpot Creek and the best guide for developing reasonable estimates at other locations within the basin.

The six highest recorded events at the Shellpot Creek gage have peak discharges that are all greater than the 5-year event (20 percent chance of annual exceedance). Data for these events are given in Table 9.1. Because of the small size and nearly complete urbanization of this basin, it is reasonable to expect less variability in initial rainfall loss by infiltration at various times of the year; therefore, no additional search of rainfall records was made to find storms that were more severe than those resulting in these peak discharges.



9.2. Discharge-Frequency Curve for Shellpot Creek

TABLE 9.1

DATA FOR HISTORICAL EVENTS

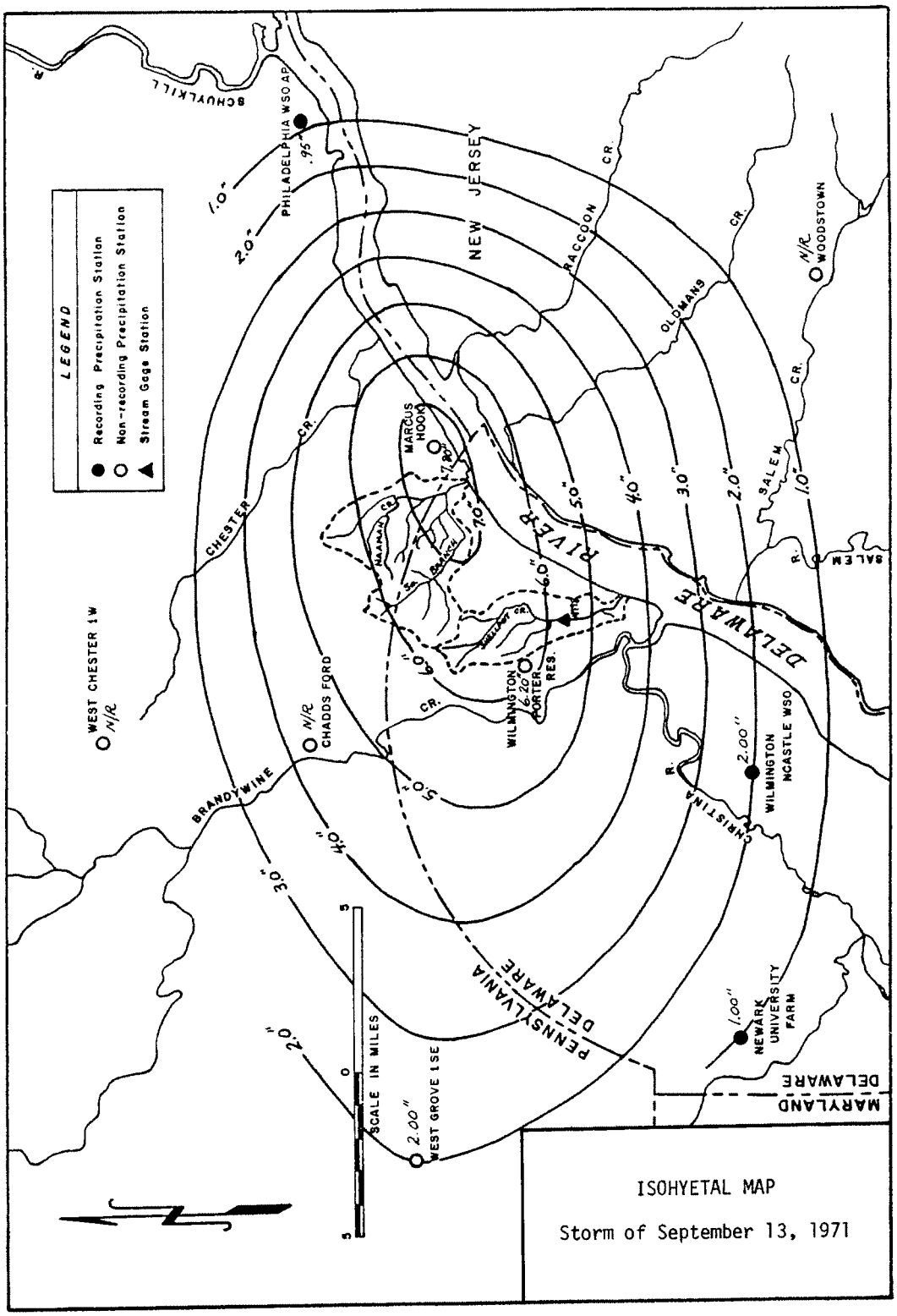
Date of Peak	AVERAGE FLOW Peak (cfs)	1 Day (cfs)	3 Day (cfs)	TP[1] (hrs)	RR[2] (ft/hr)
13 Sep 1971	6850	1300	536	2	4.5
27 Aug 1967	4650	577	263	2	5.4
9 Jul 1952	4080	643	225	3.5	2.5
23 Aug 1974	3300	386	136	4.5	2.0
18 Aug 1955	2280	279	110	2	3.7
22 Jun 1972	2240	501	183	3	2.8

1/ Time from start of rise to peak discharge
2/ Maximum rate of rise

9.3 Unit Hydrograph Studies

Five of the six events listed above were analyzed in detail with HEC-1. Isohyetal maps were prepared for each storm analyzed. Recording and nonrecording gage locations are shown on a typical isohyetal map in Figure 9.3. A great deal of judgment was required in developing isohyetal patterns for each storm because there is a substantial variation in the total storm rainfall amounts observed at the various gages surrounding the basin. The distribution of storm rainfall in time is subject to considerable error when based on stations several basin widths away. Total basin-average precipitation was estimated for each storm event. The HEC-1 unit hydrograph and loss-rate optimization option was used to determine 15-minute unit hydrograph and loss rate parameters based on observed discharge hydrographs. Rainfall and runoff data for the five storms are presented in Table 9.2.

Unit hydrograph data and basin characteristics are presented in Table 9.3. For the full basin at the gage the average Snyder t_p is 2.1 hours, and C_p is 0.77. Figure 9.4 represents a typical reconstituted



9.3. Typical Isohyetal Map

TABLE 9.2

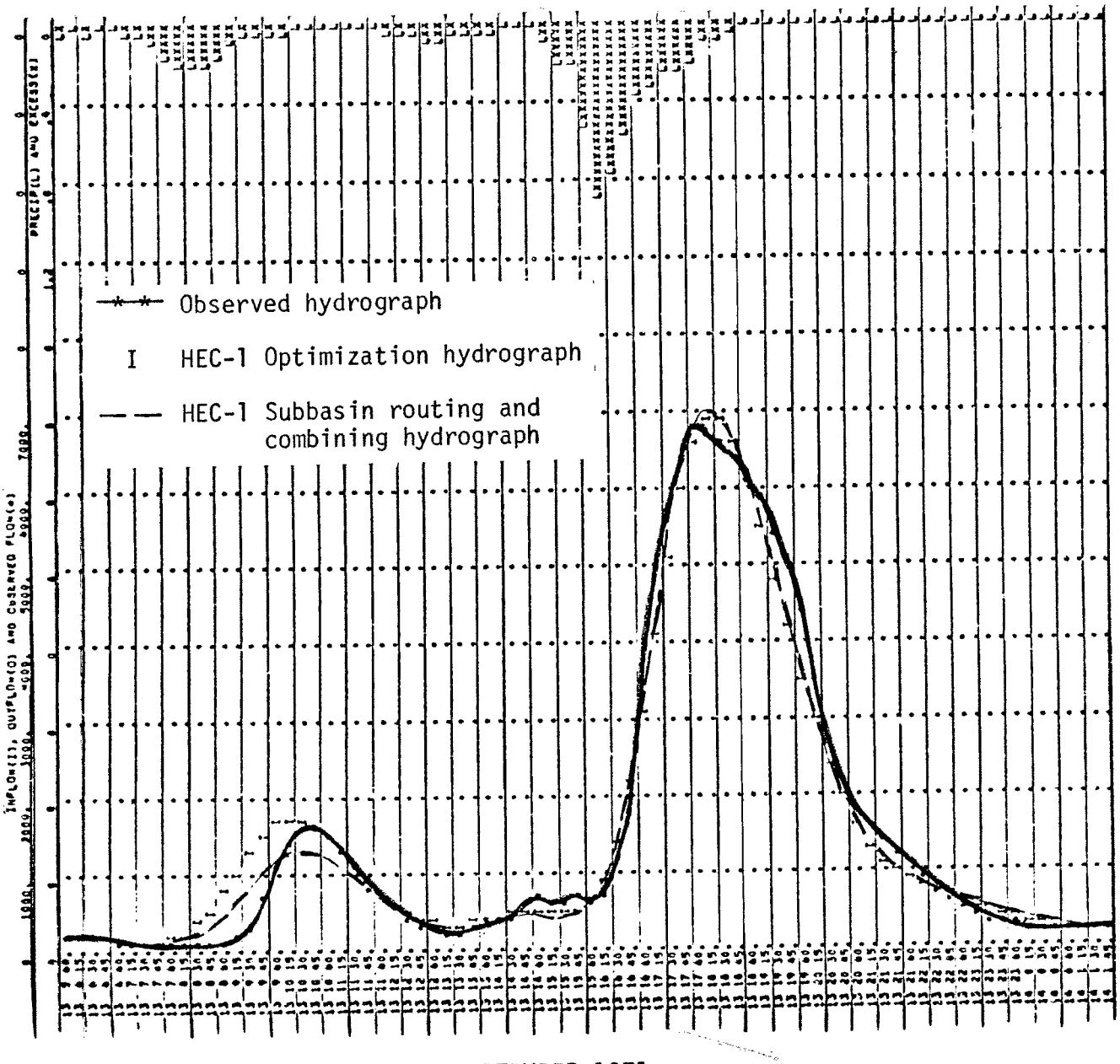
RAINFALL AND RUNOFF FOR STORM EVENTS

Event	Basin Average Rainfall and Runoff Shellpot Cr. at Wilmington, Del. (7.46 sq mi) Rainfall (inches)	Runoff (inches)
18-19 August 1955	2.44	1.52
27 August 1967	2.24	2.07
13 September 1971	6.36	6.24
22 June 1972	3.74	2.43
22-23 August 1974	3.85	1.87

TABLE 9.3

SHELLPOT CREEK BASIN
PHYSICAL CHARACTERISTICS AND
UNIT HYDROGRAPH DATA FOR SUBBASINS

Subbasin Number	DA (sq mi)	L (miles)	L_{ca} (miles)	Slope 10-85 (ft/mi)	Percent Impervious I	t_p (hours)
1	0.64	1.00	0.40	73	23	0.66
2	0.71	1.70	0.80	48	30	0.96
3	0.66	1.80	1.00	61	42	1.04
4	0.94	2.20	1.10	50	35	1.13
5	0.75	1.70	1.00	86	30	1.02
6	1.11	2.10	1.10	97	20	1.12
7	0.93	2.35	1.30	119	25	1.22
8	1.34	3.25	1.60	111	30	1.43
9	0.38	1.05	0.52	240	30	0.73
Gage	7.46	6.10	3.10	40	30	2.10
10	0.41	1.25	0.50	186	30	0.75
11	1.56	2.40	1.40	25	35	1.26



13 SEPTEMBER 1971
SHELLPOT CR. AT WILMINGTON, DEL.

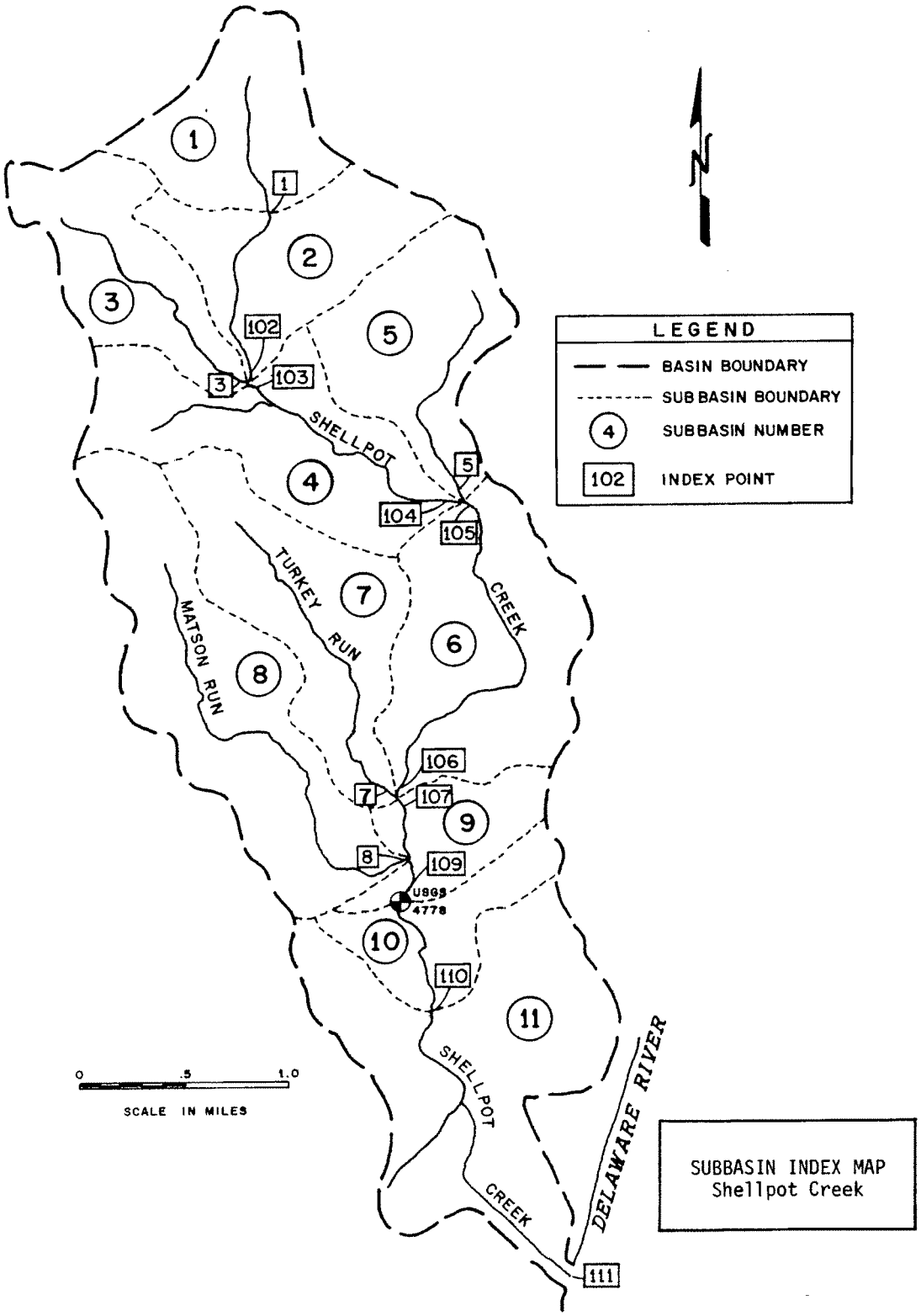
9.4. Simulated and Observed Hydrographs

hydrograph along with the observed hydrograph. Rainfall distribution was based on mass curve plots of available recorder data and an adjusted average curve. Fifteen-minute values were then interpolated from the curves. The rainfall exponent parameter ERAIN was set to zero and the loss rate parameter RTIOL was set equal to 1.0. This forced the program to optimize losses using essentially an initial loss plus a constant loss. The values of t_p and C_p were reasonably stable for the five events studied, but the loss parameters displayed more variability due to an inability to match antecedent soil moisture conditions and the sensitivity of the parameters to errors in estimating total rainfall and the rainfall distribution. The overall hydrograph reconstitutions are acceptable, and differences between observed and reconstituted hydrographs can be explained as random errors, resulting primarily from non-uniformity of rainfall distribution.

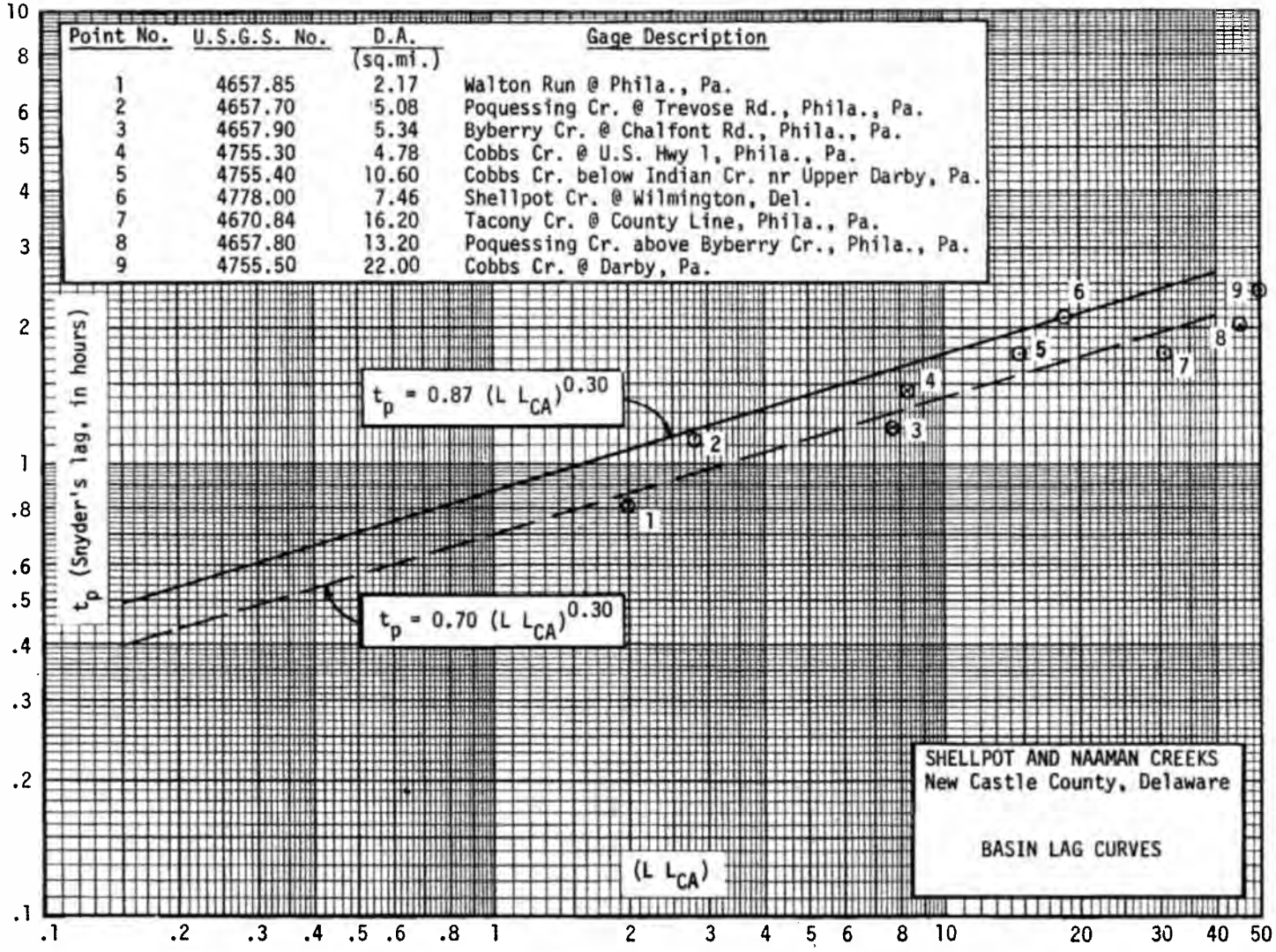
9.4 Basin Subdivision and Model Calibration

In order to determine probable flood discharges at other locations within Shellpot Creek, the basin was subdivided as shown in Figure 9.5. Index points were selected to coincide with major tributaries and spaced along the main watercourse in such a way as to result in only minor changes in discharges between mainstem index points. The percent imperviousness was estimated from areal photographs and published information.

To develop appropriate unit hydrographs for each sub-basin, a relationship between the basin physical characteristics of stream length (L) and length to center of basin (L_{ca}) versus unit hydrograph lag (t_p) was developed from a comparison of Shellpot Creek parameters with those for gaged urban basins in Philadelphia, Pennsylvania. Also given consideration was the t_p versus $L\ L_{ca}$ relation adopted in the Red Lion Creek Study described in Chapter 10. Initial estimates for t_p were based on a line drawn through the Shellpot Creek five-storm average value which was drawn parallel to lines describing relations adopted in other Delaware and southeastern Pennsylvania stream studies. This line (Fig. 9.6) has the equation $t_p = 0.87\ (L\ L_{ca})^{0.30}$. A Snyder peaking parameter C_p of 0.77 was adopted for all subbasins. It is the average value determined in the optimization studies discussed above. Starting discharge (STRTQ) varied from 0.13 to 30 cfs per sq mi for the various events and was based on gage data. For the final loss-rate



9.5. Basin Subdivision



9.6. Regional Parameters

parameters, the initial-loss volume ranged from 0.4 to 2.0 in. and constant loss-rates from 0.06 to 0.65 in. per hr for the five storm events. A constant ratio of the peak (18 percent of the peak discharge) was selected for the start of recession discharge (QRCSN), and a rate-of-recession parameter (RTIOR) equal to 3.0 was used for each subbasin based on a 15-minute time interval.

9.5 Channel Routing Criteria

Channel routing is required in the model to provide the correct translation of the flood hydrograph along the stream from index point to index point. Routing provides the timing and attenuation which reflect the storage characteristics of the channel and overbank sections of the stream reach. Since detailed stream cross-section and bridge data were unavailable, approximate routing methods were used. Channel reach lengths and slopes were estimated from USGS 1:24,000 scale maps that had a contour interval of 10 ft. A value of average velocity was then estimated for each channel reach based on Manning's equation and assuming steady flow with an average slope equal to the channel slope. The Muskingum routing method was used with a discharge weighting coefficient of X = 0.3. A reach travel time K in hours was estimated from the mean velocity. Adjustments were made to K as necessary to make the routed and combined hydrographs for the nine contributing subbasins agree with the observed runoff events at the stream gage.

9.6 Hypothetical Storm Runoff Estimates

Hypothetical storm data were developed by the procedures described in Chapter 4 and the Appendix of this report. Twenty-four-hour storms were developed for return periods of 2-years, 10-years, 100-years, and for the Standard Project Storm (SPS). The computed 24-hour point rainfall values were assumed to be applicable to areas of up to 1 sq mi. Adjustments were made to all durations (15-minute to 24-hour) for areas of 5, 10, and 15 sq mi, and the storms were distributed into successive 15-minute periods. These adjusted and distributed data were used in the stream-system option of the HEC-1 computer program to generate consistent hydrographs for each subbasin and combining point.

The model results at the gage were compared with the adopted discharge-frequency curve shown in Figure 9.2, and adjustments were made to loss rate parameters until reasonable agreement was obtained. However, even with zero loss, the 100-year and Standard Project Storms could not be made to give peak discharges as high as those given by the curve. It is generally accepted that unit hydrographs have a shorter t_p when intense storms occur over basins having confined flood plains. Therefore, it was rationalized that values of t_p for the 100-year and the Standard Project Flood (SPF) could reasonably be adjusted by a factor of 0.8. An adjustment factor of 0.8 was also applied to the channel-routing time-of-travel K values. This allowed reasonable loss-rate parameters to be adopted and resulted in values consistent with the statistical analysis of observed annual maximum discharges and SPF shown in Figure 9.2. Final loss parameters (STRTL and CNSTL) used for all subbasins were:

	2-Yr	10-Yr	100-Yr	SPF
Initial Loss (STRTL) in in.	2.0	1.5	0.5	0.5
Constant Rate (CNSTL) in in./hr	1.0	0.8	0.1	0.05

9.7 Regional Discharge-Frequency Comparisons

Regional discharge-frequency characteristics were determined using data from studies of other basins in the area (Hydrologic Engineering Center, 1974). The following correlation relationship for these regional data was developed:

$$\log Q_m = C_m + 0.87 \log (DA) \quad \ldots\ldots\ldots\ldots\ldots\ldots (9.1)$$

where

Q_m = geometric mean of the annual flood peaks in cfs,
C_m = "mapping coefficient" for a particular basin in the region, and
DA = drainage area in sq mi

A regression equation which contained the main channel slope in addition to DA produced a slightly better correlation (the regression coefficient R^2 was 0.897 when the slope was included, versus 0.871 for the relationship

expressed by equation 9.1) The equation with the slope was not used, however, because it was felt that the great deal of effort needed to determine S for all the ungaged streams was not justified for such a small increase in R^2.

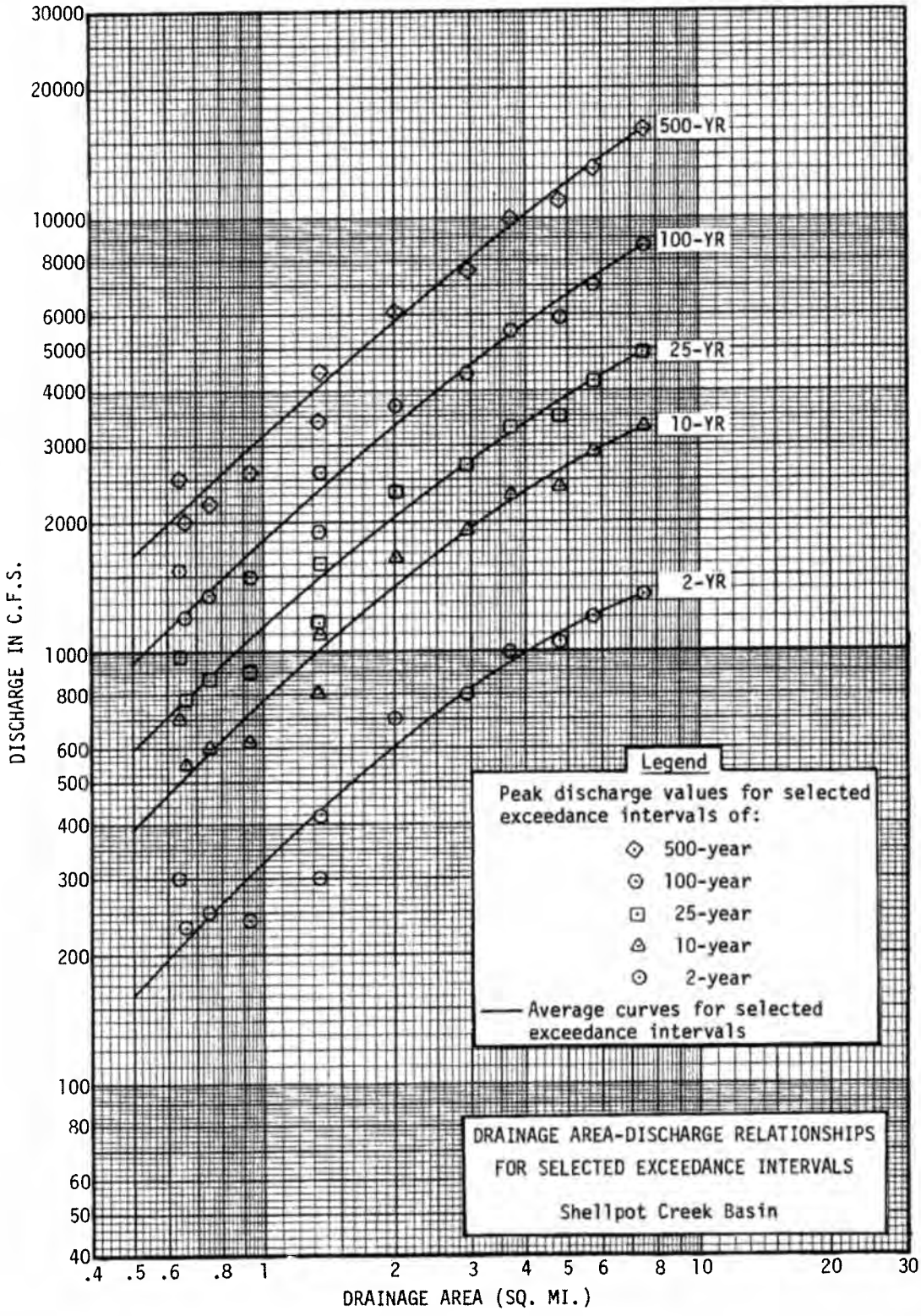
The mapping coefficient C_m is the difference between the observed and computed mean logarithm of the flow. For the Shellpot Creek data the coefficient was relatively high (C_m = 2.392). This was attributed to the high percentage of urbanized area within the basin in comparison to the other basins in the region.

The equation developed in the regional studies for estimating S the standard deviation of the logarithms of annual maximum discharges is:

$$S = C_s - 0.05 \log (DA) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9.2)$$

where C_s is a mapping coefficient for the standard deviation. The C_s value was determined to be 0.311. This value is consistent with data from adjacent basins.

Computed values of log Q_m and S for each index point were used as input to a regional discharge-frequency program, using an assumed equivalent length of record of 20 years and a regional skew of 0.5. Results were plotted and used to evaluate results of the hypothetical-storm approach discussed above. Since the regression equation does not account for differences in land use, channel slopes, or basin shape, it was felt that the answers determined from the HEC-1 model were better. Consequently, the flows computed from the HEC-1 model runs were given more weight in the preparation of recommended curves. Discharges based on the recommended curves are given in Table 9.4 for all index points. The relatively wide scatter displayed on plots of peak discharges versus drainage area in Figure 9.7 are attributable to the sensitivity of peak discharges to differences in land use, basin shape, and channel slopes.



9.7. Drainage Area - Discharge Relationships

TABLE 9.4

RECOMMENDED PEAK DISCHARGES AT SELECTED INDEX POINTS
(SHELLPOT CREEK BASIN)

Index Point	Location Description	D.A. (sq mi)	Peak Discharges (in C.F.S.) for Selected Exceedance Intervals					
			2-Year	10-Year	25-Year	100-Year	SPF	500-Year
1	Subbasin No. 1	0.64	300	700	980	1530	1700	2500
102	Subbasins 1 and 2	1.35	420	1100	1600	2600	3000	4400
3	Subbasin No. 3	0.66	230	550	780	1200	1400	2000
103	Subbasins 1 thru 3	2.01	700	1650	2350	3700	4500	6100
104	Subbasins 1 thru 4	2.95	800	1900	2700	4400	5500	7600
5	Subbasin No. 5	0.75	250	600	860	1350	1600	2200
105	Subbasins 1 thru 5	3.70	1000	2300	3300	5500	6900	10000
106	Subbasins 1 thru 6	4.81	1050	2400	3500	5900	7900	11000
7	Subbasin No. 7 (Turkey Run)	0.93	240	620	900	1500	1800	2600
107	Subbasins 1 thru 7	5.74	1200	2900	4200	7000	9500	13000
8	Subbasin No. 8 (Matson Run)	1.34	300	800	1170	1900	2500	3400
109	Subbasins 1 thru 9 (USGS Gage) (Shellpot Cr. at Wilmington, Del.)	7.46	1350	3300	4900	8600	12000	16000

1/Refer to Figure 9.5 for subbasin and index point locations.

9.8 Conclusions

Discharges for primary index points on Shellpot Creek are summarized in Table 9.4 for selected exceedance intervals. Discharges at other exceedance intervals can be estimated from plots of the data. If discharge estimates are needed for additional index points along the stream, discharges can be determined by interpolation based on respective drainage areas and the nearest upstream and downstream index point. The 100-year peak discharge estimate for this basin appears high (approximately 1,200 cfs per sq mi) when compared with other streams in Delaware and southeastern Pennsylvania, but with 30 years of observed data on Shellpot Creek it is reasonable to use the discharge-frequency curve from these data as the best indication of what could occur on the urbanized subbasins.

CHAPTER 10

CASE STUDY III - ANALYSIS WITH NO AVAILABLE DATA

The hydrologist is frequently faced with the situation in which either no gage is available in the basin studied or the record is so short that frequency relationships cannot be determined. Typifying such a situation is the example presented here, Red Lion Creek Basin (HEC, 1976c). The single gage available had a record of only nine years at the time of the study, and this record was from a crest stage gage with no capability to define the complete hydrograph.

Regional data were used to develop relationships for unit hydrograph parameters to determine discharge-frequency relationships for the basin for use in a Flood Plain Information Report. Loss rates adopted were based on results of the HEC-1 rainfall-runoff model calibration for one of the subbasins within the study area where the limited streamflow records were available.

10.1 Study Outline

The steps followed in the study were as follows:

(1) A study map was developed using USGS topographic maps (scale 1:24,000), and the basin boundary was defined. Index stations were located along the stream reaches where discharge-frequency data were required.

(2) The watershed was subdivided into subbasins at each of the index stations and/or required control points, and physiographic characteristics were determined for each subbasin.

(3) Unit hydrograph parameters and loss rates were adopted for each subbasin on the basis of a regional analysis.

(4) Routing criteria were developed.

(5) Rainfall distributions were determined for 2-year, 10-year, 25-year, 50-year, 100-year and Standard Project Storms by procedures described in Chapter 4 and Appendix.

(6) Depth-area rainfall data were computed for each of the hypothetical storms.

(7) A HEC-1 model was developed.

(8) Discharge hydrographs at each index station for the hypothetical storm events were computed with the basin HEC-1 rainfall-runoff model.

(9) A peak discharge-frequency curve was developed for the stream gaging station by procedures from the U.S. Water Resources Council Guidelines for Determining Flood Flow Frequencies (WRC, 1976) using regional gage data.

(10) The resulting frequency curves for the gage, one based on recorded flows and the other on the HEC-1 results, were compared and loss rates as previously adopted in the basin model were adjusted until the two frequency curves coincided.

(11) A regional frequency study of annual flood peaks of nearby hydrologically similar watersheds was performed. Results were evaluated on the basis of a similar study for the Upper Delaware and Hudson River Basins.

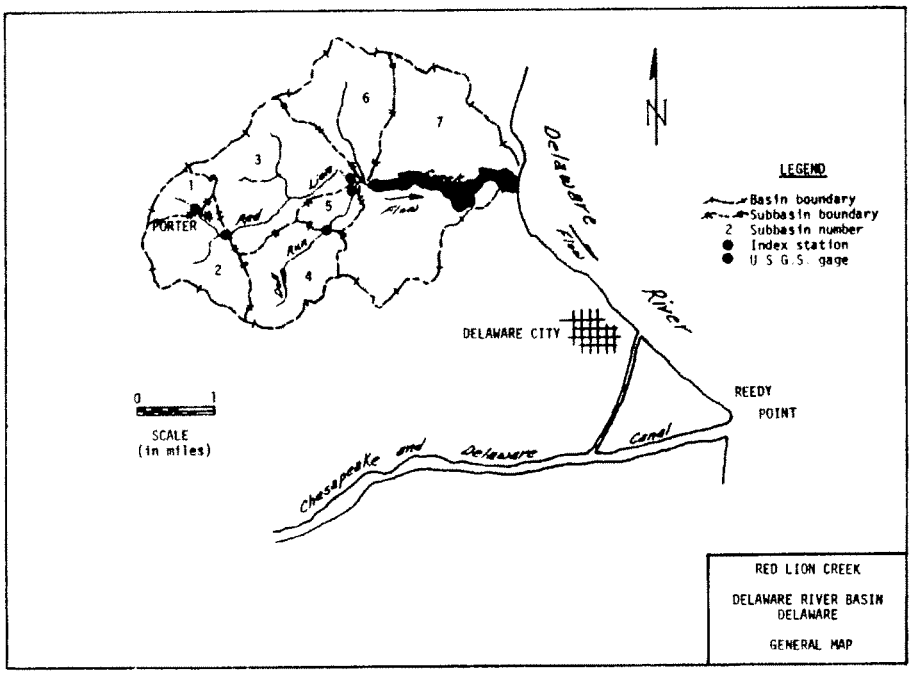
10.2 Basin Description

Red Lion Creek Basin is in northern Delaware just north of Delaware City and about 10 mi southwest of Wilmington. It has a total area of about 10 sq mi. Because the stream is a tributary to the Delaware River, stages in the lower reaches are affected by tidal conditions. Basin elevations range from sea level at the confluence with the Delaware River, to 80 ft, at the river's source. The total length of the main watercourse is about 5.4 mi. Stream slopes are very small in the lower reaches; they increase to about 10 ft per mi in the middle reaches and to 50 ft per mi in the uppermost reaches.

The study area is shown in Figure 10.1. The index stations where discharge-frequency information was requested are designated on the map.

10.3 Unit Hydrograph Analysis

Multiple regression analysis was used in a previous study to correlate t_p (Snyder's standard lag) and various physiographic characteristics of selected drainage basins in southeastern Pennsylvania (Hydrologic Engineering Center, 1976d).



10.1. Red Lion Creek Basin Study Area

This relationship was of the form:

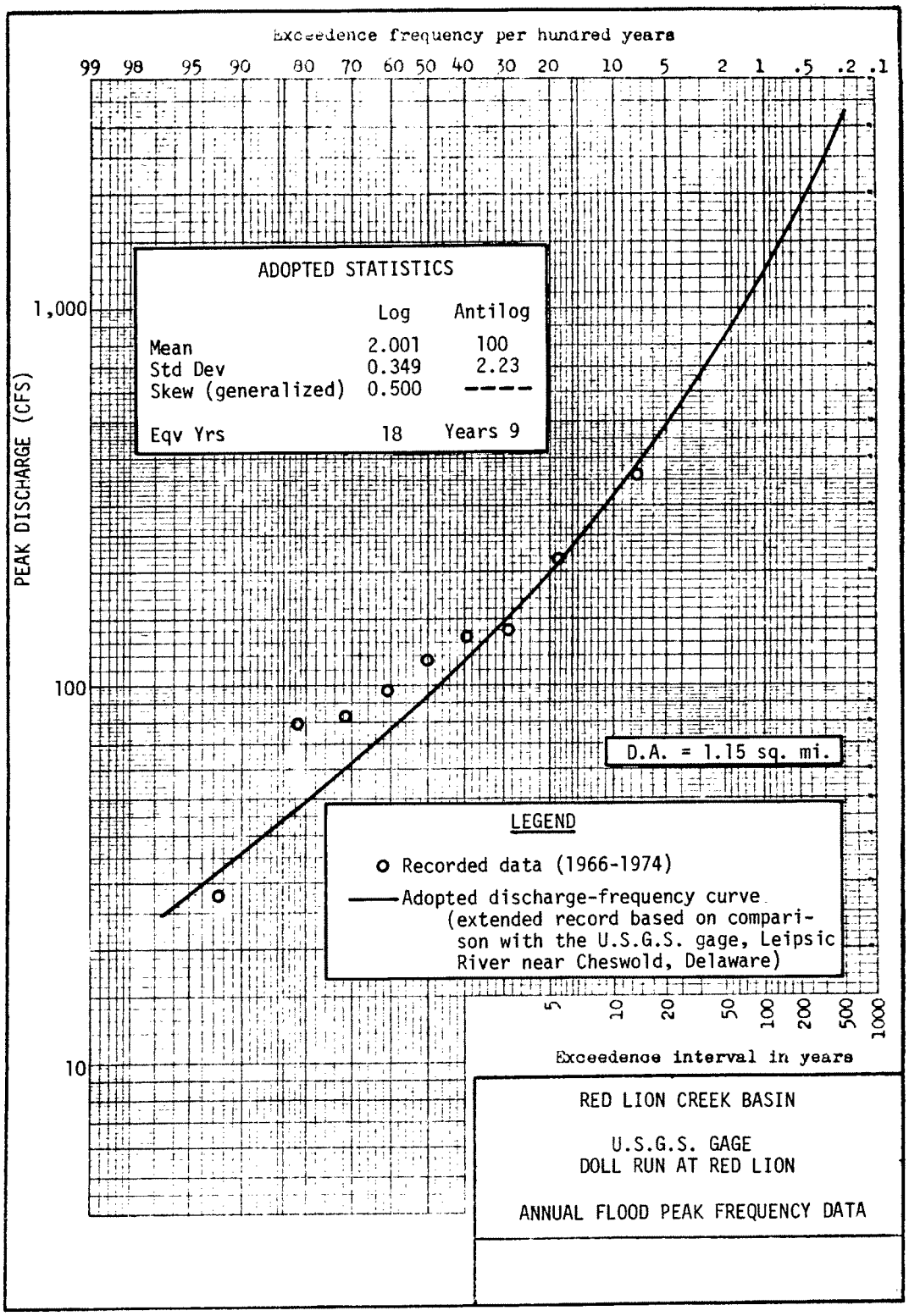
$$t_p = C_t \, (L \, L_{CA})^{0.30} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (10.1)$$

The value of C_t for Red Lion Creek was computed from selected values of t_p for the nearby Christina River Basin (Stottler, Stagg and Associates, 1975). The t_p values used were selected on the basis of physical similarities between the gaged subareas of the Christina River Basin and Red Lion Creek. The resulting relationship for the Red Lion Creek Basin is

$$t_p = 1.55 \, (L \, L_{CA})^{0.30} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (10.2)$$

10.4 Frequency Analysis

A crest-stage gage is located on Doll Run (see Figure 10.1). Records of maximum discharge are available for the water years 1966 through 1974 and recorded peak flows are plotted in Figure 10.2 according to the plotting formulation of Statistical Methods in Hydrology (Beard, 1962). Because of the short-term record at this gage (Doll Run at Red Lion, Delaware), numerous two-station comparisons were made in an effort to extend the record at this site. The only nearby long-term record that satisfied the recommended requirements given in Appendix 7 of Guidelines for Determining Flood Flow Frequency (WRC, 1976), is the USGS gage on the Leipsic River near Cheswold, Delaware. The available record at that station is 31 years (1944-1974).



10.2. Annual Flood Peak Frequency Data

According to the guidelines, if the following relationship is satisfied, then adjustment of the logarithmic mean and standard deviation of the short record is recommended:

$$r \geq 1.00 - 0.05\,(N_1 + N_2)/N_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (10.3)$$

where

r = correlation coefficient between the logarithms of the flows from the short record and the logarithms of the flows from the long record during the concurrent period

N_1 = number of years when flows were concurrently observed at the two sites

N_2 = number of years when flows were observed at the longer record site but not observed at the short record site.

In this case for N_1 of 9 years and N_2 of 22 years, the inequality (10.3) becomes

$$r \geq 0.828 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (10.4)$$

The computed value of r is 0.875; therefore, the logarithmic mean and standard deviation of the short record were respectively adjusted to 2.001 and 0.349, according to relationships contained in the guidelines. A generalized skew of 0.500 was adopted on the basis of results from a regional frequency study for the Delaware and Hudson River Basins (Hydrologic Engineering Center, 1974). The adopted statistics and the resulting discharge-frequency curve for the USGS gage, Doll Run at Red Lion, are shown in Figure 10.2.

10.5 Hypothetical Storms

Storms of various frequencies were developed for the basin under investigation. The storms selected were the Standard Project Storm (SPS) and those with recurrence intervals of 100, 50, 25, 10 and 2 years. The Standard

Project Storm (SPS) rainfall depth and distribution for the study area was developed with procedures from EM 1110-2-1411 (US Army Corps of Engineers, 1965). The 200-sq mi, 24-hour precipitation index for the basin location is 10.7 inches. This was adjusted to a 10-sq mi area, and then, using a transposition coefficient of 1.0, the SPS rainfall distribution was developed for a tabulation interval of 1 hour.

The 100-, 50-, 25-, 10-, and 2-year storms were developed by procedures described in the Appendix. Average point rainfall depths were taken from the isopluvial maps for the study area location. The depths are tabulated in Table 10.1 for each storm for durations from 1 hour to 24 hours. A rainfall distribution similar to that for the SPS was used in which the hour of greatest precipitation is preceded by the second greatest and followed by the third greatest. The rainfall depth-area data developed for the stream system procedure of HEC-1 are given in Table 10.2. This procedure automatically accounts for decreasing amounts of basin average precipitation with increased basin size (see Addendum 2, HEC-1 Flood Hydrograph Package; HEC, 1973a).

10.6 Hydrologic Basin Model

A hydrologic basin model was developed for this area using HEC-1. The area was subdivided such that flows would be computed at the various index stations indicated on Figure 10.1 and at the gaging station. Snyder's standard lag, t_p, was computed for each of the subbasins using equation (10.2). A C_p value of 0.65 was chosen based on the values for the Christina River Basin (computed values of t_p are given in Table 10.3). Channel routing coefficients were determined for the Muskingum routing technique. The Muskingum K's were estimated by the following relationship:

$$K = L/V \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (10.5)$$

where

K = estimated reach travel time in hr

L = routing reach length in mi

V = estimated average reach velocity in mi per hr computed using Manning's equation

TABLE 10.1

AVERAGE POINT RAINFALL DEPTHS
FOR DURATIONS FROM 1 HOUR TO 24 HOURS AND
RETURN PERIODS FROM 2 TO 100 YEARS[1]

Duration (hours)	Return Period				
	100-Year	50-Year	25-Year	10-Year	2-Year
	Rainfall depth in inches				
1	3.35	3.00	2.70	2.40	1.55
2	4.15	3.65	3.20	2.80	1.85
3	4.50	4.05	3.60	3.10	2.05
4	5.25	4.75	4.20	3.65	2.40
5	6.30	5.60	5.15	4.35	2.80
6	7.30	6.50	5.75	5.15	3.25

[1]Data taken from the isopluvial maps for the study area in Technical Paper No. 40, Rainfall Frequency Atlas of the United States, Dept. of Commerce, Washington, D.C., May 1961.

TABLE 10.2

24-HOUR DEPTH-AREA RAINFALL DATA FOR HYPOTHETICAL STORMS

Drainage Area (sq. mi.)	Rainfall in Inches					
	SPF	100-Year	50-Year	25-Year	10-Year	2-Year
1	12.79	7.30	6.50	5.75	5.15	3.25
2	12.73	7.26	6.47	5.72	5.12	3.23
10	12.63	7.21	6.42	5.68	5.09	3.21
20	12.36	7.13	6.35	5.62	5.03	3.18

TABLE 10.3

SELECTED DATA IN THE VICINITY OF RED LION CREEK USED IN THE ANALYSIS RELATING t_p AND PHYSIOGRAPHIC CHARACTERISTICS OF A DRAINAGE BASIN[1/]

	Gage Location	Drainage Area (sq. mi.)	t_p (hours)	C_p	L (miles)	L_{CA} (miles)
1	West Branch of Brandywine Creek @ Coatesville, Pa.	45.8	6.32	0.63	17.0	9.0
2	West Branch of Brandywine Creek near Honey Brook, Pa.	18.7	6.49	0.65	7.0	3.5
3	White Clay Creek near Newark, Del.	87.8	8.39	0.76	21.5	10.0
4	Christina River near Coochs Bridge, Del.	20.5	5.70	0.69	11.0	5.2
5	White Clay Creek above Newark, Del.	66.7	7.62	0.76	15.3	9.9
6	Little Mill Creek near Elsmere, Del.	6.7	2.34	0.55	4.5	2.2

1/ Adopted values of t_p and C_p taken from Appendix A of the preliminary hydrologic study for Christina River Basin, Pennsylvania.

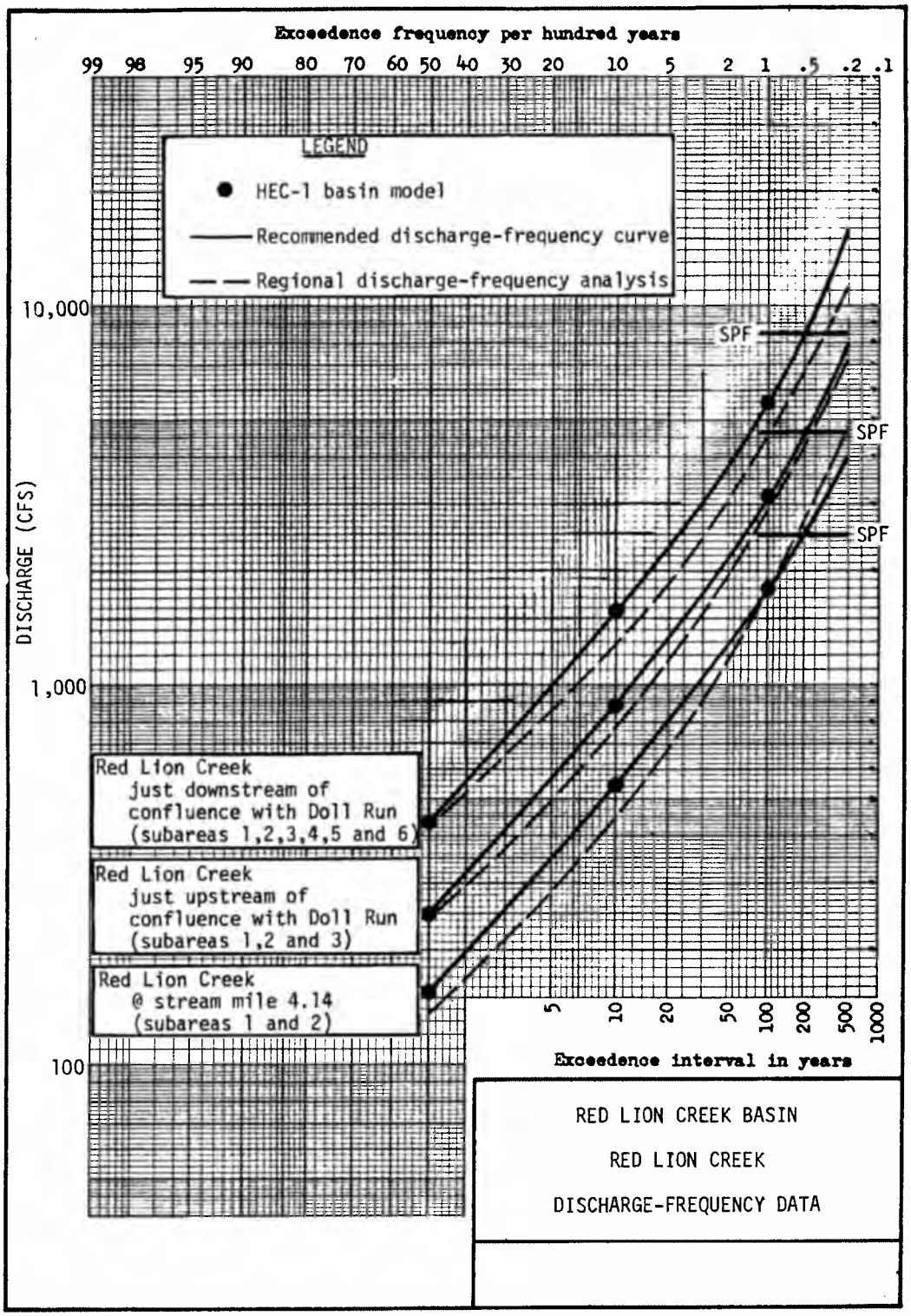
The starting discharge adopted for each subbasin was 2.0 cfs/sq mi (consistent with values for the hydrologically similar Christina River Basin). Recession discharge was begun at a value of 10 percent of the peak discharge, and RTIOR was set equal to 2.50. Loss rate parameters ranging from 0.6 to 1.0 in. initial volume and 0.08 to 0.40 in. per hr constant, depending on the magnitude of the storm event, were used in the preliminary analysis.

The basin model was run under the preceding conditions for each hypothetical storm event. Peak flows as computed at the USGS gage were compared with flows obtained from the adopted discharge-frequency curve of Figure 10.2. The initial loss rates were adjusted until the computed peak flows approximated the respective flows obtained in the frequency analysis. The results of the HEC-1 basin model and the adopted discharge-frequency curve for the gage site are shown in Figure 10.3. (To minimize effort and time in subsequent analyses only the discharges resulting from the 2-year, 10-year, 100-year and Standard Project Storm events were computed).

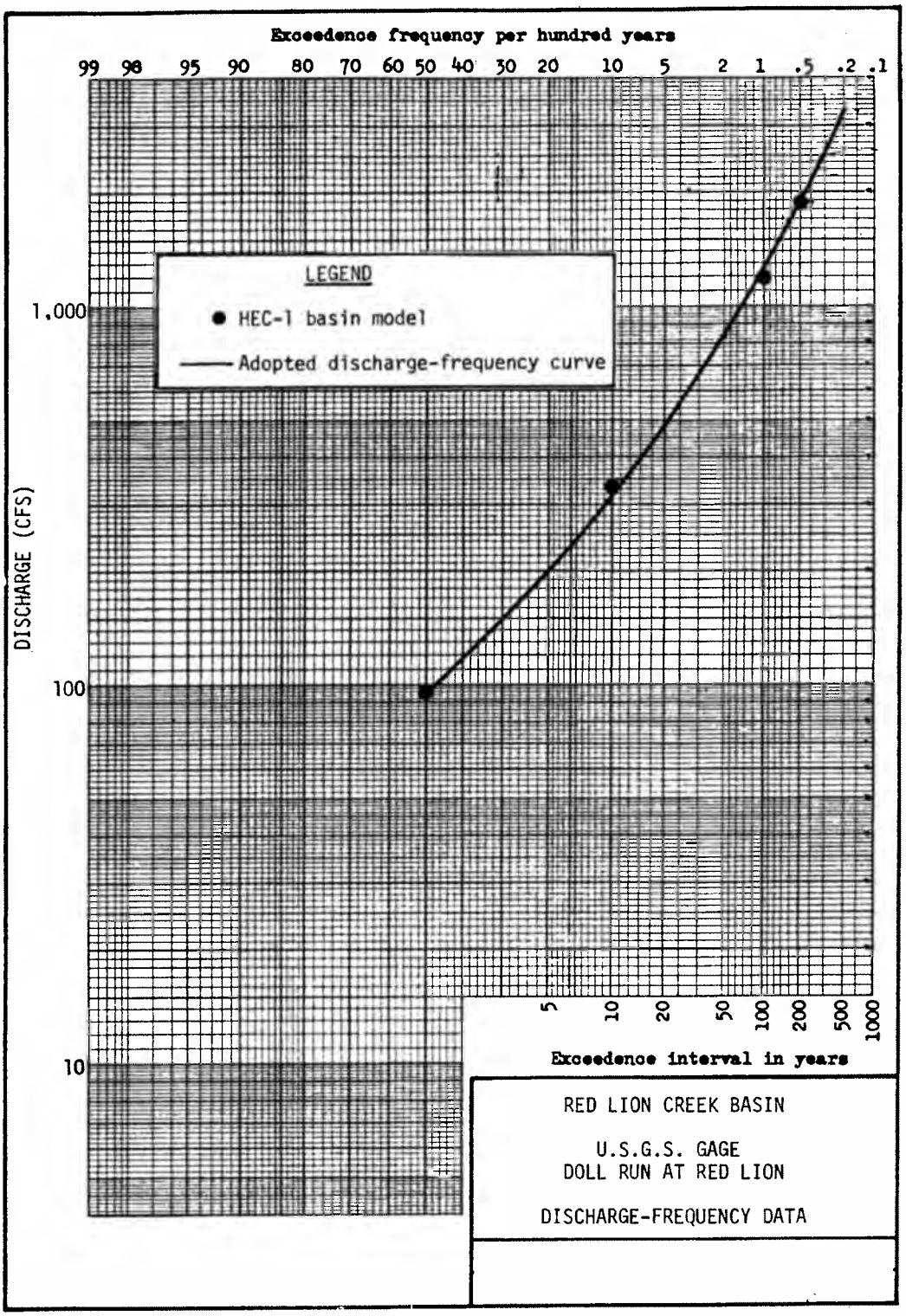
Figure 10.4 gives plots of recommended peak discharges for the hypothetical flood events at various index stations. The Standard Project Flood has been represented by a horizontal straight-line segment in Figure 10.4 because the frequency of this event cannot be stated accurately; in fact, it is not possible even to give it the same frequency at various index stations within a study area. However, the range of probable frequencies for the SPF does offer an independent check for frequency curve development. Figure 10.5 shows a plot of peak discharge versus drainage area for use as a guide in computing the discharge at other points in the basin.

10.7 Regional Discharge-Frequency Analysis

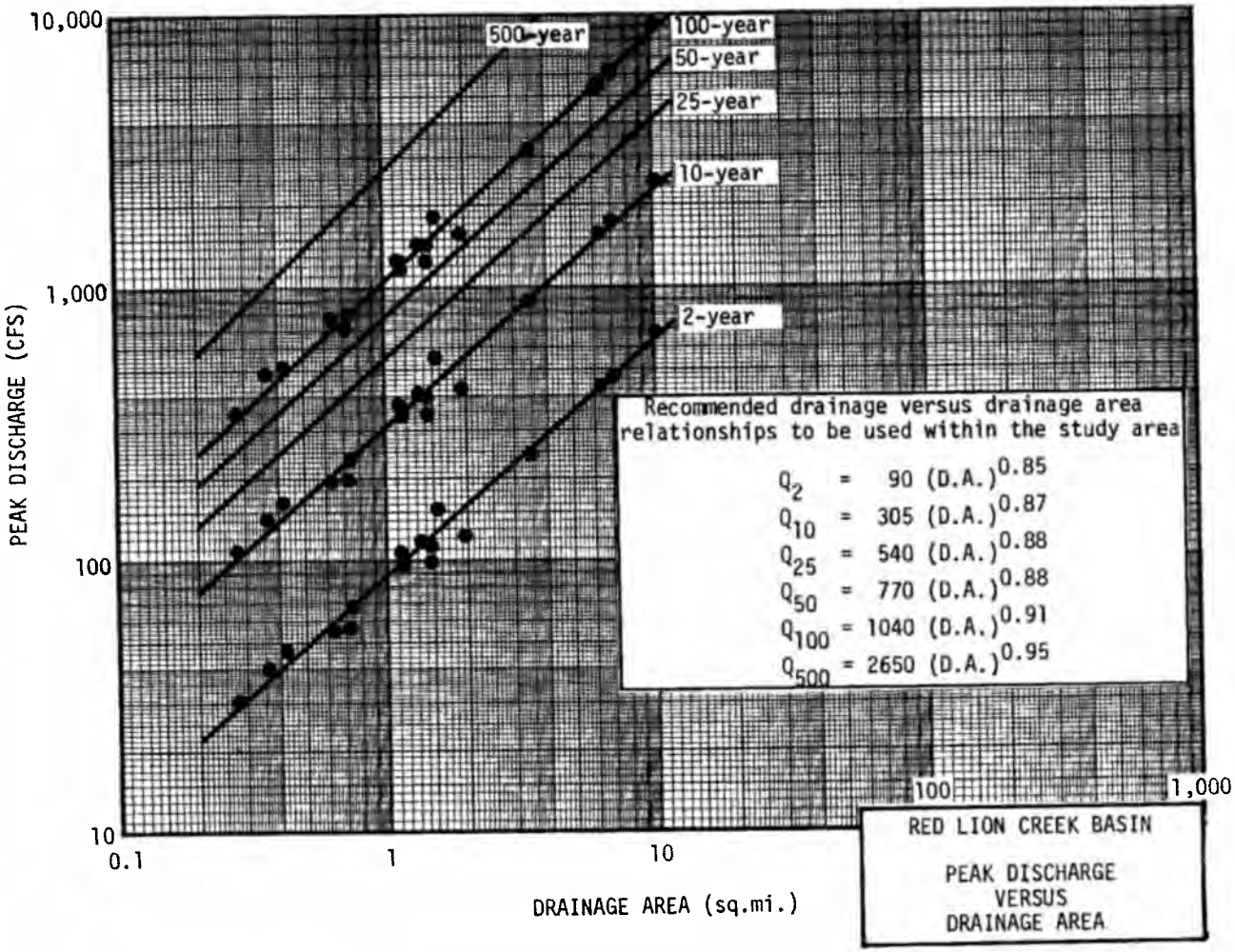
Procedures for estimating discharge-frequency curves for ungaged areas contained in the report Regional Frequency Study, Upper Delaware and Hudson River Basins, New York District, (Hydrologic Engineering Center, 1974) were followed in this study. Various basins considered hydrologically similar to the study area and within a 75-mile radius were analyzed according to criteria contained in Guidelines for Determining Flood Flow Frequency (WRC, 1976). The computed statistics for the systematic record of each subbasin



10.3. Discharge-Frequency Data



10.4. Peak Discharge for Hypothetical Events



10.5. Peak Discharge vs. Drainage Area

are given in Table 10.4. Two-station comparisons were made only within this group, and short-term records were extended where the guideline conditions were satisfied. Records were also adjusted for low outliers, high outliers, and historical data.

Records were adjusted for low outliers if the following relationship was true:

$$\left|\frac{X_n - \overline{X}}{S}\right| > (2.5 + 1.2 \log (N/10)) (1.0 - 0.4\overline{G}) \quad \ldots\ldots\ldots \quad (10.6)$$

in which

X_n = the logarithm of the lowest value in the sample of N annual flood peaks

$\overline{X}$ = mean logarithm of the N events

S = standard deviation of the logarithms of annual flood peaks

$\overline{G}$ = generalized skew coefficient

In this particular case, the generalized skew coefficient, $\overline{G}$, is 0.5; therefore the inequality (10.6) reduces to

$$\left|\frac{X_n - \overline{X}}{S}\right| > 2.0 + 0.96 \log (N/10) \quad \ldots\ldots\ldots\ldots\ldots \quad (10.7)$$

Also, the weighted skew, G, was computed for records of 25 to 100 years by the equation

$$G = \frac{N - 25}{75} G_s + \left[1 - \frac{N - 25}{75}\right] \overline{G} \quad \ldots\ldots\ldots\ldots\ldots \quad (10.8)$$

where G_s is the computed station skew.

For a $\bar{G}$ of 0.5, equation (10.8) becomes

$$G = \frac{N - 25}{75} (G_s - 0.5) + 0.5 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (10.9)$$

The generalized skew was used for records of 25 years and less. The adjusted (adopted) statistics are tabulated in Table 10.4. Map coefficients for the mean log of the annual peaks, C_m, and standard deviation, C_s, were computed from the adopted statistics and the following regression equations:

$$\log (Q_m) = C_m + 0.87 \log (DA) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (10.10)$$

where

Q_m = geometric mean of the annual flood peaks, cfs

C_m = a map coefficient for the mean log of the annual peaks

$$S = C_s - 0.05 \log (DA) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (10.11)$$

where

S = standard deviation of the logarithms of the annual flood peaks

C_s = a map coefficient for the standard deviation

The computed map coefficients are shown in Figures 10.6 and 10.7. The generalized trend of the map coefficients indicates that values of 1.95 and 0.35 for C_m and C_s, respectively, are reasonable for the Red Lion Creek Basin. Discharge-frequency curves (computed by procedures contained in the Delaware River Basin Study report, HEC, 1974), based on these particular values and using expected probability and an estimated equivalent length of record of 15 years, are shown in Figure 10.4 for comparison.

TABLE 10.4

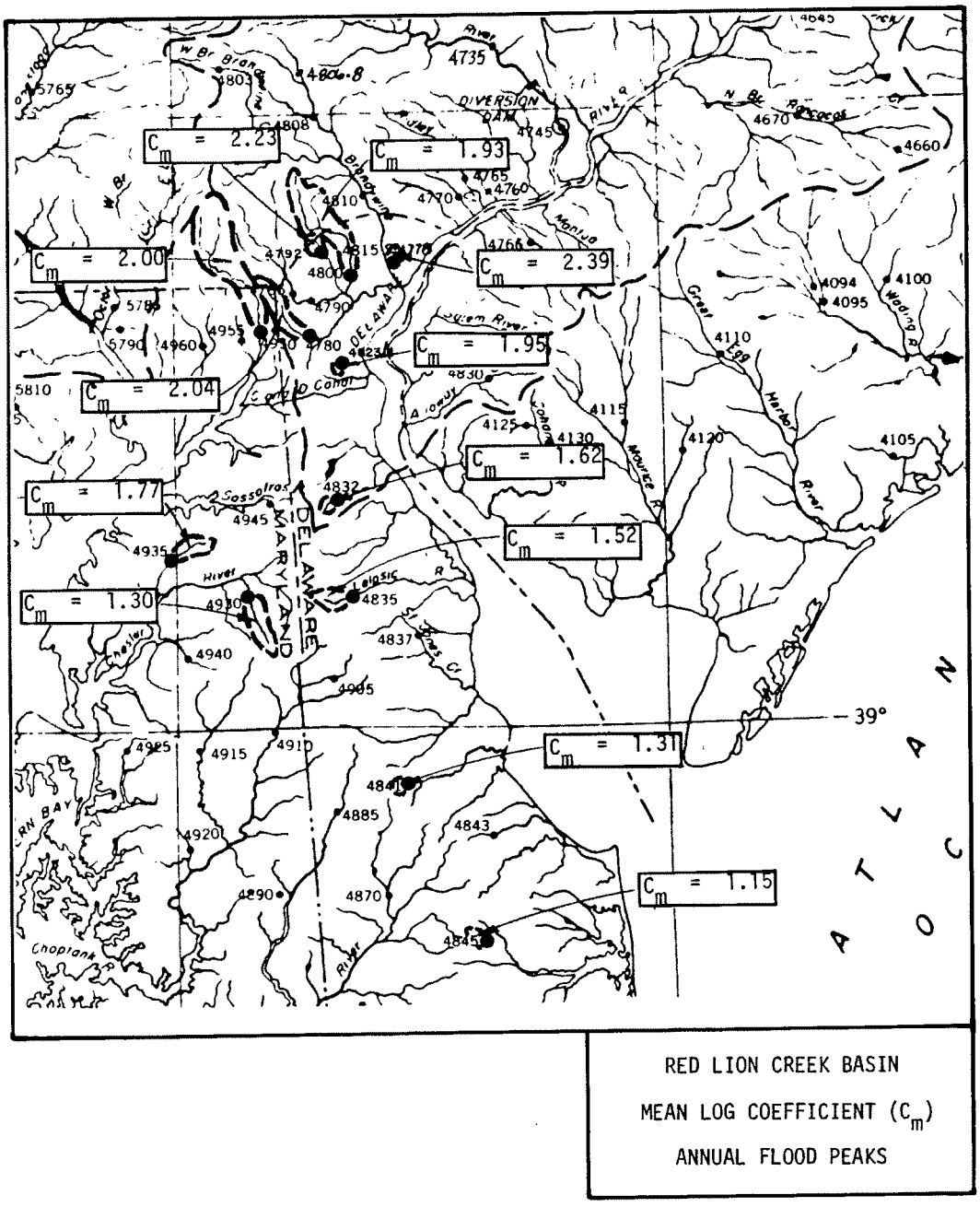
DISCHARGE-FREQUENCY STATISTICS FOR
STREAMS IN THE VICINITY OF RED LION CREEK

Gage No.	Gage Name	D.A. (sq.mi.)	Period of Record (water year)	Computed Statistics[1]			Adopted Statistics			C_m	C_s
				Mean	Std. Dev.	Skew	Mean	Std. Dev.	Skew		
				log			log				
4778	Shellpot Creek @ Wilmington, Del.	7.46	1946-74	3.152	0.272	0.728	3.152	0.272	0.512	2.39	0.32
4780	Christina River @ Coochs Bridge, Del.	20.5	1943-74	3.183	0.123	0.784	3.183	0.123	0.527	2.04	0.19
4792	Mill Creek @ Hockessin, Del.	4.19[2]	1966-74	2.762	0.248	1.407	2.762	0.248	0.500	2.23	0.28
4800	Red Clay Creek @ Wooddale, Del.	47.0	1944-74	3.380	0.164	0.518	3.380	0.164	0.501	1.93	0.25
4823.1	Doll Run @ Red Lion, Del.	1.15	1966-74	2.053	0.308	-0.436	2.001	0.349	0,500	1.95	0.35
4832	Blackbird Creek @ Blackbird, Del.	3.85	1951-74	2.126	0.321	0.299	2.126	0.321	0.500	1.62	0.35
4835	Leipsic River near Cheswold, Del.	9.35	1944-74	2.366	0.325	0.796	2.366	0.325	0.524	1.52	0.37
4841	Beaverdam Branch @ Houston, Del.	2.83	1958-74	1.707	0.231	0.045	1.707	0.231	0.500	1.31	0.25
4845	Stockley Branch @ Stockley, Del.	5.24	1943-74	1.777	0.179	-0.086	1.777	0.179	0.445	1.15	0.22
4930	Unicorn Branch near Millington, Md.	22.3	1949-74	2.475	0.281	0.006	2.475	0.281	0.500	1.30	0.35
4935	Morgan Creek near Kennedyville, Md.	10.5	1952-74	2.655	0.394	1.090	2.655	0.394	0.500	1.77	0.45
4950	Big Elk Creek @ Elk Mills, Md.[3]	52.6	1932-74	3.491	0.232	0.373	3.499	0.243	0.515	2.00	0.33

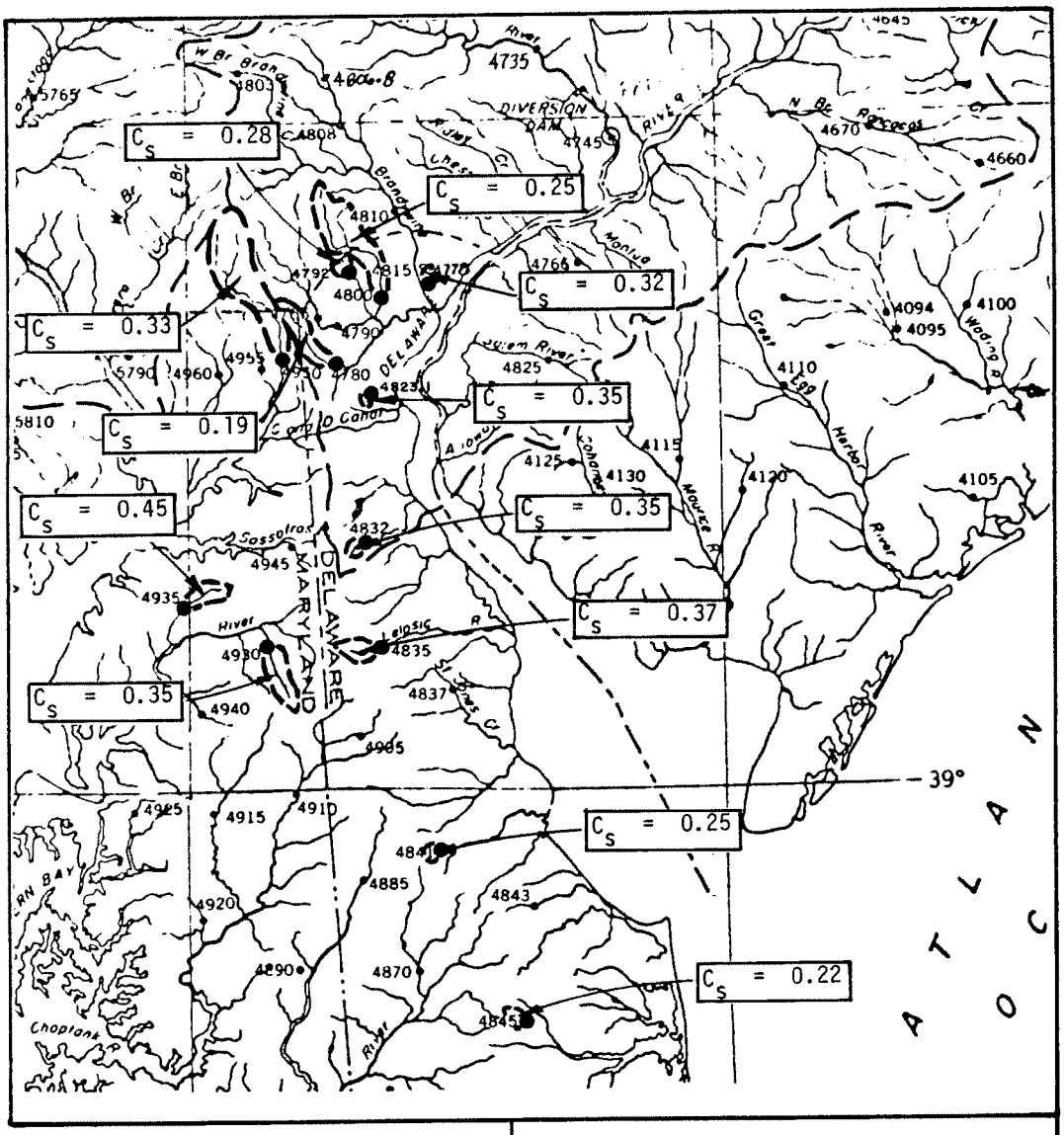
[1]Computed statistics based on the systematic record for each station.

[2]Drainage area taken as 4.04 sq. mi. since 0.15 sq. mi. probably noncontributing.

[3]Adjusted for historic data - 18,000 cfs in 1884.



10.6. Mean Log Coefficient C_m for Annual Flood Peaks



10.7. Standard Deviation Coefficient C_s for Annual Flood Peaks

CHAPTER 11

REFERENCES

1. Beard, L. R. (1962) "Statistical Methods in Hydrology," Revised Edition, U.S. Army Corps of Engineers, Davis, California.

2. Burnham, M. W. (1980) "Adoption of Floodflow Frequency Estimates at Ungaged Locations," Training Document No. 11, Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

3. Cermak, R. J. (1979) "Continuous Hydrologic Simulation of the West Branch Du Paige River Above West Chicago: An Application of Hydrocomp's HSP," Research Note No. 6, Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

4. Clark, C. O. (1945) "Storage and the Unit Hydrograph," Transactions, ASCE, Vol. 110, pp. 1419-1446.

5. Crawford, N. H. (1971) "Studies in the Application of Digital Simulation to Urban Hydrology," Hydrocomp, Inc., Palo Alto, California, September.

6. Crawford, N. H., and R. K. Linsley (1966) "Digital Simulation in Hydrology - Stanford Watershed Model IV," Stanford University, Department of Civil Engineering, Technical Report No. 39, Stanford, California.

7. DeVries, J. J., and R. C. MacArthur (1979) "Introduction and Application of Kinematic Wave Routing Techniques Using HEC-1," Training Document No. 10, Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

8. Feldman, A. (1979) "Flood Hydrograph and Peak Flow Frequency Analysis," Technical Paper No. 62, Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California, March.

9. Harley, B. M., F. E. Perkins, and P. S. Eagleson (1972) "A Modular Distributed Model of Catchment Dynamics," Ralph M. Parsons Laboratory for Water Resources and Hydrodynamic, Technical Report No. 133, M.I.T., Cambridge, Massachusetts.

10. Himmelblau, D. M. (1972) Applied Nonlinear Programming, McGraw-Hill, N.Y.

11. Hydrocomp, Inc. (1976) "Hydrocomp Simulation Programming Operations Manual," Fourth Edition, Palo Alto, California, January.

12. Hydrologic Engineering Center (1970) "Multiple Linear Regression - Generalized Computer Program 704-G1-L2020," U.S. Army Corps of Engineers, Davis, California, September.

13. Hydrologic Engineering Center (1973a) "Hydrologic Data Management," Chapter 4, Volume 2 of Hydrologic Engineering Methods for Water Resources Development, U.S. Army Corps of Engineers, Davis, California, April.

14. Hydrologic Engineering Center (1973b) "Hydrograph Analysis," Volume 4 of Hydrologic Engineering Methods for Water Resources Development, U.S. Army Corps of Engineers, Davis, California, October.

15. Hydrologic Engineering Center (1974) "Regional Frequency Study, Upper Delaware and Hudson River Basin," Report to New York District Corps of Engineers, U.S. Army Corps of Engineers, Davis, California.

16. Hydrologic Engineering Center (1975a) "Hydrologic Frequency Analysis," Vol. 3, Hydrologic Engineering Methods for Water Resources Development, U.S. Army Corps of Engineers, Davis, California.

17. Hydrologic Engineering Center (1975b) "Hypothetical Floods," Vol. 5, Hydrologic Engineering Methods for Water Resources Development, U.S. Army Corps of Engineers, Davis, California.

18. Hydrologic Engineering Center (1976a) "Hydrologic-Hydraulic Simulation, Rahway River Basin, New Jersey," Special Projects Memo No. 469, prepared for the New York District, U.S. Army Corps of Engineers, Davis, California, November.

19. Hydrologic Engineering Center (1976b) "Hydrologic Study - Shellpot and Naaman Creeks, New Castle County, Delaware," Special Projects Memo No. 471, U.S. Army Corps of Engineers, Davis, California.

20. Hydrologic Engineering Center (1976c) "Hydrologic Study - Red Lion Creek Basin, New Castle County, Delaware," Special Projects Memo No. 464, U.S. Army Corps of Engineers, Davis, California.

21. Hydrologic Engineering Center (1976d) "Hydrologic Study - Wyomissing Creek," Special Projects Memo No. 450, U.S. Army Corps of Engineers, Davis, California.

22. Hydrologic Engineering Center (1979) "HEC-2 Water Surface Profile Users Manual," U.S. Army Corps of Engineers, Davis, California, December.

23. Hydrologic Engineering Center (1980) "HEC-1 Input Description," U.S. Army Corps of Engineers, Davis, California, November.

24. Hydrologic Engineering Center (1981) "HEC-1 Flood Hydrograph Package, Users Manual," U.S. Army Corps of Engineers, Davis, California, January.

25. Hydrologic Engineering Center (1982) "OPROUT, Streamflow Routing Optimization Program, Users Manual," DRAFT, U.S. Army Corps of Engineers, Davis, California, January.

26. Lighthill, M. J., and G. B. Whitham (1955) "Kinematic Waves," Proc. Royal Soc. London, Volume 229, pages 281-316.

27. Linsley, R. K., M. A. Kohler, and J. L. H. Paulhus (1975) Hydrology for Engineers, Second Ed., McGraw-Hill, N.Y.

28. McCuen, R. H., W. J. Rawls, G. T. Fisher, and R. L. Powell (1977) "Flood Flow Frequency for Ungaged Watersheds: A Literature Evaluation," ARS-NE-86, Agricultural Research Service, U.S. Dept. of Agriculture, Beltsville, Maryland.

29. National Oceanic and Atmospheric Administration (NOAA) (1973) "Precipitation Frequency Atlas of the Western United States," Atlas 2, Volumes 1-13, Washington, D.C.

30. National Weather Service (NWS) (1956) "Seasonal Variation of Probable Maximum Precipitation (PMP), East of the 105th Meridian for Areas 10 to 1000 Square Miles and Durations of 6 to 48 Hours." Hydrometeorological Report No. 33 (HR 33), U.S. Department of Commerce, Washington, D.C.

31. National Weather Service (1960) "Generalized Estimates of PMP for the U.S. West of the 106th Meridian for Areas Less than 400 Square Miles and Durations to 24 Hours," Technical Paper No. 38 (TP 38), U.S. Department of Commerce, Washington, D.C.

32. National Weather Service (1961) "Rainfall Frequency Atlas of the United States, 30-minute to 24-hour Durations, 1- to 100-Year Return Periods," Technical Paper No. 40 (TP 40), U.S. Department of Commerce, Washington, D.C.

33. National Weather Service (1964) "Two- to Ten-Day Precipitation for Return Periods of 2 to 100 Years in the Contiguous United States," Technical Paper No. 49 (TP 49), U.S. Department of Commerce, Washington, D.C.

34. National Weather Service (1977) "Five to 60-Minute Precipitation Frequency for the Eastern and Central United States," NOAA Technical Memorandum NWS HYDRO-35, Silver Spring, Maryland.

35. National Weather Service (1978) "Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," Hydrometeorological Report No. 51, U.S. Department of Commerce, Washington, D.C.

36. National Weather Service (1981) "Application of Probable Maximum Precipitation Estimates - United States East of the 105th Meridian," Hydrometeorological Report No. 52, U.S. Dept. of Commerce, Silver Spring, Maryland.

37. Nie, N. H., C. H. Hull, J. G. Jenkins, K. Steinbrenner, D. H. Brent (1975) "Statistical Package for the Social Sciences," Second Edition, McGraw Hill, New York.

38. Resources Analysis, Incorporated (1975) MITCAT Catchment Simulation Model, Description and Users Manual, Version 6, Cambridge, Massachusetts, September.

39. Slocum, A. H., and R. A. Dandekar (1975) "Evaluation of Streamflow Routing Techniques with Special Emphasis on Determining Non-linear Routing Criteria by Optimization," Report to Hydrologic Engineering Center by Anderson-Nichols and Company, Inc., Boston, Massachusetts, October.

40. Snyder, F. F. (1938) "Synthetic Unit-Graphs," Transactions, American Geophysical Union, Vol. 19, Part 1, pp. 447-454.

41. Stottler, Stagg and Associates (1975) "Christina River Basin Study," Appendix A: Hydrologic Studies.

42. U.S. Army Corps of Engineers (1965) "Standard Project Flood Determinations," revised March 1965, EM 1110-2-1411 (formerly EB 52-8), Office of the Chief of Engineers, Washington, D.C.

43. U.S. Army Corps of Engineers (1976) "Draft Report, Chester Creek, Stage II Status Report," Philadelphia District, Philadelphia, Pennsylvania.

44. U.S. Department of Agriculture, SCS (1957) Soil Conservation Service Engineering Handbook, Section 4, "Hydrology, Supplement A," Washington, D.C.

45. U.S. Geological Survey (1974) "Magnitude and Frequency of Floods in New Jersey with Effects of Urbanization," Special Report 38, Washington, D.C.

46. Water Resources Council (1976) "Guidelines for Determining Flood Flow Frequency," Washington, D.C.

47. Woolhiser, D. A. (1975), "Simulation of Unsteady Overland Flow," in Unsteady Flow in Open Channels, K. Mahmood and V. Yevjevich, eds., Water Resources Publications, Fort Collins, Colorado.

APPENDIX

PROCEDURES FOR DEVELOPING SYNTHETIC PRECIPITATION DATA

A.1 Introduction

Synthetic or hypothetical storms are frequently used by the Corps of Engineers to generate synthetic flood events for evaluation of existing flood conditions and for study of the effects of flood-mitigation components. The degree of dependency on synthetic flood events during a flood evaluation depends generally on the number of gages and the length of hydrologic record available. For reservoir studies there is typically at least one long-record stream gage near the dam site, and thus the storage required for reservoir flood control is usually computed by period-of-record simulation techniques using recorded data. Channels, levees, and other local protection projects are more likely to be sized by synthetic storm-flood analyses since these projects often extend over many miles of the stream, and it is rare that gage information would be available throughout the reach.

Hypothetical storms are also used to ensure that rare storm-flood events are included in an overall assessment of the proposal. Since large storms that cause major floods are infrequent, the available runoff record quite possibly may not reflect the occurrence of these rare events. Analyses of major reservoirs, although relying mainly on recorded stream data, also require the use of synthetic storms (Standard Project and Probable Maximum Storms) to evaluate the safety of major dam components, such as the spillway and outlet works, and guard against overtopping of the dam. Synthetic precipitation data are also used for analyses of flooding throughout a basin, testing of the hydrologic effects of alternative land uses and flood plain regulations, and evaluation and design of flood control components. This is usually done with a model of the watershed to simulate the rainfall-runoff process, with the rainfall specified by hypothetical storms.

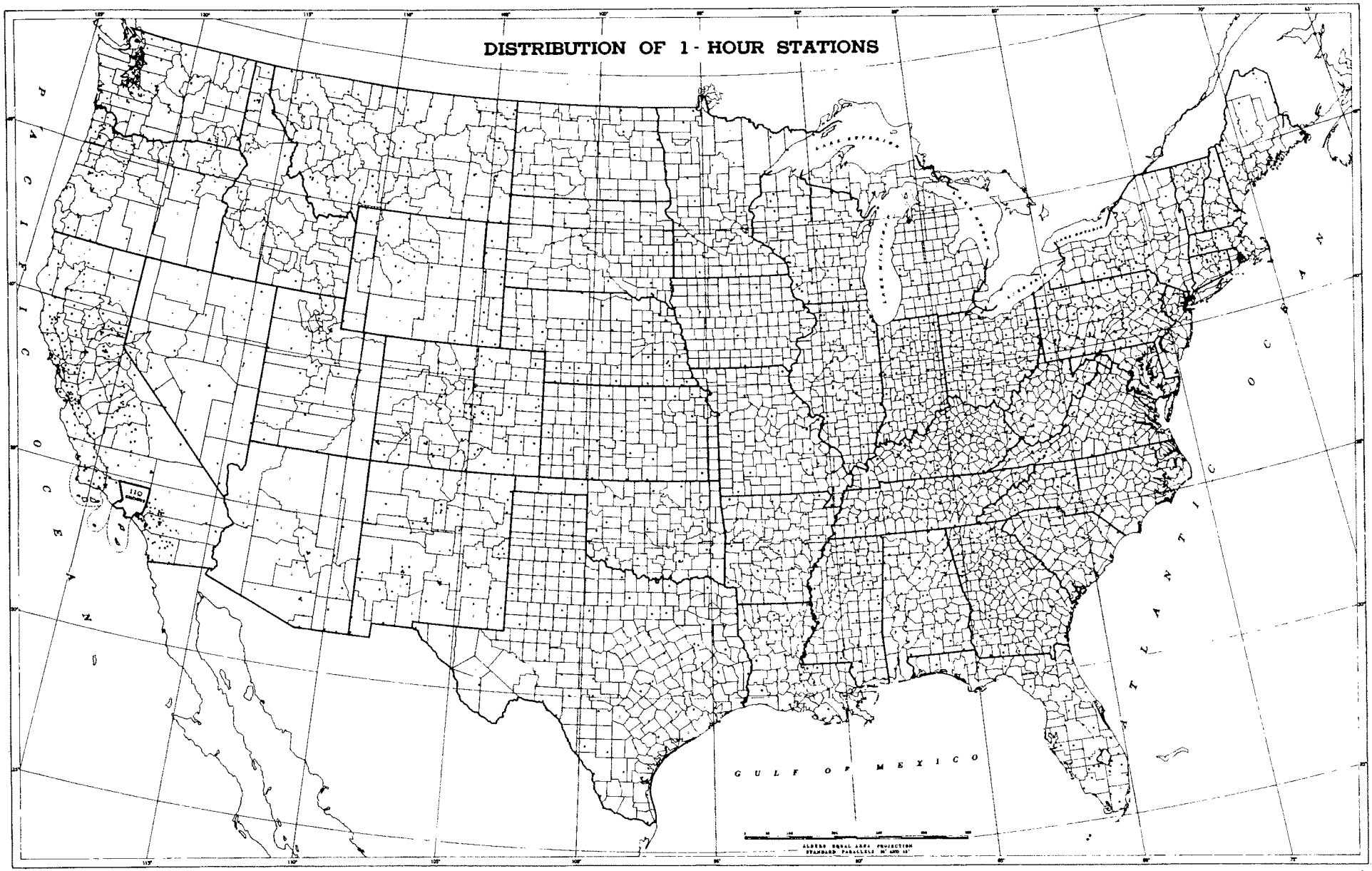
A.2 Sources of Storm Data

The primary sources of hypothetical storm information for the United States are various technical publications (TP) of the National Weather

Service (NWS) and hydrometeorological reports (HR) of the National Oceanic and Atmospheric Administration (NOAA), such as references A.1 through A.16. All publications for development of hypothetical frequency storms feature generalized isopluvial rainfall maps and/or regression equations. Other methods, such as statistical analysis of nearby long-record rain gages to derive hypothetical storms of particular frequencies in lieu of the NWS and NOAA procedures, are used extensively in some parts of the United States but not discussed here.

The geographical areas to which these publications apply is shown in Figure A.1. References A.1, A.2 and A.3 are used for the 35 states east of the Rocky Mountain area which are essentially free of significant orographic effects. The particular publication to be used depends on the storm duration under examination. The 13 mountain states containing the Rocky Mountains and those areas to the west are covered by references A.3., A.4, and other site-specific publications. The procedures described in all the NWS publications are based on statistical evaluations of long-term rainfall-gage records in a region. These evaluations include estimates of the frequency of accumulated rainfall-depth versus storm duration at each rain gage. Rainfall maps were made from these depth-duration values, and isopluvial lines were drawn on these maps to define constant rainfall-depth relationships through a region for a specific storm duration. An isopluvial map is shown in Figure A.2. Each of the NWS publications gives a detailed discussion of the derivation of the rainfall-frequency depth-duration relationships. It is strongly recommended that users of NWS data thoroughly read the pertinent sections and be familiar with the applications and limitations of the NWS material.

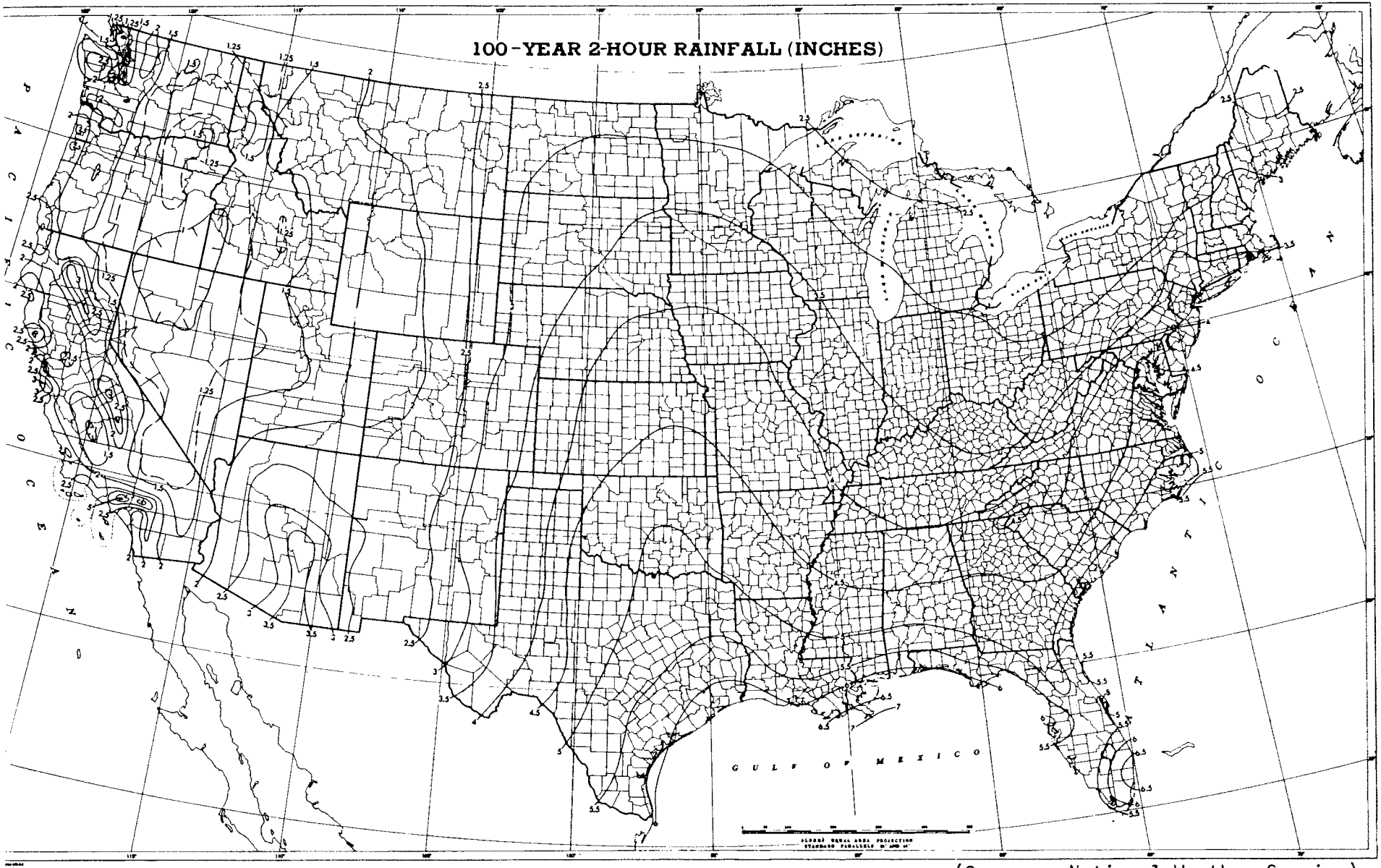
A hypothetical storm developed from NWS data is also referred to as a "balanced storm," because a consistent depth-frequency relation is used for each peak duration interval of the storm. That is, for a hypothetical 100-year return period 48-hour-duration storm, the rainfall depths for the peak 30-minute, 1-hour, 6-hour, 24-hour or other peak period would each be equal to the 100-year depth for that duration. This consistent frequency-depth-duration relationship throughout a storm would not occur in nature, because of the randomness of the rainfall events. The balanced storm concept, however, does allow for logical construction and arrangement of a storm event for a particular return period. Balanced storms are discussed in more detail later in this section.



Distribution of 1-hour stations.

(Source: National Weather Service)

A.1. Distribution of Rainfall Stations for NWS Storm Data



(Source: National Weather Service)

A.2. Typical Isopluvial Map

The Standard Project Storm (SPS) is used primarily by the Corps of Engineers and is described in reference A.9. It is treated in detail in paragraph A.5. Development of the SPS for states west of the Rocky Mountains requires site-specific criteria, which are not discussed here.

The Probable Maximum Storm (PMS) is developed primarily from NOAA and NWS criteria, some of which is given in references A.10 through A.18. The area east of the Rocky Mountains is covered by reference A.16. Paragraph A.6 of this report describes the derivation of the PMS.

A.3 Hypothetical-Frequency-Storm Derivation

Development of a storm from NWS data is straightforward and systematic. The individual performing the study must: 1) establish the appropriate storm duration and the time interval for subdividing the storm rainfall, 2) extract the rainfall values from NWS publications for his area of interest, 3) make adjustments to the rainfall depth for size of drainage area if needed, 4) adjust for partial to annual series (if required), 5) compute incremental rainfall amounts, and 6) arrange the storm rainfall increments in time. Each of these steps is described in the following paragraphs. Some example calculations to develop storm rainfall are given in Section A.4.

Storm Duration. Before constructing any hypothetical event (including the SPS and PMS), one must estimate two storm parameters: total duration and time interval for each rainfall increment. Both parameters must reflect the type and size of the drainage area being examined, the type of basin features one intends to analyze, and the location of these features. The total duration of the hypothetical storm is directly related to the time of concentration of the watershed (the travel time from the upper portions of the watershed to the most downstream point of interest). For example, if the estimated travel time is 14 hours (determined from actual records or by computation) from the watershed boundary to the lower limits of the study area, the storm duration must be at least 14 hours and preferably more. For most applications, the duration would be set to an even day (24 hours). Since a storm duration of less than 14 hours would not allow all portions of the drainage basin to contribute direct runoff to the outlet simultaneously during the course of the storm, the peak discharge at the basin outlet would

not be reflective of the rainfall event if the storm duration were made less than 14 hours. Runoff from the lower portions of the basin from, say, a 6-hour event would have left the basin before the inflow from the upper portion reached the outlet. Therefore, a minimum storm duration should be selected at least equal to, and preferably well in excess of, the estimated travel time (time of concentration) at the downstream-most point of interest. This selected duration should be increased considerably if total volume of runoff as well as peak discharge is of importance in the study. Drainage basins having an unusually large amount of flood plain storage (wide flood plains and/or large areas of swamps) may require a storm of longer-duration to capture the attenuation effect of these large natural storage areas. Reservoir studies require long-duration events for full assessment of the reservoir flood storage needed. Therefore, a maximum storm duration of 10 days may be used even if the travel time to the reservoir site is only 14 hours. Total storm duration is normally taken as some increment of a 24-hour day (3, 4, 6, or 12 hours), or a multiple of a day (1 to 10 days).

Time Interval. Once the storm duration has been established, the time interval for subdivision of the total storm must be selected. The time interval must be small enough to accurately define the flood hydrograph (especially the peak); however, too small an interval will result in excess computations by the individual or the computer. The time interval will generally be established by the fastest peaking subarea of the overall basin model for which the peak discharge is required, i.e., for later use in developing water surface profiles, to evaluate the effects of a flood control component, etc. The time interval must be small enough to define the rising limb and peak for the hydrograph for this subarea. It has been found from past experience that a time interval that gives at least 3 points on the rising limb of the hydrograph prior to the peak provides an estimation of the peak discharge that is accurate enough for most work.

Extending the previous example of the selection of a storm duration of 24 hours based on a travel time of 14 hours to the outlet, one can now select a time interval of 4 hours (14 hours divided by 3 points prior to peak = 4.67 hours, rounded down to 4 hours). This would be an appropriate time interval if one were interested only in the peak discharge at the outlet. However, if

there is a subarea upstream for which a peak discharge estimate was also necessary, then the time interval for the entire drainage basin would be based on the requirements for this subarea. For example, if the time of concentration for this subarea is 70 minutes, the interval required would be 20 minutes (70 minutes/3 points prior to peak = 23.3 minutes, rounded down to 20 minutes). Note that the 24-hour storm would now be subdivided into 72 twenty- minute intervals to define the rainfall distribution for the basin, compared with the 6 four-hour intervals where only the discharge hydrograph at the outlet was needed. Only one time interval can be specified for a given HEC-1 simulation. This means that the smaller intervals must be carried throughout the hydrograph construction, routing, and combining operations within the HEC-1 model, and this greater number of intervals will require more effort and computer time. Extreme cases occasionally occur, such as a large drainage area with a few of its subareas very small in size. Although the storm duration may be 2 days or more to reflect travel time to the outlet, a time interval of 5 minutes may be required to accurately capture the peak discharge from the smallest subareas. It may be more economical to construct a separate HEC-1 model (most likely with a short-duration storm) for each small subarea requiring a 5-minute subdivision, thereby allowing the model of the large area to use multi-hour time increments for the longer storm duration.

Data Extraction from NWS Publications. The methodology for hypothetical storm development for the Western states will be described separately from that for the remainder of the United States. Procedures for developing hypothetical storms in Hawaii and Alaska are similar to procedures for the other states.

(a) Eastern and Central United States. Once the storm duration and computation time interval have been established, the rainfall depths for key durations and each desired return period are taken from the appropriate NWS publications. For a 6-hour storm duration and 15-minute increment, for example, the 2-year hypothetical storm data for the area of interest would be obtained from TP-40 and HYDRO-35. TP-40 gives isopluvial maps of the 2-, 3- and 6-hour duration 2-year-return-period total rainfall. The 30-minute and 1-hour maps in TP-40 have been superseded by the procedures given in HYDRO-35. By determining the location of the study area on each map, one can

select the 2-year rainfall depth for each of the three durations. Since durations of one hour and less are also needed, one must use the HYDRO-35 maps of 15- and 60-minute rainfall depth and repeat the extraction of the desired 2-year rainfall depths. A value of the 30-minute rainfall depth is also obtained by applying the equation given in HYDRO-35. At this point, all available rainfall-depth information for a 6-hour-duration 15-minute-interval storm has been extracted from the NWS publications. These six values (15- and 30-minute, 1-, 2-, 3-, and 6-hour rainfall depths) will be used in the examples which follow.

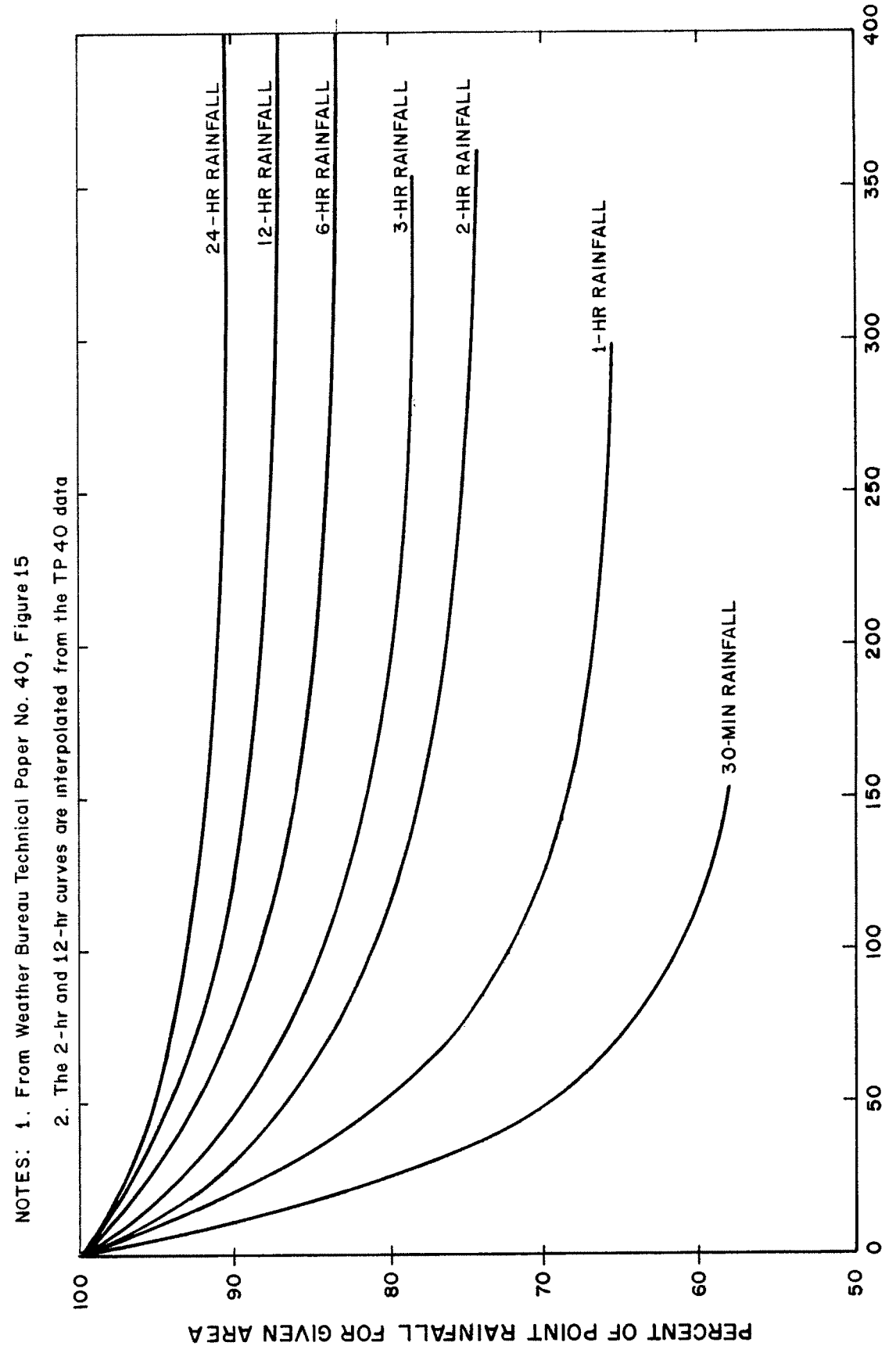
(b) Western United States. Procedures for extracting basic rainfall data from NOAA Atlas 2 for the Western states are significantly different from procedures for the rest of the United States. Maps are available for only the 6- and 24-hour-duration for various return periods. To determine a 6-hour duration 15-minute-interval 2-year-return-period storm, one would use the appropriate volume for the state in which the study area lies and extract the 6-hour and 24-hour rainfall depth at the location of the study area from the two maps. Although the total storm duration is only 6 hours, the 24-hour depth is usually needed to solve for the 1-hour-duration depths using the appropriate ratio and equation. Equations for the 2- and 3-hour-duration depths can be solved once the 1- and 6-hour depths are known. Durations of less than one hour are determined by multiplying the one hour-depth by various ratios given in Atlas 2. For the example, the maps and equations in Atlas 2 would be used to extract the 15- and 30-minute, 1-, 2-, 3- and 6-hour rainfall depths.

Areal Adjustment. Regardless of which publications were used, one now has six rainfall-depth values that must be further modified by one or more adjustment factors. The first adjustment factor is applied to the rainfall data taken from the publications. These depths are "point rainfall depths"; that is, as measured at a rain gage, i.e., a single point. The hypothetical storm will be applied to a specific watershed having a defined drainage area. For example, the amount of rainfall from a particular return-period event over a (say) 50-square-mile area would not be the same as that at a point, but would be less. A storm cannot be as intense when spread over a large area as it can be over a single point. Although the rainfall depth for any finite drainage area will be smaller than the value at a point, the

adjustment is often not made unless the study area is more than 5 to 10 square miles. As seen in Figure A.3, the application of the adjustment factor for small areas results in rainfall values that are little different from the point values. When the drainage area is larger than about 10 square miles, the adjustment becomes significant, particularly for the 30- and 60-minute durations. For the example from the previous paragraph, Figure A.3 would be entered at the drainage area under study and adjustment values for the 30-minute and 1-, 3-, and 6-hour durations would be read from the y-intercept of the drainage area and the appropriate curve. These four factors would be plotted against point rainfall depth on semi-logarithmic paper. The 2-hour-duration factor can be read from the curve, and the curve can be extrapolated to obtain a 15-minute duration factor. Since the NWS publications provide no guidance for adjustments for durations of less than 30 minutes, extrapolation to shorter durations is subject to question. This difficulty should not arise often, however, since a time subdivision of 5 or 10 minutes would imply a short time of concentration and a small basin. If the basin is small, an areal adjustment is not significant.

The adjustment factor found for each duration is used to modify the corresponding rainfall depth for that duration by multiplying these two quantities. Once this step has been completed, all rainfall values have been adjusted for the particular drainage area being studied.

Partial-to-Annual Series Adjustment. The previously described rainfall amounts are for partial-duration series of rainfall values. Conversion of rainfall values to an annual series may be needed. This adjustment is applicable only to return periods with a frequency of 10 years or less. The rainfall depth-frequency curve is converted from one for which one or more events per year were used (called a partial-duration series, which is one in which all events above some selected base value are used) to one using only a single event each year (called an annual series, in which the single highest event each year is used, even though the second highest in some years may be greater than the highest in other years). For economic analysis of agricultural areas, it is possible that damages are sustained by flood events that have a probability of occurrence of more than once per year. Where several floods per year are causing significant damage, it would be desirable to use a partial-duration series and not make the adjustment. In many



NOTES: 1. From Weather Bureau Technical Paper No. 40, Figure 15

2. The 2-hr and 12-hr curves are interpolated from the TP 40 data

AREA-DEPTH CURVES

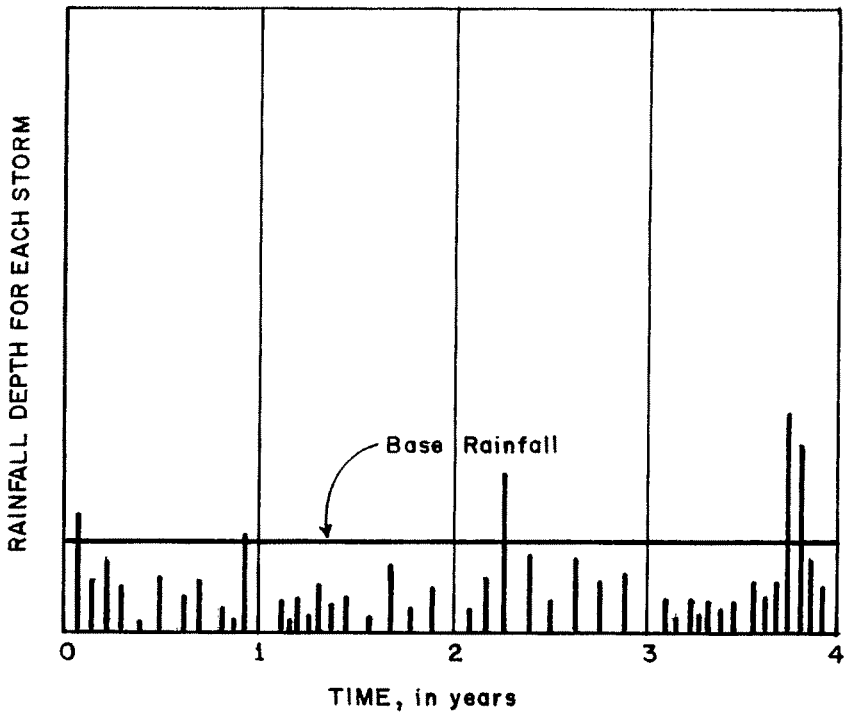
economic analyses, especially in urbanizing areas, these multiple floods (once- or twice-per-year events) do not cause significant damage. Therefore, the adjustment factor would be applied to prevent the use of biased (high) rainfall depths to determine the low end of the frequency curve. Figure A.4 illustrates the two series. The adjustment from partial-to-annual series is performed by multiplying the rainfall depths for each duration by the appropriate conversion factor. The conversion factors are as follows:

Series	Factor
2-year	0.88
5-year	0.96
10-year	0.99

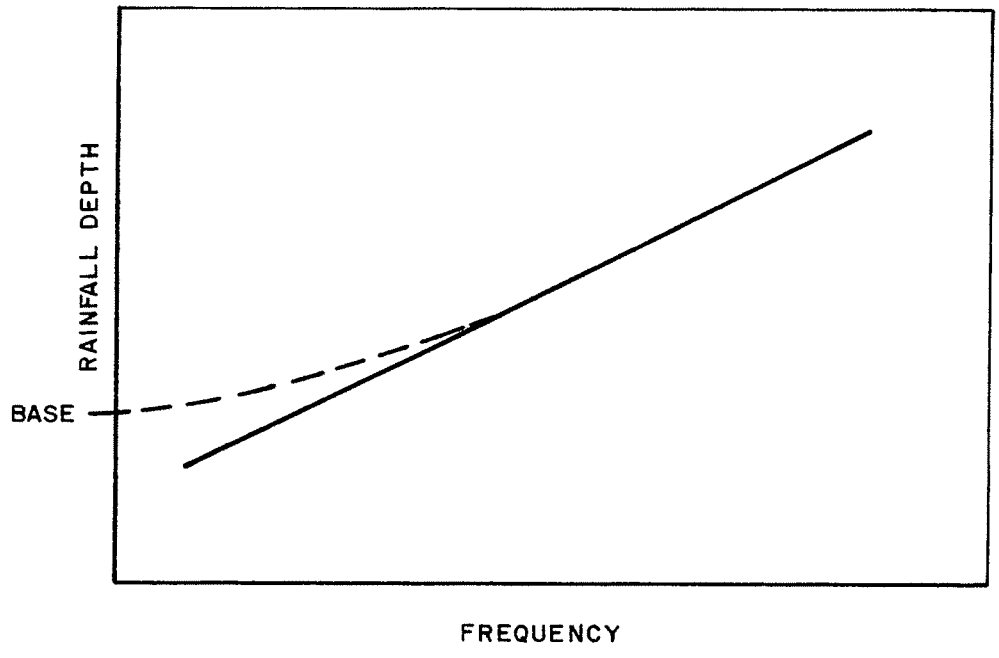
No adjustment is needed for rarer return intervals since the two curves coincide after the 10-year event. At this point, all adjustments have been made. The next step is to proceed through further breakdown and arrangement of the hypothetical storm.

Division into Incremental Values. One now takes the adjusted rainfall values for a particular storm (there are usually six values) and further subdivides these to arrive at a rainfall depth value for each time increment (for example, there will be twenty-four values for the 6-hour-duration 15-minute-interval case). This division into increments is usually performed by plotting the values of rainfall depth (in inches) versus duration (in minutes) on logarithmic paper, fitting a curve through these points, and then reading off accumulated depth values for each increment from the curve. Averaging the incremental change between the original points is usually a satisfactory alternative, since the depth-duration plot normally approximates a straight line after the first several values. Once an accumulated depth for each interval has been determined, the depths are incremented to compute that portion of the depth that occurred in each period.

Storm Arrangement. The final step in the storm definition is arrangement of the storm rainfall into a specific pattern. The pattern used most often by the Corps of Engineers is a "triangular" arrangement, with the peak period in the center of the storm. For our example, the peak 15-minute depth would be placed (assigned) to the thirteenth period of the twenty-four



a). Illustration of Partial and Annual Series



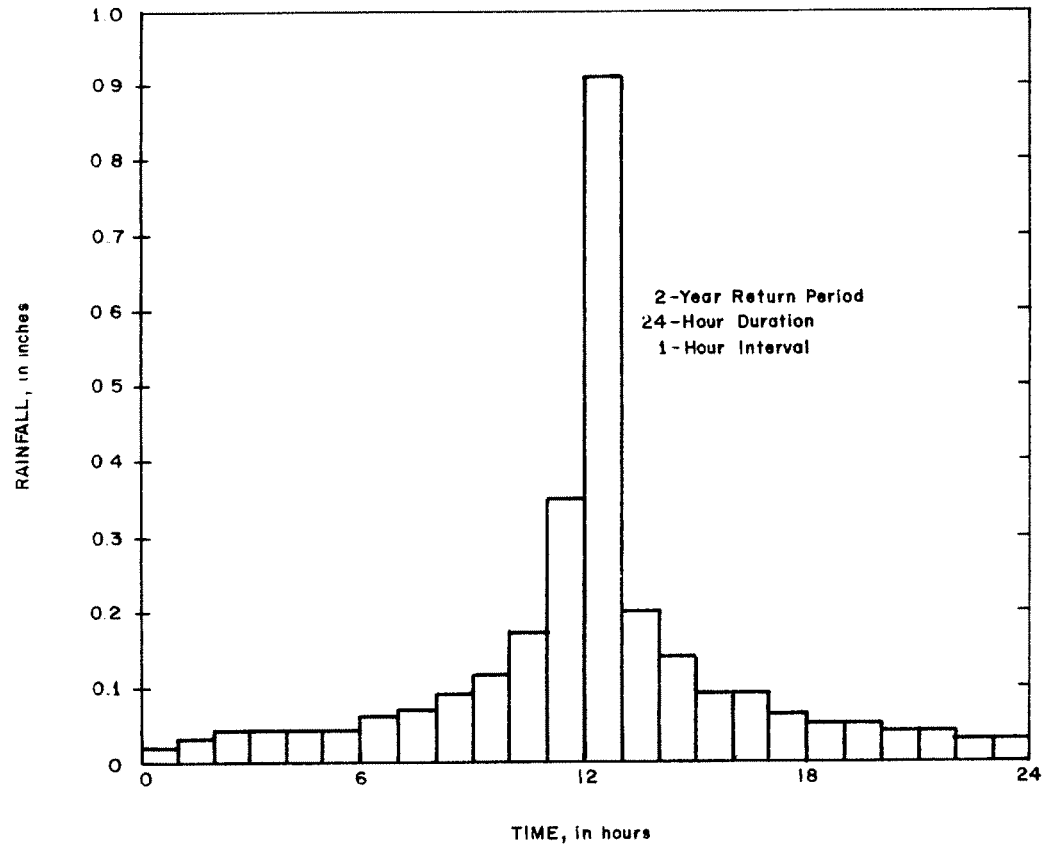
b). Comparison of Rainfall Depth vs. Frequency Curves for Partial and Annual Series.

A.4. Partial and Annual Rainfall Series

period storm sequence. The next-highest depth is placed just ahead of the peak (Period 12), the next highest depth just behind (Period 14), and so on until all 24 values are systematically arranged about the peak period.

If a storm with a duration longer than 24 hours is to be arranged, all 24-hour periods outside of the peak 24 hours can be represented by an average value for each 24-hour period. The rainfall increments cannot be moved outside the 24-hour period from which the increment was developed, however. Figure A.5 shows a sample arrangement for a twenty-four-hour rainfall.

The Standard Project Storm distribution can be used to develop an alternate arrangement of rainfall in time. However, although the SPS arrangement is sometimes applied to hypothetical-frequency storms, it was specifically derived for events much rarer than even the 100-year return-period event. Since its application will give a more severe arrangement than may be reasonable for a hypothetical-frequency event, estimates of peak discharge may be excessively high when the SPS arrangement is used.



A.5. Example of Arrangement of Hourly Rainfall Over a 24-Hour Period

Summary. The steps in developing a hypothetical storm rainfall include:

- Determine total storm duration
- Determine the time interval for subdividing the storm
- Extract data from the appropriate NWS or NOAA publications
- Adjust for area
- Adjust for annual series, if necessary
- Develop relation for accumulated depth versus time
- Increment depths for each period
- Arrange storm

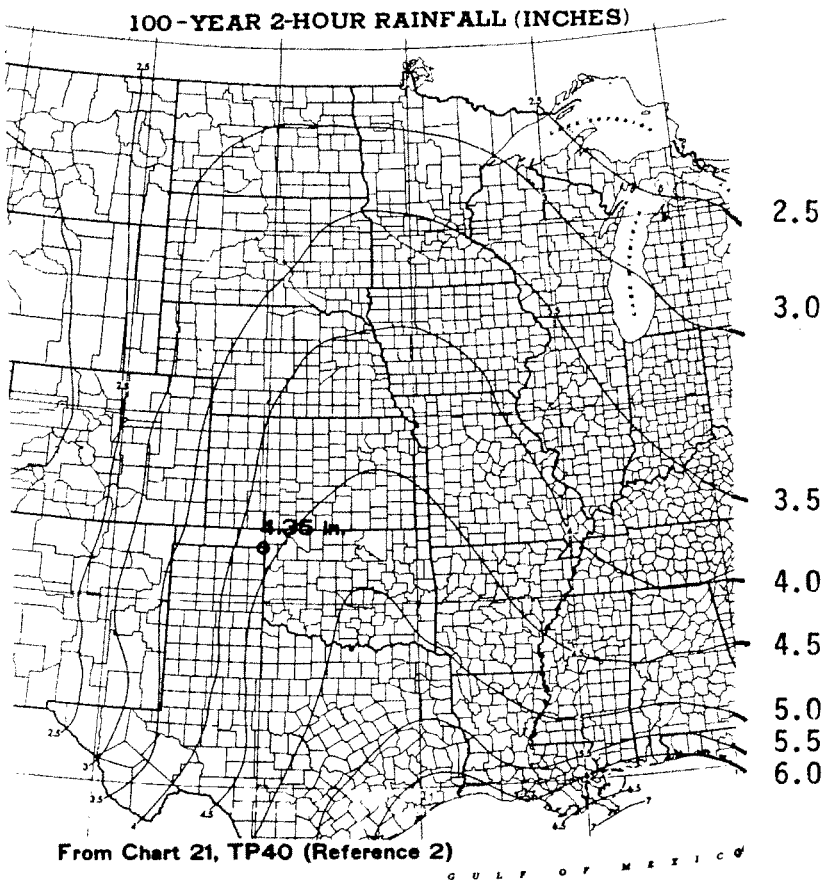
Section A.4 gives examples of hypothetical-storm determination, and Section A.7 furnishes additional information on special problems in hypothetical-storm usage.

A.4 Examples

Two example problems are presented here, one for each of the two major geographical areas of the United States.

Eastern and Central U.S. Hydrologic evaluation of a 100-square-mile watershed located at the northeast corner of the Texas "panhandle" requires development and arrangement of the 100-year recurrence-interval hypothetical storm. The total storm duration determined for the analysis is 12 hours with a time interval of 30 minutes.

To determine the properties of a 12-hour-duration 30-minute-interval storm in this region, both TP 40 and HYDRO-35 must be used. From TP 40, the maps for the 100-year return period are used to obtain rainfall depths for the peak 2-, 3-, 6-, and 12-hour durations at the northeast corner of the Texas panhandle. Values for the 15- and 60-minute rainfall depths are obtained from the maps in HYDRO-35. For example, the value for the 100-year 2-hour rainfall for the study area is obtained from TP-40 as shown in Figure A.6. The values found from TP-40 and HYDRO-35 are:



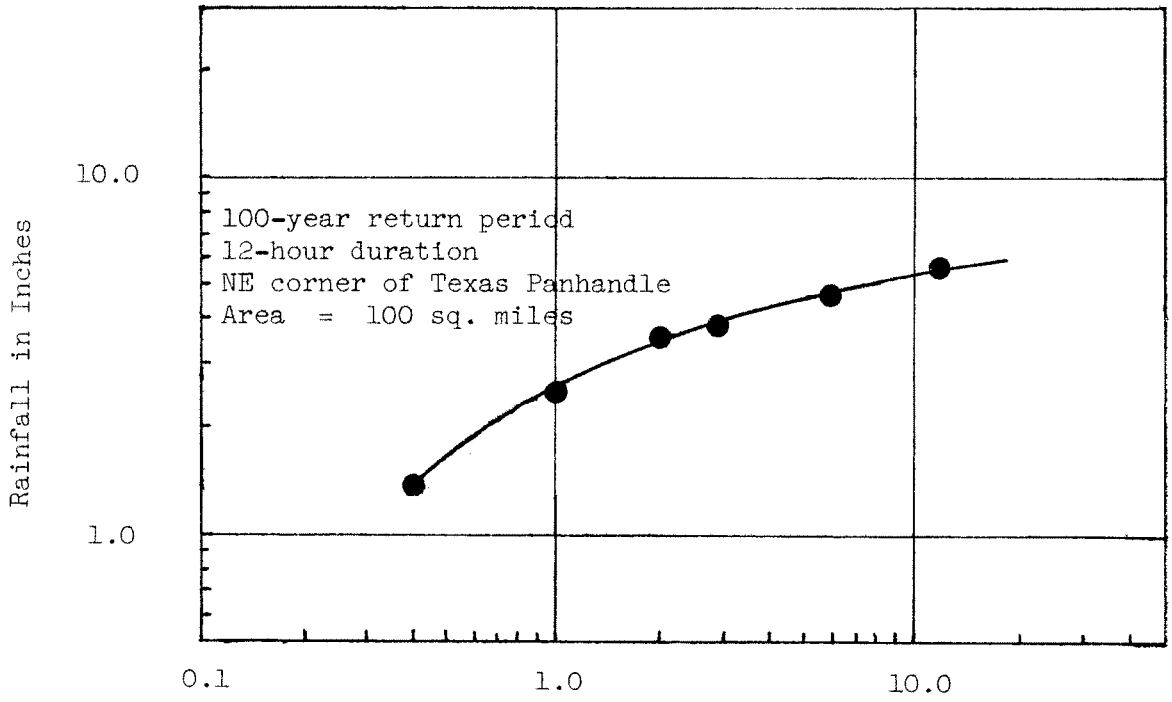
A.6. Rainfall Value for the Study Area
(Northeast Corner of Texas Panhandle)

Duration	15-min	60-min	2-hr	3-hr	6-hr	12-hr
100-year Rainfall	1.82 in.	3.46 in.	4.35 in.	4.65 in.	5.30 in.	6.00 in.

The 30-minute value is computed from Equation 7 of HYDRO-35 as follows:

30-min value = 0.49 x (60 min-value) + 0.51 x (15-min value)
= 0.49 x (3.46) + 0.51 x (1.82)
= 2.62 inches

These values of accumulated point rainfall for various durations are shown in the second column of Table A.1. The 30-minute to 12-hour point values are next adjusted for a drainage area of 100 square miles. Adjustment values are taken from Figure A.3 for each duration. Since the 100-year return period storm is being developed, no adjustment to annual series need be considered. The adjusted values are plotted (Figure A.7), and the values for intervening intervals (1.5, 2.5 hours, etc.) are interpolated; these are shown in Column (4) of Table A.1. After division into increments and arrangement, the 100-year hypothetical storm is complete (last column of Table A.1) and can now be used for input to an HEC-1 model.



A.7. Depth-Duration Relationship for Study Area (Northeast Corner of Texas Panhandle)

Western U.S. This example describes the development of the two-year return interval storm for a 2.6 square-mile basin in Davis, California. Annual-series rainfall for a 3-hour storm duration and 10-minute rainfall interval is required.

The value of the 2-year return-period rainfall depth for the 6-hour duration is read from the appropriate figure in NOAA Atlas 2, Volume XI - California, as shown in Figure A.8. Since Davis lies in Region 4 (Sacramento-San Joaquin River Valley), the depth for the 1-hour duration is determined from the equation derived for that region given in NOAA Atlas 2.

$$Y_2 = 0.107 + 0.315\ X_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (A.1)$$

where Y_2 is the 2-year 1-hour depth, and
X_1 is the 2-year 6-hour depth.

Substituting the value of 1.30 inches for X_1 in the equation gives a 2-year 1-hour depth Y_2 of 0.52 inches. Values for the depths of the 2- and 3-hour durations are determined from appropriate equations for Region 4 given in NOAA Atlas 2.

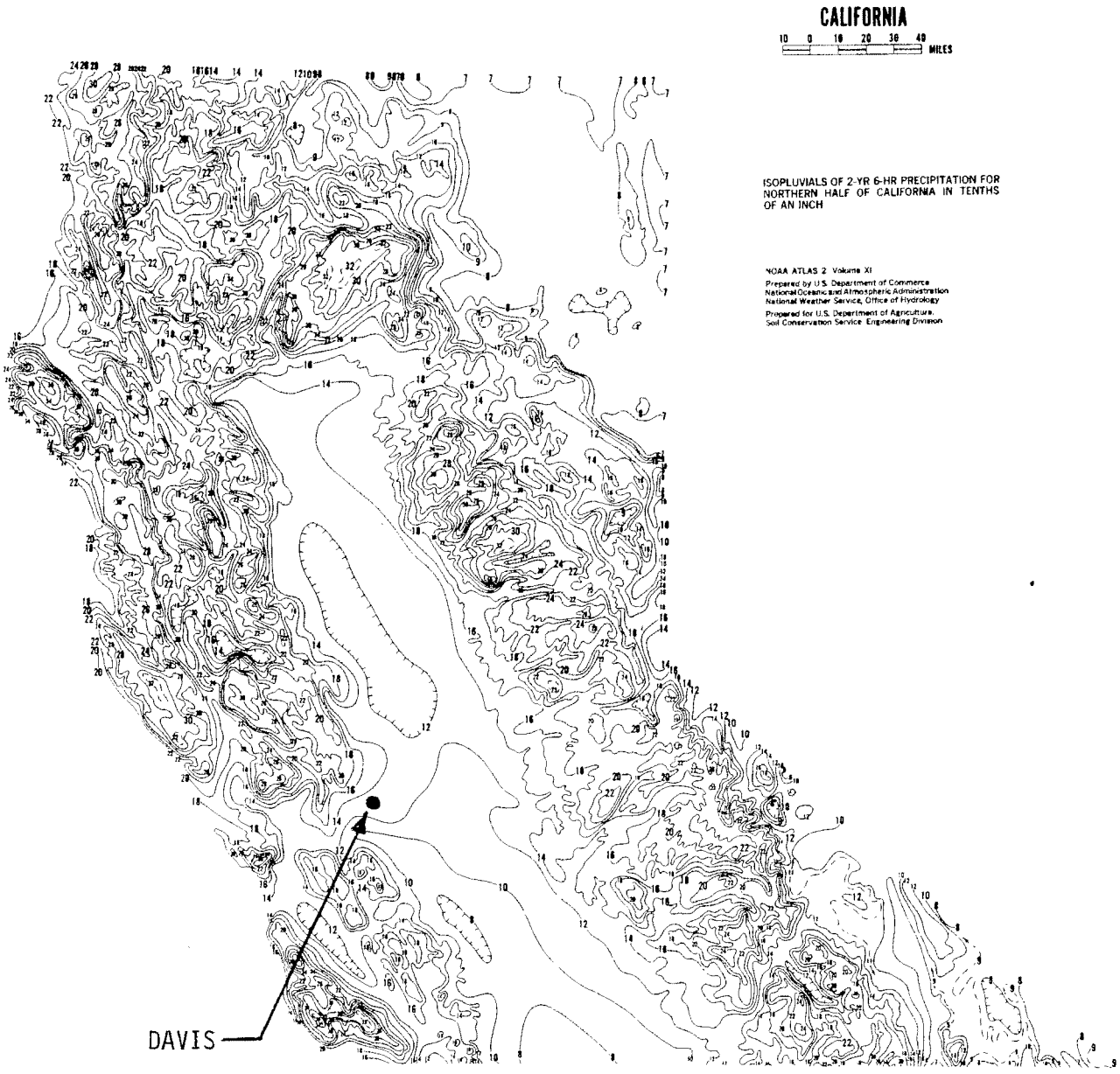
TABLE A.1

100-YEAR RAINFALL WITH TP-40, HYDRO-35

NE Corner of Texas Panhandle

Period (hours) (1)	Accum. 1/ Point Rainfall (in.) (2)	Point Rainfall 2/ Factor (100 mi^2) (3)	Accum. Depth (in.) (4)	Incre. Depth (in.) (5)	Arranged Incre. Depth (in.) (6)
0.5	2.62	0.615	1.61	1.61	0.06
1.0	3.46	0.723	2.50 4/	0.89	0.06
1.5			3.10 4/	0.60	0.06
2.0	4.35	0.810 3/	3.52	0.42	0.06
2.5			3.75	0.23	0.06
3.0	4.65	0.845	3.93	0.18	0.07
3.5			4.10	0.17	0.10
4.0			4.25	0.15	0.11
4.5			4.40	0.15	0.15
5.0			4.50	0.10	0.18
5.5			4.60	0.10	0.42
6.0	5.30	0.888	4.71	0.11	0.89
6.5			4.77	0.06	1.61
7.0			4.84	0.07	0.60
7.5			4.90	0.06	0.23
8.0			4.96	0.06	0.17
8.5			5.02	0.06	0.15
9.0			5.09	0.07	0.10
9.5			5.15	0.06	0.07
10.0			5.21	0.06	0.07
10.5			5.27	0.06	0.06
11.0			5.34	0.07	0.06
11.5			5.40	0.06	0.06
12.0	6.00	0.910 3/	5.46	0.06	0.06

1/ From TP-40, HYDRO-35.
2/ Figure A.3
3/ Interpolated from plot of 0.5-, 1-, 3-, 6-, 24-hour adjustments.
4/ Interpolated from Figure A.7 for intermediate values.



A.8. Rainfall Depth for 2-yr Return Interval, 6-hr Duration for Example (Davis, California)

2-hr depth = 0.240 x (6-hr depth)+ 0.760 x (1-hr depth)
= 0.240 (1.30) + 0.760 (0.52) = 0.71 inches

3-hr depth = 0.468 x (6-hr depth) + 0.532 x (1-hr depth)
= 0.468 (1.30) + 0.532 (0.52) = 0.89 inches

Depth values for durations of less than 1 hour are found by applying the values in Table 12, Volume IX of NOAA Atlas 2, to the 1-hour depth. For this example, these values are:

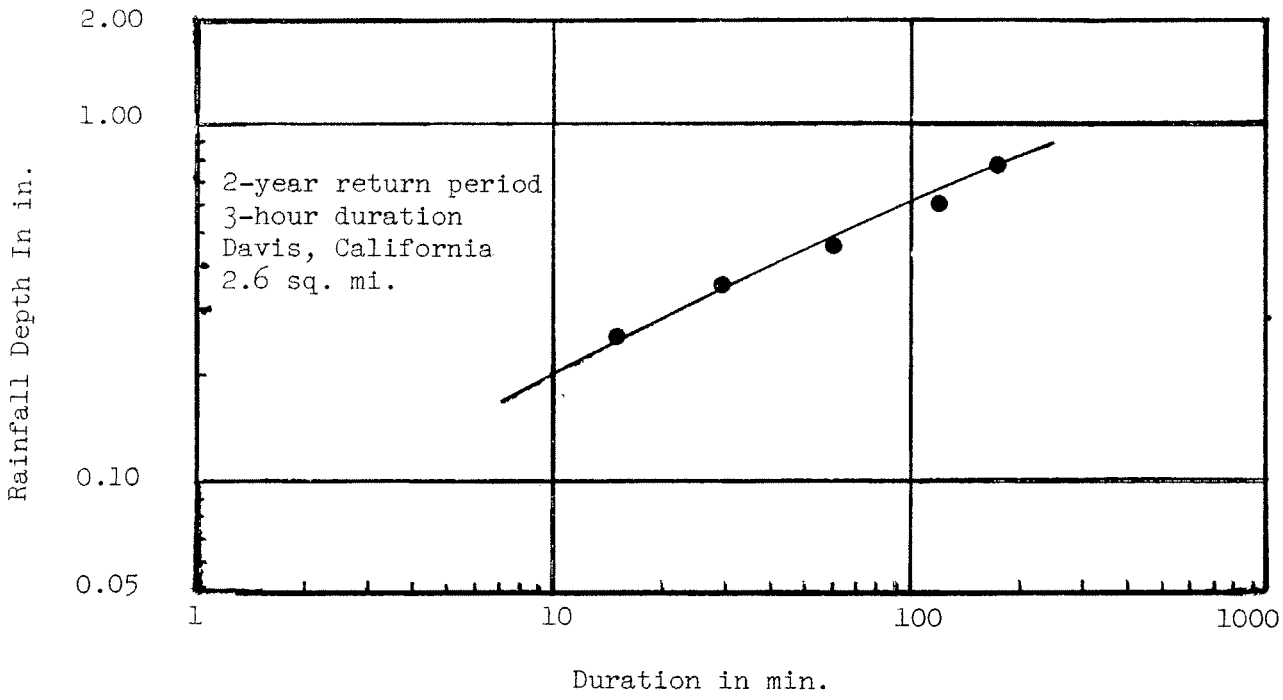
10-min-duration rainfall = 0.45 (0.52) = 0.23 inches
15-min-duration rainfall = 0.57 (0.52) = 0.30 inches
30-min-duration rainfall = 0.79 (0.52) = 0.41 inches

For a drainage area of 2.6 square miles the areal adjustment is judged to be negligible, therefore the point rainfall values are used. An adjustment from partial to annual series is desired, however, and the factor (0.88) for a two-year return period is taken from Table 2, Volume IX. The adjusted rainfall depths are given in the last column of Table A.2

TABLE A.2
SYNTHETIC 2-YEAR RAINFALL AT DAVIS, CALIFORNIA

Period	Accumulated Point Rainfall Depth (in.)	Areal Adjustment	Annual Series Adjustment	Adjusted Acumulated Depth (in.)
10 min	0.23	None	0.88	0.20
15 min	0.30	None	0.88	0.26
30 min	0.41	None	0.88	0.36
60 min	0.52	None	0.88	0.46
2 hr	0.71	None	0.88	0.62
3 hr	0.89	None	0.88	0.78

The final adjusted accumulated rain-depth values are plotted in Figure A.9. Values at 10-minute intervals are read from Figure A.9 and are incremented and arranged as shown in Table A.3. The last column represents the 2-year return period, 3-hour duration, 10-minute interval storm at Davis for input to an HEC-1 watershed model.



A.9. Rainfall Depth-Duration Relationship for Example (Davis, California)

TABLE A.3
3-HOUR-DURATION 10-MINUTE-INTERVAL 2-YEAR-RETURN-PERIOD STORM AT DAVIS, CALIFORNIA

Period (min)	Accumulated Rain Depth* (in.)	Incremental Depth (in.)	Arranged Storm (in.)
10	0.20	0.20	0.02
20	0.29	0.09	0.02
30	0.35	0.06	0.02
40	0.40	0.05	0.02
50	0.45	0.05	0.03
60	0.49	0.04	0.03
70	0.52	0.03	0.04
80	0.55	0.03	0.05
90	0.58	0.03	0.09
100	0.61	0.03	0.20
110	0.63	0.02	0.06
120	0.65	0.02	0.05
130	0.67	0.02	0.03
140	0.70	0.03	0.03
150	0.72	0.02	0.03
160	0.74	0.02	0.02
170	0.76	0.02	0.02
180	0.78	0.02	0.02

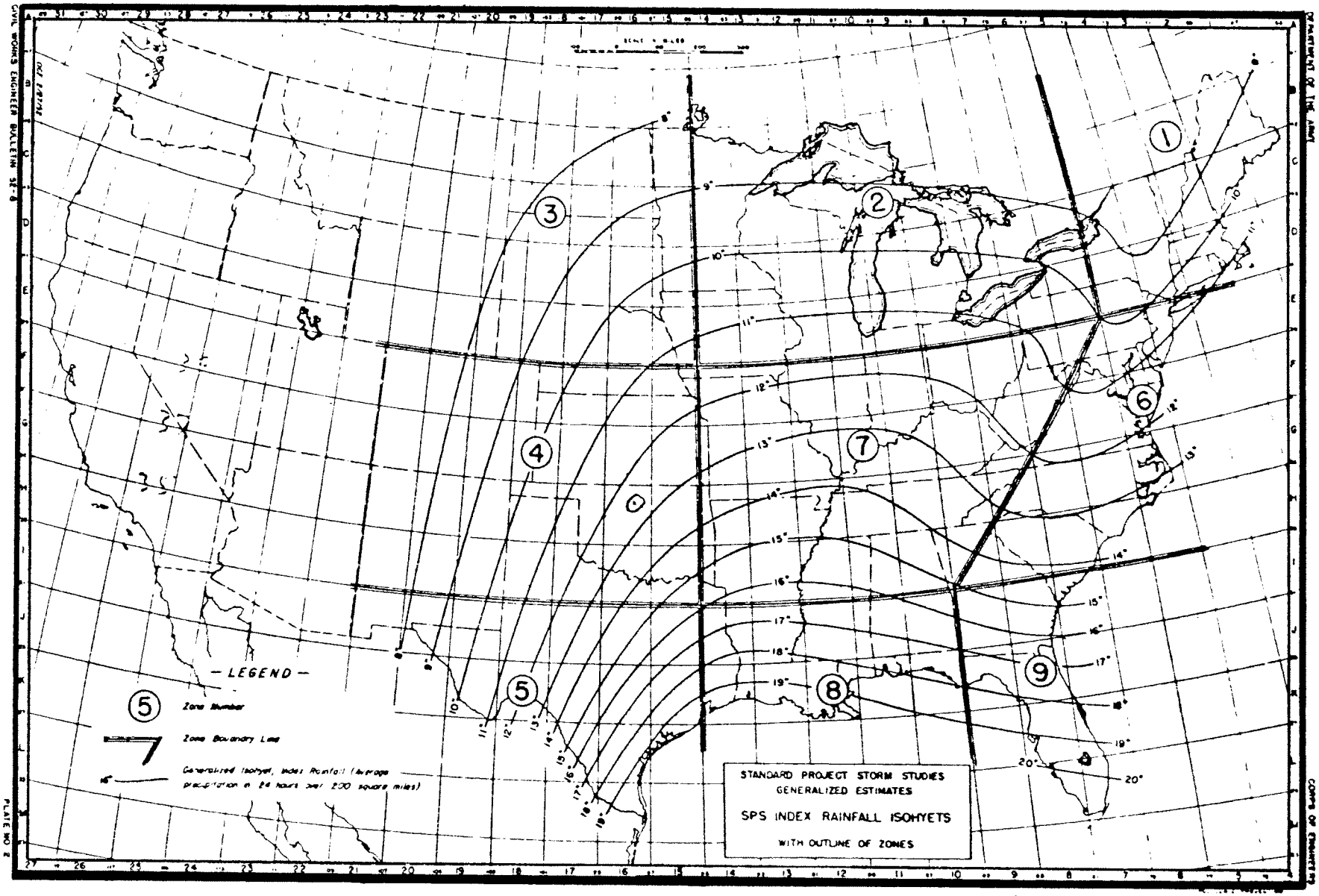
* From Figure A.9

A.5 Standard Project Storm.

The Standard Project Storm (SPS) is defined as that combination of severe meteorological events that gives the maximum precipitation reasonably characteristic of the geographic region of interest, excluding extremely rare events. Since the SPS is an infrequent event, no specific frequency can be assigned to it. It may range from a return interval of a few hundred years to a few thousand years. The SPS is often used as a design storm in which only a small degree of risk of exceedance can be tolerated such as in the design of an urban floodwall. It is usually used for comparison with the recommended protection for a particular project. Because the Standard Project Storm (SPS) is used mainly within the Corps of Engineers, only a limited number of publications describe its derivation and use, in contrast to materials available on hypothetical-frequency storms and the Probable Maximum Storm. Reference A.9 describes the SPS derivation for the United States east of 105° longitude. SPS development for the remainder of the United States must be based on various published and unpublished Corps District reports and procedures. Only SPS derivation from reference A.9 is discussed further in this section.

SPS for Eastern and Central United States. Deriving the SPS for drainage basins greater than 1000 square miles requires special studies by the National Weather Service. The general criteria in EM 1110-2-1411 (reference A.9) are applicable to basins of less than 1000 square miles. The sequence of SPS derivation described in the reference includes: selection of an "index" rainfall, determination of the 24-, 48-, 72- and 96-hour SPS rainfall based on the index and the drainage area under study, adjustment of the rainfall for a basin shape factor, division into incremental rainfall amounts, and arrangement of the incremental rainfall values into the storm sequence.

(a) The SPS index rainfall is determined using Plate 2 of reference A.9 (reproduced here as Figure A.10). The rainfall depth determined from this figure represents the SPS rainfall for an area of 200 square miles and for a 24-hour duration. Further adjustment of this rainfall value is required, however, because a SPS is a 96-hour storm by definition, and because the drainage area under study will never be exactly 200 square miles.



A.10. Index Rainfall for Standard Project Storm (Source: EM 1110-2-1411)

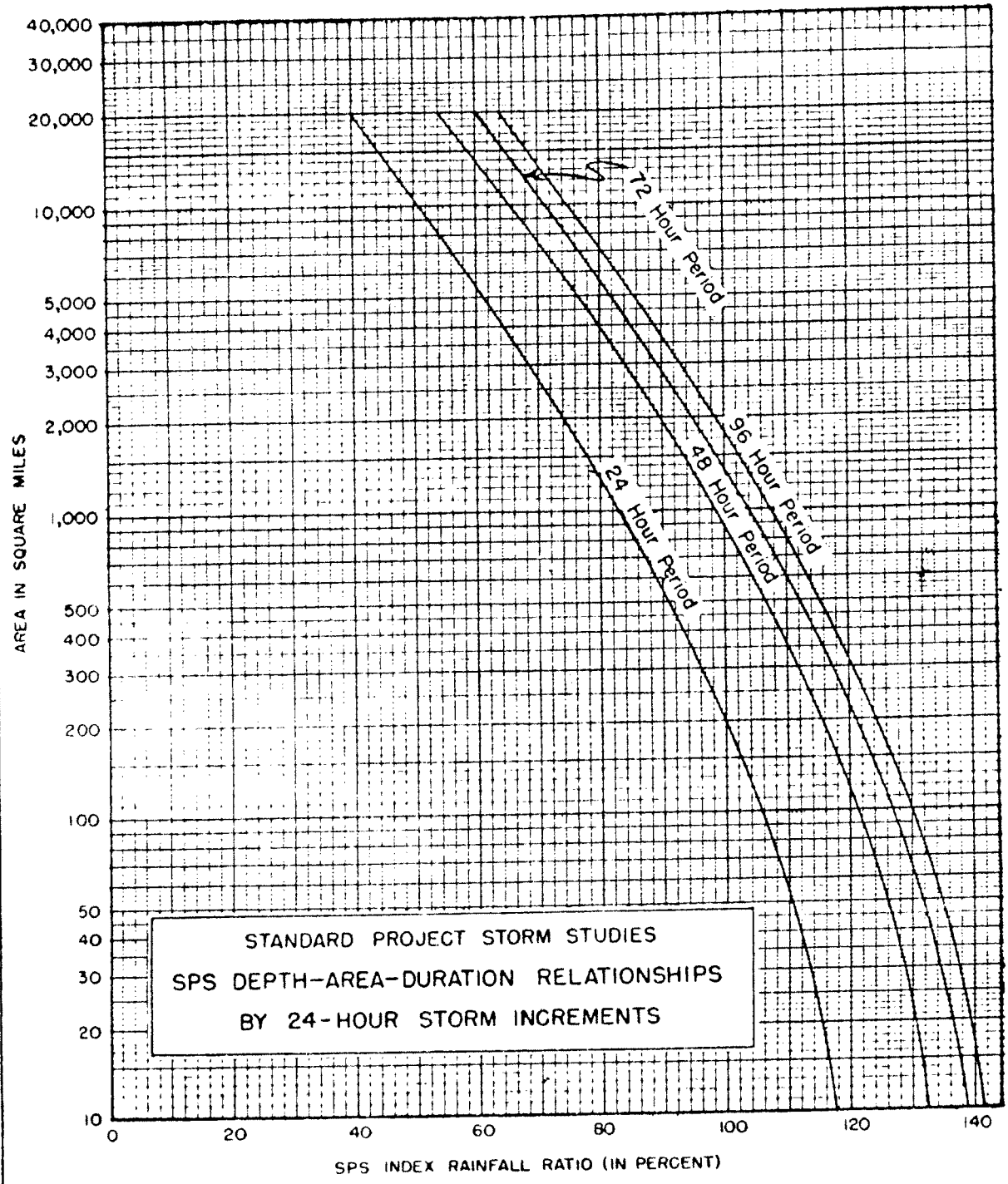
(b) Plate 9 of reference A.9 (given here as Figure A.11) is used to convert the index rainfall to 24-, 48-, 72-, and 96-hour accumulated depths adjusted for the actual drainage area. The four values taken from the curves in the figure are each multiplied by the index to arrive at the accumulated rainfall values for each duration.

(c) These values are divided into total rain for each 24-hour period and ranked in the sequence 4, 2, 1, 3, with 1 being the highest 24-hour total. The percentage of the total 96-hour storm which each 24-hour period represents is then computed. The SPS criteria are developed using the symmetrical oval-shaped isohyetal pattern shown in Figure A.12 (Plate 12 of reference A.9). The rainfall values computed thus far are for a drainage basin that the symetrical pattern matches perfectly. The fit will always be imperfect in the real world, however, so an adjustment will be required for actual basin shape. That is done by overlaying the storm pattern on the basin, using a planimeter to compute total storm volume, and from this determining the maximum depth that could occur from the most severe arrangement of the pattern. The storm pattern may require several centerings to determine the maximum depth. Unless the drainage area is extremely small, the maximum 96-hour depth will be less than the 96-hour depth already determined. This maximum value of the 96-hour depth is then multiplied by the 24-hour percentages discussed at the start of this subparagraph. The result is the 24-hour SPS rainfall totals adjusted for the shape of the study basin.

(d) Division into Increments and Arrangement of Storm. Each 24-hour period is next subdivided into four 6-hour periods using the criteria in Figure A.13 (Plate 10 of reference A.9). Division into smaller increments uses a simple average of the rainfall in each 6-hour interval, except for the peak 6-hour period of the entire storm. Further breakdown of the peak 6-hour period to one-hour periods is made using the guidelines given in Figure A.14 (Plate 11 of reference A.9). It should be noted that the 1-hour percentages based on this time distribution have occasionally been found to give rainfall values that are not sufficiently conservative, particularly in the Southwestern Division of the Corps of Engineers (SWD). The percentages developed by the SWD for the 1-hour breakdown of the SPS have been added to Figure A.14.

DEPARTMENT OF THE ARMY

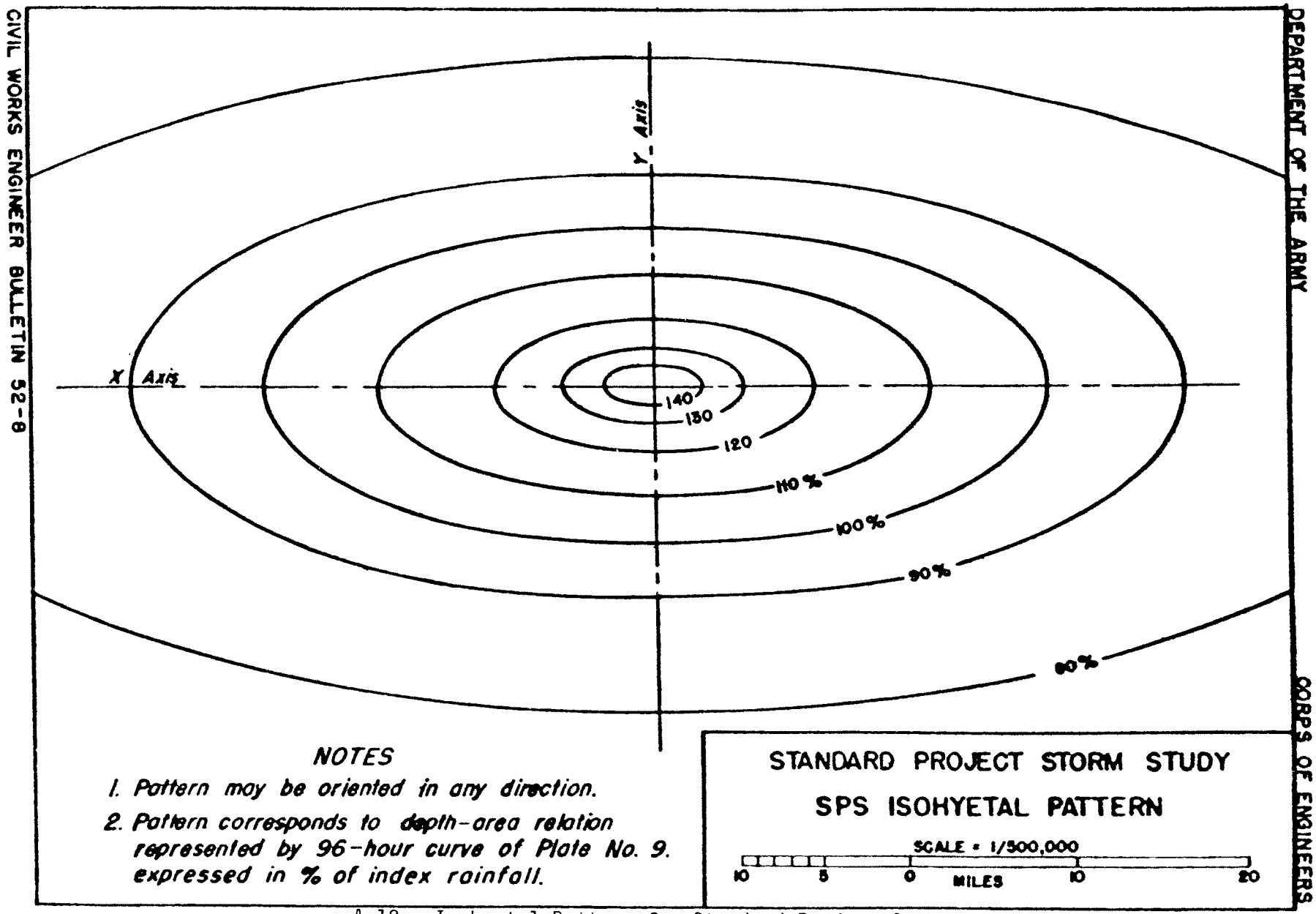
CORPS OF ENGINEERS



A.11. Adjustment of Standard Project Storm Rainfall for Watershed Area

OCE 10/5/51

CIVIL WORKS ENGINEER BULLETIN 52-8



A.12. Isohyetal Pattern for Standard Project Storms

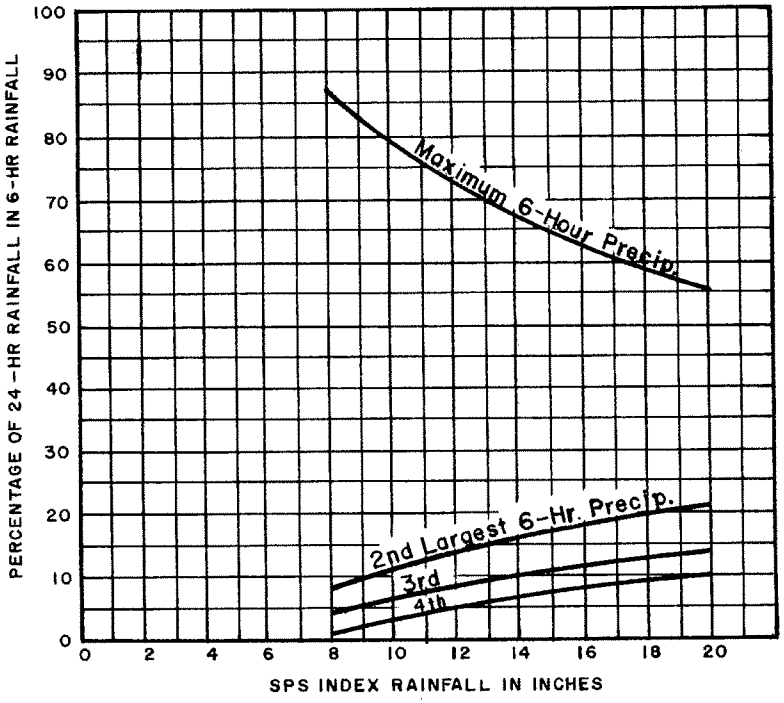


FIG.(a) SPS 24-HOUR PRECIPITATION OVER 200 SQ. MI. VS. PERCENT IN 6-HOUR PERIODS

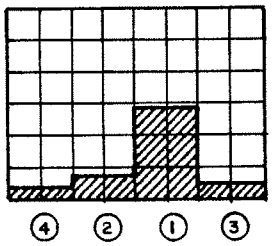


FIG.(b). TYPICAL ARRANGEMENT OF 6-HOUR RAINFALL QUANTITIES IN SPS

INDEX RAINFALL IN INCHES	PERCENTAGE OF 24-HOUR SPS RAINFALL IN DESIGNATED 6-HR PERIOD			
	④	②	①	③
1	2	3	4	5
8	1.0	8.0	87.0	4.0
9	2.1	9.5	83.0	5.4
10	3.2	11.0	79.2	6.6
11	4.3	12.3	75.9	7.5
12	5.3	13.8	72.5	8.4
13	6.1	14.9	69.6	9.4
14	7.0	16.0	66.9	10.1
15	7.6	17.0	64.5	10.9
16	8.1	17.9	62.4	11.6
17	8.8	18.9	60.3	12.0
18	9.1	19.7	58.5	12.7
19	9.8	20.3	56.8	13.1
20	10.1	21.0	56.1	13.8

FIG.(c). TABULATION OF DATA FROM FIG. (a)

A.13. Distribution of Standard Project Storm Rainfall in Time (6-hr Periods)

STANDARD PROJECT STORM STUDIES
GENERALIZED ESTIMATES

TIME DISTRIBUTION
OF 24-HOUR SPS RAINFALL

TIME DISTRIBUTION OF MAXIMUM 6-HOUR SPS RAINFALL

Rainfall Period (Sub-Division of 6-Hour Period)	Time Distribution of Maximum 6-Hour SPS Rainfall, Expressed in Percent of Total 6-Hour Rainfall *Selected Unit Rainfall Duration, t_R				
	6-Hours	3-Hours	2-Hours	1-Hour	1-Hour (SWD)
#1	#2	#3	#4	#5	
1st	100	33	26	10	4
2nd		67	53	12	8
3rd			21	15	19
4th				38	50
5th				14	11
6th				11	8
TOTAL	100	100	100	100	100

*NOTE: The "selected unit rainfall duration," t_R is determined approximately from the synthetic unit hydrograph equation, $t_r = \frac{t_p}{5.5}$ in which "t_p" is the lag time from midpoint of unit rainfall duration, t_r, to peak of unit hydrograph, in hours, (See page 11, Engineering Manual for Civil Works, Part CXIV - Hydrologic and Hydraulic Analyses, Chapter 5 - Flood-Hydrograph Analyses and Computations). The following rounded-off values are to be used in the above table:

If t_p exceeds 16, use $t_R = 6$

If t_p is between 12 and 16, use $t_R = 3$

If t_p is between 6 and 12, use $t_R = 2$

If t_p is between 4 and 6, use $t_R = 1$

A.14. Hourly Distribution of SPS Rainfall in Maximum Six-Hour Period

Rev 3-3-65

Intervals of less than one hour are sometimes needed for SPS subdivision. Table A.4 gives a breakdown for various subdivisions of an hour based on a reapplication of the percentages taken from Figure A.13. Since no official guidance is available for rainfall periods of less than one hour, procedures throughout the country vary with local usage.

TABLE A.4
SUBDIVISION OF MAXIMUM 1-HOUR SPS RAINFALL*

	1-Hour	30-Min	20-Min	10-Min	5-Min
1st	100	33	26	10	5
2nd		67	53	12	5
3rd			12	15	6
4th				38	7
5th				14	7
6th				11	12
7th					26
8th					8
9th					7
10th					6
11th					6
12th					5

* Derived by extrapolation of peak interval percentages to increments of less than 1 hour

(e) Example: Standard Project Storm Derivation.

SPS Derivation for Crab Orchard Creek, Illinois
Drainage Area = 289 Sq. Mi.
Computational time increment = 1 hr.

(1) SPS index rainfall taken from Figure A.10 is 13.3 in.
(Plate 2 of reference A.9)

(2) Using the SPS ratios from Figure A.9 (Plate 9 of reference A.9) gives:

24 hr rainfall = 96% x 13.3 = 12.77 in.
48 hr rainfall = 112% x 13.3 = 14.90 in.
72 hr rainfall = 117% x 13.3 = 15.63 in.
96 hr rainfall = 121% x 13.3 = 16.09 in.

(3) Increment, arrange, and compute percent of total

Period	0-24 hr	24-48 hr	48-72 hr	72-96 hr
Accumulated Rain (in.)	12.77	14.90	15.63	16.09
Incremental Rain (in.)	12.77	2.13	0.73	0.46
Arranged Rain (in.)	0.46	2.13	12.77	0.73
Percent of Total	2.86	13.24	79.36	4.54

(4) Analyze alternative storm centerings for the storm pattern (Figure A-12), and determine the maximum depth over the basin

The maximum depth for this drainage area shape is 15.80 in.

(5) Apply 24-hour ratios to new depth

Period	0-24 hr	24-48 hr	48-72 hr	72-96 hr
Percent of Total	2.86	13.24	79.36	4.54
Adj. depths	0.45 in.	2.09 in.	12.54 in.	0.72 in.

(6) Using Figure A.13 (Plate 10 of reference A.9), break up the storm into 6-hour intervals.

For SPS index rainfall of 13.3 in., 24-hour rainfall distribution is:

Period	Percent of 96 hr Total	Rainfall Distribution (in.) Day 1	Day 2	Day 3	Day 4
0-6 hr.	6.4	0.03	0.13	0.80	0.05
6-12 hr.	15.3	0.07	0.32	1.92	0.11
12-18 hr.	68.7	0.31	1.44	8.62	0.49
18-24 hr.	9.6	0.04	0.20	1.20	0.07

(7) Break up the maximum 6-hour period into hourly periods to complete SPS derivation, using the guidelines in Figure A.14 (Plate 11 of reference A.9). One-hour percentages of the peak 6-hour rainfall are: 10%, 12%, 15%, 38%, 14%, and 11%; the resulting distribution of hourly rainfall is shown in Table A.5.

TABLE A.5

FINAL 1-HOUR SPS RAINFALL DISTRIBUTION

Period (hr)	Hourly Rainfall (in.)
0-6	.03/6
6-12	.07/6
12-24	.31/6
18-24	.04/6
24-30	.13/6
30-36	.32/6
36-42	1.44/6
42-48	.20/6
48-54	.80/6
54-60	1.92/6
61	.86
62	1.03
63	1.29
64	3.28
65	1.21
66	.95
66-72	1.20/6
72-78	.05/6
78-84	.11/6
84-90	.49/6
90-96	.07/6

A.6 Probable Maximum Storm

The Probable Maximum Storm (PMS) is defined as the most severe combination of meteorological occurrences considered reasonably possible in a particular region. It is felt to be an upper limit of flood-producing rainfall (or snowpack melting when applicable) and is used as a design storm where virtually no risk of flooding can be tolerated. The PMS has historically been used in dam design to ensure the adequacy of spillways and top-of-dam elevations for high dams.

As with the hypothetical frequency storms, one set of generalized criteria is applied to the majority of the U.S., and a variety of regional criteria, accounting primarily for orographic effects, to the balance. Details for constructing a PMS for a particular region are given in the various Hydrometeorological Reports and Technical Papers listed in the references. The reports, HR-51 and HR-52, for the United States east of the 105th meridian, apply to most of the country and are discussed further here.

The mechanics of storm breakdown and arrangement presented in these reports are similar to methods for the western United States presented in other publications.

PMS for the Eastern and Central United States. The steps for deriving a PMS, using Probable Maximum Precipitation data from HR-51 (reference A.16) and data for the determination of shape, orientation, and distribution from HR-52 (referrence A.16a), are as follows:

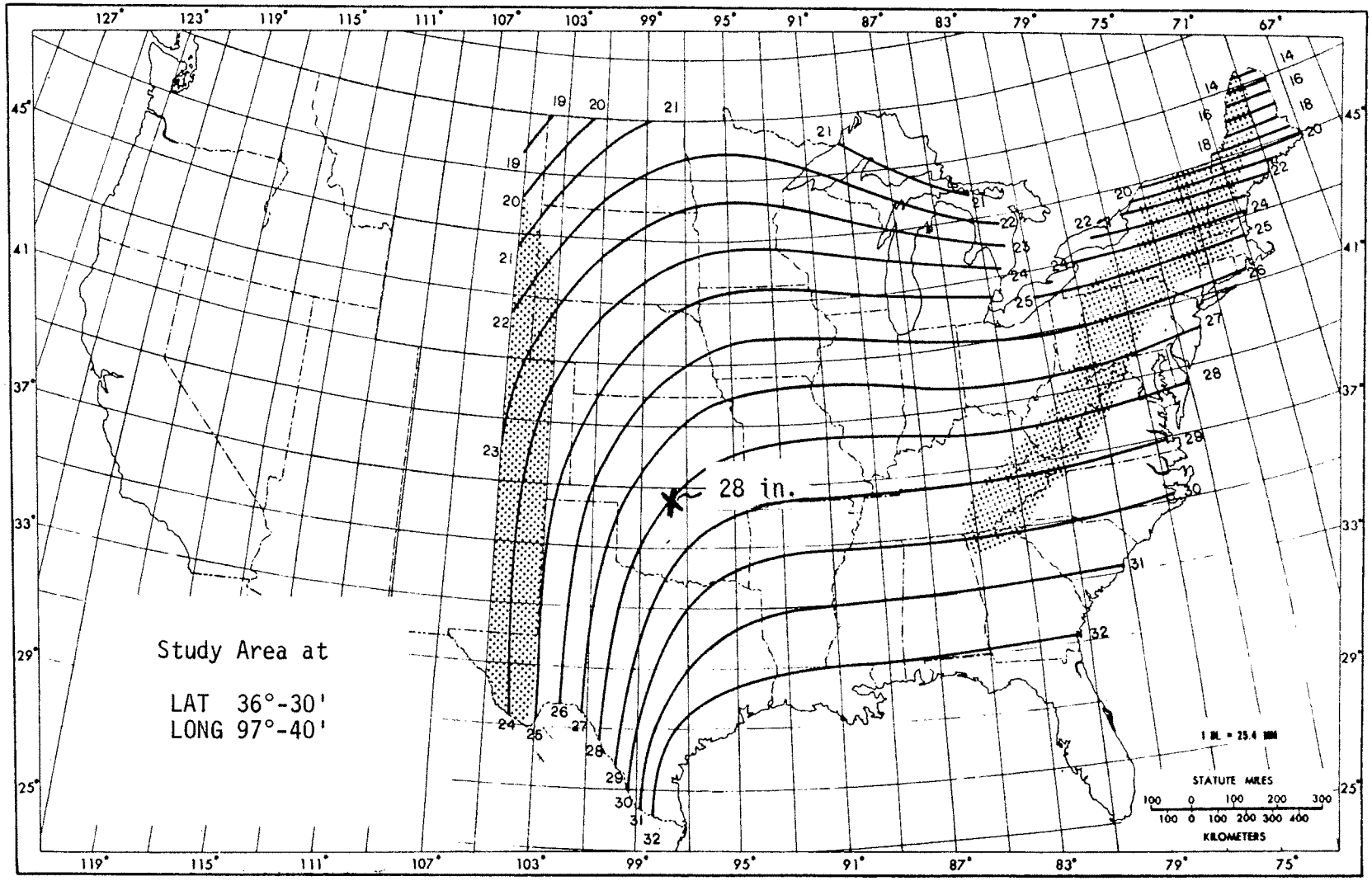
(a) Determine isohyetal Probable Maximum Precipitation (PMP) values for the study area for desired drainage area sizes (10, 100, 200, 1,000, 5,000, 10,000, 20,000 square miles) and for corresponding storm durations (6-, 12-, 24-, 48-, and 72-hours) using the appropriate plates from the report. For example, Figure A.15 shows how the 6-hour value is determined.

(b) Plot a family of duration curves (6-, 12-, 24-, 48-, and 72-hours) for PMP intensities versus drainage area size on semi-logarithmic paper, as shown in Figure A.16.

(c) Interpolate for the desired storm area, determine PMP intensities for each duration and plot on ordinary graph paper (Figure A.17).

(d) Determine rainfall in each 6-hour time interval by interpolation, then increment the rainfall by successive subtractions. The PMP will be the maximum value for the selected storm area only; areas greater or less than the selected storm area will show smaller values of PMP. Considerable trial and error computations will normally be required to determine the storm area which maximizes average precipitation in the study watershed.

(e) The "Hop Brook adjustment" has often been applied to PMP values in Corps studies for the Eastern and Central United States. It attempts to adjust for the reduced probability of a Probable Maximum Storm occurring directly over a small watershed. The smaller the watershed, the less is the likelihood of such a large storm occurring directly over it. Factors for reduction of PMP intensities for various drainage areas are shown on Table A.6, taken from reference (A.19).



(Source: National Weather Service)

All-season PMP (in.) for 6 hr 10 mi^2 (26 km^2).

A.15. Example of Probable Maximum Precipitation Intensities

TABLE A.6
HOP BROOK ADJUSTMENT FACTORS*

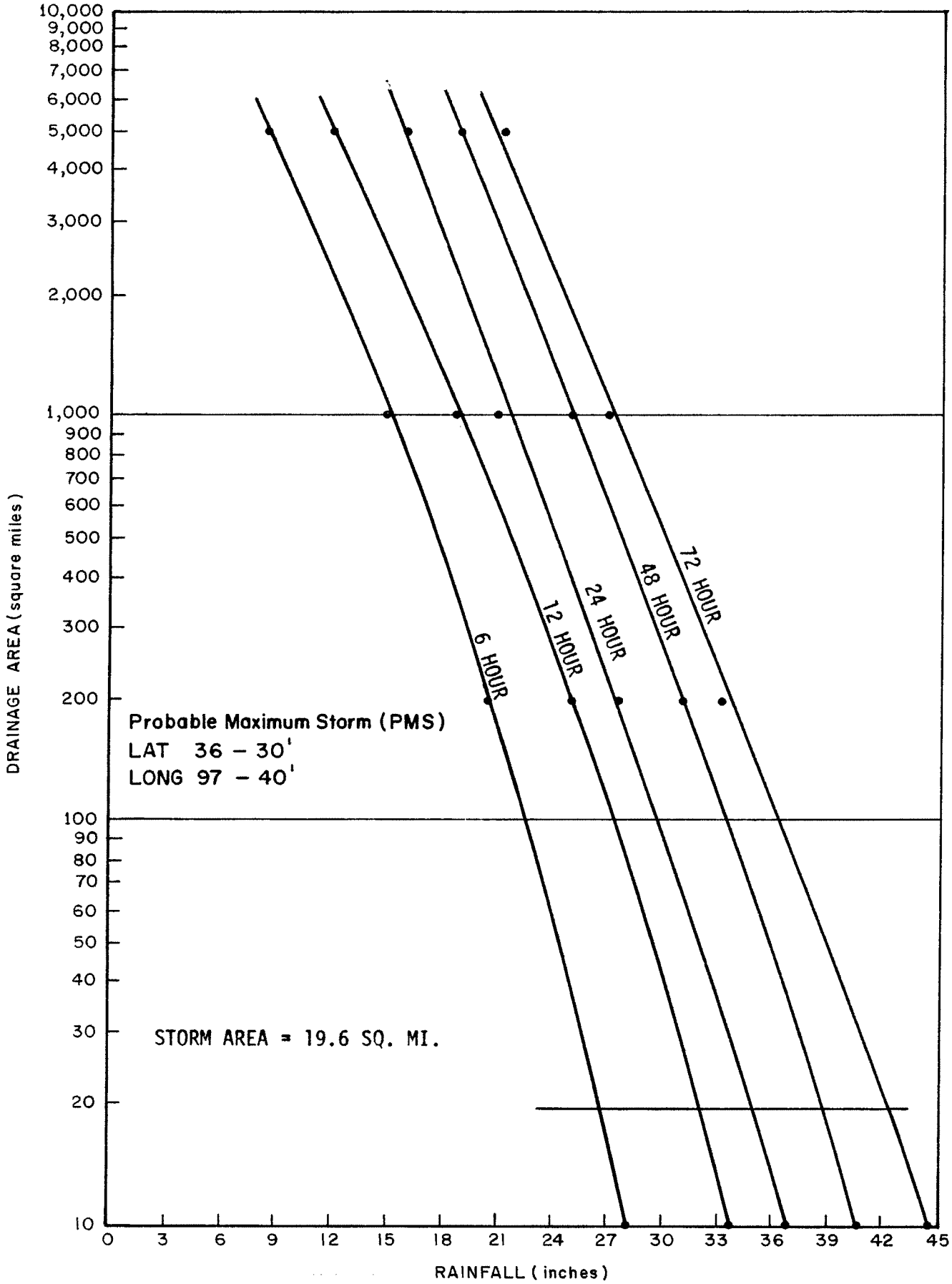
Drainage Area (sq mi)	Adjustment Factor
1000	.9
500	.9
200	.89
100	.87
50	.85
10	.80
1	.80

*Note: Not all Corps of Engineer districts apply this adjustment factor.

(f) Studies for HR-52 have found that major storms have a dominant orientation, which may or may not be similar to the general orientation of the watershed. The PMP will often be reduced, depending on the drainage area size and the angle between the storm and watershed orientation. No reduction is taken for orientation differences less than $\pm 40.°$, regardless of area, or for drainage areas less than 300 square miles, regardless of orientation. Maximum PMP reduction due to orientation is 15 percent.

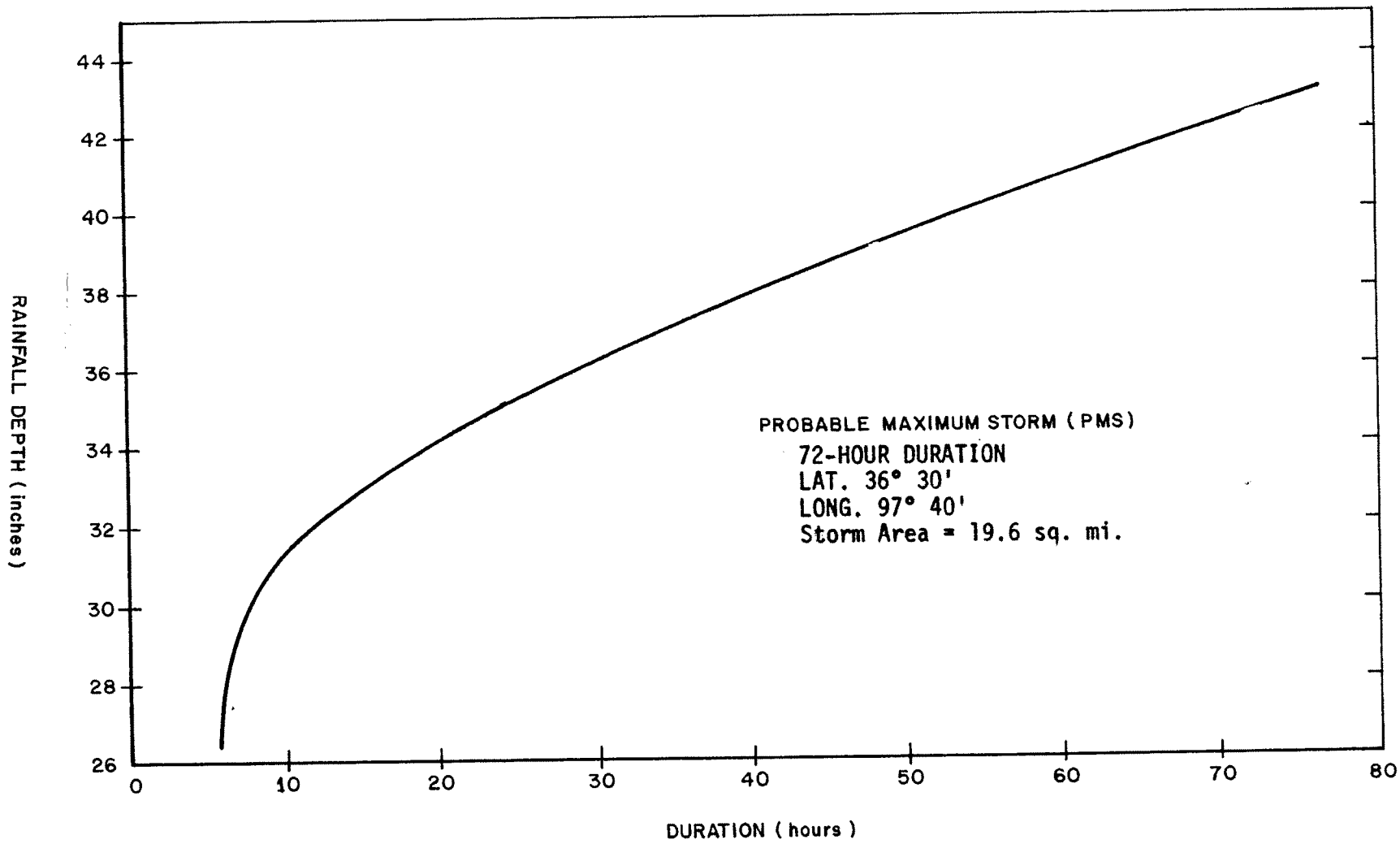
(g) Storm shape is given by criteria in HR-52, with the PMS having a general elliptical isohyetal pattern with a ratio between major and minor axes ranging from two to five. Areas less than 300 square miles may use a circular shape, if desired. The adopted ratio of the axes will be that which gives the most hydrologically-severe storm (one which maximizes volume) within the study watershed. This usually requires significant trial and error work.

(h) With the maximized storm pattern established, the spatial variability of the precipitation is determined, again by HR-52, through figures and nomographs. Spatial variability is greatest for the maximum six-hour period, diminishes for the second and third greatest six-hour periods, and has no variability for the remaining six-hour periods. Precipitation profiles are given in HR-52 to develop the spatial variation in the peak 18 hours of the PMS.



DEPTH-AREA-DURATION CURVES

A.16. Depth-Area-Duration Curves for Example Probable Maximum Storm



DEPTH-DURATION RELATIONSHIP

A.17. Rainfall Depth vs Duration for Probable Maximum Storm

(i) Final development of the PMS calls for a temporal arrangement to give the most critical hydrologic response (maximum runoff). The six-hour values of the PMS are arranged such that they decrease progressively to either side of the greatest six-hour value. The four greatest six-hour increments arre placed at any position in the sequence except during the first 24 hours. No guidance is yet available to develop PMS increments of less than six-hours. The application of SPS criteria may be appropriate for the greatest six-hour PMS increment, with each of the other six-hour PMS increments being averaged.

Only the general outline of PMS development has been given in this appendix. The engineer should refer to HR-51 and HR-52 for detailed guidance in determination of the PMS.

A.7 Supplemental Information

Additional material to consider in deriving these storm data which is also applicable to hypothetical storm calculation include:

Extrapolation of Frequency Data. The Technical Papers of the NWS indicate that a limited extrapolation (to 200-year return periods) is appropriate based on the available generalized data. However, extrapolation to a 500-year return period, as is often required for the hydrology necessary in flood-insurance studies, is of questionable validity. Rainfall for the extrapolated 500-year event may be only 20 to 30% greater than the 100-year total, but significantly less than the SPS for the same storm duration. While an SPS cannot be assigned a specific frequency of exceedance, it is likely that it is of the same order of magnitude as a 500-year event. An evaluation of the 500-year rainfall should include an examination of the SPS rainfall to assist in development of appropriate estimates of the 500-year event. An adjustment of an extrapolated 500-year rainfall total may be necessary to ensure reasonable compatibility with the SPS.

Urbanization effects. Meteorological studies have shown an increase in the number and intensity of thunderstorm rainfall events for watersheds downwind from major urban areas (population greater than one million). Studies of downwind rainfall for Chicago, St. Louis, Detroit, Washington,

Houston, New Orleans, and Cleveland have shown an increase in warm-season rainfall ranging from 10% at New Orleans, to 25% at Chicago for areas up to 30 miles downwind from the city. A study of St. Louis weather patterns (reference A.19) found that the number of heavy rainstorms has increased dramatically since 1960, with 5-minute rainfall rates increased by at least 50% over large downwind areas. While there is currently no direct way of incorporating urbanization effects into rainfall estimates, the existance of this increase should be recognized where the study watershed falls within the sphere of urban influence. Measured rainfall data could be used to supplement the generalized data which, along with conservative selection of loss rates, could account for some of the urbanization effects on rainfall. Sensitivity tests using increased rainfall amounts could be performed to evaluate this approach.

Hypothetical storm calculation within HEC-1. Once the individual is familiar with the derivation of hypothetical storms, the potential exists to perform many of the calculations with HEC-1. The current version of the computer program can develop the SPS and PMS for areas east of the 105th meridian, with the user-supplied point rainfall index and shape factor. The latest version of HEC-1 incorporates procedures for the development of annual-series hypothetical-frequency storms for the user-supplied point rainfall depth-duration array. Adjustments for depth, area, and annual series are made automatically, incremental depths are determined, and the entire storm pattern is arranged within the program.

A.8 References

(A.1) Technical Memorandum NWS HYDRO-35, "Five to 60 Minute Precipitation Frequency for the Eastern and Central U.S.," 1977.

(A.2) NWS TP 40, "Rainfall Frequency Atlas of the United States, 30-minute to 24-hour Durations, 1 to 100 Year Return Periods," 1961.

(A.3) NWS TP 49, "Two to Ten Day Precipitation for Return Periods of 2 to 100 Years in the Contiguous United States," 1964.

(A.4) NOAA Atlas 2, "Precipitation Frequency Atlas of the Western United States," Volumes 1-13, 1973.

(A.5) NWS TP 43, "Rainfall Frequency Atlas for the Hawaiian Islands, Durations to 24 Hours, Return Periods to 100 Years," 1962.

(A.6) NSW TP 51, "Two to Ten Day Rainfall for Return Periods of 2 to 100 Years in the Hawaiian Islands," 1965.

(A.7) NWS TP 47, "Probable Maximum Precipitation and Rainfall Frequency Data for Alaska, Durations to 24 Hours, Return Periods to 100 years," 1963.

(A.8) NWS TP 52, "Two To Ten Day Precipitation for Return Periods of 2 to 100 Years in Alaska," 1965.

(A.9) EM 1110-2-1411 (Formerly EB 52-8), "Standard Project Flood Determination," revised March 1965. SPS procedures for the eastern and central U.S. east of 105° longitude and for basins less than 1000 square miles.

(A.10) HR 33 "Seasonal Variation of Probable Maximum Precipitation (PMP), East of the 105th Meridian for Areas 10 to 1000 Square Miles and Durations of 6 to 48 hours," 1956. Applies to areas east of the Rockies.

(A.11) HR 36, "Interim Report on Probable Maximum Precipitation in California," (1961). For drainage areas less than 5000 square miles.

(A.12) TP 38, "Generalized Estimates of PMP for the U.S. West of the 105th Meridian for Areas Less Than 400 Square Miles and Durations to 24 Hours," 1960.

(A.13) HR 39, "Probable Maximum Precipitation in the Hawiian Islands," May 1963.

(A.14) HR 43, "Probable Maximum Precipitation, Northwest States," June 1965. Estimates of PMP for durations of 1 to 72 hours for basins from 10 to 5,000 square miles west of the Cascade Divide and 10 to 1000 square miles east of the divide in the Columbia River Basin.

(A.15) HR 49, "PMP Estimates, Colorado and Great Basin." Covers areas of California, Nevada, Utah, Arizona, Wyoming, Colorado and New Mexico for durations of 15 minutes to 6 hours and areas from 1 to 500 square miles.

(A.16) HR 51, "Probable Maximum Precipitation Estimates, United States East of 105th Meridian," 1974.

(A.16a) HR 52, "Application of Probable Maximum Precipitation Estimates - United States East of the 105th Meridian," 1981.

(A.17) EC 1110-2-163 (Draft Engineering Manual), "Spillway and Freeboard Requirements for Dams, Appendix C, Hydrometeorological Criteria and Hyetograph Estimates," U.S. Army Corps of Engineers, August 1975.

(A.18) EM 1110-2-1406, "Runoff from Snowmelt," U.S. Army Corps of Engineers, 1960.

(A.19) Changnon, S. A., "Rainfall Changes in Summer Caused by St. Louis," Science, Vol. 205, 27 July 1979, pp. 402-404.

This page is intentionally left blank to facilitate 2-sided printing.

APPENDIX B:
STREAM GAUGE DATA ANALYSIS FOR THE COUNTY OF SAN DIEGO RAINFALL DISTRIBUTION STUDY PROJECT

CIP No. 1140600

Prepared by R. Edward Beighley, Ph.D., Adjunct Professor in Civil, Construction and Environmental Engineering at San Diego State University - In collaboration with Bureau Veritas North America, Inc.

Prepared For:

County of San Diego, Watershed Protection Program
Department of Public Works
5510 Overland Avenue, Suite 410
San Diego, CA 92123

January 15th, 2013
Revised March 1st, 2013

Prepared By:

Bureau Veritas North America, Inc.
10620 Treena Street, Suite 200
San Diego, CA 92131
(858) 451-6100

This page is intentionally left blank to facilitate 2-sided printing.

Engineer's Certification

This report was prepared under the supervision of Sharon L. Humphreys, a Registered Civil Engineer in the State of California. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

Sharon L. Humphreys, PE, CFM, QSD/QSP
R.C.E. Number 60946



This page is intentionally left blank to facilitate 2-sided printing.

TABLE OF CONTENTS

1. PROJECT INTRODUCTION 1

2. ESTIMATING PEAK DISCHARGES FOR 2-, 5-, 10- AND 100-YR FLOOD EVENTS 3

3. ASSESSMENT OF VARIATIONS IN INSTANTANEOUS ANNUAL PEAK DISCHARGES OVER TIME 10

3.1 Urbanization Trends 10

3.2 Short- vs. Long-Term Climate Trends 11

4. DEVELOPMENT OF EVENT-BASED RAINFALL DISTRIBUTION CURVES FOR PAST MAJOR STORMS 14

5. COMPARISON OF EVENT-BASED RAINFALL DISTRIBUTION CURVES TO DESIGN STORMS 19

6. CONCLUSIONS 25

7. REFERENCES 27

8. APPENDICES 28

LIST OF TABLES

Table 1: Summary Statistics for Study Streamflow Gauges; Water Year, WY, is Defined as October 1, (WY - 1) through September 30, WY; where Elevation is Mean Watershed Elevation Based on 30-m Version of the USGS's National Elevation Dataset (NED). 2

Table 2: Summary Statistics for Study Rainfall Gauges. 2

Table 3: Flood Frequency Distributions for Study Sites Based on Weighted Skew (G_w), from PeakFq v5.2 with 95% Upper and Lower Confidence Limits and Corresponding Station (G) and Regional ($\overline{G}$) Skews; USGS Flood Frequency Distributions for Three Station Based on Data Through 2006 (http://water.usgs.gov/osw/streamstats/california.html; Parrett, 2011). 8

Table 4: Summary of the Kendall Tau Test Results for each Study Watershed. 11

Table 5: Period of Record (in Water Years) for each Study Gauge. 12

Table 6: Comparison Between FFDs for Water Years 1984-2009 and Corresponding Full Period of Records for Two Gauges with the Longest Periods of Record (11015000 and 11028500); Note Results Based on Using only Station Skew for the Period of Record in Question. 12

Table 7: Summary of 15-min Streamflow Data Availability. 15

Table 8: Summary of 5 Largest Flood Events for each Gauge, with the Date and Time of the Peak Discharge, Reported Peak Discharge and the Approximated Return Period of the Selected Event. 15

Table 9: Reference Times with Percentage of the Total Rainfall Occurring During and Prior to the Maximum 6-hour Period. 21

Table 10: Percentage of Total Rainfall Occurring During the 6-hour Maximum Rainfall Periods for all the Selected Events. 21

Table 11: Percentage of Total Rainfall Occurring Prior to the 6-hour Maximum Rainfall Periods for all the Selected Events. 21

Table 12: Summary Statistics for Errors (in Percentage Points) between Observed Patterns and the Selected Design Storms for the Total Rainfall Occurring before and during the 6-hour Maximum Rainfall Periods for all the Selected Events. 22

LIST FIGURES

Figure 1: Study Watersheds with Rainfall Gauge Locations..... 3

Figure 2: Instantaneous Annual Peak Discharges for Each Water Year for the Six USGS Streamflow Gauges with Linear Regression Lines that Indicate only a Minimal Fraction of the Variability (0.26% to 0.01%) in the Discharge Series is Explained by Water Year. 4

Figure 3: Flood Frequency Distributions with Upper and Lower 95% Confidence Limits Based on the USGS's PeakFq v 5.2 Program Using Weighted Skew (See **Tables 1 and 2** for data).. 9

Figure 4: Comparison Between FFDs for Water Years 1984-2009 and Corresponding Full Period of Records for Two Gauges with the Longest Periods of Record (11015000 and 11028500); Note Results Based on Using only Station Skew for the Period of Record in Question. 13

Figure 5: Typical Storm Event Processing Results Showing Measured Cumulative Rainfall (P) and 15-min Discharges (Q) and the Three Fitted Rainfall Distributions (Nested, Type B, NRCS Type I); Incremental Rainfall Values (Not Shown Here) are Provided in Appendix B.2. 18

Figure 6: Three Rainfall Distributions Selected for this Study: Type B, Nested and NRCS Type I..... 20

Figure 7: Comparison Between all Individual Event Rainfall Distributions for Each Study Watershed and the Selected Design Storms (Nested, Type B and NRCS Type I) Where Time Zero Corresponds to the Start of the Maximum 6-hr Rainfall Period. 23

Figure 8: Comparison between Individual Event Rainfall Distributions and the Selected Design Storms (Nested, Type B, NRCS Type I) for each Study Watershed (See **Appendix B.2** for data). 24

ABBREVIATIONS AND ACRONYMS

CN	Curve Number
DSCC1	Descanso RS (Rain Gauge Station)
DULC1	Dulzura Summit (Rain Gauge Station)
FFD	Flood Frequency Distributions
FLYC1	Flinn Springs Co. Park (Rain Gauge Station)
NRCS	Natural Resources Conservation Service
OCNC1	Oceanside Pumping Plant (Rain Gauge Station)
RMNC1	Ramona (Rain Gauge Station)
SDCFCD	San Diego County Flood Control District

SCS	Soil Conservation service
USGS	United States Geological Survey
WHLC1	Lake Wohlford (Rain Gauge Station)
WY	Water Year

LIST OF APPENDICES

B.1	Settings, Input and Output for PeakFq Ver. 5.2 Including Complete Listing of Instantaneous Annual Peak Discharges for the Six USGS Streamflow Gauges
B.2	Rainfall Data for All 5 Events from All 6 Gauges Where the Time Window Used to Extract the Measured Data was 18 Hours Before and 12 hours After the Time of the Selected Instantaneous Annual Peak Discharge
B.3	15-Minute Discharge Data for All 5 Events from All 6 Gauges Where the Time Window Used to Extract the Measured Data was 18 Hours Before and 12 hours After the Time of the Selected Instantaneous Annual Peak Discharge
B.4	Storm Event Processing Results Showing Measured Cumulative Rainfall (P) and 15-min Discharges (Q) and the Three Fitted Rainfall Distributions (Nested, Type B, NRCS Type I) for all 5 Events from all 6 Gauges Where the Time Window Used to Extract the Measured Data was 18 Hours Before and 12 Hours After the Time of the Selected Instantaneous Annual Peak Discharge
B.5	Storm Event Processing Results Showing Measured Cumulative Rainfall (P) and 15-min Discharges (Q) and the Three Fitted Rainfall Distributions (Nested, Type B, NRCS Type I) for all 5 Events from all 6 Gauges Where the Time Window Used to Extract the Measured Data was 16 Hours Before and 8 Hours After the Time of the Selected Instantaneous Annual Peak Discharge
B.6	Cumulative Rainfall Distributions for the Three Events Used in this Study (Nested, Type B, NRCS Type I)
B.7	County of San Diego Stream Gauge Data

1. PROJECT INTRODUCTION

The County of San Diego has retained the services of Bureau Veritas North America, Inc. (BVNA) to perform an analysis of the region's current Nested rainfall distribution methodology. Tasks performed by BVNA within the scope of this analysis included research of existing rainfall distribution methodologies used in the southwestern United States (Appendix A), processing of available United States Geological Survey (USGS) stream gauge data for six (6) basins within the County of San Diego (Appendix B), and creation of HEC-HMS models considering SCS Type B, SCS Type 1, and Nested rainfall distributions for the same six (6) basins in which stream gauge data was analyzed (Appendix C). A comparison of the results from Appendices B and C was then performed in order to determine the relationship between the available USGS peak stormwater flow rates and the peak stormwater flow rates determined by the HEC-HMS models for SCS Type B, SCS Type 1, and Nested rainfall distributions.

This portion of the report, Appendix B, describes the methods and results used to collect, verify and process USGS stream gauge data. For this study, six (6) USGS stream gauges and six (6) San Diego County Flood Control District (SDCFCD) rainfall gauges were selected after reviewing all stream gauges within the County of San Diego for applicability to this study. A list of all available stream gauges within the County of San Diego reviewed is provided in the table in Appendix B.7 along with the reason certain stream gauges were not selected for this study. Stream gauges were eliminated from further consideration in this study based on whether the area contained a major reservoir, minor detention, was located out of the County, or contained poor data. Additionally, stream gauges must have over 20 years of records to derive a reasonable and reliable 100-yr storm event estimate. Every effort was made to include the smallest watersheds in the County; however, USGS does not usually gauge smaller watersheds.

Tables 1 and 2 provide summary statistics for each selected gauge site and corresponding time series data. **Figure 1** shows the location of each site. This report provides details on estimated peak discharges for 2-year, 5--year, 10-year and 100-year storm events developed for each stream gauge location including the assessment of variations in the measured annual peak discharges over time due to urbanization and short-term and long-term climate trends. For each study watershed, event rainfall distributions for past major storms are presented and compared to event rainfall distribution curves using representative design storms such as the Nested design storm currently recommended in the 2003 version of the San Diego Country Hydrology Manual as well as the previously recommended Type B distribution and the Type I distribution recommended by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) formerly known as the Soil Conservation Service (SCS). A detailed discussion on the comparison of the measured and design rainfall distributions is provided herein.

Table 1: Summary Statistics for Study Streamflow Gauges; Water Year, WY, is Defined as October 1, (WY - 1) through September 30, WY; where Elevation is Mean Watershed Elevation Based on 30-m Version of the USGS's National Elevation Dataset (NED).

USGS ID	Streamflow Station Name	River Basin	Area (sq mi)	Elevation (ft)	Start WY	End WY	No. WYs
11014000	Jamul Creek near Jamul, CA	Otay River	70.1	1600	1940	2009	62
11015000	Sweetwater River near Descanso, CA	Sweetwater River	45.4	4300	1906	2009	75
11022200	Los Coches Creek near Lakeside, CA	San Diego River	12.2	1100	1984	2009	26
11027000	Guejito Creek near San Pasqual, CA	San Dieguito River	22.5	2100	1947	2009	40
11028500	Santa Maria Creek near Ramona, CA	San Dieguito River	57.6	1800	1914	2009	70
11046100	Las Flores Creek near Oceanside, CA	Las Flores Creek	26.6	600	1952	2009	42

Table 2: Summary Statistics for Study Rainfall Gauges.

SDCFCD ID	Alert ID	Rainfall Station Name	Watershed Match for USGS ID	Elev. (ft)	Period of Record for Rainfall Data *
DULC1	48	Dulzura Summit	11014000	1512	1968 - Current
DSCC1	55	Descanso RS	11015000	3650	1948 - Current
FLYC1	45	Flinn Springs Co. Park	11022200	880	1963 - Current
WHLC1	37	Lake Wohlford	11027000	1490	1948 - Current
RMNC1	41	Ramona	11028500	1420	1963 - Current
OCNC1	67	Oceanside Pumping Plant	11046100	41	1951 - Current

* Rainfall period of records not continuous; missing data throughout listed period.

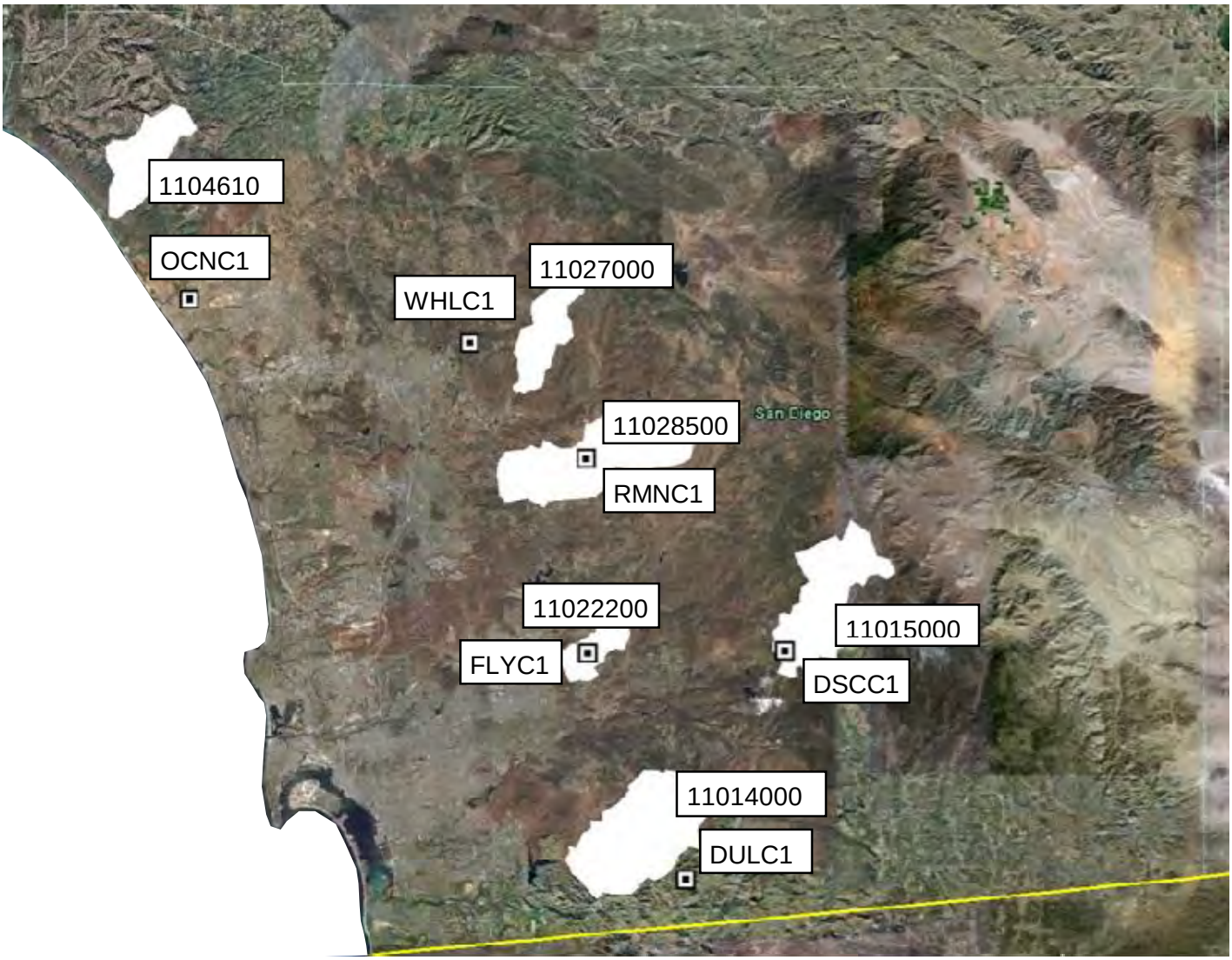


Figure 1: Study Watersheds with Rainfall Gauge Locations
(See **Tables 1 and 2** for Site Data).

Specifically, this report describes how the instantaneous annual maximum discharge series for each of the USGS streamflow study sites are used to estimate the 2-, 5-, 10- and 100-yr return period discharges (**Section 2**). Next, the validity of the return period discharge estimates is assessed for stationary (i.e., trends in the data) (**Section 3.2**) and representativeness of the sampling period (i.e., climate variability) (**Section 3.1**). Lastly, the temporal rainfall distributions observed for actual flood events from the study watersheds are characterized (**Section 4**) and compared to three common design distributions (Nested, Type B & NRCS Type I) (**Section 5**).

2. ESTIMATING PEAK DISCHARGES FOR 2-, 5-, 10- AND 100-YR FLOOD EVENTS

Figure 2 shows the instantaneous annual peak discharges from the six USGS streamflow gauges listed in **Table 1**. **Appendix B.1** lists the raw data obtained from the USGS.

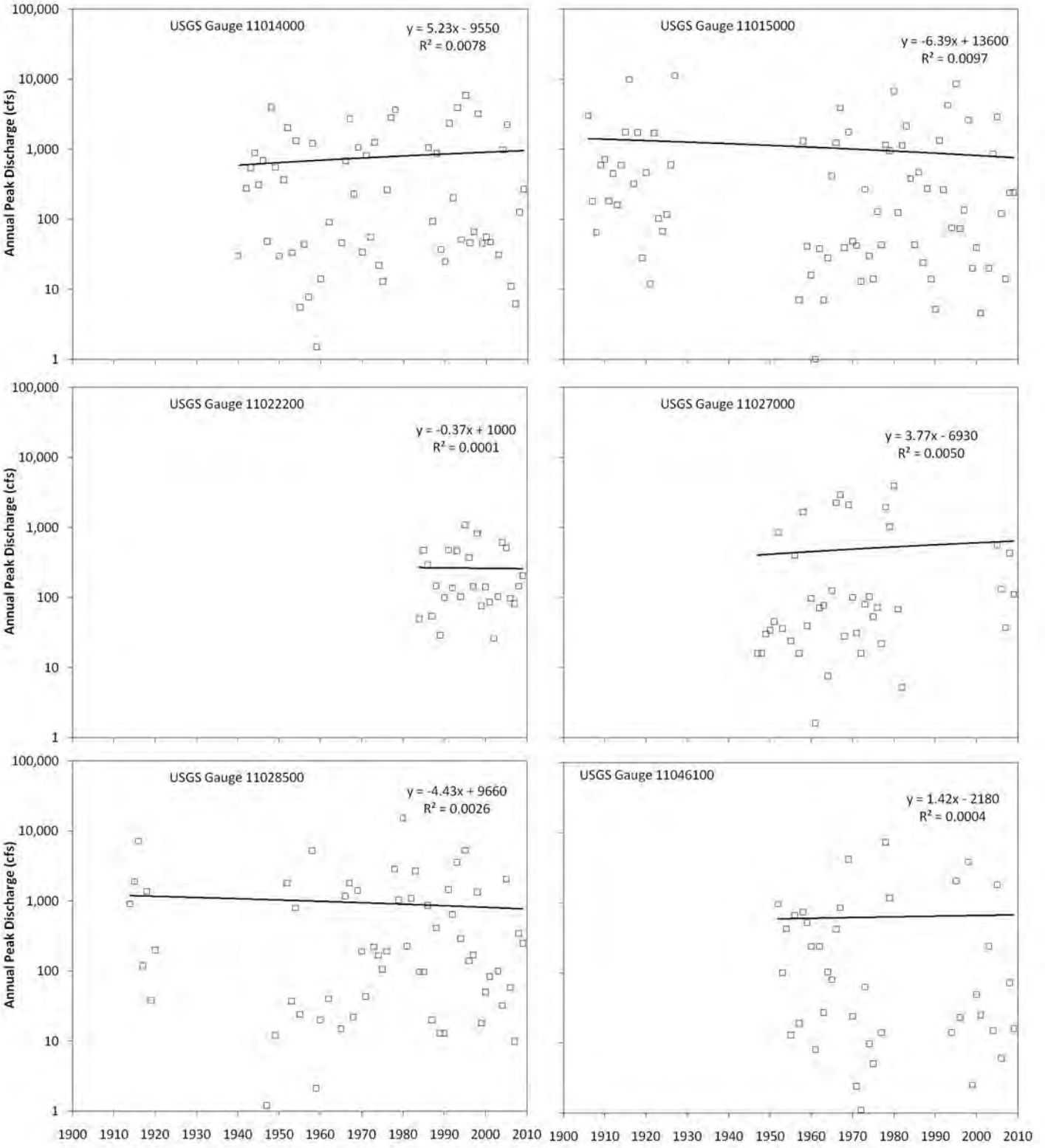


Figure 2: Instantaneous Annual Peak Discharges for Each Water Year for the Six USGS Streamflow Gauges with Linear Regression Lines that Indicate only a Minimal Fraction of the Variability (0.26% to 0.01%) in the Discharge Series is Explained by Water Year.

To determine the Flood Frequency Distributions (FFD) for each gauge, the USGS's program PeakFq Ver. 5.2 was used (see **Appendix B.1** for all program settings and complete listing of all input and output files). This program uses the methods described in the Advisory Committee on Water Information (ACWI), Subcommittee on Hydrology, Hydrologic Frequency Analysis Group, Bulletin 17-B, Guidelines for Determining Flood Frequency to fit the instantaneous annual peak discharge series to the Log Pearson Type III distribution. To fit the data to the distribution requires basic statistics (mean, standard deviation and skew) for the instantaneous annual peak discharges at a site plus additional information for regional skew, if used. There are three skew options available within the program (regional, station and weighted skew). To lessen the effects of sample size, Bulletin 17-B guidelines recommends using weighted skew, G_w, which is a function of the skew of the annual maximum discharge series at the site and the regional skew.

$$G_w = \frac{(MSE_{\overline{G}})(G) + (MSE_G)(\overline{G})}{MSE_{\overline{G}} + MSE_G} \tag{1}$$

where G is station skew, $\overline{G}$ is regional skew, MSE_G is mean square error of the station skew estimate, and $MSE_{\overline{G}}$ is the mean square error of the regional skew estimate. Station skew is determined by:

$$G = \frac{N}{(N-1)(N-2)S^3}\sum_{i=1}^{N}(x_i - \overline{x})^3 \tag{2}$$

where x_i is the station's log-transformed annual peak discharge for water year i, $\overline{x}$ is the station's log-transformed mean of annual peak discharges, S is station's log-transformed standard deviation of annual peal discharges, and N is the station's number of years of peak discharge record. The mean square error for the station skew is approximated by:

$$MSE_G = 10^{\left[A - B\left(\mathrm{Log10}\left(\frac{N}{10}\right)\right)\right]} \tag{3}$$

$$A = -0.33 + 0.08|G| \quad \text{if } |G| \leq 0.90, \tag{4}$$

$$A = -0.52 + 0.30|G| \quad \text{if } |G| > 0.90, \tag{5}$$

$$B = 0.94 - 0.26|G| \quad \text{if } |G| \leq 1.50, \tag{6}$$

$$B = 0.55 \quad \text{if } |G| > 1.50 \tag{7}$$

The guidelines also recommend developing localized regional skew to improve the skew estimate. For example, the default regional skew values in PeakFq Ver. 5.2 vary little for the study sites (-0.15 to -0.23) and have a MSE_G of 0.30. Here, the method for estimating regional skew is based on mean watershed elevation (Veilleux and Stedinger, 2010; Parrett et al., 2010):

$$\overline{G} = -0.62 + 1.3[1 - \exp(-(Elev/6500)^2)] \quad (8)$$

where $Elev$ is mean watershed ground elevation (ft) upstream of the site, the mean square error for the regional skew estimate is: $MSE_{\overline{G}} = 0.13$, and $\overline{G}$ ranges from -0.16 to -0.61 (see Table 3).

For low and high outliers, annual maximum discharge below the low outlier threshold, X_L, or greater than the high outlier threshold, X_H, were removed from the series. The threshold values were determined by:

$$X_L = \overline{X} - K_N S \quad (9)$$

$$X_H = \overline{X} + K_N S \quad (10)$$

where X_L and X_H are the low and high outlier thresholds, respectively, in log units, $\overline{X}$ is the mean, K_N is the 10% significance value for a normal distribution for a sample size of N, and S is the station's log-transformed standard deviation of annual peak discharges. The above equations were superseded for low outlier values of 4.5 and 12 cfs for 11015000 and 11028500, respectively, based on additional analysis of the gauge data by Parrett et al. (2010).

Table 3 and **Figure 3** provide summary results for the FFD analysis including 95% upper and lower confidence limits per the Bulletin 17-B Guidelines based on weighted skew (eqs. 1,2,8). In addition, FFD's for four stations: 11015000, 11027000, 11028500 and 11046100, obtained from the USGS's online publication (http://pubs.usgs.gov/sir/2012/5113/) are presented in **Table 3**. The USGS discharges are based on data through water year 2006 and were originally developed by Parrett et al. (2010) and recently updated by Gotvald et. al. (2012). In general, the discharges developed here agree well (e.g., mean difference in the 100-yr discharge from the USGS and this study, which includes data through water year 2008, is only 6.0%. The other two gauges were not included in the Parrett et al. (2010) study or Gotvald et. al. (2012) study. The favorable agreement with the published USGS FFD's supports the methods used here: new regional skew model with weighted skew option in PeakFq.

It is important to note that Bulletin 17-B requires the discharge series to be stationary or representative of uniform watershed conditions (see **Section 3** for detailed analysis). For example, urbanization can change a watershed's response to rainfall, which typically leads to larger peak discharges. If a watershed experiences substantial urbanization or other modifications (e.g., urbanization, mining, agricultural changes, channelization, or other), the USGS flags each annual peak discharge values impacted by the changes associated with the modifications. In this analysis, only gauge numbers 11022200 and 11028500 had discharges flagged by the USGS as impacted. For gauge 11028500, the last seven peak discharges were flagged by the USGS, and therefore not included in the FFD analysis. For gauge No. 11022200 (Los Coches Creek), all the peak discharges were flagged by the USGS. However, the runoff curve number (CN) and lag time calculations based on land cover analysis for the

Los Coches Creek watershed did not change over the period of record (1984-2009). For the Los Coches Creek watershed, the 100-yr CN value and lag time were 89 and 105.2 min, respectively, for 1983, 1989 and 2010 conditions (see Task 3 analysis). For the less frequent events, CN values only varied from 83 to 84 over the period of record. Although the discharges were flagged by the USGS (i.e., discharges impacted by urbanization, channelization, etc.), the land use/land cover conditions have been approximately constant over the period of record. Thus, the flagged discharges were used to estimate the FFD for only one gauge: 11022200 (Los Coches Creek).

Building on the above discussion, it is important to note the low flood discharges from station 11022200, which is highly developed (e.g., mean watershed CN value is 89), relative to the other sites. For example, the 100-yr discharge from Los Coches Creek (11022200) is 111 cfs/sq mi compared to a mean of 350 cfs/sq mi ranging from 180 to 496 cfs/sq mi for the other 5 stations. The FFD for Los Coches Creek is also flatter than the other sites (**Figure 3**) due to its discharge series having the largest positive skew value (**Table 3**). Given that all the measured peak discharges are flagged as URBAN (see above paragraph), it is possible that urban regulation/modifications limits the magnitude of the larger flood flows. Thus, the FFD is relatively flat and the yield (cfs/sq mi) is lower for the larger floods.

Table 3: Flood Frequency Distributions for Study Sites Based on Weighted Skew (G_w), from PeakFq v5.2 with 95% Upper and Lower Confidence Limits and Corresponding Station (G) and Regional ($\overline{G}$) Skews; USGS Flood Frequency Distributions for Four Stations Based on Data Through 2006 (http://pubs.usgs.gov/sir/2012/5113/ ; Gotvald, 2012).

USGS ID	Skew Values	Case	2-yr (cfs)	5-yr (cfs)	10-yr (cfs)	25-yr (cfs)	50-yr (cfs)	100-yr (cfs)	200-yr (cfs)
11014000 (Jamul Creek)	G_w = -0.466	FFD	166	975	2,240	5,070	8,290	12,600	18,100
	$\overline{G}$ = -0.544	Lower	103	579	1,257	2,654	4,141	6,032	8,354
	G = -0.400	Upper	269	1,794	4,526	11,410	19,980	32,240	48,950
11015000 (Sweetwater River)	G_w = -0.014	FFD	185	1,040	2,580	6,740	12,500	21,800	36,300
	$\overline{G}$ = -0.159	Lower	124	680	1,582	3,819	6,702	11,070	17,490
	G = 0.089	Upper	275	1,713	4,633	13,580	27,350	51,420	91,750
		USGS	186	1,100	2,740	7,060	12,900	22,000	35,700
11022200 (Los Coches Creek) (Note 1)	G_w = -0.309	FFD	173	386	572	851	1,090	1,350	1,630
	$\overline{G}$ = -0.583	Lower	124	274	391	554	684	821	963
	G = 0.116	Upper	242	602	966	1,578	2,146	2,809	3,569
11027000 (Guejito Creek)	G_w = -0.096	FFD	98.0	467	1,040	2,400	4,100	6,610	10,200
	$\overline{G}$ = -0.491	Lower	59.6	275	574	1,215	1,946	2,953	4,300
	G = 0.379	Upper	161	887	2,229	5,989	11,330	20,060	33,760
		USGS	97	461	1,010	2,260	3,750	5,880	8,800
11028500 (Santa Maria Creek) (Note 2)	G_w = -0.343	FFD	146	968	2,410	6,060	10,700	17,400	26,800
	$\overline{G}$ = -0.524	Lower	89.2	565	1,323	3,069	5,115	7,941	11,690
	G = -0.342	Upper	241	1,814	5,016	14,190	27,040	47,370	77,840
		USGS	122	960	2,480	6,230	10,700	17,000	25,200
11046100 (Las Flores Creek)	G_w = -0.290	FFD	69.4	537	1,460	4,040	7,600	13,200	21,500
	$\overline{G}$ = -0.609	Lower	36.1	267	671	1,675	2,929	4,749	7,281
	G = 0.009	Upper	134	1,251	3,951	1,3010	27,430	52,740	94,500
		USGS	82	596	1,550	4,020	7,210	11,900	18,600

(See **Appendix B.1** for program settings, input, output and raw data)

Note 1: All instantaneous annual peak discharges were flagged as URBAN by the USGS.

Note 2: Last 7 years of data not used to develop FFDs because peaks flagged as URBAN by USGS.

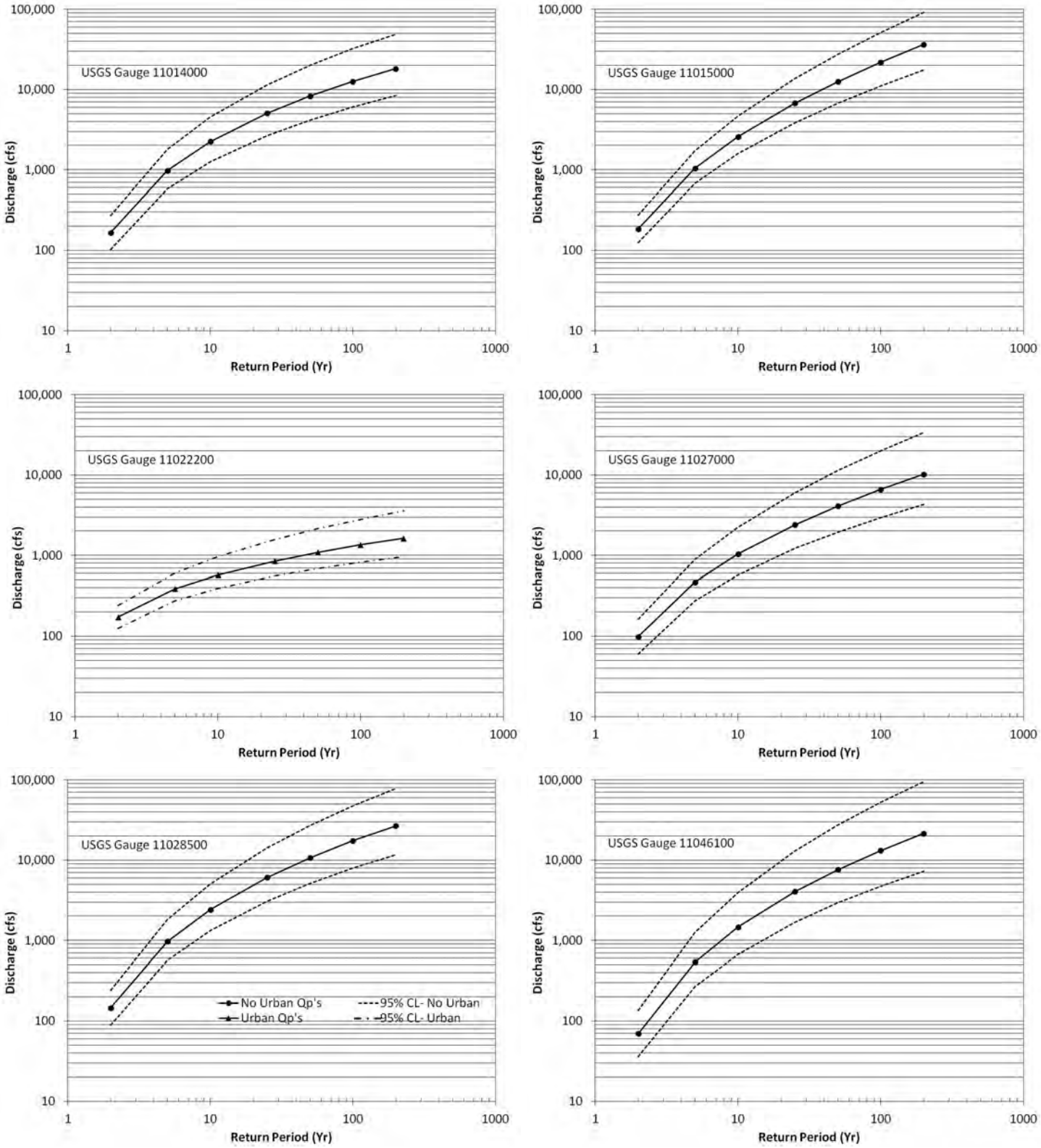


Figure 3: Flood Frequency Distributions with Upper and Lower 95% Confidence Limits Based on the USGS's PeakFq v 5.2 Program Using Weighted Skew (See **Tables 1 and 2** for data).

3. ASSESSMENT OF VARIATIONS IN INSTANTANEOUS ANNUAL PEAK DISCHARGES OVER TIME

Two of the major assumptions in flood frequency analysis are: (1) an instantaneous annual peak discharge series is stationary (i.e., no trends in the data), and (2) the sample data represents the population (i.e., the period of record is sufficiently large to ensure sample from low and high flow years are reasonably well represented). The following two sections expand on these issues to ensure the data for the study sites are suitable for the flood frequency analysis performed in the previous section.

3.1 Urbanization Trends

In Task 3, land use conditions (CN with corresponding lag time) throughout the gauging period were assessed for each of the study watersheds except USGS ID 11027000, Guejito Creek near San Pasqual, which did not have any change in land use over the period of record. Although CN values were shown to be constant or vary by +/- 1, each discharge series was tested for stationary (i.e., no trend in the data or representative of uniform watershed and climate conditions).

The Kendall Tau hypothesis test was used to determine if trends are present in the instantaneous annual peak discharge series. Specifically, the null hypothesis for the Kendall Tau test states that two quantities (e.g., X,Y pairs where X = Qpeak and Y = Water Year) are statistically independent. If the null hypothesis is rejected, the two quantities are statistically dependent (i.e., there is a significant trend in Qpeak over time). The Kendall Tau test is a non-parametric test well suited for assessing discharge series, where the range in values can vary by several orders of magnitude (Beighley and Moglen 2002; 2003). For the analysis, the Kendall Tau coefficient was estimated by equation 1:

$$\tau = \frac{(n_c - n_d)}{\frac{1}{2}n(n-1)} \tag{11}$$

where n_c is the number of concordant pairs ($X_i > X_j$ and $Y_i > Y_j$ or if both $X_i < X_j$ and $Y_i < Y_j$), n_d is the number of discordant pairs ($X_i > X_j$ and $Y_i < Y_j$ or if both $X_i < X_j$ and $Y_i > Y_j$), and n is the total number of pairs, where Tau (τ) can range from -1 for perfect disagreement; negative trend in Q vs. time, to 1 for perfect agreement; positive trend in Q vs. time. If the two quantities are independent, Tau should be near zero. **Table 3** provides the Kendall Tau values for the peak discharge series from each study site. The Tau values range from -0.18 to 0.22, which are close to zero as expected (i.e., suggests no trends). To determine if the null hypothesis (i.e., no trend) can be rejected, it is assumed that Tau coefficient is normally distributed with a mean of zero and a variance of $[2(2n+5)/9n(n-1)]$. Thus, we use the standard normal distribution and the Z value determined by equation 2:

$$Z = \frac{(n_c - n_d)}{\sqrt{\frac{n(n-1)(2n+5)}{2}}} \quad (12)$$

Here, a two-tailed test is performed, which accounts for positive or negative trends in the discharge series. With the Z value determined using equation 2, the cumulative probability of (-| Z |) is obtained from the standard normal table and multiplied by 2 to account for the two-tailed test. This resulting value is the p-value used to test the null hypothesis, where the p-value represents the probability of accepting the null hypothesis when in fact it is not true. If the p-value is less than 5%, we reject the null hypothesis (Q, Time are statistically independent; no trend) and conclude that there is a significant trend in the discharge series. **Table 4** provides all the Kendall Tau values and the corresponding p-values. For this analysis, there are no p-values less than 5%, thus, there are no significant trends in the annual peak discharge time series. Note, Guejito Creek (11027000) has a p-value of 5.03%. Although this value is close to the selected 5% level of significance, it is not significant. In hypothesis testing, the results are binary (significant or not). It is not possible to assess the results qualitatively (i.e., nearly significant). Again, the results of this analysis yield no significant trends in the discharge data. This finding is consistent with CN analysis from Task 3, and the low R2 values (<0.01) for all the linear regression lines through the discharge series (Qp vs. Water Year) shown in **Figure 2**. Note, the R2 value is a measure of explained variation by the model ranging from 0 to 1, with an R2 value of 1 representing a perfect model.

Table 4: Summary of the Kendall Tau Test Results for each Study Watershed.

Gauge ID	Kendall Tau	P-value	n	m (cfs/yr)	b (cfs)	R2
11014000	0.0048	0.9564	62	5.2	-9551	0.0078
11015000	-0.0977	0.2151	75	-6.4	13600	0.0097
11022200	0.0215	0.8774	26	-0.4	1001	0.0001
11027000	0.2154	0.0503	40	3.8	-6930	0.0050
11028500	0.0783	0.3380	70	-4.4	9662	0.0026
11046100	-0.1777	0.0973	42	1.4	-2180	0.0004

3.2 Short- vs. Long-Term Climate Trends

In this section, the specific periods of record are assessed to determine if they are representative of longer periods. **Table 5** lists the study sites and their detailed periods of record, which in some cases are not continuous. Although most gauges have more than 40-70 years of data, which are relatively long periods of records in terms of discharge data, Los Coches Creek (11022200) has only 26 years (1984-2009). To determine if this shorter period of record is representative of the longer periods captured by the other gauges, data for the period 1984-2009 were extracted from the data series for two different gauges (11014000 and 11028500), with the longest periods of record (70-75 years). For this analysis, FFDs were determined as described above, with the exception of skew. Only station skew was used rather

than weighted skew to focus on the impacts of sample period for the gauges in question. The reason for using the weighted skew option (equation 1; function of both station and regional skew) is to increase the effective sampling period. Here, the intent is only to assess data from two different sample periods. **Table 6** and **Figure 4** show the comparison between the short and long period FFDs for the two gauges.

Table 5: Period of Record (in Water Years) for each Study Gauge.

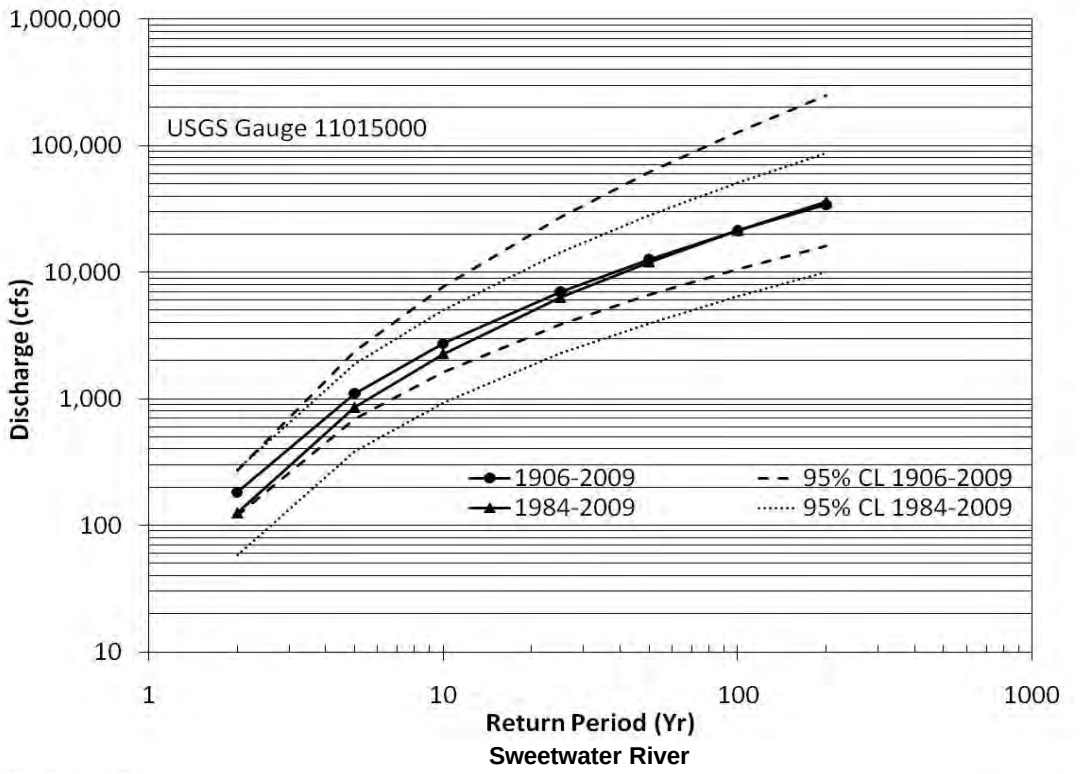
USGS ID	Station Name	Period of Record * (Water Years)	Number of Water Years
11014000	Jamul Creek near Jamul, CA	1940-1978; 1986-2009	62
11015000	Sweetwater River near Descanso, CA	1906-1927, 1957-2009	75
11022200	Los Coches Creek near Lakeside, CA	1984-2009	26
11027000	Guejito Creek near San Pasqual, CA	1947-1982, 2005-2009	40
11028500	Santa Maria Creek near Ramona, CA	1914-1920, 1947-2009	70
11046100	Las Flores Creek near Oceanside, CA	1952-1979, 1994-2009	42

* The listed periods of record are generally complete but may be missing a few individual years.

Table 6: Comparison Between FFDs for Water Years 1984-2009 and Corresponding Full Period of Records for Two Gauges with the Longest Periods of Record (11015000 and 11028500); Note Results Based on Using only Station Skew for the Period of Record in Question.

USGS ID	Period	Case	2-yr (cfs)	5-yr (cfs)	10-yr (cfs)	25-yr (cfs)	50-yr (cfs)	100-yr (cfs)	200-yr (cfs)
11015000	1906-2009*	FFD	182	1,103	2,726	6,971	12,600	21,260	34,050
		Lower	120	697	1,627	3,854	6,602	10,590	16,190
		Upper	278	1,869	5,065	14,480	28,230	51,070	87,200
11015000	1984-2009	FFD	125	854	2,266	6,284	12,010	21,330	35,880
		Lower	58	384	931	2,273	3,963	6,461	10,020
		Upper	271	2,377	7,731	27,350	61,680	127,600	246,900
11028500	1914-2009*	FFD	118	1,080	2,800	6,692	10,910	16,160	22,330
		Lower	64	558	1,362	3,041	4,753	6,797	9,113
		Upper	218	2,321	6,643	17,590	30,500	47,560	68,580
11028500	1984-2009	FFD	144	722	1,723	4,460	8,347	14,790	25,140
		Lower	77	380	837	1,918	3,276	5,313	8,292
		Upper	268	1,636	4,688	15,280	33,650	69,560	136,800

* See **Table 3** and **Appendix B.1** for complete data period, some years missing.



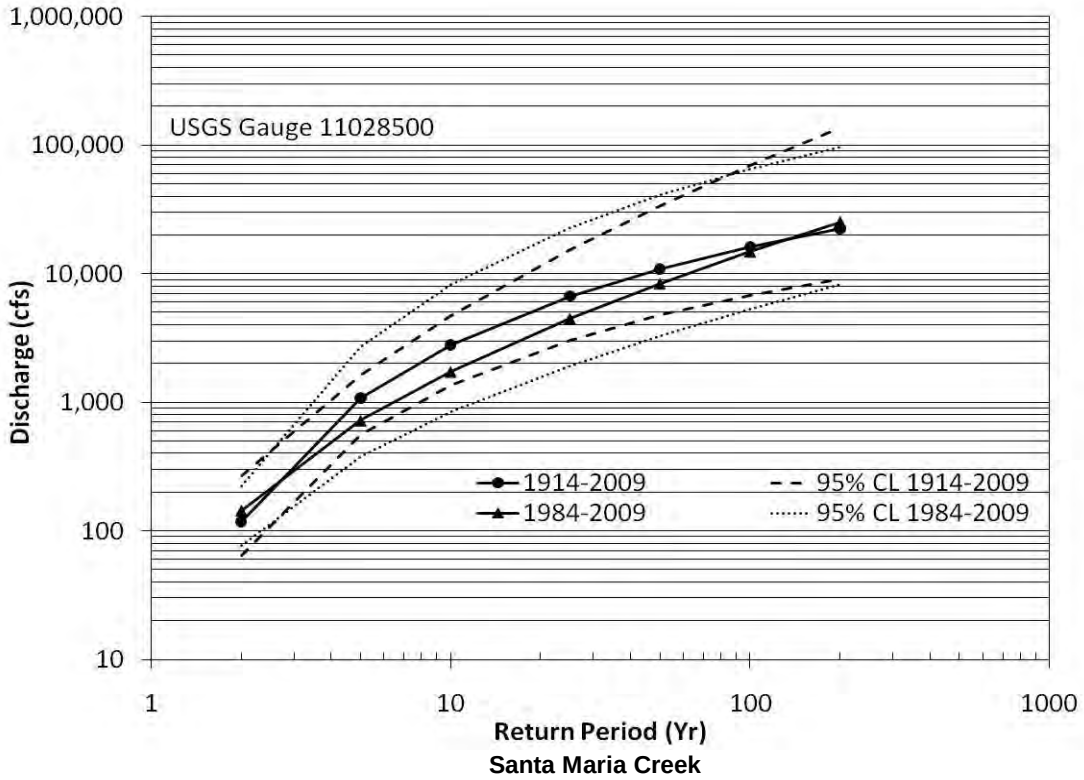


Figure 4: Comparison Between FFDs for Water Years 1984-2009 and Corresponding Full Period of Records for Two Gauges with the Longest Periods of Record (11015000 and 11028500); Note Results Based on Using only Station Skew for the Period of Record in Question.

In general, the differences between specific return period discharges are minimal. For Sweetwater River (11015000) the difference in the 100-yr discharge is only 70 cfs (0.3%). For the other return periods, the differences range from -31% (2-yr) to 5% (200-yr). For Santa Maria Creek (11028500) the difference in the 100-yr discharge is only 1,370 cfs (-8.5%). For the other return periods, the differences range from -38% (2-yr) to 13% (200-yr). Based on the small differences (0.03% and -8.5%) in the 100-yr discharges between the short- and long-term periods, the shorter period (1984-2009) of record for Los Coches Creek appears to be representative of the longer period signal. This assessment combined with the trend assessment in the previous section suggests that the annual peak discharges used in the study have stationary signals and are representative of relatively long-terms climate conditions.

4. DEVELOPMENT OF EVENT-BASED RAINFALL DISTRIBUTION CURVES FOR PAST MAJOR STORMS

In this section, a combination of rainfall rates and discharges were used to obtain the temporal rainfall distributions for select large flood events. **Figure 1** and **Table 2** show the matched rainfall-streamflow gauges used in this analysis. Note, this analysis is only intended to assess the temporal distributions of rainfall and runoff (i.e., no spatial analysis or development of watershed averaged rainfall magnitudes). Thus, the gauge elevations and actual locations with the study watersheds are not critical. Here, it is assumed that a rainfall gauge located relatively close to the study watershed provides a temporal distribution of rainfall that is representative of the actual temporal distribution for the study watershed.

The critical data used in this analysis were 15-min streamflow provided by the USGS and hourly to instantaneous rainfall rates provided by the San Diego Country Flood Control District. The high temporal resolution data are needed to match rainfall and runoff pattern (i.e., start of rainfall, time of peak discharge, etc.). Daily data are not sufficient for this analysis. Although **Tables 1 and 5** list relatively long periods of records for the discharge data, **Table 7** lists the periods of records for the higher temporal resolution data. In general, the 15-min discharge data are only available for 1988 to current except for two sites which are available from 1993-current and 2004-current. The 15-min interval is needed to identify the exact time of the instantaneous peak discharge. The instantaneous annual peak discharges provided by the USGS only indicate the date of the peak. Thus, it is not possible to obtain rainfall for the previous 6-, 12-, 16-, 18-hours, etc. needed to assess the temporal rainfall distributions.

To assess temporal rainfall distributions, the five largest annual peak discharges, which occurred when high temporal resolution Q and P data were available, were selected for each USGS gauge. **Table 8** lists the events and their approximate return period. The number of events was limited to five per gauge due to the limited period of record for the 15-min discharge data (**Table 7**) and gaps in the high temporal resolution rainfall (hourly to instantaneous).

Table 7: Summary of 15-min Streamflow Data Availability.

USGS ID	15-min Discharge Data Available
11014000	1988 - Current
11015000	1988 - Current
11022200	1988 - Current
11027000	2004 - Current
11028500	1988 - Current
11046100	1993 - Current

Table 8: Summary of 5 Largest Flood Events for each Gauge, with the Date and Time of the Peak Discharge, Reported Peak Discharge and the Approximated Return Period of the Selected Event.

USGS ID	Quantity	Event 1	Event 2	Event 3	Event 4	Event 5
11014000	Date - Time	3/1/91 8:30	1/16/93 14:15	3/5/95 23:00	2/22/04 14:00	10/20/04 13:15
11014000	Peak (cfs)	2,340	3,910	5,870	980	2,230
11014000	Return Period	10-yr	10- to 25-yr	25-yr	5-yr	10-yr
11015000	Date - Time	2/20/1980 6:00*	1/16/1993 16:00	3/6/1995 0:00	2/14/1998 22:15	1/11/2005 11:00
11015000	Peak (cfs)	6,750	4,220	8,600	2,580	2,900
11015000	Return Period	25-yr	10- to 25-yr	25- to 50-yr	10-yr	10-yr
11022200	Date - Time	1/16/1993 12:30	3/5/1995 21:15	3/13/1996 6:00	2/22/2004 14:45	1/9/2005 22:00
11022200	Peak (cfs)	462	1,090	372	609	508
11022200	Return Period	10-yr	25-yr	5-yr	10-yr	10-yr
11027000	Date - Time	2/21/1980 10:00*	2/21/2005 15:15	1/2/2006 20:30	1/7/2008 7:00	12/17/2008 18:00
11027000	Peak (cfs)	3,940	563	130	430	110
11027000	Return Period	25-yr	5-yr	2- to 5-yr	5-yr	2- to 5-yr
11028500	Date - Time	2/21/1980 10:00*	2/15/1992 19:45	2/19/1993 22:00	3/5/95 23:15	1/11/05 10:15
11028500	Peak (cfs)	15,200	638	3,550	5,270	2,050
11028500	Return Period	50- to 100-yr	2- to 5-yr	10-yr	10- to 25-yr	5- to 10-yr
11046100	Date - Time	2/25/1969 18:00*	3/1/1978 12:00*	3/5/1995 22:15	1/11/05 4:50	2/22/2008 11:30
11046100	Peak (cfs)	4,200	7,300	2,070	1,810	72
11046100	Return Period	10- to 25-yr	25- to 50-yr	10-yr	10-yr	2-yr

* Date of instantaneous annual maximum discharge; actual time assumed because 15-minute streamflow data not available and no other flood events overlap with rainfall dataset.

To process the event data, the following steps were performed. First, the dates of the annual events were selected. Next, the actual time of the event was obtained from the 15-min discharge data. With the actual time of the event, a time window was defined as 18 hours prior to the peak and 12 hours after the peak. Next, the rainfall and 15-min discharges were extracted from the database (see **Appendices B.2 and B.3** for data). **Figure 5** shows two

typical plots of the processing results with the actual rainfall distribution, hydrograph and three fitted rainfall distributions (Nested, Type B and NRCS Type I; where the fitting procedure, described in the next section, matches the starting time of the maximum 6-hr rainfall periods). **Figure 5** was selected to illustrate two different events: (top) steady rainfall with a less clearly defined period of intense rainfall, and (bottom) light rainfall with a clearly defined peak intensity period prior to the peak discharge. **Appendix B.4** contains all 30 figures (i.e., 5 events for each of the 6 gauges) for the time window (-18 to +12 hours around the peak) optimized after analyzing all the events and several time windows. **Appendix B.5** contain the figures for a shorter window (-16 to +8 hours) for comparison. In general, the selected time window resulted in three important characteristics: (1) no or little rainfall for the first few hours, (2) near baseflow discharge at the start of the time window, and (3) the peak discharge following the largest pulse of rainfall. Storm events illustrated in **Figure 5** are two different, but both common, storm events observed in this study. All events for all gauges are shown in **Appendix B.4**.

Given the challenge of capturing only the rainfall that caused the peak discharge while considering the potential design storm distributions, the time window was also selected because it generally encompasses all the design storm timing characteristics of the studied distributions without being too large such that it encompasses multiple rainfall events. For example, the Nested storm's peak intensity is at approximately hour 16, and the Type B and Type I storms peak between hours 9 and 10. Thus, the selection of 18 hours before and 12 hours after the peak discharge provides a window that generally contains all three design storm patterns. Given the importance of rainfall prior to the peak discharge, the 18-hrs before the peak was selected to encompass all three distributions (rainfall starts approximately 10 to 16 hrs before peak rainfall intensity) while allowing for up to 2-hrs of lag between rainfall and corresponding river discharge. For the time after the peak discharge, the 12 hrs generally encompassed all three distributions (rainfall ends approximately 8 to 14 hrs after peak rainfall intensity) while not extending too long as to start including a second rainfall event. For example, the Type I and B storms end approximately 14 hours after their peak rainfall intensity. Here, the time window stops at 12 hours after the peak discharge. Assuming there is a lag of sometime between the rainfall and resulting discharge at the gauge, a 24-hr Type I and B rainfall event would stop in less than 14 hours after the peak discharge. Given that the time missing from the time window for the Type I & B distributions is less than 2 hrs, (i.e., 14 hr from peak intensity to end of rain vs. 12 hrs from peak discharge to end of time window) and the fraction of rainfall included in the last 2 hrs of those distributions is less than 4% of the total, stopping the time window 12 hrs after the peak discharge is reasonable. Increasing the time window on either side of the peak discharge resulted in rainfall from other storms being included in the analysis. Although storms prior to the annual peak event influence the initial conditions of the watershed, the intent of this analysis was to extract the approximate 24-hr rainfall that resulted in the annual maximum peak discharge.

Note, for 3 of the 6 streamflow gauges, only 4 flood events overlapped with the available data (i.e., no 15-min discharge data available for 3 events). For 1 gauge, only 3 flood events overlapped (i.e., 2 events without 15-min discharge data). Because 15-min discharge data were not available for 5 of the 30 events (see footnote in **Table 8**), an annual peak discharge

date with an assumed time of the peak was used to replace the time of peak coming from the 15-min discharge data. Trial and error was used to obtain the approximate 24-hour rainfall distribution with a peak somewhere from 6-18 hours and near zero rainfall at the beginning and ending of the 24 hours. The key was to obtain near zero rainfall at the start/end of the 24 hours (i.e., find the start/end of the actual 24-hour storm). This process was only needed to extract rainfall from the database as described above. The study rainfall distributions were fit to the data as described in the next section.

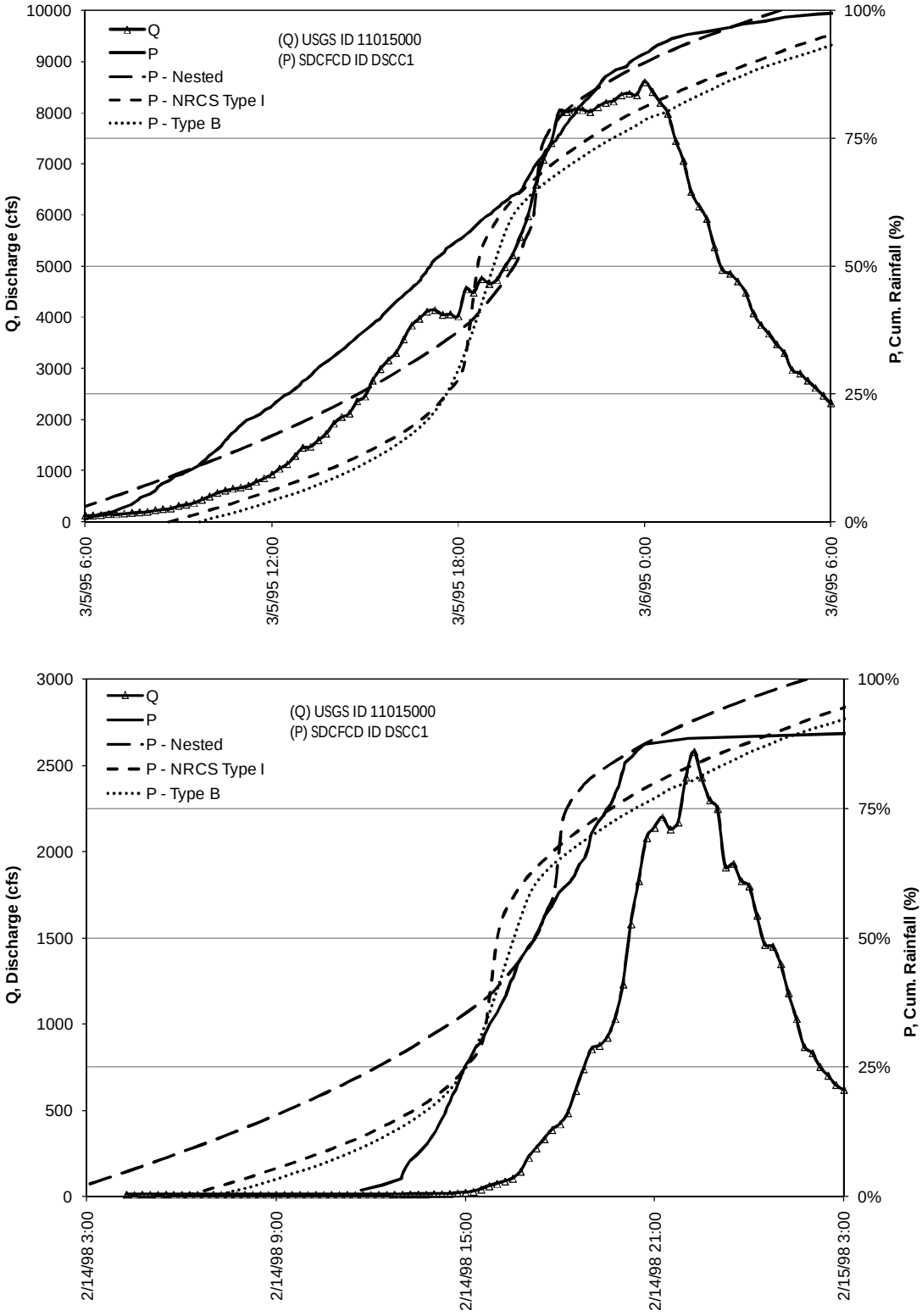


Figure 5: Typical Storm Event Processing Results Showing Measured Cumulative Rainfall (P) and 15-min Discharges (Q) and the Three Fitted Rainfall Distributions (Nested, Type B, NRCS Type I); Incremental Rainfall Values (Not Shown Here) are Provided in Appendix B.2.

5. COMPARISON OF EVENT-BASED RAINFALL DISTRIBUTION CURVES TO DESIGN STORMS

Once the rainfall data was extracted for each event, the actual temporal distribution was determined and fit to three different rainfall distributions: (1) Type-B storm from 1993 version of the San Diego County Hydrology Manual, (2) Nested storm from the 2003 version of the San Diego County Hydrology Manual, and (3) NRCS Type I distribution recommended for San Diego County by the NRCS (NRCS, 1986). The Type B and Nested storms are described in detail in the respective Hydrology Manuals. **Figure 6** shows the three storm distributions (see **Appendix B.6** for values).

A "reference" time was defined for each event to fit the design storm temporal distributions to the actual distributions based on measured rainfall data with varying time steps and durations (i.e., not 24-hrs or uniform time spacing). Here, the reference time was assumed to be the time associated with the start of the maximum 6-hour rainfall period. **Table 9** lists the reference time for each of the design storms. In general, the 6-hour time window following the reference time accounts for 54 to 58% of the total rainfall. To plot the design storm distributions on the actual rainfall distribution (**Figure 5** and **Appendix B.4**), the reference time of the design storm (**Table 9**) was set to the actual event reference time. For example, in **Figure 5**, USGS ID 11015000, Event No. 3, the start of the maximum 6-hr rainfall period for the observed rainfall is 3/5/1995 at 4:40 PM, which corresponds to hour 7 of the Type B distribution (**Table 9**). Thus, the starting time for the Type B design storm distribution is 3/5/1995 at 9:40 AM, which is the reference time for the observed rainfall minus the reference time for the Type B design storm. See **Table 9** for the reference times for the other design distributions. The starting times of the Nested and Type I storms are 3/5/1995 at 4:40 AM and 3/5/1995 at 8:40 AM, respectively.

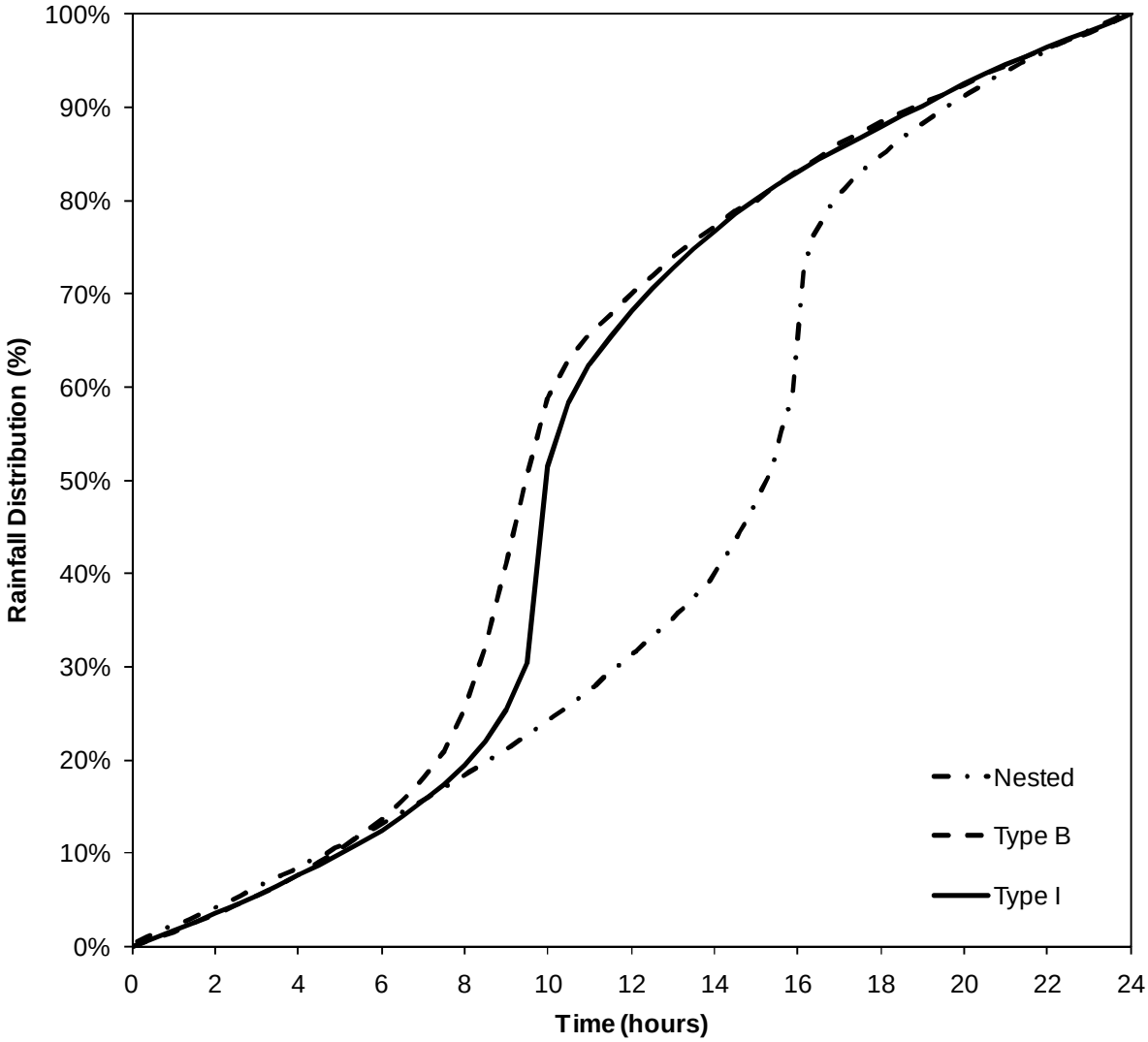


Figure 6: Three Rainfall Distributions Selected for this Study: Type B, Nested and NRCS Type I
(See **Appendix B.6** for Values).

To assess the design storm patterns relative to the observed rainfall, **Tables 10 and 11**, respectively, list the percentage of rainfall within the 6-hour maximum rainfall periods and prior to the 6-hr maximum period for the selected storm events. Across these events, the maximum 6-hour period rainfall ranges from 40 to 90%, with a mean of 61%. Comparing the percentages in **Tables 9 and 10** results in the following errors: the NRCS Type I Storm has a mean error of 3.0 percentage points, the Type B Storm has a mean error of 4.2 percentage points, and the Nested Storm has a mean error of 6.9 percentage points. **Table 12** provides additional summary statistics for each design storm.

Table 9: Reference Times with Percentage of the Total Rainfall Occurring During and Prior to the Maximum 6-hour Period.

Design Storm	Reference Time	Rainfall During Maximum 6-hr Period	Rainfall Prior to Maximum 6-hr Period
Type B	Hour 7	56.3%	15.7%
Nested	Hour 12	53.6%	30.8%
Type I	Hour 8	57.5%	17.3%

Table 10: Percentage of Total Rainfall Occurring During the 6-hour Maximum Rainfall Periods for all the Selected Events.

USGS ID	Event 1	Event 2	Event 3	Event 4	Event 5
11014000	52.5%	58.1%	45.5%	56.6%	53.7%
11015000	40.5%	54.0%	40.4%	72.4%	67.7%
11022200	50.0%	45.0%	55.3%	55.2%	77.4%
11027000	69.6%	56.5%	71.8%	66.7%	42.9%
11028500	65.1%	50.0%	45.1%	75.0%	89.4%
11046100	65.8%	78.3%	47.3%	76.5%	89.8%

Table 11: Percentage of Total Rainfall Occurring Prior to the 6-hour Maximum Rainfall Periods for all the Selected Events.

USGS ID	Event 1	Event 2	Event 3	Event 4	Event 5
11014000	39.0%	25.6%	43.9%	5.7%	17.1%
11015000	29.7%	27.0%	45.9%	11.5%	12.3%
11022200	29.2%	45.0%	35.7%	4.5%	19.4%
11027000	13.0%	34.8%	20.5%	15.2%	14.3%
11028500	11.6%	38.6%	35.2%	7.5%	5.2%
11046100	32.7%	8.7%	41.8%	11.8%	5.1%

To assess the timing of the maximum rainfall period, the cumulative rainfall prior to the maximum 6-hour period was used. For example, the peak period for the Nested storm occurs later in the event (i.e., after 31% of the rainfall) relative to the Type B and I events (i.e., after 16 to 17% of the total rainfall). For comparison, **Table 11** lists the rainfall prior to the 6-hour period for each event. Across these events, the rainfall occurring prior to the maximum 6-hour period ranges from 5 to 46%, with a mean of 23%. Comparing the percentages in **Tables 9 and 11** results in the following errors: the NRCS Type I Storm has a mean error of 5.6 percentage points; the Type B Storm has a mean error of 7.2 percentage points, and the Nested Storm has a mean error of -7.9 percentage points. Here, negative errors indicate that the Nested design storm has more rainfall occurring before the peak period relative to the observed data. **Table 12** provides additional summary statistics for each design storm.

Table 12: Summary Statistics for Errors (in Percentage Points) between Observed Patterns and the Selected Design Storms for the Total Rainfall Occurring before and during the 6-hour Maximum Rainfall Periods for all the Selected Events.

	Errors for max 6-hrs			Errors for prior to max 6-hrs			Mean Absolute Errors		
Statistic	Nested	Type B	Type I	Nested	Type B	Type I	Nested	Type B	Type I
Mean	6.9%	4.2%	3.0%	-7.9%	7.2%	5.6%	6.6%	5.8%	4.5%
Median	2.9%	0.3%	-1.0%	-10.9%	4.2%	2.6%	5.2%	3.4%	3.0%
Minimum	-13.2%	-15.9%	-17.1%	-26.3%	-11.2%	-12.8%	19.5%	14.0%	15.3%
Maximum	36.2%	33.5%	32.3%	15.1%	30.2%	28.6%	26.0%	31.5%	30.2%

[Error values in percentage points; for example, Event 1 at USGD ID 11027000, the error for NRCS Type I storm for the rainfall prior to the peak period is -4.3% = 13.0% (event value) - 17.3% (Type I value).]

To illustrate the variability of the observed rainfall, each rainfall distribution is compared for all watersheds (**Figure 7**) and for each individual watershed (**Figure 8**). Note, to combine multiple events on a given plot, time zero is defined at the start of the maximum 6-hr rainfall period (i.e., the reference time described above). **Figure 8** highlights the variability of the event rainfall distributions in San Diego County but also shows that the three design storms used here generally capture the pattern of the observed rainfall. However, given the variability in the event distributions obtained in this study, it is not possible to derive a single representative event rainfall distribution for San Diego County. To reduce the variability or isolate groups of distributions, additional research, which increases the number of watersheds and rainfall gauges, is needed.

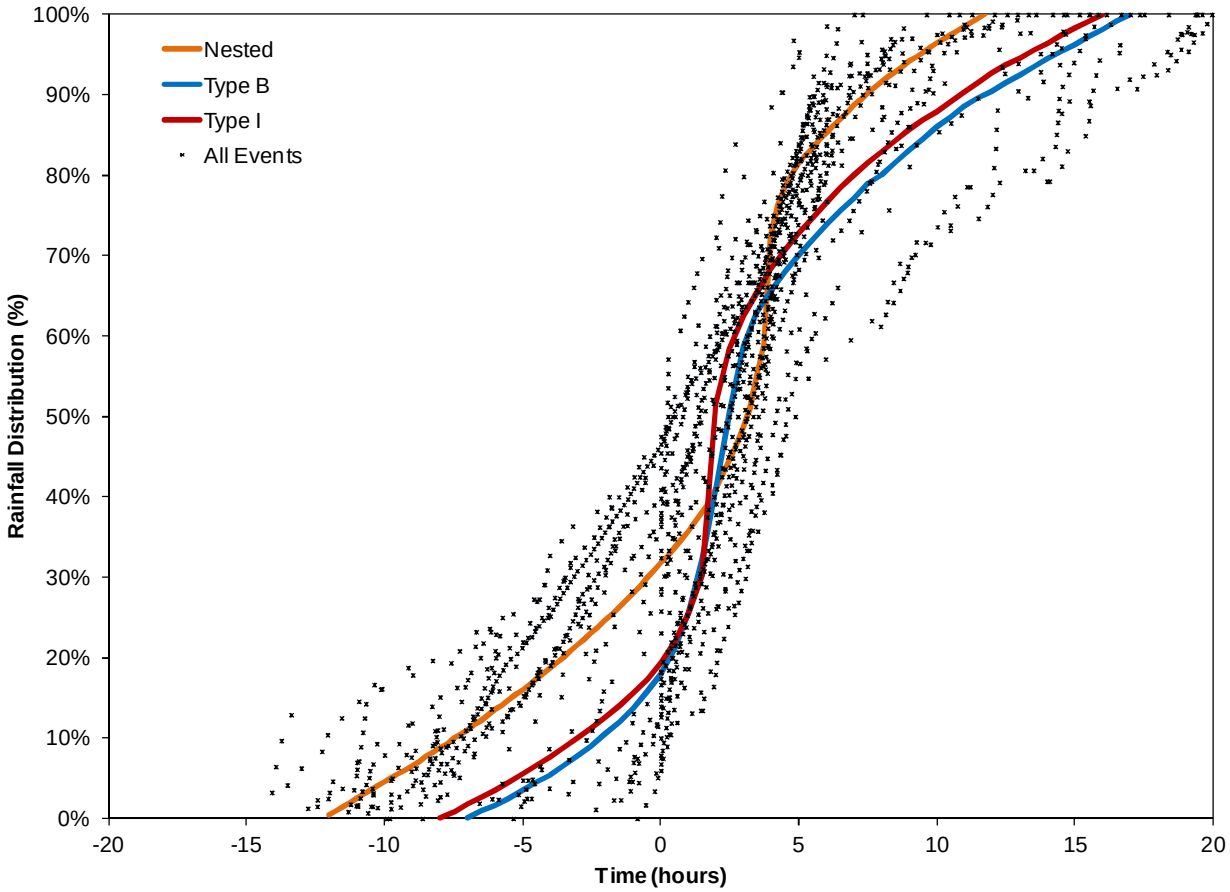


Figure 7: Comparison Between all Individual Event Rainfall Distributions for Each Study Watershed and the Selected Design Storms (Nested, Type B and NRCS Type I) Where Time Zero Corresponds to the Start of the Maximum 6-hr Rainfall Period.

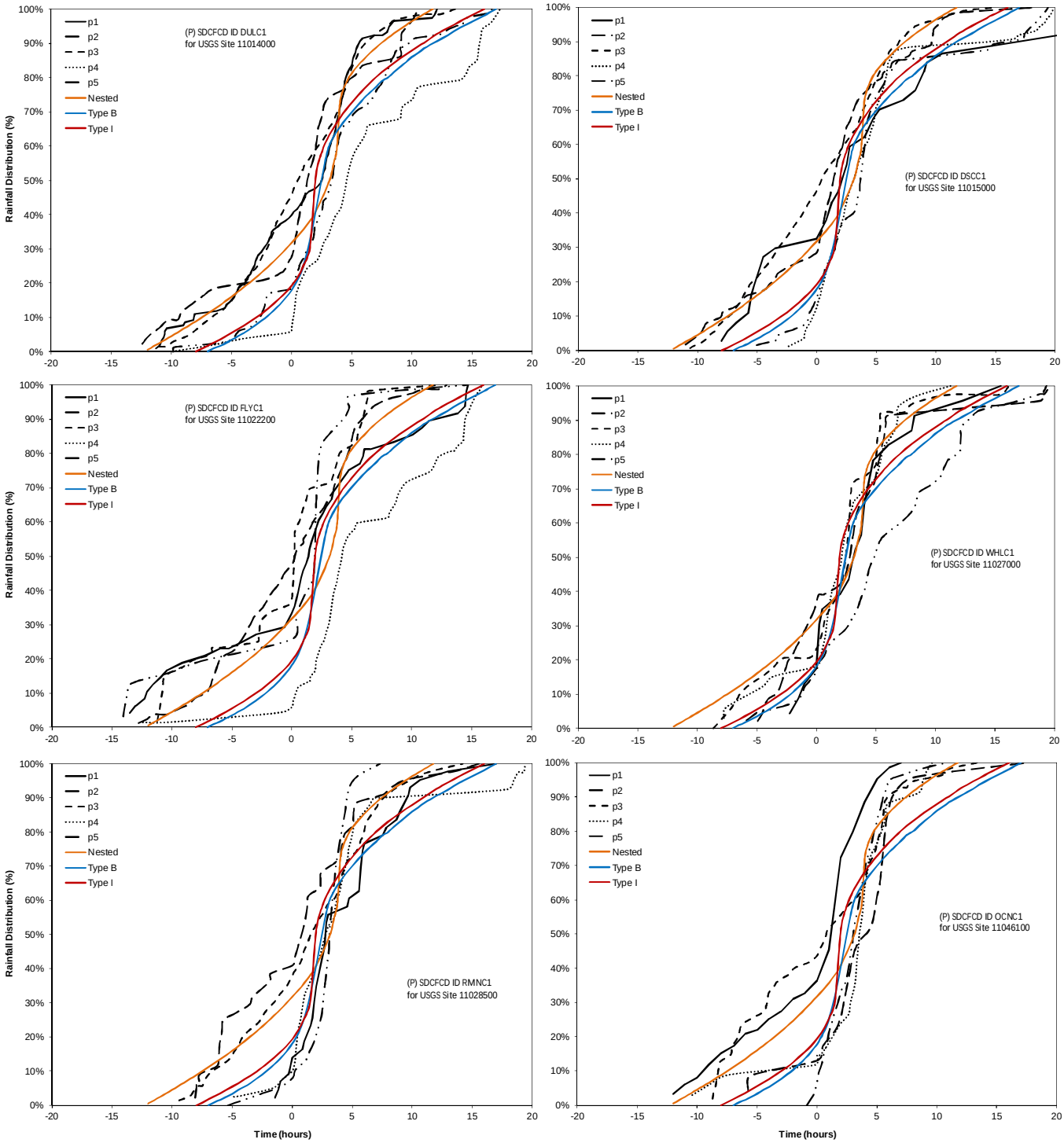


Figure 8: Comparison between Individual Event Rainfall Distributions and the Selected Design Storms (Nested, Type B, NRCS Type I) for each Study Watershed (See **Appendix B.2** for data).

6. CONCLUSIONS

This report describes the methods and results related to Task 2 of the Rainfall Distribution Study project to collect, verify and process United States Geological Survey (USGS) stream gauge data. For this study, six (6) USGS stream gauges and six (6) San Diego County Flood Control District (SDCFCD) rainfall gauges were used. This report specifically summarizes the analysis and results for estimating specific return period peak discharges, assessment of the data used to develop the return period discharges for stationary and sampling period(s) representative of current conditions, assessment of the temporal rainfall distributions observed for actual flood events, and the comparison between observed and design storm temporal distributions.

Three design storms were assessed in the report: (1) Type-B storm from 1993 version of the San Diego County Hydrology Manual, (2) Nested storm from the 2003 version of the San Diego County Hydrology Manual, and (3) NRCS Type I for San Diego County (NRCS, 1986). In general, the Type B and Type I distributions are similar with minor differences around the peak intensity period. The primary difference between the design storms is the timing of the peak intensity period. The Nested storm's peak intensity occurs at 16 hours compared to the ±9 hours for the Type B and Type I distributions. Specifically, the start of the Nested storm's peak 6-hr period occurs at hour 12 with 31% of the rainfall prior to that period and 54% of the total rainfall during the 6-hr maximum period. The start of the Type B storm's peak 6-hr period occurs at hour 7 with 16% of the rainfall prior to that period and 56% of the total rainfall during the 6-hr maximum period. The start of the Type I storm's peak 6-hr period occurs at hour 8 with 17% of the rainfall prior to that period and 58% of the total rainfall during the 6-hr maximum period. Although the peak periods account for nearly the same fraction of total rainfall, the start of this period shifts the fraction of rainfall before the peak period from about 16-17% for Type B and Type I to 31% for the Nested storm.

To compare the selected design storms with observed rainfall patterns for large discharge events, the five largest annual peak discharges, which occurred during periods where high temporal resolution discharge and rainfall data were available, were selected. For these events, discharge and rainfall data were extracted using a time window of 18 hours before to 12 hours after the time of the peak discharge. Additional details are provided to assess the selected time window. Next, three characteristics were determined for the extracted data: percentage of rainfall during the maximum 6-hour period, the start time for the maximum 6-hour period, and the percentage of rainfall before the start of the 6-hour period. The start time was used to align the observed and design storm patterns (see **Appendices B.4 and B.5**). The percentage values were used to assess the peak period of rainfall and its location within the storm event. Based on these measures, the results of this study suggest that all three design storms generally agree with the observed rainfall patterns. The primary difference between the observed and design storm patterns is related to the fraction of rainfall occurring before the maximum 6-hour period. In general, the observed rainfall patterns received about 6-7 percent more rainfall prior to the start of the peak period relative to the Type I and Type B storms and about 8 percent less rainfall relative to the Nested storm. The observed rainfall

patterns also received about 7 percent more rainfall during the peak period relative to the Nested storm and 3-4 percent more rainfall relative to the Type I and Type B storms, respectively. However, it is important to highlight the variability of the rainfall distributions obtained for the study watersheds.

From a design standpoint, peak discharges would generally be larger if the peak rainfall period occurs later in the storm event (i.e., like the Nested storm). However, peak discharges would generally be larger if the fraction of rainfall in the peak period is larger (i.e., like the Type B and Type I storms). Based on the comparison between the observed and design storm patterns, the observed patterns highlight characteristics from all the design storms. For example, the fraction of observed rainfall prior to the start of the peak period is higher than the Type I and Type B storms and less than the Nested storm (i.e., Nested storm is conservative). However, the fraction of observed rainfall during the peak period is higher than all the design storms but closest to the Type I storm (i.e., Type I storm is conservative). Building on the results of this study, Appendix C of this report will create six (6) single-basin HEC-HMS models of the basins discussed in this report in order to generate basin outflow hydrographs for the Nested, Type B, and Type 1 storm distributions. The resulting outflow hydrographs will be compared with the USGS data discussed herein in an effort to determine which storm distribution methodology generates results that best align with the observed USGS stream gauge data.

7. REFERENCES

Advisory Committee on Water Information (ACWI), Subcommittee on Hydrology, Hydrologic Frequency Analysis Group, Bulletin 17-B, Guidelines for Determining Flood Frequency. (October 10, 2002).

Beighley, R.E. and G.E. Moglen. Adjusting Measured Peak Discharges from an Urbanizing Watershed to Reflect a Stationary Land Use Signal, Water Resources Res. 39(4):4.1-4.11 (2003).

Beighley, R.E. and G.E. Moglen. Trend Assessment in Rainfall-Runoff Behavior in Urbanizing Watersheds, ASCE Journal of Hydrologic Engineering 7(1):27-34 (2002).

County of San Diego, Department of Public Works, Flood Control Division, San Diego County Hydrology Manual. (April 1993).

County of San Diego, Department of Public Works, Flood Control Division, San Diego County Hydrology Manual. (June 2003).

Gotvald, A.J., Barth, N.A., Veilleux, A.G., and Parrett, C., Methods for Determining Magnitude and Frequency of Floods in California, Based on Data through Water Year 2006. (2012).

Natural Resources Conservation Service (NRCS), Urban Hydrology for Small Watersheds, Technical Release No. 55, U.S. Department of Agriculture, Conservation Engineering Division. (June 1986).

Parrett, C., Veilleux, A., Stedinger, J.R., Barth, N.A., Knifong, D.L., and Ferris, J.C., 2011, Regional skew for California, and flood frequency for selected sites in the Sacramento–San Joaquin River Basin, based on data through water year 2006: U.S. Geological Survey Scientific Investigations Report 2010–5260, 94 p. (2010).

Veilleux A.G., and J.R. Stedinger. Bayesian GLS Analysis of California Regional Skew, Proceedings of the World Environmental and Water Resources Congress 2010: Challenges of Change, pp. 2422-2431, (http://dx.doi.org/10.1061/41114(371)249). (2010)

8. APPENDICES

B.1 Settings, Input and Output for PeakFq Ver. 5.2 Including Complete Listing of Instantaneous Annual Peak Discharges for the Six USGS Streamflow Gauges

B.2 Rainfall Data for All 5 Events from All 6 Gauges Where the Time Window Used to Extract the Measured Data was 18 Hours Before and 12 hours After the Time of the Selected Instantaneous Annual Peak Discharge

B.3 15-Minute Discharge Data for All 5 Events from All 6 Gauges Where the Time Window Used to Extract the Measured Data was 18 Hours Before and 12 hours After the Time of the Selected Instantaneous Annual Peak Discharge

B.4 Storm Event Processing Results Showing Measured Cumulative Rainfall (P) and 15-min Discharges (Q) and the Three Fitted Rainfall Distributions (Nested, Type B, NRCS Type I) for all 5 Events from all 6 Gauges Where the Time Window Used to Extract the Measured Data was 18 Hours Before and 12 Hours After the Time of the Selected Instantaneous Annual Peak Discharge

B.5 Storm Event Processing Results Showing Measured Cumulative Rainfall (P) and 15-min Discharges (Q) and the Three Fitted Rainfall Distributions (Nested, Type B, NRCS Type I) for all 5 Events from all 6 Gauges Where the Time Window Used to Extract the Measured Data was 16 Hours Before and 8 Hours After the Time of the Selected Instantaneous Annual Peak Discharge

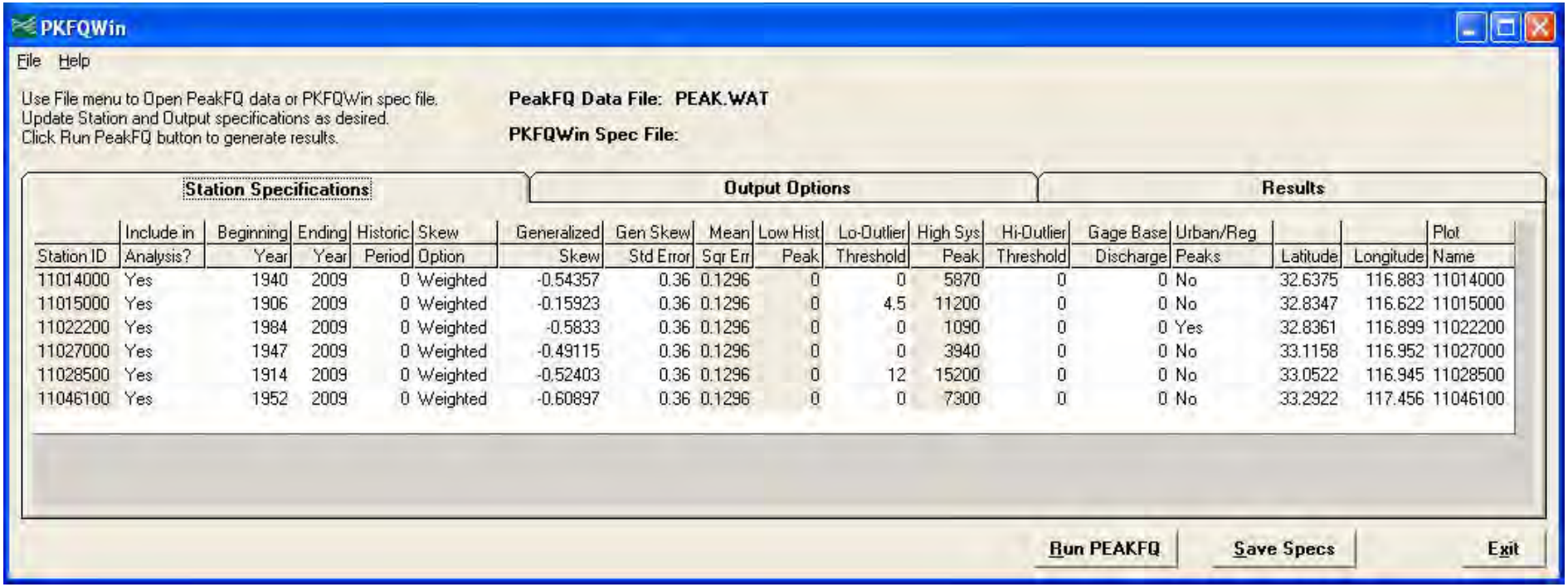
B.6 Cumulative Rainfall Distributions for the Three Events Used in this Study (Nested, Type B, NRCS Type I)

B.7 County of San Diego Stream Gauge Data

Appendix B.1

Settings, Input and Output for the PeakFq V. 5.2 Program Including Complete Listing of Instantaneous Annual Peak Discharges for the Six USGS Streamflow Gauges

This page is intentionally left blank to facilitate 2-sided printing.



Station ID	Include in Analysis?	Beginning Year	Ending Year	Historic Period	Skew Option	Generalized Skew	Gen Skew Std Error	Mean Sqr Err	Low Hist Peak	Lo-Outlier Threshold	High Sys Peak	Hi-Outlier Threshold	Gage Base Discharge	Urban/Reg Peaks	Latitude	Longitude	Plot Name
11014000	Yes	1940	2009	0	Weighted	-0.54357	0.36	0.1296	0	0	5870	0	0	No	32.6375	116.883	11014000
11015000	Yes	1906	2009	0	Weighted	-0.15923	0.36	0.1296	0	4.5	11200	0	0	No	32.8347	116.622	11015000
11022200	Yes	1984	2009	0	Weighted	-0.5833	0.36	0.1296	0	0	1090	0	0	Yes	32.8361	116.899	11022200
11027000	Yes	1947	2009	0	Weighted	-0.49115	0.36	0.1296	0	0	3940	0	0	No	33.1158	116.952	11027000
11028500	Yes	1914	2009	0	Weighted	-0.52403	0.36	0.1296	0	12	15200	0	0	No	33.0522	116.945	11028500
11046100	Yes	1952	2009	0	Weighted	-0.60897	0.36	0.1296	0	0	7300	0	0	No	33.2922	117.456	11046100

Figure B1.1 - PKFQ Interface showing all settings.

Table B1.1 – Input file for PKFQ Program (data obtained from USGS in WATSTORE format; file name = peak.wat)

```
Z11014000                USGS
H11014000     3238151165300000606073SW1807030470.1        511.64
N11014000     JAMUL C NR JAMUL CA
Y11014000
311014000     19400410   30.015
311014000     19420314    2765
311014000     19430127    5455
311014000     19440223    8905
311014000     19441112    3115
311014000     19451223    6905
311014000     19470402   48.015
311014000     19471201   40005
311014000     19490112    5505
311014000     19500211   30.05
311014000     19510216    3635
311014000     19520316   20305          5.046
311014000     19521202   33.05          2.20
311014000     19540322   13105          4.37
311014000     19550118   5.505          1.37
311014000     19560312   44.05          2.54
311014000     19570214   7.705          1.45
311014000     19580403   12205          4.27
311014000     19590221   1.505          1.11
311014000     19600112   14.05          1.78
311014000     1961       0.005
311014000     19620225   91.05          2.94
311014000     1963       0.005
311014000     1964       0.005
311014000     19650410   46.05          2.54
311014000     19651123    6805          3.60
311014000     19661206   27205          5.56
311014000     19680308    2305          3.36
311014000     19690226   10605          4.07
311014000     19700427   34.05          2.23
311014000     19701221    8105          3.75
311014000     19720606   56.05          2.70
311014000     19721111   12505          4.31
311014000     19740331   22.025
311014000     19750410   13.05          1.62
311014000     19760209    2635          3.42
311014000     19761022   28205          5.63
311014000     19780301   36505          6.16
311014000     19851125   10505          4.14
311014000     19870922   93.05          2.94
311014000     19880118    8685          4.04
311014000     19890325   37.05          2.23
311014000     19891118   25.05          1.94
311014000     19910301   23405          5.03
311014000     19920215    2015          3.38
311014000     19930116   39105          6.19
311014000     19940217   51.05          2.49
311014000     19950305   58705          7.59
311014000     19951220   46.05          2.41
311014000     19970113     665          2.82
311014000     19980214   32005          5.68
311014000     19981108     455          2.452
311014000     20000222     565          2.65
311014000     20010213     475          2.52
```

311014000 20020212 0.34125
311014000 20030316 315 2.09
311014000 20040222 9805 4.12
311014000 20041020 22305 5.10
311014000 20060311 115 1.56
311014000 20070219 6.205 1.38
311014000 20080214 1265 3.18
311014000 20081217 2685 3.54
Z11015000 USGS
H11015000 32500511637200006060 73SW1807030445.4 3269.24
N11015000 SWEETWATER R NR DESCANSO CA
Y11015000
311015000 19060324 3000 9.25
311015000 19070118 180
311015000 19080910 65.0
311015000 19090122 595
311015000 19100101 712
311015000 19110204 1821
311015000 19120308 450
311015000 19130912 160
311015000 19140221 595 6.50
311015000 19150210 1750 5.50
311015000 19160127 9870
311015000 19170416 320 1.90
311015000 19180312 1720 4.30
311015000 19190402 28.0 2.70
311015000 19200222 463 4.70
311015000 19201105 12.0 2.24
311015000 19211226 1700 7.03
311015000 19221214 103 3.09
311015000 19240405 67.0 2.74
311015000 19250423 116 3.12
311015000 19260406 600 5.10
311015000 19270216 11200 13.26
311015000 19570521 7.00 2.67
311015000 19580403 1290 6.60
311015000 19590216 41.0 2.82
311015000 19600428 16.0 2.54
311015000 19610126 1.00 2.18
311015000 19620324 38.0 3.21
311015000 19630317 7.00 2.52
311015000 19640324 28.0 3.06
311015000 19650410 415 5.05
311015000 19651123 1230 6.53
311015000 19661206 3890 8.93
311015000 19671219 39.0 4.15
311015000 19690225 1750 7.62
311015000 19700305 48.0 4.02
311015000 19701130 42.0 3.96
311015000 19711227 13.0 3.60
311015000 19730313 266 5.17
311015000 19740108 30.0 4.08
311015000 19750409 14.0 3.69
311015000 19760209 129 4.72
311015000 19770103 43.0 4.15
311015000 19780302 1150 8.12
311015000 19790328 958 7.87
311015000 19800220 6750 12.31
311015000 19810209 124 5.76
311015000 19820210 1130 8.10
311015000 19830302 2140D 9.28
311015000 19840817 380D 6.68

311015000 19850328 43.0 5.20
311015000 19860215 468 6.89
311015000 19870321 24.0 4.84
311015000 19880117 274 6.31
311015000 19881225 14.0 4.78
311015000 19900218 5.20 4.59
311015000 19910301 1340 8.39
311015000 19920215 265 7.06
311015000 19930116 4220 10.90
311015000 19940208 75.0 5.91
311015000 19950305 8600 13.22
311015000 19960313 73.0 5.89
311015000 19970113 134 6.28
311015000 19980214 2580 9.70
311015000 19981129 20 4.92
311015000 20000221 39 5.57
311015000 20010227 4.6 4.642
311015000 20020318 0.60 4.48
311015000 20030227 20 5.29
311015000 20031225 861 7.98
311015000 20050111 2900 10.82
311015000 20060405 120 6.19
311015000 20070219 14 5.08
311015000 20080107 238 7.69
311015000 20090216 240 7.52
Z11022200 USGS
H11022200 32501011653580006060 73SW1807030412.2 560
N11022200 LOS COCHES C NR LAKESIDE CA
Y11022200
311022200 19831120 50.01C
311022200 19841218 470C 7.20
311022200 19851125 290C 6.32
311022200 19870321 54.0C 3.95
311022200 19871031 146C 5.22
311022200 19881225 29.0C 3.48
311022200 19900114 99.0C 4.68
311022200 19910327 474C 7.47
311022200 19920212 136C 5.09
311022200 19930116 462C 7.41
311022200 19940325 103C 4.54
311022200 19950305 1090C 9.74
311022200 19960313 372C 6.81
311022200 19970112 144C 4.89
311022200 19980208 819C 8.89
311022200 19990125 75C 3.99
311022200 20000221 142C 4.86
311022200 20010112 86C 4.13
311022200 20020318 26C 3.41
311022200 20030225 102C 4.42
311022200 20040222 609C 8.08
311022200 20050109 508C 7.57
311022200 20060311 97C 4.29
311022200 20070219 82C 4.14
311022200 20071201 145C 4.92
311022200 20081217 204C 5.54
Z11027000 USGS
H11027000 33065711657080006060 73SW1807030422.5 610.00
N11027000 GUEJITO C NR SAN PASQUAL CA
Y11027000
311027000 19461228 16.0 2.14
311027000 19471205 16.0 2.18
311027000 19490207 30.0 2.35

311027000 19500207 34.0 2.38
311027000 19510129 45.0 2.49
311027000 19520118 842 4.11
311027000 19521202 36.0 2.382
311027000 19550119 24.0 2.26
311027000 19560127 403 3.97
311027000 19570129 16.0 2.12
311027000 19580403 1660 5.83
311027000 19590217 39.0 2.47
311027000 19600210 97.0 2.84
311027000 19610328 1.60 0.790
311027000 19620221 71.0 2.61
311027000 19630211 77.0 2.77
311027000 19640323 7.50 1.77
311027000 19650410 125 3.02
311027000 19651122 2250 7.45
311027000 19661206 2920 6.78
311027000 19671219 28.0 2.34
311027000 19690125 2100 6.20
311027000 19700228 100 2.90
311027000 19710102 31.0 2.39
311027000 19711227 16.0 2.14
311027000 19730313 80.0 2.79
311027000 19740108 102 2.92
311027000 19750308 53.0 2.60
311027000 19760209 72.0 2.74
311027000 19770103 22.0 2.23
311027000 19780301 1950 6.46
311027000 19790328 1020 5.00
311027000 19800220 3940 7.22
311027000 19810301 68.0 2.69
311027000 19811230 5.20 1.48
311027000 20050221 563 4.27
311027000 20060102 130 3.08
311027000 20070826 37 2.42
311027000 20080107 430 3.98
311027000 20081217 110 2.99
Z11028500 USGS
H11028500 33030811656410006060 73SW1807030457.6 1294.44
N11028500 SANTA MARIA C NR RAMONA CA
Y11028500
311028500 19140221 904 5.00
311028500 19150210 1890 7.05
311028500 19160127 7140 15.90
311028500 19170223 118 3.03
311028500 19180312 1370 6.00
311028500 19190321 38.0 2.50
311028500 19200326 198 3.45
311028500 19470321 1.20 1.266
311028500 19480324 0.30 1.05
311028500 19490207 12.0 1.80
311028500 19500325 0.70 1.04
311028500 1951 0.00
311028500 19520316 1800 4.16
311028500 19521116 37.0 1.81
311028500 19540322 795 3.43
311028500 19550118 24.0 1.72
311028500 19560331 0.101
311028500 19570402 0.101
311028500 19580322 5220 5.42
311028500 19590222 2.10 1.22
311028500 19600210 20.0 1.69

311028500 1961 0.00
311028500 19620221 40.0 1.85
311028500 1963 0.00
311028500 1964 0.00
311028500 19650412 15.0 1.62
311028500 19651123 1170 4.56
311028500 19661206 1800 5.18
311028500 19671218 22.0 1.78
311028500 19690225 1400 4.80
311028500 19700305 190 2.60
311028500 19701221 43.0 1.90
311028500 19720205 0.01 0.93
311028500 19730213 220 2.70
311028500 19740108 167 2.51
311028500 19750408 105 2.24
311028500 19760209 190 2.60
311028500 19770108 0.43 1.02
311028500 19780305 2850 5.97
311028500 19790131 1030 4.29
311028500 19800221 15200 14.39
311028500 19810301 226 2.49
311028500 19820317 1090 4.42
311028500 19830302 2670 6.48
311028500 19831225 97.0 2.11
311028500 19841228 97.0 2.11
311028500 19860215 867 4.01
311028500 19870315 20.0 1.74
311028500 19880118 411 3.08
311028500 19881225 13.0 1.60
311028500 19900117 13.0 1.61
311028500 19910327 1450 4.99
311028500 19920215 638 3.56
311028500 19930219 3550 7.35
311028500 19940217 292 2.79
311028500 19950305 5270 8.80
311028500 19960313 139 2.35
311028500 19970113 169 2.45
311028500 19980214 1340 5.28
311028500 19990412 18 1.71
311028500 20000224 50 2.06
311028500 20010310 83 2.31
311028500 20020318 0.19 0.96
311028500 20030316 99C 2.41
311028500 20040223 32C 1.88
311028500 20050111 2050C 6.31
311028500 20060405 58C 2.13
311028500 20070219 9.80C 1.54
311028500 20080214 341C 3.39
311028500 20081217 249C 3.09
Z11046100 USGS
H11046100 331732117272100060607 3SW1807030126.6 35.00
N11046100 LAS FLORES C NR OCEANSIDE CA
Y11046100
311046100 19520116 960 4.75
311046100 19521202 100 1.43
311046100 19540213 425 2.61
311046100 19550118 13.0 0.66
311046100 19560127 666 3.78
311046100 19570129 19.0 0.79
311046100 19580316 740 3.65
311046100 19590106 520 2.60
311046100 19600202 238 1.60

311046100	19610126	8.00	0.62
311046100	19620208	238	1.55
311046100	19630918	27.0	0.56
311046100	19631120	102	0.88
311046100	19650401	80.0	0.87
311046100	19651122	421	2.27
311046100	19661206	848	4.19
311046100	19690225	4200	7.25
311046100	19700228	24.0	1.04
311046100	19701221	2.40	0.42
311046100	19711228	1.10	0.32
311046100	19730211	63.0	1.59
311046100	19740108	9.70	0.63
311046100	19750408	5.00	0.61
311046100	19760206	0.65	0.27
311046100	19770106	14.0	0.73
311046100	19780301	7300	13.50
311046100	19790131	1170	3.66
311046100	19940217	14.0	0.63
311046100	19950305	2070	7.03
311046100	19960221	23.0	0.77
311046100	19970126		
311046100	19980224	3830	9.44
311046100	19990412	2.5	0.43
311046100	20000308	49	1.05
311046100	20010226	25	0.79
311046100	20011124	0.94	0.352
311046100	20030315	239	1.92
311046100	20040226	15	0.71
311046100	20050111	1810	5.79
311046100	20060405	6	0.570
311046100	20070131	0.64	0.340
311046100	20080222	72	1.25
311046100	20081215	16	0.740

Table B1.2 – Output file for final FFD analysis (file name = Final_Output.PRT)

```
1
 Program PeakFq          U. S. GEOLOGICAL SURVEY           Seq.000.000
 Ver. 5.2          Annual peak flow frequency analysis     Run Date / Time
 11/01/2007          following Bulletin 17-B Guidelines     10/16/2011 10:29

                     --- PROCESSING OPTIONS ---

                   Plot option         = None
                   Basin char output   = TAB-SEPARATED
                   Print option        = Yes
                   Debug print         = No
                   Input peaks listing = Long
                   Input peaks format  = WATSTORE peak file

                   Input files used:
                     peaks (ascii)  - C:\DOCUMENTS AND
SETTINGS\XPMUSER\DESKTOP\PKFQWINFILES\PEAK.WAT
                     specifications - PKFQWPSF.TMP
                   Output file(s):
                     main - C:\DOCUMENTS AND
SETTINGS\XPMUSER\DESKTOP\PKFQWINFILES\FINAL_OUTPUT.PRT
                     bcd  - C:\DOCUMENTS AND
SETTINGS\XPMUSER\DESKTOP\PKFQWINFILES\FINAL_OUTPUT.BCD

1


 Program PeakFq          U. S. GEOLOGICAL SURVEY           Seq.001.001
 Ver. 5.2          Annual peak flow frequency analysis     Run Date / Time
 11/01/2007          following Bulletin 17-B Guidelines     10/16/2011 10:29

               Station - 11014000  JAMUL C NR JAMUL CA


                  I N P U T   D A T A   S U M M A R Y

              Number of peaks in record           =       62
              Peaks not used in analysis          =       0
              Systematic peaks in analysis        =       62
              Historic peaks in analysis          =       0
              Years of historic record            =       0
              Generalized skew                    =   -0.544
                   Standard error                 =    0.360
                   Mean Square error              =    0.130
              Skew option                         =   WEIGHTED
              Gage base discharge                 =      0.0
              User supplied high outlier threshold =   --
              User supplied low outlier criterion  =   --
              Plotting position parameter         =     0.00



 *********  NOTICE  --  Preliminary machine computations.        *********
 *********  User responsible for assessment and interpretation.  *********

  *WCF107I-ACCEPTED GEN SKEW OUTSIDE MAP LIMITS.  -0.544  -0.400   0.800
   WCF133I-SYSTEMATIC PEAKS BELOW GAGE BASE WERE NOTED.         3      0.0
   WCF195I-NO LOW OUTLIERS WERE DETECTED BELOW CRITERION.               0.3
   WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE.     79474.1
1
```

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.001.002
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11014000 JAMUL C NR JAMUL CA

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE	LOGARITHMIC		
	EXCEEDANCE	STANDARD		
	DISCHARGE PROBABILITY	MEAN	DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	0.9516	2.1429	0.9883	-0.400
BULL.17B ESTIMATE	0.0	0.9516	2.1429	0.9883	-0.466

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL		'EXPECTED	95-PCT CONFIDENCE LIMITS	
EXCEEDANCE	BULL.17B	SYSTEMATIC	PROBABILITY'	FOR BULL. 17B ESTIMATES
PROBABILITY	ESTIMATE	RECORD	ESTIMATE	LOWER	UPPER
0.9500	2.5	2.6	2.2	1.0	5.0
0.9000	6.9	6.9	6.4	3.3	12.5
0.8000	21.9	21.7	21.2	12.1	36.7
0.6667	60.8	59.4	60.0	36.3	98.1
0.5000	165.7	161.7	165.7	102.8	269.4
0.4292	246.3	240.8	247.3	153.1	406.8
0.2000	975.2	972.9	999.5	579.3	1794.0
0.1000	2239.0	2289.0	2342.0	1257.0	4526.0
0.0400	5071.0	5369.0	5459.0	2654.0	11410.0
0.0200	8289.0	9018.0	9136.0	4141.0	19980.0
0.0100	12590.0	14080.0	14220.0	6032.0	32240.0
0.0050	18110.0	20800.0	20980.0	8354.0	48950.0
0.0020	27450.0	32680.0	32900.0	12110.0	79050.0

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.001.003
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11014000 JAMUL C NR JAMUL CA

I N P U T D A T A L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1940	30.0		1972	56.0	
1942	276.0		1973	1250.0	
1943	545.0		1974	22.0	
1944	890.0		1975	13.0	
1945	311.0		1976	263.0	
1946	690.0		1977	2820.0	
1947	48.0		1978	3650.0	

1948	4000.0	1986	1050.0
1949	550.0	1987	93.0
1950	30.0	1988	868.0
1951	363.0	1989	37.0
1952	2030.0	1990	25.0
1953	33.0	1991	2340.0
1954	1310.0	1992	201.0
1955	5.5	1993	3910.0
1956	44.0	1994	51.0
1957	7.7	1995	5870.0
1958	1220.0	1996	46.0
1959	1.5	1997	66.0
1960	14.0	1998	3200.0
1961	0.0	1999	45.0
1962	91.0	2000	56.0
1963	0.0	2001	47.0
1964	0.0	2002	0.3
1965	46.0	2003	31.0
1966	680.0	2004	980.0
1967	2720.0	2005	2230.0
1968	230.0	2006	11.0
1969	1060.0	2007	6.2
1970	34.0	2008	126.0
1971	810.0	2009	268.0

Explanation of peak discharge qualification codes

PeakFQ CODE	NWIS CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

- Minus-flagged discharge -- Not used in computation
  -8888.0 -- No discharge value given
- Minus-flagged water year -- Historic peak used in computation

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.001.004
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11014000 JAMUL C NR JAMUL CA

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1995	5870.0	0.0159	0.0159
1948	4000.0	0.0317	0.0317
1993	3910.0	0.0476	0.0476

1978	3650.0	0.0635	0.0635
1998	3200.0	0.0794	0.0794
1977	2820.0	0.0952	0.0952
1967	2720.0	0.1111	0.1111
1991	2340.0	0.1270	0.1270
2005	2230.0	0.1429	0.1429
1952	2030.0	0.1587	0.1587
1954	1310.0	0.1746	0.1746
1973	1250.0	0.1905	0.1905
1958	1220.0	0.2063	0.2063
1969	1060.0	0.2222	0.2222
1986	1050.0	0.2381	0.2381
2004	980.0	0.2540	0.2540
1944	890.0	0.2698	0.2698
1988	868.0	0.2857	0.2857
1971	810.0	0.3016	0.3016
1946	690.0	0.3175	0.3175
1966	680.0	0.3333	0.3333
1949	550.0	0.3492	0.3492
1943	545.0	0.3651	0.3651
1951	363.0	0.3810	0.3810
1945	311.0	0.3968	0.3968
1942	276.0	0.4127	0.4127
2009	268.0	0.4286	0.4286
1976	263.0	0.4444	0.4444
1968	230.0	0.4603	0.4603
1992	201.0	0.4762	0.4762
2008	126.0	0.4921	0.4921
1987	93.0	0.5079	0.5079
1962	91.0	0.5238	0.5238
1997	66.0	0.5397	0.5397
1972	56.0	0.5556	0.5556
2000	56.0	0.5714	0.5714
1994	51.0	0.5873	0.5873
1947	48.0	0.6032	0.6032
2001	47.0	0.6190	0.6190
1965	46.0	0.6349	0.6349
1996	46.0	0.6508	0.6508
1999	45.0	0.6667	0.6667
1956	44.0	0.6825	0.6825
1989	37.0	0.6984	0.6984
1970	34.0	0.7143	0.7143
1953	33.0	0.7302	0.7302
2003	31.0	0.7460	0.7460
1940	30.0	0.7619	0.7619
1950	30.0	0.7778	0.7778
1990	25.0	0.7937	0.7937
1974	22.0	0.8095	0.8095
1960	14.0	0.8254	0.8254
1975	13.0	0.8413	0.8413
2006	11.0	0.8571	0.8571
1957	7.7	0.8730	0.8730
2007	6.2	0.8889	0.8889
1955	5.5	0.9048	0.9048
1959	1.5	0.9206	0.9206
2002	0.3	0.9365	0.9365
1961	0.0	--	--
1963	0.0	--	--
1964	0.0	--	--

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.002.001
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11015000 SWEETWATER R NR DESCANSO CA

I N P U T D A T A S U M M A R Y

Number of peaks in record = 75
Peaks not used in analysis = 0
Systematic peaks in analysis = 75
Historic peaks in analysis = 0
Years of historic record = 0
Generalized skew = -0.159
Standard error = 0.360
Mean Square error = 0.130
Skew option = WEIGHTED
Gage base discharge = 0.0
User supplied high outlier threshold = --
User supplied low outlier criterion = 4.5
Plotting position parameter = 0.00

********* NOTICE -- Preliminary machine computations. *********
********* User responsible for assessment and interpretation. *********

WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE. 0.0
*WCF191I-USER LOW-OUTLIER CRITERION SUPERSEDES 17B. 4.5 0.3
WCF198I-LOW OUTLIERS BELOW FLOOD BASE WERE DROPPED. 2 4.5
WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE. 101163.1
1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.002.002
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11015000 SWEETWATER R NR DESCANSO CA

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE	LOGARITHMIC		
	EXCEEDANCE	STANDARD		
	DISCHARGE	PROBABILITY	MEAN	DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	2.2333	0.9531	-0.175
BULL.17B ESTIMATE	4.5	0.9733	2.2645	0.8957	-0.014

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	'EXPECTED SYSTEMATIC RECORD	95-PCT CONFIDENCE LIMITS PROBABILITY' ESTIMATE	FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9950	--	0.4	--	--	--
0.9900	--	0.8	--	--	--

0.9500	6.1	4.2	5.7	3.1	10.6
0.9000	13.0	9.9	12.5	7.2	21.3
0.8000	32.5	27.6	31.8	19.8	49.9
0.6667	75.9	70.1	75.3	49.4	113.0
0.5000	184.8	182.4	184.8	124.4	274.5
0.4292	266.9	269.1	267.7	180.4	400.5
0.2000	1045.0	1103.0	1067.0	679.8	1713.0
0.1000	2577.0	2726.0	2687.0	1582.0	4633.0
0.0400	6736.0	6971.0	7259.0	3819.0	13580.0
0.0200	12510.0	12600.0	13890.0	6702.0	27350.0
0.0100	21830.0	21260.0	25070.0	11070.0	51420.0
0.0050	36310.0	34050.0	43270.0	17490.0	91750.0
0.0020	67190.0	59640.0	84570.0	30370.0	185200.0

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.002.003
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11015000 SWEETWATER R NR DESCANSO CA

I N P U T D A T A L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1906	3000.0		1973	266.0	
1907	180.0		1974	30.0	
1908	65.0		1975	14.0	
1909	595.0		1976	129.0	
1910	712.0		1977	43.0	
1911	182.0		1978	1150.0	
1912	450.0		1979	958.0	
1913	160.0		1980	6750.0	
1914	595.0		1981	124.0	
1915	1750.0		1982	1130.0	
1916	9870.0		1983	2140.0	
1917	320.0		1984	380.0	
1918	1720.0		1985	43.0	
1919	28.0		1986	468.0	
1920	463.0		1987	24.0	
1921	12.0		1988	274.0	
1922	1700.0		1989	14.0	
1923	103.0		1990	5.2	
1924	67.0		1991	1340.0	
1925	116.0		1992	265.0	
1926	600.0		1993	4220.0	
1927	11200.0		1994	75.0	
1957	7.0		1995	8600.0	
1958	1290.0		1996	73.0	
1959	41.0		1997	134.0	
1960	16.0		1998	2580.0	
1961	1.0		1999	20.0	
1962	38.0		2000	39.0	
1963	7.0		2001	4.6	
1964	28.0		2002	0.6	
1965	415.0		2003	20.0	
1966	1230.0		2004	861.0	
1967	3890.0		2005	2900.0	
1968	39.0		2006	120.0	

1969	1750.0	2007	14.0
1970	48.0	2008	238.0
1971	42.0	2009	240.0
1972	13.0		

Explanation of peak discharge qualification codes

PeakFQ CODE	NWIS CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

- Minus-flagged discharge -- Not used in computation
  -8888.0 -- No discharge value given
- Minus-flagged water year -- Historic peak used in computation

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.002.004
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11015000 SWEETWATER R NR DESCANSO CA

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1927	11200.0	0.0132	0.0132
1916	9870.0	0.0263	0.0263
1995	8600.0	0.0395	0.0395
1980	6750.0	0.0526	0.0526
1993	4220.0	0.0658	0.0658
1967	3890.0	0.0789	0.0789
1906	3000.0	0.0921	0.0921
2005	2900.0	0.1053	0.1053
1998	2580.0	0.1184	0.1184
1983	2140.0	0.1316	0.1316
1915	1750.0	0.1447	0.1447
1969	1750.0	0.1579	0.1579
1918	1720.0	0.1711	0.1711
1922	1700.0	0.1842	0.1842
1991	1340.0	0.1974	0.1974
1958	1290.0	0.2105	0.2105
1966	1230.0	0.2237	0.2237
1978	1150.0	0.2368	0.2368
1982	1130.0	0.2500	0.2500
1979	958.0	0.2632	0.2632
2004	861.0	0.2763	0.2763
1910	712.0	0.2895	0.2895
1926	600.0	0.3026	0.3026

1909	595.0	0.3158	0.3158
1914	595.0	0.3289	0.3289
1986	468.0	0.3421	0.3421
1920	463.0	0.3553	0.3553
1912	450.0	0.3684	0.3684
1965	415.0	0.3816	0.3816
1984	380.0	0.3947	0.3947
1917	320.0	0.4079	0.4079
1988	274.0	0.4211	0.4211
1973	266.0	0.4342	0.4342
1992	265.0	0.4474	0.4474
2009	240.0	0.4605	0.4605
2008	238.0	0.4737	0.4737
1911	182.0	0.4868	0.4868
1907	180.0	0.5000	0.5000
1913	160.0	0.5132	0.5132
1997	134.0	0.5263	0.5263
1976	129.0	0.5395	0.5395
1981	124.0	0.5526	0.5526
2006	120.0	0.5658	0.5658
1925	116.0	0.5789	0.5789
1923	103.0	0.5921	0.5921
1994	75.0	0.6053	0.6053
1996	73.0	0.6184	0.6184
1924	67.0	0.6316	0.6316
1908	65.0	0.6447	0.6447
1970	48.0	0.6579	0.6579
1977	43.0	0.6711	0.6711
1985	43.0	0.6842	0.6842
1971	42.0	0.6974	0.6974
1959	41.0	0.7105	0.7105
1968	39.0	0.7237	0.7237
2000	39.0	0.7368	0.7368
1962	38.0	0.7500	0.7500
1974	30.0	0.7632	0.7632
1919	28.0	0.7763	0.7763
1964	28.0	0.7895	0.7895
1987	24.0	0.8026	0.8026
1999	20.0	0.8158	0.8158
2003	20.0	0.8289	0.8289
1960	16.0	0.8421	0.8421
1975	14.0	0.8553	0.8553
1989	14.0	0.8684	0.8684
2007	14.0	0.8816	0.8816
1972	13.0	0.8947	0.8947
1921	12.0	0.9079	0.9079
1957	7.0	0.9211	0.9211
1963	7.0	0.9342	0.9342
1990	5.2	0.9474	0.9474
2001	4.6	0.9605	0.9605
1961	1.0	0.9737	0.9737
2002	0.6	0.9868	0.9868

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.003.001
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11022200 LOS COCHES C NR LAKESIDE CA

I N P U T D A T A S U M M A R Y

Number of peaks in record = 26
Peaks not used in analysis = 0
Systematic peaks in analysis = 26
Historic peaks in analysis = 0
Years of historic record = 0
Generalized skew = -0.583
Standard error = 0.360
Mean Square error = 0.130
Skew option = WEIGHTED
Gage base discharge = 0.0
User supplied high outlier threshold = --
User supplied low outlier criterion = --
Plotting position parameter = 0.00

********* NOTICE -- Preliminary machine computations. *********
********* User responsible for assessment and interpretation. *********

*WCF107I-ACCEPTED GEN SKEW OUTSIDE MAP LIMITS. -0.583 -0.400 0.800
WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE. 0.0
WCF195I-NO LOW OUTLIERS WERE DETECTED BELOW CRITERION. 13.4
WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE. 2019.5
1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.003.002
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11022200 LOS COCHES C NR LAKESIDE CA

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE	LOGARITHMIC		
	EXCEEDANCE	STANDARD		
	DISCHARGE	PROBABILITY	MEAN	DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	2.2155	0.4356	0.116
BULL.17B ESTIMATE	0.0	1.0000	2.2155	0.4356	-0.309

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL		'EXPECTED	95-PCT CONFIDENCE LIMITS
EXCEEDANCE	BULL.17B	SYSTEMATIC	PROBABILITY' FOR BULL. 17B ESTIMATES
PROBABILITY	ESTIMATE	RECORD	ESTIMATE	LOWER	UPPER
0.9950	9.3	13.8	6.6	3.6	17.2
0.9900	12.7	17.4	9.8	5.4	22.4
0.9500	29.0	32.6	25.9	15.3	45.2
0.9000	44.1	46.0	41.2	25.7	65.1
0.8000	71.9	70.3	69.6	46.5	101.3
0.6667	111.4	105.0	109.9	77.1	154.0
0.5000	172.9	161.1	172.9	124.3	242.0
0.4292	206.3	192.7	207.3	149.1	292.9
0.2000	386.4	379.6	397.4	273.7	601.6

0.1000	571.9	600.9	602.4	390.6	965.8
0.0400	850.8	988.7	930.5	553.6	1578.0
0.0200	1087.0	1370.0	1228.0	684.0	2146.0
0.0100	1346.0	1844.0	1575.0	820.7	2809.0
0.0050	1626.0	2425.0	1976.0	963.4	3569.0
0.0020	2030.0	3392.0	2601.0	1161.0	4732.0

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.003.003
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11022200 LOS COCHES C NR LAKESIDE CA

I N P U T D A T A L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1984	50.0	K	1997	144.0	K
1985	470.0	K	1998	819.0	K
1986	290.0	K	1999	75.0	K
1987	54.0	K	2000	142.0	K
1988	146.0	K	2001	86.0	K
1989	29.0	K	2002	26.0	K
1990	99.0	K	2003	102.0	K
1991	474.0	K	2004	609.0	K
1992	136.0	K	2005	508.0	K
1993	462.0	K	2006	97.0	K
1994	103.0	K	2007	82.0	K
1995	1090.0	K	2008	145.0	K
1996	372.0	K	2009	204.0	K

Explanation of peak discharge qualification codes

PeakFQ CODE	NWIS CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

- Minus-flagged discharge -- Not used in computation
  -8888.0 -- No discharge value given
- Minus-flagged water year -- Historic peak used in computation

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.003.004
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11022200 LOS COCHES C NR LAKESIDE CA

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1995	1090.0	0.0370	0.0370
1998	819.0	0.0741	0.0741
2004	609.0	0.1111	0.1111
2005	508.0	0.1481	0.1481
1991	474.0	0.1852	0.1852
1985	470.0	0.2222	0.2222
1993	462.0	0.2593	0.2593
1996	372.0	0.2963	0.2963
1986	290.0	0.3333	0.3333
2009	204.0	0.3704	0.3704
1988	146.0	0.4074	0.4074
2008	145.0	0.4444	0.4444
1997	144.0	0.4815	0.4815
2000	142.0	0.5185	0.5185
1992	136.0	0.5556	0.5556
1994	103.0	0.5926	0.5926
2003	102.0	0.6296	0.6296
1990	99.0	0.6667	0.6667
2006	97.0	0.7037	0.7037
2001	86.0	0.7407	0.7407
2007	82.0	0.7778	0.7778
1999	75.0	0.8148	0.8148
1987	54.0	0.8519	0.8519
1984	50.0	0.8889	0.8889
1989	29.0	0.9259	0.9259
2002	26.0	0.9630	0.9630

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.004.001
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11027000 GUEJITO C NR SAN PASQUAL CA

I N P U T D A T A S U M M A R Y

Number of peaks in record = 40
Peaks not used in analysis = 0
Systematic peaks in analysis = 40
Historic peaks in analysis = 0
Years of historic record = 0
Generalized skew = -0.491
Standard error = 0.360
Mean Square error = 0.130
Skew option = WEIGHTED
Gage base discharge = 0.0
User supplied high outlier threshold = --
User supplied low outlier criterion = --
Plotting position parameter = 0.00

********* NOTICE -- Preliminary machine computations. *********

********* User responsible for assessment and interpretation. *********

*WCF107I-ACCEPTED GEN SKEW OUTSIDE MAP LIMITS. -0.491 -0.400 0.800
WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE. 0.0
WCF195I-NO LOW OUTLIERS WERE DETECTED BELOW CRITERION. 0.6
WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE. 14745.3
1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.004.002
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11027000 GUEJITO C NR SAN PASQUAL CA

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE	LOGARITHMIC		
	EXCEEDANCE	STANDARD		
	DISCHARGE	PROBABILITY	MEAN	DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	1.9780	0.8168	0.379
BULL.17B ESTIMATE	0.0	1.0000	1.9780	0.8168	-0.096

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	'EXPECTED SYSTEMATIC RECORD	95-PCT CONFIDENCE LIMITS PROBABILITY' ESTIMATE	FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9950	0.6	1.5	0.4	0.2	1.6
0.9900	1.0	2.0	0.8	0.3	2.4
0.9500	4.1	5.3	3.6	1.7	8.0
0.9000	8.4	9.3	7.8	3.9	15.2
0.8000	19.7	19.1	19.0	10.4	33.4
0.6667	43.4	38.6	42.7	25.0	70.9
0.5000	98.0	84.4	98.0	59.6	161.4
0.4292	136.9	118.3	137.7	83.9	229.4
0.2000	466.7	442.7	483.8	275.3	887.0
0.1000	1038.0	1128.0	1112.0	573.5	2229.0
0.0400	2402.0	3227.0	2717.0	1215.0	5989.0
0.0200	4102.0	6556.0	4870.0	1946.0	11330.0
0.0100	6608.0	12660.0	8284.0	2953.0	20060.0
0.0050	10180.0	23510.0	13560.0	4300.0	33760.0
0.0020	17120.0	50880.0	24880.0	6738.0	63180.0

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.004.003
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11027000 GUEJITO C NR SAN PASQUAL CA

I N P U T D A T A L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1947	16.0		1968	28.0	
1948	16.0		1969	2100.0	
1949	30.0		1970	100.0	
1950	34.0		1971	31.0	
1951	45.0		1972	16.0	
1952	842.0		1973	80.0	
1953	36.0		1974	102.0	
1955	24.0		1975	53.0	
1956	403.0		1976	72.0	
1957	16.0		1977	22.0	
1958	1660.0		1978	1950.0	
1959	39.0		1979	1020.0	
1960	97.0		1980	3940.0	
1961	1.6		1981	68.0	
1962	71.0		1982	5.2	
1963	77.0		2005	563.0	
1964	7.5		2006	130.0	
1965	125.0		2007	37.0	
1966	2250.0		2008	430.0	
1967	2920.0		2009	110.0	

Explanation of peak discharge qualification codes

PeakFQ CODE	NWIS CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

- Minus-flagged discharge -- Not used in computation
  -8888.0 -- No discharge value given
- Minus-flagged water year -- Historic peak used in computation

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.004.004
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11027000 GUEJITO C NR SAN PASQUAL CA

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1980	3940.0	0.0244	0.0244
1967	2920.0	0.0488	0.0488
1966	2250.0	0.0732	0.0732
1969	2100.0	0.0976	0.0976
1978	1950.0	0.1220	0.1220

1958	1660.0	0.1463	0.1463
1979	1020.0	0.1707	0.1707
1952	842.0	0.1951	0.1951
2005	563.0	0.2195	0.2195
2008	430.0	0.2439	0.2439
1956	403.0	0.2683	0.2683
2006	130.0	0.2927	0.2927
1965	125.0	0.3171	0.3171
2009	110.0	0.3415	0.3415
1974	102.0	0.3659	0.3659
1970	100.0	0.3902	0.3902
1960	97.0	0.4146	0.4146
1973	80.0	0.4390	0.4390
1963	77.0	0.4634	0.4634
1976	72.0	0.4878	0.4878
1962	71.0	0.5122	0.5122
1981	68.0	0.5366	0.5366
1975	53.0	0.5610	0.5610
1951	45.0	0.5854	0.5854
1959	39.0	0.6098	0.6098
2007	37.0	0.6341	0.6341
1953	36.0	0.6585	0.6585
1950	34.0	0.6829	0.6829
1971	31.0	0.7073	0.7073
1949	30.0	0.7317	0.7317
1968	28.0	0.7561	0.7561
1955	24.0	0.7805	0.7805
1977	22.0	0.8049	0.8049
1947	16.0	0.8293	0.8293
1948	16.0	0.8537	0.8537
1957	16.0	0.8780	0.8780
1972	16.0	0.9024	0.9024
1964	7.5	0.9268	0.9268
1982	5.2	0.9512	0.9512
1961	1.6	0.9756	0.9756

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.005.001
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11028500 SANTA MARIA C NR RAMONA CA

I N P U T D A T A S U M M A R Y

Number of peaks in record = 70
Peaks not used in analysis = 7
Systematic peaks in analysis = 63
Historic peaks in analysis = 0
Years of historic record = 0
Generalized skew = -0.524
Standard error = 0.360
Mean Square error = 0.130
Skew option = WEIGHTED
Gage base discharge = 0.0
User supplied high outlier threshold = --
User supplied low outlier criterion = 12.0
Plotting position parameter = 0.00

```
*********  NOTICE  --  Preliminary machine computations.        *********
*********  User responsible for assessment and interpretation.  *********

 *WCF107I-ACCEPTED GEN SKEW OUTSIDE MAP LIMITS.  -0.524  -0.400   0.800
**WCF109W-PEAKS WITH MINUS-FLAGGED DISCHARGES WERE BYPASSED.       7
**WCF113W-NUMBER OF SYSTEMATIC PEAKS HAS BEEN REDUCED TO NSYS =   63
  WCF133I-SYSTEMATIC PEAKS BELOW GAGE BASE WERE NOTED.         4      0.0
 *WCF191I-USER LOW-OUTLIER CRITERION SUPERSEDES 17B.        12.0      0.0
  WCF198I-LOW OUTLIERS BELOW FLOOD BASE WERE DROPPED.      10        12.0
  WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE.     58066.7
  WCF002J-CALCS COMPLETED.  RETURN CODE =  2
1


 Program PeakFq          U. S. GEOLOGICAL SURVEY           Seq.005.002
 Ver. 5.2          Annual peak flow frequency analysis      Run Date / Time
 11/01/2007         following Bulletin 17-B Guidelines       10/16/2011 10:29

             Station - 11028500  SANTA MARIA C NR RAMONA CA


        ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

                  FLOOD BASE                  LOGARITHMIC
              ---------------------  ------------------------------
                       EXCEEDANCE                STANDARD
               DISCHARGE PROBABILITY     MEAN     DEVIATION     SKEW
              ------------------------------------------------------
SYSTEMATIC RECORD       0.0     0.9365     1.8252      1.4784     -0.928
BULL.17B ESTIMATE      12.0     0.7778     2.1066      1.0296     -0.343


   ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

    ANNUAL                          'EXPECTED   95-PCT CONFIDENCE LIMITS
  EXCEEDANCE     BULL.17B    SYSTEMATIC PROBABILITY'  FOR BULL. 17B ESTIMATES
  PROBABILITY    ESTIMATE      RECORD     ESTIMATE        LOWER        UPPER

    0.9000         --          0.7         --          --          --
    0.8000         --          4.9         --          --          --
    0.6667        51.7        25.0        51.0        30.2        84.8
    0.5000       146.3       112.4       146.3        89.2       241.3
    0.4292       221.8       197.8       222.8       135.7       371.7
    0.2000       967.7      1222.0       993.5       564.9      1814.0
    0.1000      2413.0      3258.0      2534.0      1323.0      5016.0
    0.0400      6055.0      7731.0      6578.0      3069.0     14190.0
    0.0200     10660.0     12330.0     11910.0      5115.0     27040.0
    0.0100     17380.0     17740.0     20030.0      7941.0     47370.0
    0.0050     26770.0     23710.0     31870.0     11690.0     77840.0
    0.0020     44320.0     32030.0     55170.0     18330.0    139100.0
1


 Program PeakFq          U. S. GEOLOGICAL SURVEY           Seq.005.003
 Ver. 5.2          Annual peak flow frequency analysis      Run Date / Time
 11/01/2007         following Bulletin 17-B Guidelines       10/16/2011 10:29

             Station - 11028500  SANTA MARIA C NR RAMONA CA
```

I N P U T D A T A L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1914	904.0		1975	105.0	
1915	1890.0		1976	190.0	
1916	7140.0		1977	0.4	
1917	118.0		1978	2850.0	
1918	1370.0		1979	1030.0	
1919	38.0		1980	15200.0	
1920	198.0		1981	226.0	
1947	1.2		1982	1090.0	
1948	0.3		1983	2670.0	
1949	12.0		1984	97.0	
1950	0.7		1985	97.0	
1951	0.0		1986	867.0	
1952	1800.0		1987	20.0	
1953	37.0		1988	411.0	
1954	795.0		1989	13.0	
1955	24.0		1990	13.0	
1956	0.1		1991	1450.0	
1957	0.1		1992	638.0	
1958	5220.0		1993	3550.0	
1959	2.1		1994	292.0	
1960	20.0		1995	5270.0	
1961	0.0		1996	139.0	
1962	40.0		1997	169.0	
1963	0.0		1998	1340.0	
1964	0.0		1999	18.0	
1965	15.0		2000	50.0	
1966	1170.0		2001	83.0	
1967	1800.0		2002	0.2	
1968	22.0		2003	-99.0	K
1969	1400.0		2004	-32.0	K
1970	190.0		2005	-2050.0	K
1971	43.0		2006	-58.0	K
1972	0.0		2007	-9.8	K
1973	220.0		2008	-341.0	K
1974	167.0		2009	-249.0	K

Explanation of peak discharge qualification codes

PeakFQ CODE	NWIS CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

- Minus-flagged discharge -- Not used in computation
  -8888.0 -- No discharge value given
- Minus-flagged water year -- Historic peak used in computation

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.005.004
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11028500 SANTA MARIA C NR RAMONA CA

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1980	15200.0	0.0156	0.0156
1916	7140.0	0.0313	0.0313
1995	5270.0	0.0469	0.0469
1958	5220.0	0.0625	0.0625
1993	3550.0	0.0781	0.0781
1978	2850.0	0.0938	0.0938
1983	2670.0	0.1094	0.1094
1915	1890.0	0.1250	0.1250
1952	1800.0	0.1406	0.1406
1967	1800.0	0.1563	0.1563
1991	1450.0	0.1719	0.1719
1969	1400.0	0.1875	0.1875
1918	1370.0	0.2031	0.2031
1998	1340.0	0.2188	0.2188
1966	1170.0	0.2344	0.2344
1982	1090.0	0.2500	0.2500
1979	1030.0	0.2656	0.2656
1914	904.0	0.2813	0.2813
1986	867.0	0.2969	0.2969
1954	795.0	0.3125	0.3125
1992	638.0	0.3281	0.3281
1988	411.0	0.3438	0.3438
1994	292.0	0.3594	0.3594
1981	226.0	0.3750	0.3750
1973	220.0	0.3906	0.3906
1920	198.0	0.4063	0.4063
1970	190.0	0.4219	0.4219
1976	190.0	0.4375	0.4375
1997	169.0	0.4531	0.4531
1974	167.0	0.4688	0.4688
1996	139.0	0.4844	0.4844
1917	118.0	0.5000	0.5000
1975	105.0	0.5156	0.5156
1984	97.0	0.5313	0.5313
1985	97.0	0.5469	0.5469
2001	83.0	0.5625	0.5625
2000	50.0	0.5781	0.5781
1971	43.0	0.5938	0.5938
1962	40.0	0.6094	0.6094
1919	38.0	0.6250	0.6250
1953	37.0	0.6406	0.6406
1955	24.0	0.6563	0.6563
1968	22.0	0.6719	0.6719
1960	20.0	0.6875	0.6875
1987	20.0	0.7031	0.7031
1999	18.0	0.7188	0.7188
1965	15.0	0.7344	0.7344
1989	13.0	0.7500	0.7500
1990	13.0	0.7656	0.7656

1949	12.0	0.7813	0.7813
1959	2.1	0.7969	0.7969
1947	1.2	0.8125	0.8125
1950	0.7	0.8281	0.8281
1977	0.4	0.8438	0.8438
1948	0.3	0.8594	0.8594
2002	0.2	0.8750	0.8750
1956	0.1	0.8906	0.8906
1957	0.1	0.9063	0.9063
1972	0.0	0.9219	0.9219
1951	0.0	--	--
1961	0.0	--	--
1963	0.0	--	--
1964	0.0	--	--
2004	-32.0	--	--
2006	-58.0	--	--
2003	-99.0	--	--
2009	-249.0	--	--
2008	-341.0	--	--
2005	-2050.0	--	--
2007	-9.8	--	--

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.006.001
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11046100 LAS FLORES C NR OCEANSIDE CA

I N P U T D A T A S U M M A R Y

Number of peaks in record = 42
Peaks not used in analysis = 0
Systematic peaks in analysis = 42
Historic peaks in analysis = 0
Years of historic record = 0
Generalized skew = -0.609
Standard error = 0.360
Mean Square error = 0.130
Skew option = WEIGHTED
Gage base discharge = 0.0
User supplied high outlier threshold = --
User supplied low outlier criterion = --
Plotting position parameter = 0.00

********* NOTICE -- Preliminary machine computations. *********
********* User responsible for assessment and interpretation. *********

*WCF107I-ACCEPTED GEN SKEW OUTSIDE MAP LIMITS. -0.609 -0.400 0.800
WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE. 0.0
WCF195I-NO LOW OUTLIERS WERE DETECTED BELOW CRITERION. 0.1
WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE. 58924.6

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.006.002
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11046100 LAS FLORES C NR OCEANSIDE CA

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE	LOGARITHMIC		
	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	1.7878	1.1046	0.009
BULL.17B ESTIMATE	0.0	1.0000	1.7878	1.1046	-0.290

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	'EXPECTED SYSTEMATIC RECORD	PROBABILITY' ESTIMATE	95-PCT CONFIDENCE LIMITS FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9950	0.0	0.1	0.0	0.0	0.2
0.9900	0.1	0.2	0.1	0.0	0.3
0.9500	0.8	0.9	0.6	0.2	1.9
0.9000	2.2	2.4	2.0	0.8	4.9
0.8000	7.5	7.2	7.2	3.3	15.1
0.6667	22.8	20.4	22.3	11.1	43.6
0.5000	69.4	61.1	69.4	36.1	134.4
0.4292	108.6	96.2	109.4	56.9	215.4
0.2000	536.6	520.9	560.5	266.8	1251.0
0.1000	1461.0	1601.0	1585.0	670.9	3951.0
0.0400	4045.0	5309.0	4651.0	1675.0	13010.0
0.0200	7603.0	11530.0	9189.0	2929.0	27430.0
0.0100	13180.0	23180.0	16810.0	4749.0	52740.0
0.0050	21480.0	43930.0	29050.0	7281.0	94500.0
0.0020	38120.0	95410.0	55950.0	12000.0	187800.0

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.006.003
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11046100 LAS FLORES C NR OCEANSIDE CA

I N P U T D A T A L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1952	960.0		1974	9.7	
1953	100.0		1975	5.0	
1954	425.0		1976	0.6	
1955	13.0		1977	14.0	
1956	666.0		1978	7300.0	
1957	19.0		1979	1170.0	
1958	740.0		1994	14.0	
1959	520.0		1995	2070.0	
1960	238.0		1996	23.0	
1961	8.0		1998	3830.0	

1962	238.0	1999	2.5
1963	27.0	2000	49.0
1964	102.0	2001	25.0
1965	80.0	2002	0.9
1966	421.0	2003	239.0
1967	848.0	2004	15.0
1969	4200.0	2005	1810.0
1970	24.0	2006	6.0
1971	2.4	2007	0.6
1972	1.1	2008	72.0
1973	63.0	2009	16.0

Explanation of peak discharge qualification codes

PeakFQ CODE	NWIS CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

- Minus-flagged discharge -- Not used in computation
  -8888.0 -- No discharge value given
- Minus-flagged water year -- Historic peak used in computation

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.006.004
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 10/16/2011 10:29

Station - 11046100 LAS FLORES C NR OCEANSIDE CA

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1978	7300.0	0.0233	0.0233
1969	4200.0	0.0465	0.0465
1998	3830.0	0.0698	0.0698
1995	2070.0	0.0930	0.0930
2005	1810.0	0.1163	0.1163
1979	1170.0	0.1395	0.1395
1952	960.0	0.1628	0.1628
1967	848.0	0.1860	0.1860
1958	740.0	0.2093	0.2093
1956	666.0	0.2326	0.2326
1959	520.0	0.2558	0.2558
1954	425.0	0.2791	0.2791
1966	421.0	0.3023	0.3023
2003	239.0	0.3256	0.3256
1960	238.0	0.3488	0.3488
1962	238.0	0.3721	0.3721

1964	102.0	0.3953	0.3953
1953	100.0	0.4186	0.4186
1965	80.0	0.4419	0.4419
2008	72.0	0.4651	0.4651
1973	63.0	0.4884	0.4884
2000	49.0	0.5116	0.5116
1963	27.0	0.5349	0.5349
2001	25.0	0.5581	0.5581
1970	24.0	0.5814	0.5814
1996	23.0	0.6047	0.6047
1957	19.0	0.6279	0.6279
2009	16.0	0.6512	0.6512
2004	15.0	0.6744	0.6744
1977	14.0	0.6977	0.6977
1994	14.0	0.7209	0.7209
1955	13.0	0.7442	0.7442
1974	9.7	0.7674	0.7674
1961	8.0	0.7907	0.7907
2006	6.0	0.8140	0.8140
1975	5.0	0.8372	0.8372
1999	2.5	0.8605	0.8605
1971	2.4	0.8837	0.8837
1972	1.1	0.9070	0.9070
2002	0.9	0.9302	0.9302
1976	0.6	0.9535	0.9535
2007	0.6	0.9767	0.9767

1

End PeakFQ analysis.
Stations processed : 6
Number of errors : 0
Stations skipped : 0
Station years : 315

Data records may have been ignored for the stations listed below.
(Card type must be Y, Z, N, H, I, 2, 3, 4, or *.)
(2, 4, and * records are ignored.)

For the station below, the following records were ignored:

FINISHED PROCESSING STATION: 11014000 USGS JAMUL C NR JAMUL CA

For the station below, the following records were ignored:

FINISHED PROCESSING STATION: 11015000 USGS SWEETWATER R NR DESCANSO CA

For the station below, the following records were ignored:

FINISHED PROCESSING STATION: 11022200 USGS LOS COCHES C NR LAKESIDE CA

For the station below, the following records were ignored:

FINISHED PROCESSING STATION: 11027000 USGS GUEJITO C NR SAN PASQUAL CA

For the station below, the following records were ignored:

FINISHED PROCESSING STATION: 11028500 USGS SANTA MARIA C NR RAMONA CA

For the station below, the following records were ignored:

FINISHED PROCESSING STATION: 11046100 USGS LAS FLORES C NR OCEANSIDE CA

For the station below, the following records were ignored:

FINISHED PROCESSING STATION:

Table B1.3 – Instantaneous annual peak discharges for the six USGS streamflow gauges.

Codes	Streamflow-Qualification
1	Discharge is a maximum daily average
2	Discharge is an estimate
5	Discharge affected to unknown degree by regulation or diversion
6	Discharge by regulation of diversion
C	All/part of record affected by Urbanization, mining, agr. changes, chann., other
D	Base discharge changed during this year

USGS ID 11014000

Date	Year	Peak (cfs)	Code
4/10/1940	1940	30	1,5
3/14/1942	1942	276	5
1/27/1943	1943	545	5
2/23/1944	1944	890	5
11/12/1944	1945	311	5
12/23/1945	1946	690	5
4/2/1947	1947	48	1,5
12/1/1947	1948	4000	5
1/12/1949	1949	550	5
2/11/1950	1950	30	5
2/16/1951	1951	363	5
3/16/1952	1952	2030	5
12/2/1952	1953	33	5
3/22/1954	1954	1310	5
1/18/1955	1955	5.5	5
3/12/1956	1956	44	5
2/14/1957	1957	7.7	5
4/3/1958	1958	1220	5
2/21/1959	1959	1.5	5
1/12/1960	1960	14	5
11/30/1960	1961	0	5
2/25/1962	1962	91	5
11/30/1962	1963	0	5
11/30/1963	1964	0	5
4/10/1965	1965	46	5
11/23/1965	1966	680	5
12/6/1966	1967	2720	5
3/8/1968	1968	230	5
2/26/1969	1969	1060	5
4/27/1970	1970	34	5
12/21/1970	1971	810	5
6/6/1972	1972	56	5
11/11/1972	1973	1250	5
3/31/1974	1974	22	2,5
4/10/1975	1975	13	5
2/9/1976	1976	263	5
10/22/1976	1977	2820	5
3/1/1978	1978	3650	5
11/25/1985	1986	1050	5
9/22/1987	1987	93	5
1/18/1988	1988	868	5
3/25/1989	1989	37	5
11/18/1989	1990	25	5
3/1/1991	1991	2340	5
2/15/1992	1992	201	5
1/16/1993	1993	3910	5
2/17/1994	1994	51	5
3/5/1995	1995	5870	5
12/20/1995	1996	46	5
1/13/1997	1997	66	5
2/14/1998	1998	3200	5
11/8/1998	1999	45	5
2/22/2000	2000	56	5
2/13/2001	2001	47	5
2/12/2002	2002	0.34	1,2,5
3/16/2003	2003	31	5
2/22/2004	2004	980	5
10/20/2004	2005	2230	5
3/11/2006	2006	11	5
2/19/2007	2007	6.2	5
2/14/2008	2008	126	5
12/17/2008	2009	268	5

USGS ID 11015000

Date	Year	Peak (cfs)	Code
3/24/1906	1906	3000	
1/18/1907	1907	180	
9/10/1908	1908	65	
1/22/1909	1909	595	
1/1/1910	1910	712	
2/4/1911	1911	182	1
3/8/1912	1912	450	
9/12/1913	1913	160	
2/21/1914	1914	595	
2/10/1915	1915	1750	
1/27/1916	1916	9870	
4/16/1917	1917	320	
3/12/1918	1918	1720	
4/2/1919	1919	28	
2/22/1920	1920	463	
11/5/1920	1921	12	
12/26/1921	1922	1700	
12/14/1922	1923	103	
4/5/1924	1924	67	
4/23/1925	1925	116	
4/6/1926	1926	600	
2/16/1927	1927	11200	
5/21/1957	1957	7	
4/3/1958	1958	1290	
2/16/1959	1959	41	
4/28/1960	1960	16	
1/26/1961	1961	1	
3/24/1962	1962	38	
3/17/1963	1963	7	
3/24/1964	1964	28	
4/10/1965	1965	415	
11/23/1965	1966	1230	
12/6/1966	1967	3890	
12/19/1967	1968	39	
2/25/1969	1969	1750	
3/5/1970	1970	48	
11/30/1970	1971	42	
12/27/1971	1972	13	
3/13/1973	1973	266	
1/8/1974	1974	30	
4/9/1975	1975	14	
2/9/1976	1976	129	
1/3/1977	1977	43	
3/2/1978	1978	1150	
3/28/1979	1979	958	
2/20/1980	1980	6750	
2/9/1981	1981	124	
2/10/1982	1982	1130	
3/2/1983	1983	2140	D
8/17/1984	1984	380	D
3/28/1985	1985	43	
2/15/1986	1986	468	
3/21/1987	1987	24	
1/17/1988	1988	274	
12/25/1988	1989	14	
2/18/1990	1990	5.2	
3/1/1991	1991	1340	
2/15/1992	1992	265	
1/16/1993	1993	4220	
2/8/1994	1994	75	
3/5/1995	1995	8600	
3/13/1996	1996	73	
1/13/1997	1997	134	
2/14/1998	1998	2580	
11/29/1998	1999	20	
2/21/2000	2000	39	
2/27/2001	2001	4.6	
3/18/2002	2002	0.6	
2/27/2003	2003	20	
12/25/2003	2004	861	
1/11/2005	2005	2900	
4/5/2006	2006	120	
2/19/2007	2007	14	
1/7/2008	2008	238	
2/16/2009	2009	240	

USGS 11022200

Date	Year	Peak (cfs)	Code
11/20/1983	1984	50	1,C
12/18/1984	1985	470	C
11/25/1985	1986	290	C
3/21/1987	1987	54	C
10/31/1987	1988	146	C
12/25/1988	1989	29	C
1/14/1990	1990	99	C
3/27/1991	1991	474	C
2/12/1992	1992	136	C
1/16/1993	1993	462	C
3/25/1994	1994	103	C
3/5/1995	1995	1090	C
3/13/1996	1996	372	C
1/12/1997	1997	144	C
2/8/1998	1998	819	C
1/25/1999	1999	75	C
2/21/2000	2000	142	C
1/12/2001	2001	86	C
3/18/2002	2002	26	C
2/25/2003	2003	102	C
2/22/2004	2004	609	C
1/9/2005	2005	508	C
3/11/2006	2006	97	C
2/19/2007	2007	82	C
12/1/2007	2008	145	C
12/17/2008	2009	204	C

Table B1.3 (cont.) – Instantaneous annual peak discharges for the six USGS streamflow gauges.

Codes	Streamflow-Qualification
1	Discharge is a maximum daily average
2	Discharge is an estimate
5	Discharge affected to unknown degree by regulation or diversion
6	Discharge by regulation of diversion
C	All/part of record affected by Urbanization, mining, agr. changes, chann., other
D	Base discharge changed during this year

USGS 11027000

Date	Year	Peak (cfs)	Code
12/28/1946	1947	16	
12/5/1947	1948	16	
2/7/1949	1949	30	
2/7/1950	1950	34	
1/29/1951	1951	45	
1/18/1952	1952	842	
12/2/1952	1953	36	
1/19/1955	1955	24	
1/27/1956	1956	403	
1/29/1957	1957	16	
4/3/1958	1958	1660	
2/17/1959	1959	39	
2/10/1960	1960	97	
3/28/1961	1961	1.6	
2/21/1962	1962	71	
2/11/1963	1963	77	
3/23/1964	1964	7.5	
4/10/1965	1965	125	
11/22/1965	1966	2250	
12/6/1966	1967	2920	
12/19/1967	1968	28	
1/25/1969	1969	2100	
2/28/1970	1970	100	
1/2/1971	1971	31	
12/27/1971	1972	16	
3/13/1973	1973	80	
1/8/1974	1974	102	
3/8/1975	1975	53	
2/9/1976	1976	72	
1/3/1977	1977	22	
3/1/1978	1978	1950	
3/28/1979	1979	1020	5
2/20/1980	1980	3940	
3/1/1981	1981	68	
12/30/1981	1982	5.2	
2/21/2005	2005	563	
1/2/2006	2006	130	
8/26/2007	2007	37	
1/7/2008	2008	430	
12/17/2008	2009	110	

USGS ID 11028500

Date	Year	Peak (cfs)	Code
2/21/1914	1914	904	5
2/10/1915	1915	1890	
1/27/1916	1916	7140	
2/23/1917	1917	118	
3/12/1918	1918	1370	6
3/21/1919	1919	38	
3/26/1920	1920	198	
3/21/1947	1947	1.2	
3/24/1948	1948	0.3	
2/7/1949	1949	12	
3/25/1950	1950	0.7	
11/30/1950	1951	0	
3/16/1952	1952	1800	
11/16/1952	1953	37	
3/22/1954	1954	795	
1/18/1955	1955	24	
3/31/1956	1956	0.1	1
4/2/1957	1957	0.1	1
3/22/1958	1958	5220	
2/22/1959	1959	2.1	
2/10/1960	1960	20	
11/30/1960	1961	0	
2/21/1962	1962	40	
11/30/1962	1963	0	
11/30/1963	1964	0	
4/12/1965	1965	15	
11/23/1965	1966	1170	
12/6/1966	1967	1800	
12/18/1967	1968	22	
2/25/1969	1969	1400	
3/5/1970	1970	190	
12/21/1970	1971	43	
2/5/1972	1972	0.01	
2/13/1973	1973	220	
1/8/1974	1974	167	
4/8/1975	1975	105	
2/9/1976	1976	190	
1/8/1977	1977	0.43	
3/5/1978	1978	2850	
1/31/1979	1979	1030	
2/21/1980	1980	15200	
3/1/1981	1981	226	
3/17/1982	1982	1090	
3/2/1983	1983	2670	
12/25/1983	1984	97	
12/28/1984	1985	97	
2/15/1986	1986	867	
3/15/1987	1987	20	
1/18/1988	1988	411	
12/25/1988	1989	13	
1/17/1990	1990	13	
3/27/1991	1991	1450	
2/15/1992	1992	638	
2/19/1993	1993	3550	
2/17/1994	1994	292	
3/5/1995	1995	5270	
3/13/1996	1996	139	
1/13/1997	1997	169	
2/14/1998	1998	1340	
4/12/1999	1999	18	
2/24/2000	2000	50	
3/10/2001	2001	83	
3/18/2002	2002	0.19	
3/16/2003	2003	99	C
2/23/2004	2004	32	C
1/11/2005	2005	2050	C
4/5/2006	2006	58	C
2/19/2007	2007	9.8	C
2/14/2008	2008	341	C
12/17/2008	2009	249	C

USGS ID 11046100

Date	Year	Peak (cfs)	Code
1/16/1952	1952	960	
12/2/1952	1953	100	
2/13/1954	1954	425	
1/18/1955	1955	13	
1/27/1956	1956	666	
1/29/1957	1957	19	
3/16/1958	1958	740	
1/6/1959	1959	520	
2/2/1960	1960	238	
1/26/1961	1961	8	
2/8/1962	1962	238	
9/18/1963	1963	27	
11/20/1963	1964	102	
4/1/1965	1965	80	
11/22/1965	1966	421	
12/6/1966	1967	848	
2/25/1969	1969	4200	
2/28/1970	1970	24	
12/21/1970	1971	2.4	
12/28/1971	1972	1.1	
2/11/1973	1973	63	
1/8/1974	1974	9.7	
4/8/1975	1975	5	
2/6/1976	1976	0.65	
1/6/1977	1977	14	
3/1/1978	1978	7300	
1/31/1979	1979	1170	
2/17/1994	1994	14	
3/5/1995	1995	2070	
2/21/1996	1996	23	
2/24/1998	1998	3830	
4/12/1999	1999	2.5	
3/8/2000	2000	49	
2/26/2001	2001	25	
11/24/2001	2002	0.94	
3/15/2003	2003	239	
2/26/2004	2004	15	
1/11/2005	2005	1810	
4/5/2006	2006	6	
1/31/2007	2007	0.64	
2/22/2008	2008	72	
12/15/2008	2009	16	

Appendix B.2

Rainfall Data for All 5 Events from All 6 Gauges Where the Time Window Used to Extract the Measured Data was 18 Hours Before and 12 Hours After the Time of the Selected Instantaneous Annual Peak Discharge

This page is intentionally left blank to facilitate 2-sided printing.

Table B2.1: Incremental & cumulative event rainfall for SDCFCD ID DULC1 (USGS 11014000).

Date-Time	Inc. P (in)	Cum. P (%)
2/28/91 14:41	0.039	0.85%
2/28/91 15:01	0.039	1.69%
2/28/91 15:07	0.039	2.54%
2/28/91 15:11	0.039	3.39%
2/28/91 15:20	0.039	4.24%
2/28/91 15:26	0.039	5.08%
2/28/91 15:28	0.039	5.93%
2/28/91 15:35	0.039	6.78%
2/28/91 16:58	0.039	7.63%
2/28/91 17:07	0.039	8.47%
2/28/91 17:48	0.039	9.32%
2/28/91 17:52	0.039	10.17%
2/28/91 17:55	0.039	11.02%
2/28/91 19:46	0.039	11.86%
2/28/91 20:26	0.039	12.71%
2/28/91 20:32	0.039	13.56%
2/28/91 20:51	0.039	14.41%
2/28/91 21:02	0.039	15.25%
2/28/91 21:12	0.039	16.10%
2/28/91 21:21	0.039	16.95%
2/28/91 21:30	0.039	17.80%
2/28/91 21:35	0.039	18.64%
2/28/91 21:49	0.039	19.49%
2/28/91 22:04	0.000	19.49%
2/28/91 22:09	0.039	20.34%
2/28/91 22:19	0.039	21.19%
2/28/91 22:27	0.039	22.03%
2/28/91 22:36	0.039	22.88%
2/28/91 22:41	0.039	23.73%
2/28/91 22:48	0.039	24.58%
2/28/91 22:54	0.039	25.42%
2/28/91 22:59	0.039	26.27%
2/28/91 23:03	0.039	27.12%
2/28/91 23:09	0.039	27.97%
2/28/91 23:24	0.039	28.81%
2/28/91 23:34	0.039	29.66%
2/28/91 23:44	0.039	30.51%
2/28/91 23:56	0.039	31.36%
3/1/91 0:04	0.039	32.20%
3/1/91 0:11	0.039	33.05%
3/1/91 0:15	0.039	33.90%
3/1/91 0:19	0.039	34.75%
3/1/91 0:28	0.039	35.59%
3/1/91 0:47	0.039	36.44%
3/1/91 1:04	0.039	37.29%
3/1/91 1:28	0.039	38.14%
3/1/91 1:45	0.039	38.98%
3/1/91 2:00	0.039	39.83%
3/1/91 2:09	0.039	40.68%
3/1/91 2:25	0.039	41.53%
3/1/91 2:34	0.039	42.37%
3/1/91 2:45	0.039	43.22%
3/1/91 2:55	0.039	44.07%
3/1/91 3:04	0.039	44.92%
3/1/91 3:08	0.039	45.76%
3/1/91 3:24	0.039	46.61%
3/1/91 3:57	0.039	47.46%
3/1/91 4:11	0.039	48.31%
3/1/91 4:22	0.039	49.15%
3/1/91 4:29	0.039	50.00%
3/1/91 4:34	0.039	50.85%
3/1/91 4:35	0.039	51.69%
3/1/91 4:40	0.039	52.54%
3/1/91 4:46	0.039	53.39%
3/1/91 4:47	0.039	54.24%
3/1/91 4:50	0.039	55.08%
3/1/91 4:51	0.039	55.93%
3/1/91 4:55	0.039	56.78%
3/1/91 5:01	0.039	57.63%
3/1/91 5:04	0.039	58.47%
3/1/91 5:08	0.039	59.32%
3/1/91 5:12	0.039	60.17%
3/1/91 5:16	0.039	61.02%
3/1/91 5:21	0.039	61.86%

Date-Time	Inc. P (in)	Cum. P (%)
1/15/93 21:17	0.039	2.33%
1/15/93 21:50	0.039	4.65%
1/15/93 22:43	0.039	6.98%
1/15/93 23:26	0.039	9.30%
1/16/93 0:14	0.000	9.30%
1/16/93 0:34	0.039	11.63%
1/16/93 1:26	0.039	13.95%
1/16/93 2:20	0.039	16.28%
1/16/93 3:25	0.039	18.60%
1/16/93 7:21	0.039	20.93%
1/16/93 8:56	0.039	23.26%
1/16/93 9:20	0.039	25.58%
1/16/93 9:43	0.039	27.91%
1/16/93 9:54	0.039	30.23%
1/16/93 9:59	0.039	32.56%
1/16/93 10:08	0.039	34.88%
1/16/93 10:12	0.039	37.21%
1/16/93 10:20	0.039	39.53%
1/16/93 10:26	0.039	41.86%
1/16/93 10:38	0.039	44.19%
1/16/93 10:52	0.039	46.51%
1/16/93 10:57	0.039	48.84%
1/16/93 11:04	0.039	51.16%
1/16/93 11:15	0.039	53.49%
1/16/93 11:28	0.039	55.81%
1/16/93 11:39	0.039	58.14%
1/16/93 11:40	0.000	58.14%
1/16/93 11:44	0.039	60.47%
1/16/93 11:50	0.039	62.79%
1/16/93 11:53	0.039	65.12%
1/16/93 12:06	0.039	67.44%
1/16/93 12:17	0.039	69.77%
1/16/93 12:24	0.039	72.09%
1/16/93 12:52	0.039	74.42%
1/16/93 14:07	0.039	76.74%
1/16/93 14:24	0.039	79.07%
1/16/93 15:12	0.039	81.40%
1/16/93 15:43	0.039	83.72%
1/16/93 18:40	0.039	86.05%
1/16/93 18:44	0.039	88.37%
1/16/93 18:48	0.039	90.70%
1/16/93 18:52	0.039	93.02%
1/16/93 19:25	0.039	95.35%
1/16/93 19:54	0.039	97.67%
1/16/93 20:09	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
3/5/95 6:16	0.039	1.52%
3/5/95 6:49	0.000	1.52%
3/5/95 7:29	0.039	3.03%
3/5/95 8:34	0.039	4.55%
3/5/95 9:12	0.039	6.06%
3/5/95 9:42	0.039	7.58%
3/5/95 10:15	0.039	9.09%
3/5/95 10:48	0.039	10.61%
3/5/95 11:30	0.039	12.12%
3/5/95 11:53	0.039	13.64%
3/5/95 12:20	0.039	15.15%
3/5/95 12:34	0.039	16.67%
3/5/95 12:47	0.039	18.18%
3/5/95 13:04	0.039	19.70%
3/5/95 13:28	0.039	21.21%
3/5/95 13:47	0.039	22.73%
3/5/95 14:15	0.039	24.24%
3/5/95 14:32	0.039	25.76%
3/5/95 14:44	0.039	27.27%
3/5/95 14:57	0.039	28.79%
3/5/95 15:14	0.039	30.30%
3/5/95 15:25	0.039	31.82%
3/5/95 15:35	0.039	33.33%
3/5/95 15:45	0.039	34.85%
3/5/95 15:53	0.039	36.36%
3/5/95 16:01	0.039	37.88%
3/5/95 16:17	0.039	39.39%
3/5/95 16:33	0.039	40.91%
3/5/95 16:41	0.039	42.42%
3/5/95 16:58	0.039	43.94%
3/5/95 17:15	0.039	45.45%
3/5/95 17:22	0.039	46.97%
3/5/95 17:32	0.039	48.48%
3/5/95 17:46	0.039	50.00%
3/5/95 17:59	0.039	51.52%
3/5/95 18:09	0.039	53.03%
3/5/95 18:12	0.000	53.03%
3/5/95 18:20	0.039	54.55%
3/5/95 18:40	0.039	56.06%
3/5/95 18:58	0.039	57.58%
3/5/95 19:16	0.039	59.09%
3/5/95 19:35	0.039	60.61%
3/5/95 19:55	0.039	62.12%
3/5/95 20:11	0.039	63.64%
3/5/95 20:20	0.039	65.15%
3/5/95 20:38	0.039	66.67%
3/5/95 20:50	0.039	68.18%
3/5/95 21:02	0.039	69.70%
3/5/95 21:13	0.039	71.21%
3/5/95 21:21	0.039	72.73%
3/5/95 21:28	0.039	74.24%
3/5/95 21:37	0.039	75.76%
3/5/95 21:46	0.039	77.27%
3/5/95 21:55	0.039	78.79%
3/5/95 22:02	0.039	80.30%
3/5/95 22:09	0.039	81.82%
3/5/95 22:18	0.039	83.33%
3/5/95 22:31	0.039	84.85%
3/5/95 22:43	0.039	86.36%
3/5/95 22:55	0.039	87.88%
3/5/95 23:13	0.039	89.39%
3/5/95 23:38	0.039	90.91%
3/6/95 0:09	0.039	92.42%
3/6/95 0:43	0.039	93.94%
3/6/95 1:21	0.039	95.45%
3/6/95 1:58	0.039	96.97%
3/6/95 4:19	0.039	98.48%
3/6/95 5:35	0.000	98.48%
3/6/95 6:50	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
2/21/04 22:43	0.000	0.00%
2/22/04 2:04	0.039	1.89%
2/22/04 4:36	0.039	3.77%
2/22/04 8:28	0.039	5.66%
2/22/04 8:39	0.039	7.55%
2/22/04 8:44	0.039	9.43%
2/22/04 8:50	0.039	11.32%
2/22/04 8:54	0.039	13.21%
2/22/04 8:57	0.039	15.09%
2/22/04 9:01	0.039	16.98%
2/22/04 9:13	0.039	18.87%
2/22/04 9:24	0.039	20.75%
2/22/04 9:40	0.039	22.64%
2/22/04 9:59	0.039	24.53%
2/22/04 10:42	0.039	26.42%
2/22/04 10:43	0.000	26.42%
2/22/04 10:59	0.039	28.30%
2/22/04 11:09	0.039	30.19%
2/22/04 11:20	0.039	32.08%
2/22/04 11:41	0.039	33.96%
2/22/04 11:52	0.039	35.85%
2/22/04 12:04	0.039	37.74%
2/22/04 12:16	0.039	39.62%
2/22/04 12:40	0.039	41.51%
2/22/04 12:50	0.039	43.40%
2/22/04 12:57	0.039	45.28%
2/22/04 13:04	0.039	47.17%
2/22/04 13:09	0.039	49.06%
2/22/04 13:15	0.039	50.94%
2/22/04 13:23	0.039	52.83%
2/22/04 13:31	0.039	54.72%
2/22/04 13:41	0.039	56.60%
2/22/04 13:55	0.039	58.49%
2/22/04 14:15	0.039	60.38%
2/22/04 14:36	0.039	62.26%
2/22/04 14:51	0.039	64.15%
2/22/04 15:02	0.039	66.04%
2/22/04 17:34	0.039	67.92%
2/22/04 17:43	0.039	69.81%
2/22/04 17:54	0.039	71.70%
2/22/04 18:39	0.039	73.58%
2/22/04 18:54	0.039	75.47%
2/22/04 19:17	0.039	77.36%
2/22/04 22:38	0.039	79.25%
2/22/04 22:43	0.000	79.25%
2/22/04 23:10	0.039	81.13%
2/22/04 23:22	0.039	83.02%
2/23/04 0:01	0.039	84.91%
2/23/04 0:09	0.039	86.79%
2/23/04 0:12	0.039	88.68%
2/23/04 0:18	0.039	90.57%
2/23/04 0:24	0.039	92.45%
2/23/04 0:32	0.039	94.34%
2/23/04 1:16	0.039	96.23%
2/23/04 1:59	0.079	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
10/19/04 22:27	0.000	0.00%
10/19/04 22:30	0.039	1.22%
10/20/04 2:10	0.039	2.44%
10/20/04 3:23	0.039	3.66%
10/20/04 3:38	0.039	4.88%
10/20/04 3:58	0.039	6.10%
10/20/04 4:57	0.039	7.32%
10/20/04 5:35	0.079	9.76%
10/20/04 5:47	0.039	10.98%
10/20/04 5:56	0.039	12.20%
10/20/04 6:03	0.039	13.41%
10/20/04 6:08	0.039	14.63%
10/20/04 6:12	0.039	15.85%
10/20/04 6:29	0.039	17.07%
10/20/04 8:17	0.039	18.29%
10/20/04 8:21	0.039	19.51%
10/20/04 8:31	0.039	20.73%
10/20/04 8:39	0.039	21.95%
10/20/04 8:44	0.039	23.17%
10/20/04 8:54	0.039	24.39%
10/20/04 8:59	0.039	25.61%
10/20/04 9:26	0.079	28.05%
10/20/04 9:30	0.039	29.27%
10/20/04 9:41	0.039	30.49%
10/20/04 9:51	0.039	31.71%
10/20/04 10:04	0.039	32.93%
10/20/04 10:08	0.039	34.15%
10/20/04 10:11	0.039	35.37%
10/20/04 10:16	0.079	37.80%
10/20/04 10:27	0.000	37.80%
10/20/04 10:30	0.039	39.02%
10/20/04 10:44	0.039	40.24%
10/20/04 10:50	0.039	41.46%
10/20/04 10:53	0.039	42.68%
10/20/04 10:55	0.039	43.90%
10/20/04 11:15	0.039	45.12%
10/20/04 11:20	0.039	46.34%
10/20/04 11:27	0.039	47.56%
10/20/04 11:32	0.039	48.78%
10/20/04 11:37	0.039	50.00%
10/20/04 11:42	0.039	51.22%
10/20/04 11:45	0.039	52.44%
10/20/04 11:48	0.039	53.66%
10/20/04 11:51	0.039	54.88%
10/20/04 11:53	0.039	56.10%
10/20/04 11:56	0.039	57.32%
10/20/04 11:59	0.039	58.54%
10/20/04 12:05	0.039	59.76%
10/20/04 12:09	0.039	60.98%
10/20/04 12:12	0.039	62.20%
10/20/04 12:19	0.039	63.41%
10/20/04 12:28	0.039	64.63%
10/20/04 12:37	0.039	65.85%
10/20/04 13:05	0.039	67.07%
10/20/04 13:16	0.039	68.29%
10/20/04 13:28	0.039	69.51%
10/20/04 13:53	0.039	70.73%
10/20/04 14:30	0.039	71.95%
10/20/04 14:48	0.039	73.17%
10/20/04 15:06	0.039	74.39%
10/20/04 15:14	0.039	75.61%
10/20/04 15:27	0.039	76.83%
10/20/04 15:44	0.039	78.05%
10/20/04 15:54	0.039	79.27%
10/20/04 16:04	0.039	80.49%
10/20/04 16:12	0.039	81.71%
10/20/04 16:22	0.039	82.93%
10/20/04 16:29	0.039	84.15%
10/20/04 16:37	0.039	85.37%
10/20/04 16:50	0.039	86.59%
10/20/04 16:58	0.039	87.80%
10/20/04 17:33	0.039	89.02%
10/20/04 18:08	0.039	90.24%
10/20/04 18:32	0.039	91.46%

Table B2.1(cont.): Incremental & cumulative event rainfall for SDCFCD ID DULC1 (11014000).

Date-Time	Inc. P (in)	Cum. P (%)
3/1/91 5:28	0.039	62.71%
3/1/91 5:33	0.039	63.56%
3/1/91 5:37	0.039	64.41%
3/1/91 5:39	0.039	65.25%
3/1/91 5:41	0.039	66.10%
3/1/91 5:44	0.039	66.95%
3/1/91 5:47	0.039	67.80%
3/1/91 5:52	0.039	68.64%
3/1/91 5:56	0.039	69.49%
3/1/91 5:58	0.039	70.34%
3/1/91 6:00	0.039	71.19%
3/1/91 6:03	0.039	72.03%
3/1/91 6:05	0.039	72.88%
3/1/91 6:08	0.039	73.73%
3/1/91 6:14	0.039	74.58%
3/1/91 6:17	0.039	75.42%
3/1/91 6:19	0.039	76.27%
3/1/91 6:21	0.039	77.12%
3/1/91 6:23	0.039	77.97%
3/1/91 6:25	0.039	78.81%
3/1/91 6:28	0.039	79.66%
3/1/91 6:34	0.039	80.51%
3/1/91 6:40	0.039	81.36%
3/1/91 6:46	0.039	82.20%
3/1/91 6:53	0.039	83.05%
3/1/91 6:59	0.039	83.90%
3/1/91 7:04	0.039	84.75%
3/1/91 7:07	0.039	85.59%
3/1/91 7:11	0.039	86.44%
3/1/91 7:17	0.039	87.29%
3/1/91 7:22	0.039	88.14%
3/1/91 7:28	0.039	88.98%
3/1/91 7:33	0.039	89.83%
3/1/91 7:40	0.039	90.68%
3/1/91 7:53	0.039	91.53%
3/1/91 8:49	0.039	92.37%
3/1/91 9:30	0.000	92.37%
3/1/91 9:54	0.039	93.22%
3/1/91 10:01	0.039	94.07%
3/1/91 10:06	0.039	94.92%
3/1/91 10:18	0.039	95.76%
3/1/91 10:28	0.039	96.61%
3/1/91 13:40	0.039	97.46%
3/1/91 13:52	0.039	98.31%
3/1/91 14:00	0.039	99.15%
3/1/91 14:05	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)

Date-Time	Inc. P (in)	Cum. P (%)

Date-Time	Inc. P (in)	Cum. P (%)

Date-Time	Inc. P (in)	Cum. P (%)
10/20/04 20:44	0.039	92.68%
10/20/04 21:13	0.039	93.90%
10/20/04 22:01	0.039	95.12%
10/20/04 22:27	0.000	95.12%
10/20/04 22:36	0.039	96.34%
10/20/04 22:55	0.039	97.56%
10/21/04 0:34	0.039	98.78%
10/21/04 0:56	0.039	100.00%

Table B2.2: Incremental & cumulative event rainfall for SDCFCD ID DSCC1 (USGS 11015000).

Date-Time	Inc. P (in)	Cum. P (%)
2/19/80 12:15	0.100	2.70%
2/19/80 12:45	0.100	5.41%
2/19/80 13:30	0.100	8.11%
2/19/80 14:30	0.100	10.81%
2/19/80 14:45	0.200	16.22%
2/19/80 15:00	0.100	18.92%
2/19/80 15:30	0.200	24.32%
2/19/80 15:45	0.100	27.03%
2/19/80 16:45	0.100	29.73%
2/19/80 20:15	0.100	32.43%
2/19/80 21:00	0.200	37.84%
2/19/80 21:30	0.200	43.24%
2/19/80 22:00	0.100	45.95%
2/19/80 22:30	0.200	51.35%
2/19/80 22:45	0.100	54.05%
2/19/80 23:00	0.200	59.46%
2/20/80 0:15	0.100	62.16%
2/20/80 1:00	0.200	67.57%
2/20/80 1:30	0.100	70.27%
2/20/80 3:30	0.100	72.97%
2/20/80 4:30	0.100	75.68%
2/20/80 5:15	0.200	81.08%
2/20/80 5:30	0.100	83.78%
2/20/80 6:45	0.100	86.49%
2/20/80 11:45	0.100	89.19%
2/20/80 16:30	0.100	91.89%
2/20/80 17:00	0.100	94.59%
2/20/80 17:15	0.100	97.30%
2/20/80 17:45	0.100	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
1/15/93 22:29	0.039	1.59%
1/15/93 23:06	0.039	3.17%
1/15/93 23:44	0.039	4.76%
1/16/93 0:00	0.039	6.35%
1/16/93 0:18	0.039	7.94%
1/16/93 1:25	0.039	9.52%
1/16/93 1:39	0.039	11.11%
1/16/93 2:43	0.039	12.70%
1/16/93 3:11	0.039	14.29%
1/16/93 3:40	0.039	15.87%
1/16/93 5:05	0.039	17.46%
1/16/93 5:31	0.039	19.05%
1/16/93 5:59	0.039	20.63%
1/16/93 6:13	0.039	22.22%
1/16/93 6:54	0.039	23.81%
1/16/93 7:47	0.039	25.40%
1/16/93 8:53	0.039	26.98%
1/16/93 9:31	0.039	28.57%
1/16/93 9:38	0.039	30.16%
1/16/93 9:44	0.039	31.75%
1/16/93 9:48	0.039	33.33%
1/16/93 9:57	0.039	34.92%
1/16/93 10:02	0.039	36.51%
1/16/93 10:07	0.039	38.10%
1/16/93 10:19	0.079	41.27%
1/16/93 10:26	0.039	42.86%
1/16/93 10:35	0.039	44.44%
1/16/93 10:41	0.039	46.03%
1/16/93 10:48	0.039	47.62%
1/16/93 10:53	0.039	49.21%
1/16/93 10:58	0.039	50.79%
1/16/93 11:05	0.039	52.38%
1/16/93 11:16	0.079	55.56%
1/16/93 11:29	0.039	57.14%
1/16/93 11:37	0.039	58.73%
1/16/93 11:43	0.039	60.32%
1/16/93 11:48	0.039	61.90%
1/16/93 11:55	0.039	63.49%
1/16/93 12:00	0.039	65.08%
1/16/93 12:16	0.039	66.67%
1/16/93 12:26	0.039	68.25%
1/16/93 12:34	0.039	69.84%
1/16/93 12:44	0.039	71.43%
1/16/93 12:58	0.039	73.02%
1/16/93 13:21	0.039	74.60%
1/16/93 13:50	0.039	76.19%
1/16/93 14:07	0.039	77.78%
1/16/93 14:55	0.039	79.37%
1/16/93 15:06	0.039	80.95%
1/16/93 15:41	0.039	82.54%
1/16/93 15:55	0.039	84.13%
1/16/93 17:10	0.039	85.71%
1/16/93 17:35	0.039	87.30%
1/16/93 19:02	0.039	88.89%
1/16/93 19:06	0.039	90.48%
1/16/93 19:15	0.039	92.06%
1/16/93 19:20	0.039	93.65%
1/16/93 19:46	0.039	95.24%
1/16/93 20:09	0.039	96.83%
1/16/93 21:14	0.039	98.41%
1/17/93 3:54	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
3/5/95 6:03	0.039	0.68%
3/5/95 6:24	0.039	1.37%
3/5/95 6:53	0.039	2.05%
3/5/95 7:11	0.039	2.74%
3/5/95 7:28	0.039	3.42%
3/5/95 7:41	0.039	4.11%
3/5/95 7:47	0.039	4.79%
3/5/95 8:05	0.039	5.48%
3/5/95 8:15	0.039	6.16%
3/5/95 8:22	0.039	6.85%
3/5/95 8:29	0.039	7.53%
3/5/95 8:43	0.039	8.22%
3/5/95 8:53	0.039	8.90%
3/5/95 9:09	0.039	9.59%
3/5/95 9:25	0.039	10.27%
3/5/95 9:36	0.039	10.96%
3/5/95 9:44	0.039	11.64%
3/5/95 9:52	0.039	12.33%
3/5/95 10:01	0.039	13.01%
3/5/95 10:09	0.039	13.70%
3/5/95 10:18	0.039	14.38%
3/5/95 10:24	0.039	15.07%
3/5/95 10:30	0.039	15.75%
3/5/95 10:35	0.039	16.44%
3/5/95 10:42	0.039	17.12%
3/5/95 10:49	0.039	17.81%
3/5/95 10:57	0.039	18.49%
3/5/95 11:03	0.039	19.18%
3/5/95 11:13	0.039	19.86%
3/5/95 11:27	0.039	20.55%
3/5/95 11:38	0.039	21.23%
3/5/95 11:47	0.039	21.92%
3/5/95 11:59	0.039	22.60%
3/5/95 12:06	0.039	23.29%
3/5/95 12:15	0.039	23.97%
3/5/95 12:25	0.039	24.66%
3/5/95 12:36	0.039	25.34%
3/5/95 12:46	0.039	26.03%
3/5/95 12:54	0.039	26.71%
3/5/95 13:00	0.039	27.40%
3/5/95 13:08	0.039	28.08%
3/5/95 13:16	0.039	28.77%
3/5/95 13:23	0.039	29.45%
3/5/95 13:31	0.039	30.14%
3/5/95 13:38	0.039	30.82%
3/5/95 13:49	0.039	31.51%
3/5/95 13:57	0.039	32.19%
3/5/95 14:07	0.039	32.88%
3/5/95 14:14	0.039	33.56%
3/5/95 14:23	0.039	34.25%
3/5/95 14:31	0.039	34.93%
3/5/95 14:38	0.039	35.62%
3/5/95 14:46	0.039	36.30%
3/5/95 14:54	0.039	36.99%
3/5/95 15:03	0.039	37.67%
3/5/95 15:12	0.039	38.36%
3/5/95 15:20	0.039	39.04%
3/5/95 15:28	0.039	39.73%
3/5/95 15:34	0.039	40.41%
3/5/95 15:41	0.039	41.10%
3/5/95 15:48	0.039	41.78%
3/5/95 15:54	0.039	42.47%
3/5/95 16:01	0.039	43.15%
3/5/95 16:10	0.039	43.84%
3/5/95 16:18	0.039	44.52%
3/5/95 16:25	0.039	45.21%
3/5/95 16:33	0.039	45.89%
3/5/95 16:40	0.039	46.58%
3/5/95 16:46	0.039	47.26%
3/5/95 16:50	0.039	47.95%
3/5/95 16:56	0.039	48.63%
3/5/95 17:01	0.039	49.32%
3/5/95 17:05	0.039	50.00%
3/5/95 17:10	0.039	50.68%

Date-Time	Inc. P (in)	Cum. P (%)
2/14/98 11:42	0.039	1.15%
2/14/98 12:22	0.039	2.30%
2/14/98 12:58	0.039	3.45%
2/14/98 13:02	0.039	4.60%
2/14/98 13:07	0.039	5.75%
2/14/98 13:16	0.039	6.90%
2/14/98 13:30	0.039	8.05%
2/14/98 13:48	0.079	10.34%
2/14/98 13:57	0.039	11.49%
2/14/98 14:04	0.039	12.64%
2/14/98 14:09	0.039	13.79%
2/14/98 14:15	0.039	14.94%
2/14/98 14:22	0.039	16.09%
2/14/98 14:26	0.039	17.24%
2/14/98 14:31	0.039	18.39%
2/14/98 14:36	0.039	19.54%
2/14/98 14:42	0.039	20.69%
2/14/98 14:46	0.039	21.84%
2/14/98 14:51	0.039	22.99%
2/14/98 14:55	0.039	24.14%
2/14/98 15:01	0.039	25.29%
2/14/98 15:08	0.039	26.44%
2/14/98 15:20	0.079	28.74%
2/14/98 15:29	0.039	29.89%
2/14/98 15:35	0.039	31.03%
2/14/98 15:41	0.039	32.18%
2/14/98 15:47	0.039	33.33%
2/14/98 16:01	0.079	35.63%
2/14/98 16:07	0.039	36.78%
2/14/98 16:13	0.039	37.93%
2/14/98 16:19	0.039	39.08%
2/14/98 16:22	0.039	40.23%
2/14/98 16:26	0.039	41.38%
2/14/98 16:31	0.039	42.53%
2/14/98 16:35	0.039	43.68%
2/14/98 16:40	0.039	44.83%
2/14/98 16:46	0.039	45.98%
2/14/98 16:53	0.039	47.13%
2/14/98 17:00	0.039	48.28%
2/14/98 17:08	0.039	49.43%
2/14/98 17:14	0.039	50.57%
2/14/98 17:21	0.039	51.72%
2/14/98 17:26	0.039	52.87%
2/14/98 17:31	0.039	54.02%
2/14/98 17:37	0.039	55.17%
2/14/98 17:46	0.039	56.32%
2/14/98 17:52	0.039	57.47%
2/14/98 17:57	0.039	58.62%
2/14/98 18:08	0.039	59.77%
2/14/98 18:21	0.039	60.92%
2/14/98 18:28	0.039	62.07%
2/14/98 18:33	0.039	63.22%
2/14/98 18:38	0.039	64.37%
2/14/98 18:47	0.039	65.52%
2/14/98 18:51	0.039	66.67%
2/14/98 18:55	0.039	67.82%
2/14/98 18:57	0.039	68.97%
2/14/98 18:59	0.039	70.11%
2/14/98 19:06	0.039	71.26%
2/14/98 19:14	0.039	72.41%
2/14/98 19:22	0.039	73.56%
2/14/98 19:28	0.039	74.71%
2/14/98 19:37	0.039	75.86%
2/14/98 19:42	0.039	77.01%
2/14/98 19:46	0.039	78.16%
2/14/98 19:51	0.039	79.31%
2/14/98 19:58	0.079	81.61%
2/14/98 20:02	0.039	82.76%
2/14/98 20:03	0.039	83.91%
2/14/98 20:17	0.039	85.06%
2/14/98 20:26	0.039	86.21%
2/14/98 20:40	0.039	87.36%
2/14/98 22:04	0.039	88.51%
2/15/98 3:21	0.039	89.66%

Date-Time	Inc. P (in)	Cum. P (%)
1/10/05 22:26	0.039	1.54%
1/11/05 0:09	0.039	3.08%
1/11/05 0:19	0.039	4.62%
1/11/05 1:34	0.039	6.15%
1/11/05 2:32	0.039	7.69%
1/11/05 2:46	0.039	9.23%
1/11/05 2:51	0.039	10.77%
1/11/05 3:06	0.039	12.31%
1/11/05 3:30	0.079	15.38%
1/11/05 3:36	0.039	16.92%
1/11/05 3:48	0.039	18.46%
1/11/05 3:54	0.039	20.00%
1/11/05 4:01	0.039	21.54%
1/11/05 4:16	0.079	24.62%
1/11/05 4:33	0.039	26.15%
1/11/05 4:41	0.039	27.69%
1/11/05 4:58	0.039	29.23%
1/11/05 5:04	0.039	30.77%
1/11/05 5:12	0.039	32.31%
1/11/05 5:20	0.039	33.85%
1/11/05 5:24	0.039	35.38%
1/11/05 5:38	0.039	36.92%
1/11/05 5:57	0.039	38.46%
1/11/05 6:34	0.039	40.00%
1/11/05 6:45	0.039	41.54%
1/11/05 6:52	0.039	43.08%
1/11/05 6:56	0.039	44.62%
1/11/05 7:05	0.039	46.15%
1/11/05 7:05	0.039	47.69%
1/11/05 7:11	0.079	50.77%
1/11/05 7:15	0.039	52.31%
1/11/05 7:18	0.039	53.85%
1/11/05 7:21	0.039	55.38%
1/11/05 7:23	0.039	56.92%
1/11/05 7:27	0.039	58.46%
1/11/05 7:31	0.039	60.00%
1/11/05 7:33	0.039	61.54%
1/11/05 7:36	0.039	63.08%
1/11/05 7:38	0.039	64.62%
1/11/05 7:40	0.039	66.15%
1/11/05 7:57	0.079	69.23%
1/11/05 8:14	0.079	72.31%
1/11/05 8:28	0.039	73.85%
1/11/05 8:42	0.039	75.38%
1/11/05 8:59	0.039	76.92%
1/11/05 9:13	0.039	78.46%
1/11/05 9:15	0.039	80.00%
1/11/05 9:44	0.039	81.54%
1/11/05 10:02	0.039	83.08%
1/11/05 10:20	0.039	84.62%
1/11/05 10:26	0.000	84.62%
1/11/05 18:00	0.079	87.69%
1/11/05 18:17	0.039	89.23%
1/11/05 20:44	0.039	90.77%
1/11/05 20:57	0.039	92.31%
1/11/05 21:21	0.039	93.85%
1/11/05 21:50	0.039	95.38%
1/11/05 22:12	0.039	96.92%
1/11/05 22:36	0.039	98.46%
1/11/05 22:54	0.039	100.00%

Table B2.2(cont.): Incremental & cumulative event rainfall for SDCFCD ID DSCC1 (11015000).

Date-Time	Inc. P (in)	Cum. P (%)

Date-Time	Inc. P (in)	Cum. P (%)

Date-Time	Inc. P (in)	Cum. P (%)
3/5/95 17:16	0.039	51.37%
3/5/95 17:33	0.079	52.74%
3/5/95 17:38	0.039	53.42%
3/5/95 17:47	0.039	54.11%
3/5/95 17:56	0.039	54.79%
3/5/95 18:07	0.039	55.48%
3/5/95 18:16	0.039	56.16%
3/5/95 18:23	0.039	56.85%
3/5/95 18:32	0.039	57.53%
3/5/95 18:38	0.039	58.22%
3/5/95 18:45	0.039	58.90%
3/5/95 18:52	0.039	59.59%
3/5/95 19:02	0.039	60.27%
3/5/95 19:10	0.039	60.96%
3/5/95 19:19	0.039	61.64%
3/5/95 19:26	0.039	62.33%
3/5/95 19:35	0.039	63.01%
3/5/95 19:44	0.039	63.70%
3/5/95 19:57	0.039	64.38%
3/5/95 20:04	0.039	65.07%
3/5/95 20:07	0.039	65.75%
3/5/95 20:11	0.039	66.44%
3/5/95 20:14	0.039	67.12%
3/5/95 20:19	0.039	67.81%
3/5/95 20:22	0.039	68.49%
3/5/95 20:26	0.039	69.18%
3/5/95 20:30	0.039	69.86%
3/5/95 20:36	0.039	70.55%
3/5/95 20:42	0.039	71.23%
3/5/95 20:46	0.039	71.92%
3/5/95 20:50	0.039	72.60%
3/5/95 20:56	0.039	73.29%
3/5/95 21:02	0.039	73.97%
3/5/95 21:09	0.039	74.66%
3/5/95 21:13	0.039	75.34%
3/5/95 21:18	0.039	76.03%
3/5/95 21:23	0.039	76.71%
3/5/95 21:26	0.039	77.40%
3/5/95 21:32	0.039	78.08%
3/5/95 21:37	0.039	78.77%
3/5/95 21:43	0.039	79.45%
3/5/95 21:47	0.039	80.14%
3/5/95 21:52	0.039	80.82%
3/5/95 21:58	0.039	81.51%
3/5/95 22:06	0.039	82.19%
3/5/95 22:12	0.039	82.88%
3/5/95 22:18	0.039	83.56%
3/5/95 22:28	0.079	84.93%
3/5/95 22:34	0.039	85.62%
3/5/95 22:39	0.039	86.30%
3/5/95 22:44	0.039	86.99%
3/5/95 22:53	0.039	87.67%
3/5/95 23:06	0.039	88.36%
3/5/95 23:25	0.039	89.04%
3/5/95 23:31	0.039	89.73%
3/5/95 23:38	0.039	90.41%
3/5/95 23:53	0.039	91.10%
3/6/95 0:05	0.039	91.78%
3/6/95 0:15	0.039	92.47%
3/6/95 0:26	0.039	93.15%
3/6/95 0:43	0.039	93.84%
3/6/95 0:55	0.039	94.52%
3/6/95 1:24	0.039	95.21%
3/6/95 2:03	0.039	95.89%
3/6/95 2:46	0.039	96.58%
3/6/95 3:11	0.039	97.26%
3/6/95 3:53	0.039	97.95%
3/6/95 4:32	0.039	98.63%
3/6/95 5:34	0.039	99.32%
3/6/95 7:49	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
2/15/98 6:35	0.039	90.80%
2/15/98 7:02	0.039	91.95%
2/15/98 8:25	0.039	93.10%
2/15/98 8:43	0.039	94.25%
2/15/98 9:10	0.039	95.40%
2/15/98 9:21	0.039	96.55%
2/15/98 9:40	0.039	97.70%
2/15/98 9:50	0.039	98.85%
2/15/98 10:01	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)

Table B2.3: Incremental & cumulative event rainfall for SDCFCD ID FLYC1 (USGS 11022200).

Date-Time	Inc. P (in)	Cum. P (%)
1/15/93 19:28	0.079	4.17%
1/15/93 19:58	0.039	6.25%
1/15/93 20:43	0.039	8.33%
1/15/93 20:55	0.039	10.42%
1/15/93 21:25	0.039	12.50%
1/15/93 22:03	0.039	14.58%
1/15/93 22:36	0.039	16.67%
1/15/93 23:50	0.039	18.75%
1/16/93 1:42	0.039	20.83%
1/16/93 3:00	0.039	22.92%
1/16/93 3:44	0.000	22.92%
1/16/93 4:53	0.039	25.00%
1/16/93 6:00	0.039	27.08%
1/16/93 8:24	0.039	29.17%
1/16/93 8:59	0.079	33.33%
1/16/93 9:14	0.039	35.42%
1/16/93 9:22	0.039	37.50%
1/16/93 9:30	0.039	39.58%
1/16/93 9:46	0.079	43.75%
1/16/93 9:56	0.039	45.83%
1/16/93 10:11	0.039	47.92%
1/16/93 10:22	0.039	50.00%
1/16/93 10:27	0.039	52.08%
1/16/93 10:36	0.039	54.17%
1/16/93 11:02	0.079	58.33%
1/16/93 11:13	0.039	60.42%
1/16/93 11:35	0.039	62.50%
1/16/93 11:53	0.039	64.58%
1/16/93 12:18	0.039	66.67%
1/16/93 12:27	0.039	68.75%
1/16/93 12:50	0.039	70.83%
1/16/93 13:17	0.039	72.92%
1/16/93 13:42	0.039	75.00%
1/16/93 14:43	0.039	77.08%
1/16/93 14:56	0.039	79.17%
1/16/93 15:02	0.039	81.25%
1/16/93 15:31	0.000	81.25%
1/16/93 17:29	0.039	83.33%
1/16/93 19:03	0.039	85.42%
1/16/93 19:52	0.039	87.50%
1/16/93 20:28	0.039	89.58%
1/16/93 22:50	0.039	91.67%
1/16/93 23:25	0.039	93.75%
1/16/93 23:29	0.039	95.83%
1/16/93 23:33	0.039	97.92%
1/16/93 23:41	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
3/5/95 3:33	0.039	1.25%
3/5/95 4:17	0.039	2.50%
3/5/95 4:48	0.039	3.75%
3/5/95 6:37	0.039	5.00%
3/5/95 7:28	0.039	6.25%
3/5/95 7:58	0.039	7.50%
3/5/95 8:21	0.039	8.75%
3/5/95 9:11	0.039	10.00%
3/5/95 9:26	0.039	11.25%
3/5/95 9:35	0.039	12.50%
3/5/95 9:41	0.039	13.75%
3/5/95 9:50	0.039	15.00%
3/5/95 9:57	0.039	16.25%
3/5/95 10:05	0.039	17.50%
3/5/95 10:12	0.039	18.75%
3/5/95 10:21	0.039	20.00%
3/5/95 10:51	0.039	21.25%
3/5/95 11:31	0.039	22.50%
3/5/95 11:48	0.039	23.75%
3/5/95 12:01	0.039	25.00%
3/5/95 12:16	0.039	26.24%
3/5/95 12:29	0.039	27.49%
3/5/95 12:39	0.039	28.74%
3/5/95 12:52	0.039	29.99%
3/5/95 13:03	0.039	31.24%
3/5/95 13:14	0.039	32.49%
3/5/95 13:34	0.039	33.74%
3/5/95 13:55	0.039	34.99%
3/5/95 14:07	0.039	36.24%
3/5/95 14:21	0.039	37.49%
3/5/95 14:32	0.039	38.74%
3/5/95 14:48	0.039	39.99%
3/5/95 15:07	0.039	41.24%
3/5/95 15:22	0.039	42.49%
3/5/95 15:32	0.039	43.74%
3/5/95 15:43	0.039	44.99%
3/5/95 16:20	0.079	47.49%
3/5/95 16:30	0.039	48.74%
3/5/95 16:35	0.039	49.99%
3/5/95 16:41	0.039	51.24%
3/5/95 16:50	0.039	52.49%
3/5/95 17:17	0.039	53.74%
3/5/95 17:18	0.039	54.99%
3/5/95 17:32	0.039	56.24%
3/5/95 17:57	0.079	58.74%
3/5/95 18:06	0.039	59.99%
3/5/95 18:21	0.039	61.24%
3/5/95 18:55	0.079	63.74%
3/5/95 19:09	0.039	64.99%
3/5/95 19:31	0.079	67.49%
3/5/95 19:46	0.039	68.74%
3/5/95 19:51	0.039	69.99%
3/5/95 19:57	0.039	71.24%
3/5/95 20:08	0.039	72.49%
3/5/95 20:16	0.039	73.74%
3/5/95 20:25	0.039	74.99%
3/5/95 20:36	0.039	76.23%
3/5/95 20:47	0.039	77.48%
3/5/95 20:55	0.039	78.73%
3/5/95 21:02	0.039	79.98%
3/5/95 21:08	0.040	81.25%
3/5/95 21:14	0.039	82.50%
3/5/95 21:19	0.039	83.75%
3/5/95 21:29	0.079	86.25%
3/5/95 21:37	0.039	87.50%
3/5/95 21:51	0.039	88.75%
3/5/95 22:12	0.039	90.00%
3/5/95 22:30	0.039	91.25%
3/5/95 23:10	0.079	93.75%
3/5/95 23:48	0.039	95.00%
3/6/95 0:44	0.039	96.25%
3/6/95 2:20	0.039	97.50%
3/6/95 3:19	0.039	98.75%
3/6/95 5:15	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
3/12/96 17:08	0.039	1.79%
3/12/96 17:15	0.039	3.57%
3/12/96 17:21	0.039	5.36%
3/12/96 17:26	0.039	7.14%
3/12/96 17:30	0.039	8.93%
3/12/96 17:35	0.039	10.71%
3/12/96 17:38	0.039	12.50%
3/12/96 17:41	0.039	14.28%
3/12/96 18:14	0.039	16.07%
3/12/96 19:23	0.039	17.85%
3/12/96 20:06	0.039	19.64%
3/12/96 21:39	0.039	21.42%
3/12/96 21:41	0.039	23.21%
3/12/96 22:12	0.000	23.21%
3/13/96 1:31	0.039	24.99%
3/13/96 1:34	0.039	26.78%
3/13/96 1:41	0.039	28.56%
3/13/96 1:44	0.039	30.35%
3/13/96 2:02	0.039	32.13%
3/13/96 2:44	0.039	33.92%
3/13/96 4:05	0.039	35.70%
3/13/96 4:22	0.039	37.49%
3/13/96 4:26	0.039	39.27%
3/13/96 4:28	0.039	41.06%
3/13/96 4:30	0.039	42.84%
3/13/96 4:30	0.039	44.63%
3/13/96 4:33	0.039	46.42%
3/13/96 4:34	0.039	48.20%
3/13/96 4:36	0.079	51.77%
3/13/96 4:37	0.039	53.56%
3/13/96 4:38	0.039	55.34%
3/13/96 4:38	0.039	57.13%
3/13/96 5:04	0.079	60.70%
3/13/96 5:12	0.039	62.48%
3/13/96 5:21	0.039	64.27%
3/13/96 5:33	0.039	66.05%
3/13/96 5:40	0.039	67.84%
3/13/96 5:51	0.039	69.62%
3/13/96 7:30	0.039	71.41%
3/13/96 7:48	0.039	73.19%
3/13/96 7:57	0.039	74.98%
3/13/96 8:06	0.039	76.76%
3/13/96 8:26	0.079	80.33%
3/13/96 9:17	0.039	82.12%
3/13/96 9:48	0.039	83.90%
3/13/96 9:53	0.039	85.69%
3/13/96 10:14	0.079	89.26%
3/13/96 10:22	0.039	91.05%
3/13/96 10:29	0.039	92.83%
3/13/96 10:36	0.039	94.62%
3/13/96 10:43	0.040	96.43%
3/13/96 10:46	0.039	98.21%
3/13/96 16:54	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
2/21/04 21:24	0.039	1.49%
2/21/04 23:20	0.000	1.49%
2/22/04 4:41	0.039	2.99%
2/22/04 9:02	0.039	4.48%
2/22/04 9:50	0.039	5.97%
2/22/04 9:55	0.039	7.46%
2/22/04 10:04	0.039	8.96%
2/22/04 10:12	0.039	10.45%
2/22/04 10:25	0.039	11.94%
2/22/04 11:17	0.039	13.43%
2/22/04 11:20	0.000	13.43%
2/22/04 11:23	0.039	14.93%
2/22/04 11:45	0.039	16.42%
2/22/04 11:49	0.039	17.91%
2/22/04 11:51	0.039	19.40%
2/22/04 11:58	0.039	20.90%
2/22/04 12:07	0.039	22.39%
2/22/04 12:16	0.039	23.88%
2/22/04 12:31	0.039	25.37%
2/22/04 12:38	0.039	26.87%
2/22/04 12:44	0.039	28.36%
2/22/04 12:54	0.039	29.85%
2/22/04 12:59	0.039	31.34%
2/22/04 13:07	0.079	34.33%
2/22/04 13:10	0.039	35.82%
2/22/04 13:18	0.079	38.81%
2/22/04 13:23	0.039	40.30%
2/22/04 13:32	0.039	41.79%
2/22/04 13:37	0.039	43.28%
2/22/04 13:41	0.039	44.78%
2/22/04 13:53	0.079	47.76%
2/22/04 13:58	0.039	49.25%
2/22/04 14:02	0.039	50.75%
2/22/04 14:07	0.039	52.24%
2/22/04 14:26	0.079	55.22%
2/22/04 14:44	0.039	56.72%
2/22/04 15:08	0.039	58.21%
2/22/04 15:17	0.039	59.70%
2/22/04 17:48	0.039	61.19%
2/22/04 17:58	0.039	62.69%
2/22/04 18:15	0.039	64.18%
2/22/04 18:30	0.039	65.67%
2/22/04 18:37	0.039	67.16%
2/22/04 18:47	0.039	68.66%
2/22/04 19:03	0.039	70.15%
2/22/04 19:25	0.039	71.64%
2/22/04 20:19	0.039	73.13%
2/22/04 21:20	0.039	74.63%
2/22/04 21:39	0.039	76.12%
2/22/04 21:50	0.039	77.61%
2/22/04 22:06	0.039	79.10%
2/22/04 23:01	0.039	80.60%
2/22/04 23:20	0.000	80.60%
2/22/04 23:39	0.039	82.09%
2/23/04 0:07	0.039	83.58%
2/23/04 0:10	0.039	85.07%
2/23/04 0:12	0.039	86.57%
2/23/04 0:14	0.039	88.06%
2/23/04 0:16	0.039	89.55%
2/23/04 0:23	0.039	91.04%
2/23/04 0:37	0.039	92.54%
2/23/04 0:47	0.039	94.03%
2/23/04 1:00	0.039	95.52%
2/23/04 1:12	0.039	97.01%
2/23/04 1:31	0.039	98.51%
2/23/04 1:41	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
1/9/05 4:10	0.039	3.23%
1/9/05 4:19	0.039	6.45%
1/9/05 4:31	0.039	9.68%
1/9/05 4:53	0.039	12.90%
1/9/05 8:09	0.039	16.13%
1/9/05 10:39	0.039	19.35%
1/9/05 18:15	0.079	25.81%
1/9/05 18:35	0.079	32.26%
1/9/05 18:54	0.039	35.48%
1/9/05 19:19	0.039	38.71%
1/9/05 19:52	0.039	41.94%
1/9/05 20:05	0.039	45.16%
1/9/05 20:10	0.079	51.61%
1/9/05 20:11	0.039	54.84%
1/9/05 20:12	0.039	58.06%
1/9/05 20:13	0.039	61.29%
1/9/05 20:15	0.039	64.52%
1/9/05 20:21	0.079	70.97%
1/9/05 20:24	0.039	74.19%
1/9/05 20:28	0.039	77.42%
1/9/05 20:35	0.039	80.65%
1/9/05 20:56	0.039	83.87%
1/9/05 22:37	0.079	90.32%
1/9/05 22:39	0.000	90.32%
1/9/05 23:02	0.039	93.55%
1/9/05 23:03	0.039	96.77%
1/10/05 8:51	0.039	100.00%

Table B2.4: Incremental & cumulative event rainfall for SDCFCD ID WHLC1 (USGS 11027000)

Date-Time	Inc. P (in)	Cum. P (%)
2/20/80 15:15	0.100	4.35%
2/20/80 16:00	0.100	8.70%
2/20/80 16:30	0.100	13.04%
2/20/80 17:30	0.100	17.39%
2/20/80 17:45	0.300	30.43%
2/20/80 18:00	0.100	34.78%
2/20/80 19:30	0.100	39.13%
2/20/80 20:15	0.100	43.48%
2/20/80 20:30	0.100	47.83%
2/20/80 20:45	0.100	52.17%
2/20/80 21:15	0.100	56.52%
2/20/80 21:30	0.200	65.22%
2/20/80 21:45	0.100	69.57%
2/20/80 22:00	0.100	73.91%
2/20/80 22:15	0.100	78.26%
2/20/80 23:30	0.100	82.61%
2/21/80 1:30	0.100	86.96%
2/21/80 1:45	0.100	91.30%
2/21/80 5:45	0.100	95.65%
2/21/80 9:00	0.100	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
2/21/05 2:39	0.039	2.17%
2/21/05 3:02	0.039	4.35%
2/21/05 3:13	0.039	6.52%
2/21/05 3:33	0.039	8.70%
2/21/05 4:22	0.039	10.87%
2/21/05 4:59	0.118	17.39%
2/21/05 5:11	0.039	19.57%
2/21/05 5:36	0.039	21.74%
2/21/05 5:55	0.039	23.91%
2/21/05 6:33	0.079	28.26%
2/21/05 6:52	0.039	30.43%
2/21/05 7:09	0.039	32.61%
2/21/05 7:25	0.039	34.78%
2/21/05 7:36	0.039	36.96%
2/21/05 7:49	0.039	39.13%
2/21/05 8:13	0.000	39.13%
2/21/05 9:19	0.039	41.30%
2/21/05 9:56	0.039	43.48%
2/21/05 10:06	0.039	45.65%
2/21/05 10:24	0.079	50.00%
2/21/05 10:35	0.079	54.35%
2/21/05 10:41	0.039	56.52%
2/21/05 10:46	0.039	58.70%
2/21/05 10:52	0.039	60.87%
2/21/05 11:01	0.039	63.04%
2/21/05 11:15	0.039	65.22%
2/21/05 11:45	0.039	67.39%
2/21/05 12:07	0.039	69.57%
2/21/05 12:28	0.039	71.74%
2/21/05 12:42	0.079	76.09%
2/21/05 12:51	0.039	78.26%
2/21/05 13:01	0.039	80.43%
2/21/05 13:07	0.039	82.61%
2/21/05 13:16	0.039	84.78%
2/21/05 13:22	0.039	86.96%
2/21/05 13:26	0.039	89.13%
2/21/05 13:35	0.039	91.30%
2/21/05 19:58	0.039	93.48%
2/22/05 2:26	0.039	95.65%
2/22/05 2:39	0.039	97.83%
2/22/05 2:57	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
1/2/06 2:36	0.000	0.00%
1/2/06 3:56	0.079	5.13%
1/2/06 4:26	0.039	7.69%
1/2/06 4:53	0.039	10.26%
1/2/06 5:39	0.039	12.82%
1/2/06 6:49	0.039	15.38%
1/2/06 7:40	0.039	17.95%
1/2/06 8:30	0.039	20.51%
1/2/06 10:36	0.000	20.51%
1/2/06 11:14	0.039	23.08%
1/2/06 11:32	0.039	25.64%
1/2/06 11:44	0.039	28.21%
1/2/06 11:53	0.039	30.77%
1/2/06 12:07	0.039	33.33%
1/2/06 12:56	0.079	38.46%
1/2/06 13:15	0.039	41.03%
1/2/06 13:27	0.039	43.59%
1/2/06 13:33	0.039	46.15%
1/2/06 13:39	0.039	48.72%
1/2/06 13:44	0.039	51.28%
1/2/06 13:50	0.039	53.85%
1/2/06 13:55	0.039	56.41%
1/2/06 13:58	0.039	58.97%
1/2/06 14:01	0.039	61.54%
1/2/06 14:03	0.039	64.10%
1/2/06 14:04	0.039	66.67%
1/2/06 14:09	0.039	69.23%
1/2/06 14:19	0.039	71.79%
1/2/06 15:35	0.039	74.36%
1/2/06 16:13	0.039	76.92%
1/2/06 16:15	0.039	79.49%
1/2/06 16:19	0.039	82.05%
1/2/06 16:21	0.039	84.62%
1/2/06 16:34	0.039	87.18%
1/2/06 16:36	0.039	89.74%
1/2/06 16:45	0.039	92.31%
1/2/06 18:36	0.000	92.31%
1/2/06 19:21	0.039	94.87%
1/2/06 22:28	0.039	97.44%
1/3/06 2:36	0.000	97.44%
1/3/06 3:22	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
1/6/08 13:56	0.039	3.03%
1/6/08 14:05	0.039	6.06%
1/6/08 17:08	0.079	12.12%
1/6/08 18:05	0.039	15.15%
1/6/08 21:41	0.039	18.18%
1/6/08 22:03	0.039	21.21%
1/6/08 22:16	0.039	24.24%
1/6/08 22:27	0.039	27.27%
1/6/08 22:32	0.039	30.30%
1/6/08 22:40	0.039	33.33%
1/6/08 22:48	0.039	36.36%
1/6/08 22:57	0.039	39.39%
1/6/08 23:13	0.039	42.42%
1/6/08 23:31	0.039	45.45%
1/6/08 23:45	0.039	48.48%
1/6/08 23:51	0.039	51.52%
1/6/08 23:59	0.039	54.55%
1/7/08 0:07	0.039	57.58%
1/7/08 0:19	0.039	60.61%
1/7/08 0:37	0.039	63.64%
1/7/08 0:50	0.039	66.67%
1/7/08 0:57	0.000	66.67%
1/7/08 1:43	0.039	69.70%
1/7/08 2:34	0.039	72.73%
1/7/08 2:54	0.039	75.76%
1/7/08 3:07	0.039	78.79%
1/7/08 3:17	0.039	81.82%
1/7/08 3:53	0.039	84.85%
1/7/08 4:21	0.039	87.88%
1/7/08 4:31	0.039	90.91%
1/7/08 4:33	0.039	93.94%
1/7/08 6:00	0.039	96.97%
1/7/08 8:57	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
12/17/08 0:07	0.039	2.38%
12/17/08 1:01	0.039	4.76%
12/17/08 1:12	0.000	4.76%
12/17/08 3:44	0.039	7.14%
12/17/08 4:44	0.039	9.52%
12/17/08 4:58	0.039	11.90%
12/17/08 5:30	0.039	14.29%
12/17/08 6:00	0.039	16.67%
12/17/08 6:10	0.039	19.05%
12/17/08 6:41	0.039	21.43%
12/17/08 6:55	0.039	23.81%
12/17/08 7:32	0.039	26.19%
12/17/08 8:20	0.039	28.57%
12/17/08 8:50	0.039	30.95%
12/17/08 9:07	0.039	33.33%
12/17/08 9:12	0.000	33.33%
12/17/08 9:31	0.039	35.71%
12/17/08 9:45	0.039	38.10%
12/17/08 10:03	0.039	40.48%
12/17/08 10:12	0.039	42.86%
12/17/08 10:20	0.039	45.24%
12/17/08 10:31	0.039	47.62%
12/17/08 10:52	0.039	50.00%
12/17/08 11:20	0.079	54.76%
12/17/08 11:58	0.039	57.14%
12/17/08 12:53	0.039	59.52%
12/17/08 13:38	0.039	61.90%
12/17/08 14:13	0.039	64.29%
12/17/08 14:26	0.039	66.67%
12/17/08 14:39	0.039	69.05%
12/17/08 15:46	0.039	71.43%
12/17/08 16:29	0.039	73.81%
12/17/08 16:45	0.039	76.19%
12/17/08 17:06	0.039	78.57%
12/17/08 17:12	0.000	78.57%
12/17/08 18:04	0.039	80.95%
12/17/08 18:07	0.039	83.33%
12/17/08 18:09	0.039	85.71%
12/17/08 18:11	0.039	88.10%
12/17/08 18:56	0.039	90.48%
12/17/08 19:45	0.039	92.86%
12/17/08 22:36	0.039	95.24%
12/18/08 0:49	0.039	97.62%
12/18/08 1:12	0.000	97.62%
12/18/08 1:36	0.039	100.00%

Table B2.5: Incremental & cumulative event rainfall for SDCFCD ID RMNC1 (USGS 11028500)

Date-Time	Inc. P (in)	Cum. P (%)
2/20/80 16:00	0.100	2.33%
2/20/80 16:18	0.100	4.65%
2/20/80 16:27	0.100	6.98%
2/20/80 17:09	0.100	9.30%
2/20/80 17:18	0.100	11.63%
2/20/80 17:27	0.100	13.95%
2/20/80 18:18	0.100	16.28%
2/20/80 18:27	0.100	18.60%
2/20/80 19:00	0.200	23.26%
2/20/80 19:09	0.100	25.58%
2/20/80 19:18	0.200	30.23%
2/20/80 19:27	0.200	34.88%
2/20/80 20:09	0.500	46.51%
2/20/80 20:18	0.300	53.49%
2/20/80 20:27	0.100	55.81%
2/20/80 22:00	0.100	58.14%
2/20/80 22:09	0.100	60.47%
2/20/80 23:00	0.100	62.79%
2/20/80 23:09	0.300	69.77%
2/20/80 23:18	0.200	74.42%
2/20/80 23:27	0.100	76.74%
2/21/80 1:00	0.100	79.07%
2/21/80 1:18	0.100	81.40%
2/21/80 2:09	0.100	83.72%
2/21/80 2:27	0.100	86.05%
2/21/80 3:09	0.200	90.70%
2/21/80 3:18	0.100	93.02%
2/21/80 4:09	0.100	95.35%
2/21/80 6:27	0.100	97.67%
2/21/80 10:27	0.100	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
2/19/93 7:01	0.040	2.27%
2/19/93 7:06	0.040	4.55%
2/19/93 7:08	0.040	6.82%
2/19/93 7:21	0.000	6.82%
2/19/93 7:24	0.040	9.09%
2/19/93 8:47	0.040	11.36%
2/19/93 8:58	0.040	13.64%
2/19/93 9:00	0.040	15.91%
2/19/93 9:03	0.040	18.18%
2/19/93 9:12	0.040	20.45%
2/19/93 9:16	0.040	22.73%
2/19/93 9:22	0.040	25.00%
2/19/93 10:30	0.040	27.27%
2/19/93 11:34	0.040	29.55%
2/19/93 11:49	0.040	31.82%
2/19/93 13:14	0.080	36.36%
2/19/93 13:19	0.040	38.64%
2/19/93 15:06	0.040	40.91%
2/19/93 15:18	0.040	43.18%
2/19/93 15:30	0.040	45.45%
2/19/93 15:40	0.040	47.73%
2/19/93 15:53	0.040	50.00%
2/19/93 16:03	0.040	52.27%
2/19/93 16:12	0.040	54.55%
2/19/93 16:18	0.040	56.82%
2/19/93 16:22	0.040	59.09%
2/19/93 16:27	0.040	61.36%
2/19/93 17:22	0.040	63.64%
2/19/93 17:27	0.040	65.91%
2/19/93 17:31	0.040	68.18%
2/19/93 18:27	0.040	70.45%
2/19/93 19:06	0.040	72.73%
2/19/93 19:10	0.040	75.00%
2/19/93 19:20	0.040	77.27%
2/19/93 19:29	0.040	79.55%
2/19/93 20:09	0.040	81.82%
2/19/93 20:11	0.040	84.09%
2/19/93 20:14	0.040	86.36%
2/19/93 20:28	0.040	88.64%
2/19/93 22:36	0.040	90.91%
2/19/93 23:23	0.040	93.18%
2/20/93 0:45	0.040	95.45%
2/20/93 4:28	0.040	97.73%
2/20/93 6:38	0.040	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
3/5/95 6:19	0.040	1.41%
3/5/95 7:14	0.040	2.82%
3/5/95 7:33	0.040	4.23%
3/5/95 7:55	0.040	5.63%
3/5/95 8:14	0.000	5.63%
3/5/95 8:25	0.040	7.04%
3/5/95 8:38	0.040	8.45%
3/5/95 9:00	0.040	9.86%
3/5/95 9:37	0.040	11.27%
3/5/95 10:12	0.040	12.68%
3/5/95 10:39	0.040	14.08%
3/5/95 10:52	0.040	15.49%
3/5/95 11:07	0.040	16.90%
3/5/95 11:22	0.040	18.31%
3/5/95 11:33	0.040	19.72%
3/5/95 11:53	0.040	21.13%
3/5/95 12:50	0.080	23.94%
3/5/95 13:09	0.040	25.35%
3/5/95 13:22	0.040	26.76%
3/5/95 13:41	0.040	28.17%
3/5/95 14:26	0.080	30.99%
3/5/95 14:41	0.040	32.39%
3/5/95 15:02	0.040	33.80%
3/5/95 15:20	0.040	35.21%
3/5/95 15:45	0.080	38.03%
3/5/95 15:58	0.040	39.44%
3/5/95 16:17	0.040	40.85%
3/5/95 16:29	0.040	42.25%
3/5/95 16:36	0.040	43.66%
3/5/95 16:42	0.040	45.07%
3/5/95 16:53	0.040	46.48%
3/5/95 17:12	0.080	49.30%
3/5/95 17:21	0.040	50.70%
3/5/95 17:37	0.040	52.11%
3/5/95 18:03	0.080	54.93%
3/5/95 18:21	0.040	56.34%
3/5/95 18:32	0.040	57.75%
3/5/95 18:46	0.040	59.15%
3/5/95 19:16	0.040	60.56%
3/5/95 19:28	0.040	61.97%
3/5/95 19:38	0.040	63.38%
3/5/95 19:42	0.040	64.79%
3/5/95 19:46	0.040	66.20%
3/5/95 19:54	0.040	67.61%
3/5/95 20:03	0.040	69.01%
3/5/95 20:12	0.040	70.42%
3/5/95 20:25	0.040	71.83%
3/5/95 21:08	0.080	74.65%
3/5/95 21:19	0.040	76.06%
3/5/95 21:26	0.040	77.46%
3/5/95 21:39	0.040	78.87%
3/5/95 21:44	0.040	80.28%
3/5/95 21:57	0.080	83.10%
3/5/95 22:46	0.120	87.32%
3/5/95 22:58	0.040	88.73%
3/5/95 23:23	0.040	90.14%
3/5/95 23:53	0.040	91.55%
3/6/95 0:25	0.040	92.96%
3/6/95 1:09	0.040	94.37%
3/6/95 2:45	0.080	97.18%
3/6/95 5:56	0.080	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
1/10/05 21:23	0.039	2.50%
1/10/05 21:33	0.000	2.50%
1/11/05 0:36	0.039	5.00%
1/11/05 1:23	0.039	7.50%
1/11/05 2:14	0.039	10.00%
1/11/05 2:27	0.039	12.50%
1/11/05 2:31	0.039	15.00%
1/11/05 2:35	0.039	17.50%
1/11/05 2:40	0.039	20.00%
1/11/05 2:45	0.039	22.50%
1/11/05 2:56	0.039	25.00%
1/11/05 3:02	0.039	27.50%
1/11/05 3:09	0.039	30.00%
1/11/05 3:17	0.039	32.50%
1/11/05 3:35	0.039	35.00%
1/11/05 3:54	0.039	37.50%
1/11/05 4:09	0.039	40.00%
1/11/05 4:26	0.039	42.50%
1/11/05 4:40	0.039	45.00%
1/11/05 4:49	0.039	47.50%
1/11/05 5:02	0.039	50.00%
1/11/05 5:16	0.039	52.50%
1/11/05 5:45	0.039	55.00%
1/11/05 5:49	0.039	57.50%
1/11/05 5:57	0.039	60.00%
1/11/05 6:12	0.039	62.50%
1/11/05 6:20	0.039	65.00%
1/11/05 6:31	0.039	67.50%
1/11/05 6:40	0.039	70.00%
1/11/05 6:52	0.039	72.50%
1/11/05 6:56	0.039	75.00%
1/11/05 7:08	0.039	77.50%
1/11/05 7:17	0.039	80.00%
1/11/05 7:29	0.039	82.50%
1/11/05 8:37	0.079	87.50%
1/11/05 9:02	0.039	90.00%
1/11/05 9:33	0.000	90.00%
1/11/05 20:11	0.039	92.50%
1/11/05 20:41	0.039	95.00%
1/11/05 21:06	0.039	97.50%
1/11/05 21:33	0.000	97.50%
1/11/05 21:40	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
2/14/08 4:48	0.000	0.00%
2/14/08 9:03	0.079	5.24%
2/14/08 10:09	0.039	7.86%
2/14/08 10:27	0.039	10.48%
2/14/08 11:16	0.039	13.10%
2/14/08 11:36	0.039	15.72%
2/14/08 11:57	0.039	18.34%
2/14/08 12:10	0.039	20.96%
2/14/08 12:35	0.079	26.19%
2/14/08 12:50	0.118	34.05%
2/14/08 12:56	0.039	36.67%
2/14/08 13:00	0.039	39.29%
2/14/08 13:05	0.039	41.91%
2/14/08 13:11	0.039	44.53%
2/14/08 13:14	0.039	47.15%
2/14/08 13:16	0.039	49.77%
2/14/08 13:18	0.039	52.39%
2/14/08 13:22	0.039	55.01%
2/14/08 13:26	0.039	57.63%
2/14/08 13:34	0.079	62.87%
2/14/08 13:40	0.039	65.49%
2/14/08 13:44	0.039	68.11%
2/14/08 13:49	0.039	70.73%
2/14/08 14:28	0.200	84.03%
2/14/08 15:09	0.160	94.68%
2/14/08 17:27	0.080	100.00%

Table B2.6: Incremental & cumulative event rainfall for SDCFCD ID OCNC1 (USGS 11046100).

Date-Time	Inc. P (in)	Cum. P (%)
2/25/69 0:00	0.090	3.24%
2/25/69 1:00	0.080	6.12%
2/25/69 2:00	0.050	7.91%
2/25/69 3:00	0.110	11.87%
2/25/69 4:00	0.090	15.11%
2/25/69 5:00	0.060	17.27%
2/25/69 6:00	0.100	20.86%
2/25/69 7:00	0.030	21.94%
2/25/69 8:00	0.090	25.18%
2/25/69 9:00	0.060	27.34%
2/25/69 10:00	0.100	30.94%
2/25/69 11:00	0.050	32.73%
2/25/69 12:00	0.100	36.33%
2/25/69 13:00	0.250	45.32%
2/25/69 14:00	0.750	72.30%
2/25/69 15:00	0.210	79.86%
2/25/69 16:00	0.240	88.49%
2/25/69 17:00	0.190	95.32%
2/25/69 18:00	0.090	98.56%
2/25/69 19:00	0.040	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
2/28/78 18:15	0.100	4.35%
2/28/78 18:30	0.100	8.70%
3/1/78 0:00	0.100	13.04%
3/1/78 0:30	0.100	17.39%
3/1/78 1:30	0.100	21.74%
3/1/78 2:00	0.100	26.09%
3/1/78 2:15	0.100	30.43%
3/1/78 2:30	0.100	34.78%
3/1/78 3:00	0.200	43.48%
3/1/78 3:30	0.100	47.83%
3/1/78 4:30	0.100	52.17%
3/1/78 5:00	0.200	60.87%
3/1/78 5:15	0.100	65.22%
3/1/78 5:45	0.400	82.61%
3/1/78 6:00	0.100	86.96%
3/1/78 6:30	0.100	91.30%
3/1/78 8:00	0.100	95.65%
3/1/78 17:30	0.100	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
3/5/95 6:21	0.039	1.82%
3/5/95 6:26	0.039	3.64%
3/5/95 6:36	0.039	5.45%
3/5/95 6:41	0.039	7.27%
3/5/95 6:47	0.039	9.09%
3/5/95 6:52	0.039	10.91%
3/5/95 7:01	0.039	12.73%
3/5/95 7:50	0.039	14.55%
3/5/95 7:58	0.039	16.36%
3/5/95 8:10	0.039	18.18%
3/5/95 8:31	0.039	20.00%
3/5/95 8:37	0.039	21.82%
3/5/95 8:51	0.039	23.64%
3/5/95 9:42	0.039	25.45%
3/5/95 10:39	0.039	27.27%
3/5/95 10:49	0.039	29.09%
3/5/95 10:51	0.000	29.09%
3/5/95 10:56	0.039	30.91%
3/5/95 11:02	0.039	32.73%
3/5/95 11:27	0.039	34.55%
3/5/95 11:51	0.039	36.36%
3/5/95 12:44	0.039	38.18%
3/5/95 13:11	0.039	40.00%
3/5/95 14:29	0.039	41.82%
3/5/95 15:03	0.039	43.64%
3/5/95 15:17	0.039	45.45%
3/5/95 15:33	0.039	47.27%
3/5/95 15:46	0.039	49.09%
3/5/95 15:54	0.039	50.91%
3/5/95 16:20	0.039	52.73%
3/5/95 16:48	0.039	54.55%
3/5/95 17:13	0.039	56.36%
3/5/95 17:37	0.039	58.18%
3/5/95 18:10	0.039	60.00%
3/5/95 18:37	0.039	61.82%
3/5/95 18:55	0.039	63.64%
3/5/95 19:04	0.039	65.45%
3/5/95 19:09	0.039	67.27%
3/5/95 19:15	0.039	69.09%
3/5/95 19:27	0.039	70.91%
3/5/95 19:45	0.039	72.73%
3/5/95 19:56	0.039	74.55%
3/5/95 20:02	0.039	76.36%
3/5/95 20:10	0.039	78.18%
3/5/95 20:22	0.039	80.00%
3/5/95 20:28	0.039	81.82%
3/5/95 20:32	0.039	83.64%
3/5/95 20:36	0.039	85.45%
3/5/95 20:39	0.039	87.27%
3/5/95 20:45	0.039	89.09%
3/5/95 21:13	0.039	90.91%
3/5/95 22:14	0.039	92.73%
3/5/95 22:31	0.000	92.73%
3/5/95 23:01	0.039	94.55%
3/6/95 1:26	0.039	96.36%
3/6/95 2:00	0.039	98.18%
3/6/95 4:22	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
1/10/05 11:12	0.039	2.94%
1/10/05 12:35	0.039	5.88%
1/10/05 14:12	0.039	8.82%
1/10/05 21:28	0.039	11.76%
1/10/05 21:37	0.039	14.71%
1/10/05 21:56	0.000	14.71%
1/10/05 23:02	0.079	20.59%
1/10/05 23:31	0.039	23.53%
1/11/05 0:15	0.039	26.47%
1/11/05 0:23	0.039	29.41%
1/11/05 0:35	0.039	32.35%
1/11/05 0:48	0.039	35.29%
1/11/05 0:53	0.039	38.24%
1/11/05 0:55	0.039	41.18%
1/11/05 1:00	0.039	44.12%
1/11/05 1:06	0.039	47.06%
1/11/05 1:09	0.039	50.00%
1/11/05 1:17	0.039	52.94%
1/11/05 1:25	0.039	55.88%
1/11/05 1:30	0.039	58.82%
1/11/05 1:33	0.039	61.76%
1/11/05 1:39	0.039	64.71%
1/11/05 1:49	0.039	67.65%
1/11/05 1:54	0.039	70.59%
1/11/05 2:11	0.039	73.53%
1/11/05 2:38	0.039	76.47%
1/11/05 3:14	0.079	82.35%
1/11/05 3:21	0.039	85.29%
1/11/05 3:36	0.039	88.24%
1/11/05 6:05	0.039	91.18%
1/11/05 6:24	0.039	94.12%
1/11/05 6:42	0.039	97.06%
1/11/05 7:14	0.039	100.00%

Date-Time	Inc. P (in)	Cum. P (%)
2/22/08 0:49	0.000	0.00%
2/22/08 1:08	0.039	1.69%
2/22/08 1:27	0.039	3.39%
2/22/08 1:34	0.039	5.08%
2/22/08 1:41	0.039	6.78%
2/22/08 1:44	0.039	8.47%
2/22/08 1:53	0.039	10.17%
2/22/08 2:04	0.039	11.86%
2/22/08 2:09	0.039	13.56%
2/22/08 2:16	0.039	15.25%
2/22/08 2:25	0.039	16.95%
2/22/08 2:33	0.039	18.64%
2/22/08 2:37	0.039	20.34%
2/22/08 2:43	0.039	22.03%
2/22/08 2:53	0.039	23.73%
2/22/08 3:02	0.039	25.42%
2/22/08 3:08	0.039	27.12%
2/22/08 3:19	0.039	28.81%
2/22/08 3:27	0.039	30.51%
2/22/08 3:37	0.039	32.20%
2/22/08 3:45	0.039	33.90%
2/22/08 4:01	0.039	35.59%
2/22/08 4:10	0.039	37.29%
2/22/08 4:15	0.039	38.98%
2/22/08 4:21	0.039	40.68%
2/22/08 4:24	0.039	42.37%
2/22/08 4:33	0.079	45.76%
2/22/08 4:39	0.039	47.46%
2/22/08 4:44	0.079	50.85%
2/22/08 4:48	0.039	52.54%
2/22/08 4:54	0.039	54.24%
2/22/08 5:01	0.039	55.93%
2/22/08 5:11	0.079	59.32%
2/22/08 5:22	0.079	62.71%
2/22/08 5:27	0.039	64.41%
2/22/08 5:32	0.039	66.10%
2/22/08 5:36	0.039	67.80%
2/22/08 5:42	0.039	69.49%
2/22/08 5:48	0.039	71.19%
2/22/08 5:56	0.039	72.88%
2/22/08 6:03	0.039	74.58%
2/22/08 6:13	0.039	76.27%
2/22/08 6:20	0.039	77.97%
2/22/08 6:26	0.039	79.66%
2/22/08 6:35	0.039	81.36%
2/22/08 6:41	0.039	83.05%
2/22/08 6:48	0.039	84.75%
2/22/08 6:58	0.039	86.44%
2/22/08 7:05	0.039	88.14%
2/22/08 7:12	0.039	89.83%
2/22/08 7:23	0.039	91.53%
2/22/08 7:35	0.039	93.22%
2/22/08 7:40	0.039	94.92%
2/22/08 8:56	0.039	96.61%
2/22/08 10:28	0.039	98.31%
2/22/08 12:30	0.039	100.00%

Appendix B.3

15-Minute Discharge Data for All 5 Events from All 6 Gauges Where the Time Window Used to Extract the Measured Data was 18 Hours Before and 12 hours After the Time of the Selected Instantaneous Annual Peak Discharge

This page is intentionally left blank to facilitate 2-sided printing.

Table B3.1: 15-min event discharge data for USGS Site 11014000.

Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)
2/28/91 14:30	7.6	1/15/93 20:15	2150	3/5/95 5:00	69	2/21/04 20:00	0.64	10/19/04 19:15	9.6
2/28/91 14:45	7.6	1/15/93 20:30	2170	3/5/95 5:15	68	2/21/04 20:15	0.64	10/19/04 19:30	9.1
2/28/91 15:00	7.8	1/15/93 20:45	2120	3/5/95 5:30	69	2/21/04 20:30	0.64	10/19/04 19:45	7.7
2/28/91 15:15	8.3	1/15/93 21:00	2280	3/5/95 5:45	69	2/21/04 20:45	0.64	10/19/04 20:00	6.6
2/28/91 15:30	8.3	1/15/93 21:15	2210	3/5/95 6:00	71	2/21/04 21:00	0.64	10/19/04 20:15	5.6
2/28/91 15:45	8.6	1/15/93 21:30	2280	3/5/95 6:15	71	2/21/04 21:15	0.64	10/19/04 20:30	4.6
2/28/91 16:00	8.6	1/15/93 21:45	2120	3/5/95 6:30	71	2/21/04 21:30	0.64	10/19/04 20:45	3.7
2/28/91 16:15	8.6	1/15/93 22:00	2100	3/5/95 6:45	71	2/21/04 21:45	0.64	10/19/04 21:00	3.2
2/28/91 16:30	8.8	1/15/93 22:15	2070	3/5/95 7:00	72	2/21/04 22:00	0.64	10/19/04 21:15	2.7
2/28/91 16:45	9.1	1/15/93 22:30	1990	3/5/95 7:15	71	2/21/04 22:15	0.64	10/19/04 21:30	2.4
2/28/91 17:00	9.9	1/15/93 22:45	2120	3/5/95 7:30	71	2/21/04 22:30	0.64	10/19/04 21:45	2
2/28/91 17:15	10	1/15/93 23:00	2040	3/5/95 7:45	75	2/21/04 22:45	0.64	10/19/04 22:00	1.6
2/28/91 17:30	10	1/15/93 23:15	2120	3/5/95 8:00	77	2/21/04 23:00	0.64	10/19/04 22:15	1.3
2/28/91 17:45	11	1/15/93 23:30	2060	3/5/95 8:15	78	2/21/04 23:15	0.64	10/19/04 22:30	1.2
2/28/91 18:00	11	1/15/93 23:45	2120	3/5/95 8:30	81	2/21/04 23:30	0.64	10/19/04 22:45	1.2
2/28/91 18:15	11	1/16/93 0:00	2060	3/5/95 8:45	81	2/21/04 23:45	0.64	10/19/04 23:00	1.5
2/28/91 18:30	11	1/16/93 0:15	2050	3/5/95 9:00	84	2/22/04 0:00	0.64	10/19/04 23:15	1.5
2/28/91 18:45	11	1/16/93 0:30	2040	3/5/95 9:15	87	2/22/04 0:15	0.64	10/19/04 23:30	1.6
2/28/91 19:00	12	1/16/93 0:45	2010	3/5/95 9:30	93	2/22/04 0:30	0.64	10/19/04 23:45	1.6
2/28/91 19:15	12	1/16/93 1:00	1970	3/5/95 9:45	103	2/22/04 0:45	0.64	10/20/04 0:00	1.5
2/28/91 19:30	14	1/16/93 1:15	1970	3/5/95 10:00	112	2/22/04 1:00	0.64	10/20/04 0:15	1.3
2/28/91 19:45	18	1/16/93 1:30	2050	3/5/95 10:15	119	2/22/04 1:15	0.64	10/20/04 0:30	1.2
2/28/91 20:00	44	1/16/93 1:45	2010	3/5/95 10:30	127	2/22/04 1:30	0.64	10/20/04 0:45	0.98
2/28/91 20:15	61	1/16/93 2:00	1980	3/5/95 10:45	142	2/22/04 1:45	0.64	10/20/04 1:00	0.98
2/28/91 20:30	61	1/16/93 2:15	2010	3/5/95 11:00	147	2/22/04 2:00	0.64	10/20/04 1:15	0.98
2/28/91 20:45	57	1/16/93 2:30	1990	3/5/95 11:15	165	2/22/04 2:15	0.64	10/20/04 1:30	0.98
2/28/91 21:00	54	1/16/93 2:45	1970	3/5/95 11:30	168	2/22/04 2:30	0.64	10/20/04 1:45	0.98
2/28/91 21:15	53	1/16/93 3:00	1900	3/5/95 11:45	180	2/22/04 2:45	0.64	10/20/04 2:00	0.98
2/28/91 21:30	50	1/16/93 3:15	1940	3/5/95 12:00	200	2/22/04 3:00	0.64	10/20/04 2:15	0.98
2/28/91 21:45	45	1/16/93 3:30	1870	3/5/95 12:15	205	2/22/04 3:15	0.64	10/20/04 2:30	0.98
2/28/91 22:00	44	1/16/93 3:45	1870	3/5/95 12:30	236	2/22/04 3:30	0.64	10/20/04 2:45	0.98
2/28/91 22:15	47	1/16/93 4:00	1900	3/5/95 12:45	337	2/22/04 3:45	0.64	10/20/04 3:00	0.98
2/28/91 22:30	49	1/16/93 4:15	1870	3/5/95 13:00	392	2/22/04 4:00	0.64	10/20/04 3:15	0.98
2/28/91 22:45	50	1/16/93 4:30	1840	3/5/95 13:15	402	2/22/04 4:15	0.64	10/20/04 3:30	0.98
2/28/91 23:00	50	1/16/93 4:45	1870	3/5/95 13:30	552	2/22/04 4:30	0.64	10/20/04 3:45	0.98
2/28/91 23:15	52	1/16/93 5:00	1830	3/5/95 13:45	526	2/22/04 4:45	0.64	10/20/04 4:00	0.98
2/28/91 23:30	51	1/16/93 5:15	1820	3/5/95 14:00	651	2/22/04 5:00	0.64	10/20/04 4:15	0.98
2/28/91 23:45	48	1/16/93 5:30	1790	3/5/95 14:15	714	2/22/04 5:15	0.64	10/20/04 4:30	0.98
3/1/91 0:00	81	1/16/93 5:45	1760	3/5/95 14:30	936	2/22/04 5:30	0.64	10/20/04 4:45	0.98
3/1/91 0:15	134	1/16/93 6:00	1750	3/5/95 14:45	936	2/22/04 5:45	0.64	10/20/04 5:00	0.98
3/1/91 0:30	180	1/16/93 6:15	1740	3/5/95 15:00	1160	2/22/04 6:00	0.64	10/20/04 5:15	0.98
3/1/91 0:45	188	1/16/93 6:30	1710	3/5/95 15:15	957	2/22/04 6:15	0.64	10/20/04 5:30	0.98
3/1/91 1:00	210	1/16/93 6:45	1690	3/5/95 15:30	1150	2/22/04 6:30	0.64	10/20/04 5:45	0.98
3/1/91 1:15	236	1/16/93 7:00	1710	3/5/95 15:45	1150	2/22/04 6:45	0.64	10/20/04 6:00	0.98
3/1/91 1:30	283	1/16/93 7:15	1690	3/5/95 16:00	1290	2/22/04 7:00	3.4	10/20/04 6:15	0.98
3/1/91 1:45	360	1/16/93 7:30	1670	3/5/95 16:15	1440	2/22/04 7:15	3	10/20/04 6:30	0.98
3/1/91 2:00	352	1/16/93 7:45	1620	3/5/95 16:30	1590	2/22/04 7:30	2.4	10/20/04 6:45	0.98
3/1/91 2:15	295	1/16/93 8:00	1650	3/5/95 16:45	1740	2/22/04 7:45	2.3	10/20/04 7:00	0.98
3/1/91 2:30	433	1/16/93 8:15	1600	3/5/95 17:00	1710	2/22/04 8:00	1.9	10/20/04 7:15	0.98
3/1/91 2:45	422	1/16/93 8:30	1600	3/5/95 17:15	1700	2/22/04 8:15	1.7	10/20/04 7:30	28
3/1/91 3:00	501	1/16/93 8:45	1620	3/5/95 17:30	1570	2/22/04 8:30	1.6	10/20/04 7:45	21
3/1/91 3:15	384	1/16/93 9:00	1590	3/5/95 17:45	1660	2/22/04 8:45	1.3	10/20/04 8:00	14
3/1/91 3:30	316	1/16/93 9:15	1570	3/5/95 18:00	1950	2/22/04 9:00	1.3	10/20/04 8:15	10
3/1/91 3:45	276	1/16/93 9:30	1570	3/5/95 18:15	1980	2/22/04 9:15	1.3	10/20/04 8:30	7.2
3/1/91 4:00	289	1/16/93 9:45	1540	3/5/95 18:30	2290	2/22/04 9:30	1.2	10/20/04 8:45	5.8
3/1/91 4:15	309	1/16/93 10:00	1570	3/5/95 18:45	2200	2/22/04 9:45	1.2	10/20/04 9:00	4.3
3/1/91 4:30	276	1/16/93 10:15	1710	3/5/95 19:00	2450	2/22/04 10:00	64	10/20/04 9:15	3.7
3/1/91 4:45	225	1/16/93 10:30	1900	3/5/95 19:15	2570	2/22/04 10:15	43	10/20/04 9:30	3.2
3/1/91 5:00	188	1/16/93 10:45	2120	3/5/95 19:30	2850	2/22/04 10:30	31	10/20/04 9:45	29
3/1/91 5:15	176	1/16/93 11:00	2330	3/5/95 19:45	2920	2/22/04 10:45	126	10/20/04 10:00	106
3/1/91 5:30	225	1/16/93 11:15	2470	3/5/95 20:00	3150	2/22/04 11:00	139	10/20/04 10:15	96
3/1/91 5:45	302	1/16/93 11:30	2820	3/5/95 20:15	3370	2/22/04 11:15	115	10/20/04 10:30	74
3/1/91 6:00	360	1/16/93 11:45	3160	3/5/95 20:30	3660	2/22/04 11:30	100	10/20/04 10:45	92
3/1/91 6:15	433	1/16/93 12:00	3350	3/5/95 20:45	3890	2/22/04 11:45	93	10/20/04 11:00	215
3/1/91 6:30	714	1/16/93 12:15	3540	3/5/95 21:00	4170	2/22/04 12:00	85	10/20/04 11:15	205
3/1/91 6:45	895	1/16/93 12:30	3560	3/5/95 21:15	4590	2/22/04 12:15	74	10/20/04 11:30	195
3/1/91 7:00	1160	1/16/93 12:45	3760	3/5/95 21:30	4790	2/22/04 12:30	66	10/20/04 11:45	200
3/1/91 7:15	1250	1/16/93 13:00	3770	3/5/95 21:45	5010	2/22/04 12:45	80	10/20/04 12:00	295
3/1/91 7:30	1520	1/16/93 13:15	3690	3/5/95 22:00	4990	2/22/04 13:00	113	10/20/04 12:15	1860
3/1/91 7:45	1650	1/16/93 13:30	3620	3/5/95 22:15	5170	2/22/04 13:15	124	10/20/04 12:30	1660
3/1/91 8:00	1870	1/16/93 13:45	3820	3/5/95 22:30	5360	2/22/04 13:30	295	10/20/04 12:45	1210
3/1/91 8:15	2170	1/16/93 14:00	3890	3/5/95 22:45	5650	2/22/04 13:45	664	10/20/04 13:00	1640
3/1/91 8:30	2340	1/16/93 14:15	3910	3/5/95 23:00	5870	2/22/04 14:00	980	10/20/04 13:15	2230
3/1/91 8:45	2310	1/16/93 14:30	3610	3/5/95 23:15	5480	2/22/04 14:15	832	10/20/04 13:30	1640

Table B3.1(cont.): 15-min event discharge data for USGS Site 11014000.

Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)
3/1/91 9:00	2300	1/16/93 14:45	3480	3/5/95 23:30	5560	2/22/04 14:30	845	10/20/04 13:45	1180
3/1/91 9:15	2190	1/16/93 15:00	3450	3/5/95 23:45	5530	2/22/04 14:45	761	10/20/04 14:00	995
3/1/91 9:30	2110	1/16/93 15:15	3350	3/6/95 0:00	5500	2/22/04 15:00	761	10/20/04 14:15	884
3/1/91 9:45	1950	1/16/93 15:30	3230	3/6/95 0:15	5300	2/22/04 15:15	601	10/20/04 14:30	832
3/1/91 10:00	1870	1/16/93 15:45	3230	3/6/95 0:30	5320	2/22/04 15:30	441	10/20/04 14:45	733
3/1/91 10:15	1650	1/16/93 16:00	3080	3/6/95 0:45	5180	2/22/04 15:45	295	10/20/04 15:00	664
3/1/91 10:30	1490	1/16/93 16:15	2930	3/6/95 1:00	4900	2/22/04 16:00	215	10/20/04 15:15	632
3/1/91 10:45	1390	1/16/93 16:30	2880	3/6/95 1:15	4830	2/22/04 16:15	195	10/20/04 15:30	484
3/1/91 11:00	1130	1/16/93 16:45	2790	3/6/95 1:30	4720	2/22/04 16:30	317	10/20/04 15:45	275
3/1/91 11:15	1020	1/16/93 17:00	2790	3/6/95 1:45	4540	2/22/04 16:45	268	10/20/04 16:00	210
3/1/91 11:30	818	1/16/93 17:15	2710	3/6/95 2:00	4330	2/22/04 17:00	172	10/20/04 16:15	232
3/1/91 11:45	714	1/16/93 17:30	2610	3/6/95 2:15	4260	2/22/04 17:15	124	10/20/04 16:30	215
3/1/91 12:00	607	1/16/93 17:45	2630	3/6/95 2:30	4160	2/22/04 17:30	115	10/20/04 16:45	215
3/1/91 12:15	552	1/16/93 18:00	2490	3/6/95 2:45	3850	2/22/04 17:45	117	10/20/04 17:00	232
3/1/91 12:30	539	1/16/93 18:15	2460	3/6/95 3:00	3820	2/22/04 18:00	126	10/20/04 17:15	262
3/1/91 12:45	466	1/16/93 18:30	2350	3/6/95 3:15	3580	2/22/04 18:15	119	10/20/04 17:30	221
3/1/91 13:00	422	1/16/93 18:45	2260	3/6/95 3:30	3490	2/22/04 18:30	113	10/20/04 17:45	195
3/1/91 13:15	402	1/16/93 19:00	2220	3/6/95 3:45	3340	2/22/04 18:45	124	10/20/04 18:00	226
3/1/91 13:30	360	1/16/93 19:15	2160	3/6/95 4:00	3300	2/22/04 19:00	166	10/20/04 18:15	200
3/1/91 13:45	323	1/16/93 19:30	2140	3/6/95 4:15	3200	2/22/04 19:15	484	10/20/04 18:30	158
3/1/91 14:00	270	1/16/93 19:45	2090	3/6/95 4:30	3150	2/22/04 19:30	484	10/20/04 18:45	136
3/1/91 14:15	241	1/16/93 20:00	2120	3/6/95 4:45	2900	2/22/04 19:45	601	10/20/04 19:00	126
3/1/91 14:30	205	1/16/93 20:15	2110	3/6/95 5:00	2940	2/22/04 20:00	402	10/20/04 19:15	115
3/1/91 14:45	176	1/16/93 20:30	2170	3/6/95 5:15	2770	2/22/04 20:15	390	10/20/04 19:30	108
3/1/91 15:00	158	1/16/93 20:45	2160	3/6/95 5:30	2760	2/22/04 20:30	390	10/20/04 19:45	117
3/1/91 15:15	155	1/16/93 21:00	2110	3/6/95 5:45	2680	2/22/04 20:45	243	10/20/04 20:00	104
3/1/91 15:30	142	1/16/93 21:15	2150	3/6/95 6:00	2750	2/22/04 21:00	155	10/20/04 20:15	98
3/1/91 15:45	137	1/16/93 21:30	2170	3/6/95 6:15	2510	2/22/04 21:15	115	10/20/04 20:30	108
3/1/91 16:00	134	1/16/93 21:45	2120	3/6/95 6:30	2570	2/22/04 21:30	94	10/20/04 20:45	110
3/1/91 16:15	129	1/16/93 22:00	2170	3/6/95 6:45	2500	2/22/04 21:45	106	10/20/04 21:00	96
3/1/91 16:30	124	1/16/93 22:15	2140	3/6/95 7:00	2430	2/22/04 22:00	115	10/20/04 21:15	96
3/1/91 16:45	119	1/16/93 22:30	2120	3/6/95 7:15	2420	2/22/04 22:15	99	10/20/04 21:30	95
3/1/91 17:00	114	1/16/93 22:45	2070	3/6/95 7:30	2450	2/22/04 22:30	85	10/20/04 21:45	95
3/1/91 17:15	110	1/16/93 23:00	2040	3/6/95 7:45	2420	2/22/04 22:45	71	10/20/04 22:00	94
3/1/91 17:30	106	1/16/93 23:15	2050	3/6/95 8:00	2380	2/22/04 23:00	56	10/20/04 22:15	92
3/1/91 17:45	106	1/16/93 23:30	1990	3/6/95 8:15	2370	2/22/04 23:15	52	10/20/04 22:30	91
3/1/91 18:00	103	1/16/93 23:45	2020	3/6/95 8:30	2300	2/22/04 23:30	48	10/20/04 22:45	89
3/1/91 18:15	97	1/17/93 0:00	1980	3/6/95 8:45	2220	2/22/04 23:45	48	10/20/04 23:00	86
3/1/91 18:30	93	1/17/93 0:15	1900	3/6/95 9:00	2190	2/23/04 0:00	48	10/20/04 23:15	84
3/1/91 18:45	89	1/17/93 0:30	1920	3/6/95 9:15	2110	2/23/04 0:15	90	10/20/04 23:30	84
3/1/91 19:00	86	1/17/93 0:45	1910	3/6/95 9:30	2010	2/23/04 0:30	166	10/20/04 23:45	83
3/1/91 19:15	83	1/17/93 1:00	1910	3/6/95 9:45	1950	2/23/04 0:45	185	10/21/04 0:00	82
3/1/91 19:30	79	1/17/93 1:15	1880	3/6/95 10:00	1990	2/23/04 1:00	149	10/21/04 0:15	81
3/1/91 19:45	77	1/17/93 1:30	1910	3/6/95 10:15	1970	2/23/04 1:15	158	10/21/04 0:30	80
3/1/91 20:00	75	1/17/93 1:45	1880	3/6/95 10:30	1840	2/23/04 1:30	324	10/21/04 0:45	80
3/1/91 20:15	74	1/17/93 2:00	1910	3/6/95 10:45	1820	2/23/04 1:45	226	10/21/04 1:00	79

Table B3.2: 15-min event discharge data for USGS Site 11015000.

Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)
n/a		1/15/93 22:00	1500	3/5/95 6:00	126	2/14/98 4:15	12	1/10/05 17:00	132
		1/15/93 22:15	1450	3/5/95 6:15	126	2/14/98 4:30	11	1/10/05 17:15	130
		1/15/93 22:30	1390	3/5/95 6:30	136	2/14/98 4:45	12	1/10/05 17:30	132
		1/15/93 22:45	1360	3/5/95 6:45	153	2/14/98 5:00	12	1/10/05 17:45	130
		1/15/93 23:00	1390	3/5/95 7:00	149	2/14/98 5:15	11	1/10/05 18:00	130
		1/15/93 23:15	1390	3/5/95 7:15	164	2/14/98 5:30	12	1/10/05 18:15	130
		1/15/93 23:30	1350	3/5/95 7:30	178	2/14/98 5:45	11	1/10/05 18:30	126
		1/15/93 23:45	1380	3/5/95 7:45	188	2/14/98 6:00	11	1/10/05 18:45	126
		1/16/93 0:00	1410	3/5/95 8:00	200	2/14/98 6:15	11	1/10/05 19:00	126
		1/16/93 0:15	1330	3/5/95 8:15	228	2/14/98 6:30	11	1/10/05 19:15	126
		1/16/93 0:30	1360	3/5/95 8:30	248	2/14/98 6:45	11	1/10/05 19:30	126
		1/16/93 0:45	1350	3/5/95 8:45	261	2/14/98 7:00	11	1/10/05 19:45	123
		1/16/93 1:00	1360	3/5/95 9:00	314	2/14/98 7:15	11	1/10/05 20:00	123
		1/16/93 1:15	1290	3/5/95 9:15	336	2/14/98 7:30	11	1/10/05 20:15	123
		1/16/93 1:30	1300	3/5/95 9:30	371	2/14/98 7:45	11	1/10/05 20:30	123
		1/16/93 1:45	1220	3/5/95 9:45	433	2/14/98 8:00	11	1/10/05 20:45	121
		1/16/93 2:00	1130	3/5/95 10:00	498	2/14/98 8:15	11	1/10/05 21:00	119
		1/16/93 2:15	1040	3/5/95 10:15	570	2/14/98 8:30	11	1/10/05 21:15	119
		1/16/93 2:30	1030	3/5/95 10:30	613	2/14/98 8:45	11	1/10/05 21:30	117
		1/16/93 2:45	1010	3/5/95 10:45	648	2/14/98 9:00	11	1/10/05 21:45	119
		1/16/93 3:00	971	3/5/95 11:00	671	2/14/98 9:15	11	1/10/05 22:00	119
		1/16/93 3:15	945	3/5/95 11:15	708	2/14/98 9:30	11	1/10/05 22:15	116
		1/16/93 3:30	878	3/5/95 11:30	785	2/14/98 9:45	11	1/10/05 22:30	114
		1/16/93 3:45	839	3/5/95 11:45	854	2/14/98 10:00	11	1/10/05 22:45	116
		1/16/93 4:00	831	3/5/95 12:00	929	2/14/98 10:15	11	1/10/05 23:00	109
		1/16/93 4:15	767	3/5/95 12:15	1040	2/14/98 10:30	11	1/10/05 23:15	112
		1/16/93 4:30	759	3/5/95 12:30	1130	2/14/98 10:45	11	1/10/05 23:30	110
		1/16/93 4:45	736	3/5/95 12:45	1290	2/14/98 11:00	11	1/10/05 23:45	112
		1/16/93 5:00	713	3/5/95 13:00	1450	2/14/98 11:15	11	1/11/05 0:00	109
		1/16/93 5:15	683	3/5/95 13:15	1470	2/14/98 11:30	11	1/11/05 0:15	109
		1/16/93 5:30	640	3/5/95 13:30	1600	2/14/98 11:45	11	1/11/05 0:30	112
		1/16/93 5:45	612	3/5/95 13:45	1720	2/14/98 12:00	11	1/11/05 0:45	109
		1/16/93 6:00	579	3/5/95 14:00	1920	2/14/98 12:15	11	1/11/05 1:00	110
		1/16/93 6:15	573	3/5/95 14:15	2050	2/14/98 12:30	11	1/11/05 1:15	109
		1/16/93 6:30	560	3/5/95 14:30	2120	2/14/98 12:45	12	1/11/05 1:30	110
		1/16/93 6:45	541	3/5/95 14:45	2360	2/14/98 13:00	12	1/11/05 1:45	109
		1/16/93 7:00	529	3/5/95 15:00	2450	2/14/98 13:15	13	1/11/05 2:00	109
		1/16/93 7:15	529	3/5/95 15:15	2760	2/14/98 13:30	13	1/11/05 2:15	109
		1/16/93 7:30	535	3/5/95 15:30	2990	2/14/98 13:45	13	1/11/05 2:30	110
		1/16/93 7:45	511	3/5/95 15:45	3160	2/14/98 14:00	15	1/11/05 2:45	112
		1/16/93 8:00	511	3/5/95 16:00	3300	2/14/98 14:15	15	1/11/05 3:00	112
		1/16/93 8:15	494	3/5/95 16:15	3570	2/14/98 14:30	16	1/11/05 3:15	114
		1/16/93 8:30	494	3/5/95 16:30	3840	2/14/98 14:45	20	1/11/05 3:30	119
		1/16/93 8:45	460	3/5/95 16:45	3970	2/14/98 15:00	23	1/11/05 3:45	126
		1/16/93 9:00	449	3/5/95 17:00	4110	2/14/98 15:15	29	1/11/05 4:00	134
		1/16/93 9:15	428	3/5/95 17:15	4140	2/14/98 15:30	42	1/11/05 4:15	142
		1/16/93 9:30	434	3/5/95 17:30	4050	2/14/98 15:45	61	1/11/05 4:30	155
		1/16/93 9:45	413	3/5/95 17:45	4060	2/14/98 16:00	74	1/11/05 4:45	175
		1/16/93 10:00	413	3/5/95 18:00	4020	2/14/98 16:15	87	1/11/05 5:00	190
		1/16/93 10:15	413	3/5/95 18:15	4550	2/14/98 16:30	105	1/11/05 5:15	216
		1/16/93 10:30	444	3/5/95 18:30	4480	2/14/98 16:45	144	1/11/05 5:30	242
		1/16/93 10:45	505	3/5/95 18:45	4750	2/14/98 17:00	225	1/11/05 5:45	287
		1/16/93 11:00	606	3/5/95 19:00	4650	2/14/98 17:15	280	1/11/05 6:00	336
		1/16/93 11:15	720	3/5/95 19:15	4730	2/14/98 17:30	333	1/11/05 6:15	379
		1/16/93 11:30	895	3/5/95 19:30	4980	2/14/98 17:45	387	1/11/05 6:30	420
		1/16/93 11:45	1130	3/5/95 19:45	5210	2/14/98 18:00	420	1/11/05 6:45	447
		1/16/93 12:00	1470	3/5/95 20:00	5570	2/14/98 18:15	484	1/11/05 7:00	484
		1/16/93 12:15	1750	3/5/95 20:15	5980	2/14/98 18:30	613	1/11/05 7:15	533
		1/16/93 12:30	2020	3/5/95 20:30	6590	2/14/98 18:45	739	1/11/05 7:30	671
		1/16/93 12:45	2420	3/5/95 20:45	7080	2/14/98 19:00	854	1/11/05 7:45	971
		1/16/93 13:00	2860	3/5/95 21:00	7410	2/14/98 19:15	875	1/11/05 8:00	1220
		1/16/93 13:15	3100	3/5/95 21:15	8010	2/14/98 19:30	922	1/11/05 8:15	1410
		1/16/93 13:30	3190	3/5/95 21:30	8010	2/14/98 19:45	1030	1/11/05 8:30	1680
		1/16/93 13:45	3320	3/5/95 21:45	8050	2/14/98 20:00	1230	1/11/05 8:45	2120
		1/16/93 14:00	3460	3/5/95 22:00	8050	2/14/98 20:15	1580	1/11/05 9:00	2160
		1/16/93 14:15	3540	3/5/95 22:15	8010	2/14/98 20:30	1830	1/11/05 9:15	2080
		1/16/93 14:30	3570	3/5/95 22:30	8110	2/14/98 20:45	2080	1/11/05 9:30	2080
		1/16/93 14:45	3720	3/5/95 22:45	8190	2/14/98 21:00	2140	1/11/05 9:45	2140
		1/16/93 15:00	3810	3/5/95 23:00	8220	2/14/98 21:15	2200	1/11/05 10:00	2310
		1/16/93 15:15	3870	3/5/95 23:15	8340	2/14/98 21:30	2130	1/11/05 10:15	2480
		1/16/93 15:30	4050	3/5/95 23:30	8370	2/14/98 21:45	2170	1/11/05 10:30	2600
		1/16/93 15:45	4000	3/5/95 23:45	8340	2/14/98 22:00	2430	1/11/05 10:45	2730
		1/16/93 16:00	4220	3/6/95 0:00	8600	2/14/98 22:15	2580	1/11/05 11:00	2900
		1/16/93 16:15	4080	3/6/95 0:15	8410	2/14/98 22:30	2430	1/11/05 11:15	2570

Table B3.2(cont.): 15-min event discharge data for USGS Site 11015000.

Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)
n/a		1/16/93 16:30	4080	3/6/95 0:30	8190	2/14/98 22:45	2300	1/11/05 11:30	2360
		1/16/93 16:45	3960	3/6/95 0:45	7980	2/14/98 23:00	2250	1/11/05 11:45	2020
		1/16/93 17:00	3930	3/6/95 1:00	7450	2/14/98 23:15	1910	1/11/05 12:00	1790
		1/16/93 17:15	3870	3/6/95 1:15	7060	2/14/98 23:30	1930	1/11/05 12:15	1500
		1/16/93 17:30	3720	3/6/95 1:30	6450	2/14/98 23:45	1830	1/11/05 12:30	1370
		1/16/93 17:45	3570	3/6/95 1:45	6170	2/15/98 0:00	1800	1/11/05 12:45	1180
		1/16/93 18:00	3540	3/6/95 2:00	5920	2/15/98 0:15	1630	1/11/05 13:00	1050
		1/16/93 18:15	3420	3/6/95 2:15	5370	2/15/98 0:30	1460	1/11/05 13:15	971
		1/16/93 18:30	3220	3/6/95 2:30	4930	2/15/98 0:45	1450	1/11/05 13:30	902
		1/16/93 18:45	3040	3/6/95 2:45	4850	2/15/98 1:00	1350	1/11/05 13:45	792
		1/16/93 19:00	2990	3/6/95 3:00	4700	2/15/98 1:15	1180	1/11/05 14:00	733
		1/16/93 19:15	2890	3/6/95 3:15	4480	2/15/98 1:30	1030	1/11/05 14:15	613
		1/16/93 19:30	2580	3/6/95 3:30	4080	2/15/98 1:45	868	1/11/05 14:30	580
		1/16/93 19:45	2500	3/6/95 3:45	3850	2/15/98 2:00	833	1/11/05 14:45	489
		1/16/93 20:00	2420	3/6/95 4:00	3680	2/15/98 2:15	752	1/11/05 15:00	460
		1/16/93 20:15	2400	3/6/95 4:15	3470	2/15/98 2:30	702	1/11/05 15:15	403
		1/16/93 20:30	2370	3/6/95 4:30	3300	2/15/98 2:45	648	1/11/05 15:30	379
		1/16/93 20:45	2390	3/6/95 4:45	2970	2/15/98 3:00	619	1/11/05 15:45	355
		1/16/93 21:00	2300	3/6/95 5:00	2900	2/15/98 3:15	619	1/11/05 16:00	367
		1/16/93 21:15	2250	3/6/95 5:15	2760	2/15/98 3:30	523	1/11/05 16:15	363
		1/16/93 21:30	2220	3/6/95 5:30	2620	2/15/98 3:45	479	1/11/05 16:30	359
		1/16/93 21:45	2280	3/6/95 5:45	2470	2/15/98 4:00	429	1/11/05 16:45	348
		1/16/93 22:00	2160	3/6/95 6:00	2320	2/15/98 4:15	412	1/11/05 17:00	344
		1/16/93 22:15	2120	3/6/95 6:15	2300	2/15/98 4:30	383	1/11/05 17:15	333
		1/16/93 22:30	2100	3/6/95 6:30	2210	2/15/98 4:45	348	1/11/05 17:30	333
		1/16/93 22:45	2050	3/6/95 6:45	1990	2/15/98 5:00	333	1/11/05 17:45	321
		1/16/93 23:00	1980	3/6/95 7:00	1870	2/15/98 5:15	314	1/11/05 18:00	318
		1/16/93 23:15	1950	3/6/95 7:15	1830	2/15/98 5:30	304	1/11/05 18:15	311
		1/16/93 23:30	1870	3/6/95 7:30	1770	2/15/98 5:45	297	1/11/05 18:30	311
		1/16/93 23:45	1870	3/6/95 7:45	1640	2/15/98 6:00	307	1/11/05 18:45	311
		1/17/93 0:00	1800	3/6/95 8:00	1600	2/15/98 6:15	307	1/11/05 19:00	304
		1/17/93 0:15	1810	3/6/95 8:15	1520	2/15/98 6:30	293	1/11/05 19:15	297
		1/17/93 0:30	1770	3/6/95 8:30	1490	2/15/98 6:45	307	1/11/05 19:30	297
		1/17/93 0:45	1620	3/6/95 8:45	1390	2/15/98 7:00	300	1/11/05 19:45	290
		1/17/93 1:00	1590	3/6/95 9:00	1330	2/15/98 7:15	304	1/11/05 20:00	283
		1/17/93 1:15	1500	3/6/95 9:15	1270	2/15/98 7:30	300	1/11/05 20:15	290
		1/17/93 1:30	1440	3/6/95 9:30	1210	2/15/98 7:45	287	1/11/05 20:30	287
		1/17/93 1:45	1390	3/6/95 9:45	1160	2/15/98 8:00	297	1/11/05 20:45	280
		1/17/93 2:00	1310	3/6/95 10:00	1100	2/15/98 8:15	287	1/11/05 21:00	270
		1/17/93 2:15	1270	3/6/95 10:15	1070	2/15/98 8:30	287	1/11/05 21:15	267
		1/17/93 2:30	1220	3/6/95 10:30	1060	2/15/98 8:45	277	1/11/05 21:30	277
		1/17/93 2:45	1170	3/6/95 10:45	1010	2/15/98 9:00	277	1/11/05 21:45	283
		1/17/93 3:00	1110	3/6/95 11:00	993	2/15/98 9:15	277	1/11/05 22:00	297
		1/17/93 3:15	1070	3/6/95 11:15	950	2/15/98 9:30	270	1/11/05 22:15	300
		1/17/93 3:30	1020	3/6/95 11:30	922	2/15/98 9:45	273	1/11/05 22:30	333
		1/17/93 3:45	962	3/6/95 11:45	902	2/15/98 10:00	283	1/11/05 22:45	304

Table B3.3: 15-min event discharge data for USGS Site 11022200.

Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)
1/15/93 18:30	260	3/5/95 3:15	11	3/12/96 12:00	1.7	2/21/04 20:45	1.1	1/9/05 4:00	14
1/15/93 18:45	281	3/5/95 3:30	11	3/12/96 12:15	1.7	2/21/04 21:00	1	1/9/05 4:15	14
1/15/93 19:00	274	3/5/95 3:45	11	3/12/96 12:30	1.7	2/21/04 21:15	0.93	1/9/05 4:30	17
1/15/93 19:15	250	3/5/95 4:00	19	3/12/96 12:45	1.7	2/21/04 21:30	1	1/9/05 4:45	28
1/15/93 19:30	239	3/5/95 4:15	21	3/12/96 13:00	1.7	2/21/04 21:45	1.2	1/9/05 5:00	36
1/15/93 19:45	221	3/5/95 4:30	22	3/12/96 13:15	1.7	2/21/04 22:00	1.5	1/9/05 5:15	46
1/15/93 20:00	216	3/5/95 4:45	25	3/12/96 13:30	1.7	2/21/04 22:15	1.7	1/9/05 5:30	44
1/15/93 20:15	204	3/5/95 5:00	25	3/12/96 13:45	1.7	2/21/04 22:30	1.7	1/9/05 5:45	36
1/15/93 20:30	204	3/5/95 5:15	23	3/12/96 14:00	1.7	2/21/04 22:45	1.5	1/9/05 6:00	32
1/15/93 20:45	194	3/5/95 5:30	23	3/12/96 14:15	1.7	2/21/04 23:00	1.5	1/9/05 6:15	32
1/15/93 21:00	177	3/5/95 5:45	22	3/12/96 14:30	1.7	2/21/04 23:15	1.5	1/9/05 6:30	37
1/15/93 21:15	181	3/5/95 6:00	20	3/12/96 14:45	1.7	2/21/04 23:30	1.5	1/9/05 6:45	41
1/15/93 21:30	190	3/5/95 6:15	21	3/12/96 15:00	1.7	2/21/04 23:45	1.7	1/9/05 7:00	40
1/15/93 21:45	199	3/5/95 6:30	22	3/12/96 15:15	1.7	2/22/04 0:00	1.5	1/9/05 7:15	37
1/15/93 22:00	190	3/5/95 6:45	29	3/12/96 15:30	1.7	2/22/04 0:15	1.4	1/9/05 7:30	33
1/15/93 22:15	183	3/5/95 7:00	34	3/12/96 15:45	1.7	2/22/04 0:30	1.4	1/9/05 7:45	30
1/15/93 22:30	178	3/5/95 7:15	35	3/12/96 16:00	1.7	2/22/04 0:45	1.1	1/9/05 8:00	28
1/15/93 22:45	174	3/5/95 7:30	38	3/12/96 16:15	1.7	2/22/04 1:00	1.1	1/9/05 8:15	26
1/15/93 23:00	172	3/5/95 7:45	46	3/12/96 16:30	1.7	2/22/04 1:15	1.1	1/9/05 8:30	26
1/15/93 23:15	168	3/5/95 8:00	47	3/12/96 16:45	1.7	2/22/04 1:30	1	1/9/05 8:45	25
1/15/93 23:30	159	3/5/95 8:15	45	3/12/96 17:00	1.7	2/22/04 1:45	1	1/9/05 9:00	29
1/15/93 23:45	150	3/5/95 8:30	45	3/12/96 17:15	1.7	2/22/04 2:00	1.1	1/9/05 9:15	31
1/16/93 0:00	143	3/5/95 8:45	50	3/12/96 17:30	2.3	2/22/04 2:15	1.1	1/9/05 9:30	32
1/16/93 0:15	141	3/5/95 9:00	69	3/12/96 17:45	13	2/22/04 2:30	1.1	1/9/05 9:45	35
1/16/93 0:30	130	3/5/95 9:15	113	3/12/96 18:00	49	2/22/04 2:45	1	1/9/05 10:00	34
1/16/93 0:45	125	3/5/95 9:30	133	3/12/96 18:15	82	2/22/04 3:00	1	1/9/05 10:15	33
1/16/93 1:00	115	3/5/95 9:45	140	3/12/96 18:30	74	2/22/04 3:15	1.2	1/9/05 10:30	37
1/16/93 1:15	109	3/5/95 10:00	127	3/12/96 18:45	52	2/22/04 3:30	1.4	1/9/05 10:45	40
1/16/93 1:30	105	3/5/95 10:15	117	3/12/96 19:00	39	2/22/04 3:45	1.2	1/9/05 11:00	41
1/16/93 1:45	99	3/5/95 10:30	127	3/12/96 19:15	41	2/22/04 4:00	1.1	1/9/05 11:15	39
1/16/93 2:00	102	3/5/95 10:45	124	3/12/96 19:30	40	2/22/04 4:15	1.1	1/9/05 11:30	36
1/16/93 2:15	105	3/5/95 11:00	124	3/12/96 19:45	35	2/22/04 4:30	1.2	1/9/05 11:45	32
1/16/93 2:30	101	3/5/95 11:15	121	3/12/96 20:00	31	2/22/04 4:45	1.4	1/9/05 12:00	30
1/16/93 2:45	100	3/5/95 11:30	135	3/12/96 20:15	52	2/22/04 5:00	1.5	1/9/05 12:15	27
1/16/93 3:00	98	3/5/95 11:45	143	3/12/96 20:30	59	2/22/04 5:15	1.9	1/9/05 12:30	26
1/16/93 3:15	96	3/5/95 12:00	151	3/12/96 20:45	51	2/22/04 5:30	2.7	1/9/05 12:45	23
1/16/93 3:30	94	3/5/95 12:15	167	3/12/96 21:00	45	2/22/04 5:45	2.5	1/9/05 13:00	22
1/16/93 3:45	98	3/5/95 12:30	160	3/12/96 21:15	38	2/22/04 6:00	2.3	1/9/05 13:15	21
1/16/93 4:00	93	3/5/95 12:45	171	3/12/96 21:30	32	2/22/04 6:15	2.1	1/9/05 13:30	20
1/16/93 4:15	94	3/5/95 13:00	182	3/12/96 21:45	29	2/22/04 6:30	2.1	1/9/05 13:45	18
1/16/93 4:30	90	3/5/95 13:15	180	3/12/96 22:00	26	2/22/04 6:45	2.5	1/9/05 14:00	18
1/16/93 4:45	88	3/5/95 13:30	180	3/12/96 22:15	23	2/22/04 7:00	2.3	1/9/05 14:15	17
1/16/93 5:00	88	3/5/95 13:45	186	3/12/96 22:30	20	2/22/04 7:15	2.1	1/9/05 14:30	16
1/16/93 5:15	88	3/5/95 14:00	190	3/12/96 22:45	24	2/22/04 7:30	1.9	1/9/05 14:45	15
1/16/93 5:30	90	3/5/95 14:15	196	3/12/96 23:00	26	2/22/04 7:45	1.7	1/9/05 15:00	14
1/16/93 5:45	89	3/5/95 14:30	198	3/12/96 23:15	22	2/22/04 8:00	1.7	1/9/05 15:15	14
1/16/93 6:00	88	3/5/95 14:45	205	3/12/96 23:30	18	2/22/04 8:15	1.7	1/9/05 15:30	14
1/16/93 6:15	84	3/5/95 15:00	215	3/12/96 23:45	16	2/22/04 8:30	1.7	1/9/05 15:45	14
1/16/93 6:30	87	3/5/95 15:15	225	3/13/96 0:00	16	2/22/04 8:45	1.7	1/9/05 16:00	13
1/16/93 6:45	86	3/5/95 15:30	228	3/13/96 0:15	15	2/22/04 9:00	1.5	1/9/05 16:15	13
1/16/93 7:00	82	3/5/95 15:45	243	3/13/96 0:30	14	2/22/04 9:15	1.5	1/9/05 16:30	13
1/16/93 7:15	84	3/5/95 16:00	274	3/13/96 0:45	13	2/22/04 9:30	1.5	1/9/05 16:45	12
1/16/93 7:30	82	3/5/95 16:15	306	3/13/96 1:00	11	2/22/04 9:45	11	1/9/05 17:00	7.6
1/16/93 7:45	77	3/5/95 16:30	316	3/13/96 1:15	9.9	2/22/04 10:00	7.6	1/9/05 17:15	7.6
1/16/93 8:00	77	3/5/95 16:45	345	3/13/96 1:30	10	2/22/04 10:15	10	1/9/05 17:30	7.6
1/16/93 8:15	75	3/5/95 17:00	385	3/13/96 1:45	17	2/22/04 10:30	43	1/9/05 17:45	7.6
1/16/93 8:30	77	3/5/95 17:15	427	3/13/96 2:00	63	2/22/04 10:45	37	1/9/05 18:00	7.2
1/16/93 8:45	80	3/5/95 17:30	460	3/13/96 2:15	73	2/22/04 11:00	49	1/9/05 18:15	7.2
1/16/93 9:00	88	3/5/95 17:45	422	3/13/96 2:30	97	2/22/04 11:15	48	1/9/05 18:30	8.5
1/16/93 9:15	99	3/5/95 18:00	429	3/13/96 2:45	90	2/22/04 11:30	32	1/9/05 18:45	14
1/16/93 9:30	123	3/5/95 18:15	427	3/13/96 3:00	71	2/22/04 11:45	32	1/9/05 19:00	15
1/16/93 9:45	148	3/5/95 18:30	435	3/13/96 3:15	70	2/22/04 12:00	24	1/9/05 19:15	30
1/16/93 10:00	181	3/5/95 18:45	452	3/13/96 3:30	73	2/22/04 12:15	55	1/9/05 19:30	32
1/16/93 10:15	222	3/5/95 19:00	472	3/13/96 3:45	59	2/22/04 12:30	166	1/9/05 19:45	39
1/16/93 10:30	254	3/5/95 19:15	456	3/13/96 4:00	48	2/22/04 12:45	295	1/9/05 20:00	58
1/16/93 10:45	271	3/5/95 19:30	478	3/13/96 4:15	65	2/22/04 13:00	273	1/9/05 20:15	85
1/16/93 11:00	254	3/5/95 19:45	523	3/13/96 4:30	68	2/22/04 13:15	249	1/9/05 20:30	183
1/16/93 11:15	322	3/5/95 20:00	551	3/13/96 4:45	139	2/22/04 13:30	248	1/9/05 20:45	323
1/16/93 11:30	371	3/5/95 20:15	569	3/13/96 5:00	173	2/22/04 13:45	384	1/9/05 21:00	306
1/16/93 11:45	407	3/5/95 20:30	635	3/13/96 5:15	287	2/22/04 14:00	467	1/9/05 21:15	351
1/16/93 12:00	431	3/5/95 20:45	752	3/13/96 5:30	277	2/22/04 14:15	534	1/9/05 21:30	396
1/16/93 12:15	396	3/5/95 21:00	867	3/13/96 5:45	299	2/22/04 14:30	576	1/9/05 21:45	412
1/16/93 12:30	462	3/5/95 21:15	1090	3/13/96 6:00	372	2/22/04 14:45	609	1/9/05 22:00	508
1/16/93 12:45	431	3/5/95 21:30	902	3/13/96 6:15	260	2/22/04 15:00	569	1/9/05 22:15	295

Table B3.3(cont.): 15-min event discharge data for USGS Site 11022200.

Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)
1/16/93 13:00	458	3/5/95 21:45	876	3/13/96 6:30	225	2/22/04 15:15	481	1/9/05 22:30	213
1/16/93 13:15	396	3/5/95 22:00	867	3/13/96 6:45	272	2/22/04 15:30	421	1/9/05 22:45	150
1/16/93 13:30	324	3/5/95 22:15	824	3/13/96 7:00	248	2/22/04 15:45	370	1/9/05 23:00	133
1/16/93 13:45	298	3/5/95 22:30	790	3/13/96 7:15	210	2/22/04 16:00	317	1/9/05 23:15	131
1/16/93 14:00	286	3/5/95 22:45	739	3/13/96 7:30	142	2/22/04 16:15	261	1/9/05 23:30	102
1/16/93 14:15	271	3/5/95 23:00	657	3/13/96 7:45	117	2/22/04 16:30	227	1/9/05 23:45	111
1/16/93 14:30	265	3/5/95 23:15	597	3/13/96 8:00	111	2/22/04 16:45	210	1/10/05 0:00	100
1/16/93 14:45	249	3/5/95 23:30	538	3/13/96 8:15	133	2/22/04 17:00	189	1/10/05 0:15	96
1/16/93 15:00	208	3/5/95 23:45	452	3/13/96 8:30	169	2/22/04 17:15	178	1/10/05 0:30	97
1/16/93 15:15	202	3/6/95 0:00	396	3/13/96 8:45	203	2/22/04 17:30	166	1/10/05 0:45	92
1/16/93 15:30	202	3/6/95 0:15	350	3/13/96 9:00	180	2/22/04 17:45	156	1/10/05 1:00	89
1/16/93 15:45	199	3/6/95 0:30	312	3/13/96 9:15	121	2/22/04 18:00	151	1/10/05 1:15	83
1/16/93 16:00	179	3/6/95 0:45	282	3/13/96 9:30	123	2/22/04 18:15	149	1/10/05 1:30	86
1/16/93 16:15	172	3/6/95 1:00	249	3/13/96 9:45	125	2/22/04 18:30	144	1/10/05 1:45	74
1/16/93 16:30	167	3/6/95 1:15	235	3/13/96 10:00	150	2/22/04 18:45	166	1/10/05 2:00	61
1/16/93 16:45	167	3/6/95 1:30	205	3/13/96 10:15	144	2/22/04 19:00	169	1/10/05 2:15	58
1/16/93 17:00	146	3/6/95 1:45	196	3/13/96 10:30	214	2/22/04 19:15	177	1/10/05 2:30	48
1/16/93 17:15	147	3/6/95 2:00	184	3/13/96 10:45	238	2/22/04 19:30	192	1/10/05 2:45	54
1/16/93 17:30	138	3/6/95 2:15	183	3/13/96 11:00	242	2/22/04 19:45	176	1/10/05 3:00	50
1/16/93 17:45	131	3/6/95 2:30	171	3/13/96 11:15	240	2/22/04 20:00	172	1/10/05 3:15	48
1/16/93 18:00	125	3/6/95 2:45	166	3/13/96 11:30	219	2/22/04 20:15	166	1/10/05 3:30	47
1/16/93 18:15	122	3/6/95 3:00	157	3/13/96 11:45	207	2/22/04 20:30	159	1/10/05 3:45	44
1/16/93 18:30	116	3/6/95 3:15	148	3/13/96 12:00	193	2/22/04 20:45	162	1/10/05 4:00	45
1/16/93 18:45	111	3/6/95 3:30	141	3/13/96 12:15	166	2/22/04 21:00	162	1/10/05 4:15	41
1/16/93 19:00	109	3/6/95 3:45	137	3/13/96 12:30	144	2/22/04 21:15	154	1/10/05 4:30	40
1/16/93 19:15	109	3/6/95 4:00	130	3/13/96 12:45	137	2/22/04 21:30	147	1/10/05 4:45	40
1/16/93 19:30	112	3/6/95 4:15	124	3/13/96 13:00	114	2/22/04 21:45	141	1/10/05 5:00	40
1/16/93 19:45	117	3/6/95 4:30	122	3/13/96 13:15	105	2/22/04 22:00	146	1/10/05 5:15	39
1/16/93 20:00	117	3/6/95 4:45	124	3/13/96 13:30	94	2/22/04 22:15	146	1/10/05 5:30	38
1/16/93 20:15	117	3/6/95 5:00	122	3/13/96 13:45	88	2/22/04 22:30	144	1/10/05 5:45	37
1/16/93 20:30	122	3/6/95 5:15	119	3/13/96 14:00	85	2/22/04 22:45	144	1/10/05 6:00	35
1/16/93 20:45	124	3/6/95 5:30	115	3/13/96 14:15	81	2/22/04 23:00	135	1/10/05 6:15	35
1/16/93 21:00	131	3/6/95 5:45	113	3/13/96 14:30	73	2/22/04 23:15	133	1/10/05 6:30	34
1/16/93 21:15	130	3/6/95 6:00	108	3/13/96 14:45	67	2/22/04 23:30	134	1/10/05 6:45	35
1/16/93 21:30	125	3/6/95 6:15	105	3/13/96 15:00	58	2/22/04 23:45	134	1/10/05 7:00	32
1/16/93 21:45	122	3/6/95 6:30	99	3/13/96 15:15	52	2/23/04 0:00	131	1/10/05 7:15	31
1/16/93 22:00	116	3/6/95 6:45	96	3/13/96 15:30	49	2/23/04 0:15	140	1/10/05 7:30	31
1/16/93 22:15	109	3/6/95 7:00	94	3/13/96 15:45	44	2/23/04 0:30	192	1/10/05 7:45	29
1/16/93 22:30	105	3/6/95 7:15	87	3/13/96 16:00	43	2/23/04 0:45	218	1/10/05 8:00	30
1/16/93 22:45	103	3/6/95 7:30	87	3/13/96 16:15	39	2/23/04 1:00	260	1/10/05 8:15	29
1/16/93 23:00	98	3/6/95 7:45	85	3/13/96 16:30	35	2/23/04 1:15	285	1/10/05 8:30	29
1/16/93 23:15	98	3/6/95 8:00	82	3/13/96 16:45	34	2/23/04 1:30	318	1/10/05 8:45	28
1/16/93 23:30	112	3/6/95 8:15	78	3/13/96 17:00	31	2/23/04 1:45	356	1/10/05 9:00	27
1/16/93 23:45	153	3/6/95 8:30	80	3/13/96 17:15	32	2/23/04 2:00	323	1/10/05 9:15	26
1/17/93 0:00	194	3/6/95 8:45	78	3/13/96 17:30	33	2/23/04 2:15	306	1/10/05 9:30	27
1/17/93 0:15	267	3/6/95 9:00	77	3/13/96 17:45	32	2/23/04 2:30	271	1/10/05 9:45	26

Table B3.4: 15-min event discharge data for USGS Site 11027000.

Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)
n/a		2/20/05 21:15	19	1/2/06 2:30	1.6	1/6/08 13:00	15	12/17/08 0:00	0.86
		2/20/05 21:30	20	1/2/06 2:45	1.6	1/6/08 13:15	15	12/17/08 0:15	0.83
		2/20/05 21:45	19	1/2/06 3:00	1.6	1/6/08 13:30	15	12/17/08 0:30	0.86
		2/20/05 22:00	19	1/2/06 3:15	1.6	1/6/08 13:45	14	12/17/08 0:45	0.86
		2/20/05 22:15	17	1/2/06 3:30	1.7	1/6/08 14:00	14	12/17/08 1:00	0.86
		2/20/05 22:30	17	1/2/06 3:45	1.7	1/6/08 14:15	14	12/17/08 1:15	0.86
		2/20/05 22:45	17	1/2/06 4:00	1.7	1/6/08 14:30	13	12/17/08 1:30	0.83
		2/20/05 23:00	19	1/2/06 4:15	1.8	1/6/08 14:45	14	12/17/08 1:45	0.83
		2/20/05 23:15	18	1/2/06 4:30	1.8	1/6/08 15:00	16	12/17/08 2:00	0.83
		2/20/05 23:30	18	1/2/06 4:45	1.8	1/6/08 15:15	18	12/17/08 2:15	0.83
		2/20/05 23:45	19	1/2/06 5:00	1.8	1/6/08 15:30	17	12/17/08 2:30	0.83
		2/21/05 0:00	18	1/2/06 5:15	1.8	1/6/08 15:45	17	12/17/08 2:45	0.86
		2/21/05 0:15	18	1/2/06 5:30	1.8	1/6/08 16:00	16	12/17/08 3:00	0.86
		2/21/05 0:30	18	1/2/06 5:45	1.8	1/6/08 16:15	15	12/17/08 3:15	0.86
		2/21/05 0:45	17	1/2/06 6:00	1.9	1/6/08 16:30	18	12/17/08 3:30	0.86
		2/21/05 1:00	18	1/2/06 6:15	1.9	1/6/08 16:45	20	12/17/08 3:45	0.89
		2/21/05 1:15	17	1/2/06 6:30	1.9	1/6/08 17:00	20	12/17/08 4:00	0.89
		2/21/05 1:30	17	1/2/06 6:45	1.9	1/6/08 17:15	17	12/17/08 4:15	0.91
		2/21/05 1:45	16	1/2/06 7:00	1.9	1/6/08 17:30	20	12/17/08 4:30	0.91
		2/21/05 2:00	18	1/2/06 7:15	1.9	1/6/08 17:45	21	12/17/08 4:45	0.91
		2/21/05 2:15	18	1/2/06 7:30	1.9	1/6/08 18:00	22	12/17/08 5:00	0.94
		2/21/05 2:30	17	1/2/06 7:45	2	1/6/08 18:15	20	12/17/08 5:15	0.94
		2/21/05 2:45	17	1/2/06 8:00	2	1/6/08 18:30	19	12/17/08 5:30	0.94
		2/21/05 3:00	19	1/2/06 8:15	2	1/6/08 18:45	19	12/17/08 5:45	0.94
		2/21/05 3:15	18	1/2/06 8:30	2	1/6/08 19:00	17	12/17/08 6:00	0.94
		2/21/05 3:30	19	1/2/06 8:45	2	1/6/08 19:15	16	12/17/08 6:15	0.91
		2/21/05 3:45	19	1/2/06 9:00	2.1	1/6/08 19:30	16	12/17/08 6:30	0.94
		2/21/05 4:00	20	1/2/06 9:15	2.1	1/6/08 19:45	14	12/17/08 6:45	0.94
		2/21/05 4:15	19	1/2/06 9:30	2.1	1/6/08 20:00	15	12/17/08 7:00	0.97
		2/21/05 4:30	21	1/2/06 9:45	2.1	1/6/08 20:15	13	12/17/08 7:15	0.97
		2/21/05 4:45	21	1/2/06 10:00	2.1	1/6/08 20:30	12	12/17/08 7:30	0.99
		2/21/05 5:00	23	1/2/06 10:15	2.2	1/6/08 20:45	12	12/17/08 7:45	0.99
		2/21/05 5:15	24	1/2/06 10:30	2.2	1/6/08 21:00	12	12/17/08 8:00	0.99
		2/21/05 5:30	25	1/2/06 10:45	2.2	1/6/08 21:15	12	12/17/08 8:15	1
		2/21/05 5:45	21	1/2/06 11:00	2.2	1/6/08 21:30	12	12/17/08 8:30	1
		2/21/05 6:00	25	1/2/06 11:15	2.2	1/6/08 21:45	12	12/17/08 8:45	1.3
		2/21/05 6:15	28	1/2/06 11:30	2.2	1/6/08 22:00	12	12/17/08 9:00	1.9
		2/21/05 6:30	27	1/2/06 11:45	2.2	1/6/08 22:15	13	12/17/08 9:15	2.2
		2/21/05 6:45	29	1/2/06 12:00	2.2	1/6/08 22:30	13	12/17/08 9:30	2.4
		2/21/05 7:00	31	1/2/06 12:15	2.3	1/6/08 22:45	13	12/17/08 9:45	3
		2/21/05 7:15	39	1/2/06 12:30	2.3	1/6/08 23:00	12	12/17/08 10:00	22
		2/21/05 7:30	42	1/2/06 12:45	2.2	1/6/08 23:15	12	12/17/08 10:15	24
		2/21/05 7:45	48	1/2/06 13:00	2.2	1/6/08 23:30	12	12/17/08 10:30	52
		2/21/05 8:00	68	1/2/06 13:15	2.2	1/6/08 23:45	12	12/17/08 10:45	64
		2/21/05 8:15	117	1/2/06 13:30	2.2	1/7/08 0:00	12	12/17/08 11:00	78
		2/21/05 8:30	140	1/2/06 13:45	2.3	1/7/08 0:15	12	12/17/08 11:15	80
		2/21/05 8:45	171	1/2/06 14:00	2.4	1/7/08 0:30	12	12/17/08 11:30	77
		2/21/05 9:00	190	1/2/06 14:15	2.6	1/7/08 0:45	13	12/17/08 11:45	72
		2/21/05 9:15	206	1/2/06 14:30	2.6	1/7/08 1:00	13	12/17/08 12:00	75
		2/21/05 9:30	200	1/2/06 14:45	2.6	1/7/08 1:15	14	12/17/08 12:15	74
		2/21/05 9:45	145	1/2/06 15:00	2.8	1/7/08 1:30	15	12/17/08 12:30	63
		2/21/05 10:00	158	1/2/06 15:15	3.2	1/7/08 1:45	18	12/17/08 12:45	54
		2/21/05 10:15	163	1/2/06 15:30	3.1	1/7/08 2:00	28	12/17/08 13:00	47
		2/21/05 10:30	176	1/2/06 15:45	3.2	1/7/08 2:15	28	12/17/08 13:15	38
		2/21/05 10:45	195	1/2/06 16:00	3.3	1/7/08 2:30	49	12/17/08 13:30	40
		2/21/05 11:00	192	1/2/06 16:15	3.5	1/7/08 2:45	97	12/17/08 13:45	44
		2/21/05 11:15	198	1/2/06 16:30	3.6	1/7/08 3:00	161	12/17/08 14:00	41
		2/21/05 11:30	195	1/2/06 16:45	3.8	1/7/08 3:15	283	12/17/08 14:15	44
		2/21/05 11:45	253	1/2/06 17:00	4.1	1/7/08 3:30	384	12/17/08 14:30	50
		2/21/05 12:00	297	1/2/06 17:15	4.2	1/7/08 3:45	327	12/17/08 14:45	45
		2/21/05 12:15	393	1/2/06 17:30	4.4	1/7/08 4:00	338	12/17/08 15:00	47
		2/21/05 12:30	380	1/2/06 17:45	4.5	1/7/08 4:15	355	12/17/08 15:15	42
		2/21/05 12:45	435	1/2/06 18:00	4.6	1/7/08 4:30	338	12/17/08 15:30	43
		2/21/05 13:00	331	1/2/06 18:15	5	1/7/08 4:45	323	12/17/08 15:45	49
		2/21/05 13:15	359	1/2/06 18:30	6.1	1/7/08 5:00	331	12/17/08 16:00	56
		2/21/05 13:30	276	1/2/06 18:45	7	1/7/08 5:15	367	12/17/08 16:15	56
		2/21/05 13:45	346	1/2/06 19:00	8.1	1/7/08 5:30	376	12/17/08 16:30	54
		2/21/05 14:00	371	1/2/06 19:15	8.8	1/7/08 5:45	355	12/17/08 16:45	50
		2/21/05 14:15	279	1/2/06 19:30	8.4	1/7/08 6:00	331	12/17/08 17:00	55
		2/21/05 14:30	407	1/2/06 19:45	8.7	1/7/08 6:15	398	12/17/08 17:15	78
		2/21/05 14:45	355	1/2/06 20:00	24	1/7/08 6:30	426	12/17/08 17:30	97
		2/21/05 15:00	416	1/2/06 20:15	33	1/7/08 6:45	411	12/17/08 17:45	99
		2/21/05 15:15	563	1/2/06 20:30	130	1/7/08 7:00	430	12/17/08 18:00	110
		2/21/05 15:30	308	1/2/06 20:45	125	1/7/08 7:15	402	12/17/08 18:15	77

Table B3.4(cont.): 15-min event discharge data for USGS Site 11027000.

Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)
n/a		2/21/05 15:45	231	1/2/06 21:00	65	1/7/08 7:30	393	12/17/08 18:30	63
		2/21/05 16:00	371	1/2/06 21:15	47	1/7/08 7:45	308	12/17/08 18:45	67
		2/21/05 16:15	75	1/2/06 21:30	52	1/7/08 8:00	393	12/17/08 19:00	75
		2/21/05 16:30	130	1/2/06 21:45	47	1/7/08 8:15	393	12/17/08 19:15	77
		2/21/05 16:45	225	1/2/06 22:00	44	1/7/08 8:30	389	12/17/08 19:30	102
		2/21/05 17:00	174	1/2/06 22:15	36	1/7/08 8:45	300	12/17/08 19:45	78
		2/21/05 17:15	192	1/2/06 22:30	33	1/7/08 9:00	286	12/17/08 20:00	71
		2/21/05 17:30	184	1/2/06 22:45	33	1/7/08 9:15	240	12/17/08 20:15	67
		2/21/05 17:45	168	1/2/06 23:00	29	1/7/08 9:30	250	12/17/08 20:30	58
		2/21/05 18:00	161	1/2/06 23:15	29	1/7/08 9:45	253	12/17/08 20:45	56
		2/21/05 18:15	171	1/2/06 23:30	27	1/7/08 10:00	217	12/17/08 21:00	60
		2/21/05 18:30	147	1/2/06 23:45	23	1/7/08 10:15	153	12/17/08 21:15	53
		2/21/05 18:45	135	1/3/06 0:00	23	1/7/08 10:30	182	12/17/08 21:30	45
		2/21/05 19:00	125	1/3/06 0:15	23	1/7/08 10:45	203	12/17/08 21:45	45
		2/21/05 19:15	132	1/3/06 0:30	20	1/7/08 11:00	142	12/17/08 22:00	47
		2/21/05 19:30	147	1/3/06 0:45	20	1/7/08 11:15	161	12/17/08 22:15	49
		2/21/05 19:45	117	1/3/06 1:00	19	1/7/08 11:30	147	12/17/08 22:30	44
		2/21/05 20:00	130	1/3/06 1:15	17	1/7/08 11:45	135	12/17/08 22:45	45
		2/21/05 20:15	112	1/3/06 1:30	17	1/7/08 12:00	150	12/17/08 23:00	43
		2/21/05 20:30	110	1/3/06 1:45	15	1/7/08 12:15	123	12/17/08 23:15	47
		2/21/05 20:45	93	1/3/06 2:00	16	1/7/08 12:30	115	12/17/08 23:30	47
		2/21/05 21:00	97	1/3/06 2:15	15	1/7/08 12:45	101	12/17/08 23:45	48
		2/21/05 21:15	112	1/3/06 2:30	14	1/7/08 13:00	95	12/18/08 0:00	40
		2/21/05 21:30	80	1/3/06 2:45	14	1/7/08 13:15	106	12/18/08 0:15	40
		2/21/05 21:45	80	1/3/06 3:00	14	1/7/08 13:30	90	12/18/08 0:30	40
		2/21/05 22:00	90	1/3/06 3:15	13	1/7/08 13:45	101	12/18/08 0:45	37
		2/21/05 22:15	69	1/3/06 3:30	13	1/7/08 14:00	91	12/18/08 1:00	37
		2/21/05 22:30	68	1/3/06 3:45	13	1/7/08 14:15	85	12/18/08 1:15	38
		2/21/05 22:45	77	1/3/06 4:00	13	1/7/08 14:30	81	12/18/08 1:30	35
		2/21/05 23:00	80	1/3/06 4:15	12	1/7/08 14:45	81	12/18/08 1:45	35
		2/21/05 23:15	53	1/3/06 4:30	12	1/7/08 15:00	78	12/18/08 2:00	33
		2/21/05 23:30	77	1/3/06 4:45	12	1/7/08 15:15	64	12/18/08 2:15	36
		2/21/05 23:45	69	1/3/06 5:00	12	1/7/08 15:30	80	12/18/08 2:30	35
		2/22/05 0:00	59	1/3/06 5:15	11	1/7/08 15:45	83	12/18/08 2:45	33
		2/22/05 0:15	59	1/3/06 5:30	12	1/7/08 16:00	67	12/18/08 3:00	32
		2/22/05 0:30	67	1/3/06 5:45	11	1/7/08 16:15	64	12/18/08 3:15	30
		2/22/05 0:45	56	1/3/06 6:00	11	1/7/08 16:30	64	12/18/08 3:30	31
		2/22/05 1:00	74	1/3/06 6:15	12	1/7/08 16:45	63	12/18/08 3:45	30
		2/22/05 1:15	68	1/3/06 6:30	11	1/7/08 17:00	54	12/18/08 4:00	30
		2/22/05 1:30	55	1/3/06 6:45	11	1/7/08 17:15	63	12/18/08 4:15	30
		2/22/05 1:45	71	1/3/06 7:00	11	1/7/08 17:30	52	12/18/08 4:30	28
		2/22/05 2:00	60	1/3/06 7:15	10	1/7/08 17:45	39	12/18/08 4:45	28
		2/22/05 2:15	64	1/3/06 7:30	10	1/7/08 18:00	50	12/18/08 5:00	28
		2/22/05 2:30	59	1/3/06 7:45	10	1/7/08 18:15	58	12/18/08 5:15	28
		2/22/05 2:45	50	1/3/06 8:00	9.8	1/7/08 18:30	41	12/18/08 5:30	25
		2/22/05 3:00	63	1/3/06 8:15	9.5	1/7/08 18:45	47	12/18/08 5:45	25

Table B3.5: 15-min event discharge data for USGS Site 11028500.

Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)
n/a		2/19/93 4:00	1060	3/5/95 5:15	23	1/10/05 16:15	116	2/14/08 2:45	1.5
		2/19/93 4:15	1040	3/5/95 5:30	25	1/10/05 16:30	112	2/14/08 3:00	1.5
		2/19/93 4:30	1020	3/5/95 5:45	25	1/10/05 16:45	109	2/14/08 3:15	1.6
		2/19/93 4:45	1030	3/5/95 6:00	28	1/10/05 17:00	107	2/14/08 3:30	1.5
		2/19/93 5:00	1010	3/5/95 6:15	31	1/10/05 17:15	106	2/14/08 3:45	1.6
		2/19/93 5:15	988	3/5/95 6:30	36	1/10/05 17:30	102	2/14/08 4:00	1.6
		2/19/93 5:30	988	3/5/95 6:45	39	1/10/05 17:45	101	2/14/08 4:15	1.6
		2/19/93 5:45	962	3/5/95 7:00	45	1/10/05 18:00	101	2/14/08 4:30	1.6
		2/19/93 6:00	931	3/5/95 7:15	53	1/10/05 18:15	96	2/14/08 4:45	1.6
		2/19/93 6:15	910	3/5/95 7:30	66	1/10/05 18:30	94	2/14/08 5:00	1.6
		2/19/93 6:30	900	3/5/95 7:45	74	1/10/05 18:45	93	2/14/08 5:15	1.6
		2/19/93 6:45	895	3/5/95 8:00	94	1/10/05 19:00	89	2/14/08 5:30	1.6
		2/19/93 7:00	875	3/5/95 8:15	109	1/10/05 19:15	88	2/14/08 5:45	1.6
		2/19/93 7:15	875	3/5/95 8:30	123	1/10/05 19:30	86	2/14/08 6:00	1.6
		2/19/93 7:30	859	3/5/95 8:45	137	1/10/05 19:45	85	2/14/08 6:15	1.6
		2/19/93 7:45	831	3/5/95 9:00	148	1/10/05 20:00	85	2/14/08 6:30	1.7
		2/19/93 8:00	819	3/5/95 9:15	160	1/10/05 20:15	82	2/14/08 6:45	1.7
		2/19/93 8:15	808	3/5/95 9:30	185	1/10/05 20:30	80	2/14/08 7:00	1.7
		2/19/93 8:30	787	3/5/95 9:45	228	1/10/05 20:45	79	2/14/08 7:15	1.8
		2/19/93 8:45	808	3/5/95 10:00	263	1/10/05 21:00	77	2/14/08 7:30	1.8
		2/19/93 9:00	819	3/5/95 10:15	322	1/10/05 21:15	76	2/14/08 7:45	1.8
		2/19/93 9:15	859	3/5/95 10:30	371	1/10/05 21:30	75	2/14/08 8:00	1.8
		2/19/93 9:30	859	3/5/95 10:45	425	1/10/05 21:45	75	2/14/08 8:15	1.8
		2/19/93 9:45	905	3/5/95 11:00	487	1/10/05 22:00	73	2/14/08 8:30	1.9
		2/19/93 10:00	921	3/5/95 11:15	513	1/10/05 22:15	72	2/14/08 8:45	2.1
		2/19/93 10:15	962	3/5/95 11:30	558	1/10/05 22:30	70	2/14/08 9:00	2.2
		2/19/93 10:30	1060	3/5/95 11:45	581	1/10/05 22:45	70	2/14/08 9:15	2.2
		2/19/93 10:45	1330	3/5/95 12:00	638	1/10/05 23:00	70	2/14/08 9:30	2.2
		2/19/93 11:00	1560	3/5/95 12:15	687	1/10/05 23:15	69	2/14/08 9:45	2.2
		2/19/93 11:15	1640	3/5/95 12:30	754	1/10/05 23:30	69	2/14/08 10:00	2.2
		2/19/93 11:30	1690	3/5/95 12:45	819	1/10/05 23:45	67	2/14/08 10:15	2.2
		2/19/93 11:45	1740	3/5/95 13:00	864	1/11/05 0:00	67	2/14/08 10:30	2.2
		2/19/93 12:00	1760	3/5/95 13:15	915	1/11/05 0:15	66	2/14/08 10:45	2.3
		2/19/93 12:15	1760	3/5/95 13:30	1030	1/11/05 0:30	66	2/14/08 11:00	2.5
		2/19/93 12:30	1760	3/5/95 13:45	1060	1/11/05 0:45	66	2/14/08 11:15	2.6
		2/19/93 12:45	1750	3/5/95 14:00	1130	1/11/05 1:00	66	2/14/08 11:30	2.9
		2/19/93 13:00	1760	3/5/95 14:15	1190	1/11/05 1:15	65	2/14/08 11:45	3.2
		2/19/93 13:15	1740	3/5/95 14:30	1270	1/11/05 1:30	65	2/14/08 12:00	3.6
		2/19/93 13:30	1690	3/5/95 14:45	1320	1/11/05 1:45	65	2/14/08 12:15	3.7
		2/19/93 13:45	1660	3/5/95 15:00	1460	1/11/05 2:00	65	2/14/08 12:30	4.1
		2/19/93 14:00	1640	3/5/95 15:15	1540	1/11/05 2:15	65	2/14/08 12:45	5.1
		2/19/93 14:15	1630	3/5/95 15:30	1610	1/11/05 2:30	66	2/14/08 13:00	6.7
		2/19/93 14:30	1680	3/5/95 15:45	1700	1/11/05 2:45	69	2/14/08 13:15	22
		2/19/93 14:45	1720	3/5/95 16:00	1780	1/11/05 3:00	70	2/14/08 13:30	60
		2/19/93 15:00	1770	3/5/95 16:15	1860	1/11/05 3:15	73	2/14/08 13:45	62
		2/19/93 15:15	1780	3/5/95 16:30	1950	1/11/05 3:30	82	2/14/08 14:00	52
		2/19/93 15:30	1830	3/5/95 16:45	2070	1/11/05 3:45	94	2/14/08 14:15	48
		2/19/93 15:45	1800	3/5/95 17:00	2140	1/11/05 4:00	94	2/14/08 14:30	61
		2/19/93 16:00	1820	3/5/95 17:15	2220	1/11/05 4:15	141	2/14/08 14:45	65
		2/19/93 16:15	1790	3/5/95 17:30	2280	1/11/05 4:30	173	2/14/08 15:00	67
		2/19/93 16:30	1770	3/5/95 17:45	2420	1/11/05 4:45	211	2/14/08 15:15	66
		2/19/93 16:45	1810	3/5/95 18:00	2470	1/11/05 5:00	281	2/14/08 15:30	75
		2/19/93 17:00	1830	3/5/95 18:15	2500	1/11/05 5:15	348	2/14/08 15:45	107
		2/19/93 17:15	1840	3/5/95 18:30	2570	1/11/05 5:30	418	2/14/08 16:00	127
		2/19/93 17:30	1870	3/5/95 18:45	2700	1/11/05 5:45	473	2/14/08 16:15	137
		2/19/93 17:45	1910	3/5/95 19:00	2870	1/11/05 6:00	473	2/14/08 16:30	149
		2/19/93 18:00	2020	3/5/95 19:15	3080	1/11/05 6:15	568	2/14/08 16:45	157
		2/19/93 18:15	2140	3/5/95 19:30	3200	1/11/05 6:30	633	2/14/08 17:00	164
		2/19/93 18:30	2350	3/5/95 19:45	3340	1/11/05 6:45	731	2/14/08 17:15	175
		2/19/93 18:45	2420	3/5/95 20:00	3510	1/11/05 7:00	869	2/14/08 17:30	191
		2/19/93 19:00	2400	3/5/95 20:15	3530	1/11/05 7:15	970	2/14/08 17:45	206
		2/19/93 19:15	2500	3/5/95 20:30	3650	1/11/05 7:30	1050	2/14/08 18:00	227
		2/19/93 19:30	2590	3/5/95 20:45	3940	1/11/05 7:45	1120	2/14/08 18:15	243
		2/19/93 19:45	2660	3/5/95 21:00	4130	1/11/05 8:00	1220	2/14/08 18:30	263
		2/19/93 20:00	2620	3/5/95 21:15	4240	1/11/05 8:15	1340	2/14/08 18:45	269
		2/19/93 20:15	2710	3/5/95 21:30	4400	1/11/05 8:30	1420	2/14/08 19:00	257
		2/19/93 20:30	2780	3/5/95 21:45	4610	1/11/05 8:45	1500	2/14/08 19:15	275
		2/19/93 20:45	3090	3/5/95 22:00	4640	1/11/05 9:00	1550	2/14/08 19:30	284
		2/19/93 21:00	3060	3/5/95 22:15	4670	1/11/05 9:15	1640	2/14/08 19:45	299
		2/19/93 21:15	3050	3/5/95 22:30	4790	1/11/05 9:30	1740	2/14/08 20:00	312
		2/19/93 21:30	3170	3/5/95 22:45	5080	1/11/05 9:45	1790	2/14/08 20:15	331
		2/19/93 21:45	3270	3/5/95 23:00	5060	1/11/05 10:00	1870	2/14/08 20:30	335
		2/19/93 22:00	3550	3/5/95 23:15	5270	1/11/05 10:15	2050	2/14/08 20:45	341
		2/19/93 22:15	3210	3/5/95 23:30	5140	1/11/05 10:30	1880	2/14/08 21:00	331

Table B3.5(cont.): 15-min event discharge data for USGS Site 11028500.

Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)
n/a		2/19/93 22:30	3160	3/5/95 23:45	5110	1/11/05 10:45	1890	2/14/08 21:15	322
		2/19/93 22:45	2990	3/6/95 0:00	4940	1/11/05 11:00	1850	2/14/08 21:30	312
		2/19/93 23:00	3100	3/6/95 0:15	5000	1/11/05 11:15	1830	2/14/08 21:45	309
		2/19/93 23:15	3110	3/6/95 0:30	4960	1/11/05 11:30	1820	2/14/08 22:00	296
		2/19/93 23:30	3090	3/6/95 0:45	4890	1/11/05 11:45	1770	2/14/08 22:15	287
		2/19/93 23:45	3130	3/6/95 1:00	5020	1/11/05 12:00	1730	2/14/08 22:30	281
		2/20/93 0:00	2930	3/6/95 1:15	5110	1/11/05 12:15	1690	2/14/08 22:45	266
		2/20/93 0:15	2850	3/6/95 1:30	4960	1/11/05 12:30	1600	2/14/08 23:00	251
		2/20/93 0:30	2620	3/6/95 1:45	4710	1/11/05 12:45	1520	2/14/08 23:15	238
		2/20/93 0:45	2520	3/6/95 2:00	4670	1/11/05 13:00	1470	2/14/08 23:30	224
		2/20/93 1:00	2420	3/6/95 2:15	4600	1/11/05 13:15	1370	2/14/08 23:45	204
		2/20/93 1:15	2490	3/6/95 2:30	4530	1/11/05 13:30	1260	2/15/08 0:00	191
		2/20/93 1:30	2350	3/6/95 2:45	4410	1/11/05 13:45	1150	2/15/08 0:15	180
		2/20/93 1:45	2260	3/6/95 3:00	4290	1/11/05 14:00	1100	2/15/08 0:30	168
		2/20/93 2:00	2180	3/6/95 3:15	4240	1/11/05 14:15	1040	2/15/08 0:45	155
		2/20/93 2:15	2200	3/6/95 3:30	4040	1/11/05 14:30	941	2/15/08 1:00	147
		2/20/93 2:30	2200	3/6/95 3:45	3940	1/11/05 14:45	847	2/15/08 1:15	137
		2/20/93 2:45	2110	3/6/95 4:00	3700	1/11/05 15:00	885	2/15/08 1:30	127
		2/20/93 3:00	2090	3/6/95 4:15	3520	1/11/05 15:15	755	2/15/08 1:45	120
		2/20/93 3:15	2090	3/6/95 4:30	3380	1/11/05 15:30	716	2/15/08 2:00	111
		2/20/93 3:30	2000	3/6/95 4:45	3150	1/11/05 15:45	780	2/15/08 2:15	106
		2/20/93 3:45	2010	3/6/95 5:00	3010	1/11/05 16:00	795	2/15/08 2:30	101
		2/20/93 4:00	1800	3/6/95 5:15	2970	1/11/05 16:15	750	2/15/08 2:45	96
		2/20/93 4:15	1930	3/6/95 5:30	2790	1/11/05 16:30	735	2/15/08 3:00	93
		2/20/93 4:30	1800	3/6/95 5:45	2660	1/11/05 16:45	726	2/15/08 3:15	88
		2/20/93 4:45	1790	3/6/95 6:00	2610	1/11/05 17:00	702	2/15/08 3:30	83
		2/20/93 5:00	1760	3/6/95 6:15	2460	1/11/05 17:15	660	2/15/08 3:45	80
		2/20/93 5:15	1790	3/6/95 6:30	2490	1/11/05 17:30	642	2/15/08 4:00	76
		2/20/93 5:30	1760	3/6/95 6:45	2530	1/11/05 17:45	611	2/15/08 4:15	73
		2/20/93 5:45	1600	3/6/95 7:00	2440	1/11/05 18:00	594	2/15/08 4:30	69
		2/20/93 6:00	1650	3/6/95 7:15	2340	1/11/05 18:15	568	2/15/08 4:45	66
		2/20/93 6:15	1650	3/6/95 7:30	2220	1/11/05 18:30	547	2/15/08 5:00	63
		2/20/93 6:30	1570	3/6/95 7:45	2150	1/11/05 18:45	527	2/15/08 5:15	61
		2/20/93 6:45	1590	3/6/95 8:00	2150	1/11/05 19:00	511	2/15/08 5:30	60
		2/20/93 7:00	1500	3/6/95 8:15	2090	1/11/05 19:15	484	2/15/08 5:45	57
		2/20/93 7:15	1450	3/6/95 8:30	2000	1/11/05 19:30	465	2/15/08 6:00	56
		2/20/93 7:30	1440	3/6/95 8:45	1960	1/11/05 19:45	450	2/15/08 6:15	53
		2/20/93 7:45	1360	3/6/95 9:00	1940	1/11/05 20:00	428	2/15/08 6:30	51
		2/20/93 8:00	1430	3/6/95 9:15	1840	1/11/05 20:15	414	2/15/08 6:45	50
		2/20/93 8:15	1450	3/6/95 9:30	1810	1/11/05 20:30	394	2/15/08 7:00	48
		2/20/93 8:30	1410	3/6/95 9:45	1720	1/11/05 20:45	376	2/15/08 7:15	47
		2/20/93 8:45	1400	3/6/95 10:00	1700	1/11/05 21:00	362	2/15/08 7:30	45
		2/20/93 9:00	1360	3/6/95 10:15	1620	1/11/05 21:15	348	2/15/08 7:45	44
		2/20/93 9:15	1370	3/6/95 10:30	1540	1/11/05 21:30	331	2/15/08 8:00	42
		2/20/93 9:30	1350	3/6/95 10:45	1600	1/11/05 21:45	318	2/15/08 8:15	40
		2/20/93 9:45	1320	3/6/95 11:00	1560	1/11/05 22:00	309	2/15/08 8:30	39

Table B3.6: 15-min event discharge data for USGS Site 11046100.

Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)
n/a		n/a		3/5/95 4:15	36	1/10/05 11:00	96	2/21/08 17:30	0.07
				3/5/95 4:30	38	1/10/05 11:15	92	2/21/08 17:45	0.07
				3/5/95 4:45	44	1/10/05 11:30	82	2/21/08 18:00	0.07
				3/5/95 5:00	47	1/10/05 11:45	79	2/21/08 18:15	0.07
				3/5/95 5:15	52	1/10/05 12:00	76	2/21/08 18:30	0.07
				3/5/95 5:30	60	1/10/05 12:15	72	2/21/08 18:45	0.07
				3/5/95 5:45	94	1/10/05 12:30	67	2/21/08 19:00	0.07
				3/5/95 6:00	165	1/10/05 12:45	66	2/21/08 19:15	0.07
				3/5/95 6:15	199	1/10/05 13:00	66	2/21/08 19:30	0.07
				3/5/95 6:30	253	1/10/05 13:15	64	2/21/08 19:45	0.07
				3/5/95 6:45	270	1/10/05 13:30	61	2/21/08 20:00	0.07
				3/5/95 7:00	297	1/10/05 13:45	62	2/21/08 20:15	0.07
				3/5/95 7:15	337	1/10/05 14:00	60	2/21/08 20:30	0.07
				3/5/95 7:30	337	1/10/05 14:15	62	2/21/08 20:45	0.07
				3/5/95 7:45	334	1/10/05 14:30	64	2/21/08 21:00	0.07
				3/5/95 8:00	351	1/10/05 14:45	69	2/21/08 21:15	0.07
				3/5/95 8:15	359	1/10/05 15:00	75	2/21/08 21:30	0.07
				3/5/95 8:30	371	1/10/05 15:15	80	2/21/08 21:45	0.07
				3/5/95 8:45	364	1/10/05 15:30	82	2/21/08 22:00	0.07
				3/5/95 9:00	389	1/10/05 15:45	94	2/21/08 22:15	0.07
				3/5/95 9:15	418	1/10/05 16:00	99	2/21/08 22:30	0.07
				3/5/95 9:30	410	1/10/05 16:15	117	2/21/08 22:45	0.07
				3/5/95 9:45	434	1/10/05 16:30	139	2/21/08 23:00	0.07
				3/5/95 10:00	459	1/10/05 16:45	169	2/21/08 23:15	0.07
				3/5/95 10:15	470	1/10/05 17:00	190	2/21/08 23:30	0.07
				3/5/95 10:30	479	1/10/05 17:15	185	2/21/08 23:45	0.07
				3/5/95 10:45	510	1/10/05 17:30	176	2/22/08 0:00	0.07
				3/5/95 11:00	516	1/10/05 17:45	176	2/22/08 0:15	0.07
				3/5/95 11:15	502	1/10/05 18:00	186	2/22/08 0:30	0.07
				3/5/95 11:30	499	1/10/05 18:15	177	2/22/08 0:45	0.07
				3/5/95 11:45	549	1/10/05 18:30	160	2/22/08 1:00	0.08
				3/5/95 12:00	570	1/10/05 18:45	169	2/22/08 1:15	0.07
				3/5/95 12:15	598	1/10/05 19:00	169	2/22/08 1:30	0.07
				3/5/95 12:30	637	1/10/05 19:15	169	2/22/08 1:45	0.07
				3/5/95 12:45	686	1/10/05 19:30	158	2/22/08 2:00	0.07
				3/5/95 13:00	686	1/10/05 19:45	158	2/22/08 2:15	0.07
				3/5/95 13:15	758	1/10/05 20:00	167	2/22/08 2:30	0.08
				3/5/95 13:30	830	1/10/05 20:15	160	2/22/08 2:45	0.74
				3/5/95 13:45	837	1/10/05 20:30	167	2/22/08 3:00	1.1
				3/5/95 14:00	889	1/10/05 20:45	152	2/22/08 3:15	1.2
				3/5/95 14:15	905	1/10/05 21:00	134	2/22/08 3:30	1.2
				3/5/95 14:30	908	1/10/05 21:15	122	2/22/08 3:45	1.2
				3/5/95 14:45	889	1/10/05 21:30	119	2/22/08 4:00	1.4
				3/5/95 15:00	867	1/10/05 21:45	109	2/22/08 4:15	1.6
				3/5/95 15:15	830	1/10/05 22:00	119	2/22/08 4:30	2.5
				3/5/95 15:30	772	1/10/05 22:15	119	2/22/08 4:45	4.8
				3/5/95 15:45	717	1/10/05 22:30	114	2/22/08 5:00	11
				3/5/95 16:00	663	1/10/05 22:45	110	2/22/08 5:15	14
				3/5/95 16:15	653	1/10/05 23:00	116	2/22/08 5:30	17
				3/5/95 16:30	646	1/10/05 23:15	132	2/22/08 5:45	19
				3/5/95 16:45	663	1/10/05 23:30	158	2/22/08 6:00	19
				3/5/95 17:00	669	1/10/05 23:45	174	2/22/08 6:15	19
				3/5/95 17:15	755	1/11/05 0:00	160	2/22/08 6:30	19
				3/5/95 17:30	786	1/11/05 0:15	165	2/22/08 6:45	22
				3/5/95 17:45	848	1/11/05 0:30	170	2/22/08 7:00	22
				3/5/95 18:00	901	1/11/05 0:45	207	2/22/08 7:15	24
				3/5/95 18:15	1010	1/11/05 1:00	351	2/22/08 7:30	28
				3/5/95 18:30	1010	1/11/05 1:15	510	2/22/08 7:45	33
				3/5/95 18:45	1100	1/11/05 1:30	621	2/22/08 8:00	39
				3/5/95 19:00	1200	1/11/05 1:45	723	2/22/08 8:15	49
				3/5/95 19:15	1220	1/11/05 2:00	845	2/22/08 8:30	51
				3/5/95 19:30	1230	1/11/05 2:15	920	2/22/08 8:45	54
				3/5/95 19:45	1200	1/11/05 2:30	990	2/22/08 9:00	60
				3/5/95 20:00	1230	1/11/05 2:45	1060	2/22/08 9:15	61
				3/5/95 20:15	1300	1/11/05 3:00	1150	2/22/08 9:30	60
				3/5/95 20:30	1380	1/11/05 3:15	1210	2/22/08 9:45	60
				3/5/95 20:45	1490	1/11/05 3:30	1250	2/22/08 10:00	59
				3/5/95 21:00	1550	1/11/05 3:45	1360	2/22/08 10:15	60
				3/5/95 21:15	1750	1/11/05 4:00	1390	2/22/08 10:30	59
				3/5/95 21:30	1810	1/11/05 4:15	1460	2/22/08 10:45	64
				3/5/95 21:45	1790	1/11/05 4:30	1660	2/22/08 11:00	65
				3/5/95 22:00	1900	1/11/05 4:45	1720	2/22/08 11:15	67
				3/5/95 22:15	2070	1/11/05 4:50	1810	2/22/08 11:30	72
				3/5/95 22:30	1950	1/11/05 5:00	1720	2/22/08 11:45	69

Table B3.6(cont.): 15-min event discharge data for USGS Site 11046100

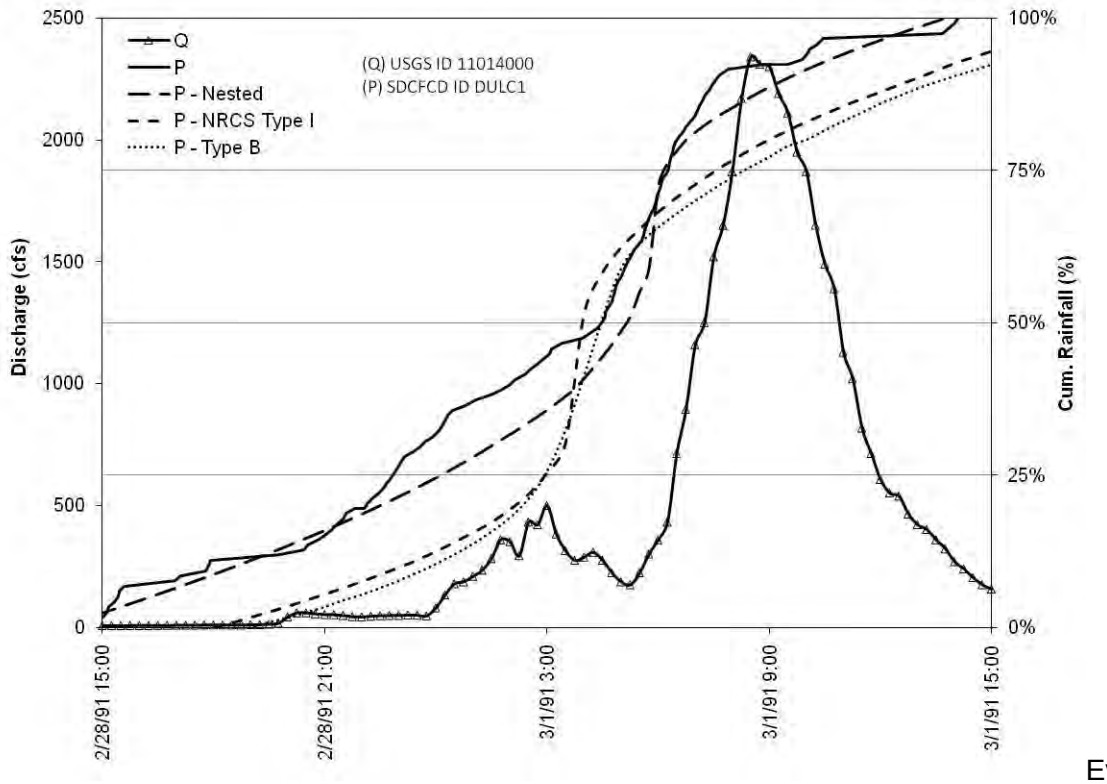
Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)	Date-Time	Q (cfs)
n/a		n/a		3/5/95 22:45	1930	1/11/05 5:15	1660	2/22/08 12:00	68
				3/5/95 23:00	1810	1/11/05 5:30	1520	2/22/08 12:15	67
				3/5/95 23:15	1740	1/11/05 5:45	1470	2/22/08 12:30	60
				3/5/95 23:30	1640	1/11/05 6:00	1350	2/22/08 12:45	59
				3/5/95 23:45	1630	1/11/05 6:15	1340	2/22/08 13:00	57
				3/6/95 0:00	1650	1/11/05 6:30	1300	2/22/08 13:15	57
				3/6/95 0:15	1640	1/11/05 6:45	1220	2/22/08 13:30	52
				3/6/95 0:30	1620	1/11/05 7:00	1240	2/22/08 13:45	52
				3/6/95 0:45	1580	1/11/05 7:15	1220	2/22/08 14:00	51
				3/6/95 1:00	1520	1/11/05 7:30	1190	2/22/08 14:15	50
				3/6/95 1:15	1520	1/11/05 7:45	1220	2/22/08 14:30	48
				3/6/95 1:30	1420	1/11/05 8:00	1140	2/22/08 14:45	45
				3/6/95 1:45	1380	1/11/05 8:15	1150	2/22/08 15:00	45
				3/6/95 2:00	1350	1/11/05 8:30	1160	2/22/08 15:15	43
				3/6/95 2:15	1290	1/11/05 8:45	1120	2/22/08 15:30	42
				3/6/95 2:30	1280	1/11/05 9:00	1030	2/22/08 15:45	39
				3/6/95 2:45	1240	1/11/05 9:15	982	2/22/08 16:00	39
				3/6/95 3:00	1240	1/11/05 9:30	998	2/22/08 16:15	37
				3/6/95 3:15	1200	1/11/05 9:45	943	2/22/08 16:30	35
				3/6/95 3:30	1160	1/11/05 10:00	920	2/22/08 16:45	33
				3/6/95 3:45	1150	1/11/05 10:15	834	2/22/08 17:00	32
				3/6/95 4:00	1080	1/11/05 10:30	823	2/22/08 17:15	31
				3/6/95 4:15	901	1/11/05 10:45	776	2/22/08 17:30	28
				3/6/95 4:30	916	1/11/05 11:00	727	2/22/08 17:45	27
				3/6/95 4:45	874	1/11/05 11:15	683	2/22/08 18:00	26
				3/6/95 5:00	819	1/11/05 11:30	624	2/22/08 18:15	25
				3/6/95 5:15	779	1/11/05 11:45	602	2/22/08 18:30	24
				3/6/95 5:30	710	1/11/05 12:00	570	2/22/08 18:45	23
				3/6/95 5:45	683	1/11/05 12:15	537	2/22/08 19:00	22
				3/6/95 6:00	646	1/11/05 12:30	496	2/22/08 19:15	21
				3/6/95 6:15	614	1/11/05 12:45	464	2/22/08 19:30	20
				3/6/95 6:30	580	1/11/05 13:00	429	2/22/08 19:45	19
				3/6/95 6:45	573	1/11/05 13:15	407	2/22/08 20:00	19
				3/6/95 7:00	552	1/11/05 13:30	379	2/22/08 20:15	18
				3/6/95 7:15	537	1/11/05 13:45	361	2/22/08 20:30	17
				3/6/95 7:30	499	1/11/05 14:00	337	2/22/08 20:45	16
				3/6/95 7:45	490	1/11/05 14:15	311	2/22/08 21:00	16
				3/6/95 8:00	473	1/11/05 14:30	284	2/22/08 21:15	15
				3/6/95 8:15	456	1/11/05 14:45	264	2/22/08 21:30	15
				3/6/95 8:30	445	1/11/05 15:00	249	2/22/08 21:45	14
				3/6/95 8:45	413	1/11/05 15:15	219	2/22/08 22:00	14
				3/6/95 9:00	405	1/11/05 15:30	219	2/22/08 22:15	13
				3/6/95 9:15	392	1/11/05 15:45	190	2/22/08 22:30	12
				3/6/95 9:30	389	1/11/05 16:00	185	2/22/08 22:45	12
				3/6/95 9:45	382	1/11/05 16:15	169	2/22/08 23:00	11
				3/6/95 10:00	369	1/11/05 16:30	169	2/22/08 23:15	10

.

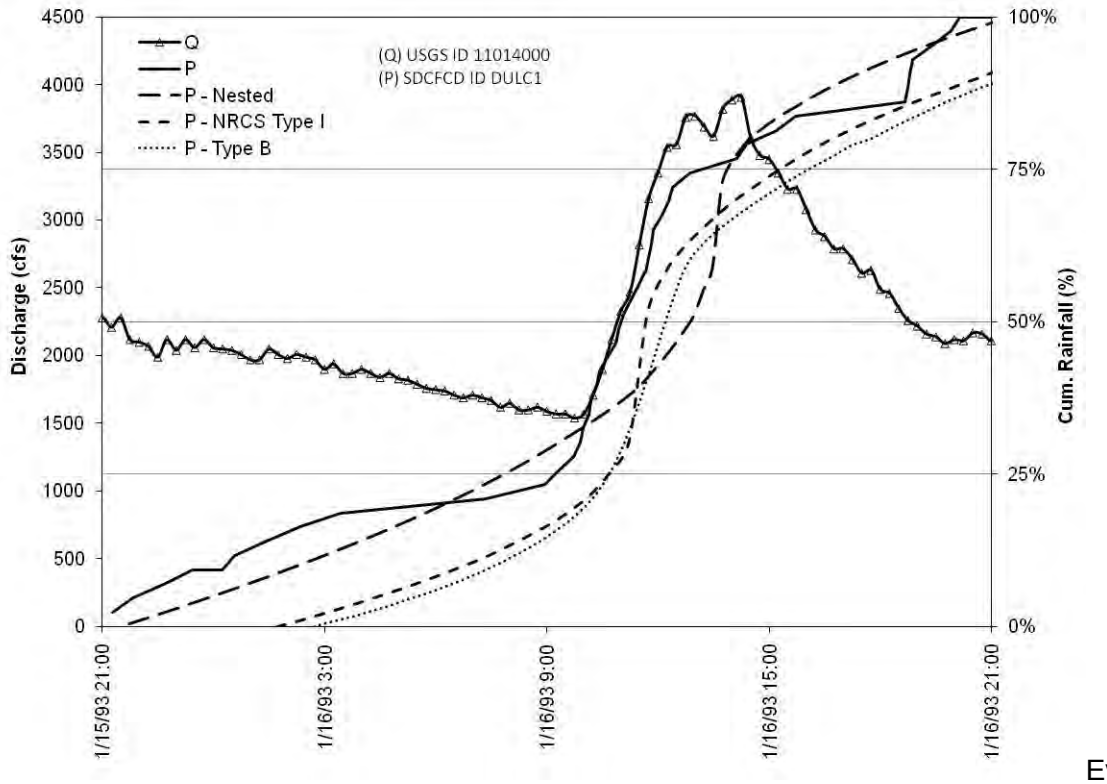
Appendix B.4

Storm Event Processing Results Showing Measured Cumulative Rainfall (P) and 15-min Discharges (Q) and the Three Fitted Rainfall Distributions (Nested, Type B, NRCS Type I) for all 5 Events from all 6 Gauges Where the Time Window Used to Extract the Measured Data was 18 Hours Before and 12 Hours After the Time of the Selected Instantaneous Annual Peak Discharge

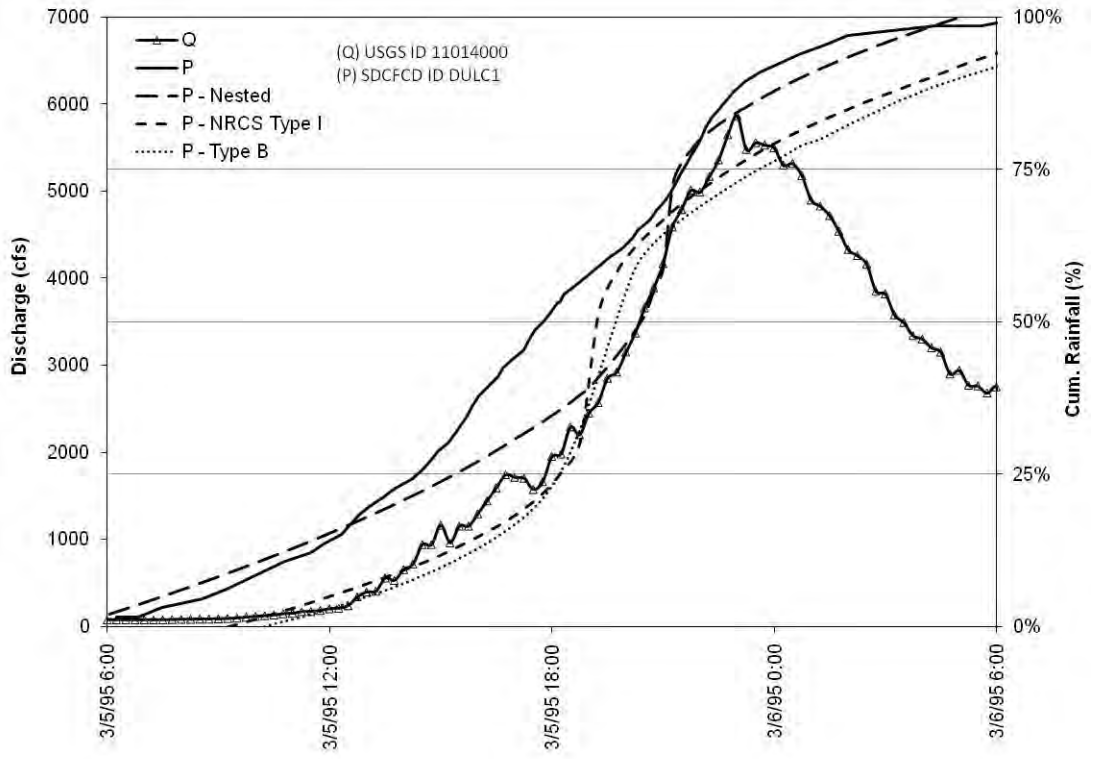
This page is intentionally left blank to facilitate 2-sided printing.



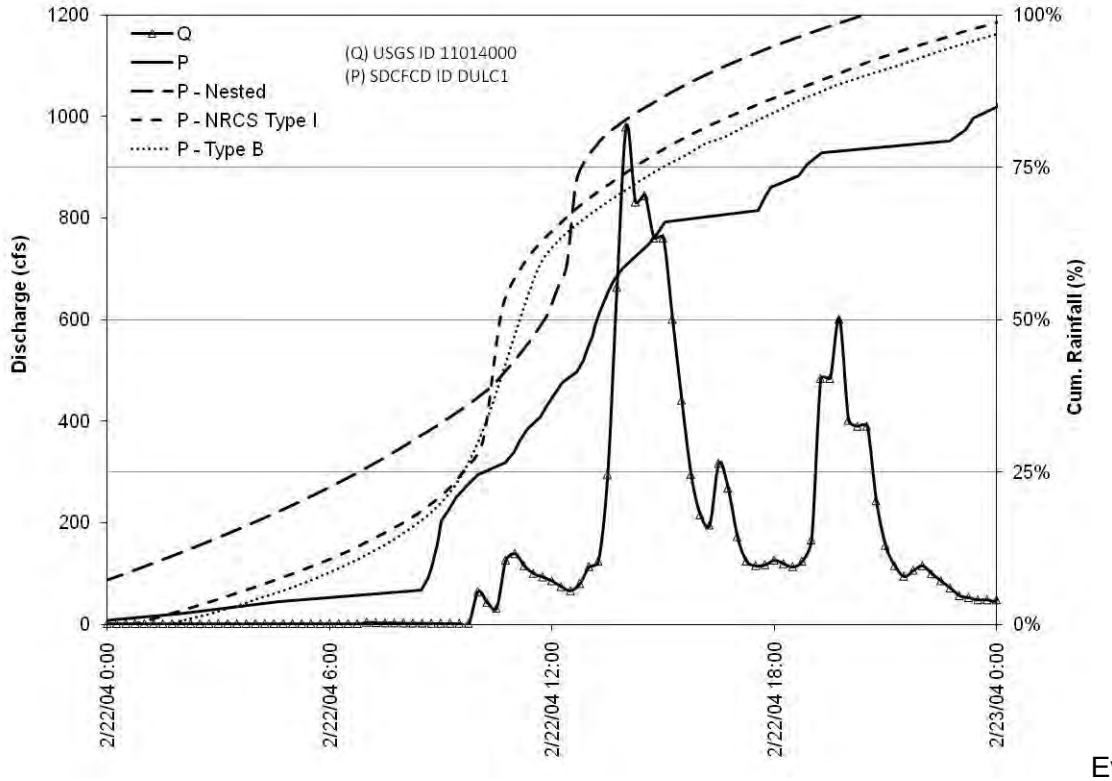
Event 1



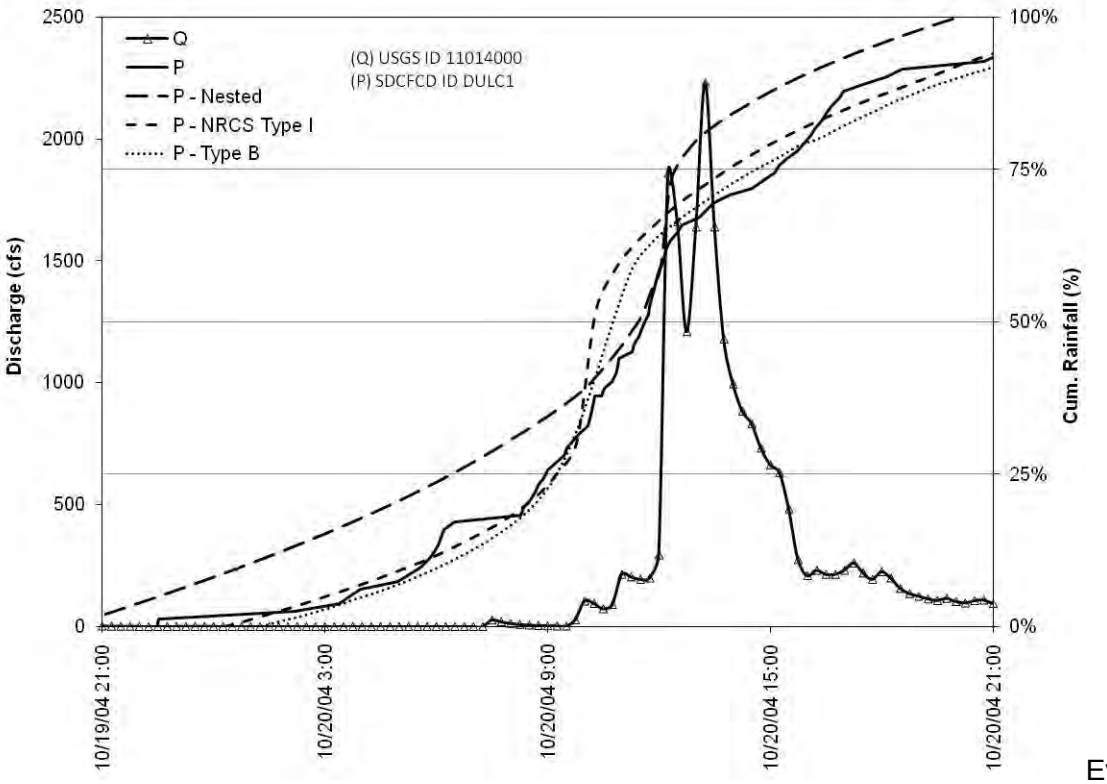
Event 2



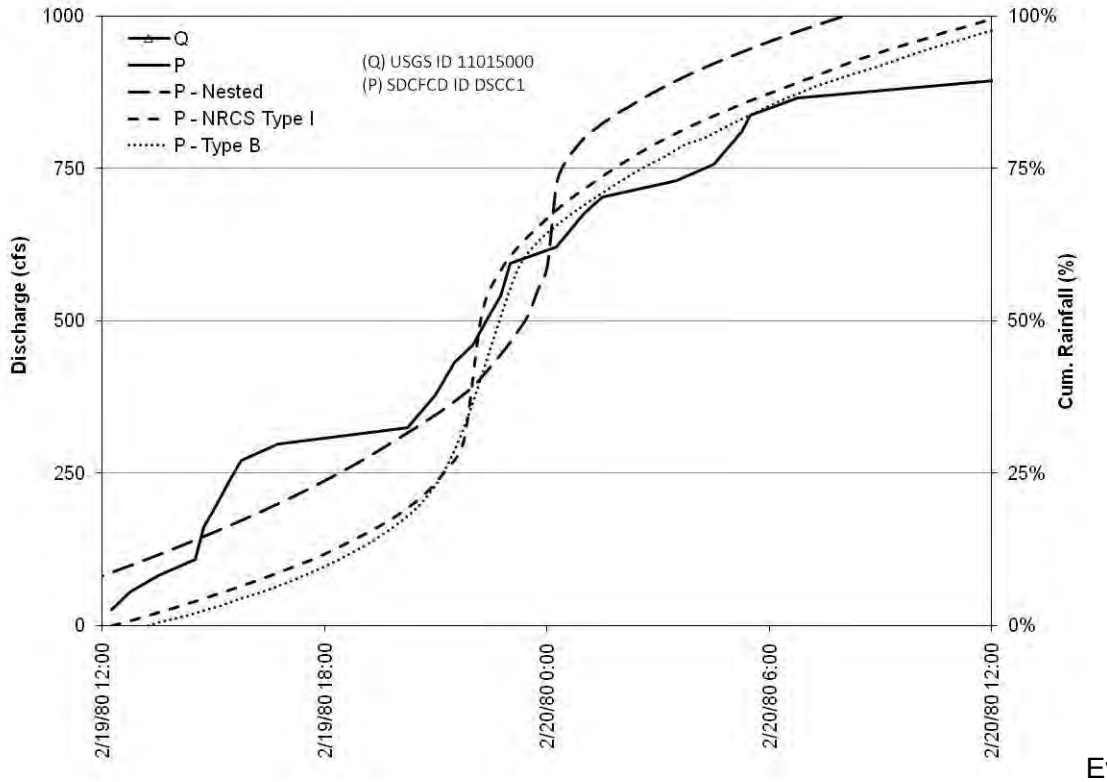
Event 3



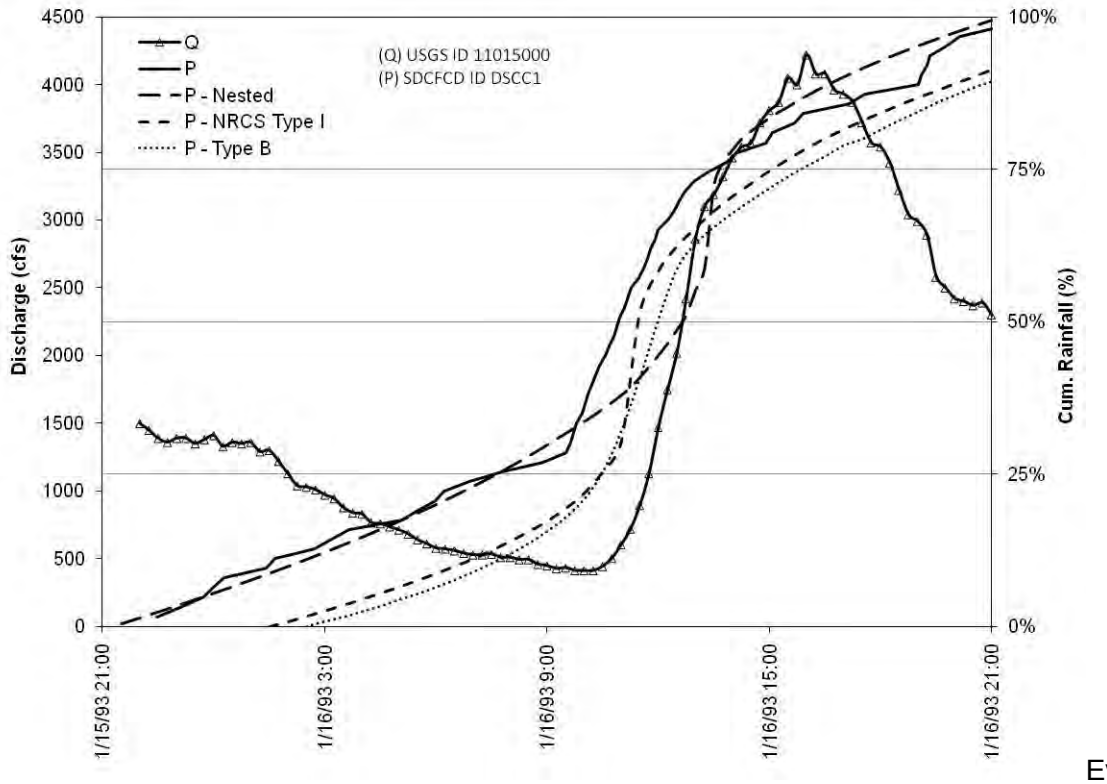
Event 4



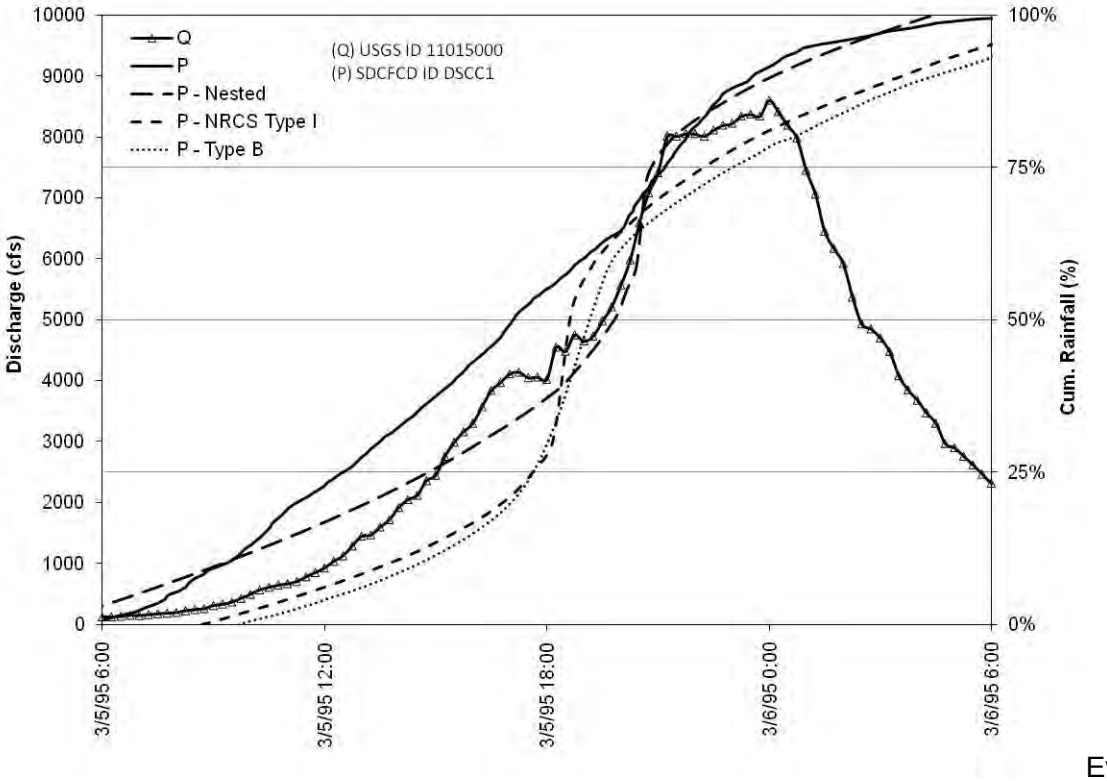
Event 5



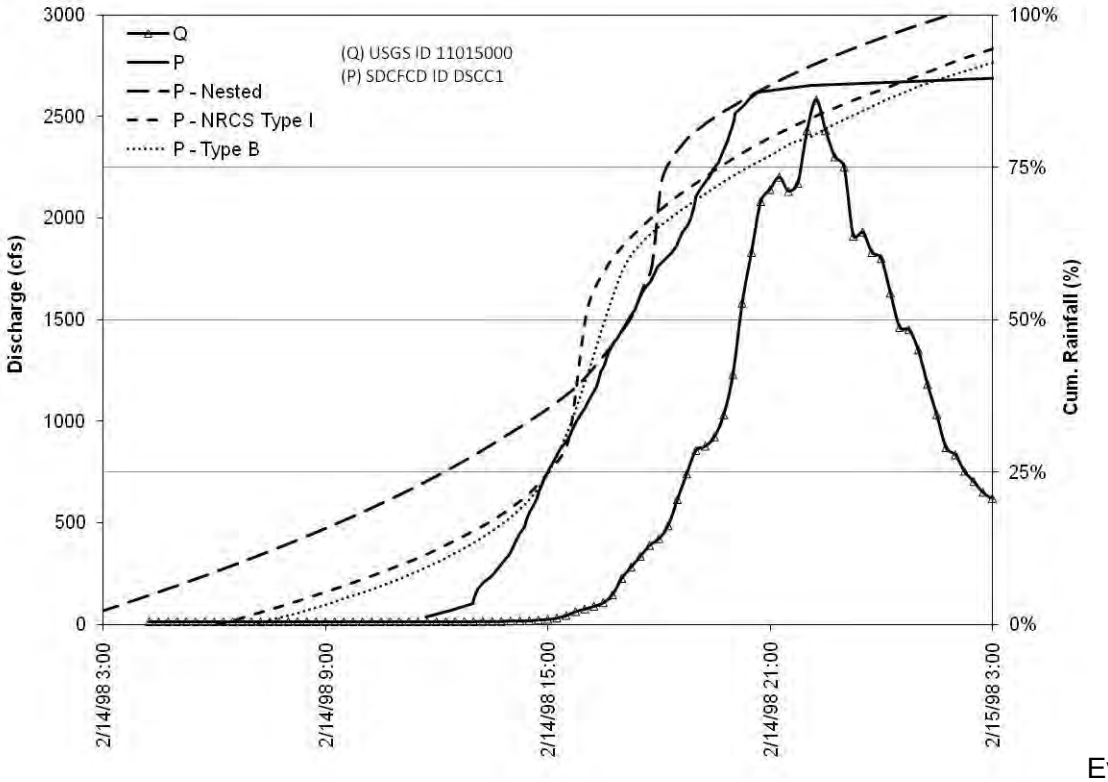
Event 1



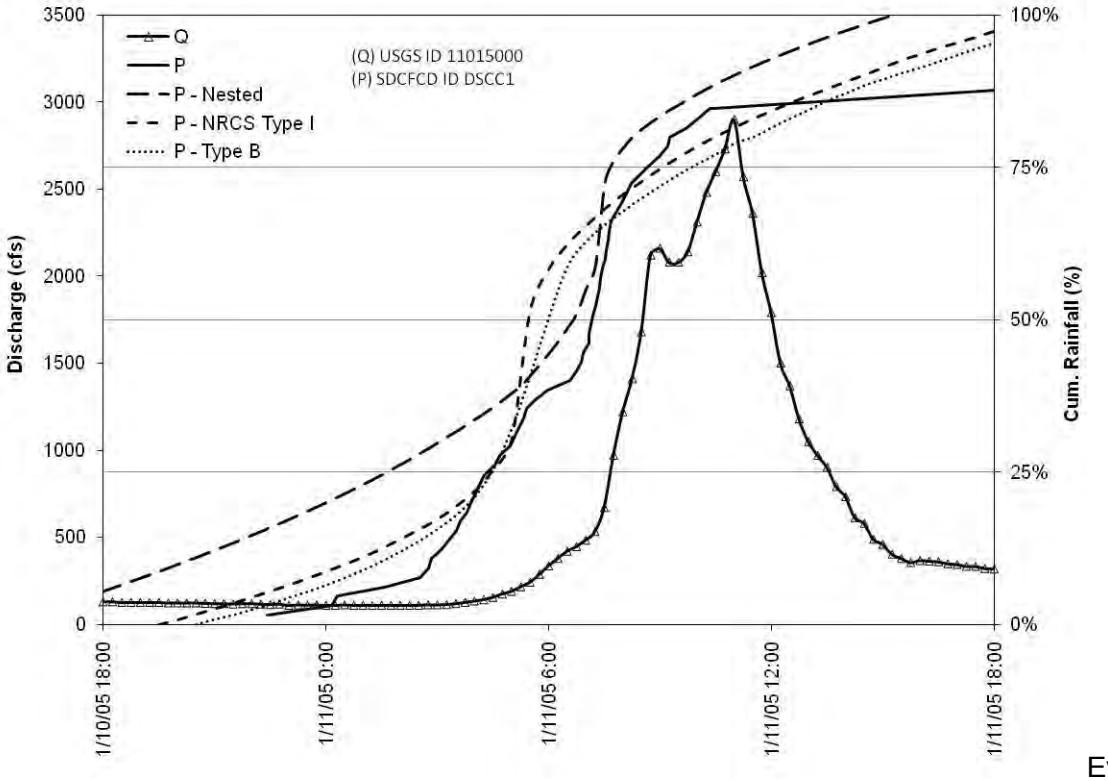
Event 2



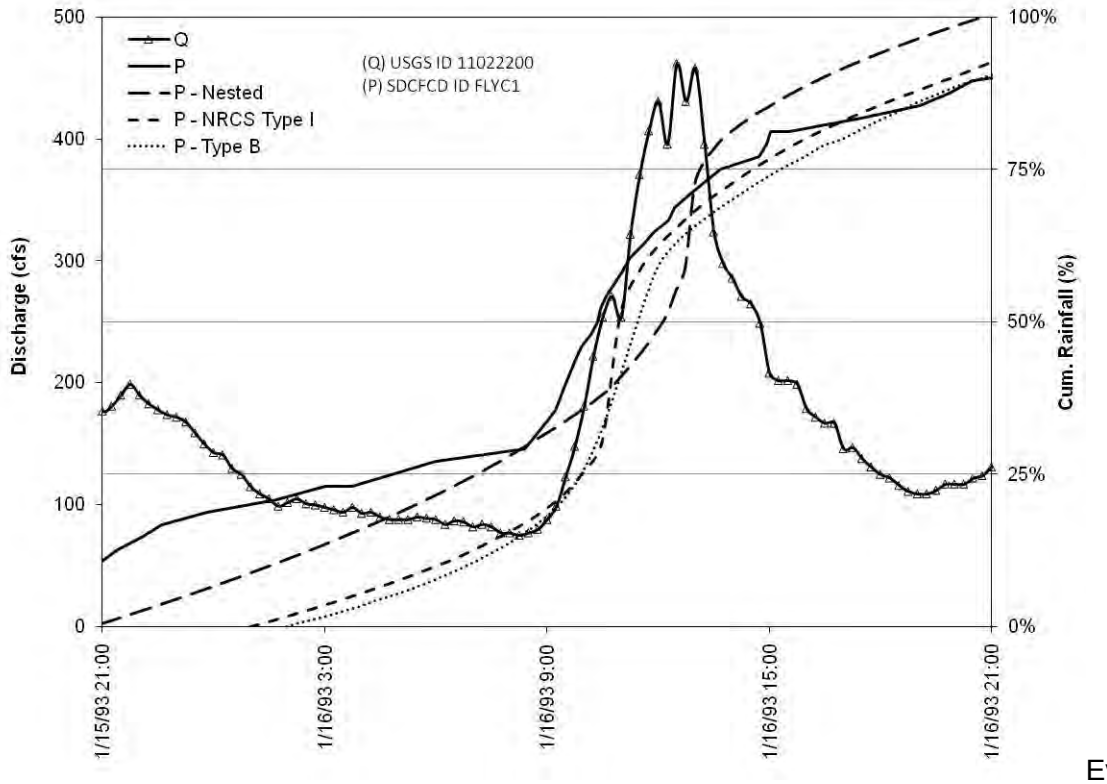
Event 3



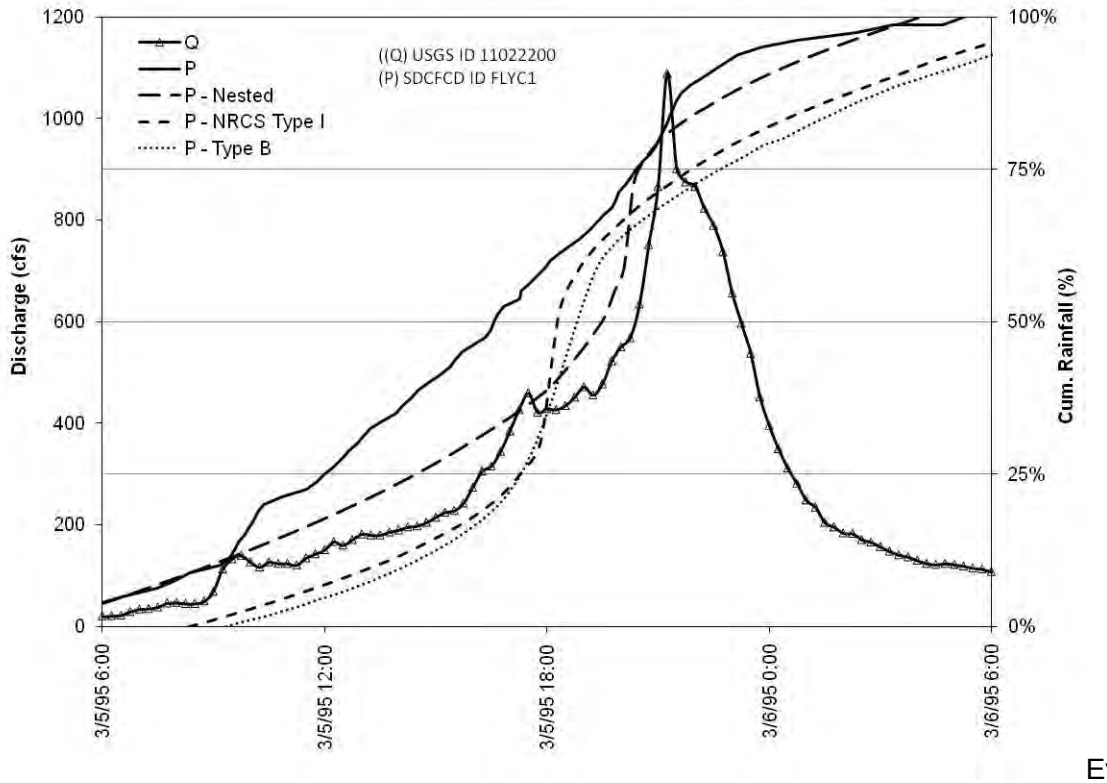
Event 4



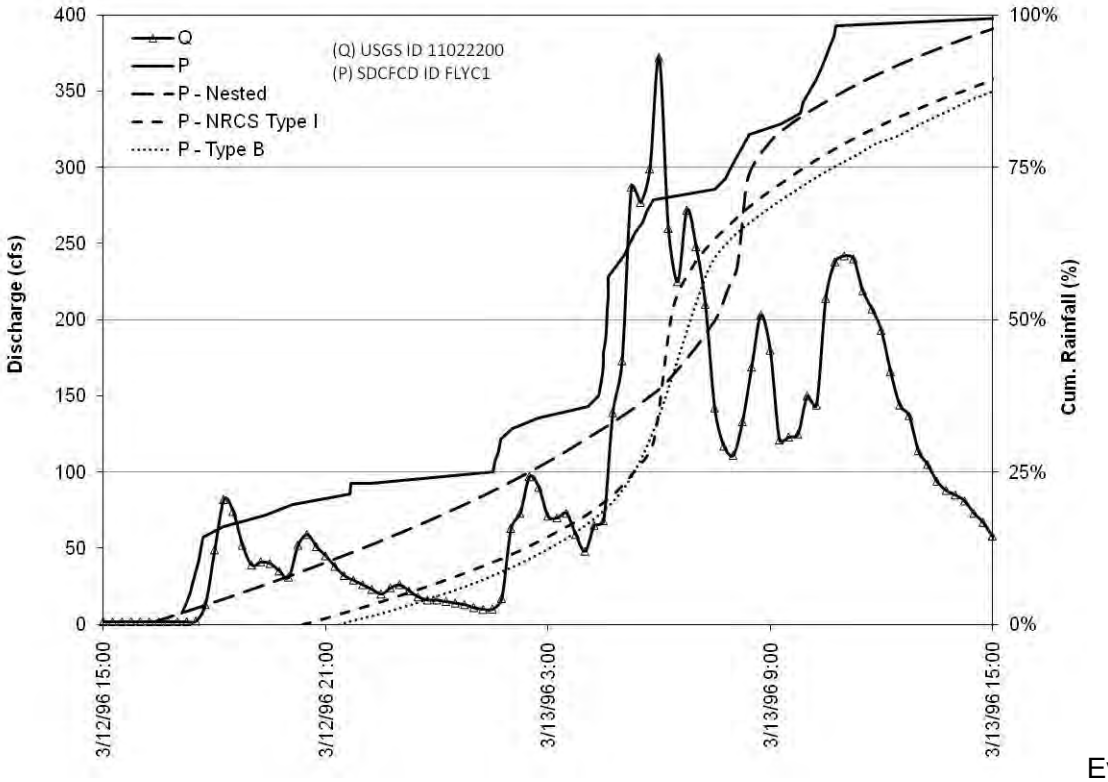
Event 5



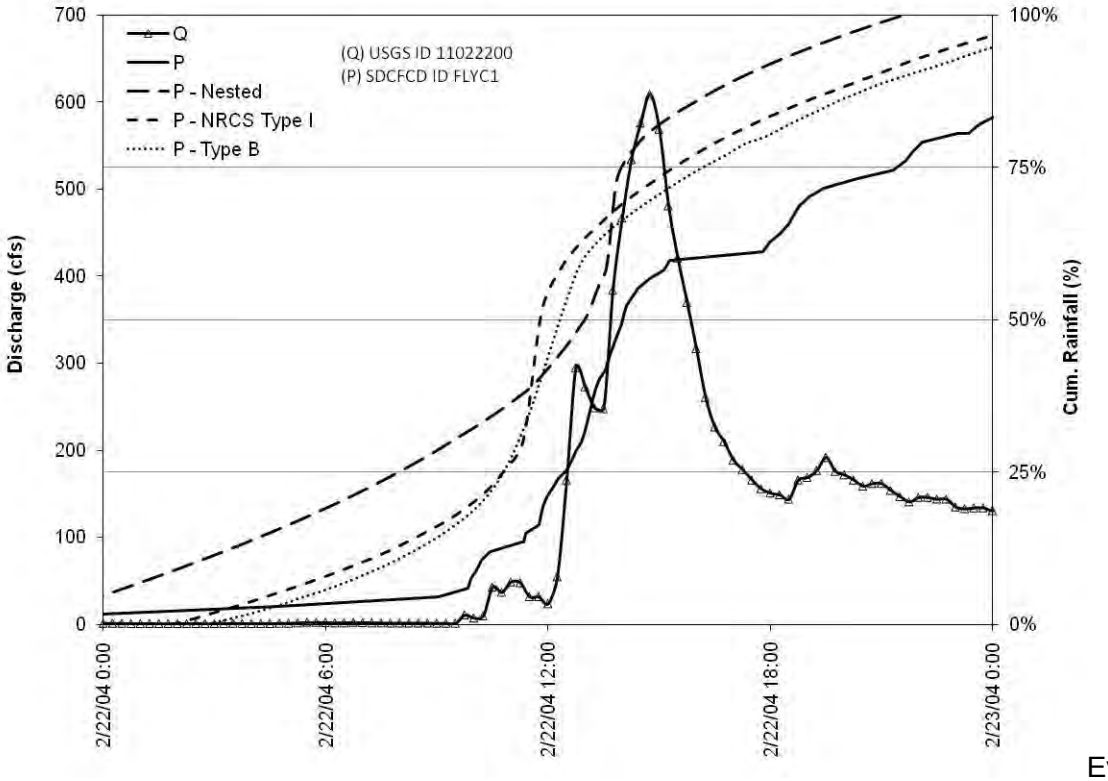
Event 1



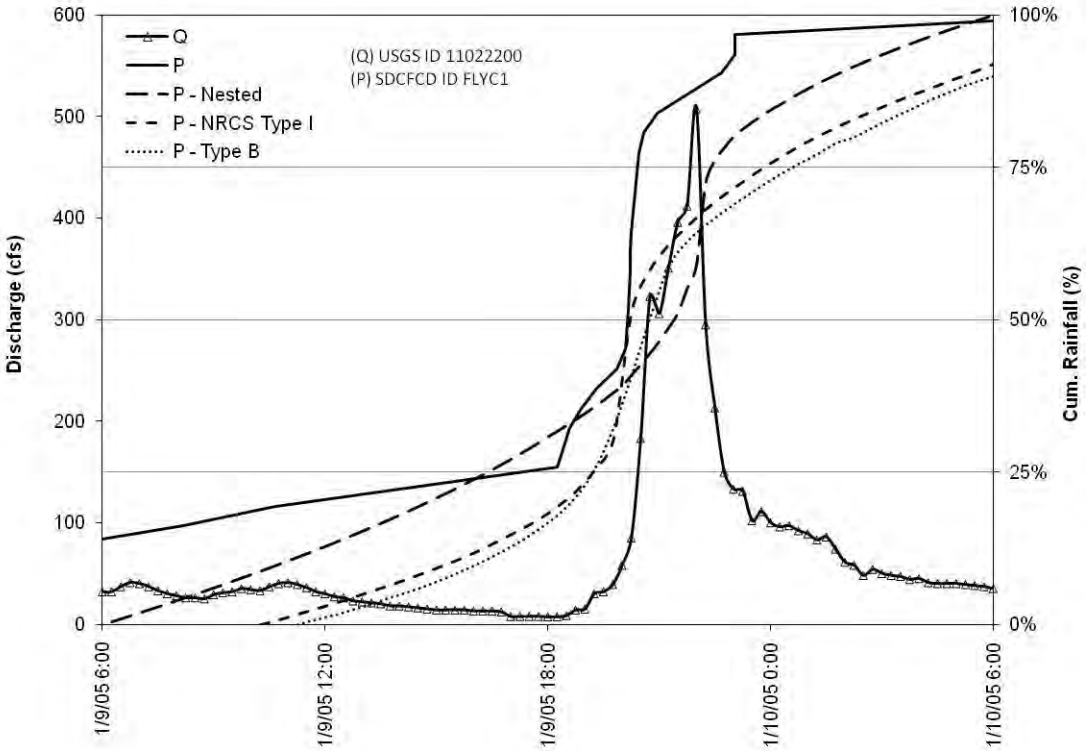
Event 2



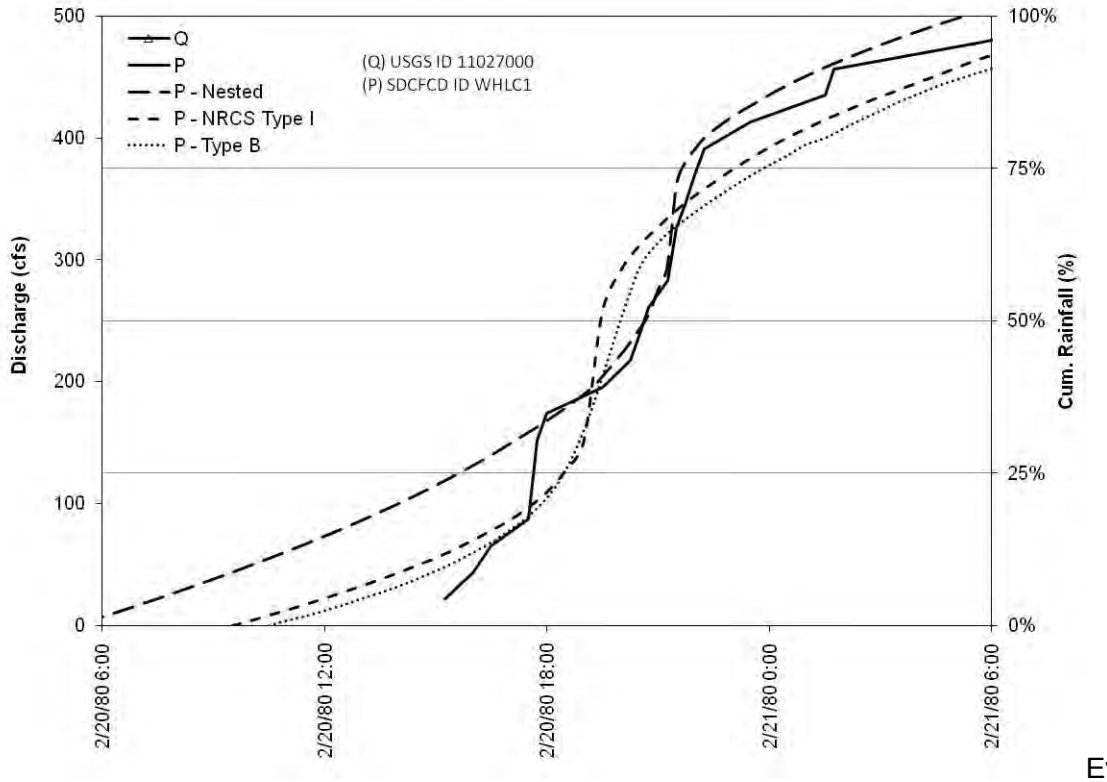
Event 3



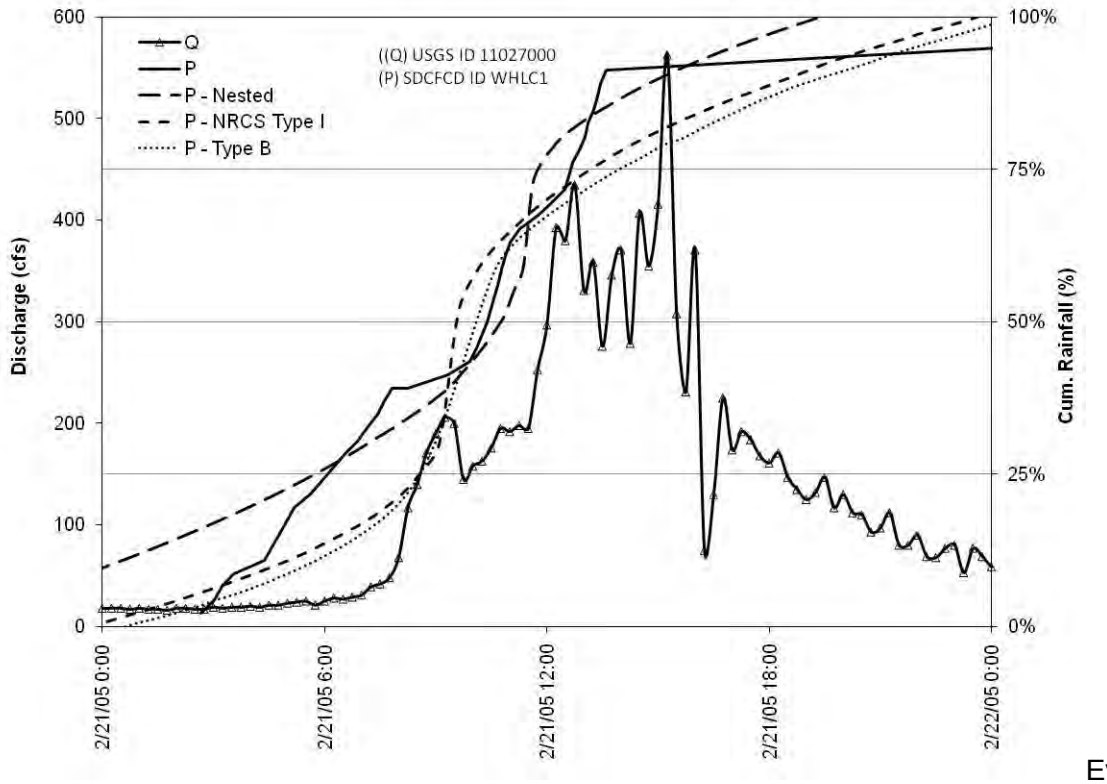
Event 4



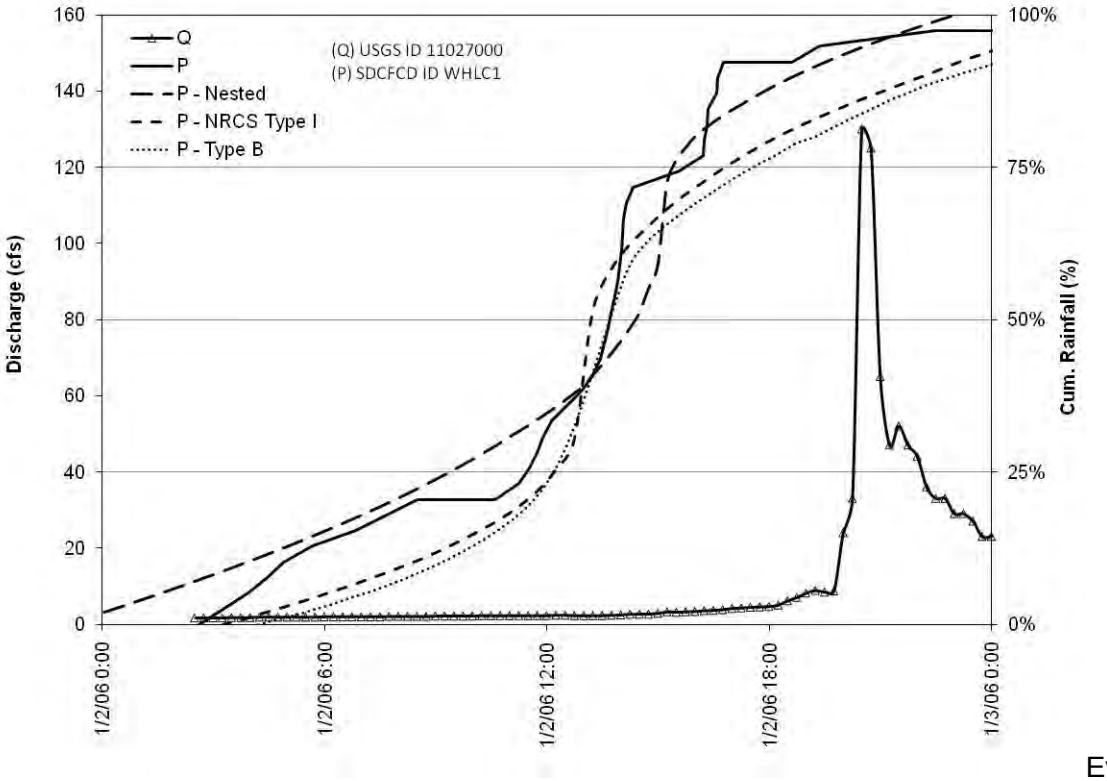
Event 5



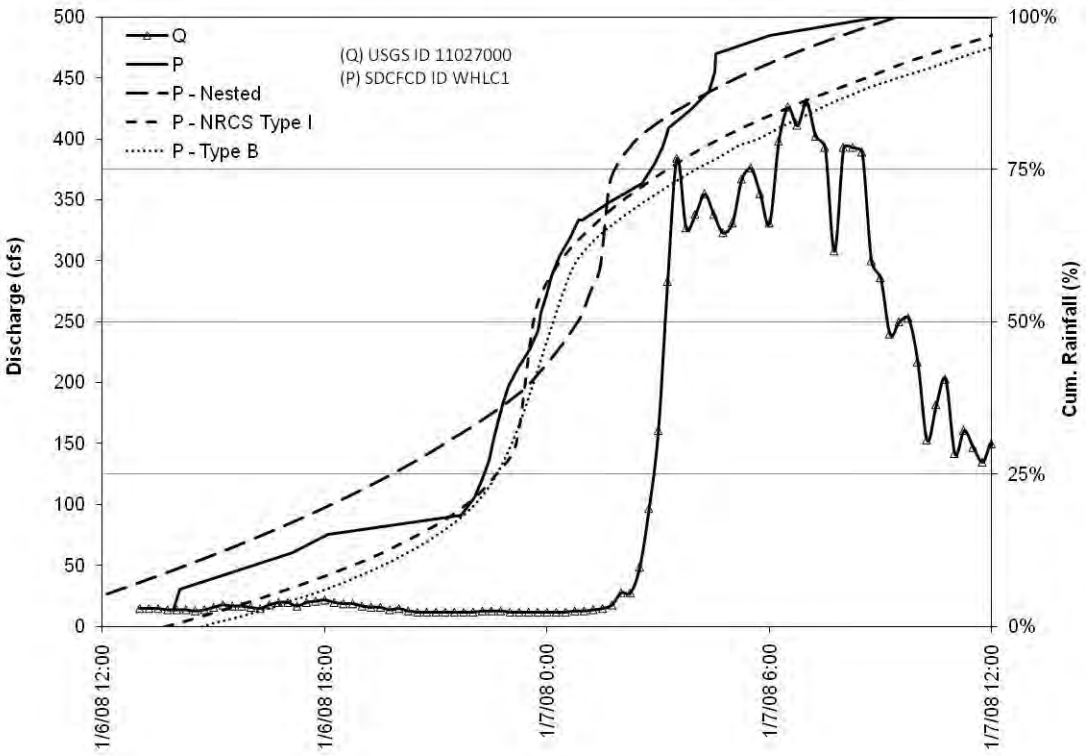
Event 1



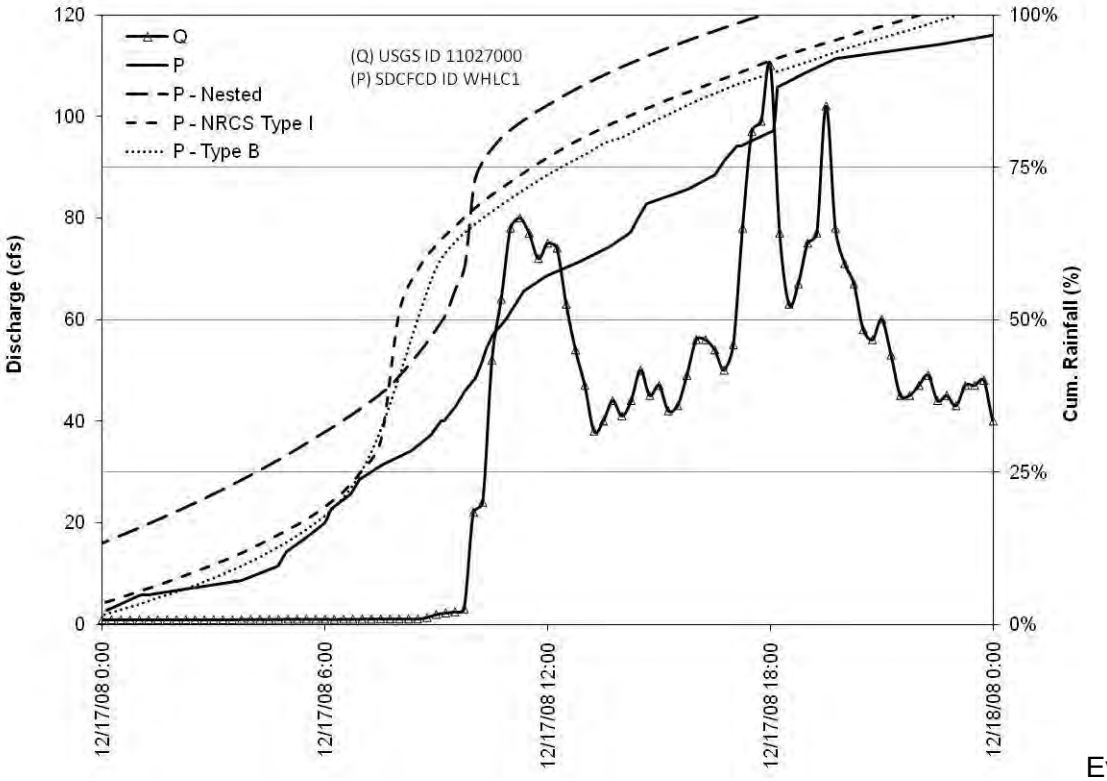
Event 2



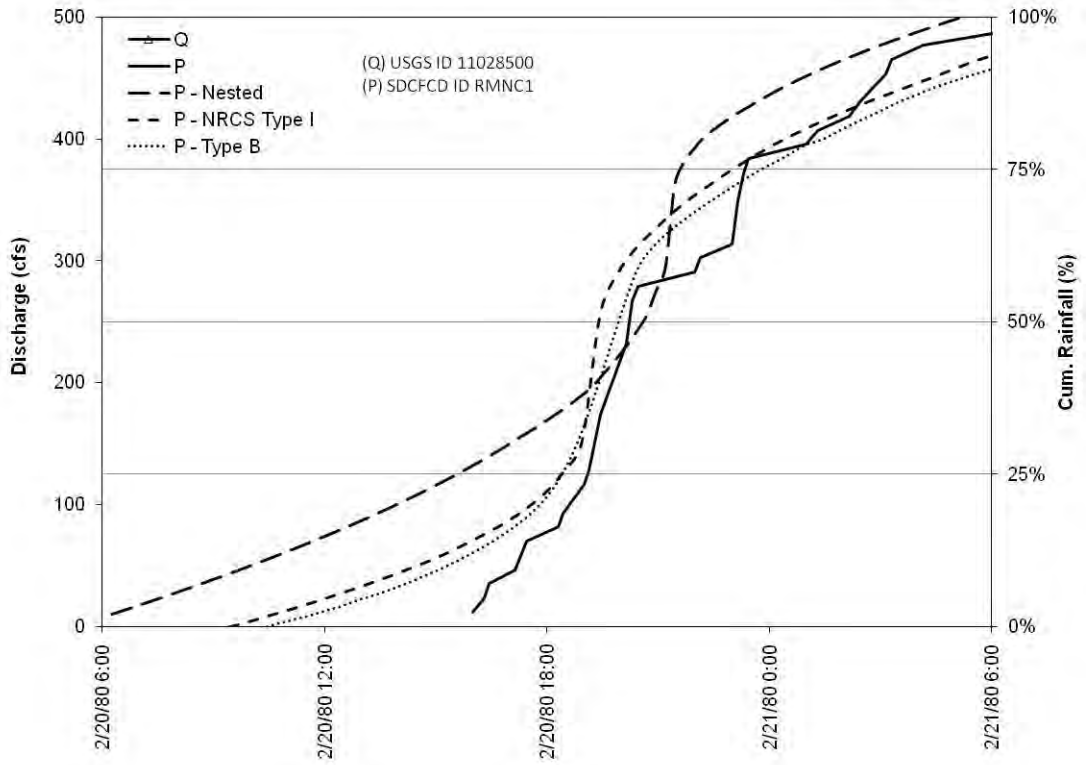
Event 3



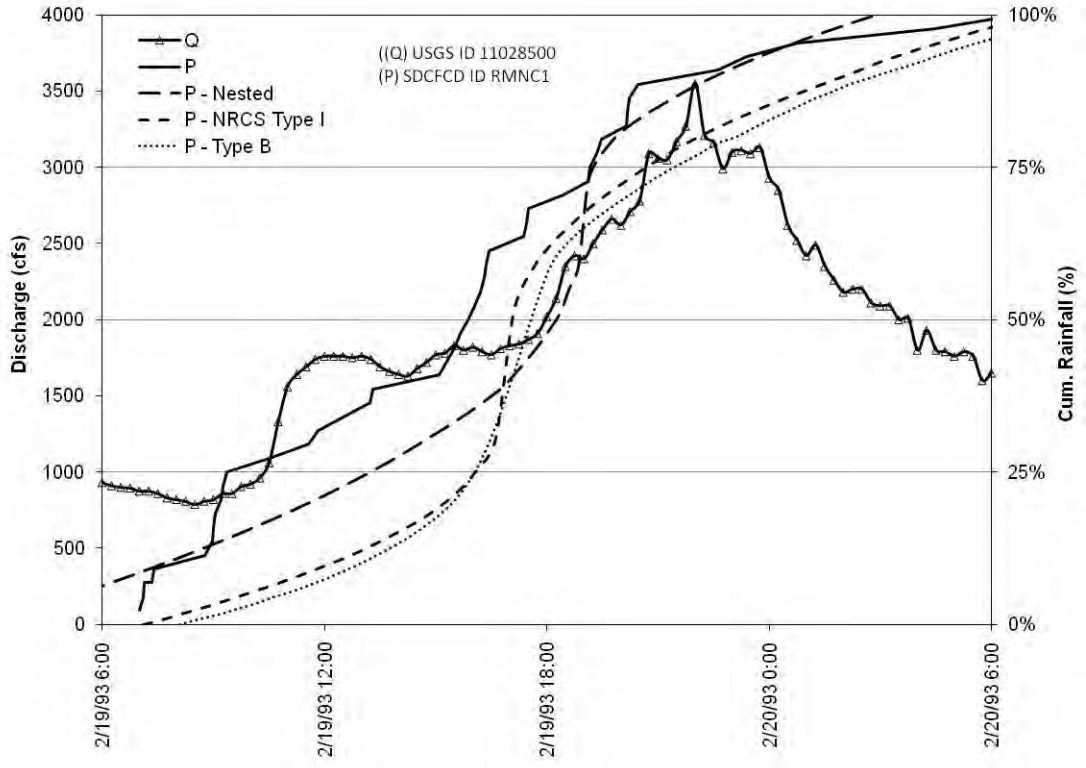
Event 4



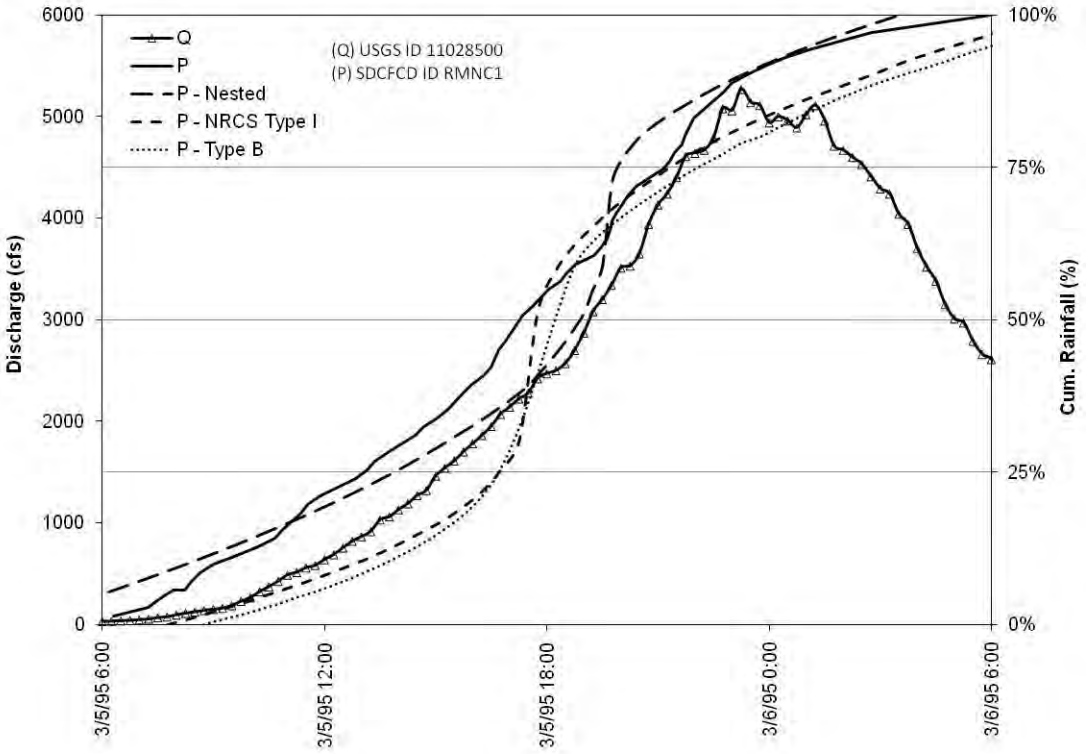
Event 5



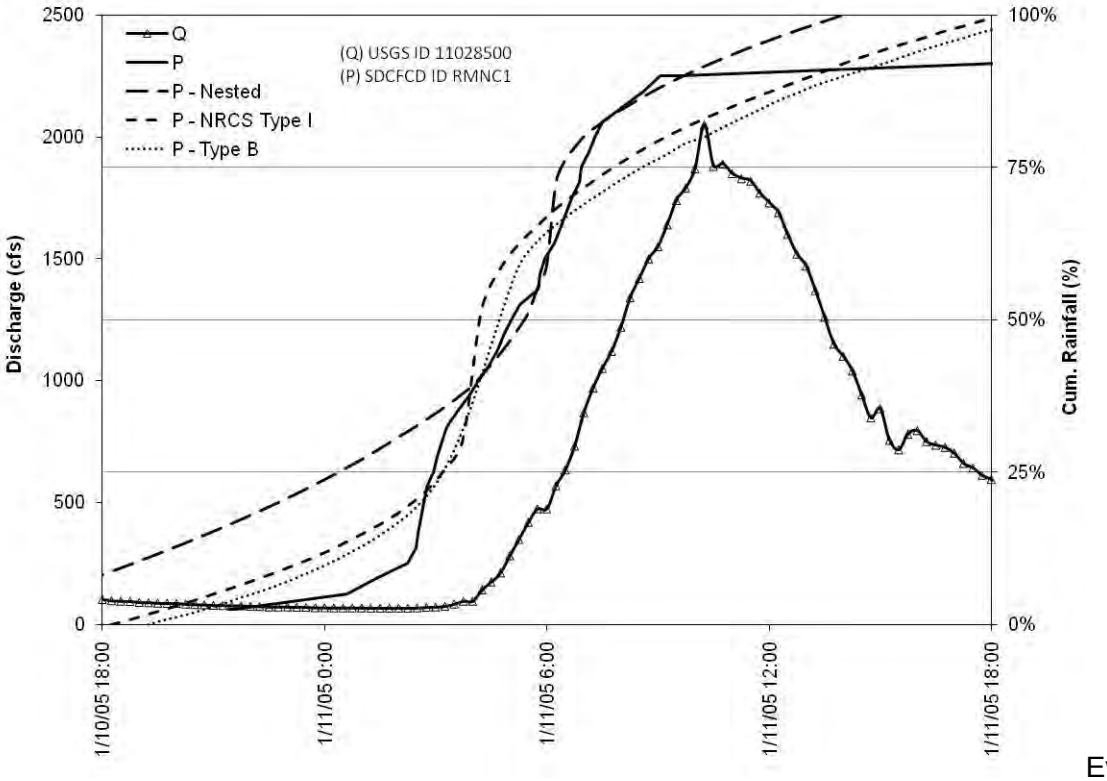
Event 1



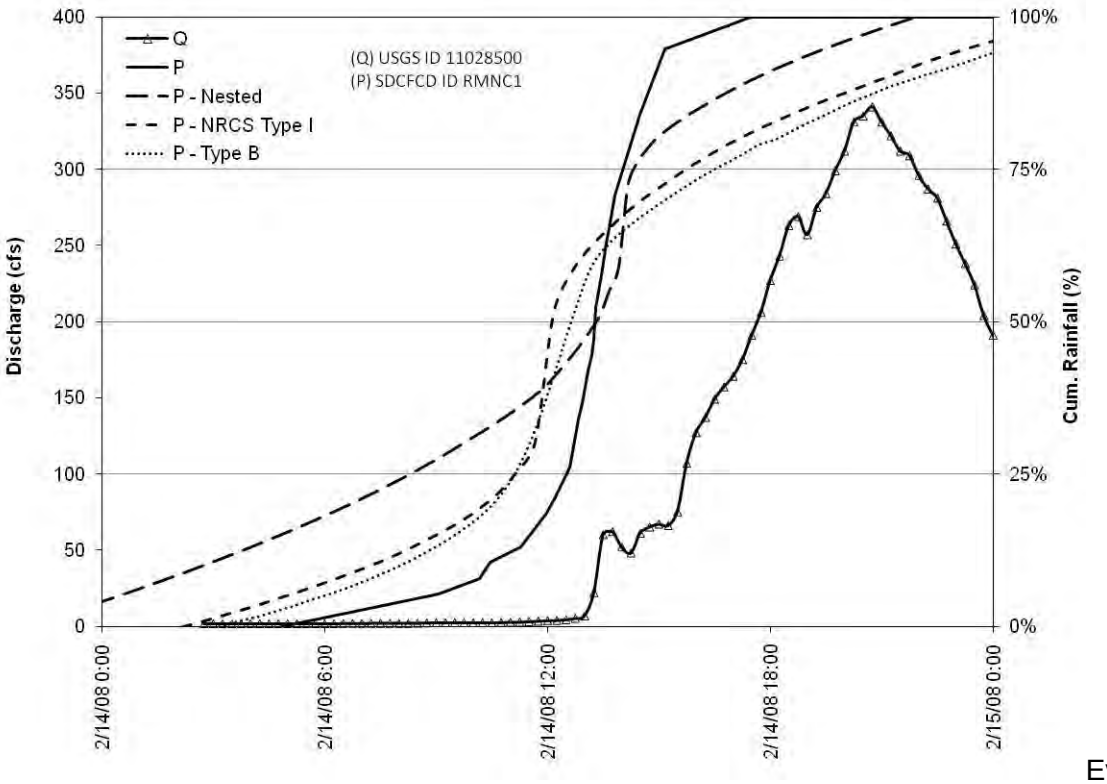
Event 2



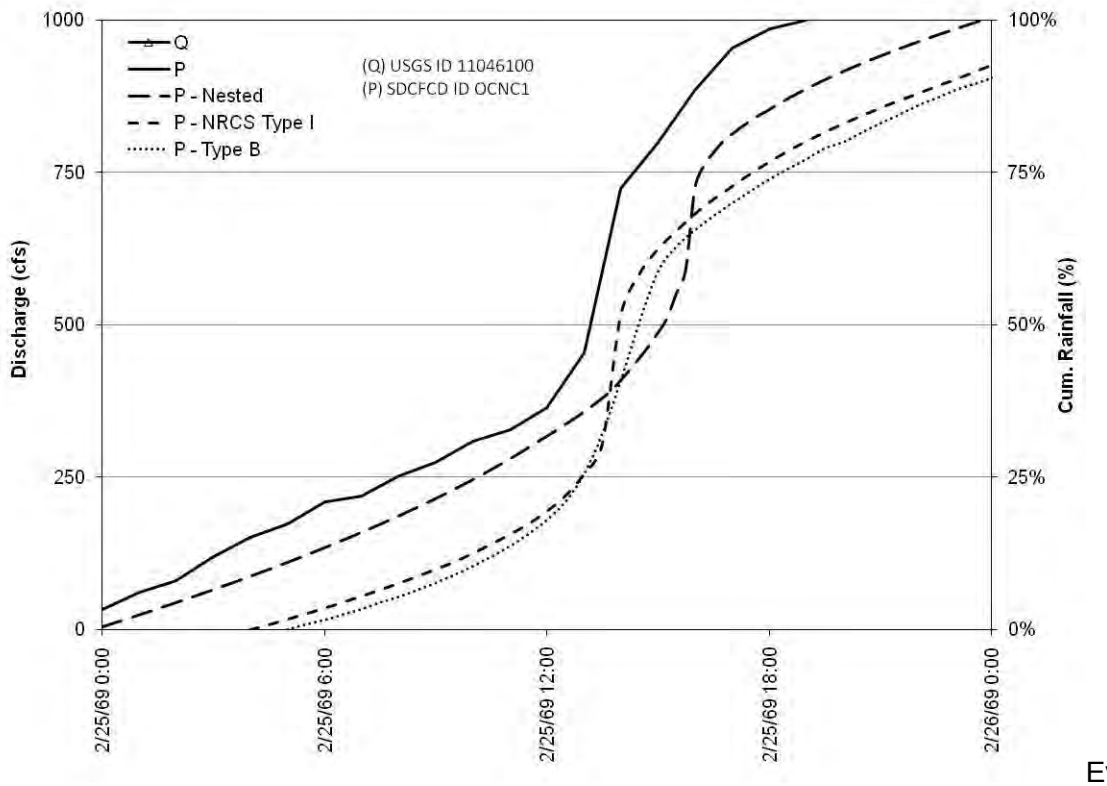
Event 3



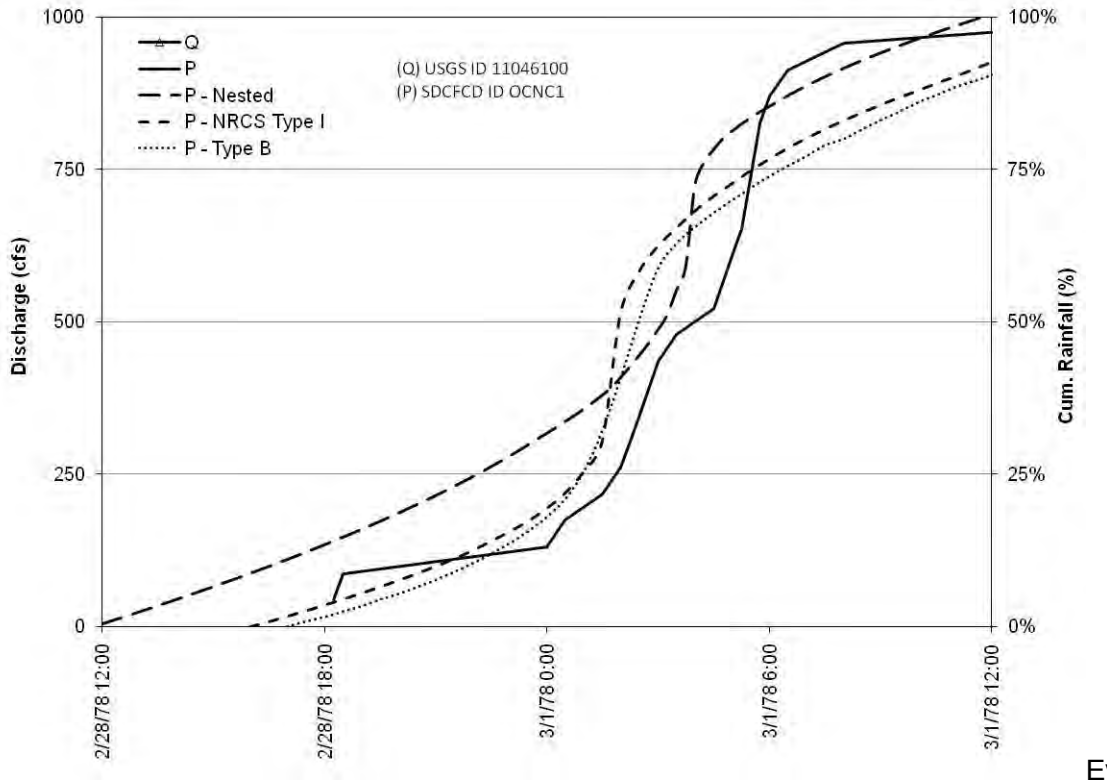
Event 4



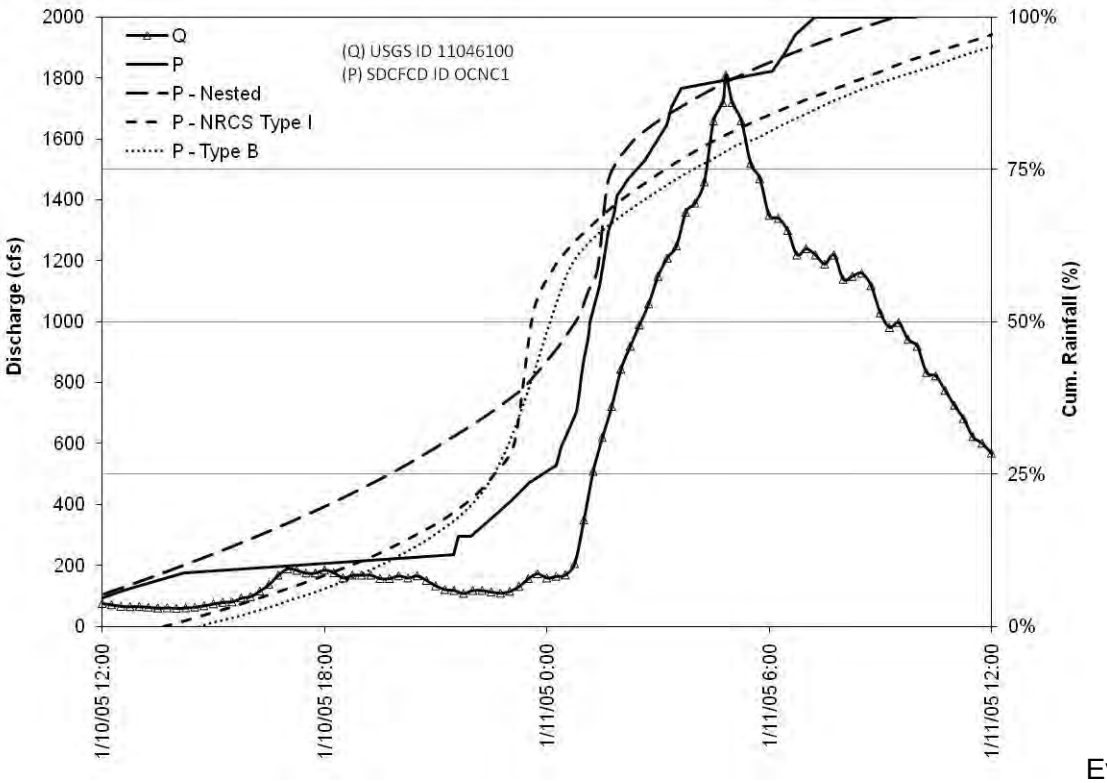
Event 5



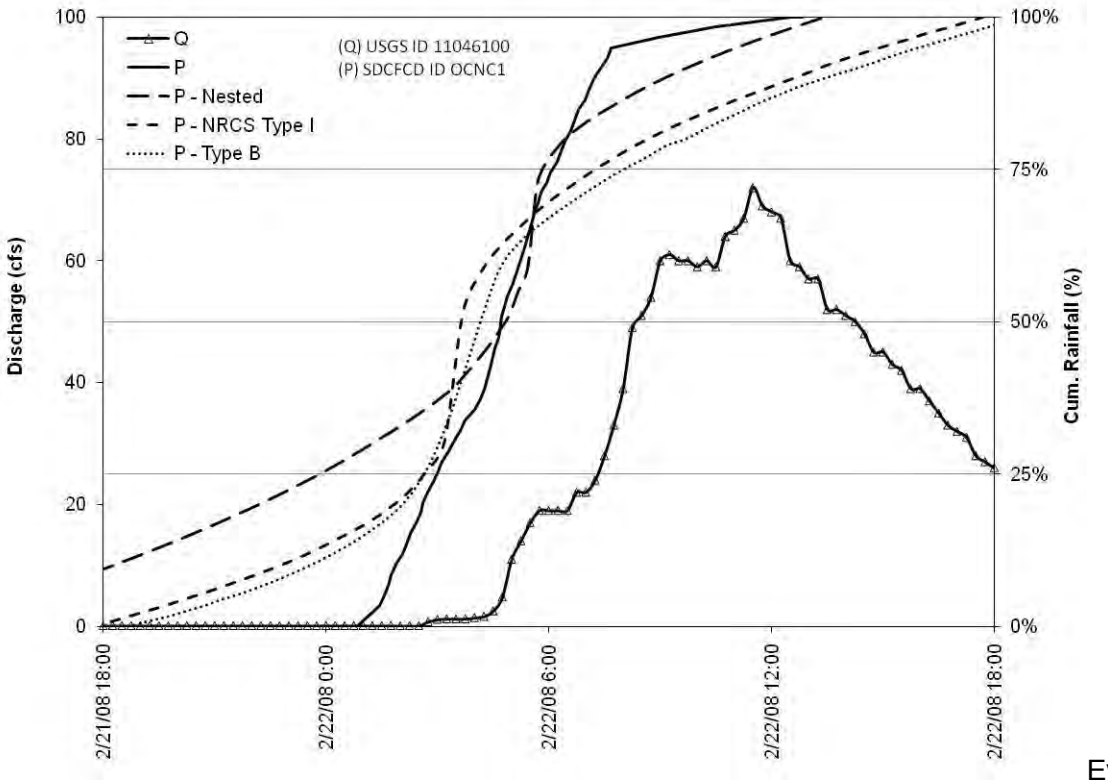
Event 1



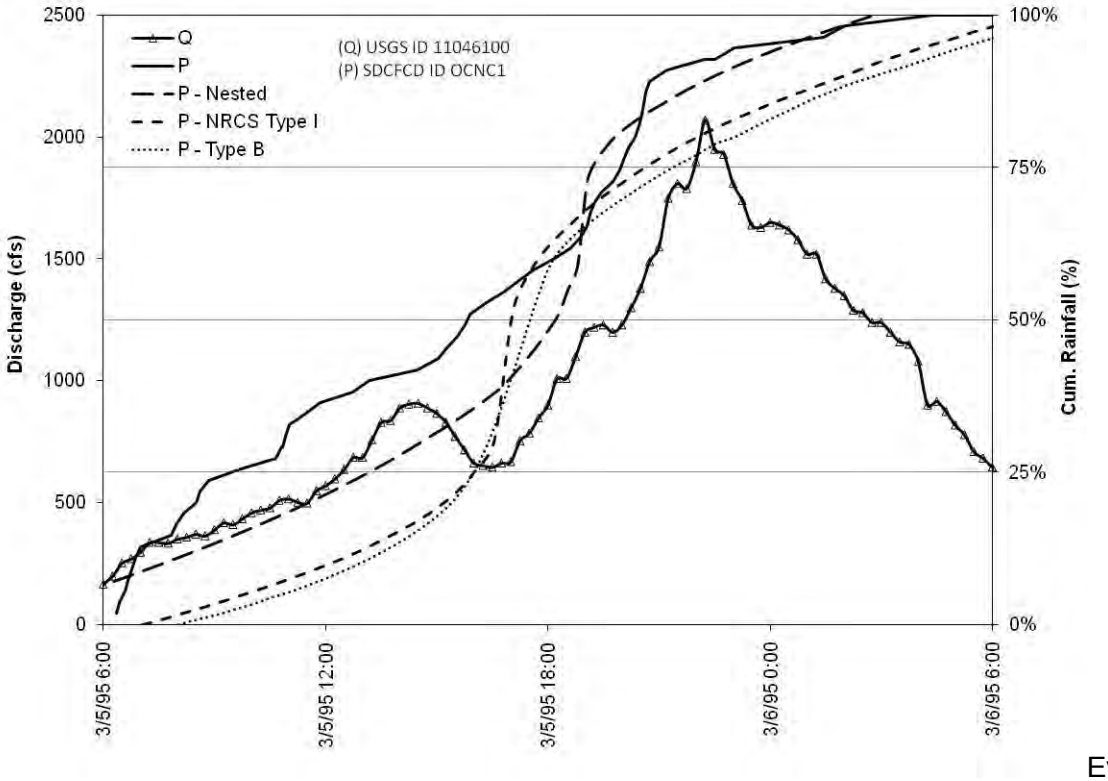
Event 2



Event 3



Event 4



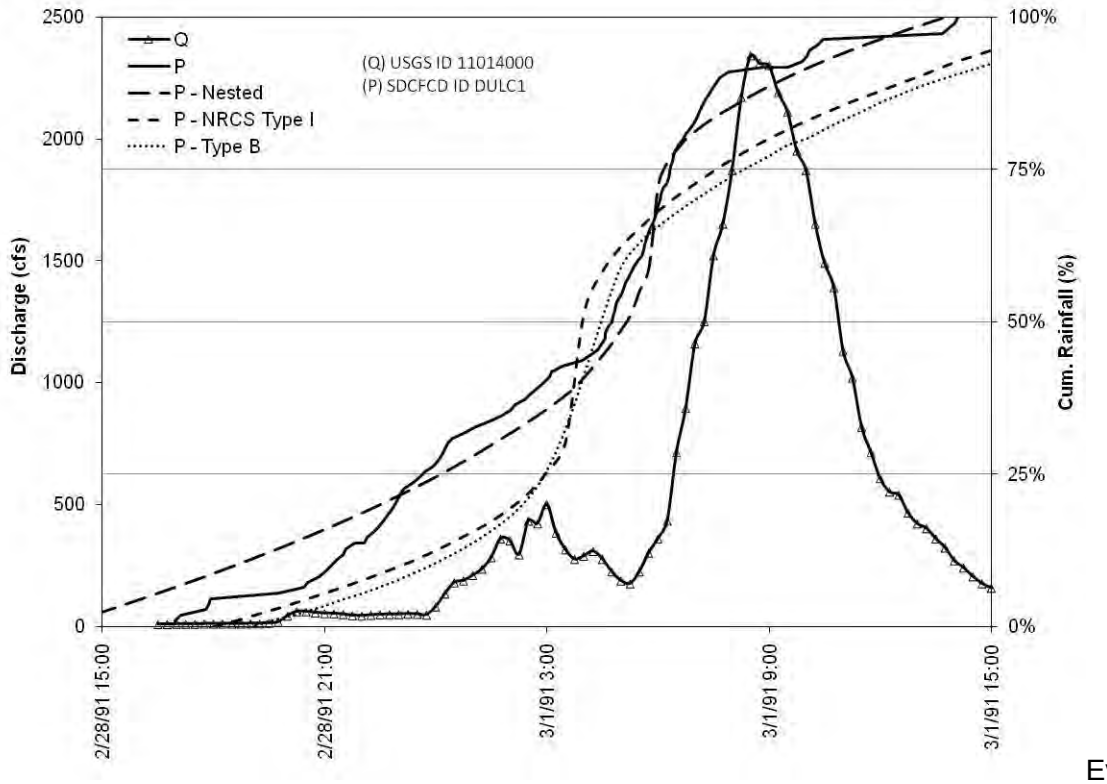
Event 5

This page is intentionally left blank to facilitate 2-sided printing.

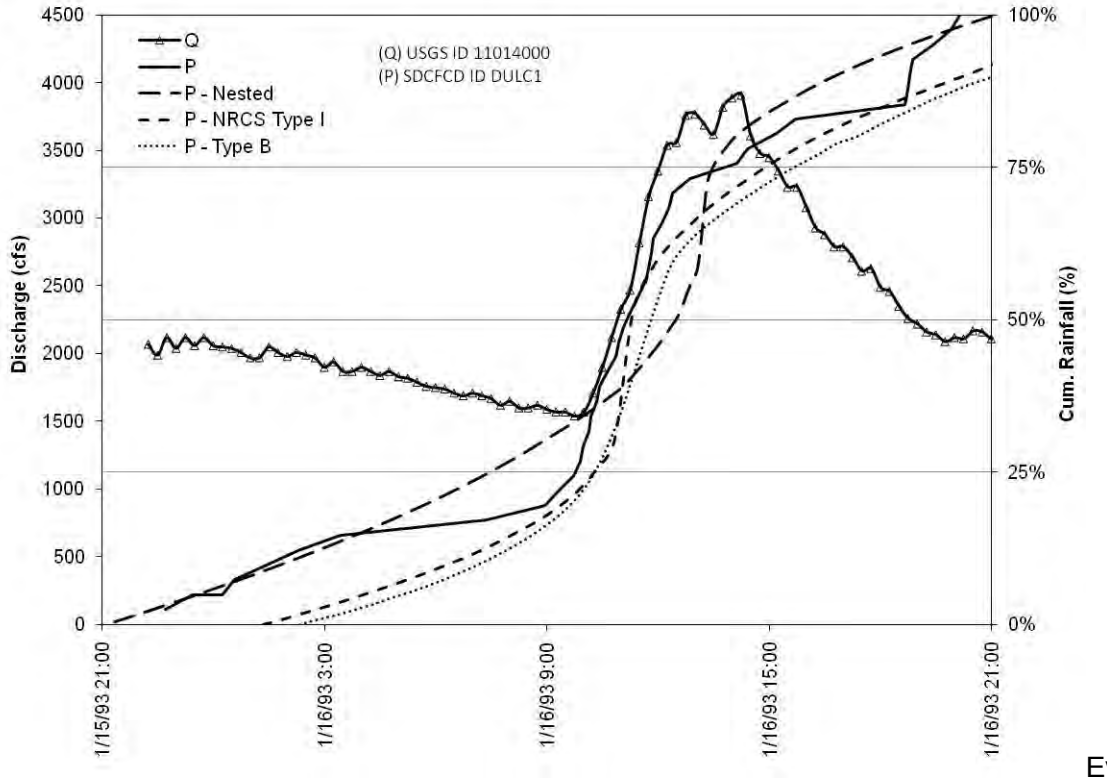
Appendix B.5

Storm Event Processing Results Showing Measured Cumulative Rainfall (P) and 15-min Discharges (Q) and the Three Fitted Rainfall Distributions (Nested, Type B, NRCS Type I) for all 5 Events from all 6 Gauges Where the Time Window Used to Extract the Measured Data was 16 Hours Before and 8 Hours After the Time of the Selected Instantaneous Annual Peak Discharge

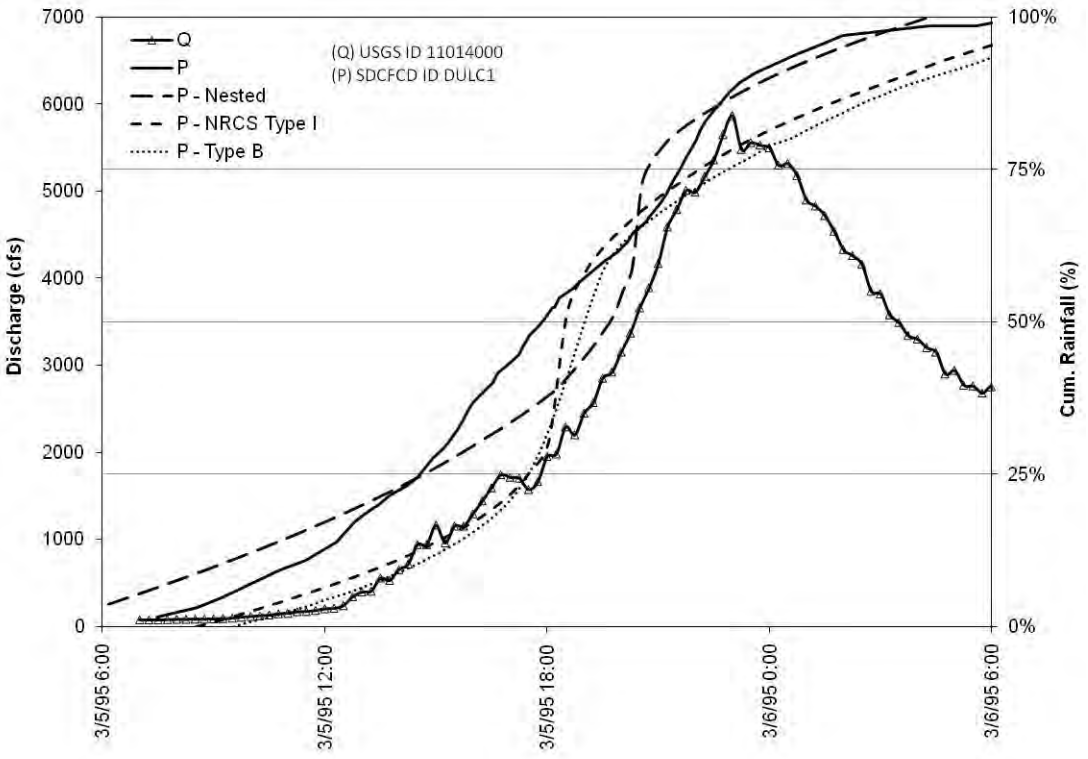
This page is intentionally left blank to facilitate 2-sided printing.



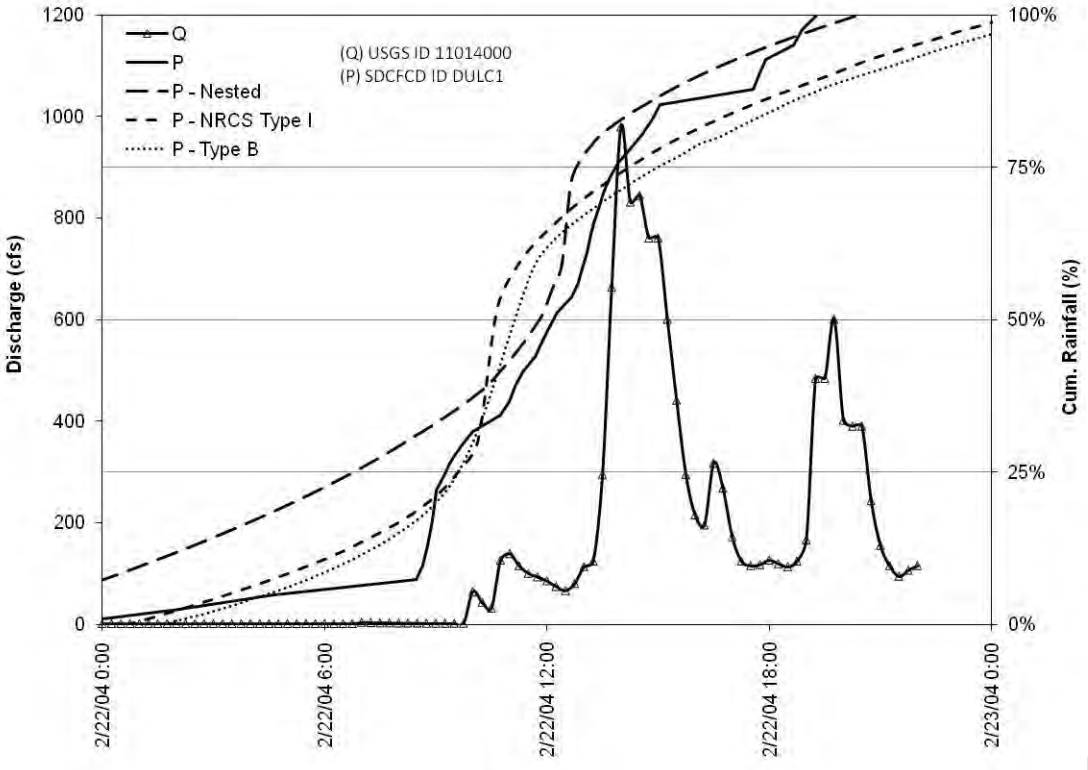
Event 1



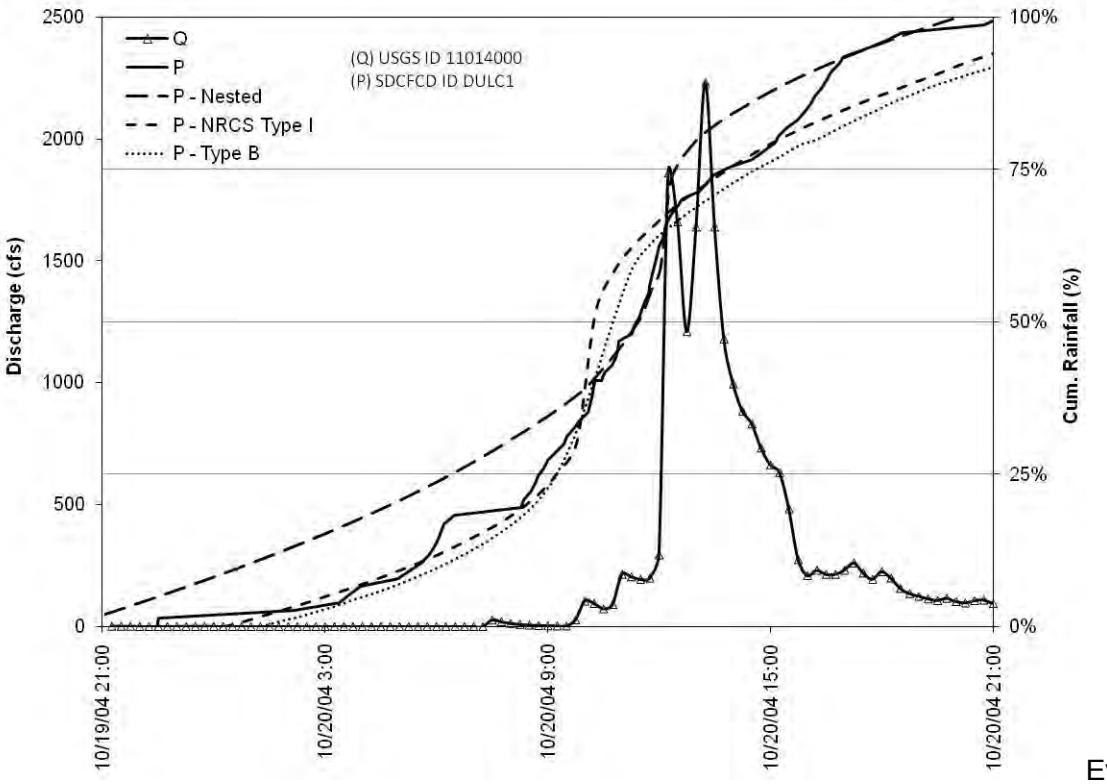
Event 2



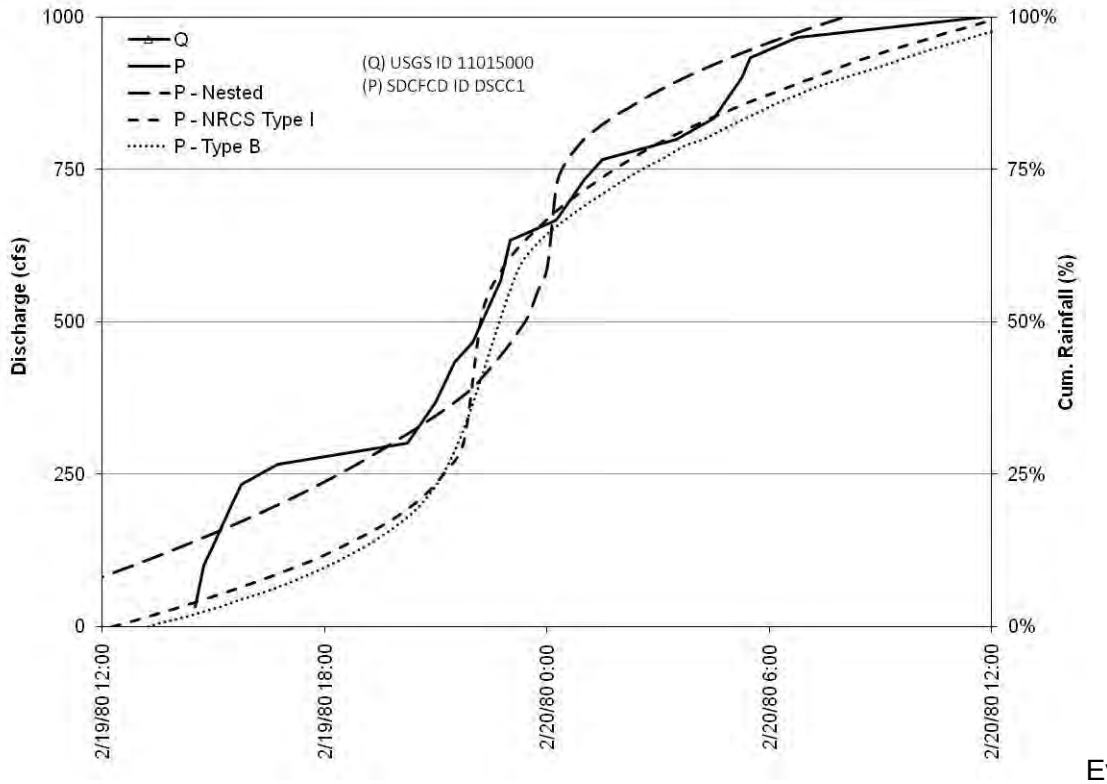
Event 3



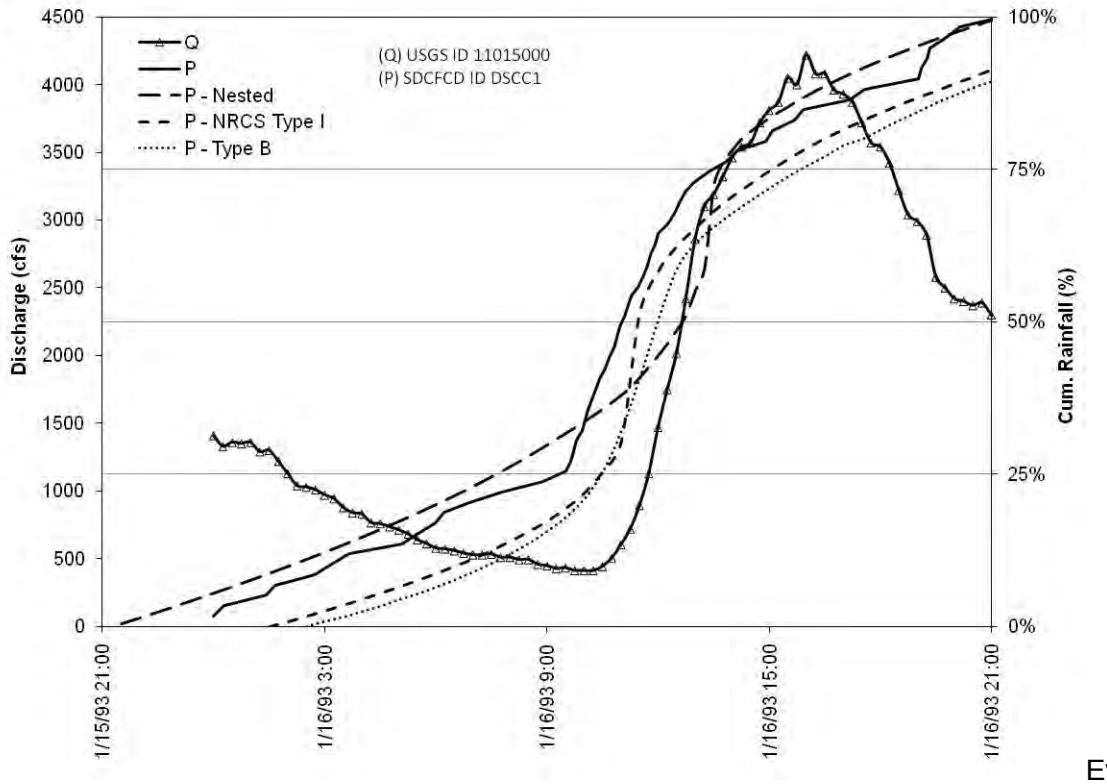
Event 4



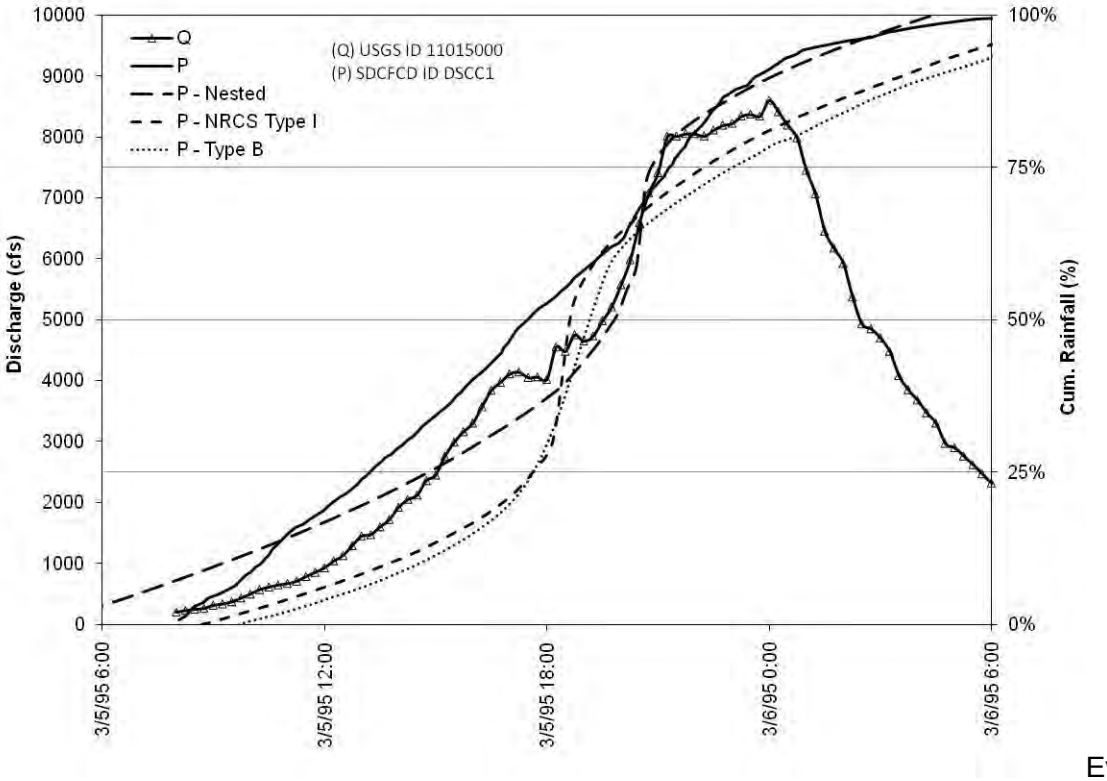
Event 5



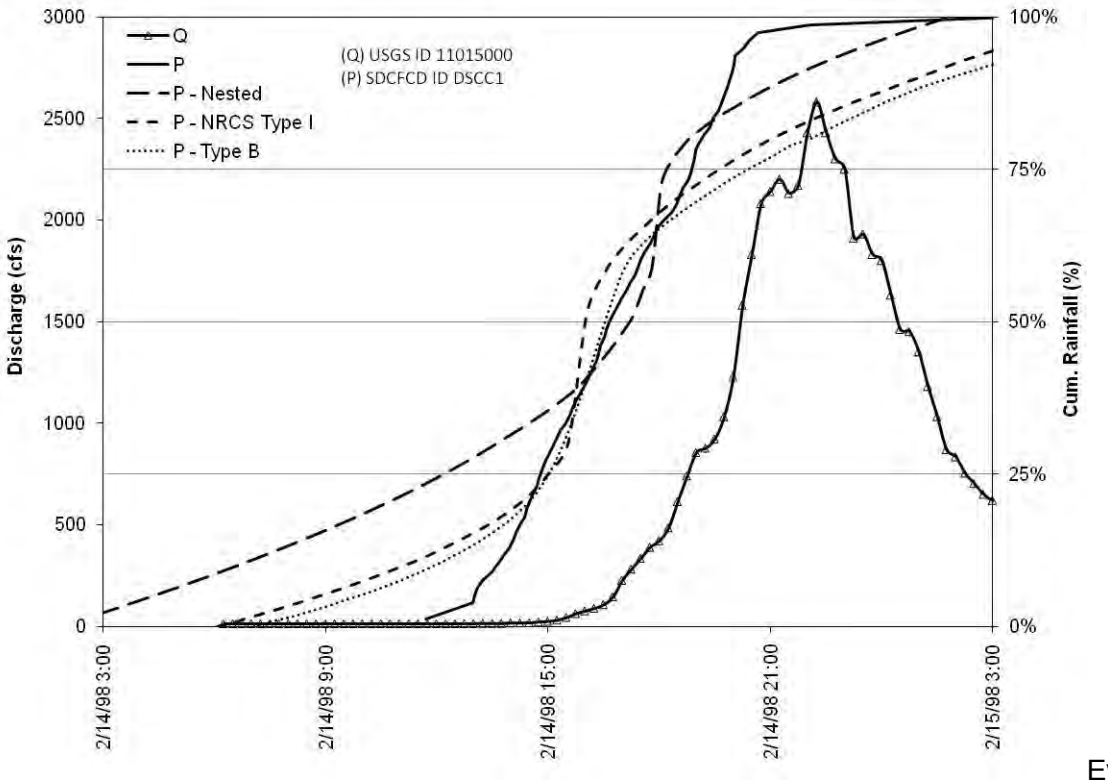
Event 1



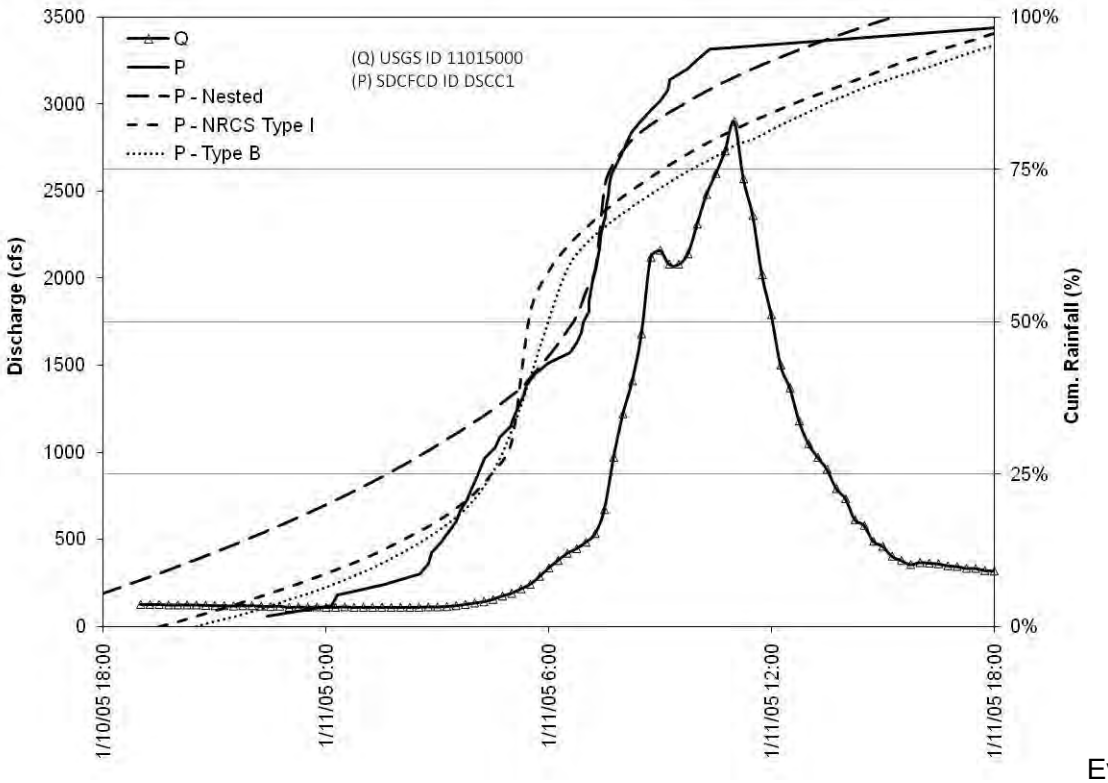
Event 2



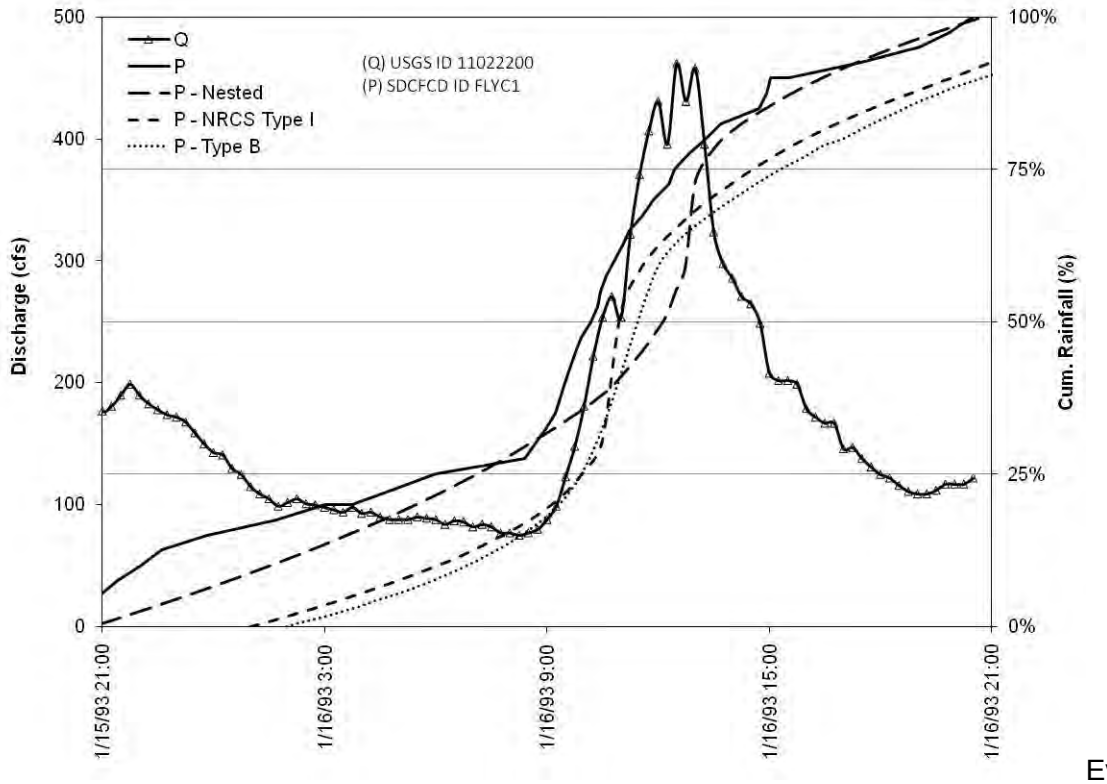
Event 3



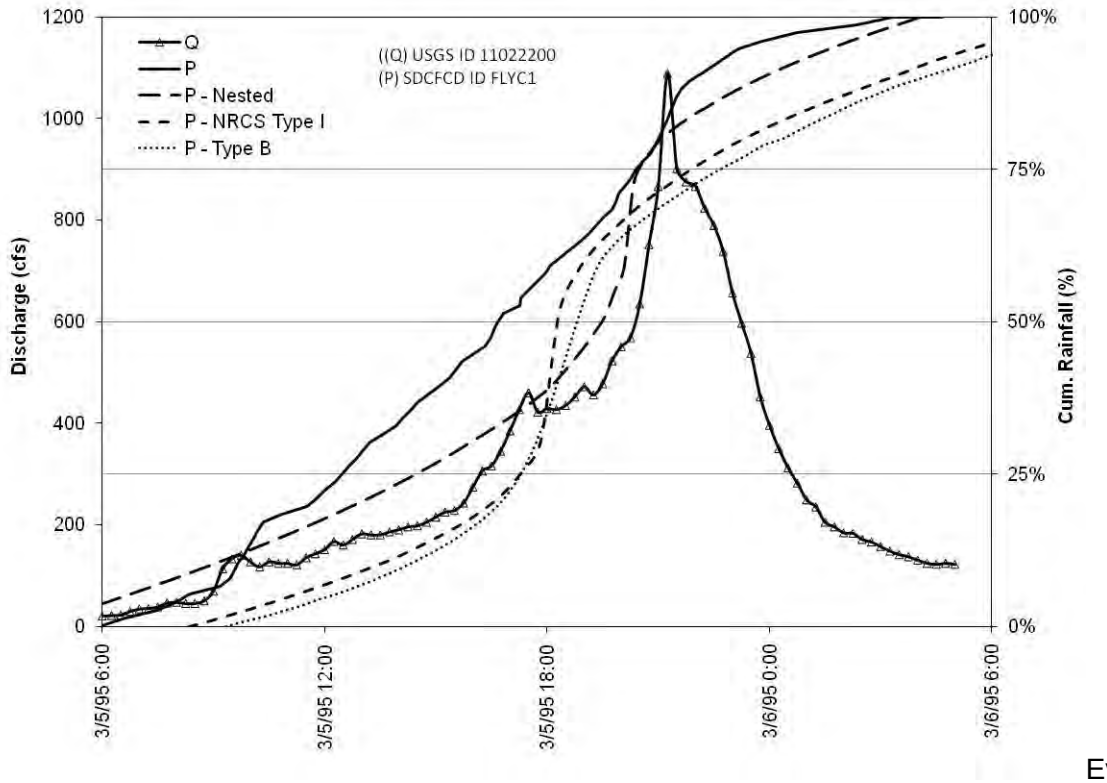
Event 4



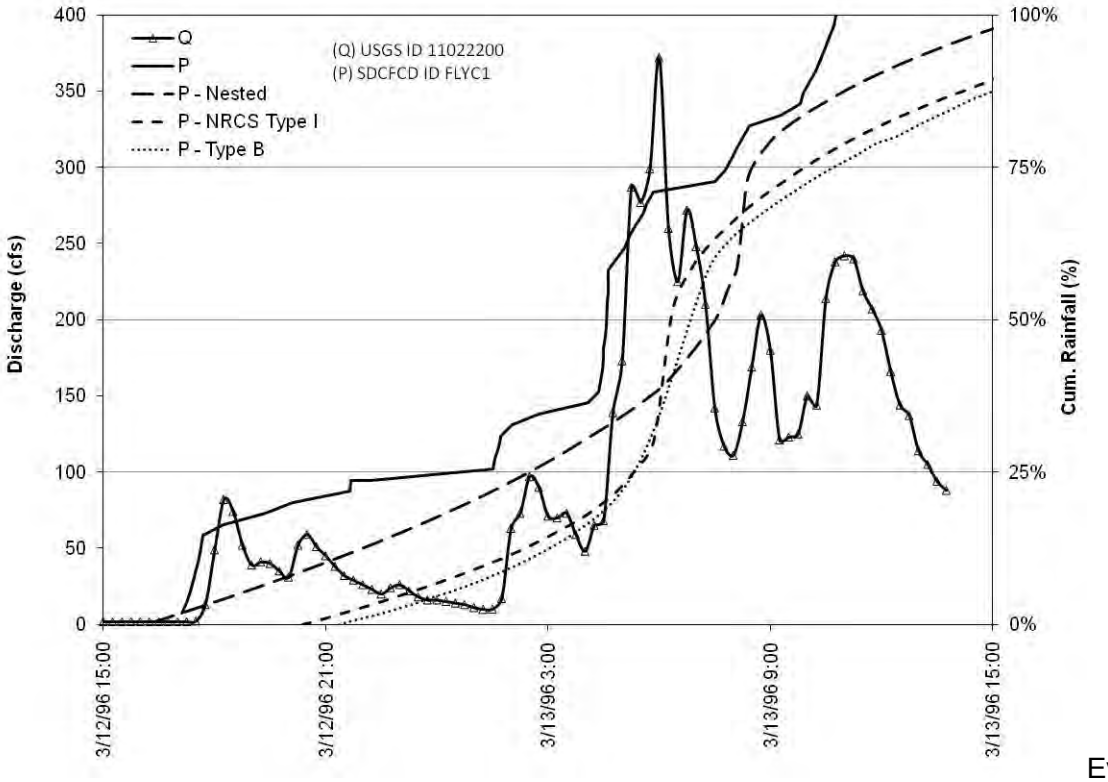
Event 5



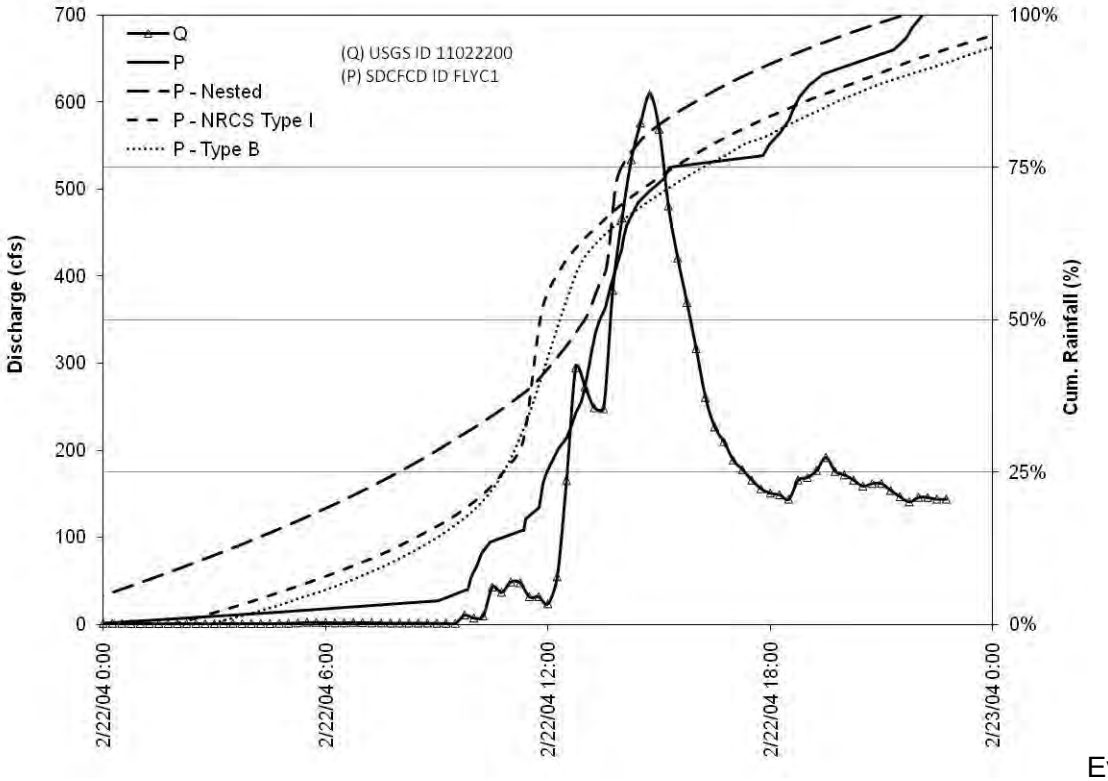
Event 1



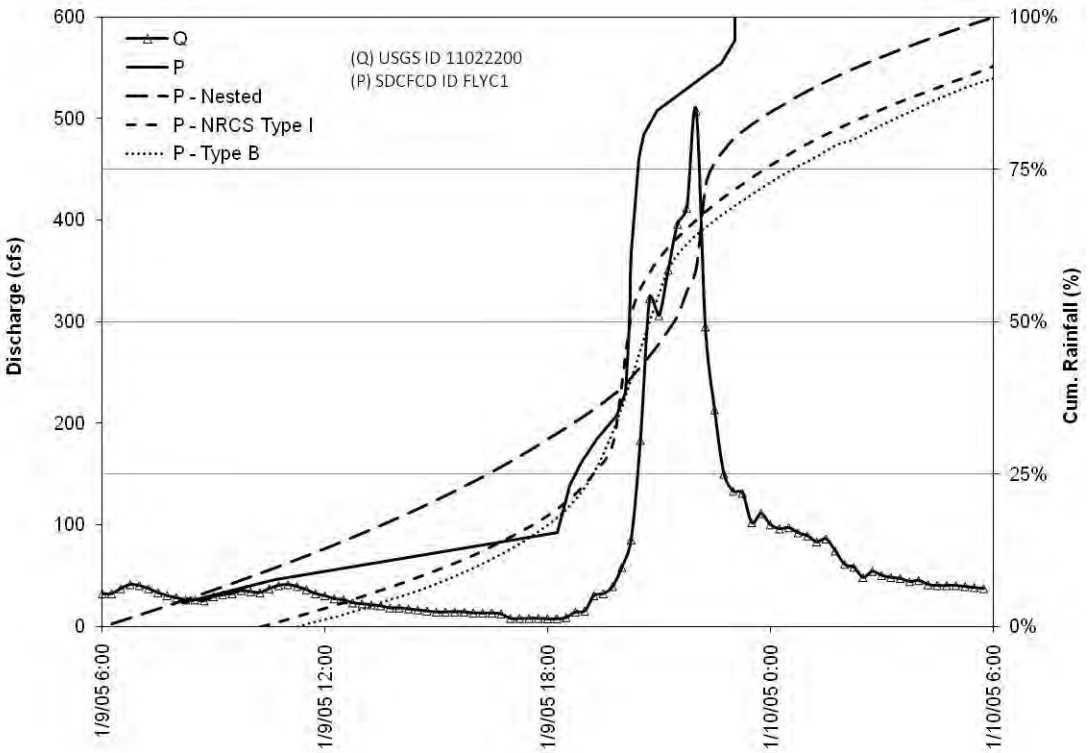
Event 2



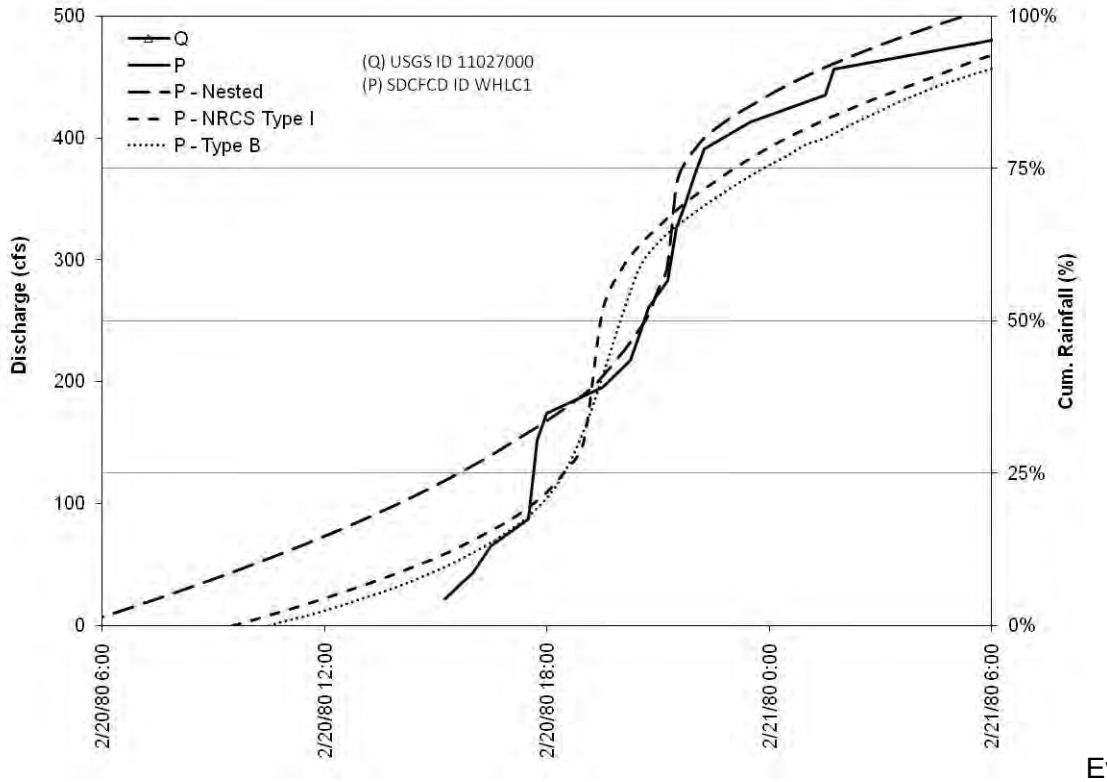
Event 3



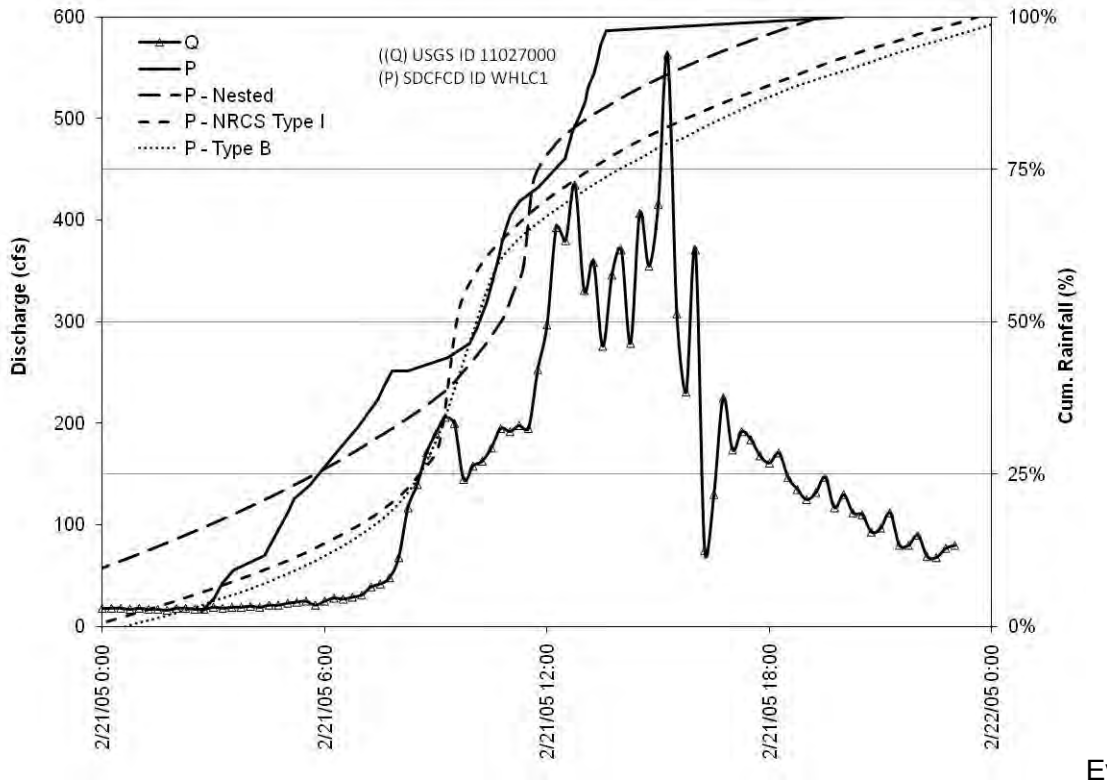
Event 4



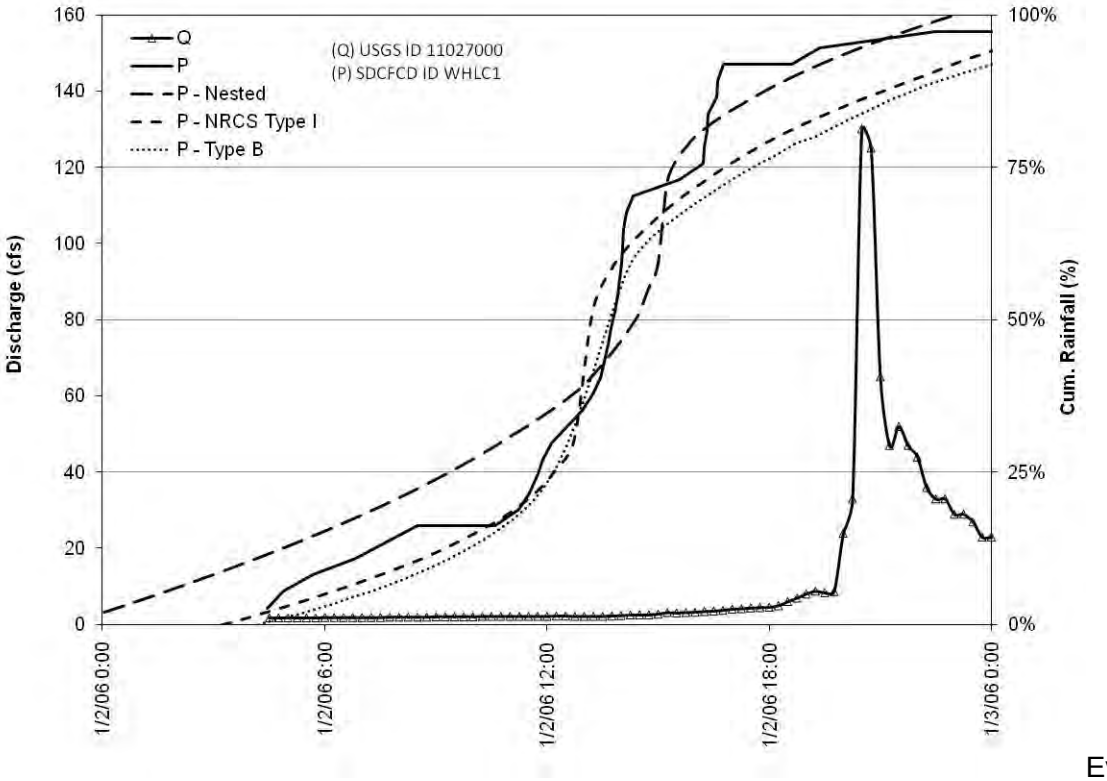
Event 5



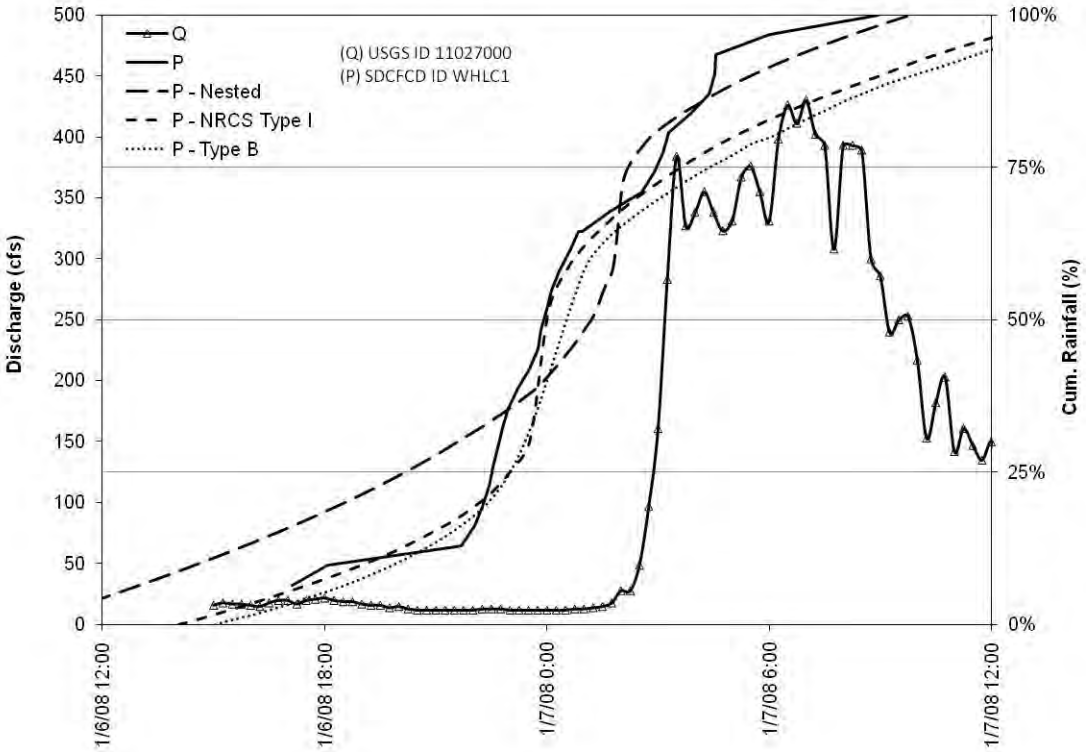
Event 1



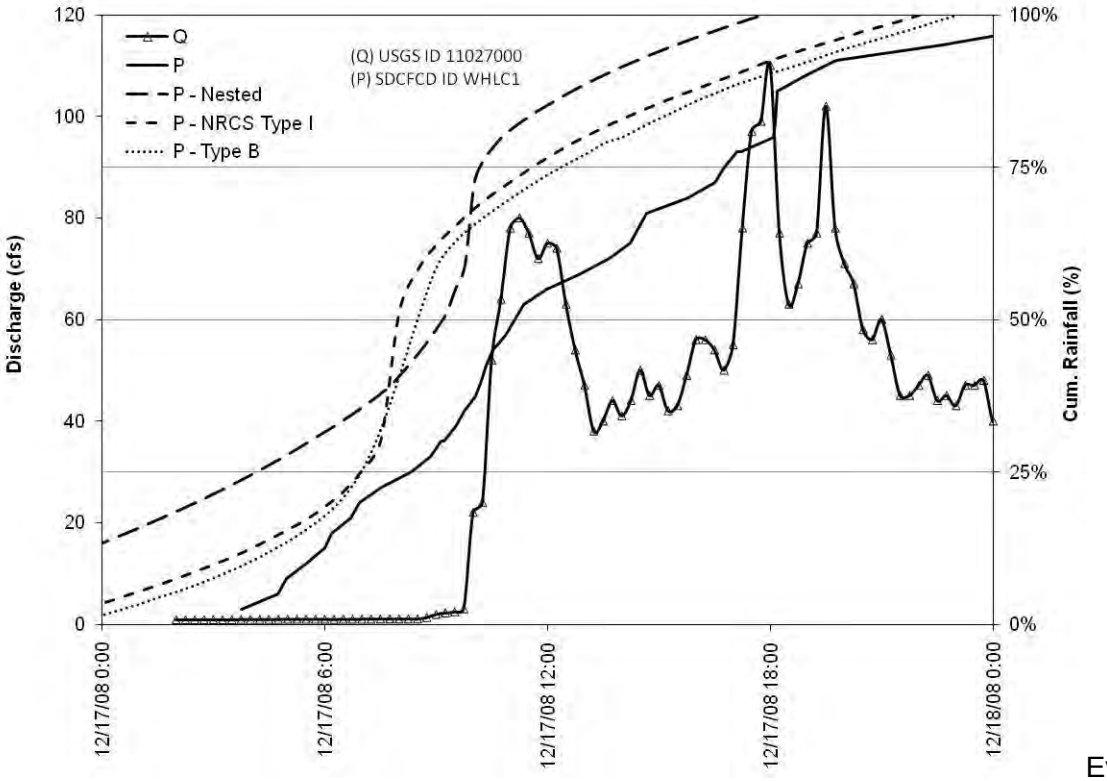
Event 2



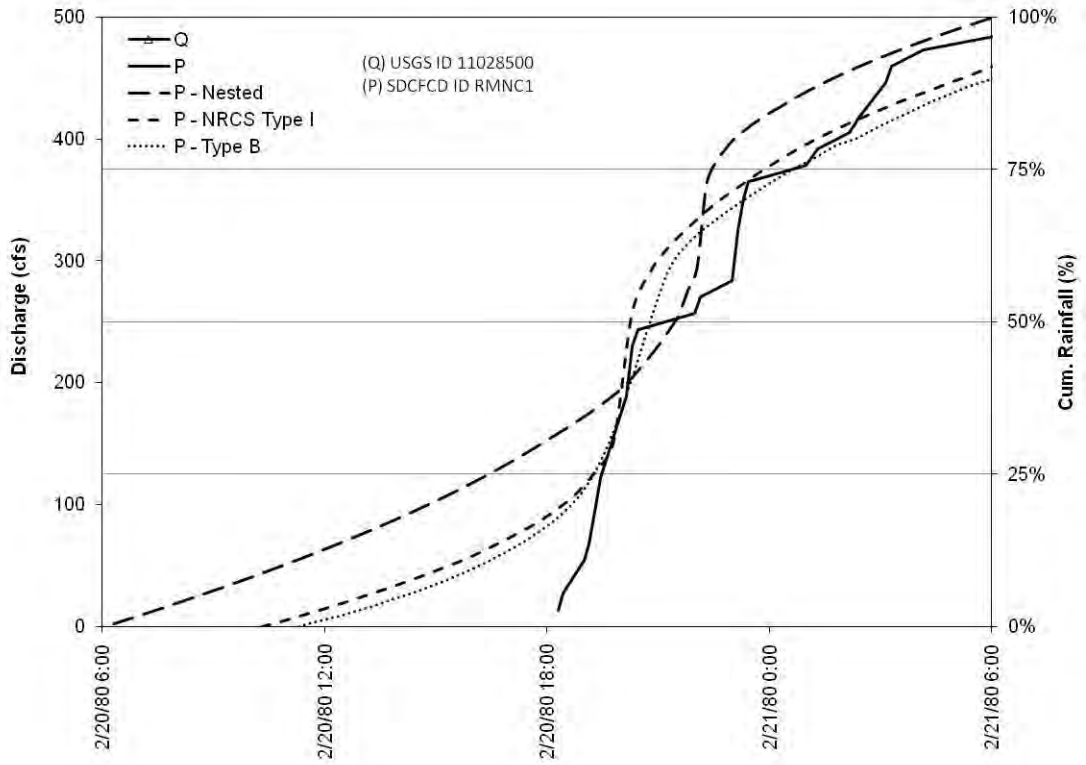
Event 3



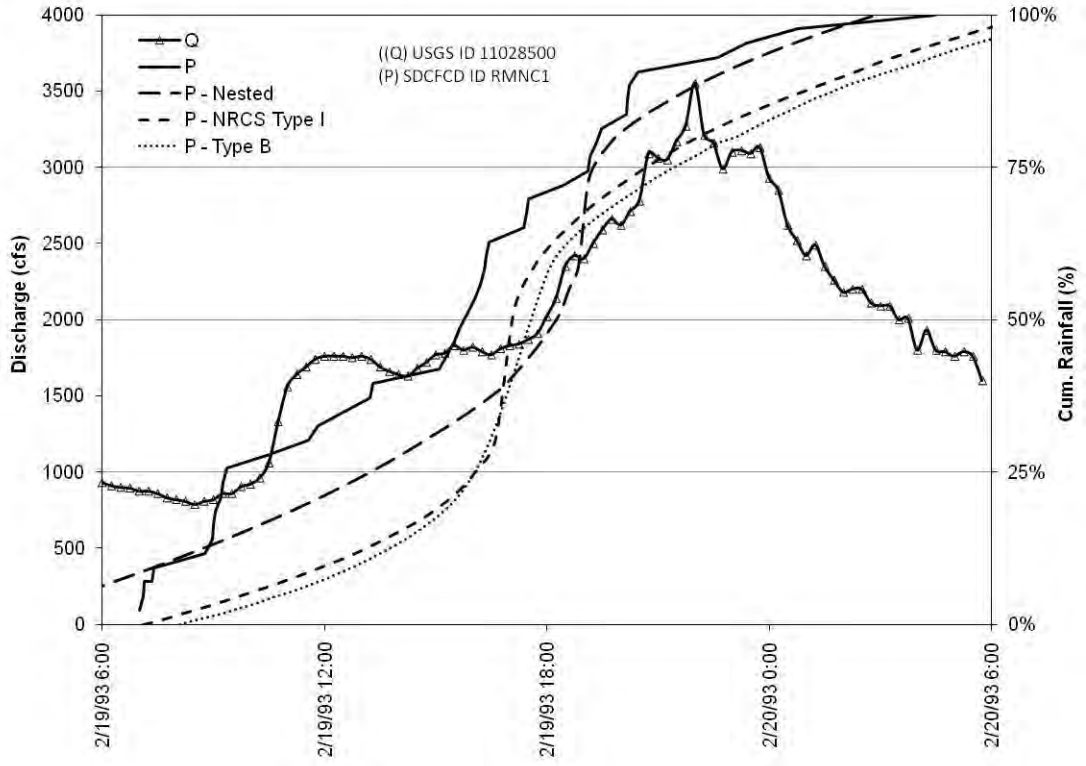
Event 4



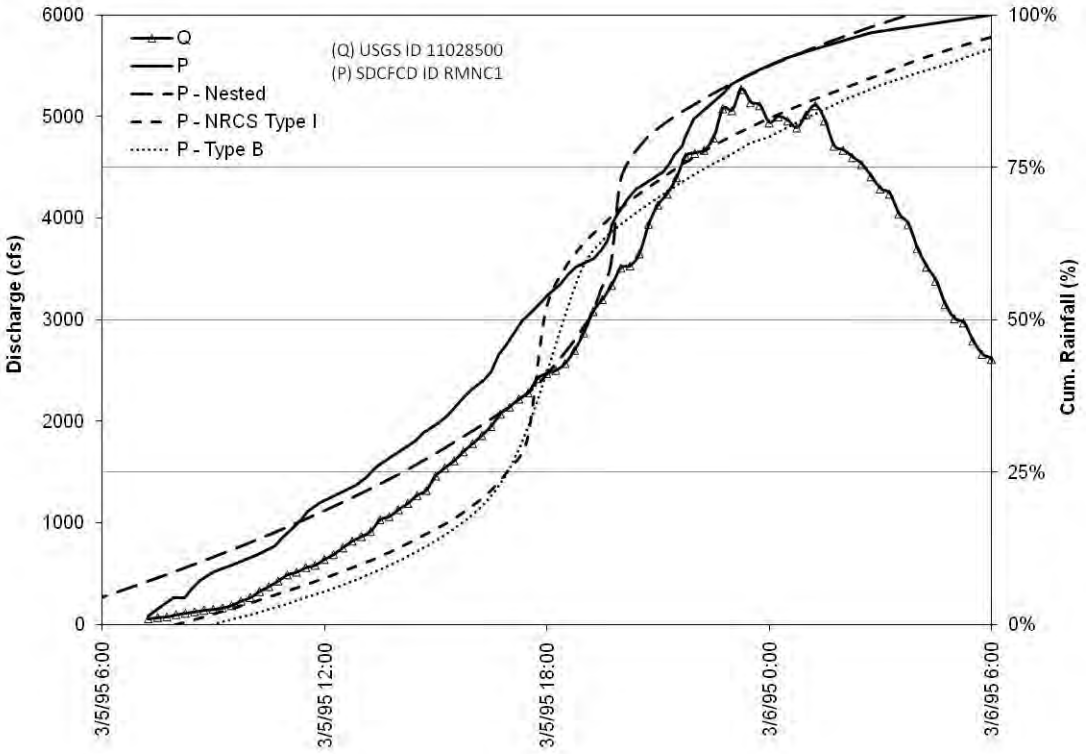
Event 5



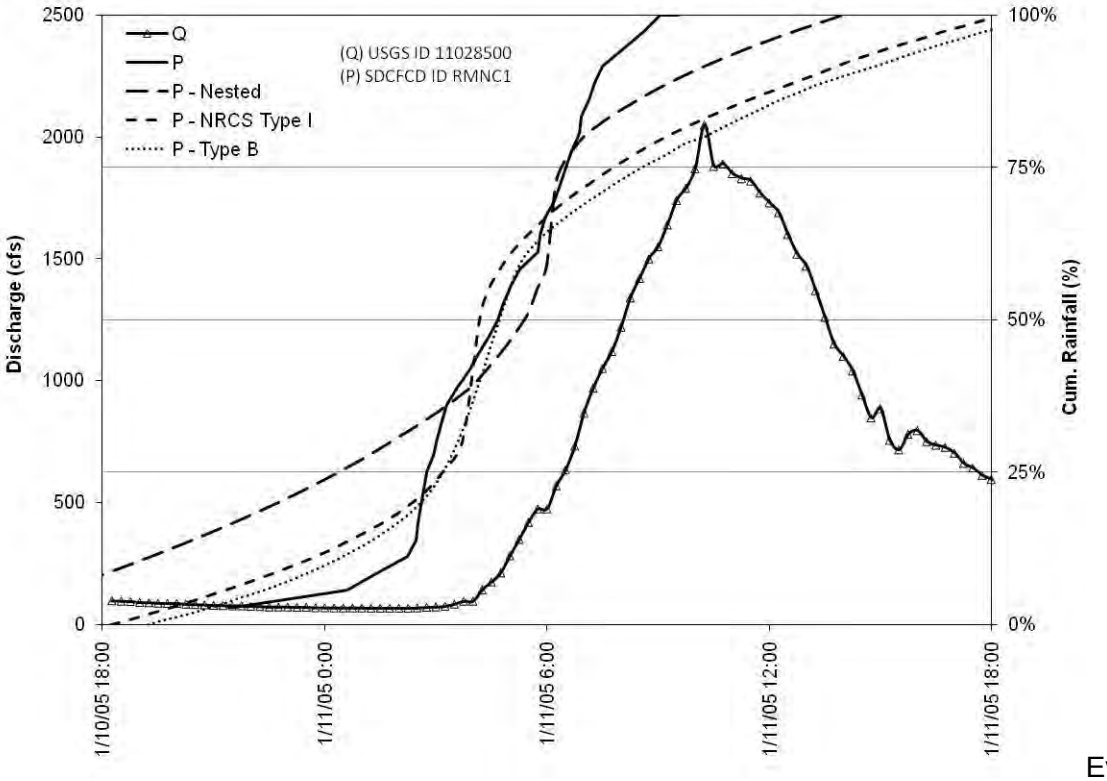
Event 1



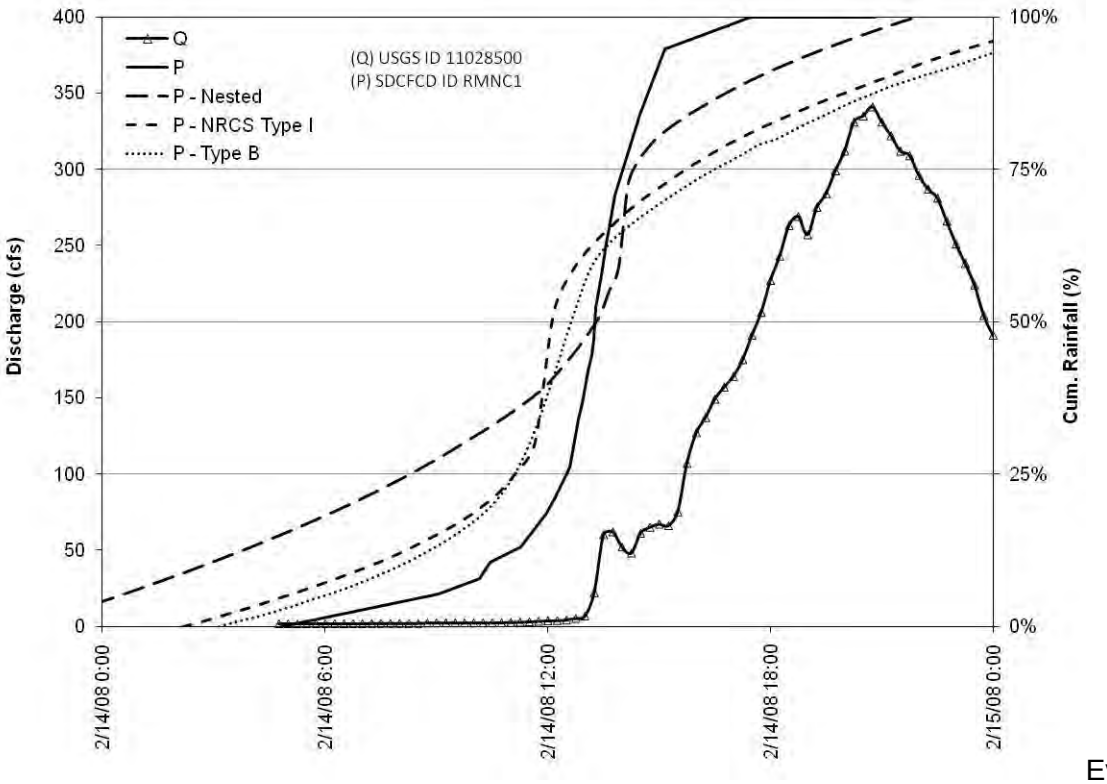
Event 2



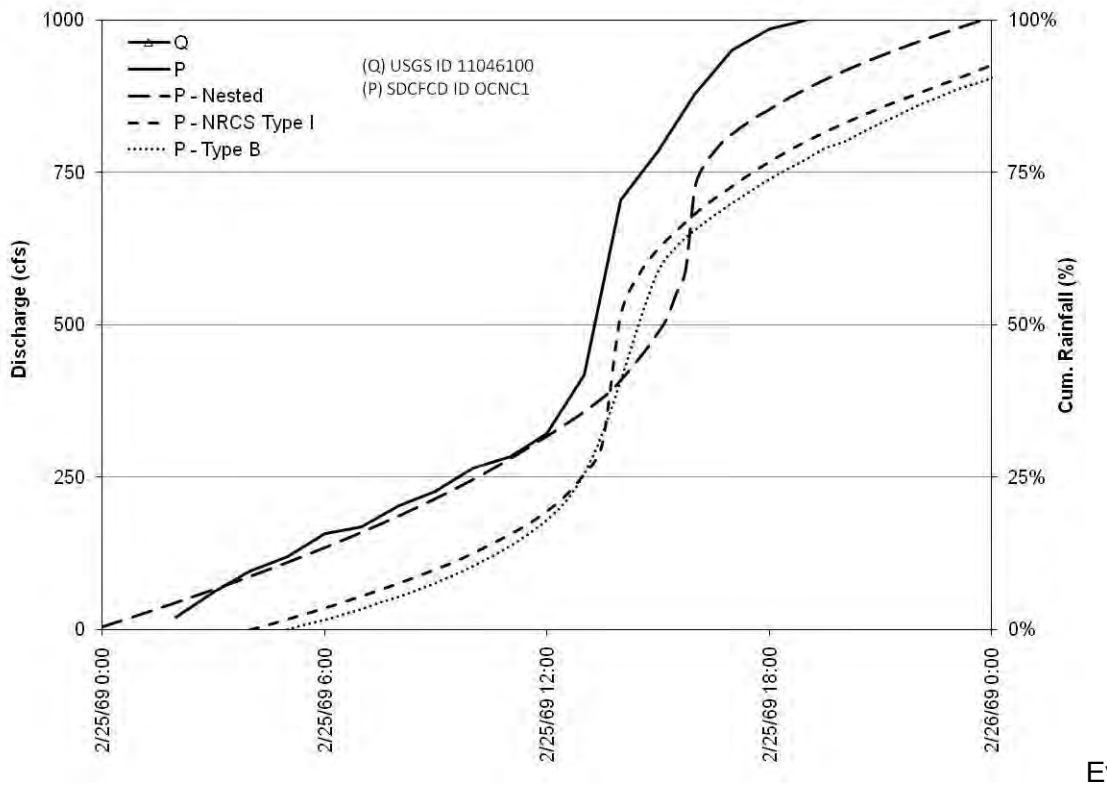
Event 3



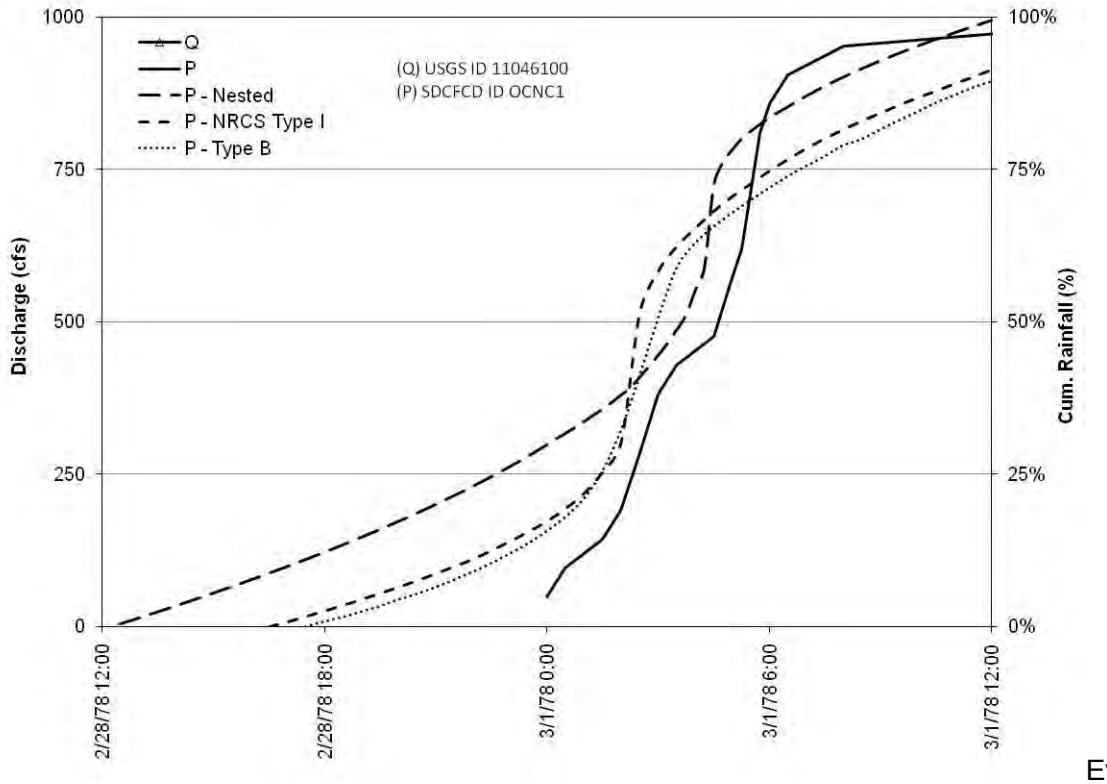
Event 4



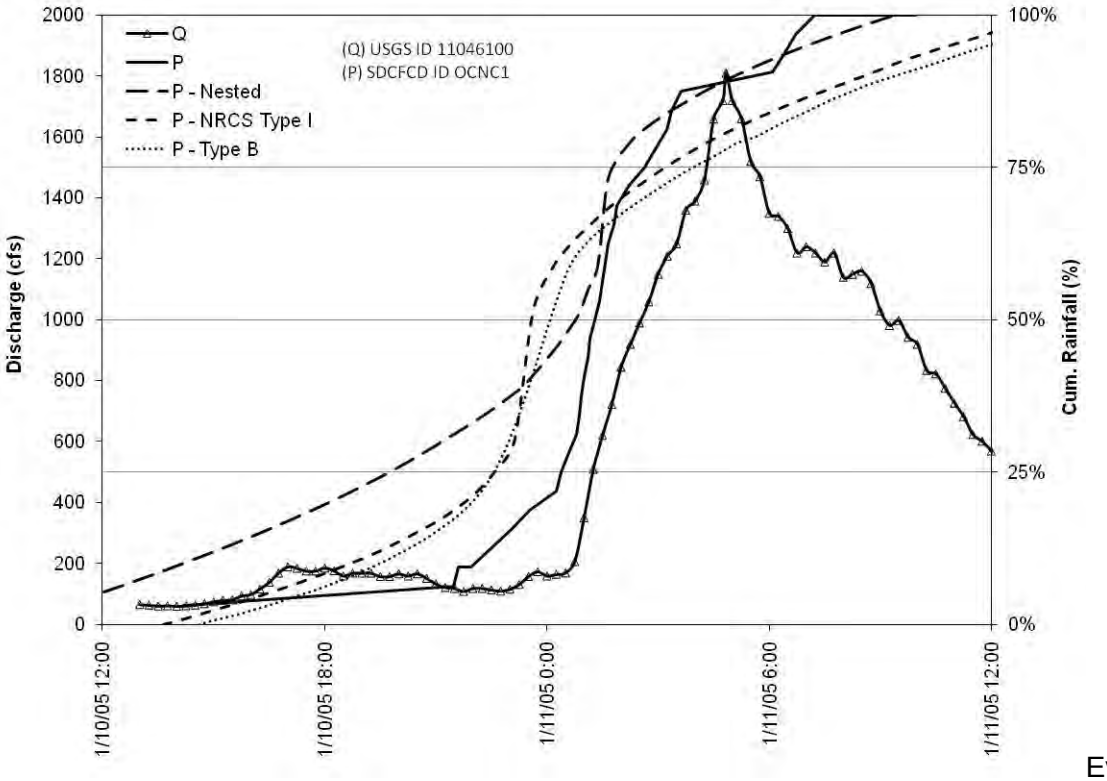
Event 5



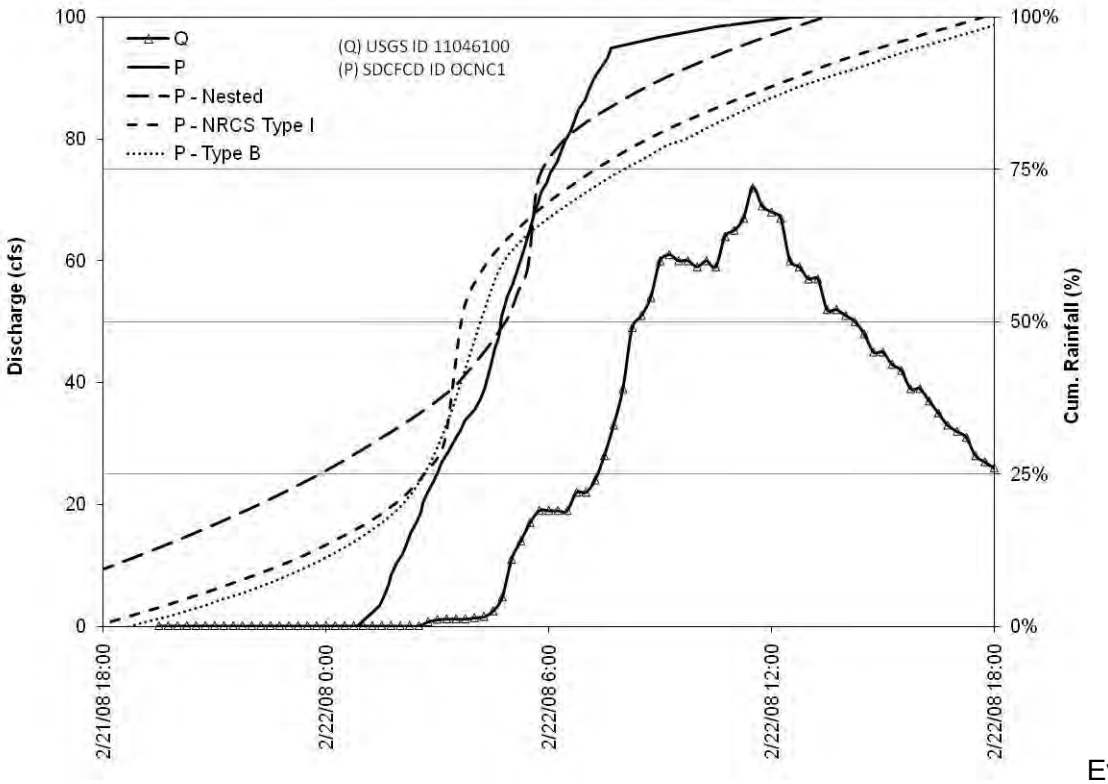
Event 1



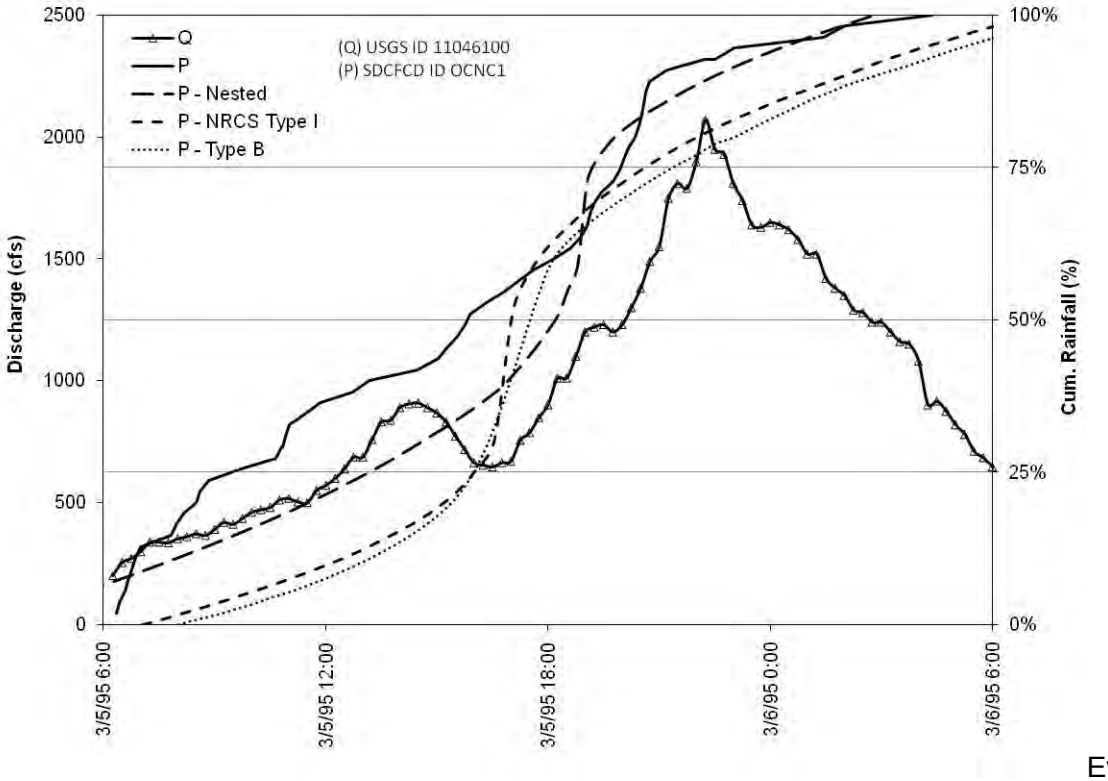
Event 2



Event 3



Event 4



Event 5

This page is intentionally left blank to facilitate 2-sided printing.

Appendix B.6

Cumulative Rainfall Distributions for the Three Events Used in this Study (Nested, Type B, NRCS Type I)

This page is intentionally left blank to facilitate 2-sided printing.

Table B6.1: Cumulative Rainfall Distributions for Nested, Type B and Type 1

	Cumulative Rainfall (%)		
Time (hr)	Nested	Type B	NRCS Type I
0.0	0.0%	0.0%	0.0%
0.5	1.2%	0.9%	0.8%
1.0	2.2%	1.6%	1.7%
1.5	3.2%	2.5%	2.6%
2.0	4.2%	3.4%	3.5%
2.5	5.3%	4.5%	4.5%
3.0	6.3%	5.4%	5.5%
3.5	7.4%	6.5%	6.5%
4.0	8.5%	7.7%	7.6%
4.5	9.6%	9.0%	8.7%
5.0	10.8%	10.4%	9.9%
5.5	12.0%	12.0%	11.1%
6.0	13.2%	13.7%	12.5%
6.5	14.4%	15.7%	14.0%
7.0	15.7%	18.0%	15.6%
7.5	17.0%	21.0%	17.3%
8.0	18.3%	25.5%	19.4%
8.5	19.7%	32.2%	21.9%
9.0	21.2%	41.0%	25.4%
9.5	22.7%	50.5%	30.3%
10.0	24.2%	58.8%	51.5%
10.5	25.9%	62.9%	58.3%
11.0	27.6%	65.6%	62.4%
11.5	29.4%	67.9%	65.4%
12.0	31.3%	70.0%	68.2%
12.5	33.2%	72.0%	70.6%
13.0	35.2%	73.9%	72.7%
13.5	37.4%	75.6%	74.8%
14.0	40.1%	77.2%	76.7%
14.5	43.6%	79.0%	78.5%
15.0	47.6%	80.0%	80.1%
15.5	53.1%	81.6%	81.6%
16.0	65.6%	83.1%	83.0%
16.5	77.2%	84.5%	84.3%
17.0	80.7%	86.0%	85.6%
17.5	83.0%	87.2%	86.8%
18.0	84.9%	88.5%	87.9%
18.5	86.7%	89.5%	89.1%
19.0	88.3%	90.5%	90.2%
19.5	89.8%	91.4%	91.4%
20.0	91.2%	92.4%	92.6%
20.5	92.6%	93.5%	93.6%
21.0	93.8%	94.5%	94.6%
21.5	95.0%	95.4%	95.5%
22.0	96.1%	96.3%	96.4%
22.5	97.2%	97.2%	97.4%
23.0	98.3%	98.1%	98.2%
23.5	99.3%	99.1%	99.1%
24.0	100.0%	100.0%	100.0%

Appendix B.7

County of San Diego Stream Gauge Data

This page is intentionally left blank to facilitate 2-sided printing.

Table B7.1: County of San Diego Stream Gauge Data

					REASON NOT USED					
GAGE #	NAME	BASIN	WS AREA	START	MAJOR RESERVOIR	MINOR DETENTION	OUT OF COUNTY	POOR DATA	ACCEPTABLE	NOTES
11012500	Campo Creek near Campo, CA	Tijuana River	85	1936	X	X	X			
11014000	Jamul Creek near Jamul, CA	Otay River	70.1	1940					X	
11016200	Sweetwater River at Dehesa, CA	Sweetwater River	131	2005	X					
11015000	Sweetwater River near Descanso, CA	Sweetwater River	45.4	1905					X	
11023000	San Diego River at Fashion Valley, at San Diego, CA	San Diego River	429	1982	X					
11022480	San Diego River at Mast Road, near Santee, CA	San Diego River	368	1916	X					
11022200	Los Coches Creek near Lakeside, CA	San Diego River	12.2	1983					X	
11023340	Los Penasquitos Creek near Poway, CA	Los Penasquitos Creek	42.1	1964		X				
11028500	Santa Maria Creek near Ramona, CA	San Dieguito River	57.6	1946					X	
11027000	Guejito Creek near San Pasqual, CA	San Dieguito River	22.5	1946					X	
11025500	Santa Ysabel Creek near Ramona, CA	San Dieguito River	112	1943	X					
11042000	San Luis Rey River at Oceanside, CA	San Luis Rey River	557	1916	X					
11036700	San Luis Rey River at Cole Grade Rd Near Pauma Valley, CA	San Luis Rey River	282	2008	X					
					REASON NOT USED					

GAGE #	NAME	BASIN	WS AREA	START	MAJOR RESERVOIR	MINOR DETENTION	OUT OF COUNTY	POOR DATA	ACCEPTABLE	NOTES
11035700	San Luis Rey River at Valley Center Rd Near Pauma Valley, CA	San Luis Rey River	261	2008	X					
11035550	San Luis Rey River at Oasis Crossing Near Pauma Valley, CA	San Luis Rey River	242	2008	X					
11044250	Rainbow Creek near Fallbrook, CA	Santa Margarita River	10.3	1989	X		X			
11044300	Santa Margarita River at Fallbrook Public Utility District Sump, near Fallbrook, CA	Santa Margarita River	620	1989	X		X			
11044350	Sandia Creek near Fallbrook, CA	Santa Margarita River	21.1	1989			X			
11045300	Fallbrook Creek near Fallbrook, CA	Santa Margarita River	6.97	1993		X				
11044800	De Luz Creek near De Luz, CA	Santa Margarita River	33	1992			X			
11045700	O'Neill Lake Spill Channel near Fallbrook, CA	Santa Margarita River	9.77	1998	X					
11045600	O'Neill Lake Outlet Channel near Fallbrook, CA	Santa Margarita River	9.77	1998	X					
11046000	Santa Margarita River at Ysidora, CA	Santa Margarita River	723	1923	X		X			
11046050	Santa Margarita River at Mouth, near Oceanside, CA	Santa Margarita River	744	1989	X		X			

					REASON NOT USED					
GAGE #	NAME	BASIN	WS AREA	START	MAJOR RESERVOIR	MINOR DETENTION	OUT OF COUNTY	POOR DATA	ACCEPTABLE	NOTES
11046090	Las Flores Creek at Las Pulgas Canyon, near Oceanside, CA	Las Flores Creek	15.6	1998					X*	WITHIN 11046100 WITH SHORTER PERIOD OF RECORD
11046100	Las Flores Creek near Oceanside, CA	Las Flores Creek	26.6	1951					X	
11046250	San Onofre Creek at San Onofre, CA	San Onofre Creek	42.2	1946		X		X		
11046360	Cristianitos Creek above San Mateo Creek, near San Clemente, CA	San Mateo Creek	31.6	1993			X			

APPENDIX C:
HYDROLOGIC BASIN MODELING FOR THE COUNTY OF SAN DIEGO RAINFALL DISTRIBUTION STUDY PROJECT

CIP No. 1140600

Prepared For:

County of San Diego, Watershed Protection Program
Department of Public Works
5510 Overland Avenue, Suite 410
San Diego, CA 92123

January 15th, 2013

Prepared By:

Bureau Veritas North America, Inc.
10620 Treena Street, Suite 200
San Diego, CA 92131
(858) 451-6100

This page is intentionally left blank to facilitate 2-sided printing.

Engineer's Certification

This report was prepared under the supervision of Charles S. Mohrlock, a Registered Civil Engineer in the State of California. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.



Charles S. Mohrlock, M.S., P.E., CFM
R.C.E. Number 78322

This page is intentionally left blank to facilitate 2-sided printing.

TABLE OF CONTENTS

1. PROJECT INTRODUCTION 1

2. SINGLE BASIN HEC-HMS HYDROLOGIC MODELS 2

2.1 General Basin Information 3

2.1.1 Basin Size and Location 3

2.1.2 PZN Adjustment Factors 4

2.1.3 Unadjusted CN Values 5

2.1.4 Adjusted CN Values 7

2.1.5 Lag Time 8

2.1.6 Unadjusted Rainfall Depths 11

2.1.7 Adjusted Rainfall Depths 12

2.2 Rainfall Distribution Information 13

2.2.1 SCS Type B Rainfall Distribution 13

2.2.2 SCS Type 1 Rainfall Distribution 14

2.2.3 Nested Rainfall Distribution 15

2.3 HEC-HMS Inputs 18

2.3.1 Basin Model Inputs 18

2.3.2 Meteorologic Model Inputs 19

2.3.3 Control Specification Inputs 20

2.3.4 Time-Series Data 20

2.4 HEC-HMS Outputs 21

3. REFERENCES 21

4. APPENDICES 21

LIST OF TABLES

Table 1: Example Las Flores PZN Adjustment Factor 4

Table 2: Example Las Flores Creek Adjusted CN Values 7

Table 3: Rainfall Depth-Area Adjustment Factor (Nested) 12

LIST FIGURES

Figure 1: Example Las Flores Creek Basin Delineation from USGS Topo Maps..... 3
Figure 2: Example Las Flores Creek Basin PZN Value Map 4
Figure 3: Example Las Flores Creek Unadjusted CN Value Maps 6
Figure 4: Example Las Flores Creek USGS Topography for Flow Path Characteristics..... 9
Figure 5: Example Las Flores Creek Aerial Imagery for Manning's n-value Determination 10
Figure 6: Example Las Flores Creek Basin $P_{100,24}$ and $P_{100,6}$ Unadjusted Rainfall Depths 11
Figure 7: Rainfall Depth-Area Adjustment Factor (Type B, Type 1) 12
Figure 8: SCS Type B 24-Hour Cumulative Distribution Ratio.....13
Figure 9: SCS Type B 6-Hour Cumulative Distribution Ratio.....13
Figure 10: SCS Type 1 24-Hour Cumulative Distribution Ratio 14
Figure 11: Example Las Flores Creek Basin Log-Log Distribution 15
Figure 12: Construction of Nested Hydrograph (2003 SDCHM).....16

LIST OF APPENDICES

C.1 Type B, Type 1, Nested, and Gauge Results Comparison Summary
C.2 PZN Adjustment Factors
C.3 Unadjusted CN Values
C.4 Adjusted CN Values
C.5 Lag Time Calculations
C.6 Unadjusted Rainfall Depths (Isopluvial Maps)
C.7 Adjusted Rainfall Depths
C.8 SCS Type B Distribution
C.9 SCS Type 1 Distribution
C.10 Nested Rainfall Distribution
C.11 1993 vs 2003 San Diego County Hydrology Manual
C.12 HEC-HMS Outputs

ABBREVIATIONS AND ACRONYMS

ArcGIS	Geographic Information Systems Software
BVNA	Bureau Veritas North America, Inc.
CN	Curve Number
GIS	Geographic Information Systems
HEC	Hydrologic Engineering Center
HMS	Hydrologic Modeling System
NRCS	Natural Resources Conservation Service
PZN	Precipitation Zone Number
SANGIS	San Diego Geographic Information Systems
SCS	Soil Conservation Service
SDCHM	San Diego County Hydrology Manual
SSURGO	Soil Survey Geographic
Topo	Topography
USGS	United States Geological Survey

1. PROJECT INTRODUCTION

The County of San Diego has retained the services of Bureau Veritas North America, Inc. (BVNA) to perform an analysis of the region's current Nested rainfall distribution methodology. Tasks performed by BVNA within the scope of this analysis included research of existing rainfall distribution methodologies used in the southwestern United States (Appendix A), processing of available United States Geological Survey (USGS) stream gauge data for six (6) basins within the County of San Diego (Appendix B), and creation of HEC-HMS models considering SCS Type B, SCS Type 1, and Nested rainfall distributions for the same six (6) basins in which stream gauge data was analyzed (Appendix C). A comparison of the results from Appendices B and C was then performed in order to determine the relationship between the available USGS peak stormwater flow rates and the peak stormwater flow rates determined by the HEC-HMS models for SCS Type B, SCS Type 1, and Nested rainfall distributions.

This portion of the report, Appendix C, created six (6) single-basin HEC-HMS hydrologic models of basins located within the County of San Diego for which USGS stream gauge data was available and generated basin outflow hydrographs for a series of assumed storm events and storm distributions as identified below.

Basin Models:

1. Guejito Creek
2. Jamul Creek
3. Las Flores Creek
4. Los Coches Creek
5. Santa Maria Creek
6. Sweetwater River

Storm Events and Distributions Considered for Each Model:

1. SCS Type B Rainfall Distribution
    - 100-year, 10-year, 5-year, and 2-year -- 24-hour storm events
    - 100-year, 10-year, 5-year, and 2-year -- 6-hour storm events
2. SCS Type 1 Rainfall Distribution
    - 100-year, 10-year, 5-year, and 2-year -- 24-hour storm events
    - 100-year, 10-year, 5-year, and 2-year -- 6-hour storm events
3. Nested Rainfall Distribution
    - 100-year, 10-year, 5-year, and 2-year -- 24-hour storm events
    - *Note: 6-hour storm event is not applicable to the Nested rainfall distribution.

2. SINGLE BASIN HEC-HMS HYDROLOGIC MODELS

Six (6) single-basin HEC-HMS hydrologic models have been developed for basins with available USGS stream gauge data. These basins include the following:

1. Guejito Creek
2. Jamul Creek
3. Las Flores Creek
4. Los Coches Creek
5. Santa Maria Creek
6. Sweetwater River

General basin information such as basin size and location, PZN adjustment factors, unadjusted CN values, adjusted CN values, lag times, unadjusted rainfall depths, and adjusted rainfall depths, were determined for these basins as discussed in Section 2.1 of this report. Rainfall distribution information related to the SCS Type B rainfall distribution, SCS Type 1 rainfall distribution, and Nested rainfall distribution was determined as discussed in Section 2.2 of this report. This information was used to populate the required hydrologic inputs for the HEC-HMS models and generate outflow hydrographs at each basin. A comparison summary of the SCS Type B, SCS Type 1, Nested, and USGS gauge results is provided in Appendix C.1 of this report.

2.1 General Basin Information

2.1.1 Basin Size and Location

Basin delineations have been determined through examination of USGS topographic maps available through the ArcGIS online database. Known USGS stream gauge locations were identified on the maps and basin delineations were determined through examination of the USGS contours. This process created a georeferenced ArcGIS model for each basin that provided basin information including basin size and basin location. As discussed in the sections that follow, these georeferenced models also allowed for various land use, soil type, hydrologic conditions, and aerial imagery overlays to be applied to the basin areas in order to determine necessary hydrologic characteristics. The accuracy of each ArcGIS basin model determined by this method was also confirmed through examination of available hydrologic basin maps provided by the County of San Diego.

Figure 1 below illustrates the basin delineation for Las Flores Creek as determined per examination of 1:24,000 scale USGS Topo Maps (bottom left). For illustrative purposes, a 2010 aerial image overlay is also included (bottom right).

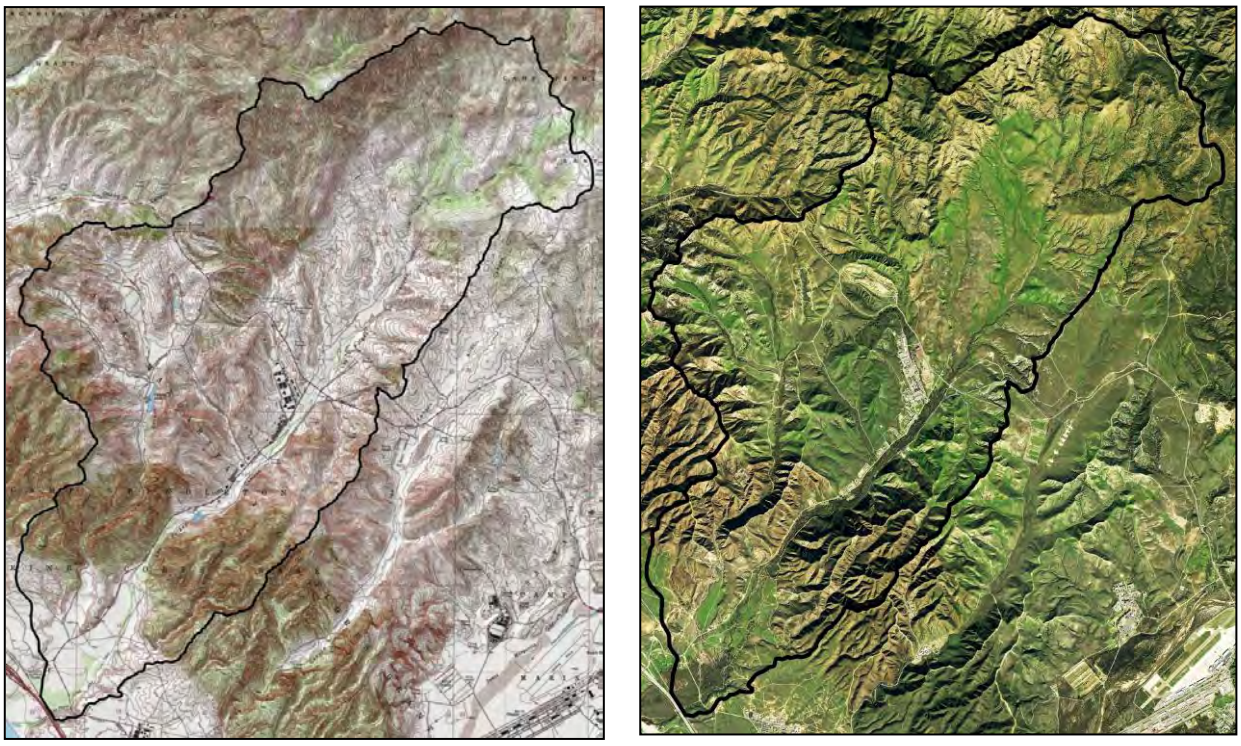


Figure 1: Example Las Flores Creek Basin Delineation from USGS Topo Maps

2.1.2 PZN Adjustment Factors

PZN adjustment factors have been determined per guidelines set forth in Section 4.1.2.4 of the 2003 SDCHM. These factors reflect the orographic effects within San Diego County and are utilized to adjust basin CN values as described in Section 2.1.4 of this report. Determining PZN adjustment factors for each basin is a two-step process as described below.

First, PZN values for each basin were determined by creating an exhibit that overlaid known basin boundaries with the PZN Map located in Appendix C of the 2003 SDCHM. Through visual inspection of this exhibit, a PZN value was interpolated with respect to the area centroid of each basin. See Figure 2 at right for an excerpt of this exhibit depicting the Las Flores Creek basin.

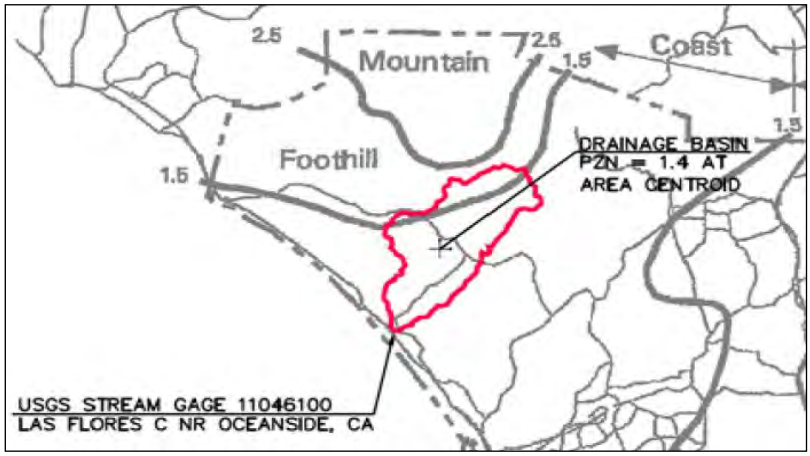


Figure 2: Example Las Flores Creek Basin PZN Value Map

Second, PZN adjustment factors were determined for each basin by linearly interpolating the values provided in Table 4-6 of the 2003 SDCHM with respect to the previously determined PZN values and the desired storm frequency. For example, the Las Flores Creek basin illustrated in Figure 2 above was found to have a PZN value of 1.4. Per linear interpolation of the data in Table 4-6 of the 2003 SDCHM, as shown in Table 1, the Las Flores Creek basin was calculated to have a PZN adjustment factor of 2.4 for the 100-year storm event and PZN adjustment factor of 1.9 for the 10, 5, and 2-year storm events.

Table 4-6

PZN ADJUSTMENT FACTORS FOR FLOW COMPUTATIONS
(San Diego County)

Storm Frequency	Coast (PZN = 1.0)	1.4	Foothills (PZN = 2.0)	Mountains (PZN = 3.0)	Desert (PZN = 4.0)
Less than 35-year return period	1.5	1.9	2.5	2.0	1.5
Greater than or equal to 35-year return period	2.0	2.4	3.0	3.0	2.0

Notes: PZN is the precipitation zone number (see Map, Appendix C). The PZN adjustment factor represents the PZN Condition that the CN for the watershed should be adjusted to.

Table 1: Example Las Flores PZN Adjustment Factor

More detailed information regarding PZN adjustment factors is included in Appendix C.2 of this report.

2.1.3 Unadjusted CN Values

Unadjusted CN values have been determined per guidelines set forth in Section 4.1.2 of the 2003 SDCHM. These values represent the relationship between rainfall and runoff for a watershed based upon characteristics such as soil type, ground cover, and hydrologic condition.

The soil types present within each basin have been determined by overlaying basin delineations with available soils information in ArcGIS. The soil information utilized in this analysis was taken from the Soil Survey Geographic (SSURGO) soil survey dated December 17, 2007.

The types of ground cover present within each basin have been determined by overlaying basin delineations with SANGIS land use and vegetation data in ArcGIS. Because SANGIS land use and vegetation designations do not directly correlate with the ground cover descriptions utilized in the 2003 SDCHM, it was necessary to convert the SANGIS land use and vegetation designations to the NRCS cover descriptions specified in the 2003 SDCHM. Relationships between these cover designations were developed using good engineering judgment and are included in Appendix C.3 of this report.

The hydrologic conditions within each basin have been determined through visual observation of available aerial photography from 2010. Observed conditions were classified as good, fair, or poor per Hydrologic Conditions Classification Tables 4-3 through 4-5 of the 2003 SDCHM and an ArcGIS shapefile was created to represent the observed hydrologic conditions.

After basin characteristics such as soil type, ground cover, and hydrologic condition were identified, appropriate CN values were then determined from data provided in Table 4-2 of the 2003 SDCHM. Figure 3 on the next page illustrates the soil type, ground cover, hydrologic condition, and unadjusted CN value shapefiles associated with the Las Flores Creek basin.

More detailed information regarding unadjusted CN values is included in Appendix C.3 of this report.

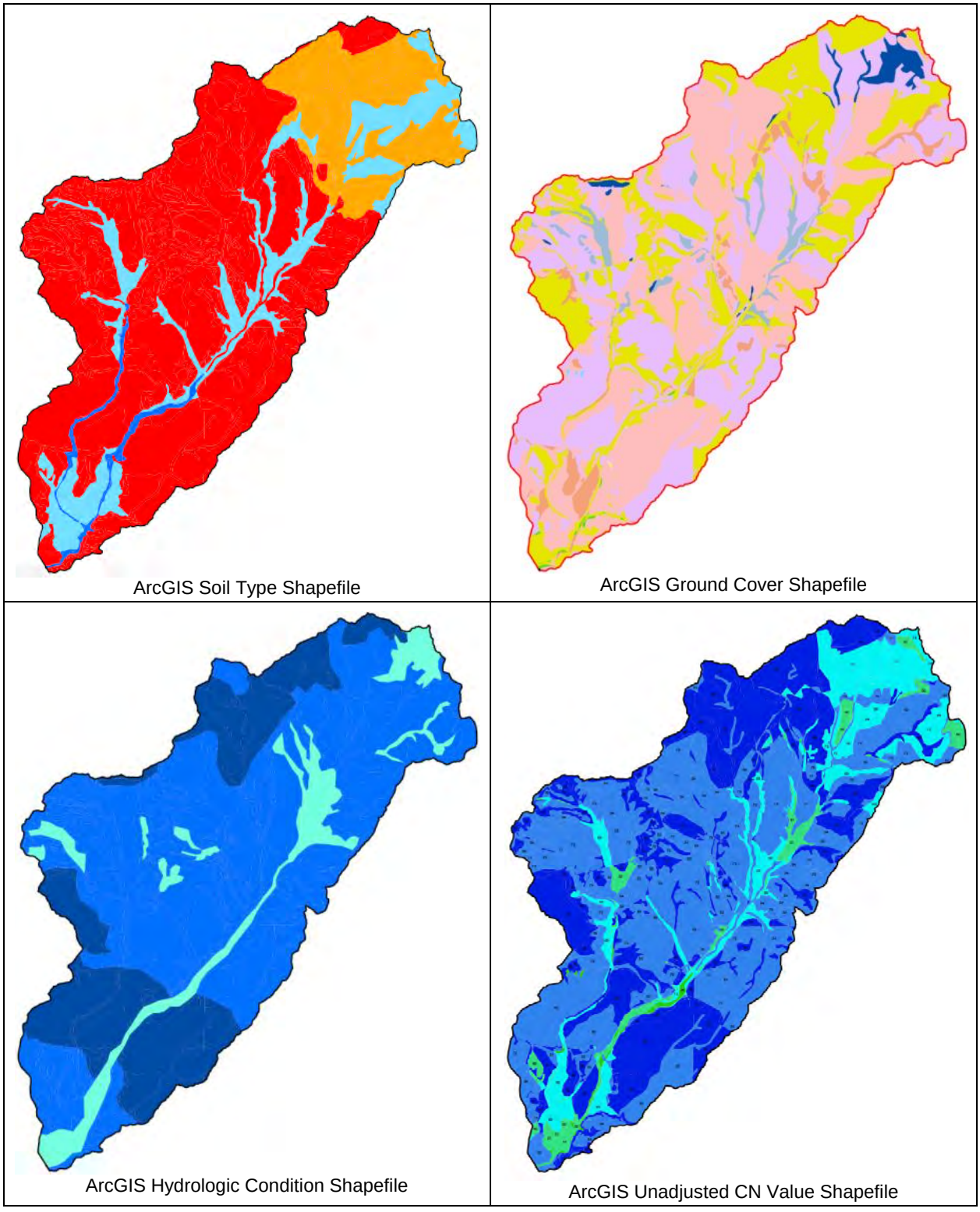


Figure 3: Example Las Flores Creek Unadjusted CN Value Maps

2.1.4 Adjusted CN Values

Adjusted CN values have been determined per guidelines set forth in Section 4.2.4 of the 2003 SDCHM. Similar to the unadjusted CN Values, these values represent the relationship between the rainfall and runoff for a watershed based upon characteristics such as soil type, ground cover, and hydrologic condition; however, the adjusted CN values also take into account basin characteristics such as the storm frequency and PZN adjustment factor. Adjusted CN values were determined through linear interpolation of the data provided in Table 4-10 of the 2003 SDCHM.

First, the unadjusted CN value for each basin, as determined in Section 2.1.3 of this report, was located in the column titled "PZN Condition = 2.0". The adjusted CN value was then linearly interpolated from the values located immediately to the left or right of this value with respect to the appropriate PZN adjustment factor as determined in Section 2.1.2 of this report.

The calculations of the adjusted CN values for the Las Flores Creek basin are depicted in Table 2 at right. The unadjusted CN value for the Las Flores Creek basin was 82. Therefore, the adjusted CN value for the 2, 5, and 10-year storm events (PZN Condition 1.9) is 80 and the adjusted CN for the 100-year storm event (PZN Condition 2.4) is 86.

More detailed information regarding adjusted CN values is included in Appendix C.4 of this report.

Table 4-10

RUNOFF CURVE NUMBERS FOR PZN CONDITIONS 1.0, 2.0, AND 3.0

CN For:			CN For:		
PZN Condition = 1.0	PZN Condition = 2.0	PZN Condition = 3.0	PZN Condition = 1.0	PZN Condition = 2.0	PZN Condition = 3.0
100	100	100	40	60	78
97	99	100	39	59	77
94	98	99	38	58	76
91	97	99	37	57	75
89	96	99	37	56	75
87	95	98	34	55	73
85	94	98	34	54	73
83	93	98	33	53	72
81	92	97	32	52	71
80	91	97	31	51	70
78	90	96	31	50	70
76	89	96	30	49	69
75	88	95	29	48	68
73	87	95	28	47	67
72	86	94	27	46	66
70	85	94	26	45	65
68	84	93	25	44	64
67	83	93	25	43	63
66	82	92	24	42	62
64	81	92	23	41	61
63	80	91	22	40	60
62	79	91	21	39	59
60	78	90	21	38	58
59	77	89	20	37	57
58	76	89	19	36	56
57	75	88	18	35	55
55	74	88	18	34	54
54	73	87	17	33	53
53	72	86	16	32	52
52	71	86	16	31	51
51	70	85	15	30	50
50	69	84			
48	68	84	12	25	43
47	67	83	9	20	37
46	66	82	6	15	30
45	65	82	4	10	22
44	64	81	2	5	13
43	63	80	0	0	0
42	62	79			
41	61	78			

Table 2: Example Las Flores Creek Adjusted CN Values

2.1.5 Lag Time

Lag times have been determined per guidelines set forth in Section 4.3.1 of the 2003 SDCHM. There are two types of lag time defined in the 2003 SDCHM, United States Army Corps of Engineers (Corps Lag) and NRCS lag. This analysis utilizes the NRCS lag times in its calculations. The NRCS lag of a watershed is defined as the time for the center of mass of excess rainfall to the time of the peak of the unit hydrograph and is calculated per equations 4-17 and 4-21 of the 2003 SDCHM.

Several key hydrologic characteristics of a basin affect its calculated lag time including:

- Length of the longest watercourse within the basin
    - This length was determined by overlaying basin boundaries with available USGS topographic maps and measuring the length of the longest watercourse.
- Length to centroid of watercourse
    - This length was determined by first identifying the area-centroid of the basin then measuring the length of the flow path from the low point of the watershed to the area-centroid.
- Highest elevation along the longest watercourse
    - This elevation was determined through examination of the USGS contours at the most upstream portion of the watercourse.
- Lowest elevation along the watercourse
    - This elevation was determined through examination of the USGS contours at the most downstream portion of the watercourse.
- Overall slope of the longest watercourse
    - The overall slope of the longest watercourse was determined by dividing the difference between the highest and lowest elevations on the watercourse (in feet) by the length of the longest watercourse (in miles).
- Average Manning's n-values of the watercourse and its tributaries
    - Manning's n-values were determined from Table A-5 of the 2005 San Diego County Drainage Design Manual through examination of 2010 aerial photographs of the entire watercourse.

Figures 4 and 5 on the pages that follow illustrate the exhibits utilized in the determination of lag times for the Las Flores Creek Basin. Figure 4 illustrates the use of 1:24,000 scale USGS Topo Maps to determine the length of the longest watercourse within the basin, the length of the longest watercourse measured upstream to a point opposite the watershed centroid, the highest elevation along the longest watercourse, the lowest elevation along the watercourse and the overall slope of the longest watercourse. Figure 5 illustrates the use of aerial photography for the determination of Manning's n-values. More detailed information regarding lag time calculations is included in Appendix C.5 of this report.

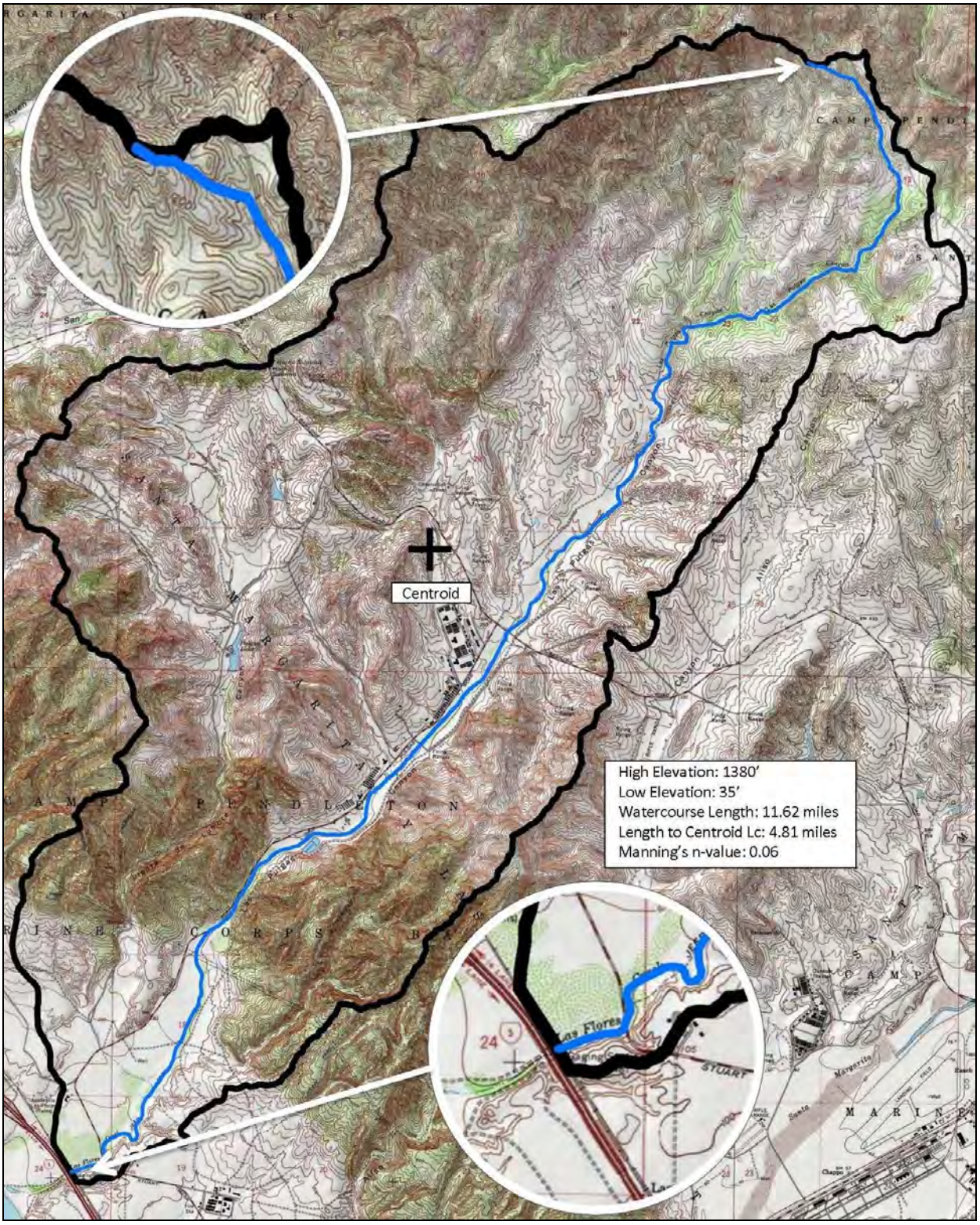


Figure 4: Example Las Flores Creek USGS Topography for Flow Path Characteristics

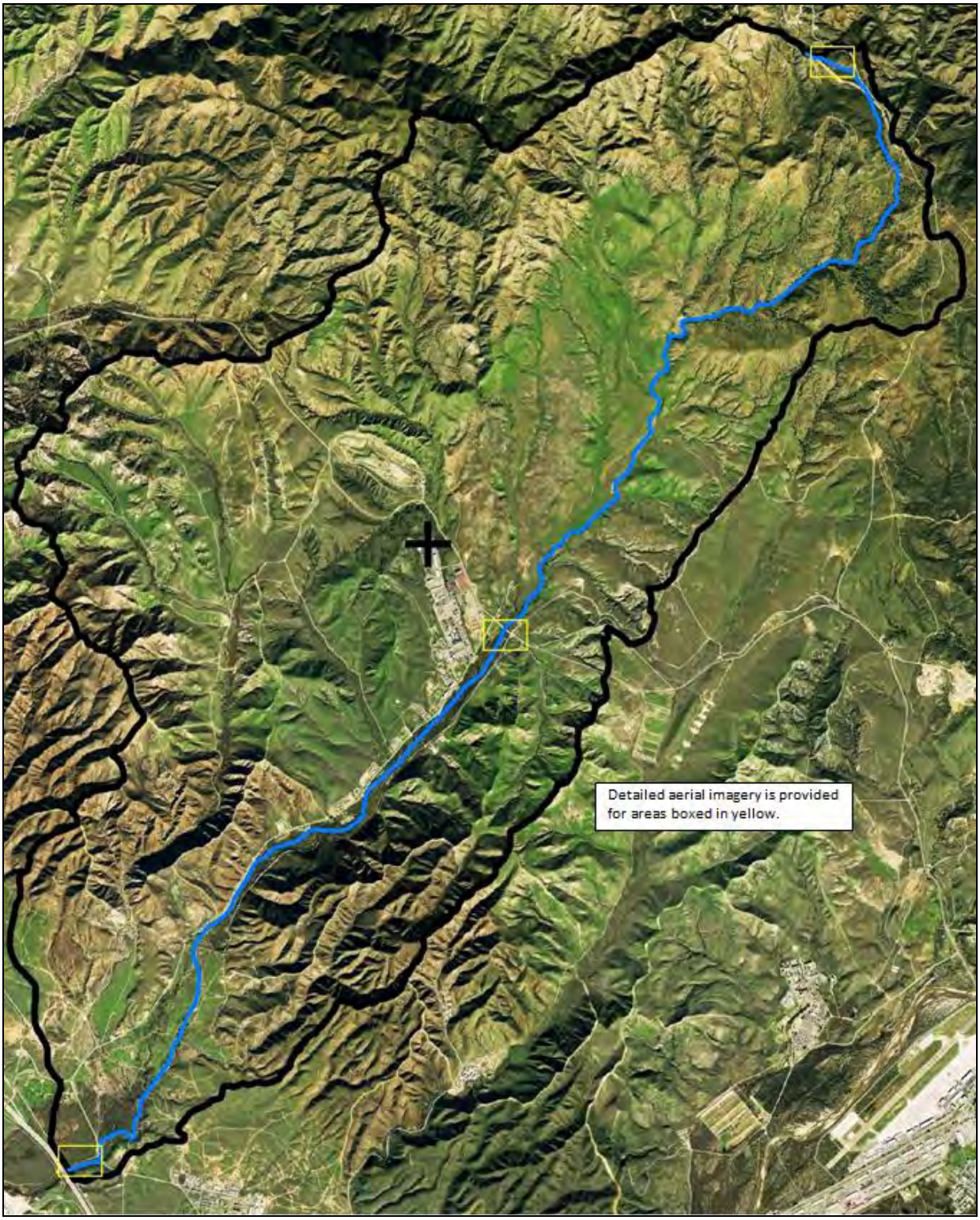


Figure 5: Example Las Flores Creek Aerial Imagery for Manning's n-value Determination

2.1.6 Unadjusted Rainfall Depths

Unadjusted rainfall depths have been determined per guidelines set forth in Section 4.2.2 of the 2003 SDCHM. These values represent the depth of rain, in inches, that is anticipated to fall at a given point within each basin for 2, 5, 10, and 100-year storm events for two different storm durations, the 24-hour storm (P_{24}) and the 6-hour storm (P_6). Rainfall depths for 24-hour and 6-hour storm events were determined for each basin by utilizing AutoCAD to overlay the basin boundaries onto Isopluvial Maps located in Appendix B of the 2003 SDCHM and visually interpolating a rainfall depth with respect to the area centroid of each basin. If P_6 values were not within 45% to 65% of the P_{24} values, P_6 values were increased or decreased as necessary to be within this range.

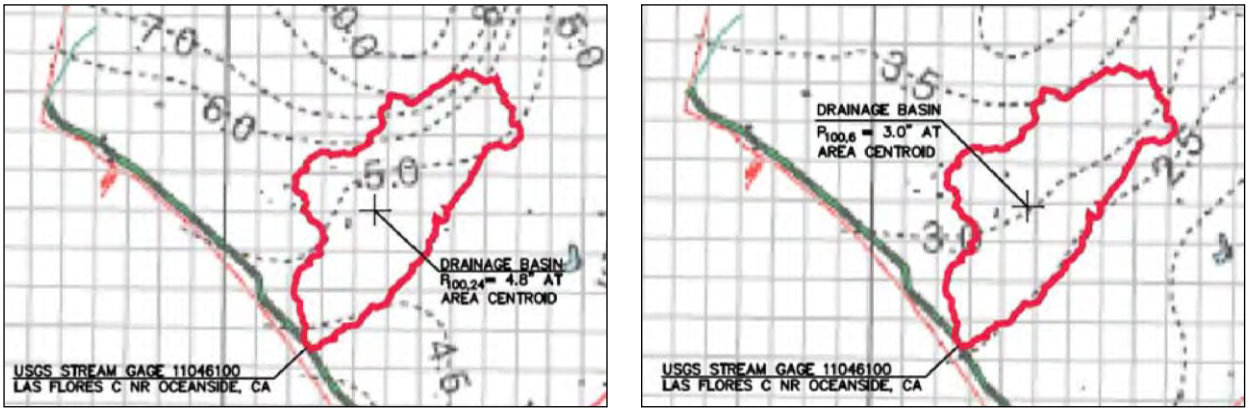


Figure 6: Example Las Flores Creek Basin $P_{100,24}$ and $P_{100,6}$ Unadjusted Rainfall Depths

Figure 6 above illustrates that unadjusted rainfall depths for the Las Flores Creek Basin are 4.8" for a 100 year, 24-hour storm event and 3.0" for a 100 year, 6-hour storm event.

More detailed information regarding unadjusted rainfall depths is included in Appendix C.6 of this report.

2.1.7 Adjusted Rainfall Depths

Adjusted rainfall depths have been determined utilizing different methodologies for each type of storm distribution being modeled. As described below, the adjusted rainfall depths for SCS Type B and SCS Type 1 distributions were determined per guidelines set forth in the 1993 SDCHM while adjusted rainfall depths for the Nested distribution were determined per guidelines set forth in the 2003 SDCHM. Adjusted rainfall depths differ from unadjusted rainfall depths in that adjusted rainfall depths represent the average rainfall depth anticipated over a given area while the unadjusted rainfall depths represent the point rainfall depth anticipated for a point within a given area.

Adjusted rainfall depths for the SCS Type 1 and SCS Type B distributions have been determined per guidelines set forth in Section II.B and Figure II-B-2 of the 1993 SDCHM. Adjusted rainfall depths for 24-hour and 6-hour storms were determined for each basin by multiplying the unadjusted rainfall depths, as determined in Section 2.1.6 of this report, by a rainfall depth-area adjustment factor obtained from Figure II-B-2 of the 1993 SDCHM (see Figure 7 at right). These rainfall depth-area adjustment factors were visually determined by intersecting known basin area values with the "Pacific Coastal Climate" graph and reading the associated adjustment factor from the y-axis.

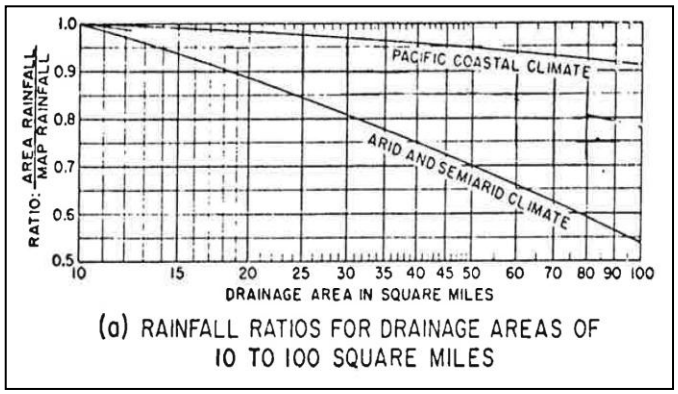


Figure 7: Rainfall Depth-Area Adjustment Factor

Adjusted rainfall depths for the Nested distribution have been determined per guidelines set forth in Section 4.1.1.3 and Table 4-1 of the 2003 SDCHM. These depths were determined for each basin by multiplying the unadjusted rainfall depths, as determined in Section 2.1.6 of this report, by a series of rainfall depth-area adjustment factors associated with 30-minute, 1-hour, 3-hour, 6-hour, and 24-hour storms. These rainfall depth-area adjustment factors were linearly interpolated from the data on Table 4-1 of the 2003 SDCHM (see Table 3 at right) with respect to the basin area and the duration of the storm.

More detailed information regarding adjusted rainfall depths for SCS Type 1 and SCS Type B Distributions is included in Appendix C.9 of this report. More detailed information regarding adjusted rainfall depths for the Nested distribution is included in Appendix C.10 of this report.

Watershed Area (square miles)	Rainfall Depth-Area Adjustment for Duration				
	30-Minute	1-Hour	3-Hour	6-Hour	24-Hour
0	1.000	1.000	1.000	1.000	1.000
5	0.942	0.970	0.980	0.985	0.990
10	0.900	0.947	0.970	0.980	0.985
20	0.834	0.900	0.952	0.963	0.975
30	0.768	0.858	0.932	0.950	0.964
40	0.730	0.830	0.915	0.940	0.958
50	0.692	0.800	0.900	0.928	0.952
60	0.663	0.778	0.883	0.920	0.948
70	0.645	0.760	0.872	0.912	0.945
80	0.630	0.746	0.862	0.904	0.942
90	0.620	0.735	0.853	0.896	0.938
100	0.610	0.722	0.845	0.890	0.935
125	0.588	0.700	0.830	0.878	0.930
150	0.572	0.685	0.818	0.865	0.925
175	0.572	0.672	0.808	0.858	0.922
200	0.572	0.666	0.798	0.851	0.918
225	0.572	0.660	0.790	0.845	0.915
250	0.572	0.655	0.787	0.842	0.914
300	0.572	0.652	0.782	0.838	0.912
350	0.572	0.652	0.780	0.830	0.910
400	0.572	0.652	0.780	0.828	0.908

Table 3: Rainfall Depth-Area Adjustment Factor

2.2 Rainfall Distribution Information

2.2.1 SCS Type B Rainfall Distribution

The SCS Type B rainfall distributions for each basin have been determined for 100, 10, 5, and 2 year storm events for 6-hour and 24-hour storm durations. Basin specific distribution calculations are included in Appendix C.8 of this report, while a general discussion of the methodology used to generate the SCS Type B cumulative rainfall distribution ratios is included below.

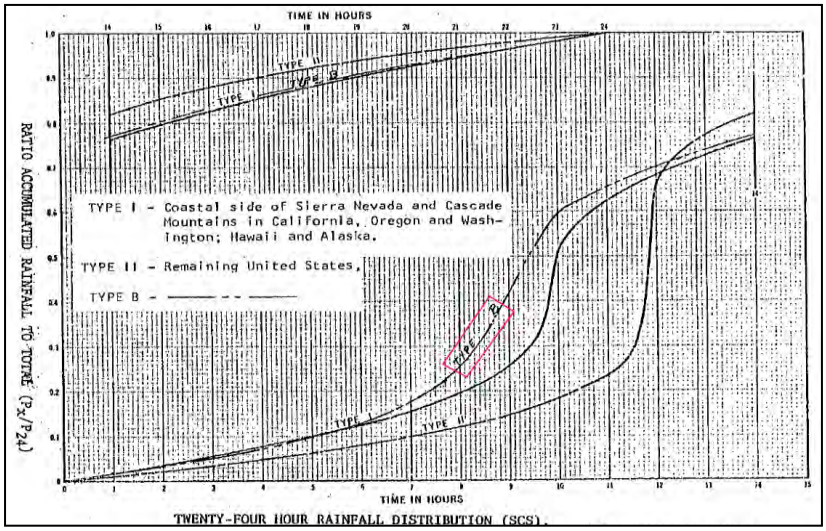


Figure 8: SCS Type B 24-Hour Cumulative Distribution Ratio

SCS Type B 24-hr cumulative rainfall distribution ratios have been determined through linear interpolation of the ratios provided in Table II-B-2 of the 1993 SDCHM. The rainfall ratios in Table II-B-2 provide cumulative rainfall distribution ratios for the 24-hour storm event at 30-minute intervals. These values were linearly interpolated in order to obtain cumulative rainfall distribution ratios at 5-minute intervals. Figure 8 above illustrates Figure II-B-1 of the 1993 SDCHM which is a graph of the ratios provided in Table II-B-2.

SCS Type B, 6-hr distribution ratios have been determined through visual interpolation of the values illustrated in Figure II-B-2(b) of the 1993 SDCHM (see Figure 9 at right). All ratios interpolated from this figure were found to directly correspond with ratios determined for the SCS Type B, 24-hr distribution at time values 4 times greater than the time values of the 6-hr distribution. For example, the cumulative rainfall depth ratio for the SCS Type B, 24-hr distribution at a time of 40 minutes is equal to the cumulative rainfall depth ratio for the SCS Type B, 6-hr distribution at a time of 10 minutes. This relationship between the 6-hour and 24-hour distributions likely exists because the 1993 SDCHM extrapolated the 24-hour distribution from the 6-hour Type B distribution depicted in the SCS and Earth Dams and Reservoirs (TR-60) document. More detailed information regarding the SCS Type B rainfall distribution is included in Appendix C.8 of this report.

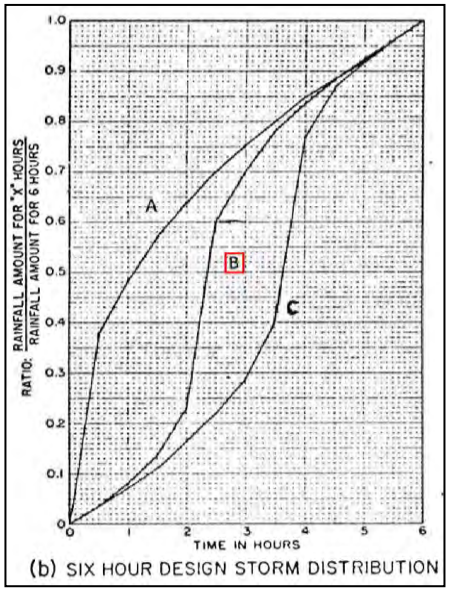


Figure 9: SCS Type B 6-Hour Cumulative Distribution Ratio

2.2.2 SCS Type 1 Rainfall Distribution

The SCS Type 1 rainfall distributions for each basin have been determined for 100, 10, 5, and 2 year storm events for both 6-hour and 24-hour storm durations. Basin specific distribution calculations for each basin are included in Appendix C.9 of this report and a general discussion of the methodology used to generate the SCS Type 1 cumulative rainfall distribution ratios is included below.

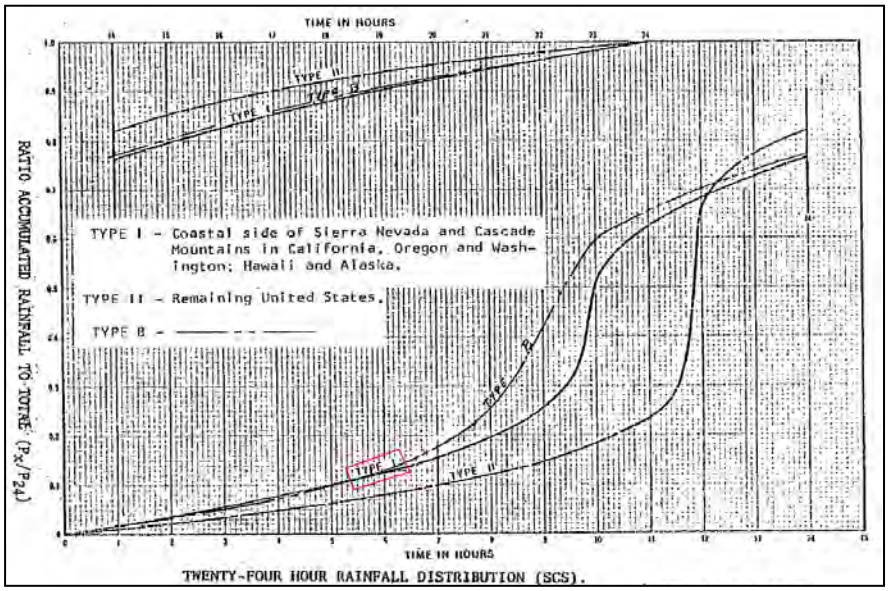


Figure 10: SCS Type 1 24-Hour Cumulative Distribution Ratio

SCS Type 1, 24-hr cumulative distribution ratios have been determined through visual determination of the values illustrated in Figure II-B-1 of the 1993 SDCHM (see Figure 10 above). Similar to the SCS Type B, 24-hour distribution, these ratios were determined at 30 minute intervals then linearly interpolated to obtain ratios at 5 minute intervals.

The 1993 SDCHM does not have any data that relates the SCS Type 1, 6-hour distribution to the 24-hour distribution. In an effort to apply good engineering judgment to determine SCS Type 1, 6-hour cumulative distribution ratios, the same method that was used to relate the SCS Type B 6-hour and 24-hour distribution ratios was applied to the SCS Type 1, 6-hour and 24-hour ratios. This method consisted of first determining the SCS Type 1, 24-hour distribution, then dividing the time values by 4 and maintaining the same cumulative rainfall ratios.

More detailed information regarding basin-specific distribution calculations as well as copies of relevant tables and figures are included in Appendix C.9 of this report.

2.2.3 Nested Rainfall Distribution

The Nested rainfall distributions for each basin have been determined for 100, 10, 5, and 2 year storm events. Basin specific distribution calculations for each basin are included in Appendix C.10 of this report and a general discussion of the methodology used to generate the Nested distribution is included below.

Calculation of the Nested rainfall distribution was divided into three tasks: determining cumulative rainfall depths, determining adjusted cumulative and incremental rainfall depths, and applying the 2/3 – 1/3 nested distribution to the data.

Cumulative Rainfall Depths

Cumulative rainfall depths for the Nested distribution have been determined per Section 4.3.2 of the 2003 SDCHM. For durations between 0 and 6 hours, cumulative rainfall depths are calculated per Equations 4-25 and 4-26. Equation 4-25 calculates the intensity of rainfall for a given duration as a function of the unadjusted 6-hour rainfall depth as determined in Section 2.1.6 of this report. Equation 4-26 then multiplies the calculated intensity by the duration in order to obtain a cumulative rainfall depth in inches.

$I = 7.44\ P_6\ D^{-0.645}$ Equation 4-25 of 2003 SDCHM

$P = I\ (D/60)$ Equation 4-26 of 2003 SDCHM

Where:

P_6: Unadjusted 6-hour rainfall depth (inches) as determined in Section 2.1.6 of this report.

D: Duration in minutes (all duration times used in this analysis are 5 minutes)

For durations between 6 and 24 hours, unadjusted cumulative rainfall depths are calculated at 5-minute intervals through log-log interpolation between 6-hour and 24-hour unadjusted rainfall depths. The 2003 SDCHM states that this log-log interpolation may be read from a log-log chart by extending a straight line on log-log paper between the 6-hour and 24-hour rainfall values. For more consistent results, this analysis has also supplemented the use of log-log paper with the log-log interpolation equation provided in Figure 11 at right.

This figure, illustrates the log-log distribution of the 100-year, unadjusted cumulative rainfall depths for the Las Flores Creek basin between the 6th and 24th hours of the Nested rainfall distribution.

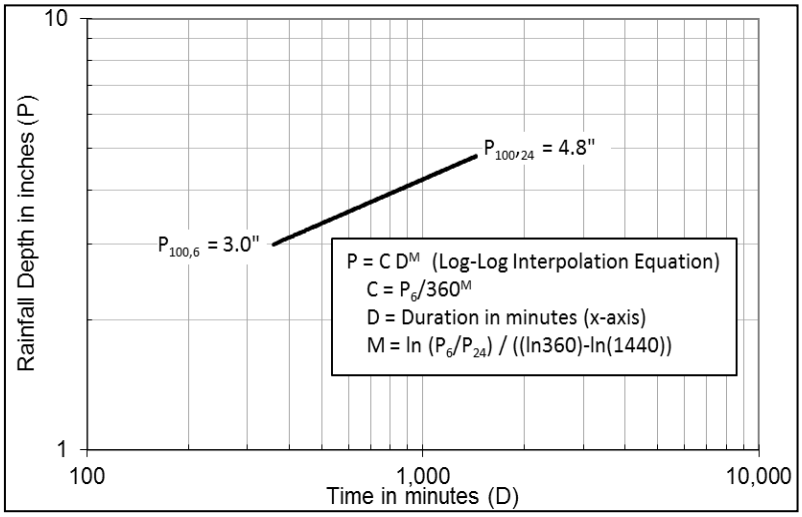


Figure 11: Example Las Flores Creek Basin Log-Log Distribution

Adjusted Cumulative and Incremental Rainfall Depths

Adjusted cumulative rainfall depths for the Nested distribution represent the cumulative rainfall depth experienced after a specified duration of the 24-hour storm event has elapsed. These depths have been determined at each 5-minute storm interval throughout the duration of the 24-hour storm event for each basin as described in Section 2.1.7 of this report.

Adjusted incremental rainfall depths for the Nested distribution represent the incremental rainfall depth experienced during a specified 5-minute interval of the 24-hour storm duration. These depths have been calculated by taking the difference of sequentially located cumulative adjusted rainfall depths.

2/3 – 1/3 Distribution

The Nested distribution represents a hypothetical, synthetic storm distribution. The term "nested" is fitting as this distribution is organized such that the maximum 5 minutes of rainfall is nested within the maximum 10 minutes; the maximum 10 minutes is nested within the maximum 15 minutes; and so forth until the 24-hour storm pattern is developed. As illustrated in Figure 12 below, the maximum adjusted incremental rainfall occurs at the 965th minute (from minutes 960 to 965) of the 24-hour storm. The next two highest adjusted incremental rainfall values occur concurrently before the 960th minute, and the next highest adjusted incremental rainfall value occurs after the 965th minute. This pattern is continuously repeated and the resulting hyetograph reflects increasing adjusted incremental rainfall values from 0 to 965 minutes and decreasing adjusted incremental rainfall values from 965 to 1440 minutes, representing a 2/3 – 1/3 distribution.

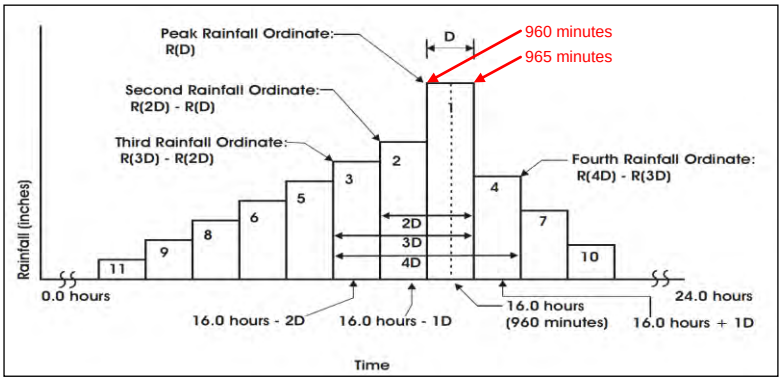


Figure 12: Construction of Nested Hydrograph (2003 SDCHM)

Nested rainfall distributions were created for each basin per guidelines set forth in Section 4.3.2 of the 2003 SDCHM. Adjusted incremental rainfall values determined per the steps above were first assigned an ordinate number to aid in the sorting process necessary to create a 2/3 – 1/3 distribution. Given that the Nested distribution covers a duration of 1440 minutes and that the desired hyetograph consists of 5-minute intervals, it was determined that the hyetograph would be constructed with data from 288 ordinates; (1440 minutes divided by 5-minute intervals = 288) and the maximum adjusted incremental rainfall would occur during the 193rd ordinate. The maximum adjusted incremental rainfall for each basin was then identified and labeled as ordinate 193, the second largest value was labeled 192, the third largest value 191, and the fourth largest value was labeled 194 and so on until all increments were assigned an ordinate

number. Adjusted incremental rainfall values were then assigned to different time durations based upon the assigned ordinate numbers in order to create the 2/3 – 1/3 distribution.

More detailed information regarding Nested rainfall distributions is included in Appendix C.10 of this report.

2.3 HEC-HMS Inputs

Single-basin hydrologic basin models for each of the six basins identified in this analysis were created utilizing HEC-HMS version 3.5 software. HEC-HMS models were created utilizing the previously calculated General Basin Information and Rainfall Distribution Ratios as described in Section 2.1 and 2.2 of this report. The required HEC-HMS inputs are categorized into four sections: Basin Model Inputs, Meteorologic Model Inputs, Control Specification Inputs, and Time-Series Data Inputs as described in the sections that follow.

2.3.1 Basin Model Inputs

Basin model inputs within the HEC-HMS software consist of three sub-categories: subbasin information, loss methods, and transform. These sub-categories have been populated for each basin as follows:

Subbasin Information Category:
Area: As determined per Section 2.1.1 of this report.
Canopy Method: None
Surface Method: None
Loss Method: SCS Curve Number (See Loss Methods Category below)
Transform Method: SCS Unit Hydrograph
Baseflow Method: None

Loss Methods Category:
Initial Abstraction: N/A
Curve Number: As determined per Section 2.1.4 of this report.
Impervious %: 0.0

Transform Category:
Graph Type: Standard
Lag Time: As determined per Section 2.1.5 of this report

As identified in Section 2.1.4 of this report, the adjusted CN value for a single-basin varies depending on the storm event being modeled. As such, several subbasin models were created for each basin within HEC-HMS in order to correctly define the unique basin model inputs such as CN values occurring within the subbasin during the following storm events.

- Basin Models
  - 100-Year, 24-Hour
  - 100-Year, 6-Hour
  - 10-Year, 24-Hour
  - 10-Year, 6-Hour
  - 5-Year, 24-Hour
  - 5-Year, 6-Hour
  - 2-Year, 24-Hour
  - 2-Year, 6-Hour

2.3.2 Meteorologic Model Inputs

Meteorologic Model Inputs within HEC-HMS version 3.5 software are used to link the basin model inputs described in Section 2.3.1 above, with the appropriate rainfall time-series data. These inputs consist of three subcategories: meteorology model, basins, and options and have been populated for each storm event as follows.

Meteorology Model
Precipitation: Specified Hyetograph (Identified in tables below)
Evapotranspiration: None
Snowmelt: None
Unit System: U.S. Customary

Specified Hyetographs
Specified Hyetographs (as presented in Appendices C.8 – C.10 of this report) were linked with the appropriate subbasins as illustrated below.

- SCS Type B Rainfall Distribution

Subbasin Name	Gauge
100-Year, 24-Hour	100-Year, 24-Hour, SCS Type B
100-Year, 6-Hour	100-Year, 6-Hour, SCS Type B
10-Year, 24-Hour	10-Year, 24-Hour, SCS Type B
10-Year, 6-Hour	10-Year, 6-Hour, SCS Type B
5-Year, 24-Hour	5-Year, 24-Hour, SCS Type B
5-Year, 6-Hour	5-Year, 6-Hour, SCS Type B
2-Year, 24-Hour	2-Year, 24-Hour, SCS Type B
2-Year, 6-Hour	2-Year, 6-Hour, SCS Type B

- SCS Type 1 Rainfall Distribution

Subbasin Name	Gauge
100-Year, 24-Hour	100-Year, 24-Hour, SCS Type 1
100-Year, 6-Hour	100-Year, 6-Hour, SCS Type 1
10-Year, 24-Hour	10-Year, 24-Hour, SCS Type 1
10-Year, 6-Hour	10-Year, 6-Hour, SCS Type 1
5-Year, 24-Hour	5-Year, 24-Hour, SCS Type 1
5-Year, 6-Hour	5-Year, 6-Hour, SCS Type 1
2-Year, 24-Hour	2-Year, 24-Hour, SCS Type 1
2-Year, 6-Hour	2-Year, 6-Hour, SCS Type 1

- Nested Rainfall Distribution

Subbasin Name	Gauge
100-Year, 24-Hour	100-Year, Nested
10-Year, 24-Hour	10-Year, Nested
5-Year, 24-Hour	5-Year, Nested
2-Year, 24-Hour	2-Year, Nested

Basins:
Basin Model: Basin Models for 24-Hour Events and 6-Hour Events
Area: As determined per Section 2.1.1 of this report.
Canopy Method: None

Options:
Replace Missing: No
Total Override: No

2.3.3 Control Specification Inputs

Control Specifications within the HEC-HMS software identify the time interval and duration for the simulated hydrograph. Two control specifications were defined for the analyses performed within this report.

- 24-Hour Duration with 5-Minute Time Intervals
- 6-Hour Duration with 5-Minute Time Intervals.

2.3.4 Time-Series Data

Time-series data was defined at 5-minute intervals for the SCS Type B, SCS Type 1, and Nested rainfall distributions. SCS Type B and SCS Type 1 distributions were defined in cumulative inches of rainfall per 5-minute interval while the Nested distribution was defined in incremental inches of rainfall per 5-minute interval.

Precipitation Gauges:

- SCS Type B Distribution (Hyetographs from Appendix C.8 of this report)
  - 100-Year, 24-Hour
  - 100-Year, 6-Hour
  - 10-Year, 24-Hour
  - 10-Year, 6-Hour
  - 5-Year, 24-Hour
  - 5-Year, 6-Hour
  - 2-Year, 24-Hour
  - 2-Year, 6-Hour

- SCS Type 1 Distribution (Hyetographs from Appendix C.9 of this report)
  - 100-Year, 24-Hour
  - 100-Year, 6-Hour
  - 10-Year, 24-Hour
  - 10-Year, 6-Hour
  - 5-Year, 24-Hour
  - 5-Year, 6-Hour
  - 2-Year, 24-Hour
  - 2-Year, 6-Hour

- Nested Distribution (Hyetographs from Appendix C.10 of this report)
    - 100-Year, 24-Hour
    - 10-Year, 24-Hour
    - 5-Year, 24-Hour
    - 2-Year, 24-Hour

Time-Series Data Input Controls:
Data Source: Manual Entry
Units: Cumulative Inches for SCS Type B, and SCS Type 1 distributions. Incremental Inches for Nested rainfall distribution.
Time Interval: 5 minutes

2.4 HEC-HMS Outputs

HEC-HMS outputs for the six (6) basins modeled include full page illustrations of hydrographs as well as outflow summary tables with information including: peak discharge, time of peak discharge, total precipitation, total direct runoff, total loss, total baseflow, and total excess flow. Due to the number of basins, storm events, and rainfall distributions modeled within this analysis, the results are too extensive to present here and are instead included in Appendix C.12 of this report.

3. REFERENCES

County of San Diego, Department of Public Works, Flood Control Division, San Diego County Hydrology Manual. (April 1993).

County of San Diego, Department of Public Works, Flood Control Division, San Diego County Hydrology Manual. (June 2003).

San Diego County Drainage Design Manual, County of San Diego Department of Public Works Flood Control Section. (July 2005)

United States Department of Agriculture (USDA), Soil Conservation Service (SCS). Earth Dams and Reservoirs, Technical Release 60. (October 1985).

4. APPENDICES

C.1 Type B, Type 1, Nested, and Gauge Results Comparison Summary

C.2 PZN Adjustment Factors

C.3 Unadjusted CN Values

C.4 Adjusted CN Values

C.5 Lag Time Calculations

C.6 Unadjusted Rainfall Depths (Isopluvial Maps)

C.7 Adjusted Rainfall Depths

C.8 SCS Type B Distribution

C.9 SCS Type 1 Distribution

C.10 Nested Rainfall Distribution

C.11 1993 vs 2003 San Diego County Hydrology Manual

C.12 HEC-HMS Outputs

This page is intentionally left blank to facilitate 2-sided printing.

Appendix C.1

Type B, Type 1, Nested, and Gauge Results Comparison Summary

This page is intentionally left blank to facilitate 2-sided printing.

Type B, Type 1, Nested, and Gauge Results Comparison Summary - 24-Hr Event

Basin Variables			Guejito Creek	Jamul Creek	Las Flores Creek	Los Coches Creek	Santa Maria Creek	Sweetwater River
Basin Information [1, 2, 3]	Area (square miles)		22.5	70.1	26.6	12.2	57.0	44.5
	Lag Time (minutes)		122.3	135.2	136.8	114.4	308.4	193.0
	Adjusted Rainfall Depth (inches)	100 yr - 24 hr	7.9	6.0	4.6	6.2	5.7	11.4
		10 yr - 24 hr	5.4	3.4	3.2	3.7	3.8	6.7
		5 yr - 24 hr	4.3	3.0	2.7	3.3	3.3	5.7
		2 yr - 24 hr	3.3	2.0	1.8	2.4	2.4	4.3
	Adjusted CN Values	100 yr	90	92	86	89	88	90
		10 yr	82	88	80	84	82	79
		5 yr	82	88	80	84	82	79
		2 yr	82	88	80	84	82	79
Peak Flowrate Data [4]	Q_{100} (cfs)	Type B - 24-hr	13,566	30,473	6,951	5,599	13,188	31,986
		Type 1 - 24-hr	15,009	33,276	7,584	6,260	13,832	33,799
		Nested	13,618	28,216	9,564	5,571	15,122	27,421
		FFD Gauge	**6,610**	**12,600**	**12,600**	**1,350**	**17,400**	**21,800**
	Q_{10} (cfs)	Type B - 24-hr	6,862	12,876	2,876	2,313	5,859	13,285
		Type 1 - 24-hr	7,571	14,055	3,110	2,566	6,208	14,178
		Nested	7,447	15,218	4,250	2,894	7,684	14,479
		FFD Gauge	**1,040**	**2,240**	**2,240**	**572**	**2,410**	**2,580**
	Q_5 (cfs)	Type B - 24-hr	4,822	10,651	2,030	1,914	4,592	10,379
		Type 1 - 24-hr	5,308	11,619	2,188	2,117	4,875	11,087
		Nested	5,756	13,899	3,344	2,459	6,058	11,788
		FFD Gauge	**467**	**975**	**975**	**386**	**968**	**1,040**
	Q_2 (cfs)	Type B - 24-hr	3,067	5,384	753	1,070	2,505	6,505
		Type 1 - 24-hr	3,359	5,844	801	1,172	2,673	6,960
		Nested	4,146	8,058	1,588	1,535	3,633	7,603
		FFD Gauge	**98**	**166**	**166**	**173**	**146**	**185**

1. Lag Time Calculations are included in Appendix C.5 of this report.
2. Adjusted rainfall depths as determined per calculations in Appendix C.7 of this report. These depths are applicable to Type 1 and Type B storms only, refer to Appendix C.10 for the Nested adjusted rainfall depths.
3. Adjusted CN values as determined per calculations in Appendix C.4 of this report.
4. Peak discharge flow rates (cfs) as determined per HEC-HMS Output included in Appendix C.12 of this report.

Type B, Type 1, Nested, and Gauge Results Comparison Summary - 6-Hr Event

Basin Variables			Guejito Creek	Jamul Creek	Las Flores Creek	Los Coches Creek	Santa Maria Creek	Sweetwater River
Basin Information [1, 2, 3]	Area (square miles)		22.5	70.1	26.6	12.2	57.0	44.5
	Lag Time (minutes)		122.3	135.2	136.8	114.4	308.4	193.0
	Adjusted Rainfall Depth (inches)	100 yr - 6 hr	3.9	2.9	2.9	2.9	3.3	4.8
		10 yr - 6 hr	2.5	1.9	1.8	1.9	2.3	3.3
		5 yr - 6 hr	2.1	1.7	1.6	1.7	1.9	2.9
		2 yr - 6 hr	1.8	1.3	1.3	1.3	1.5	2.1
	Adjusted CN Values	100 yr	90	92	86	89	88	90
		10 yr	82	88	80	84	82	79
		5 yr	82	88	80	84	82	79
		2 yr	82	88	80	84	82	79
Peak Flowrate Data [4]	Q_{100} (cfs)	Type B - 6-hr	9,980	21,351	6,015	3,560	6,660	19,296
		Type 1 - 6-hr	10,382	22,188	6,288	3,724	6,391	19,755
		FFD Gauge	**6,610**	**12,600**	**12,600**	**1,350**	**17,400**	**21,800**
	Q_{10} (cfs)	Type B - 6-hr	3,340	8,861	1,630	1,251	2,378	7,045
		Type 1 - 6-hr	3,515	9,284	1,715	1,320	2,290	7,176
		FFD Gauge	**1,040**	**2,240**	**2,240**	**572**	**2,410**	**2,580**
	Q_5 (cfs)	Type B - 6-hr	2,364	7,265	1,230	992	1,550	5,502
		Type 1 - 6-hr	2,493	7,618	1,293	1,047	1,496	5,599
		FFD Gauge	**467**	**975**	**975**	**386**	**968**	**1,040**
	Q_2 (cfs)	Type B - 6-hr	1,703	4,334	710	537	851	2,759
		Type 1 - 6-hr	1,796	4,557	743	568	824	2,799
		FFD Gauge	**98**	**166**	**166**	**173**	**146**	**185**

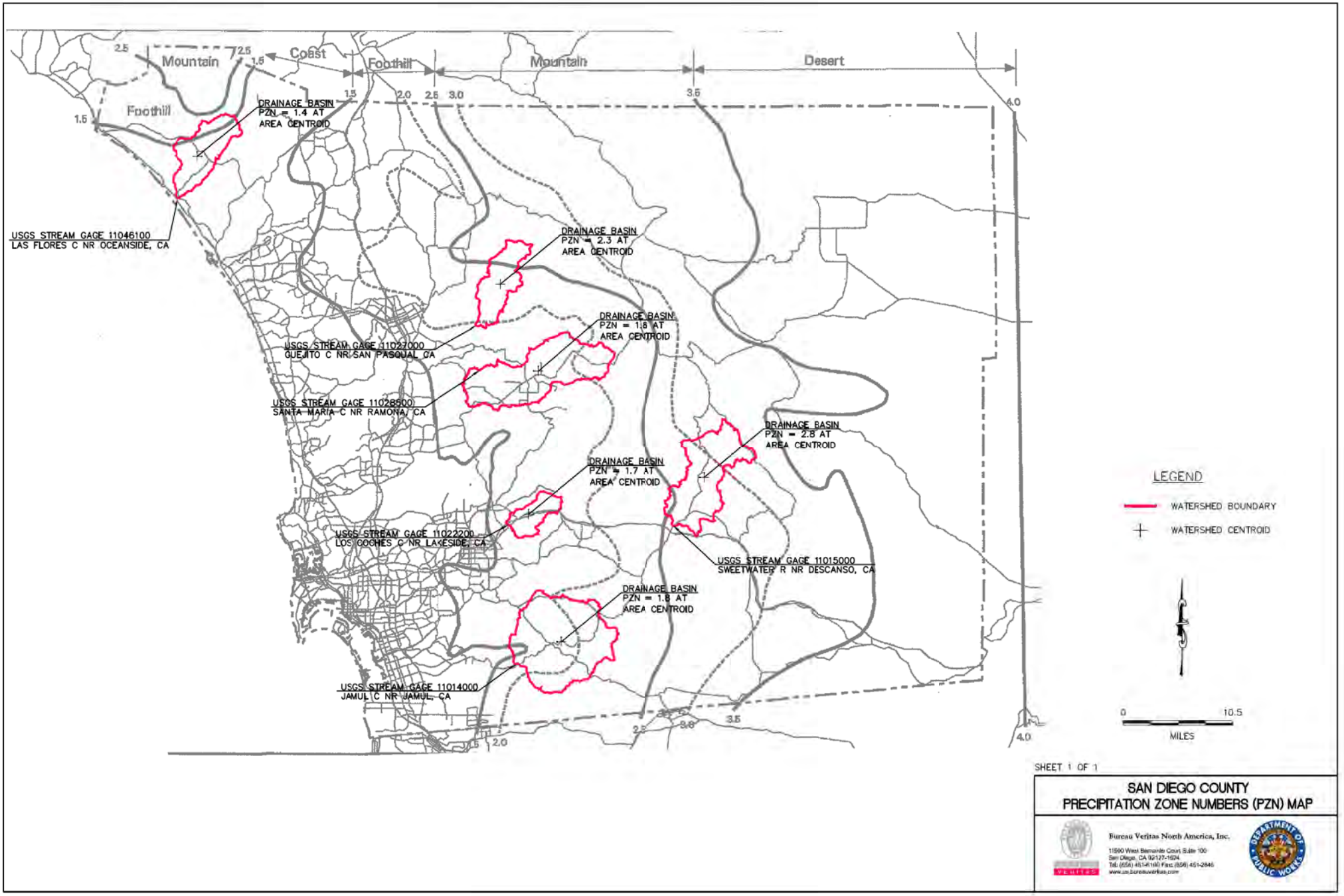
1. Lag Time Calculations are included in Appendix C.5 of this report.
2. Adjusted rainfall depths as determined per calculations in Appendix C.7 of this report. These depths are applicable to Type 1 and Type B storms only, refer to Appendix C.10 for the Nested adjusted rainfall depths.
3. Adjusted CN values as determined per calculations in Appendix C.4 of this report.
4. Peak discharge flow rates (cfs) as determined per HEC-HMS Output included in Appendix C.12 of this report.

*Note: 6-hr results are provided for informational purposes only.

Appendix C.2

PZN Adjustment Factors

This page is intentionally left blank to facilitate 2-sided printing.



SHEET 1 OF 1

SAN DIEGO COUNTY
PRECIPITATION ZONE NUMBERS (PZN) MAP

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

PZN Adjustment Factors for Type 1, Type B, and Nested Storms

Watershed Name	PZN Map Value [1]	PZN Adjustment Factors [2]			
		100-yr	10-yr	5-yr	2-yr
Guejito Creek	2.3	3.0	2.4	2.4	2.4
Jamul Creek	1.8	2.8	2.3	2.3	2.3
Las Flores Creek	1.4	2.4	1.9	1.9	1.9
Los Coches Creek	1.7	2.7	2.2	2.2	2.2
Santa Maria Creek	1.8	2.8	2.3	2.3	2.3
Sweetwater River	2.8	3.0	2.1	2.1	2.1

1. PZN values are determined through linear interpolation of the PZN Map values with respect to the area centroid of each basin as illustrated on the previous page.

2. PZN Adjustment Factors are determined through linear interpolation of the values listed in Table 4-6 of the 2003 SDCHM (see below).

Table 4-6

PZN ADJUSTMENT FACTORS FOR FLOW COMPUTATIONS
(San Diego County)

Storm Frequency	Coast (PZN = 1.0)	Foothills (PZN = 2.0)	Mountains (PZN = 3.0)	Desert (PZN = 4.0)
Less than 35-year return period	1.5	2.5	2.0	1.5
Greater than or equal to 35-year return period	2.0	3.0	3.0	2.0

Notes: PZN is the precipitation zone number (see Map, Appendix C). The PZN adjustment factor represents the PZN Condition that the CN for the watershed should be adjusted to.

Appendix C.3

Unadjusted CN Values

This page is intentionally left blank to facilitate 2-sided printing.

Table 4-2
RUNOFF CURVE NUMBERS[1] FOR PZN CONDITION = 2.0

Cover Description	Cover Treatment or Practice[2]	Hydrologic Condition[3]	Average Percent Impervious Area[4]	Curve Numbers for Hydrologic Soil Groups: A	B	C	D
Developing urban areas and newly graded areas (pervious areas only, no vegetation)				77	86	91	94
Impervious areas: Paved parking lots, roofs, and driveways (excluding right-of-way)				98	98	98	98
Residential districts by average lot size:[4]							
1/8 acre or less (town houses)			65%	77	85	90	92
1/4 acre			38%	61	75	83	87
1/3 acre			30%	57	72	81	86
1/2 acre			25%	54	70	80	85
1 acre			20%	51	68	79	84
2 acres			12%	46	65	77	82
Streets and roads	Paved; curbs and storm drains (excluding right-of-way)			98	98	98	98
	Paved; open ditches (including right-of-way)			83	89	92	93
	Gravel (including right-of-way)			76	85	89	91
	Hard surface (including right-of-way)			74	84	90	92
	Dirt (including right-of-way)			72	82	87	89
Urban districts[4]	Commercial and business		85%	89	92	94	95
	Industrial		72%	81	88	91	93
Western desert urban areas:							
Natural desert landscaping (pervious areas only)[5]				63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)				96	96	96	96

Table 4-2 (Continued)
RUNOFF CURVE NUMBERS[1] FOR PZN CONDITION = 2.0

Cover Description	Cover Treatment or Practice[2]	Hydrologic Condition[3]	Average Percent Impervious Area[4]	Curve Numbers for Hydrologic Soil Groups: A	B	C	D
Close-seeded legumes or rotated pasture	Straight row	Poor		66	77	85	89
		Good		58	72	81	85
	Contoured	Poor		64	75	83	85
		Good		55	69	78	83
	Contoured and terraced	Poor		63	73	80	83
		Good		51	67	76	80
Cultivated land	Without conservation treatment			72	81	88	91
	With conservation treatment			62	71	78	81
Fallow	Bare soil			77	86	91	94
	Crop residue cover	Poor		76	85	90	92
		Good		74	83	88	90
Farmsteads (buildings, lanes, driveways, and surrounding lots)				59	74	82	86
Irrigated pasture		Poor		58	74	83	87
		Fair		44	65	77	82
		Good		33	58	72	79
Orchards (deciduous)			(see glossary description)				
Orchards (evergreen)		Poor		57	73	82	86
		Fair		44	65	77	82
		Good		33	58	72	79
Row crops	Straight row	Poor		72	81	88	91
		Good		67	78	85	89
	Contoured	Poor		70	79	84	88
		Good		65	75	82	86

Table 4-2 (Continued)
RUNOFF CURVE NUMBERS[1] FOR PZN CONDITION = 2.0

Cover Description	Cover Treatment or Practice[2]	Hydrologic Condition[3]	Average Percent Impervious Area[4]	Curve Numbers for Hydrologic Soil Groups: A	B	C	D
Small grain	Straight row	Poor		65	76	84	88
		Good		63	75	83	87
	Contoured	Poor		63	74	82	85
		Good		61	73	81	84
Vineyards[6]	Disked			76	85	90	92
	Annual grass or legume cover	Poor		65	78	85	89
		Fair		50	69	79	84
		Good		38	61	74	80
Annual grass (Dryland pasture)		Poor		67	78	86	89
		Fair		50	69	79	84
		Good		38	61	74	80
Barren				78	86	91	93
Meadow		Poor		63	77	85	88
		Fair		51	70	80	84
		Good		30	58	72	78
Open space (lawns, parks, golf courses, cemeteries, etc.)[7]	Grass cover <50%	Poor		68	79	86	89
	Grass cover 50% to 75%	Fair		49	69	79	84
	Grass cover >75%	Good		39	61	74	80
Pasture or range land		Poor		68	79	86	89
		Fair		49	69	79	84
		Good		39	61	74	80
Perennial grass		Poor		67	79	86	89
		Fair		50	69	79	84
		Good		38	61	74	80

Table 4-2 (Continued)
RUNOFF CURVE NUMBERS[1] FOR PZN CONDITION = 2.0

Cover Description	Cover Treatment or Practice[2]	Hydrologic Condition[3]	Average Percent Impervious Area[4]	Curve Numbers for Hydrologic Soil Groups: A	B	C	D
Turf[8]		Poor		58	74	83	87
		Fair		44	65	77	82
		Good		33	58	72	79
Water surfaces (during floods)				97	98	99	99
Broadleaf chaparral		Poor		53	70	80	85
		Fair		40	63	75	81
		Good		31	57	71	78
Desert shrub–major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus		Poor		63	77	85	88
		Fair		55	72	81	86
		Good		49	68	79	84
Herbaceous–mixture of grass, weeds, and low-growing brush, with brush the minor element		Poor	[9]		80	87	93
		Fair	[9]		71	81	89
		Good	[9]		62	74	85
Narrowleaf chaparral		Poor		71	82	88	91
		Fair		55	72	81	86
Oak-aspen–mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush		Poor	[9]		66	74	79
		Fair	[9]		48	57	63
		Good	[9]		30	41	48
Open brush		Poor		62	76	84	88
		Fair		46	66	77	83
		Good		41	63	75	81

Table 4-2 (Continued)
RUNOFF CURVE NUMBERS[1] FOR PZN CONDITION = 2.0

Cover Description	Cover Treatment or Practice[2]	Hydrologic Condition[3]	Average Percent Impervious Area[4]	Curve Numbers for Hydrologic Soil Groups: A	B	C	D
Pinyon-juniper–pinyon, juniper, or both; grass understory		Poor	[9]	75	85	89
		Fair	[9]	58	73	80
		Good	[9]	41	61	71
Sagebrush with grass understory		Poor	[9]	67	80	85
		Fair	[9]	51	63	70
		Good	[9]	35	47	55
Wood or forest land		Thin stand, poor cover	45	66	77	83
		Good cover	25	55	70	77
Woods (woodland)		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	28	55	70	77
Woodland-grass combination		Poor	57	73	82	86
		Fair	44	65	77	82
		Good	33	58	72	79

1 Average runoff condition, and $I_a = 0.2S$.
2 Hydrologic practices described as "straight row" and "contoured" are defined in the glossary.
3 For definition of hydrologic condition, see Tables 4-3, 4-4, and 4-5.
4 The average percent impervious area shown was used to develop the composite CNs. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. If the impervious area is not directly connected, the NRCS method has an adjustment to reduce the effect.
5 Composite CNs for natural desert landscaping should be computed based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CNs are assumed equivalent to desert shrub in poor hydrologic condition.
6 See glossary.
7 CNs shown are equivalent to those of pasture. Composite CNs may be computed for other combinations of open space cover type.
8 Includes lawns, cemeteries, golf courses and parks with ground cover of mowed and irrigated perennial grass.
9 CNs for Group A have not been developed.

Table 4-3

CLASSIFICATION OF NATIVE PASTURE OR RANGE

Vegetative Condition	Hydrologic Condition
Heavily grazed. Has no mulch or has plant cover on less than 50% of the area.	Poor
Not heavily grazed. Has plant cover on 50% to 75% of the area.	Fair
Lightly grazed. Has plant cover on more than 75% of the area.	Good

Table 4-4

AIR-DRY WEIGHT CLASSIFICATION OF NATIVE PASTURE OR RANGE

	Plant and litter air-dry weight (tons per acre):		
Cover density	Less than 0.5	0.5 to 1.5	More than 1.5
Less than 50%	Poor	Poor+	Fair
50% to 75%	Poor+	Fair	Fair+
More than 75%	Fair	Fair+	Good

Table 4-5

CLASSIFICATION OF WOODS

Vegetative Condition	Hydrologic Condition
Heavily grazed or regularly burned. Litter, small trees, and brush are destroyed.	Poor
Grazed but not burned. There may be some litter but these woods are not protected.	Fair
Protected from grazing. Litter and shrubs cover the soil.	Good

SANGIS Land Use to NRCS Cover Description - Conversion

SANGIS Land Use	NRCS Cover Description
Arterial Commercial	Urban Districts (Commercial and Business)
Cemetery	Perrenial Grass
Coast Range, Klamath and Peninsular Coniferous Forest	Pinyon-juniper-pinyon
Communications and Utilities	Urban Districts (Commercial and Business)
Community Shopping Center	Urban Districts (Commercial and Business)
Elementary School	Urban Districts (Commercial and Business)
Extractive Industry	Urban Districts (Industrial)
Field Crops	Row Crops: Straight Row
Fire/Police Station	Urban Districts (Commercial and Business)
Freeway	Streets and Roads Paved: Curbs and storm drains
General Aviation Airport	Urban Districts (Commercial and Business)
Hotel/Motel (Low-Rise)	Urban Districts (Commercial and Business)
Intensive Agriculture	Irrigated Pasture
Junior High School or Middle School	Urban Districts (Commercial and Business)
Junkyard/Dump/Landfill	Open Space
Landscape Open Space	Open Space
Library	Urban Districts (Commercial and Business)
Light Industry - General	Urban Districts (Industrial)
Mobile Home Park	Residential Districts: 1/8 acre
Mule Fat Scrub	Woods (woodland)
Multi-Family Residential	Residential Districts: 1/8 acre
Office (Low-Rise)	Urban Districts (Commercial and Business)
Open Space Park or Preserve	Open Space
Orchard or Vineyard	Orchards (evergreen)
Other Group Quarters Facility	Residential Districts: 1/8 acre
Other Health Care	Urban Districts (Commercial and Business)
Other Public Services	Urban Districts (Commercial and Business)
Other Recreation - Low	Open Space
Other Retail Trade and Strip	Urban Districts (Commercial and Business)
Other Transportation	Urban Districts (Commercial and Business)
Park - Active	Open Space
Post Office	Urban Districts (Commercial and Business)
Religious Facility	Urban Districts (Commercial and Business)
Road Right of Way	Streets and Roads Paved: Curbs and storm drains
School District Office	Urban Districts (Commercial and Business)
Senior High School	Urban Districts (Commercial and Business)
Service Station	Urban Districts (Commercial and Business)
Single Family Detached	Residential Districts: 1/3 acre
Single Family Multiple-Units	Residential Districts: 1/8 acre
Single Family Residential Without Units	Residential Districts: 1/4 acre
Southern Cottonwood-willow Riparian Forest	Woods (woodland)
Southern Riparian Scrub	Woods (woodland)
Spaced Rural Residential	Residential Districts: 2 acre
Warehousing	Urban Districts (Industrial)

SANGIS Vegetation Type to NRCS Cover Description - Conversion

SANGIS Vegetation Type	NRCS Cover Description
Alkali Meadows and Seeps	Meadow
Alkali Seep	Meadow
Big Sagebrush Scrub	Narrowleaf Chaparral
Black Oak Forest	Woods (woodland)
Black Oak Woodland	Woods (woodland)
Canyon Live Oak Forest	Woods (woodland)
Chamise Chaparral	Narrowleaf Chaparral
Chaparral	Narrowleaf Chaparral
Cismontane Woodland	Woods (woodland)
Coast Live Oak Forest	Woods (woodland)
Coast Live Oak Woodland	Woods (woodland)
Coast Range, Klamath and Peninsular Coniferous Forest*	Woods (woodland)
Coastal and Valley Freshwater Marsh	Meadow
Coastal Sage-Chaparral Scrub	Narrowleaf Chaparral
Coulter Pine Forest	Pinyon-juniper-pinyon
Dense Coast Live Oak Woodland	Woods (woodland)
Dense Engelmann Oak Woodland	Woods (woodland)
Diegan Coastal Sage Scrub	Narrowleaf Chaparral
Disturbed Habitat	Barren
Disturbed Wetland	Barren
Dry Montane Meadows	Meadow
Engelmann Oak Woodland	Woods (woodland)
Eucalyptus Woodland	Woods (woodland)
Extensive Agriculture - Field/Pasture, Row Crops	Row Crops: Straight Row
Field/Pasture	Irrigated Pasture
Flat-topped Buckwheat*	Narrowleaf Chaparral
Foothill/Mountain Perennial Grassland*	Perrenial Grass
Freshwater	Negligible, Exclude From Area
Freshwater Seep	Meadow
General Agriculture	Row Crops: Straight Row
Granitic Chamise Chaparral*	Narrowleaf Chaparral
Granitic Northern Mixed Chaparral*	Broadleaf Chaparral
Granitic Southern Mixed Chaparral	Broadleaf Chaparral
Intensive Agriculture - Dairies, Nurseries, Chicken Ranches	Irrigated Pasture
Interior Live Oak Chaparral	Narrowleaf Chaparral
Jeffrey Pine Forest	Woods (woodland)
Mafic Northern Mixed Chaparral*	Broadleaf Chaparral
Meadow and Seep	Meadow
Mixed Oak Woodland*	Woods (woodland)
Mixed Oak/Coniferous/Bigcone/Coulter*	Woods (woodland)
Montane Chaparral	Narrowleaf Chaparral
Montane Manzanita Chaparral	Narrowleaf Chaparral
Montane Meadow	Meadow
Montane Scrub Oak Chaparral	Narrowleaf Chaparral
Mule Fat Scrub	Woods (woodland)
Native Grassland	Perrenial Grass
Non-Native Grassland	Annual Grass
Non-Native Vegetation	Open Space
Non-Vegetated Channel, Floodway, Lakeshore Fringe	Barren
Northern Mixed Chaparral*	Broadleaf Chaparral
Open Coast Live Oak Woodland	Woods (woodland)
Open Engelmann Oak Woodland	Woods (woodland)
Orchards and Vineyards	Orchards (evergreen)

SANGIS Vegetation Type to NRCS Cover Description - Conversion

SANGIS Vegetation Type	NRCS Cover Description
Pasture	Irrigated Pasture
Riversidian Upland Sage Scrub	Narrowleaf Chaparral
Row Crops	Row Crops: Straight Row
San Diego Mesa Claypan Vernal Pool (southern mesas)	Meadow
Sierran Mixed Coniferous Forest	Broadleaf Chaparral
Southern Arroyo Willow Riparian Forest	Woods (woodland)
Southern Coast Live Oak Riparian Forest	Woods (woodland)
Southern Cottonwood-willow Riparian Forest	Woods (woodland)
Southern Mixed Chaparral	Narrowleaf Chaparral
Southern Riparian Forest	Woods (woodland)
Southern Riparian Forest	Woods (woodland)
Southern Riparian Scrub	Woods (woodland)
Southern Sycamore-alder Riparian Woodland	Woods (woodland)
Southern Willow Scrub	Woods (woodland)
Undifferentiated Open Woodland*	Woods (woodland)
Urban/Developed	Perrenial Grass
Valley and Foothill Grassland	Perrenial Grass
Valley Needlegrass Grassland	Perrenial Grass
Vernal Pool	Meadow
White Alder Riparian Forest	Woods (woodland)
Wildflower Field	Annual Grass

Assumptions for Determination of Unadjusted CN Values

Basin	Soil Type [1]	Land Use / Ground Cover [2]	Hydrologic Condition [3]
Guejito Creek	2007 SSURGO soil data was unavailable for a small portion of the basin. These areas were assigned Soil Type B or C to match the typical observed surrounding soil types.	County provided 2010 SANGIS Landuse shapefiles were converted to NRCS Ground Cover per the conversion table on the previous pages.	Hydrologic Condition values of Good, Fair, or Poor have been assigned throughout the basin based on visual observation of available 2008 imagery.
Jamul Creek	2007 SSURGO soil data was available for all portions of the basin. No assumptions regarding soil types were made.	County provided 2010 SANGIS Landuse shapefiles were converted to NRCS Ground Cover per the conversion table on the previous pages.	Hydrologic Condition values of Good, Fair, or Poor have been assigned throughout the basin based on visual observation of available 2008 imagery.
Las Flores Creek	2007 SSURGO soil data was unavailable for several areas of the basin. These areas were assigned Soil Type D to match the typical observed surrounding soil types.	County provided 1989 SANGIS Landuse shapefiles were converted to NRCS Ground Cover per the conversion table on the previous pages.	Hydrologic Condition values of Good, Fair, or Poor have been assigned throughout the basin based on visual observation of available 2008 imagery.
Los Coches Creek	2007 SSURGO soil data was available for all portions of the basin. No assumptions regarding soil types were made.	County provided 2010 SANGIS Landuse shapefiles were converted to NRCS Ground Cover per the conversion table on the previous pages.	Hydrologic Condition values of Good, Fair, or Poor have been assigned throughout the basin based on visual observation of available 2008 imagery.
Santa Maria Creek	2007 SSURGO soil data was available for all portions of the basin. No assumptions regarding soil types were made.	County provided 2009 SANGIS Landuse shapefiles were converted to NRCS Ground Cover per the conversion table on the previous pages.	Hydrologic Condition values of Good, Fair, or Poor have been assigned throughout the basin based on visual observation of available 2008 imagery.
Sweetwater River	2007 SSURGO soil data was unavailable for a significant portion of the basin. This area was assigned Soil Type C to match the typical observed surrounding soil types.	County provided 2010 SANGIS Landuse shapefiles were converted to NRCS Ground Cover per the conversion table on the previous pages.	Hydrologic Condition values of Good, Fair, or Poor have been assigned throughout the basin based on visual observation of available 2008 imagery.

1. Soil types have been determined per available SSURGO soil survey dated December 17, 2007.

2. Land Use / Ground Covers have been determined by converting County provided SANGIS Landuse shapefiles into NRCS format for use in Table 4-2 of the 2003 SDCHM.

3. Hydrologic Conditions have been determined per Table 4-3 of the 2003 SDCHM through visual observation of 2008 aerial imagery.

Unadjusted CN Values for Guejito Creek

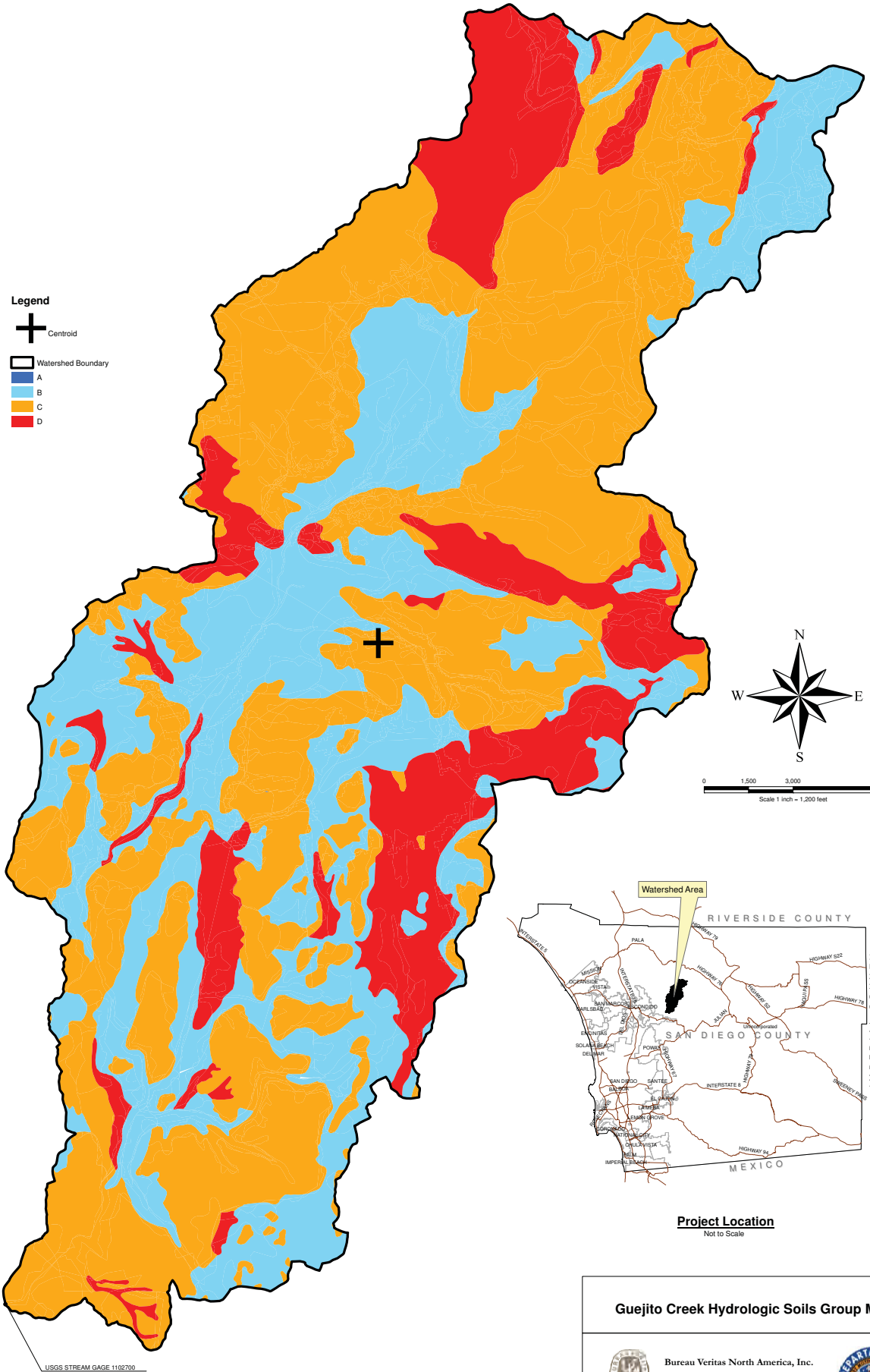
Guejito Creek - CN_2 Calculations

Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
2045.37	0.1425	Annual Grass	Fair	B	**69**	9.83
468.76	0.0327	Annual Grass	Fair	C	**79**	2.58
880.03	0.0613	Annual Grass	Fair	D	**84**	5.15
33.28	0.0023	Annual Grass	Good	B	**61**	0.14
0.17	0.0000	Annual Grass	Good	C	**74**	0.00
0.01	0.0000	Annual Grass	Good	D	**80**	0.00
13.05	0.0009	Annual Grass	Poor	B	**78**	0.07
3.11	0.0002	Annual Grass	Poor	C	**86**	0.02
0.60	0.0000	Annual Grass	Poor	D	**89**	0.00
0.19	0.0000	Barren	Fair	B	**86**	0.00
6.70	0.0005	Broadleaf Chaparral	Fair	B	**63**	0.03
20.78	0.0014	Broadleaf Chaparral	Fair	C	**75**	0.11
0.87	0.0001	Broadleaf Chaparral	Fair	D	**81**	0.00
51.85	0.0036	Meadow	Fair	B	**70**	0.25
11.44	0.0008	Meadow	Fair	C	**80**	0.06
15.35	0.0011	Meadow	Fair	D	**84**	0.09
2.22	0.0002	Meadow	Good	B	**58**	0.01
1.47	0.0001	Meadow	Poor	B	**77**	0.01
0.09	0.0000	Meadow	Poor	C	**85**	0.00
0.63	0.0000	Meadow	Poor	D	**88**	0.00
300.57	0.0209	Narrowleaf Chaparral	Fair	B	**82**	1.72
1527.33	0.1064	Narrowleaf Chaparral	Fair	C	**88**	9.37
169.73	0.0118	Narrowleaf Chaparral	Fair	D	**91**	1.08
11.42	0.0008	Narrowleaf Chaparral	Good	B	**72**	0.06
99.20	0.0069	Narrowleaf Chaparral	Good	C	**81**	0.56
21.61	0.0015	Narrowleaf Chaparral	Good	D	**86**	0.13
79.13	0.0055	Narrowleaf Chaparral	Poor	B	**82**	0.45
2241.05	0.1562	Narrowleaf Chaparral	Poor	C	**88**	13.74
1026.10	0.0715	Narrowleaf Chaparral	Poor	D	**91**	6.51
1.11	0.0001	Ponds, Exclude From Area			**0**	0.00
0.75	0.0001	Orchards (evergreen)	Fair	B	**65**	0.00
215.63	0.0150	Orchards (evergreen)	Fair	C	**77**	1.16
2.24	0.0002	Orchards (evergreen)	Fair	D	**82**	0.01
5.42	0.0004	Orchards (evergreen)	Good	B	**58**	0.02
10.72	0.0007	Orchards (evergreen)	Good	D	**79**	0.06
76.98	0.0054	Orchards (evergreen)	Poor	C	**82**	0.44
1.70	0.0001	Orchards (evergreen)	Poor	D	**86**	0.01
121.71	0.0085	Perrenial Grass	Fair	B	**69**	0.59
99.38	0.0069	Perrenial Grass	Fair	C	**79**	0.55
58.14	0.0041	Perrenial Grass	Fair	D	**84**	0.34
28.56	0.0020	Perrenial Grass	Good	B	**61**	0.12
0.35	0.0000	Perrenial Grass	Good	C	**74**	0.00
1.20	0.0001	Perrenial Grass	Good	D	**80**	0.01
19.75	0.0014	Perrenial Grass	Poor	B	**79**	0.11
0.21	0.0000	Perrenial Grass	Poor	C	**86**	0.00
2.65	0.0002	Perrenial Grass	Poor	D	**89**	0.02
22.91	0.0016	Pinyon-juniper-pinyon	Fair	B	**58**	0.09
0.48	0.0000	Residential: 2 acre	Fair	B	**65**	0.00
68.57	0.0048	Residential: 2 acre	Poor	C	**77**	0.37
3.68	0.0003	Residential: 2 acre	Poor	D	**82**	0.02
1407.05	0.0981	Woods (woodland)	Fair	B	**60**	5.88

Guejito Creek - CN_2 Calculations

Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
1872.13	0.1305	Woods (woodland)	Fair	C	**73**	9.52
249.82	0.0174	Woods (woodland)	Fair	D	**79**	1.38
206.90	0.0144	Woods (woodland)	Good	B	**55**	0.79
290.75	0.0203	Woods (woodland)	Good	C	**70**	1.42
28.58	0.0020	Woods (woodland)	Good	D	**77**	0.15
104.26	0.0073	Woods (woodland)	Poor	B	**66**	0.48
371.31	0.0259	Woods (woodland)	Poor	C	**77**	1.99
90.50	0.0063	Woods (woodland)	Poor	D	**83**	0.52
14,396	**1.00**					**78.04**
					Use CN_2 =	**78**

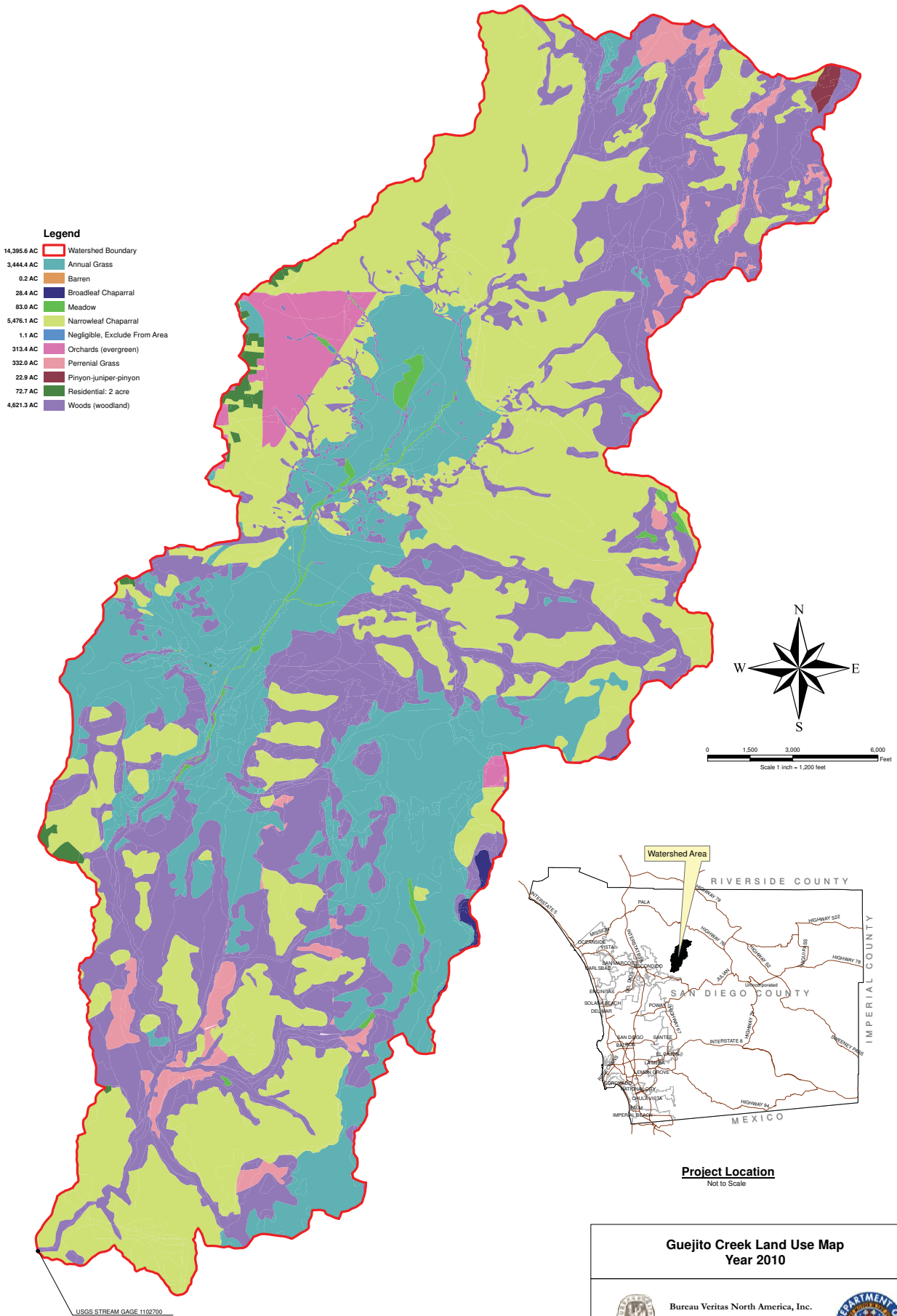
1. GIS shapefiles for hydrologic soil group, cover description, and hydrologic condition were overlayed to generate the data above. CN_2 values were then associated with this data per Table 4-2 of the 2003 SDCHM.



Project Location
Not to Scale

Guejito Creek Hydrologic Soils Group Map

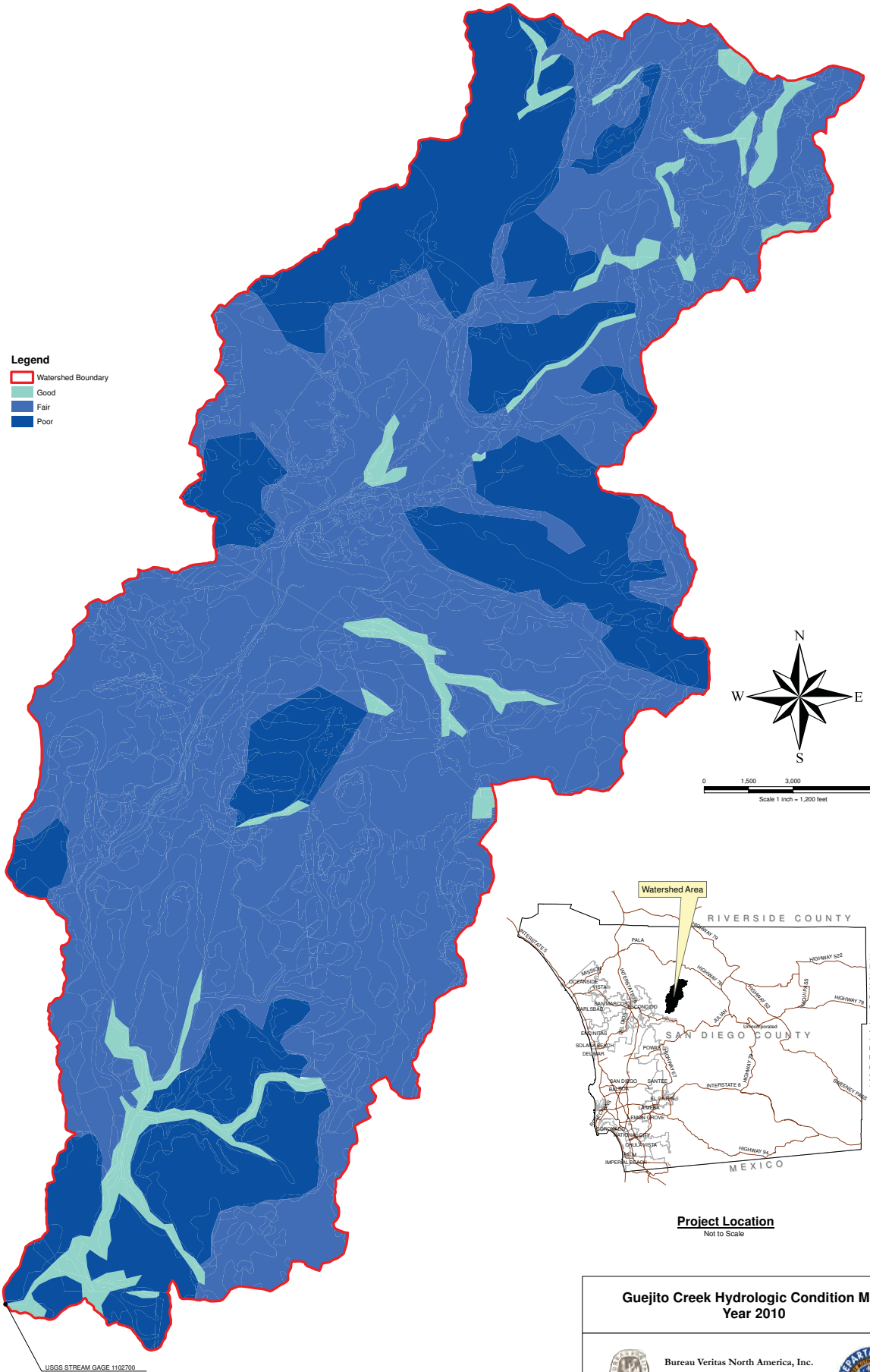
Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



Project Location
Not to Scale

Guejito Creek Land Use Map
Year 2010

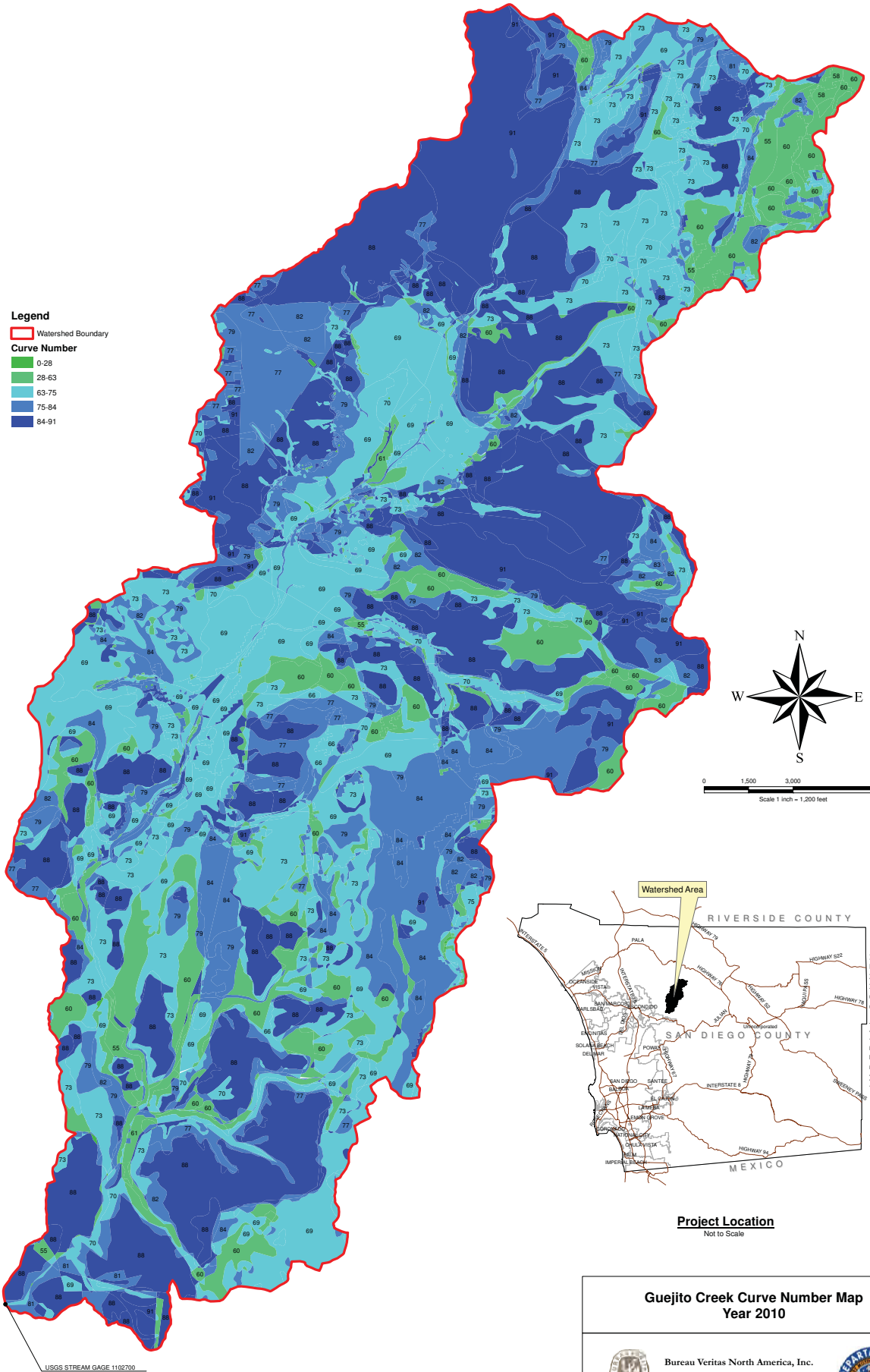
Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



Project Location
Not to Scale

Guejito Creek Hydrologic Condition Map
Year 2010

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



Project Location
Not to Scale

Guejito Creek Curve Number Map
Year 2010

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

Unadjusted CN Values for Jamul Creek

Jamul Creek - CN_2 Calculations

Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
20.57	0.0005	Annual Grass	Fair	B	**69**	0.03
21.61	0.0005	Annual Grass	Fair	C	**79**	0.04
5.19	0.0001	Annual Grass	Fair	D	**84**	0.01
1.86	0.0000	Annual Grass	Good	B	**61**	0.00
0.09	0.0000	Annual Grass	Poor	C	**86**	0.00
17.91	0.0004	Annual Grass	Poor	D	**89**	0.04
2.44	0.0001	Barren	Fair	A	**78**	0.00
319.33	0.0071	Barren	Fair	B	**86**	0.61
189.70	0.0042	Barren	Fair	C	**91**	0.38
197.47	0.0044	Barren	Fair	D	**93**	0.41
0.01	0.0000	Barren	Good	A	**78**	0.00
35.25	0.0008	Barren	Good	B	**86**	0.07
18.69	0.0004	Barren	Good	C	**91**	0.04
18.73	0.0004	Barren	Good	D	**93**	0.04
1.47	0.0000	Barren	Poor	A	**78**	0.00
42.79	0.0010	Barren	Poor	B	**86**	0.08
67.40	0.0015	Barren	Poor	C	**91**	0.14
89.08	0.0020	Barren	Poor	D	**93**	0.18
133.50	0.0030	Broadleaf Chaparral	Fair	B	**63**	0.19
694.05	0.0155	Broadleaf Chaparral	Fair	C	**75**	1.16
70.41	0.0016	Broadleaf Chaparral	Fair	D	**81**	0.13
90.59	0.0020	Broadleaf Chaparral	Good	B	**57**	0.12
24.05	0.0005	Broadleaf Chaparral	Good	C	**71**	0.04
17.98	0.0004	Broadleaf Chaparral	Good	D	**78**	0.03
0.30	0.0000	Broadleaf Chaparral	Poor	A	**53**	0.00
196.95	0.0044	Broadleaf Chaparral	Poor	B	**70**	0.31
453.52	0.0101	Broadleaf Chaparral	Poor	C	**80**	0.81
1501.76	0.0334	Broadleaf Chaparral	Poor	D	**85**	2.84
61.03	0.0014	Irrigated Pasture	Fair	B	**65**	0.09
24.30	0.0005	Irrigated Pasture	Fair	C	**77**	0.04
6.59	0.0001	Irrigated Pasture	Fair	D	**82**	0.01
19.69	0.0004	Meadow	Fair	B	**70**	0.03
1.84	0.0000	Meadow	Fair	C	**80**	0.00
0.14	0.0000	Meadow	Fair	D	**84**	0.00
34.50	0.0008	Narrowleaf Chaparral	Fair	A	**71**	0.05
1829.93	0.0408	Narrowleaf Chaparral	Fair	B	**82**	3.34
2958.98	0.0659	Narrowleaf Chaparral	Fair	C	**88**	5.80
11588.28	0.2581	Narrowleaf Chaparral	Fair	D	**91**	23.49
2.19	0.0000	Narrowleaf Chaparral	Good	A	**55**	0.00
116.21	0.0026	Narrowleaf Chaparral	Good	B	**72**	0.19
103.58	0.0023	Narrowleaf Chaparral	Good	C	**81**	0.19
896.52	0.0200	Narrowleaf Chaparral	Good	D	**86**	1.72
22.07	0.0005	Narrowleaf Chaparral	Poor	A	**71**	0.03
254.94	0.0057	Narrowleaf Chaparral	Poor	B	**82**	0.47
643.48	0.0143	Narrowleaf Chaparral	Poor	C	**88**	1.26
7126.58	0.1587	Narrowleaf Chaparral	Poor	D	**91**	14.44
9.47	0.0002	Water Body, Exclude From Area			**0**	0.00
51.20	0.0011	Open Space	Fair	B	**70**	0.08
43.00	0.0010	Open Space	Fair	C	**80**	0.08
1508.19	0.0336	Open Space	Fair	D	**84**	2.82

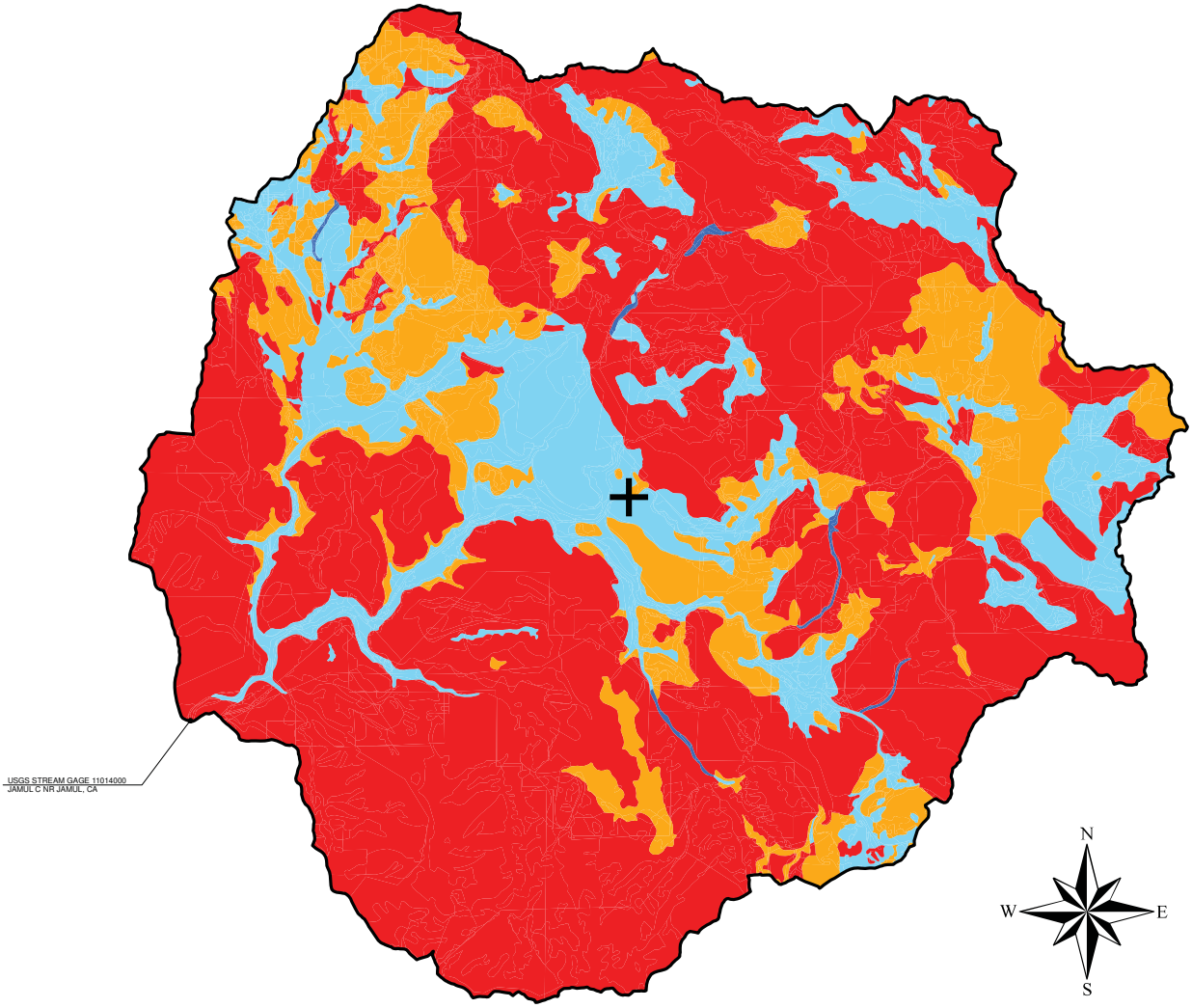
Jamul Creek - CN_2 Calculations

Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
1.47	0.0000	Open Space	Poor	C	**85**	0.00
1257.39	0.0280	Open Space	Poor	D	**88**	2.46
30.69	0.0007	Orchards (evergreen)	Fair	B	**65**	0.04
31.99	0.0007	Orchards (evergreen)	Fair	C	**77**	0.05
35.67	0.0008	Orchards (evergreen)	Fair	D	**82**	0.07
22.82	0.0005	Orchards (evergreen)	Good	C	**72**	0.04
4.48	0.0001	Orchards (evergreen)	Good	D	**79**	0.01
3.58	0.0001	Orchards (evergreen)	Poor	A	**57**	0.00
7.09	0.0002	Orchards (evergreen)	Poor	B	**73**	0.01
7.08	0.0002	Orchards (evergreen)	Poor	C	**82**	0.01
40.87	0.0009	Orchards (evergreen)	Poor	D	**86**	0.08
1.91	0.0000	Perrenial Grass	Fair	A	**50**	0.00
899.20	0.0200	Perrenial Grass	Fair	B	**69**	1.38
644.50	0.0144	Perrenial Grass	Fair	C	**79**	1.13
302.01	0.0067	Perrenial Grass	Fair	D	**84**	0.57
110.34	0.0025	Perrenial Grass	Good	B	**61**	0.15
17.44	0.0004	Perrenial Grass	Good	C	**74**	0.03
36.21	0.0008	Perrenial Grass	Good	D	**80**	0.06
17.03	0.0004	Perrenial Grass	Poor	B	**79**	0.03
23.41	0.0005	Perrenial Grass	Poor	C	**86**	0.04
105.02	0.0023	Perrenial Grass	Poor	D	**89**	0.21
472.88	0.0105	Residential Districts: 2 acre	Fair	B	**65**	0.68
788.85	0.0176	Residential Districts: 2 acre	Fair	C	**77**	1.35
366.02	0.0082	Residential Districts: 2 acre	Fair	D	**82**	0.67
4.34	0.0001	Residential Districts: 2 acre	Good	B	**65**	0.01
3.30	0.0001	Residential Districts: 2 acre	Good	C	**77**	0.01
39.06	0.0009	Residential Districts: 2 acre	Good	D	**82**	0.07
178.74	0.0040	Residential Districts: 2 acre	Poor	B	**65**	0.26
69.91	0.0016	Residential Districts: 2 acre	Poor	C	**77**	0.12
835.09	0.0186	Residential Districts: 2 acre	Poor	D	**82**	1.53
2.54	0.0001	Row Crops: Straight Row	Fair	A	**72**	0.00
1542.00	0.0343	Row Crops: Straight Row	Fair	B	**81**	2.78
782.38	0.0174	Row Crops: Straight Row	Fair	C	**88**	1.53
258.05	0.0057	Row Crops: Straight Row	Fair	D	**91**	0.52
50.26	0.0011	Row Crops: Straight Row	Good	B	**78**	0.09
10.66	0.0002	Row Crops: Straight Row	Good	C	**85**	0.02
5.58	0.0001	Row Crops: Straight Row	Good	D	**89**	0.01
18.08	0.0004	Row Crops: Straight Row	Poor	B	**81**	0.03
5.66	0.0001	Row Crops: Straight Row	Poor	C	**88**	0.01
6.63	0.0001	Row Crops: Straight Row	Poor	D	**91**	0.01
14.33	0.0003	Urban Districts (Commercial and Business)	Fair	B	**92**	0.03
4.39	0.0001	Urban Districts (Commercial and Business)	Fair	C	**94**	0.01
2.83	0.0001	Urban Districts (Commercial and Business)	Fair	D	**95**	0.01
15.55	0.0003	Woods (woodland)	Fair	A	**36**	0.01
524.25	0.0117	Woods (woodland)	Fair	B	**60**	0.70
279.80	0.0062	Woods (woodland)	Fair	C	**73**	0.45
1838.31	0.0409	Woods (woodland)	Fair	D	**79**	3.23
11.56	0.0003	Woods (woodland)	Good	A	**28**	0.01
678.92	0.0151	Woods (woodland)	Good	B	**55**	0.83

Jamul Creek - CN_2 Calculations

Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
77.98	0.0017	Woods (woodland)	Good	C	**70**	0.12
295.96	0.0066	Woods (woodland)	Good	D	**77**	0.51
29.50	0.0007	Woods (woodland)	Poor	A	**45**	0.03
40.32	0.0009	Woods (woodland)	Poor	B	**66**	0.06
45.71	0.0010	Woods (woodland)	Poor	C	**77**	0.08
461.34	0.0103	Woods (woodland)	Poor	D	**83**	0.85
44,896	**1.00**					**84.87**
					Use CN_2 =	**85**

1. GIS shapefiles for hydrologic soil group, cover description, and hydrologic condition were overlayed to generate the data above. CN_2 values were then associated with this data per Table 4-2 of the 2003 SDCHM.



Legend

Centroid

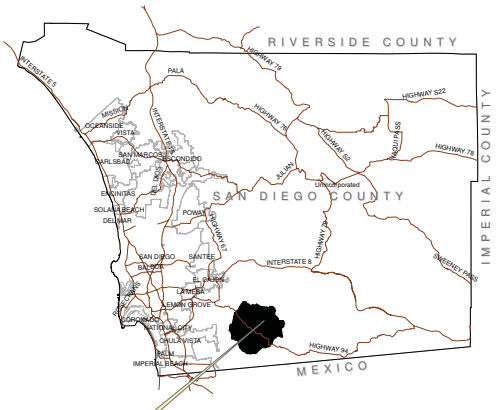
Watershed Boundary

A

B

C

D

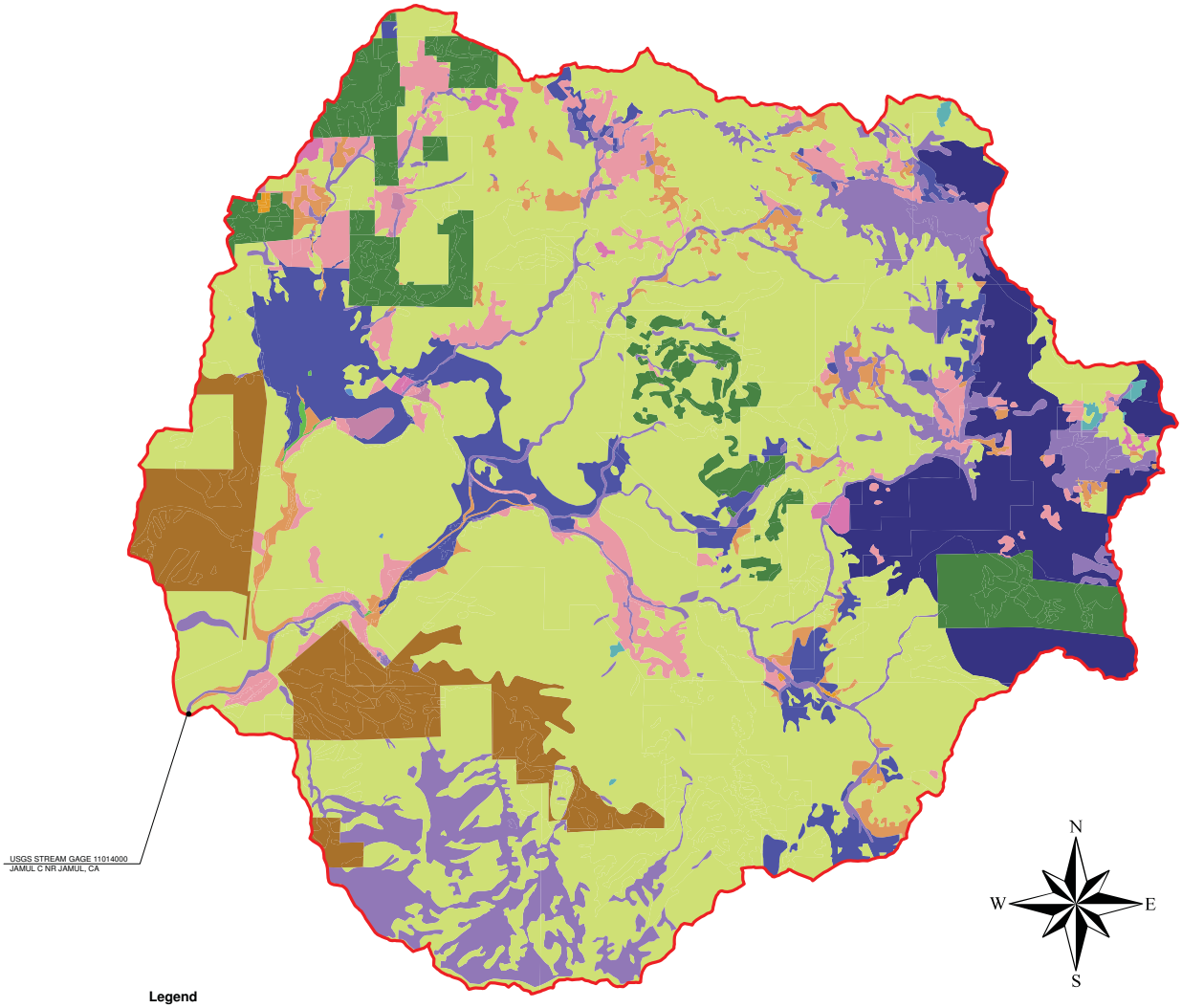


Project Location

Not to Scale

Jamul Creek Hydrologic Soils Group Map

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

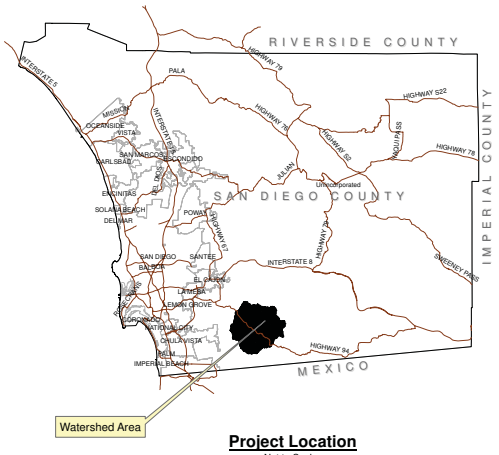


0 1,500 3,000 6,000 Feet

Scale 1 inch = 1,200 feet

Legend

44882.5 AC	Watershed Boundary
67.2 AC	Annual Grass
982.3 AC	Barren
3,183.1 AC	Broadleaf Chaparral
91.9 AC	Irrigated Pasture
21.7 AC	Meadow
25,577.3 AC	Narrowleaf Chaparral
9.5 AC	Negligible, Exclude From Area
2,861.2 AC	Open Space
184.3 AC	Orchards (evergreen)
2,157.1 AC	Perrenial Grass
2,758.2 AC	Residential Districts: 2 acre
2,681.8 AC	Row Crops: Straight Row
21.5 AC	Urban Districts (Commercial and Business)
4,299.2 AC	Woods (woodland)

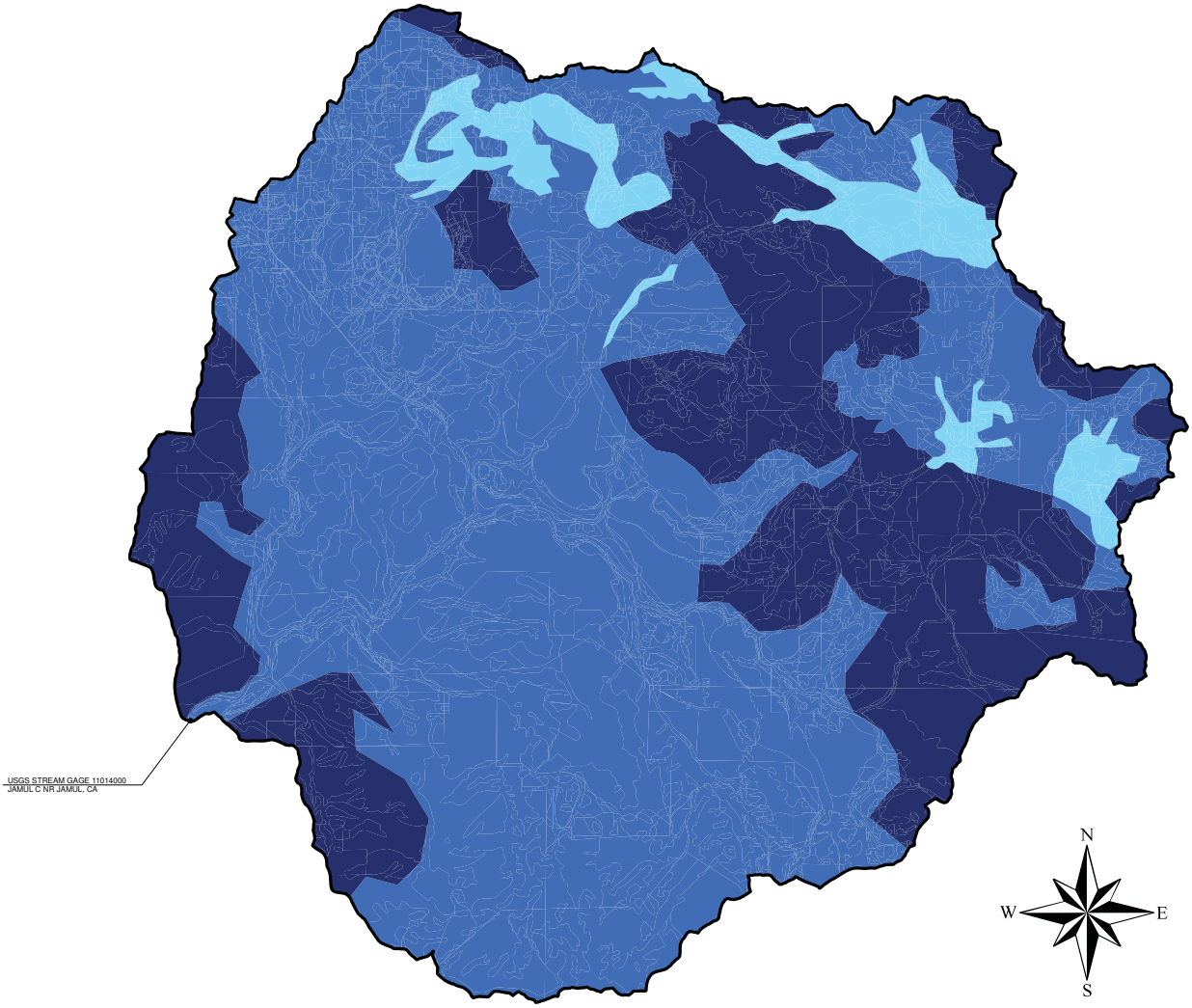


Project Location

Not to Scale

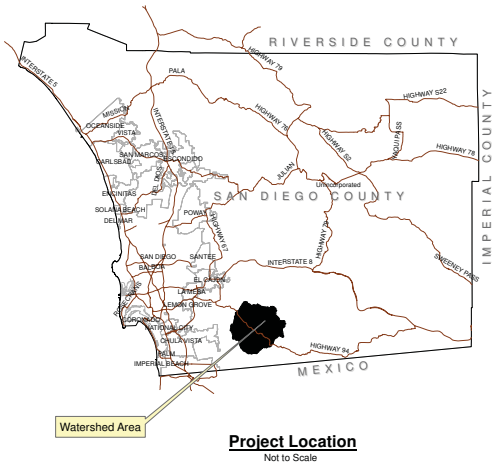
Jamul Creek Land Use Map
Year 2010

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



Legend

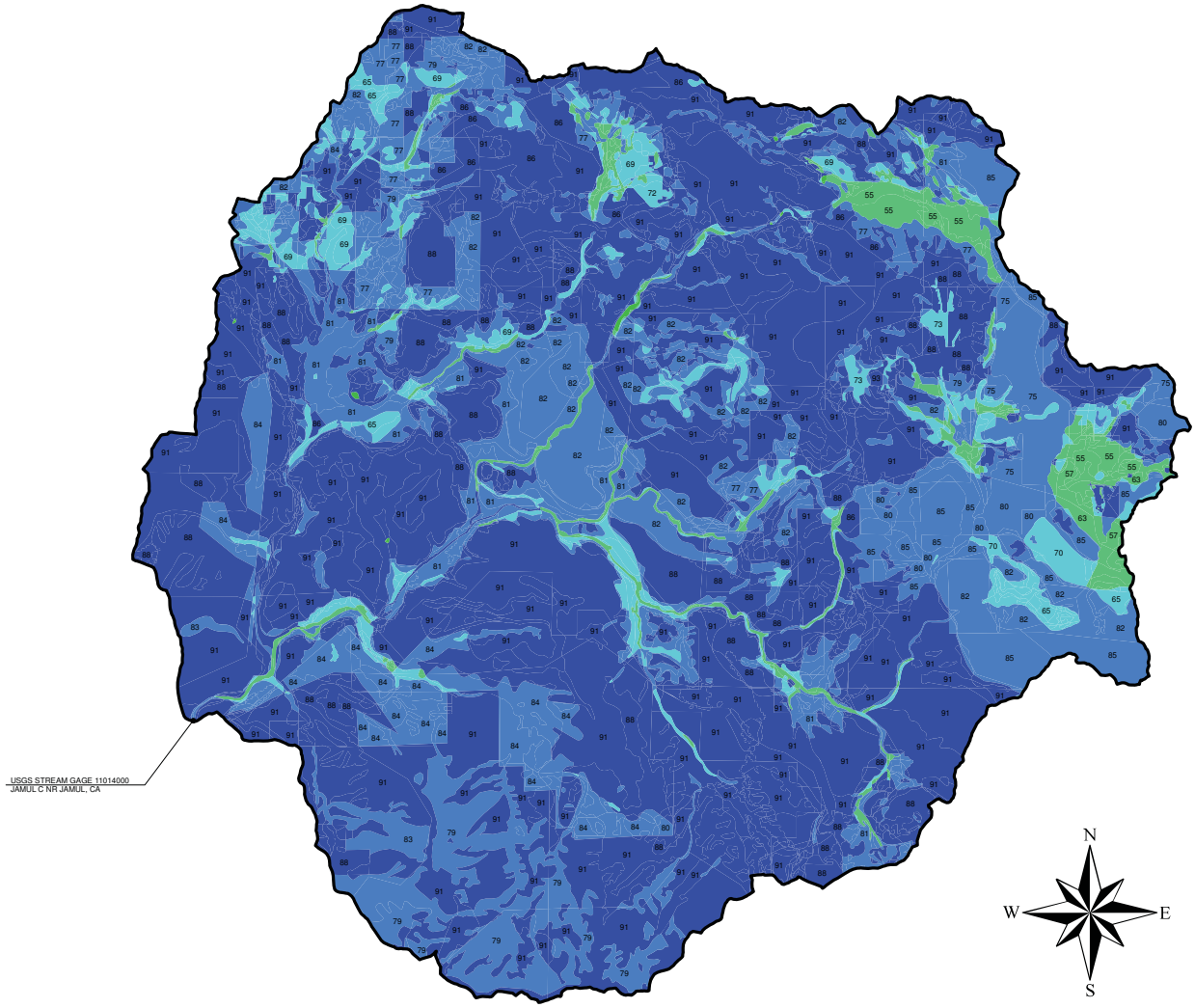
- Watershed Boundary
- Good
- Fair
- Poor



Project Location
Not to Scale

Jamul Creek Hydrologic Condition Map

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

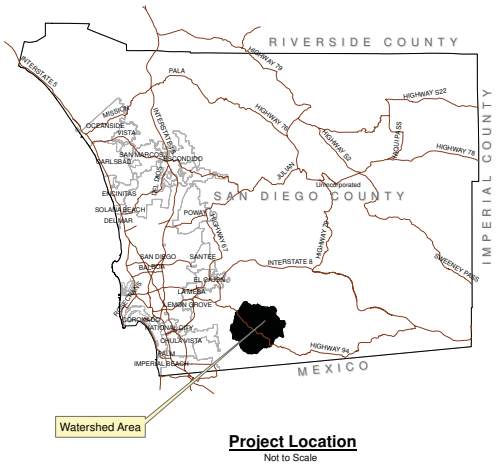


Legend

- Watershed Boundary

Curve Number

- 0-28
- 28-63
- 63-74
- 74-85
- 85-95



Project Location
Not to Scale

Jamul Creek Curve Number Map

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

Unadjusted CN Values for Las Flores Creek

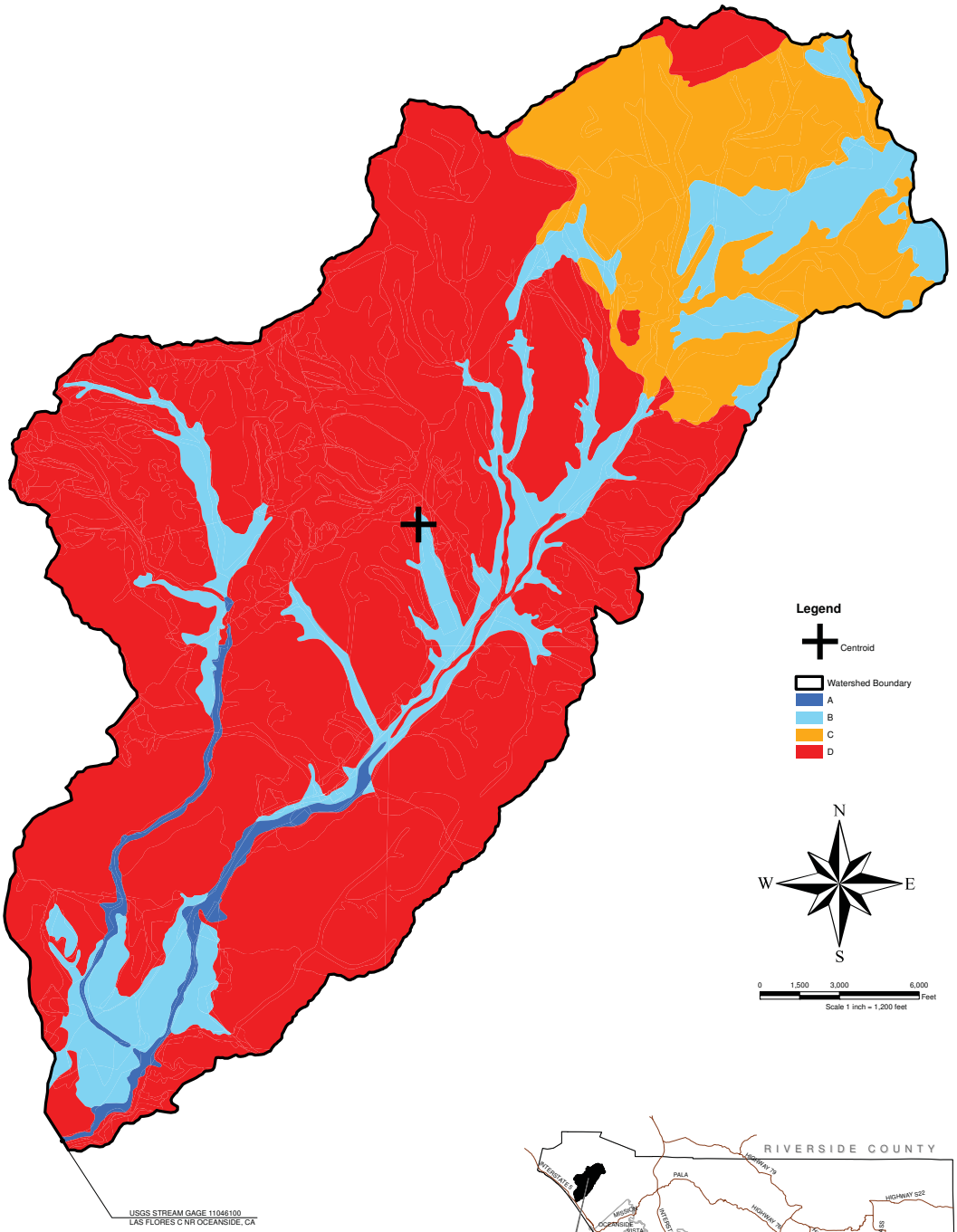
Las Flores Creek - CN_2 Calculations

Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
211.86	0.01	Annual Grass	Fair	B	**69**	0.86
96.55	0.01	Annual Grass	Fair	D	**84**	0.48
97.66	0.01	Annual Grass	Good	B	**61**	0.35
0.81	0.00	Annual Grass	Good	C	**74**	0.00
29.32	0.00	Annual Grass	Good	D	**80**	0.14
0.80	0.00	Broadleaf Chaparral	Fair	B	**63**	0.00
47.34	0.00	Broadleaf Chaparral	Fair	C	**75**	0.21
10.22	0.00	Broadleaf Chaparral	Fair	D	**81**	0.05
196.47	0.01	Broadleaf Chaparral	Good	C	**71**	0.82
3.91	0.00	Broadleaf Chaparral	Good	D	**78**	0.02
5.27	0.00	Broadleaf Chaparral	Poor	C	**80**	0.02
29.18	0.00	Broadleaf Chaparral	Poor	D	**85**	0.15
2.03	0.00	Meadow	Fair	A	**51**	0.01
0.22	0.00	Meadow	Fair	B	**70**	0.00
10.18	0.00	Meadow	Fair	D	**84**	0.05
4.61	0.00	Meadow	Good	A	**30**	0.01
0.25	0.00	Meadow	Good	B	**58**	0.00
3.64	0.00	Meadow	Good	D	**78**	0.02
0.15	0.00	Meadow	Poor	B	**77**	0.00
0.76	0.00	Meadow	Poor	D	**88**	0.00
55.37	0.00	Narrowleaf Chaparral	Fair	A	**71**	0.23
552.01	0.03	Narrowleaf Chaparral	Fair	B	**82**	2.66
483.39	0.03	Narrowleaf Chaparral	Fair	C	**88**	2.50
1569.05	0.09	Narrowleaf Chaparral	Fair	D	**91**	8.38
92.21	0.01	Narrowleaf Chaparral	Good	A	**55**	0.30
134.02	0.01	Narrowleaf Chaparral	Good	B	**72**	0.57
15.47	0.00	Narrowleaf Chaparral	Good	C	**81**	0.07
172.40	0.01	Narrowleaf Chaparral	Good	D	**86**	0.87
16.44	0.00	Narrowleaf Chaparral	Poor	A	**71**	0.07
25.29	0.00	Narrowleaf Chaparral	Poor	B	**82**	0.12
358.59	0.02	Narrowleaf Chaparral	Poor	C	**88**	1.85
621.81	0.04	Narrowleaf Chaparral	Poor	D	**91**	3.32
7.21	0.00	Negligible, Exclude From Area	Poor	D	**0**	0.00
11.57	0.00	Perrenial Grass	Fair	A	**50**	0.03
793.58	0.05	Perrenial Grass	Fair	B	**69**	3.21
421.09	0.02	Perrenial Grass	Fair	C	**79**	1.95
2327.56	0.14	Perrenial Grass	Fair	D	**84**	11.47
13.06	0.00	Perrenial Grass	Good	A	**38**	0.03
112.41	0.01	Perrenial Grass	Good	B	**61**	0.40
38.68	0.00	Perrenial Grass	Good	C	**74**	0.17
150.74	0.01	Perrenial Grass	Good	D	**80**	0.71
24.95	0.00	Perrenial Grass	Poor	A	**67**	0.10
5.56	0.00	Perrenial Grass	Poor	B	**79**	0.03
6.14	0.00	Perrenial Grass	Poor	C	**86**	0.03
1970.87	0.12	Perrenial Grass	Poor	D	**89**	10.29
1.47	0.00	Residential Districts: 1/8 acre	Good	D	**92**	0.01
2.05	0.00	Residential Districts: 1/8 acre	Poor	B	**85**	0.01
102.18	0.01	Urban Districts (Commercial and B	Fair	B	**92**	0.55
179.08	0.01	Urban Districts (Commercial and B	Fair	D	**95**	1.00
91.14	0.01	Urban Districts (Commercial and B	Good	B	**92**	0.49
152.12	0.01	Urban Districts (Commercial and B	Good	C	**94**	0.84

Las Flores Creek - CN_2 Calculations

Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
14.03	0.00	Urban Districts (Commercial and B	Good	D	**95**	0.08
14.24	0.00	Urban Districts (Commercial and B	Poor	A	**89**	0.07
26.14	0.00	Urban Districts (Commercial and B	Poor	D	**95**	0.15
7.29	0.00	Woods (woodland)	Fair	A	**36**	0.02
300.07	0.02	Woods (woodland)	Fair	B	**60**	1.06
784.43	0.05	Woods (woodland)	Fair	C	**73**	3.36
2984.02	0.18	Woods (woodland)	Fair	D	**79**	13.83
42.18	0.00	Woods (woodland)	Good	A	**28**	0.07
54.59	0.00	Woods (woodland)	Good	B	**55**	0.18
17.08	0.00	Woods (woodland)	Good	C	**70**	0.07
311.87	0.02	Woods (woodland)	Good	D	**77**	1.41
11.22	0.00	Woods (woodland)	Poor	A	**45**	0.03
5.09	0.00	Woods (woodland)	Poor	B	**66**	0.02
30.20	0.00	Woods (woodland)	Poor	C	**77**	0.14
1183.08	0.07	Woods (woodland)	Poor	D	**83**	5.76
17,044	**1.00**					**81.66**
					Use CN_2 =	**82**

1. GIS shapefiles for hydrologic soil group, cover description, and hydrologic condition were overlayed to generate the data above. CN_2 values were then associated with this data per Table 4-2 of the 2003 SDCHM.



Legend

Centroid

Watershed Boundary

A

B

C

D

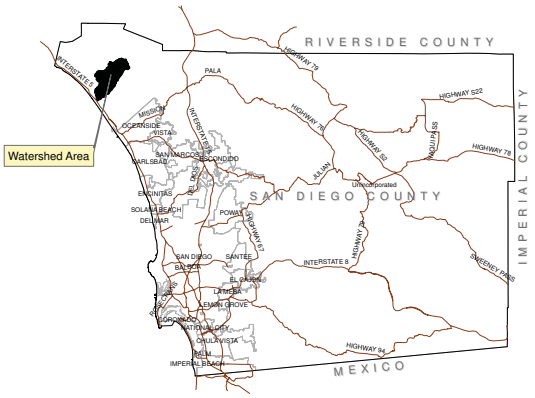
N

W E

S

0 1,500 3,000 6,000 Feet

Scale 1 inch = 1,200 feet

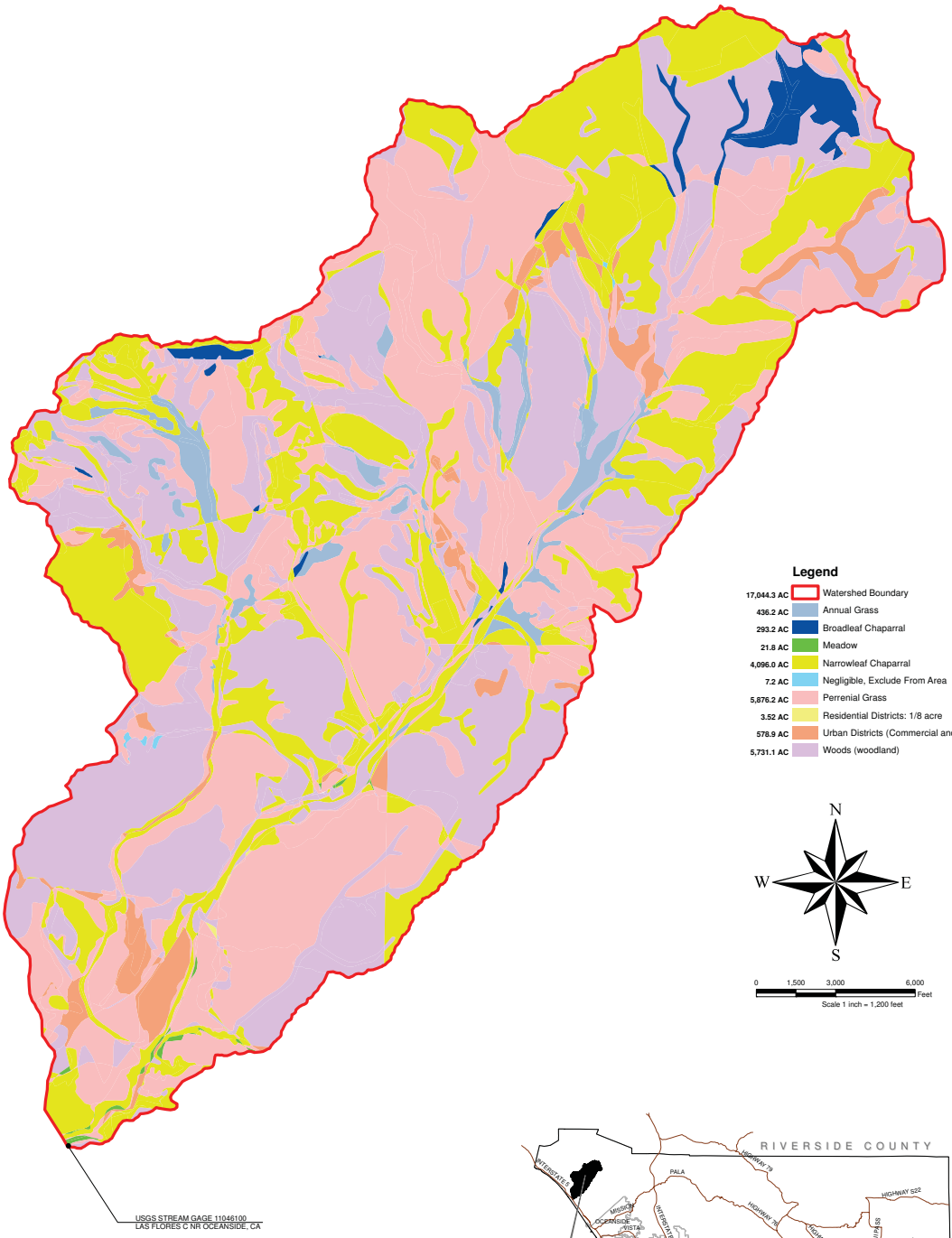


Project Location

Not to Scale

Las Flores Creek Hydrologic Soils Group Map
Year 1989

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



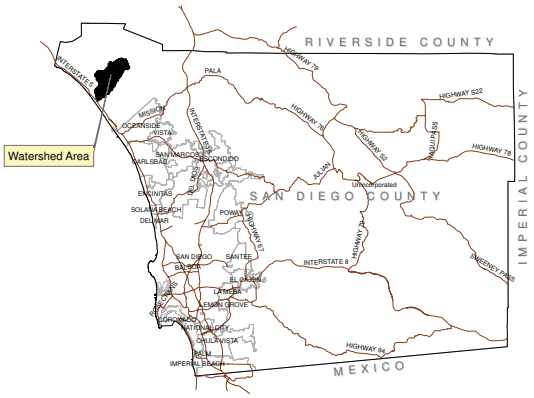
Legend

17,044.3 AC	Watershed Boundary
436.2 AC	Annual Grass
293.2 AC	Broadleaf Chaparral
21.8 AC	Meadow
4,096.0 AC	Narrowleaf Chaparral
7.2 AC	Negligible, Exclude From Area
5,876.2 AC	Perrenial Grass
3.52 AC	Residential Districts: 1/8 acre
578.9 AC	Urban Districts (Commercial and Business)
5,731.1 AC	Woods (woodland)

N
W E
S

0 1,500 3,000 6,000 Feet

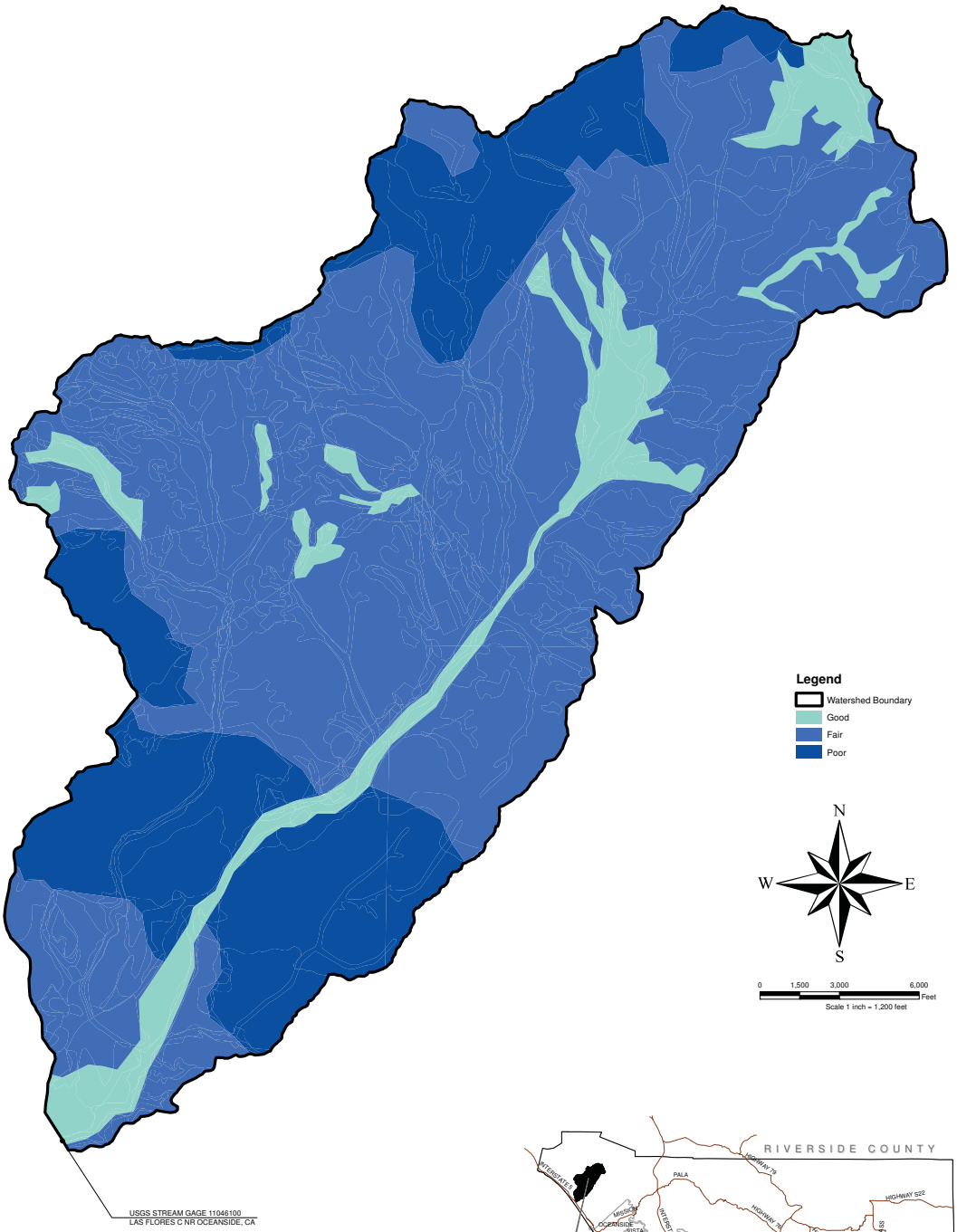
Scale 1 inch = 1,200 feet



Project Location
Not to Scale

Las Flores Creek Land Use Map
Year 1989

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



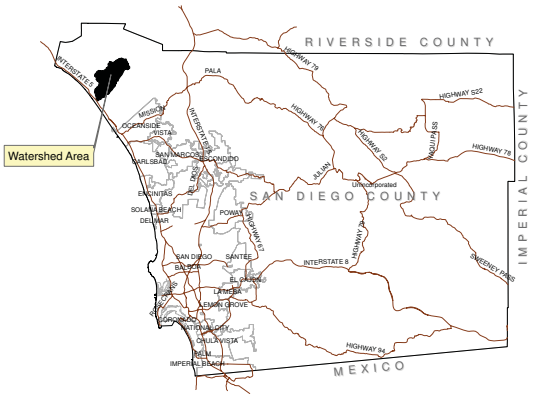
Legend

- Watershed Boundary
- Good
- Fair
- Poor

N
W E
S

0 1,500 3,000 6,000 Feet

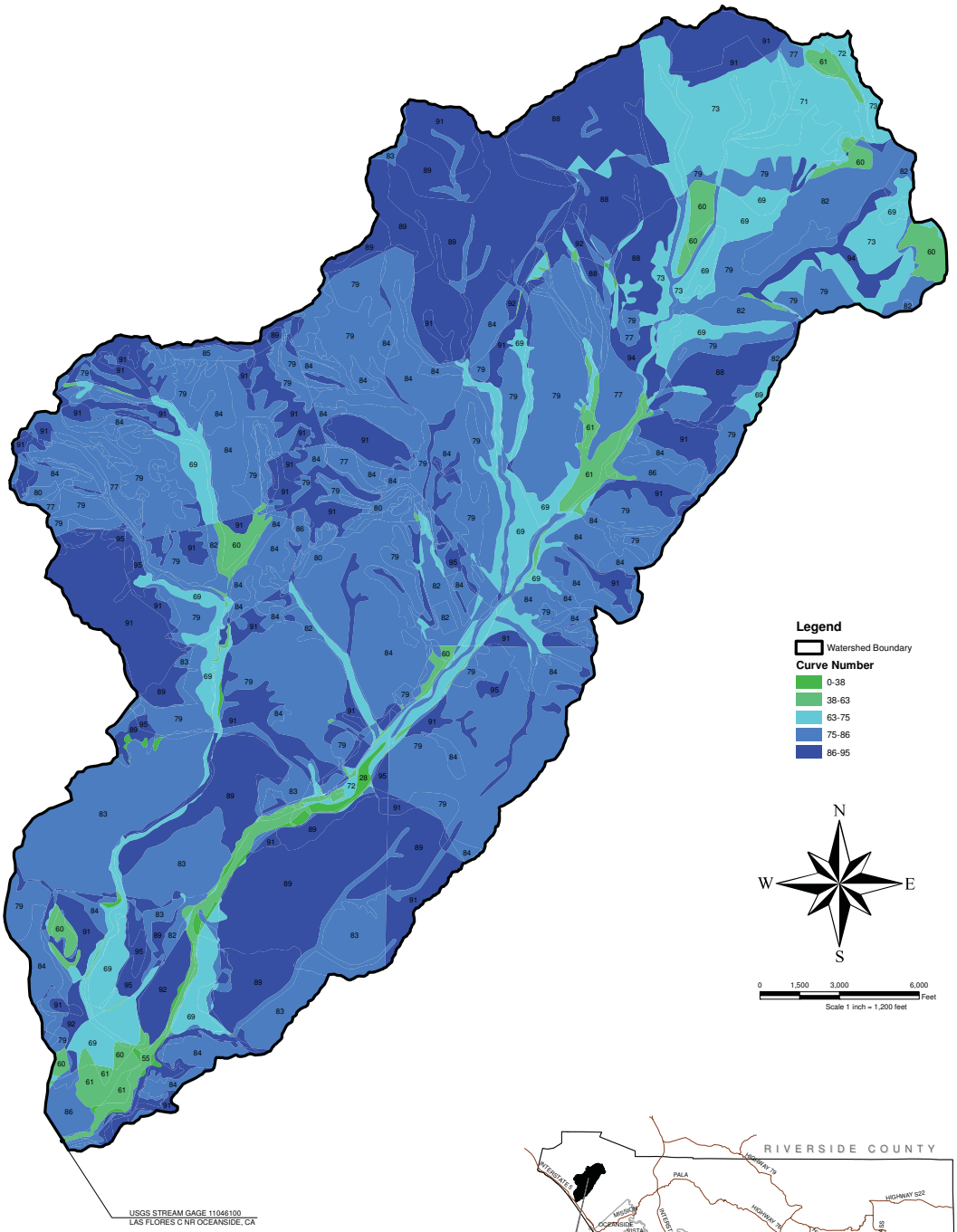
Scale 1 inch = 1,200 feet



Project Location
Not to Scale

Las Flores Creek Hydrologic Condition Map Year 1989

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



Legend

Watershed Boundary

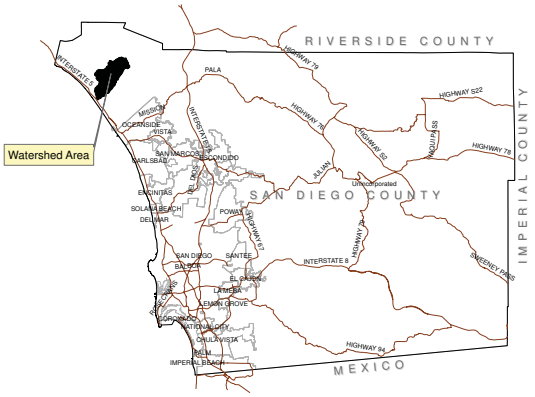
Curve Number

- 0-38
- 38-63
- 63-75
- 75-86
- 86-95

N
W E
S

0 1,500 3,000 6,000 Feet

Scale 1 inch = 1,200 feet



Project Location

Not to Scale

Las Flores Creek Curve Number Map
Year 1989

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

Unadjusted CN Values for Los Coches Creek

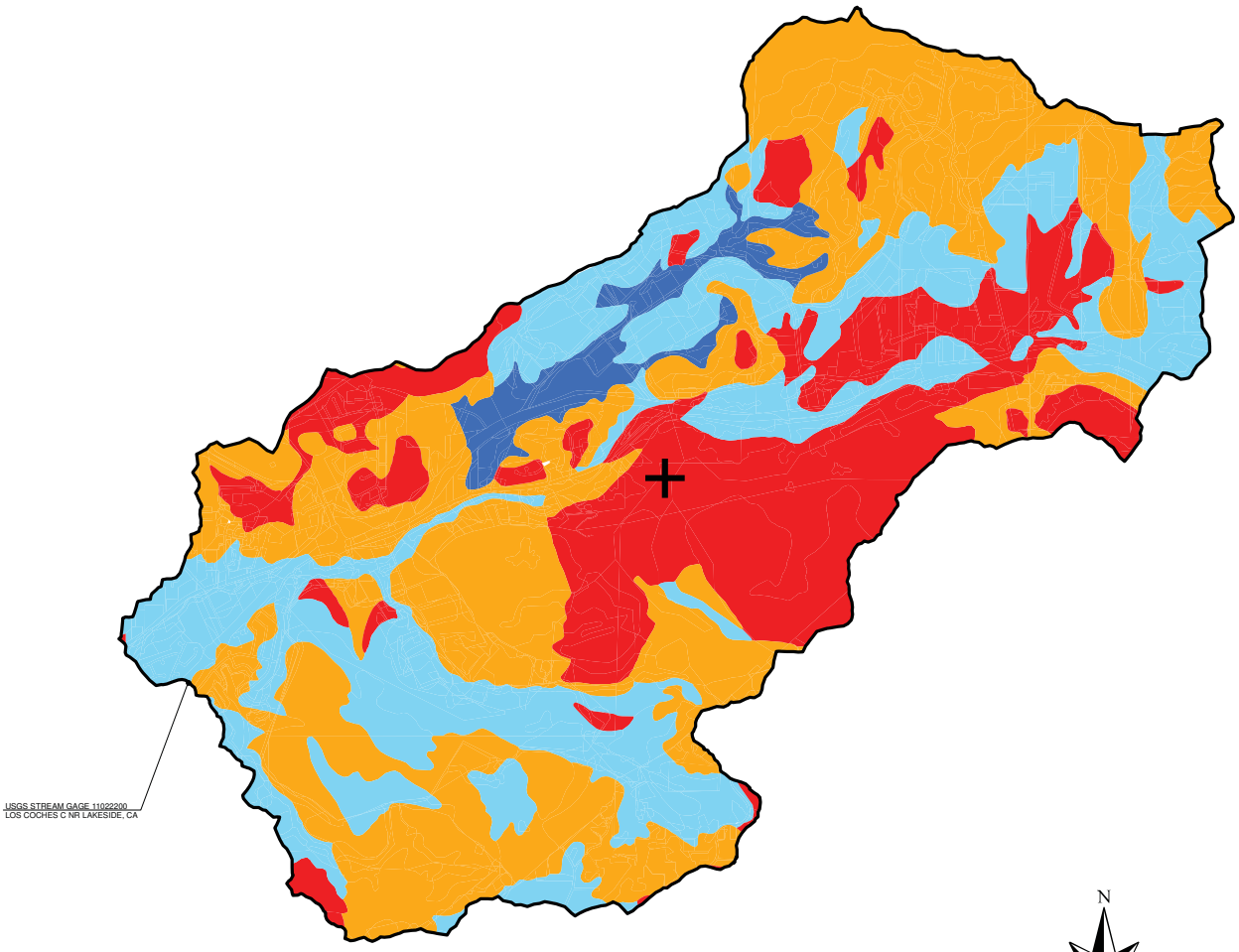
Los Coches Creek - CN_2 Calculations

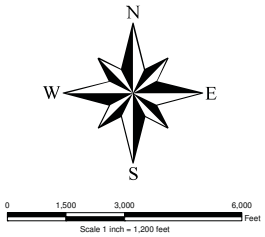
Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
15.88	0.0020	Barren	Fair	A	**78**	0.16
84.89	0.0109	Barren	Fair	B	**86**	0.94
50.46	0.0065	Barren	Fair	C	**91**	0.59
29.51	0.0038	Barren	Fair	D	**93**	0.35
1.91	0.0002	Barren	Poor	B	**86**	0.02
9.03	0.0012	Barren	Poor	C	**91**	0.11
0.07	0.0000	Broadleaf Chaparral	Fair	B	**63**	0.00
27.06	0.0035	Narrowleaf Chaparral	Fair	A	**71**	0.25
366.09	0.0470	Narrowleaf Chaparral	Fair	B	**82**	3.86
990.23	0.1272	Narrowleaf Chaparral	Fair	C	**88**	11.19
403.43	0.0518	Narrowleaf Chaparral	Fair	D	**91**	4.72
8.75	0.0011	Narrowleaf Chaparral	Good	B	**72**	0.08
13.65	0.0018	Narrowleaf Chaparral	Good	C	**81**	0.14
0.14	0.0000	Narrowleaf Chaparral	Good	D	**86**	0.00
14.11	0.0018	Narrowleaf Chaparral	Poor	B	**82**	0.15
311.30	0.0400	Narrowleaf Chaparral	Poor	C	**88**	3.52
672.15	0.0863	Narrowleaf Chaparral	Poor	D	**91**	7.86
13.59	0.0017	Open Space	Fair	B	**70**	0.12
32.07	0.0041	Open Space	Fair	C	**80**	0.33
33.52	0.0043	Open Space	Fair	D	**84**	0.36
14.28	0.0018	Open Space	Good	B	**58**	0.11
9.76	0.0013	Open Space	Good	C	**72**	0.09
69.07	0.0089	Perrenial Grass	Fair	A	**50**	0.44
594.19	0.0763	Perrenial Grass	Fair	B	**69**	5.27
259.02	0.0333	Perrenial Grass	Fair	C	**79**	2.63
240.73	0.0309	Perrenial Grass	Fair	D	**84**	2.60
7.78	0.0010	Perrenial Grass	Good	B	**61**	0.06
6.70	0.0009	Perrenial Grass	Good	C	**74**	0.06
2.06	0.0003	Perrenial Grass	Poor	B	**79**	0.02
11.11	0.0014	Perrenial Grass	Poor	C	**86**	0.12
2.98	0.0004	Perrenial Grass	Poor	D	**89**	0.03
3.76	0.0005	Residential Districts: 1/3 acre	Fair	B	**72**	0.03
10.56	0.0014	Residential Districts: 1/3 acre	Fair	C	**81**	0.11
3.67	0.0005	Residential Districts: 1/4 acre	Fair	A	**61**	0.03
152.17	0.0195	Residential Districts: 1/4 acre	Fair	B	**75**	1.47
321.83	0.0413	Residential Districts: 1/4 acre	Fair	C	**83**	3.43
116.09	0.0149	Residential Districts: 1/4 acre	Fair	D	**87**	1.30
5.28	0.0007	Residential Districts: 1/4 acre	Good	B	**75**	0.05
14.17	0.0018	Residential Districts: 1/4 acre	Good	C	**83**	0.15
59.08	0.0076	Residential Districts: 1/8 acre	Fair	B	**85**	0.65
92.79	0.0119	Residential Districts: 1/8 acre	Fair	C	**90**	1.07
45.55	0.0059	Residential Districts: 1/8 acre	Fair	D	**92**	0.54
0.02	0.0000	Residential Districts: 1/8 acre	Good	C	**90**	0.00
57.51	0.0074	Residential Districts: 2 acre	Fair	A	**46**	0.34
176.85	0.0227	Residential Districts: 2 acre	Fair	B	**65**	1.48
753.14	0.0967	Residential Districts: 2 acre	Fair	C	**77**	7.45
157.40	0.0202	Residential Districts: 2 acre	Fair	D	**82**	1.66
93.35	0.0120	Residential Districts: 2 acre	Good	B	**65**	0.78
15.45	0.0020	Residential Districts: 2 acre	Good	C	**77**	0.15
15.76	0.0020	Residential Districts: 2 acre	Good	D	**82**	0.17
0.08	0.0000	Residential Districts: 2 acre	Poor	C	**77**	0.00

Los Coches Creek - CN_2 Calculations

Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
0.03	0.0000	Residential Districts: 2 acre	Poor	D	**82**	0.00
51.69	0.0066	Row Crops: Straight Row	Fair	A	**72**	0.48
138.27	0.0178	Row Crops: Straight Row	Fair	B	**81**	1.44
21.76	0.0028	Row Crops: Straight Row	Fair	C	**88**	0.25
61.15	0.0079	Row Crops: Straight Row	Fair	D	**91**	0.71
281.18	0.0361	Row Crops: Straight Row	Good	B	**78**	2.82
212.13	0.0272	Row Crops: Straight Row	Good	C	**85**	2.32
9.92	0.0013	Row Crops: Straight Row	Good	D	**89**	0.11
0.40	0.0001	Row Crops: Straight Row	Poor	B	**81**	0.00
2.10	0.0003	Row Crops: Straight Row	Poor	C	**88**	0.02
209.08	0.0269	Streets and Roads Paved: Curbs and storm drains			**98**	2.63
70.45	0.0090	Urban Districts (Commercial and Business)	Fair	B	**92**	0.83
25.10	0.0032	Urban Districts (Commercial and Business)	Fair	C	**94**	0.30
7.03	0.0009	Urban Districts (Commercial and Business)	Fair	D	**95**	0.09
2.60	0.0003	Urban Districts (Commercial and Business)	Good	B	**92**	0.03
1.42	0.0002	Urban Districts (Commercial and Business)	Good	C	**94**	0.02
1.88	0.0002	Urban Districts (Commercial and Business)	Good	D	**95**	0.02
24.63	0.0032	Urban Districts (Industrial)	Fair	A	**81**	0.26
21.34	0.0027	Urban Districts (Industrial)	Fair	B	**88**	0.24
22.32	0.0029	Urban Districts (Industrial)	Fair	C	**91**	0.26
14.64	0.0019	Urban Districts (Industrial)	Poor	D	**93**	0.17
21.58	0.0028	Woods (woodland)	Fair	A	**36**	0.10
50.17	0.0064	Woods (woodland)	Fair	B	**60**	0.39
29.74	0.0038	Woods (woodland)	Fair	C	**73**	0.28
85.35	0.0110	Woods (woodland)	Fair	D	**79**	0.87
18.82	0.0024	Woods (woodland)	Good	B	**55**	0.13
1.03	0.0001	Woods (woodland)	Good	C	**70**	0.01
1.33	0.0002	Woods (woodland)	Good	D	**77**	0.01
7.44	0.0010	Woods (woodland)	Poor	D	**83**	0.08
7,785	**1.00**					**81.90**
					Use CN_2 =	**82**

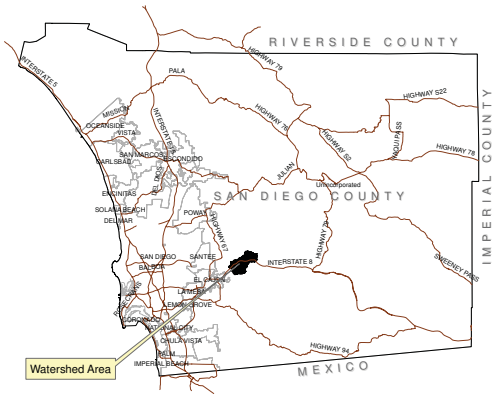
1. GIS shapefiles for hydrologic soil group, cover description, and hydrologic condition were overlayed to generate the data above. CN_2 values were then associated with this data per Table 4-2 of the 2003 SDCHM.





Legend

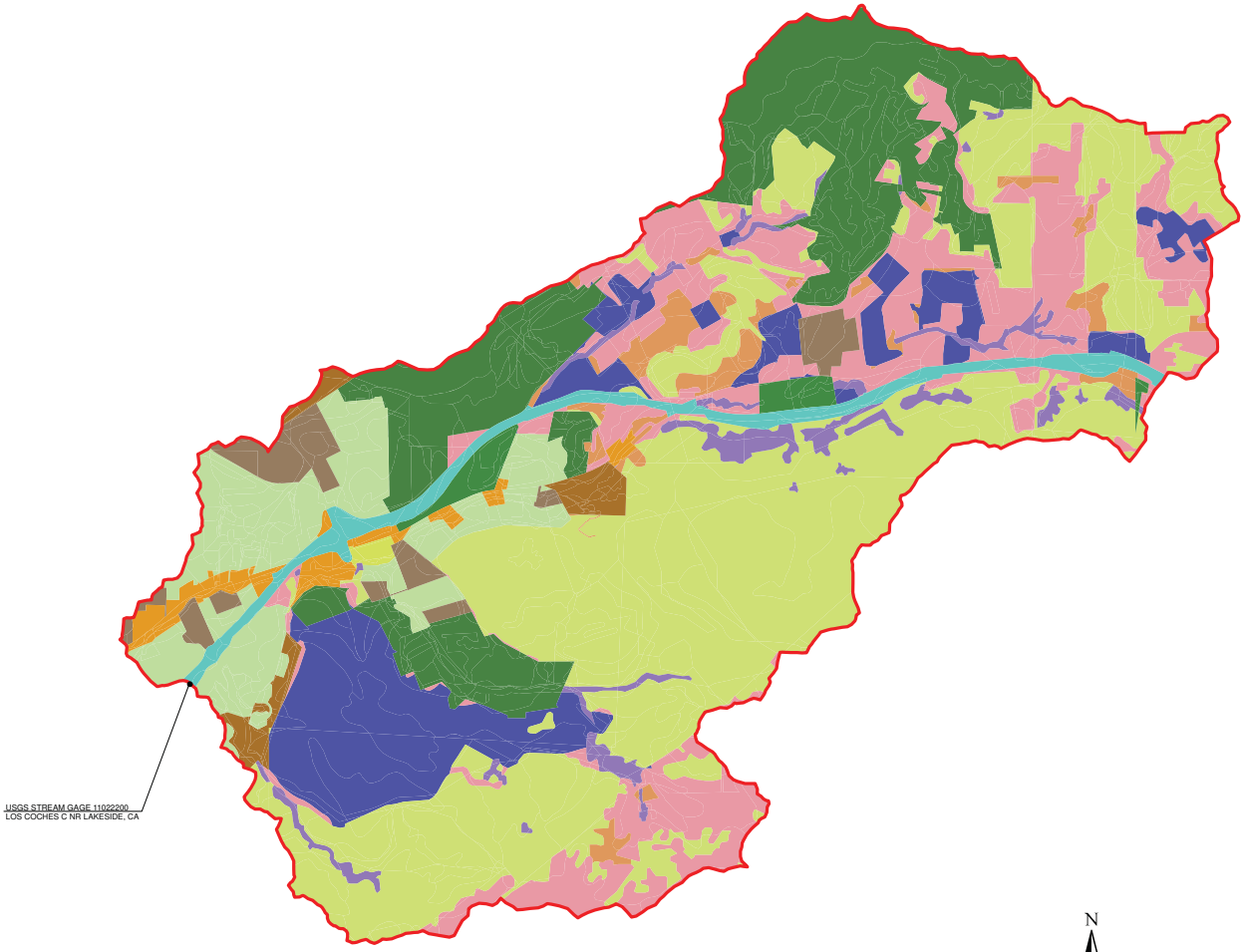
- Centroid
- Watershed Boundary
- A
- B
- C
- D

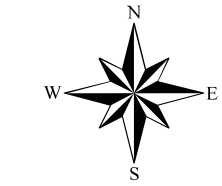


Project Location
Not to Scale

Los Coches Creek Hydrologic Soils Group Map

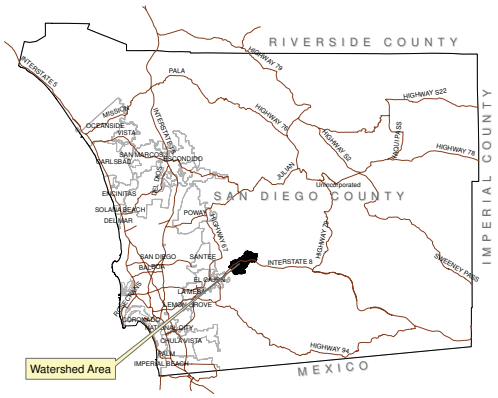
Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





Legend

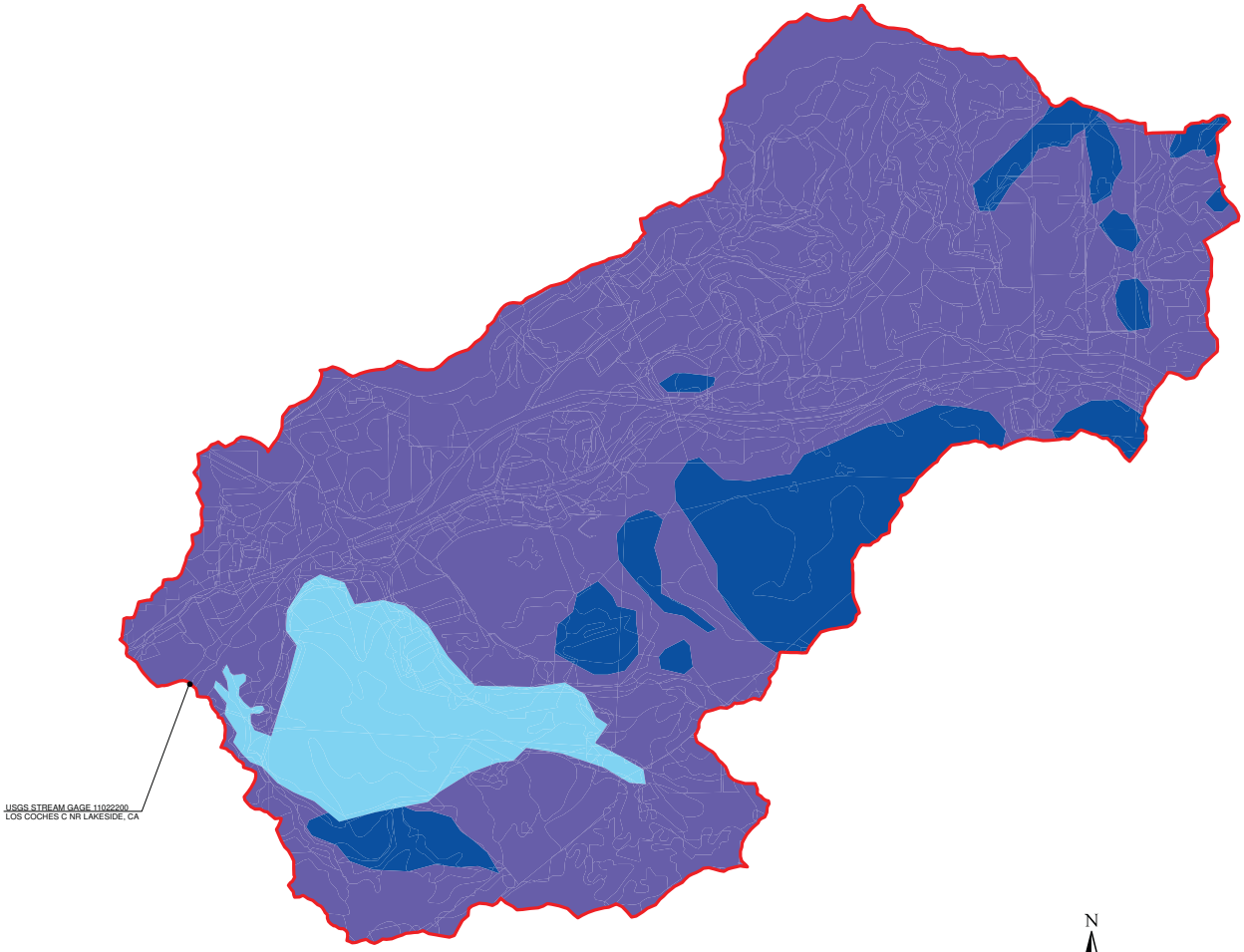
7,784.6 AC	Watershed Boundary
191.7 AC	Barren
0.1 AC	Broadleaf Chaparral
2,806.9 AC	Narrowleaf Chaparral
103.2 AC	Open Space
1,193.7 AC	Perrenial Grass
14.3 AC	Residential Districts: 1/3 acre
613.2 AC	Residential Districts: 1/4 acre
256.9 AC	Residential Districts: 1/8 acre
1,715.7 AC	Residential Districts: 2 acre
202.5 AC	Row Crops: Straight Row
476.5 AC	Streets and Roads Paved: Curbs and storm drains
11.0 AC	Urban Districts (Commercial and Business)
30.1 AC	Urban Districts (Industrial)
202.1 AC	Woods (woodland)

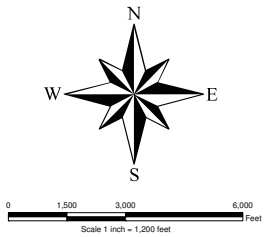


Project Location
Not to Scale

Los Coches Creek Land Use Map
Year 2010

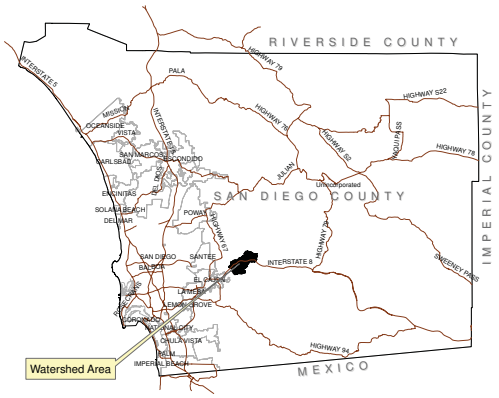
Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





Legend

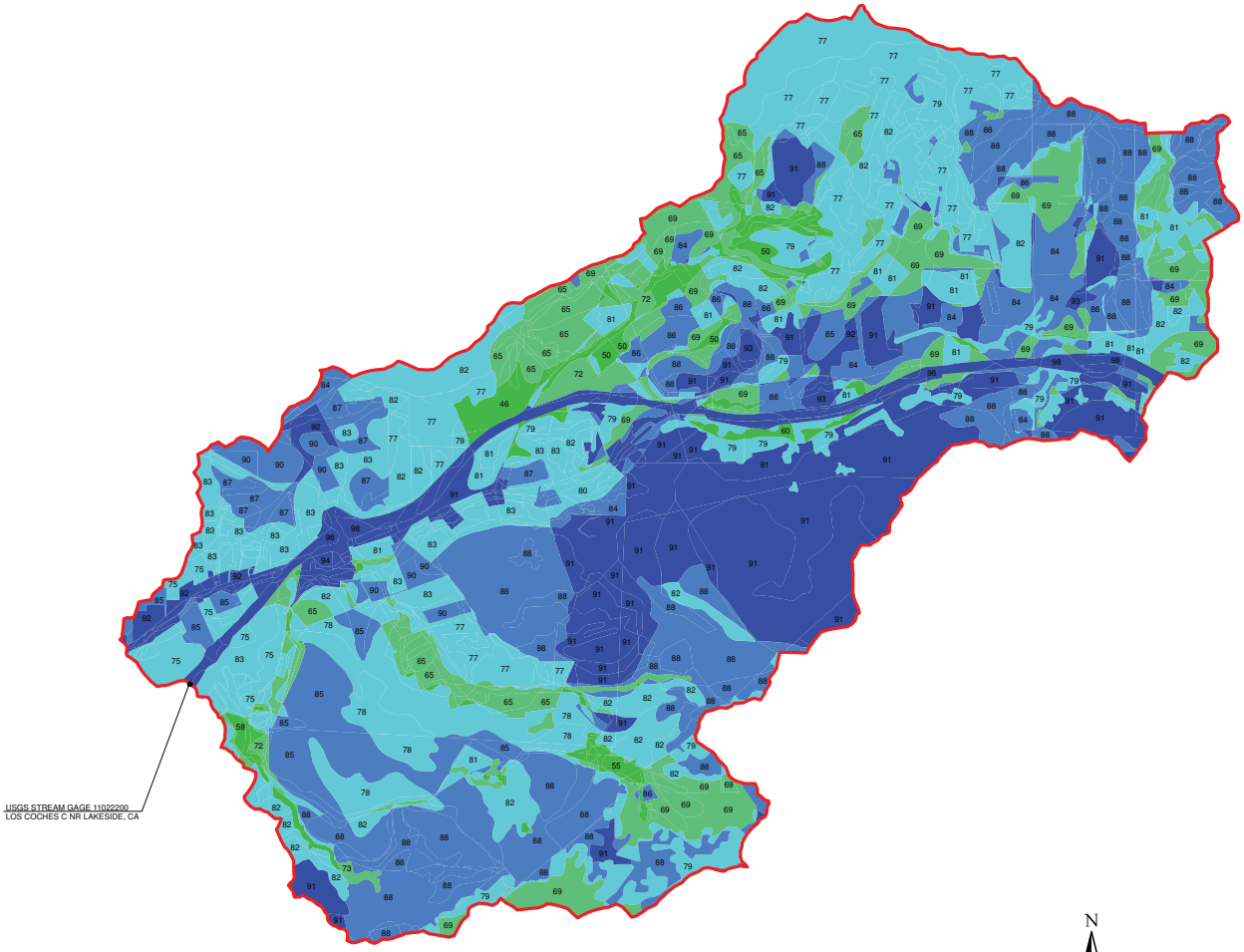
- Watershed Boundary
- Good
- Fair
- Poor

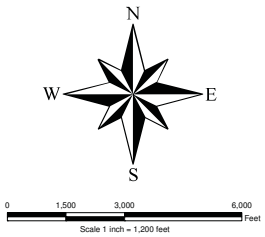


Project Location
Not to Scale

Los Coches Creek Hydrologic Condition Map Year 2010

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



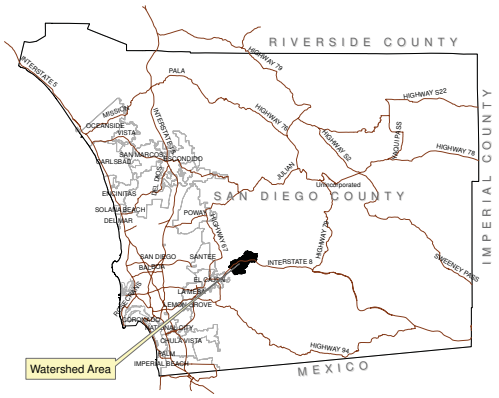


Legend

Watershed Boundary

Curve Number

- 36-61
- 61-74
- 74-83
- 83-90
- 90-98



Project Location
Not to Scale

Los Coches Creek Curve Number Map Year 2010

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

Unadjusted CN Values for Santa Maria Creek

Santa Maria Creek - CN_2 Calculations

Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
0.85	0.0000	Annual Grass	Fair	A	**50**	0.00
362.78	0.0100	Annual Grass	Fair	B	**69**	0.69
147.40	0.0041	Annual Grass	Fair	C	**79**	0.32
74.87	0.0021	Annual Grass	Fair	D	**84**	0.17
157.47	0.0043	Annual Grass	Good	B	**61**	0.26
207.61	0.0057	Annual Grass	Good	C	**74**	0.42
8.93	0.0002	Annual Grass	Good	D	**80**	0.02
11.82	0.0003	Annual Grass	Poor	B	**78**	0.03
2.42	0.0001	Annual Grass	Poor	C	**86**	0.01
0.05	0.0000	Annual Grass	Poor	D	**89**	0.00
7.95	0.0002	Barren	Fair	B	**86**	0.02
11.13	0.0003	Barren	Fair	C	**91**	0.03
14.77	0.0004	Barren	Fair	D	**93**	0.04
17.83	0.0005	Barren	Good	B	**86**	0.04
3.61	0.0001	Barren	Good	C	**91**	0.01
2.79	0.0001	Barren	Poor	B	**89**	0.01
10.74	0.0003	Barren	Poor	C	**91**	0.03
0.97	0.0000	Barren	Poor	D	**93**	0.00
154.22	0.0042	Broadleaf Chaparral	Fair	B	**63**	0.27
227.68	0.0063	Broadleaf Chaparral	Fair	C	**75**	0.47
1250.95	0.0344	Broadleaf Chaparral	Fair	D	**81**	2.79
4.37	0.0001	Broadleaf Chaparral	Good	B	**57**	0.01
15.03	0.0004	Broadleaf Chaparral	Good	C	**71**	0.03
3.25	0.0001	Broadleaf Chaparral	Good	D	**78**	0.01
16.06	0.0004	Broadleaf Chaparral	Poor	B	**70**	0.03
141.06	0.0039	Broadleaf Chaparral	Poor	C	**80**	0.31
546.51	0.0150	Broadleaf Chaparral	Poor	D	**85**	1.28
27.20	0.0007	Developing Urban Areas and Newly Graded Areas	Fair	B	**86**	0.06
50.04	0.0014	Developing Urban Areas and Newly Graded Areas	Fair	C	**91**	0.13
1.80	0.0000	Developing Urban Areas and Newly Graded Areas	Fair	D	**94**	0.00
0.21	0.0000	Developing Urban Areas and Newly Graded Areas	Good	B	**86**	0.00
4.01	0.0001	Developing Urban Areas and Newly Graded Areas	Good	C	**91**	0.01
4.95	0.0001	Irrigated Pasture	Fair	A	**44**	0.01
389.14	0.0107	Irrigated Pasture	Fair	B	**65**	0.70
156.68	0.0043	Irrigated Pasture	Fair	C	**77**	0.33
113.49	0.0031	Irrigated Pasture	Fair	D	**82**	0.26
11.37	0.0003	Irrigated Pasture	Good	A	**33**	0.01
424.30	0.0117	Irrigated Pasture	Good	B	**58**	0.68
190.86	0.0052	Irrigated Pasture	Good	C	**72**	0.38
248.62	0.0068	Irrigated Pasture	Good	D	**79**	0.54
16.92	0.0005	Irrigated Pasture	Poor	B	**74**	0.03
29.26	0.0008	Irrigated Pasture	Poor	C	**83**	0.07
0.13	0.0000	Meadow	Fair	A	**51**	0.00
1.17	0.0000	Meadow	Fair	B	**70**	0.00
0.13	0.0000	Meadow	Fair	D	**84**	0.00
4.34	0.0001	Meadow	Good	B	**58**	0.01
13.58	0.0004	Meadow	Good	C	**72**	0.03

Santa Maria Creek - CN_2 Calculations

Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
0.00	0.0000	Narrowleaf Chaparral	Fair	A	**71**	0.00
841.20	0.0231	Narrowleaf Chaparral	Fair	B	**82**	1.90
1563.42	0.0430	Narrowleaf Chaparral	Fair	C	**88**	3.78
1215.40	0.0334	Narrowleaf Chaparral	Fair	D	**91**	3.04
159.79	0.0044	Narrowleaf Chaparral	Good	B	**72**	0.32
249.46	0.0069	Narrowleaf Chaparral	Good	C	**81**	0.56
111.59	0.0031	Narrowleaf Chaparral	Good	D	**86**	0.26
124.11	0.0034	Narrowleaf Chaparral	Poor	B	**82**	0.28
592.96	0.0163	Narrowleaf Chaparral	Poor	C	**88**	1.43
242.34	0.0067	Narrowleaf Chaparral	Poor	D	**91**	0.61
7.40	0.0002	Water Body, Exclude From Area			**0**	0.00
55.67	0.0015	Open Space	Fair	A	**51**	0.08
799.18	0.0220	Open Space	Fair	B	**70**	1.54
251.25	0.0069	Open Space	Fair	C	**80**	0.55
906.77	0.0249	Open Space	Fair	D	**84**	2.09
196.52	0.0054	Open Space	Good	B	**58**	0.31
150.23	0.0041	Open Space	Good	C	**72**	0.30
118.65	0.0033	Open Space	Good	D	**78**	0.25
55.26	0.0015				**77**	0.12
268.15	0.0074	Open Space	Poor	C	**85**	0.63
146.58	0.0040	Open Space	Poor	D	**88**	0.35
127.72	0.0035	Orchards (evergreen)	Fair	B	**65**	0.23
219.36	0.0060	Orchards (evergreen)	Fair	C	**77**	0.46
100.41	0.0028	Orchards (evergreen)	Fair	D	**82**	0.23
105.10	0.0029	Orchards (evergreen)	Good	B	**58**	0.17
105.62	0.0029	Orchards (evergreen)	Good	C	**72**	0.21
69.69	0.0019	Orchards (evergreen)	Good	D	**79**	0.15
0.05	0.0000	Orchards (evergreen)	Poor	B	**73**	0.00
37.86	0.0010	Orchards (evergreen)	Poor	C	**82**	0.09
0.44	0.0000	Perrenial Grass	Fair	A	**50**	0.00
287.70	0.0079	Perrenial Grass	Fair	B	**69**	0.55
252.76	0.0069	Perrenial Grass	Fair	C	**79**	0.55
228.70	0.0063	Perrenial Grass	Fair	D	**84**	0.53
212.16	0.0058	Perrenial Grass	Good	B	**61**	0.36
87.89	0.0024	Perrenial Grass	Good	C	**74**	0.18
70.25	0.0019	Perrenial Grass	Good	D	**80**	0.15
10.72	0.0003	Perrenial Grass	Poor	B	**79**	0.02
25.97	0.0007	Perrenial Grass	Poor	C	**86**	0.06
28.94	0.0008	Perrenial Grass	Poor	D	**89**	0.07
112.73	0.0031	Residential Districts: 1/3 acre	Fair	B	**72**	0.22
1.03	0.0000	Residential Districts: 1/3 acre	Fair	C	**81**	0.00
199.73	0.0055	Residential Districts: 1/3 acre	Fair	D	**86**	0.47
217.45	0.0060	Residential Districts: 1/3 acre	Good	B	**72**	0.43
72.83	0.0020	Residential Districts: 1/3 acre	Good	C	**81**	0.16
200.72	0.0055	Residential Districts: 1/3 acre	Good	D	**86**	0.47
18.19	0.0005	Residential Districts: 1/4 acre	Fair	B	**75**	0.04
12.88	0.0004	Residential Districts: 1/4 acre	Fair	C	**83**	0.03
3.90	0.0001	Residential Districts: 1/4 acre	Fair	D	**87**	0.01
15.34	0.0004	Residential Districts: 1/4 acre	Good	B	**75**	0.03
0.74	0.0000	Residential Districts: 1/4 acre	Good	C	**83**	0.00

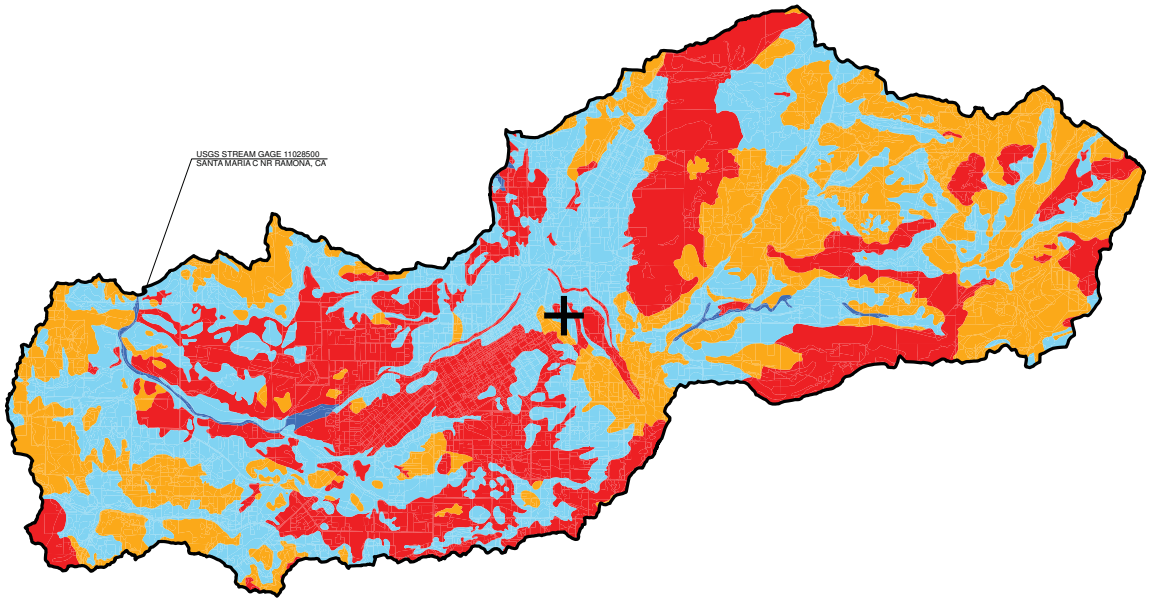
Santa Maria Creek - CN_2 Calculations

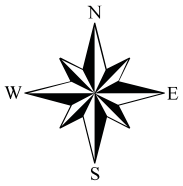
Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
0.47	0.0000	Residential Districts: 1/4 acre	Good	D	**87**	0.00
1.28	0.0000	Residential Districts: 1/4 acre	Poor	C	**83**	0.00
36.69	0.0010	Residential Districts: 1/8 acre	Fair	B	**85**	0.09
5.38	0.0001	Residential Districts: 1/8 acre	Fair	C	**90**	0.01
94.52	0.0026	Residential Districts: 1/8 acre	Fair	D	**92**	0.24
56.31	0.0015	Residential Districts: 1/8 acre	Good	B	**85**	0.13
10.52	0.0003	Residential Districts: 1/8 acre	Good	C	**90**	0.03
13.91	0.0004	Residential Districts: 1/8 acre	Good	D	**92**	0.04
31.41	0.0009	Residential Districts: 2 acre	Fair	A	**46**	0.04
2347.73	0.0646	Residential Districts: 2 acre	Fair	B	**65**	4.20
1809.70	0.0498	Residential Districts: 2 acre	Fair	C	**77**	3.83
1802.37	0.0496	Residential Districts: 2 acre	Fair	D	**82**	4.06
35.99	0.0010	Residential Districts: 2 acre	Good	A	**46**	0.05
2734.07	0.0752	Residential Districts: 2 acre	Good	B	**65**	4.89
1524.44	0.0419	Residential Districts: 2 acre	Good	C	**77**	3.23
922.87	0.0254	Residential Districts: 2 acre	Good	D	**82**	2.08
8.35	0.0002	Residential Districts: 2 acre	Poor	B	**65**	0.01
130.09	0.0036	Residential Districts: 2 acre	Poor	C	**77**	0.28
137.77	0.0038	Residential Districts: 2 acre	Poor	D	**82**	0.31
77.14	0.0021	Row Crops: Straight Row	Fair	A	**72**	0.15
1496.22	0.0411	Row Crops: Straight Row	Fair	B	**81**	3.33
629.84	0.0173	Row Crops: Straight Row	Fair	C	**88**	1.52
1165.37	0.0320	Row Crops: Straight Row	Fair	D	**91**	2.92
14.26	0.0004	Row Crops: Straight Row	Good	A	**67**	0.03
630.14	0.0173	Row Crops: Straight Row	Good	B	**78**	1.35
259.97	0.0071	Row Crops: Straight Row	Good	C	**85**	0.61
349.79	0.0096	Row Crops: Straight Row	Good	D	**89**	0.86
29.94	0.0008	Row Crops: Straight Row	Poor	B	**81**	0.07
22.59	0.0006	Row Crops: Straight Row	Poor	C	**88**	0.05
26.17	0.0007	Row Crops: Straight Row	Poor	D	**91**	0.07
955.07	0.0263	Streets and Roads Paved: Curbs and storm drains			**98**	2.57
1.21	0.0000	Urban Districts (Commercial and Business)	Fair	A	**89**	0.00
184.12	0.0051	Urban Districts (Commercial and Business)	Fair	B	**92**	0.47
18.90	0.0005	Urban Districts (Commercial and Business)	Fair	C	**94**	0.05
437.19	0.0120	Urban Districts (Commercial and Business)	Fair	D	**95**	1.14
48.30	0.0013	Urban Districts (Commercial and Business)	Good	B	**92**	0.12
31.14	0.0009	Urban Districts (Commercial and Business)	Good	C	**94**	0.08
66.70	0.0018	Urban Districts (Commercial and Business)	Good	D	**95**	0.17
3.05	0.0001	Urban Districts (Commercial and Business)	Poor	B	**92**	0.01
0.00	0.0000	Urban Districts (Commercial and Business)	Poor	C	**94**	0.00
60.76	0.0017	Urban Districts (Industrial)	Fair	B	**88**	0.15
11.64	0.0003	Urban Districts (Industrial)	Fair	C	**91**	0.03
9.84	0.0003	Urban Districts (Industrial)	Fair	D	**93**	0.03

Santa Maria Creek - CN_2 Calculations

Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
3.24	0.0001	Urban Districts (Industrial)	Good	B	**88**	0.01
0.02	0.0000	Urban Districts (Industrial)	Good	C	**91**	0.00
9.19	0.0003	Urban Districts (Industrial)	Good	D	**93**	0.02
5.04	0.0001	Woods (woodland)	Fair	A	**36**	0.00
503.28	0.0138	Woods (woodland)	Fair	B	**60**	0.83
841.99	0.0232	Woods (woodland)	Fair	C	**73**	1.69
172.97	0.0048	Woods (woodland)	Fair	D	**79**	0.38
145.35	0.0040	Woods (woodland)	Good	B	**55**	0.22
304.26	0.0084	Woods (woodland)	Good	C	**70**	0.59
30.60	0.0008	Woods (woodland)	Good	D	**77**	0.06
18.36	0.0005	Woods (woodland)	Poor	B	**66**	0.03
67.30	0.0019	Woods (woodland)	Poor	C	**77**	0.14
60.67	0.0017	Woods (woodland)	Poor	D	**83**	0.14
36,370	**1.00**					**78.19**
					Use CN_2 =	**78**

1. GIS shapefiles for hydrologic soil group, cover description, and hydrologic condition were overlayed to generate the data above. CN_2 values were then associated with this data per Table 4-2 of the 2003 SDCHM.





0 1,500 3,000 6,000
Feet
Scale 1 inch = 1,200 feet

Legend

Centroid

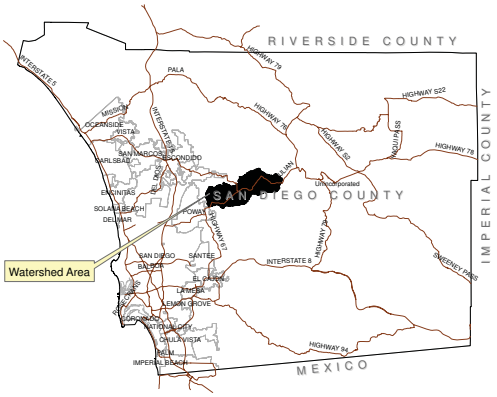
Watershed Boundary

A

B

C

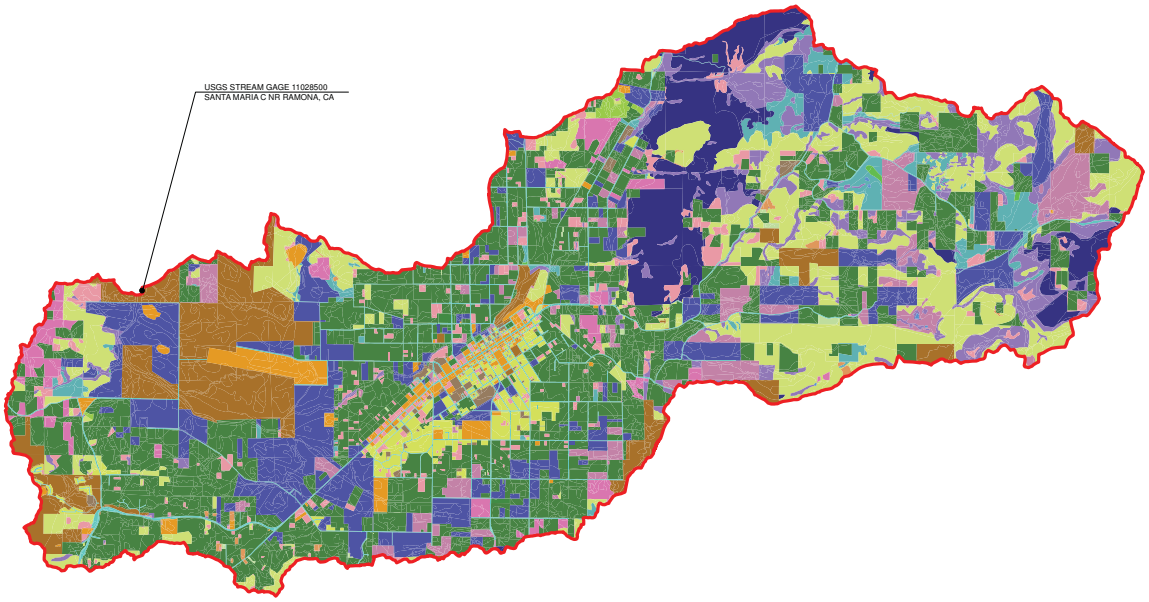
D



Project Location
Not to Scale

Santa Maria Creek Hydrologic Soils Group Map

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

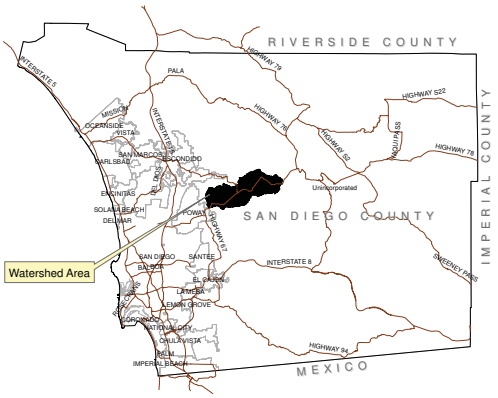


Legend

36,369.7 AC	Watershed Boundary
974.2 AC	Annual Grass
69.8 AC	Barren
2,359.1 AC	Broadleaf Chaparral
83.3 AC	Developing Urban Areas and Newly Graded Areas
83.3 AC	Irrigated Pasture
1,585.6 AC	Meadow
19.4 AC	Narrowleaf Chaparral
5,100.3 AC	Negligible, Exclude From Area
7.4 AC	Open Space
2,948.3 AC	Orchards (evergreen)
765.8 AC	Perrenial Grass
1,205.5 AC	Residential Districts: 1/3 acre
804.5 AC	Residential Districts: 1/4 acre
52.8 AC	Residential Districts: 1/8 acre
217.3 AC	Residential Districts: 2 acre
11,484.8 AC	Row Crops: Straight Row
4,701.5 AC	Streets and Roads Paved: Curbs and storm drains
955.1 AC	Urban Districts (Commercial and Business)
790.6 AC	Urban Districts (Industrial)
2,149.8 AC	Woods (woodland)

N
W E
S

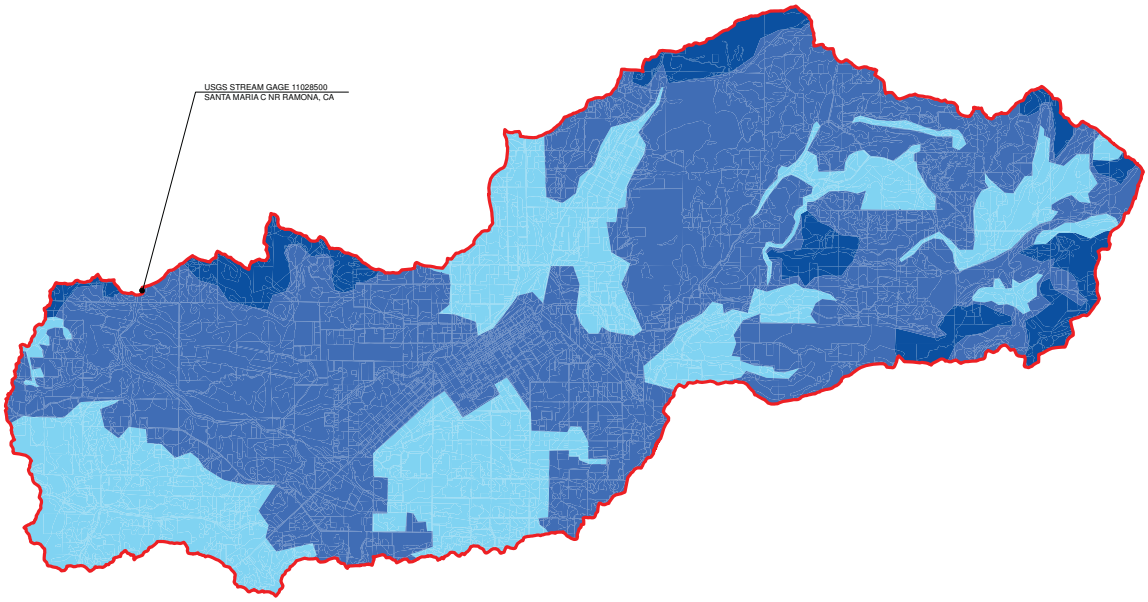
0 1,500 3,000 6,000
Feet
Scale 1 inch = 1,200 feet

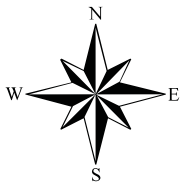


Project Location
Not to Scale

Santa Maria Creek Land Use Map
Year 2009

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

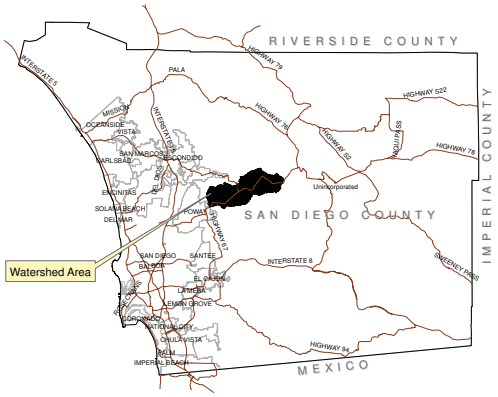




0 1,500 3,000 6,000
Feet
Scale 1 inch = 1,200 feet

Legend

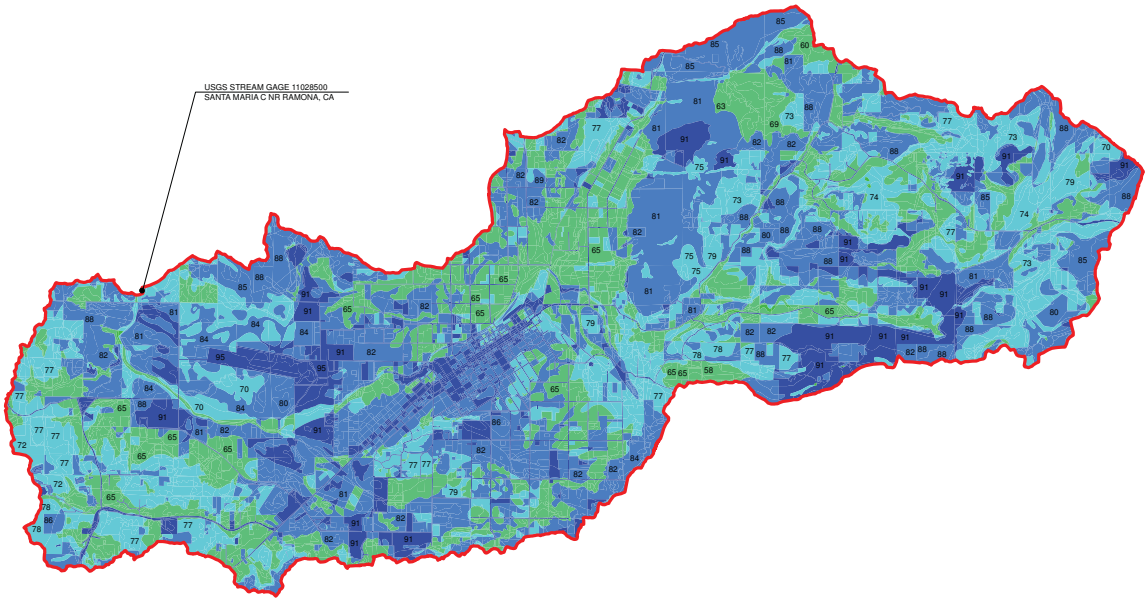
- Watershed Boundary
- Good
- Fair
- Poor

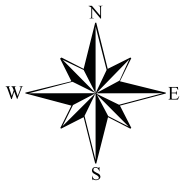


Project Location
Not to Scale

Santa Maria Creek Hydrologic Condition Map
Year 2009

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





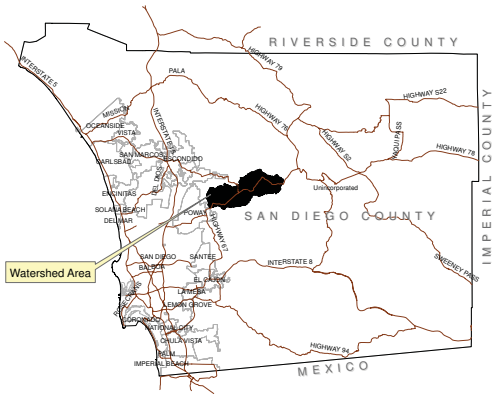
0 1,500 3,000 6,000
Feet
Scale 1 inch = 1,200 feet

Legend

Watershed Boundary

Curve Number

- 0-36
- 36-69
- 69-79
- 79-89
- 89-98



Project Location
Not to Scale

Santa Maria Creek Curve Number Map
Year 2009

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

Unadjusted CN Values for Sweetwater River

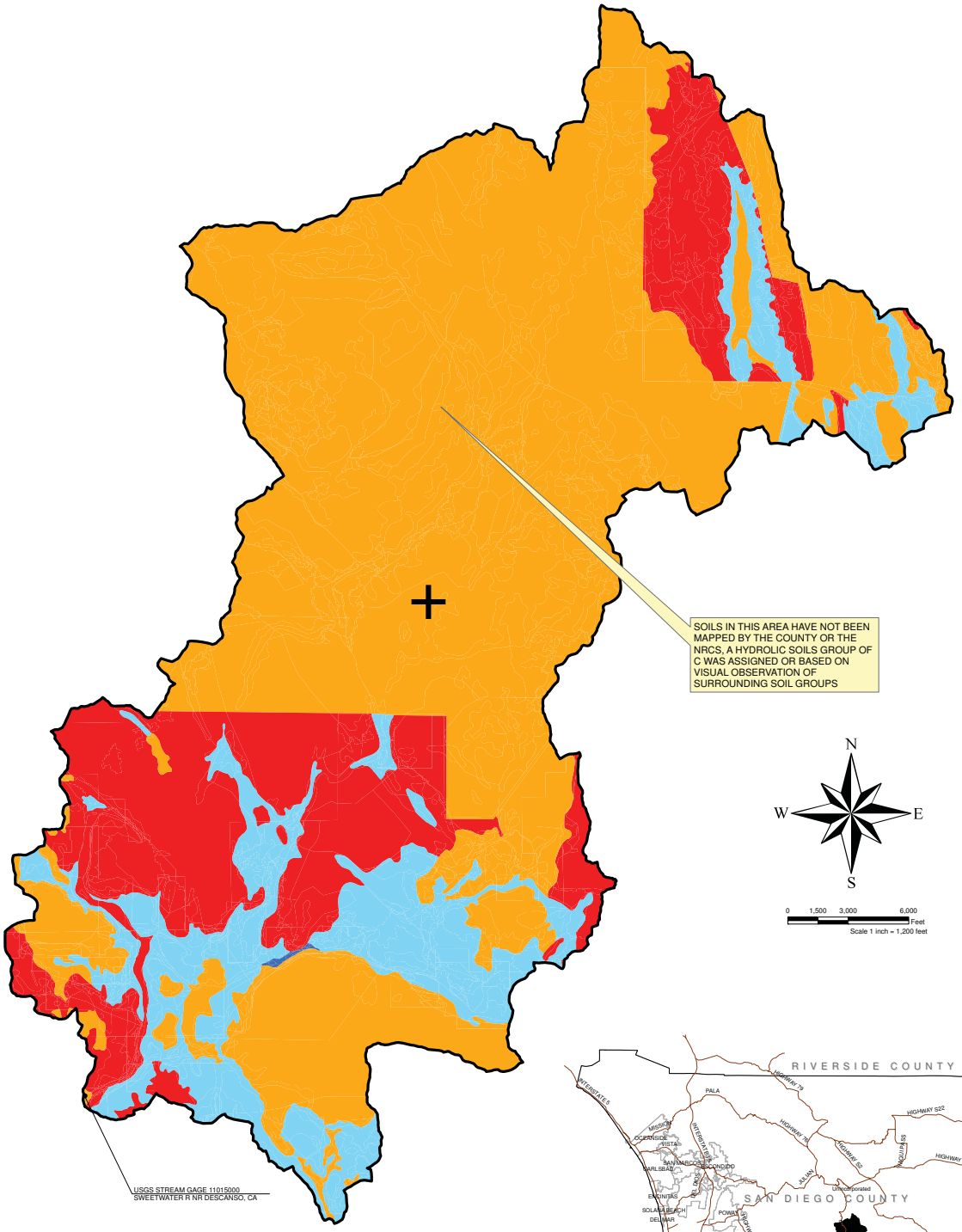
Sweetwater River - CN_2 Calculations

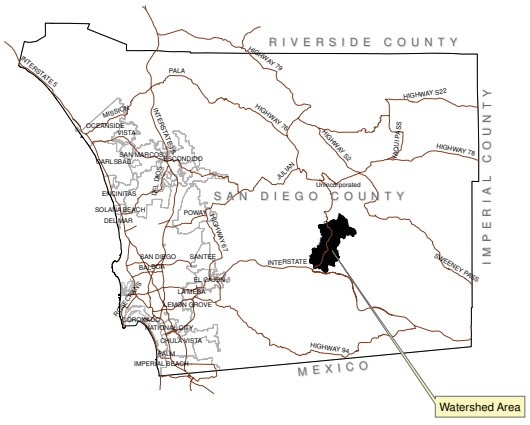
Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
48.66	0.0017	Annual Grass	Fair	B	**69**	0.12
34.58	0.0012	Annual Grass	Fair	C	**79**	0.10
24.94	0.0009	Annual Grass	Fair	D	**84**	0.07
0.57	0.0000	Annual Grass	Good	B	**61**	0.00
0.99	0.0000	Annual Grass	Good	C	**74**	0.00
5.84	0.0002	Annual Grass	Poor	C	**86**	0.02
116.17	0.0041	Barren	Fair	C	**91**	0.37
2.20	0.0001	Barren	Fair	D	**93**	0.01
0.56	0.0000	Barren	Poor	C	**91**	0.00
19.73	0.0007	Barren	Poor	D	**93**	0.06
0.06	0.0000	Broadleaf Chaparral	Fair	A	**40**	0.00
602.20	0.0212	Broadleaf Chaparral	Fair	B	**63**	1.33
1185.64	0.0417	Broadleaf Chaparral	Fair	C	**75**	3.12
763.91	0.0268	Broadleaf Chaparral	Fair	D	**81**	2.17
145.86	0.0051	Broadleaf Chaparral	Good	B	**57**	0.29
584.36	0.0205	Broadleaf Chaparral	Good	C	**71**	1.46
19.04	0.0007	Broadleaf Chaparral	Good	D	**78**	0.05
50.72	0.0018	Broadleaf Chaparral	Poor	B	**70**	0.12
36.67	0.0013	Broadleaf Chaparral	Poor	C	**80**	0.10
994.26	0.0349	Broadleaf Chaparral	Poor	D	**85**	2.97
17.29	0.0006	Meadow	Fair	B	**70**	0.04
32.87	0.0012	Meadow	Fair	D	**84**	0.10
122.89	0.0043	Meadow	Poor	B	**77**	0.33
95.44	0.0034	Meadow	Poor	C	**85**	0.29
7.68	0.0003	Meadow	Poor	D	**88**	0.02
75.78	0.0027	Narrowleaf Chaparral	Fair	B	**82**	0.22
439.58	0.0154	Narrowleaf Chaparral	Fair	C	**88**	1.36
253.50	0.0089	Narrowleaf Chaparral	Fair	D	**91**	0.81
6.65	0.0002	Narrowleaf Chaparral	Good	B	**72**	0.02
177.35	0.0062	Narrowleaf Chaparral	Good	C	**81**	0.50
125.80	0.0044	Narrowleaf Chaparral	Good	D	**86**	0.38
9.15	0.0003	Narrowleaf Chaparral	Poor	B	**82**	0.03
251.53	0.0088	Narrowleaf Chaparral	Poor	C	**88**	0.78
497.97	0.0175	Narrowleaf Chaparral	Poor	D	**91**	1.59
25.46	0.0009	Water Body, Exclude From Area			**0**	0.00
230.80	0.0081	Open Space	Fair	B	**70**	0.57
10125.92	0.3558	Open Space	Fair	C	**80**	28.46
329.53	0.0116	Open Space	Fair	D	**84**	0.97
411.51	0.0145	Open Space	Good	B	**58**	0.84
3018.16	0.1061	Open Space	Good	C	**72**	7.64
286.75	0.0101	Open Space	Good	D	**78**	0.79
39.60	0.0014	Open Space	Poor	B	**77**	0.11
1756.08	0.0617	Open Space	Poor	C	**85**	5.25
1803.15	0.0634	Open Space	Poor	D	**88**	5.58
4.64	0.0002	Perrenial Grass	Fair	A	**50**	0.01
266.42	0.0094	Perrenial Grass	Fair	B	**69**	0.65
79.42	0.0028	Perrenial Grass	Fair	C	**79**	0.22
94.61	0.0033	Perrenial Grass	Fair	D	**84**	0.28
0.83	0.0000	Perrenial Grass	Good	B	**61**	0.00
17.97	0.0006	Perrenial Grass	Good	C	**74**	0.05

Sweetwater River - CN_2 Calculations

Area A_i (ac)	Fraction of Total Area (A_i/A)	Cover Description	Hydrologic Condition	Hydrologic Soil Group	CN_2	Partial CN_2 CN_2 x A_i/A
14.70	0.0005	Perrenial Grass	Good	D	**80**	0.04
43.16	0.0015	Perrenial Grass	Poor	B	**79**	0.12
24.03	0.0008	Perrenial Grass	Poor	C	**86**	0.07
29.08	0.0010	Perrenial Grass	Poor	D	**89**	0.09
173.12	0.0061	Residential Districts: 1/4 acre	Fair	B	**75**	0.46
71.07	0.0025	Residential Districts: 1/4 acre	Fair	C	**83**	0.21
66.51	0.0023	Residential Districts: 1/4 acre	Fair	D	**87**	0.20
1.46	0.0001	Residential Districts: 1/4 acre	Good	B	**75**	0.00
0.93	0.0000	Residential Districts: 1/4 acre	Good	C	**83**	0.00
23.76	0.0008	Residential Districts: 1/4 acre	Good	D	**87**	0.07
18.45	0.0006	Residential Districts: 1/8 acre	Fair	B	**85**	0.06
4.60	0.0002	Residential Districts: 1/8 acre	Good	C	**90**	0.01
167.26	0.0059	Residential Districts: 2 acre	Fair	B	**65**	0.38
17.20	0.0006	Residential Districts: 2 acre	Fair	C	**77**	0.05
5.58	0.0002	Residential Districts: 2 acre	Fair	D	**82**	0.02
28.27	0.0010	Residential Districts: 2 acre	Good	B	**65**	0.06
18.34	0.0006	Residential Districts: 2 acre	Good	C	**77**	0.05
5.65	0.0002	Residential Districts: 2 acre	Poor	D	**82**	0.02
170.25	0.0060	Row Crops: Straight Row	Fair	B	**81**	0.48
113.69	0.0040	Row Crops: Straight Row	Fair	C	**88**	0.35
0.93	0.0000	Row Crops: Straight Row	Fair	D	**91**	0.00
9.59	0.0003	Streets and Roads Paved: Curbs and storm drains			**98**	0.03
23.10	0.0008	Urban Districts (Commercial and Business)	Fair	B	**92**	0.07
2.22	0.0001	Urban Districts (Commercial and Business)	Fair	D	**95**	0.01
0.30	0.0000	Urban Districts (Commercial and Business)	Good	B	**92**	0.00
9.29	0.0003	Woods (woodland)	Fair	A	**36**	0.01
979.76	0.0344	Woods (woodland)	Fair	B	**60**	2.07
346.22	0.0122	Woods (woodland)	Fair	C	**73**	0.89
275.96	0.0097	Woods (woodland)	Fair	D	**79**	0.77
74.90	0.0026	Woods (woodland)	Good	B	**55**	0.14
93.28	0.0033	Woods (woodland)	Good	C	**70**	0.23
52.67	0.0019	Woods (woodland)	Good	D	**77**	0.14
181.13	0.0064	Woods (woodland)	Poor	B	**66**	0.42
38.51	0.0014	Woods (woodland)	Poor	C	**77**	0.10
132.48	0.0047	Woods (woodland)	Poor	D	**83**	0.39
28,459	**1.00**					**78.28**
					Use CN_2 =	**78**

1. GIS shapefiles for hydrologic soil group, cover description, and hydrologic condition were overlayed to generate the data above. CN_2 values were then associated with this data per Table 4-2 of the 2003 SDCHM.





Project Location
Not to Scale

Legend

Centroid

Watershed Boundary

A

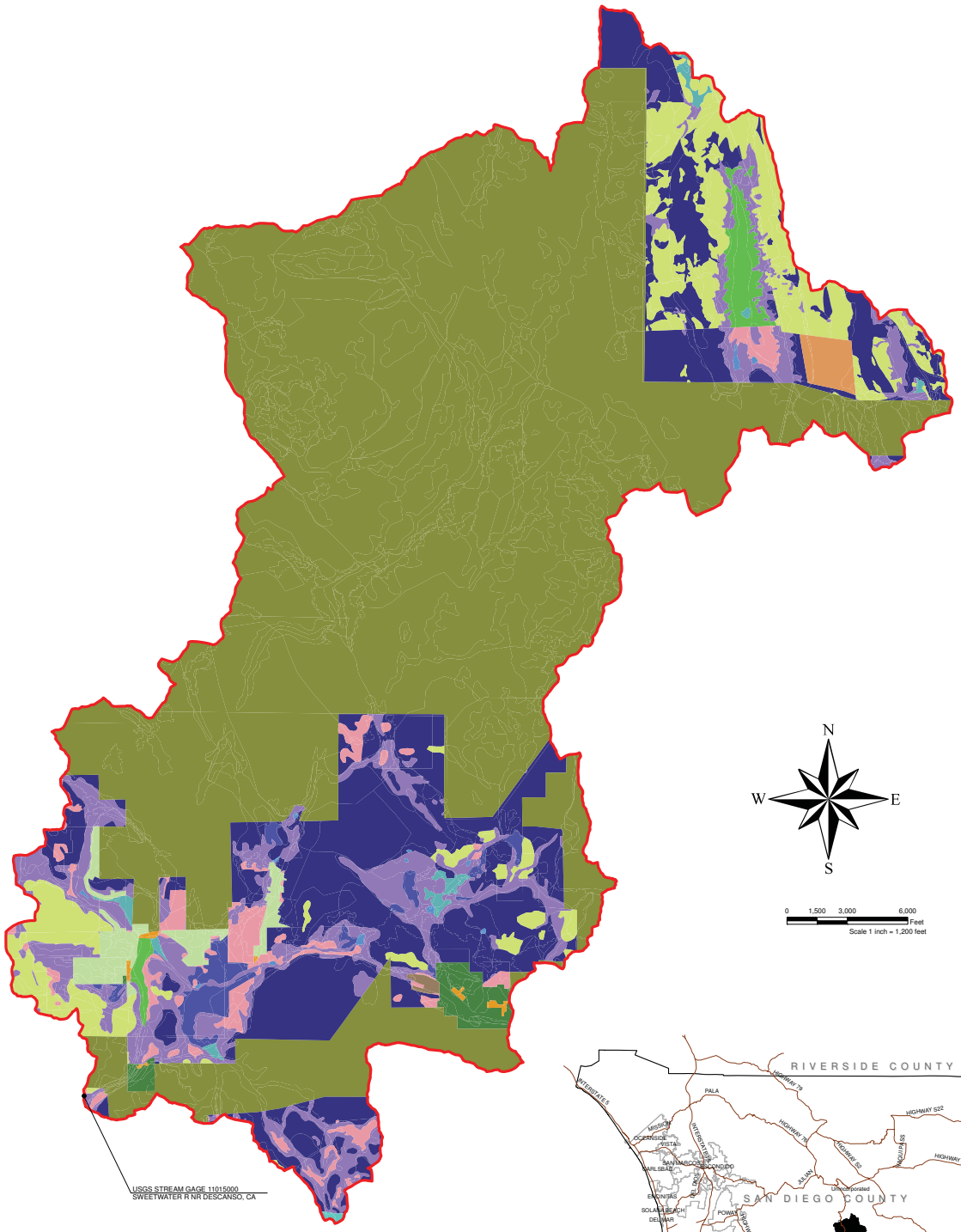
B

C

D

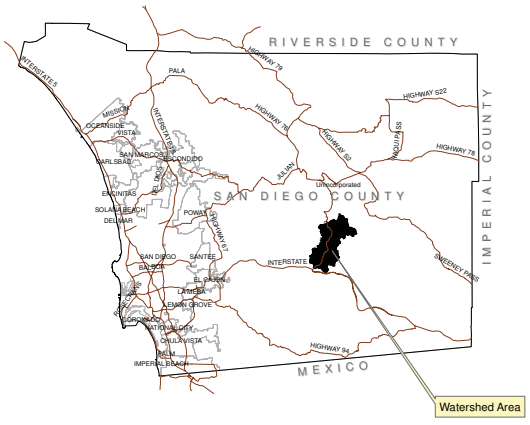
Sweetwater River Hydrologic Soils Group Map

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



N
W E
S

0 1,500 3,000 6,000 Feet
Scale 1 inch = 1,200 feet



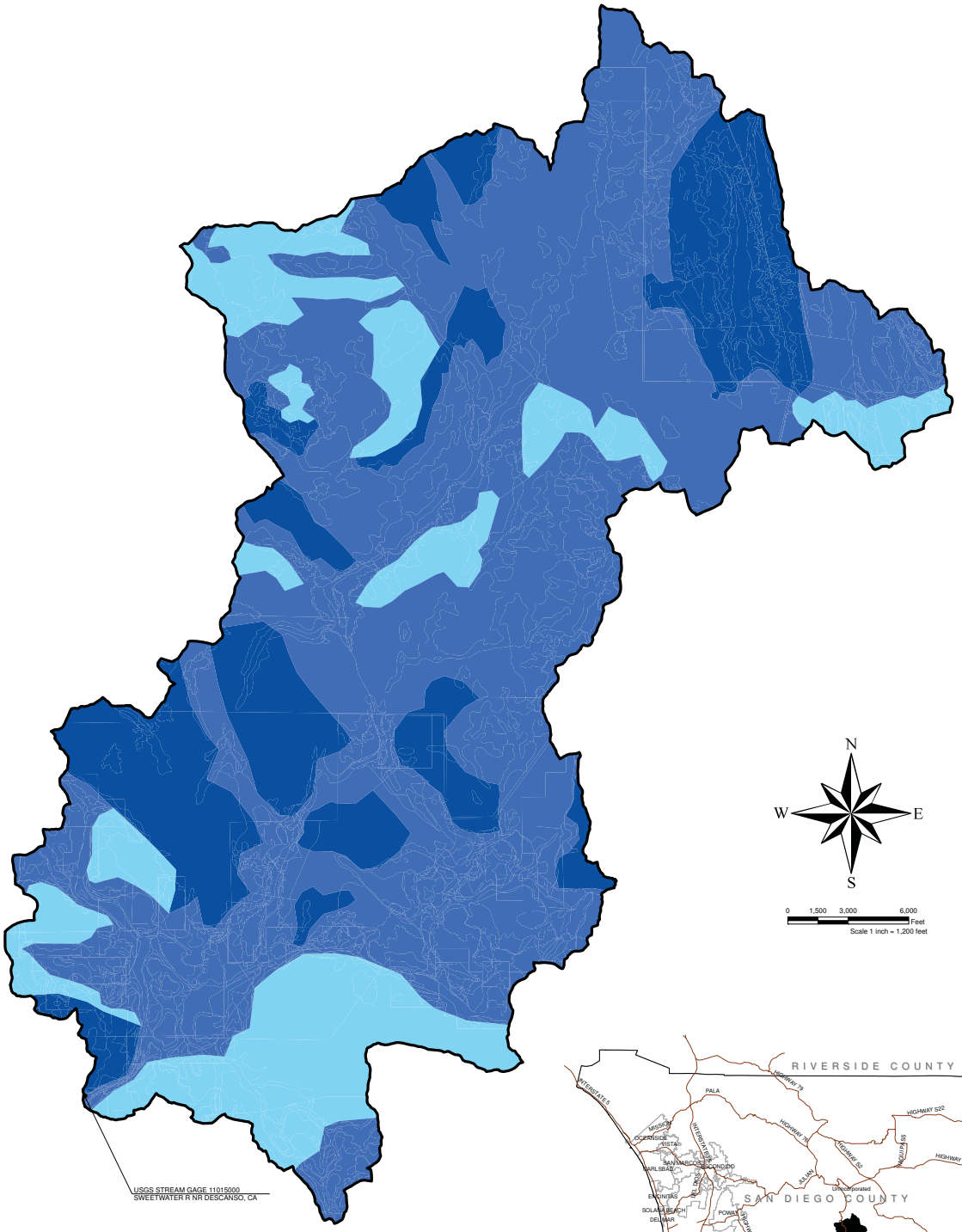
Project Location
Not to Scale

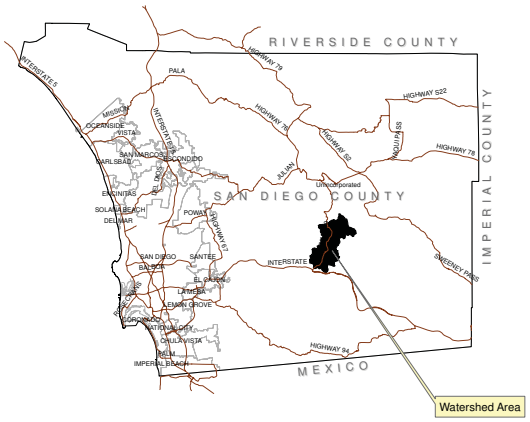
Legend

28,458.8 AC	Watershed Boundary
115.6 AC	Annual Grass
138.7 AC	Barren
4,382.7 AC	Broadleaf Chaparral
0 AC	Irrigated Pasture
276.2 AC	Meadow
1,837.3 AC	Narrowleaf Chaparral
25.5 AC	Negligible, Exclude From Area
18,001.5 AC	Open Space
574.9 AC	Perrenial Grass
0 AC	Residential Districts: 1/3 acre
336.9 AC	Residential Districts: 1/4 acre
23.1 AC	Residential Districts: 1/8 acre
242.3 AC	Residential Districts: 2 acre
284.9 AC	Row Crops: Straight Row
9.6 AC	Streets and Roads Paved: Curbs and storm drains
25.6 AC	Urban Districts (Commercial and Business)
2,184.2 AC	Woods (woodland)

Sweetwater River Land Use Map
Year 2010

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



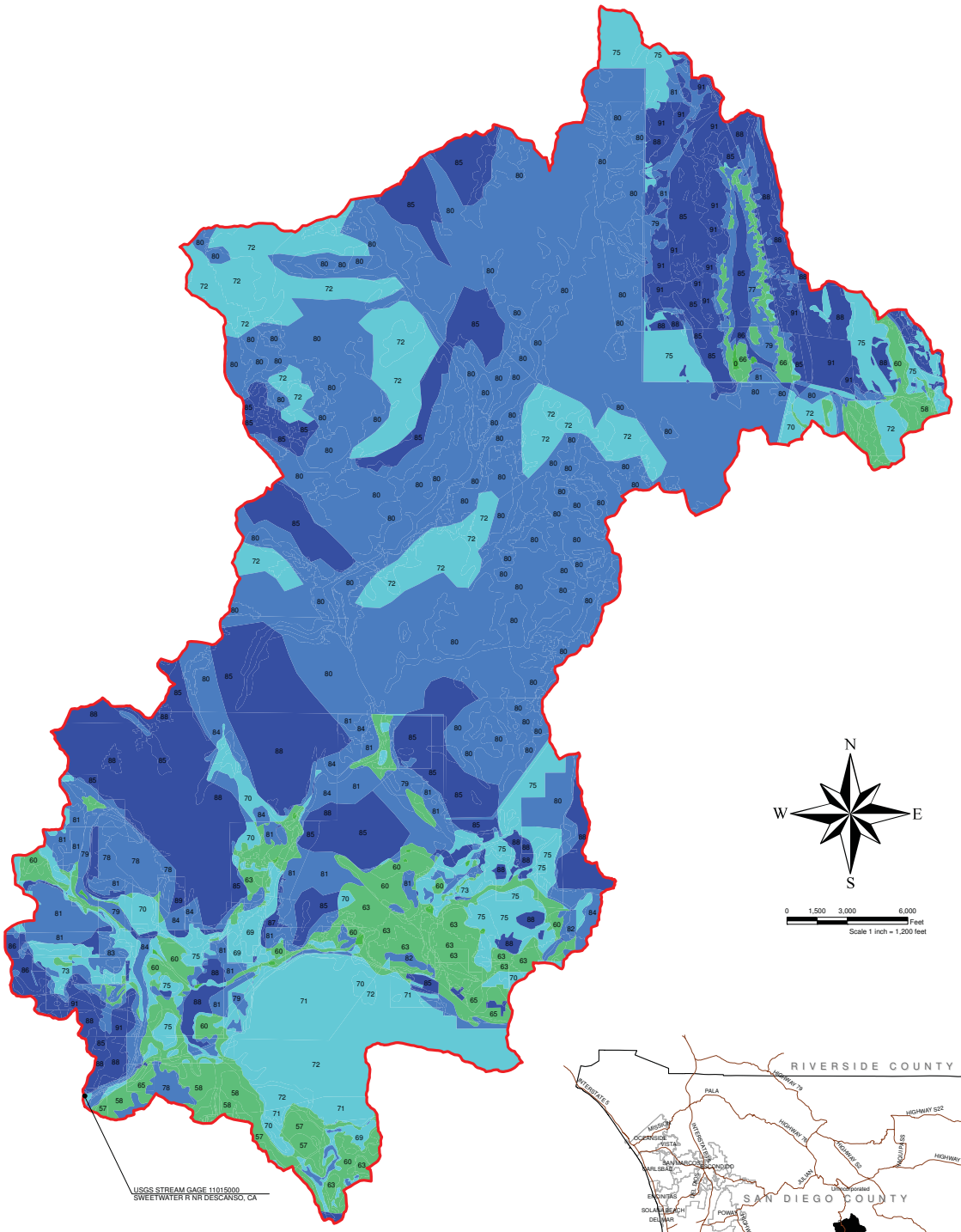


Project Location
Not to Scale

Legend
- Watershed Boundary
- Good
- Fair
- Poor

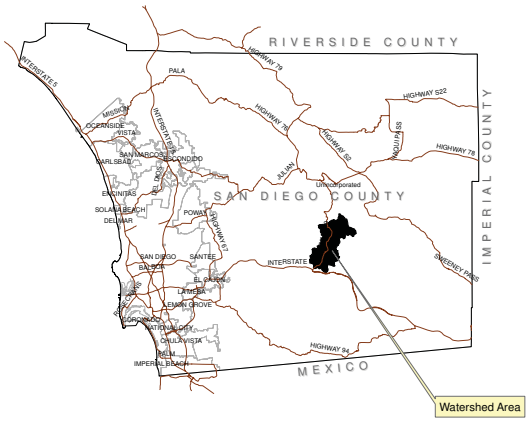
Sweetwater River Hydrologic Condition Map

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



N
W E
S

0 1,500 3,000 6,000 Feet
Scale 1 inch = 1,200 feet



Project Location
Not to Scale

Legend

Watershed Boundary

Curve Number

- 0-25
- 25-66
- 66-75
- 75-84
- 84-98

2010 Sweetwater River Curve Number Map

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

This page is intentionally left blank to facilitate 2-sided printing.

Appendix C.4

Adjusted CN Values

This page is intentionally left blank to facilitate 2-sided printing.

CN Value Adjustments for Type 1, Type B, and Nested Storms

Watershed Name	CN_3 [3]	CN_2 [2]	CN_1 [1]	PZN [4]	PZN Adjustment Factors [5]				Adjusted CN Values [6]			
	3.0	2.0	1.0		100-yr	10-yr	5-yr	2-yr	100-yr	10-yr	5-yr	2-yr
Guejito Creek	90	78	60	2.3	3.0	2.4	2.4	2.4	90	82	82	82
Jamul Creek	94	85	70	1.8	2.8	2.3	2.3	2.3	92	88	88	88
Las Flores Creek	92	82	66	1.4	2.4	1.9	1.9	1.9	86	80	80	80
Los Coches Creek	92	82	66	1.7	2.7	2.2	2.2	2.2	89	84	84	84
Santa Maria Creek	90	78	60	1.8	2.8	2.3	2.3	2.3	88	82	82	82
Sweetwater River	90	78	60	2.8	3.0	2.1	2.1	2.1	90	79	79	79

1. CN_1 represents the CN value for a PZN value of 1.0 as determined per Table 4-10 of the 2003 SDCHM (included on next page).

2. CN_2 represents the CN value for a PZN value of 2.0 as determined per Table 4-10 of the 2003 SDCHM (included on next page). This is the unadjusted CN value as determined per CN Value analysis included in Appendix C.3.

3. CN_3 represents the CN value for a PZN value of 3.0 as determined per Table 4-10 of the 2003 SDCHM (included on next page).

4. PZN (Precipitation Zone Number) values are determined per PZN Maps located in Appendix C of the 2003 SDCHM. These maps are included in Appendix C.2 of this report.

5. PZN Adjustment Factors as determined in Appendix C.2 of this report.

6. Adjusted CN Values are linearly interpolated from the values provided in Table 4-10 of the 2003 SDCHM (included on next page).

Table 4-10

RUNOFF CURVE NUMBERS FOR PZN CONDITIONS 1.0, 2.0, AND 3.0

CN For:			CN For:		
PZN Condition = 1.0	PZN Condition = 2.0	PZN Condition = 3.0	PZN Condition = 1.0	PZN Condition = 2.0	PZN Condition = 3.0
100	100	100	40	60	78
97	99	100	39	59	77
94	98	99	38	58	76
91	97	99	37	57	75
89	96	99	37	56	75
87	95	98	34	55	73
85	94	98	34	54	73
83	93	98	33	53	72
81	92	97	32	52	71
80	91	97	31	51	70
78	90	96	31	50	70
76	89	96	30	49	69
75	88	95	29	48	68
73	87	95	28	47	67
72	86	94	27	46	66
70	85	94	26	45	65
68	84	93	25	44	64
67	83	93	25	43	63
66	82	92	24	42	62
64	81	92	23	41	61
63	80	91	22	40	60
62	79	91	21	39	59
60	78	90	21	38	58
59	77	89	20	37	57
58	76	89	19	36	56
57	75	88	18	35	55
55	74	88	18	34	54
54	73	87	17	33	53
53	72	86	16	32	52
52	71	86	16	31	51
51	70	85	15	30	50
50	69	84			
48	68	84	12	25	43
47	67	83	9	20	37
46	66	82	6	15	30
45	65	82	4	10	22
44	64	81	2	5	13
43	63	80	0	0	0
42	62	79			
41	61	78			

Appendix C.5

Lag Time Calculations

This page is intentionally left blank to facilitate 2-sided printing.

NRCS Lag Time Calculations

Basin Information [1]				Corps Lag [2]					NRCS Lag [3]			
Watershed Name	Area (mi^2)	High Elevation (ft)	Low Elevation (ft)	L (mi)	L_c (mi)	s (ft/mi)	n (Manning's)	Corps T_L (hr)	T_p (hr)	D max (min)	NRCS TL (hr)	NRCS TL (min)
Guejito Creek	22.5	4,200	560	11.88	5.73	306	0.06	2.41	2.08	5	2.04	122.3
Jamul Creek	70.1	3,280	510	12.80	5.79	216	0.06	2.66	2.29	5	2.25	135.2
Las Flores Creek	26.6	1,380	35	11.62	4.81	116	0.06	2.69	2.32	5	2.28	136.8
Los Coches Creek	12.2	1,920	560	6.64	2.43	205	0.09	2.26	1.95	5	1.91	114.4
Santa Maria Creek	57.0	3,270	1,294	18.26	8.42	108	0.09	6.01	5.18	5	5.14	308.4
Sweetwater River	44.5	5,420	3,269	16.76	8.57	128	0.06	3.78	3.26	5	3.22	193.0

1. Basin information obtained through evaluation of USGS topo maps (see attached aerial imagery)
2. Corps Lag has been calculated per Eq 4-17 of the 2003 SDCHM:

Corps T_L (hours) = 24 n $((L \times L_c) / s^{0.5})^m$ where:

L = Length of longest watercourse in miles. This length has been determined through examination of USGS topography (see attached)

L_c = Length along longest watercourse in miles, measured upstream to a point opposite the watershed centroid. This length has been determined through examination of USGS topography (see attached)

s = overall slope of drainage area between the headwaters and the collection point (feet per mile)

m = a constant determined by regional flood reconstitution studies (0.38 for San Diego County)

n = the average of the Manning's n-values of the watercourse and its tributaries. This value has been determined through examination of 2010 aerial imagery of the entire watercourse. Aerial imagery depicting example Manning's n-values at headwaters, centroid, and tailwaters of each basin are attached.

3. NRCS Lag has been calculated per Eq 4-21 of the 2003 SDCHM:

NRCS T_L (hours) = 0.862 (Corps T_L) - D/2 where:

Tp = 0.862 (Corps T_L)

Corps T_L = Corps Lag Time as identified in note 2 above

D: 5 minutes (Assumed period of effective rainfall)

States Army Engineer District Los Angeles Corps of Engineers, 1976). Corps lag for a drainage area can be defined as the elapsed time (in hours) from the beginning of unit effective rainfall to the instant that the summation hydrograph for the point of concentration reaches 50% of ultimate discharge. Corps lag is an empirical expression of the physical characteristics of a drainage area in terms of time. Corps lag can be expressed by the empirical formula:

$$\text{Corps } T_l \text{ (hours)} = 24\ \bar{n}\ ((L \times L_c) / s^{0.5})^m \qquad \text{(Eq. 4-17)}$$

where: L = length to longest watercourse (miles)

L_c = length along longest watercourse, measured upstream to a point opposite the watershed centroid (miles)

s = overall slope of drainage area between the headwaters and the collection point (feet per mile)

m = a constant determined by regional flood reconstitution studies (0.38 for San Diego County)

$\bar{n}$ = the average of the Manning's n values of the watercourse and its tributaries (see Section 4.3.5)

Figure 4-4 shows that 50% of ultimate discharge ($Q_t/Q_a = 0.5$) occurs at $t/T_p = 1.16$. Since Corps lag is defined as the time at which 50% of ultimate discharge occurs, Corps lag is related to T_p by the following equations:

$$\text{Corps } T_l = 1.16\ T_p \qquad \text{(Eq. 4-18)}$$

Or:

$$T_p = 0.862\ \text{Corps } T_l \qquad \text{(Eq. 4-19)}$$

for the typical NRCS dimensionless unit hydrograph.

4.1.5.3 NRCS Lag

Lag as defined by the NRCS for use with the NRCS dimensionless unit hydrograph (herein referred to as NRCS lag or NRCS T_l) differs from Corps lag. The NRCS lag of a watershed is defined as the time from the center of mass of excess rainfall to the time to peak of the unit hydrograph. NRCS lag is dependent on the period of effective rainfall (D) selected for the analysis. A small amount of variation is allowable in D, however D should be approximately $0.2T_p$. The center of mass of effective rainfall is found as (D/2).

NRCS lag is found by first determining T_p using one of the equations given above in Section 4.1.5.2 or below in Section 4.1.5.5, and then selecting an appropriate D for the study based on T_p. NRCS lag is then determined by the following equation:

$$\text{NRCS } T_l = T_p - D/2 \qquad \text{(Eq. 4-20)}$$

4.1.5.4 Relationship between Corps Lag and NRCS Lag

By combining equations 4-19 and 4-20 above, NRCS lag can also be calculated from Corps lag using the following relationship:

$$\text{NRCS } T_l = 0.862 \text{ Corps } T_l - D/2 \qquad \text{(Eq. 4-21)}$$

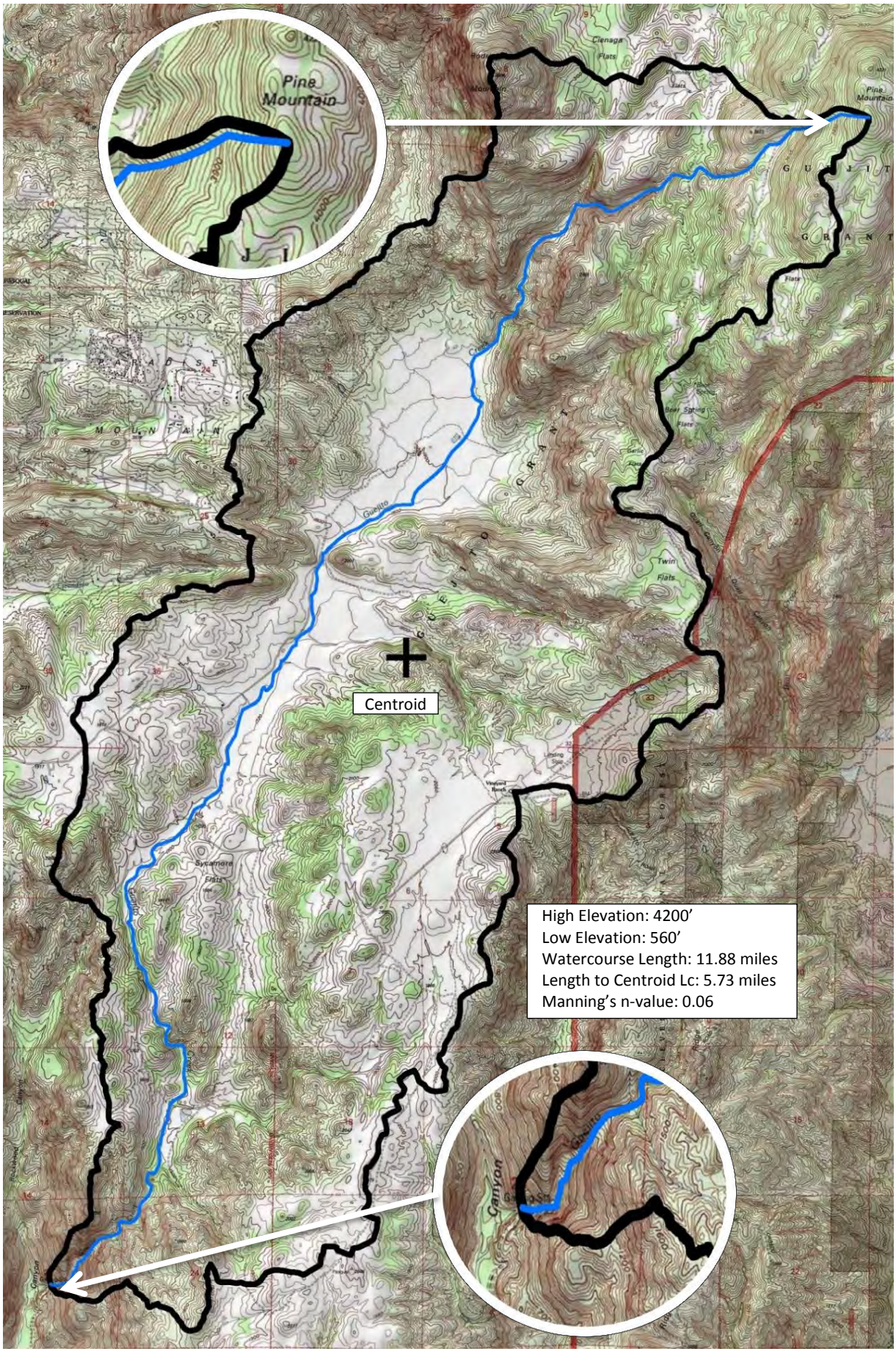
4.1.5.5 Relationships between T_p, T_c, and Corps Lag

When the lags determined from summation hydrographs for several gauged drainage areas are correlated to the hydrologic characteristics of the drainage areas, an empirical relationship is usually apparent. This relationship can then be used to determine the lags for comparable drainage areas for which the hydrologic characteristics can be determined, but for which the distribution graphs for concentration points cannot be determined because of inadequate hydrologic data. By comparing lag values (obtained from the analysis of rainfall-runoff data) to catchment T_c values estimated from a detailed RM analysis, a relationship is readily determined.

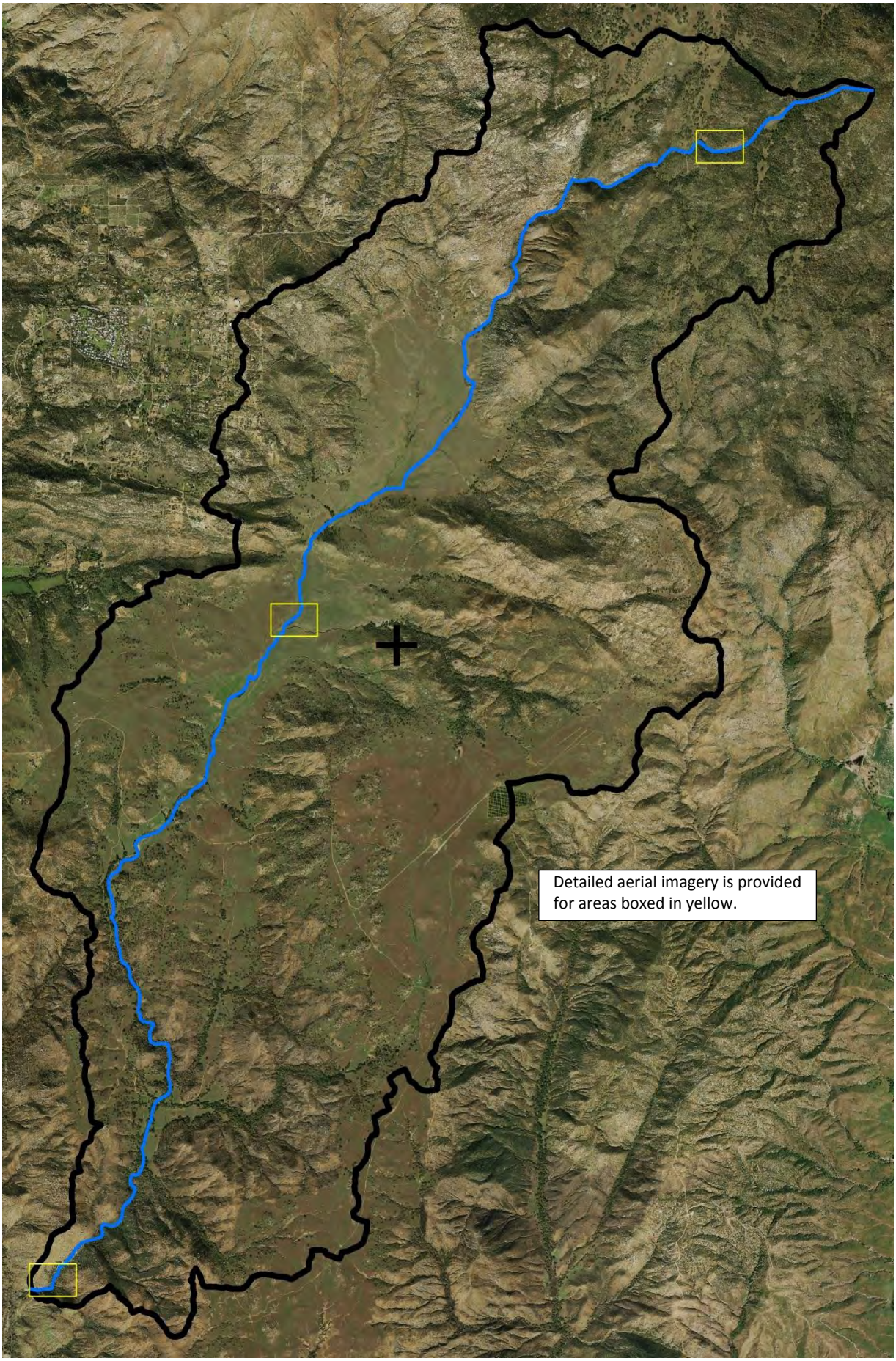
Table A-5 Average Manning Roughness Coefficients for Natural Channels

Minor Streams (Surface Width at Flood Stage < 100 ft)	
Fairly Regular Section	
(A) Some Grass and Weeds, Little or No Brush	0.030
(B) Dense Growth of Weeds, Depth of Flow Materially Greater Than Weed Height	0.040
(C) Some Weeds, Light Brush on Banks	0.040
(D) Some Weeds, Heavy Brush on Banks	0.060
(E) For Trees within Channel with Branches Submerged at High Stage, Increase All Above Values By	0.015
Irregular Section, with Pools, Slight Channel Meander	
Channels (A) to (E) Above, Increase All Values By	0.015
Mountain Streams; No Vegetation in Channel, Banks Usually Steep, Trees and Brush along Banks Submerged at High Stage	
(A) Bottom, Gravel, Cobbles and Few Boulders	0.050
(B) Bottom, Cobbles with Large Boulders	0.060
Flood Plains (Adjacent To Natural Streams)	
Pasture, No Brush	
(A) Short Grass	0.030
(B) High Grass	0.040
Cultivated Areas	
(A) No Crop	0.040
(B) Mature Row Crops	0.040
(C) Mature Field Crops	0.050
Heavy Weeds, Scattered Brush	0.050
Light Brush and Trees	0.060
Medium To Dense Brush	0.090
Dense Willows	0.170
Cleared Land with Tree Stumps, 100-150 Per Acre	0.060
Heavy Stand of Timber, Little Undergrowth	
(A) Flood Depth below Branches	0.110
(B) Flood Depth Reaches Branches	0.140

Guejito Creek Lag Time Exhibits



USGS Topography of Guejito Creek Basin



Aerial Imagery for Guejito Creek Basin



Aerial Imagery of watercourse near headwaters
Manning's n-value = 0.09 (Medium to Dense Brush)

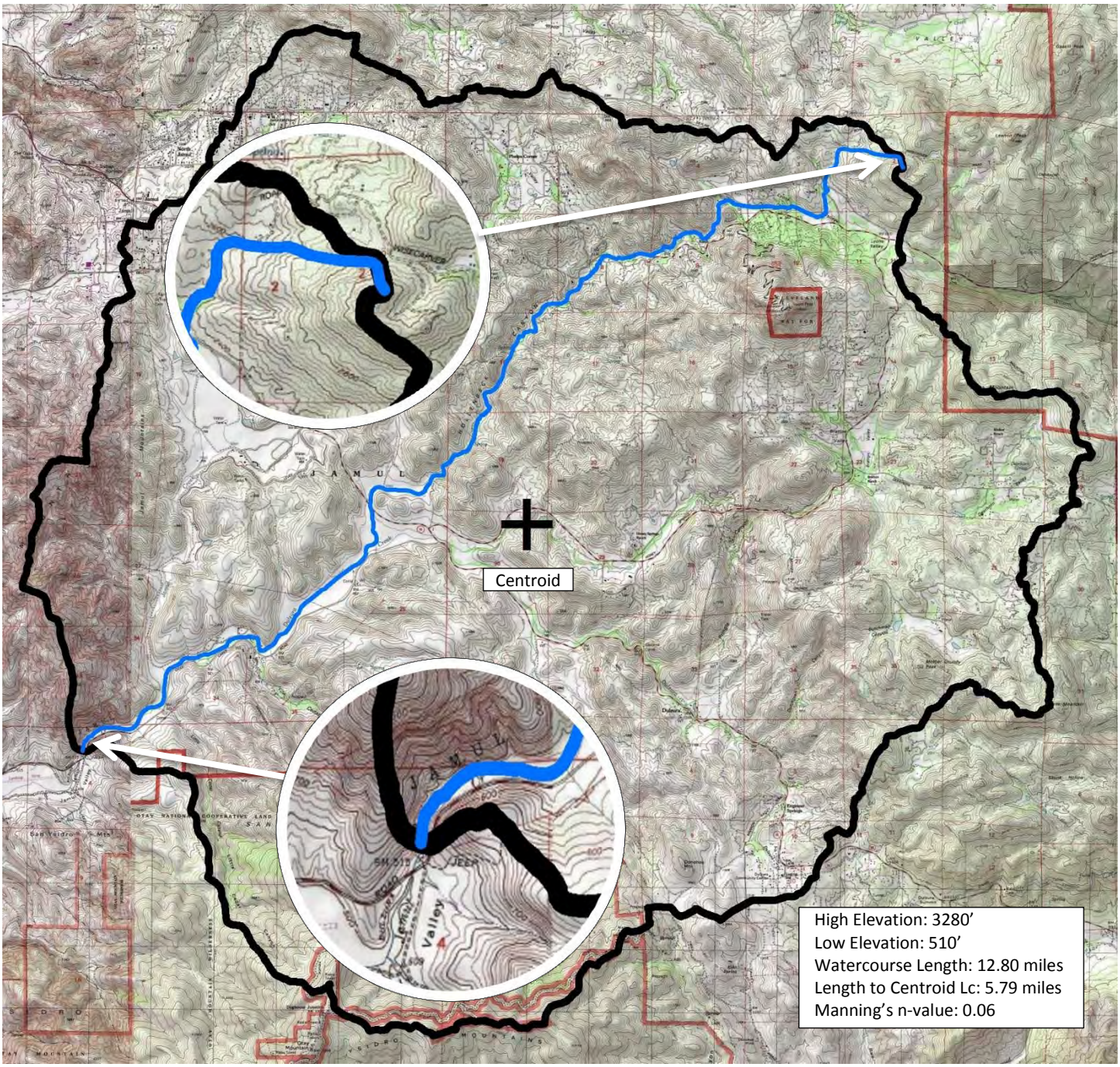


Aerial imagery of watercourse near area-centroid
Manning's n-value = 0.04 (High Grass)

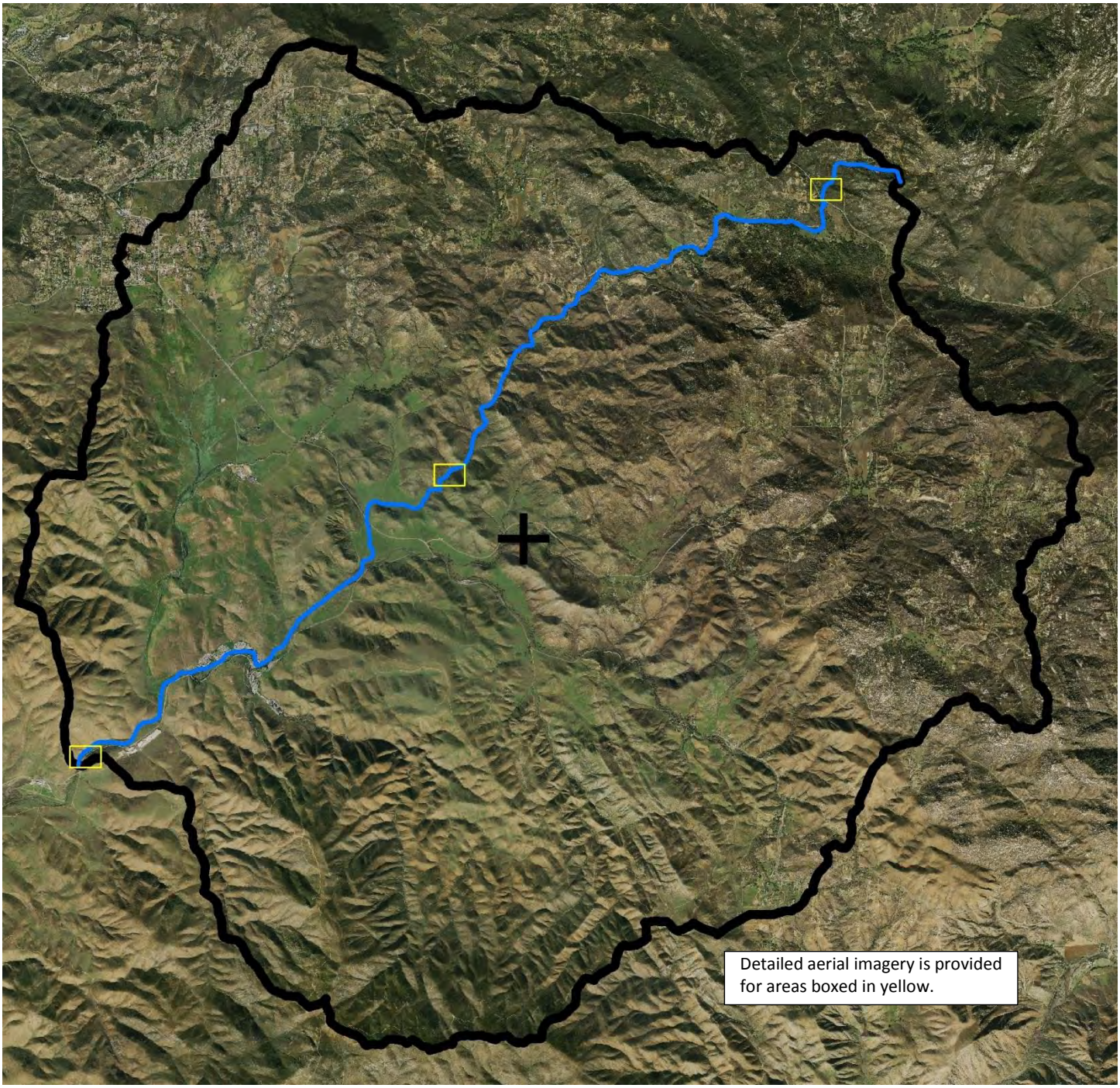


Aerial imagery of watercourse near downstream USGS stream gage
Manning's n-value = 0.06 (Light Brush and Trees)

Jamul Creek Lag Time Exhibits



USGS Topography of Jamul Creek Basin



Aerial Imagery for Jamul Creek Basin



Aerial Imagery of watercourse near headwaters
Manning's n-value = 0.09 (Medium to Dense Brush)

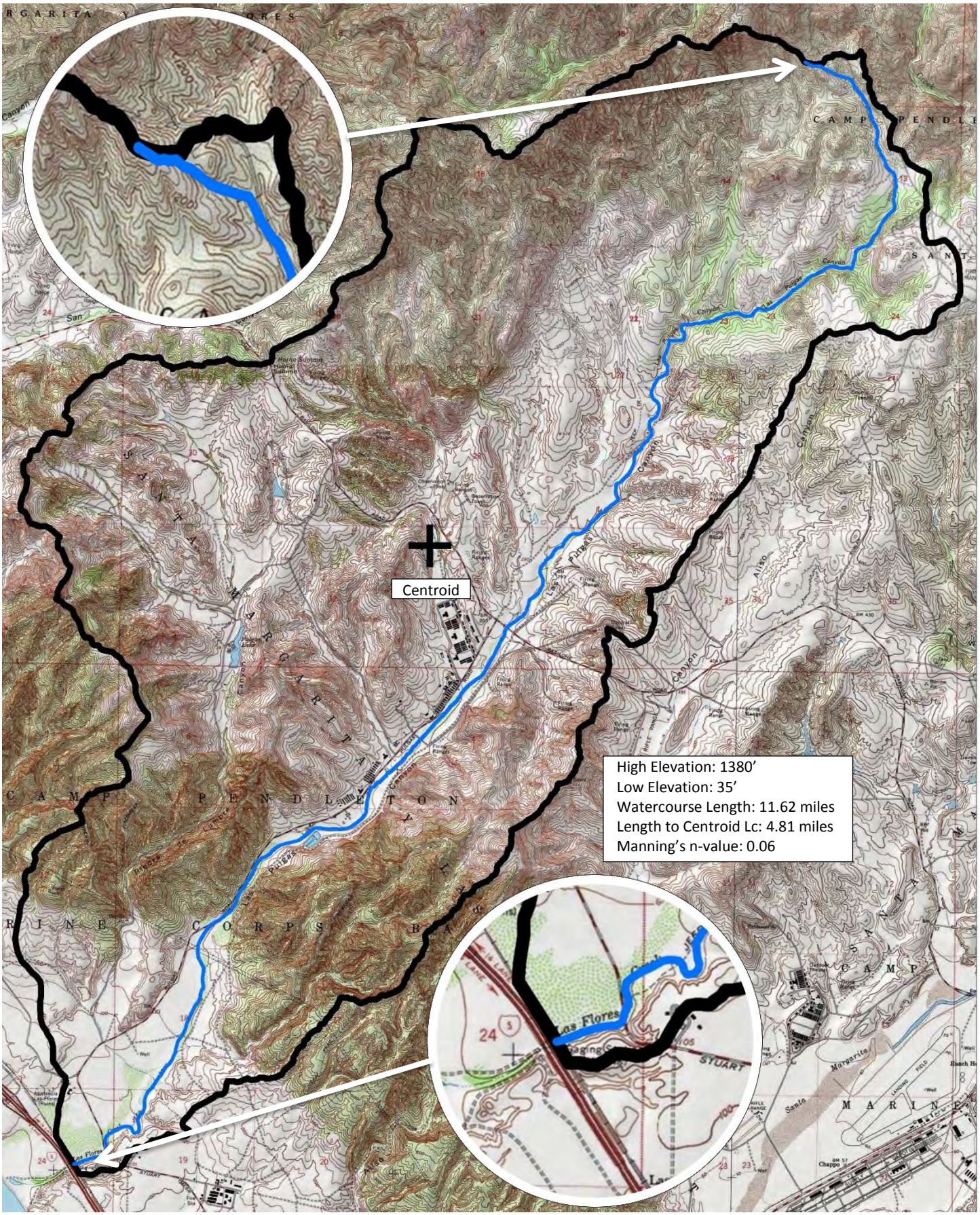


Aerial imagery of watercourse near area-centroid
Manning's n-value = 0.06 (Light Brush and Trees)

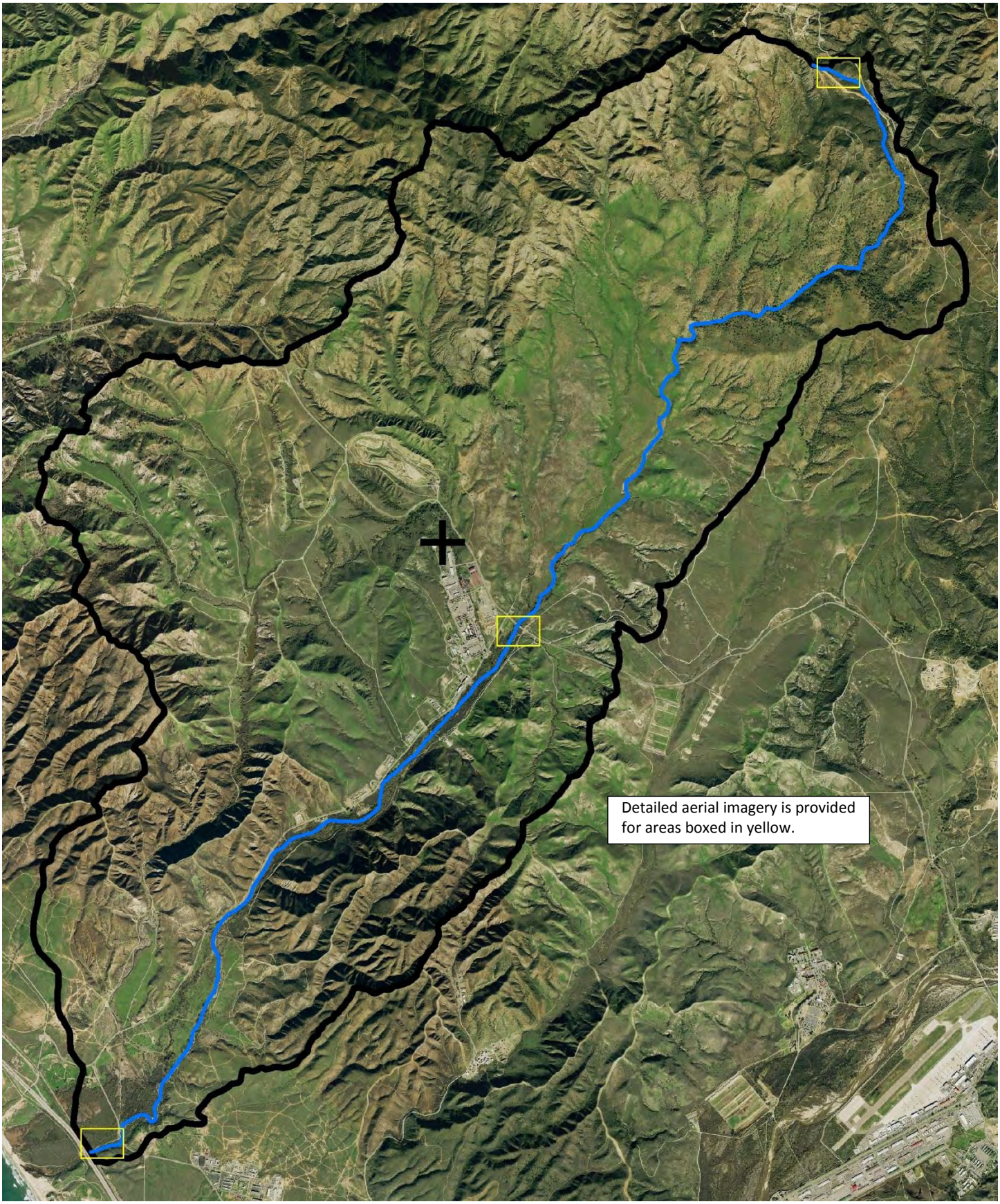


Aerial imagery of watercourse near downstream USGS stream gage
Manning's n-value = 0.06 (Light Brush and Trees)

Las Flores Creek Lag Time Exhibits



USGS Topography of Las Flores Creek Basin



Aerial Imagery for Las Flores Creek Basin



Aerial Imagery of watercourse near headwaters
Manning's n-value = 0.06 (Light Brush and Trees)



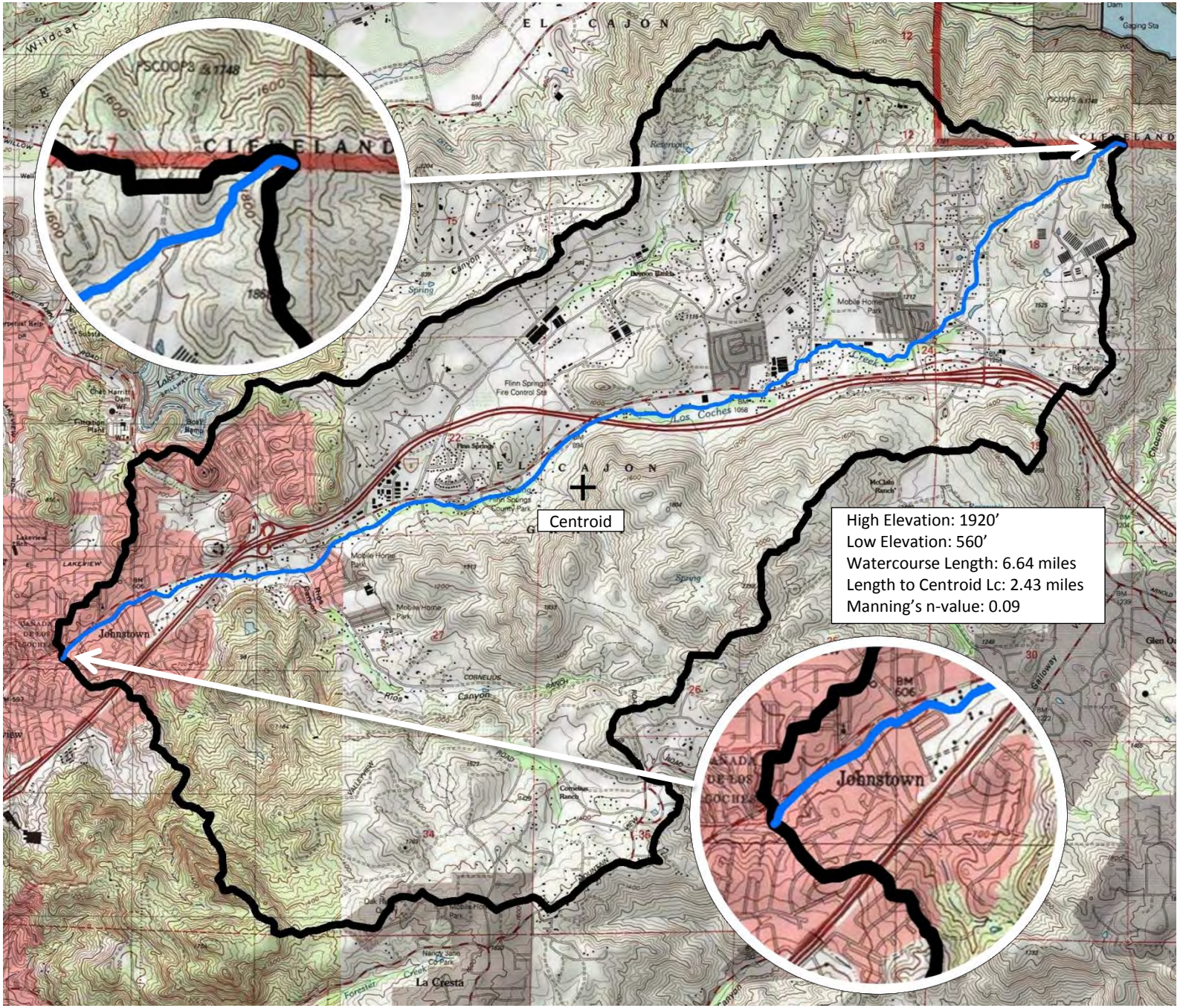
Aerial imagery of watercourse near area-centroid
Manning's n-value = 0.06 (Light Brush and Trees)



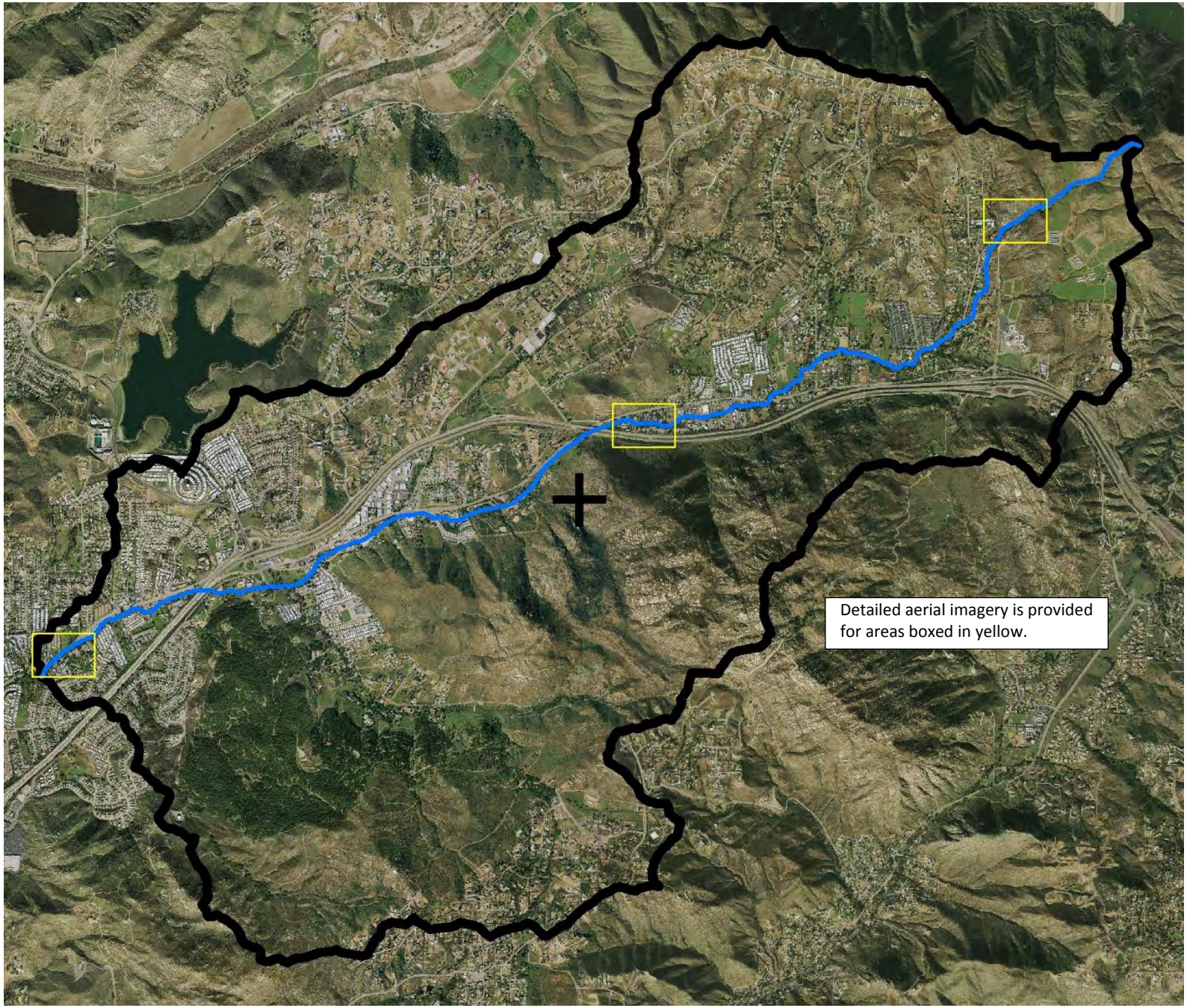
Aerial imagery of watercourse near downstream USGS stream gage

Manning's n-value = 0.09 (Medium to Dense Brush)

Los Coches Creek Lag Time Exhibits



USGS Topo Map of Los Coches Creek Basin



Aerial Imagery of Los Coches Creek Basin



Aerial Imagery of watercourse near headwaters
Manning's n-value = 0.09 (Medium to Dense Brush)

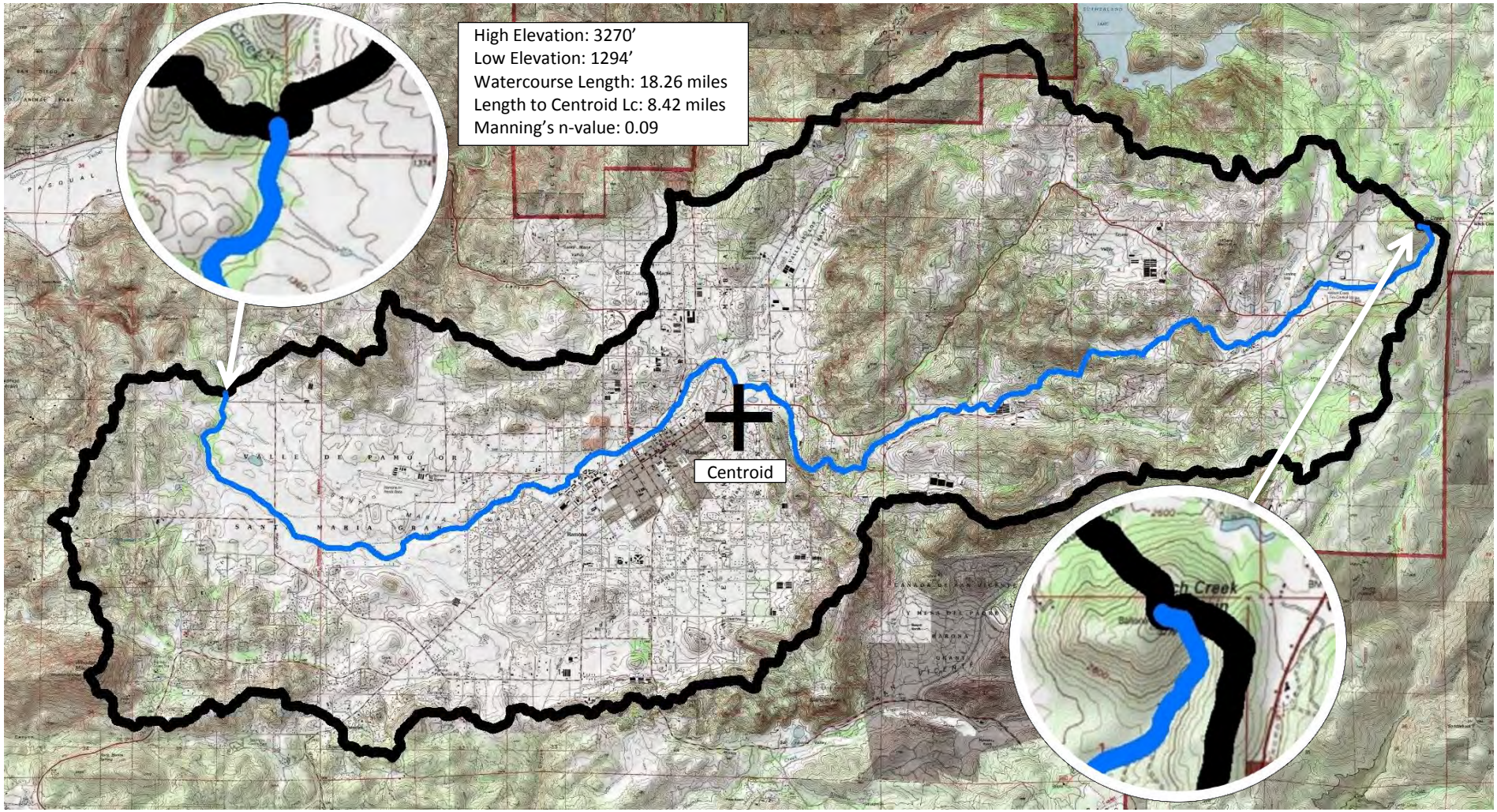


Aerial imagery of watercourse near area-centroid
Manning's n-value = 0.09 (Medium to Dense Brush)

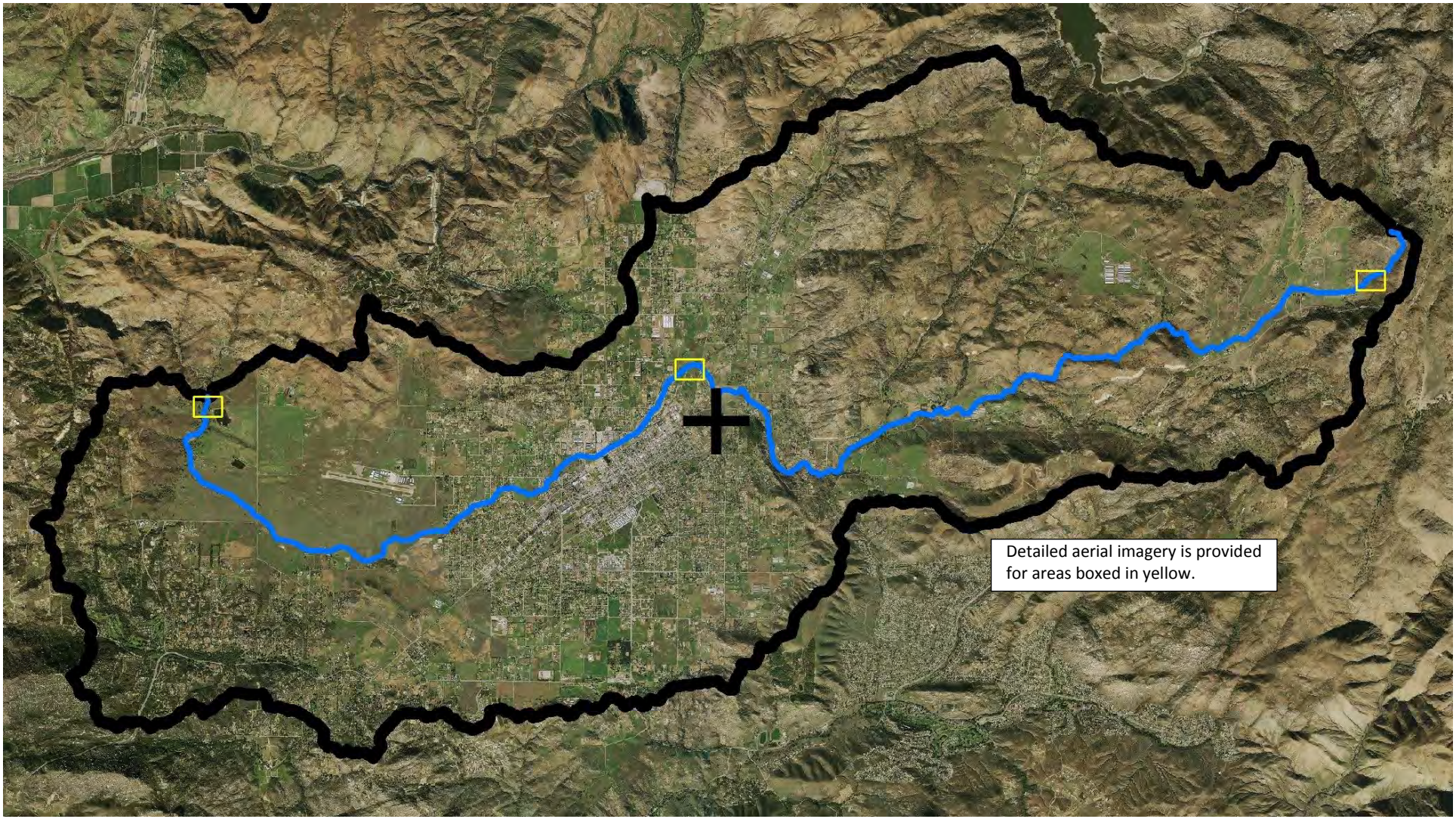


Aerial imagery of watercourse near downstream USGS stream gage
Manning's n-value = 0.09 (Medium to Dense Brush)

Santa Maria Creek Lag Time Exhibits



USGS Topo Map of Santa Maria Creek Basin



Aerial Imagery of Santa Maria Creek Basin



Aerial Imagery of watercourse near headwaters
Manning's n-value = 0.06 (Light Brush and Trees)

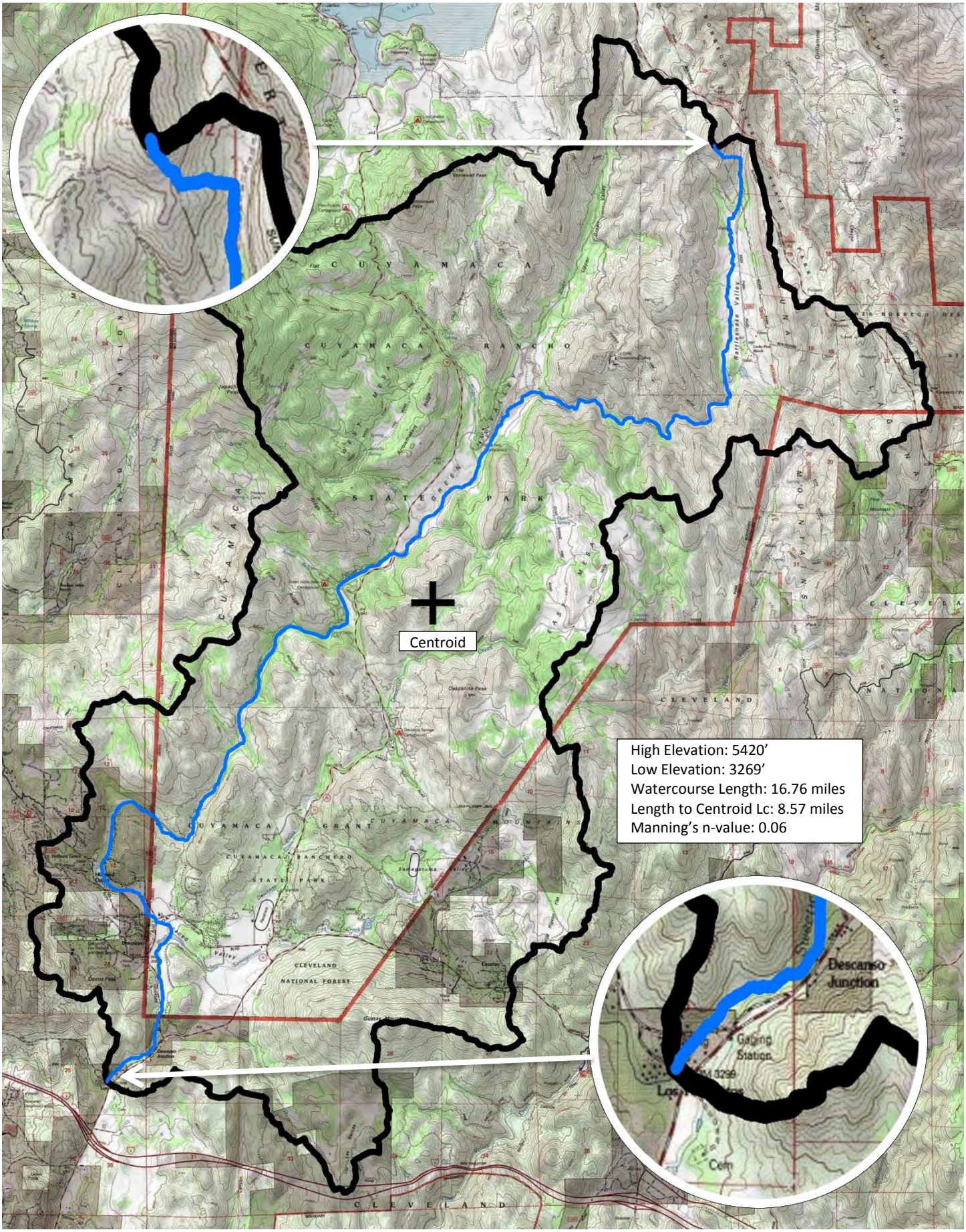


Aerial imagery of watercourse near area-centroid
Manning's n-value = 0.09 (Medium to Dense Brush)

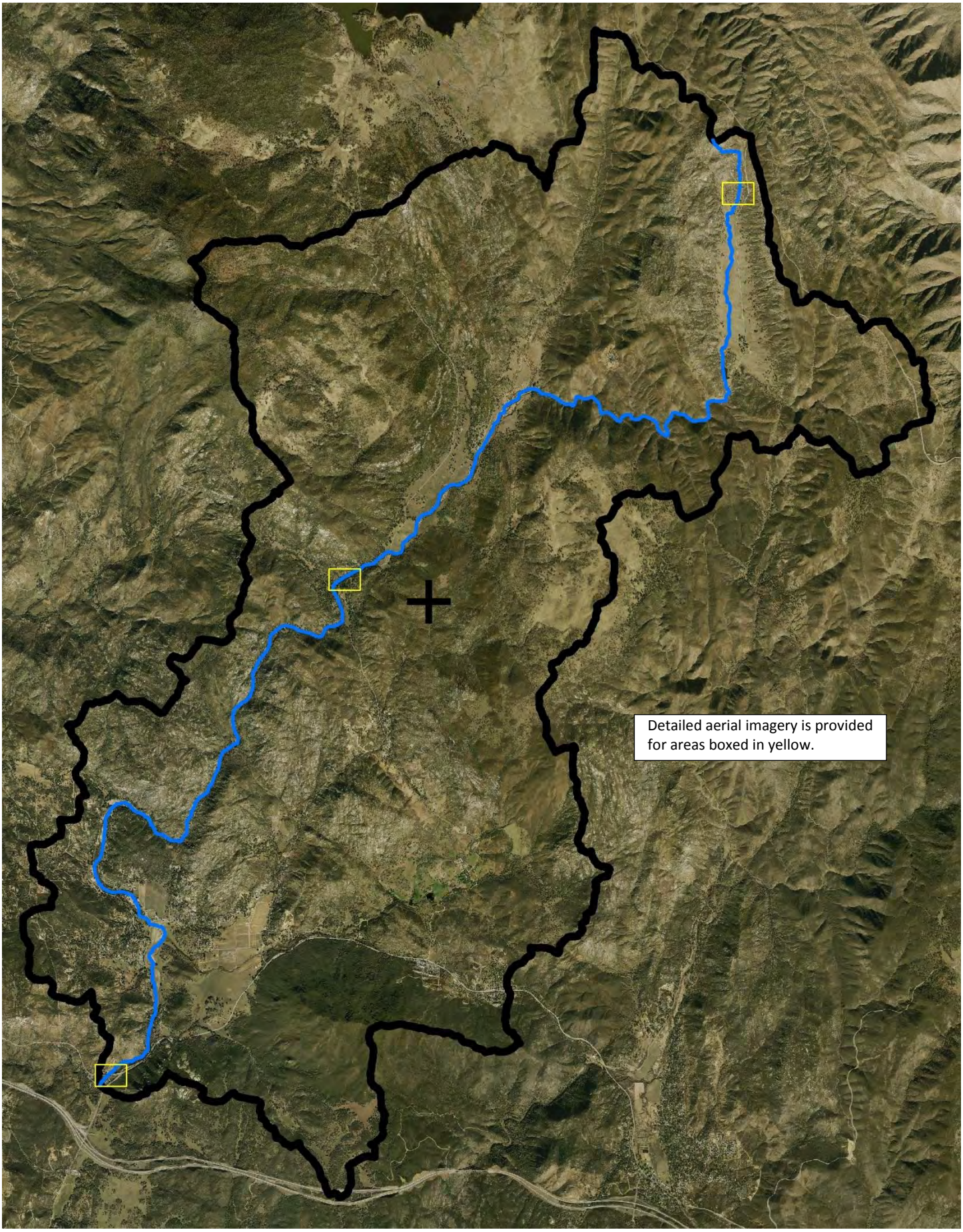


Aerial imagery of watercourse near downstream USGS stream gage
Manning's n-value = 0.09 (Medium to Dense Brush)

Sweetwater River Lag Time Exhibits



USGS Topo Map of Sweetwater River Basin



Aerial Imagery of Sweetwater River Basin



Aerial Imagery of watercourse near headwaters
Manning's n-value = 0.06 (Light Brush and Trees)



Aerial imagery of watercourse near area-centroid
Manning's n-value = 0.06 (Light Brush and Trees)



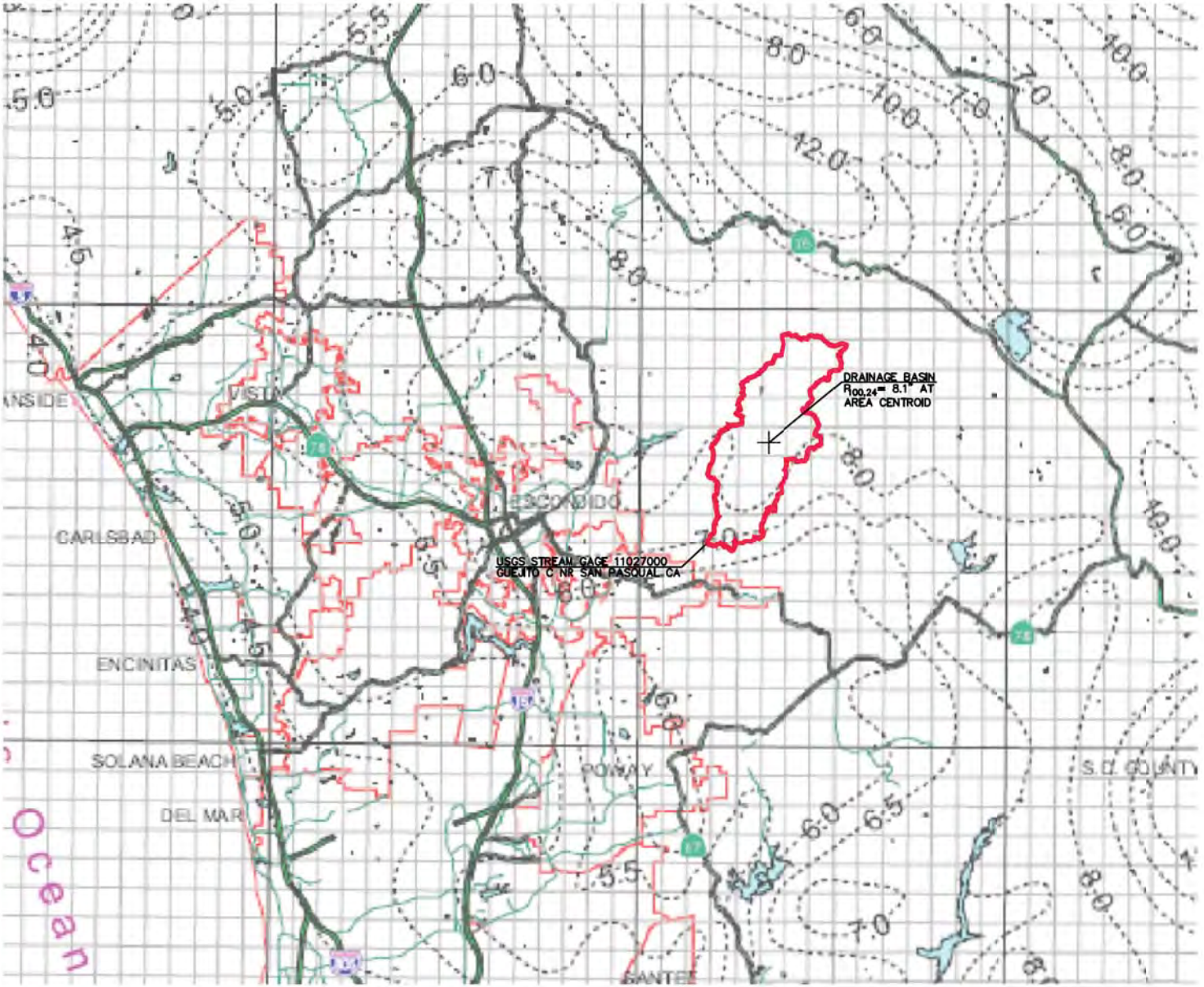
Aerial imagery of watercourse near downstream USGS stream gage
Manning's n-value = 0.06 (Light Brush and Trees)

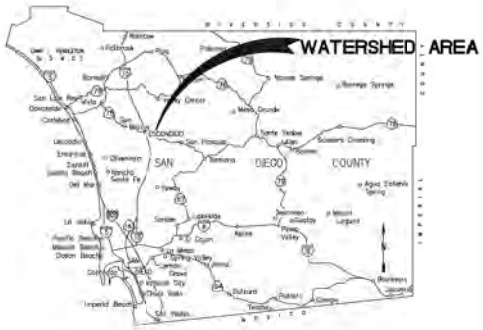
Appendix C.6

Unadjusted Rainfall Depths (Isopluvial Maps)

This page is intentionally left blank to facilitate 2-sided printing.

Guejito Creek Isopluvials





PROJECT LOCATION
NO SCALE

LEGEND

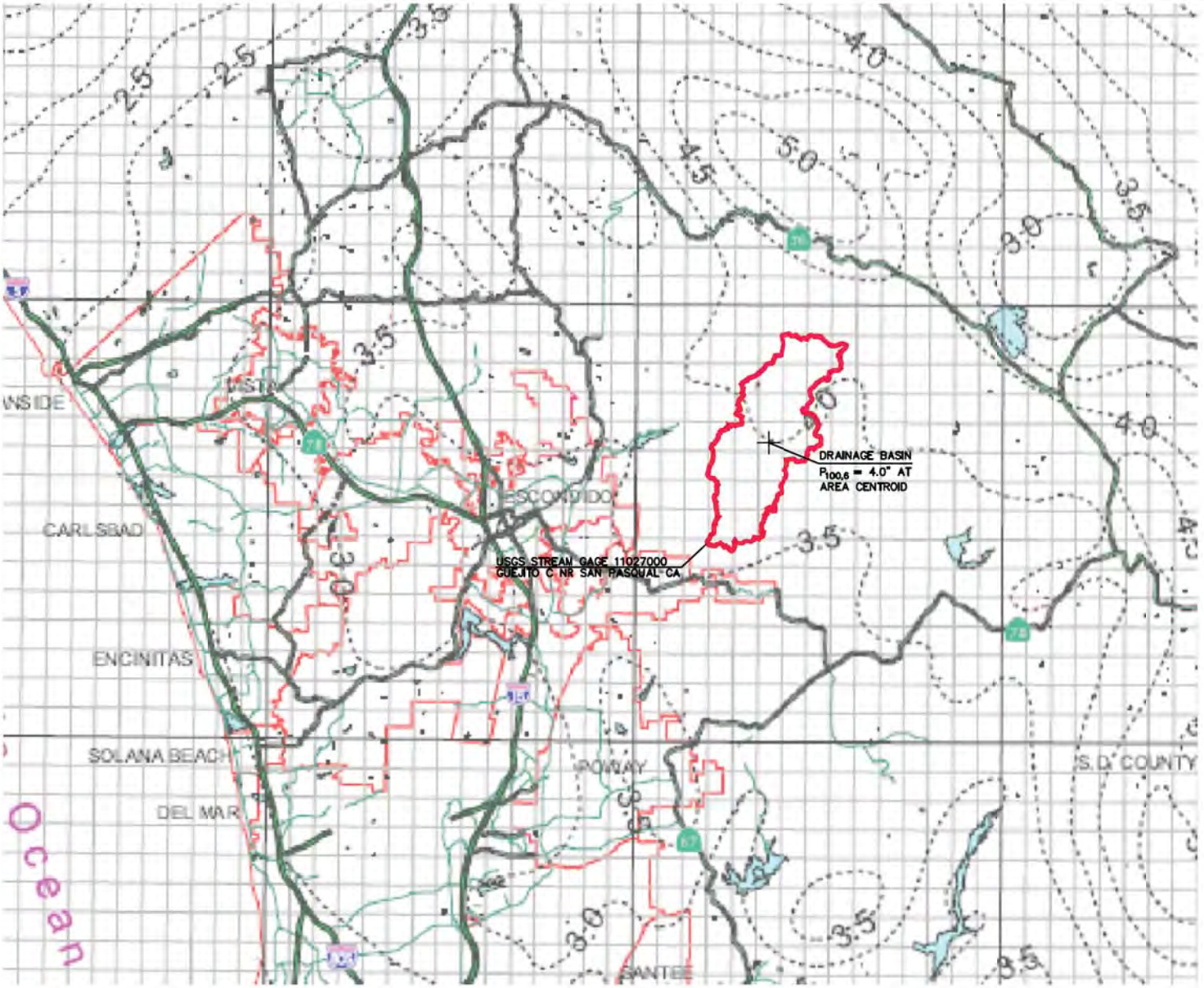
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

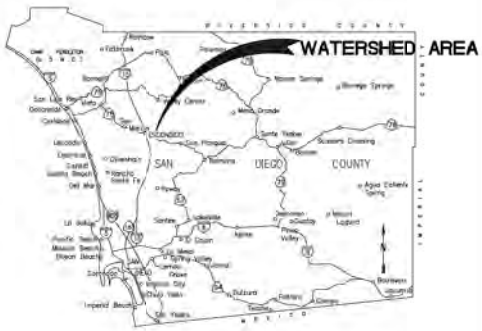
3 0 3 Miles

SHEET 8 OF 8

GUEJITO CREEK ISOPLUVIAL MAP
100 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2946
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

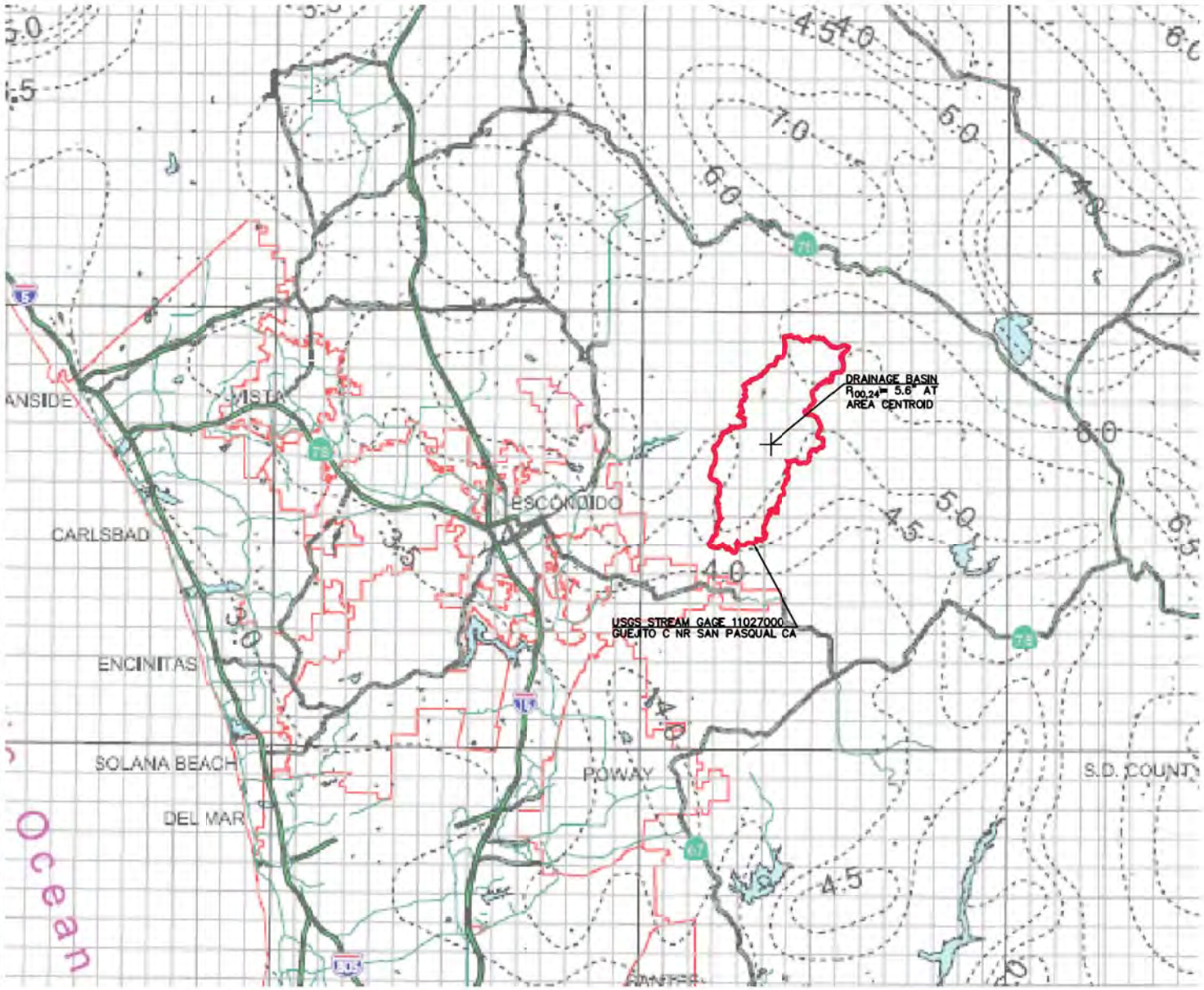
LEGEND

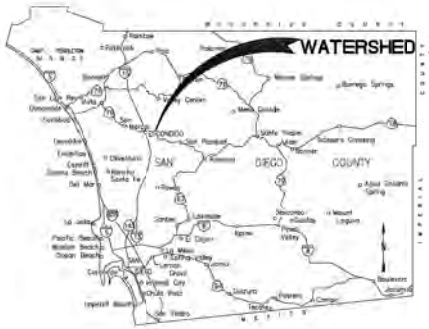
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 7 OF 8

GUEJITO CREEK ISOPLUVIAL MAP
100 YEAR RAINFALL EVENT – 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

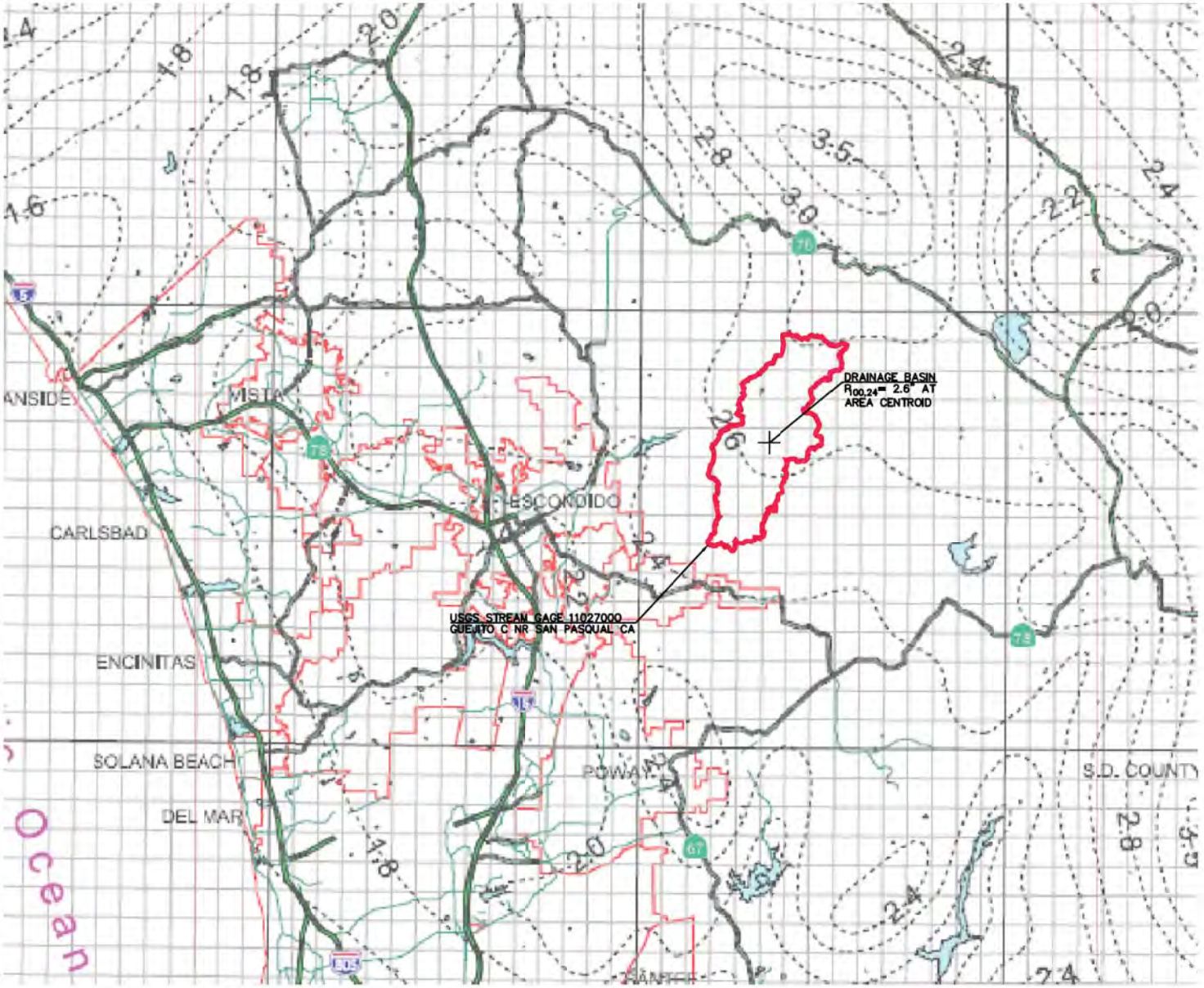
LEGEND

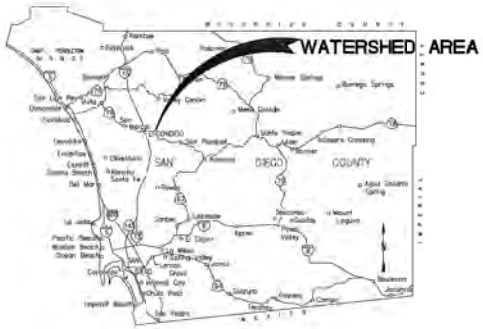
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 6 OF 8

QUEJITO CREEK ISOPLUVIAL MAP
10 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

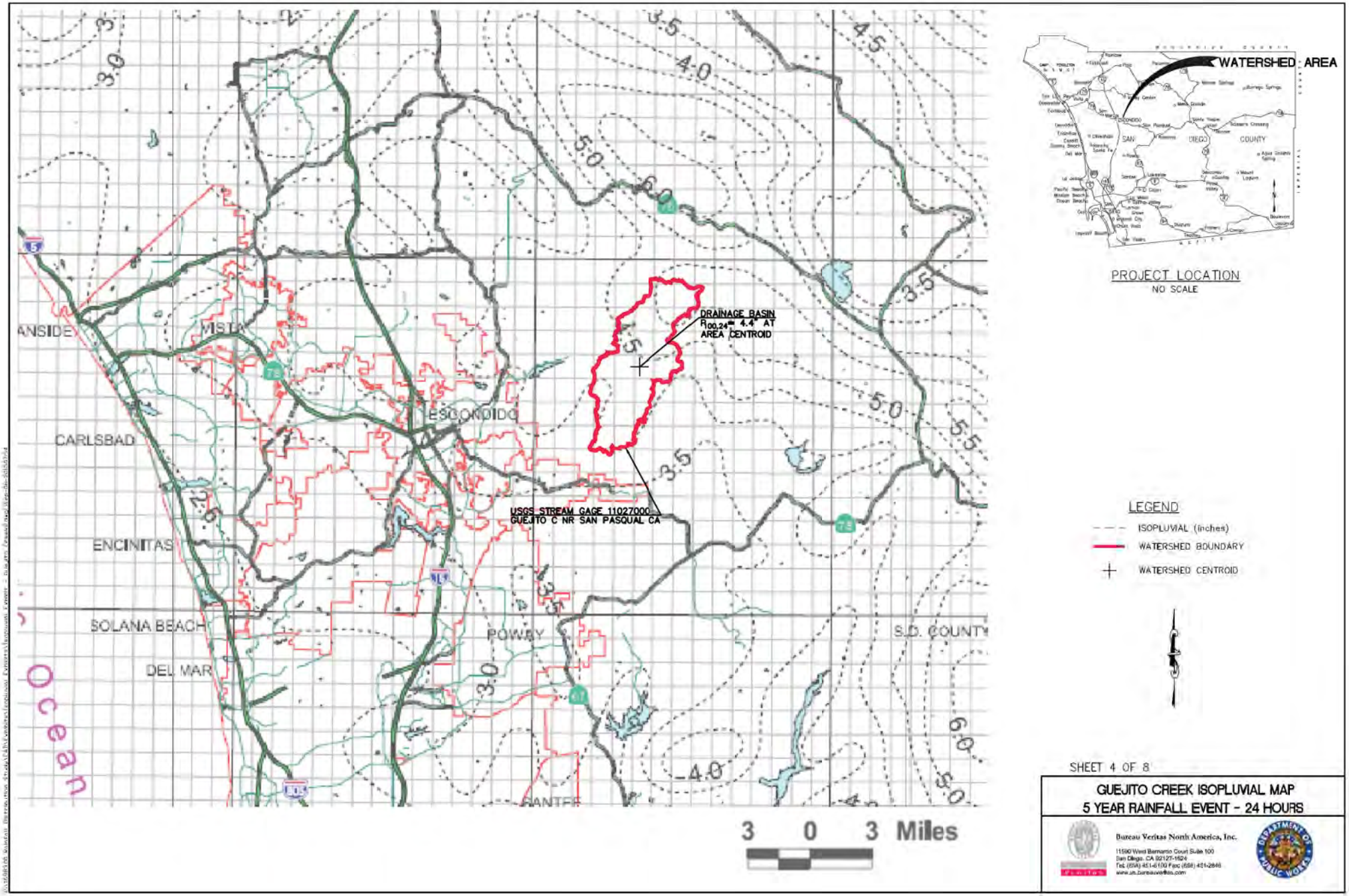
LEGEND

- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 5 OF 8

QUEJITO CREEK ISOPLUVIAL MAP
10 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



PROJECT LOCATION
NO SCALE

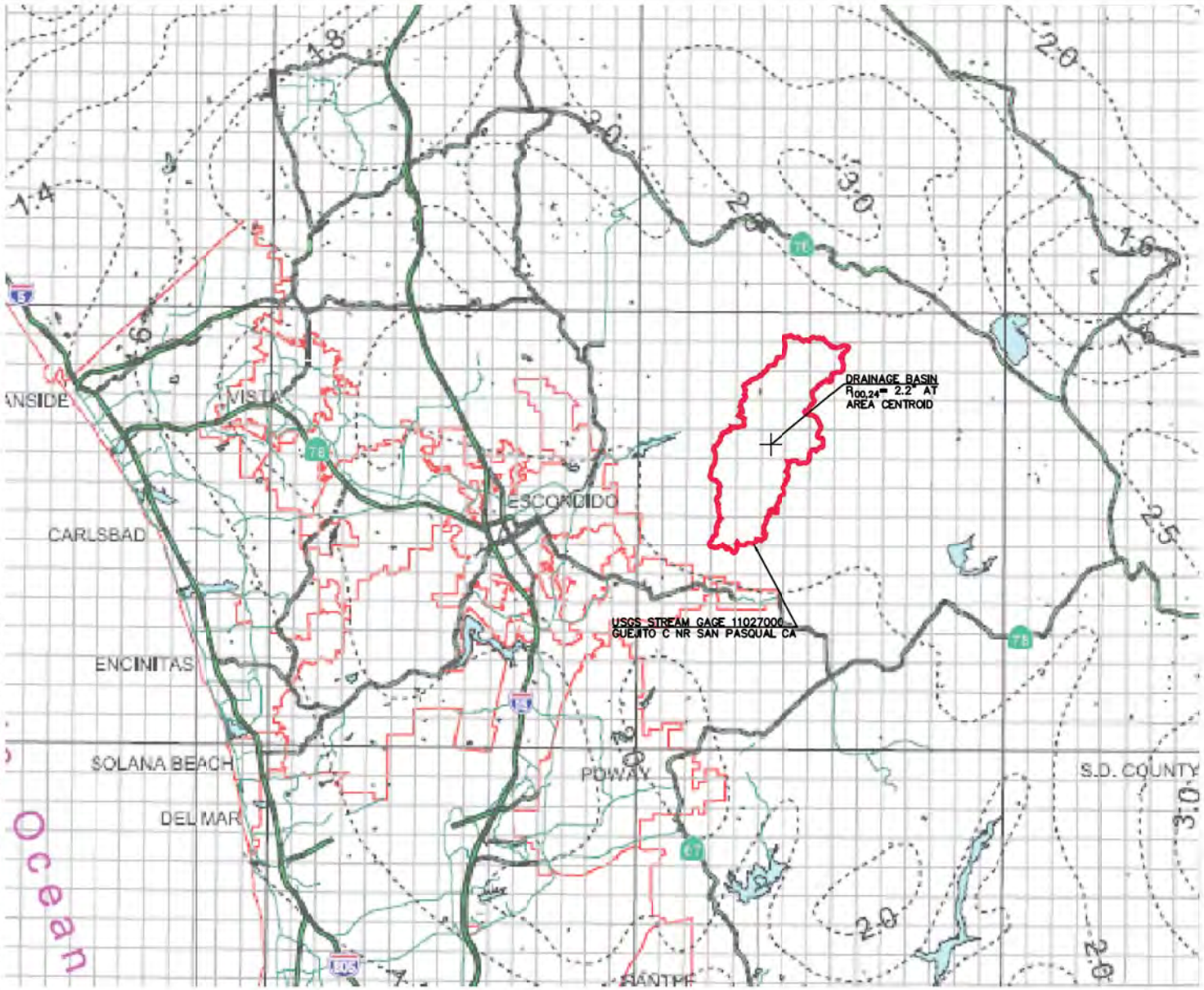
LEGEND

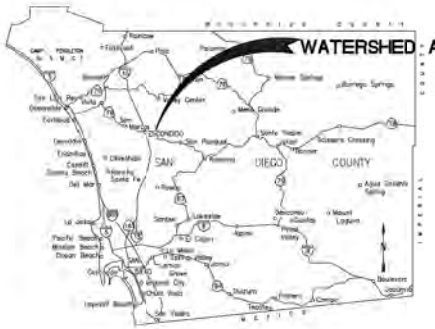
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 4 OF 8

GUEJITO CREEK ISOPLUVIAL MAP
5 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

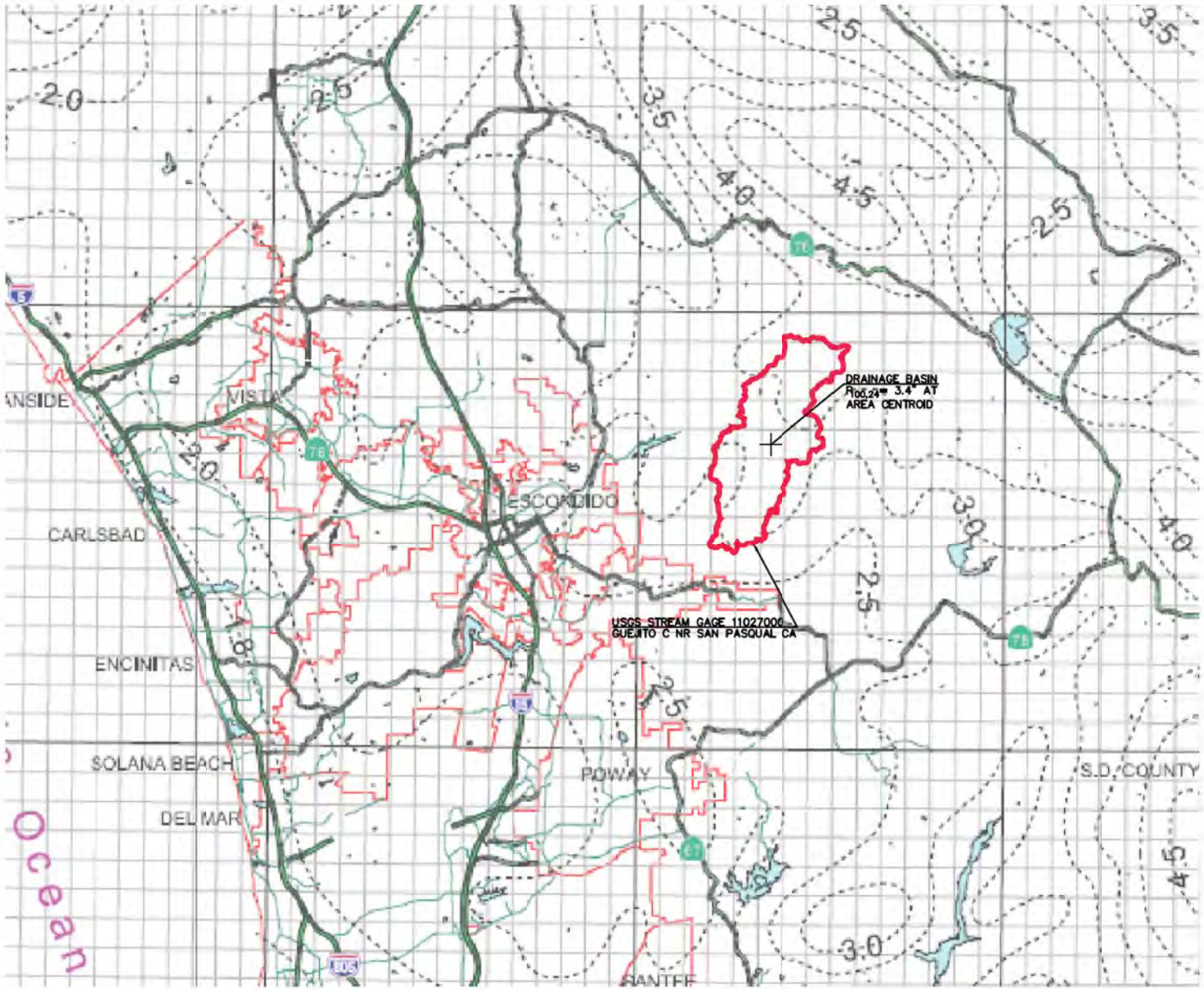
LEGEND

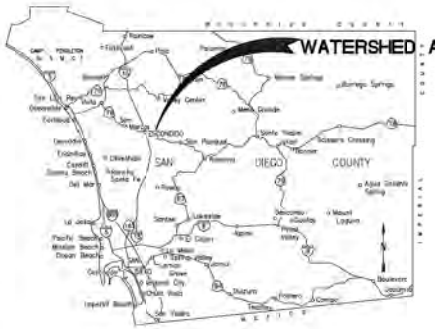
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 3 OF 8

QUEJITO CREEK ISOPLUVIAL MAP
5 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

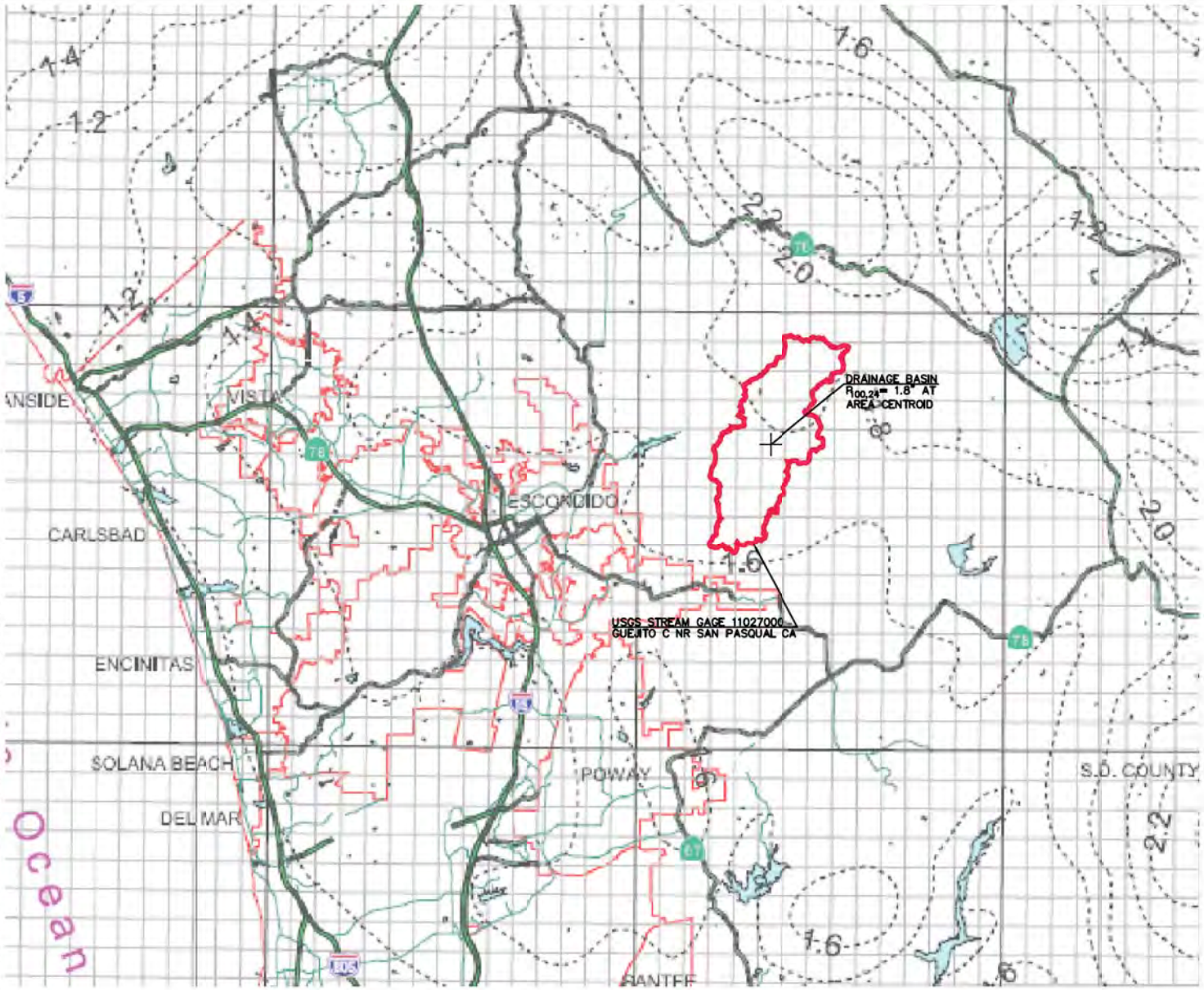
LEGEND

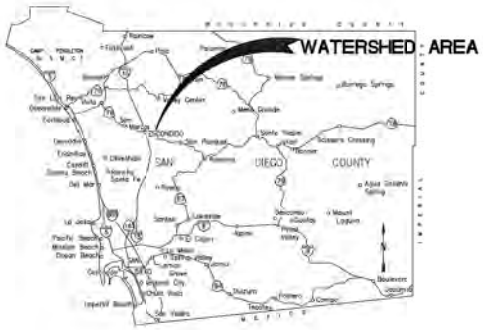
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 2 OF 8

GUEJITO CREEK ISOPLUVIAL MAP
2 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

LEGEND

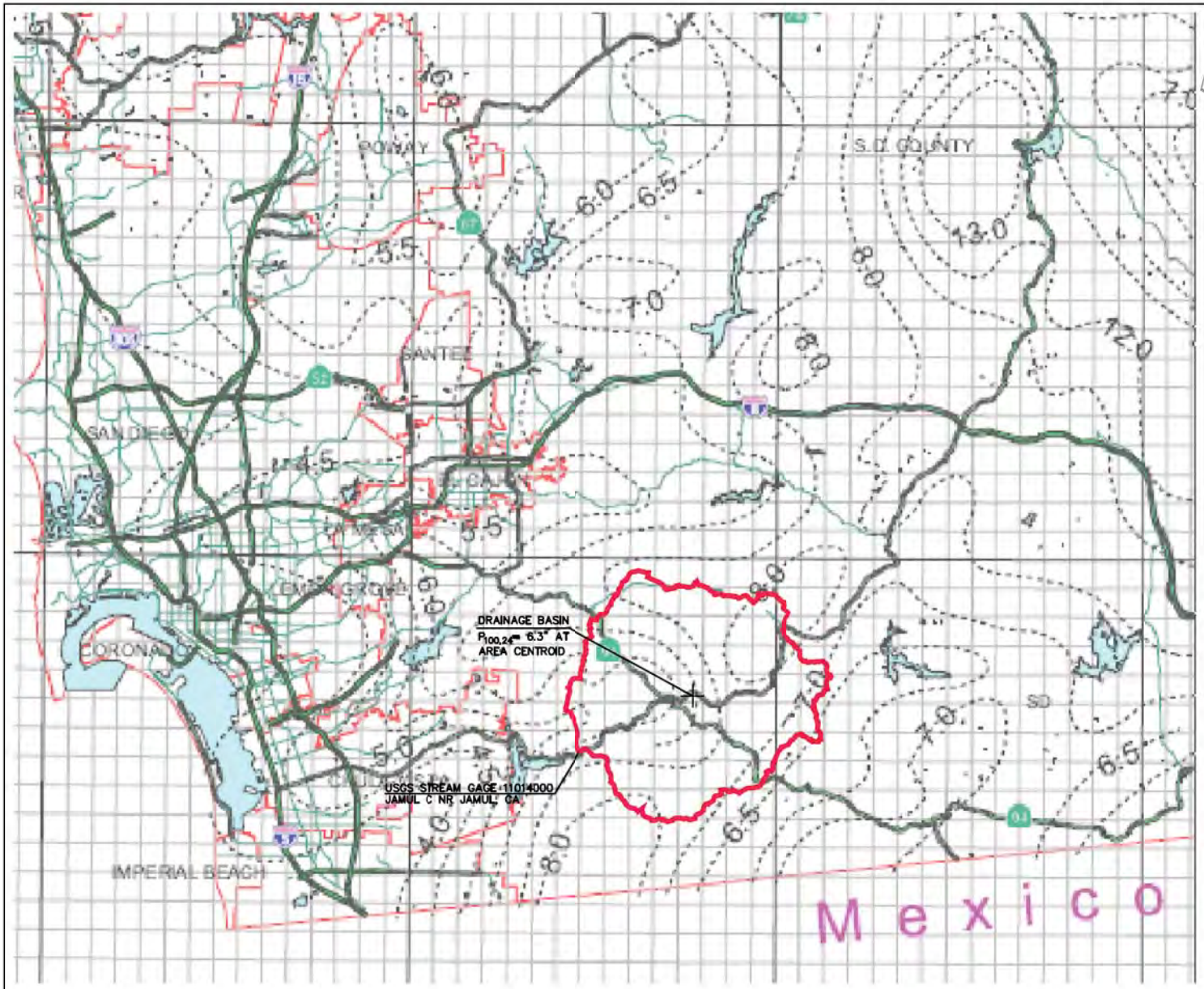
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

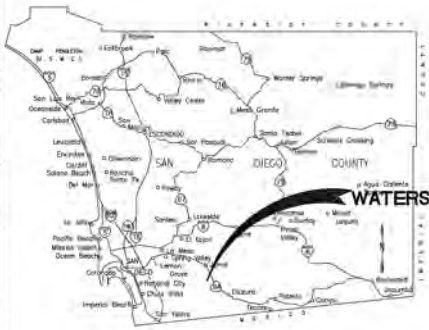
SHEET 1 OF 8

GUEJITO CREEK ISOPLUVIAL MAP
2 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

Jamul Creek Isopluvials





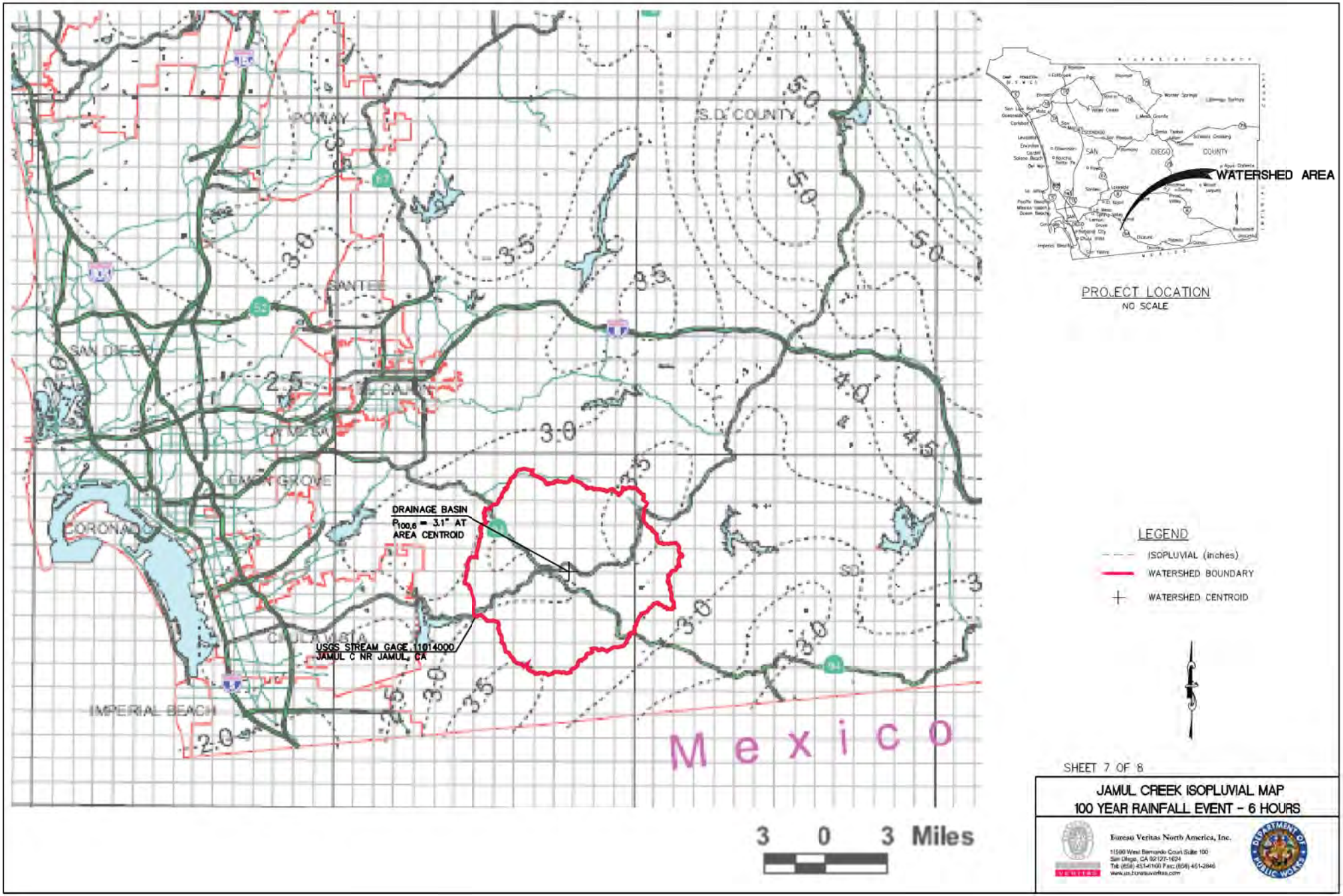
PROJECT LOCATION
NO SCALE

LEGEND
ISOPLUVIAL (inches)
WATERSHED BOUNDARY
WATERSHED CENTROID

SHEET 8 OF 8

JAMUL CREEK ISOPLUVIAL MAP
100 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6160 Fax: (858) 451-2846
www.us.bureauveritas.com



PROJECT LOCATION
NO SCALE

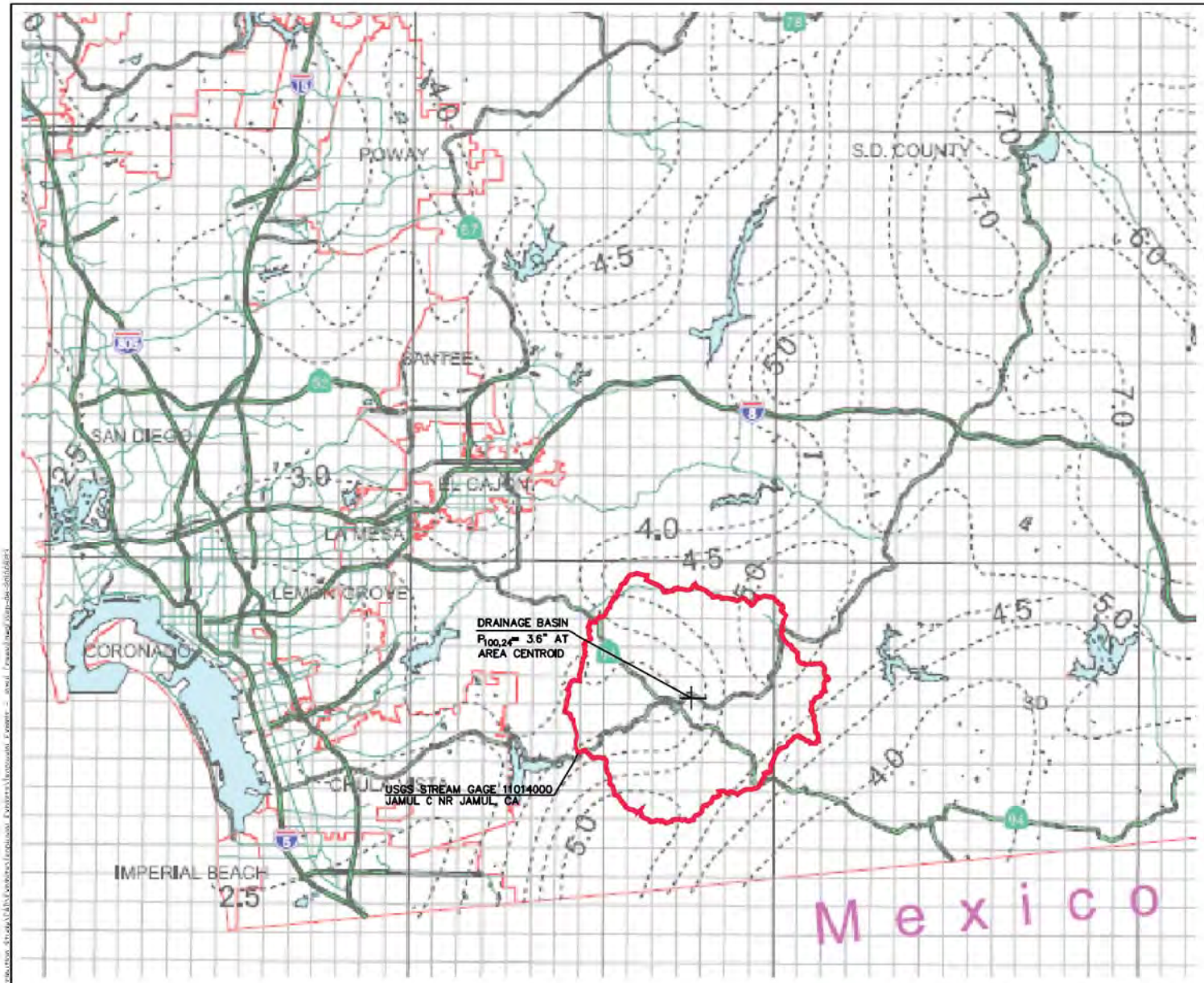
LEGEND

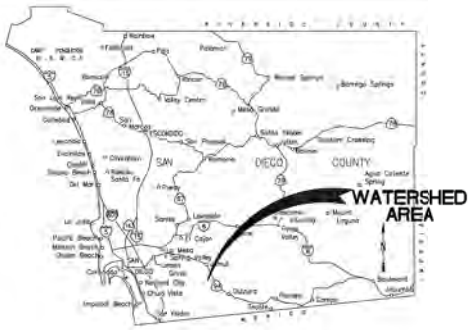
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 7 OF 8

JAMUL CREEK ISOPLUVIAL MAP
100 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

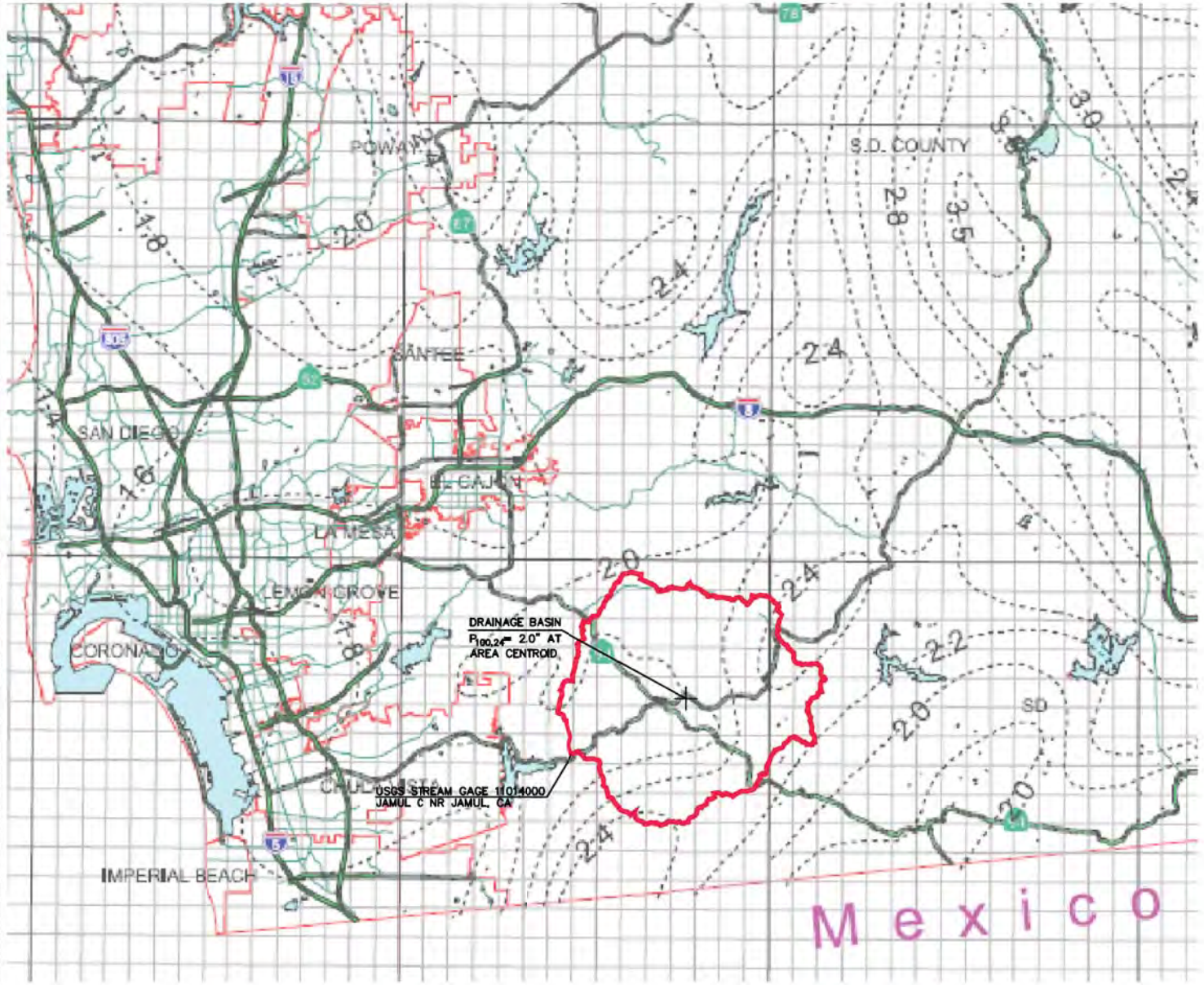
LEGEND

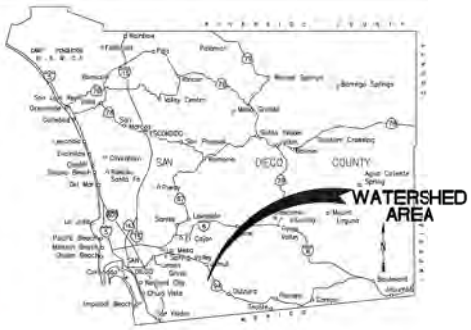
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 6 OF 8

JAMUL CREEK ISOPLUVIAL MAP
10 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

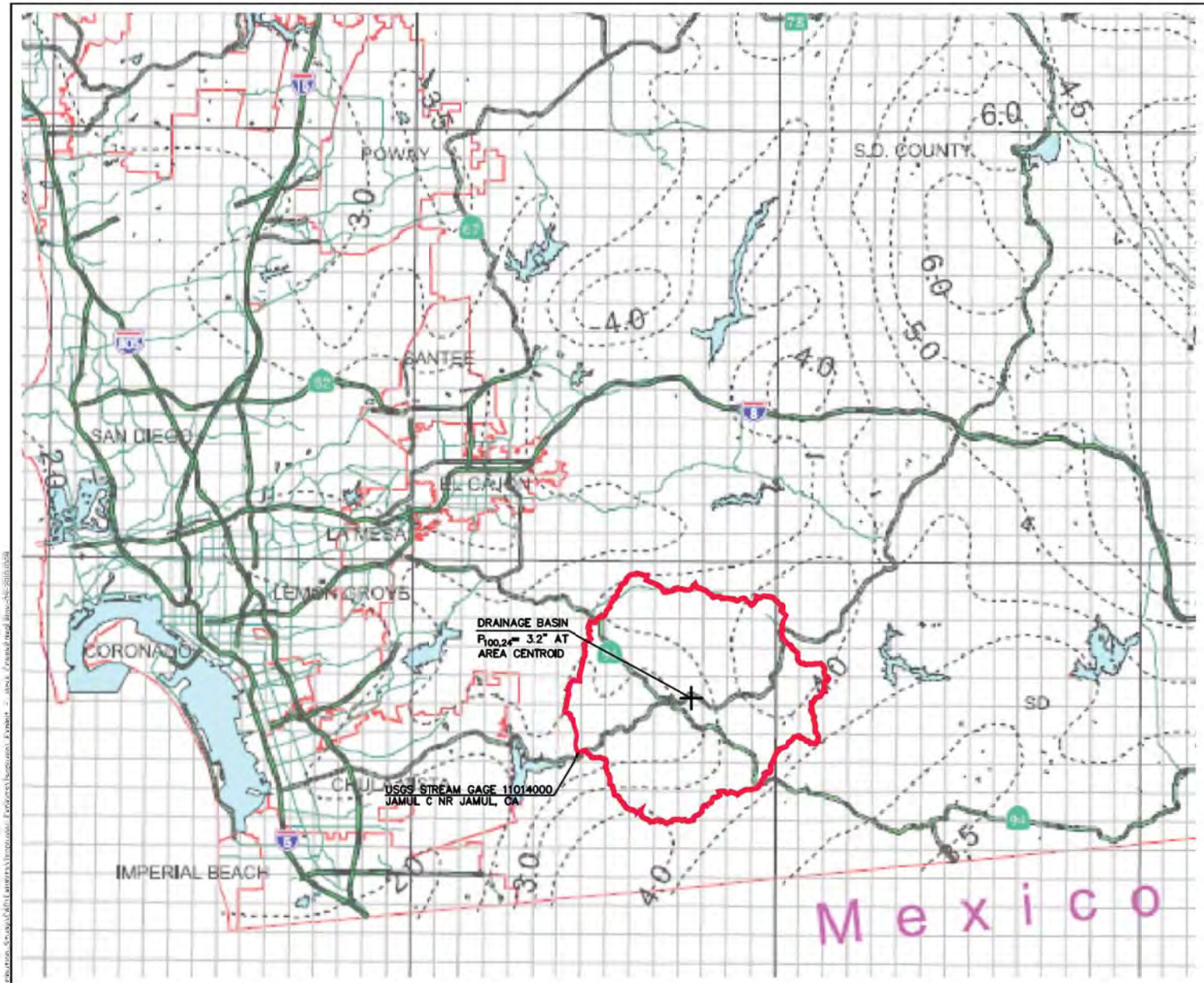
LEGEND

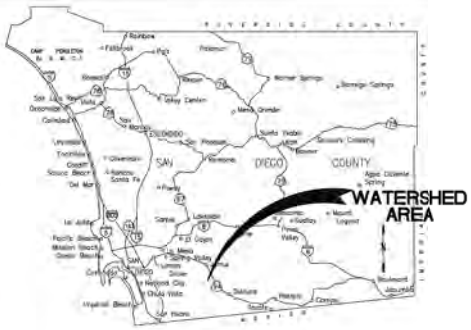
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 5 OF 8

JAMUL CREEK ISOPLUVIAL MAP
10 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

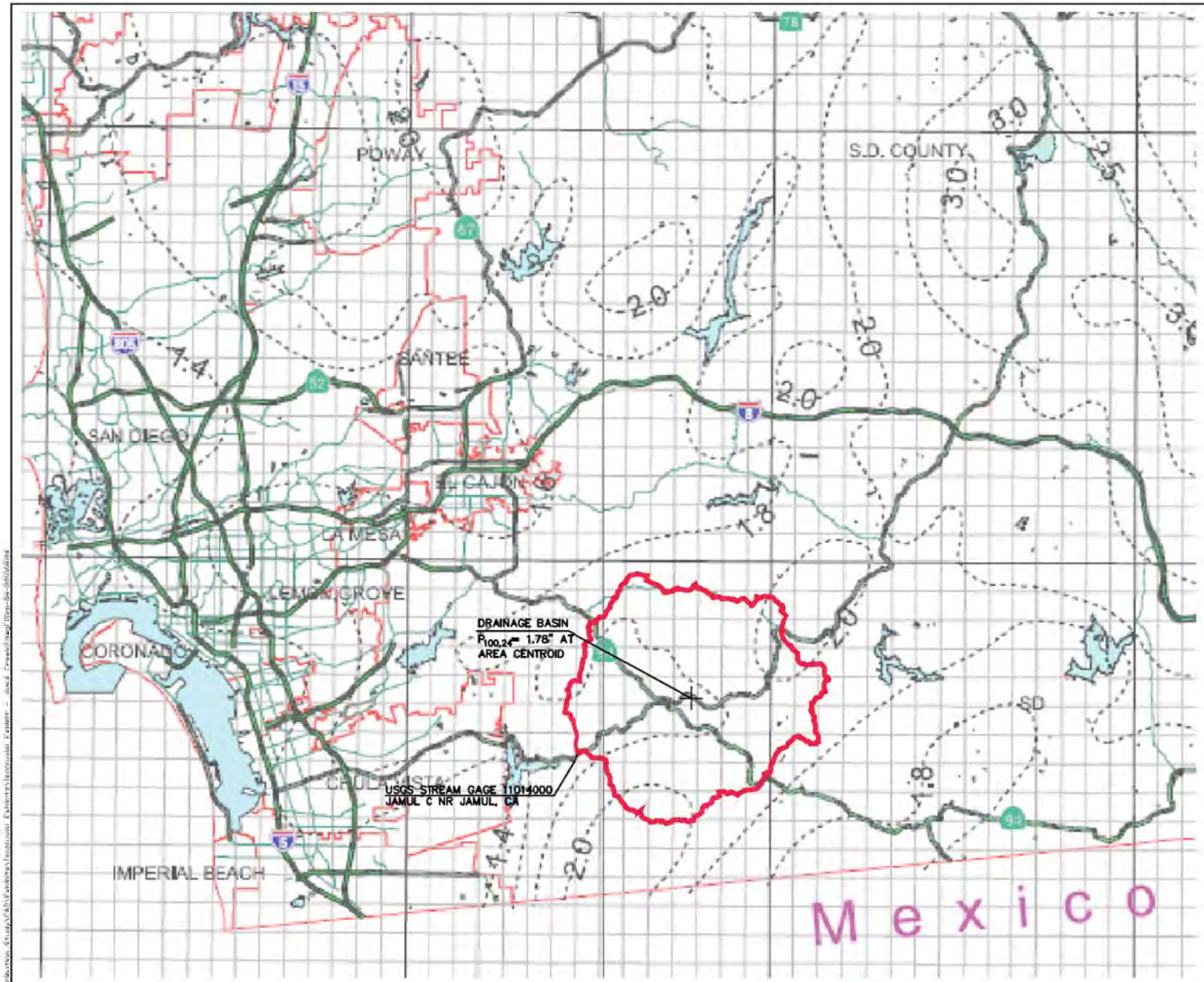
LEGEND

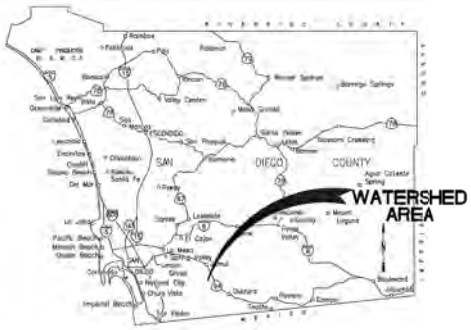
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 4 OF 8

JAMUL CREEK ISOPLUVIAL MAP
5 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
1535 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 481-5100 Fax: (858) 481-5848
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

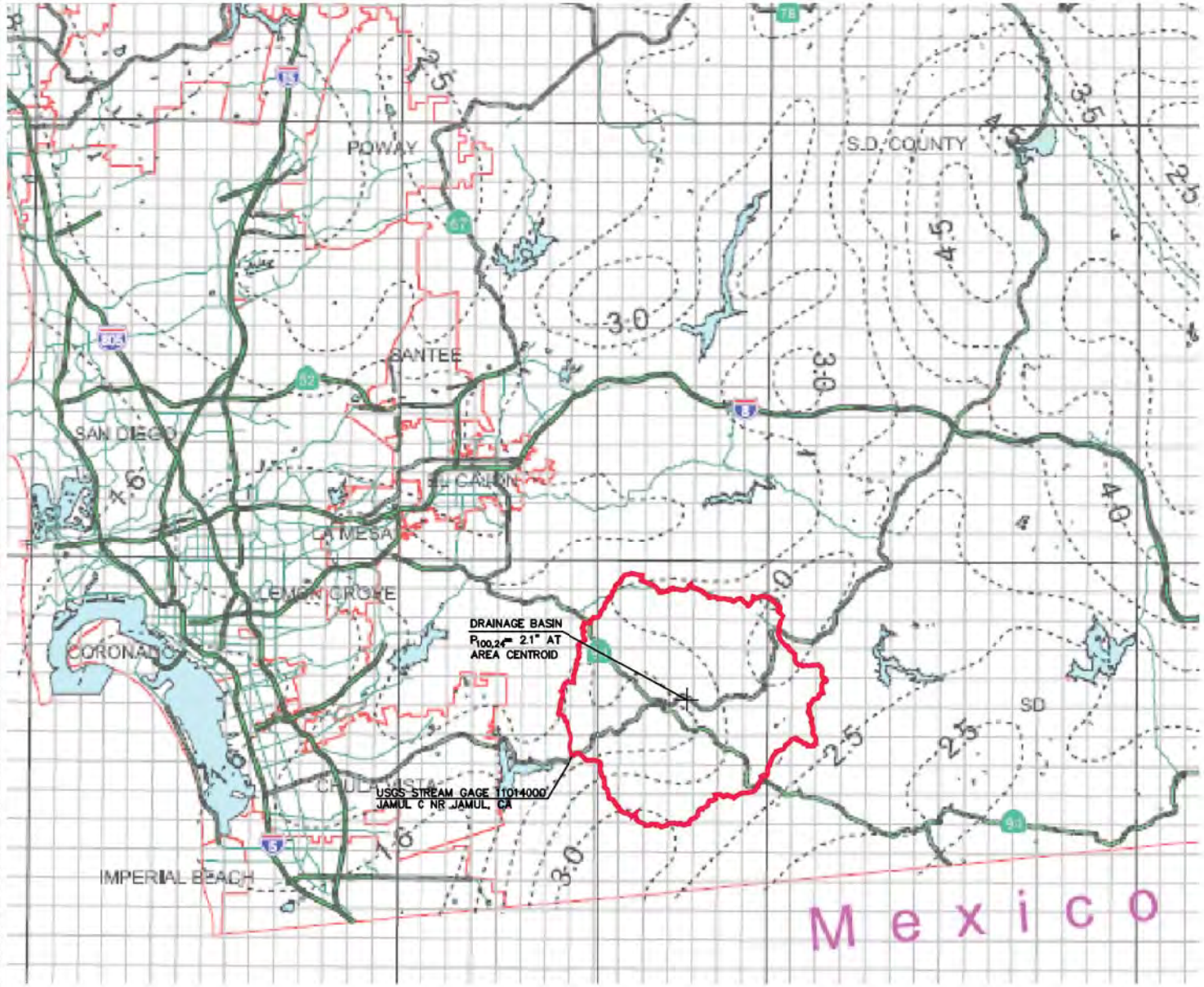
LEGEND

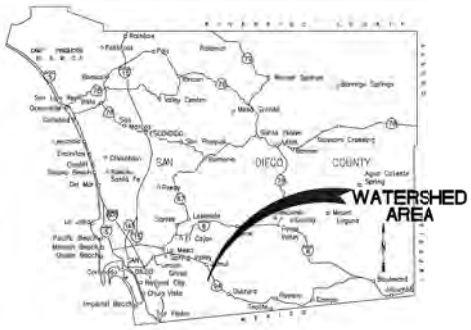
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 3 OF 8

JAMUL CREEK ISOPLUVIAL MAP
5 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

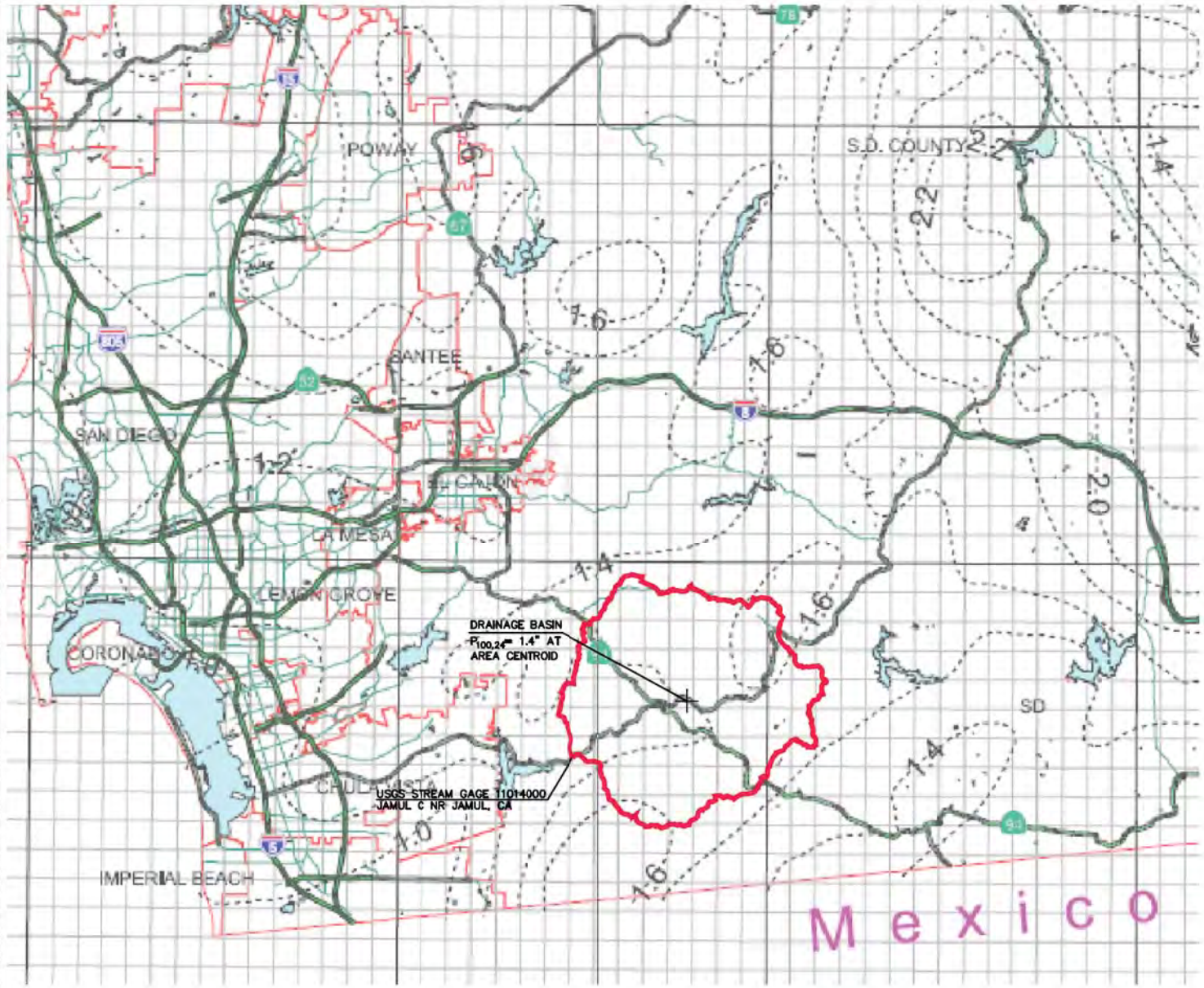
LEGEND

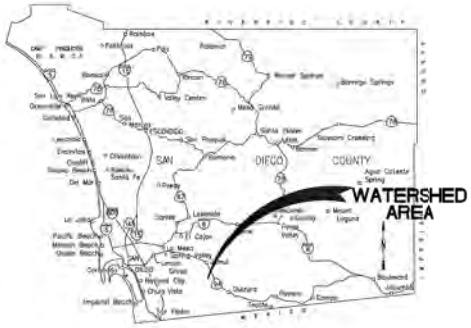
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 2 OF 8

JAMUL CREEK ISOPLUVIAL MAP
2 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

LEGEND

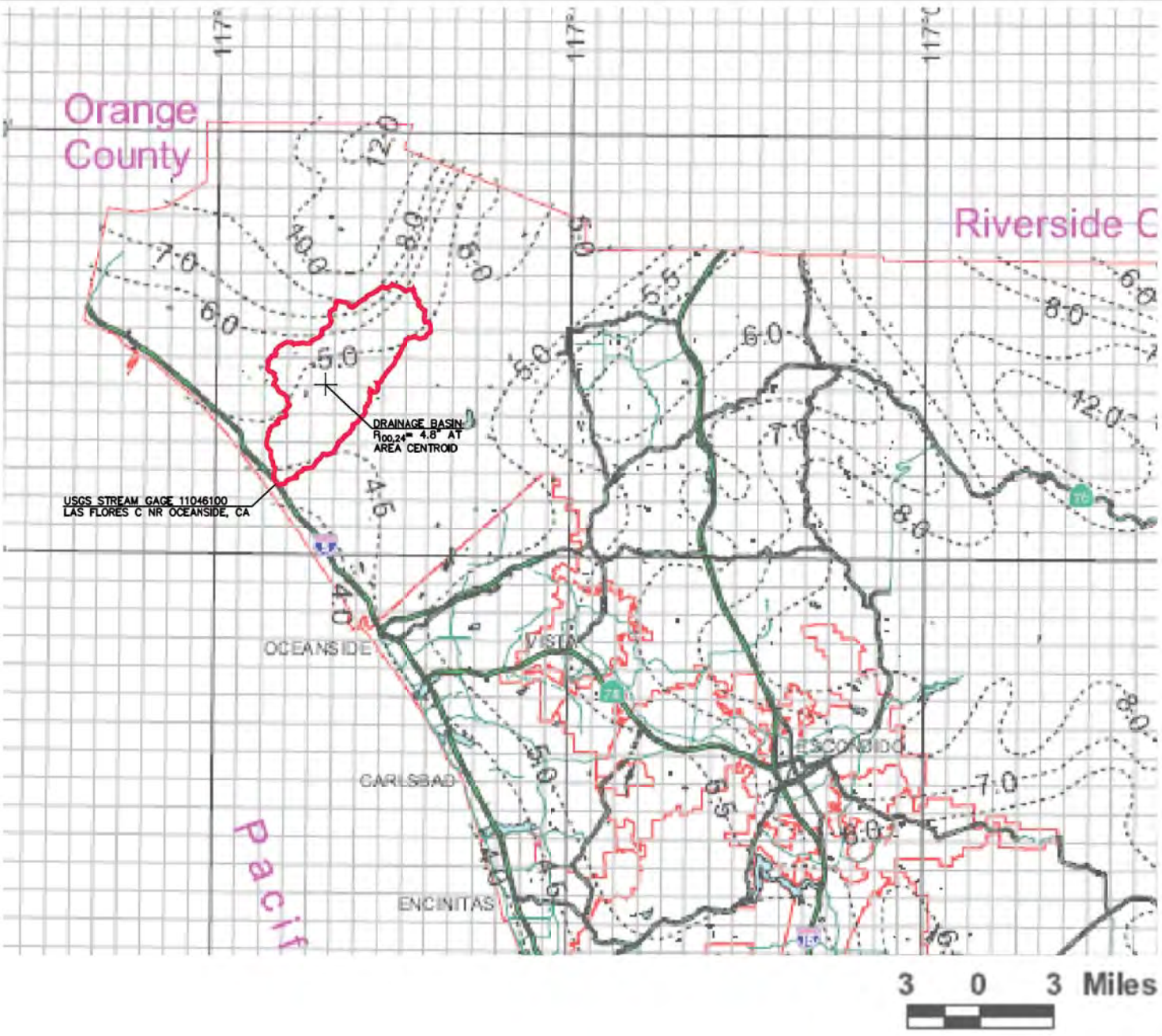
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

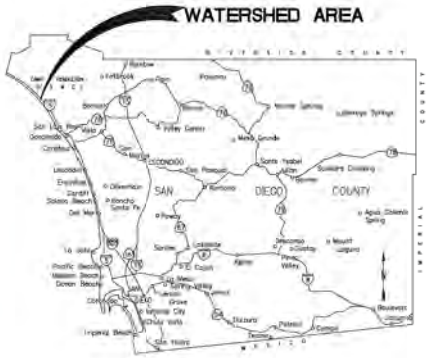
SHEET 1 OF 8

JAMUL CREEK ISOPLUVIAL MAP
2 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

Las Flores Creek Isopluvials





PROJECT LOCATION
NO SCALE

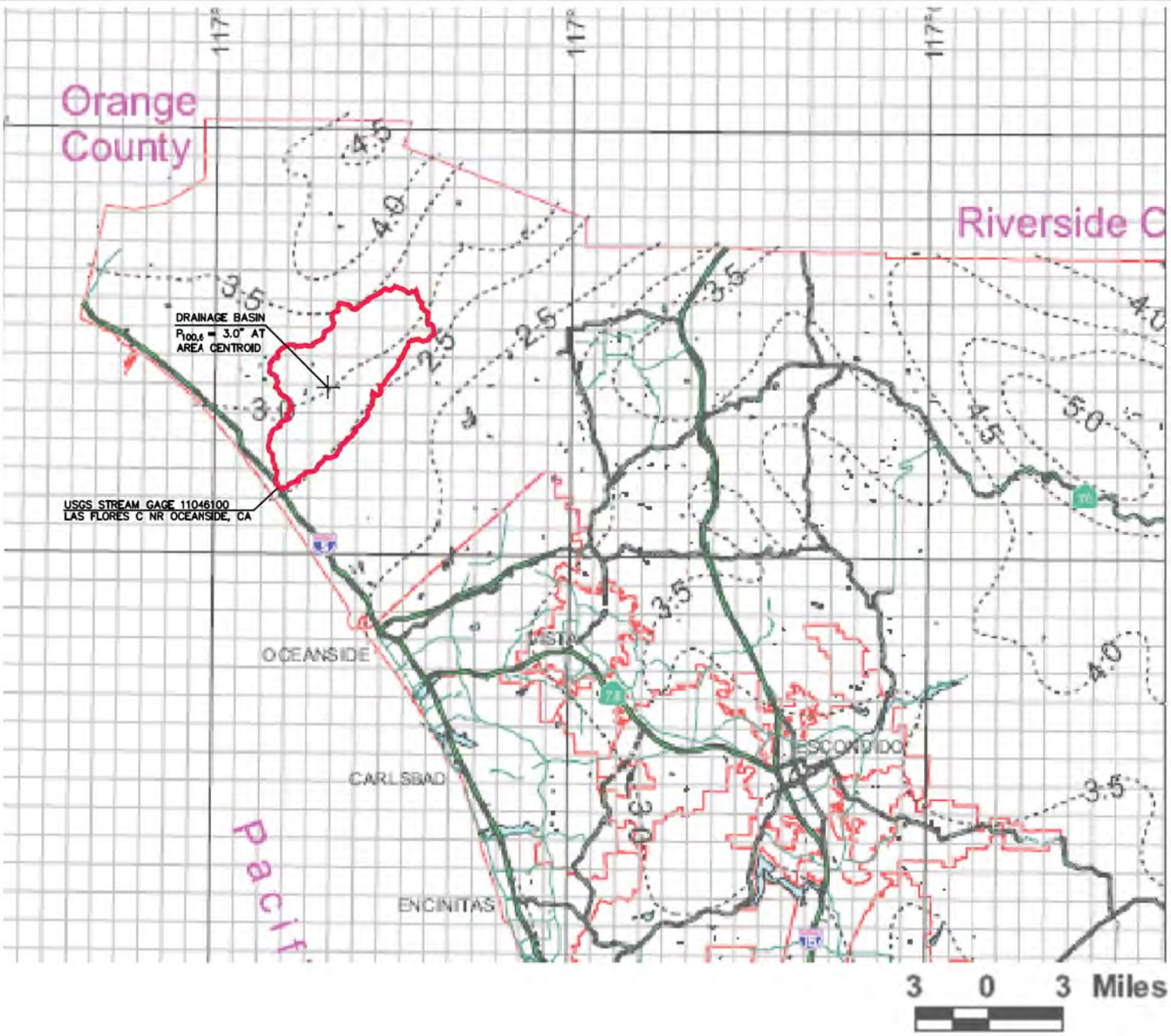
LEGEND

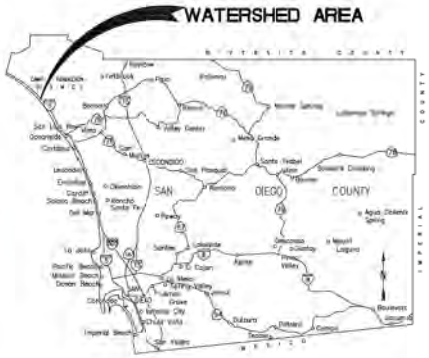
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 8 OF 8

LAS FLORES CREEK ISOPLUVIAL MAP
100 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2946
www.us.bureauveritas.com





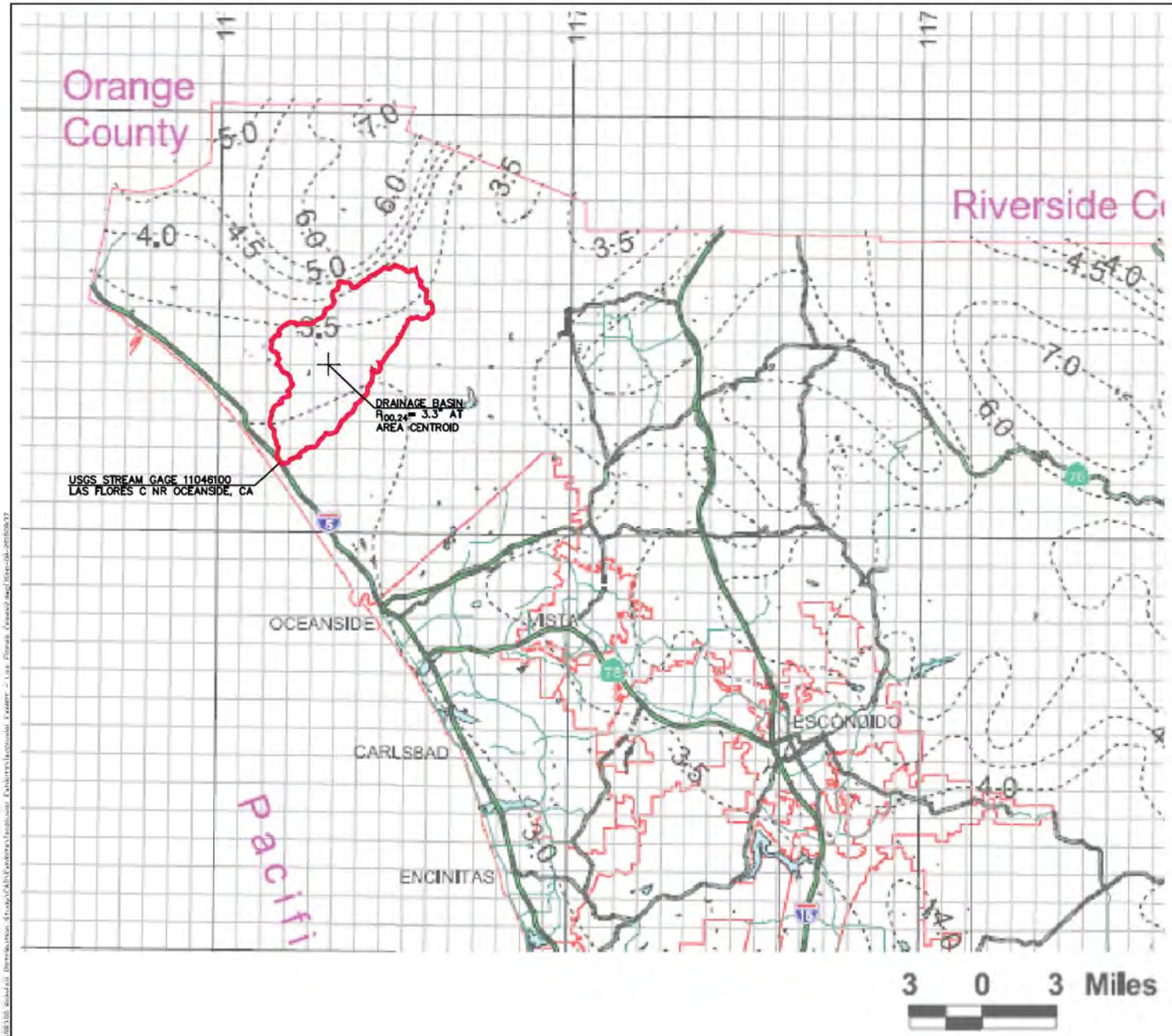
PROJECT LOCATION
NO SCALE

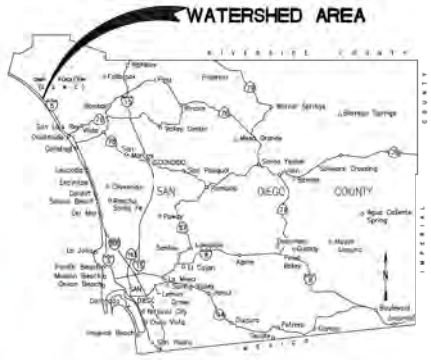
LEGEND
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 7 OF 8

LAS FLORES CREEK ISOPLUVIAL MAP
100 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

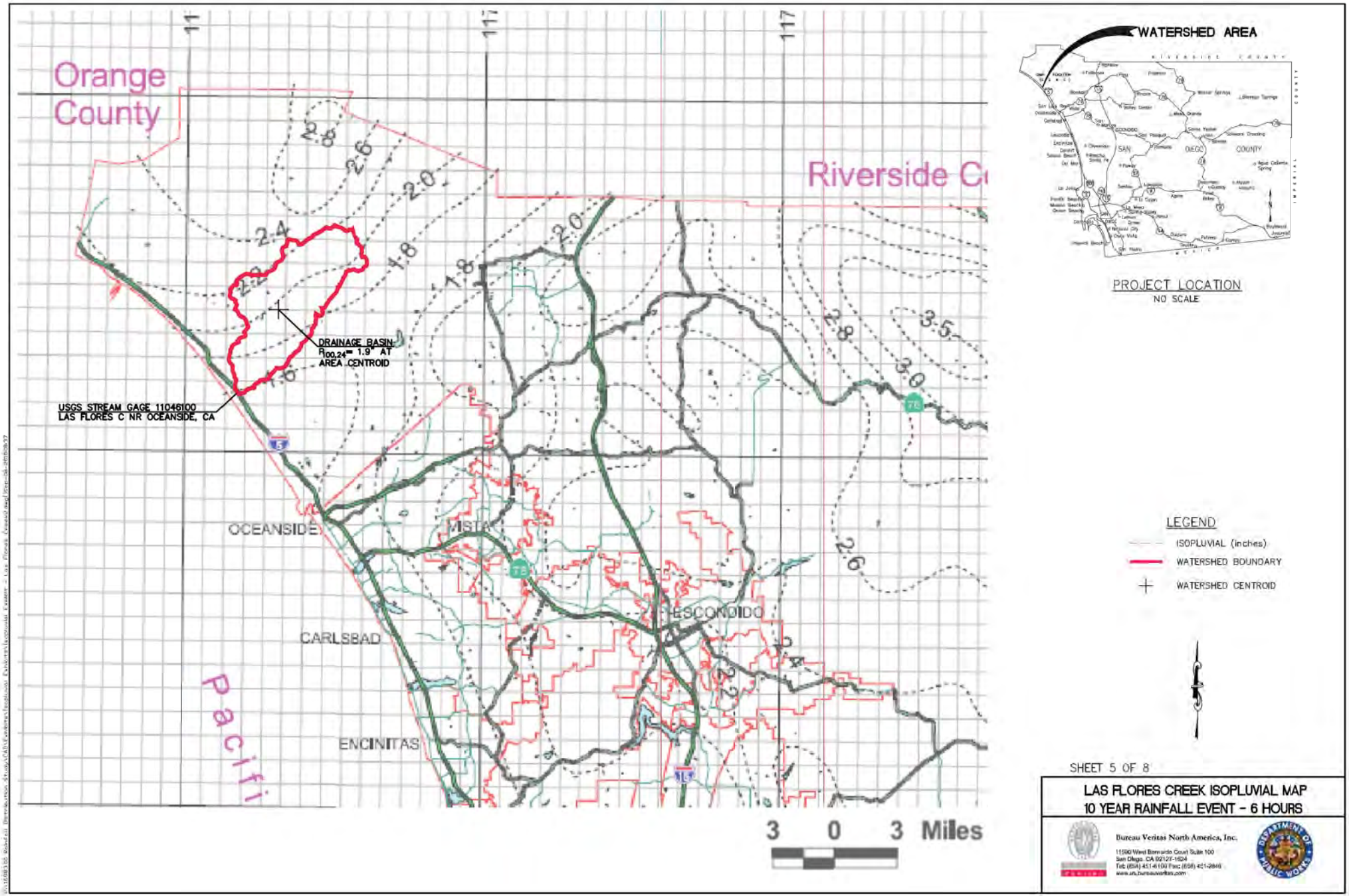
LEGEND

- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 6 OF 8

LAS FLORES CREEK ISOPLUVIAL MAP
10 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11999 Wend Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



WATERSHED AREA

PROJECT LOCATION
NO SCALE

LEGEND

ISOPLUVIAL (inches)

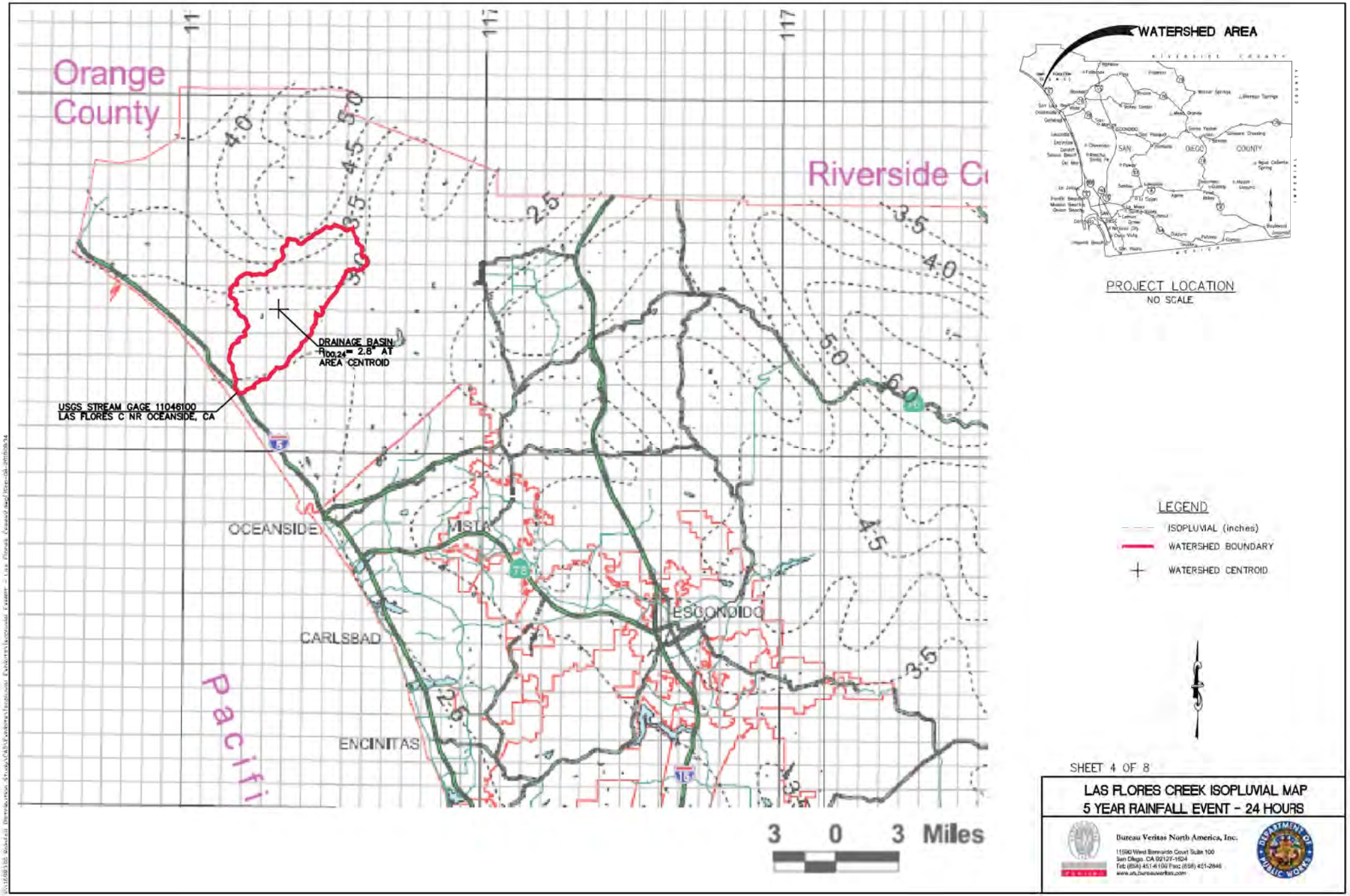
WATERSHED BOUNDARY

WATERSHED CENTROID

SHEET 5 OF 8

LAS FLORES CREEK ISOPLUVIAL MAP
10 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



WATERSHED AREA

PROJECT LOCATION
NO SCALE

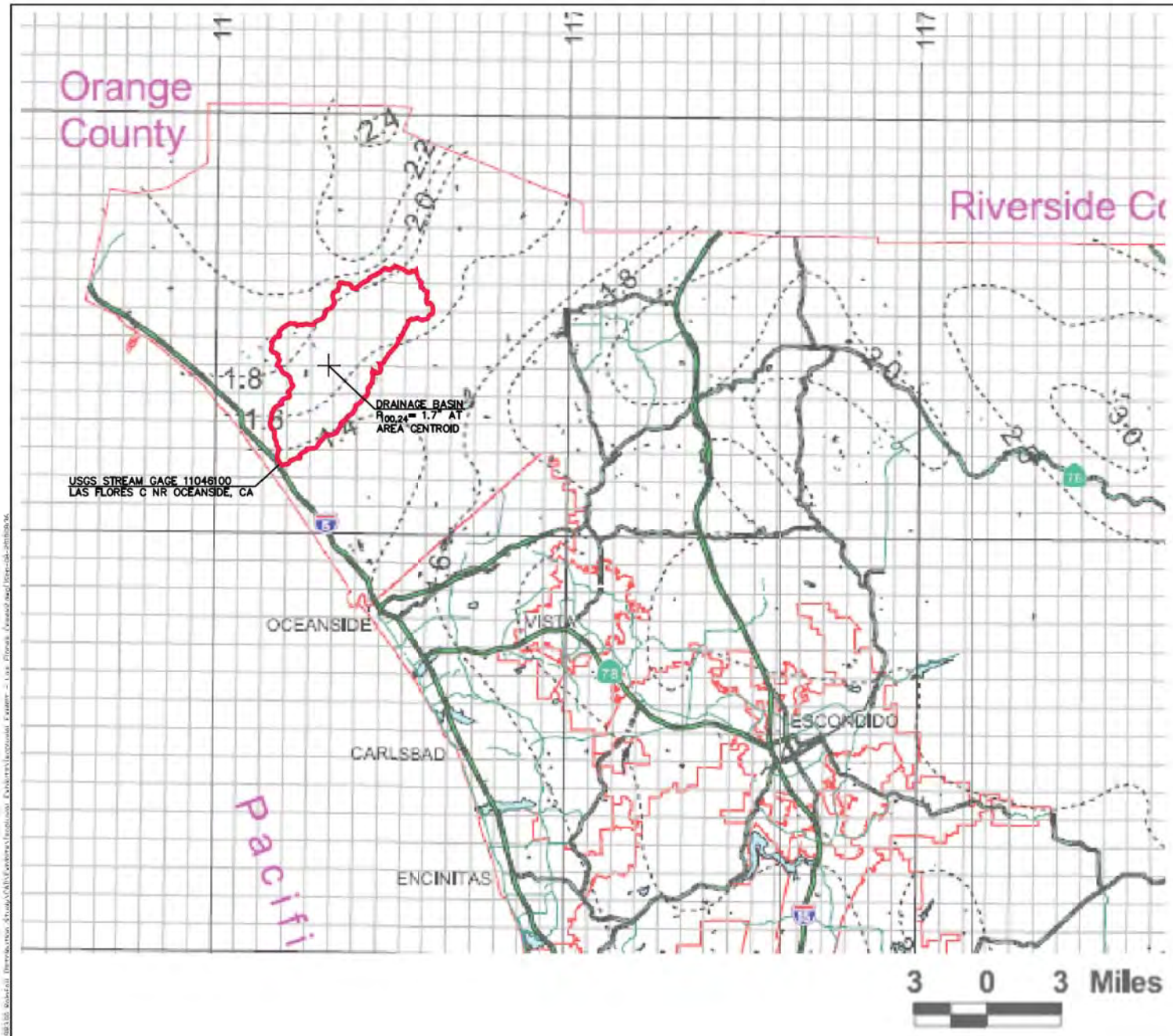
LEGEND

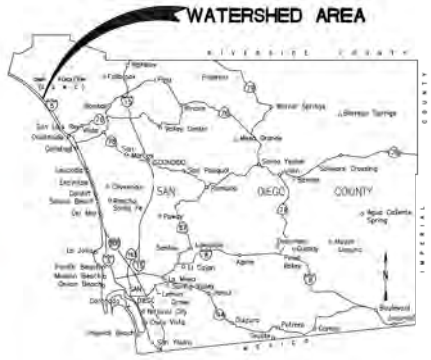
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 4 OF 8

LAS FLORES CREEK ISOPLUVIAL MAP
5 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

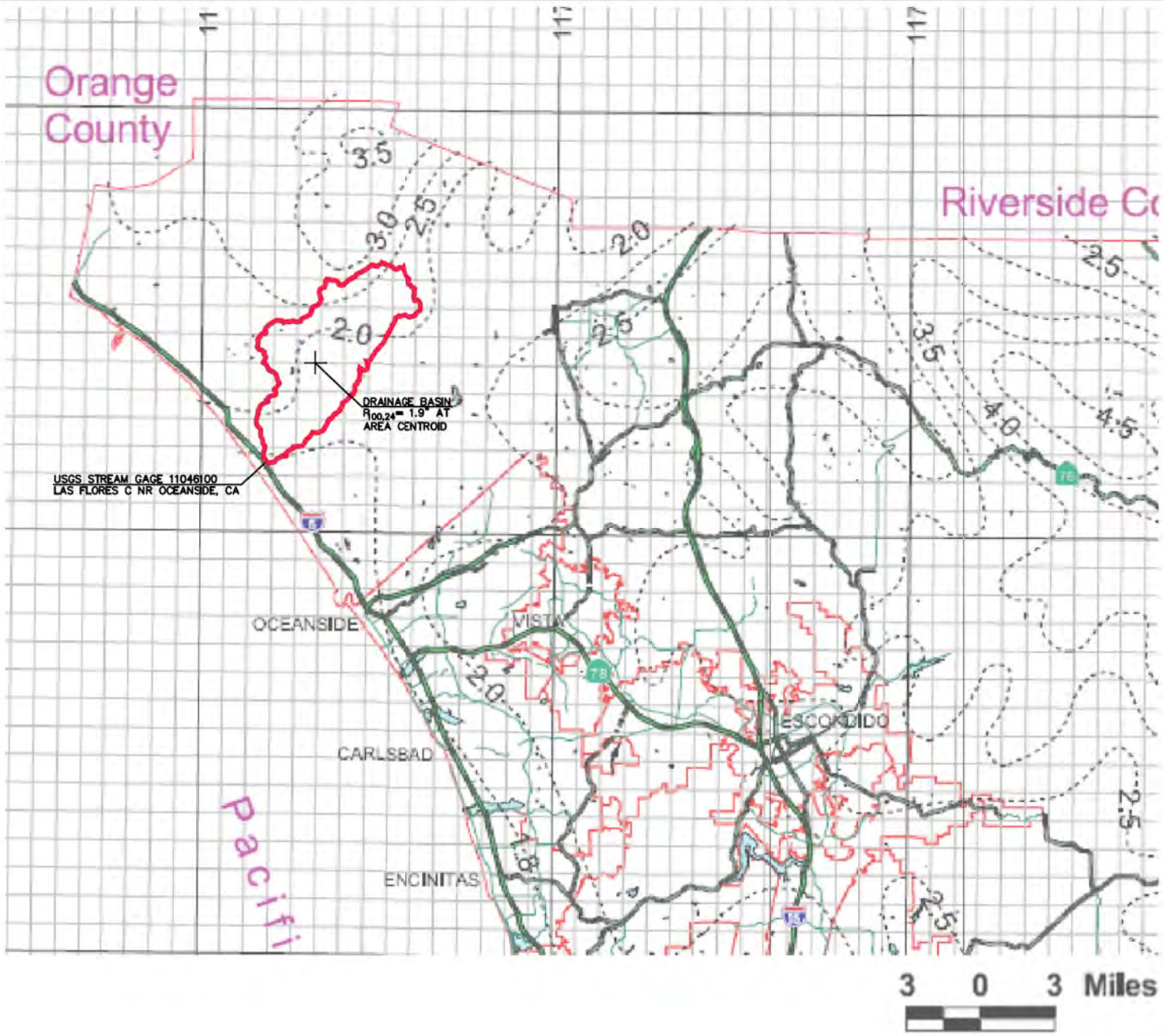
LEGEND

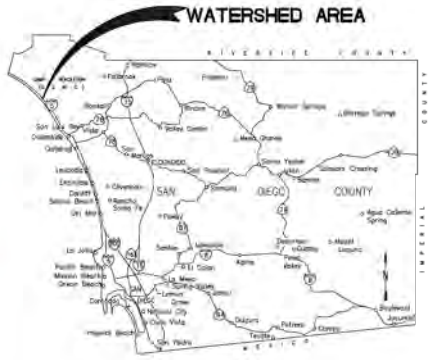
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 3 OF 8

LAS FLORES CREEK ISOPLUVIAL MAP
5 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

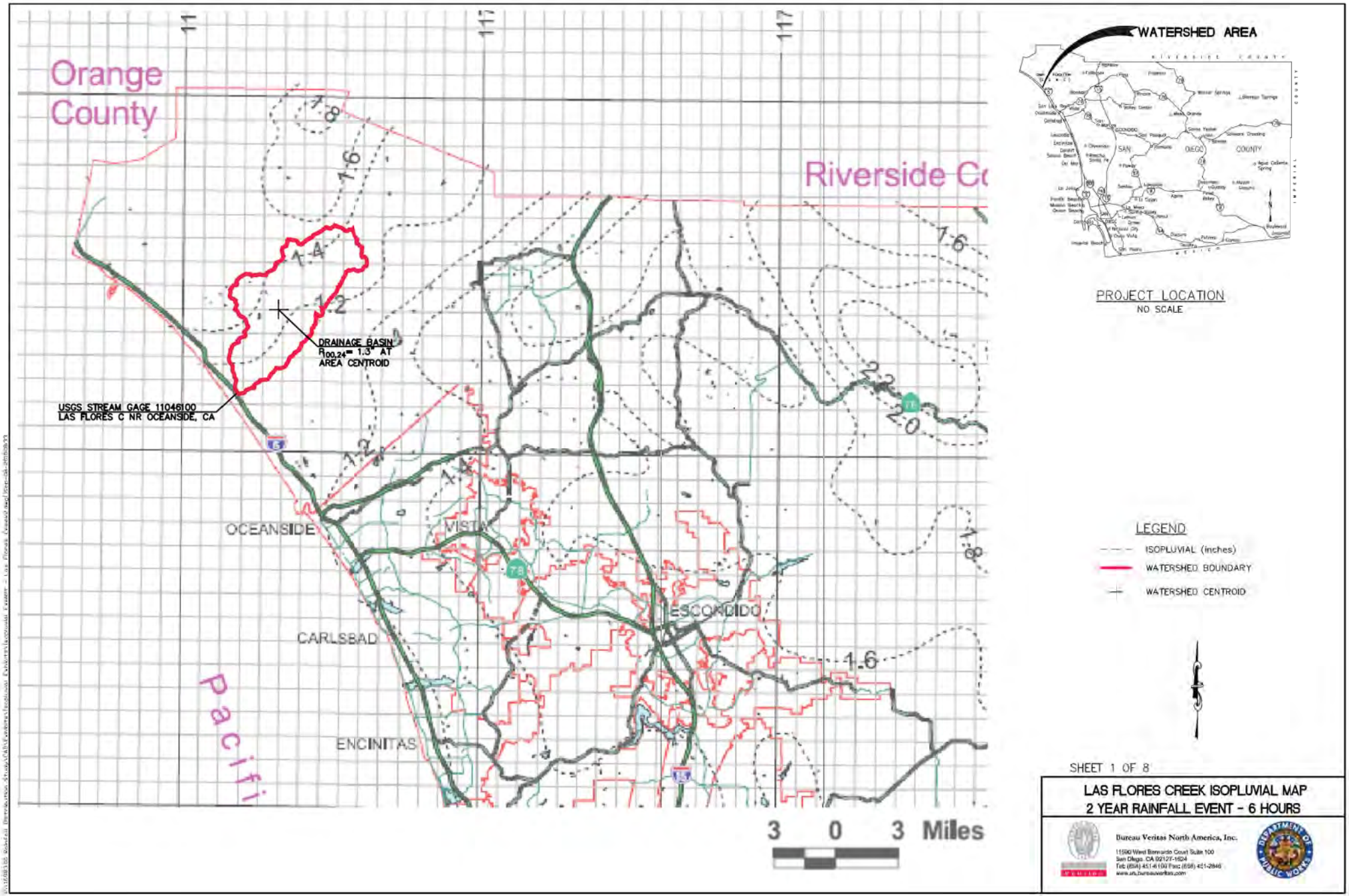
LEGEND

- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 2 OF 8

LAS FLORES CREEK ISOPLUVIAL MAP
2 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



PROJECT LOCATION
NO SCALE

LEGEND

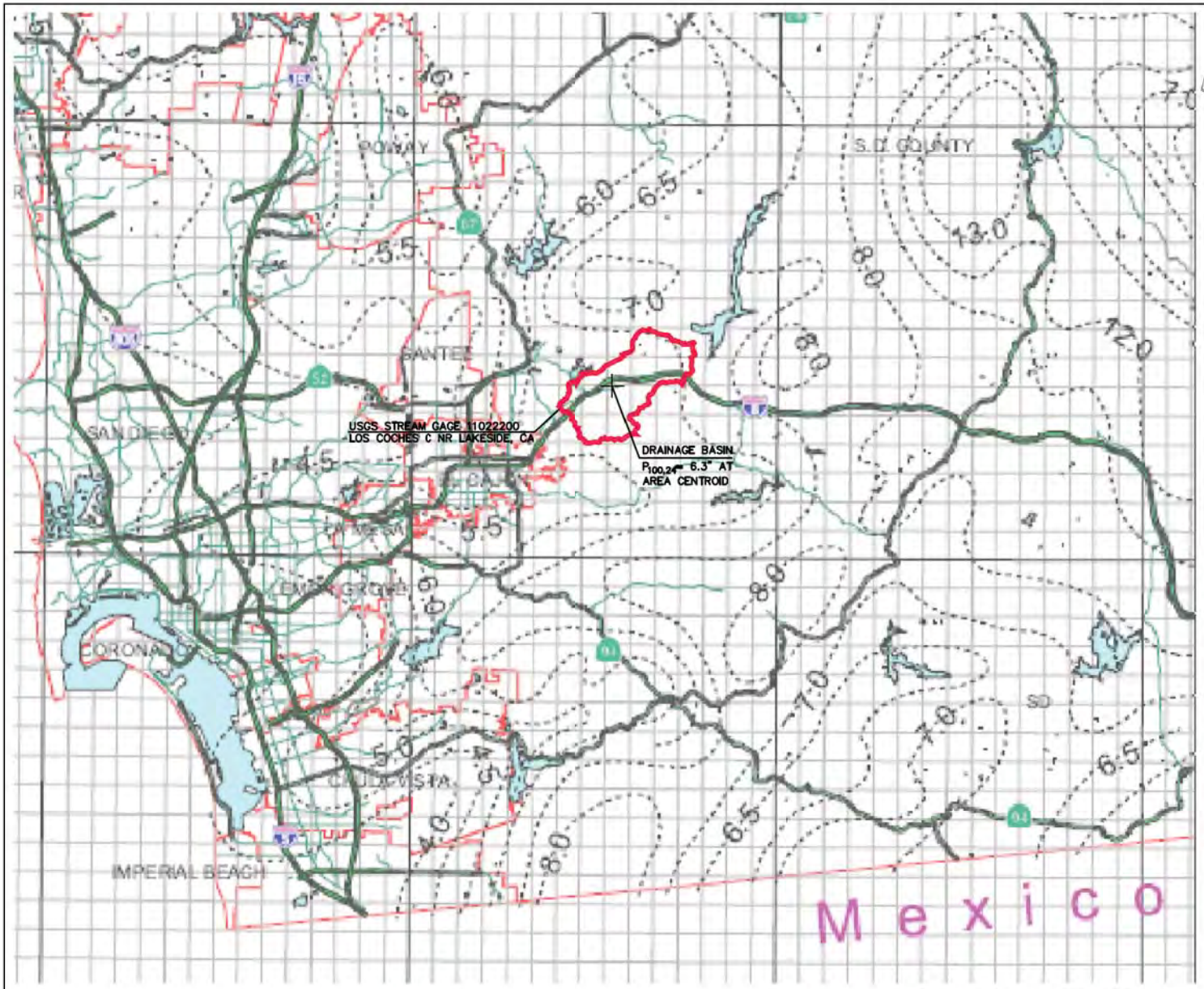
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 1 OF 8

LAS FLORES CREEK ISOPLUVIAL MAP
2 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

Los Coches Creek Isopluvials





PROJECT LOCATION
NO SCALE

LEGEND

ISOPLUVIAL (inches)

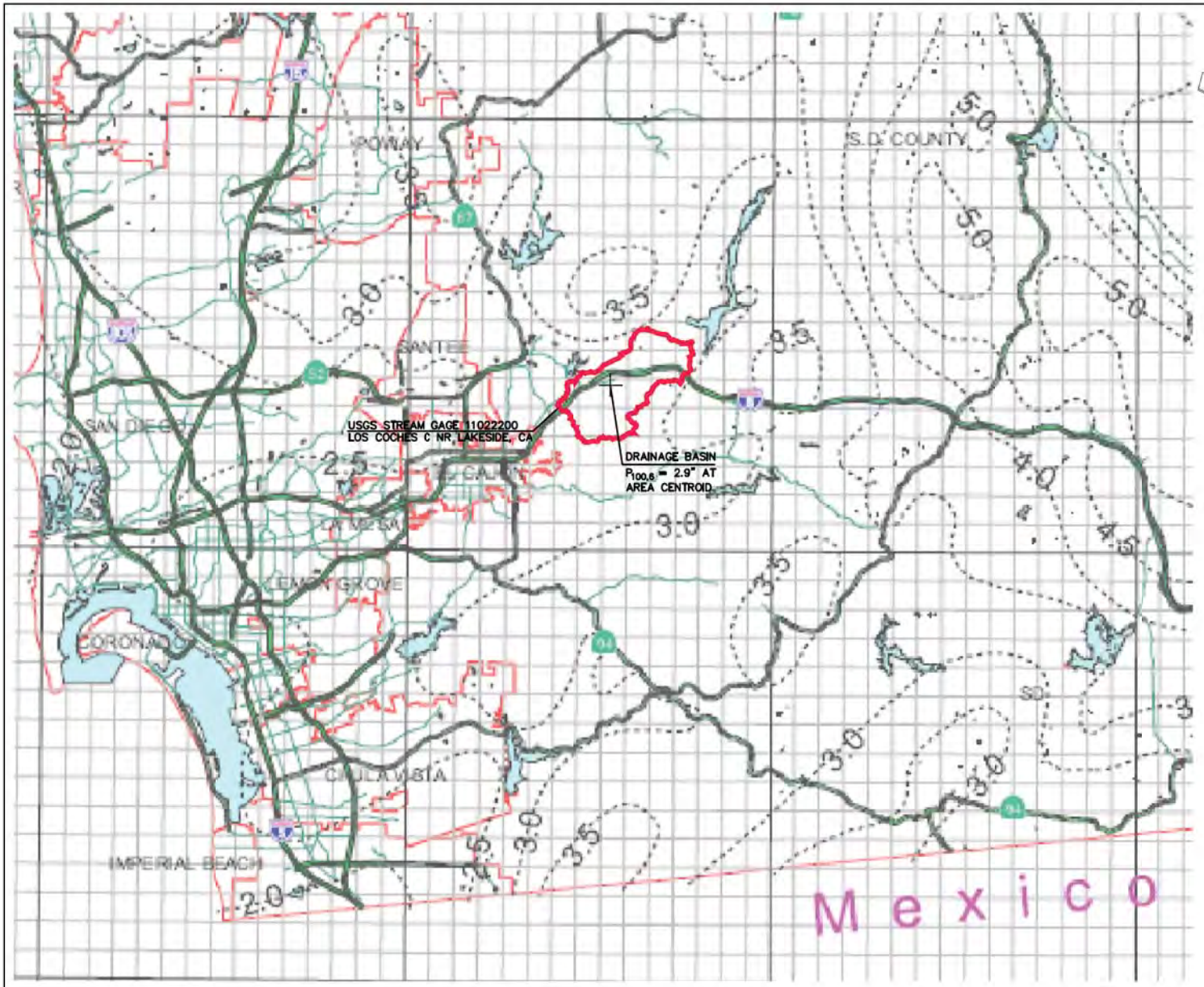
WATERSHED BOUNDARY

WATERSHED CENTROID

SHEET 8 OF 8

LOS COCHES CREEK ISOPLUVIAL MAP
100 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-1160 Fax: (858) 451-2846
www.us.bureauveritas.com





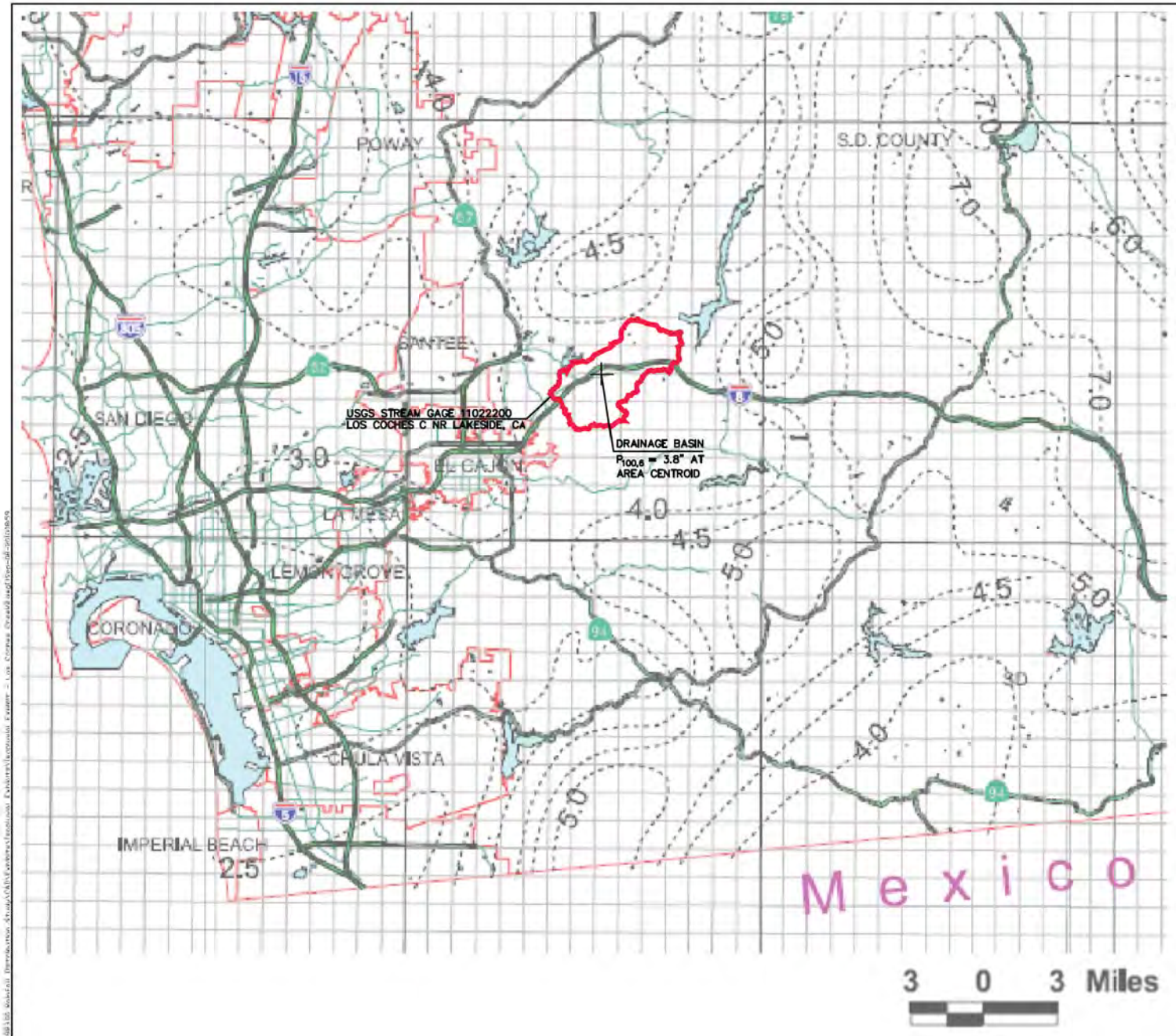
PROJECT LOCATION
NO SCALE

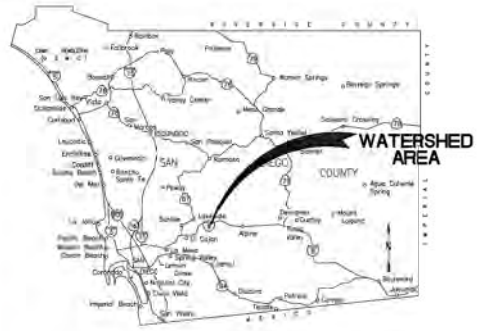
LEGEND
ISOPLUVIAL (inches)
WATERSHED BOUNDARY
WATERSHED CENTROID

SHEET 7 OF 8

LOS COCHES CREEK ISOPLUVIAL MAP
100 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-1100 Fax: (858) 451-2946
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

LEGEND

ISOPLUVIAL (inches)

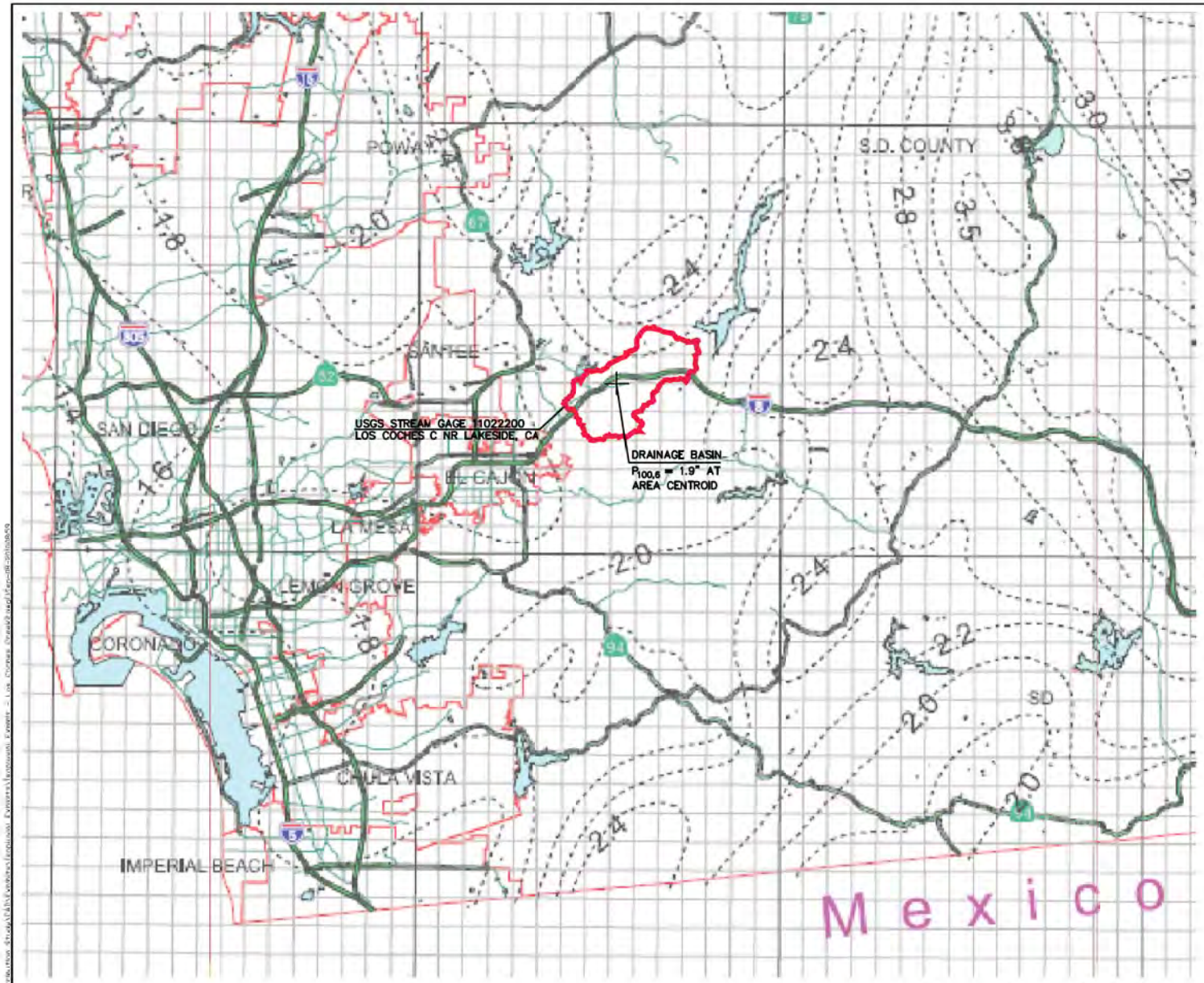
WATERSHED BOUNDARY

WATERSHED CENTROID

SHEET 6 OF 8

LOS COCHES CREEK ISOPLUVIAL MAP
10 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

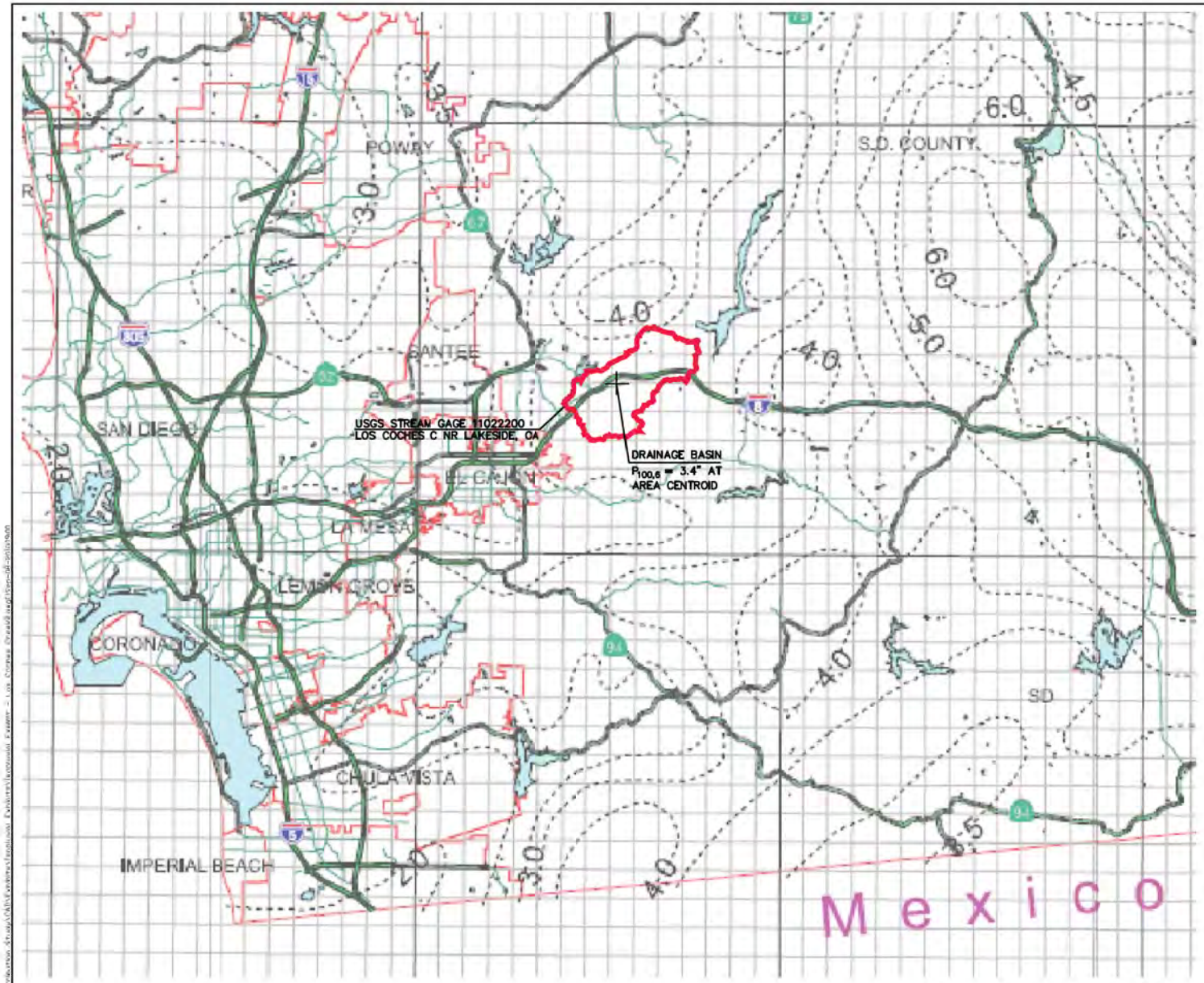
LEGEND

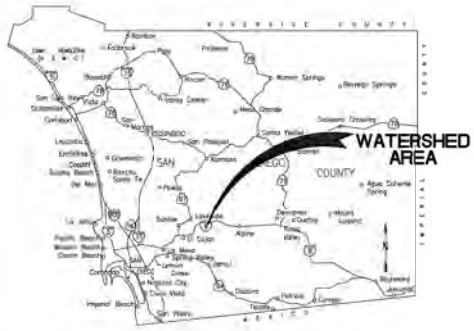
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 5 OF 8

LOS COCHES CREEK ISOPLUVIAL MAP
10 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

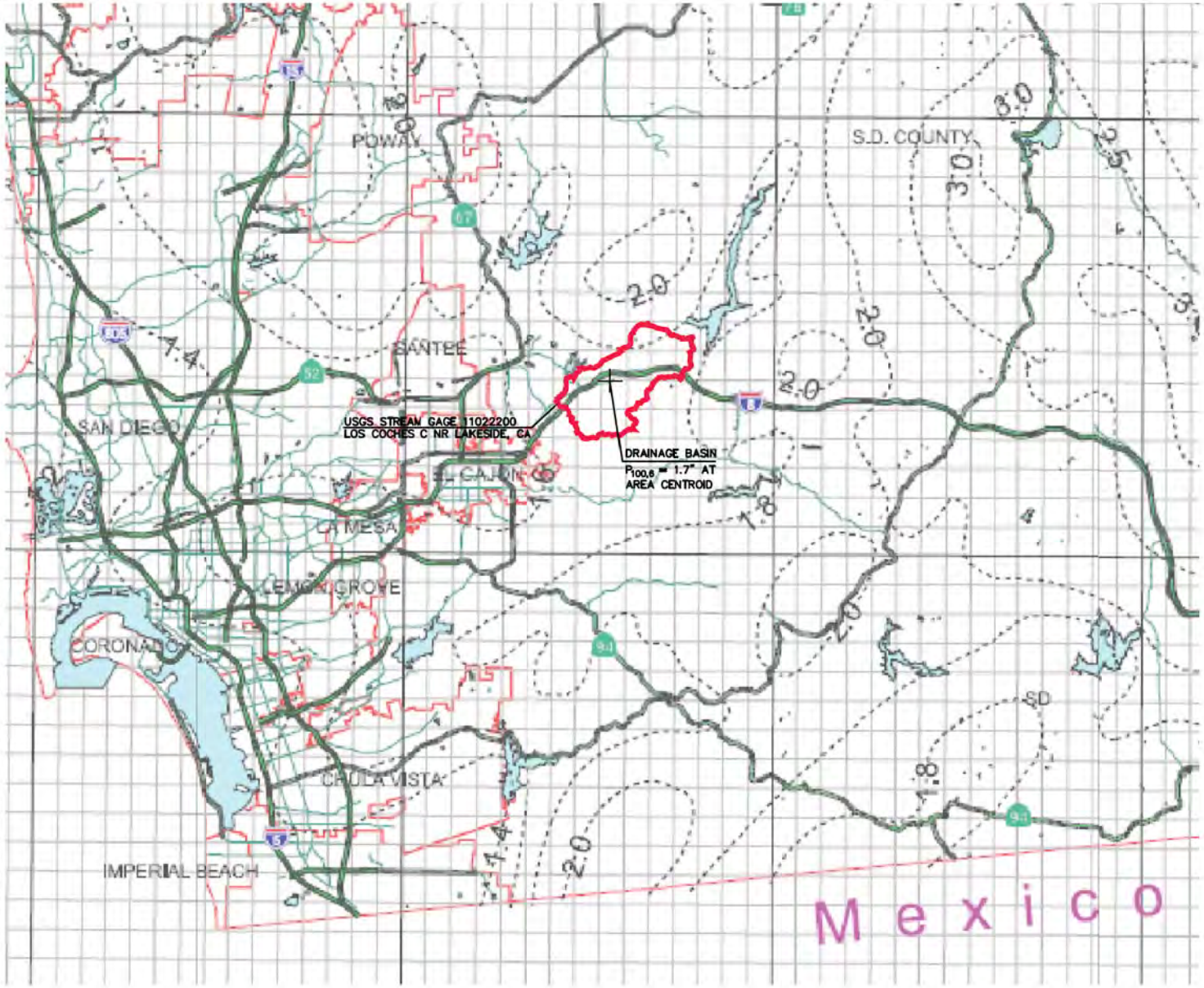
LEGEND

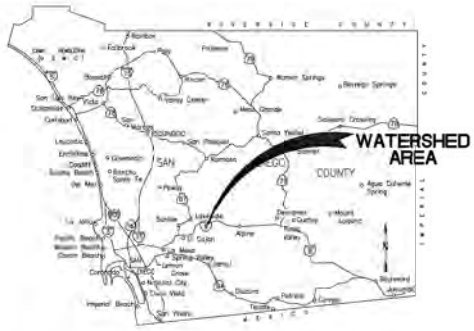
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 4 OF 8

LOS COCHES CREEK ISOPLUVIAL MAP
5 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

LEGEND

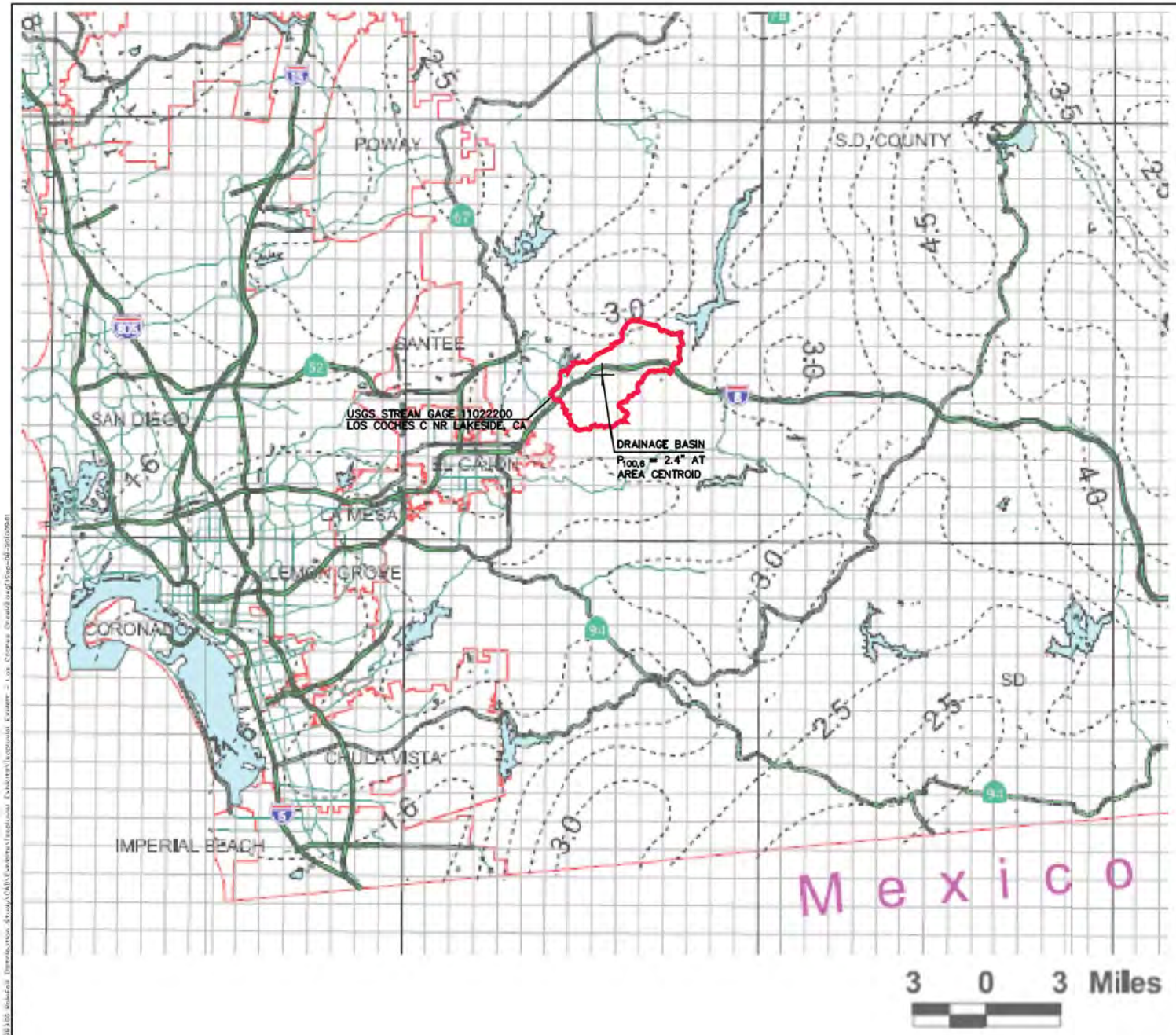
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

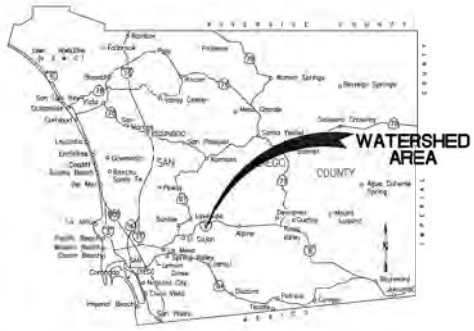
3 0 3 Miles

SHEET 3 OF 8

LOS COCHES CREEK ISOPLUVIAL MAP
5 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11990 Wend Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

LEGEND

ISOPLUVIAL (inches)

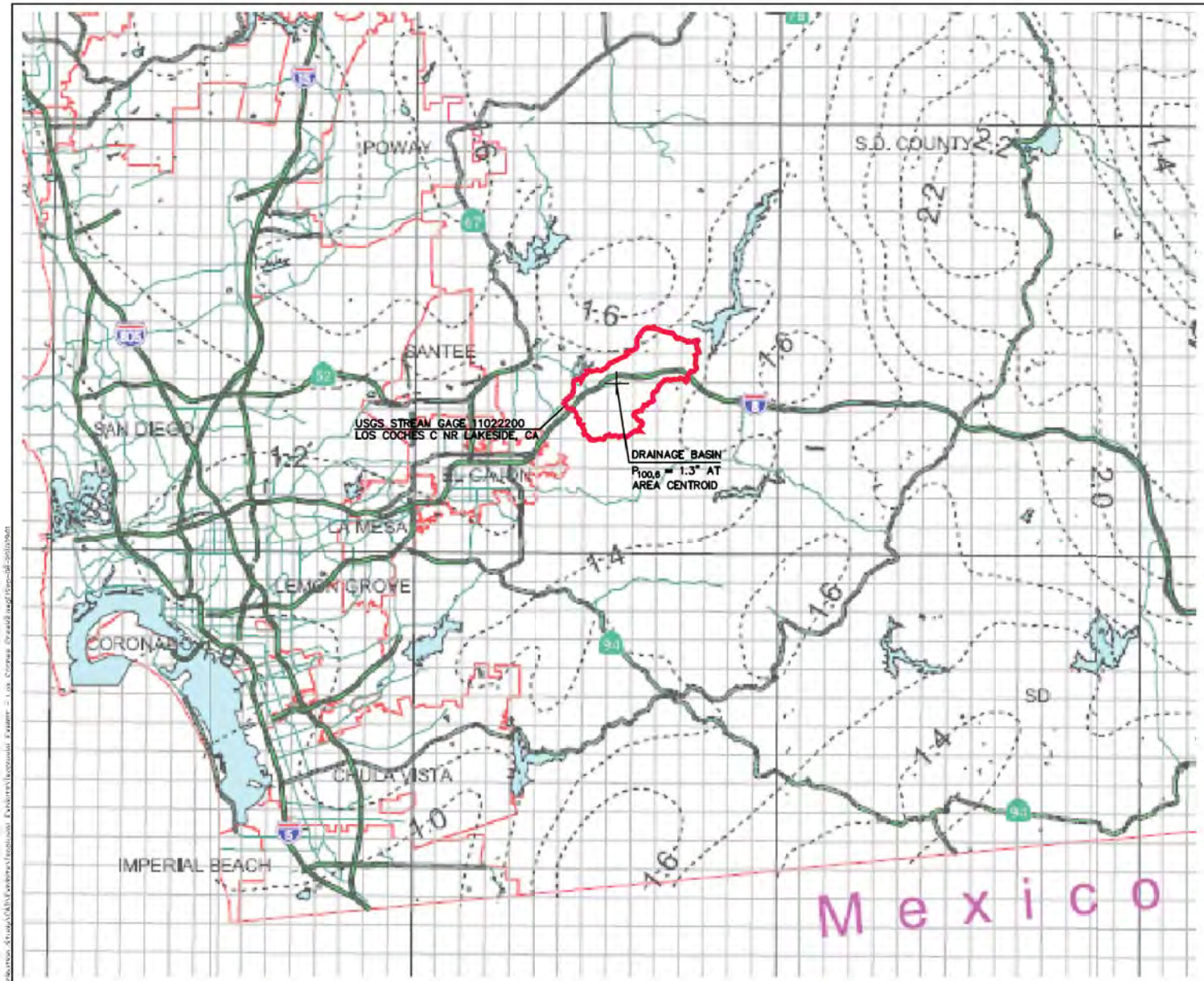
WATERSHED BOUNDARY

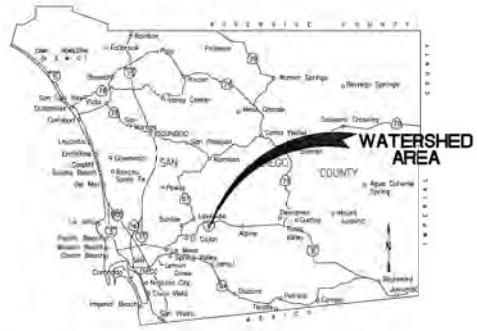
WATERSHED CENTROID

SHEET 2 OF 8

LOS COCHES CREEK ISOPLUVIAL MAP
2 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

LEGEND

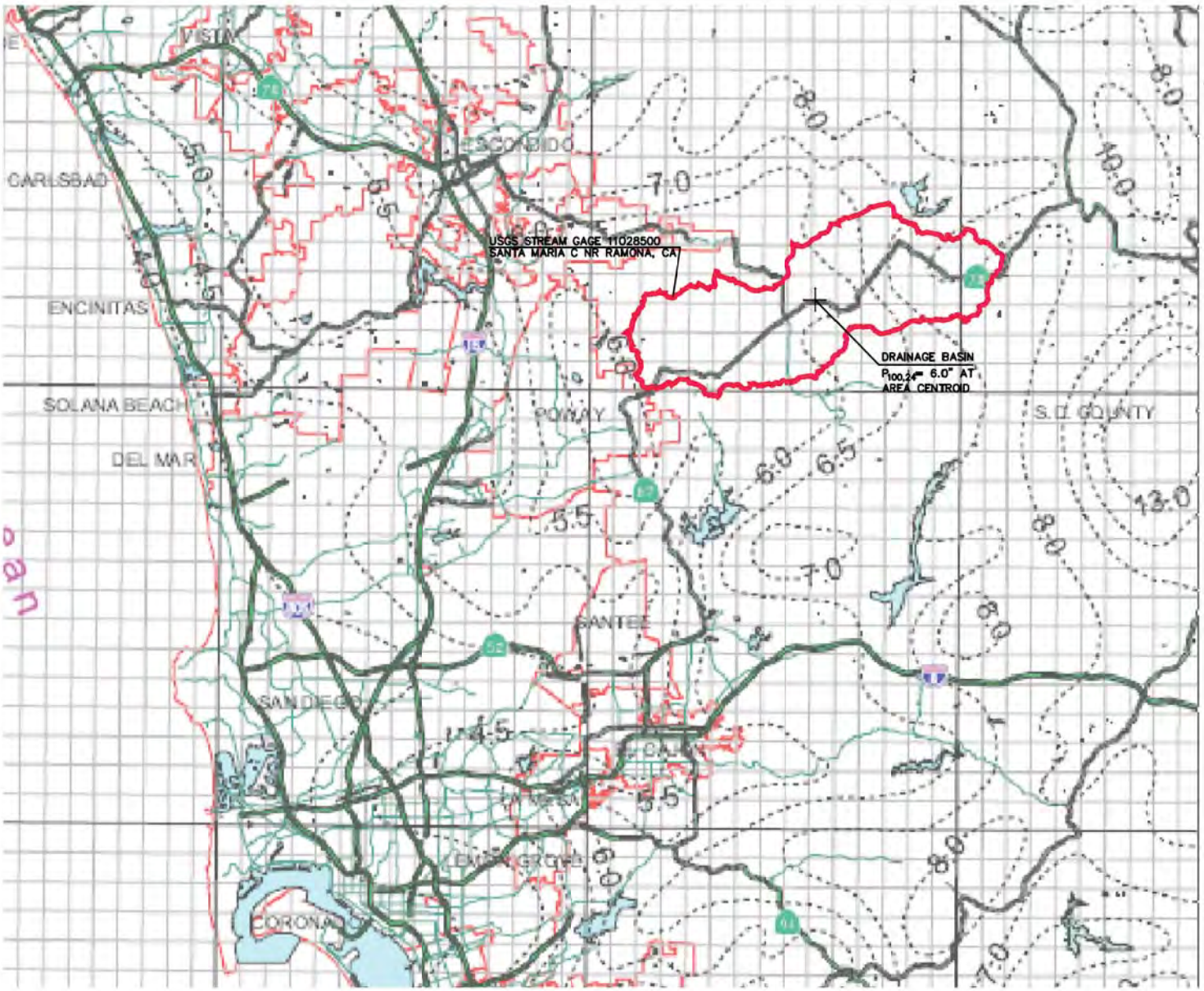
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 1 OF 8

LOS COCHES CREEK ISOPLUVIAL MAP
2 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

Santa Maria Creek Isopluvials





PROJECT LOCATION
NO SCALE

LEGEND

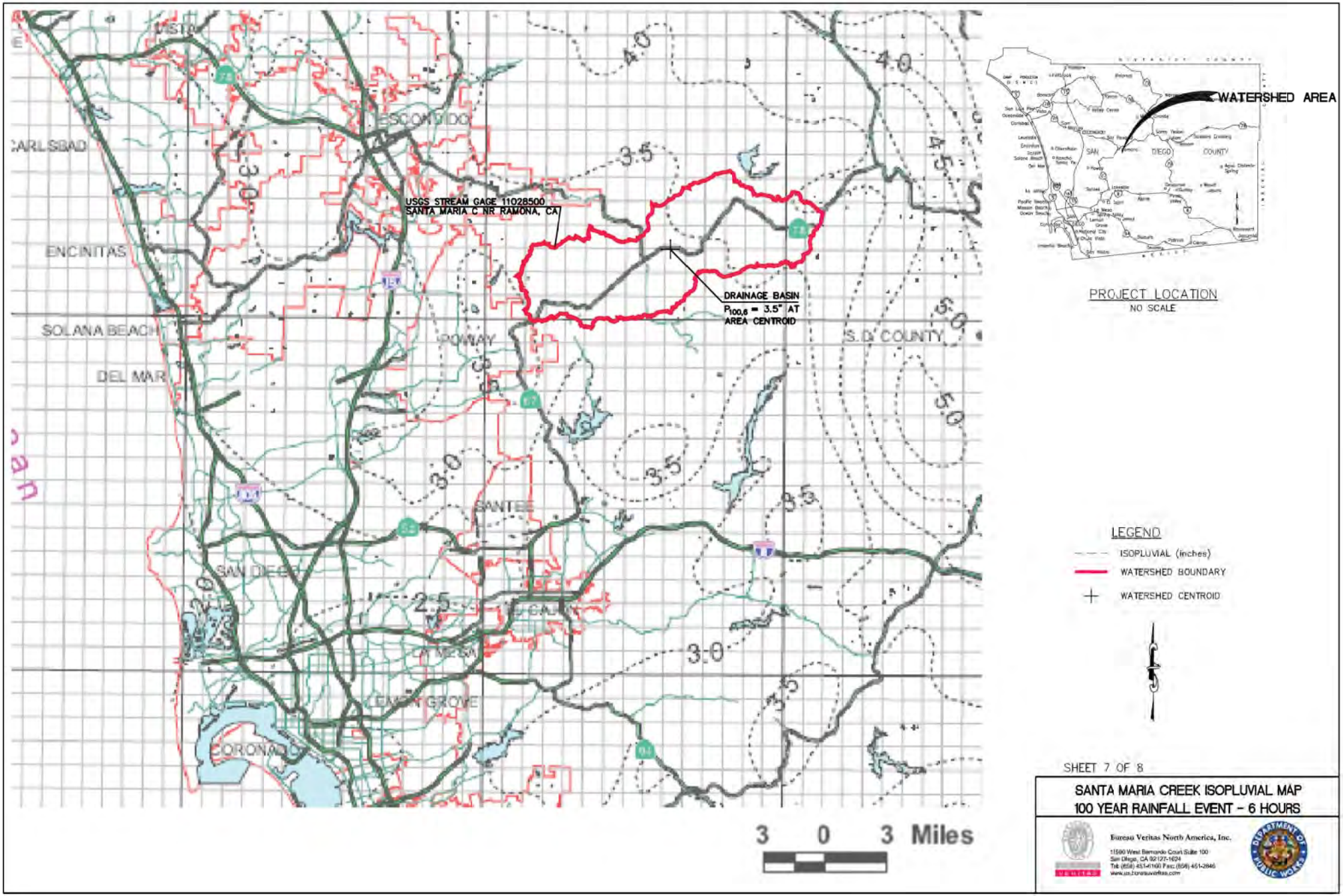
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

3 0 3 Miles

SHEET 8 OF 8

SANTA MARIA CREEK ISOPLUVIAL MAP
100 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com



PROJECT LOCATION
NO SCALE

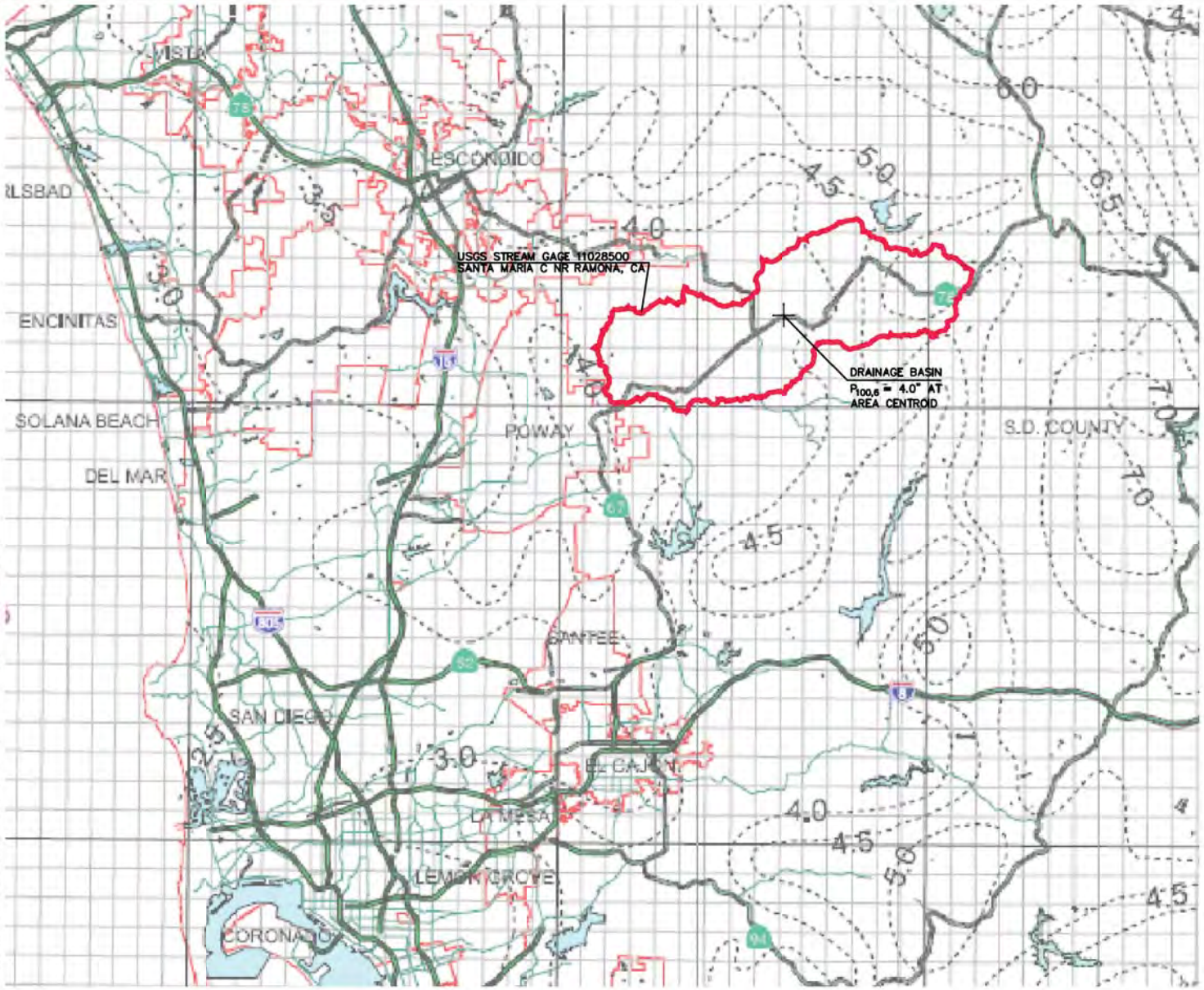
LEGEND

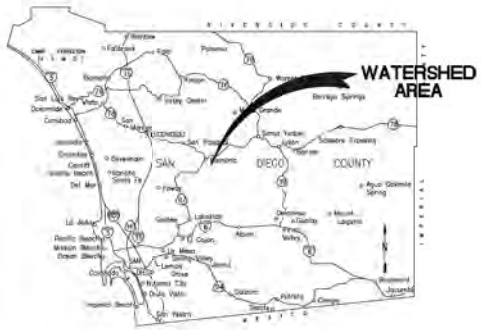
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 7 OF 8

SANTA MARIA CREEK ISOPLUVIAL MAP
100 YEAR RAINFALL EVENT – 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2946
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

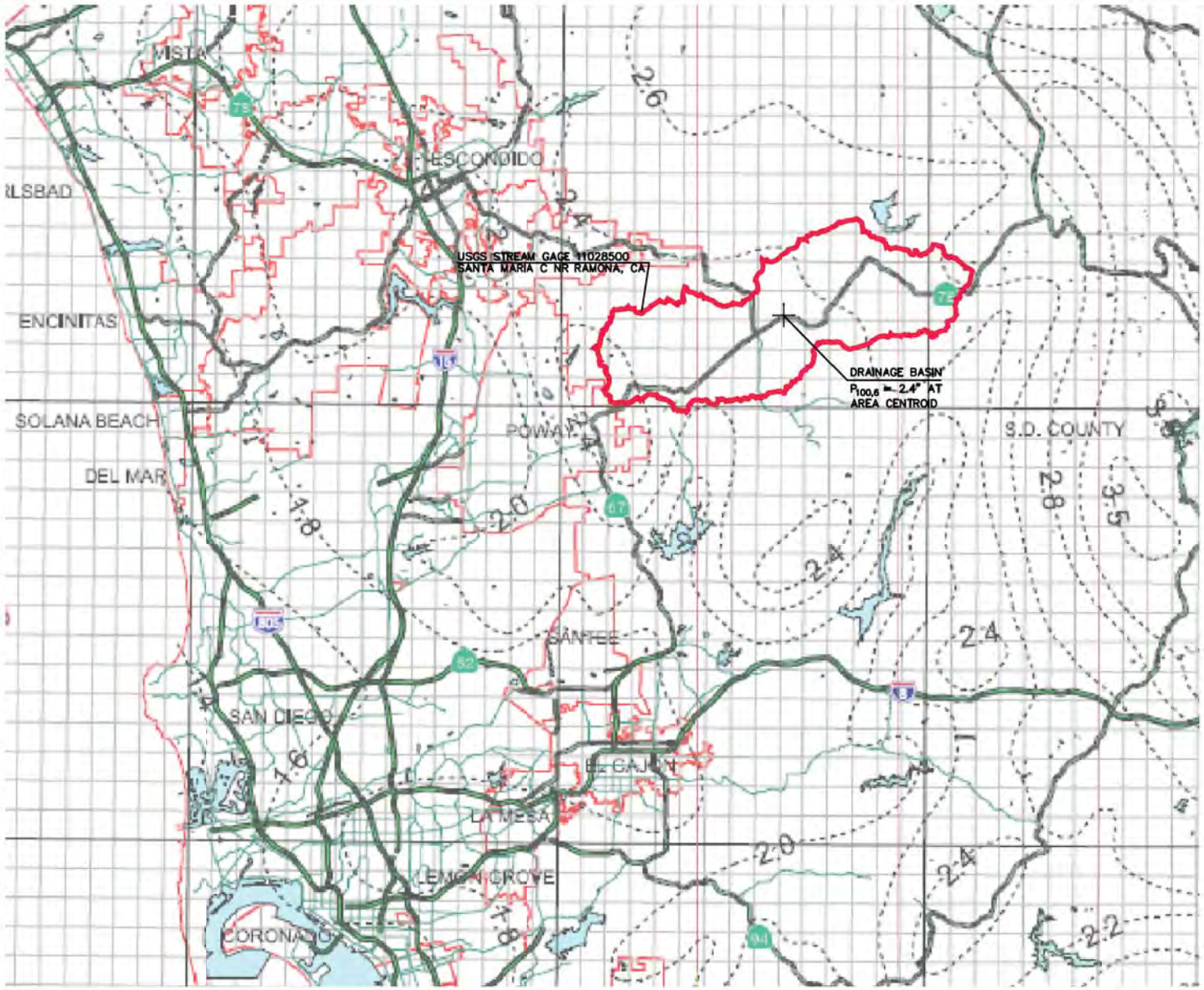
LEGEND

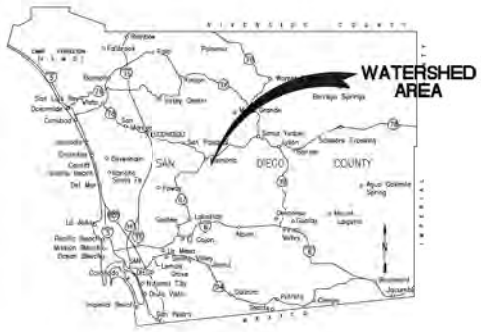
- ISOPLUVIAL (Inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 6 OF 8

SANTA MARIA CREEK ISOPLUVIAL MAP
10 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

LEGEND

ISOPLUVIAL (inches)

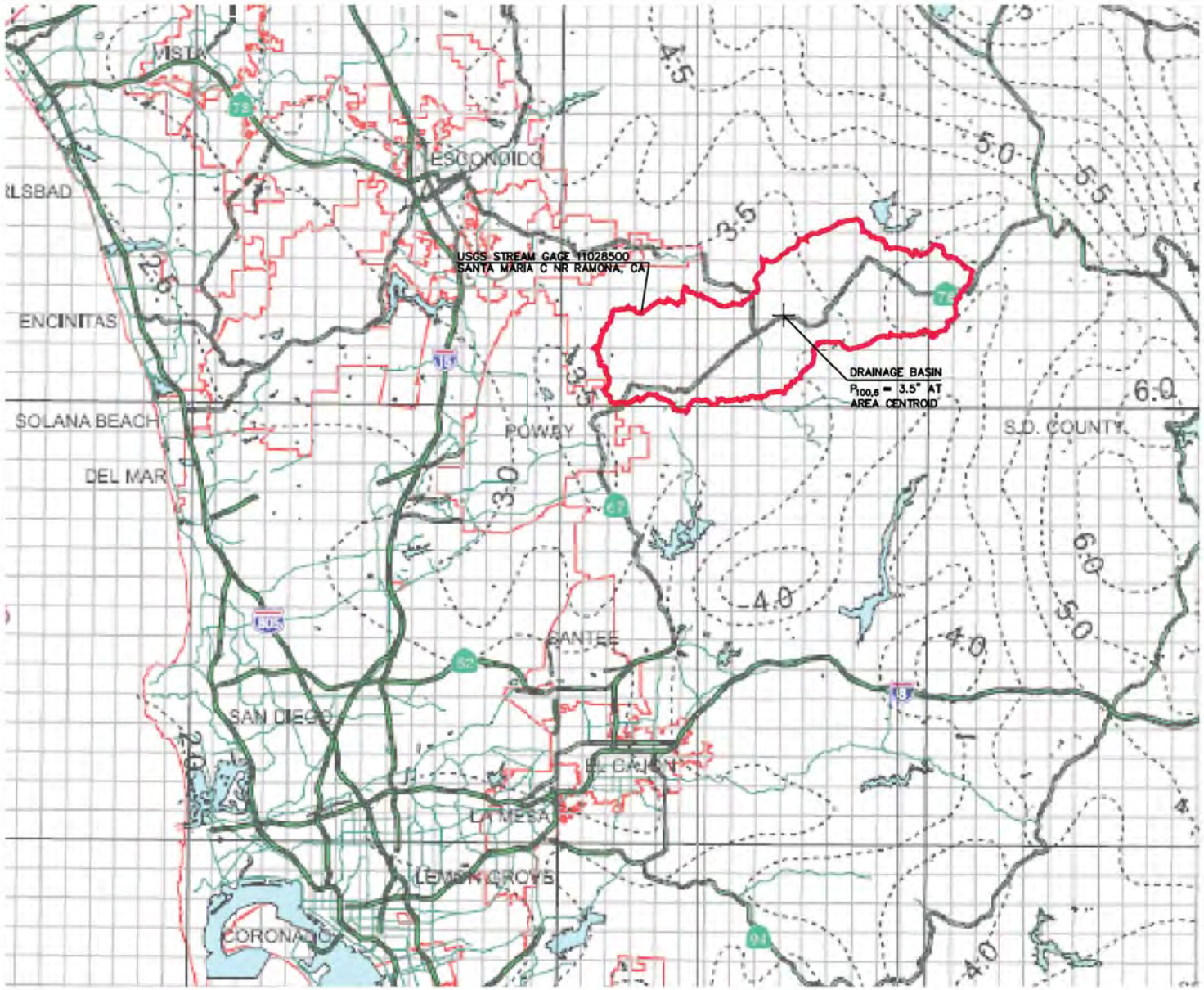
WATERSHED BOUNDARY

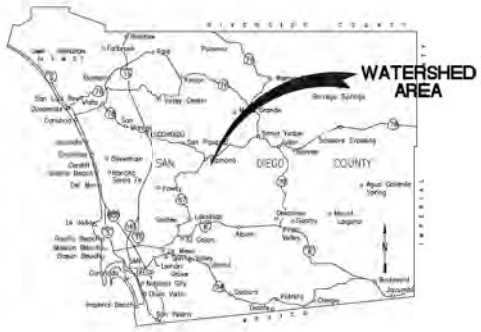
WATERSHED CENTROID

SHEET 5 OF 8

SANTA MARIA CREEK ISOPLUVIAL MAP
10 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

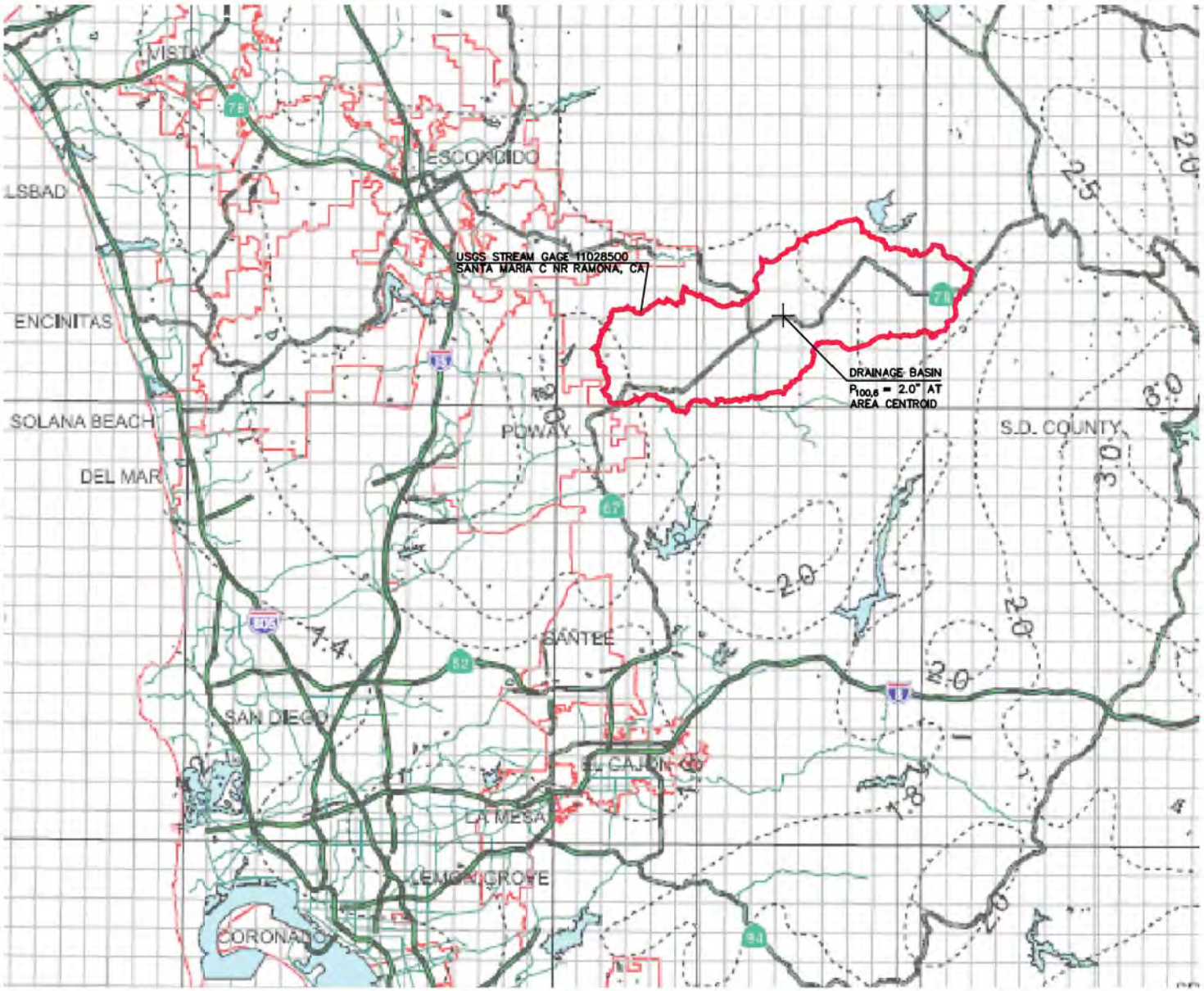
LEGEND

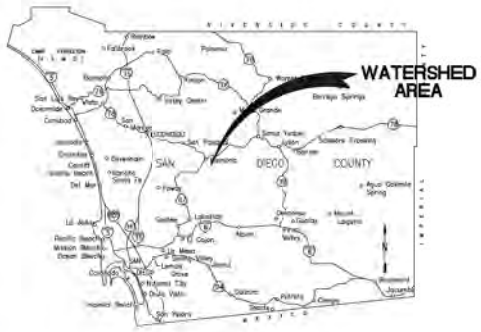
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 4 OF 8

SANTA MARIA CREEK ISOPLUVIAL MAP
5 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

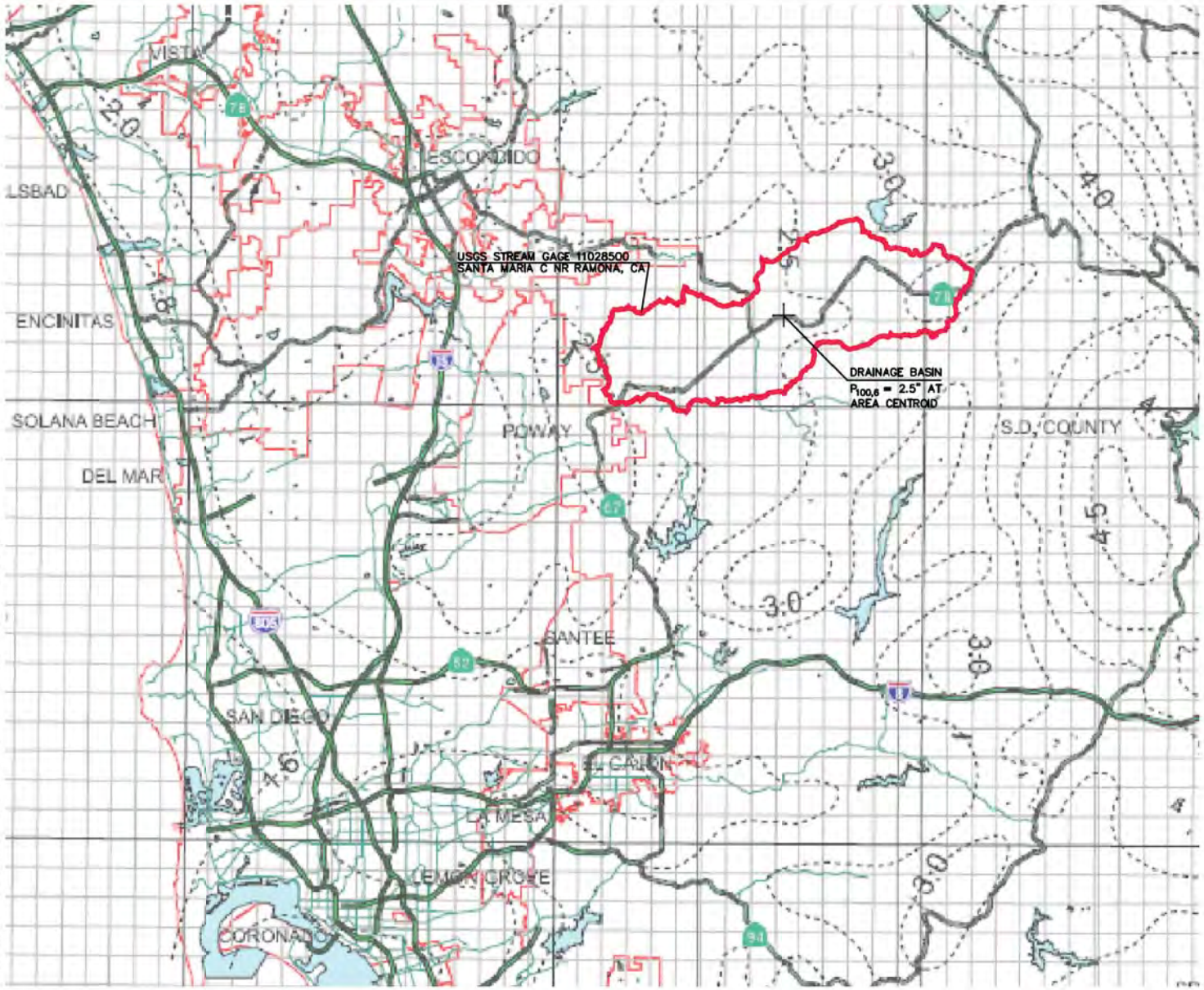
LEGEND

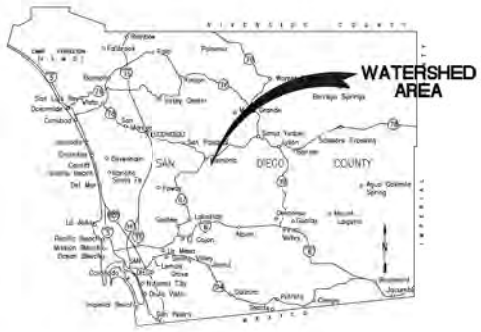
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 3 OF 8

SANTA MARIA CREEK ISOPLUVIAL MAP
5 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

LEGEND

ISOPLUVIAL (inches)

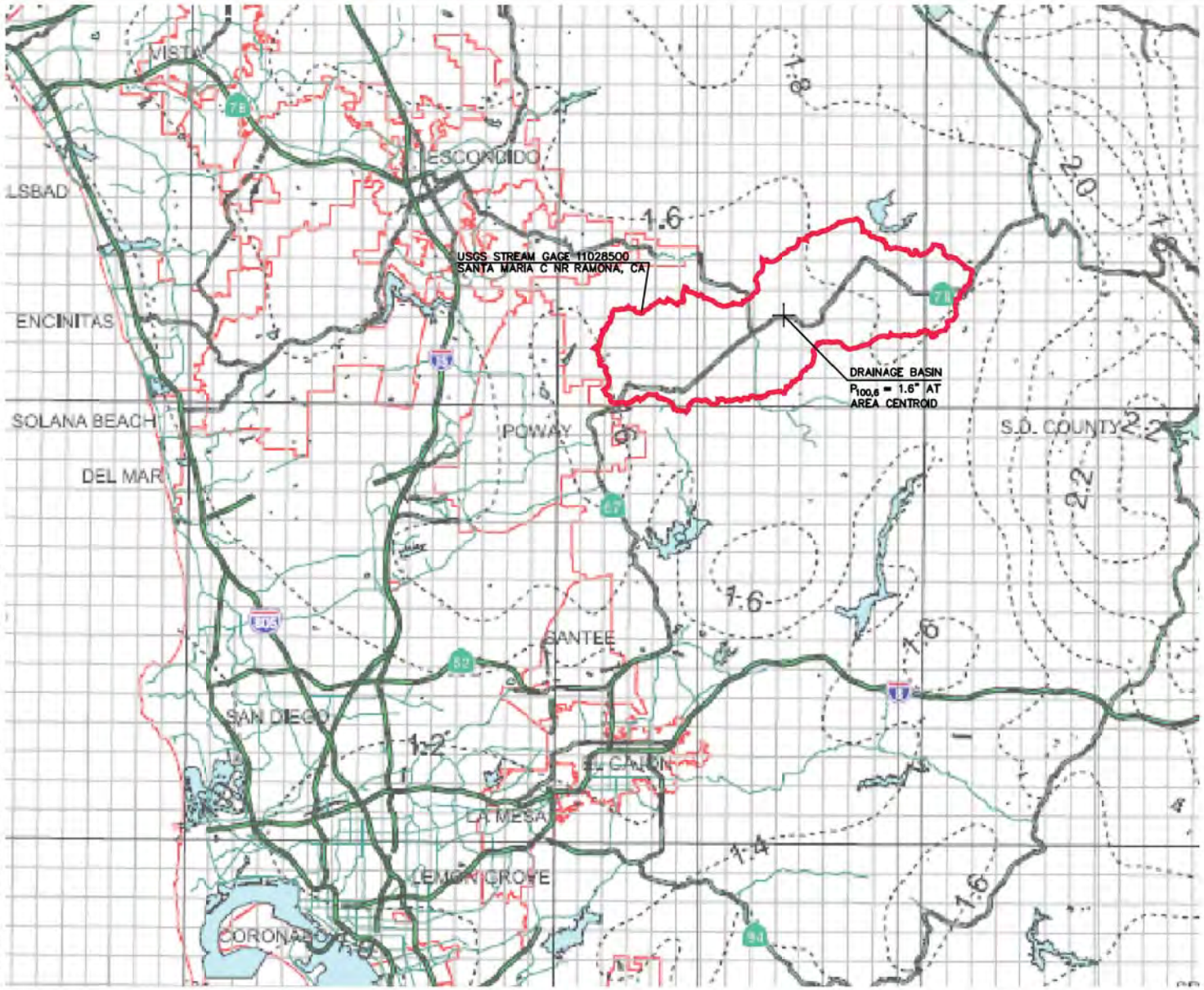
WATERSHED BOUNDARY

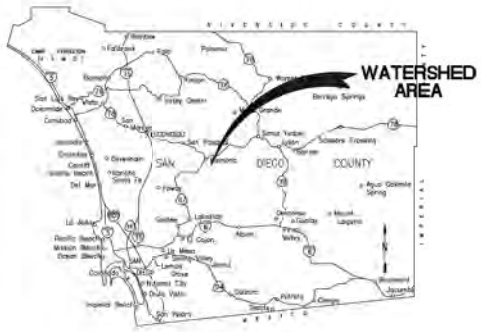
WATERSHED CENTROID

SHEET 2 OF 8

SANTA MARIA CREEK ISOPLUVIAL MAP
2 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

LEGEND

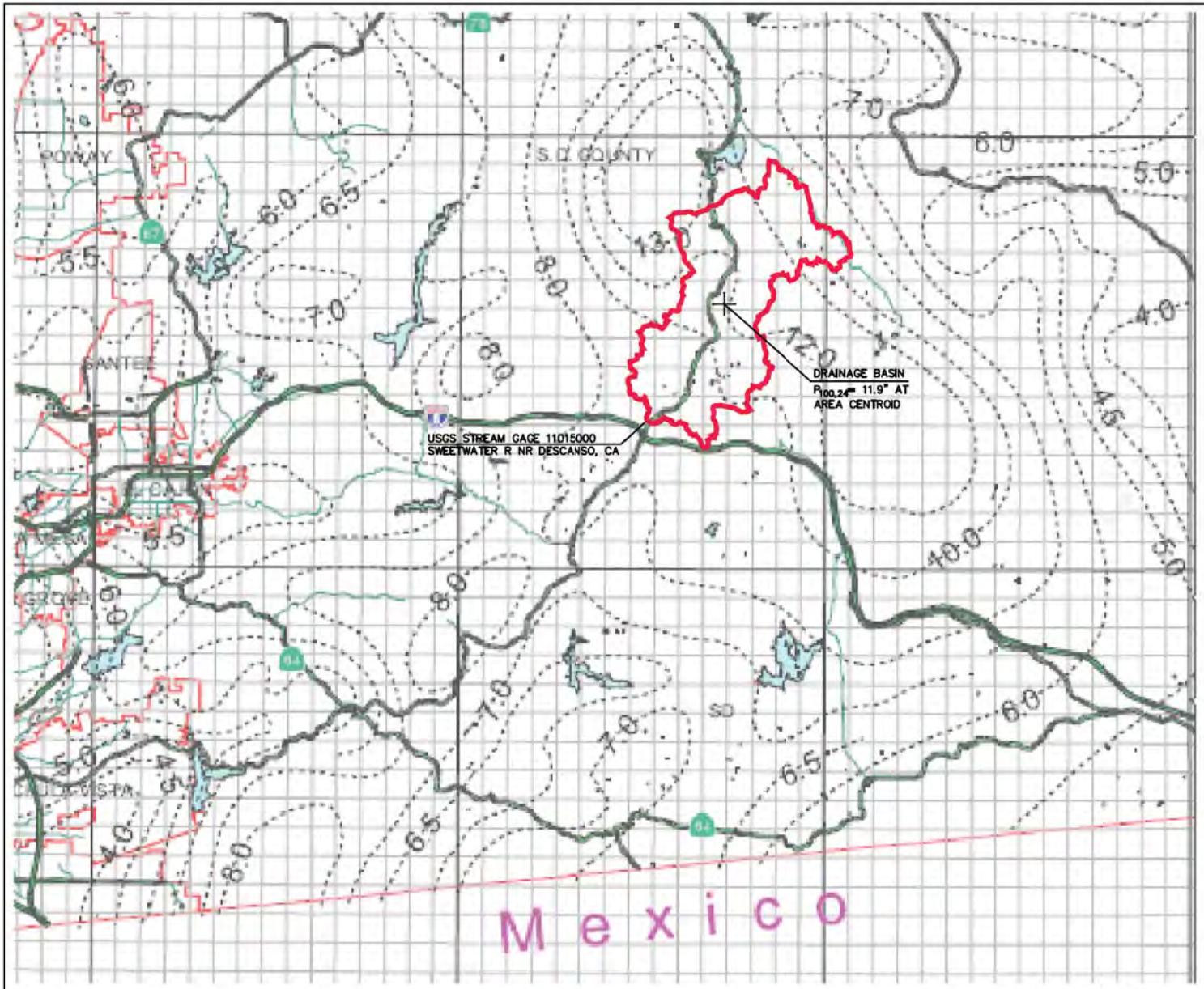
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

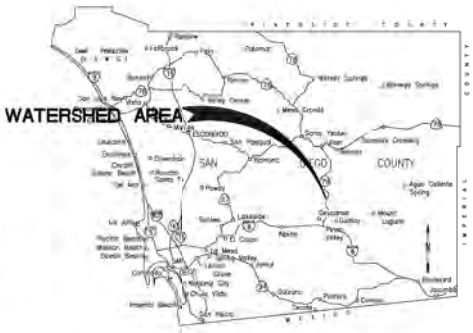
SHEET 1 OF 8

SANTA MARIA CREEK ISOPLUVIAL MAP
2 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

Sweetwater River Isopluvials





PROJECT LOCATION
NO SCALE

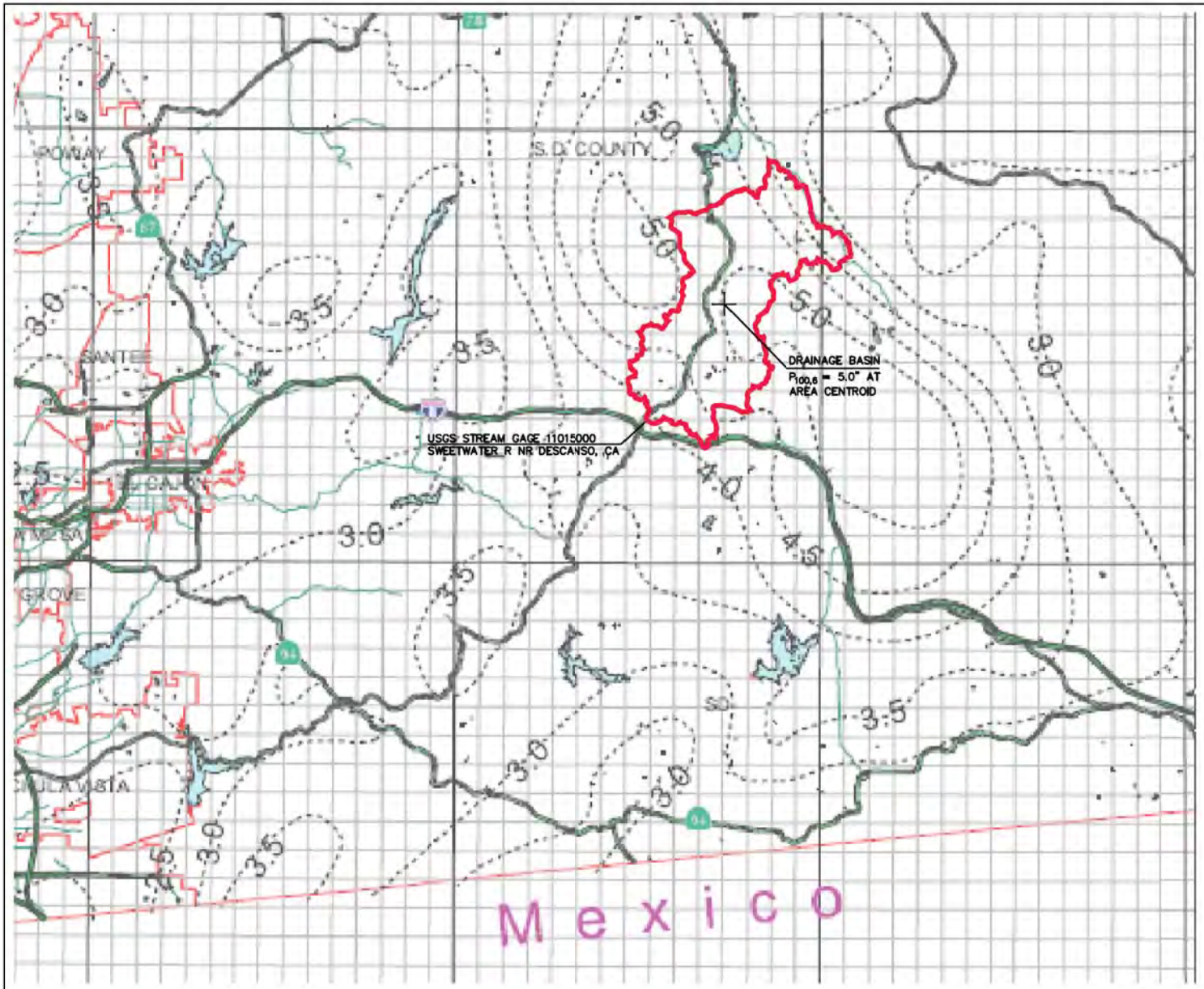
LEGEND

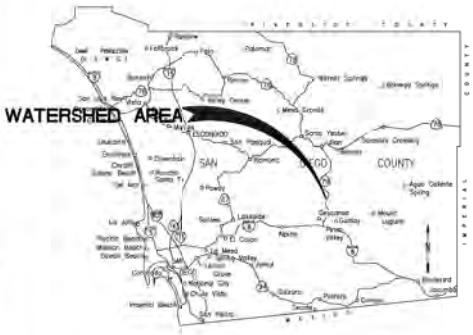
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 8 OF 8

SWEETWATER RIVER ISOPLUVIAL MAP
100 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2946
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

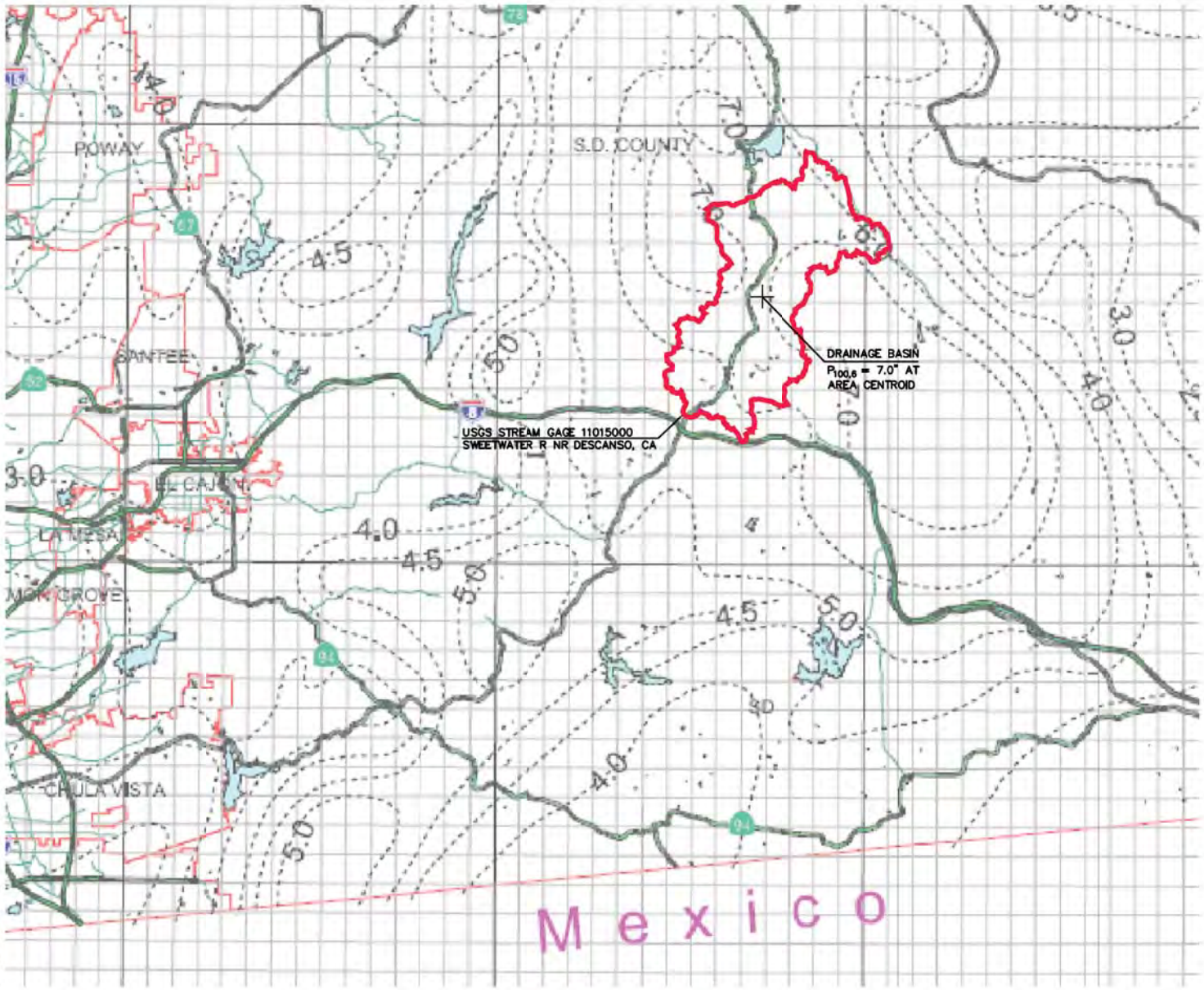
LEGEND

- ISOPLUVIAL (Inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 7 OF 8

SWEETWATER RIVER ISOPLUVIAL MAP
100 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

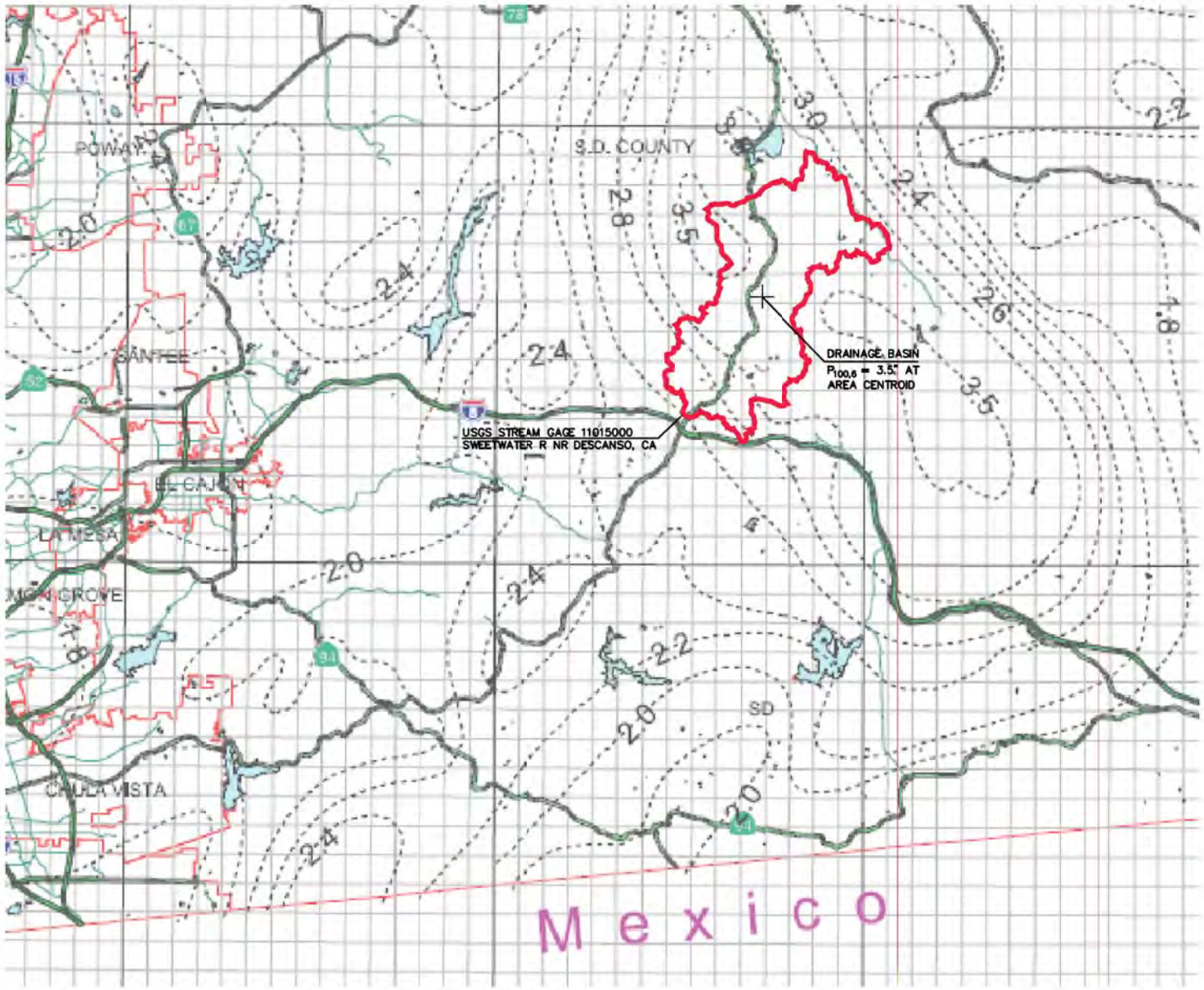
LEGEND

- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 6 OF 8

SWEETWATER RIVER ISOPLUVIAL MAP
10 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

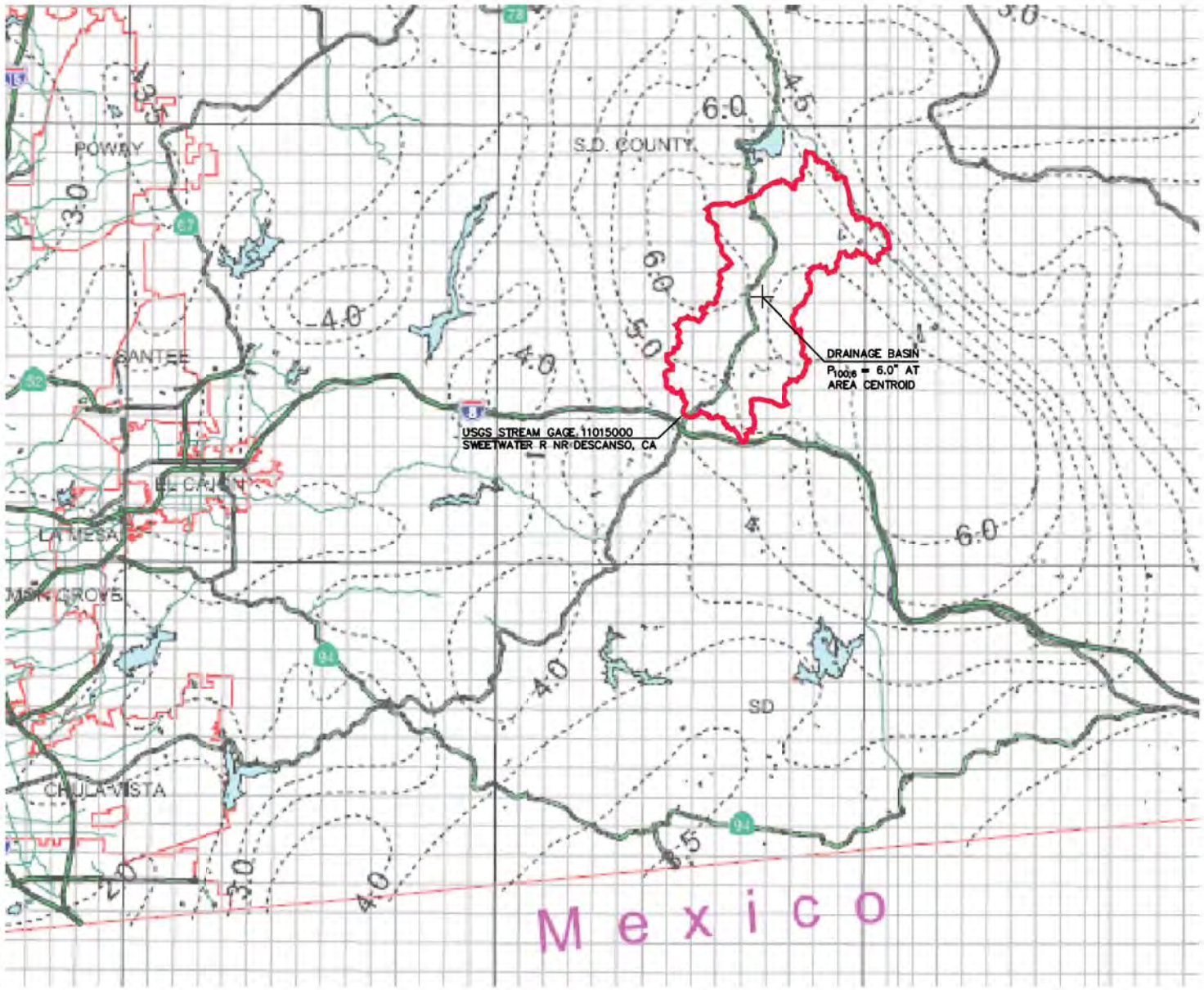
LEGEND

- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 5 OF 8

SWEETWATER RIVER ISOPLUVIAL MAP
10 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11590 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

LEGEND

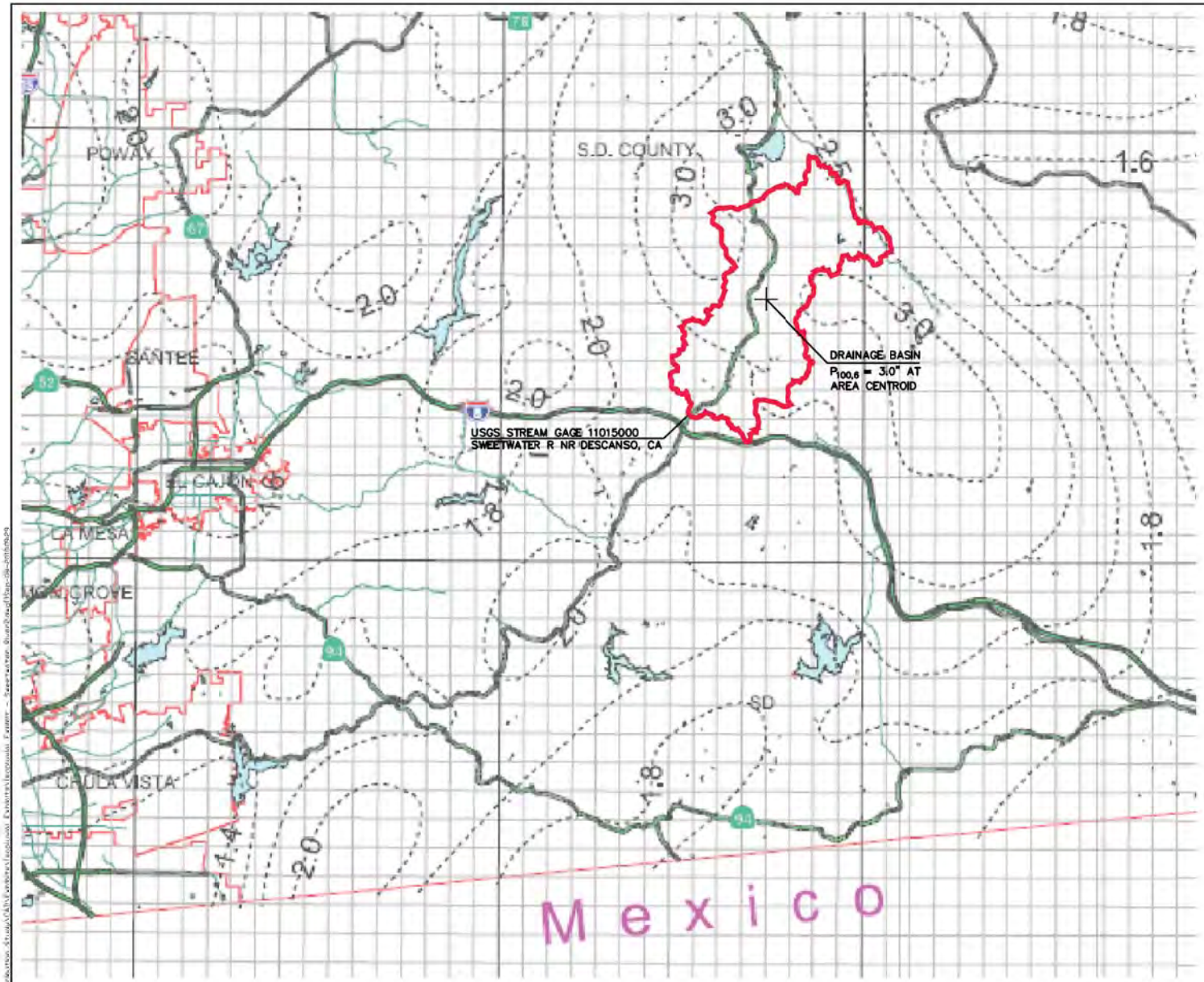
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

N

SHEET 4 OF 8

SWEETWATER RIVER ISOPLUVIAL MAP
5 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

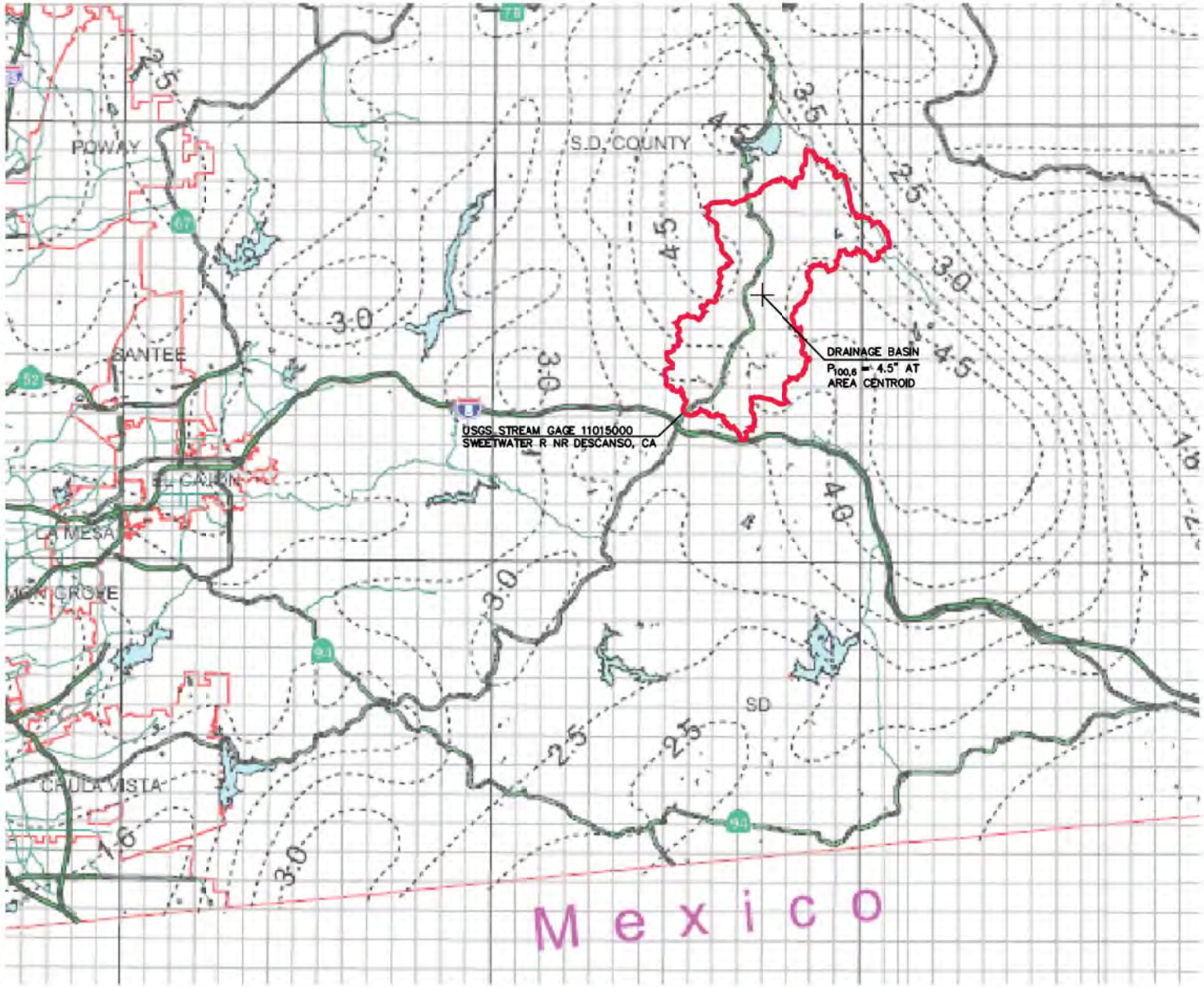
LEGEND

- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 3 OF 8

SWEETWATER RIVER ISOPLUVIAL MAP
5 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

LEGEND

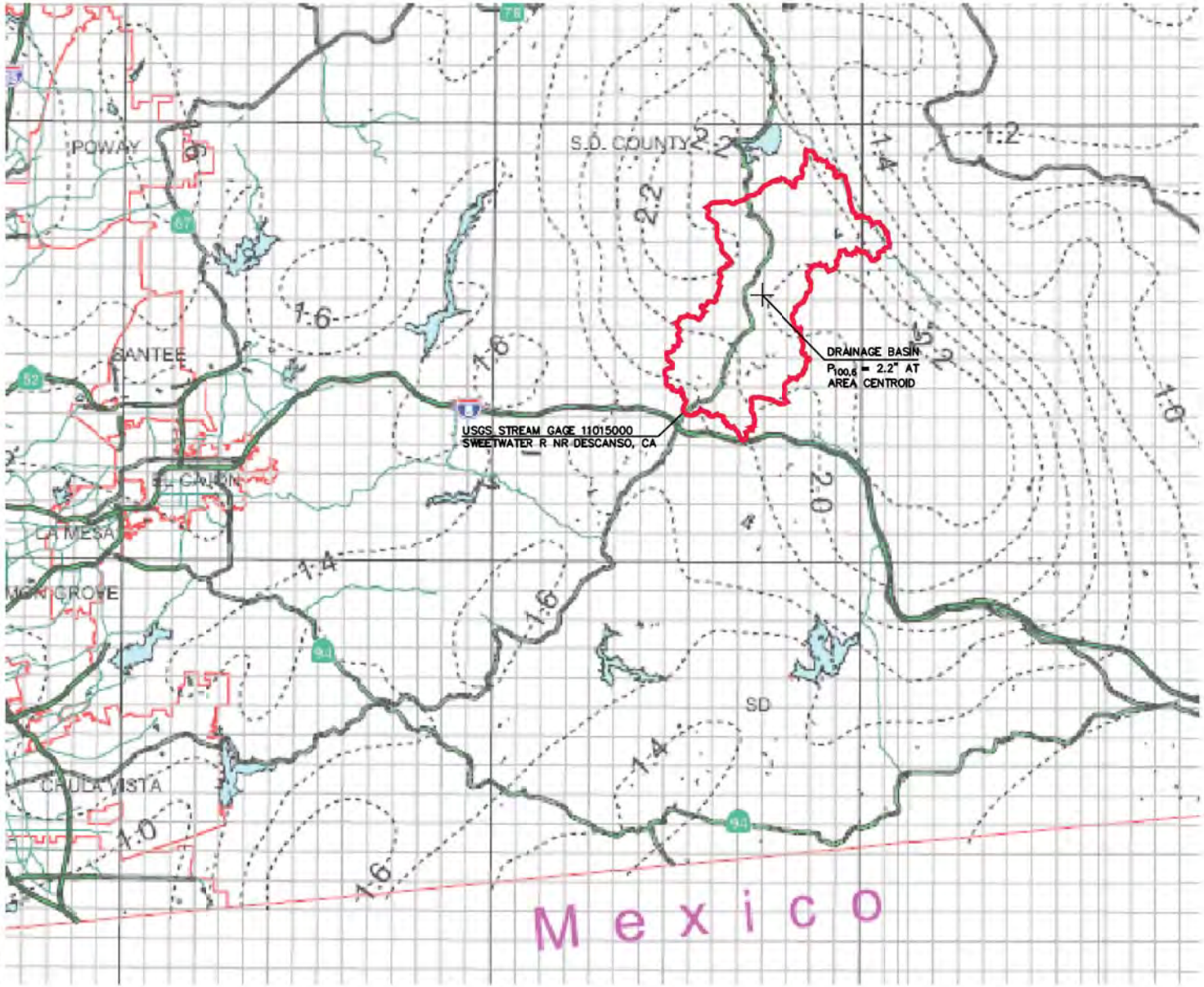
- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

3 0 3 Miles

SHEET 2 OF 8

SWEETWATER RIVER ISOPLUVIAL MAP
2 YEAR RAINFALL EVENT - 24 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com





PROJECT LOCATION
NO SCALE

LEGEND

- ISOPLUVIAL (inches)
- WATERSHED BOUNDARY
- WATERSHED CENTROID

SHEET 1 OF 8

SWEETWATER RIVER ISOPLUVIAL MAP
2 YEAR RAINFALL EVENT - 6 HOURS

Bureau Veritas North America, Inc.
11990 West Bernardo Court Suite 100
San Diego, CA 92127-1624
Tel: (858) 451-6100 Fax: (858) 451-2846
www.us.bureauveritas.com

Appendix C.7

Adjusted Rainfall Depths

This page is intentionally left blank to facilitate 2-sided printing.

Rainfall Depth-Area Adjustments for Type 1 and Type B Storms

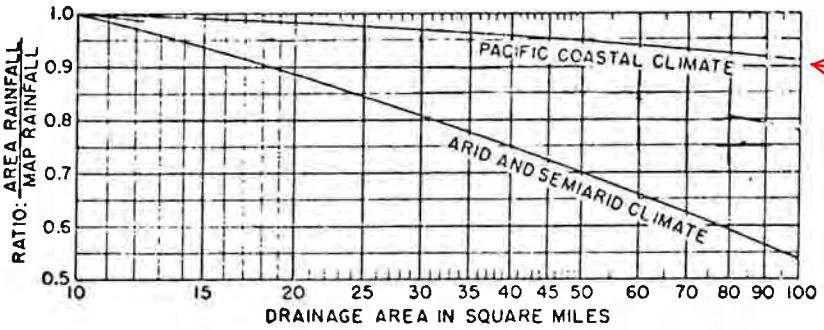
Watershed Name	Area (mi^2)	Rainfall Depth-Area Adjustment Ratio [1]	Unadjusted Rainfall Depths [2]								Adjusted Rainfall Depths [3]							
		24 hr	$P_{100\ yr-24\ hr}$	$P_{10\ yr-24\ hr}$	$P_{5\ yr-24\ hr}$	$P_{2\ yr-24\ hr}$	$P_{100\ yr-6\ hr}$	$P_{10\ yr-6\ hr}$	$P_{5\ yr-6\ hr}$	$P_{2\ yr-6\ hr}$	$P_{100\ yr-24\ hr}$	$P_{10\ yr-24\ hr}$	$P_{5\ yr-24\ hr}$	$P_{2\ yr-24\ hr}$	$P_{100\ yr-6\ hr}$	$P_{10\ yr-6\ hr}$	$P_{5\ yr-6\ hr}$	$P_{2\ yr-6\ hr}$
Guejito Creek	22.5	0.972	8.1	5.6	4.4	3.4	4.0	2.6	2.2	1.8	7.9	5.4	4.3	3.3	3.9	2.5	2.1	1.8
Jamul Creek	70.1	0.945	6.3	3.6	3.2	2.1	3.1	2.0	1.8	1.4	6.0	3.4	3.0	2.0	2.9	1.9	1.7	1.3
Las Flores Creek	26.6	0.968	4.8	3.3	2.8	1.9	3.0	1.9	1.7	1.3	4.6	3.2	2.7	1.8	2.9	1.8	1.6	1.3
Los Coches Creek	12.2	0.983	6.3	3.8	3.4	2.4	2.9	1.9	1.7	1.3	6.2	3.7	3.3	2.4	2.9	1.9	1.7	1.3
Santa Maria Creek	57.0	0.949	6.0	4.0	3.5	2.5	3.5	2.4	2.0	1.6	5.7	3.8	3.3	2.4	3.3	2.3	1.9	1.5
Sweetwater River	44.5	0.955	11.9	7.0	6.0	4.5	5.0	3.5	3.0	2.2	11.4	6.7	5.7	4.3	4.8	3.3	2.9	2.1

1. Rainfall Depth-Area Adjustment factors are visually interpreted from the values provided in Figure II-B-2(a) of the 1993 SDCHM. These values also correspond with the ratios interpolated from the 24 hr adjustment ratios in Table 4-1 of the 2003 SDCHM. Excerpts from these Figures and Tables are included in the pages that follow.
2. Unadjusted Rainfall Depths (inches) are determined per Isopluvial Maps provided in Appendix B of the 2003 SDCHM. Relevant excerpts of these Isopluvial Maps are included in Appendix C.6 of this report.
3. Adjusted Rainfall Depths (inches) are determined by multiplying the Unadjusted Rainfall Depths by the Rainfall Depth-Area Adjustment factor.
4. Note that the Nested Storm Distribution utilizes different Rainfall Depth-Area Adjustments. Refer to Appendix C.10 for Nested Rainfall Distribution Calculations.

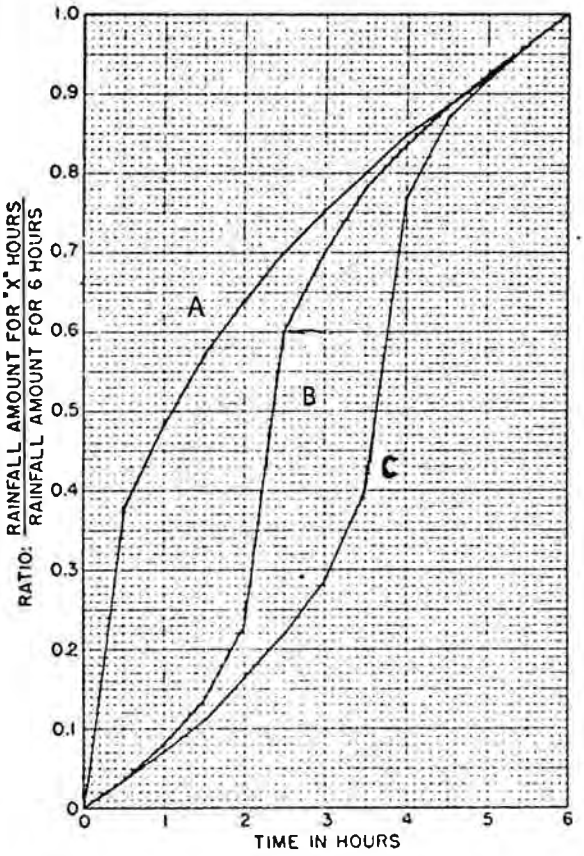
FIGURE II-B-2

Excerpt from 1993 San Diego County Hydrology Manual

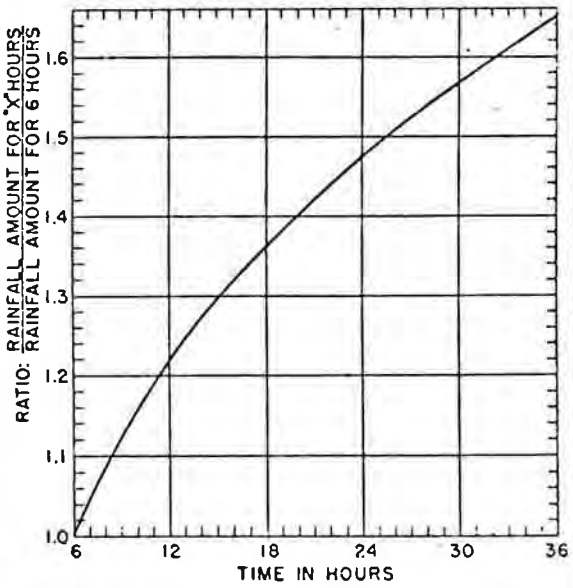
HYDROLOGY: CRITERIA FOR DESIGN STORMS



(a) RAINFALL RATIOS FOR DRAINAGE AREAS OF 10 TO 100 SQUARE MILES



(b) SIX HOUR DESIGN STORM DISTRIBUTION



(c) RELATIVE INCREASE IN RAINFALL AMOUNT FOR STORM DURATIONS OVER SIX HOURS

From: SCS Engineering Handbook Section 4, Hydrology, p.21.81 Figure 21.2

REFERENCE

U.S. Department of Agriculture
Soil Conservation Service
Engineering Division

COUNTY OF SAN DIEGO
DEPARTMENT OF SANITATION AND FLOOD CONTROL

Table 4-1
RAINFALL DEPTH-AREA ADJUSTMENT DATA POINTS

Watershed Area (square miles)	Rainfall Depth-Area Adjustment for Duration				
	30-Minute	1-Hour	3-Hour	6-Hour	24-Hour
0	1.000	1.000	1.000	1.000	1.000
5	0.942	0.970	0.980	0.985	0.990
10	0.900	0.947	0.970	0.980	0.985
20	0.834	0.900	0.952	0.963	0.975
30	0.768	0.858	0.932	0.950	0.964
40	0.730	0.830	0.915	0.940	0.958
50	0.692	0.800	0.900	0.928	0.952
60	0.663	0.778	0.883	0.920	0.948
70	0.645	0.760	0.872	0.912	0.945
80	0.630	0.746	0.862	0.904	0.942
90	0.620	0.735	0.853	0.896	0.938
100	0.610	0.722	0.845	0.890	0.935
125	0.588	0.700	0.830	0.878	0.930
150	0.572	0.685	0.818	0.865	0.925
175	0.572	0.672	0.808	0.858	0.922
200	0.572	0.666	0.798	0.851	0.918
225	0.572	0.660	0.790	0.845	0.915
250	0.572	0.655	0.787	0.842	0.914
300	0.572	0.652	0.782	0.838	0.912
350	0.572	0.652	0.780	0.830	0.910
400	0.572	0.652	0.780	0.828	0.908

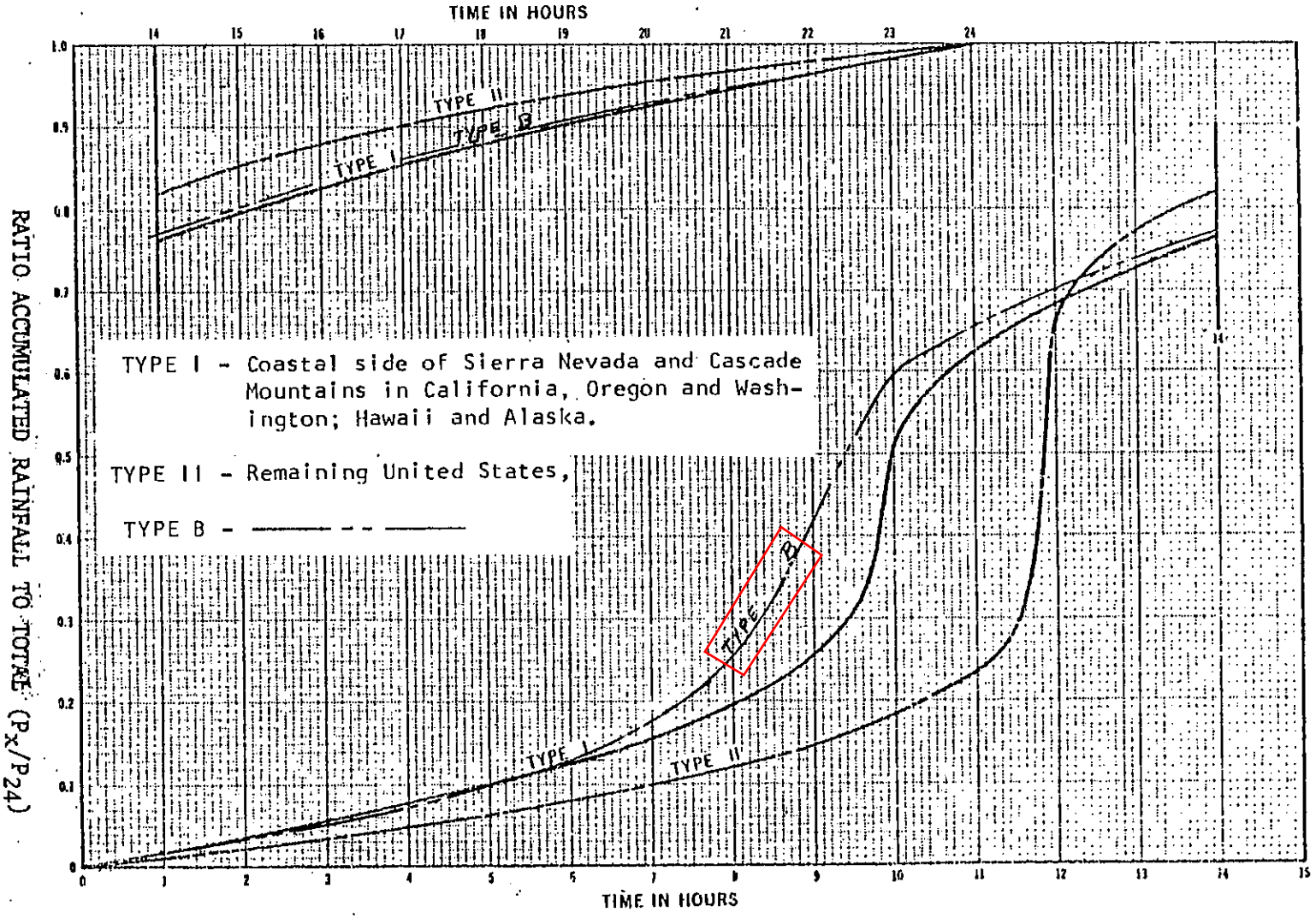
This page is intentionally left blank to facilitate 2-sided printing.

Appendix C.8

SCS Type B Distribution

This page is intentionally left blank to facilitate 2-sided printing.

Figure II-B-1



TWENTY-FOUR HOUR RAINFALL DISTRIBUTION (SCS).

COUNTY OF SAN DIEGO
DEPARTMENT OF SANITATION
AND FLOOD CONTROL

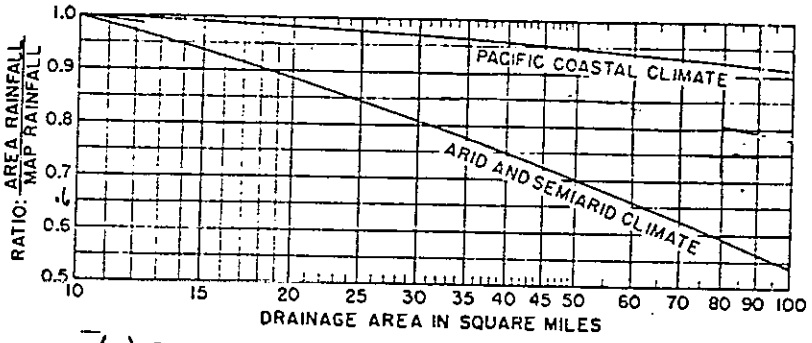
TABLE II-B-2

CUMULATIVE RAINFALL TABLE, ONE-DAY WATERSHED EVALUATION STORM-TYPE B

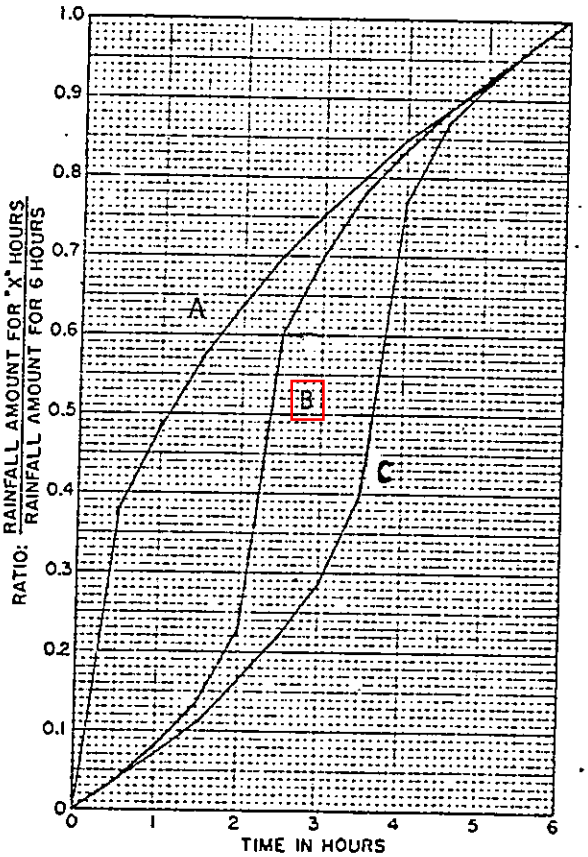
Time	P/P_{24}	Time	P/P_{24}
0	.000	12.0	.700
.5	.009	12.5	.720
1.0	.016	13.0	.739
1.5	.025	13.5	.756
2.0	.034	14.0	.772
2.5	.045	14.5	.790
3.0	.054	15.0	.800
3.5	.065	15.5	.816
4.0	.077	16.0	.831
4.5	.090	16.5	.845
5.0	.104	17.0	.860
5.5	.120	17.5	.872
6.0	.137	18.0	.885
6.5	.157	18.5	.895
7.0	.180	19.0	.905
7.5	.210	19.5	.914
8.0	.255	20.0	.924
8.5	.322	20.5	.935
9.0	.410	21.0	.945
9.5	.506	21.5	.954
10.0	.588	22.0	.963
10.5	.629	22.5	.972
11.0	.656	23.0	.981
11.5	.679	23.5	.991
		24.0	1.000

FIGURE II-B-2

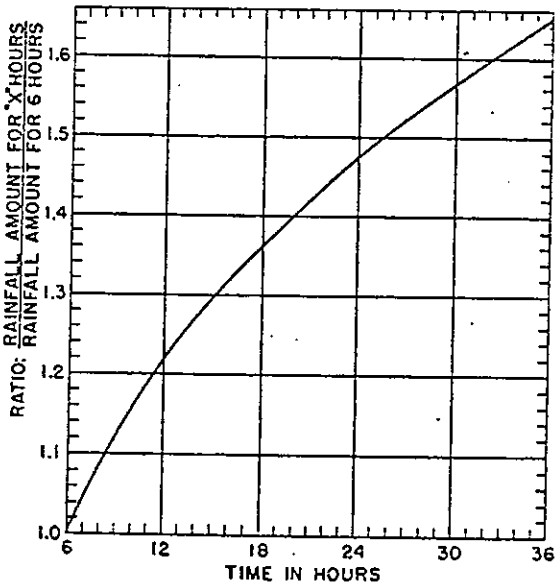
HYDROLOGY: CRITERIA FOR DESIGN STORMS



(a) RAINFALL RATIOS FOR DRAINAGE AREAS OF 10 TO 100 SQUARE MILES



(b) SIX HOUR DESIGN STORM DISTRIBUTION



(c) RELATIVE INCREASE IN RAINFALL AMOUNT FOR STORM DURATIONS OVER SIX HOURS

From: SCS Engineering Handbook Section 4, Hydrology, p.21.81, Figure 21.2

REFERENCE

U.S. Department of Agriculture
Soil Conservation Service
Engineering Division

COUNTY OF SAN DIEGO
DEPARTMENT OF SANITATION AND FLOOD CONTROL

SCS Type B – 24 Hour Distribution Ratios

Time (min)	P_x/P_{24} [1] (ratio)
0	0.000
5	0.002
10	0.003
15	0.005
20	0.006
25	0.008
30	0.009
35	0.010
40	0.011
45	0.013
50	0.014
55	0.015
60	0.016
65	0.018
70	0.019
75	0.021
80	0.022
85	0.024
90	0.025
95	0.027
100	0.028
105	0.030
110	0.031
115	0.033
120	0.034
125	0.036
130	0.038
135	0.040
140	0.041
145	0.043
150	0.045
155	0.047
160	0.048
165	0.050
170	0.051
175	0.053
180	0.054
185	0.056
190	0.058
195	0.060
200	0.061
205	0.063
210	0.065
215	0.067
220	0.069
225	0.071
230	0.073
235	0.075
240	0.077

Time (min)	P_x/P_{24} [1] (ratio)
245	0.079
250	0.081
255	0.084
260	0.086
265	0.088
270	0.090
275	0.092
280	0.095
285	0.097
290	0.099
295	0.102
300	0.104
305	0.107
310	0.109
315	0.112
320	0.115
325	0.117
330	0.120
335	0.123
340	0.126
345	0.129
350	0.131
355	0.134
360	0.137
365	0.140
370	0.144
375	0.147
380	0.150
385	0.154
390	0.157
395	0.161
400	0.165
405	0.169
410	0.172
415	0.176
420	0.180
425	0.185
430	0.190
435	0.195
440	0.200
445	0.205
450	0.210
455	0.218
460	0.225
465	0.233
470	0.240
475	0.248
480	0.255
485	0.266

Time (min)	P_x/P_{24} [1] (ratio)
490	0.277
495	0.289
500	0.300
505	0.311
510	0.322
515	0.337
520	0.351
525	0.366
530	0.381
535	0.395
540	0.410
545	0.426
550	0.442
555	0.458
560	0.474
565	0.490
570	0.506
575	0.520
580	0.533
585	0.547
590	0.561
595	0.574
600	0.588
605	0.595
610	0.602
615	0.609
620	0.615
625	0.622
630	0.629
635	0.634
640	0.638
645	0.643
650	0.647
655	0.652
660	0.656
665	0.660
670	0.664
675	0.668
680	0.671
685	0.675
690	0.679
695	0.683
700	0.686
705	0.690
710	0.693
715	0.697
720	0.700
725	0.703
730	0.707

Time (min)	P_x/P_{24} [1] (ratio)
735	0.710
740	0.713
745	0.717
750	0.720
755	0.723
760	0.726
765	0.730
770	0.733
775	0.736
780	0.739
785	0.742
790	0.745
795	0.748
800	0.750
805	0.753
810	0.756
815	0.759
820	0.761
825	0.764
830	0.767
835	0.769
840	0.772
845	0.775
850	0.778
855	0.781
860	0.784
865	0.787
870	0.790
875	0.792
880	0.793
885	0.795
890	0.797
895	0.798
900	0.800
905	0.803
910	0.805
915	0.808
920	0.811
925	0.813
930	0.816
935	0.819
940	0.821
945	0.824
950	0.826
955	0.829
960	0.831
965	0.833
970	0.836
975	0.838

Time (min)	P_x/P_{24} [1] (ratio)
980	0.840
985	0.843
990	0.845
995	0.848
1000	0.850
1005	0.853
1010	0.855
1015	0.858
1020	0.860
1025	0.862
1030	0.864
1035	0.866
1040	0.868
1045	0.870
1050	0.872
1055	0.874
1060	0.876
1065	0.879
1070	0.881
1075	0.883
1080	0.885
1085	0.887
1090	0.888
1095	0.890
1100	0.892
1105	0.893
1110	0.895
1115	0.897
1120	0.898
1125	0.900
1130	0.902
1135	0.903
1140	0.905
1145	0.907
1150	0.908
1155	0.910
1160	0.911
1165	0.913
1170	0.914
1175	0.916
1180	0.917
1185	0.919
1190	0.921
1195	0.922
1200	0.924
1205	0.926
1210	0.928
1215	0.930
1220	0.931

Time (min)	P_x/P_{24} [1] (ratio)
1225	0.933
1230	0.935
1235	0.937
1240	0.938
1245	0.940
1250	0.942
1255	0.943
1260	0.945
1265	0.947
1270	0.948
1275	0.950
1280	0.951
1285	0.953
1290	0.954
1295	0.956
1300	0.957
1305	0.959
1310	0.960
1315	0.962
1320	0.963
1325	0.965
1330	0.966
1335	0.968
1340	0.969
1345	0.971
1350	0.972
1355	0.974
1360	0.975
1365	0.977
1370	0.978
1375	0.980
1380	0.981
1385	0.983
1390	0.984
1395	0.986
1400	0.988
1405	0.989
1410	0.991
1415	0.993
1420	0.994
1425	0.996
1430	0.997
1435	0.999
1440	1.000

1. P_x/P_{24} values as linearly interpolated from Table II-B-2 of the 1993 SDCHM.

SCS Type B – 6 Hour Distribution Ratios

Time (min)	P_x/P_6 [1] (ratio)
0	0.000
5	0.006
10	0.011
15	0.016
20	0.022
25	0.028
30	0.034
35	0.041
40	0.048
45	0.054
50	0.061
55	0.069
60	0.077
65	0.086
70	0.095
75	0.104
80	0.115
85	0.126
90	0.137
95	0.150
100	0.165
105	0.180
110	0.200
115	0.225
120	0.255
125	0.300
130	0.351
135	0.410
140	0.474
145	0.533
150	0.588
155	0.615
160	0.638
165	0.656
170	0.671
175	0.686
180	0.700
185	0.713
190	0.726
195	0.739
200	0.750
205	0.761
210	0.772
215	0.784
220	0.793
225	0.800
230	0.811
235	0.821
240	0.831
245	0.840
250	0.850
255	0.860
260	0.868
265	0.876
270	0.885
275	0.892
280	0.898
285	0.905
290	0.911
295	0.917
300	0.924
305	0.931
310	0.938
315	0.945
320	0.951
325	0.957
330	0.963
335	0.969
340	0.975
345	0.981
350	0.988
355	0.994
360	1.000

1. P_x/P_6 ratios correspond to P_x/P_{24} ratios at times (in minutes) that are 4 times greater than P_x/P_6 times. For example P_x/P_6 at 100 minutes equals P_x/P_{24} at 400 minutes. These ratios match the values provided in Figure II-B-2 of the 1993 SDCHM.

SCS Type B - 100 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{100,24}$ [2]= 7.9		SCS Type B - 24 Hr Distribution Jamul Basin $P_{100,24}$ [2]= 6.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{100,24}$ [2]= 4.6		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{100,24}$ [2]= 6.2		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{100,24}$ [2]= 5.7		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{100,24}$ [2]= 11.4	
Time (min)	Time (hrs)	P_x/P_{24} [1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.002	5	0.016	5	0.012	5	0.009	5	0.012	5	0.011	5	0.023
10	0.17	0.003	10	0.024	10	0.018	10	0.014	10	0.019	10	0.017	10	0.034
15	0.25	0.005	15	0.040	15	0.030	15	0.023	15	0.031	15	0.029	15	0.057
20	0.33	0.006	20	0.047	20	0.036	20	0.028	20	0.037	20	0.034	20	0.068
25	0.42	0.008	25	0.063	25	0.048	25	0.037	25	0.050	25	0.046	25	0.091
30	0.50	0.009	30	0.071	30	0.054	30	0.041	30	0.056	30	0.051	30	0.103
35	0.58	0.010	35	0.079	35	0.060	35	0.046	35	0.062	35	0.057	35	0.114
40	0.67	0.011	40	0.087	40	0.066	40	0.051	40	0.068	40	0.063	40	0.125
45	0.75	0.013	45	0.103	45	0.078	45	0.060	45	0.081	45	0.074	45	0.148
50	0.83	0.014	50	0.111	50	0.084	50	0.064	50	0.087	50	0.080	50	0.160
55	0.92	0.015	55	0.119	55	0.090	55	0.069	55	0.093	55	0.086	55	0.171
60	1.00	0.016	60	0.126	60	0.096	60	0.074	60	0.099	60	0.091	60	0.182
65	1.08	0.018	65	0.142	65	0.108	65	0.083	65	0.112	65	0.103	65	0.205
70	1.17	0.019	70	0.150	70	0.114	70	0.087	70	0.118	70	0.108	70	0.217
75	1.25	0.021	75	0.166	75	0.126	75	0.097	75	0.130	75	0.120	75	0.239
80	1.33	0.022	80	0.174	80	0.132	80	0.101	80	0.136	80	0.125	80	0.251
85	1.42	0.024	85	0.190	85	0.144	85	0.110	85	0.149	85	0.137	85	0.274
90	1.50	0.025	90	0.198	90	0.150	90	0.115	90	0.155	90	0.143	90	0.285
95	1.58	0.027	95	0.213	95	0.162	95	0.124	95	0.167	95	0.154	95	0.308
100	1.67	0.028	100	0.221	100	0.168	100	0.129	100	0.174	100	0.160	100	0.319
105	1.75	0.030	105	0.237	105	0.180	105	0.138	105	0.186	105	0.171	105	0.342
110	1.83	0.031	110	0.245	110	0.186	110	0.143	110	0.192	110	0.177	110	0.353
115	1.92	0.033	115	0.261	115	0.198	115	0.152	115	0.205	115	0.188	115	0.376
120	2.00	0.034	120	0.269	120	0.204	120	0.156	120	0.211	120	0.194	120	0.388
125	2.08	0.036	125	0.284	125	0.216	125	0.166	125	0.223	125	0.205	125	0.410
130	2.17	0.038	130	0.300	130	0.228	130	0.175	130	0.236	130	0.217	130	0.433
135	2.25	0.040	135	0.316	135	0.240	135	0.184	135	0.248	135	0.228	135	0.456
140	2.33	0.041	140	0.324	140	0.246	140	0.189	140	0.254	140	0.234	140	0.467
145	2.42	0.043	145	0.340	145	0.258	145	0.198	145	0.267	145	0.245	145	0.490
150	2.50	0.045	150	0.356	150	0.270	150	0.207	150	0.279	150	0.257	150	0.513
155	2.58	0.047	155	0.371	155	0.282	155	0.216	155	0.291	155	0.268	155	0.536
160	2.67	0.048	160	0.379	160	0.288	160	0.221	160	0.298	160	0.274	160	0.547
165	2.75	0.050	165	0.395	165	0.300	165	0.230	165	0.310	165	0.285	165	0.570
170	2.83	0.051	170	0.403	170	0.306	170	0.235	170	0.316	170	0.291	170	0.581
175	2.92	0.053	175	0.419	175	0.318	175	0.244	175	0.329	175	0.302	175	0.604
180	3.00	0.054	180	0.427	180	0.324	180	0.248	180	0.335	180	0.308	180	0.616
185	3.08	0.056	185	0.442	185	0.336	185	0.258	185	0.347	185	0.319	185	0.638
190	3.17	0.058	190	0.458	190	0.348	190	0.267	190	0.360	190	0.331	190	0.661
195	3.25	0.060	195	0.474	195	0.360	195	0.276	195	0.372	195	0.342	195	0.684
200	3.33	0.061	200	0.482	200	0.366	200	0.281	200	0.378	200	0.348	200	0.695
205	3.42	0.063	205	0.498	205	0.378	205	0.290	205	0.391	205	0.359	205	0.718
210	3.50	0.065	210	0.514	210	0.390	210	0.299	210	0.403	210	0.371	210	0.741
215	3.58	0.067	215	0.529	215	0.402	215	0.308	215	0.415	215	0.382	215	0.764
220	3.67	0.069	220	0.545	220	0.414	220	0.317	220	0.428	220	0.393	220	0.787
225	3.75	0.071	225	0.561	225	0.426	225	0.327	225	0.440	225	0.405	225	0.809
230	3.83	0.073	230	0.577	230	0.438	230	0.336	230	0.453	230	0.416	230	0.832
235	3.92	0.075	235	0.593	235	0.450	235	0.345	235	0.465	235	0.428	235	0.855
240	4.00	0.077	240	0.608	240	0.462	240	0.354	240	0.477	240	0.439	240	0.878
245	4.08	0.079	245	0.624	245	0.474	245	0.363	245	0.490	245	0.450	245	0.901
250	4.17	0.081	250	0.640	250	0.486	250	0.373	250	0.502	250	0.462	250	0.923
255	4.25	0.084	255	0.664	255	0.504	255	0.386	255	0.521	255	0.479	255	0.958
260	4.33	0.086	260	0.679	260	0.516	260	0.396	260	0.533	260	0.490	260	0.980
265	4.42	0.088	265	0.695	265	0.528	265	0.405	265	0.546	265	0.502	265	1.003

SCS Type B - 100 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{100,24}$[2]= 7.9		SCS Type B - 24 Hr Distribution Jamul Basin $P_{100,24}$[2]= 6.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{100,24}$[2]= 4.6		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{100,24}$[2]= 6.2		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{100,24}$[2]= 5.7		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{100,24}$[2]= 11.4	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.090	270	0.711	270	0.540	270	0.414	270	0.558	270	0.513	270	1.026
275	4.58	0.092	275	0.727	275	0.552	275	0.423	275	0.570	275	0.524	275	1.049
280	4.67	0.095	280	0.751	280	0.570	280	0.437	280	0.589	280	0.542	280	1.083
285	4.75	0.097	285	0.766	285	0.582	285	0.446	285	0.601	285	0.553	285	1.106
290	4.83	0.099	290	0.782	290	0.594	290	0.455	290	0.614	290	0.564	290	1.129
295	4.92	0.102	295	0.806	295	0.612	295	0.469	295	0.632	295	0.581	295	1.163
300	5.00	0.104	300	0.822	300	0.624	300	0.478	300	0.645	300	0.593	300	1.186
305	5.08	0.107	305	0.845	305	0.642	305	0.492	305	0.663	305	0.610	305	1.220
310	5.17	0.109	310	0.861	310	0.654	310	0.501	310	0.676	310	0.621	310	1.243
315	5.25	0.112	315	0.885	315	0.672	315	0.515	315	0.694	315	0.638	315	1.277
320	5.33	0.115	320	0.909	320	0.690	320	0.529	320	0.713	320	0.656	320	1.311
325	5.42	0.117	325	0.924	325	0.702	325	0.538	325	0.725	325	0.667	325	1.334
330	5.50	0.120	330	0.948	330	0.720	330	0.552	330	0.744	330	0.684	330	1.368
335	5.58	0.123	335	0.972	335	0.738	335	0.566	335	0.763	335	0.701	335	1.402
340	5.67	0.126	340	0.995	340	0.756	340	0.580	340	0.781	340	0.718	340	1.436
345	5.75	0.129	345	1.019	345	0.774	345	0.593	345	0.800	345	0.735	345	1.471
350	5.83	0.131	350	1.035	350	0.786	350	0.603	350	0.812	350	0.747	350	1.493
355	5.92	0.134	355	1.059	355	0.804	355	0.616	355	0.831	355	0.764	355	1.528
360	6.00	0.137	360	1.082	360	0.822	360	0.630	360	0.849	360	0.781	360	1.562
365	6.08	0.140	365	1.106	365	0.840	365	0.644	365	0.868	365	0.798	365	1.596
370	6.17	0.144	370	1.138	370	0.864	370	0.662	370	0.893	370	0.821	370	1.642
375	6.25	0.147	375	1.161	375	0.882	375	0.676	375	0.911	375	0.838	375	1.676
380	6.33	0.150	380	1.185	380	0.900	380	0.690	380	0.930	380	0.855	380	1.710
385	6.42	0.154	385	1.217	385	0.924	385	0.708	385	0.955	385	0.878	385	1.756
390	6.50	0.157	390	1.240	390	0.942	390	0.722	390	0.973	390	0.895	390	1.790
395	6.58	0.161	395	1.272	395	0.966	395	0.741	395	0.998	395	0.918	395	1.835
400	6.67	0.165	400	1.304	400	0.990	400	0.759	400	1.023	400	0.941	400	1.881
405	6.75	0.169	405	1.335	405	1.014	405	0.777	405	1.048	405	0.963	405	1.927
410	6.83	0.172	410	1.359	410	1.032	410	0.791	410	1.066	410	0.980	410	1.961
415	6.92	0.176	415	1.390	415	1.056	415	0.810	415	1.091	415	1.003	415	2.006
420	7.00	0.180	420	1.422	420	1.080	420	0.828	420	1.116	420	1.026	420	2.052
425	7.08	0.185	425	1.462	425	1.110	425	0.851	425	1.147	425	1.055	425	2.109
430	7.17	0.190	430	1.501	430	1.140	430	0.874	430	1.178	430	1.083	430	2.166
435	7.25	0.195	435	1.541	435	1.170	435	0.897	435	1.209	435	1.112	435	2.223
440	7.33	0.200	440	1.580	440	1.200	440	0.920	440	1.240	440	1.140	440	2.280
445	7.42	0.205	445	1.620	445	1.230	445	0.943	445	1.271	445	1.169	445	2.337
450	7.50	0.210	450	1.659	450	1.260	450	0.966	450	1.302	450	1.197	450	2.394
455	7.58	0.218	455	1.722	455	1.308	455	1.003	455	1.352	455	1.243	455	2.485
460	7.67	0.225	460	1.778	460	1.350	460	1.035	460	1.395	460	1.283	460	2.565
465	7.75	0.233	465	1.841	465	1.398	465	1.072	465	1.445	465	1.328	465	2.656
470	7.83	0.240	470	1.896	470	1.440	470	1.104	470	1.488	470	1.368	470	2.736
475	7.92	0.248	475	1.959	475	1.488	475	1.141	475	1.538	475	1.414	475	2.827
480	8.00	0.255	480	2.015	480	1.530	480	1.173	480	1.581	480	1.454	480	2.907
485	8.08	0.266	485	2.101	485	1.596	485	1.224	485	1.649	485	1.516	485	3.032
490	8.17	0.277	490	2.188	490	1.662	490	1.274	490	1.717	490	1.579	490	3.158
495	8.25	0.289	495	2.283	495	1.734	495	1.329	495	1.792	495	1.647	495	3.295
500	8.33	0.300	500	2.370	500	1.800	500	1.380	500	1.860	500	1.710	500	3.420
505	8.42	0.311	505	2.457	505	1.866	505	1.431	505	1.928	505	1.773	505	3.545
510	8.50	0.322	510	2.544	510	1.932	510	1.481	510	1.996	510	1.835	510	3.671
515	8.58	0.337	515	2.662	515	2.022	515	1.550	515	2.089	515	1.921	515	3.842
520	8.67	0.351	520	2.773	520	2.106	520	1.615	520	2.176	520	2.001	520	4.001
525	8.75	0.366	525	2.891	525	2.196	525	1.684	525	2.269	525	2.086	525	4.172
530	8.83	0.381	530	3.010	530	2.286	530	1.753	530	2.362	530	2.172	530	4.343
535	8.92	0.395	535	3.121	535	2.370	535	1.817	535	2.449	535	2.252	535	4.503

SCS Type B - 100 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{100,24}$ [2]= 7.9		SCS Type B - 24 Hr Distribution Jamul Basin $P_{100,24}$ [2]= 6.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{100,24}$ [2]= 4.6		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{100,24}$ [2]= 6.2		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{100,24}$ [2]= 5.7		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{100,24}$ [2]= 11.4	
Time (min)	Time (hrs)	P_x/P_{24} [1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
540	9.00	0.410	540	3.239	540	2.460	540	1.886	540	2.542	540	2.337	540	4.674
545	9.08	0.426	545	3.365	545	2.556	545	1.960	545	2.641	545	2.428	545	4.856
550	9.17	0.442	550	3.492	550	2.652	550	2.033	550	2.740	550	2.519	550	5.039
555	9.25	0.458	555	3.618	555	2.748	555	2.107	555	2.840	555	2.611	555	5.221
560	9.33	0.474	560	3.745	560	2.844	560	2.180	560	2.939	560	2.702	560	5.404
565	9.42	0.490	565	3.871	565	2.940	565	2.254	565	3.038	565	2.793	565	5.586
570	9.50	0.506	570	3.997	570	3.036	570	2.328	570	3.137	570	2.884	570	5.768
575	9.58	0.520	575	4.108	575	3.120	575	2.392	575	3.224	575	2.964	575	5.928
580	9.67	0.533	580	4.211	580	3.198	580	2.452	580	3.305	580	3.038	580	6.076
585	9.75	0.547	585	4.321	585	3.282	585	2.516	585	3.391	585	3.118	585	6.236
590	9.83	0.561	590	4.432	590	3.366	590	2.581	590	3.478	590	3.198	590	6.395
595	9.92	0.574	595	4.535	595	3.444	595	2.640	595	3.559	595	3.272	595	6.544
600	10.00	0.588	600	4.645	600	3.528	600	2.705	600	3.646	600	3.352	600	6.703
605	10.08	0.595	605	4.701	605	3.570	605	2.737	605	3.689	605	3.392	605	6.783
610	10.17	0.602	610	4.756	610	3.612	610	2.769	610	3.732	610	3.431	610	6.863
615	10.25	0.609	615	4.811	615	3.654	615	2.801	615	3.776	615	3.471	615	6.943
620	10.33	0.615	620	4.859	620	3.690	620	2.829	620	3.813	620	3.506	620	7.011
625	10.42	0.622	625	4.914	625	3.732	625	2.861	625	3.856	625	3.545	625	7.091
630	10.50	0.629	630	4.969	630	3.774	630	2.893	630	3.900	630	3.585	630	7.171
635	10.58	0.634	635	5.009	635	3.804	635	2.916	635	3.931	635	3.614	635	7.228
640	10.67	0.638	640	5.040	640	3.828	640	2.935	640	3.956	640	3.637	640	7.273
645	10.75	0.643	645	5.080	645	3.858	645	2.958	645	3.987	645	3.665	645	7.330
650	10.83	0.647	650	5.111	650	3.882	650	2.976	650	4.011	650	3.688	650	7.376
655	10.92	0.652	655	5.151	655	3.912	655	2.999	655	4.042	655	3.716	655	7.433
660	11.00	0.656	660	5.182	660	3.936	660	3.018	660	4.067	660	3.739	660	7.478
665	11.08	0.660	665	5.214	665	3.960	665	3.036	665	4.092	665	3.762	665	7.524
670	11.17	0.664	670	5.246	670	3.984	670	3.054	670	4.117	670	3.785	670	7.570
675	11.25	0.668	675	5.277	675	4.008	675	3.073	675	4.142	675	3.808	675	7.615
680	11.33	0.671	680	5.301	680	4.026	680	3.087	680	4.160	680	3.825	680	7.649
685	11.42	0.675	685	5.333	685	4.050	685	3.105	685	4.185	685	3.848	685	7.695
690	11.50	0.679	690	5.364	690	4.074	690	3.123	690	4.210	690	3.870	690	7.741
695	11.58	0.683	695	5.396	695	4.098	695	3.142	695	4.235	695	3.893	695	7.786
700	11.67	0.686	700	5.419	700	4.116	700	3.156	700	4.253	700	3.910	700	7.820
705	11.75	0.690	705	5.451	705	4.140	705	3.174	705	4.278	705	3.933	705	7.866
710	11.83	0.693	710	5.475	710	4.158	710	3.188	710	4.297	710	3.950	710	7.900
715	11.92	0.697	715	5.506	715	4.182	715	3.206	715	4.321	715	3.973	715	7.946
720	12.00	0.700	720	5.530	720	4.200	720	3.220	720	4.340	720	3.990	720	7.980
725	12.08	0.703	725	5.554	725	4.218	725	3.234	725	4.359	725	4.007	725	8.014
730	12.17	0.707	730	5.585	730	4.242	730	3.252	730	4.383	730	4.030	730	8.060
735	12.25	0.710	735	5.609	735	4.260	735	3.266	735	4.402	735	4.047	735	8.094
740	12.33	0.713	740	5.633	740	4.278	740	3.280	740	4.421	740	4.064	740	8.128
745	12.42	0.717	745	5.664	745	4.302	745	3.298	745	4.445	745	4.087	745	8.174
750	12.50	0.720	750	5.688	750	4.320	750	3.312	750	4.464	750	4.104	750	8.208
755	12.58	0.723	755	5.712	755	4.338	755	3.326	755	4.483	755	4.121	755	8.242
760	12.67	0.726	760	5.735	760	4.356	760	3.340	760	4.501	760	4.138	760	8.276
765	12.75	0.730	765	5.767	765	4.380	765	3.358	765	4.526	765	4.161	765	8.322
770	12.83	0.733	770	5.791	770	4.398	770	3.372	770	4.545	770	4.178	770	8.356
775	12.92	0.736	775	5.814	775	4.416	775	3.386	775	4.563	775	4.195	775	8.390
780	13.00	0.739	780	5.838	780	4.434	780	3.399	780	4.582	780	4.212	780	8.425
785	13.08	0.742	785	5.862	785	4.452	785	3.413	785	4.600	785	4.229	785	8.459
790	13.17	0.745	790	5.886	790	4.470	790	3.427	790	4.619	790	4.247	790	8.493
795	13.25	0.748	795	5.909	795	4.488	795	3.441	795	4.638	795	4.264	795	8.527
800	13.33	0.750	800	5.925	800	4.500	800	3.450	800	4.650	800	4.275	800	8.550
805	13.42	0.753	805	5.949	805	4.518	805	3.464	805	4.669	805	4.292	805	8.584

SCS Type B - 100 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{100,24}$ [2]= 7.9		SCS Type B - 24 Hr Distribution Jamul Basin $P_{100,24}$ [2]= 6.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{100,24}$ [2]= 4.6		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{100,24}$ [2]= 6.2		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{100,24}$ [2]= 5.7		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{100,24}$ [2]= 11.4	
Time (min)	Time (hrs)	P_x/P_{24} [1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
810	13.50	0.756	810	5.972	810	4.536	810	3.478	810	4.687	810	4.309	810	8.618
815	13.58	0.759	815	5.996	815	4.554	815	3.491	815	4.706	815	4.326	815	8.653
820	13.67	0.761	820	6.012	820	4.566	820	3.501	820	4.718	820	4.338	820	8.675
825	13.75	0.764	825	6.036	825	4.584	825	3.514	825	4.737	825	4.355	825	8.710
830	13.83	0.767	830	6.059	830	4.602	830	3.528	830	4.755	830	4.372	830	8.744
835	13.92	0.769	835	6.075	835	4.614	835	3.537	835	4.768	835	4.383	835	8.767
840	14.00	0.772	840	6.099	840	4.632	840	3.551	840	4.786	840	4.400	840	8.801
845	14.08	0.775	845	6.123	845	4.650	845	3.565	845	4.805	845	4.418	845	8.835
850	14.17	0.778	850	6.146	850	4.668	850	3.579	850	4.824	850	4.435	850	8.869
855	14.25	0.781	855	6.170	855	4.686	855	3.593	855	4.842	855	4.452	855	8.903
860	14.33	0.784	860	6.194	860	4.704	860	3.606	860	4.861	860	4.469	860	8.938
865	14.42	0.787	865	6.217	865	4.722	865	3.620	865	4.879	865	4.486	865	8.972
870	14.50	0.790	870	6.241	870	4.740	870	3.634	870	4.898	870	4.503	870	9.006
875	14.58	0.792	875	6.257	875	4.752	875	3.643	875	4.910	875	4.514	875	9.029
880	14.67	0.793	880	6.265	880	4.758	880	3.648	880	4.917	880	4.520	880	9.040
885	14.75	0.795	885	6.281	885	4.770	885	3.657	885	4.929	885	4.532	885	9.063
890	14.83	0.797	890	6.296	890	4.782	890	3.666	890	4.941	890	4.543	890	9.086
895	14.92	0.798	895	6.304	895	4.788	895	3.671	895	4.948	895	4.549	895	9.097
900	15.00	0.800	900	6.320	900	4.800	900	3.680	900	4.960	900	4.560	900	9.120
905	15.08	0.803	905	6.344	905	4.818	905	3.694	905	4.979	905	4.577	905	9.154
910	15.17	0.805	910	6.360	910	4.830	910	3.703	910	4.991	910	4.589	910	9.177
915	15.25	0.808	915	6.383	915	4.848	915	3.717	915	5.010	915	4.606	915	9.211
920	15.33	0.811	920	6.407	920	4.866	920	3.731	920	5.028	920	4.623	920	9.245
925	15.42	0.813	925	6.423	925	4.878	925	3.740	925	5.041	925	4.634	925	9.268
930	15.50	0.816	930	6.446	930	4.896	930	3.754	930	5.059	930	4.651	930	9.302
935	15.58	0.819	935	6.470	935	4.914	935	3.767	935	5.078	935	4.668	935	9.337
940	15.67	0.821	940	6.486	940	4.926	940	3.777	940	5.090	940	4.680	940	9.359
945	15.75	0.824	945	6.510	945	4.944	945	3.790	945	5.109	945	4.697	945	9.394
950	15.83	0.826	950	6.525	950	4.956	950	3.800	950	5.121	950	4.708	950	9.416
955	15.92	0.829	955	6.549	955	4.974	955	3.813	955	5.140	955	4.725	955	9.451
960	16.00	0.831	960	6.565	960	4.986	960	3.823	960	5.152	960	4.737	960	9.473
965	16.08	0.833	965	6.581	965	4.998	965	3.832	965	5.165	965	4.748	965	9.496
970	16.17	0.836	970	6.604	970	5.016	970	3.846	970	5.183	970	4.765	970	9.530
975	16.25	0.838	975	6.620	975	5.028	975	3.855	975	5.196	975	4.777	975	9.553
980	16.33	0.840	980	6.636	980	5.040	980	3.864	980	5.208	980	4.788	980	9.576
985	16.42	0.843	985	6.660	985	5.058	985	3.878	985	5.227	985	4.805	985	9.610
990	16.50	0.845	990	6.676	990	5.070	990	3.887	990	5.239	990	4.817	990	9.633
995	16.58	0.848	995	6.699	995	5.088	995	3.901	995	5.258	995	4.834	995	9.667
1000	16.67	0.850	1000	6.715	1000	5.100	1000	3.910	1000	5.270	1000	4.845	1000	9.690
1005	16.75	0.853	1005	6.739	1005	5.118	1005	3.924	1005	5.289	1005	4.862	1005	9.724
1010	16.83	0.855	1010	6.755	1010	5.130	1010	3.933	1010	5.301	1010	4.874	1010	9.747
1015	16.92	0.858	1015	6.778	1015	5.148	1015	3.947	1015	5.320	1015	4.891	1015	9.781
1020	17.00	0.860	1020	6.794	1020	5.160	1020	3.956	1020	5.332	1020	4.902	1020	9.804
1025	17.08	0.862	1025	6.810	1025	5.172	1025	3.965	1025	5.344	1025	4.913	1025	9.827
1030	17.17	0.864	1030	6.826	1030	5.184	1030	3.974	1030	5.357	1030	4.925	1030	9.850
1035	17.25	0.866	1035	6.841	1035	5.196	1035	3.984	1035	5.369	1035	4.936	1035	9.872
1040	17.33	0.868	1040	6.857	1040	5.208	1040	3.993	1040	5.382	1040	4.948	1040	9.895
1045	17.42	0.870	1045	6.873	1045	5.220	1045	4.002	1045	5.394	1045	4.959	1045	9.918
1050	17.50	0.872	1050	6.889	1050	5.232	1050	4.011	1050	5.406	1050	4.970	1050	9.941
1055	17.58	0.874	1055	6.905	1055	5.244	1055	4.020	1055	5.419	1055	4.982	1055	9.964
1060	17.67	0.876	1060	6.920	1060	5.256	1060	4.030	1060	5.431	1060	4.993	1060	9.986
1065	17.75	0.879	1065	6.944	1065	5.274	1065	4.043	1065	5.450	1065	5.010	1065	10.021
1070	17.83	0.881	1070	6.960	1070	5.286	1070	4.053	1070	5.462	1070	5.022	1070	10.043
1075	17.92	0.883	1075	6.976	1075	5.298	1075	4.062	1075	5.475	1075	5.033	1075	10.066

SCS Type B - 100 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{100,24}$ [2]= 7.9		SCS Type B - 24 Hr Distribution Jamul Basin $P_{100,24}$ [2]= 6.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{100,24}$ [2]= 4.6		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{100,24}$ [2]= 6.2		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{100,24}$ [2]= 5.7		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{100,24}$ [2]= 11.4	
Time (min)	Time (hrs)	P_x/P_{24} [1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1080	18.00	0.885	1080	6.992	1080	5.310	1080	4.071	1080	5.487	1080	5.045	1080	10.089
1085	18.08	0.887	1085	7.007	1085	5.322	1085	4.080	1085	5.499	1085	5.056	1085	10.112
1090	18.17	0.888	1090	7.015	1090	5.328	1090	4.085	1090	5.506	1090	5.062	1090	10.123
1095	18.25	0.890	1095	7.031	1095	5.340	1095	4.094	1095	5.518	1095	5.073	1095	10.146
1100	18.33	0.892	1100	7.047	1100	5.352	1100	4.103	1100	5.530	1100	5.084	1100	10.169
1105	18.42	0.893	1105	7.055	1105	5.358	1105	4.108	1105	5.537	1105	5.090	1105	10.180
1110	18.50	0.895	1110	7.071	1110	5.370	1110	4.117	1110	5.549	1110	5.102	1110	10.203
1115	18.58	0.897	1115	7.086	1115	5.382	1115	4.126	1115	5.561	1115	5.113	1115	10.226
1120	18.67	0.898	1120	7.094	1120	5.388	1120	4.131	1120	5.568	1120	5.119	1120	10.237
1125	18.75	0.900	1125	7.110	1125	5.400	1125	4.140	1125	5.580	1125	5.130	1125	10.260
1130	18.83	0.902	1130	7.126	1130	5.412	1130	4.149	1130	5.592	1130	5.141	1130	10.283
1135	18.92	0.903	1135	7.134	1135	5.418	1135	4.154	1135	5.599	1135	5.147	1135	10.294
1140	19.00	0.905	1140	7.150	1140	5.430	1140	4.163	1140	5.611	1140	5.159	1140	10.317
1145	19.08	0.907	1145	7.165	1145	5.442	1145	4.172	1145	5.623	1145	5.170	1145	10.340
1150	19.17	0.908	1150	7.173	1150	5.448	1150	4.177	1150	5.630	1150	5.176	1150	10.351
1155	19.25	0.910	1155	7.189	1155	5.460	1155	4.186	1155	5.642	1155	5.187	1155	10.374
1160	19.33	0.911	1160	7.197	1160	5.466	1160	4.191	1160	5.648	1160	5.193	1160	10.385
1165	19.42	0.913	1165	7.213	1165	5.478	1165	4.200	1165	5.661	1165	5.204	1165	10.408
1170	19.50	0.914	1170	7.221	1170	5.484	1170	4.204	1170	5.667	1170	5.210	1170	10.420
1175	19.58	0.916	1175	7.236	1175	5.496	1175	4.214	1175	5.679	1175	5.221	1175	10.442
1180	19.67	0.917	1180	7.244	1180	5.502	1180	4.218	1180	5.685	1180	5.227	1180	10.454
1185	19.75	0.919	1185	7.260	1185	5.514	1185	4.227	1185	5.698	1185	5.238	1185	10.477
1190	19.83	0.921	1190	7.276	1190	5.526	1190	4.237	1190	5.710	1190	5.250	1190	10.499
1195	19.92	0.922	1195	7.284	1195	5.532	1195	4.241	1195	5.716	1195	5.255	1195	10.511
1200	20.00	0.924	1200	7.300	1200	5.544	1200	4.250	1200	5.729	1200	5.267	1200	10.534
1205	20.08	0.926	1205	7.315	1205	5.556	1205	4.260	1205	5.741	1205	5.278	1205	10.556
1210	20.17	0.928	1210	7.331	1210	5.568	1210	4.269	1210	5.754	1210	5.290	1210	10.579
1215	20.25	0.930	1215	7.347	1215	5.580	1215	4.278	1215	5.766	1215	5.301	1215	10.602
1220	20.33	0.931	1220	7.355	1220	5.586	1220	4.283	1220	5.772	1220	5.307	1220	10.613
1225	20.42	0.933	1225	7.371	1225	5.598	1225	4.292	1225	5.785	1225	5.318	1225	10.636
1230	20.50	0.935	1230	7.387	1230	5.610	1230	4.301	1230	5.797	1230	5.330	1230	10.659
1235	20.58	0.937	1235	7.402	1235	5.622	1235	4.310	1235	5.809	1235	5.341	1235	10.682
1240	20.67	0.938	1240	7.410	1240	5.628	1240	4.315	1240	5.816	1240	5.347	1240	10.693
1245	20.75	0.940	1245	7.426	1245	5.640	1245	4.324	1245	5.828	1245	5.358	1245	10.716
1250	20.83	0.942	1250	7.442	1250	5.652	1250	4.333	1250	5.840	1250	5.369	1250	10.739
1255	20.92	0.943	1255	7.450	1255	5.658	1255	4.338	1255	5.847	1255	5.375	1255	10.750
1260	21.00	0.945	1260	7.466	1260	5.670	1260	4.347	1260	5.859	1260	5.387	1260	10.773
1265	21.08	0.947	1265	7.481	1265	5.682	1265	4.356	1265	5.871	1265	5.398	1265	10.796
1270	21.17	0.948	1270	7.489	1270	5.688	1270	4.361	1270	5.878	1270	5.404	1270	10.807
1275	21.25	0.950	1275	7.505	1275	5.700	1275	4.370	1275	5.890	1275	5.415	1275	10.830
1280	21.33	0.951	1280	7.513	1280	5.706	1280	4.375	1280	5.896	1280	5.421	1280	10.841
1285	21.42	0.953	1285	7.529	1285	5.718	1285	4.384	1285	5.909	1285	5.432	1285	10.864
1290	21.50	0.954	1290	7.537	1290	5.724	1290	4.388	1290	5.915	1290	5.438	1290	10.876
1295	21.58	0.956	1295	7.552	1295	5.736	1295	4.398	1295	5.927	1295	5.449	1295	10.898
1300	21.67	0.957	1300	7.560	1300	5.742	1300	4.402	1300	5.933	1300	5.455	1300	10.910
1305	21.75	0.959	1305	7.576	1305	5.754	1305	4.411	1305	5.946	1305	5.466	1305	10.933
1310	21.83	0.960	1310	7.584	1310	5.760	1310	4.416	1310	5.952	1310	5.472	1310	10.944
1315	21.92	0.962	1315	7.600	1315	5.772	1315	4.425	1315	5.964	1315	5.483	1315	10.967
1320	22.00	0.963	1320	7.608	1320	5.778	1320	4.430	1320	5.971	1320	5.489	1320	10.978
1325	22.08	0.965	1325	7.624	1325	5.790	1325	4.439	1325	5.983	1325	5.501	1325	11.001
1330	22.17	0.966	1330	7.631	1330	5.796	1330	4.444	1330	5.989	1330	5.506	1330	11.012
1335	22.25	0.968	1335	7.647	1335	5.808	1335	4.453	1335	6.002	1335	5.518	1335	11.035
1340	22.33	0.969	1340	7.655	1340	5.814	1340	4.457	1340	6.008	1340	5.523	1340	11.047
1345	22.42	0.971	1345	7.671	1345	5.826	1345	4.467	1345	6.020	1345	5.535	1345	11.069

SCS Type B - 100 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{100,24}$[2]= 7.9		SCS Type B - 24 Hr Distribution Jamul Basin $P_{100,24}$[2]= 6.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{100,24}$[2]= 4.6		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{100,24}$[2]= 6.2		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{100,24}$[2]= 5.7		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{100,24}$[2]= 11.4	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1350	22.50	0.972	1350	7.679	1350	5.832	1350	4.471	1350	6.026	1350	5.540	1350	11.081
1355	22.58	0.974	1355	7.695	1355	5.844	1355	4.480	1355	6.039	1355	5.552	1355	11.104
1360	22.67	0.975	1360	7.703	1360	5.850	1360	4.485	1360	6.045	1360	5.558	1360	11.115
1365	22.75	0.977	1365	7.718	1365	5.862	1365	4.494	1365	6.057	1365	5.569	1365	11.138
1370	22.83	0.978	1370	7.726	1370	5.868	1370	4.499	1370	6.064	1370	5.575	1370	11.149
1375	22.92	0.980	1375	7.742	1375	5.880	1375	4.508	1375	6.076	1375	5.586	1375	11.172
1380	23.00	0.981	1380	7.750	1380	5.886	1380	4.513	1380	6.082	1380	5.592	1380	11.183
1385	23.08	0.983	1385	7.766	1385	5.898	1385	4.522	1385	6.095	1385	5.603	1385	11.206
1390	23.17	0.984	1390	7.774	1390	5.904	1390	4.526	1390	6.101	1390	5.609	1390	11.218
1395	23.25	0.986	1395	7.789	1395	5.916	1395	4.536	1395	6.113	1395	5.620	1395	11.240
1400	23.33	0.988	1400	7.805	1400	5.928	1400	4.545	1400	6.126	1400	5.632	1400	11.263
1405	23.42	0.989	1405	7.813	1405	5.934	1405	4.549	1405	6.132	1405	5.637	1405	11.275
1410	23.50	0.991	1410	7.829	1410	5.946	1410	4.559	1410	6.144	1410	5.649	1410	11.297
1415	23.58	0.993	1415	7.845	1415	5.958	1415	4.568	1415	6.157	1415	5.660	1415	11.320
1420	23.67	0.994	1420	7.853	1420	5.964	1420	4.572	1420	6.163	1420	5.666	1420	11.332
1425	23.75	0.996	1425	7.868	1425	5.976	1425	4.582	1425	6.175	1425	5.677	1425	11.354
1430	23.83	0.997	1430	7.876	1430	5.982	1430	4.586	1430	6.181	1430	5.683	1430	11.366
1435	23.92	0.999	1435	7.892	1435	5.994	1435	4.595	1435	6.194	1435	5.694	1435	11.389
1440	24.00	1.000	1440	7.900	1440	6.000	1440	4.600	1440	6.200	1440	5.700	1440	11.400

1. P_x/P_{24} values at 30 minute intervals have been determined per values indicated in Table II-B-2 of the 1993 SCHM. P_x/P_{24} values at 5 minute intervals have been linearly interpolated from the 30-minute data.

2. $P_{100,24}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type B - 100 Yr - 6 Hr Distribution

SCS Type B - 6 Hr Distribution Ratios			SCS Type B - 6 Hr Distribution Guejito Basin $P_{100,6}$ [3] = 3.9		SCS Type B - 6 Hr Distribution Jamul Basin $P_{100,6}$ [3] = 2.9		SCS Type B - 6 Hr Distribution Las Flores Basin $P_{100,6}$ [3] = 2.9		SCS Type B - 6 Hr Distribution Los Coches Basin $P_{100,6}$ [3] = 2.9		SCS Type B - 6 Hr Distribution Santa Maria Basin $P_{100,6}$ [3] = 3.3		SCS Type B - 6 Hr Distribution Sweetwater Basin $P_{100,6}$ [3] = 4.8	
Time [1] (min)	Time (hrs)	P_x/P_6 [2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.006	5	0.023	5	0.017	5	0.017	5	0.017	5	0.020	5	0.029
10	0.17	0.011	10	0.043	10	0.032	10	0.032	10	0.032	10	0.036	10	0.053
15	0.25	0.016	15	0.062	15	0.046	15	0.046	15	0.046	15	0.053	15	0.077
20	0.33	0.022	20	0.086	20	0.064	20	0.064	20	0.064	20	0.073	20	0.106
25	0.42	0.028	25	0.109	25	0.081	25	0.081	25	0.081	25	0.092	25	0.134
30	0.50	0.034	30	0.133	30	0.099	30	0.099	30	0.099	30	0.112	30	0.163
35	0.58	0.041	35	0.160	35	0.119	35	0.119	35	0.119	35	0.135	35	0.197
40	0.67	0.048	40	0.187	40	0.139	40	0.139	40	0.139	40	0.158	40	0.230
45	0.75	0.054	45	0.211	45	0.157	45	0.157	45	0.157	45	0.178	45	0.259
50	0.83	0.061	50	0.238	50	0.177	50	0.177	50	0.177	50	0.201	50	0.293
55	0.92	0.069	55	0.269	55	0.200	55	0.200	55	0.200	55	0.228	55	0.331
60	1.00	0.077	60	0.300	60	0.223	60	0.223	60	0.223	60	0.254	60	0.370
65	1.08	0.086	65	0.335	65	0.249	65	0.249	65	0.249	65	0.284	65	0.413
70	1.17	0.095	70	0.371	70	0.276	70	0.276	70	0.276	70	0.314	70	0.456
75	1.25	0.104	75	0.406	75	0.302	75	0.302	75	0.302	75	0.343	75	0.499
80	1.33	0.115	80	0.449	80	0.334	80	0.334	80	0.334	80	0.380	80	0.552
85	1.42	0.126	85	0.491	85	0.365	85	0.365	85	0.365	85	0.416	85	0.605
90	1.50	0.137	90	0.534	90	0.397	90	0.397	90	0.397	90	0.452	90	0.658
95	1.58	0.150	95	0.585	95	0.435	95	0.435	95	0.435	95	0.495	95	0.720
100	1.67	0.165	100	0.644	100	0.479	100	0.479	100	0.479	100	0.545	100	0.792
105	1.75	0.180	105	0.702	105	0.522	105	0.522	105	0.522	105	0.594	105	0.864
110	1.83	0.200	110	0.780	110	0.580	110	0.580	110	0.580	110	0.660	110	0.960
115	1.92	0.225	115	0.878	115	0.653	115	0.653	115	0.653	115	0.743	115	1.080
120	2.00	0.255	120	0.995	120	0.740	120	0.740	120	0.740	120	0.842	120	1.224
125	2.08	0.300	125	1.170	125	0.870	125	0.870	125	0.870	125	0.990	125	1.440
130	2.17	0.351	130	1.369	130	1.018	130	1.018	130	1.018	130	1.158	130	1.685
135	2.25	0.410	135	1.599	135	1.189	135	1.189	135	1.189	135	1.353	135	1.968
140	2.33	0.474	140	1.849	140	1.375	140	1.375	140	1.375	140	1.564	140	2.275
145	2.42	0.533	145	2.079	145	1.546	145	1.546	145	1.546	145	1.759	145	2.558
150	2.50	0.588	150	2.293	150	1.705	150	1.705	150	1.705	150	1.940	150	2.822
155	2.58	0.615	155	2.399	155	1.784	155	1.784	155	1.784	155	2.030	155	2.952
160	2.67	0.638	160	2.488	160	1.850	160	1.850	160	1.850	160	2.105	160	3.062
165	2.75	0.656	165	2.558	165	1.902	165	1.902	165	1.902	165	2.165	165	3.149
170	2.83	0.671	170	2.617	170	1.946	170	1.946	170	1.946	170	2.214	170	3.221
175	2.92	0.686	175	2.675	175	1.989	175	1.989	175	1.989	175	2.264	175	3.293
180	3.00	0.700	180	2.730	180	2.030	180	2.030	180	2.030	180	2.310	180	3.360
185	3.08	0.713	185	2.781	185	2.068	185	2.068	185	2.068	185	2.353	185	3.422
190	3.17	0.726	190	2.831	190	2.105	190	2.105	190	2.105	190	2.396	190	3.485
195	3.25	0.739	195	2.882	195	2.143	195	2.143	195	2.143	195	2.439	195	3.547
200	3.33	0.750	200	2.925	200	2.175	200	2.175	200	2.175	200	2.475	200	3.600
205	3.42	0.761	205	2.968	205	2.207	205	2.207	205	2.207	205	2.511	205	3.653
210	3.50	0.772	210	3.011	210	2.239	210	2.239	210	2.239	210	2.548	210	3.706
215	3.58	0.784	215	3.058	215	2.274	215	2.274	215	2.274	215	2.587	215	3.763
220	3.67	0.793	220	3.093	220	2.300	220	2.300	220	2.300	220	2.617	220	3.806
225	3.75	0.800	225	3.120	225	2.320	225	2.320	225	2.320	225	2.640	225	3.840
230	3.83	0.811	230	3.163	230	2.352	230	2.352	230	2.352	230	2.676	230	3.893
235	3.92	0.821	235	3.202	235	2.381	235	2.381	235	2.381	235	2.709	235	3.941
240	4.00	0.831	240	3.241	240	2.410	240	2.410	240	2.410	240	2.742	240	3.989
245	4.08	0.840	245	3.276	245	2.436	245	2.436	245	2.436	245	2.772	245	4.032
250	4.17	0.850	250	3.315	250	2.465	250	2.465	250	2.465	250	2.805	250	4.080
255	4.25	0.860	255	3.354	255	2.494	255	2.494	255	2.494	255	2.838	255	4.128
260	4.33	0.868	260	3.385	260	2.517	260	2.517	260	2.517	260	2.864	260	4.166
265	4.42	0.876	265	3.416	265	2.540	265	2.540	265	2.540	265	2.891	265	4.205

SCS Type B - 100 Yr - 6 Hr Distribution

SCS Type B - 6 Hr Distribution Ratios			SCS Type B - 6 Hr Distribution Guejito Basin $P_{100,6}$[3]= 3.9		SCS Type B - 6 Hr Distribution Jamul Basin $P_{100,6}$[3]= 2.9		SCS Type B - 6 Hr Distribution Las Flores Basin $P_{100,6}$[3]= 2.9		SCS Type B - 6 Hr Distribution Los Coches Basin $P_{100,6}$[3]= 2.9		SCS Type B - 6 Hr Distribution Santa Maria Basin $P_{100,6}$[3]= 3.3		SCS Type B - 6 Hr Distribution Sweetwater Basin $P_{100,6}$[3]= 4.8	
Time[1] (min)	Time (hrs)	P_x/P_6[2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.885	270	3.452	270	2.567	270	2.567	270	2.567	270	2.921	270	4.248
275	4.58	0.892	275	3.479	275	2.587	275	2.587	275	2.587	275	2.944	275	4.282
280	4.67	0.898	280	3.502	280	2.604	280	2.604	280	2.604	280	2.963	280	4.310
285	4.75	0.905	285	3.530	285	2.625	285	2.625	285	2.625	285	2.987	285	4.344
290	4.83	0.911	290	3.553	290	2.642	290	2.642	290	2.642	290	3.006	290	4.373
295	4.92	0.917	295	3.576	295	2.659	295	2.659	295	2.659	295	3.026	295	4.402
300	5.00	0.924	300	3.604	300	2.680	300	2.680	300	2.680	300	3.049	300	4.435
305	5.08	0.931	305	3.631	305	2.700	305	2.700	305	2.700	305	3.072	305	4.469
310	5.17	0.938	310	3.658	310	2.720	310	2.720	310	2.720	310	3.095	310	4.502
315	5.25	0.945	315	3.686	315	2.741	315	2.741	315	2.741	315	3.119	315	4.536
320	5.33	0.951	320	3.709	320	2.758	320	2.758	320	2.758	320	3.138	320	4.565
325	5.42	0.957	325	3.732	325	2.775	325	2.775	325	2.775	325	3.158	325	4.594
330	5.50	0.963	330	3.756	330	2.793	330	2.793	330	2.793	330	3.178	330	4.622
335	5.58	0.969	335	3.779	335	2.810	335	2.810	335	2.810	335	3.198	335	4.651
340	5.67	0.975	340	3.803	340	2.828	340	2.828	340	2.828	340	3.218	340	4.680
345	5.75	0.981	345	3.826	345	2.845	345	2.845	345	2.845	345	3.237	345	4.709
350	5.83	0.988	350	3.853	350	2.865	350	2.865	350	2.865	350	3.260	350	4.742
355	5.92	0.994	355	3.877	355	2.883	355	2.883	355	2.883	355	3.280	355	4.771
360	6.00	1.000	360	3.900	360	2.900	360	2.900	360	2.900	360	3.300	360	4.800

1. Time values for the 6 hr distribution are determined by dividing the time intervals from the SCS Type B - 24 hr distribution by 4.

2. P_x/P_6 ratios correspond to P_x/P_{24} ratios at times (in minutes) that are 4 times greater than P_x/P_6 times. For example, P_x/P_6 at 100 minutes equals P_x/P_{24} at 400 minutes.

3. $P_{100,6}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type B - 10 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{10,24}$[2]= 5.4		SCS Type B - 24 Hr Distribution Jamul Basin $P_{10,24}$[2]= 3.4		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{10,24}$[2]= 3.2		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{10,24}$[2]= 3.7		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{10,24}$[2]= 3.8		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{10,24}$[2]= 6.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.002	5	0.011	5	0.007	5	0.006	5	0.007	5	0.008	5	0.013
10	0.17	0.003	10	0.016	10	0.010	10	0.010	10	0.011	10	0.011	10	0.020
15	0.25	0.005	15	0.027	15	0.017	15	0.016	15	0.019	15	0.019	15	0.034
20	0.33	0.006	20	0.032	20	0.020	20	0.019	20	0.022	20	0.023	20	0.040
25	0.42	0.008	25	0.043	25	0.027	25	0.026	25	0.030	25	0.030	25	0.054
30	0.50	0.009	30	0.049	30	0.031	30	0.029	30	0.033	30	0.034	30	0.060
35	0.58	0.010	35	0.054	35	0.034	35	0.032	35	0.037	35	0.038	35	0.067
40	0.67	0.011	40	0.059	40	0.037	40	0.035	40	0.041	40	0.042	40	0.074
45	0.75	0.013	45	0.070	45	0.044	45	0.042	45	0.048	45	0.049	45	0.087
50	0.83	0.014	50	0.076	50	0.048	50	0.045	50	0.052	50	0.053	50	0.094
55	0.92	0.015	55	0.081	55	0.051	55	0.048	55	0.056	55	0.057	55	0.101
60	1.00	0.016	60	0.086	60	0.054	60	0.051	60	0.059	60	0.061	60	0.107
65	1.08	0.018	65	0.097	65	0.061	65	0.058	65	0.067	65	0.068	65	0.121
70	1.17	0.019	70	0.103	70	0.065	70	0.061	70	0.070	70	0.072	70	0.127
75	1.25	0.021	75	0.113	75	0.071	75	0.067	75	0.078	75	0.080	75	0.141
80	1.33	0.022	80	0.119	80	0.075	80	0.070	80	0.081	80	0.084	80	0.147
85	1.42	0.024	85	0.130	85	0.082	85	0.077	85	0.089	85	0.091	85	0.161
90	1.50	0.025	90	0.135	90	0.085	90	0.080	90	0.093	90	0.095	90	0.168
95	1.58	0.027	95	0.146	95	0.092	95	0.086	95	0.100	95	0.103	95	0.181
100	1.67	0.028	100	0.151	100	0.095	100	0.090	100	0.104	100	0.106	100	0.188
105	1.75	0.030	105	0.162	105	0.102	105	0.096	105	0.111	105	0.114	105	0.201
110	1.83	0.031	110	0.167	110	0.105	110	0.099	110	0.115	110	0.118	110	0.208
115	1.92	0.033	115	0.178	115	0.112	115	0.106	115	0.122	115	0.125	115	0.221
120	2.00	0.034	120	0.184	120	0.116	120	0.109	120	0.126	120	0.129	120	0.228
125	2.08	0.036	125	0.194	125	0.122	125	0.115	125	0.133	125	0.137	125	0.241
130	2.17	0.038	130	0.205	130	0.129	130	0.122	130	0.141	130	0.144	130	0.255
135	2.25	0.040	135	0.216	135	0.136	135	0.128	135	0.148	135	0.152	135	0.268
140	2.33	0.041	140	0.221	140	0.139	140	0.131	140	0.152	140	0.156	140	0.275
145	2.42	0.043	145	0.232	145	0.146	145	0.138	145	0.159	145	0.163	145	0.288
150	2.50	0.045	150	0.243	150	0.153	150	0.144	150	0.167	150	0.171	150	0.302
155	2.58	0.047	155	0.254	155	0.160	155	0.150	155	0.174	155	0.179	155	0.315
160	2.67	0.048	160	0.259	160	0.163	160	0.154	160	0.178	160	0.182	160	0.322
165	2.75	0.050	165	0.270	165	0.170	165	0.160	165	0.185	165	0.190	165	0.335
170	2.83	0.051	170	0.275	170	0.173	170	0.163	170	0.189	170	0.194	170	0.342
175	2.92	0.053	175	0.286	175	0.180	175	0.170	175	0.196	175	0.201	175	0.355
180	3.00	0.054	180	0.292	180	0.184	180	0.173	180	0.200	180	0.205	180	0.362
185	3.08	0.056	185	0.302	185	0.190	185	0.179	185	0.207	185	0.213	185	0.375
190	3.17	0.058	190	0.313	190	0.197	190	0.186	190	0.215	190	0.220	190	0.389
195	3.25	0.060	195	0.324	195	0.204	195	0.192	195	0.222	195	0.228	195	0.402
200	3.33	0.061	200	0.329	200	0.207	200	0.195	200	0.226	200	0.232	200	0.409
205	3.42	0.063	205	0.340	205	0.214	205	0.202	205	0.233	205	0.239	205	0.422
210	3.50	0.065	210	0.351	210	0.221	210	0.208	210	0.241	210	0.247	210	0.436
215	3.58	0.067	215	0.362	215	0.228	215	0.214	215	0.248	215	0.255	215	0.449
220	3.67	0.069	220	0.373	220	0.235	220	0.221	220	0.255	220	0.262	220	0.462
225	3.75	0.071	225	0.383	225	0.241	225	0.227	225	0.263	225	0.270	225	0.476
230	3.83	0.073	230	0.394	230	0.248	230	0.234	230	0.270	230	0.277	230	0.489
235	3.92	0.075	235	0.405	235	0.255	235	0.240	235	0.278	235	0.285	235	0.503
240	4.00	0.077	240	0.416	240	0.262	240	0.246	240	0.285	240	0.293	240	0.516
245	4.08	0.079	245	0.427	245	0.269	245	0.253	245	0.292	245	0.300	245	0.529
250	4.17	0.081	250	0.437	250	0.275	250	0.259	250	0.300	250	0.308	250	0.543
255	4.25	0.084	255	0.454	255	0.286	255	0.269	255	0.311	255	0.319	255	0.563
260	4.33	0.086	260	0.464	260	0.292	260	0.275	260	0.318	260	0.327	260	0.576
265	4.42	0.088	265	0.475	265	0.299	265	0.282	265	0.326	265	0.334	265	0.590

SCS Type B - 10 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{10,24}$[2]= 5.4		SCS Type B - 24 Hr Distribution Jamul Basin $P_{10,24}$[2]= 3.4		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{10,24}$[2]= 3.2		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{10,24}$[2]= 3.7		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{10,24}$[2]= 3.8		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{10,24}$[2]= 6.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.090	270	0.486	270	0.306	270	0.288	270	0.333	270	0.342	270	0.603
275	4.58	0.092	275	0.497	275	0.313	275	0.294	275	0.340	275	0.350	275	0.616
280	4.67	0.095	280	0.513	280	0.323	280	0.304	280	0.352	280	0.361	280	0.637
285	4.75	0.097	285	0.524	285	0.330	285	0.310	285	0.359	285	0.369	285	0.650
290	4.83	0.099	290	0.535	290	0.337	290	0.317	290	0.366	290	0.376	290	0.663
295	4.92	0.102	295	0.551	295	0.347	295	0.326	295	0.377	295	0.388	295	0.683
300	5.00	0.104	300	0.562	300	0.354	300	0.333	300	0.385	300	0.395	300	0.697
305	5.08	0.107	305	0.578	305	0.364	305	0.342	305	0.396	305	0.407	305	0.717
310	5.17	0.109	310	0.589	310	0.371	310	0.349	310	0.403	310	0.414	310	0.730
315	5.25	0.112	315	0.605	315	0.381	315	0.358	315	0.414	315	0.426	315	0.750
320	5.33	0.115	320	0.621	320	0.391	320	0.368	320	0.426	320	0.437	320	0.771
325	5.42	0.117	325	0.632	325	0.398	325	0.374	325	0.433	325	0.445	325	0.784
330	5.50	0.120	330	0.648	330	0.408	330	0.384	330	0.444	330	0.456	330	0.804
335	5.58	0.123	335	0.664	335	0.418	335	0.394	335	0.455	335	0.467	335	0.824
340	5.67	0.126	340	0.680	340	0.428	340	0.403	340	0.466	340	0.479	340	0.844
345	5.75	0.129	345	0.697	345	0.439	345	0.413	345	0.477	345	0.490	345	0.864
350	5.83	0.131	350	0.707	350	0.445	350	0.419	350	0.485	350	0.498	350	0.878
355	5.92	0.134	355	0.724	355	0.456	355	0.429	355	0.496	355	0.509	355	0.898
360	6.00	0.137	360	0.740	360	0.466	360	0.438	360	0.507	360	0.521	360	0.918
365	6.08	0.140	365	0.756	365	0.476	365	0.448	365	0.518	365	0.532	365	0.938
370	6.17	0.144	370	0.778	370	0.490	370	0.461	370	0.533	370	0.547	370	0.965
375	6.25	0.147	375	0.794	375	0.500	375	0.470	375	0.544	375	0.559	375	0.985
380	6.33	0.150	380	0.810	380	0.510	380	0.480	380	0.555	380	0.570	380	1.005
385	6.42	0.154	385	0.832	385	0.524	385	0.493	385	0.570	385	0.585	385	1.032
390	6.50	0.157	390	0.848	390	0.534	390	0.502	390	0.581	390	0.597	390	1.052
395	6.58	0.161	395	0.869	395	0.547	395	0.515	395	0.596	395	0.612	395	1.079
400	6.67	0.165	400	0.891	400	0.561	400	0.528	400	0.611	400	0.627	400	1.106
405	6.75	0.169	405	0.913	405	0.575	405	0.541	405	0.625	405	0.642	405	1.132
410	6.83	0.172	410	0.929	410	0.585	410	0.550	410	0.636	410	0.654	410	1.152
415	6.92	0.176	415	0.950	415	0.598	415	0.563	415	0.651	415	0.669	415	1.179
420	7.00	0.180	420	0.972	420	0.612	420	0.576	420	0.666	420	0.684	420	1.206
425	7.08	0.185	425	0.999	425	0.629	425	0.592	425	0.685	425	0.703	425	1.240
430	7.17	0.190	430	1.026	430	0.646	430	0.608	430	0.703	430	0.722	430	1.273
435	7.25	0.195	435	1.053	435	0.663	435	0.624	435	0.722	435	0.741	435	1.307
440	7.33	0.200	440	1.080	440	0.680	440	0.640	440	0.740	440	0.760	440	1.340
445	7.42	0.205	445	1.107	445	0.697	445	0.656	445	0.759	445	0.779	445	1.374
450	7.50	0.210	450	1.134	450	0.714	450	0.672	450	0.777	450	0.798	450	1.407
455	7.58	0.218	455	1.177	455	0.741	455	0.698	455	0.807	455	0.828	455	1.461
460	7.67	0.225	460	1.215	460	0.765	460	0.720	460	0.833	460	0.855	460	1.508
465	7.75	0.233	465	1.258	465	0.792	465	0.746	465	0.862	465	0.885	465	1.561
470	7.83	0.240	470	1.296	470	0.816	470	0.768	470	0.888	470	0.912	470	1.608
475	7.92	0.248	475	1.339	475	0.843	475	0.794	475	0.918	475	0.942	475	1.662
480	8.00	0.255	480	1.377	480	0.867	480	0.816	480	0.944	480	0.969	480	1.709
485	8.08	0.266	485	1.436	485	0.904	485	0.851	485	0.984	485	1.011	485	1.782
490	8.17	0.277	490	1.496	490	0.942	490	0.886	490	1.025	490	1.053	490	1.856
495	8.25	0.289	495	1.561	495	0.983	495	0.925	495	1.069	495	1.098	495	1.936
500	8.33	0.300	500	1.620	500	1.020	500	0.960	500	1.110	500	1.140	500	2.010
505	8.42	0.311	505	1.679	505	1.057	505	0.995	505	1.151	505	1.182	505	2.084
510	8.50	0.322	510	1.739	510	1.095	510	1.030	510	1.191	510	1.224	510	2.157
515	8.58	0.337	515	1.820	515	1.146	515	1.078	515	1.247	515	1.281	515	2.258
520	8.67	0.351	520	1.895	520	1.193	520	1.123	520	1.299	520	1.334	520	2.352
525	8.75	0.366	525	1.976	525	1.244	525	1.171	525	1.354	525	1.391	525	2.452
530	8.83	0.381	530	2.057	530	1.295	530	1.219	530	1.410	530	1.448	530	2.553
535	8.92	0.395	535	2.133	535	1.343	535	1.264	535	1.462	535	1.501	535	2.647

SCS Type B - 10 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{10,24}$[2]= 5.4		SCS Type B - 24 Hr Distribution Jamul Basin $P_{10,24}$[2]= 3.4		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{10,24}$[2]= 3.2		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{10,24}$[2]= 3.7		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{10,24}$[2]= 3.8		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{10,24}$[2]= 6.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
540	9.00	0.410	540	2.214	540	1.394	540	1.312	540	1.517	540	1.558	540	2.747
545	9.08	0.426	545	2.300	545	1.448	545	1.363	545	1.576	545	1.619	545	2.854
550	9.17	0.442	550	2.387	550	1.503	550	1.414	550	1.635	550	1.680	550	2.961
555	9.25	0.458	555	2.473	555	1.557	555	1.466	555	1.695	555	1.740	555	3.069
560	9.33	0.474	560	2.560	560	1.612	560	1.517	560	1.754	560	1.801	560	3.176
565	9.42	0.490	565	2.646	565	1.666	565	1.568	565	1.813	565	1.862	565	3.283
570	9.50	0.506	570	2.732	570	1.720	570	1.619	570	1.872	570	1.923	570	3.390
575	9.58	0.520	575	2.808	575	1.768	575	1.664	575	1.924	575	1.976	575	3.484
580	9.67	0.533	580	2.878	580	1.812	580	1.706	580	1.972	580	2.025	580	3.571
585	9.75	0.547	585	2.954	585	1.860	585	1.750	585	2.024	585	2.079	585	3.665
590	9.83	0.561	590	3.029	590	1.907	590	1.795	590	2.076	590	2.132	590	3.759
595	9.92	0.574	595	3.100	595	1.952	595	1.837	595	2.124	595	2.181	595	3.846
600	10.00	0.588	600	3.175	600	1.999	600	1.882	600	2.176	600	2.234	600	3.940
605	10.08	0.595	605	3.213	605	2.023	605	1.904	605	2.202	605	2.261	605	3.987
610	10.17	0.602	610	3.251	610	2.047	610	1.926	610	2.227	610	2.288	610	4.033
615	10.25	0.609	615	3.289	615	2.071	615	1.949	615	2.253	615	2.314	615	4.080
620	10.33	0.615	620	3.321	620	2.091	620	1.968	620	2.276	620	2.337	620	4.121
625	10.42	0.622	625	3.359	625	2.115	625	1.990	625	2.301	625	2.364	625	4.167
630	10.50	0.629	630	3.397	630	2.139	630	2.013	630	2.327	630	2.390	630	4.214
635	10.58	0.634	635	3.424	635	2.156	635	2.029	635	2.346	635	2.409	635	4.248
640	10.67	0.638	640	3.445	640	2.169	640	2.042	640	2.361	640	2.424	640	4.275
645	10.75	0.643	645	3.472	645	2.186	645	2.058	645	2.379	645	2.443	645	4.308
650	10.83	0.647	650	3.494	650	2.200	650	2.070	650	2.394	650	2.459	650	4.335
655	10.92	0.652	655	3.521	655	2.217	655	2.086	655	2.412	655	2.478	655	4.368
660	11.00	0.656	660	3.542	660	2.230	660	2.099	660	2.427	660	2.493	660	4.395
665	11.08	0.660	665	3.564	665	2.244	665	2.112	665	2.442	665	2.508	665	4.422
670	11.17	0.664	670	3.586	670	2.258	670	2.125	670	2.457	670	2.523	670	4.449
675	11.25	0.668	675	3.607	675	2.271	675	2.138	675	2.472	675	2.538	675	4.476
680	11.33	0.671	680	3.623	680	2.281	680	2.147	680	2.483	680	2.550	680	4.496
685	11.42	0.675	685	3.645	685	2.295	685	2.160	685	2.498	685	2.565	685	4.523
690	11.50	0.679	690	3.667	690	2.309	690	2.173	690	2.512	690	2.580	690	4.549
695	11.58	0.683	695	3.688	695	2.322	695	2.186	695	2.527	695	2.595	695	4.576
700	11.67	0.686	700	3.704	700	2.332	700	2.195	700	2.538	700	2.607	700	4.596
705	11.75	0.690	705	3.726	705	2.346	705	2.208	705	2.553	705	2.622	705	4.623
710	11.83	0.693	710	3.742	710	2.356	710	2.218	710	2.564	710	2.633	710	4.643
715	11.92	0.697	715	3.764	715	2.370	715	2.230	715	2.579	715	2.649	715	4.670
720	12.00	0.700	720	3.780	720	2.380	720	2.240	720	2.590	720	2.660	720	4.690
725	12.08	0.703	725	3.796	725	2.390	725	2.250	725	2.601	725	2.671	725	4.710
730	12.17	0.707	730	3.818	730	2.404	730	2.262	730	2.616	730	2.687	730	4.737
735	12.25	0.710	735	3.834	735	2.414	735	2.272	735	2.627	735	2.698	735	4.757
740	12.33	0.713	740	3.850	740	2.424	740	2.282	740	2.638	740	2.709	740	4.777
745	12.42	0.717	745	3.872	745	2.438	745	2.294	745	2.653	745	2.725	745	4.804
750	12.50	0.720	750	3.888	750	2.448	750	2.304	750	2.664	750	2.736	750	4.824
755	12.58	0.723	755	3.904	755	2.458	755	2.314	755	2.675	755	2.747	755	4.844
760	12.67	0.726	760	3.920	760	2.468	760	2.323	760	2.686	760	2.759	760	4.864
765	12.75	0.730	765	3.942	765	2.482	765	2.336	765	2.701	765	2.774	765	4.891
770	12.83	0.733	770	3.958	770	2.492	770	2.346	770	2.712	770	2.785	770	4.911
775	12.92	0.736	775	3.974	775	2.502	775	2.355	775	2.723	775	2.797	775	4.931
780	13.00	0.739	780	3.991	780	2.513	780	2.365	780	2.734	780	2.808	780	4.951
785	13.08	0.742	785	4.007	785	2.523	785	2.374	785	2.745	785	2.820	785	4.971
790	13.17	0.745	790	4.023	790	2.533	790	2.384	790	2.757	790	2.831	790	4.992
795	13.25	0.748	795	4.039	795	2.543	795	2.394	795	2.768	795	2.842	795	5.012
800	13.33	0.750	800	4.050	800	2.550	800	2.400	800	2.775	800	2.850	800	5.025
805	13.42	0.753	805	4.066	805	2.560	805	2.410	805	2.786	805	2.861	805	5.045

SCS Type B - 10 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{10,24}$[2]= 5.4		SCS Type B - 24 Hr Distribution Jamul Basin $P_{10,24}$[2]= 3.4		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{10,24}$[2]= 3.2		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{10,24}$[2]= 3.7		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{10,24}$[2]= 3.8		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{10,24}$[2]= 6.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
810	13.50	0.756	810	4.082	810	2.570	810	2.419	810	2.797	810	2.873	810	5.065
815	13.58	0.759	815	4.099	815	2.581	815	2.429	815	2.808	815	2.884	815	5.085
820	13.67	0.761	820	4.109	820	2.587	820	2.435	820	2.816	820	2.892	820	5.099
825	13.75	0.764	825	4.126	825	2.598	825	2.445	825	2.827	825	2.903	825	5.119
830	13.83	0.767	830	4.142	830	2.608	830	2.454	830	2.838	830	2.915	830	5.139
835	13.92	0.769	835	4.153	835	2.615	835	2.461	835	2.845	835	2.922	835	5.152
840	14.00	0.772	840	4.169	840	2.625	840	2.470	840	2.856	840	2.934	840	5.172
845	14.08	0.775	845	4.185	845	2.635	845	2.480	845	2.868	845	2.945	845	5.193
850	14.17	0.778	850	4.201	850	2.645	850	2.490	850	2.879	850	2.956	850	5.213
855	14.25	0.781	855	4.217	855	2.655	855	2.499	855	2.890	855	2.968	855	5.233
860	14.33	0.784	860	4.234	860	2.666	860	2.509	860	2.901	860	2.979	860	5.253
865	14.42	0.787	865	4.250	865	2.676	865	2.518	865	2.912	865	2.991	865	5.273
870	14.50	0.790	870	4.266	870	2.686	870	2.528	870	2.923	870	3.002	870	5.293
875	14.58	0.792	875	4.277	875	2.693	875	2.534	875	2.930	875	3.010	875	5.306
880	14.67	0.793	880	4.282	880	2.696	880	2.538	880	2.934	880	3.013	880	5.313
885	14.75	0.795	885	4.293	885	2.703	885	2.544	885	2.942	885	3.021	885	5.327
890	14.83	0.797	890	4.304	890	2.710	890	2.550	890	2.949	890	3.029	890	5.340
895	14.92	0.798	895	4.309	895	2.713	895	2.554	895	2.953	895	3.032	895	5.347
900	15.00	0.800	900	4.320	900	2.720	900	2.560	900	2.960	900	3.040	900	5.360
905	15.08	0.803	905	4.336	905	2.730	905	2.570	905	2.971	905	3.051	905	5.380
910	15.17	0.805	910	4.347	910	2.737	910	2.576	910	2.979	910	3.059	910	5.394
915	15.25	0.808	915	4.363	915	2.747	915	2.586	915	2.990	915	3.070	915	5.414
920	15.33	0.811	920	4.379	920	2.757	920	2.595	920	3.001	920	3.082	920	5.434
925	15.42	0.813	925	4.390	925	2.764	925	2.602	925	3.008	925	3.089	925	5.447
930	15.50	0.816	930	4.406	930	2.774	930	2.611	930	3.019	930	3.101	930	5.467
935	15.58	0.819	935	4.423	935	2.785	935	2.621	935	3.030	935	3.112	935	5.487
940	15.67	0.821	940	4.433	940	2.791	940	2.627	940	3.038	940	3.120	940	5.501
945	15.75	0.824	945	4.450	945	2.802	945	2.637	945	3.049	945	3.131	945	5.521
950	15.83	0.826	950	4.460	950	2.808	950	2.643	950	3.056	950	3.139	950	5.534
955	15.92	0.829	955	4.477	955	2.819	955	2.653	955	3.067	955	3.150	955	5.554
960	16.00	0.831	960	4.487	960	2.825	960	2.659	960	3.075	960	3.158	960	5.568
965	16.08	0.833	965	4.498	965	2.832	965	2.666	965	3.082	965	3.165	965	5.581
970	16.17	0.836	970	4.514	970	2.842	970	2.675	970	3.093	970	3.177	970	5.601
975	16.25	0.838	975	4.525	975	2.849	975	2.682	975	3.101	975	3.184	975	5.615
980	16.33	0.840	980	4.536	980	2.856	980	2.688	980	3.108	980	3.192	980	5.628
985	16.42	0.843	985	4.552	985	2.866	985	2.698	985	3.119	985	3.203	985	5.648
990	16.50	0.845	990	4.563	990	2.873	990	2.704	990	3.127	990	3.211	990	5.662
995	16.58	0.848	995	4.579	995	2.883	995	2.714	995	3.138	995	3.222	995	5.682
1000	16.67	0.850	1000	4.590	1000	2.890	1000	2.720	1000	3.145	1000	3.230	1000	5.695
1005	16.75	0.853	1005	4.606	1005	2.900	1005	2.730	1005	3.156	1005	3.241	1005	5.715
1010	16.83	0.855	1010	4.617	1010	2.907	1010	2.736	1010	3.164	1010	3.249	1010	5.729
1015	16.92	0.858	1015	4.633	1015	2.917	1015	2.746	1015	3.175	1015	3.260	1015	5.749
1020	17.00	0.860	1020	4.644	1020	2.924	1020	2.752	1020	3.182	1020	3.268	1020	5.762
1025	17.08	0.862	1025	4.655	1025	2.931	1025	2.758	1025	3.189	1025	3.276	1025	5.775
1030	17.17	0.864	1030	4.666	1030	2.938	1030	2.765	1030	3.197	1030	3.283	1030	5.789
1035	17.25	0.866	1035	4.676	1035	2.944	1035	2.771	1035	3.204	1035	3.291	1035	5.802
1040	17.33	0.868	1040	4.687	1040	2.951	1040	2.778	1040	3.212	1040	3.298	1040	5.816
1045	17.42	0.870	1045	4.698	1045	2.958	1045	2.784	1045	3.219	1045	3.306	1045	5.829
1050	17.50	0.872	1050	4.709	1050	2.965	1050	2.790	1050	3.226	1050	3.314	1050	5.842
1055	17.58	0.874	1055	4.720	1055	2.972	1055	2.797	1055	3.234	1055	3.321	1055	5.856
1060	17.67	0.876	1060	4.730	1060	2.978	1060	2.803	1060	3.241	1060	3.329	1060	5.869
1065	17.75	0.879	1065	4.747	1065	2.989	1065	2.813	1065	3.252	1065	3.340	1065	5.889
1070	17.83	0.881	1070	4.757	1070	2.995	1070	2.819	1070	3.260	1070	3.348	1070	5.903
1075	17.92	0.883	1075	4.768	1075	3.002	1075	2.826	1075	3.267	1075	3.355	1075	5.916

SCS Type B - 10 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{10,24}$[2]= 5.4		SCS Type B - 24 Hr Distribution Jamul Basin $P_{10,24}$[2]= 3.4		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{10,24}$[2]= 3.2		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{10,24}$[2]= 3.7		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{10,24}$[2]= 3.8		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{10,24}$[2]= 6.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1080	18.00	0.885	1080	4.779	1080	3.009	1080	2.832	1080	3.275	1080	3.363	1080	5.930
1085	18.08	0.887	1085	4.790	1085	3.016	1085	2.838	1085	3.282	1085	3.371	1085	5.943
1090	18.17	0.888	1090	4.795	1090	3.019	1090	2.842	1090	3.286	1090	3.374	1090	5.950
1095	18.25	0.890	1095	4.806	1095	3.026	1095	2.848	1095	3.293	1095	3.382	1095	5.963
1100	18.33	0.892	1100	4.817	1100	3.033	1100	2.854	1100	3.300	1100	3.390	1100	5.976
1105	18.42	0.893	1105	4.822	1105	3.036	1105	2.858	1105	3.304	1105	3.393	1105	5.983
1110	18.50	0.895	1110	4.833	1110	3.043	1110	2.864	1110	3.312	1110	3.401	1110	5.997
1115	18.58	0.897	1115	4.844	1115	3.050	1115	2.870	1115	3.319	1115	3.409	1115	6.010
1120	18.67	0.898	1120	4.849	1120	3.053	1120	2.874	1120	3.323	1120	3.412	1120	6.017
1125	18.75	0.900	1125	4.860	1125	3.060	1125	2.880	1125	3.330	1125	3.420	1125	6.030
1130	18.83	0.902	1130	4.871	1130	3.067	1130	2.886	1130	3.337	1130	3.428	1130	6.043
1135	18.92	0.903	1135	4.876	1135	3.070	1135	2.890	1135	3.341	1135	3.431	1135	6.050
1140	19.00	0.905	1140	4.887	1140	3.077	1140	2.896	1140	3.349	1140	3.439	1140	6.064
1145	19.08	0.907	1145	4.898	1145	3.084	1145	2.902	1145	3.356	1145	3.447	1145	6.077
1150	19.17	0.908	1150	4.903	1150	3.087	1150	2.906	1150	3.360	1150	3.450	1150	6.084
1155	19.25	0.910	1155	4.914	1155	3.094	1155	2.912	1155	3.367	1155	3.458	1155	6.097
1160	19.33	0.911	1160	4.919	1160	3.097	1160	2.915	1160	3.371	1160	3.462	1160	6.104
1165	19.42	0.913	1165	4.930	1165	3.104	1165	2.922	1165	3.378	1165	3.469	1165	6.117
1170	19.50	0.914	1170	4.936	1170	3.108	1170	2.925	1170	3.382	1170	3.473	1170	6.124
1175	19.58	0.916	1175	4.946	1175	3.114	1175	2.931	1175	3.389	1175	3.481	1175	6.137
1180	19.67	0.917	1180	4.952	1180	3.118	1180	2.934	1180	3.393	1180	3.485	1180	6.144
1185	19.75	0.919	1185	4.963	1185	3.125	1185	2.941	1185	3.400	1185	3.492	1185	6.157
1190	19.83	0.921	1190	4.973	1190	3.131	1190	2.947	1190	3.408	1190	3.500	1190	6.171
1195	19.92	0.922	1195	4.979	1195	3.135	1195	2.950	1195	3.411	1195	3.504	1195	6.177
1200	20.00	0.924	1200	4.990	1200	3.142	1200	2.957	1200	3.419	1200	3.511	1200	6.191
1205	20.08	0.926	1205	5.000	1205	3.148	1205	2.963	1205	3.426	1205	3.519	1205	6.204
1210	20.17	0.928	1210	5.011	1210	3.155	1210	2.970	1210	3.434	1210	3.526	1210	6.218
1215	20.25	0.930	1215	5.022	1215	3.162	1215	2.976	1215	3.441	1215	3.534	1215	6.231
1220	20.33	0.931	1220	5.027	1220	3.165	1220	2.979	1220	3.445	1220	3.538	1220	6.238
1225	20.42	0.933	1225	5.038	1225	3.172	1225	2.986	1225	3.452	1225	3.545	1225	6.251
1230	20.50	0.935	1230	5.049	1230	3.179	1230	2.992	1230	3.460	1230	3.553	1230	6.265
1235	20.58	0.937	1235	5.060	1235	3.186	1235	2.998	1235	3.467	1235	3.561	1235	6.278
1240	20.67	0.938	1240	5.065	1240	3.189	1240	3.002	1240	3.471	1240	3.564	1240	6.285
1245	20.75	0.940	1245	5.076	1245	3.196	1245	3.008	1245	3.478	1245	3.572	1245	6.298
1250	20.83	0.942	1250	5.087	1250	3.203	1250	3.014	1250	3.485	1250	3.580	1250	6.311
1255	20.92	0.943	1255	5.092	1255	3.206	1255	3.018	1255	3.489	1255	3.583	1255	6.318
1260	21.00	0.945	1260	5.103	1260	3.213	1260	3.024	1260	3.497	1260	3.591	1260	6.332
1265	21.08	0.947	1265	5.114	1265	3.220	1265	3.030	1265	3.504	1265	3.599	1265	6.345
1270	21.17	0.948	1270	5.119	1270	3.223	1270	3.034	1270	3.508	1270	3.602	1270	6.352
1275	21.25	0.950	1275	5.130	1275	3.230	1275	3.040	1275	3.515	1275	3.610	1275	6.365
1280	21.33	0.951	1280	5.135	1280	3.233	1280	3.043	1280	3.519	1280	3.614	1280	6.372
1285	21.42	0.953	1285	5.146	1285	3.240	1285	3.050	1285	3.526	1285	3.621	1285	6.385
1290	21.50	0.954	1290	5.152	1290	3.244	1290	3.053	1290	3.530	1290	3.625	1290	6.392
1295	21.58	0.956	1295	5.162	1295	3.250	1295	3.059	1295	3.537	1295	3.633	1295	6.405
1300	21.67	0.957	1300	5.168	1300	3.254	1300	3.062	1300	3.541	1300	3.637	1300	6.412
1305	21.75	0.959	1305	5.179	1305	3.261	1305	3.069	1305	3.548	1305	3.644	1305	6.425
1310	21.83	0.960	1310	5.184	1310	3.264	1310	3.072	1310	3.552	1310	3.648	1310	6.432
1315	21.92	0.962	1315	5.195	1315	3.271	1315	3.078	1315	3.559	1315	3.656	1315	6.445
1320	22.00	0.963	1320	5.200	1320	3.274	1320	3.082	1320	3.563	1320	3.659	1320	6.452
1325	22.08	0.965	1325	5.211	1325	3.281	1325	3.088	1325	3.571	1325	3.667	1325	6.466
1330	22.17	0.966	1330	5.216	1330	3.284	1330	3.091	1330	3.574	1330	3.671	1330	6.472
1335	22.25	0.968	1335	5.227	1335	3.291	1335	3.098	1335	3.582	1335	3.678	1335	6.486
1340	22.33	0.969	1340	5.233	1340	3.295	1340	3.101	1340	3.585	1340	3.682	1340	6.492
1345	22.42	0.971	1345	5.243	1345	3.301	1345	3.107	1345	3.593	1345	3.690	1345	6.506

SCS Type B - 10 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{10,24}$[2]= 5.4		SCS Type B - 24 Hr Distribution Jamul Basin $P_{10,24}$[2]= 3.4		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{10,24}$[2]= 3.2		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{10,24}$[2]= 3.7		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{10,24}$[2]= 3.8		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{10,24}$[2]= 6.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1350	22.50	0.972	1350	5.249	1350	3.305	1350	3.110	1350	3.596	1350	3.694	1350	6.512
1355	22.58	0.974	1355	5.260	1355	3.312	1355	3.117	1355	3.604	1355	3.701	1355	6.526
1360	22.67	0.975	1360	5.265	1360	3.315	1360	3.120	1360	3.608	1360	3.705	1360	6.533
1365	22.75	0.977	1365	5.276	1365	3.322	1365	3.126	1365	3.615	1365	3.713	1365	6.546
1370	22.83	0.978	1370	5.281	1370	3.325	1370	3.130	1370	3.619	1370	3.716	1370	6.553
1375	22.92	0.980	1375	5.292	1375	3.332	1375	3.136	1375	3.626	1375	3.724	1375	6.566
1380	23.00	0.981	1380	5.297	1380	3.335	1380	3.139	1380	3.630	1380	3.728	1380	6.573
1385	23.08	0.983	1385	5.308	1385	3.342	1385	3.146	1385	3.637	1385	3.735	1385	6.586
1390	23.17	0.984	1390	5.314	1390	3.346	1390	3.149	1390	3.641	1390	3.739	1390	6.593
1395	23.25	0.986	1395	5.324	1395	3.352	1395	3.155	1395	3.648	1395	3.747	1395	6.606
1400	23.33	0.988	1400	5.335	1400	3.359	1400	3.162	1400	3.656	1400	3.754	1400	6.620
1405	23.42	0.989	1405	5.341	1405	3.363	1405	3.165	1405	3.659	1405	3.758	1405	6.626
1410	23.50	0.991	1410	5.351	1410	3.369	1410	3.171	1410	3.667	1410	3.766	1410	6.640
1415	23.58	0.993	1415	5.362	1415	3.376	1415	3.178	1415	3.674	1415	3.773	1415	6.653
1420	23.67	0.994	1420	5.368	1420	3.380	1420	3.181	1420	3.678	1420	3.777	1420	6.660
1425	23.75	0.996	1425	5.378	1425	3.386	1425	3.187	1425	3.685	1425	3.785	1425	6.673
1430	23.83	0.997	1430	5.384	1430	3.390	1430	3.190	1430	3.689	1430	3.789	1430	6.680
1435	23.92	0.999	1435	5.395	1435	3.397	1435	3.197	1435	3.696	1435	3.796	1435	6.693
1440	24.00	1.000	1440	5.400	1440	3.400	1440	3.200	1440	3.700	1440	3.800	1440	6.700

1. P_x/P_{24} values at 30 minute intervals have been determined per values indicated in Table II-B-2 of the 1993 SCHM. P_x/P_{24} values at 5 minute intervals have been linearly interpolated from the 30-minute data.

2. $P_{10,24}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type B - 10 Yr - 6 Hr Distribution

SCS Type B - 6 Hr Distribution Ratios			SCS Type B - 6 Hr Distribution Guejito Basin $P_{10,6}$ [3]= 2.5		SCS Type B - 6 Hr Distribution Jamul Basin $P_{10,6}$ [3]= 1.9		SCS Type B - 6 Hr Distribution Las Flores Basin $P_{10,6}$ [3]= 1.8		SCS Type B - 6 Hr Distribution Los Coches Basin $P_{10,6}$ [3]= 1.9		SCS Type B - 6 Hr Distribution Santa Maria Basin $P_{10,6}$ [3]= 2.3		SCS Type B - 6 Hr Distribution Sweetwater Basin $P_{10,6}$ [3]= 3.3	
Time [1] (min)	Time (hrs)	P_x/P_6 [2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.006	5	0.015	5	0.011	5	0.011	5	0.011	5	0.014	5	0.020
10	0.17	0.011	10	0.028	10	0.021	10	0.020	10	0.021	10	0.025	10	0.036
15	0.25	0.016	15	0.040	15	0.030	15	0.029	15	0.030	15	0.037	15	0.053
20	0.33	0.022	20	0.055	20	0.042	20	0.040	20	0.042	20	0.051	20	0.073
25	0.42	0.028	25	0.070	25	0.053	25	0.050	25	0.053	25	0.064	25	0.092
30	0.50	0.034	30	0.085	30	0.065	30	0.061	30	0.065	30	0.078	30	0.112
35	0.58	0.041	35	0.103	35	0.078	35	0.074	35	0.078	35	0.094	35	0.135
40	0.67	0.048	40	0.120	40	0.091	40	0.086	40	0.091	40	0.110	40	0.158
45	0.75	0.054	45	0.135	45	0.103	45	0.097	45	0.103	45	0.124	45	0.178
50	0.83	0.061	50	0.153	50	0.116	50	0.110	50	0.116	50	0.140	50	0.201
55	0.92	0.069	55	0.173	55	0.131	55	0.124	55	0.131	55	0.159	55	0.228
60	1.00	0.077	60	0.193	60	0.146	60	0.139	60	0.146	60	0.177	60	0.254
65	1.08	0.086	65	0.215	65	0.163	65	0.155	65	0.163	65	0.198	65	0.284
70	1.17	0.095	70	0.238	70	0.181	70	0.171	70	0.181	70	0.219	70	0.314
75	1.25	0.104	75	0.260	75	0.198	75	0.187	75	0.198	75	0.239	75	0.343
80	1.33	0.115	80	0.288	80	0.219	80	0.207	80	0.219	80	0.265	80	0.380
85	1.42	0.126	85	0.315	85	0.239	85	0.227	85	0.239	85	0.290	85	0.416
90	1.50	0.137	90	0.343	90	0.260	90	0.247	90	0.260	90	0.315	90	0.452
95	1.58	0.150	95	0.375	95	0.285	95	0.270	95	0.285	95	0.345	95	0.495
100	1.67	0.165	100	0.413	100	0.314	100	0.297	100	0.314	100	0.380	100	0.545
105	1.75	0.180	105	0.450	105	0.342	105	0.324	105	0.342	105	0.414	105	0.594
110	1.83	0.200	110	0.500	110	0.380	110	0.360	110	0.380	110	0.460	110	0.660
115	1.92	0.225	115	0.563	115	0.428	115	0.405	115	0.428	115	0.518	115	0.743
120	2.00	0.255	120	0.638	120	0.485	120	0.459	120	0.485	120	0.587	120	0.842
125	2.08	0.300	125	0.750	125	0.570	125	0.540	125	0.570	125	0.690	125	0.990
130	2.17	0.351	130	0.878	130	0.667	130	0.632	130	0.667	130	0.807	130	1.158
135	2.25	0.410	135	1.025	135	0.779	135	0.738	135	0.779	135	0.943	135	1.353
140	2.33	0.474	140	1.185	140	0.901	140	0.853	140	0.901	140	1.090	140	1.564
145	2.42	0.533	145	1.333	145	1.013	145	0.959	145	1.013	145	1.226	145	1.759
150	2.50	0.588	150	1.470	150	1.117	150	1.058	150	1.117	150	1.352	150	1.940
155	2.58	0.615	155	1.538	155	1.169	155	1.107	155	1.169	155	1.415	155	2.030
160	2.67	0.638	160	1.595	160	1.212	160	1.148	160	1.212	160	1.467	160	2.105
165	2.75	0.656	165	1.640	165	1.246	165	1.181	165	1.246	165	1.509	165	2.165
170	2.83	0.671	170	1.678	170	1.275	170	1.208	170	1.275	170	1.543	170	2.214
175	2.92	0.686	175	1.715	175	1.303	175	1.235	175	1.303	175	1.578	175	2.264
180	3.00	0.700	180	1.750	180	1.330	180	1.260	180	1.330	180	1.610	180	2.310
185	3.08	0.713	185	1.783	185	1.355	185	1.283	185	1.355	185	1.640	185	2.353
190	3.17	0.726	190	1.815	190	1.379	190	1.307	190	1.379	190	1.670	190	2.396
195	3.25	0.739	195	1.848	195	1.404	195	1.330	195	1.404	195	1.700	195	2.439
200	3.33	0.750	200	1.875	200	1.425	200	1.350	200	1.425	200	1.725	200	2.475
205	3.42	0.761	205	1.903	205	1.446	205	1.370	205	1.446	205	1.750	205	2.511
210	3.50	0.772	210	1.930	210	1.467	210	1.390	210	1.467	210	1.776	210	2.548
215	3.58	0.784	215	1.960	215	1.490	215	1.411	215	1.490	215	1.803	215	2.587
220	3.67	0.793	220	1.983	220	1.507	220	1.427	220	1.507	220	1.824	220	2.617
225	3.75	0.800	225	2.000	225	1.520	225	1.440	225	1.520	225	1.840	225	2.640
230	3.83	0.811	230	2.028	230	1.541	230	1.460	230	1.541	230	1.865	230	2.676
235	3.92	0.821	235	2.053	235	1.560	235	1.478	235	1.560	235	1.888	235	2.709
240	4.00	0.831	240	2.078	240	1.579	240	1.496	240	1.579	240	1.911	240	2.742
245	4.08	0.840	245	2.100	245	1.596	245	1.512	245	1.596	245	1.932	245	2.772
250	4.17	0.850	250	2.125	250	1.615	250	1.530	250	1.615	250	1.955	250	2.805
255	4.25	0.860	255	2.150	255	1.634	255	1.548	255	1.634	255	1.978	255	2.838
260	4.33	0.868	260	2.170	260	1.649	260	1.562	260	1.649	260	1.996	260	2.864
265	4.42	0.876	265	2.190	265	1.664	265	1.577	265	1.664	265	2.015	265	2.891

SCS Type B - 10 Yr - 6 Hr Distribution

SCS Type B - 6 Hr Distribution Ratios			SCS Type B - 6 Hr Distribution Guejito Basin $P_{10,6}$[3]= 2.5		SCS Type B - 6 Hr Distribution Jamul Basin $P_{10,6}$[3]= 1.9		SCS Type B - 6 Hr Distribution Las Flores Basin $P_{10,6}$[3]= 1.8		SCS Type B - 6 Hr Distribution Los Coches Basin $P_{10,6}$[3]= 1.9		SCS Type B - 6 Hr Distribution Santa Maria Basin $P_{10,6}$[3]= 2.3		SCS Type B - 6 Hr Distribution Sweetwater Basin $P_{10,6}$[3]= 3.3	
Time[1] (min)	Time (hrs)	P_x/P_6[2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.885	270	2.213	270	1.682	270	1.593	270	1.682	270	2.036	270	2.921
275	4.58	0.892	275	2.230	275	1.695	275	1.606	275	1.695	275	2.052	275	2.944
280	4.67	0.898	280	2.245	280	1.706	280	1.616	280	1.706	280	2.065	280	2.963
285	4.75	0.905	285	2.263	285	1.720	285	1.629	285	1.720	285	2.082	285	2.987
290	4.83	0.911	290	2.278	290	1.731	290	1.640	290	1.731	290	2.095	290	3.006
295	4.92	0.917	295	2.293	295	1.742	295	1.651	295	1.742	295	2.109	295	3.026
300	5.00	0.924	300	2.310	300	1.756	300	1.663	300	1.756	300	2.125	300	3.049
305	5.08	0.931	305	2.328	305	1.769	305	1.676	305	1.769	305	2.141	305	3.072
310	5.17	0.938	310	2.345	310	1.782	310	1.688	310	1.782	310	2.157	310	3.095
315	5.25	0.945	315	2.363	315	1.796	315	1.701	315	1.796	315	2.174	315	3.119
320	5.33	0.951	320	2.378	320	1.807	320	1.712	320	1.807	320	2.187	320	3.138
325	5.42	0.957	325	2.393	325	1.818	325	1.723	325	1.818	325	2.201	325	3.158
330	5.50	0.963	330	2.408	330	1.830	330	1.733	330	1.830	330	2.215	330	3.178
335	5.58	0.969	335	2.423	335	1.841	335	1.744	335	1.841	335	2.229	335	3.198
340	5.67	0.975	340	2.438	340	1.853	340	1.755	340	1.853	340	2.243	340	3.218
345	5.75	0.981	345	2.453	345	1.864	345	1.766	345	1.864	345	2.256	345	3.237
350	5.83	0.988	350	2.470	350	1.877	350	1.778	350	1.877	350	2.272	350	3.260
355	5.92	0.994	355	2.485	355	1.889	355	1.789	355	1.889	355	2.286	355	3.280
360	6.00	1.000	360	2.500	360	1.900	360	1.800	360	1.900	360	2.300	360	3.300

1. Time values for the 6 hr distribution are determined by dividing the time intervals from the SCS Type B - 24 hr distribution by 4.
2. P_x/P_6 ratios correspond to P_x/P_{24} ratios at times (in minutes) that are 4 times greater than P_x/P_6 times. For example, P_x/P_6 at 100 minutes equals P_x/P_{24} at 400 minutes.
3. $P_{10,6}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type B - 5 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{5,24}$[2]= 4.3		SCS Type B - 24 Hr Distribution Jamul Basin $P_{5,24}$[2]= 3.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{5,24}$[2]= 2.7		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{5,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{5,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{5,24}$[2]= 5.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.002	5	0.009	5	0.006	5	0.005	5	0.007	5	0.007	5	0.011
10	0.17	0.003	10	0.013	10	0.009	10	0.008	10	0.010	10	0.010	10	0.017
15	0.25	0.005	15	0.022	15	0.015	15	0.014	15	0.017	15	0.017	15	0.029
20	0.33	0.006	20	0.026	20	0.018	20	0.016	20	0.020	20	0.020	20	0.034
25	0.42	0.008	25	0.034	25	0.024	25	0.022	25	0.026	25	0.026	25	0.046
30	0.50	0.009	30	0.039	30	0.027	30	0.024	30	0.030	30	0.030	30	0.051
35	0.58	0.010	35	0.043	35	0.030	35	0.027	35	0.033	35	0.033	35	0.057
40	0.67	0.011	40	0.047	40	0.033	40	0.030	40	0.036	40	0.036	40	0.063
45	0.75	0.013	45	0.056	45	0.039	45	0.035	45	0.043	45	0.043	45	0.074
50	0.83	0.014	50	0.060	50	0.042	50	0.038	50	0.046	50	0.046	50	0.080
55	0.92	0.015	55	0.065	55	0.045	55	0.041	55	0.050	55	0.050	55	0.086
60	1.00	0.016	60	0.069	60	0.048	60	0.043	60	0.053	60	0.053	60	0.091
65	1.08	0.018	65	0.077	65	0.054	65	0.049	65	0.059	65	0.059	65	0.103
70	1.17	0.019	70	0.082	70	0.057	70	0.051	70	0.063	70	0.063	70	0.108
75	1.25	0.021	75	0.090	75	0.063	75	0.057	75	0.069	75	0.069	75	0.120
80	1.33	0.022	80	0.095	80	0.066	80	0.059	80	0.073	80	0.073	80	0.125
85	1.42	0.024	85	0.103	85	0.072	85	0.065	85	0.079	85	0.079	85	0.137
90	1.50	0.025	90	0.108	90	0.075	90	0.068	90	0.083	90	0.083	90	0.143
95	1.58	0.027	95	0.116	95	0.081	95	0.073	95	0.089	95	0.089	95	0.154
100	1.67	0.028	100	0.120	100	0.084	100	0.076	100	0.092	100	0.092	100	0.160
105	1.75	0.030	105	0.129	105	0.090	105	0.081	105	0.099	105	0.099	105	0.171
110	1.83	0.031	110	0.133	110	0.093	110	0.084	110	0.102	110	0.102	110	0.177
115	1.92	0.033	115	0.142	115	0.099	115	0.089	115	0.109	115	0.109	115	0.188
120	2.00	0.034	120	0.146	120	0.102	120	0.092	120	0.112	120	0.112	120	0.194
125	2.08	0.036	125	0.155	125	0.108	125	0.097	125	0.119	125	0.119	125	0.205
130	2.17	0.038	130	0.163	130	0.114	130	0.103	130	0.125	130	0.125	130	0.217
135	2.25	0.040	135	0.172	135	0.120	135	0.108	135	0.132	135	0.132	135	0.228
140	2.33	0.041	140	0.176	140	0.123	140	0.111	140	0.135	140	0.135	140	0.234
145	2.42	0.043	145	0.185	145	0.129	145	0.116	145	0.142	145	0.142	145	0.245
150	2.50	0.045	150	0.194	150	0.135	150	0.122	150	0.149	150	0.149	150	0.257
155	2.58	0.047	155	0.202	155	0.141	155	0.127	155	0.155	155	0.155	155	0.268
160	2.67	0.048	160	0.206	160	0.144	160	0.130	160	0.158	160	0.158	160	0.274
165	2.75	0.050	165	0.215	165	0.150	165	0.135	165	0.165	165	0.165	165	0.285
170	2.83	0.051	170	0.219	170	0.153	170	0.138	170	0.168	170	0.168	170	0.291
175	2.92	0.053	175	0.228	175	0.159	175	0.143	175	0.175	175	0.175	175	0.302
180	3.00	0.054	180	0.232	180	0.162	180	0.146	180	0.178	180	0.178	180	0.308
185	3.08	0.056	185	0.241	185	0.168	185	0.151	185	0.185	185	0.185	185	0.319
190	3.17	0.058	190	0.249	190	0.174	190	0.157	190	0.191	190	0.191	190	0.331
195	3.25	0.060	195	0.258	195	0.180	195	0.162	195	0.198	195	0.198	195	0.342
200	3.33	0.061	200	0.262	200	0.183	200	0.165	200	0.201	200	0.201	200	0.348
205	3.42	0.063	205	0.271	205	0.189	205	0.170	205	0.208	205	0.208	205	0.359
210	3.50	0.065	210	0.280	210	0.195	210	0.176	210	0.215	210	0.215	210	0.371
215	3.58	0.067	215	0.288	215	0.201	215	0.181	215	0.221	215	0.221	215	0.382
220	3.67	0.069	220	0.297	220	0.207	220	0.186	220	0.228	220	0.228	220	0.393
225	3.75	0.071	225	0.305	225	0.213	225	0.192	225	0.234	225	0.234	225	0.405
230	3.83	0.073	230	0.314	230	0.219	230	0.197	230	0.241	230	0.241	230	0.416
235	3.92	0.075	235	0.323	235	0.225	235	0.203	235	0.248	235	0.248	235	0.428
240	4.00	0.077	240	0.331	240	0.231	240	0.208	240	0.254	240	0.254	240	0.439
245	4.08	0.079	245	0.340	245	0.237	245	0.213	245	0.261	245	0.261	245	0.450
250	4.17	0.081	250	0.348	250	0.243	250	0.219	250	0.267	250	0.267	250	0.462
255	4.25	0.084	255	0.361	255	0.252	255	0.227	255	0.277	255	0.277	255	0.479
260	4.33	0.086	260	0.370	260	0.258	260	0.232	260	0.284	260	0.284	260	0.490
265	4.42	0.088	265	0.378	265	0.264	265	0.238	265	0.290	265	0.290	265	0.502

SCS Type B - 5 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{5,24}$[2]= 4.3		SCS Type B - 24 Hr Distribution Jamul Basin $P_{5,24}$[2]= 3.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{5,24}$[2]= 2.7		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{5,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{5,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{5,24}$[2]= 5.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.090	270	0.387	270	0.270	270	0.243	270	0.297	270	0.297	270	0.513
275	4.58	0.092	275	0.396	275	0.276	275	0.248	275	0.304	275	0.304	275	0.524
280	4.67	0.095	280	0.409	280	0.285	280	0.257	280	0.314	280	0.314	280	0.542
285	4.75	0.097	285	0.417	285	0.291	285	0.262	285	0.320	285	0.320	285	0.553
290	4.83	0.099	290	0.426	290	0.297	290	0.267	290	0.327	290	0.327	290	0.564
295	4.92	0.102	295	0.439	295	0.306	295	0.275	295	0.337	295	0.337	295	0.581
300	5.00	0.104	300	0.447	300	0.312	300	0.281	300	0.343	300	0.343	300	0.593
305	5.08	0.107	305	0.460	305	0.321	305	0.289	305	0.353	305	0.353	305	0.610
310	5.17	0.109	310	0.469	310	0.327	310	0.294	310	0.360	310	0.360	310	0.621
315	5.25	0.112	315	0.482	315	0.336	315	0.302	315	0.370	315	0.370	315	0.638
320	5.33	0.115	320	0.495	320	0.345	320	0.311	320	0.380	320	0.380	320	0.656
325	5.42	0.117	325	0.503	325	0.351	325	0.316	325	0.386	325	0.386	325	0.667
330	5.50	0.120	330	0.516	330	0.360	330	0.324	330	0.396	330	0.396	330	0.684
335	5.58	0.123	335	0.529	335	0.369	335	0.332	335	0.406	335	0.406	335	0.701
340	5.67	0.126	340	0.542	340	0.378	340	0.340	340	0.416	340	0.416	340	0.718
345	5.75	0.129	345	0.555	345	0.387	345	0.348	345	0.426	345	0.426	345	0.735
350	5.83	0.131	350	0.563	350	0.393	350	0.354	350	0.432	350	0.432	350	0.747
355	5.92	0.134	355	0.576	355	0.402	355	0.362	355	0.442	355	0.442	355	0.764
360	6.00	0.137	360	0.589	360	0.411	360	0.370	360	0.452	360	0.452	360	0.781
365	6.08	0.140	365	0.602	365	0.420	365	0.378	365	0.462	365	0.462	365	0.798
370	6.17	0.144	370	0.619	370	0.432	370	0.389	370	0.475	370	0.475	370	0.821
375	6.25	0.147	375	0.632	375	0.441	375	0.397	375	0.485	375	0.485	375	0.838
380	6.33	0.150	380	0.645	380	0.450	380	0.405	380	0.495	380	0.495	380	0.855
385	6.42	0.154	385	0.662	385	0.462	385	0.416	385	0.508	385	0.508	385	0.878
390	6.50	0.157	390	0.675	390	0.471	390	0.424	390	0.518	390	0.518	390	0.895
395	6.58	0.161	395	0.692	395	0.483	395	0.435	395	0.531	395	0.531	395	0.918
400	6.67	0.165	400	0.710	400	0.495	400	0.446	400	0.545	400	0.545	400	0.941
405	6.75	0.169	405	0.727	405	0.507	405	0.456	405	0.558	405	0.558	405	0.963
410	6.83	0.172	410	0.740	410	0.516	410	0.464	410	0.568	410	0.568	410	0.980
415	6.92	0.176	415	0.757	415	0.528	415	0.475	415	0.581	415	0.581	415	1.003
420	7.00	0.180	420	0.774	420	0.540	420	0.486	420	0.594	420	0.594	420	1.026
425	7.08	0.185	425	0.796	425	0.555	425	0.500	425	0.611	425	0.611	425	1.055
430	7.17	0.190	430	0.817	430	0.570	430	0.513	430	0.627	430	0.627	430	1.083
435	7.25	0.195	435	0.839	435	0.585	435	0.527	435	0.644	435	0.644	435	1.112
440	7.33	0.200	440	0.860	440	0.600	440	0.540	440	0.660	440	0.660	440	1.140
445	7.42	0.205	445	0.882	445	0.615	445	0.554	445	0.677	445	0.677	445	1.169
450	7.50	0.210	450	0.903	450	0.630	450	0.567	450	0.693	450	0.693	450	1.197
455	7.58	0.218	455	0.937	455	0.654	455	0.589	455	0.719	455	0.719	455	1.243
460	7.67	0.225	460	0.968	460	0.675	460	0.608	460	0.743	460	0.743	460	1.283
465	7.75	0.233	465	1.002	465	0.699	465	0.629	465	0.769	465	0.769	465	1.328
470	7.83	0.240	470	1.032	470	0.720	470	0.648	470	0.792	470	0.792	470	1.368
475	7.92	0.248	475	1.066	475	0.744	475	0.670	475	0.818	475	0.818	475	1.414
480	8.00	0.255	480	1.097	480	0.765	480	0.689	480	0.842	480	0.842	480	1.454
485	8.08	0.266	485	1.144	485	0.798	485	0.718	485	0.878	485	0.878	485	1.516
490	8.17	0.277	490	1.191	490	0.831	490	0.748	490	0.914	490	0.914	490	1.579
495	8.25	0.289	495	1.243	495	0.867	495	0.780	495	0.954	495	0.954	495	1.647
500	8.33	0.300	500	1.290	500	0.900	500	0.810	500	0.990	500	0.990	500	1.710
505	8.42	0.311	505	1.337	505	0.933	505	0.840	505	1.026	505	1.026	505	1.773
510	8.50	0.322	510	1.385	510	0.966	510	0.869	510	1.063	510	1.063	510	1.835
515	8.58	0.337	515	1.449	515	1.011	515	0.910	515	1.112	515	1.112	515	1.921
520	8.67	0.351	520	1.509	520	1.053	520	0.948	520	1.158	520	1.158	520	2.001
525	8.75	0.366	525	1.574	525	1.098	525	0.988	525	1.208	525	1.208	525	2.086
530	8.83	0.381	530	1.638	530	1.143	530	1.029	530	1.257	530	1.257	530	2.172
535	8.92	0.395	535	1.699	535	1.185	535	1.067	535	1.304	535	1.304	535	2.252

SCS Type B - 5 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{5,24}$[2]= 4.3		SCS Type B - 24 Hr Distribution Jamul Basin $P_{5,24}$[2]= 3.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{5,24}$[2]= 2.7		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{5,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{5,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{5,24}$[2]= 5.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
540	9.00	0.410	540	1.763	540	1.230	540	1.107	540	1.353	540	1.353	540	2.337
545	9.08	0.426	545	1.832	545	1.278	545	1.150	545	1.406	545	1.406	545	2.428
550	9.17	0.442	550	1.901	550	1.326	550	1.193	550	1.459	550	1.459	550	2.519
555	9.25	0.458	555	1.969	555	1.374	555	1.237	555	1.511	555	1.511	555	2.611
560	9.33	0.474	560	2.038	560	1.422	560	1.280	560	1.564	560	1.564	560	2.702
565	9.42	0.490	565	2.107	565	1.470	565	1.323	565	1.617	565	1.617	565	2.793
570	9.50	0.506	570	2.176	570	1.518	570	1.366	570	1.670	570	1.670	570	2.884
575	9.58	0.520	575	2.236	575	1.560	575	1.404	575	1.716	575	1.716	575	2.964
580	9.67	0.533	580	2.292	580	1.599	580	1.439	580	1.759	580	1.759	580	3.038
585	9.75	0.547	585	2.352	585	1.641	585	1.477	585	1.805	585	1.805	585	3.118
590	9.83	0.561	590	2.412	590	1.683	590	1.515	590	1.851	590	1.851	590	3.198
595	9.92	0.574	595	2.468	595	1.722	595	1.550	595	1.894	595	1.894	595	3.272
600	10.00	0.588	600	2.528	600	1.764	600	1.588	600	1.940	600	1.940	600	3.352
605	10.08	0.595	605	2.559	605	1.785	605	1.607	605	1.964	605	1.964	605	3.392
610	10.17	0.602	610	2.589	610	1.806	610	1.625	610	1.987	610	1.987	610	3.431
615	10.25	0.609	615	2.619	615	1.827	615	1.644	615	2.010	615	2.010	615	3.471
620	10.33	0.615	620	2.645	620	1.845	620	1.661	620	2.030	620	2.030	620	3.506
625	10.42	0.622	625	2.675	625	1.866	625	1.679	625	2.053	625	2.053	625	3.545
630	10.50	0.629	630	2.705	630	1.887	630	1.698	630	2.076	630	2.076	630	3.585
635	10.58	0.634	635	2.726	635	1.902	635	1.712	635	2.092	635	2.092	635	3.614
640	10.67	0.638	640	2.743	640	1.914	640	1.723	640	2.105	640	2.105	640	3.637
645	10.75	0.643	645	2.765	645	1.929	645	1.736	645	2.122	645	2.122	645	3.665
650	10.83	0.647	650	2.782	650	1.941	650	1.747	650	2.135	650	2.135	650	3.688
655	10.92	0.652	655	2.804	655	1.956	655	1.760	655	2.152	655	2.152	655	3.716
660	11.00	0.656	660	2.821	660	1.968	660	1.771	660	2.165	660	2.165	660	3.739
665	11.08	0.660	665	2.838	665	1.980	665	1.782	665	2.178	665	2.178	665	3.762
670	11.17	0.664	670	2.855	670	1.992	670	1.793	670	2.191	670	2.191	670	3.785
675	11.25	0.668	675	2.872	675	2.004	675	1.804	675	2.204	675	2.204	675	3.808
680	11.33	0.671	680	2.885	680	2.013	680	1.812	680	2.214	680	2.214	680	3.825
685	11.42	0.675	685	2.903	685	2.025	685	1.823	685	2.228	685	2.228	685	3.848
690	11.50	0.679	690	2.920	690	2.037	690	1.833	690	2.241	690	2.241	690	3.870
695	11.58	0.683	695	2.937	695	2.049	695	1.844	695	2.254	695	2.254	695	3.893
700	11.67	0.686	700	2.950	700	2.058	700	1.852	700	2.264	700	2.264	700	3.910
705	11.75	0.690	705	2.967	705	2.070	705	1.863	705	2.277	705	2.277	705	3.933
710	11.83	0.693	710	2.980	710	2.079	710	1.871	710	2.287	710	2.287	710	3.950
715	11.92	0.697	715	2.997	715	2.091	715	1.882	715	2.300	715	2.300	715	3.973
720	12.00	0.700	720	3.010	720	2.100	720	1.890	720	2.310	720	2.310	720	3.990
725	12.08	0.703	725	3.023	725	2.109	725	1.898	725	2.320	725	2.320	725	4.007
730	12.17	0.707	730	3.040	730	2.121	730	1.909	730	2.333	730	2.333	730	4.030
735	12.25	0.710	735	3.053	735	2.130	735	1.917	735	2.343	735	2.343	735	4.047
740	12.33	0.713	740	3.066	740	2.139	740	1.925	740	2.353	740	2.353	740	4.064
745	12.42	0.717	745	3.083	745	2.151	745	1.936	745	2.366	745	2.366	745	4.087
750	12.50	0.720	750	3.096	750	2.160	750	1.944	750	2.376	750	2.376	750	4.104
755	12.58	0.723	755	3.109	755	2.169	755	1.952	755	2.386	755	2.386	755	4.121
760	12.67	0.726	760	3.122	760	2.178	760	1.960	760	2.396	760	2.396	760	4.138
765	12.75	0.730	765	3.139	765	2.190	765	1.971	765	2.409	765	2.409	765	4.161
770	12.83	0.733	770	3.152	770	2.199	770	1.979	770	2.419	770	2.419	770	4.178
775	12.92	0.736	775	3.165	775	2.208	775	1.987	775	2.429	775	2.429	775	4.195
780	13.00	0.739	780	3.178	780	2.217	780	1.995	780	2.439	780	2.439	780	4.212
785	13.08	0.742	785	3.191	785	2.226	785	2.003	785	2.449	785	2.449	785	4.229
790	13.17	0.745	790	3.204	790	2.235	790	2.012	790	2.459	790	2.459	790	4.247
795	13.25	0.748	795	3.216	795	2.244	795	2.020	795	2.468	795	2.468	795	4.264
800	13.33	0.750	800	3.225	800	2.250	800	2.025	800	2.475	800	2.475	800	4.275
805	13.42	0.753	805	3.238	805	2.259	805	2.033	805	2.485	805	2.485	805	4.292

SCS Type B - 5 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{5,24}$[2]= 4.3		SCS Type B - 24 Hr Distribution Jamul Basin $P_{5,24}$[2]= 3.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{5,24}$[2]= 2.7		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{5,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{5,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{5,24}$[2]= 5.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
810	13.50	0.756	810	3.251	810	2.268	810	2.041	810	2.495	810	2.495	810	4.309
815	13.58	0.759	815	3.264	815	2.277	815	2.049	815	2.505	815	2.505	815	4.326
820	13.67	0.761	820	3.272	820	2.283	820	2.055	820	2.511	820	2.511	820	4.338
825	13.75	0.764	825	3.285	825	2.292	825	2.063	825	2.521	825	2.521	825	4.355
830	13.83	0.767	830	3.298	830	2.301	830	2.071	830	2.531	830	2.531	830	4.372
835	13.92	0.769	835	3.307	835	2.307	835	2.076	835	2.538	835	2.538	835	4.383
840	14.00	0.772	840	3.320	840	2.316	840	2.084	840	2.548	840	2.548	840	4.400
845	14.08	0.775	845	3.333	845	2.325	845	2.093	845	2.558	845	2.558	845	4.418
850	14.17	0.778	850	3.345	850	2.334	850	2.101	850	2.567	850	2.567	850	4.435
855	14.25	0.781	855	3.358	855	2.343	855	2.109	855	2.577	855	2.577	855	4.452
860	14.33	0.784	860	3.371	860	2.352	860	2.117	860	2.587	860	2.587	860	4.469
865	14.42	0.787	865	3.384	865	2.361	865	2.125	865	2.597	865	2.597	865	4.486
870	14.50	0.790	870	3.397	870	2.370	870	2.133	870	2.607	870	2.607	870	4.503
875	14.58	0.792	875	3.406	875	2.376	875	2.138	875	2.614	875	2.614	875	4.514
880	14.67	0.793	880	3.410	880	2.379	880	2.141	880	2.617	880	2.617	880	4.520
885	14.75	0.795	885	3.419	885	2.385	885	2.147	885	2.624	885	2.624	885	4.532
890	14.83	0.797	890	3.427	890	2.391	890	2.152	890	2.630	890	2.630	890	4.543
895	14.92	0.798	895	3.431	895	2.394	895	2.155	895	2.633	895	2.633	895	4.549
900	15.00	0.800	900	3.440	900	2.400	900	2.160	900	2.640	900	2.640	900	4.560
905	15.08	0.803	905	3.453	905	2.409	905	2.168	905	2.650	905	2.650	905	4.577
910	15.17	0.805	910	3.462	910	2.415	910	2.174	910	2.657	910	2.657	910	4.589
915	15.25	0.808	915	3.474	915	2.424	915	2.182	915	2.666	915	2.666	915	4.606
920	15.33	0.811	920	3.487	920	2.433	920	2.190	920	2.676	920	2.676	920	4.623
925	15.42	0.813	925	3.496	925	2.439	925	2.195	925	2.683	925	2.683	925	4.634
930	15.50	0.816	930	3.509	930	2.448	930	2.203	930	2.693	930	2.693	930	4.651
935	15.58	0.819	935	3.522	935	2.457	935	2.211	935	2.703	935	2.703	935	4.668
940	15.67	0.821	940	3.530	940	2.463	940	2.217	940	2.709	940	2.709	940	4.680
945	15.75	0.824	945	3.543	945	2.472	945	2.225	945	2.719	945	2.719	945	4.697
950	15.83	0.826	950	3.552	950	2.478	950	2.230	950	2.726	950	2.726	950	4.708
955	15.92	0.829	955	3.565	955	2.487	955	2.238	955	2.736	955	2.736	955	4.725
960	16.00	0.831	960	3.573	960	2.493	960	2.244	960	2.742	960	2.742	960	4.737
965	16.08	0.833	965	3.582	965	2.499	965	2.249	965	2.749	965	2.749	965	4.748
970	16.17	0.836	970	3.595	970	2.508	970	2.257	970	2.759	970	2.759	970	4.765
975	16.25	0.838	975	3.603	975	2.514	975	2.263	975	2.765	975	2.765	975	4.777
980	16.33	0.840	980	3.612	980	2.520	980	2.268	980	2.772	980	2.772	980	4.788
985	16.42	0.843	985	3.625	985	2.529	985	2.276	985	2.782	985	2.782	985	4.805
990	16.50	0.845	990	3.634	990	2.535	990	2.282	990	2.789	990	2.789	990	4.817
995	16.58	0.848	995	3.646	995	2.544	995	2.290	995	2.798	995	2.798	995	4.834
1000	16.67	0.850	1000	3.655	1000	2.550	1000	2.295	1000	2.805	1000	2.805	1000	4.845
1005	16.75	0.853	1005	3.668	1005	2.559	1005	2.303	1005	2.815	1005	2.815	1005	4.862
1010	16.83	0.855	1010	3.677	1010	2.565	1010	2.309	1010	2.822	1010	2.822	1010	4.874
1015	16.92	0.858	1015	3.689	1015	2.574	1015	2.317	1015	2.831	1015	2.831	1015	4.891
1020	17.00	0.860	1020	3.698	1020	2.580	1020	2.322	1020	2.838	1020	2.838	1020	4.902
1025	17.08	0.862	1025	3.707	1025	2.586	1025	2.327	1025	2.845	1025	2.845	1025	4.913
1030	17.17	0.864	1030	3.715	1030	2.592	1030	2.333	1030	2.851	1030	2.851	1030	4.925
1035	17.25	0.866	1035	3.724	1035	2.598	1035	2.338	1035	2.858	1035	2.858	1035	4.936
1040	17.33	0.868	1040	3.732	1040	2.604	1040	2.344	1040	2.864	1040	2.864	1040	4.948
1045	17.42	0.870	1045	3.741	1045	2.610	1045	2.349	1045	2.871	1045	2.871	1045	4.959
1050	17.50	0.872	1050	3.750	1050	2.616	1050	2.354	1050	2.878	1050	2.878	1050	4.970
1055	17.58	0.874	1055	3.758	1055	2.622	1055	2.360	1055	2.884	1055	2.884	1055	4.982
1060	17.67	0.876	1060	3.767	1060	2.628	1060	2.365	1060	2.891	1060	2.891	1060	4.993
1065	17.75	0.879	1065	3.780	1065	2.637	1065	2.373	1065	2.901	1065	2.901	1065	5.010
1070	17.83	0.881	1070	3.788	1070	2.643	1070	2.379	1070	2.907	1070	2.907	1070	5.022
1075	17.92	0.883	1075	3.797	1075	2.649	1075	2.384	1075	2.914	1075	2.914	1075	5.033

SCS Type B - 5 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{5,24}$[2]= 4.3		SCS Type B - 24 Hr Distribution Jamul Basin $P_{5,24}$[2]= 3.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{5,24}$[2]= 2.7		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{5,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{5,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{5,24}$[2]= 5.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1080	18.00	0.885	1080	3.806	1080	2.655	1080	2.390	1080	2.921	1080	2.921	1080	5.045
1085	18.08	0.887	1085	3.814	1085	2.661	1085	2.395	1085	2.927	1085	2.927	1085	5.056
1090	18.17	0.888	1090	3.818	1090	2.664	1090	2.398	1090	2.930	1090	2.930	1090	5.062
1095	18.25	0.890	1095	3.827	1095	2.670	1095	2.403	1095	2.937	1095	2.937	1095	5.073
1100	18.33	0.892	1100	3.836	1100	2.676	1100	2.408	1100	2.944	1100	2.944	1100	5.084
1105	18.42	0.893	1105	3.840	1105	2.679	1105	2.411	1105	2.947	1105	2.947	1105	5.090
1110	18.50	0.895	1110	3.849	1110	2.685	1110	2.417	1110	2.954	1110	2.954	1110	5.102
1115	18.58	0.897	1115	3.857	1115	2.691	1115	2.422	1115	2.960	1115	2.960	1115	5.113
1120	18.67	0.898	1120	3.861	1120	2.694	1120	2.425	1120	2.963	1120	2.963	1120	5.119
1125	18.75	0.900	1125	3.870	1125	2.700	1125	2.430	1125	2.970	1125	2.970	1125	5.130
1130	18.83	0.902	1130	3.879	1130	2.706	1130	2.435	1130	2.977	1130	2.977	1130	5.141
1135	18.92	0.903	1135	3.883	1135	2.709	1135	2.438	1135	2.980	1135	2.980	1135	5.147
1140	19.00	0.905	1140	3.892	1140	2.715	1140	2.444	1140	2.987	1140	2.987	1140	5.159
1145	19.08	0.907	1145	3.900	1145	2.721	1145	2.449	1145	2.993	1145	2.993	1145	5.170
1150	19.17	0.908	1150	3.904	1150	2.724	1150	2.452	1150	2.996	1150	2.996	1150	5.176
1155	19.25	0.910	1155	3.913	1155	2.730	1155	2.457	1155	3.003	1155	3.003	1155	5.187
1160	19.33	0.911	1160	3.917	1160	2.733	1160	2.460	1160	3.006	1160	3.006	1160	5.193
1165	19.42	0.913	1165	3.926	1165	2.739	1165	2.465	1165	3.013	1165	3.013	1165	5.204
1170	19.50	0.914	1170	3.930	1170	2.742	1170	2.468	1170	3.016	1170	3.016	1170	5.210
1175	19.58	0.916	1175	3.939	1175	2.748	1175	2.473	1175	3.023	1175	3.023	1175	5.221
1180	19.67	0.917	1180	3.943	1180	2.751	1180	2.476	1180	3.026	1180	3.026	1180	5.227
1185	19.75	0.919	1185	3.952	1185	2.757	1185	2.481	1185	3.033	1185	3.033	1185	5.238
1190	19.83	0.921	1190	3.960	1190	2.763	1190	2.487	1190	3.039	1190	3.039	1190	5.250
1195	19.92	0.922	1195	3.965	1195	2.766	1195	2.489	1195	3.043	1195	3.043	1195	5.255
1200	20.00	0.924	1200	3.973	1200	2.772	1200	2.495	1200	3.049	1200	3.049	1200	5.267
1205	20.08	0.926	1205	3.982	1205	2.778	1205	2.500	1205	3.056	1205	3.056	1205	5.278
1210	20.17	0.928	1210	3.990	1210	2.784	1210	2.506	1210	3.062	1210	3.062	1210	5.290
1215	20.25	0.930	1215	3.999	1215	2.790	1215	2.511	1215	3.069	1215	3.069	1215	5.301
1220	20.33	0.931	1220	4.003	1220	2.793	1220	2.514	1220	3.072	1220	3.072	1220	5.307
1225	20.42	0.933	1225	4.012	1225	2.799	1225	2.519	1225	3.079	1225	3.079	1225	5.318
1230	20.50	0.935	1230	4.021	1230	2.805	1230	2.525	1230	3.086	1230	3.086	1230	5.330
1235	20.58	0.937	1235	4.029	1235	2.811	1235	2.530	1235	3.092	1235	3.092	1235	5.341
1240	20.67	0.938	1240	4.033	1240	2.814	1240	2.533	1240	3.095	1240	3.095	1240	5.347
1245	20.75	0.940	1245	4.042	1245	2.820	1245	2.538	1245	3.102	1245	3.102	1245	5.358
1250	20.83	0.942	1250	4.051	1250	2.826	1250	2.543	1250	3.109	1250	3.109	1250	5.369
1255	20.92	0.943	1255	4.055	1255	2.829	1255	2.546	1255	3.112	1255	3.112	1255	5.375
1260	21.00	0.945	1260	4.064	1260	2.835	1260	2.552	1260	3.119	1260	3.119	1260	5.387
1265	21.08	0.947	1265	4.072	1265	2.841	1265	2.557	1265	3.125	1265	3.125	1265	5.398
1270	21.17	0.948	1270	4.076	1270	2.844	1270	2.560	1270	3.128	1270	3.128	1270	5.404
1275	21.25	0.950	1275	4.085	1275	2.850	1275	2.565	1275	3.135	1275	3.135	1275	5.415
1280	21.33	0.951	1280	4.089	1280	2.853	1280	2.568	1280	3.138	1280	3.138	1280	5.421
1285	21.42	0.953	1285	4.098	1285	2.859	1285	2.573	1285	3.145	1285	3.145	1285	5.432
1290	21.50	0.954	1290	4.102	1290	2.862	1290	2.576	1290	3.148	1290	3.148	1290	5.438
1295	21.58	0.956	1295	4.111	1295	2.868	1295	2.581	1295	3.155	1295	3.155	1295	5.449
1300	21.67	0.957	1300	4.115	1300	2.871	1300	2.584	1300	3.158	1300	3.158	1300	5.455
1305	21.75	0.959	1305	4.124	1305	2.877	1305	2.589	1305	3.165	1305	3.165	1305	5.466
1310	21.83	0.960	1310	4.128	1310	2.880	1310	2.592	1310	3.168	1310	3.168	1310	5.472
1315	21.92	0.962	1315	4.137	1315	2.886	1315	2.597	1315	3.175	1315	3.175	1315	5.483
1320	22.00	0.963	1320	4.141	1320	2.889	1320	2.600	1320	3.178	1320	3.178	1320	5.489
1325	22.08	0.965	1325	4.150	1325	2.895	1325	2.606	1325	3.185	1325	3.185	1325	5.501
1330	22.17	0.966	1330	4.154	1330	2.898	1330	2.608	1330	3.188	1330	3.188	1330	5.506
1335	22.25	0.968	1335	4.162	1335	2.904	1335	2.614	1335	3.194	1335	3.194	1335	5.518
1340	22.33	0.969	1340	4.167	1340	2.907	1340	2.616	1340	3.198	1340	3.198	1340	5.523
1345	22.42	0.971	1345	4.175	1345	2.913	1345	2.622	1345	3.204	1345	3.204	1345	5.535

SCS Type B - 5 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{5,24}$[2]= 4.3		SCS Type B - 24 Hr Distribution Jamul Basin $P_{5,24}$[2]= 3.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{5,24}$[2]= 2.7		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{5,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{5,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{5,24}$[2]= 5.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1350	22.50	0.972	1350	4.180	1350	2.916	1350	2.624	1350	3.208	1350	3.208	1350	5.540
1355	22.58	0.974	1355	4.188	1355	2.922	1355	2.630	1355	3.214	1355	3.214	1355	5.552
1360	22.67	0.975	1360	4.193	1360	2.925	1360	2.633	1360	3.218	1360	3.218	1360	5.558
1365	22.75	0.977	1365	4.201	1365	2.931	1365	2.638	1365	3.224	1365	3.224	1365	5.569
1370	22.83	0.978	1370	4.205	1370	2.934	1370	2.641	1370	3.227	1370	3.227	1370	5.575
1375	22.92	0.980	1375	4.214	1375	2.940	1375	2.646	1375	3.234	1375	3.234	1375	5.586
1380	23.00	0.981	1380	4.218	1380	2.943	1380	2.649	1380	3.237	1380	3.237	1380	5.592
1385	23.08	0.983	1385	4.227	1385	2.949	1385	2.654	1385	3.244	1385	3.244	1385	5.603
1390	23.17	0.984	1390	4.231	1390	2.952	1390	2.657	1390	3.247	1390	3.247	1390	5.609
1395	23.25	0.986	1395	4.240	1395	2.958	1395	2.662	1395	3.254	1395	3.254	1395	5.620
1400	23.33	0.988	1400	4.248	1400	2.964	1400	2.668	1400	3.260	1400	3.260	1400	5.632
1405	23.42	0.989	1405	4.253	1405	2.967	1405	2.670	1405	3.264	1405	3.264	1405	5.637
1410	23.50	0.991	1410	4.261	1410	2.973	1410	2.676	1410	3.270	1410	3.270	1410	5.649
1415	23.58	0.993	1415	4.270	1415	2.979	1415	2.681	1415	3.277	1415	3.277	1415	5.660
1420	23.67	0.994	1420	4.274	1420	2.982	1420	2.684	1420	3.280	1420	3.280	1420	5.666
1425	23.75	0.996	1425	4.283	1425	2.988	1425	2.689	1425	3.287	1425	3.287	1425	5.677
1430	23.83	0.997	1430	4.287	1430	2.991	1430	2.692	1430	3.290	1430	3.290	1430	5.683
1435	23.92	0.999	1435	4.296	1435	2.997	1435	2.697	1435	3.297	1435	3.297	1435	5.694
1440	24.00	1.000	1440	4.300	1440	3.000	1440	2.700	1440	3.300	1440	3.300	1440	5.700

1. P_x/P_{24} values at 30 minute intervals have been determined per values indicated in Table II-B-2 of the 1993 SCHM. P_x/P_{24} values at 5 minute intervals have been linearly interpolated from the 30-minute data.

2. $P_{5,24}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type B - 5 Yr - 6 Hr Distribution

SCS Type B - 6 Hr Distribution Ratios			SCS Type B - 6 Hr Distribution Guejito Basin $P_{5,6}$[3]= 2.1		SCS Type B - 6 Hr Distribution Jamul Basin $P_{5,6}$[3]= 1.7		SCS Type B - 6 Hr Distribution Las Flores Basin $P_{5,6}$[3]= 1.6		SCS Type B - 6 Hr Distribution Los Coches Basin $P_{5,6}$[3]= 1.7		SCS Type B - 6 Hr Distribution Santa Maria Basin $P_{5,6}$[3]= 1.9		SCS Type B - 6 Hr Distribution Sweetwater Basin $P_{5,6}$[3]= 2.9	
Time[1] (min)	Time (hrs)	P_x/P_6[2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.006	5	0.013	5	0.010	5	0.010	5	0.010	5	0.011	5	0.017
10	0.17	0.011	10	0.023	10	0.019	10	0.018	10	0.019	10	0.021	10	0.032
15	0.25	0.016	15	0.034	15	0.027	15	0.026	15	0.027	15	0.030	15	0.046
20	0.33	0.022	20	0.046	20	0.037	20	0.035	20	0.037	20	0.042	20	0.064
25	0.42	0.028	25	0.059	25	0.048	25	0.045	25	0.048	25	0.053	25	0.081
30	0.50	0.034	30	0.071	30	0.058	30	0.054	30	0.058	30	0.065	30	0.099
35	0.58	0.041	35	0.086	35	0.070	35	0.066	35	0.070	35	0.078	35	0.119
40	0.67	0.048	40	0.101	40	0.082	40	0.077	40	0.082	40	0.091	40	0.139
45	0.75	0.054	45	0.113	45	0.092	45	0.086	45	0.092	45	0.103	45	0.157
50	0.83	0.061	50	0.128	50	0.104	50	0.098	50	0.104	50	0.116	50	0.177
55	0.92	0.069	55	0.145	55	0.117	55	0.110	55	0.117	55	0.131	55	0.200
60	1.00	0.077	60	0.162	60	0.131	60	0.123	60	0.131	60	0.146	60	0.223
65	1.08	0.086	65	0.181	65	0.146	65	0.138	65	0.146	65	0.163	65	0.249
70	1.17	0.095	70	0.200	70	0.162	70	0.152	70	0.162	70	0.181	70	0.276
75	1.25	0.104	75	0.218	75	0.177	75	0.166	75	0.177	75	0.198	75	0.302
80	1.33	0.115	80	0.242	80	0.196	80	0.184	80	0.196	80	0.219	80	0.334
85	1.42	0.126	85	0.265	85	0.214	85	0.202	85	0.214	85	0.239	85	0.365
90	1.50	0.137	90	0.288	90	0.233	90	0.219	90	0.233	90	0.260	90	0.397
95	1.58	0.150	95	0.315	95	0.255	95	0.240	95	0.255	95	0.285	95	0.435
100	1.67	0.165	100	0.347	100	0.281	100	0.264	100	0.281	100	0.314	100	0.479
105	1.75	0.180	105	0.378	105	0.306	105	0.288	105	0.306	105	0.342	105	0.522
110	1.83	0.200	110	0.420	110	0.340	110	0.320	110	0.340	110	0.380	110	0.580
115	1.92	0.225	115	0.473	115	0.383	115	0.360	115	0.383	115	0.428	115	0.653
120	2.00	0.255	120	0.536	120	0.434	120	0.408	120	0.434	120	0.485	120	0.740
125	2.08	0.300	125	0.630	125	0.510	125	0.480	125	0.510	125	0.570	125	0.870
130	2.17	0.351	130	0.737	130	0.597	130	0.562	130	0.597	130	0.667	130	1.018
135	2.25	0.410	135	0.861	135	0.697	135	0.656	135	0.697	135	0.779	135	1.189
140	2.33	0.474	140	0.995	140	0.806	140	0.758	140	0.806	140	0.901	140	1.375
145	2.42	0.533	145	1.119	145	0.906	145	0.853	145	0.906	145	1.013	145	1.546
150	2.50	0.588	150	1.235	150	1.000	150	0.941	150	1.000	150	1.117	150	1.705
155	2.58	0.615	155	1.292	155	1.046	155	0.984	155	1.046	155	1.169	155	1.784
160	2.67	0.638	160	1.340	160	1.085	160	1.021	160	1.085	160	1.212	160	1.850
165	2.75	0.656	165	1.378	165	1.115	165	1.050	165	1.115	165	1.246	165	1.902
170	2.83	0.671	170	1.409	170	1.141	170	1.074	170	1.141	170	1.275	170	1.946
175	2.92	0.686	175	1.441	175	1.166	175	1.098	175	1.166	175	1.303	175	1.989
180	3.00	0.700	180	1.470	180	1.190	180	1.120	180	1.190	180	1.330	180	2.030
185	3.08	0.713	185	1.497	185	1.212	185	1.141	185	1.212	185	1.355	185	2.068
190	3.17	0.726	190	1.525	190	1.234	190	1.162	190	1.234	190	1.379	190	2.105
195	3.25	0.739	195	1.552	195	1.256	195	1.182	195	1.256	195	1.404	195	2.143
200	3.33	0.750	200	1.575	200	1.275	200	1.200	200	1.275	200	1.425	200	2.175
205	3.42	0.761	205	1.598	205	1.294	205	1.218	205	1.294	205	1.446	205	2.207
210	3.50	0.772	210	1.621	210	1.312	210	1.235	210	1.312	210	1.467	210	2.239
215	3.58	0.784	215	1.646	215	1.333	215	1.254	215	1.333	215	1.490	215	2.274
220	3.67	0.793	220	1.665	220	1.348	220	1.269	220	1.348	220	1.507	220	2.300
225	3.75	0.800	225	1.680	225	1.360	225	1.280	225	1.360	225	1.520	225	2.320
230	3.83	0.811	230	1.703	230	1.379	230	1.298	230	1.379	230	1.541	230	2.352
235	3.92	0.821	235	1.724	235	1.396	235	1.314	235	1.396	235	1.560	235	2.381
240	4.00	0.831	240	1.745	240	1.413	240	1.330	240	1.413	240	1.579	240	2.410
245	4.08	0.840	245	1.764	245	1.428	245	1.344	245	1.428	245	1.596	245	2.436
250	4.17	0.850	250	1.785	250	1.445	250	1.360	250	1.445	250	1.615	250	2.465
255	4.25	0.860	255	1.806	255	1.462	255	1.376	255	1.462	255	1.634	255	2.494
260	4.33	0.868	260	1.823	260	1.476	260	1.389	260	1.476	260	1.649	260	2.517
265	4.42	0.876	265	1.840	265	1.489	265	1.402	265	1.489	265	1.664	265	2.540

SCS Type B - 5 Yr - 6 Hr Distribution

SCS Type B - 6 Hr Distribution Ratios			SCS Type B - 6 Hr Distribution Guejito Basin $P_{5,6}$[3]= 2.1		SCS Type B - 6 Hr Distribution Jamul Basin $P_{5,6}$[3]= 1.7		SCS Type B - 6 Hr Distribution Las Flores Basin $P_{5,6}$[3]= 1.6		SCS Type B - 6 Hr Distribution Los Coches Basin $P_{5,6}$[3]= 1.7		SCS Type B - 6 Hr Distribution Santa Maria Basin $P_{5,6}$[3]= 1.9		SCS Type B - 6 Hr Distribution Sweetwater Basin $P_{5,6}$[3]= 2.9	
Time[1] (min)	Time (hrs)	P_x/P_6[2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.885	270	1.859	270	1.505	270	1.416	270	1.505	270	1.682	270	2.567
275	4.58	0.892	275	1.873	275	1.516	275	1.427	275	1.516	275	1.695	275	2.587
280	4.67	0.898	280	1.886	280	1.527	280	1.437	280	1.527	280	1.706	280	2.604
285	4.75	0.905	285	1.901	285	1.539	285	1.448	285	1.539	285	1.720	285	2.625
290	4.83	0.911	290	1.913	290	1.549	290	1.458	290	1.549	290	1.731	290	2.642
295	4.92	0.917	295	1.926	295	1.559	295	1.467	295	1.559	295	1.742	295	2.659
300	5.00	0.924	300	1.940	300	1.571	300	1.478	300	1.571	300	1.756	300	2.680
305	5.08	0.931	305	1.955	305	1.583	305	1.490	305	1.583	305	1.769	305	2.700
310	5.17	0.938	310	1.970	310	1.595	310	1.501	310	1.595	310	1.782	310	2.720
315	5.25	0.945	315	1.985	315	1.607	315	1.512	315	1.607	315	1.796	315	2.741
320	5.33	0.951	320	1.997	320	1.617	320	1.522	320	1.617	320	1.807	320	2.758
325	5.42	0.957	325	2.010	325	1.627	325	1.531	325	1.627	325	1.818	325	2.775
330	5.50	0.963	330	2.022	330	1.637	330	1.541	330	1.637	330	1.830	330	2.793
335	5.58	0.969	335	2.035	335	1.647	335	1.550	335	1.647	335	1.841	335	2.810
340	5.67	0.975	340	2.048	340	1.658	340	1.560	340	1.658	340	1.853	340	2.828
345	5.75	0.981	345	2.060	345	1.668	345	1.570	345	1.668	345	1.864	345	2.845
350	5.83	0.988	350	2.075	350	1.680	350	1.581	350	1.680	350	1.877	350	2.865
355	5.92	0.994	355	2.087	355	1.690	355	1.590	355	1.690	355	1.889	355	2.883
360	6.00	1.000	360	2.100	360	1.700	360	1.600	360	1.700	360	1.900	360	2.900

1. Time values for the 6 hr distribution are determined by dividing the time intervals from the SCS Type B - 24 hr distribution by 4.
2. P_x/P_6 ratios correspond to P_x/P_{24} ratios at times (in minutes) that are 4 times greater than P_x/P_6 times. For example, P_x/P_6 at 100 minutes equals P_x/P_{24} at 400 minutes.
3. $P_{5,6}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type B - 2 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{2,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Jamul Basin $P_{2,24}$[2]= 2.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{2,24}$[2]= 1.8		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{2,24}$[2]= 2.4		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{2,24}$[2]= 2.4		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{2,24}$[2]= 4.3	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.002	5	0.007	5	0.004	5	0.004	5	0.005	5	0.005	5	0.009
10	0.17	0.003	10	0.010	10	0.006	10	0.005	10	0.007	10	0.007	10	0.013
15	0.25	0.005	15	0.017	15	0.010	15	0.009	15	0.012	15	0.012	15	0.022
20	0.33	0.006	20	0.020	20	0.012	20	0.011	20	0.014	20	0.014	20	0.026
25	0.42	0.008	25	0.026	25	0.016	25	0.014	25	0.019	25	0.019	25	0.034
30	0.50	0.009	30	0.030	30	0.018	30	0.016	30	0.022	30	0.022	30	0.039
35	0.58	0.010	35	0.033	35	0.020	35	0.018	35	0.024	35	0.024	35	0.043
40	0.67	0.011	40	0.036	40	0.022	40	0.020	40	0.026	40	0.026	40	0.047
45	0.75	0.013	45	0.043	45	0.026	45	0.023	45	0.031	45	0.031	45	0.056
50	0.83	0.014	50	0.046	50	0.028	50	0.025	50	0.034	50	0.034	50	0.060
55	0.92	0.015	55	0.050	55	0.030	55	0.027	55	0.036	55	0.036	55	0.065
60	1.00	0.016	60	0.053	60	0.032	60	0.029	60	0.038	60	0.038	60	0.069
65	1.08	0.018	65	0.059	65	0.036	65	0.032	65	0.043	65	0.043	65	0.077
70	1.17	0.019	70	0.063	70	0.038	70	0.034	70	0.046	70	0.046	70	0.082
75	1.25	0.021	75	0.069	75	0.042	75	0.038	75	0.050	75	0.050	75	0.090
80	1.33	0.022	80	0.073	80	0.044	80	0.040	80	0.053	80	0.053	80	0.095
85	1.42	0.024	85	0.079	85	0.048	85	0.043	85	0.058	85	0.058	85	0.103
90	1.50	0.025	90	0.083	90	0.050	90	0.045	90	0.060	90	0.060	90	0.108
95	1.58	0.027	95	0.089	95	0.054	95	0.049	95	0.065	95	0.065	95	0.116
100	1.67	0.028	100	0.092	100	0.056	100	0.050	100	0.067	100	0.067	100	0.120
105	1.75	0.030	105	0.099	105	0.060	105	0.054	105	0.072	105	0.072	105	0.129
110	1.83	0.031	110	0.102	110	0.062	110	0.056	110	0.074	110	0.074	110	0.133
115	1.92	0.033	115	0.109	115	0.066	115	0.059	115	0.079	115	0.079	115	0.142
120	2.00	0.034	120	0.112	120	0.068	120	0.061	120	0.082	120	0.082	120	0.146
125	2.08	0.036	125	0.119	125	0.072	125	0.065	125	0.086	125	0.086	125	0.155
130	2.17	0.038	130	0.125	130	0.076	130	0.068	130	0.091	130	0.091	130	0.163
135	2.25	0.040	135	0.132	135	0.080	135	0.072	135	0.096	135	0.096	135	0.172
140	2.33	0.041	140	0.135	140	0.082	140	0.074	140	0.098	140	0.098	140	0.176
145	2.42	0.043	145	0.142	145	0.086	145	0.077	145	0.103	145	0.103	145	0.185
150	2.50	0.045	150	0.149	150	0.090	150	0.081	150	0.108	150	0.108	150	0.194
155	2.58	0.047	155	0.155	155	0.094	155	0.085	155	0.113	155	0.113	155	0.202
160	2.67	0.048	160	0.158	160	0.096	160	0.086	160	0.115	160	0.115	160	0.206
165	2.75	0.050	165	0.165	165	0.100	165	0.090	165	0.120	165	0.120	165	0.215
170	2.83	0.051	170	0.168	170	0.102	170	0.092	170	0.122	170	0.122	170	0.219
175	2.92	0.053	175	0.175	175	0.106	175	0.095	175	0.127	175	0.127	175	0.228
180	3.00	0.054	180	0.178	180	0.108	180	0.097	180	0.130	180	0.130	180	0.232
185	3.08	0.056	185	0.185	185	0.112	185	0.101	185	0.134	185	0.134	185	0.241
190	3.17	0.058	190	0.191	190	0.116	190	0.104	190	0.139	190	0.139	190	0.249
195	3.25	0.060	195	0.198	195	0.120	195	0.108	195	0.144	195	0.144	195	0.258
200	3.33	0.061	200	0.201	200	0.122	200	0.110	200	0.146	200	0.146	200	0.262
205	3.42	0.063	205	0.208	205	0.126	205	0.113	205	0.151	205	0.151	205	0.271
210	3.50	0.065	210	0.215	210	0.130	210	0.117	210	0.156	210	0.156	210	0.280
215	3.58	0.067	215	0.221	215	0.134	215	0.121	215	0.161	215	0.161	215	0.288
220	3.67	0.069	220	0.228	220	0.138	220	0.124	220	0.166	220	0.166	220	0.297
225	3.75	0.071	225	0.234	225	0.142	225	0.128	225	0.170	225	0.170	225	0.305
230	3.83	0.073	230	0.241	230	0.146	230	0.131	230	0.175	230	0.175	230	0.314
235	3.92	0.075	235	0.248	235	0.150	235	0.135	235	0.180	235	0.180	235	0.323
240	4.00	0.077	240	0.254	240	0.154	240	0.139	240	0.185	240	0.185	240	0.331
245	4.08	0.079	245	0.261	245	0.158	245	0.142	245	0.190	245	0.190	245	0.340
250	4.17	0.081	250	0.267	250	0.162	250	0.146	250	0.194	250	0.194	250	0.348
255	4.25	0.084	255	0.277	255	0.168	255	0.151	255	0.202	255	0.202	255	0.361
260	4.33	0.086	260	0.284	260	0.172	260	0.155	260	0.206	260	0.206	260	0.370
265	4.42	0.088	265	0.290	265	0.176	265	0.158	265	0.211	265	0.211	265	0.378

SCS Type B - 2 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{2,24}{}^{2}$= 3.3		SCS Type B - 24 Hr Distribution Jamul Basin $P_{2,24}{}^{2}$= 2.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{2,24}{}^{2}$= 1.8		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{2,24}{}^{2}$= 2.4		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{2,24}{}^{2}$= 2.4		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{2,24}{}^{2}$= 4.3	
Time (min)	Time (hrs)	$P_x/P_{24}{}^{1}$ (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.090	270	0.297	270	0.180	270	0.162	270	0.216	270	0.216	270	0.387
275	4.58	0.092	275	0.304	275	0.184	275	0.166	275	0.221	275	0.221	275	0.396
280	4.67	0.095	280	0.314	280	0.190	280	0.171	280	0.228	280	0.228	280	0.409
285	4.75	0.097	285	0.320	285	0.194	285	0.175	285	0.233	285	0.233	285	0.417
290	4.83	0.099	290	0.327	290	0.198	290	0.178	290	0.238	290	0.238	290	0.426
295	4.92	0.102	295	0.337	295	0.204	295	0.184	295	0.245	295	0.245	295	0.439
300	5.00	0.104	300	0.343	300	0.208	300	0.187	300	0.250	300	0.250	300	0.447
305	5.08	0.107	305	0.353	305	0.214	305	0.193	305	0.257	305	0.257	305	0.460
310	5.17	0.109	310	0.360	310	0.218	310	0.196	310	0.262	310	0.262	310	0.469
315	5.25	0.112	315	0.370	315	0.224	315	0.202	315	0.269	315	0.269	315	0.482
320	5.33	0.115	320	0.380	320	0.230	320	0.207	320	0.276	320	0.276	320	0.495
325	5.42	0.117	325	0.386	325	0.234	325	0.211	325	0.281	325	0.281	325	0.503
330	5.50	0.120	330	0.396	330	0.240	330	0.216	330	0.288	330	0.288	330	0.516
335	5.58	0.123	335	0.406	335	0.246	335	0.221	335	0.295	335	0.295	335	0.529
340	5.67	0.126	340	0.416	340	0.252	340	0.227	340	0.302	340	0.302	340	0.542
345	5.75	0.129	345	0.426	345	0.258	345	0.232	345	0.310	345	0.310	345	0.555
350	5.83	0.131	350	0.432	350	0.262	350	0.236	350	0.314	350	0.314	350	0.563
355	5.92	0.134	355	0.442	355	0.268	355	0.241	355	0.322	355	0.322	355	0.576
360	6.00	0.137	360	0.452	360	0.274	360	0.247	360	0.329	360	0.329	360	0.589
365	6.08	0.140	365	0.462	365	0.280	365	0.252	365	0.336	365	0.336	365	0.602
370	6.17	0.144	370	0.475	370	0.288	370	0.259	370	0.346	370	0.346	370	0.619
375	6.25	0.147	375	0.485	375	0.294	375	0.265	375	0.353	375	0.353	375	0.632
380	6.33	0.150	380	0.495	380	0.300	380	0.270	380	0.360	380	0.360	380	0.645
385	6.42	0.154	385	0.508	385	0.308	385	0.277	385	0.370	385	0.370	385	0.662
390	6.50	0.157	390	0.518	390	0.314	390	0.283	390	0.377	390	0.377	390	0.675
395	6.58	0.161	395	0.531	395	0.322	395	0.290	395	0.386	395	0.386	395	0.692
400	6.67	0.165	400	0.545	400	0.330	400	0.297	400	0.396	400	0.396	400	0.710
405	6.75	0.169	405	0.558	405	0.338	405	0.304	405	0.406	405	0.406	405	0.727
410	6.83	0.172	410	0.568	410	0.344	410	0.310	410	0.413	410	0.413	410	0.740
415	6.92	0.176	415	0.581	415	0.352	415	0.317	415	0.422	415	0.422	415	0.757
420	7.00	0.180	420	0.594	420	0.360	420	0.324	420	0.432	420	0.432	420	0.774
425	7.08	0.185	425	0.611	425	0.370	425	0.333	425	0.444	425	0.444	425	0.796
430	7.17	0.190	430	0.627	430	0.380	430	0.342	430	0.456	430	0.456	430	0.817
435	7.25	0.195	435	0.644	435	0.390	435	0.351	435	0.468	435	0.468	435	0.839
440	7.33	0.200	440	0.660	440	0.400	440	0.360	440	0.480	440	0.480	440	0.860
445	7.42	0.205	445	0.677	445	0.410	445	0.369	445	0.492	445	0.492	445	0.882
450	7.50	0.210	450	0.693	450	0.420	450	0.378	450	0.504	450	0.504	450	0.903
455	7.58	0.218	455	0.719	455	0.436	455	0.392	455	0.523	455	0.523	455	0.937
460	7.67	0.225	460	0.743	460	0.450	460	0.405	460	0.540	460	0.540	460	0.968
465	7.75	0.233	465	0.769	465	0.466	465	0.419	465	0.559	465	0.559	465	1.002
470	7.83	0.240	470	0.792	470	0.480	470	0.432	470	0.576	470	0.576	470	1.032
475	7.92	0.248	475	0.818	475	0.496	475	0.446	475	0.595	475	0.595	475	1.066
480	8.00	0.255	480	0.842	480	0.510	480	0.459	480	0.612	480	0.612	480	1.097
485	8.08	0.266	485	0.878	485	0.532	485	0.479	485	0.638	485	0.638	485	1.144
490	8.17	0.277	490	0.914	490	0.554	490	0.499	490	0.665	490	0.665	490	1.191
495	8.25	0.289	495	0.954	495	0.578	495	0.520	495	0.694	495	0.694	495	1.243
500	8.33	0.300	500	0.990	500	0.600	500	0.540	500	0.720	500	0.720	500	1.290
505	8.42	0.311	505	1.026	505	0.622	505	0.560	505	0.746	505	0.746	505	1.337
510	8.50	0.322	510	1.063	510	0.644	510	0.580	510	0.773	510	0.773	510	1.385
515	8.58	0.337	515	1.112	515	0.674	515	0.607	515	0.809	515	0.809	515	1.449
520	8.67	0.351	520	1.158	520	0.702	520	0.632	520	0.842	520	0.842	520	1.509
525	8.75	0.366	525	1.208	525	0.732	525	0.659	525	0.878	525	0.878	525	1.574
530	8.83	0.381	530	1.257	530	0.762	530	0.686	530	0.914	530	0.914	530	1.638
535	8.92	0.395	535	1.304	535	0.790	535	0.711	535	0.948	535	0.948	535	1.699

SCS Type B - 2 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{2,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Jamul Basin $P_{2,24}$[2]= 2.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{2,24}$[2]= 1.8		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{2,24}$[2]= 2.4		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{2,24}$[2]= 2.4		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{2,24}$[2]= 4.3	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
540	9.00	0.410	540	1.353	540	0.820	540	0.738	540	0.984	540	0.984	540	1.763
545	9.08	0.426	545	1.406	545	0.852	545	0.767	545	1.022	545	1.022	545	1.832
550	9.17	0.442	550	1.459	550	0.884	550	0.796	550	1.061	550	1.061	550	1.901
555	9.25	0.458	555	1.511	555	0.916	555	0.824	555	1.099	555	1.099	555	1.969
560	9.33	0.474	560	1.564	560	0.948	560	0.853	560	1.138	560	1.138	560	2.038
565	9.42	0.490	565	1.617	565	0.980	565	0.882	565	1.176	565	1.176	565	2.107
570	9.50	0.506	570	1.670	570	1.012	570	0.911	570	1.214	570	1.214	570	2.176
575	9.58	0.520	575	1.716	575	1.040	575	0.936	575	1.248	575	1.248	575	2.236
580	9.67	0.533	580	1.759	580	1.066	580	0.959	580	1.279	580	1.279	580	2.292
585	9.75	0.547	585	1.805	585	1.094	585	0.985	585	1.313	585	1.313	585	2.352
590	9.83	0.561	590	1.851	590	1.122	590	1.010	590	1.346	590	1.346	590	2.412
595	9.92	0.574	595	1.894	595	1.148	595	1.033	595	1.378	595	1.378	595	2.468
600	10.00	0.588	600	1.940	600	1.176	600	1.058	600	1.411	600	1.411	600	2.528
605	10.08	0.595	605	1.964	605	1.190	605	1.071	605	1.428	605	1.428	605	2.559
610	10.17	0.602	610	1.987	610	1.204	610	1.084	610	1.445	610	1.445	610	2.589
615	10.25	0.609	615	2.010	615	1.218	615	1.096	615	1.462	615	1.462	615	2.619
620	10.33	0.615	620	2.030	620	1.230	620	1.107	620	1.476	620	1.476	620	2.645
625	10.42	0.622	625	2.053	625	1.244	625	1.120	625	1.493	625	1.493	625	2.675
630	10.50	0.629	630	2.076	630	1.258	630	1.132	630	1.510	630	1.510	630	2.705
635	10.58	0.634	635	2.092	635	1.268	635	1.141	635	1.522	635	1.522	635	2.726
640	10.67	0.638	640	2.105	640	1.276	640	1.148	640	1.531	640	1.531	640	2.743
645	10.75	0.643	645	2.122	645	1.286	645	1.157	645	1.543	645	1.543	645	2.765
650	10.83	0.647	650	2.135	650	1.294	650	1.165	650	1.553	650	1.553	650	2.782
655	10.92	0.652	655	2.152	655	1.304	655	1.174	655	1.565	655	1.565	655	2.804
660	11.00	0.656	660	2.165	660	1.312	660	1.181	660	1.574	660	1.574	660	2.821
665	11.08	0.660	665	2.178	665	1.320	665	1.188	665	1.584	665	1.584	665	2.838
670	11.17	0.664	670	2.191	670	1.328	670	1.195	670	1.594	670	1.594	670	2.855
675	11.25	0.668	675	2.204	675	1.336	675	1.202	675	1.603	675	1.603	675	2.872
680	11.33	0.671	680	2.214	680	1.342	680	1.208	680	1.610	680	1.610	680	2.885
685	11.42	0.675	685	2.228	685	1.350	685	1.215	685	1.620	685	1.620	685	2.903
690	11.50	0.679	690	2.241	690	1.358	690	1.222	690	1.630	690	1.630	690	2.920
695	11.58	0.683	695	2.254	695	1.366	695	1.229	695	1.639	695	1.639	695	2.937
700	11.67	0.686	700	2.264	700	1.372	700	1.235	700	1.646	700	1.646	700	2.950
705	11.75	0.690	705	2.277	705	1.380	705	1.242	705	1.656	705	1.656	705	2.967
710	11.83	0.693	710	2.287	710	1.386	710	1.247	710	1.663	710	1.663	710	2.980
715	11.92	0.697	715	2.300	715	1.394	715	1.255	715	1.673	715	1.673	715	2.997
720	12.00	0.700	720	2.310	720	1.400	720	1.260	720	1.680	720	1.680	720	3.010
725	12.08	0.703	725	2.320	725	1.406	725	1.265	725	1.687	725	1.687	725	3.023
730	12.17	0.707	730	2.333	730	1.414	730	1.273	730	1.697	730	1.697	730	3.040
735	12.25	0.710	735	2.343	735	1.420	735	1.278	735	1.704	735	1.704	735	3.053
740	12.33	0.713	740	2.353	740	1.426	740	1.283	740	1.711	740	1.711	740	3.066
745	12.42	0.717	745	2.366	745	1.434	745	1.291	745	1.721	745	1.721	745	3.083
750	12.50	0.720	750	2.376	750	1.440	750	1.296	750	1.728	750	1.728	750	3.096
755	12.58	0.723	755	2.386	755	1.446	755	1.301	755	1.735	755	1.735	755	3.109
760	12.67	0.726	760	2.396	760	1.452	760	1.307	760	1.742	760	1.742	760	3.122
765	12.75	0.730	765	2.409	765	1.460	765	1.314	765	1.752	765	1.752	765	3.139
770	12.83	0.733	770	2.419	770	1.466	770	1.319	770	1.759	770	1.759	770	3.152
775	12.92	0.736	775	2.429	775	1.472	775	1.325	775	1.766	775	1.766	775	3.165
780	13.00	0.739	780	2.439	780	1.478	780	1.330	780	1.774	780	1.774	780	3.178
785	13.08	0.742	785	2.449	785	1.484	785	1.336	785	1.781	785	1.781	785	3.191
790	13.17	0.745	790	2.459	790	1.490	790	1.341	790	1.788	790	1.788	790	3.204
795	13.25	0.748	795	2.468	795	1.496	795	1.346	795	1.795	795	1.795	795	3.216
800	13.33	0.750	800	2.475	800	1.500	800	1.350	800	1.800	800	1.800	800	3.225
805	13.42	0.753	805	2.485	805	1.506	805	1.355	805	1.807	805	1.807	805	3.238

SCS Type B - 2 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{2,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Jamul Basin $P_{2,24}$[2]= 2.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{2,24}$[2]= 1.8		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{2,24}$[2]= 2.4		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{2,24}$[2]= 2.4		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{2,24}$[2]= 4.3	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
810	13.50	0.756	810	2.495	810	1.512	810	1.361	810	1.814	810	1.814	810	3.251
815	13.58	0.759	815	2.505	815	1.518	815	1.366	815	1.822	815	1.822	815	3.264
820	13.67	0.761	820	2.511	820	1.522	820	1.370	820	1.826	820	1.826	820	3.272
825	13.75	0.764	825	2.521	825	1.528	825	1.375	825	1.834	825	1.834	825	3.285
830	13.83	0.767	830	2.531	830	1.534	830	1.381	830	1.841	830	1.841	830	3.298
835	13.92	0.769	835	2.538	835	1.538	835	1.384	835	1.846	835	1.846	835	3.307
840	14.00	0.772	840	2.548	840	1.544	840	1.390	840	1.853	840	1.853	840	3.320
845	14.08	0.775	845	2.558	845	1.550	845	1.395	845	1.860	845	1.860	845	3.333
850	14.17	0.778	850	2.567	850	1.556	850	1.400	850	1.867	850	1.867	850	3.345
855	14.25	0.781	855	2.577	855	1.562	855	1.406	855	1.874	855	1.874	855	3.358
860	14.33	0.784	860	2.587	860	1.568	860	1.411	860	1.882	860	1.882	860	3.371
865	14.42	0.787	865	2.597	865	1.574	865	1.417	865	1.889	865	1.889	865	3.384
870	14.50	0.790	870	2.607	870	1.580	870	1.422	870	1.896	870	1.896	870	3.397
875	14.58	0.792	875	2.614	875	1.584	875	1.426	875	1.901	875	1.901	875	3.406
880	14.67	0.793	880	2.617	880	1.586	880	1.427	880	1.903	880	1.903	880	3.410
885	14.75	0.795	885	2.624	885	1.590	885	1.431	885	1.908	885	1.908	885	3.419
890	14.83	0.797	890	2.630	890	1.594	890	1.435	890	1.913	890	1.913	890	3.427
895	14.92	0.798	895	2.633	895	1.596	895	1.436	895	1.915	895	1.915	895	3.431
900	15.00	0.800	900	2.640	900	1.600	900	1.440	900	1.920	900	1.920	900	3.440
905	15.08	0.803	905	2.650	905	1.606	905	1.445	905	1.927	905	1.927	905	3.453
910	15.17	0.805	910	2.657	910	1.610	910	1.449	910	1.932	910	1.932	910	3.462
915	15.25	0.808	915	2.666	915	1.616	915	1.454	915	1.939	915	1.939	915	3.474
920	15.33	0.811	920	2.676	920	1.622	920	1.460	920	1.946	920	1.946	920	3.487
925	15.42	0.813	925	2.683	925	1.626	925	1.463	925	1.951	925	1.951	925	3.496
930	15.50	0.816	930	2.693	930	1.632	930	1.469	930	1.958	930	1.958	930	3.509
935	15.58	0.819	935	2.703	935	1.638	935	1.474	935	1.966	935	1.966	935	3.522
940	15.67	0.821	940	2.709	940	1.642	940	1.478	940	1.970	940	1.970	940	3.530
945	15.75	0.824	945	2.719	945	1.648	945	1.483	945	1.978	945	1.978	945	3.543
950	15.83	0.826	950	2.726	950	1.652	950	1.487	950	1.982	950	1.982	950	3.552
955	15.92	0.829	955	2.736	955	1.658	955	1.492	955	1.990	955	1.990	955	3.565
960	16.00	0.831	960	2.742	960	1.662	960	1.496	960	1.994	960	1.994	960	3.573
965	16.08	0.833	965	2.749	965	1.666	965	1.499	965	1.999	965	1.999	965	3.582
970	16.17	0.836	970	2.759	970	1.672	970	1.505	970	2.006	970	2.006	970	3.595
975	16.25	0.838	975	2.765	975	1.676	975	1.508	975	2.011	975	2.011	975	3.603
980	16.33	0.840	980	2.772	980	1.680	980	1.512	980	2.016	980	2.016	980	3.612
985	16.42	0.843	985	2.782	985	1.686	985	1.517	985	2.023	985	2.023	985	3.625
990	16.50	0.845	990	2.789	990	1.690	990	1.521	990	2.028	990	2.028	990	3.634
995	16.58	0.848	995	2.798	995	1.696	995	1.526	995	2.035	995	2.035	995	3.646
1000	16.67	0.850	1000	2.805	1000	1.700	1000	1.530	1000	2.040	1000	2.040	1000	3.655
1005	16.75	0.853	1005	2.815	1005	1.706	1005	1.535	1005	2.047	1005	2.047	1005	3.668
1010	16.83	0.855	1010	2.822	1010	1.710	1010	1.539	1010	2.052	1010	2.052	1010	3.677
1015	16.92	0.858	1015	2.831	1015	1.716	1015	1.544	1015	2.059	1015	2.059	1015	3.689
1020	17.00	0.860	1020	2.838	1020	1.720	1020	1.548	1020	2.064	1020	2.064	1020	3.698
1025	17.08	0.862	1025	2.845	1025	1.724	1025	1.552	1025	2.069	1025	2.069	1025	3.707
1030	17.17	0.864	1030	2.851	1030	1.728	1030	1.555	1030	2.074	1030	2.074	1030	3.715
1035	17.25	0.866	1035	2.858	1035	1.732	1035	1.559	1035	2.078	1035	2.078	1035	3.724
1040	17.33	0.868	1040	2.864	1040	1.736	1040	1.562	1040	2.083	1040	2.083	1040	3.732
1045	17.42	0.870	1045	2.871	1045	1.740	1045	1.566	1045	2.088	1045	2.088	1045	3.741
1050	17.50	0.872	1050	2.878	1050	1.744	1050	1.570	1050	2.093	1050	2.093	1050	3.750
1055	17.58	0.874	1055	2.884	1055	1.748	1055	1.573	1055	2.098	1055	2.098	1055	3.758
1060	17.67	0.876	1060	2.891	1060	1.752	1060	1.577	1060	2.102	1060	2.102	1060	3.767
1065	17.75	0.879	1065	2.901	1065	1.758	1065	1.582	1065	2.110	1065	2.110	1065	3.780
1070	17.83	0.881	1070	2.907	1070	1.762	1070	1.586	1070	2.114	1070	2.114	1070	3.788
1075	17.92	0.883	1075	2.914	1075	1.766	1075	1.589	1075	2.119	1075	2.119	1075	3.797

SCS Type B - 2 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{2,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Jamul Basin $P_{2,24}$[2]= 2.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{2,24}$[2]= 1.8		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{2,24}$[2]= 2.4		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{2,24}$[2]= 2.4		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{2,24}$[2]= 4.3	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1080	18.00	0.885	1080	2.921	1080	1.770	1080	1.593	1080	2.124	1080	2.124	1080	3.806
1085	18.08	0.887	1085	2.927	1085	1.774	1085	1.597	1085	2.129	1085	2.129	1085	3.814
1090	18.17	0.888	1090	2.930	1090	1.776	1090	1.598	1090	2.131	1090	2.131	1090	3.818
1095	18.25	0.890	1095	2.937	1095	1.780	1095	1.602	1095	2.136	1095	2.136	1095	3.827
1100	18.33	0.892	1100	2.944	1100	1.784	1100	1.606	1100	2.141	1100	2.141	1100	3.836
1105	18.42	0.893	1105	2.947	1105	1.786	1105	1.607	1105	2.143	1105	2.143	1105	3.840
1110	18.50	0.895	1110	2.954	1110	1.790	1110	1.611	1110	2.148	1110	2.148	1110	3.849
1115	18.58	0.897	1115	2.960	1115	1.794	1115	1.615	1115	2.153	1115	2.153	1115	3.857
1120	18.67	0.898	1120	2.963	1120	1.796	1120	1.616	1120	2.155	1120	2.155	1120	3.861
1125	18.75	0.900	1125	2.970	1125	1.800	1125	1.620	1125	2.160	1125	2.160	1125	3.870
1130	18.83	0.902	1130	2.977	1130	1.804	1130	1.624	1130	2.165	1130	2.165	1130	3.879
1135	18.92	0.903	1135	2.980	1135	1.806	1135	1.625	1135	2.167	1135	2.167	1135	3.883
1140	19.00	0.905	1140	2.987	1140	1.810	1140	1.629	1140	2.172	1140	2.172	1140	3.892
1145	19.08	0.907	1145	2.993	1145	1.814	1145	1.633	1145	2.177	1145	2.177	1145	3.900
1150	19.17	0.908	1150	2.996	1150	1.816	1150	1.634	1150	2.179	1150	2.179	1150	3.904
1155	19.25	0.910	1155	3.003	1155	1.820	1155	1.638	1155	2.184	1155	2.184	1155	3.913
1160	19.33	0.911	1160	3.006	1160	1.822	1160	1.640	1160	2.186	1160	2.186	1160	3.917
1165	19.42	0.913	1165	3.013	1165	1.826	1165	1.643	1165	2.191	1165	2.191	1165	3.926
1170	19.50	0.914	1170	3.016	1170	1.828	1170	1.645	1170	2.194	1170	2.194	1170	3.930
1175	19.58	0.916	1175	3.023	1175	1.832	1175	1.649	1175	2.198	1175	2.198	1175	3.939
1180	19.67	0.917	1180	3.026	1180	1.834	1180	1.651	1180	2.201	1180	2.201	1180	3.943
1185	19.75	0.919	1185	3.033	1185	1.838	1185	1.654	1185	2.206	1185	2.206	1185	3.952
1190	19.83	0.921	1190	3.039	1190	1.842	1190	1.658	1190	2.210	1190	2.210	1190	3.960
1195	19.92	0.922	1195	3.043	1195	1.844	1195	1.660	1195	2.213	1195	2.213	1195	3.965
1200	20.00	0.924	1200	3.049	1200	1.848	1200	1.663	1200	2.218	1200	2.218	1200	3.973
1205	20.08	0.926	1205	3.056	1205	1.852	1205	1.667	1205	2.222	1205	2.222	1205	3.982
1210	20.17	0.928	1210	3.062	1210	1.856	1210	1.670	1210	2.227	1210	2.227	1210	3.990
1215	20.25	0.930	1215	3.069	1215	1.860	1215	1.674	1215	2.232	1215	2.232	1215	3.999
1220	20.33	0.931	1220	3.072	1220	1.862	1220	1.676	1220	2.234	1220	2.234	1220	4.003
1225	20.42	0.933	1225	3.079	1225	1.866	1225	1.679	1225	2.239	1225	2.239	1225	4.012
1230	20.50	0.935	1230	3.086	1230	1.870	1230	1.683	1230	2.244	1230	2.244	1230	4.021
1235	20.58	0.937	1235	3.092	1235	1.874	1235	1.687	1235	2.249	1235	2.249	1235	4.029
1240	20.67	0.938	1240	3.095	1240	1.876	1240	1.688	1240	2.251	1240	2.251	1240	4.033
1245	20.75	0.940	1245	3.102	1245	1.880	1245	1.692	1245	2.256	1245	2.256	1245	4.042
1250	20.83	0.942	1250	3.109	1250	1.884	1250	1.696	1250	2.261	1250	2.261	1250	4.051
1255	20.92	0.943	1255	3.112	1255	1.886	1255	1.697	1255	2.263	1255	2.263	1255	4.055
1260	21.00	0.945	1260	3.119	1260	1.890	1260	1.701	1260	2.268	1260	2.268	1260	4.064
1265	21.08	0.947	1265	3.125	1265	1.894	1265	1.705	1265	2.273	1265	2.273	1265	4.072
1270	21.17	0.948	1270	3.128	1270	1.896	1270	1.706	1270	2.275	1270	2.275	1270	4.076
1275	21.25	0.950	1275	3.135	1275	1.900	1275	1.710	1275	2.280	1275	2.280	1275	4.085
1280	21.33	0.951	1280	3.138	1280	1.902	1280	1.712	1280	2.282	1280	2.282	1280	4.089
1285	21.42	0.953	1285	3.145	1285	1.906	1285	1.715	1285	2.287	1285	2.287	1285	4.098
1290	21.50	0.954	1290	3.148	1290	1.908	1290	1.717	1290	2.290	1290	2.290	1290	4.102
1295	21.58	0.956	1295	3.155	1295	1.912	1295	1.721	1295	2.294	1295	2.294	1295	4.111
1300	21.67	0.957	1300	3.158	1300	1.914	1300	1.723	1300	2.297	1300	2.297	1300	4.115
1305	21.75	0.959	1305	3.165	1305	1.918	1305	1.726	1305	2.302	1305	2.302	1305	4.124
1310	21.83	0.960	1310	3.168	1310	1.920	1310	1.728	1310	2.304	1310	2.304	1310	4.128
1315	21.92	0.962	1315	3.175	1315	1.924	1315	1.732	1315	2.309	1315	2.309	1315	4.137
1320	22.00	0.963	1320	3.178	1320	1.926	1320	1.733	1320	2.311	1320	2.311	1320	4.141
1325	22.08	0.965	1325	3.185	1325	1.930	1325	1.737	1325	2.316	1325	2.316	1325	4.150
1330	22.17	0.966	1330	3.188	1330	1.932	1330	1.739	1330	2.318	1330	2.318	1330	4.154
1335	22.25	0.968	1335	3.194	1335	1.936	1335	1.742	1335	2.323	1335	2.323	1335	4.162
1340	22.33	0.969	1340	3.198	1340	1.938	1340	1.744	1340	2.326	1340	2.326	1340	4.167
1345	22.42	0.971	1345	3.204	1345	1.942	1345	1.748	1345	2.330	1345	2.330	1345	4.175

SCS Type B - 2 Yr - 24 Hr Distribution

SCS Type B - 24 Hr Distribution Ratios			SCS Type B - 24 Hr Distribution Guejito Basin $P_{2,24}$[2]= 3.3		SCS Type B - 24 Hr Distribution Jamul Basin $P_{2,24}$[2]= 2.0		SCS Type B - 24 Hr Distribution Las Flores Basin $P_{2,24}$[2]= 1.8		SCS Type B - 24 Hr Distribution Los Coches Basin $P_{2,24}$[2]= 2.4		SCS Type B - 24 Hr Distribution Santa Maria Basin $P_{2,24}$[2]= 2.4		SCS Type B - 24 Hr Distribution Sweetwater Basin $P_{2,24}$[2]= 4.3	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1350	22.50	0.972	1350	3.208	1350	1.944	1350	1.750	1350	2.333	1350	2.333	1350	4.180
1355	22.58	0.974	1355	3.214	1355	1.948	1355	1.753	1355	2.338	1355	2.338	1355	4.188
1360	22.67	0.975	1360	3.218	1360	1.950	1360	1.755	1360	2.340	1360	2.340	1360	4.193
1365	22.75	0.977	1365	3.224	1365	1.954	1365	1.759	1365	2.345	1365	2.345	1365	4.201
1370	22.83	0.978	1370	3.227	1370	1.956	1370	1.760	1370	2.347	1370	2.347	1370	4.205
1375	22.92	0.980	1375	3.234	1375	1.960	1375	1.764	1375	2.352	1375	2.352	1375	4.214
1380	23.00	0.981	1380	3.237	1380	1.962	1380	1.766	1380	2.354	1380	2.354	1380	4.218
1385	23.08	0.983	1385	3.244	1385	1.966	1385	1.769	1385	2.359	1385	2.359	1385	4.227
1390	23.17	0.984	1390	3.247	1390	1.968	1390	1.771	1390	2.362	1390	2.362	1390	4.231
1395	23.25	0.986	1395	3.254	1395	1.972	1395	1.775	1395	2.366	1395	2.366	1395	4.240
1400	23.33	0.988	1400	3.260	1400	1.976	1400	1.778	1400	2.371	1400	2.371	1400	4.248
1405	23.42	0.989	1405	3.264	1405	1.978	1405	1.780	1405	2.374	1405	2.374	1405	4.253
1410	23.50	0.991	1410	3.270	1410	1.982	1410	1.784	1410	2.378	1410	2.378	1410	4.261
1415	23.58	0.993	1415	3.277	1415	1.986	1415	1.787	1415	2.383	1415	2.383	1415	4.270
1420	23.67	0.994	1420	3.280	1420	1.988	1420	1.789	1420	2.386	1420	2.386	1420	4.274
1425	23.75	0.996	1425	3.287	1425	1.992	1425	1.793	1425	2.390	1425	2.390	1425	4.283
1430	23.83	0.997	1430	3.290	1430	1.994	1430	1.795	1430	2.393	1430	2.393	1430	4.287
1435	23.92	0.999	1435	3.297	1435	1.998	1435	1.798	1435	2.398	1435	2.398	1435	4.296
1440	24.00	1.000	1440	3.300	1440	2.000	1440	1.800	1440	2.400	1440	2.400	1440	4.300

1. P_x/P_{24} values at 30 minute intervals have been determined per values indicated in Table II-B-2 of the 1993 SCHM. P_x/P_{24} values at 5 minute intervals have been linearly interpolated from the 30-minute data.

2. $P_{2,24}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type B - 2 Yr - 6 Hr Distribution

SCS Type B - 6 Hr Distribution Ratios			SCS Type B - 6 Hr Distribution Guejito Basin $P_{2,6}$[3]= 1.8		SCS Type B - 6 Hr Distribution Jamul Basin $P_{2,6}$[3]= 1.3		SCS Type B - 6 Hr Distribution Las Flores Basin $P_{2,6}$[3]= 1.3		SCS Type B - 6 Hr Distribution Los Coches Basin $P_{2,6}$[3]= 1.3		SCS Type B - 6 Hr Distribution Santa Maria Basin $P_{2,6}$[3]= 1.5		SCS Type B - 6 Hr Distribution Sweetwater Basin $P_{2,6}$[3]= 2.1	
Time[1] (min)	Time (hrs)	P_x/P_6[2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.006	5	0.011	5	0.008	5	0.008	5	0.008	5	0.009	5	0.013
10	0.17	0.011	10	0.020	10	0.014	10	0.014	10	0.014	10	0.017	10	0.023
15	0.25	0.016	15	0.029	15	0.021	15	0.021	15	0.021	15	0.024	15	0.034
20	0.33	0.022	20	0.040	20	0.029	20	0.029	20	0.029	20	0.033	20	0.046
25	0.42	0.028	25	0.050	25	0.036	25	0.036	25	0.036	25	0.042	25	0.059
30	0.50	0.034	30	0.061	30	0.044	30	0.044	30	0.044	30	0.051	30	0.071
35	0.58	0.041	35	0.074	35	0.053	35	0.053	35	0.053	35	0.062	35	0.086
40	0.67	0.048	40	0.086	40	0.062	40	0.062	40	0.062	40	0.072	40	0.101
45	0.75	0.054	45	0.097	45	0.070	45	0.070	45	0.070	45	0.081	45	0.113
50	0.83	0.061	50	0.110	50	0.079	50	0.079	50	0.079	50	0.092	50	0.128
55	0.92	0.069	55	0.124	55	0.090	55	0.090	55	0.090	55	0.104	55	0.145
60	1.00	0.077	60	0.139	60	0.100	60	0.100	60	0.100	60	0.116	60	0.162
65	1.08	0.086	65	0.155	65	0.112	65	0.112	65	0.112	65	0.129	65	0.181
70	1.17	0.095	70	0.171	70	0.124	70	0.124	70	0.124	70	0.143	70	0.200
75	1.25	0.104	75	0.187	75	0.135	75	0.135	75	0.135	75	0.156	75	0.218
80	1.33	0.115	80	0.207	80	0.150	80	0.150	80	0.150	80	0.173	80	0.242
85	1.42	0.126	85	0.227	85	0.164	85	0.164	85	0.164	85	0.189	85	0.265
90	1.50	0.137	90	0.247	90	0.178	90	0.178	90	0.178	90	0.206	90	0.288
95	1.58	0.150	95	0.270	95	0.195	95	0.195	95	0.195	95	0.225	95	0.315
100	1.67	0.165	100	0.297	100	0.215	100	0.215	100	0.215	100	0.248	100	0.347
105	1.75	0.180	105	0.324	105	0.234	105	0.234	105	0.234	105	0.270	105	0.378
110	1.83	0.200	110	0.360	110	0.260	110	0.260	110	0.260	110	0.300	110	0.420
115	1.92	0.225	115	0.405	115	0.293	115	0.293	115	0.293	115	0.338	115	0.473
120	2.00	0.255	120	0.459	120	0.332	120	0.332	120	0.332	120	0.383	120	0.536
125	2.08	0.300	125	0.540	125	0.390	125	0.390	125	0.390	125	0.450	125	0.630
130	2.17	0.351	130	0.632	130	0.456	130	0.456	130	0.456	130	0.527	130	0.737
135	2.25	0.410	135	0.738	135	0.533	135	0.533	135	0.533	135	0.615	135	0.861
140	2.33	0.474	140	0.853	140	0.616	140	0.616	140	0.616	140	0.711	140	0.995
145	2.42	0.533	145	0.959	145	0.693	145	0.693	145	0.693	145	0.800	145	1.119
150	2.50	0.588	150	1.058	150	0.764	150	0.764	150	0.764	150	0.882	150	1.235
155	2.58	0.615	155	1.107	155	0.800	155	0.800	155	0.800	155	0.923	155	1.292
160	2.67	0.638	160	1.148	160	0.829	160	0.829	160	0.829	160	0.957	160	1.340
165	2.75	0.656	165	1.181	165	0.853	165	0.853	165	0.853	165	0.984	165	1.378
170	2.83	0.671	170	1.208	170	0.872	170	0.872	170	0.872	170	1.007	170	1.409
175	2.92	0.686	175	1.235	175	0.892	175	0.892	175	0.892	175	1.029	175	1.441
180	3.00	0.700	180	1.260	180	0.910	180	0.910	180	0.910	180	1.050	180	1.470
185	3.08	0.713	185	1.283	185	0.927	185	0.927	185	0.927	185	1.070	185	1.497
190	3.17	0.726	190	1.307	190	0.944	190	0.944	190	0.944	190	1.089	190	1.525
195	3.25	0.739	195	1.330	195	0.961	195	0.961	195	0.961	195	1.109	195	1.552
200	3.33	0.750	200	1.350	200	0.975	200	0.975	200	0.975	200	1.125	200	1.575
205	3.42	0.761	205	1.370	205	0.989	205	0.989	205	0.989	205	1.142	205	1.598
210	3.50	0.772	210	1.390	210	1.004	210	1.004	210	1.004	210	1.158	210	1.621
215	3.58	0.784	215	1.411	215	1.019	215	1.019	215	1.019	215	1.176	215	1.646
220	3.67	0.793	220	1.427	220	1.031	220	1.031	220	1.031	220	1.190	220	1.665
225	3.75	0.800	225	1.440	225	1.040	225	1.040	225	1.040	225	1.200	225	1.680
230	3.83	0.811	230	1.460	230	1.054	230	1.054	230	1.054	230	1.217	230	1.703
235	3.92	0.821	235	1.478	235	1.067	235	1.067	235	1.067	235	1.232	235	1.724
240	4.00	0.831	240	1.496	240	1.080	240	1.080	240	1.080	240	1.247	240	1.745
245	4.08	0.840	245	1.512	245	1.092	245	1.092	245	1.092	245	1.260	245	1.764
250	4.17	0.850	250	1.530	250	1.105	250	1.105	250	1.105	250	1.275	250	1.785
255	4.25	0.860	255	1.548	255	1.118	255	1.118	255	1.118	255	1.290	255	1.806
260	4.33	0.868	260	1.562	260	1.128	260	1.128	260	1.128	260	1.302	260	1.823
265	4.42	0.876	265	1.577	265	1.139	265	1.139	265	1.139	265	1.314	265	1.840

SCS Type B - 2 Yr - 6 Hr Distribution

SCS Type B - 6 Hr Distribution Ratios			SCS Type B - 6 Hr Distribution Guejito Basin $P_{2,6}$[3]= 1.8		SCS Type B - 6 Hr Distribution Jamul Basin $P_{2,6}$[3]= 1.3		SCS Type B - 6 Hr Distribution Las Flores Basin $P_{2,6}$[3]= 1.3		SCS Type B - 6 Hr Distribution Los Coches Basin $P_{2,6}$[3]= 1.3		SCS Type B - 6 Hr Distribution Santa Maria Basin $P_{2,6}$[3]= 1.5		SCS Type B - 6 Hr Distribution Sweetwater Basin $P_{2,6}$[3]= 2.1	
Time[1] (min)	Time (hrs)	P_x/P_6[2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.885	270	1.593	270	1.151	270	1.151	270	1.151	270	1.328	270	1.859
275	4.58	0.892	275	1.606	275	1.160	275	1.160	275	1.160	275	1.338	275	1.873
280	4.67	0.898	280	1.616	280	1.167	280	1.167	280	1.167	280	1.347	280	1.886
285	4.75	0.905	285	1.629	285	1.177	285	1.177	285	1.177	285	1.358	285	1.901
290	4.83	0.911	290	1.640	290	1.184	290	1.184	290	1.184	290	1.367	290	1.913
295	4.92	0.917	295	1.651	295	1.192	295	1.192	295	1.192	295	1.376	295	1.926
300	5.00	0.924	300	1.663	300	1.201	300	1.201	300	1.201	300	1.386	300	1.940
305	5.08	0.931	305	1.676	305	1.210	305	1.210	305	1.210	305	1.397	305	1.955
310	5.17	0.938	310	1.688	310	1.219	310	1.219	310	1.219	310	1.407	310	1.970
315	5.25	0.945	315	1.701	315	1.229	315	1.229	315	1.229	315	1.418	315	1.985
320	5.33	0.951	320	1.712	320	1.236	320	1.236	320	1.236	320	1.427	320	1.997
325	5.42	0.957	325	1.723	325	1.244	325	1.244	325	1.244	325	1.436	325	2.010
330	5.50	0.963	330	1.733	330	1.252	330	1.252	330	1.252	330	1.445	330	2.022
335	5.58	0.969	335	1.744	335	1.260	335	1.260	335	1.260	335	1.454	335	2.035
340	5.67	0.975	340	1.755	340	1.268	340	1.268	340	1.268	340	1.463	340	2.048
345	5.75	0.981	345	1.766	345	1.275	345	1.275	345	1.275	345	1.472	345	2.060
350	5.83	0.988	350	1.778	350	1.284	350	1.284	350	1.284	350	1.482	350	2.075
355	5.92	0.994	355	1.789	355	1.292	355	1.292	355	1.292	355	1.491	355	2.087
360	6.00	1.000	360	1.800	360	1.300	360	1.300	360	1.300	360	1.500	360	2.100

1. Time values for the 6 hr distribution are determined by dividing the time intervals from the SCS Type B - 24 hr distribution by 4.
2. P_x/P_6 ratios correspond to P_x/P_{24} ratios at times (in minutes) that are 4 times greater than P_x/P_6 times. For example, P_x/P_6 at 100 minutes equals P_x/P_{24} at 400 minutes.
3. $P_{2,6}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

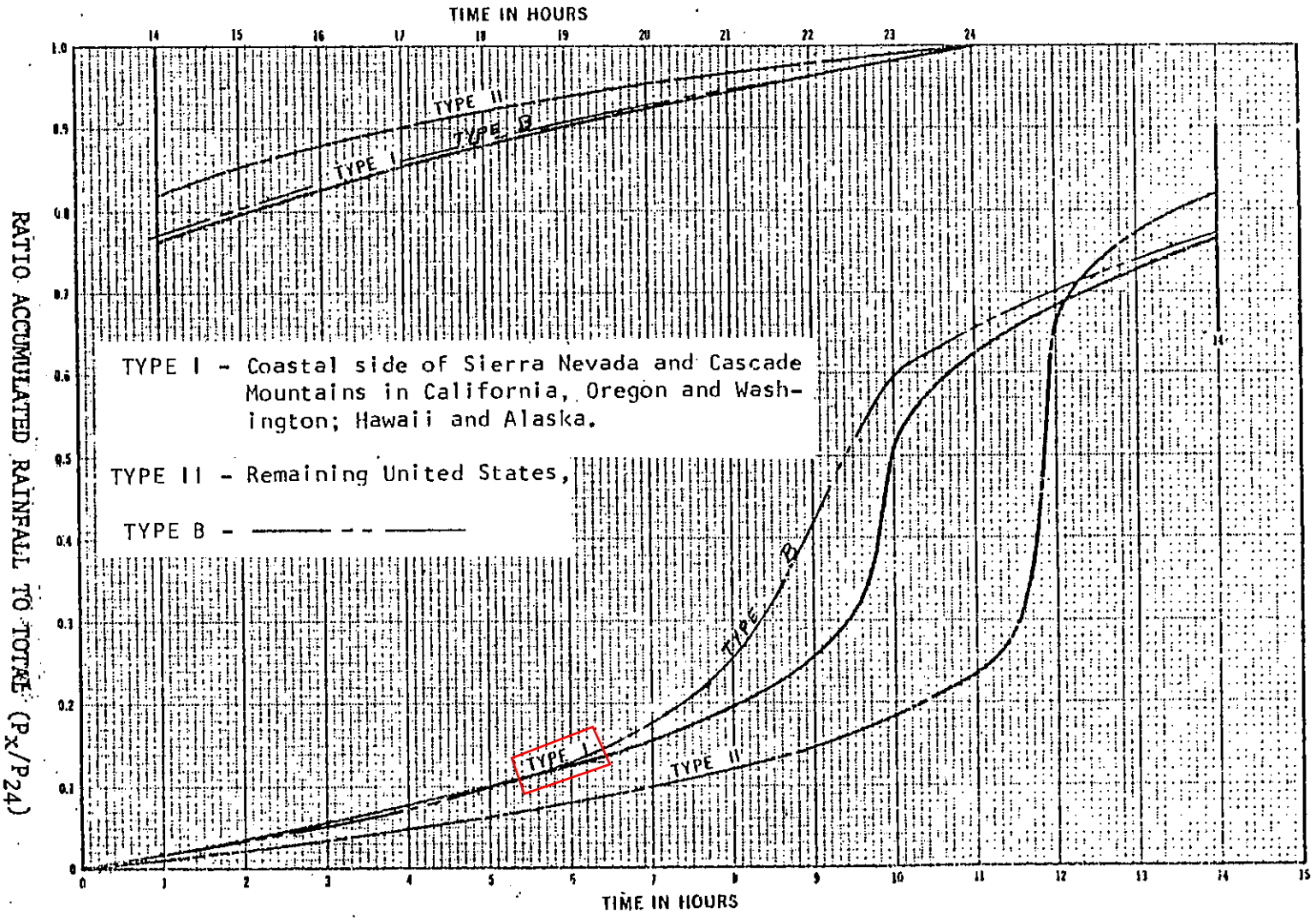
This page is intentionally left blank to facilitate 2-sided printing.

Appendix C.9

SCS Type 1 Distribution

This page is intentionally left blank to facilitate 2-sided printing.

Figure II-B-1



TWENTY-FOUR HOUR RAINFALL DISTRIBUTION (SCS).

COUNTY OF SAN DIEGO
DEPARTMENT OF SANITATION
AND FLOOD CONTROL

SCS Type 1 – 24 Hour Distribution Ratios

Time (min)	P_x/P_{24} [1] (ratio)
0	0.000
5	0.001
10	0.003
15	0.004
20	0.006
25	0.007
30	0.009
35	0.010
40	0.012
45	0.013
50	0.014
55	0.016
60	0.017
65	0.019
70	0.020
75	0.022
80	0.023
85	0.025
90	0.026
95	0.028
100	0.029
105	0.030
110	0.032
115	0.033
120	0.035
125	0.036
130	0.038
135	0.039
140	0.041
145	0.042
150	0.044
155	0.046
160	0.047
165	0.049
170	0.051
175	0.052
180	0.054
185	0.056
190	0.058
195	0.059
200	0.061
205	0.063
210	0.065
215	0.066
220	0.068
225	0.070
230	0.072
235	0.074
240	0.076

Time (min)	P_x/P_{24} [1] (ratio)
245	0.078
250	0.080
255	0.082
260	0.084
265	0.086
270	0.088
275	0.090
280	0.092
285	0.094
290	0.096
295	0.098
300	0.100
305	0.102
310	0.104
315	0.106
320	0.108
325	0.110
330	0.112
335	0.114
340	0.116
345	0.118
350	0.121
355	0.123
360	0.125
365	0.127
370	0.129
375	0.132
380	0.134
385	0.136
390	0.139
395	0.142
400	0.144
405	0.147
410	0.150
415	0.153
420	0.156
425	0.159
430	0.162
435	0.165
440	0.168
445	0.171
450	0.174
455	0.178
460	0.181
465	0.184
470	0.187
475	0.191
480	0.194
485	0.197

Time (min)	P_x/P_{24} [1] (ratio)
490	0.201
495	0.205
500	0.209
505	0.214
510	0.219
515	0.224
520	0.229
525	0.235
530	0.241
535	0.247
540	0.254
545	0.261
550	0.268
555	0.276
560	0.285
565	0.293
570	0.303
575	0.316
580	0.336
585	0.362
590	0.411
595	0.475
600	0.515
605	0.530
610	0.542
615	0.555
620	0.565
625	0.575
630	0.583
635	0.590
640	0.597
645	0.604
650	0.611
655	0.617
660	0.623
665	0.629
670	0.634
675	0.640
680	0.645
685	0.650
690	0.655
695	0.660
700	0.665
705	0.670
710	0.675
715	0.679
720	0.684
725	0.688
730	0.693

Time (min)	P_x/P_{24} [1] (ratio)
735	0.697
740	0.701
745	0.705
750	0.709
755	0.713
760	0.717
765	0.721
770	0.725
775	0.728
780	0.732
785	0.735
790	0.739
795	0.742
800	0.746
805	0.749
810	0.752
815	0.755
820	0.758
825	0.761
830	0.764
835	0.767
840	0.770
845	0.773
850	0.775
855	0.778
860	0.781
865	0.783
870	0.786
875	0.789
880	0.791
885	0.794
890	0.797
895	0.799
900	0.802
905	0.804
910	0.807
915	0.810
920	0.812
925	0.815
930	0.817
935	0.820
940	0.822
945	0.825
950	0.827
955	0.829
960	0.832
965	0.834
970	0.837
975	0.839

Time (min)	P_x/P_{24} [1] (ratio)
980	0.841
985	0.844
990	0.846
995	0.848
1000	0.851
1005	0.853
1010	0.855
1015	0.858
1020	0.860
1025	0.862
1030	0.864
1035	0.867
1040	0.869
1045	0.871
1050	0.873
1055	0.875
1060	0.877
1065	0.880
1070	0.882
1075	0.884
1080	0.886
1085	0.888
1090	0.890
1095	0.892
1100	0.894
1105	0.896
1110	0.898
1115	0.900
1120	0.902
1125	0.904
1130	0.906
1135	0.908
1140	0.910
1145	0.912
1150	0.914
1155	0.916
1160	0.917
1165	0.919
1170	0.921
1175	0.923
1180	0.925
1185	0.927
1190	0.928
1195	0.930
1200	0.932
1205	0.934
1210	0.935
1215	0.937
1220	0.939

Time (min)	P_x/P_{24} [1] (ratio)
1225	0.940
1230	0.942
1235	0.944
1240	0.945
1245	0.947
1250	0.949
1255	0.950
1260	0.952
1265	0.953
1270	0.955
1275	0.957
1280	0.958
1285	0.960
1290	0.961
1295	0.963
1300	0.964
1305	0.966
1310	0.967
1315	0.968
1320	0.970
1325	0.971
1330	0.973
1335	0.974
1340	0.975
1345	0.977
1350	0.978
1355	0.979
1360	0.981
1365	0.982
1370	0.983
1375	0.984
1380	0.986
1385	0.987
1390	0.988
1395	0.989
1400	0.991
1405	0.992
1410	0.993
1415	0.994
1420	0.995
1425	0.996
1430	0.998
1435	0.999
1440	1.000

1. P_x/P_{24} values as linearly interpolated from Figure II-B-1 of the 1993 SDCHM.

SCS Type 1 – 6 Hour Distribution Ratios

Time (min)	P_x/P_6[1] (ratio)
0	0.000
5	0.006
10	0.012
15	0.017
20	0.023
25	0.029
30	0.035
35	0.041
40	0.047
45	0.054
50	0.061
55	0.068
60	0.076
65	0.084
70	0.092
75	0.100
80	0.108
85	0.116
90	0.125
95	0.134
100	0.144
105	0.156
110	0.168
115	0.181
120	0.194
125	0.209
130	0.229
135	0.254
140	0.285
145	0.336
150	0.515
155	0.565
160	0.597
165	0.623
170	0.645
175	0.665
180	0.684
185	0.701
190	0.717
195	0.732
200	0.746
205	0.758
210	0.770
215	0.781
220	0.791
225	0.802
230	0.812
235	0.822
240	0.832
245	0.841
250	0.851
255	0.860
260	0.869
265	0.877
270	0.886
275	0.894
280	0.902
285	0.910
290	0.917
295	0.925
300	0.932
305	0.939
310	0.945
315	0.952
320	0.958
325	0.964
330	0.970
335	0.975
340	0.981
345	0.986
350	0.991
355	0.995
360	1.000

1. P_x/P_6 ratios correspond to P_x/P_{24} ratios at times (in minutes) that are 4 times greater than P_x/P_6 times. For example P_x/P_6 at 100 minutes equals P_x/P_{24} at 400 minutes.

SCS Type 1 - 100 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{100,24}$ [2]= 7.9		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{100,24}$ [2]= 6.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{100,24}$ [2]= 4.6		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{100,24}$ [2]= 6.2		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{100,24}$ [2]= 5.7		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{100,24}$ [2]= 11.4	
Time (min)	Time (hrs)	P_x/P_{24} [1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.001	5	0.008	5	0.006	5	0.005	5	0.006	5	0.006	5	0.011
10	0.17	0.003	10	0.024	10	0.018	10	0.014	10	0.019	10	0.017	10	0.034
15	0.25	0.004	15	0.032	15	0.024	15	0.018	15	0.025	15	0.023	15	0.046
20	0.33	0.006	20	0.047	20	0.036	20	0.028	20	0.037	20	0.034	20	0.068
25	0.42	0.007	25	0.055	25	0.042	25	0.032	25	0.043	25	0.040	25	0.080
30	0.50	0.009	30	0.071	30	0.054	30	0.041	30	0.056	30	0.051	30	0.103
35	0.58	0.010	35	0.079	35	0.060	35	0.046	35	0.062	35	0.057	35	0.114
40	0.67	0.012	40	0.095	40	0.072	40	0.055	40	0.074	40	0.068	40	0.137
45	0.75	0.013	45	0.103	45	0.078	45	0.060	45	0.081	45	0.074	45	0.148
50	0.83	0.014	50	0.111	50	0.084	50	0.064	50	0.087	50	0.080	50	0.160
55	0.92	0.016	55	0.126	55	0.096	55	0.074	55	0.099	55	0.091	55	0.182
60	1.00	0.017	60	0.134	60	0.102	60	0.078	60	0.105	60	0.097	60	0.194
65	1.08	0.019	65	0.150	65	0.114	65	0.087	65	0.118	65	0.108	65	0.217
70	1.17	0.020	70	0.158	70	0.120	70	0.092	70	0.124	70	0.114	70	0.228
75	1.25	0.022	75	0.174	75	0.132	75	0.101	75	0.136	75	0.125	75	0.251
80	1.33	0.023	80	0.182	80	0.138	80	0.106	80	0.143	80	0.131	80	0.262
85	1.42	0.025	85	0.198	85	0.150	85	0.115	85	0.155	85	0.143	85	0.285
90	1.50	0.026	90	0.205	90	0.156	90	0.120	90	0.161	90	0.148	90	0.296
95	1.58	0.028	95	0.221	95	0.168	95	0.129	95	0.174	95	0.160	95	0.319
100	1.67	0.029	100	0.229	100	0.174	100	0.133	100	0.180	100	0.165	100	0.331
105	1.75	0.030	105	0.237	105	0.180	105	0.138	105	0.186	105	0.171	105	0.342
110	1.83	0.032	110	0.253	110	0.192	110	0.147	110	0.198	110	0.182	110	0.365
115	1.92	0.033	115	0.261	115	0.198	115	0.152	115	0.205	115	0.188	115	0.376
120	2.00	0.035	120	0.277	120	0.210	120	0.161	120	0.217	120	0.200	120	0.399
125	2.08	0.036	125	0.284	125	0.216	125	0.166	125	0.223	125	0.205	125	0.410
130	2.17	0.038	130	0.300	130	0.228	130	0.175	130	0.236	130	0.217	130	0.433
135	2.25	0.039	135	0.308	135	0.234	135	0.179	135	0.242	135	0.222	135	0.445
140	2.33	0.041	140	0.324	140	0.246	140	0.189	140	0.254	140	0.234	140	0.467
145	2.42	0.042	145	0.332	145	0.252	145	0.193	145	0.260	145	0.239	145	0.479
150	2.50	0.044	150	0.348	150	0.264	150	0.202	150	0.273	150	0.251	150	0.502
155	2.58	0.046	155	0.363	155	0.276	155	0.212	155	0.285	155	0.262	155	0.524
160	2.67	0.047	160	0.371	160	0.282	160	0.216	160	0.291	160	0.268	160	0.536
165	2.75	0.049	165	0.387	165	0.294	165	0.225	165	0.304	165	0.279	165	0.559
170	2.83	0.051	170	0.403	170	0.306	170	0.235	170	0.316	170	0.291	170	0.581
175	2.92	0.052	175	0.411	175	0.312	175	0.239	175	0.322	175	0.296	175	0.593
180	3.00	0.054	180	0.427	180	0.324	180	0.248	180	0.335	180	0.308	180	0.616
185	3.08	0.056	185	0.442	185	0.336	185	0.258	185	0.347	185	0.319	185	0.638
190	3.17	0.058	190	0.458	190	0.348	190	0.267	190	0.360	190	0.331	190	0.661
195	3.25	0.059	195	0.466	195	0.354	195	0.271	195	0.366	195	0.336	195	0.673
200	3.33	0.061	200	0.482	200	0.366	200	0.281	200	0.378	200	0.348	200	0.695
205	3.42	0.063	205	0.498	205	0.378	205	0.290	205	0.391	205	0.359	205	0.718
210	3.50	0.065	210	0.514	210	0.390	210	0.299	210	0.403	210	0.371	210	0.741
215	3.58	0.066	215	0.521	215	0.396	215	0.304	215	0.409	215	0.376	215	0.752
220	3.67	0.068	220	0.537	220	0.408	220	0.313	220	0.422	220	0.388	220	0.775
225	3.75	0.070	225	0.553	225	0.420	225	0.322	225	0.434	225	0.399	225	0.798
230	3.83	0.072	230	0.569	230	0.432	230	0.331	230	0.446	230	0.410	230	0.821
235	3.92	0.074	235	0.585	235	0.444	235	0.340	235	0.459	235	0.422	235	0.844
240	4.00	0.076	240	0.600	240	0.456	240	0.350	240	0.471	240	0.433	240	0.866
245	4.08	0.078	245	0.616	245	0.468	245	0.359	245	0.484	245	0.445	245	0.889
250	4.17	0.080	250	0.632	250	0.480	250	0.368	250	0.496	250	0.456	250	0.912
255	4.25	0.082	255	0.648	255	0.492	255	0.377	255	0.508	255	0.467	255	0.935
260	4.33	0.084	260	0.664	260	0.504	260	0.386	260	0.521	260	0.479	260	0.958
265	4.42	0.086	265	0.679	265	0.516	265	0.396	265	0.533	265	0.490	265	0.980

SCS Type 1 - 100 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{100,24}$ [2]= 7.9		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{100,24}$ [2]= 6.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{100,24}$ [2]= 4.6		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{100,24}$ [2]= 6.2		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{100,24}$ [2]= 5.7		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{100,24}$ [2]= 11.4	
Time (min)	Time (hrs)	P_x/P_{24} [1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.088	270	0.695	270	0.528	270	0.405	270	0.546	270	0.502	270	1.003
275	4.58	0.090	275	0.711	275	0.540	275	0.414	275	0.558	275	0.513	275	1.026
280	4.67	0.092	280	0.727	280	0.552	280	0.423	280	0.570	280	0.524	280	1.049
285	4.75	0.094	285	0.743	285	0.564	285	0.432	285	0.583	285	0.536	285	1.072
290	4.83	0.096	290	0.758	290	0.576	290	0.442	290	0.595	290	0.547	290	1.094
295	4.92	0.098	295	0.774	295	0.588	295	0.451	295	0.608	295	0.559	295	1.117
300	5.00	0.100	300	0.790	300	0.600	300	0.460	300	0.620	300	0.570	300	1.140
305	5.08	0.102	305	0.806	305	0.612	305	0.469	305	0.632	305	0.581	305	1.163
310	5.17	0.104	310	0.822	310	0.624	310	0.478	310	0.645	310	0.593	310	1.186
315	5.25	0.106	315	0.837	315	0.636	315	0.488	315	0.657	315	0.604	315	1.208
320	5.33	0.108	320	0.853	320	0.648	320	0.497	320	0.670	320	0.616	320	1.231
325	5.42	0.110	325	0.869	325	0.660	325	0.506	325	0.682	325	0.627	325	1.254
330	5.50	0.112	330	0.885	330	0.672	330	0.515	330	0.694	330	0.638	330	1.277
335	5.58	0.114	335	0.901	335	0.684	335	0.524	335	0.707	335	0.650	335	1.300
340	5.67	0.116	340	0.916	340	0.696	340	0.534	340	0.719	340	0.661	340	1.322
345	5.75	0.118	345	0.932	345	0.708	345	0.543	345	0.732	345	0.673	345	1.345
350	5.83	0.121	350	0.956	350	0.726	350	0.557	350	0.750	350	0.690	350	1.379
355	5.92	0.123	355	0.972	355	0.738	355	0.566	355	0.763	355	0.701	355	1.402
360	6.00	0.125	360	0.988	360	0.750	360	0.575	360	0.775	360	0.713	360	1.425
365	6.08	0.127	365	1.003	365	0.762	365	0.584	365	0.787	365	0.724	365	1.448
370	6.17	0.129	370	1.019	370	0.774	370	0.593	370	0.800	370	0.735	370	1.471
375	6.25	0.132	375	1.043	375	0.792	375	0.607	375	0.818	375	0.752	375	1.505
380	6.33	0.134	380	1.059	380	0.804	380	0.616	380	0.831	380	0.764	380	1.528
385	6.42	0.136	385	1.074	385	0.816	385	0.626	385	0.843	385	0.775	385	1.550
390	6.50	0.139	390	1.098	390	0.834	390	0.639	390	0.862	390	0.792	390	1.585
395	6.58	0.142	395	1.122	395	0.852	395	0.653	395	0.880	395	0.809	395	1.619
400	6.67	0.144	400	1.138	400	0.864	400	0.662	400	0.893	400	0.821	400	1.642
405	6.75	0.147	405	1.161	405	0.882	405	0.676	405	0.911	405	0.838	405	1.676
410	6.83	0.150	410	1.185	410	0.900	410	0.690	410	0.930	410	0.855	410	1.710
415	6.92	0.153	415	1.209	415	0.918	415	0.704	415	0.949	415	0.872	415	1.744
420	7.00	0.156	420	1.232	420	0.936	420	0.718	420	0.967	420	0.889	420	1.778
425	7.08	0.159	425	1.256	425	0.954	425	0.731	425	0.986	425	0.906	425	1.813
430	7.17	0.162	430	1.280	430	0.972	430	0.745	430	1.004	430	0.923	430	1.847
435	7.25	0.165	435	1.304	435	0.990	435	0.759	435	1.023	435	0.941	435	1.881
440	7.33	0.168	440	1.327	440	1.008	440	0.773	440	1.042	440	0.958	440	1.915
445	7.42	0.171	445	1.351	445	1.026	445	0.787	445	1.060	445	0.975	445	1.949
450	7.50	0.174	450	1.375	450	1.044	450	0.800	450	1.079	450	0.992	450	1.984
455	7.58	0.178	455	1.406	455	1.068	455	0.819	455	1.104	455	1.015	455	2.029
460	7.67	0.181	460	1.430	460	1.086	460	0.833	460	1.122	460	1.032	460	2.063
465	7.75	0.184	465	1.454	465	1.104	465	0.846	465	1.141	465	1.049	465	2.098
470	7.83	0.187	470	1.477	470	1.122	470	0.860	470	1.159	470	1.066	470	2.132
475	7.92	0.191	475	1.509	475	1.146	475	0.879	475	1.184	475	1.089	475	2.177
480	8.00	0.194	480	1.533	480	1.164	480	0.892	480	1.203	480	1.106	480	2.212
485	8.08	0.197	485	1.556	485	1.182	485	0.906	485	1.221	485	1.123	485	2.246
490	8.17	0.201	490	1.588	490	1.206	490	0.925	490	1.246	490	1.146	490	2.291
495	8.25	0.205	495	1.620	495	1.230	495	0.943	495	1.271	495	1.169	495	2.337
500	8.33	0.209	500	1.651	500	1.254	500	0.961	500	1.296	500	1.191	500	2.383
505	8.42	0.214	505	1.691	505	1.284	505	0.984	505	1.327	505	1.220	505	2.440
510	8.50	0.219	510	1.730	510	1.314	510	1.007	510	1.358	510	1.248	510	2.497
515	8.58	0.224	515	1.770	515	1.344	515	1.030	515	1.389	515	1.277	515	2.554
520	8.67	0.229	520	1.809	520	1.374	520	1.053	520	1.420	520	1.305	520	2.611
525	8.75	0.235	525	1.857	525	1.410	525	1.081	525	1.457	525	1.340	525	2.679
530	8.83	0.241	530	1.904	530	1.446	530	1.109	530	1.494	530	1.374	530	2.747
535	8.92	0.247	535	1.951	535	1.482	535	1.136	535	1.531	535	1.408	535	2.816

SCS Type 1 - 100 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{100,24}$ [2]= 7.9		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{100,24}$ [2]= 6.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{100,24}$ [2]= 4.6		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{100,24}$ [2]= 6.2		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{100,24}$ [2]= 5.7		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{100,24}$ [2]= 11.4	
Time (min)	Time (hrs)	P_x/P_{24} [1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
540	9.00	0.254	540	2.007	540	1.524	540	1.168	540	1.575	540	1.448	540	2.896
545	9.08	0.261	545	2.062	545	1.566	545	1.201	545	1.618	545	1.488	545	2.975
550	9.17	0.268	550	2.117	550	1.608	550	1.233	550	1.662	550	1.528	550	3.055
555	9.25	0.276	555	2.180	555	1.656	555	1.270	555	1.711	555	1.573	555	3.146
560	9.33	0.285	560	2.252	560	1.710	560	1.311	560	1.767	560	1.625	560	3.249
565	9.42	0.293	565	2.315	565	1.758	565	1.348	565	1.817	565	1.670	565	3.340
570	9.50	0.303	570	2.394	570	1.818	570	1.394	570	1.879	570	1.727	570	3.454
575	9.58	0.316	575	2.496	575	1.896	575	1.454	575	1.959	575	1.801	575	3.602
580	9.67	0.336	580	2.654	580	2.016	580	1.546	580	2.083	580	1.915	580	3.830
585	9.75	0.362	585	2.860	585	2.172	585	1.665	585	2.244	585	2.063	585	4.127
590	9.83	0.411	590	3.247	590	2.466	590	1.891	590	2.548	590	2.343	590	4.685
595	9.92	0.475	595	3.753	595	2.850	595	2.185	595	2.945	595	2.708	595	5.415
600	10.00	0.515	600	4.069	600	3.090	600	2.369	600	3.193	600	2.936	600	5.871
605	10.08	0.530	605	4.187	605	3.180	605	2.438	605	3.286	605	3.021	605	6.042
610	10.17	0.542	610	4.282	610	3.252	610	2.493	610	3.360	610	3.089	610	6.179
615	10.25	0.555	615	4.385	615	3.330	615	2.553	615	3.441	615	3.164	615	6.327
620	10.33	0.565	620	4.464	620	3.390	620	2.599	620	3.503	620	3.221	620	6.441
625	10.42	0.575	625	4.543	625	3.450	625	2.645	625	3.565	625	3.278	625	6.555
630	10.50	0.583	630	4.606	630	3.498	630	2.682	630	3.615	630	3.323	630	6.646
635	10.58	0.590	635	4.661	635	3.540	635	2.714	635	3.658	635	3.363	635	6.726
640	10.67	0.597	640	4.716	640	3.582	640	2.746	640	3.701	640	3.403	640	6.806
645	10.75	0.604	645	4.772	645	3.624	645	2.778	645	3.745	645	3.443	645	6.886
650	10.83	0.611	650	4.827	650	3.666	650	2.811	650	3.788	650	3.483	650	6.965
655	10.92	0.617	655	4.874	655	3.702	655	2.838	655	3.825	655	3.517	655	7.034
660	11.00	0.623	660	4.922	660	3.738	660	2.866	660	3.863	660	3.551	660	7.102
665	11.08	0.629	665	4.969	665	3.774	665	2.893	665	3.900	665	3.585	665	7.171
670	11.17	0.634	670	5.009	670	3.804	670	2.916	670	3.931	670	3.614	670	7.228
675	11.25	0.640	675	5.056	675	3.840	675	2.944	675	3.968	675	3.648	675	7.296
680	11.33	0.645	680	5.096	680	3.870	680	2.967	680	3.999	680	3.677	680	7.353
685	11.42	0.650	685	5.135	685	3.900	685	2.990	685	4.030	685	3.705	685	7.410
690	11.50	0.655	690	5.175	690	3.930	690	3.013	690	4.061	690	3.734	690	7.467
695	11.58	0.660	695	5.214	695	3.960	695	3.036	695	4.092	695	3.762	695	7.524
700	11.67	0.665	700	5.254	700	3.990	700	3.059	700	4.123	700	3.791	700	7.581
705	11.75	0.670	705	5.293	705	4.020	705	3.082	705	4.154	705	3.819	705	7.638
710	11.83	0.675	710	5.333	710	4.050	710	3.105	710	4.185	710	3.848	710	7.695
715	11.92	0.679	715	5.364	715	4.074	715	3.123	715	4.210	715	3.870	715	7.741
720	12.00	0.684	720	5.404	720	4.104	720	3.146	720	4.241	720	3.899	720	7.798
725	12.08	0.688	725	5.435	725	4.128	725	3.165	725	4.266	725	3.922	725	7.843
730	12.17	0.693	730	5.475	730	4.158	730	3.188	730	4.297	730	3.950	730	7.900
735	12.25	0.697	735	5.506	735	4.182	735	3.206	735	4.321	735	3.973	735	7.946
740	12.33	0.701	740	5.538	740	4.206	740	3.225	740	4.346	740	3.996	740	7.991
745	12.42	0.705	745	5.570	745	4.230	745	3.243	745	4.371	745	4.019	745	8.037
750	12.50	0.709	750	5.601	750	4.254	750	3.261	750	4.396	750	4.041	750	8.083
755	12.58	0.713	755	5.633	755	4.278	755	3.280	755	4.421	755	4.064	755	8.128
760	12.67	0.717	760	5.664	760	4.302	760	3.298	760	4.445	760	4.087	760	8.174
765	12.75	0.721	765	5.696	765	4.326	765	3.317	765	4.470	765	4.110	765	8.219
770	12.83	0.725	770	5.728	770	4.350	770	3.335	770	4.495	770	4.133	770	8.265
775	12.92	0.728	775	5.751	775	4.368	775	3.349	775	4.514	775	4.150	775	8.299
780	13.00	0.732	780	5.783	780	4.392	780	3.367	780	4.538	780	4.172	780	8.345
785	13.08	0.735	785	5.807	785	4.410	785	3.381	785	4.557	785	4.190	785	8.379
790	13.17	0.739	790	5.838	790	4.434	790	3.399	790	4.582	790	4.212	790	8.425
795	13.25	0.742	795	5.862	795	4.452	795	3.413	795	4.600	795	4.229	795	8.459
800	13.33	0.746	800	5.893	800	4.476	800	3.432	800	4.625	800	4.252	800	8.504
805	13.42	0.749	805	5.917	805	4.494	805	3.445	805	4.644	805	4.269	805	8.539

SCS Type 1 - 100 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{100,24}$ [2]= 7.9		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{100,24}$ [2]= 6.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{100,24}$ [2]= 4.6		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{100,24}$ [2]= 6.2		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{100,24}$ [2]= 5.7		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{100,24}$ [2]= 11.4	
Time (min)	Time (hrs)	P_x/P_{24} [1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
810	13.50	0.752	810	5.941	810	4.512	810	3.459	810	4.662	810	4.286	810	8.573
815	13.58	0.755	815	5.965	815	4.530	815	3.473	815	4.681	815	4.304	815	8.607
820	13.67	0.758	820	5.988	820	4.548	820	3.487	820	4.700	820	4.321	820	8.641
825	13.75	0.761	825	6.012	825	4.566	825	3.501	825	4.718	825	4.338	825	8.675
830	13.83	0.764	830	6.036	830	4.584	830	3.514	830	4.737	830	4.355	830	8.710
835	13.92	0.767	835	6.059	835	4.602	835	3.528	835	4.755	835	4.372	835	8.744
840	14.00	0.770	840	6.083	840	4.620	840	3.542	840	4.774	840	4.389	840	8.778
845	14.08	0.773	845	6.107	845	4.638	845	3.556	845	4.793	845	4.406	845	8.812
850	14.17	0.775	850	6.123	850	4.650	850	3.565	850	4.805	850	4.418	850	8.835
855	14.25	0.778	855	6.146	855	4.668	855	3.579	855	4.824	855	4.435	855	8.869
860	14.33	0.781	860	6.170	860	4.686	860	3.593	860	4.842	860	4.452	860	8.903
865	14.42	0.783	865	6.186	865	4.698	865	3.602	865	4.855	865	4.463	865	8.926
870	14.50	0.786	870	6.209	870	4.716	870	3.616	870	4.873	870	4.480	870	8.960
875	14.58	0.789	875	6.233	875	4.734	875	3.629	875	4.892	875	4.497	875	8.995
880	14.67	0.791	880	6.249	880	4.746	880	3.639	880	4.904	880	4.509	880	9.017
885	14.75	0.794	885	6.273	885	4.764	885	3.652	885	4.923	885	4.526	885	9.052
890	14.83	0.797	890	6.296	890	4.782	890	3.666	890	4.941	890	4.543	890	9.086
895	14.92	0.799	895	6.312	895	4.794	895	3.675	895	4.954	895	4.554	895	9.109
900	15.00	0.802	900	6.336	900	4.812	900	3.689	900	4.972	900	4.571	900	9.143
905	15.08	0.804	905	6.352	905	4.824	905	3.698	905	4.985	905	4.583	905	9.166
910	15.17	0.807	910	6.375	910	4.842	910	3.712	910	5.003	910	4.600	910	9.200
915	15.25	0.810	915	6.399	915	4.860	915	3.726	915	5.022	915	4.617	915	9.234
920	15.33	0.812	920	6.415	920	4.872	920	3.735	920	5.034	920	4.628	920	9.257
925	15.42	0.815	925	6.439	925	4.890	925	3.749	925	5.053	925	4.646	925	9.291
930	15.50	0.817	930	6.454	930	4.902	930	3.758	930	5.065	930	4.657	930	9.314
935	15.58	0.820	935	6.478	935	4.920	935	3.772	935	5.084	935	4.674	935	9.348
940	15.67	0.822	940	6.494	940	4.932	940	3.781	940	5.096	940	4.685	940	9.371
945	15.75	0.825	945	6.518	945	4.950	945	3.795	945	5.115	945	4.703	945	9.405
950	15.83	0.827	950	6.533	950	4.962	950	3.804	950	5.127	950	4.714	950	9.428
955	15.92	0.829	955	6.549	955	4.974	955	3.813	955	5.140	955	4.725	955	9.451
960	16.00	0.832	960	6.573	960	4.992	960	3.827	960	5.158	960	4.742	960	9.485
965	16.08	0.834	965	6.589	965	5.004	965	3.836	965	5.171	965	4.754	965	9.508
970	16.17	0.837	970	6.612	970	5.022	970	3.850	970	5.189	970	4.771	970	9.542
975	16.25	0.839	975	6.628	975	5.034	975	3.859	975	5.202	975	4.782	975	9.565
980	16.33	0.841	980	6.644	980	5.046	980	3.869	980	5.214	980	4.794	980	9.587
985	16.42	0.844	985	6.668	985	5.064	985	3.882	985	5.233	985	4.811	985	9.622
990	16.50	0.846	990	6.683	990	5.076	990	3.892	990	5.245	990	4.822	990	9.644
995	16.58	0.848	995	6.699	995	5.088	995	3.901	995	5.258	995	4.834	995	9.667
1000	16.67	0.851	1000	6.723	1000	5.106	1000	3.915	1000	5.276	1000	4.851	1000	9.701
1005	16.75	0.853	1005	6.739	1005	5.118	1005	3.924	1005	5.289	1005	4.862	1005	9.724
1010	16.83	0.855	1010	6.755	1010	5.130	1010	3.933	1010	5.301	1010	4.874	1010	9.747
1015	16.92	0.858	1015	6.778	1015	5.148	1015	3.947	1015	5.320	1015	4.891	1015	9.781
1020	17.00	0.860	1020	6.794	1020	5.160	1020	3.956	1020	5.332	1020	4.902	1020	9.804
1025	17.08	0.862	1025	6.810	1025	5.172	1025	3.965	1025	5.344	1025	4.913	1025	9.827
1030	17.17	0.864	1030	6.826	1030	5.184	1030	3.974	1030	5.357	1030	4.925	1030	9.850
1035	17.25	0.867	1035	6.849	1035	5.202	1035	3.988	1035	5.375	1035	4.942	1035	9.884
1040	17.33	0.869	1040	6.865	1040	5.214	1040	3.997	1040	5.388	1040	4.953	1040	9.907
1045	17.42	0.871	1045	6.881	1045	5.226	1045	4.007	1045	5.400	1045	4.965	1045	9.929
1050	17.50	0.873	1050	6.897	1050	5.238	1050	4.016	1050	5.413	1050	4.976	1050	9.952
1055	17.58	0.875	1055	6.913	1055	5.250	1055	4.025	1055	5.425	1055	4.988	1055	9.975
1060	17.67	0.877	1060	6.928	1060	5.262	1060	4.034	1060	5.437	1060	4.999	1060	9.998
1065	17.75	0.880	1065	6.952	1065	5.280	1065	4.048	1065	5.456	1065	5.016	1065	10.032
1070	17.83	0.882	1070	6.968	1070	5.292	1070	4.057	1070	5.468	1070	5.027	1070	10.055
1075	17.92	0.884	1075	6.984	1075	5.304	1075	4.066	1075	5.481	1075	5.039	1075	10.078

SCS Type 1 - 100 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{100,24}$ [2]= 7.9		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{100,24}$ [2]= 6.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{100,24}$ [2]= 4.6		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{100,24}$ [2]= 6.2		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{100,24}$ [2]= 5.7		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{100,24}$ [2]= 11.4	
Time (min)	Time (hrs)	P_x/P_{24} [1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1080	18.00	0.886	1080	6.999	1080	5.316	1080	4.076	1080	5.493	1080	5.050	1080	10.100
1085	18.08	0.888	1085	7.015	1085	5.328	1085	4.085	1085	5.506	1085	5.062	1085	10.123
1090	18.17	0.890	1090	7.031	1090	5.340	1090	4.094	1090	5.518	1090	5.073	1090	10.146
1095	18.25	0.892	1095	7.047	1095	5.352	1095	4.103	1095	5.530	1095	5.084	1095	10.169
1100	18.33	0.894	1100	7.063	1100	5.364	1100	4.112	1100	5.543	1100	5.096	1100	10.192
1105	18.42	0.896	1105	7.078	1105	5.376	1105	4.122	1105	5.555	1105	5.107	1105	10.214
1110	18.50	0.898	1110	7.094	1110	5.388	1110	4.131	1110	5.568	1110	5.119	1110	10.237
1115	18.58	0.900	1115	7.110	1115	5.400	1115	4.140	1115	5.580	1115	5.130	1115	10.260
1120	18.67	0.902	1120	7.126	1120	5.412	1120	4.149	1120	5.592	1120	5.141	1120	10.283
1125	18.75	0.904	1125	7.142	1125	5.424	1125	4.158	1125	5.605	1125	5.153	1125	10.306
1130	18.83	0.906	1130	7.157	1130	5.436	1130	4.168	1130	5.617	1130	5.164	1130	10.328
1135	18.92	0.908	1135	7.173	1135	5.448	1135	4.177	1135	5.630	1135	5.176	1135	10.351
1140	19.00	0.910	1140	7.189	1140	5.460	1140	4.186	1140	5.642	1140	5.187	1140	10.374
1145	19.08	0.912	1145	7.205	1145	5.472	1145	4.195	1145	5.654	1145	5.198	1145	10.397
1150	19.17	0.914	1150	7.221	1150	5.484	1150	4.204	1150	5.667	1150	5.210	1150	10.420
1155	19.25	0.916	1155	7.236	1155	5.496	1155	4.214	1155	5.679	1155	5.221	1155	10.442
1160	19.33	0.917	1160	7.244	1160	5.502	1160	4.218	1160	5.685	1160	5.227	1160	10.454
1165	19.42	0.919	1165	7.260	1165	5.514	1165	4.227	1165	5.698	1165	5.238	1165	10.477
1170	19.50	0.921	1170	7.276	1170	5.526	1170	4.237	1170	5.710	1170	5.250	1170	10.499
1175	19.58	0.923	1175	7.292	1175	5.538	1175	4.246	1175	5.723	1175	5.261	1175	10.522
1180	19.67	0.925	1180	7.308	1180	5.550	1180	4.255	1180	5.735	1180	5.273	1180	10.545
1185	19.75	0.927	1185	7.323	1185	5.562	1185	4.264	1185	5.747	1185	5.284	1185	10.568
1190	19.83	0.928	1190	7.331	1190	5.568	1190	4.269	1190	5.754	1190	5.290	1190	10.579
1195	19.92	0.930	1195	7.347	1195	5.580	1195	4.278	1195	5.766	1195	5.301	1195	10.602
1200	20.00	0.932	1200	7.363	1200	5.592	1200	4.287	1200	5.778	1200	5.312	1200	10.625
1205	20.08	0.934	1205	7.379	1205	5.604	1205	4.296	1205	5.791	1205	5.324	1205	10.648
1210	20.17	0.935	1210	7.387	1210	5.610	1210	4.301	1210	5.797	1210	5.330	1210	10.659
1215	20.25	0.937	1215	7.402	1215	5.622	1215	4.310	1215	5.809	1215	5.341	1215	10.682
1220	20.33	0.939	1220	7.418	1220	5.634	1220	4.319	1220	5.822	1220	5.352	1220	10.705
1225	20.42	0.940	1225	7.426	1225	5.640	1225	4.324	1225	5.828	1225	5.358	1225	10.716
1230	20.50	0.942	1230	7.442	1230	5.652	1230	4.333	1230	5.840	1230	5.369	1230	10.739
1235	20.58	0.944	1235	7.458	1235	5.664	1235	4.342	1235	5.853	1235	5.381	1235	10.762
1240	20.67	0.945	1240	7.466	1240	5.670	1240	4.347	1240	5.859	1240	5.387	1240	10.773
1245	20.75	0.947	1245	7.481	1245	5.682	1245	4.356	1245	5.871	1245	5.398	1245	10.796
1250	20.83	0.949	1250	7.497	1250	5.694	1250	4.365	1250	5.884	1250	5.409	1250	10.819
1255	20.92	0.950	1255	7.505	1255	5.700	1255	4.370	1255	5.890	1255	5.415	1255	10.830
1260	21.00	0.952	1260	7.521	1260	5.712	1260	4.379	1260	5.902	1260	5.426	1260	10.853
1265	21.08	0.953	1265	7.529	1265	5.718	1265	4.384	1265	5.909	1265	5.432	1265	10.864
1270	21.17	0.955	1270	7.545	1270	5.730	1270	4.393	1270	5.921	1270	5.444	1270	10.887
1275	21.25	0.957	1275	7.560	1275	5.742	1275	4.402	1275	5.933	1275	5.455	1275	10.910
1280	21.33	0.958	1280	7.568	1280	5.748	1280	4.407	1280	5.940	1280	5.461	1280	10.921
1285	21.42	0.960	1285	7.584	1285	5.760	1285	4.416	1285	5.952	1285	5.472	1285	10.944
1290	21.50	0.961	1290	7.592	1290	5.766	1290	4.421	1290	5.958	1290	5.478	1290	10.955
1295	21.58	0.963	1295	7.608	1295	5.778	1295	4.430	1295	5.971	1295	5.489	1295	10.978
1300	21.67	0.964	1300	7.616	1300	5.784	1300	4.434	1300	5.977	1300	5.495	1300	10.990
1305	21.75	0.966	1305	7.631	1305	5.796	1305	4.444	1305	5.989	1305	5.506	1305	11.012
1310	21.83	0.967	1310	7.639	1310	5.802	1310	4.448	1310	5.995	1310	5.512	1310	11.024
1315	21.92	0.968	1315	7.647	1315	5.808	1315	4.453	1315	6.002	1315	5.518	1315	11.035
1320	22.00	0.970	1320	7.663	1320	5.820	1320	4.462	1320	6.014	1320	5.529	1320	11.058
1325	22.08	0.971	1325	7.671	1325	5.826	1325	4.467	1325	6.020	1325	5.535	1325	11.069
1330	22.17	0.973	1330	7.687	1330	5.838	1330	4.476	1330	6.033	1330	5.546	1330	11.092
1335	22.25	0.974	1335	7.695	1335	5.844	1335	4.480	1335	6.039	1335	5.552	1335	11.104
1340	22.33	0.975	1340	7.703	1340	5.850	1340	4.485	1340	6.045	1340	5.558	1340	11.115
1345	22.42	0.977	1345	7.718	1345	5.862	1345	4.494	1345	6.057	1345	5.569	1345	11.138

SCS Type 1 - 100 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{100,24}$ [2]= 7.9		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{100,24}$ [2]= 6.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{100,24}$ [2]= 4.6		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{100,24}$ [2]= 6.2		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{100,24}$ [2]= 5.7		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{100,24}$ [2]= 11.4	
Time (min)	Time (hrs)	P_x/P_{24} [1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1350	22.50	0.978	1350	7.726	1350	5.868	1350	4.499	1350	6.064	1350	5.575	1350	11.149
1355	22.58	0.979	1355	7.734	1355	5.874	1355	4.503	1355	6.070	1355	5.580	1355	11.161
1360	22.67	0.981	1360	7.750	1360	5.886	1360	4.513	1360	6.082	1360	5.592	1360	11.183
1365	22.75	0.982	1365	7.758	1365	5.892	1365	4.517	1365	6.088	1365	5.597	1365	11.195
1370	22.83	0.983	1370	7.766	1370	5.898	1370	4.522	1370	6.095	1370	5.603	1370	11.206
1375	22.92	0.984	1375	7.774	1375	5.904	1375	4.526	1375	6.101	1375	5.609	1375	11.218
1380	23.00	0.986	1380	7.789	1380	5.916	1380	4.536	1380	6.113	1380	5.620	1380	11.240
1385	23.08	0.987	1385	7.797	1385	5.922	1385	4.540	1385	6.119	1385	5.626	1385	11.252
1390	23.17	0.988	1390	7.805	1390	5.928	1390	4.545	1390	6.126	1390	5.632	1390	11.263
1395	23.25	0.989	1395	7.813	1395	5.934	1395	4.549	1395	6.132	1395	5.637	1395	11.275
1400	23.33	0.991	1400	7.829	1400	5.946	1400	4.559	1400	6.144	1400	5.649	1400	11.297
1405	23.42	0.992	1405	7.837	1405	5.952	1405	4.563	1405	6.150	1405	5.654	1405	11.309
1410	23.50	0.993	1410	7.845	1410	5.958	1410	4.568	1410	6.157	1410	5.660	1410	11.320
1415	23.58	0.994	1415	7.853	1415	5.964	1415	4.572	1415	6.163	1415	5.666	1415	11.332
1420	23.67	0.995	1420	7.861	1420	5.970	1420	4.577	1420	6.169	1420	5.672	1420	11.343
1425	23.75	0.996	1425	7.868	1425	5.976	1425	4.582	1425	6.175	1425	5.677	1425	11.354
1430	23.83	0.998	1430	7.884	1430	5.988	1430	4.591	1430	6.188	1430	5.689	1430	11.377
1435	23.92	0.999	1435	7.892	1435	5.994	1435	4.595	1435	6.194	1435	5.694	1435	11.389
1440	24.00	1.000	1440	7.900	1440	6.000	1440	4.600	1440	6.200	1440	5.700	1440	11.400

1. P_x/P_{24} ratios have been determined through linear intepolation of values derived from Figure II-B-1 of the 1993 SDCHM at 30 minute intervals.

2. $P_{100,24}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type 1 - 100 Yr - 6 Hr Distribution

SCS Type 1 - 6 Hr Distribution Ratios			SCS Type 1 - 6 Hr Distribution Guejito Basin $P_{100,6}$ [3]= 3.9		SCS Type 1 - 6 Hr Distribution Jamul Basin $P_{100,6}$ [3]= 2.9		SCS Type 1 - 6 Hr Distribution Las Flores Basin $P_{100,6}$ [3]= 2.9		SCS Type 1 - 6 Hr Distribution Los Coches Basin $P_{100,6}$ [3]= 2.9		SCS Type 1 - 6 Hr Distribution Santa Maria Basin $P_{100,6}$ [3]= 3.3		SCS Type 1 - 6 Hr Distribution Sweetwater Basin $P_{100,6}$ [3]= 4.8	
Time [1] (min)	Time (hrs)	P_x/P_6 [2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.006	5	0.023	5	0.017	5	0.017	5	0.017	5	0.020	5	0.029
10	0.17	0.012	10	0.047	10	0.035	10	0.035	10	0.035	10	0.040	10	0.058
15	0.25	0.017	15	0.066	15	0.049	15	0.049	15	0.049	15	0.056	15	0.082
20	0.33	0.023	20	0.090	20	0.067	20	0.067	20	0.067	20	0.076	20	0.110
25	0.42	0.029	25	0.113	25	0.084	25	0.084	25	0.084	25	0.096	25	0.139
30	0.50	0.035	30	0.137	30	0.102	30	0.102	30	0.102	30	0.116	30	0.168
35	0.58	0.041	35	0.160	35	0.119	35	0.119	35	0.119	35	0.135	35	0.197
40	0.67	0.047	40	0.183	40	0.136	40	0.136	40	0.136	40	0.155	40	0.226
45	0.75	0.054	45	0.211	45	0.157	45	0.157	45	0.157	45	0.178	45	0.259
50	0.83	0.061	50	0.238	50	0.177	50	0.177	50	0.177	50	0.201	50	0.293
55	0.92	0.068	55	0.265	55	0.197	55	0.197	55	0.197	55	0.224	55	0.326
60	1.00	0.076	60	0.296	60	0.220	60	0.220	60	0.220	60	0.251	60	0.365
65	1.08	0.084	65	0.328	65	0.244	65	0.244	65	0.244	65	0.277	65	0.403
70	1.17	0.092	70	0.359	70	0.267	70	0.267	70	0.267	70	0.304	70	0.442
75	1.25	0.100	75	0.390	75	0.290	75	0.290	75	0.290	75	0.330	75	0.480
80	1.33	0.108	80	0.421	80	0.313	80	0.313	80	0.313	80	0.356	80	0.518
85	1.42	0.116	85	0.452	85	0.336	85	0.336	85	0.336	85	0.383	85	0.557
90	1.50	0.125	90	0.488	90	0.363	90	0.363	90	0.363	90	0.413	90	0.600
95	1.58	0.134	95	0.523	95	0.389	95	0.389	95	0.389	95	0.442	95	0.643
100	1.67	0.144	100	0.562	100	0.418	100	0.418	100	0.418	100	0.475	100	0.691
105	1.75	0.156	105	0.608	105	0.452	105	0.452	105	0.452	105	0.515	105	0.749
110	1.83	0.168	110	0.655	110	0.487	110	0.487	110	0.487	110	0.554	110	0.806
115	1.92	0.181	115	0.706	115	0.525	115	0.525	115	0.525	115	0.597	115	0.869
120	2.00	0.194	120	0.757	120	0.563	120	0.563	120	0.563	120	0.640	120	0.931
125	2.08	0.209	125	0.815	125	0.606	125	0.606	125	0.606	125	0.690	125	1.003
130	2.17	0.229	130	0.893	130	0.664	130	0.664	130	0.664	130	0.756	130	1.099
135	2.25	0.254	135	0.991	135	0.737	135	0.737	135	0.737	135	0.838	135	1.219
140	2.33	0.285	140	1.112	140	0.827	140	0.827	140	0.827	140	0.941	140	1.368
145	2.42	0.336	145	1.310	145	0.974	145	0.974	145	0.974	145	1.109	145	1.613
150	2.50	0.515	150	2.009	150	1.494	150	1.494	150	1.494	150	1.700	150	2.472
155	2.58	0.565	155	2.204	155	1.639	155	1.639	155	1.639	155	1.865	155	2.712
160	2.67	0.597	160	2.328	160	1.731	160	1.731	160	1.731	160	1.970	160	2.866
165	2.75	0.623	165	2.430	165	1.807	165	1.807	165	1.807	165	2.056	165	2.990
170	2.83	0.645	170	2.516	170	1.871	170	1.871	170	1.871	170	2.129	170	3.096
175	2.92	0.665	175	2.594	175	1.929	175	1.929	175	1.929	175	2.195	175	3.192
180	3.00	0.684	180	2.668	180	1.984	180	1.984	180	1.984	180	2.257	180	3.283
185	3.08	0.701	185	2.734	185	2.033	185	2.033	185	2.033	185	2.313	185	3.365
190	3.17	0.717	190	2.796	190	2.079	190	2.079	190	2.079	190	2.366	190	3.442
195	3.25	0.732	195	2.855	195	2.123	195	2.123	195	2.123	195	2.416	195	3.514
200	3.33	0.746	200	2.909	200	2.163	200	2.163	200	2.163	200	2.462	200	3.581
205	3.42	0.758	205	2.956	205	2.198	205	2.198	205	2.198	205	2.501	205	3.638
210	3.50	0.770	210	3.003	210	2.233	210	2.233	210	2.233	210	2.541	210	3.696
215	3.58	0.781	215	3.046	215	2.265	215	2.265	215	2.265	215	2.577	215	3.749
220	3.67	0.791	220	3.085	220	2.294	220	2.294	220	2.294	220	2.610	220	3.797
225	3.75	0.802	225	3.128	225	2.326	225	2.326	225	2.326	225	2.647	225	3.850
230	3.83	0.812	230	3.167	230	2.355	230	2.355	230	2.355	230	2.680	230	3.898
235	3.92	0.822	235	3.206	235	2.384	235	2.384	235	2.384	235	2.713	235	3.946
240	4.00	0.832	240	3.245	240	2.413	240	2.413	240	2.413	240	2.746	240	3.994
245	4.08	0.841	245	3.280	245	2.439	245	2.439	245	2.439	245	2.775	245	4.037
250	4.17	0.851	250	3.319	250	2.468	250	2.468	250	2.468	250	2.808	250	4.085
255	4.25	0.860	255	3.354	255	2.494	255	2.494	255	2.494	255	2.838	255	4.128
260	4.33	0.869	260	3.389	260	2.520	260	2.520	260	2.520	260	2.868	260	4.171
265	4.42	0.877	265	3.420	265	2.543	265	2.543	265	2.543	265	2.894	265	4.210

SCS Type 1 - 100 Yr - 6 Hr Distribution

SCS Type 1 - 6 Hr Distribution Ratios			SCS Type 1 - 6 Hr Distribution Guejito Basin $P_{100,6}$ [3]= 3.9		SCS Type 1 - 6 Hr Distribution Jamul Basin $P_{100,6}$ [3]= 2.9		SCS Type 1 - 6 Hr Distribution Las Flores Basin $P_{100,6}$ [3]= 2.9		SCS Type 1 - 6 Hr Distribution Los Coches Basin $P_{100,6}$ [3]= 2.9		SCS Type 1 - 6 Hr Distribution Santa Maria Basin $P_{100,6}$ [3]= 3.3		SCS Type 1 - 6 Hr Distribution Sweetwater Basin $P_{100,6}$ [3]= 4.8	
Time [1] (min)	Time (hrs)	P_x/P_6 [2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.886	270	3.455	270	2.569	270	2.569	270	2.569	270	2.924	270	4.253
275	4.58	0.894	275	3.487	275	2.593	275	2.593	275	2.593	275	2.950	275	4.291
280	4.67	0.902	280	3.518	280	2.616	280	2.616	280	2.616	280	2.977	280	4.330
285	4.75	0.910	285	3.549	285	2.639	285	2.639	285	2.639	285	3.003	285	4.368
290	4.83	0.917	290	3.576	290	2.659	290	2.659	290	2.659	290	3.026	290	4.402
295	4.92	0.925	295	3.608	295	2.683	295	2.683	295	2.683	295	3.053	295	4.440
300	5.00	0.932	300	3.635	300	2.703	300	2.703	300	2.703	300	3.076	300	4.474
305	5.08	0.939	305	3.662	305	2.723	305	2.723	305	2.723	305	3.099	305	4.507
310	5.17	0.945	310	3.686	310	2.741	310	2.741	310	2.741	310	3.119	310	4.536
315	5.25	0.952	315	3.713	315	2.761	315	2.761	315	2.761	315	3.142	315	4.570
320	5.33	0.958	320	3.736	320	2.778	320	2.778	320	2.778	320	3.161	320	4.598
325	5.42	0.964	325	3.760	325	2.796	325	2.796	325	2.796	325	3.181	325	4.627
330	5.50	0.970	330	3.783	330	2.813	330	2.813	330	2.813	330	3.201	330	4.656
335	5.58	0.975	335	3.803	335	2.828	335	2.828	335	2.828	335	3.218	335	4.680
340	5.67	0.981	340	3.826	340	2.845	340	2.845	340	2.845	340	3.237	340	4.709
345	5.75	0.986	345	3.845	345	2.859	345	2.859	345	2.859	345	3.254	345	4.733
350	5.83	0.991	350	3.865	350	2.874	350	2.874	350	2.874	350	3.270	350	4.757
355	5.92	0.995	355	3.881	355	2.886	355	2.886	355	2.886	355	3.284	355	4.776
360	6.00	1.000	360	3.900	360	2.900	360	2.900	360	2.900	360	3.300	360	4.800

1. Time values for the 6 hr distribution are determined by dividing the time intervals from the SCS Type 1 - 24 hr distribution by 4.

2. P_x/P_6 ratios correspond to P_x/P_{24} ratios at times (in minutes) that are 4 times greater than P_x/P_6 times. For example, P_x/P_6 at 100 minutes equals P_x/P_{24} at 400 minutes.

3. $P_{100,6}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type 1 - 10 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{10,24}$[2]= 5.4		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{10,24}$[2]= 3.4		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{10,24}$[2]= 3.2		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{10,24}$[2]= 3.7		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{10,24}$[2]= 3.8		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{10,24}$[2]= 6.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.001	5	0.005	5	0.003	5	0.003	5	0.004	5	0.004	5	0.007
10	0.17	0.003	10	0.016	10	0.010	10	0.010	10	0.011	10	0.011	10	0.020
15	0.25	0.004	15	0.022	15	0.014	15	0.013	15	0.015	15	0.015	15	0.027
20	0.33	0.006	20	0.032	20	0.020	20	0.019	20	0.022	20	0.023	20	0.040
25	0.42	0.007	25	0.038	25	0.024	25	0.022	25	0.026	25	0.027	25	0.047
30	0.50	0.009	30	0.049	30	0.031	30	0.029	30	0.033	30	0.034	30	0.060
35	0.58	0.010	35	0.054	35	0.034	35	0.032	35	0.037	35	0.038	35	0.067
40	0.67	0.012	40	0.065	40	0.041	40	0.038	40	0.044	40	0.046	40	0.080
45	0.75	0.013	45	0.070	45	0.044	45	0.042	45	0.048	45	0.049	45	0.087
50	0.83	0.014	50	0.076	50	0.048	50	0.045	50	0.052	50	0.053	50	0.094
55	0.92	0.016	55	0.086	55	0.054	55	0.051	55	0.059	55	0.061	55	0.107
60	1.00	0.017	60	0.092	60	0.058	60	0.054	60	0.063	60	0.065	60	0.114
65	1.08	0.019	65	0.103	65	0.065	65	0.061	65	0.070	65	0.072	65	0.127
70	1.17	0.020	70	0.108	70	0.068	70	0.064	70	0.074	70	0.076	70	0.134
75	1.25	0.022	75	0.119	75	0.075	75	0.070	75	0.081	75	0.084	75	0.147
80	1.33	0.023	80	0.124	80	0.078	80	0.074	80	0.085	80	0.087	80	0.154
85	1.42	0.025	85	0.135	85	0.085	85	0.080	85	0.093	85	0.095	85	0.168
90	1.50	0.026	90	0.140	90	0.088	90	0.083	90	0.096	90	0.099	90	0.174
95	1.58	0.028	95	0.151	95	0.095	95	0.090	95	0.104	95	0.106	95	0.188
100	1.67	0.029	100	0.157	100	0.099	100	0.093	100	0.107	100	0.110	100	0.194
105	1.75	0.030	105	0.162	105	0.102	105	0.096	105	0.111	105	0.114	105	0.201
110	1.83	0.032	110	0.173	110	0.109	110	0.102	110	0.118	110	0.122	110	0.214
115	1.92	0.033	115	0.178	115	0.112	115	0.106	115	0.122	115	0.125	115	0.221
120	2.00	0.035	120	0.189	120	0.119	120	0.112	120	0.130	120	0.133	120	0.235
125	2.08	0.036	125	0.194	125	0.122	125	0.115	125	0.133	125	0.137	125	0.241
130	2.17	0.038	130	0.205	130	0.129	130	0.122	130	0.141	130	0.144	130	0.255
135	2.25	0.039	135	0.211	135	0.133	135	0.125	135	0.144	135	0.148	135	0.261
140	2.33	0.041	140	0.221	140	0.139	140	0.131	140	0.152	140	0.156	140	0.275
145	2.42	0.042	145	0.227	145	0.143	145	0.134	145	0.155	145	0.160	145	0.281
150	2.50	0.044	150	0.238	150	0.150	150	0.141	150	0.163	150	0.167	150	0.295
155	2.58	0.046	155	0.248	155	0.156	155	0.147	155	0.170	155	0.175	155	0.308
160	2.67	0.047	160	0.254	160	0.160	160	0.150	160	0.174	160	0.179	160	0.315
165	2.75	0.049	165	0.265	165	0.167	165	0.157	165	0.181	165	0.186	165	0.328
170	2.83	0.051	170	0.275	170	0.173	170	0.163	170	0.189	170	0.194	170	0.342
175	2.92	0.052	175	0.281	175	0.177	175	0.166	175	0.192	175	0.198	175	0.348
180	3.00	0.054	180	0.292	180	0.184	180	0.173	180	0.200	180	0.205	180	0.362
185	3.08	0.056	185	0.302	185	0.190	185	0.179	185	0.207	185	0.213	185	0.375
190	3.17	0.058	190	0.313	190	0.197	190	0.186	190	0.215	190	0.220	190	0.389
195	3.25	0.059	195	0.319	195	0.201	195	0.189	195	0.218	195	0.224	195	0.395
200	3.33	0.061	200	0.329	200	0.207	200	0.195	200	0.226	200	0.232	200	0.409
205	3.42	0.063	205	0.340	205	0.214	205	0.202	205	0.233	205	0.239	205	0.422
210	3.50	0.065	210	0.351	210	0.221	210	0.208	210	0.241	210	0.247	210	0.436
215	3.58	0.066	215	0.356	215	0.224	215	0.211	215	0.244	215	0.251	215	0.442
220	3.67	0.068	220	0.367	220	0.231	220	0.218	220	0.252	220	0.258	220	0.456
225	3.75	0.070	225	0.378	225	0.238	225	0.224	225	0.259	225	0.266	225	0.469
230	3.83	0.072	230	0.389	230	0.245	230	0.230	230	0.266	230	0.274	230	0.482
235	3.92	0.074	235	0.400	235	0.252	235	0.237	235	0.274	235	0.281	235	0.496
240	4.00	0.076	240	0.410	240	0.258	240	0.243	240	0.281	240	0.289	240	0.509
245	4.08	0.078	245	0.421	245	0.265	245	0.250	245	0.289	245	0.296	245	0.523
250	4.17	0.080	250	0.432	250	0.272	250	0.256	250	0.296	250	0.304	250	0.536
255	4.25	0.082	255	0.443	255	0.279	255	0.262	255	0.303	255	0.312	255	0.549
260	4.33	0.084	260	0.454	260	0.286	260	0.269	260	0.311	260	0.319	260	0.563
265	4.42	0.086	265	0.464	265	0.292	265	0.275	265	0.318	265	0.327	265	0.576

SCS Type 1 - 10 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{10,24}$[2]= 5.4		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{10,24}$[2]= 3.4		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{10,24}$[2]= 3.2		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{10,24}$[2]= 3.7		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{10,24}$[2]= 3.8		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{10,24}$[2]= 6.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.088	270	0.475	270	0.299	270	0.282	270	0.326	270	0.334	270	0.590
275	4.58	0.090	275	0.486	275	0.306	275	0.288	275	0.333	275	0.342	275	0.603
280	4.67	0.092	280	0.497	280	0.313	280	0.294	280	0.340	280	0.350	280	0.616
285	4.75	0.094	285	0.508	285	0.320	285	0.301	285	0.348	285	0.357	285	0.630
290	4.83	0.096	290	0.518	290	0.326	290	0.307	290	0.355	290	0.365	290	0.643
295	4.92	0.098	295	0.529	295	0.333	295	0.314	295	0.363	295	0.372	295	0.657
300	5.00	0.100	300	0.540	300	0.340	300	0.320	300	0.370	300	0.380	300	0.670
305	5.08	0.102	305	0.551	305	0.347	305	0.326	305	0.377	305	0.388	305	0.683
310	5.17	0.104	310	0.562	310	0.354	310	0.333	310	0.385	310	0.395	310	0.697
315	5.25	0.106	315	0.572	315	0.360	315	0.339	315	0.392	315	0.403	315	0.710
320	5.33	0.108	320	0.583	320	0.367	320	0.346	320	0.400	320	0.410	320	0.724
325	5.42	0.110	325	0.594	325	0.374	325	0.352	325	0.407	325	0.418	325	0.737
330	5.50	0.112	330	0.605	330	0.381	330	0.358	330	0.414	330	0.426	330	0.750
335	5.58	0.114	335	0.616	335	0.388	335	0.365	335	0.422	335	0.433	335	0.764
340	5.67	0.116	340	0.626	340	0.394	340	0.371	340	0.429	340	0.441	340	0.777
345	5.75	0.118	345	0.637	345	0.401	345	0.378	345	0.437	345	0.448	345	0.791
350	5.83	0.121	350	0.653	350	0.411	350	0.387	350	0.448	350	0.460	350	0.811
355	5.92	0.123	355	0.664	355	0.418	355	0.394	355	0.455	355	0.467	355	0.824
360	6.00	0.125	360	0.675	360	0.425	360	0.400	360	0.463	360	0.475	360	0.838
365	6.08	0.127	365	0.686	365	0.432	365	0.406	365	0.470	365	0.483	365	0.851
370	6.17	0.129	370	0.697	370	0.439	370	0.413	370	0.477	370	0.490	370	0.864
375	6.25	0.132	375	0.713	375	0.449	375	0.422	375	0.488	375	0.502	375	0.884
380	6.33	0.134	380	0.724	380	0.456	380	0.429	380	0.496	380	0.509	380	0.898
385	6.42	0.136	385	0.734	385	0.462	385	0.435	385	0.503	385	0.517	385	0.911
390	6.50	0.139	390	0.751	390	0.473	390	0.445	390	0.514	390	0.528	390	0.931
395	6.58	0.142	395	0.767	395	0.483	395	0.454	395	0.525	395	0.540	395	0.951
400	6.67	0.144	400	0.778	400	0.490	400	0.461	400	0.533	400	0.547	400	0.965
405	6.75	0.147	405	0.794	405	0.500	405	0.470	405	0.544	405	0.559	405	0.985
410	6.83	0.150	410	0.810	410	0.510	410	0.480	410	0.555	410	0.570	410	1.005
415	6.92	0.153	415	0.826	415	0.520	415	0.490	415	0.566	415	0.581	415	1.025
420	7.00	0.156	420	0.842	420	0.530	420	0.499	420	0.577	420	0.593	420	1.045
425	7.08	0.159	425	0.859	425	0.541	425	0.509	425	0.588	425	0.604	425	1.065
430	7.17	0.162	430	0.875	430	0.551	430	0.518	430	0.599	430	0.616	430	1.085
435	7.25	0.165	435	0.891	435	0.561	435	0.528	435	0.611	435	0.627	435	1.106
440	7.33	0.168	440	0.907	440	0.571	440	0.538	440	0.622	440	0.638	440	1.126
445	7.42	0.171	445	0.923	445	0.581	445	0.547	445	0.633	445	0.650	445	1.146
450	7.50	0.174	450	0.940	450	0.592	450	0.557	450	0.644	450	0.661	450	1.166
455	7.58	0.178	455	0.961	455	0.605	455	0.570	455	0.659	455	0.676	455	1.193
460	7.67	0.181	460	0.977	460	0.615	460	0.579	460	0.670	460	0.688	460	1.213
465	7.75	0.184	465	0.994	465	0.626	465	0.589	465	0.681	465	0.699	465	1.233
470	7.83	0.187	470	1.010	470	0.636	470	0.598	470	0.692	470	0.711	470	1.253
475	7.92	0.191	475	1.031	475	0.649	475	0.611	475	0.707	475	0.726	475	1.280
480	8.00	0.194	480	1.048	480	0.660	480	0.621	480	0.718	480	0.737	480	1.300
485	8.08	0.197	485	1.064	485	0.670	485	0.630	485	0.729	485	0.749	485	1.320
490	8.17	0.201	490	1.085	490	0.683	490	0.643	490	0.744	490	0.764	490	1.347
495	8.25	0.205	495	1.107	495	0.697	495	0.656	495	0.759	495	0.779	495	1.374
500	8.33	0.209	500	1.129	500	0.711	500	0.669	500	0.773	500	0.794	500	1.400
505	8.42	0.214	505	1.156	505	0.728	505	0.685	505	0.792	505	0.813	505	1.434
510	8.50	0.219	510	1.183	510	0.745	510	0.701	510	0.810	510	0.832	510	1.467
515	8.58	0.224	515	1.210	515	0.762	515	0.717	515	0.829	515	0.851	515	1.501
520	8.67	0.229	520	1.237	520	0.779	520	0.733	520	0.847	520	0.870	520	1.534
525	8.75	0.235	525	1.269	525	0.799	525	0.752	525	0.870	525	0.893	525	1.575
530	8.83	0.241	530	1.301	530	0.819	530	0.771	530	0.892	530	0.916	530	1.615
535	8.92	0.247	535	1.334	535	0.840	535	0.790	535	0.914	535	0.939	535	1.655

SCS Type 1 - 10 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{10,24}$[2]= 5.4		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{10,24}$[2]= 3.4		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{10,24}$[2]= 3.2		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{10,24}$[2]= 3.7		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{10,24}$[2]= 3.8		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{10,24}$[2]= 6.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
540	9.00	0.254	540	1.372	540	0.864	540	0.813	540	0.940	540	0.965	540	1.702
545	9.08	0.261	545	1.409	545	0.887	545	0.835	545	0.966	545	0.992	545	1.749
550	9.17	0.268	550	1.447	550	0.911	550	0.858	550	0.992	550	1.018	550	1.796
555	9.25	0.276	555	1.490	555	0.938	555	0.883	555	1.021	555	1.049	555	1.849
560	9.33	0.285	560	1.539	560	0.969	560	0.912	560	1.055	560	1.083	560	1.910
565	9.42	0.293	565	1.582	565	0.996	565	0.938	565	1.084	565	1.113	565	1.963
570	9.50	0.303	570	1.636	570	1.030	570	0.970	570	1.121	570	1.151	570	2.030
575	9.58	0.316	575	1.706	575	1.074	575	1.011	575	1.169	575	1.201	575	2.117
580	9.67	0.336	580	1.814	580	1.142	580	1.075	580	1.243	580	1.277	580	2.251
585	9.75	0.362	585	1.955	585	1.231	585	1.158	585	1.339	585	1.376	585	2.425
590	9.83	0.411	590	2.219	590	1.397	590	1.315	590	1.521	590	1.562	590	2.754
595	9.92	0.475	595	2.565	595	1.615	595	1.520	595	1.758	595	1.805	595	3.183
600	10.00	0.515	600	2.781	600	1.751	600	1.648	600	1.906	600	1.957	600	3.451
605	10.08	0.530	605	2.862	605	1.802	605	1.696	605	1.961	605	2.014	605	3.551
610	10.17	0.542	610	2.927	610	1.843	610	1.734	610	2.005	610	2.060	610	3.631
615	10.25	0.555	615	2.997	615	1.887	615	1.776	615	2.054	615	2.109	615	3.719
620	10.33	0.565	620	3.051	620	1.921	620	1.808	620	2.091	620	2.147	620	3.786
625	10.42	0.575	625	3.105	625	1.955	625	1.840	625	2.128	625	2.185	625	3.853
630	10.50	0.583	630	3.148	630	1.982	630	1.866	630	2.157	630	2.215	630	3.906
635	10.58	0.590	635	3.186	635	2.006	635	1.888	635	2.183	635	2.242	635	3.953
640	10.67	0.597	640	3.224	640	2.030	640	1.910	640	2.209	640	2.269	640	4.000
645	10.75	0.604	645	3.262	645	2.054	645	1.933	645	2.235	645	2.295	645	4.047
650	10.83	0.611	650	3.299	650	2.077	650	1.955	650	2.261	650	2.322	650	4.094
655	10.92	0.617	655	3.332	655	2.098	655	1.974	655	2.283	655	2.345	655	4.134
660	11.00	0.623	660	3.364	660	2.118	660	1.994	660	2.305	660	2.367	660	4.174
665	11.08	0.629	665	3.397	665	2.139	665	2.013	665	2.327	665	2.390	665	4.214
670	11.17	0.634	670	3.424	670	2.156	670	2.029	670	2.346	670	2.409	670	4.248
675	11.25	0.640	675	3.456	675	2.176	675	2.048	675	2.368	675	2.432	675	4.288
680	11.33	0.645	680	3.483	680	2.193	680	2.064	680	2.387	680	2.451	680	4.322
685	11.42	0.650	685	3.510	685	2.210	685	2.080	685	2.405	685	2.470	685	4.355
690	11.50	0.655	690	3.537	690	2.227	690	2.096	690	2.424	690	2.489	690	4.389
695	11.58	0.660	695	3.564	695	2.244	695	2.112	695	2.442	695	2.508	695	4.422
700	11.67	0.665	700	3.591	700	2.261	700	2.128	700	2.461	700	2.527	700	4.456
705	11.75	0.670	705	3.618	705	2.278	705	2.144	705	2.479	705	2.546	705	4.489
710	11.83	0.675	710	3.645	710	2.295	710	2.160	710	2.498	710	2.565	710	4.523
715	11.92	0.679	715	3.667	715	2.309	715	2.173	715	2.512	715	2.580	715	4.549
720	12.00	0.684	720	3.694	720	2.326	720	2.189	720	2.531	720	2.599	720	4.583
725	12.08	0.688	725	3.715	725	2.339	725	2.202	725	2.546	725	2.614	725	4.610
730	12.17	0.693	730	3.742	730	2.356	730	2.218	730	2.564	730	2.633	730	4.643
735	12.25	0.697	735	3.764	735	2.370	735	2.230	735	2.579	735	2.649	735	4.670
740	12.33	0.701	740	3.785	740	2.383	740	2.243	740	2.594	740	2.664	740	4.697
745	12.42	0.705	745	3.807	745	2.397	745	2.256	745	2.609	745	2.679	745	4.724
750	12.50	0.709	750	3.829	750	2.411	750	2.269	750	2.623	750	2.694	750	4.750
755	12.58	0.713	755	3.850	755	2.424	755	2.282	755	2.638	755	2.709	755	4.777
760	12.67	0.717	760	3.872	760	2.438	760	2.294	760	2.653	760	2.725	760	4.804
765	12.75	0.721	765	3.893	765	2.451	765	2.307	765	2.668	765	2.740	765	4.831
770	12.83	0.725	770	3.915	770	2.465	770	2.320	770	2.683	770	2.755	770	4.858
775	12.92	0.728	775	3.931	775	2.475	775	2.330	775	2.694	775	2.766	775	4.878
780	13.00	0.732	780	3.953	780	2.489	780	2.342	780	2.708	780	2.782	780	4.904
785	13.08	0.735	785	3.969	785	2.499	785	2.352	785	2.720	785	2.793	785	4.925
790	13.17	0.739	790	3.991	790	2.513	790	2.365	790	2.734	790	2.808	790	4.951
795	13.25	0.742	795	4.007	795	2.523	795	2.374	795	2.745	795	2.820	795	4.971
800	13.33	0.746	800	4.028	800	2.536	800	2.387	800	2.760	800	2.835	800	4.998
805	13.42	0.749	805	4.045	805	2.547	805	2.397	805	2.771	805	2.846	805	5.018

SCS Type 1 - 10 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{10,24}$[2]= 5.4		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{10,24}$[2]= 3.4		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{10,24}$[2]= 3.2		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{10,24}$[2]= 3.7		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{10,24}$[2]= 3.8		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{10,24}$[2]= 6.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
810	13.50	0.752	810	4.061	810	2.557	810	2.406	810	2.782	810	2.858	810	5.038
815	13.58	0.755	815	4.077	815	2.567	815	2.416	815	2.794	815	2.869	815	5.059
820	13.67	0.758	820	4.093	820	2.577	820	2.426	820	2.805	820	2.880	820	5.079
825	13.75	0.761	825	4.109	825	2.587	825	2.435	825	2.816	825	2.892	825	5.099
830	13.83	0.764	830	4.126	830	2.598	830	2.445	830	2.827	830	2.903	830	5.119
835	13.92	0.767	835	4.142	835	2.608	835	2.454	835	2.838	835	2.915	835	5.139
840	14.00	0.770	840	4.158	840	2.618	840	2.464	840	2.849	840	2.926	840	5.159
845	14.08	0.773	845	4.174	845	2.628	845	2.474	845	2.860	845	2.937	845	5.179
850	14.17	0.775	850	4.185	850	2.635	850	2.480	850	2.868	850	2.945	850	5.193
855	14.25	0.778	855	4.201	855	2.645	855	2.490	855	2.879	855	2.956	855	5.213
860	14.33	0.781	860	4.217	860	2.655	860	2.499	860	2.890	860	2.968	860	5.233
865	14.42	0.783	865	4.228	865	2.662	865	2.506	865	2.897	865	2.975	865	5.246
870	14.50	0.786	870	4.244	870	2.672	870	2.515	870	2.908	870	2.987	870	5.266
875	14.58	0.789	875	4.261	875	2.683	875	2.525	875	2.919	875	2.998	875	5.286
880	14.67	0.791	880	4.271	880	2.689	880	2.531	880	2.927	880	3.006	880	5.300
885	14.75	0.794	885	4.288	885	2.700	885	2.541	885	2.938	885	3.017	885	5.320
890	14.83	0.797	890	4.304	890	2.710	890	2.550	890	2.949	890	3.029	890	5.340
895	14.92	0.799	895	4.315	895	2.717	895	2.557	895	2.956	895	3.036	895	5.353
900	15.00	0.802	900	4.331	900	2.727	900	2.566	900	2.967	900	3.048	900	5.373
905	15.08	0.804	905	4.342	905	2.734	905	2.573	905	2.975	905	3.055	905	5.387
910	15.17	0.807	910	4.358	910	2.744	910	2.582	910	2.986	910	3.067	910	5.407
915	15.25	0.810	915	4.374	915	2.754	915	2.592	915	2.997	915	3.078	915	5.427
920	15.33	0.812	920	4.385	920	2.761	920	2.598	920	3.004	920	3.086	920	5.440
925	15.42	0.815	925	4.401	925	2.771	925	2.608	925	3.016	925	3.097	925	5.461
930	15.50	0.817	930	4.412	930	2.778	930	2.614	930	3.023	930	3.105	930	5.474
935	15.58	0.820	935	4.428	935	2.788	935	2.624	935	3.034	935	3.116	935	5.494
940	15.67	0.822	940	4.439	940	2.795	940	2.630	940	3.041	940	3.124	940	5.507
945	15.75	0.825	945	4.455	945	2.805	945	2.640	945	3.053	945	3.135	945	5.528
950	15.83	0.827	950	4.466	950	2.812	950	2.646	950	3.060	950	3.143	950	5.541
955	15.92	0.829	955	4.477	955	2.819	955	2.653	955	3.067	955	3.150	955	5.554
960	16.00	0.832	960	4.493	960	2.829	960	2.662	960	3.078	960	3.162	960	5.574
965	16.08	0.834	965	4.504	965	2.836	965	2.669	965	3.086	965	3.169	965	5.588
970	16.17	0.837	970	4.520	970	2.846	970	2.678	970	3.097	970	3.181	970	5.608
975	16.25	0.839	975	4.531	975	2.853	975	2.685	975	3.104	975	3.188	975	5.621
980	16.33	0.841	980	4.541	980	2.859	980	2.691	980	3.112	980	3.196	980	5.635
985	16.42	0.844	985	4.558	985	2.870	985	2.701	985	3.123	985	3.207	985	5.655
990	16.50	0.846	990	4.568	990	2.876	990	2.707	990	3.130	990	3.215	990	5.668
995	16.58	0.848	995	4.579	995	2.883	995	2.714	995	3.138	995	3.222	995	5.682
1000	16.67	0.851	1000	4.595	1000	2.893	1000	2.723	1000	3.149	1000	3.234	1000	5.702
1005	16.75	0.853	1005	4.606	1005	2.900	1005	2.730	1005	3.156	1005	3.241	1005	5.715
1010	16.83	0.855	1010	4.617	1010	2.907	1010	2.736	1010	3.164	1010	3.249	1010	5.729
1015	16.92	0.858	1015	4.633	1015	2.917	1015	2.746	1015	3.175	1015	3.260	1015	5.749
1020	17.00	0.860	1020	4.644	1020	2.924	1020	2.752	1020	3.182	1020	3.268	1020	5.762
1025	17.08	0.862	1025	4.655	1025	2.931	1025	2.758	1025	3.189	1025	3.276	1025	5.775
1030	17.17	0.864	1030	4.666	1030	2.938	1030	2.765	1030	3.197	1030	3.283	1030	5.789
1035	17.25	0.867	1035	4.682	1035	2.948	1035	2.774	1035	3.208	1035	3.295	1035	5.809
1040	17.33	0.869	1040	4.693	1040	2.955	1040	2.781	1040	3.215	1040	3.302	1040	5.822
1045	17.42	0.871	1045	4.703	1045	2.961	1045	2.787	1045	3.223	1045	3.310	1045	5.836
1050	17.50	0.873	1050	4.714	1050	2.968	1050	2.794	1050	3.230	1050	3.317	1050	5.849
1055	17.58	0.875	1055	4.725	1055	2.975	1055	2.800	1055	3.238	1055	3.325	1055	5.863
1060	17.67	0.877	1060	4.736	1060	2.982	1060	2.806	1060	3.245	1060	3.333	1060	5.876
1065	17.75	0.880	1065	4.752	1065	2.992	1065	2.816	1065	3.256	1065	3.344	1065	5.896
1070	17.83	0.882	1070	4.763	1070	2.999	1070	2.822	1070	3.263	1070	3.352	1070	5.909
1075	17.92	0.884	1075	4.774	1075	3.006	1075	2.829	1075	3.271	1075	3.359	1075	5.923

SCS Type 1 - 10 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{10,24}$[2]= 5.4		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{10,24}$[2]= 3.4		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{10,24}$[2]= 3.2		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{10,24}$[2]= 3.7		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{10,24}$[2]= 3.8		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{10,24}$[2]= 6.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1080	18.00	0.886	1080	4.784	1080	3.012	1080	2.835	1080	3.278	1080	3.367	1080	5.936
1085	18.08	0.888	1085	4.795	1085	3.019	1085	2.842	1085	3.286	1085	3.374	1085	5.950
1090	18.17	0.890	1090	4.806	1090	3.026	1090	2.848	1090	3.293	1090	3.382	1090	5.963
1095	18.25	0.892	1095	4.817	1095	3.033	1095	2.854	1095	3.300	1095	3.390	1095	5.976
1100	18.33	0.894	1100	4.828	1100	3.040	1100	2.861	1100	3.308	1100	3.397	1100	5.990
1105	18.42	0.896	1105	4.838	1105	3.046	1105	2.867	1105	3.315	1105	3.405	1105	6.003
1110	18.50	0.898	1110	4.849	1110	3.053	1110	2.874	1110	3.323	1110	3.412	1110	6.017
1115	18.58	0.900	1115	4.860	1115	3.060	1115	2.880	1115	3.330	1115	3.420	1115	6.030
1120	18.67	0.902	1120	4.871	1120	3.067	1120	2.886	1120	3.337	1120	3.428	1120	6.043
1125	18.75	0.904	1125	4.882	1125	3.074	1125	2.893	1125	3.345	1125	3.435	1125	6.057
1130	18.83	0.906	1130	4.892	1130	3.080	1130	2.899	1130	3.352	1130	3.443	1130	6.070
1135	18.92	0.908	1135	4.903	1135	3.087	1135	2.906	1135	3.360	1135	3.450	1135	6.084
1140	19.00	0.910	1140	4.914	1140	3.094	1140	2.912	1140	3.367	1140	3.458	1140	6.097
1145	19.08	0.912	1145	4.925	1145	3.101	1145	2.918	1145	3.374	1145	3.466	1145	6.110
1150	19.17	0.914	1150	4.936	1150	3.108	1150	2.925	1150	3.382	1150	3.473	1150	6.124
1155	19.25	0.916	1155	4.946	1155	3.114	1155	2.931	1155	3.389	1155	3.481	1155	6.137
1160	19.33	0.917	1160	4.952	1160	3.118	1160	2.934	1160	3.393	1160	3.485	1160	6.144
1165	19.42	0.919	1165	4.963	1165	3.125	1165	2.941	1165	3.400	1165	3.492	1165	6.157
1170	19.50	0.921	1170	4.973	1170	3.131	1170	2.947	1170	3.408	1170	3.500	1170	6.171
1175	19.58	0.923	1175	4.984	1175	3.138	1175	2.954	1175	3.415	1175	3.507	1175	6.184
1180	19.67	0.925	1180	4.995	1180	3.145	1180	2.960	1180	3.423	1180	3.515	1180	6.198
1185	19.75	0.927	1185	5.006	1185	3.152	1185	2.966	1185	3.430	1185	3.523	1185	6.211
1190	19.83	0.928	1190	5.011	1190	3.155	1190	2.970	1190	3.434	1190	3.526	1190	6.218
1195	19.92	0.930	1195	5.022	1195	3.162	1195	2.976	1195	3.441	1195	3.534	1195	6.231
1200	20.00	0.932	1200	5.033	1200	3.169	1200	2.982	1200	3.448	1200	3.542	1200	6.244
1205	20.08	0.934	1205	5.044	1205	3.176	1205	2.989	1205	3.456	1205	3.549	1205	6.258
1210	20.17	0.935	1210	5.049	1210	3.179	1210	2.992	1210	3.460	1210	3.553	1210	6.265
1215	20.25	0.937	1215	5.060	1215	3.186	1215	2.998	1215	3.467	1215	3.561	1215	6.278
1220	20.33	0.939	1220	5.071	1220	3.193	1220	3.005	1220	3.474	1220	3.568	1220	6.291
1225	20.42	0.940	1225	5.076	1225	3.196	1225	3.008	1225	3.478	1225	3.572	1225	6.298
1230	20.50	0.942	1230	5.087	1230	3.203	1230	3.014	1230	3.485	1230	3.580	1230	6.311
1235	20.58	0.944	1235	5.098	1235	3.210	1235	3.021	1235	3.493	1235	3.587	1235	6.325
1240	20.67	0.945	1240	5.103	1240	3.213	1240	3.024	1240	3.497	1240	3.591	1240	6.332
1245	20.75	0.947	1245	5.114	1245	3.220	1245	3.030	1245	3.504	1245	3.599	1245	6.345
1250	20.83	0.949	1250	5.125	1250	3.227	1250	3.037	1250	3.511	1250	3.606	1250	6.358
1255	20.92	0.950	1255	5.130	1255	3.230	1255	3.040	1255	3.515	1255	3.610	1255	6.365
1260	21.00	0.952	1260	5.141	1260	3.237	1260	3.046	1260	3.522	1260	3.618	1260	6.378
1265	21.08	0.953	1265	5.146	1265	3.240	1265	3.050	1265	3.526	1265	3.621	1265	6.385
1270	21.17	0.955	1270	5.157	1270	3.247	1270	3.056	1270	3.534	1270	3.629	1270	6.399
1275	21.25	0.957	1275	5.168	1275	3.254	1275	3.062	1275	3.541	1275	3.637	1275	6.412
1280	21.33	0.958	1280	5.173	1280	3.257	1280	3.066	1280	3.545	1280	3.640	1280	6.419
1285	21.42	0.960	1285	5.184	1285	3.264	1285	3.072	1285	3.552	1285	3.648	1285	6.432
1290	21.50	0.961	1290	5.189	1290	3.267	1290	3.075	1290	3.556	1290	3.652	1290	6.439
1295	21.58	0.963	1295	5.200	1295	3.274	1295	3.082	1295	3.563	1295	3.659	1295	6.452
1300	21.67	0.964	1300	5.206	1300	3.278	1300	3.085	1300	3.567	1300	3.663	1300	6.459
1305	21.75	0.966	1305	5.216	1305	3.284	1305	3.091	1305	3.574	1305	3.671	1305	6.472
1310	21.83	0.967	1310	5.222	1310	3.288	1310	3.094	1310	3.578	1310	3.675	1310	6.479
1315	21.92	0.968	1315	5.227	1315	3.291	1315	3.098	1315	3.582	1315	3.678	1315	6.486
1320	22.00	0.970	1320	5.238	1320	3.298	1320	3.104	1320	3.589	1320	3.686	1320	6.499
1325	22.08	0.971	1325	5.243	1325	3.301	1325	3.107	1325	3.593	1325	3.690	1325	6.506
1330	22.17	0.973	1330	5.254	1330	3.308	1330	3.114	1330	3.600	1330	3.697	1330	6.519
1335	22.25	0.974	1335	5.260	1335	3.312	1335	3.117	1335	3.604	1335	3.701	1335	6.526
1340	22.33	0.975	1340	5.265	1340	3.315	1340	3.120	1340	3.608	1340	3.705	1340	6.533
1345	22.42	0.977	1345	5.276	1345	3.322	1345	3.126	1345	3.615	1345	3.713	1345	6.546

SCS Type 1 - 10 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{10,24}$[2]= 5.4		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{10,24}$[2]= 3.4		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{10,24}$[2]= 3.2		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{10,24}$[2]= 3.7		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{10,24}$[2]= 3.8		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{10,24}$[2]= 6.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1350	22.50	0.978	1350	5.281	1350	3.325	1350	3.130	1350	3.619	1350	3.716	1350	6.553
1355	22.58	0.979	1355	5.287	1355	3.329	1355	3.133	1355	3.622	1355	3.720	1355	6.559
1360	22.67	0.981	1360	5.297	1360	3.335	1360	3.139	1360	3.630	1360	3.728	1360	6.573
1365	22.75	0.982	1365	5.303	1365	3.339	1365	3.142	1365	3.633	1365	3.732	1365	6.579
1370	22.83	0.983	1370	5.308	1370	3.342	1370	3.146	1370	3.637	1370	3.735	1370	6.586
1375	22.92	0.984	1375	5.314	1375	3.346	1375	3.149	1375	3.641	1375	3.739	1375	6.593
1380	23.00	0.986	1380	5.324	1380	3.352	1380	3.155	1380	3.648	1380	3.747	1380	6.606
1385	23.08	0.987	1385	5.330	1385	3.356	1385	3.158	1385	3.652	1385	3.751	1385	6.613
1390	23.17	0.988	1390	5.335	1390	3.359	1390	3.162	1390	3.656	1390	3.754	1390	6.620
1395	23.25	0.989	1395	5.341	1395	3.363	1395	3.165	1395	3.659	1395	3.758	1395	6.626
1400	23.33	0.991	1400	5.351	1400	3.369	1400	3.171	1400	3.667	1400	3.766	1400	6.640
1405	23.42	0.992	1405	5.357	1405	3.373	1405	3.174	1405	3.670	1405	3.770	1405	6.646
1410	23.50	0.993	1410	5.362	1410	3.376	1410	3.178	1410	3.674	1410	3.773	1410	6.653
1415	23.58	0.994	1415	5.368	1415	3.380	1415	3.181	1415	3.678	1415	3.777	1415	6.660
1420	23.67	0.995	1420	5.373	1420	3.383	1420	3.184	1420	3.682	1420	3.781	1420	6.667
1425	23.75	0.996	1425	5.378	1425	3.386	1425	3.187	1425	3.685	1425	3.785	1425	6.673
1430	23.83	0.998	1430	5.389	1430	3.393	1430	3.194	1430	3.693	1430	3.792	1430	6.687
1435	23.92	0.999	1435	5.395	1435	3.397	1435	3.197	1435	3.696	1435	3.796	1435	6.693
1440	24.00	1.000	1440	5.400	1440	3.400	1440	3.200	1440	3.700	1440	3.800	1440	6.700

1. P_x/P_{24} ratios have been determined through linear intepolation of values derived from Figure II-B-1 of the 1993 SDCHM at 30 minute intervals.

2. $P_{10,24}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type 1 - 10 Yr - 6 Hr Distribution

SCS Type 1 - 6 Hr Distribution Ratios			SCS Type 1 - 6 Hr Distribution Guejito Basin $P_{10,6}$ [3]= 2.5		SCS Type 1 - 6 Hr Distribution Jamul Basin $P_{10,6}$ [3]= 1.9		SCS Type 1 - 6 Hr Distribution Las Flores Basin $P_{10,6}$ [3]= 1.8		SCS Type 1 - 6 Hr Distribution Los Coches Basin $P_{10,6}$ [3]= 1.9		SCS Type 1 - 6 Hr Distribution Santa Maria Basin $P_{10,6}$ [3]= 2.3		SCS Type 1 - 6 Hr Distribution Sweetwater Basin $P_{10,6}$ [3]= 3.3	
Time [1] (min)	Time (hrs)	P_x/P_6 [2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.006	5	0.015	5	0.011	5	0.011	5	0.011	5	0.014	5	0.020
10	0.17	0.012	10	0.030	10	0.023	10	0.022	10	0.023	10	0.028	10	0.040
15	0.25	0.017	15	0.043	15	0.032	15	0.031	15	0.032	15	0.039	15	0.056
20	0.33	0.023	20	0.058	20	0.044	20	0.041	20	0.044	20	0.053	20	0.076
25	0.42	0.029	25	0.073	25	0.055	25	0.052	25	0.055	25	0.067	25	0.096
30	0.50	0.035	30	0.088	30	0.067	30	0.063	30	0.067	30	0.081	30	0.116
35	0.58	0.041	35	0.103	35	0.078	35	0.074	35	0.078	35	0.094	35	0.135
40	0.67	0.047	40	0.118	40	0.089	40	0.085	40	0.089	40	0.108	40	0.155
45	0.75	0.054	45	0.135	45	0.103	45	0.097	45	0.103	45	0.124	45	0.178
50	0.83	0.061	50	0.153	50	0.116	50	0.110	50	0.116	50	0.140	50	0.201
55	0.92	0.068	55	0.170	55	0.129	55	0.122	55	0.129	55	0.156	55	0.224
60	1.00	0.076	60	0.190	60	0.144	60	0.137	60	0.144	60	0.175	60	0.251
65	1.08	0.084	65	0.210	65	0.160	65	0.151	65	0.160	65	0.193	65	0.277
70	1.17	0.092	70	0.230	70	0.175	70	0.166	70	0.175	70	0.212	70	0.304
75	1.25	0.100	75	0.250	75	0.190	75	0.180	75	0.190	75	0.230	75	0.330
80	1.33	0.108	80	0.270	80	0.205	80	0.194	80	0.205	80	0.248	80	0.356
85	1.42	0.116	85	0.290	85	0.220	85	0.209	85	0.220	85	0.267	85	0.383
90	1.50	0.125	90	0.313	90	0.238	90	0.225	90	0.238	90	0.288	90	0.413
95	1.58	0.134	95	0.335	95	0.255	95	0.241	95	0.255	95	0.308	95	0.442
100	1.67	0.144	100	0.360	100	0.274	100	0.259	100	0.274	100	0.331	100	0.475
105	1.75	0.156	105	0.390	105	0.296	105	0.281	105	0.296	105	0.359	105	0.515
110	1.83	0.168	110	0.420	110	0.319	110	0.302	110	0.319	110	0.386	110	0.554
115	1.92	0.181	115	0.453	115	0.344	115	0.326	115	0.344	115	0.416	115	0.597
120	2.00	0.194	120	0.485	120	0.369	120	0.349	120	0.369	120	0.446	120	0.640
125	2.08	0.209	125	0.523	125	0.397	125	0.376	125	0.397	125	0.481	125	0.690
130	2.17	0.229	130	0.573	130	0.435	130	0.412	130	0.435	130	0.527	130	0.756
135	2.25	0.254	135	0.635	135	0.483	135	0.457	135	0.483	135	0.584	135	0.838
140	2.33	0.285	140	0.713	140	0.542	140	0.513	140	0.542	140	0.656	140	0.941
145	2.42	0.336	145	0.840	145	0.638	145	0.605	145	0.638	145	0.773	145	1.109
150	2.50	0.515	150	1.288	150	0.979	150	0.927	150	0.979	150	1.185	150	1.700
155	2.58	0.565	155	1.413	155	1.074	155	1.017	155	1.074	155	1.300	155	1.865
160	2.67	0.597	160	1.493	160	1.134	160	1.075	160	1.134	160	1.373	160	1.970
165	2.75	0.623	165	1.558	165	1.184	165	1.121	165	1.184	165	1.433	165	2.056
170	2.83	0.645	170	1.613	170	1.226	170	1.161	170	1.226	170	1.484	170	2.129
175	2.92	0.665	175	1.663	175	1.264	175	1.197	175	1.264	175	1.530	175	2.195
180	3.00	0.684	180	1.710	180	1.300	180	1.231	180	1.300	180	1.573	180	2.257
185	3.08	0.701	185	1.753	185	1.332	185	1.262	185	1.332	185	1.612	185	2.313
190	3.17	0.717	190	1.793	190	1.362	190	1.291	190	1.362	190	1.649	190	2.366
195	3.25	0.732	195	1.830	195	1.391	195	1.318	195	1.391	195	1.684	195	2.416
200	3.33	0.746	200	1.865	200	1.417	200	1.343	200	1.417	200	1.716	200	2.462
205	3.42	0.758	205	1.895	205	1.440	205	1.364	205	1.440	205	1.743	205	2.501
210	3.50	0.770	210	1.925	210	1.463	210	1.386	210	1.463	210	1.771	210	2.541
215	3.58	0.781	215	1.953	215	1.484	215	1.406	215	1.484	215	1.796	215	2.577
220	3.67	0.791	220	1.978	220	1.503	220	1.424	220	1.503	220	1.819	220	2.610
225	3.75	0.802	225	2.005	225	1.524	225	1.444	225	1.524	225	1.845	225	2.647
230	3.83	0.812	230	2.030	230	1.543	230	1.462	230	1.543	230	1.868	230	2.680
235	3.92	0.822	235	2.055	235	1.562	235	1.480	235	1.562	235	1.891	235	2.713
240	4.00	0.832	240	2.080	240	1.581	240	1.498	240	1.581	240	1.914	240	2.746
245	4.08	0.841	245	2.103	245	1.598	245	1.514	245	1.598	245	1.934	245	2.775
250	4.17	0.851	250	2.128	250	1.617	250	1.532	250	1.617	250	1.957	250	2.808
255	4.25	0.860	255	2.150	255	1.634	255	1.548	255	1.634	255	1.978	255	2.838
260	4.33	0.869	260	2.173	260	1.651	260	1.564	260	1.651	260	1.999	260	2.868
265	4.42	0.877	265	2.193	265	1.666	265	1.579	265	1.666	265	2.017	265	2.894

SCS Type 1 - 10 Yr - 6 Hr Distribution

SCS Type 1 - 6 Hr Distribution Ratios			SCS Type 1 - 6 Hr Distribution Guejito Basin $P_{10,6}$[3]= 2.5		SCS Type 1 - 6 Hr Distribution Jamul Basin $P_{10,6}$[3]= 1.9		SCS Type 1 - 6 Hr Distribution Las Flores Basin $P_{10,6}$[3]= 1.8		SCS Type 1 - 6 Hr Distribution Los Coches Basin $P_{10,6}$[3]= 1.9		SCS Type 1 - 6 Hr Distribution Santa Maria Basin $P_{10,6}$[3]= 2.3		SCS Type 1 - 6 Hr Distribution Sweetwater Basin $P_{10,6}$[3]= 3.3	
Time[1] (min)	Time (hrs)	P_x/P_6[2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.886	270	2.215	270	1.683	270	1.595	270	1.683	270	2.038	270	2.924
275	4.58	0.894	275	2.235	275	1.699	275	1.609	275	1.699	275	2.056	275	2.950
280	4.67	0.902	280	2.255	280	1.714	280	1.624	280	1.714	280	2.075	280	2.977
285	4.75	0.910	285	2.275	285	1.729	285	1.638	285	1.729	285	2.093	285	3.003
290	4.83	0.917	290	2.293	290	1.742	290	1.651	290	1.742	290	2.109	290	3.026
295	4.92	0.925	295	2.313	295	1.758	295	1.665	295	1.758	295	2.128	295	3.053
300	5.00	0.932	300	2.330	300	1.771	300	1.678	300	1.771	300	2.144	300	3.076
305	5.08	0.939	305	2.348	305	1.784	305	1.690	305	1.784	305	2.160	305	3.099
310	5.17	0.945	310	2.363	310	1.796	310	1.701	310	1.796	310	2.174	310	3.119
315	5.25	0.952	315	2.380	315	1.809	315	1.714	315	1.809	315	2.190	315	3.142
320	5.33	0.958	320	2.395	320	1.820	320	1.724	320	1.820	320	2.203	320	3.161
325	5.42	0.964	325	2.410	325	1.832	325	1.735	325	1.832	325	2.217	325	3.181
330	5.50	0.970	330	2.425	330	1.843	330	1.746	330	1.843	330	2.231	330	3.201
335	5.58	0.975	335	2.438	335	1.853	335	1.755	335	1.853	335	2.243	335	3.218
340	5.67	0.981	340	2.453	340	1.864	340	1.766	340	1.864	340	2.256	340	3.237
345	5.75	0.986	345	2.465	345	1.873	345	1.775	345	1.873	345	2.268	345	3.254
350	5.83	0.991	350	2.478	350	1.883	350	1.784	350	1.883	350	2.279	350	3.270
355	5.92	0.995	355	2.488	355	1.891	355	1.791	355	1.891	355	2.289	355	3.284
360	6.00	1.000	360	2.500	360	1.900	360	1.800	360	1.900	360	2.300	360	3.300

1. Time values for the 6 hr distribution are determined by dividing the time intervals from the SCS Type 1 - 24 hr distribution by 4.
2. P_x/P_6 ratios correspond to P_x/P_{24} ratios at times (in minutes) that are 4 times greater than P_x/P_6 times. For example, P_x/P_6 at 100 minutes equals P_x/P_{24} at 400 minutes.
3. $P_{10,6}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type 1 - 5 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{5,24}$[2]= 4.3		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{5,24}$[2]= 3.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{5,24}$[2]= 2.7		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{5,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{5,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{5,24}$[2]= 5.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.001	5	0.004	5	0.003	5	0.003	5	0.003	5	0.003	5	0.006
10	0.17	0.003	10	0.013	10	0.009	10	0.008	10	0.010	10	0.010	10	0.017
15	0.25	0.004	15	0.017	15	0.012	15	0.011	15	0.013	15	0.013	15	0.023
20	0.33	0.006	20	0.026	20	0.018	20	0.016	20	0.020	20	0.020	20	0.034
25	0.42	0.007	25	0.030	25	0.021	25	0.019	25	0.023	25	0.023	25	0.040
30	0.50	0.009	30	0.039	30	0.027	30	0.024	30	0.030	30	0.030	30	0.051
35	0.58	0.010	35	0.043	35	0.030	35	0.027	35	0.033	35	0.033	35	0.057
40	0.67	0.012	40	0.052	40	0.036	40	0.032	40	0.040	40	0.040	40	0.068
45	0.75	0.013	45	0.056	45	0.039	45	0.035	45	0.043	45	0.043	45	0.074
50	0.83	0.014	50	0.060	50	0.042	50	0.038	50	0.046	50	0.046	50	0.080
55	0.92	0.016	55	0.069	55	0.048	55	0.043	55	0.053	55	0.053	55	0.091
60	1.00	0.017	60	0.073	60	0.051	60	0.046	60	0.056	60	0.056	60	0.097
65	1.08	0.019	65	0.082	65	0.057	65	0.051	65	0.063	65	0.063	65	0.108
70	1.17	0.020	70	0.086	70	0.060	70	0.054	70	0.066	70	0.066	70	0.114
75	1.25	0.022	75	0.095	75	0.066	75	0.059	75	0.073	75	0.073	75	0.125
80	1.33	0.023	80	0.099	80	0.069	80	0.062	80	0.076	80	0.076	80	0.131
85	1.42	0.025	85	0.108	85	0.075	85	0.068	85	0.083	85	0.083	85	0.143
90	1.50	0.026	90	0.112	90	0.078	90	0.070	90	0.086	90	0.086	90	0.148
95	1.58	0.028	95	0.120	95	0.084	95	0.076	95	0.092	95	0.092	95	0.160
100	1.67	0.029	100	0.125	100	0.087	100	0.078	100	0.096	100	0.096	100	0.165
105	1.75	0.030	105	0.129	105	0.090	105	0.081	105	0.099	105	0.099	105	0.171
110	1.83	0.032	110	0.138	110	0.096	110	0.086	110	0.106	110	0.106	110	0.182
115	1.92	0.033	115	0.142	115	0.099	115	0.089	115	0.109	115	0.109	115	0.188
120	2.00	0.035	120	0.151	120	0.105	120	0.095	120	0.116	120	0.116	120	0.200
125	2.08	0.036	125	0.155	125	0.108	125	0.097	125	0.119	125	0.119	125	0.205
130	2.17	0.038	130	0.163	130	0.114	130	0.103	130	0.125	130	0.125	130	0.217
135	2.25	0.039	135	0.168	135	0.117	135	0.105	135	0.129	135	0.129	135	0.222
140	2.33	0.041	140	0.176	140	0.123	140	0.111	140	0.135	140	0.135	140	0.234
145	2.42	0.042	145	0.181	145	0.126	145	0.113	145	0.139	145	0.139	145	0.239
150	2.50	0.044	150	0.189	150	0.132	150	0.119	150	0.145	150	0.145	150	0.251
155	2.58	0.046	155	0.198	155	0.138	155	0.124	155	0.152	155	0.152	155	0.262
160	2.67	0.047	160	0.202	160	0.141	160	0.127	160	0.155	160	0.155	160	0.268
165	2.75	0.049	165	0.211	165	0.147	165	0.132	165	0.162	165	0.162	165	0.279
170	2.83	0.051	170	0.219	170	0.153	170	0.138	170	0.168	170	0.168	170	0.291
175	2.92	0.052	175	0.224	175	0.156	175	0.140	175	0.172	175	0.172	175	0.296
180	3.00	0.054	180	0.232	180	0.162	180	0.146	180	0.178	180	0.178	180	0.308
185	3.08	0.056	185	0.241	185	0.168	185	0.151	185	0.185	185	0.185	185	0.319
190	3.17	0.058	190	0.249	190	0.174	190	0.157	190	0.191	190	0.191	190	0.331
195	3.25	0.059	195	0.254	195	0.177	195	0.159	195	0.195	195	0.195	195	0.336
200	3.33	0.061	200	0.262	200	0.183	200	0.165	200	0.201	200	0.201	200	0.348
205	3.42	0.063	205	0.271	205	0.189	205	0.170	205	0.208	205	0.208	205	0.359
210	3.50	0.065	210	0.280	210	0.195	210	0.176	210	0.215	210	0.215	210	0.371
215	3.58	0.066	215	0.284	215	0.198	215	0.178	215	0.218	215	0.218	215	0.376
220	3.67	0.068	220	0.292	220	0.204	220	0.184	220	0.224	220	0.224	220	0.388
225	3.75	0.070	225	0.301	225	0.210	225	0.189	225	0.231	225	0.231	225	0.399
230	3.83	0.072	230	0.310	230	0.216	230	0.194	230	0.238	230	0.238	230	0.410
235	3.92	0.074	235	0.318	235	0.222	235	0.200	235	0.244	235	0.244	235	0.422
240	4.00	0.076	240	0.327	240	0.228	240	0.205	240	0.251	240	0.251	240	0.433
245	4.08	0.078	245	0.335	245	0.234	245	0.211	245	0.257	245	0.257	245	0.445
250	4.17	0.080	250	0.344	250	0.240	250	0.216	250	0.264	250	0.264	250	0.456
255	4.25	0.082	255	0.353	255	0.246	255	0.221	255	0.271	255	0.271	255	0.467
260	4.33	0.084	260	0.361	260	0.252	260	0.227	260	0.277	260	0.277	260	0.479
265	4.42	0.086	265	0.370	265	0.258	265	0.232	265	0.284	265	0.284	265	0.490

SCS Type 1 - 5 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{5,24}$[2]= 4.3		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{5,24}$[2]= 3.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{5,24}$[2]= 2.7		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{5,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{5,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{5,24}$[2]= 5.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.088	270	0.378	270	0.264	270	0.238	270	0.290	270	0.290	270	0.502
275	4.58	0.090	275	0.387	275	0.270	275	0.243	275	0.297	275	0.297	275	0.513
280	4.67	0.092	280	0.396	280	0.276	280	0.248	280	0.304	280	0.304	280	0.524
285	4.75	0.094	285	0.404	285	0.282	285	0.254	285	0.310	285	0.310	285	0.536
290	4.83	0.096	290	0.413	290	0.288	290	0.259	290	0.317	290	0.317	290	0.547
295	4.92	0.098	295	0.421	295	0.294	295	0.265	295	0.323	295	0.323	295	0.559
300	5.00	0.100	300	0.430	300	0.300	300	0.270	300	0.330	300	0.330	300	0.570
305	5.08	0.102	305	0.439	305	0.306	305	0.275	305	0.337	305	0.337	305	0.581
310	5.17	0.104	310	0.447	310	0.312	310	0.281	310	0.343	310	0.343	310	0.593
315	5.25	0.106	315	0.456	315	0.318	315	0.286	315	0.350	315	0.350	315	0.604
320	5.33	0.108	320	0.464	320	0.324	320	0.292	320	0.356	320	0.356	320	0.616
325	5.42	0.110	325	0.473	325	0.330	325	0.297	325	0.363	325	0.363	325	0.627
330	5.50	0.112	330	0.482	330	0.336	330	0.302	330	0.370	330	0.370	330	0.638
335	5.58	0.114	335	0.490	335	0.342	335	0.308	335	0.376	335	0.376	335	0.650
340	5.67	0.116	340	0.499	340	0.348	340	0.313	340	0.383	340	0.383	340	0.661
345	5.75	0.118	345	0.507	345	0.354	345	0.319	345	0.389	345	0.389	345	0.673
350	5.83	0.121	350	0.520	350	0.363	350	0.327	350	0.399	350	0.399	350	0.690
355	5.92	0.123	355	0.529	355	0.369	355	0.332	355	0.406	355	0.406	355	0.701
360	6.00	0.125	360	0.538	360	0.375	360	0.338	360	0.413	360	0.413	360	0.713
365	6.08	0.127	365	0.546	365	0.381	365	0.343	365	0.419	365	0.419	365	0.724
370	6.17	0.129	370	0.555	370	0.387	370	0.348	370	0.426	370	0.426	370	0.735
375	6.25	0.132	375	0.568	375	0.396	375	0.356	375	0.436	375	0.436	375	0.752
380	6.33	0.134	380	0.576	380	0.402	380	0.362	380	0.442	380	0.442	380	0.764
385	6.42	0.136	385	0.585	385	0.408	385	0.367	385	0.449	385	0.449	385	0.775
390	6.50	0.139	390	0.598	390	0.417	390	0.375	390	0.459	390	0.459	390	0.792
395	6.58	0.142	395	0.611	395	0.426	395	0.383	395	0.469	395	0.469	395	0.809
400	6.67	0.144	400	0.619	400	0.432	400	0.389	400	0.475	400	0.475	400	0.821
405	6.75	0.147	405	0.632	405	0.441	405	0.397	405	0.485	405	0.485	405	0.838
410	6.83	0.150	410	0.645	410	0.450	410	0.405	410	0.495	410	0.495	410	0.855
415	6.92	0.153	415	0.658	415	0.459	415	0.413	415	0.505	415	0.505	415	0.872
420	7.00	0.156	420	0.671	420	0.468	420	0.421	420	0.515	420	0.515	420	0.889
425	7.08	0.159	425	0.684	425	0.477	425	0.429	425	0.525	425	0.525	425	0.906
430	7.17	0.162	430	0.697	430	0.486	430	0.437	430	0.535	430	0.535	430	0.923
435	7.25	0.165	435	0.710	435	0.495	435	0.446	435	0.545	435	0.545	435	0.941
440	7.33	0.168	440	0.722	440	0.504	440	0.454	440	0.554	440	0.554	440	0.958
445	7.42	0.171	445	0.735	445	0.513	445	0.462	445	0.564	445	0.564	445	0.975
450	7.50	0.174	450	0.748	450	0.522	450	0.470	450	0.574	450	0.574	450	0.992
455	7.58	0.178	455	0.765	455	0.534	455	0.481	455	0.587	455	0.587	455	1.015
460	7.67	0.181	460	0.778	460	0.543	460	0.489	460	0.597	460	0.597	460	1.032
465	7.75	0.184	465	0.791	465	0.552	465	0.497	465	0.607	465	0.607	465	1.049
470	7.83	0.187	470	0.804	470	0.561	470	0.505	470	0.617	470	0.617	470	1.066
475	7.92	0.191	475	0.821	475	0.573	475	0.516	475	0.630	475	0.630	475	1.089
480	8.00	0.194	480	0.834	480	0.582	480	0.524	480	0.640	480	0.640	480	1.106
485	8.08	0.197	485	0.847	485	0.591	485	0.532	485	0.650	485	0.650	485	1.123
490	8.17	0.201	490	0.864	490	0.603	490	0.543	490	0.663	490	0.663	490	1.146
495	8.25	0.205	495	0.882	495	0.615	495	0.554	495	0.677	495	0.677	495	1.169
500	8.33	0.209	500	0.899	500	0.627	500	0.564	500	0.690	500	0.690	500	1.191
505	8.42	0.214	505	0.920	505	0.642	505	0.578	505	0.706	505	0.706	505	1.220
510	8.50	0.219	510	0.942	510	0.657	510	0.591	510	0.723	510	0.723	510	1.248
515	8.58	0.224	515	0.963	515	0.672	515	0.605	515	0.739	515	0.739	515	1.277
520	8.67	0.229	520	0.985	520	0.687	520	0.618	520	0.756	520	0.756	520	1.305
525	8.75	0.235	525	1.011	525	0.705	525	0.635	525	0.776	525	0.776	525	1.340
530	8.83	0.241	530	1.036	530	0.723	530	0.651	530	0.795	530	0.795	530	1.374
535	8.92	0.247	535	1.062	535	0.741	535	0.667	535	0.815	535	0.815	535	1.408

SCS Type 1 - 5 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{5,24}$[2]= 4.3		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{5,24}$[2]= 3.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{5,24}$[2]= 2.7		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{5,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{5,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{5,24}$[2]= 5.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
540	9.00	0.254	540	1.092	540	0.762	540	0.686	540	0.838	540	0.838	540	1.448
545	9.08	0.261	545	1.122	545	0.783	545	0.705	545	0.861	545	0.861	545	1.488
550	9.17	0.268	550	1.152	550	0.804	550	0.724	550	0.884	550	0.884	550	1.528
555	9.25	0.276	555	1.187	555	0.828	555	0.745	555	0.911	555	0.911	555	1.573
560	9.33	0.285	560	1.226	560	0.855	560	0.770	560	0.941	560	0.941	560	1.625
565	9.42	0.293	565	1.260	565	0.879	565	0.791	565	0.967	565	0.967	565	1.670
570	9.50	0.303	570	1.303	570	0.909	570	0.818	570	1.000	570	1.000	570	1.727
575	9.58	0.316	575	1.359	575	0.948	575	0.853	575	1.043	575	1.043	575	1.801
580	9.67	0.336	580	1.445	580	1.008	580	0.907	580	1.109	580	1.109	580	1.915
585	9.75	0.362	585	1.557	585	1.086	585	0.977	585	1.195	585	1.195	585	2.063
590	9.83	0.411	590	1.767	590	1.233	590	1.110	590	1.356	590	1.356	590	2.343
595	9.92	0.475	595	2.043	595	1.425	595	1.283	595	1.568	595	1.568	595	2.708
600	10.00	0.515	600	2.215	600	1.545	600	1.391	600	1.700	600	1.700	600	2.936
605	10.08	0.530	605	2.279	605	1.590	605	1.431	605	1.749	605	1.749	605	3.021
610	10.17	0.542	610	2.331	610	1.626	610	1.463	610	1.789	610	1.789	610	3.089
615	10.25	0.555	615	2.387	615	1.665	615	1.499	615	1.832	615	1.832	615	3.164
620	10.33	0.565	620	2.430	620	1.695	620	1.526	620	1.865	620	1.865	620	3.221
625	10.42	0.575	625	2.473	625	1.725	625	1.553	625	1.898	625	1.898	625	3.278
630	10.50	0.583	630	2.507	630	1.749	630	1.574	630	1.924	630	1.924	630	3.323
635	10.58	0.590	635	2.537	635	1.770	635	1.593	635	1.947	635	1.947	635	3.363
640	10.67	0.597	640	2.567	640	1.791	640	1.612	640	1.970	640	1.970	640	3.403
645	10.75	0.604	645	2.597	645	1.812	645	1.631	645	1.993	645	1.993	645	3.443
650	10.83	0.611	650	2.627	650	1.833	650	1.650	650	2.016	650	2.016	650	3.483
655	10.92	0.617	655	2.653	655	1.851	655	1.666	655	2.036	655	2.036	655	3.517
660	11.00	0.623	660	2.679	660	1.869	660	1.682	660	2.056	660	2.056	660	3.551
665	11.08	0.629	665	2.705	665	1.887	665	1.698	665	2.076	665	2.076	665	3.585
670	11.17	0.634	670	2.726	670	1.902	670	1.712	670	2.092	670	2.092	670	3.614
675	11.25	0.640	675	2.752	675	1.920	675	1.728	675	2.112	675	2.112	675	3.648
680	11.33	0.645	680	2.774	680	1.935	680	1.742	680	2.129	680	2.129	680	3.677
685	11.42	0.650	685	2.795	685	1.950	685	1.755	685	2.145	685	2.145	685	3.705
690	11.50	0.655	690	2.817	690	1.965	690	1.769	690	2.162	690	2.162	690	3.734
695	11.58	0.660	695	2.838	695	1.980	695	1.782	695	2.178	695	2.178	695	3.762
700	11.67	0.665	700	2.860	700	1.995	700	1.796	700	2.195	700	2.195	700	3.791
705	11.75	0.670	705	2.881	705	2.010	705	1.809	705	2.211	705	2.211	705	3.819
710	11.83	0.675	710	2.903	710	2.025	710	1.823	710	2.228	710	2.228	710	3.848
715	11.92	0.679	715	2.920	715	2.037	715	1.833	715	2.241	715	2.241	715	3.870
720	12.00	0.684	720	2.941	720	2.052	720	1.847	720	2.257	720	2.257	720	3.899
725	12.08	0.688	725	2.958	725	2.064	725	1.858	725	2.270	725	2.270	725	3.922
730	12.17	0.693	730	2.980	730	2.079	730	1.871	730	2.287	730	2.287	730	3.950
735	12.25	0.697	735	2.997	735	2.091	735	1.882	735	2.300	735	2.300	735	3.973
740	12.33	0.701	740	3.014	740	2.103	740	1.893	740	2.313	740	2.313	740	3.996
745	12.42	0.705	745	3.032	745	2.115	745	1.904	745	2.327	745	2.327	745	4.019
750	12.50	0.709	750	3.049	750	2.127	750	1.914	750	2.340	750	2.340	750	4.041
755	12.58	0.713	755	3.066	755	2.139	755	1.925	755	2.353	755	2.353	755	4.064
760	12.67	0.717	760	3.083	760	2.151	760	1.936	760	2.366	760	2.366	760	4.087
765	12.75	0.721	765	3.100	765	2.163	765	1.947	765	2.379	765	2.379	765	4.110
770	12.83	0.725	770	3.118	770	2.175	770	1.958	770	2.393	770	2.393	770	4.133
775	12.92	0.728	775	3.130	775	2.184	775	1.966	775	2.402	775	2.402	775	4.150
780	13.00	0.732	780	3.148	780	2.196	780	1.976	780	2.416	780	2.416	780	4.172
785	13.08	0.735	785	3.161	785	2.205	785	1.985	785	2.426	785	2.426	785	4.190
790	13.17	0.739	790	3.178	790	2.217	790	1.995	790	2.439	790	2.439	790	4.212
795	13.25	0.742	795	3.191	795	2.226	795	2.003	795	2.449	795	2.449	795	4.229
800	13.33	0.746	800	3.208	800	2.238	800	2.014	800	2.462	800	2.462	800	4.252
805	13.42	0.749	805	3.221	805	2.247	805	2.022	805	2.472	805	2.472	805	4.269

SCS Type 1 - 5 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{5,24}$[2]= 4.3		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{5,24}$[2]= 3.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{5,24}$[2]= 2.7		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{5,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{5,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{5,24}$[2]= 5.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
810	13.50	0.752	810	3.234	810	2.256	810	2.030	810	2.482	810	2.482	810	4.286
815	13.58	0.755	815	3.247	815	2.265	815	2.039	815	2.492	815	2.492	815	4.304
820	13.67	0.758	820	3.259	820	2.274	820	2.047	820	2.501	820	2.501	820	4.321
825	13.75	0.761	825	3.272	825	2.283	825	2.055	825	2.511	825	2.511	825	4.338
830	13.83	0.764	830	3.285	830	2.292	830	2.063	830	2.521	830	2.521	830	4.355
835	13.92	0.767	835	3.298	835	2.301	835	2.071	835	2.531	835	2.531	835	4.372
840	14.00	0.770	840	3.311	840	2.310	840	2.079	840	2.541	840	2.541	840	4.389
845	14.08	0.773	845	3.324	845	2.319	845	2.087	845	2.551	845	2.551	845	4.406
850	14.17	0.775	850	3.333	850	2.325	850	2.093	850	2.558	850	2.558	850	4.418
855	14.25	0.778	855	3.345	855	2.334	855	2.101	855	2.567	855	2.567	855	4.435
860	14.33	0.781	860	3.358	860	2.343	860	2.109	860	2.577	860	2.577	860	4.452
865	14.42	0.783	865	3.367	865	2.349	865	2.114	865	2.584	865	2.584	865	4.463
870	14.50	0.786	870	3.380	870	2.358	870	2.122	870	2.594	870	2.594	870	4.480
875	14.58	0.789	875	3.393	875	2.367	875	2.130	875	2.604	875	2.604	875	4.497
880	14.67	0.791	880	3.401	880	2.373	880	2.136	880	2.610	880	2.610	880	4.509
885	14.75	0.794	885	3.414	885	2.382	885	2.144	885	2.620	885	2.620	885	4.526
890	14.83	0.797	890	3.427	890	2.391	890	2.152	890	2.630	890	2.630	890	4.543
895	14.92	0.799	895	3.436	895	2.397	895	2.157	895	2.637	895	2.637	895	4.554
900	15.00	0.802	900	3.449	900	2.406	900	2.165	900	2.647	900	2.647	900	4.571
905	15.08	0.804	905	3.457	905	2.412	905	2.171	905	2.653	905	2.653	905	4.583
910	15.17	0.807	910	3.470	910	2.421	910	2.179	910	2.663	910	2.663	910	4.600
915	15.25	0.810	915	3.483	915	2.430	915	2.187	915	2.673	915	2.673	915	4.617
920	15.33	0.812	920	3.492	920	2.436	920	2.192	920	2.680	920	2.680	920	4.628
925	15.42	0.815	925	3.505	925	2.445	925	2.201	925	2.690	925	2.690	925	4.646
930	15.50	0.817	930	3.513	930	2.451	930	2.206	930	2.696	930	2.696	930	4.657
935	15.58	0.820	935	3.526	935	2.460	935	2.214	935	2.706	935	2.706	935	4.674
940	15.67	0.822	940	3.535	940	2.466	940	2.219	940	2.713	940	2.713	940	4.685
945	15.75	0.825	945	3.548	945	2.475	945	2.228	945	2.723	945	2.723	945	4.703
950	15.83	0.827	950	3.556	950	2.481	950	2.233	950	2.729	950	2.729	950	4.714
955	15.92	0.829	955	3.565	955	2.487	955	2.238	955	2.736	955	2.736	955	4.725
960	16.00	0.832	960	3.578	960	2.496	960	2.246	960	2.746	960	2.746	960	4.742
965	16.08	0.834	965	3.586	965	2.502	965	2.252	965	2.752	965	2.752	965	4.754
970	16.17	0.837	970	3.599	970	2.511	970	2.260	970	2.762	970	2.762	970	4.771
975	16.25	0.839	975	3.608	975	2.517	975	2.265	975	2.769	975	2.769	975	4.782
980	16.33	0.841	980	3.616	980	2.523	980	2.271	980	2.775	980	2.775	980	4.794
985	16.42	0.844	985	3.629	985	2.532	985	2.279	985	2.785	985	2.785	985	4.811
990	16.50	0.846	990	3.638	990	2.538	990	2.284	990	2.792	990	2.792	990	4.822
995	16.58	0.848	995	3.646	995	2.544	995	2.290	995	2.798	995	2.798	995	4.834
1000	16.67	0.851	1000	3.659	1000	2.553	1000	2.298	1000	2.808	1000	2.808	1000	4.851
1005	16.75	0.853	1005	3.668	1005	2.559	1005	2.303	1005	2.815	1005	2.815	1005	4.862
1010	16.83	0.855	1010	3.677	1010	2.565	1010	2.309	1010	2.822	1010	2.822	1010	4.874
1015	16.92	0.858	1015	3.689	1015	2.574	1015	2.317	1015	2.831	1015	2.831	1015	4.891
1020	17.00	0.860	1020	3.698	1020	2.580	1020	2.322	1020	2.838	1020	2.838	1020	4.902
1025	17.08	0.862	1025	3.707	1025	2.586	1025	2.327	1025	2.845	1025	2.845	1025	4.913
1030	17.17	0.864	1030	3.715	1030	2.592	1030	2.333	1030	2.851	1030	2.851	1030	4.925
1035	17.25	0.867	1035	3.728	1035	2.601	1035	2.341	1035	2.861	1035	2.861	1035	4.942
1040	17.33	0.869	1040	3.737	1040	2.607	1040	2.346	1040	2.868	1040	2.868	1040	4.953
1045	17.42	0.871	1045	3.745	1045	2.613	1045	2.352	1045	2.874	1045	2.874	1045	4.965
1050	17.50	0.873	1050	3.754	1050	2.619	1050	2.357	1050	2.881	1050	2.881	1050	4.976
1055	17.58	0.875	1055	3.763	1055	2.625	1055	2.363	1055	2.888	1055	2.888	1055	4.988
1060	17.67	0.877	1060	3.771	1060	2.631	1060	2.368	1060	2.894	1060	2.894	1060	4.999
1065	17.75	0.880	1065	3.784	1065	2.640	1065	2.376	1065	2.904	1065	2.904	1065	5.016
1070	17.83	0.882	1070	3.793	1070	2.646	1070	2.381	1070	2.911	1070	2.911	1070	5.027
1075	17.92	0.884	1075	3.801	1075	2.652	1075	2.387	1075	2.917	1075	2.917	1075	5.039

SCS Type 1 - 5 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{5,24}$[2]= 4.3		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{5,24}$[2]= 3.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{5,24}$[2]= 2.7		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{5,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{5,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{5,24}$[2]= 5.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1080	18.00	0.886	1080	3.810	1080	2.658	1080	2.392	1080	2.924	1080	2.924	1080	5.050
1085	18.08	0.888	1085	3.818	1085	2.664	1085	2.398	1085	2.930	1085	2.930	1085	5.062
1090	18.17	0.890	1090	3.827	1090	2.670	1090	2.403	1090	2.937	1090	2.937	1090	5.073
1095	18.25	0.892	1095	3.836	1095	2.676	1095	2.408	1095	2.944	1095	2.944	1095	5.084
1100	18.33	0.894	1100	3.844	1100	2.682	1100	2.414	1100	2.950	1100	2.950	1100	5.096
1105	18.42	0.896	1105	3.853	1105	2.688	1105	2.419	1105	2.957	1105	2.957	1105	5.107
1110	18.50	0.898	1110	3.861	1110	2.694	1110	2.425	1110	2.963	1110	2.963	1110	5.119
1115	18.58	0.900	1115	3.870	1115	2.700	1115	2.430	1115	2.970	1115	2.970	1115	5.130
1120	18.67	0.902	1120	3.879	1120	2.706	1120	2.435	1120	2.977	1120	2.977	1120	5.141
1125	18.75	0.904	1125	3.887	1125	2.712	1125	2.441	1125	2.983	1125	2.983	1125	5.153
1130	18.83	0.906	1130	3.896	1130	2.718	1130	2.446	1130	2.990	1130	2.990	1130	5.164
1135	18.92	0.908	1135	3.904	1135	2.724	1135	2.452	1135	2.996	1135	2.996	1135	5.176
1140	19.00	0.910	1140	3.913	1140	2.730	1140	2.457	1140	3.003	1140	3.003	1140	5.187
1145	19.08	0.912	1145	3.922	1145	2.736	1145	2.462	1145	3.010	1145	3.010	1145	5.198
1150	19.17	0.914	1150	3.930	1150	2.742	1150	2.468	1150	3.016	1150	3.016	1150	5.210
1155	19.25	0.916	1155	3.939	1155	2.748	1155	2.473	1155	3.023	1155	3.023	1155	5.221
1160	19.33	0.917	1160	3.943	1160	2.751	1160	2.476	1160	3.026	1160	3.026	1160	5.227
1165	19.42	0.919	1165	3.952	1165	2.757	1165	2.481	1165	3.033	1165	3.033	1165	5.238
1170	19.50	0.921	1170	3.960	1170	2.763	1170	2.487	1170	3.039	1170	3.039	1170	5.250
1175	19.58	0.923	1175	3.969	1175	2.769	1175	2.492	1175	3.046	1175	3.046	1175	5.261
1180	19.67	0.925	1180	3.978	1180	2.775	1180	2.498	1180	3.053	1180	3.053	1180	5.273
1185	19.75	0.927	1185	3.986	1185	2.781	1185	2.503	1185	3.059	1185	3.059	1185	5.284
1190	19.83	0.928	1190	3.990	1190	2.784	1190	2.506	1190	3.062	1190	3.062	1190	5.290
1195	19.92	0.930	1195	3.999	1195	2.790	1195	2.511	1195	3.069	1195	3.069	1195	5.301
1200	20.00	0.932	1200	4.008	1200	2.796	1200	2.516	1200	3.076	1200	3.076	1200	5.312
1205	20.08	0.934	1205	4.016	1205	2.802	1205	2.522	1205	3.082	1205	3.082	1205	5.324
1210	20.17	0.935	1210	4.021	1210	2.805	1210	2.525	1210	3.086	1210	3.086	1210	5.330
1215	20.25	0.937	1215	4.029	1215	2.811	1215	2.530	1215	3.092	1215	3.092	1215	5.341
1220	20.33	0.939	1220	4.038	1220	2.817	1220	2.535	1220	3.099	1220	3.099	1220	5.352
1225	20.42	0.940	1225	4.042	1225	2.820	1225	2.538	1225	3.102	1225	3.102	1225	5.358
1230	20.50	0.942	1230	4.051	1230	2.826	1230	2.543	1230	3.109	1230	3.109	1230	5.369
1235	20.58	0.944	1235	4.059	1235	2.832	1235	2.549	1235	3.115	1235	3.115	1235	5.381
1240	20.67	0.945	1240	4.064	1240	2.835	1240	2.552	1240	3.119	1240	3.119	1240	5.387
1245	20.75	0.947	1245	4.072	1245	2.841	1245	2.557	1245	3.125	1245	3.125	1245	5.398
1250	20.83	0.949	1250	4.081	1250	2.847	1250	2.562	1250	3.132	1250	3.132	1250	5.409
1255	20.92	0.950	1255	4.085	1255	2.850	1255	2.565	1255	3.135	1255	3.135	1255	5.415
1260	21.00	0.952	1260	4.094	1260	2.856	1260	2.570	1260	3.142	1260	3.142	1260	5.426
1265	21.08	0.953	1265	4.098	1265	2.859	1265	2.573	1265	3.145	1265	3.145	1265	5.432
1270	21.17	0.955	1270	4.107	1270	2.865	1270	2.579	1270	3.152	1270	3.152	1270	5.444
1275	21.25	0.957	1275	4.115	1275	2.871	1275	2.584	1275	3.158	1275	3.158	1275	5.455
1280	21.33	0.958	1280	4.119	1280	2.874	1280	2.587	1280	3.161	1280	3.161	1280	5.461
1285	21.42	0.960	1285	4.128	1285	2.880	1285	2.592	1285	3.168	1285	3.168	1285	5.472
1290	21.50	0.961	1290	4.132	1290	2.883	1290	2.595	1290	3.171	1290	3.171	1290	5.478
1295	21.58	0.963	1295	4.141	1295	2.889	1295	2.600	1295	3.178	1295	3.178	1295	5.489
1300	21.67	0.964	1300	4.145	1300	2.892	1300	2.603	1300	3.181	1300	3.181	1300	5.495
1305	21.75	0.966	1305	4.154	1305	2.898	1305	2.608	1305	3.188	1305	3.188	1305	5.506
1310	21.83	0.967	1310	4.158	1310	2.901	1310	2.611	1310	3.191	1310	3.191	1310	5.512
1315	21.92	0.968	1315	4.162	1315	2.904	1315	2.614	1315	3.194	1315	3.194	1315	5.518
1320	22.00	0.970	1320	4.171	1320	2.910	1320	2.619	1320	3.201	1320	3.201	1320	5.529
1325	22.08	0.971	1325	4.175	1325	2.913	1325	2.622	1325	3.204	1325	3.204	1325	5.535
1330	22.17	0.973	1330	4.184	1330	2.919	1330	2.627	1330	3.211	1330	3.211	1330	5.546
1335	22.25	0.974	1335	4.188	1335	2.922	1335	2.630	1335	3.214	1335	3.214	1335	5.552
1340	22.33	0.975	1340	4.193	1340	2.925	1340	2.633	1340	3.218	1340	3.218	1340	5.558
1345	22.42	0.977	1345	4.201	1345	2.931	1345	2.638	1345	3.224	1345	3.224	1345	5.569

SCS Type 1 - 5 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{5,24}$[2]= 4.3		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{5,24}$[2]= 3.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{5,24}$[2]= 2.7		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{5,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{5,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{5,24}$[2]= 5.7	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1350	22.50	0.978	1350	4.205	1350	2.934	1350	2.641	1350	3.227	1350	3.227	1350	5.575
1355	22.58	0.979	1355	4.210	1355	2.937	1355	2.643	1355	3.231	1355	3.231	1355	5.580
1360	22.67	0.981	1360	4.218	1360	2.943	1360	2.649	1360	3.237	1360	3.237	1360	5.592
1365	22.75	0.982	1365	4.223	1365	2.946	1365	2.651	1365	3.241	1365	3.241	1365	5.597
1370	22.83	0.983	1370	4.227	1370	2.949	1370	2.654	1370	3.244	1370	3.244	1370	5.603
1375	22.92	0.984	1375	4.231	1375	2.952	1375	2.657	1375	3.247	1375	3.247	1375	5.609
1380	23.00	0.986	1380	4.240	1380	2.958	1380	2.662	1380	3.254	1380	3.254	1380	5.620
1385	23.08	0.987	1385	4.244	1385	2.961	1385	2.665	1385	3.257	1385	3.257	1385	5.626
1390	23.17	0.988	1390	4.248	1390	2.964	1390	2.668	1390	3.260	1390	3.260	1390	5.632
1395	23.25	0.989	1395	4.253	1395	2.967	1395	2.670	1395	3.264	1395	3.264	1395	5.637
1400	23.33	0.991	1400	4.261	1400	2.973	1400	2.676	1400	3.270	1400	3.270	1400	5.649
1405	23.42	0.992	1405	4.266	1405	2.976	1405	2.678	1405	3.274	1405	3.274	1405	5.654
1410	23.50	0.993	1410	4.270	1410	2.979	1410	2.681	1410	3.277	1410	3.277	1410	5.660
1415	23.58	0.994	1415	4.274	1415	2.982	1415	2.684	1415	3.280	1415	3.280	1415	5.666
1420	23.67	0.995	1420	4.279	1420	2.985	1420	2.687	1420	3.284	1420	3.284	1420	5.672
1425	23.75	0.996	1425	4.283	1425	2.988	1425	2.689	1425	3.287	1425	3.287	1425	5.677
1430	23.83	0.998	1430	4.291	1430	2.994	1430	2.695	1430	3.293	1430	3.293	1430	5.689
1435	23.92	0.999	1435	4.296	1435	2.997	1435	2.697	1435	3.297	1435	3.297	1435	5.694
1440	24.00	1.000	1440	4.300	1440	3.000	1440	2.700	1440	3.300	1440	3.300	1440	5.700

1. P_x/P_{24} ratios have been determined through linear intepolation of values derived from Figure II-B-1 of the 1993 SDCHM at 30 minute intervals.

2. $P_{5,24}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type 1 - 5 Yr - 6 Hr Distribution

SCS Type 1 - 6 Hr Distribution Ratios			SCS Type 1 - 6 Hr Distribution Guejito Basin $P_{5,6}$[3]= 2.1		SCS Type 1 - 6 Hr Distribution Jamul Basin $P_{5,6}$[3]= 1.7		SCS Type 1 - 6 Hr Distribution Las Flores Basin $P_{5,6}$[3]= 1.6		SCS Type 1 - 6 Hr Distribution Los Coches Basin $P_{5,6}$[3]= 1.7		SCS Type 1 - 6 Hr Distribution Santa Maria Basin $P_{5,6}$[3]= 1.9		SCS Type 1 - 6 Hr Distribution Sweetwater Basin $P_{5,6}$[3]= 2.9	
Time[1] (min)	Time (hrs)	P_x/P_6[2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.006	5	0.013	5	0.010	5	0.010	5	0.010	5	0.011	5	0.017
10	0.17	0.012	10	0.025	10	0.020	10	0.019	10	0.020	10	0.023	10	0.035
15	0.25	0.017	15	0.036	15	0.029	15	0.027	15	0.029	15	0.032	15	0.049
20	0.33	0.023	20	0.048	20	0.039	20	0.037	20	0.039	20	0.044	20	0.067
25	0.42	0.029	25	0.061	25	0.049	25	0.046	25	0.049	25	0.055	25	0.084
30	0.50	0.035	30	0.074	30	0.060	30	0.056	30	0.060	30	0.067	30	0.102
35	0.58	0.041	35	0.086	35	0.070	35	0.066	35	0.070	35	0.078	35	0.119
40	0.67	0.047	40	0.099	40	0.080	40	0.075	40	0.080	40	0.089	40	0.136
45	0.75	0.054	45	0.113	45	0.092	45	0.086	45	0.092	45	0.103	45	0.157
50	0.83	0.061	50	0.128	50	0.104	50	0.098	50	0.104	50	0.116	50	0.177
55	0.92	0.068	55	0.143	55	0.116	55	0.109	55	0.116	55	0.129	55	0.197
60	1.00	0.076	60	0.160	60	0.129	60	0.122	60	0.129	60	0.144	60	0.220
65	1.08	0.084	65	0.176	65	0.143	65	0.134	65	0.143	65	0.160	65	0.244
70	1.17	0.092	70	0.193	70	0.156	70	0.147	70	0.156	70	0.175	70	0.267
75	1.25	0.100	75	0.210	75	0.170	75	0.160	75	0.170	75	0.190	75	0.290
80	1.33	0.108	80	0.227	80	0.184	80	0.173	80	0.184	80	0.205	80	0.313
85	1.42	0.116	85	0.244	85	0.197	85	0.186	85	0.197	85	0.220	85	0.336
90	1.50	0.125	90	0.263	90	0.213	90	0.200	90	0.213	90	0.238	90	0.363
95	1.58	0.134	95	0.281	95	0.228	95	0.214	95	0.228	95	0.255	95	0.389
100	1.67	0.144	100	0.302	100	0.245	100	0.230	100	0.245	100	0.274	100	0.418
105	1.75	0.156	105	0.328	105	0.265	105	0.250	105	0.265	105	0.296	105	0.452
110	1.83	0.168	110	0.353	110	0.286	110	0.269	110	0.286	110	0.319	110	0.487
115	1.92	0.181	115	0.380	115	0.308	115	0.290	115	0.308	115	0.344	115	0.525
120	2.00	0.194	120	0.407	120	0.330	120	0.310	120	0.330	120	0.369	120	0.563
125	2.08	0.209	125	0.439	125	0.355	125	0.334	125	0.355	125	0.397	125	0.606
130	2.17	0.229	130	0.481	130	0.389	130	0.366	130	0.389	130	0.435	130	0.664
135	2.25	0.254	135	0.533	135	0.432	135	0.406	135	0.432	135	0.483	135	0.737
140	2.33	0.285	140	0.599	140	0.485	140	0.456	140	0.485	140	0.542	140	0.827
145	2.42	0.336	145	0.706	145	0.571	145	0.538	145	0.571	145	0.638	145	0.974
150	2.50	0.515	150	1.082	150	0.876	150	0.824	150	0.876	150	0.979	150	1.494
155	2.58	0.565	155	1.187	155	0.961	155	0.904	155	0.961	155	1.074	155	1.639
160	2.67	0.597	160	1.254	160	1.015	160	0.955	160	1.015	160	1.134	160	1.731
165	2.75	0.623	165	1.308	165	1.059	165	0.997	165	1.059	165	1.184	165	1.807
170	2.83	0.645	170	1.355	170	1.097	170	1.032	170	1.097	170	1.226	170	1.871
175	2.92	0.665	175	1.397	175	1.131	175	1.064	175	1.131	175	1.264	175	1.929
180	3.00	0.684	180	1.436	180	1.163	180	1.094	180	1.163	180	1.300	180	1.984
185	3.08	0.701	185	1.472	185	1.192	185	1.122	185	1.192	185	1.332	185	2.033
190	3.17	0.717	190	1.506	190	1.219	190	1.147	190	1.219	190	1.362	190	2.079
195	3.25	0.732	195	1.537	195	1.244	195	1.171	195	1.244	195	1.391	195	2.123
200	3.33	0.746	200	1.567	200	1.268	200	1.194	200	1.268	200	1.417	200	2.163
205	3.42	0.758	205	1.592	205	1.289	205	1.213	205	1.289	205	1.440	205	2.198
210	3.50	0.770	210	1.617	210	1.309	210	1.232	210	1.309	210	1.463	210	2.233
215	3.58	0.781	215	1.640	215	1.328	215	1.250	215	1.328	215	1.484	215	2.265
220	3.67	0.791	220	1.661	220	1.345	220	1.266	220	1.345	220	1.503	220	2.294
225	3.75	0.802	225	1.684	225	1.363	225	1.283	225	1.363	225	1.524	225	2.326
230	3.83	0.812	230	1.705	230	1.380	230	1.299	230	1.380	230	1.543	230	2.355
235	3.92	0.822	235	1.726	235	1.397	235	1.315	235	1.397	235	1.562	235	2.384
240	4.00	0.832	240	1.747	240	1.414	240	1.331	240	1.414	240	1.581	240	2.413
245	4.08	0.841	245	1.766	245	1.430	245	1.346	245	1.430	245	1.598	245	2.439
250	4.17	0.851	250	1.787	250	1.447	250	1.362	250	1.447	250	1.617	250	2.468
255	4.25	0.860	255	1.806	255	1.462	255	1.376	255	1.462	255	1.634	255	2.494
260	4.33	0.869	260	1.825	260	1.477	260	1.390	260	1.477	260	1.651	260	2.520
265	4.42	0.877	265	1.842	265	1.491	265	1.403	265	1.491	265	1.666	265	2.543

SCS Type 1 - 5 Yr - 6 Hr Distribution

SCS Type 1 - 6 Hr Distribution Ratios			SCS Type 1 - 6 Hr Distribution Guejito Basin $P_{5,6}$[3]= 2.1		SCS Type 1 - 6 Hr Distribution Jamul Basin $P_{5,6}$[3]= 1.7		SCS Type 1 - 6 Hr Distribution Las Flores Basin $P_{5,6}$[3]= 1.6		SCS Type 1 - 6 Hr Distribution Los Coches Basin $P_{5,6}$[3]= 1.7		SCS Type 1 - 6 Hr Distribution Santa Maria Basin $P_{5,6}$[3]= 1.9		SCS Type 1 - 6 Hr Distribution Sweetwater Basin $P_{5,6}$[3]= 2.9	
Time[1] (min)	Time (hrs)	P_x/P_6[2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.886	270	1.861	270	1.506	270	1.418	270	1.506	270	1.683	270	2.569
275	4.58	0.894	275	1.877	275	1.520	275	1.430	275	1.520	275	1.699	275	2.593
280	4.67	0.902	280	1.894	280	1.533	280	1.443	280	1.533	280	1.714	280	2.616
285	4.75	0.910	285	1.911	285	1.547	285	1.456	285	1.547	285	1.729	285	2.639
290	4.83	0.917	290	1.926	290	1.559	290	1.467	290	1.559	290	1.742	290	2.659
295	4.92	0.925	295	1.943	295	1.573	295	1.480	295	1.573	295	1.758	295	2.683
300	5.00	0.932	300	1.957	300	1.584	300	1.491	300	1.584	300	1.771	300	2.703
305	5.08	0.939	305	1.972	305	1.596	305	1.502	305	1.596	305	1.784	305	2.723
310	5.17	0.945	310	1.985	310	1.607	310	1.512	310	1.607	310	1.796	310	2.741
315	5.25	0.952	315	1.999	315	1.618	315	1.523	315	1.618	315	1.809	315	2.761
320	5.33	0.958	320	2.012	320	1.629	320	1.533	320	1.629	320	1.820	320	2.778
325	5.42	0.964	325	2.024	325	1.639	325	1.542	325	1.639	325	1.832	325	2.796
330	5.50	0.970	330	2.037	330	1.649	330	1.552	330	1.649	330	1.843	330	2.813
335	5.58	0.975	335	2.048	335	1.658	335	1.560	335	1.658	335	1.853	335	2.828
340	5.67	0.981	340	2.060	340	1.668	340	1.570	340	1.668	340	1.864	340	2.845
345	5.75	0.986	345	2.071	345	1.676	345	1.578	345	1.676	345	1.873	345	2.859
350	5.83	0.991	350	2.081	350	1.685	350	1.586	350	1.685	350	1.883	350	2.874
355	5.92	0.995	355	2.090	355	1.692	355	1.592	355	1.692	355	1.891	355	2.886
360	6.00	1.000	360	2.100	360	1.700	360	1.600	360	1.700	360	1.900	360	2.900

1. Time values for the 6 hr distribution are determined by dividing the time intervals from the SCS Type 1 - 24 hr distribution by 4.
2. P_x/P_6 ratios correspond to P_x/P_{24} ratios at times (in minutes) that are 4 times greater than P_x/P_6 times. For example, P_x/P_6 at 100 minutes equals P_x/P_{24} at 400 minutes.
3. $P_{5,6}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type 1 - 2 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{2,24}{}^{2}$= 3.3		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{2,24}{}^{2}$= 2.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{2,24}{}^{2}$= 1.8		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{2,24}{}^{2}$= 2.4		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{2,24}{}^{2}$= 2.4		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{2,24}{}^{2}$= 4.3	
Time (min)	Time (hrs)	$P_x/P_{24}{}^{1}$ (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.001	5	0.003	5	0.002	5	0.002	5	0.002	5	0.002	5	0.004
10	0.17	0.003	10	0.010	10	0.006	10	0.005	10	0.007	10	0.007	10	0.013
15	0.25	0.004	15	0.013	15	0.008	15	0.007	15	0.010	15	0.010	15	0.017
20	0.33	0.006	20	0.020	20	0.012	20	0.011	20	0.014	20	0.014	20	0.026
25	0.42	0.007	25	0.023	25	0.014	25	0.013	25	0.017	25	0.017	25	0.030
30	0.50	0.009	30	0.030	30	0.018	30	0.016	30	0.022	30	0.022	30	0.039
35	0.58	0.010	35	0.033	35	0.020	35	0.018	35	0.024	35	0.024	35	0.043
40	0.67	0.012	40	0.040	40	0.024	40	0.022	40	0.029	40	0.029	40	0.052
45	0.75	0.013	45	0.043	45	0.026	45	0.023	45	0.031	45	0.031	45	0.056
50	0.83	0.014	50	0.046	50	0.028	50	0.025	50	0.034	50	0.034	50	0.060
55	0.92	0.016	55	0.053	55	0.032	55	0.029	55	0.038	55	0.038	55	0.069
60	1.00	0.017	60	0.056	60	0.034	60	0.031	60	0.041	60	0.041	60	0.073
65	1.08	0.019	65	0.063	65	0.038	65	0.034	65	0.046	65	0.046	65	0.082
70	1.17	0.020	70	0.066	70	0.040	70	0.036	70	0.048	70	0.048	70	0.086
75	1.25	0.022	75	0.073	75	0.044	75	0.040	75	0.053	75	0.053	75	0.095
80	1.33	0.023	80	0.076	80	0.046	80	0.041	80	0.055	80	0.055	80	0.099
85	1.42	0.025	85	0.083	85	0.050	85	0.045	85	0.060	85	0.060	85	0.108
90	1.50	0.026	90	0.086	90	0.052	90	0.047	90	0.062	90	0.062	90	0.112
95	1.58	0.028	95	0.092	95	0.056	95	0.050	95	0.067	95	0.067	95	0.120
100	1.67	0.029	100	0.096	100	0.058	100	0.052	100	0.070	100	0.070	100	0.125
105	1.75	0.030	105	0.099	105	0.060	105	0.054	105	0.072	105	0.072	105	0.129
110	1.83	0.032	110	0.106	110	0.064	110	0.058	110	0.077	110	0.077	110	0.138
115	1.92	0.033	115	0.109	115	0.066	115	0.059	115	0.079	115	0.079	115	0.142
120	2.00	0.035	120	0.116	120	0.070	120	0.063	120	0.084	120	0.084	120	0.151
125	2.08	0.036	125	0.119	125	0.072	125	0.065	125	0.086	125	0.086	125	0.155
130	2.17	0.038	130	0.125	130	0.076	130	0.068	130	0.091	130	0.091	130	0.163
135	2.25	0.039	135	0.129	135	0.078	135	0.070	135	0.094	135	0.094	135	0.168
140	2.33	0.041	140	0.135	140	0.082	140	0.074	140	0.098	140	0.098	140	0.176
145	2.42	0.042	145	0.139	145	0.084	145	0.076	145	0.101	145	0.101	145	0.181
150	2.50	0.044	150	0.145	150	0.088	150	0.079	150	0.106	150	0.106	150	0.189
155	2.58	0.046	155	0.152	155	0.092	155	0.083	155	0.110	155	0.110	155	0.198
160	2.67	0.047	160	0.155	160	0.094	160	0.085	160	0.113	160	0.113	160	0.202
165	2.75	0.049	165	0.162	165	0.098	165	0.088	165	0.118	165	0.118	165	0.211
170	2.83	0.051	170	0.168	170	0.102	170	0.092	170	0.122	170	0.122	170	0.219
175	2.92	0.052	175	0.172	175	0.104	175	0.094	175	0.125	175	0.125	175	0.224
180	3.00	0.054	180	0.178	180	0.108	180	0.097	180	0.130	180	0.130	180	0.232
185	3.08	0.056	185	0.185	185	0.112	185	0.101	185	0.134	185	0.134	185	0.241
190	3.17	0.058	190	0.191	190	0.116	190	0.104	190	0.139	190	0.139	190	0.249
195	3.25	0.059	195	0.195	195	0.118	195	0.106	195	0.142	195	0.142	195	0.254
200	3.33	0.061	200	0.201	200	0.122	200	0.110	200	0.146	200	0.146	200	0.262
205	3.42	0.063	205	0.208	205	0.126	205	0.113	205	0.151	205	0.151	205	0.271
210	3.50	0.065	210	0.215	210	0.130	210	0.117	210	0.156	210	0.156	210	0.280
215	3.58	0.066	215	0.218	215	0.132	215	0.119	215	0.158	215	0.158	215	0.284
220	3.67	0.068	220	0.224	220	0.136	220	0.122	220	0.163	220	0.163	220	0.292
225	3.75	0.070	225	0.231	225	0.140	225	0.126	225	0.168	225	0.168	225	0.301
230	3.83	0.072	230	0.238	230	0.144	230	0.130	230	0.173	230	0.173	230	0.310
235	3.92	0.074	235	0.244	235	0.148	235	0.133	235	0.178	235	0.178	235	0.318
240	4.00	0.076	240	0.251	240	0.152	240	0.137	240	0.182	240	0.182	240	0.327
245	4.08	0.078	245	0.257	245	0.156	245	0.140	245	0.187	245	0.187	245	0.335
250	4.17	0.080	250	0.264	250	0.160	250	0.144	250	0.192	250	0.192	250	0.344
255	4.25	0.082	255	0.271	255	0.164	255	0.148	255	0.197	255	0.197	255	0.353
260	4.33	0.084	260	0.277	260	0.168	260	0.151	260	0.202	260	0.202	260	0.361
265	4.42	0.086	265	0.284	265	0.172	265	0.155	265	0.206	265	0.206	265	0.370

SCS Type 1 - 2 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{2,24}{}^{2}$= 3.3		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{2,24}{}^{2}$= 2.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{2,24}{}^{2}$= 1.8		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{2,24}{}^{2}$= 2.4		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{2,24}{}^{2}$= 2.4		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{2,24}{}^{2}$= 4.3	
Time (min)	Time (hrs)	$P_x/P_{24}{}^{1}$ (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.088	270	0.290	270	0.176	270	0.158	270	0.211	270	0.211	270	0.378
275	4.58	0.090	275	0.297	275	0.180	275	0.162	275	0.216	275	0.216	275	0.387
280	4.67	0.092	280	0.304	280	0.184	280	0.166	280	0.221	280	0.221	280	0.396
285	4.75	0.094	285	0.310	285	0.188	285	0.169	285	0.226	285	0.226	285	0.404
290	4.83	0.096	290	0.317	290	0.192	290	0.173	290	0.230	290	0.230	290	0.413
295	4.92	0.098	295	0.323	295	0.196	295	0.176	295	0.235	295	0.235	295	0.421
300	5.00	0.100	300	0.330	300	0.200	300	0.180	300	0.240	300	0.240	300	0.430
305	5.08	0.102	305	0.337	305	0.204	305	0.184	305	0.245	305	0.245	305	0.439
310	5.17	0.104	310	0.343	310	0.208	310	0.187	310	0.250	310	0.250	310	0.447
315	5.25	0.106	315	0.350	315	0.212	315	0.191	315	0.254	315	0.254	315	0.456
320	5.33	0.108	320	0.356	320	0.216	320	0.194	320	0.259	320	0.259	320	0.464
325	5.42	0.110	325	0.363	325	0.220	325	0.198	325	0.264	325	0.264	325	0.473
330	5.50	0.112	330	0.370	330	0.224	330	0.202	330	0.269	330	0.269	330	0.482
335	5.58	0.114	335	0.376	335	0.228	335	0.205	335	0.274	335	0.274	335	0.490
340	5.67	0.116	340	0.383	340	0.232	340	0.209	340	0.278	340	0.278	340	0.499
345	5.75	0.118	345	0.389	345	0.236	345	0.212	345	0.283	345	0.283	345	0.507
350	5.83	0.121	350	0.399	350	0.242	350	0.218	350	0.290	350	0.290	350	0.520
355	5.92	0.123	355	0.406	355	0.246	355	0.221	355	0.295	355	0.295	355	0.529
360	6.00	0.125	360	0.413	360	0.250	360	0.225	360	0.300	360	0.300	360	0.538
365	6.08	0.127	365	0.419	365	0.254	365	0.229	365	0.305	365	0.305	365	0.546
370	6.17	0.129	370	0.426	370	0.258	370	0.232	370	0.310	370	0.310	370	0.555
375	6.25	0.132	375	0.436	375	0.264	375	0.238	375	0.317	375	0.317	375	0.568
380	6.33	0.134	380	0.442	380	0.268	380	0.241	380	0.322	380	0.322	380	0.576
385	6.42	0.136	385	0.449	385	0.272	385	0.245	385	0.326	385	0.326	385	0.585
390	6.50	0.139	390	0.459	390	0.278	390	0.250	390	0.334	390	0.334	390	0.598
395	6.58	0.142	395	0.469	395	0.284	395	0.256	395	0.341	395	0.341	395	0.611
400	6.67	0.144	400	0.475	400	0.288	400	0.259	400	0.346	400	0.346	400	0.619
405	6.75	0.147	405	0.485	405	0.294	405	0.265	405	0.353	405	0.353	405	0.632
410	6.83	0.150	410	0.495	410	0.300	410	0.270	410	0.360	410	0.360	410	0.645
415	6.92	0.153	415	0.505	415	0.306	415	0.275	415	0.367	415	0.367	415	0.658
420	7.00	0.156	420	0.515	420	0.312	420	0.281	420	0.374	420	0.374	420	0.671
425	7.08	0.159	425	0.525	425	0.318	425	0.286	425	0.382	425	0.382	425	0.684
430	7.17	0.162	430	0.535	430	0.324	430	0.292	430	0.389	430	0.389	430	0.697
435	7.25	0.165	435	0.545	435	0.330	435	0.297	435	0.396	435	0.396	435	0.710
440	7.33	0.168	440	0.554	440	0.336	440	0.302	440	0.403	440	0.403	440	0.722
445	7.42	0.171	445	0.564	445	0.342	445	0.308	445	0.410	445	0.410	445	0.735
450	7.50	0.174	450	0.574	450	0.348	450	0.313	450	0.418	450	0.418	450	0.748
455	7.58	0.178	455	0.587	455	0.356	455	0.320	455	0.427	455	0.427	455	0.765
460	7.67	0.181	460	0.597	460	0.362	460	0.326	460	0.434	460	0.434	460	0.778
465	7.75	0.184	465	0.607	465	0.368	465	0.331	465	0.442	465	0.442	465	0.791
470	7.83	0.187	470	0.617	470	0.374	470	0.337	470	0.449	470	0.449	470	0.804
475	7.92	0.191	475	0.630	475	0.382	475	0.344	475	0.458	475	0.458	475	0.821
480	8.00	0.194	480	0.640	480	0.388	480	0.349	480	0.466	480	0.466	480	0.834
485	8.08	0.197	485	0.650	485	0.394	485	0.355	485	0.473	485	0.473	485	0.847
490	8.17	0.201	490	0.663	490	0.402	490	0.362	490	0.482	490	0.482	490	0.864
495	8.25	0.205	495	0.677	495	0.410	495	0.369	495	0.492	495	0.492	495	0.882
500	8.33	0.209	500	0.690	500	0.418	500	0.376	500	0.502	500	0.502	500	0.899
505	8.42	0.214	505	0.706	505	0.428	505	0.385	505	0.514	505	0.514	505	0.920
510	8.50	0.219	510	0.723	510	0.438	510	0.394	510	0.526	510	0.526	510	0.942
515	8.58	0.224	515	0.739	515	0.448	515	0.403	515	0.538	515	0.538	515	0.963
520	8.67	0.229	520	0.756	520	0.458	520	0.412	520	0.550	520	0.550	520	0.985
525	8.75	0.235	525	0.776	525	0.470	525	0.423	525	0.564	525	0.564	525	1.011
530	8.83	0.241	530	0.795	530	0.482	530	0.434	530	0.578	530	0.578	530	1.036
535	8.92	0.247	535	0.815	535	0.494	535	0.445	535	0.593	535	0.593	535	1.062

SCS Type 1 - 2 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{2,24}{}^{2}$= 3.3		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{2,24}{}^{2}$= 2.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{2,24}{}^{2}$= 1.8		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{2,24}{}^{2}$= 2.4		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{2,24}{}^{2}$= 2.4		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{2,24}{}^{2}$= 4.3	
Time (min)	Time (hrs)	$P_x/P_{24}{}^{1}$ (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
540	9.00	0.254	540	0.838	540	0.508	540	0.457	540	0.610	540	0.610	540	1.092
545	9.08	0.261	545	0.861	545	0.522	545	0.470	545	0.626	545	0.626	545	1.122
550	9.17	0.268	550	0.884	550	0.536	550	0.482	550	0.643	550	0.643	550	1.152
555	9.25	0.276	555	0.911	555	0.552	555	0.497	555	0.662	555	0.662	555	1.187
560	9.33	0.285	560	0.941	560	0.570	560	0.513	560	0.684	560	0.684	560	1.226
565	9.42	0.293	565	0.967	565	0.586	565	0.527	565	0.703	565	0.703	565	1.260
570	9.50	0.303	570	1.000	570	0.606	570	0.545	570	0.727	570	0.727	570	1.303
575	9.58	0.316	575	1.043	575	0.632	575	0.569	575	0.758	575	0.758	575	1.359
580	9.67	0.336	580	1.109	580	0.672	580	0.605	580	0.806	580	0.806	580	1.445
585	9.75	0.362	585	1.195	585	0.724	585	0.652	585	0.869	585	0.869	585	1.557
590	9.83	0.411	590	1.356	590	0.822	590	0.740	590	0.986	590	0.986	590	1.767
595	9.92	0.475	595	1.568	595	0.950	595	0.855	595	1.140	595	1.140	595	2.043
600	10.00	0.515	600	1.700	600	1.030	600	0.927	600	1.236	600	1.236	600	2.215
605	10.08	0.530	605	1.749	605	1.060	605	0.954	605	1.272	605	1.272	605	2.279
610	10.17	0.542	610	1.789	610	1.084	610	0.976	610	1.301	610	1.301	610	2.331
615	10.25	0.555	615	1.832	615	1.110	615	0.999	615	1.332	615	1.332	615	2.387
620	10.33	0.565	620	1.865	620	1.130	620	1.017	620	1.356	620	1.356	620	2.430
625	10.42	0.575	625	1.898	625	1.150	625	1.035	625	1.380	625	1.380	625	2.473
630	10.50	0.583	630	1.924	630	1.166	630	1.049	630	1.399	630	1.399	630	2.507
635	10.58	0.590	635	1.947	635	1.180	635	1.062	635	1.416	635	1.416	635	2.537
640	10.67	0.597	640	1.970	640	1.194	640	1.075	640	1.433	640	1.433	640	2.567
645	10.75	0.604	645	1.993	645	1.208	645	1.087	645	1.450	645	1.450	645	2.597
650	10.83	0.611	650	2.016	650	1.222	650	1.100	650	1.466	650	1.466	650	2.627
655	10.92	0.617	655	2.036	655	1.234	655	1.111	655	1.481	655	1.481	655	2.653
660	11.00	0.623	660	2.056	660	1.246	660	1.121	660	1.495	660	1.495	660	2.679
665	11.08	0.629	665	2.076	665	1.258	665	1.132	665	1.510	665	1.510	665	2.705
670	11.17	0.634	670	2.092	670	1.268	670	1.141	670	1.522	670	1.522	670	2.726
675	11.25	0.640	675	2.112	675	1.280	675	1.152	675	1.536	675	1.536	675	2.752
680	11.33	0.645	680	2.129	680	1.290	680	1.161	680	1.548	680	1.548	680	2.774
685	11.42	0.650	685	2.145	685	1.300	685	1.170	685	1.560	685	1.560	685	2.795
690	11.50	0.655	690	2.162	690	1.310	690	1.179	690	1.572	690	1.572	690	2.817
695	11.58	0.660	695	2.178	695	1.320	695	1.188	695	1.584	695	1.584	695	2.838
700	11.67	0.665	700	2.195	700	1.330	700	1.197	700	1.596	700	1.596	700	2.860
705	11.75	0.670	705	2.211	705	1.340	705	1.206	705	1.608	705	1.608	705	2.881
710	11.83	0.675	710	2.228	710	1.350	710	1.215	710	1.620	710	1.620	710	2.903
715	11.92	0.679	715	2.241	715	1.358	715	1.222	715	1.630	715	1.630	715	2.920
720	12.00	0.684	720	2.257	720	1.368	720	1.231	720	1.642	720	1.642	720	2.941
725	12.08	0.688	725	2.270	725	1.376	725	1.238	725	1.651	725	1.651	725	2.958
730	12.17	0.693	730	2.287	730	1.386	730	1.247	730	1.663	730	1.663	730	2.980
735	12.25	0.697	735	2.300	735	1.394	735	1.255	735	1.673	735	1.673	735	2.997
740	12.33	0.701	740	2.313	740	1.402	740	1.262	740	1.682	740	1.682	740	3.014
745	12.42	0.705	745	2.327	745	1.410	745	1.269	745	1.692	745	1.692	745	3.032
750	12.50	0.709	750	2.340	750	1.418	750	1.276	750	1.702	750	1.702	750	3.049
755	12.58	0.713	755	2.353	755	1.426	755	1.283	755	1.711	755	1.711	755	3.066
760	12.67	0.717	760	2.366	760	1.434	760	1.291	760	1.721	760	1.721	760	3.083
765	12.75	0.721	765	2.379	765	1.442	765	1.298	765	1.730	765	1.730	765	3.100
770	12.83	0.725	770	2.393	770	1.450	770	1.305	770	1.740	770	1.740	770	3.118
775	12.92	0.728	775	2.402	775	1.456	775	1.310	775	1.747	775	1.747	775	3.130
780	13.00	0.732	780	2.416	780	1.464	780	1.318	780	1.757	780	1.757	780	3.148
785	13.08	0.735	785	2.426	785	1.470	785	1.323	785	1.764	785	1.764	785	3.161
790	13.17	0.739	790	2.439	790	1.478	790	1.330	790	1.774	790	1.774	790	3.178
795	13.25	0.742	795	2.449	795	1.484	795	1.336	795	1.781	795	1.781	795	3.191
800	13.33	0.746	800	2.462	800	1.492	800	1.343	800	1.790	800	1.790	800	3.208
805	13.42	0.749	805	2.472	805	1.498	805	1.348	805	1.798	805	1.798	805	3.221

SCS Type 1 - 2 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{2,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{2,24}$[2]= 2.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{2,24}$[2]= 1.8		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{2,24}$[2]= 2.4		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{2,24}$[2]= 2.4		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{2,24}$[2]= 4.3	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
810	13.50	0.752	810	2.482	810	1.504	810	1.354	810	1.805	810	1.805	810	3.234
815	13.58	0.755	815	2.492	815	1.510	815	1.359	815	1.812	815	1.812	815	3.247
820	13.67	0.758	820	2.501	820	1.516	820	1.364	820	1.819	820	1.819	820	3.259
825	13.75	0.761	825	2.511	825	1.522	825	1.370	825	1.826	825	1.826	825	3.272
830	13.83	0.764	830	2.521	830	1.528	830	1.375	830	1.834	830	1.834	830	3.285
835	13.92	0.767	835	2.531	835	1.534	835	1.381	835	1.841	835	1.841	835	3.298
840	14.00	0.770	840	2.541	840	1.540	840	1.386	840	1.848	840	1.848	840	3.311
845	14.08	0.773	845	2.551	845	1.546	845	1.391	845	1.855	845	1.855	845	3.324
850	14.17	0.775	850	2.558	850	1.550	850	1.395	850	1.860	850	1.860	850	3.333
855	14.25	0.778	855	2.567	855	1.556	855	1.400	855	1.867	855	1.867	855	3.345
860	14.33	0.781	860	2.577	860	1.562	860	1.406	860	1.874	860	1.874	860	3.358
865	14.42	0.783	865	2.584	865	1.566	865	1.409	865	1.879	865	1.879	865	3.367
870	14.50	0.786	870	2.594	870	1.572	870	1.415	870	1.886	870	1.886	870	3.380
875	14.58	0.789	875	2.604	875	1.578	875	1.420	875	1.894	875	1.894	875	3.393
880	14.67	0.791	880	2.610	880	1.582	880	1.424	880	1.898	880	1.898	880	3.401
885	14.75	0.794	885	2.620	885	1.588	885	1.429	885	1.906	885	1.906	885	3.414
890	14.83	0.797	890	2.630	890	1.594	890	1.435	890	1.913	890	1.913	890	3.427
895	14.92	0.799	895	2.637	895	1.598	895	1.438	895	1.918	895	1.918	895	3.436
900	15.00	0.802	900	2.647	900	1.604	900	1.444	900	1.925	900	1.925	900	3.449
905	15.08	0.804	905	2.653	905	1.608	905	1.447	905	1.930	905	1.930	905	3.457
910	15.17	0.807	910	2.663	910	1.614	910	1.453	910	1.937	910	1.937	910	3.470
915	15.25	0.810	915	2.673	915	1.620	915	1.458	915	1.944	915	1.944	915	3.483
920	15.33	0.812	920	2.680	920	1.624	920	1.462	920	1.949	920	1.949	920	3.492
925	15.42	0.815	925	2.690	925	1.630	925	1.467	925	1.956	925	1.956	925	3.505
930	15.50	0.817	930	2.696	930	1.634	930	1.471	930	1.961	930	1.961	930	3.513
935	15.58	0.820	935	2.706	935	1.640	935	1.476	935	1.968	935	1.968	935	3.526
940	15.67	0.822	940	2.713	940	1.644	940	1.480	940	1.973	940	1.973	940	3.535
945	15.75	0.825	945	2.723	945	1.650	945	1.485	945	1.980	945	1.980	945	3.548
950	15.83	0.827	950	2.729	950	1.654	950	1.489	950	1.985	950	1.985	950	3.556
955	15.92	0.829	955	2.736	955	1.658	955	1.492	955	1.990	955	1.990	955	3.565
960	16.00	0.832	960	2.746	960	1.664	960	1.498	960	1.997	960	1.997	960	3.578
965	16.08	0.834	965	2.752	965	1.668	965	1.501	965	2.002	965	2.002	965	3.586
970	16.17	0.837	970	2.762	970	1.674	970	1.507	970	2.009	970	2.009	970	3.599
975	16.25	0.839	975	2.769	975	1.678	975	1.510	975	2.014	975	2.014	975	3.608
980	16.33	0.841	980	2.775	980	1.682	980	1.514	980	2.018	980	2.018	980	3.616
985	16.42	0.844	985	2.785	985	1.688	985	1.519	985	2.026	985	2.026	985	3.629
990	16.50	0.846	990	2.792	990	1.692	990	1.523	990	2.030	990	2.030	990	3.638
995	16.58	0.848	995	2.798	995	1.696	995	1.526	995	2.035	995	2.035	995	3.646
1000	16.67	0.851	1000	2.808	1000	1.702	1000	1.532	1000	2.042	1000	2.042	1000	3.659
1005	16.75	0.853	1005	2.815	1005	1.706	1005	1.535	1005	2.047	1005	2.047	1005	3.668
1010	16.83	0.855	1010	2.822	1010	1.710	1010	1.539	1010	2.052	1010	2.052	1010	3.677
1015	16.92	0.858	1015	2.831	1015	1.716	1015	1.544	1015	2.059	1015	2.059	1015	3.689
1020	17.00	0.860	1020	2.838	1020	1.720	1020	1.548	1020	2.064	1020	2.064	1020	3.698
1025	17.08	0.862	1025	2.845	1025	1.724	1025	1.552	1025	2.069	1025	2.069	1025	3.707
1030	17.17	0.864	1030	2.851	1030	1.728	1030	1.555	1030	2.074	1030	2.074	1030	3.715
1035	17.25	0.867	1035	2.861	1035	1.734	1035	1.561	1035	2.081	1035	2.081	1035	3.728
1040	17.33	0.869	1040	2.868	1040	1.738	1040	1.564	1040	2.086	1040	2.086	1040	3.737
1045	17.42	0.871	1045	2.874	1045	1.742	1045	1.568	1045	2.090	1045	2.090	1045	3.745
1050	17.50	0.873	1050	2.881	1050	1.746	1050	1.571	1050	2.095	1050	2.095	1050	3.754
1055	17.58	0.875	1055	2.888	1055	1.750	1055	1.575	1055	2.100	1055	2.100	1055	3.763
1060	17.67	0.877	1060	2.894	1060	1.754	1060	1.579	1060	2.105	1060	2.105	1060	3.771
1065	17.75	0.880	1065	2.904	1065	1.760	1065	1.584	1065	2.112	1065	2.112	1065	3.784
1070	17.83	0.882	1070	2.911	1070	1.764	1070	1.588	1070	2.117	1070	2.117	1070	3.793
1075	17.92	0.884	1075	2.917	1075	1.768	1075	1.591	1075	2.122	1075	2.122	1075	3.801

SCS Type 1 - 2 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{2,24}{}^{2}$= 3.3		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{2,24}{}^{2}$= 2.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{2,24}{}^{2}$= 1.8		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{2,24}{}^{2}$= 2.4		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{2,24}{}^{2}$= 2.4		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{2,24}{}^{2}$= 4.3	
Time (min)	Time (hrs)	$P_x/P_{24}{}^{1}$ (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1080	18.00	0.886	1080	2.924	1080	1.772	1080	1.595	1080	2.126	1080	2.126	1080	3.810
1085	18.08	0.888	1085	2.930	1085	1.776	1085	1.598	1085	2.131	1085	2.131	1085	3.818
1090	18.17	0.890	1090	2.937	1090	1.780	1090	1.602	1090	2.136	1090	2.136	1090	3.827
1095	18.25	0.892	1095	2.944	1095	1.784	1095	1.606	1095	2.141	1095	2.141	1095	3.836
1100	18.33	0.894	1100	2.950	1100	1.788	1100	1.609	1100	2.146	1100	2.146	1100	3.844
1105	18.42	0.896	1105	2.957	1105	1.792	1105	1.613	1105	2.150	1105	2.150	1105	3.853
1110	18.50	0.898	1110	2.963	1110	1.796	1110	1.616	1110	2.155	1110	2.155	1110	3.861
1115	18.58	0.900	1115	2.970	1115	1.800	1115	1.620	1115	2.160	1115	2.160	1115	3.870
1120	18.67	0.902	1120	2.977	1120	1.804	1120	1.624	1120	2.165	1120	2.165	1120	3.879
1125	18.75	0.904	1125	2.983	1125	1.808	1125	1.627	1125	2.170	1125	2.170	1125	3.887
1130	18.83	0.906	1130	2.990	1130	1.812	1130	1.631	1130	2.174	1130	2.174	1130	3.896
1135	18.92	0.908	1135	2.996	1135	1.816	1135	1.634	1135	2.179	1135	2.179	1135	3.904
1140	19.00	0.910	1140	3.003	1140	1.820	1140	1.638	1140	2.184	1140	2.184	1140	3.913
1145	19.08	0.912	1145	3.010	1145	1.824	1145	1.642	1145	2.189	1145	2.189	1145	3.922
1150	19.17	0.914	1150	3.016	1150	1.828	1150	1.645	1150	2.194	1150	2.194	1150	3.930
1155	19.25	0.916	1155	3.023	1155	1.832	1155	1.649	1155	2.198	1155	2.198	1155	3.939
1160	19.33	0.917	1160	3.026	1160	1.834	1160	1.651	1160	2.201	1160	2.201	1160	3.943
1165	19.42	0.919	1165	3.033	1165	1.838	1165	1.654	1165	2.206	1165	2.206	1165	3.952
1170	19.50	0.921	1170	3.039	1170	1.842	1170	1.658	1170	2.210	1170	2.210	1170	3.960
1175	19.58	0.923	1175	3.046	1175	1.846	1175	1.661	1175	2.215	1175	2.215	1175	3.969
1180	19.67	0.925	1180	3.053	1180	1.850	1180	1.665	1180	2.220	1180	2.220	1180	3.978
1185	19.75	0.927	1185	3.059	1185	1.854	1185	1.669	1185	2.225	1185	2.225	1185	3.986
1190	19.83	0.928	1190	3.062	1190	1.856	1190	1.670	1190	2.227	1190	2.227	1190	3.990
1195	19.92	0.930	1195	3.069	1195	1.860	1195	1.674	1195	2.232	1195	2.232	1195	3.999
1200	20.00	0.932	1200	3.076	1200	1.864	1200	1.678	1200	2.237	1200	2.237	1200	4.008
1205	20.08	0.934	1205	3.082	1205	1.868	1205	1.681	1205	2.242	1205	2.242	1205	4.016
1210	20.17	0.935	1210	3.086	1210	1.870	1210	1.683	1210	2.244	1210	2.244	1210	4.021
1215	20.25	0.937	1215	3.092	1215	1.874	1215	1.687	1215	2.249	1215	2.249	1215	4.029
1220	20.33	0.939	1220	3.099	1220	1.878	1220	1.690	1220	2.254	1220	2.254	1220	4.038
1225	20.42	0.940	1225	3.102	1225	1.880	1225	1.692	1225	2.256	1225	2.256	1225	4.042
1230	20.50	0.942	1230	3.109	1230	1.884	1230	1.696	1230	2.261	1230	2.261	1230	4.051
1235	20.58	0.944	1235	3.115	1235	1.888	1235	1.699	1235	2.266	1235	2.266	1235	4.059
1240	20.67	0.945	1240	3.119	1240	1.890	1240	1.701	1240	2.268	1240	2.268	1240	4.064
1245	20.75	0.947	1245	3.125	1245	1.894	1245	1.705	1245	2.273	1245	2.273	1245	4.072
1250	20.83	0.949	1250	3.132	1250	1.898	1250	1.708	1250	2.278	1250	2.278	1250	4.081
1255	20.92	0.950	1255	3.135	1255	1.900	1255	1.710	1255	2.280	1255	2.280	1255	4.085
1260	21.00	0.952	1260	3.142	1260	1.904	1260	1.714	1260	2.285	1260	2.285	1260	4.094
1265	21.08	0.953	1265	3.145	1265	1.906	1265	1.715	1265	2.287	1265	2.287	1265	4.098
1270	21.17	0.955	1270	3.152	1270	1.910	1270	1.719	1270	2.292	1270	2.292	1270	4.107
1275	21.25	0.957	1275	3.158	1275	1.914	1275	1.723	1275	2.297	1275	2.297	1275	4.115
1280	21.33	0.958	1280	3.161	1280	1.916	1280	1.724	1280	2.299	1280	2.299	1280	4.119
1285	21.42	0.960	1285	3.168	1285	1.920	1285	1.728	1285	2.304	1285	2.304	1285	4.128
1290	21.50	0.961	1290	3.171	1290	1.922	1290	1.730	1290	2.306	1290	2.306	1290	4.132
1295	21.58	0.963	1295	3.178	1295	1.926	1295	1.733	1295	2.311	1295	2.311	1295	4.141
1300	21.67	0.964	1300	3.181	1300	1.928	1300	1.735	1300	2.314	1300	2.314	1300	4.145
1305	21.75	0.966	1305	3.188	1305	1.932	1305	1.739	1305	2.318	1305	2.318	1305	4.154
1310	21.83	0.967	1310	3.191	1310	1.934	1310	1.741	1310	2.321	1310	2.321	1310	4.158
1315	21.92	0.968	1315	3.194	1315	1.936	1315	1.742	1315	2.323	1315	2.323	1315	4.162
1320	22.00	0.970	1320	3.201	1320	1.940	1320	1.746	1320	2.328	1320	2.328	1320	4.171
1325	22.08	0.971	1325	3.204	1325	1.942	1325	1.748	1325	2.330	1325	2.330	1325	4.175
1330	22.17	0.973	1330	3.211	1330	1.946	1330	1.751	1330	2.335	1330	2.335	1330	4.184
1335	22.25	0.974	1335	3.214	1335	1.948	1335	1.753	1335	2.338	1335	2.338	1335	4.188
1340	22.33	0.975	1340	3.218	1340	1.950	1340	1.755	1340	2.340	1340	2.340	1340	4.193
1345	22.42	0.977	1345	3.224	1345	1.954	1345	1.759	1345	2.345	1345	2.345	1345	4.201

SCS Type 1 - 2 Yr - 24 Hr Distribution

SCS Type 1 - 24 Hr Distribution Ratios			SCS Type 1 - 24 Hr Distribution Guejito Basin $P_{2,24}$[2]= 3.3		SCS Type 1 - 24 Hr Distribution Jamul Basin $P_{2,24}$[2]= 2.0		SCS Type 1 - 24 Hr Distribution Las Flores Basin $P_{2,24}$[2]= 1.8		SCS Type 1 - 24 Hr Distribution Los Coches Basin $P_{2,24}$[2]= 2.4		SCS Type 1 - 24 Hr Distribution Santa Maria Basin $P_{2,24}$[2]= 2.4		SCS Type 1 - 24 Hr Distribution Sweetwater Basin $P_{2,24}$[2]= 4.3	
Time (min)	Time (hrs)	P_x/P_{24}[1] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
1350	22.50	0.978	1350	3.227	1350	1.956	1350	1.760	1350	2.347	1350	2.347	1350	4.205
1355	22.58	0.979	1355	3.231	1355	1.958	1355	1.762	1355	2.350	1355	2.350	1355	4.210
1360	22.67	0.981	1360	3.237	1360	1.962	1360	1.766	1360	2.354	1360	2.354	1360	4.218
1365	22.75	0.982	1365	3.241	1365	1.964	1365	1.768	1365	2.357	1365	2.357	1365	4.223
1370	22.83	0.983	1370	3.244	1370	1.966	1370	1.769	1370	2.359	1370	2.359	1370	4.227
1375	22.92	0.984	1375	3.247	1375	1.968	1375	1.771	1375	2.362	1375	2.362	1375	4.231
1380	23.00	0.986	1380	3.254	1380	1.972	1380	1.775	1380	2.366	1380	2.366	1380	4.240
1385	23.08	0.987	1385	3.257	1385	1.974	1385	1.777	1385	2.369	1385	2.369	1385	4.244
1390	23.17	0.988	1390	3.260	1390	1.976	1390	1.778	1390	2.371	1390	2.371	1390	4.248
1395	23.25	0.989	1395	3.264	1395	1.978	1395	1.780	1395	2.374	1395	2.374	1395	4.253
1400	23.33	0.991	1400	3.270	1400	1.982	1400	1.784	1400	2.378	1400	2.378	1400	4.261
1405	23.42	0.992	1405	3.274	1405	1.984	1405	1.786	1405	2.381	1405	2.381	1405	4.266
1410	23.50	0.993	1410	3.277	1410	1.986	1410	1.787	1410	2.383	1410	2.383	1410	4.270
1415	23.58	0.994	1415	3.280	1415	1.988	1415	1.789	1415	2.386	1415	2.386	1415	4.274
1420	23.67	0.995	1420	3.284	1420	1.990	1420	1.791	1420	2.388	1420	2.388	1420	4.279
1425	23.75	0.996	1425	3.287	1425	1.992	1425	1.793	1425	2.390	1425	2.390	1425	4.283
1430	23.83	0.998	1430	3.293	1430	1.996	1430	1.796	1430	2.395	1430	2.395	1430	4.291
1435	23.92	0.999	1435	3.297	1435	1.998	1435	1.798	1435	2.398	1435	2.398	1435	4.296
1440	24.00	1.000	1440	3.300	1440	2.000	1440	1.800	1440	2.400	1440	2.400	1440	4.300

1. P_x/P_{24} ratios have been determined through linear intepolation of values derived from Figure II-B-1 of the 1993 SDCHM at 30 minute intervals.

2. $P_{2,24}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

SCS Type 1 - 2 Yr - 6 Hr Distribution

SCS Type 1 - 6 Hr Distribution Ratios			SCS Type 1 - 6 Hr Distribution Guejito Basin $P_{2,6}$ [3]= 1.8		SCS Type 1 - 6 Hr Distribution Jamul Basin $P_{2,6}$ [3]= 1.3		SCS Type 1 - 6 Hr Distribution Las Flores Basin $P_{2,6}$ [3]= 1.3		SCS Type 1 - 6 Hr Distribution Los Coches Basin $P_{2,6}$ [3]= 1.3		SCS Type 1 - 6 Hr Distribution Santa Maria Basin $P_{2,6}$ [3]= 1.5		SCS Type 1 - 6 Hr Distribution Sweetwater Basin $P_{2,6}$ [3]= 2.1	
Time [1] (min)	Time (hrs)	P_x/P_6 [2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
0	0.00	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
5	0.08	0.006	5	0.011	5	0.008	5	0.008	5	0.008	5	0.009	5	0.013
10	0.17	0.012	10	0.022	10	0.016	10	0.016	10	0.016	10	0.018	10	0.025
15	0.25	0.017	15	0.031	15	0.022	15	0.022	15	0.022	15	0.026	15	0.036
20	0.33	0.023	20	0.041	20	0.030	20	0.030	20	0.030	20	0.035	20	0.048
25	0.42	0.029	25	0.052	25	0.038	25	0.038	25	0.038	25	0.044	25	0.061
30	0.50	0.035	30	0.063	30	0.046	30	0.046	30	0.046	30	0.053	30	0.074
35	0.58	0.041	35	0.074	35	0.053	35	0.053	35	0.053	35	0.062	35	0.086
40	0.67	0.047	40	0.085	40	0.061	40	0.061	40	0.061	40	0.071	40	0.099
45	0.75	0.054	45	0.097	45	0.070	45	0.070	45	0.070	45	0.081	45	0.113
50	0.83	0.061	50	0.110	50	0.079	50	0.079	50	0.079	50	0.092	50	0.128
55	0.92	0.068	55	0.122	55	0.088	55	0.088	55	0.088	55	0.102	55	0.143
60	1.00	0.076	60	0.137	60	0.099	60	0.099	60	0.099	60	0.114	60	0.160
65	1.08	0.084	65	0.151	65	0.109	65	0.109	65	0.109	65	0.126	65	0.176
70	1.17	0.092	70	0.166	70	0.120	70	0.120	70	0.120	70	0.138	70	0.193
75	1.25	0.100	75	0.180	75	0.130	75	0.130	75	0.130	75	0.150	75	0.210
80	1.33	0.108	80	0.194	80	0.140	80	0.140	80	0.140	80	0.162	80	0.227
85	1.42	0.116	85	0.209	85	0.151	85	0.151	85	0.151	85	0.174	85	0.244
90	1.50	0.125	90	0.225	90	0.163	90	0.163	90	0.163	90	0.188	90	0.263
95	1.58	0.134	95	0.241	95	0.174	95	0.174	95	0.174	95	0.201	95	0.281
100	1.67	0.144	100	0.259	100	0.187	100	0.187	100	0.187	100	0.216	100	0.302
105	1.75	0.156	105	0.281	105	0.203	105	0.203	105	0.203	105	0.234	105	0.328
110	1.83	0.168	110	0.302	110	0.218	110	0.218	110	0.218	110	0.252	110	0.353
115	1.92	0.181	115	0.326	115	0.235	115	0.235	115	0.235	115	0.272	115	0.380
120	2.00	0.194	120	0.349	120	0.252	120	0.252	120	0.252	120	0.291	120	0.407
125	2.08	0.209	125	0.376	125	0.272	125	0.272	125	0.272	125	0.314	125	0.439
130	2.17	0.229	130	0.412	130	0.298	130	0.298	130	0.298	130	0.344	130	0.481
135	2.25	0.254	135	0.457	135	0.330	135	0.330	135	0.330	135	0.381	135	0.533
140	2.33	0.285	140	0.513	140	0.371	140	0.371	140	0.371	140	0.428	140	0.599
145	2.42	0.336	145	0.605	145	0.437	145	0.437	145	0.437	145	0.504	145	0.706
150	2.50	0.515	150	0.927	150	0.670	150	0.670	150	0.670	150	0.773	150	1.082
155	2.58	0.565	155	1.017	155	0.735	155	0.735	155	0.735	155	0.848	155	1.187
160	2.67	0.597	160	1.075	160	0.776	160	0.776	160	0.776	160	0.896	160	1.254
165	2.75	0.623	165	1.121	165	0.810	165	0.810	165	0.810	165	0.935	165	1.308
170	2.83	0.645	170	1.161	170	0.839	170	0.839	170	0.839	170	0.968	170	1.355
175	2.92	0.665	175	1.197	175	0.865	175	0.865	175	0.865	175	0.998	175	1.397
180	3.00	0.684	180	1.231	180	0.889	180	0.889	180	0.889	180	1.026	180	1.436
185	3.08	0.701	185	1.262	185	0.911	185	0.911	185	0.911	185	1.052	185	1.472
190	3.17	0.717	190	1.291	190	0.932	190	0.932	190	0.932	190	1.076	190	1.506
195	3.25	0.732	195	1.318	195	0.952	195	0.952	195	0.952	195	1.098	195	1.537
200	3.33	0.746	200	1.343	200	0.970	200	0.970	200	0.970	200	1.119	200	1.567
205	3.42	0.758	205	1.364	205	0.985	205	0.985	205	0.985	205	1.137	205	1.592
210	3.50	0.770	210	1.386	210	1.001	210	1.001	210	1.001	210	1.155	210	1.617
215	3.58	0.781	215	1.406	215	1.015	215	1.015	215	1.015	215	1.172	215	1.640
220	3.67	0.791	220	1.424	220	1.028	220	1.028	220	1.028	220	1.187	220	1.661
225	3.75	0.802	225	1.444	225	1.043	225	1.043	225	1.043	225	1.203	225	1.684
230	3.83	0.812	230	1.462	230	1.056	230	1.056	230	1.056	230	1.218	230	1.705
235	3.92	0.822	235	1.480	235	1.069	235	1.069	235	1.069	235	1.233	235	1.726
240	4.00	0.832	240	1.498	240	1.082	240	1.082	240	1.082	240	1.248	240	1.747
245	4.08	0.841	245	1.514	245	1.093	245	1.093	245	1.093	245	1.262	245	1.766
250	4.17	0.851	250	1.532	250	1.106	250	1.106	250	1.106	250	1.277	250	1.787
255	4.25	0.860	255	1.548	255	1.118	255	1.118	255	1.118	255	1.290	255	1.806
260	4.33	0.869	260	1.564	260	1.130	260	1.130	260	1.130	260	1.304	260	1.825
265	4.42	0.877	265	1.579	265	1.140	265	1.140	265	1.140	265	1.316	265	1.842

SCS Type 1 - 2 Yr - 6 Hr Distribution

SCS Type 1 - 6 Hr Distribution Ratios			SCS Type 1 - 6 Hr Distribution Guejito Basin $P_{2,6}$[3]= 1.8		SCS Type 1 - 6 Hr Distribution Jamul Basin $P_{2,6}$[3]= 1.3		SCS Type 1 - 6 Hr Distribution Las Flores Basin $P_{2,6}$[3]= 1.3		SCS Type 1 - 6 Hr Distribution Los Coches Basin $P_{2,6}$[3]= 1.3		SCS Type 1 - 6 Hr Distribution Santa Maria Basin $P_{2,6}$[3]= 1.5		SCS Type 1 - 6 Hr Distribution Sweetwater Basin $P_{2,6}$[3]= 2.1	
Time[1] (min)	Time (hrs)	P_x/P_6[2] (ratio)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)	Time (min)	P_x (in)
270	4.50	0.886	270	1.595	270	1.152	270	1.152	270	1.152	270	1.329	270	1.861
275	4.58	0.894	275	1.609	275	1.162	275	1.162	275	1.162	275	1.341	275	1.877
280	4.67	0.902	280	1.624	280	1.173	280	1.173	280	1.173	280	1.353	280	1.894
285	4.75	0.910	285	1.638	285	1.183	285	1.183	285	1.183	285	1.365	285	1.911
290	4.83	0.917	290	1.651	290	1.192	290	1.192	290	1.192	290	1.376	290	1.926
295	4.92	0.925	295	1.665	295	1.203	295	1.203	295	1.203	295	1.388	295	1.943
300	5.00	0.932	300	1.678	300	1.212	300	1.212	300	1.212	300	1.398	300	1.957
305	5.08	0.939	305	1.690	305	1.221	305	1.221	305	1.221	305	1.409	305	1.972
310	5.17	0.945	310	1.701	310	1.229	310	1.229	310	1.229	310	1.418	310	1.985
315	5.25	0.952	315	1.714	315	1.238	315	1.238	315	1.238	315	1.428	315	1.999
320	5.33	0.958	320	1.724	320	1.245	320	1.245	320	1.245	320	1.437	320	2.012
325	5.42	0.964	325	1.735	325	1.253	325	1.253	325	1.253	325	1.446	325	2.024
330	5.50	0.970	330	1.746	330	1.261	330	1.261	330	1.261	330	1.455	330	2.037
335	5.58	0.975	335	1.755	335	1.268	335	1.268	335	1.268	335	1.463	335	2.048
340	5.67	0.981	340	1.766	340	1.275	340	1.275	340	1.275	340	1.472	340	2.060
345	5.75	0.986	345	1.775	345	1.282	345	1.282	345	1.282	345	1.479	345	2.071
350	5.83	0.991	350	1.784	350	1.288	350	1.288	350	1.288	350	1.487	350	2.081
355	5.92	0.995	355	1.791	355	1.294	355	1.294	355	1.294	355	1.493	355	2.090
360	6.00	1.000	360	1.800	360	1.300	360	1.300	360	1.300	360	1.500	360	2.100

1. Time values for the 6 hr distribution are determined by dividing the time intervals from the SCS Type 1 - 24 hr distribution by 4.
2. P_x/P_6 ratios correspond to P_x/P_{24} ratios at times (in minutes) that are 4 times greater than P_x/P_6 times. For example, P_x/P_6 at 100 minutes equals P_x/P_{24} at 400 minutes.
3. $P_{2,6}$ values represent Adjusted Rainfall Depths as determined in Appendix C.7 of this report.

This page is intentionally left blank to facilitate 2-sided printing.

Appendix C.10

Nested Rainfall Distribution

This page is intentionally left blank to facilitate 2-sided printing.

Table 4-1
RAINFALL DEPTH-AREA ADJUSTMENT DATA POINTS

Watershed Area (square miles)	Rainfall Depth-Area Adjustment for Duration				
	30-Minute	1-Hour	3-Hour	6-Hour	24-Hour
0	1.000	1.000	1.000	1.000	1.000
5	0.942	0.970	0.980	0.985	0.990
10	0.900	0.947	0.970	0.980	0.985
20	0.834	0.900	0.952	0.963	0.975
30	0.768	0.858	0.932	0.950	0.964
40	0.730	0.830	0.915	0.940	0.958
50	0.692	0.800	0.900	0.928	0.952
60	0.663	0.778	0.883	0.920	0.948
70	0.645	0.760	0.872	0.912	0.945
80	0.630	0.746	0.862	0.904	0.942
90	0.620	0.735	0.853	0.896	0.938
100	0.610	0.722	0.845	0.890	0.935
125	0.588	0.700	0.830	0.878	0.930
150	0.572	0.685	0.818	0.865	0.925
175	0.572	0.672	0.808	0.858	0.922
200	0.572	0.666	0.798	0.851	0.918
225	0.572	0.660	0.790	0.845	0.915
250	0.572	0.655	0.787	0.842	0.914
300	0.572	0.652	0.782	0.838	0.912
350	0.572	0.652	0.780	0.830	0.910
400	0.572	0.652	0.780	0.828	0.908

Nested Storm Distribution for Guejito Creek

Nested Storm Inputs for Guejito Creek

Variable	Units	100 yr	10 yr	5 yr	2 yr
T_p [1]	minutes	122.3	122.3	122.3	122.3
P_6 [2]	inches	4.0	2.6	2.2	1.8
P_{6adj} [3]	inches	4.0	2.6	2.2	1.8
P_{24} [4]	inches	8.1	5.6	4.4	3.4
Area [5]	mi^2	22.5	22.5	22.5	22.5
M [6]	-	0.508961	0.553458	0.500000	0.458769
C [7]	-	0.199987	0.100039	0.115950	0.120926

1. T_p as determined per Lag Time Calculations in Appendix C.5 of this report
2. P_6 as determined per Unadjusted Rainfall Depths in Appendix C.6 of this report
3. P_{6adj} represents the adjusted value of P_6 to be within 45-65% of the P_{24} value (if necessary)
4. P_{24} as determined per Unadjusted Rainfall Depths in Appendix C.6 of this report
5. Area represents the Basin area in square miles
6. $M = \ln(P_{6adj}/P_{24})/(\ln(360) - \ln(1440))$
7. $C = P_{6adj}/360^M$

Rainfall Depth-Area Adjustments for Guejito Creek

2003 San Diego County Hydrology Manual Table 4-1					
Watershed Area (mi^2)	**Rainfall Depth-Area Adjustment for Duration**				
	30 Minute	**1 Hour**	**3 Hour**	**6 Hour**	**24 Hour**
0	1.000	1.000	1.000	1.000	1.000
5	0.942	0.970	0.980	0.985	0.990
10	0.900	0.947	0.970	0.980	0.985
20	0.834	0.900	0.952	0.963	0.975
30	0.768	0.858	0.932	0.950	0.964
40	0.730	0.830	0.915	0.940	0.958
50	0.692	0.800	0.900	0.928	0.952
60	0.663	0.778	0.883	0.920	0.948
70	0.654	0.760	0.872	0.912	0.945
80	0.630	0.746	0.862	0.904	0.942
90	0.620	0.735	0.853	0.896	0.938
100	0.610	0.722	0.845	0.890	0.935
125	0.588	0.700	0.830	0.878	0.930
150	0.572	0.685	0.818	0.865	0.925
175	0.572	0.672	0.808	0.858	0.922
200	0.572	0.666	0.798	0.851	0.918
225	0.572	0.660	0.790	0.845	0.915
250	0.572	0.655	0.787	0.842	0.914
300	0.572	0.652	0.782	0.838	0.912
350	0.572	0.652	0.780	0.830	0.910
400	0.572	0.652	0.780	0.828	0.908

Rainfall Depth-Area Adjustments for Guejito Creek [1]					
Watershed Area (mi^2)	**30 Minute**	**1 Hour**	**3 Hour**	**6 Hour**	**24 Hour**
20	0.834	0.900	0.952	0.963	0.975
22.5	**0.818**	**0.890**	**0.947**	**0.960**	**0.972**
30	0.768	0.858	0.932	0.950	0.964

1. Rainfall Depth-Area Adjustment factors associated with 30-minute, 1-hour, 3-hour, 6-hour, and 24-hour storms have been interoplated from the data on Table 4-1 of the 2003 SDCHM with respect to the basin area and the duration of the storm.

100 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.878	0.8175	0.718	193	0.718	1	0.014
10	1.123	0.8175	0.918	192	0.200	2	0.014
15	1.297	0.8175	1.060	191	0.142	3	0.014
20	1.437	0.8175	1.174	194	0.114	4	0.014
25	1.555	0.8175	1.271	190	0.097	5	0.015
30	1.659	**0.8175**	1.356	189	0.085	6	0.015
35	1.752	0.8295	1.454	195	0.097	7	0.015
40	1.837	0.8415	1.546	188	0.093	8	0.015
45	1.916	0.8535	1.635	187	0.089	9	0.015
50	1.989	0.8655	1.721	196	0.086	10	0.015
55	2.057	0.8775	1.805	186	0.084	11	0.015
60	2.122	**0.8895**	1.887	185	0.082	12	0.015
65	2.183	0.8919	1.947	197	0.060	13	0.015
70	2.241	0.8943	2.004	184	0.057	14	0.015
75	2.297	0.8967	2.060	183	0.055	15	0.015
80	2.350	0.8991	2.113	198	0.053	16	0.015
85	2.401	0.9015	2.165	182	0.052	17	0.015
90	2.450	0.9039	2.215	181	0.050	18	0.015
95	2.498	0.9063	2.264	199	0.049	19	0.015
100	2.544	0.9087	2.311	180	0.048	20	0.015
105	2.588	0.9111	2.358	179	0.047	21	0.015
110	2.631	0.9135	2.404	200	0.046	22	0.015
115	2.673	0.9159	2.448	178	0.045	23	0.015
120	2.714	0.9183	2.492	177	0.044	24	0.015
125	2.753	0.9206	2.535	201	0.043	25	0.015
130	2.792	0.9230	2.577	176	0.042	26	0.015
135	2.830	0.9254	2.619	175	0.042	27	0.015
140	2.867	0.9278	2.660	202	0.041	28	0.015
145	2.902	0.9302	2.700	174	0.040	29	0.015
150	2.938	0.9326	2.740	173	0.040	30	0.015
155	2.972	0.9350	2.779	203	0.039	31	0.016
160	3.006	0.9374	2.818	172	0.039	32	0.016
165	3.039	0.9398	2.856	171	0.038	33	0.016
170	3.071	0.9422	2.894	204	0.038	34	0.016
175	3.103	0.9446	2.931	170	0.037	35	0.016
180	3.134	**0.9470**	2.968	169	0.037	36	0.016
185	3.165	0.9474	2.998	205	0.030	37	0.016
190	3.195	0.9477	3.028	168	0.030	38	0.016
195	3.224	0.9481	3.057	167	0.029	39	0.016
200	3.253	0.9484	3.086	206	0.029	40	0.016
205	3.282	0.9488	3.114	166	0.028	41	0.016
210	3.310	0.9491	3.142	165	0.028	42	0.016
215	3.338	0.9495	3.169	207	0.028	43	0.016
220	3.365	0.9498	3.197	164	0.027	44	0.016
225	3.392	0.9502	3.223	163	0.027	45	0.016
230	3.419	0.9505	3.250	208	0.026	46	0.016
235	3.445	0.9509	3.276	162	0.026	47	0.016
240	3.471	0.9513	3.302	161	0.026	48	0.016
245	3.497	0.9516	3.327	209	0.025	49	0.016
250	3.522	0.9520	3.352	160	0.025	50	0.016
255	3.547	0.9523	3.377	159	0.025	51	0.016

100 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	3.571	0.9527	3.402	210	0.025	52	0.017
265	3.595	0.9530	3.426	158	0.024	53	0.017
270	3.619	0.9534	3.450	157	0.024	54	0.017
275	3.643	0.9537	3.474	211	0.024	55	0.017
280	3.666	0.9541	3.498	156	0.024	56	0.017
285	3.689	0.9544	3.521	155	0.023	57	0.017
290	3.712	0.9548	3.544	212	0.023	58	0.017
295	3.735	0.9551	3.567	154	0.023	59	0.017
300	3.757	0.9555	3.590	153	0.023	60	0.017
305	3.779	0.9559	3.612	213	0.022	61	0.017
310	3.801	0.9562	3.635	152	0.022	62	0.017
315	3.823	0.9566	3.657	151	0.022	63	0.017
320	3.844	0.9569	3.679	214	0.022	64	0.017
325	3.865	0.9573	3.700	150	0.022	65	0.017
330	3.886	0.9576	3.722	149	0.021	66	0.017
335	3.907	0.9580	3.743	215	0.021	67	0.017
340	3.928	0.9583	3.764	148	0.021	68	0.017
345	3.948	0.9587	3.785	147	0.021	69	0.018
350	3.968	0.9590	3.806	216	0.021	70	0.018
355	3.989	0.9594	3.827	146	0.021	71	0.018
360	**4.000**	**0.9598**	3.839	145	0.012	72	0.018
365	4.028	0.9598	3.866	217	0.027	73	0.018
370	4.056	0.9599	3.893	144	0.027	74	0.018
375	4.084	0.9599	3.920	143	0.027	75	0.018
380	4.112	0.9600	3.947	218	0.027	76	0.018
385	4.139	0.9600	3.974	142	0.027	77	0.018
390	4.166	0.9601	4.000	141	0.026	78	0.018
395	4.193	0.9602	4.026	219	0.026	79	0.018
400	4.220	0.9602	4.052	140	0.026	80	0.018
405	4.247	0.9603	4.078	139	0.026	81	0.018
410	4.274	0.9603	4.104	220	0.026	82	0.018
415	4.300	0.9604	4.130	138	0.026	83	0.019
420	4.326	0.9604	4.155	137	0.026	84	0.019
425	4.353	0.9605	4.181	221	0.025	85	0.019
430	4.379	0.9606	4.206	136	0.025	86	0.019
435	4.404	0.9606	4.231	135	0.025	87	0.019
440	4.430	0.9607	4.256	222	0.025	88	0.019
445	4.456	0.9607	4.281	134	0.025	89	0.019
450	4.481	0.9608	4.305	133	0.025	90	0.019
455	4.506	0.9608	4.330	223	0.025	91	0.019
460	4.531	0.9609	4.354	132	0.024	92	0.019
465	4.556	0.9610	4.379	131	0.024	93	0.019
470	4.581	0.9610	4.403	224	0.024	94	0.019
475	4.606	0.9611	4.427	130	0.024	95	0.020
480	4.631	0.9611	4.451	129	0.024	96	0.020
485	4.655	0.9612	4.475	225	0.024	97	0.020
490	4.680	0.9613	4.498	128	0.024	98	0.020
495	4.704	0.9613	4.522	127	0.024	99	0.020
500	4.728	0.9614	4.545	226	0.023	100	0.020
505	4.752	0.9614	4.569	126	0.023	101	0.020
510	4.776	0.9615	4.592	125	0.023	102	0.020
515	4.800	0.9615	4.615	227	0.023	103	0.020

100 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	4.823	0.9616	4.638	124	0.023	104	0.020
525	4.847	0.9617	4.661	123	0.023	105	0.021
530	4.870	0.9617	4.684	228	0.023	106	0.021
535	4.894	0.9618	4.707	122	0.023	107	0.021
540	4.917	0.9618	4.729	121	0.023	108	0.021
545	4.940	0.9619	4.752	229	0.023	109	0.021
550	4.963	0.9619	4.774	120	0.022	110	0.021
555	4.986	0.9620	4.796	119	0.022	111	0.021
560	5.009	0.9621	4.819	230	0.022	112	0.021
565	5.031	0.9621	4.841	118	0.022	113	0.022
570	5.054	0.9622	4.863	117	0.022	114	0.022
575	5.077	0.9622	4.885	231	0.022	115	0.022
580	5.099	0.9623	4.907	116	0.022	116	0.022
585	5.121	0.9624	4.928	115	0.022	117	0.022
590	5.143	0.9624	4.950	232	0.022	118	0.022
595	5.166	0.9625	4.972	114	0.022	119	0.022
600	5.188	0.9625	4.993	113	0.022	120	0.022
605	5.210	0.9626	5.015	233	0.021	121	0.023
610	5.231	0.9626	5.036	112	0.021	122	0.023
615	5.253	0.9627	5.057	111	0.021	123	0.023
620	5.275	0.9628	5.079	234	0.021	124	0.023
625	5.297	0.9628	5.100	110	0.021	125	0.023
630	5.318	0.9629	5.121	109	0.021	126	0.023
635	5.340	0.9629	5.142	235	0.021	127	0.024
640	5.361	0.9630	5.162	108	0.021	128	0.024
645	5.382	0.9630	5.183	107	0.021	129	0.024
650	5.403	0.9631	5.204	236	0.021	130	0.024
655	5.424	0.9632	5.225	106	0.021	131	0.024
660	5.446	0.9632	5.245	105	0.021	132	0.024
665	5.466	0.9633	5.266	237	0.021	133	0.025
670	5.487	0.9633	5.286	104	0.020	134	0.025
675	5.508	0.9634	5.307	103	0.020	135	0.025
680	5.529	0.9635	5.327	238	0.020	136	0.025
685	5.550	0.9635	5.347	102	0.020	137	0.026
690	5.570	0.9636	5.367	101	0.020	138	0.026
695	5.591	0.9636	5.387	239	0.020	139	0.026
700	5.611	0.9637	5.407	100	0.020	140	0.026
705	5.631	0.9637	5.427	99	0.020	141	0.026
710	5.652	0.9638	5.447	240	0.020	142	0.027
715	5.672	0.9639	5.467	98	0.020	143	0.027
720	5.692	0.9639	5.487	97	0.020	144	0.027
725	5.712	0.9640	5.506	241	0.020	145	0.012
730	5.732	0.9640	5.526	96	0.020	146	0.021
735	5.752	0.9641	5.546	95	0.020	147	0.021
740	5.772	0.9641	5.565	242	0.020	148	0.021
745	5.792	0.9642	5.585	94	0.019	149	0.021
750	5.812	0.9643	5.604	93	0.019	150	0.022
755	5.831	0.9643	5.623	243	0.019	151	0.022
760	5.851	0.9644	5.642	92	0.019	152	0.022
765	5.870	0.9644	5.662	91	0.019	153	0.023
770	5.890	0.9645	5.681	244	0.019	154	0.023
775	5.909	0.9646	5.700	90	0.019	155	0.023

100 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	5.929	0.9646	5.719	89	0.019	156	0.024
785	5.948	0.9647	5.738	245	0.019	157	0.024
790	5.967	0.9647	5.757	88	0.019	158	0.024
795	5.987	0.9648	5.776	87	0.019	159	0.025
800	6.006	0.9648	5.795	246	0.019	160	0.025
805	6.025	0.9649	5.813	86	0.019	161	0.026
810	6.044	0.9650	5.832	85	0.019	162	0.026
815	6.063	0.9650	5.851	247	0.019	163	0.027
820	6.082	0.9651	5.869	84	0.019	164	0.027
825	6.100	0.9651	5.888	83	0.019	165	0.028
830	6.119	0.9652	5.906	248	0.018	166	0.028
835	6.138	0.9652	5.925	82	0.018	167	0.029
840	6.157	0.9653	5.943	81	0.018	168	0.030
845	6.175	0.9654	5.961	249	0.018	169	0.037
850	6.194	0.9654	5.980	80	0.018	170	0.037
855	6.212	0.9655	5.998	79	0.018	171	0.038
860	6.231	0.9655	6.016	250	0.018	172	0.039
865	6.249	0.9656	6.034	78	0.018	173	0.040
870	6.268	0.9657	6.052	77	0.018	174	0.040
875	6.286	0.9657	6.070	251	0.018	175	0.042
880	6.304	0.9658	6.088	76	0.018	176	0.042
885	6.322	0.9658	6.106	75	0.018	177	0.044
890	6.341	0.9659	6.124	252	0.018	178	0.045
895	6.359	0.9659	6.142	74	0.018	179	0.047
900	6.377	0.9660	6.160	73	0.018	180	0.048
905	6.395	0.9661	6.178	253	0.018	181	0.050
910	6.413	0.9661	6.195	72	0.018	182	0.052
915	6.431	0.9662	6.213	71	0.018	183	0.055
920	6.448	0.9662	6.231	254	0.018	184	0.057
925	6.466	0.9663	6.248	70	0.018	185	0.082
930	6.484	0.9663	6.266	69	0.018	186	0.084
935	6.502	0.9664	6.283	255	0.017	187	0.089
940	6.519	0.9665	6.301	68	0.017	188	0.093
945	6.537	0.9665	6.318	67	0.017	189	0.085
950	6.555	0.9666	6.336	256	0.017	190	0.097
955	6.572	0.9666	6.353	66	0.017	191	0.142
960	6.590	0.9667	6.370	65	0.017	192	0.200
965	6.607	0.9668	6.387	257	0.017	193	0.718
970	6.624	0.9668	6.405	64	0.017	194	0.114
975	6.642	0.9669	6.422	63	0.017	195	0.097
980	6.659	0.9669	6.439	258	0.017	196	0.086
985	6.676	0.9670	6.456	62	0.017	197	0.060
990	6.694	0.9670	6.473	61	0.017	198	0.053
995	6.711	0.9671	6.490	259	0.017	199	0.049
1000	6.728	0.9672	6.507	60	0.017	200	0.046
1005	6.745	0.9672	6.524	59	0.017	201	0.043
1010	6.762	0.9673	6.541	260	0.017	202	0.041
1015	6.779	0.9673	6.558	58	0.017	203	0.039
1020	6.796	0.9674	6.575	57	0.017	204	0.038
1025	6.813	0.9674	6.591	261	0.017	205	0.030
1030	6.830	0.9675	6.608	56	0.017	206	0.029
1035	6.847	0.9676	6.625	55	0.017	207	0.028

100 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	6.864	0.9676	6.641	262	0.017	208	0.026
1045	6.880	0.9677	6.658	54	0.017	209	0.025
1050	6.897	0.9677	6.675	53	0.017	210	0.025
1055	6.914	0.9678	6.691	263	0.017	211	0.024
1060	6.930	0.9679	6.708	52	0.017	212	0.023
1065	6.947	0.9679	6.724	51	0.016	213	0.022
1070	6.964	0.9680	6.741	264	0.016	214	0.022
1075	6.980	0.9680	6.757	50	0.016	215	0.021
1080	6.997	0.9681	6.773	49	0.016	216	0.021
1085	7.013	0.9681	6.790	265	0.016	217	0.027
1090	7.030	0.9682	6.806	48	0.016	218	0.027
1095	7.046	0.9683	6.822	47	0.016	219	0.026
1100	7.062	0.9683	6.839	266	0.016	220	0.026
1105	7.079	0.9684	6.855	46	0.016	221	0.025
1110	7.095	0.9684	6.871	45	0.016	222	0.025
1115	7.111	0.9685	6.887	267	0.016	223	0.025
1120	7.127	0.9685	6.903	44	0.016	224	0.024
1125	7.144	0.9686	6.919	43	0.016	225	0.024
1130	7.160	0.9687	6.935	268	0.016	226	0.023
1135	7.176	0.9687	6.951	42	0.016	227	0.023
1140	7.192	0.9688	6.967	41	0.016	228	0.023
1145	7.208	0.9688	6.983	269	0.016	229	0.023
1150	7.224	0.9689	6.999	40	0.016	230	0.022
1155	7.240	0.9690	7.015	39	0.016	231	0.022
1160	7.256	0.9690	7.031	270	0.016	232	0.022
1165	7.272	0.9691	7.047	38	0.016	233	0.021
1170	7.288	0.9691	7.063	37	0.016	234	0.021
1175	7.304	0.9692	7.078	271	0.016	235	0.021
1180	7.319	0.9692	7.094	36	0.016	236	0.021
1185	7.335	0.9693	7.110	35	0.016	237	0.021
1190	7.351	0.9694	7.126	272	0.016	238	0.020
1195	7.367	0.9694	7.141	34	0.016	239	0.020
1200	7.382	0.9695	7.157	33	0.016	240	0.020
1205	7.398	0.9695	7.172	273	0.016	241	0.020
1210	7.413	0.9696	7.188	32	0.016	242	0.020
1215	7.429	0.9696	7.204	31	0.016	243	0.019
1220	7.445	0.9697	7.219	274	0.016	244	0.019
1225	7.460	0.9698	7.234	30	0.015	245	0.019
1230	7.476	0.9698	7.250	29	0.015	246	0.019
1235	7.491	0.9699	7.265	275	0.015	247	0.019
1240	7.506	0.9699	7.281	28	0.015	248	0.018
1245	7.522	0.9700	7.296	27	0.015	249	0.018
1250	7.537	0.9701	7.311	276	0.015	250	0.018
1255	7.552	0.9701	7.327	26	0.015	251	0.018
1260	7.568	0.9702	7.342	25	0.015	252	0.018
1265	7.583	0.9702	7.357	277	0.015	253	0.018
1270	7.598	0.9703	7.373	24	0.015	254	0.018
1275	7.614	0.9703	7.388	23	0.015	255	0.017
1280	7.629	0.9704	7.403	278	0.015	256	0.017
1285	7.644	0.9705	7.418	22	0.015	257	0.017
1290	7.659	0.9705	7.433	21	0.015	258	0.017
1295	7.674	0.9706	7.448	279	0.015	259	0.017

100 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	7.689	0.9706	7.463	20	0.015	260	0.017
1305	7.704	0.9707	7.478	19	0.015	261	0.017
1310	7.719	0.9707	7.493	280	0.015	262	0.017
1315	7.734	0.9708	7.508	18	0.015	263	0.017
1320	7.749	0.9709	7.523	17	0.015	264	0.016
1325	7.764	0.9709	7.538	281	0.015	265	0.016
1330	7.779	0.9710	7.553	16	0.015	266	0.016
1335	7.794	0.9710	7.568	15	0.015	267	0.016
1340	7.809	0.9711	7.583	282	0.015	268	0.016
1345	7.823	0.9712	7.598	14	0.015	269	0.016
1350	7.838	0.9712	7.613	13	0.015	270	0.016
1355	7.853	0.9713	7.627	283	0.015	271	0.016
1360	7.868	0.9713	7.642	12	0.015	272	0.016
1365	7.882	0.9714	7.657	11	0.015	273	0.016
1370	7.897	0.9714	7.672	284	0.015	274	0.016
1375	7.912	0.9715	7.686	10	0.015	275	0.015
1380	7.926	0.9716	7.701	9	0.015	276	0.015
1385	7.941	0.9716	7.716	285	0.015	277	0.015
1390	7.956	0.9717	7.730	8	0.015	278	0.015
1395	7.970	0.9717	7.745	7	0.015	279	0.015
1400	7.985	0.9718	7.759	286	0.015	280	0.015
1405	7.999	0.9718	7.774	6	0.015	281	0.015
1410	8.014	0.9719	7.789	5	0.015	282	0.015
1415	8.028	0.9720	7.803	287	0.015	283	0.015
1420	8.043	0.9720	7.818	4	0.014	284	0.015
1425	8.057	0.9721	7.832	3	0.014	285	0.015
1430	8.071	0.9721	7.846	288	0.014	286	0.015
1435	8.086	0.9722	7.861	2	0.014	287	0.015
1440	8.100	**0.9723**	7.875	1	0.014	288	0.014

10 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.571	0.8175	0.467	193	0.467	1	0.011
10	0.730	0.8175	0.597	192	0.130	2	0.011
15	0.843	0.8175	0.689	191	0.092	3	0.011
20	0.934	0.8175	0.763	194	0.074	4	0.011
25	1.011	0.8175	0.826	190	0.063	5	0.011
30	1.078	**0.8175**	0.882	189	0.055	6	0.011
35	1.139	0.8295	0.945	195	0.063	7	0.011
40	1.194	0.8415	1.005	188	0.060	8	0.011
45	1.245	0.8535	1.063	187	0.058	9	0.011
50	1.293	0.8655	1.119	196	0.056	10	0.011
55	1.337	0.8775	1.173	186	0.055	11	0.011
60	1.379	**0.8895**	1.227	185	0.053	12	0.011
65	1.419	0.8919	1.266	197	0.039	13	0.011
70	1.457	0.8943	1.303	184	0.037	14	0.011
75	1.493	0.8967	1.339	183	0.036	15	0.011
80	1.528	0.8991	1.373	198	0.035	16	0.011
85	1.561	0.9015	1.407	182	0.034	17	0.011
90	1.593	0.9039	1.440	181	0.033	18	0.011
95	1.624	0.9063	1.471	199	0.032	19	0.011
100	1.653	0.9087	1.502	180	0.031	20	0.011
105	1.682	0.9111	1.533	179	0.030	21	0.011
110	1.710	0.9135	1.562	200	0.030	22	0.011
115	1.738	0.9159	1.591	178	0.029	23	0.011
120	1.764	0.9183	1.620	177	0.028	24	0.011
125	1.790	0.9206	1.648	201	0.028	25	0.011
130	1.815	0.9230	1.675	176	0.027	26	0.011
135	1.839	0.9254	1.702	175	0.027	27	0.011
140	1.863	0.9278	1.729	202	0.027	28	0.011
145	1.887	0.9302	1.755	174	0.026	29	0.012
150	1.909	0.9326	1.781	173	0.026	30	0.012
155	1.932	0.9350	1.806	203	0.025	31	0.012
160	1.954	0.9374	1.831	172	0.025	32	0.012
165	1.975	0.9398	1.856	171	0.025	33	0.012
170	1.996	0.9422	1.881	204	0.025	34	0.012
175	2.017	0.9446	1.905	170	0.024	35	0.012
180	2.037	**0.9470**	1.929	169	0.024	36	0.012
185	2.057	0.9474	1.949	205	0.020	37	0.012
190	2.077	0.9477	1.968	168	0.019	38	0.012
195	2.096	0.9481	1.987	167	0.019	39	0.012
200	2.115	0.9484	2.006	206	0.019	40	0.012
205	2.133	0.9488	2.024	166	0.018	41	0.012
210	2.152	0.9491	2.042	165	0.018	42	0.012
215	2.170	0.9495	2.060	207	0.018	43	0.012
220	2.188	0.9498	2.078	164	0.018	44	0.012
225	2.205	0.9502	2.095	163	0.017	45	0.012
230	2.222	0.9505	2.112	208	0.017	46	0.012
235	2.239	0.9509	2.129	162	0.017	47	0.012
240	2.256	0.9513	2.146	161	0.017	48	0.012
245	2.273	0.9516	2.163	209	0.017	49	0.012
250	2.289	0.9520	2.179	160	0.016	50	0.012
255	2.305	0.9523	2.195	159	0.016	51	0.012

10 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	2.321	0.9527	2.211	210	0.016	52	0.012
265	2.337	0.9530	2.227	158	0.016	53	0.012
270	2.352	0.9534	2.243	157	0.016	54	0.012
275	2.368	0.9537	2.258	211	0.015	55	0.012
280	2.383	0.9541	2.274	156	0.015	56	0.012
285	2.398	0.9544	2.289	155	0.015	57	0.012
290	2.413	0.9548	2.304	212	0.015	58	0.012
295	2.428	0.9551	2.319	154	0.015	59	0.013
300	2.442	0.9555	2.333	153	0.015	60	0.013
305	2.457	0.9559	2.348	213	0.015	61	0.013
310	2.471	0.9562	2.363	152	0.014	62	0.013
315	2.485	0.9566	2.377	151	0.014	63	0.013
320	2.499	0.9569	2.391	214	0.014	64	0.013
325	2.513	0.9573	2.405	150	0.014	65	0.013
330	2.526	0.9576	2.419	149	0.014	66	0.013
335	2.540	0.9580	2.433	215	0.014	67	0.013
340	2.553	0.9583	2.447	148	0.014	68	0.013
345	2.566	0.9587	2.460	147	0.014	69	0.013
350	2.580	0.9590	2.474	216	0.014	70	0.013
355	2.593	0.9594	2.487	146	0.013	71	0.013
360	**2.600**	**0.9598**	2.495	145	0.008	72	0.013
365	2.620	0.9598	2.515	217	0.019	73	0.013
370	2.640	0.9599	2.534	144	0.019	74	0.013
375	2.659	0.9599	2.553	143	0.019	75	0.013
380	2.679	0.9600	2.572	218	0.019	76	0.013
385	2.698	0.9600	2.591	142	0.019	77	0.013
390	2.718	0.9601	2.609	141	0.019	78	0.013
395	2.737	0.9602	2.628	219	0.019	79	0.013
400	2.756	0.9602	2.646	140	0.019	80	0.013
405	2.775	0.9603	2.665	139	0.018	81	0.013
410	2.794	0.9603	2.683	220	0.018	82	0.014
415	2.813	0.9604	2.701	138	0.018	83	0.014
420	2.832	0.9604	2.720	137	0.018	84	0.014
425	2.850	0.9605	2.738	221	0.018	85	0.014
430	2.869	0.9606	2.756	136	0.018	86	0.014
435	2.887	0.9606	2.773	135	0.018	87	0.014
440	2.905	0.9607	2.791	222	0.018	88	0.014
445	2.924	0.9607	2.809	134	0.018	89	0.014
450	2.942	0.9608	2.826	133	0.018	90	0.014
455	2.960	0.9608	2.844	223	0.018	91	0.014
460	2.978	0.9609	2.861	132	0.017	92	0.014
465	2.996	0.9610	2.879	131	0.017	93	0.014
470	3.013	0.9610	2.896	224	0.017	94	0.014
475	3.031	0.9611	2.913	130	0.017	95	0.014
480	3.049	0.9611	2.930	129	0.017	96	0.014
485	3.066	0.9612	2.947	225	0.017	97	0.014
490	3.084	0.9613	2.964	128	0.017	98	0.014
495	3.101	0.9613	2.981	127	0.017	99	0.015
500	3.118	0.9614	2.998	226	0.017	100	0.015
505	3.136	0.9614	3.015	126	0.017	101	0.015
510	3.153	0.9615	3.031	125	0.017	102	0.015
515	3.170	0.9615	3.048	227	0.017	103	0.015

10 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	3.187	0.9616	3.064	124	0.017	104	0.015
525	3.204	0.9617	3.081	123	0.016	105	0.015
530	3.221	0.9617	3.097	228	0.016	106	0.015
535	3.237	0.9618	3.114	122	0.016	107	0.015
540	3.254	0.9618	3.130	121	0.016	108	0.015
545	3.271	0.9619	3.146	229	0.016	109	0.015
550	3.287	0.9619	3.162	120	0.016	110	0.015
555	3.304	0.9620	3.178	119	0.016	111	0.015
560	3.320	0.9621	3.194	230	0.016	112	0.015
565	3.337	0.9621	3.210	118	0.016	113	0.016
570	3.353	0.9622	3.226	117	0.016	114	0.016
575	3.369	0.9622	3.242	231	0.016	115	0.016
580	3.385	0.9623	3.258	116	0.016	116	0.016
585	3.402	0.9624	3.273	115	0.016	117	0.016
590	3.418	0.9624	3.289	232	0.016	118	0.016
595	3.434	0.9625	3.305	114	0.016	119	0.016
600	3.450	0.9625	3.320	113	0.016	120	0.016
605	3.465	0.9626	3.336	233	0.015	121	0.016
610	3.481	0.9626	3.351	112	0.015	122	0.016
615	3.497	0.9627	3.367	111	0.015	123	0.016
620	3.513	0.9628	3.382	234	0.015	124	0.017
625	3.528	0.9628	3.397	110	0.015	125	0.017
630	3.544	0.9629	3.412	109	0.015	126	0.017
635	3.559	0.9629	3.428	235	0.015	127	0.017
640	3.575	0.9630	3.443	108	0.015	128	0.017
645	3.590	0.9630	3.458	107	0.015	129	0.017
650	3.606	0.9631	3.473	236	0.015	130	0.017
655	3.621	0.9632	3.488	106	0.015	131	0.017
660	3.636	0.9632	3.503	105	0.015	132	0.017
665	3.652	0.9633	3.517	237	0.015	133	0.018
670	3.667	0.9633	3.532	104	0.015	134	0.018
675	3.682	0.9634	3.547	103	0.015	135	0.018
680	3.697	0.9635	3.562	238	0.015	136	0.018
685	3.712	0.9635	3.577	102	0.015	137	0.018
690	3.727	0.9636	3.591	101	0.015	138	0.018
695	3.742	0.9636	3.606	239	0.015	139	0.018
700	3.757	0.9637	3.620	100	0.015	140	0.019
705	3.772	0.9637	3.635	99	0.015	141	0.019
710	3.786	0.9638	3.649	240	0.014	142	0.019
715	3.801	0.9639	3.664	98	0.014	143	0.019
720	3.816	0.9639	3.678	97	0.014	144	0.019
725	3.830	0.9640	3.692	241	0.014	145	0.008
730	3.845	0.9640	3.707	96	0.014	146	0.013
735	3.860	0.9641	3.721	95	0.014	147	0.014
740	3.874	0.9641	3.735	242	0.014	148	0.014
745	3.889	0.9642	3.749	94	0.014	149	0.014
750	3.903	0.9643	3.763	93	0.014	150	0.014
755	3.917	0.9643	3.778	243	0.014	151	0.014
760	3.932	0.9644	3.792	92	0.014	152	0.014
765	3.946	0.9644	3.806	91	0.014	153	0.015
770	3.960	0.9645	3.820	244	0.014	154	0.015
775	3.974	0.9646	3.834	90	0.014	155	0.015

10 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	3.989	0.9646	3.847	89	0.014	156	0.015
785	4.003	0.9647	3.861	245	0.014	157	0.016
790	4.017	0.9647	3.875	88	0.014	158	0.016
795	4.031	0.9648	3.889	87	0.014	159	0.016
800	4.045	0.9648	3.903	246	0.014	160	0.016
805	4.059	0.9649	3.916	86	0.014	161	0.017
810	4.073	0.9650	3.930	85	0.014	162	0.017
815	4.087	0.9650	3.944	247	0.014	163	0.017
820	4.101	0.9651	3.957	84	0.014	164	0.018
825	4.114	0.9651	3.971	83	0.014	165	0.018
830	4.128	0.9652	3.984	248	0.014	166	0.018
835	4.142	0.9652	3.998	82	0.014	167	0.019
840	4.156	0.9653	4.011	81	0.013	168	0.019
845	4.169	0.9654	4.025	249	0.013	169	0.024
850	4.183	0.9654	4.038	80	0.013	170	0.024
855	4.197	0.9655	4.052	79	0.013	171	0.025
860	4.210	0.9655	4.065	250	0.013	172	0.025
865	4.224	0.9656	4.078	78	0.013	173	0.026
870	4.237	0.9657	4.092	77	0.013	174	0.026
875	4.251	0.9657	4.105	251	0.013	175	0.027
880	4.264	0.9658	4.118	76	0.013	176	0.027
885	4.277	0.9658	4.131	75	0.013	177	0.028
890	4.291	0.9659	4.144	252	0.013	178	0.029
895	4.304	0.9659	4.157	74	0.013	179	0.030
900	4.317	0.9660	4.171	73	0.013	180	0.031
905	4.331	0.9661	4.184	253	0.013	181	0.033
910	4.344	0.9661	4.197	72	0.013	182	0.034
915	4.357	0.9662	4.210	71	0.013	183	0.036
920	4.370	0.9662	4.223	254	0.013	184	0.037
925	4.383	0.9663	4.236	70	0.013	185	0.053
930	4.396	0.9663	4.248	69	0.013	186	0.055
935	4.409	0.9664	4.261	255	0.013	187	0.058
940	4.423	0.9665	4.274	68	0.013	188	0.060
945	4.436	0.9665	4.287	67	0.013	189	0.055
950	4.448	0.9666	4.300	256	0.013	190	0.063
955	4.461	0.9666	4.313	66	0.013	191	0.092
960	4.474	0.9667	4.325	65	0.013	192	0.130
965	4.487	0.9668	4.338	257	0.013	193	0.467
970	4.500	0.9668	4.351	64	0.013	194	0.074
975	4.513	0.9669	4.363	63	0.013	195	0.063
980	4.526	0.9669	4.376	258	0.013	196	0.056
985	4.538	0.9670	4.389	62	0.013	197	0.039
990	4.551	0.9670	4.401	61	0.013	198	0.035
995	4.564	0.9671	4.414	259	0.013	199	0.032
1000	4.577	0.9672	4.426	60	0.013	200	0.030
1005	4.589	0.9672	4.439	59	0.013	201	0.028
1010	4.602	0.9673	4.451	260	0.012	202	0.027
1015	4.614	0.9673	4.464	58	0.012	203	0.025
1020	4.627	0.9674	4.476	57	0.012	204	0.025
1025	4.640	0.9674	4.489	261	0.012	205	0.020
1030	4.652	0.9675	4.501	56	0.012	206	0.019
1035	4.665	0.9676	4.513	55	0.012	207	0.018

10 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	4.677	0.9676	4.526	262	0.012	208	0.017
1045	4.689	0.9677	4.538	54	0.012	209	0.017
1050	4.702	0.9677	4.550	53	0.012	210	0.016
1055	4.714	0.9678	4.562	263	0.012	211	0.015
1060	4.727	0.9679	4.575	52	0.012	212	0.015
1065	4.739	0.9679	4.587	51	0.012	213	0.015
1070	4.751	0.9680	4.599	264	0.012	214	0.014
1075	4.763	0.9680	4.611	50	0.012	215	0.014
1080	4.776	0.9681	4.623	49	0.012	216	0.014
1085	4.788	0.9681	4.635	265	0.012	217	0.019
1090	4.800	0.9682	4.648	48	0.012	218	0.019
1095	4.812	0.9683	4.660	47	0.012	219	0.019
1100	4.824	0.9683	4.672	266	0.012	220	0.018
1105	4.837	0.9684	4.684	46	0.012	221	0.018
1110	4.849	0.9684	4.696	45	0.012	222	0.018
1115	4.861	0.9685	4.708	267	0.012	223	0.018
1120	4.873	0.9685	4.720	44	0.012	224	0.017
1125	4.885	0.9686	4.731	43	0.012	225	0.017
1130	4.897	0.9687	4.743	268	0.012	226	0.017
1135	4.909	0.9687	4.755	42	0.012	227	0.017
1140	4.921	0.9688	4.767	41	0.012	228	0.016
1145	4.933	0.9688	4.779	269	0.012	229	0.016
1150	4.945	0.9689	4.791	40	0.012	230	0.016
1155	4.957	0.9690	4.803	39	0.012	231	0.016
1160	4.968	0.9690	4.814	270	0.012	232	0.016
1165	4.980	0.9691	4.826	38	0.012	233	0.015
1170	4.992	0.9691	4.838	37	0.012	234	0.015
1175	5.004	0.9692	4.850	271	0.012	235	0.015
1180	5.016	0.9692	4.861	36	0.012	236	0.015
1185	5.027	0.9693	4.873	35	0.012	237	0.015
1190	5.039	0.9694	4.885	272	0.012	238	0.015
1195	5.051	0.9694	4.896	34	0.012	239	0.015
1200	5.062	0.9695	4.908	33	0.012	240	0.014
1205	5.074	0.9695	4.920	273	0.012	241	0.014
1210	5.086	0.9696	4.931	32	0.012	242	0.014
1215	5.097	0.9696	4.943	31	0.012	243	0.014
1220	5.109	0.9697	4.954	274	0.012	244	0.014
1225	5.121	0.9698	4.966	30	0.012	245	0.014
1230	5.132	0.9698	4.977	29	0.012	246	0.014
1235	5.144	0.9699	4.989	275	0.011	247	0.014
1240	5.155	0.9699	5.000	28	0.011	248	0.014
1245	5.167	0.9700	5.012	27	0.011	249	0.013
1250	5.178	0.9701	5.023	276	0.011	250	0.013
1255	5.190	0.9701	5.035	26	0.011	251	0.013
1260	5.201	0.9702	5.046	25	0.011	252	0.013
1265	5.212	0.9702	5.057	277	0.011	253	0.013
1270	5.224	0.9703	5.069	24	0.011	254	0.013
1275	5.235	0.9703	5.080	23	0.011	255	0.013
1280	5.247	0.9704	5.091	278	0.011	256	0.013
1285	5.258	0.9705	5.103	22	0.011	257	0.013
1290	5.269	0.9705	5.114	21	0.011	258	0.013
1295	5.281	0.9706	5.125	279	0.011	259	0.013

10 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	5.292	0.9706	5.136	20	0.011	260	0.012
1305	5.303	0.9707	5.148	19	0.011	261	0.012
1310	5.314	0.9707	5.159	280	0.011	262	0.012
1315	5.326	0.9708	5.170	18	0.011	263	0.012
1320	5.337	0.9709	5.181	17	0.011	264	0.012
1325	5.348	0.9709	5.192	281	0.011	265	0.012
1330	5.359	0.9710	5.204	16	0.011	266	0.012
1335	5.370	0.9710	5.215	15	0.011	267	0.012
1340	5.381	0.9711	5.226	282	0.011	268	0.012
1345	5.392	0.9712	5.237	14	0.011	269	0.012
1350	5.404	0.9712	5.248	13	0.011	270	0.012
1355	5.415	0.9713	5.259	283	0.011	271	0.012
1360	5.426	0.9713	5.270	12	0.011	272	0.012
1365	5.437	0.9714	5.281	11	0.011	273	0.012
1370	5.448	0.9714	5.292	284	0.011	274	0.012
1375	5.459	0.9715	5.303	10	0.011	275	0.011
1380	5.470	0.9716	5.314	9	0.011	276	0.011
1385	5.481	0.9716	5.325	285	0.011	277	0.011
1390	5.492	0.9717	5.336	8	0.011	278	0.011
1395	5.502	0.9717	5.347	7	0.011	279	0.011
1400	5.513	0.9718	5.358	286	0.011	280	0.011
1405	5.524	0.9718	5.369	6	0.011	281	0.011
1410	5.535	0.9719	5.380	5	0.011	282	0.011
1415	5.546	0.9720	5.390	287	0.011	283	0.011
1420	5.557	0.9720	5.401	4	0.011	284	0.011
1425	5.568	0.9721	5.412	3	0.011	285	0.011
1430	5.578	0.9721	5.423	288	0.011	286	0.011
1435	5.589	0.9722	5.434	2	0.011	287	0.011
1440	5.600	**0.9723**	5.445	1	0.011	288	0.011

5 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.483	0.8175	0.395	193	0.395	1	0.008
10	0.618	0.8175	0.505	192	0.110	2	0.008
15	0.713	0.8175	0.583	191	0.078	3	0.008
20	0.790	0.8175	0.646	194	0.063	4	0.008
25	0.855	0.8175	0.699	190	0.053	5	0.008
30	0.912	**0.8175**	0.746	189	0.047	6	0.008
35	0.964	0.8295	0.799	195	0.054	7	0.008
40	1.011	0.8415	0.850	188	0.051	8	0.008
45	1.054	0.8535	0.899	187	0.049	9	0.008
50	1.094	0.8655	0.947	196	0.047	10	0.008
55	1.132	0.8775	0.993	186	0.046	11	0.008
60	1.167	**0.8895**	1.038	185	0.045	12	0.008
65	1.201	0.8919	1.071	197	0.033	13	0.008
70	1.233	0.8943	1.102	184	0.032	14	0.008
75	1.263	0.8967	1.133	183	0.030	15	0.008
80	1.293	0.8991	1.162	198	0.029	16	0.008
85	1.321	0.9015	1.191	182	0.028	17	0.008
90	1.348	0.9039	1.218	181	0.028	18	0.008
95	1.374	0.9063	1.245	199	0.027	19	0.008
100	1.399	0.9087	1.271	180	0.026	20	0.008
105	1.424	0.9111	1.297	179	0.026	21	0.008
110	1.447	0.9135	1.322	200	0.025	22	0.008
115	1.470	0.9159	1.347	178	0.025	23	0.008
120	1.493	0.9183	1.371	177	0.024	24	0.008
125	1.514	0.9206	1.394	201	0.024	25	0.008
130	1.536	0.9230	1.417	176	0.023	26	0.008
135	1.556	0.9254	1.440	175	0.023	27	0.008
140	1.577	0.9278	1.463	202	0.022	28	0.008
145	1.596	0.9302	1.485	174	0.022	29	0.008
150	1.616	0.9326	1.507	173	0.022	30	0.008
155	1.635	0.9350	1.528	203	0.022	31	0.008
160	1.653	0.9374	1.550	172	0.021	32	0.008
165	1.671	0.9398	1.571	171	0.021	33	0.008
170	1.689	0.9422	1.591	204	0.021	34	0.008
175	1.707	0.9446	1.612	170	0.021	35	0.008
180	1.724	**0.9470**	1.632	169	0.020	36	0.008
185	1.741	0.9474	1.649	205	0.017	37	0.008
190	1.757	0.9477	1.665	168	0.016	38	0.008
195	1.773	0.9481	1.681	167	0.016	39	0.009
200	1.789	0.9484	1.697	206	0.016	40	0.009
205	1.805	0.9488	1.713	166	0.016	41	0.009
210	1.821	0.9491	1.728	165	0.015	42	0.009
215	1.836	0.9495	1.743	207	0.015	43	0.009
220	1.851	0.9498	1.758	164	0.015	44	0.009
225	1.866	0.9502	1.773	163	0.015	45	0.009
230	1.880	0.9505	1.787	208	0.015	46	0.009
235	1.895	0.9509	1.802	162	0.014	47	0.009
240	1.909	0.9513	1.816	161	0.014	48	0.009
245	1.923	0.9516	1.830	209	0.014	49	0.009
250	1.937	0.9520	1.844	160	0.014	50	0.009
255	1.951	0.9523	1.858	159	0.014	51	0.009

5 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.964	0.9527	1.871	210	0.014	52	0.009
265	1.977	0.9530	1.885	158	0.013	53	0.009
270	1.991	0.9534	1.898	157	0.013	54	0.009
275	2.004	0.9537	1.911	211	0.013	55	0.009
280	2.016	0.9541	1.924	156	0.013	56	0.009
285	2.029	0.9544	1.937	155	0.013	57	0.009
290	2.042	0.9548	1.949	212	0.013	58	0.009
295	2.054	0.9551	1.962	154	0.013	59	0.009
300	2.066	0.9555	1.974	153	0.012	60	0.009
305	2.079	0.9559	1.987	213	0.012	61	0.009
310	2.091	0.9562	1.999	152	0.012	62	0.009
315	2.103	0.9566	2.011	151	0.012	63	0.009
320	2.114	0.9569	2.023	214	0.012	64	0.009
325	2.126	0.9573	2.035	150	0.012	65	0.009
330	2.138	0.9576	2.047	149	0.012	66	0.009
335	2.149	0.9580	2.059	215	0.012	67	0.009
340	2.160	0.9583	2.070	148	0.012	68	0.009
345	2.172	0.9587	2.082	147	0.012	69	0.009
350	2.183	0.9590	2.093	216	0.011	70	0.009
355	2.194	0.9594	2.105	146	0.011	71	0.009
360	**2.200**	**0.9598**	2.111	145	0.007	72	0.009
365	2.215	0.9598	2.126	217	0.015	73	0.010
370	2.230	0.9599	2.141	144	0.015	74	0.010
375	2.245	0.9599	2.155	143	0.015	75	0.010
380	2.260	0.9600	2.170	218	0.014	76	0.010
385	2.275	0.9600	2.184	142	0.014	77	0.010
390	2.290	0.9601	2.198	141	0.014	78	0.010
395	2.304	0.9602	2.213	219	0.014	79	0.010
400	2.319	0.9602	2.227	140	0.014	80	0.010
405	2.333	0.9603	2.241	139	0.014	81	0.010
410	2.348	0.9603	2.255	220	0.014	82	0.010
415	2.362	0.9604	2.269	138	0.014	83	0.010
420	2.376	0.9604	2.282	137	0.014	84	0.010
425	2.390	0.9605	2.296	221	0.014	85	0.010
430	2.404	0.9606	2.310	136	0.014	86	0.010
435	2.418	0.9606	2.323	135	0.014	87	0.010
440	2.432	0.9607	2.337	222	0.013	88	0.010
445	2.446	0.9607	2.350	134	0.013	89	0.010
450	2.460	0.9608	2.363	133	0.013	90	0.010
455	2.473	0.9608	2.376	223	0.013	91	0.010
460	2.487	0.9609	2.390	132	0.013	92	0.010
465	2.500	0.9610	2.403	131	0.013	93	0.010
470	2.514	0.9610	2.416	224	0.013	94	0.010
475	2.527	0.9611	2.429	130	0.013	95	0.011
480	2.540	0.9611	2.442	129	0.013	96	0.011
485	2.554	0.9612	2.454	225	0.013	97	0.011
490	2.567	0.9613	2.467	128	0.013	98	0.011
495	2.580	0.9613	2.480	127	0.013	99	0.011
500	2.593	0.9614	2.493	226	0.013	100	0.011
505	2.606	0.9614	2.505	126	0.013	101	0.011
510	2.619	0.9615	2.518	125	0.013	102	0.011
515	2.631	0.9615	2.530	227	0.012	103	0.011

5 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	2.644	0.9616	2.543	124	0.012	104	0.011
525	2.657	0.9617	2.555	123	0.012	105	0.011
530	2.669	0.9617	2.567	228	0.012	106	0.011
535	2.682	0.9618	2.579	122	0.012	107	0.011
540	2.694	0.9618	2.592	121	0.012	108	0.011
545	2.707	0.9619	2.604	229	0.012	109	0.011
550	2.719	0.9619	2.616	120	0.012	110	0.011
555	2.732	0.9620	2.628	119	0.012	111	0.011
560	2.744	0.9621	2.640	230	0.012	112	0.011
565	2.756	0.9621	2.652	118	0.012	113	0.012
570	2.768	0.9622	2.664	117	0.012	114	0.012
575	2.780	0.9622	2.675	231	0.012	115	0.012
580	2.792	0.9623	2.687	116	0.012	116	0.012
585	2.804	0.9624	2.699	115	0.012	117	0.012
590	2.816	0.9624	2.711	232	0.012	118	0.012
595	2.828	0.9625	2.722	114	0.012	119	0.012
600	2.840	0.9625	2.734	113	0.012	120	0.012
605	2.852	0.9626	2.745	233	0.012	121	0.012
610	2.864	0.9626	2.757	112	0.011	122	0.012
615	2.875	0.9627	2.768	111	0.011	123	0.012
620	2.887	0.9628	2.780	234	0.011	124	0.012
625	2.899	0.9628	2.791	110	0.011	125	0.013
630	2.910	0.9629	2.802	109	0.011	126	0.013
635	2.922	0.9629	2.814	235	0.011	127	0.013
640	2.933	0.9630	2.825	108	0.011	128	0.013
645	2.945	0.9630	2.836	107	0.011	129	0.013
650	2.956	0.9631	2.847	236	0.011	130	0.013
655	2.968	0.9632	2.858	106	0.011	131	0.013
660	2.979	0.9632	2.869	105	0.011	132	0.013
665	2.990	0.9633	2.880	237	0.011	133	0.013
670	3.001	0.9633	2.891	104	0.011	134	0.013
675	3.012	0.9634	2.902	103	0.011	135	0.014
680	3.024	0.9635	2.913	238	0.011	136	0.014
685	3.035	0.9635	2.924	102	0.011	137	0.014
690	3.046	0.9636	2.935	101	0.011	138	0.014
695	3.057	0.9636	2.946	239	0.011	139	0.014
700	3.068	0.9637	2.956	100	0.011	140	0.014
705	3.079	0.9637	2.967	99	0.011	141	0.014
710	3.090	0.9638	2.978	240	0.011	142	0.014
715	3.100	0.9639	2.988	98	0.011	143	0.015
720	3.111	0.9639	2.999	97	0.011	144	0.015
725	3.122	0.9640	3.010	241	0.011	145	0.007
730	3.133	0.9640	3.020	96	0.011	146	0.011
735	3.144	0.9641	3.031	95	0.011	147	0.012
740	3.154	0.9641	3.041	242	0.010	148	0.012
745	3.165	0.9642	3.052	94	0.010	149	0.012
750	3.175	0.9643	3.062	93	0.010	150	0.012
755	3.186	0.9643	3.072	243	0.010	151	0.012
760	3.197	0.9644	3.083	92	0.010	152	0.012
765	3.207	0.9644	3.093	91	0.010	153	0.012
770	3.217	0.9645	3.103	244	0.010	154	0.013
775	3.228	0.9646	3.113	90	0.010	155	0.013

5 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	3.238	0.9646	3.124	89	0.010	156	0.013
785	3.249	0.9647	3.134	245	0.010	157	0.013
790	3.259	0.9647	3.144	88	0.010	158	0.013
795	3.269	0.9648	3.154	87	0.010	159	0.014
800	3.280	0.9648	3.164	246	0.010	160	0.014
805	3.290	0.9649	3.174	86	0.010	161	0.014
810	3.300	0.9650	3.184	85	0.010	162	0.014
815	3.310	0.9650	3.194	247	0.010	163	0.015
820	3.320	0.9651	3.204	84	0.010	164	0.015
825	3.330	0.9651	3.214	83	0.010	165	0.015
830	3.340	0.9652	3.224	248	0.010	166	0.016
835	3.351	0.9652	3.234	82	0.010	167	0.016
840	3.361	0.9653	3.244	81	0.010	168	0.016
845	3.371	0.9654	3.254	249	0.010	169	0.020
850	3.380	0.9654	3.264	80	0.010	170	0.021
855	3.390	0.9655	3.273	79	0.010	171	0.021
860	3.400	0.9655	3.283	250	0.010	172	0.021
865	3.410	0.9656	3.293	78	0.010	173	0.022
870	3.420	0.9657	3.303	77	0.010	174	0.022
875	3.430	0.9657	3.312	251	0.010	175	0.023
880	3.440	0.9658	3.322	76	0.010	176	0.023
885	3.449	0.9658	3.332	75	0.010	177	0.024
890	3.459	0.9659	3.341	252	0.010	178	0.025
895	3.469	0.9659	3.351	74	0.010	179	0.026
900	3.479	0.9660	3.360	73	0.010	180	0.026
905	3.488	0.9661	3.370	253	0.010	181	0.028
910	3.498	0.9661	3.379	72	0.009	182	0.028
915	3.507	0.9662	3.389	71	0.009	183	0.030
920	3.517	0.9662	3.398	254	0.009	184	0.032
925	3.526	0.9663	3.408	70	0.009	185	0.045
930	3.536	0.9663	3.417	69	0.009	186	0.046
935	3.545	0.9664	3.426	255	0.009	187	0.049
940	3.555	0.9665	3.436	68	0.009	188	0.051
945	3.564	0.9665	3.445	67	0.009	189	0.047
950	3.574	0.9666	3.454	256	0.009	190	0.053
955	3.583	0.9666	3.464	66	0.009	191	0.078
960	3.593	0.9667	3.473	65	0.009	192	0.110
965	3.602	0.9668	3.482	257	0.009	193	0.395
970	3.611	0.9668	3.491	64	0.009	194	0.063
975	3.621	0.9669	3.501	63	0.009	195	0.054
980	3.630	0.9669	3.510	258	0.009	196	0.047
985	3.639	0.9670	3.519	62	0.009	197	0.033
990	3.648	0.9670	3.528	61	0.009	198	0.029
995	3.657	0.9671	3.537	259	0.009	199	0.027
1000	3.667	0.9672	3.546	60	0.009	200	0.025
1005	3.676	0.9672	3.555	59	0.009	201	0.024
1010	3.685	0.9673	3.564	260	0.009	202	0.022
1015	3.694	0.9673	3.573	58	0.009	203	0.022
1020	3.703	0.9674	3.582	57	0.009	204	0.021
1025	3.712	0.9674	3.591	261	0.009	205	0.017
1030	3.721	0.9675	3.600	56	0.009	206	0.016
1035	3.730	0.9676	3.609	55	0.009	207	0.015

5 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	3.739	0.9676	3.618	262	0.009	208	0.015
1045	3.748	0.9677	3.627	54	0.009	209	0.014
1050	3.757	0.9677	3.636	53	0.009	210	0.014
1055	3.766	0.9678	3.645	263	0.009	211	0.013
1060	3.775	0.9679	3.654	52	0.009	212	0.013
1065	3.784	0.9679	3.663	51	0.009	213	0.012
1070	3.793	0.9680	3.671	264	0.009	214	0.012
1075	3.802	0.9680	3.680	50	0.009	215	0.012
1080	3.811	0.9681	3.689	49	0.009	216	0.011
1085	3.819	0.9681	3.698	265	0.009	217	0.015
1090	3.828	0.9682	3.706	48	0.009	218	0.014
1095	3.837	0.9683	3.715	47	0.009	219	0.014
1100	3.846	0.9683	3.724	266	0.009	220	0.014
1105	3.854	0.9684	3.732	46	0.009	221	0.014
1110	3.863	0.9684	3.741	45	0.009	222	0.013
1115	3.872	0.9685	3.750	267	0.009	223	0.013
1120	3.880	0.9685	3.758	44	0.009	224	0.013
1125	3.889	0.9686	3.767	43	0.009	225	0.013
1130	3.898	0.9687	3.776	268	0.009	226	0.013
1135	3.906	0.9687	3.784	42	0.009	227	0.012
1140	3.915	0.9688	3.793	41	0.009	228	0.012
1145	3.924	0.9688	3.801	269	0.009	229	0.012
1150	3.932	0.9689	3.810	40	0.009	230	0.012
1155	3.941	0.9690	3.818	39	0.009	231	0.012
1160	3.949	0.9690	3.827	270	0.008	232	0.012
1165	3.958	0.9691	3.835	38	0.008	233	0.012
1170	3.966	0.9691	3.844	37	0.008	234	0.011
1175	3.975	0.9692	3.852	271	0.008	235	0.011
1180	3.983	0.9692	3.861	36	0.008	236	0.011
1185	3.991	0.9693	3.869	35	0.008	237	0.011
1190	4.000	0.9694	3.877	272	0.008	238	0.011
1195	4.008	0.9694	3.886	34	0.008	239	0.011
1200	4.017	0.9695	3.894	33	0.008	240	0.011
1205	4.025	0.9695	3.902	273	0.008	241	0.011
1210	4.033	0.9696	3.911	32	0.008	242	0.010
1215	4.042	0.9696	3.919	31	0.008	243	0.010
1220	4.050	0.9697	3.927	274	0.008	244	0.010
1225	4.058	0.9698	3.936	30	0.008	245	0.010
1230	4.067	0.9698	3.944	29	0.008	246	0.010
1235	4.075	0.9699	3.952	275	0.008	247	0.010
1240	4.083	0.9699	3.960	28	0.008	248	0.010
1245	4.091	0.9700	3.968	27	0.008	249	0.010
1250	4.099	0.9701	3.977	276	0.008	250	0.010
1255	4.108	0.9701	3.985	26	0.008	251	0.010
1260	4.116	0.9702	3.993	25	0.008	252	0.010
1265	4.124	0.9702	4.001	277	0.008	253	0.010
1270	4.132	0.9703	4.009	24	0.008	254	0.009
1275	4.140	0.9703	4.017	23	0.008	255	0.009
1280	4.148	0.9704	4.026	278	0.008	256	0.009
1285	4.156	0.9705	4.034	22	0.008	257	0.009
1290	4.165	0.9705	4.042	21	0.008	258	0.009
1295	4.173	0.9706	4.050	279	0.008	259	0.009

5 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	4.181	0.9706	4.058	20	0.008	260	0.009
1305	4.189	0.9707	4.066	19	0.008	261	0.009
1310	4.197	0.9707	4.074	280	0.008	262	0.009
1315	4.205	0.9708	4.082	18	0.008	263	0.009
1320	4.213	0.9709	4.090	17	0.008	264	0.009
1325	4.221	0.9709	4.098	281	0.008	265	0.009
1330	4.229	0.9710	4.106	16	0.008	266	0.009
1335	4.237	0.9710	4.114	15	0.008	267	0.009
1340	4.244	0.9711	4.122	282	0.008	268	0.009
1345	4.252	0.9712	4.130	14	0.008	269	0.009
1350	4.260	0.9712	4.138	13	0.008	270	0.008
1355	4.268	0.9713	4.146	283	0.008	271	0.008
1360	4.276	0.9713	4.153	12	0.008	272	0.008
1365	4.284	0.9714	4.161	11	0.008	273	0.008
1370	4.292	0.9714	4.169	284	0.008	274	0.008
1375	4.300	0.9715	4.177	10	0.008	275	0.008
1380	4.307	0.9716	4.185	9	0.008	276	0.008
1385	4.315	0.9716	4.193	285	0.008	277	0.008
1390	4.323	0.9717	4.200	8	0.008	278	0.008
1395	4.331	0.9717	4.208	7	0.008	279	0.008
1400	4.338	0.9718	4.216	286	0.008	280	0.008
1405	4.346	0.9718	4.224	6	0.008	281	0.008
1410	4.354	0.9719	4.232	5	0.008	282	0.008
1415	4.362	0.9720	4.239	287	0.008	283	0.008
1420	4.369	0.9720	4.247	4	0.008	284	0.008
1425	4.377	0.9721	4.255	3	0.008	285	0.008
1430	4.385	0.9721	4.263	288	0.008	286	0.008
1435	4.392	0.9722	4.270	2	0.008	287	0.008
1440	4.400	**0.9723**	4.278	1	0.008	288	0.008

2 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.395	0.8175	0.323	193	0.323	1	0.005
10	0.505	0.8175	0.413	192	0.090	2	0.005
15	0.584	0.8175	0.477	191	0.064	3	0.005
20	0.646	0.8175	0.529	194	0.051	4	0.006
25	0.700	0.8175	0.572	190	0.044	5	0.006
30	0.747	**0.8175**	0.610	189	0.038	6	0.006
35	0.789	0.8295	0.654	195	0.044	7	0.006
40	0.827	0.8415	0.696	188	0.042	8	0.006
45	0.862	0.8535	0.736	187	0.040	9	0.006
50	0.895	0.8655	0.775	196	0.039	10	0.006
55	0.926	0.8775	0.812	186	0.038	11	0.006
60	0.955	**0.8895**	0.849	185	0.037	12	0.006
65	0.982	0.8919	0.876	197	0.027	13	0.006
70	1.009	0.8943	0.902	184	0.026	14	0.006
75	1.034	0.8967	0.927	183	0.025	15	0.006
80	1.058	0.8991	0.951	198	0.024	16	0.006
85	1.081	0.9015	0.974	182	0.023	17	0.006
90	1.103	0.9039	0.997	181	0.023	18	0.006
95	1.124	0.9063	1.019	199	0.022	19	0.006
100	1.145	0.9087	1.040	180	0.021	20	0.006
105	1.165	0.9111	1.061	179	0.021	21	0.006
110	1.184	0.9135	1.082	200	0.021	22	0.006
115	1.203	0.9159	1.102	178	0.020	23	0.006
120	1.221	0.9183	1.121	177	0.020	24	0.006
125	1.239	0.9206	1.141	201	0.019	25	0.006
130	1.256	0.9230	1.160	176	0.019	26	0.006
135	1.273	0.9254	1.178	175	0.019	27	0.006
140	1.290	0.9278	1.197	202	0.018	28	0.006
145	1.306	0.9302	1.215	174	0.018	29	0.006
150	1.322	0.9326	1.233	173	0.018	30	0.006
155	1.337	0.9350	1.250	203	0.018	31	0.006
160	1.353	0.9374	1.268	172	0.017	32	0.006
165	1.367	0.9398	1.285	171	0.017	33	0.006
170	1.382	0.9422	1.302	204	0.017	34	0.006
175	1.396	0.9446	1.319	170	0.017	35	0.006
180	1.410	**0.9470**	1.336	169	0.017	36	0.006
185	1.424	0.9474	1.349	205	0.014	37	0.006
190	1.438	0.9477	1.362	168	0.013	38	0.006
195	1.451	0.9481	1.376	167	0.013	39	0.006
200	1.464	0.9484	1.389	206	0.013	40	0.006
205	1.477	0.9488	1.401	166	0.013	41	0.006
210	1.490	0.9491	1.414	165	0.013	42	0.006
215	1.502	0.9495	1.426	207	0.012	43	0.006
220	1.514	0.9498	1.438	164	0.012	44	0.006
225	1.527	0.9502	1.451	163	0.012	45	0.006
230	1.539	0.9505	1.462	208	0.012	46	0.006
235	1.550	0.9509	1.474	162	0.012	47	0.006
240	1.562	0.9513	1.486	161	0.012	48	0.006
245	1.573	0.9516	1.497	209	0.011	49	0.006
250	1.585	0.9520	1.509	160	0.011	50	0.006
255	1.596	0.9523	1.520	159	0.011	51	0.006

2 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.607	0.9527	1.531	210	0.011	52	0.006
265	1.618	0.9530	1.542	158	0.011	53	0.006
270	1.629	0.9534	1.553	157	0.011	54	0.006
275	1.639	0.9537	1.563	211	0.011	55	0.006
280	1.650	0.9541	1.574	156	0.011	56	0.006
285	1.660	0.9544	1.585	155	0.011	57	0.006
290	1.670	0.9548	1.595	212	0.010	58	0.007
295	1.681	0.9551	1.605	154	0.010	59	0.007
300	1.691	0.9555	1.615	153	0.010	60	0.007
305	1.701	0.9559	1.626	213	0.010	61	0.007
310	1.711	0.9562	1.636	152	0.010	62	0.007
315	1.720	0.9566	1.646	151	0.010	63	0.007
320	1.730	0.9569	1.655	214	0.010	64	0.007
325	1.739	0.9573	1.665	150	0.010	65	0.007
330	1.749	0.9576	1.675	149	0.010	66	0.007
335	1.758	0.9580	1.684	215	0.010	67	0.007
340	1.768	0.9583	1.694	148	0.010	68	0.007
345	1.777	0.9587	1.703	147	0.009	69	0.007
350	1.786	0.9590	1.713	216	0.009	70	0.007
355	1.795	0.9594	1.722	146	0.009	71	0.007
360	**1.800**	**0.9598**	1.728	145	0.006	72	0.007
365	1.811	0.9598	1.739	217	0.011	73	0.007
370	1.823	0.9599	1.750	144	0.011	74	0.007
375	1.834	0.9599	1.761	143	0.011	75	0.007
380	1.845	0.9600	1.771	218	0.011	76	0.007
385	1.856	0.9600	1.782	142	0.011	77	0.007
390	1.867	0.9601	1.793	141	0.011	78	0.007
395	1.878	0.9602	1.803	219	0.011	79	0.007
400	1.889	0.9602	1.814	140	0.011	80	0.007
405	1.900	0.9603	1.824	139	0.010	81	0.007
410	1.911	0.9603	1.835	220	0.010	82	0.007
415	1.921	0.9604	1.845	138	0.010	83	0.007
420	1.932	0.9604	1.855	137	0.010	84	0.007
425	1.942	0.9605	1.866	221	0.010	85	0.007
430	1.953	0.9606	1.876	136	0.010	86	0.007
435	1.963	0.9606	1.886	135	0.010	87	0.007
440	1.974	0.9607	1.896	222	0.010	88	0.007
445	1.984	0.9607	1.906	134	0.010	89	0.007
450	1.994	0.9608	1.916	133	0.010	90	0.007
455	2.004	0.9608	1.926	223	0.010	91	0.008
460	2.014	0.9609	1.935	132	0.010	92	0.008
465	2.024	0.9610	1.945	131	0.010	93	0.008
470	2.034	0.9610	1.955	224	0.010	94	0.008
475	2.044	0.9611	1.965	130	0.010	95	0.008
480	2.054	0.9611	1.974	129	0.010	96	0.008
485	2.064	0.9612	1.984	225	0.010	97	0.008
490	2.073	0.9613	1.993	128	0.009	98	0.008
495	2.083	0.9613	2.003	127	0.009	99	0.008
500	2.093	0.9614	2.012	226	0.009	100	0.008
505	2.102	0.9614	2.021	126	0.009	101	0.008
510	2.112	0.9615	2.031	125	0.009	102	0.008
515	2.121	0.9615	2.040	227	0.009	103	0.008

2 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	2.131	0.9616	2.049	124	0.009	104	0.008
525	2.140	0.9617	2.058	123	0.009	105	0.008
530	2.149	0.9617	2.067	228	0.009	106	0.008
535	2.159	0.9618	2.076	122	0.009	107	0.008
540	2.168	0.9618	2.085	121	0.009	108	0.008
545	2.177	0.9619	2.094	229	0.009	109	0.008
550	2.186	0.9619	2.103	120	0.009	110	0.008
555	2.195	0.9620	2.112	119	0.009	111	0.008
560	2.204	0.9621	2.121	230	0.009	112	0.008
565	2.213	0.9621	2.130	118	0.009	113	0.009
570	2.222	0.9622	2.138	117	0.009	114	0.009
575	2.231	0.9622	2.147	231	0.009	115	0.009
580	2.240	0.9623	2.156	116	0.009	116	0.009
585	2.249	0.9624	2.164	115	0.009	117	0.009
590	2.258	0.9624	2.173	232	0.009	118	0.009
595	2.267	0.9625	2.182	114	0.009	119	0.009
600	2.275	0.9625	2.190	113	0.009	120	0.009
605	2.284	0.9626	2.199	233	0.008	121	0.009
610	2.293	0.9626	2.207	112	0.008	122	0.009
615	2.301	0.9627	2.215	111	0.008	123	0.009
620	2.310	0.9628	2.224	234	0.008	124	0.009
625	2.318	0.9628	2.232	110	0.008	125	0.009
630	2.327	0.9629	2.240	109	0.008	126	0.009
635	2.335	0.9629	2.249	235	0.008	127	0.009
640	2.344	0.9630	2.257	108	0.008	128	0.009
645	2.352	0.9630	2.265	107	0.008	129	0.010
650	2.360	0.9631	2.273	236	0.008	130	0.010
655	2.369	0.9632	2.282	106	0.008	131	0.010
660	2.377	0.9632	2.290	105	0.008	132	0.010
665	2.385	0.9633	2.298	237	0.008	133	0.010
670	2.394	0.9633	2.306	104	0.008	134	0.010
675	2.402	0.9634	2.314	103	0.008	135	0.010
680	2.410	0.9635	2.322	238	0.008	136	0.010
685	2.418	0.9635	2.330	102	0.008	137	0.010
690	2.426	0.9636	2.338	101	0.008	138	0.010
695	2.434	0.9636	2.346	239	0.008	139	0.010
700	2.442	0.9637	2.353	100	0.008	140	0.011
705	2.450	0.9637	2.361	99	0.008	141	0.011
710	2.458	0.9638	2.369	240	0.008	142	0.011
715	2.466	0.9639	2.377	98	0.008	143	0.011
720	2.474	0.9639	2.385	97	0.008	144	0.011
725	2.482	0.9640	2.392	241	0.008	145	0.006
730	2.490	0.9640	2.400	96	0.008	146	0.009
735	2.497	0.9641	2.408	95	0.008	147	0.009
740	2.505	0.9641	2.415	242	0.008	148	0.010
745	2.513	0.9642	2.423	94	0.008	149	0.010
750	2.521	0.9643	2.431	93	0.008	150	0.010
755	2.528	0.9643	2.438	243	0.008	151	0.010
760	2.536	0.9644	2.446	92	0.008	152	0.010
765	2.544	0.9644	2.453	91	0.008	153	0.010
770	2.551	0.9645	2.461	244	0.007	154	0.010
775	2.559	0.9646	2.468	90	0.007	155	0.011

2 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	2.566	0.9646	2.476	89	0.007	156	0.011
785	2.574	0.9647	2.483	245	0.007	157	0.011
790	2.581	0.9647	2.490	88	0.007	158	0.011
795	2.589	0.9648	2.498	87	0.007	159	0.011
800	2.596	0.9648	2.505	246	0.007	160	0.011
805	2.604	0.9649	2.512	86	0.007	161	0.012
810	2.611	0.9650	2.520	85	0.007	162	0.012
815	2.619	0.9650	2.527	247	0.007	163	0.012
820	2.626	0.9651	2.534	84	0.007	164	0.012
825	2.633	0.9651	2.541	83	0.007	165	0.013
830	2.641	0.9652	2.549	248	0.007	166	0.013
835	2.648	0.9652	2.556	82	0.007	167	0.013
840	2.655	0.9653	2.563	81	0.007	168	0.013
845	2.662	0.9654	2.570	249	0.007	169	0.017
850	2.670	0.9654	2.577	80	0.007	170	0.017
855	2.677	0.9655	2.584	79	0.007	171	0.017
860	2.684	0.9655	2.591	250	0.007	172	0.017
865	2.691	0.9656	2.599	78	0.007	173	0.018
870	2.698	0.9657	2.606	77	0.007	174	0.018
875	2.705	0.9657	2.613	251	0.007	175	0.019
880	2.712	0.9658	2.620	76	0.007	176	0.019
885	2.719	0.9658	2.627	75	0.007	177	0.020
890	2.727	0.9659	2.634	252	0.007	178	0.020
895	2.734	0.9659	2.640	74	0.007	179	0.021
900	2.741	0.9660	2.647	73	0.007	180	0.021
905	2.748	0.9661	2.654	253	0.007	181	0.023
910	2.754	0.9661	2.661	72	0.007	182	0.023
915	2.761	0.9662	2.668	71	0.007	183	0.025
920	2.768	0.9662	2.675	254	0.007	184	0.026
925	2.775	0.9663	2.682	70	0.007	185	0.037
930	2.782	0.9663	2.688	69	0.007	186	0.038
935	2.789	0.9664	2.695	255	0.007	187	0.040
940	2.796	0.9665	2.702	68	0.007	188	0.042
945	2.803	0.9665	2.709	67	0.007	189	0.038
950	2.809	0.9666	2.715	256	0.007	190	0.044
955	2.816	0.9666	2.722	66	0.007	191	0.064
960	2.823	0.9667	2.729	65	0.007	192	0.090
965	2.830	0.9668	2.736	257	0.007	193	0.323
970	2.836	0.9668	2.742	64	0.007	194	0.051
975	2.843	0.9669	2.749	63	0.007	195	0.044
980	2.850	0.9669	2.755	258	0.007	196	0.039
985	2.856	0.9670	2.762	62	0.007	197	0.027
990	2.863	0.9670	2.769	61	0.007	198	0.024
995	2.870	0.9671	2.775	259	0.007	199	0.022
1000	2.876	0.9672	2.782	60	0.007	200	0.021
1005	2.883	0.9672	2.788	59	0.007	201	0.019
1010	2.889	0.9673	2.795	260	0.007	202	0.018
1015	2.896	0.9673	2.801	58	0.007	203	0.018
1020	2.903	0.9674	2.808	57	0.006	204	0.017
1025	2.909	0.9674	2.814	261	0.006	205	0.014
1030	2.916	0.9675	2.821	56	0.006	206	0.013
1035	2.922	0.9676	2.827	55	0.006	207	0.012

2 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	2.928	0.9676	2.834	262	0.006	208	0.012
1045	2.935	0.9677	2.840	54	0.006	209	0.011
1050	2.941	0.9677	2.846	53	0.006	210	0.011
1055	2.948	0.9678	2.853	263	0.006	211	0.011
1060	2.954	0.9679	2.859	52	0.006	212	0.010
1065	2.961	0.9679	2.866	51	0.006	213	0.010
1070	2.967	0.9680	2.872	264	0.006	214	0.010
1075	2.973	0.9680	2.878	50	0.006	215	0.010
1080	2.980	0.9681	2.885	49	0.006	216	0.009
1085	2.986	0.9681	2.891	265	0.006	217	0.011
1090	2.992	0.9682	2.897	48	0.006	218	0.011
1095	2.999	0.9683	2.903	47	0.006	219	0.011
1100	3.005	0.9683	2.910	266	0.006	220	0.010
1105	3.011	0.9684	2.916	46	0.006	221	0.010
1110	3.017	0.9684	2.922	45	0.006	222	0.010
1115	3.024	0.9685	2.928	267	0.006	223	0.010
1120	3.030	0.9685	2.934	44	0.006	224	0.010
1125	3.036	0.9686	2.941	43	0.006	225	0.010
1130	3.042	0.9687	2.947	268	0.006	226	0.009
1135	3.048	0.9687	2.953	42	0.006	227	0.009
1140	3.054	0.9688	2.959	41	0.006	228	0.009
1145	3.061	0.9688	2.965	269	0.006	229	0.009
1150	3.067	0.9689	2.971	40	0.006	230	0.009
1155	3.073	0.9690	2.977	39	0.006	231	0.009
1160	3.079	0.9690	2.984	270	0.006	232	0.009
1165	3.085	0.9691	2.990	38	0.006	233	0.008
1170	3.091	0.9691	2.996	37	0.006	234	0.008
1175	3.097	0.9692	3.002	271	0.006	235	0.008
1180	3.103	0.9692	3.008	36	0.006	236	0.008
1185	3.109	0.9693	3.014	35	0.006	237	0.008
1190	3.115	0.9694	3.020	272	0.006	238	0.008
1195	3.121	0.9694	3.026	34	0.006	239	0.008
1200	3.127	0.9695	3.032	33	0.006	240	0.008
1205	3.133	0.9695	3.038	273	0.006	241	0.008
1210	3.139	0.9696	3.044	32	0.006	242	0.008
1215	3.145	0.9696	3.050	31	0.006	243	0.008
1220	3.151	0.9697	3.056	274	0.006	244	0.007
1225	3.157	0.9698	3.061	30	0.006	245	0.007
1230	3.163	0.9698	3.067	29	0.006	246	0.007
1235	3.169	0.9699	3.073	275	0.006	247	0.007
1240	3.175	0.9699	3.079	28	0.006	248	0.007
1245	3.180	0.9700	3.085	27	0.006	249	0.007
1250	3.186	0.9701	3.091	276	0.006	250	0.007
1255	3.192	0.9701	3.097	26	0.006	251	0.007
1260	3.198	0.9702	3.103	25	0.006	252	0.007
1265	3.204	0.9702	3.108	277	0.006	253	0.007
1270	3.210	0.9703	3.114	24	0.006	254	0.007
1275	3.215	0.9703	3.120	23	0.006	255	0.007
1280	3.221	0.9704	3.126	278	0.006	256	0.007
1285	3.227	0.9705	3.132	22	0.006	257	0.007
1290	3.233	0.9705	3.137	21	0.006	258	0.007
1295	3.238	0.9706	3.143	279	0.006	259	0.007

2 Year Nested Storm Distribution for Guejito Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	3.244	0.9706	3.149	20	0.006	260	0.007
1305	3.250	0.9707	3.155	19	0.006	261	0.006
1310	3.256	0.9707	3.160	280	0.006	262	0.006
1315	3.261	0.9708	3.166	18	0.006	263	0.006
1320	3.267	0.9709	3.172	17	0.006	264	0.006
1325	3.273	0.9709	3.177	281	0.006	265	0.006
1330	3.278	0.9710	3.183	16	0.006	266	0.006
1335	3.284	0.9710	3.189	15	0.006	267	0.006
1340	3.290	0.9711	3.194	282	0.006	268	0.006
1345	3.295	0.9712	3.200	14	0.006	269	0.006
1350	3.301	0.9712	3.206	13	0.006	270	0.006
1355	3.306	0.9713	3.211	283	0.006	271	0.006
1360	3.312	0.9713	3.217	12	0.006	272	0.006
1365	3.318	0.9714	3.223	11	0.006	273	0.006
1370	3.323	0.9714	3.228	284	0.006	274	0.006
1375	3.329	0.9715	3.234	10	0.006	275	0.006
1380	3.334	0.9716	3.239	9	0.006	276	0.006
1385	3.340	0.9716	3.245	285	0.006	277	0.006
1390	3.345	0.9717	3.251	8	0.006	278	0.006
1395	3.351	0.9717	3.256	7	0.006	279	0.006
1400	3.356	0.9718	3.262	286	0.006	280	0.006
1405	3.362	0.9718	3.267	6	0.006	281	0.006
1410	3.367	0.9719	3.273	5	0.006	282	0.006
1415	3.373	0.9720	3.278	287	0.006	283	0.006
1420	3.378	0.9720	3.284	4	0.006	284	0.006
1425	3.384	0.9721	3.289	3	0.005	285	0.006
1430	3.389	0.9721	3.295	288	0.005	286	0.006
1435	3.395	0.9722	3.300	2	0.005	287	0.006
1440	3.400	**0.9723**	3.306	1	0.005	288	0.005

Notes for Nested Storm Distribution

Notes

1. Cumulative Rainfall Depths for durations between 0 and 6 hours are determined per Equations 4-25 and 4-26 of the 2003 SDCHM. Cumulative Rainfall Depths for durations between 6 and 24 hours are interpolated using log-log interpolation.

Eq 4-25: $I = 7.44\ p_6\ D^{-0.645}$ (0-6 hr durations)

Eq 4-26: $P = I\ (D/60)$ (0-6 hr durations)

Eq X-XX $P = C\ D^{M}$ (6-24 hr durations)

Where $C = p_{6adj}/360^{M}$

D = Time in minutes

$M = \ln(p_{6adj}/p_{24})/(\ln(360) - \ln(1440))$

2. Rainfall Depth-Area Adjustment Ratios are determined per linear interpolation between the values provided in Table 4-1 of the 2003 SDCHM.

3. Cumulative Adjusted Rainfall Depth is the Cumulative Rainfall Depth multiplied by the Rainfall Depth-Area Adjustment Ratio.

4. Ordinate Numbers provided by County of San Diego

5. Incremental Rainfall represents the difference in Cumulative Adjusted Rainfall Depths between consecutive rainfall ordinates.

6. Sorted Incremental Rainfall values are sorted by the Ordinate Numbers.

Nested Storm Distribution for Jamul Creek

Nested Storm Inputs for Jamul Creek

Variable	Units	100 yr	10 yr	5 yr	2 yr
T_p [1]	minutes	135.2	135.2	135.2	135.2
P_6 [2]	inches	3.1	2.0	1.8	1.4
P_{6adj} [3]	inches	3.1	2.0	1.8	1.4
P_{24} [4]	inches	6.3	3.6	3.7	2.1
Area [5]	mi^2	70.1	70.1	70.1	70.1
M [6]	-	0.511542	0.423998	0.519764	0.310744
C [7]	-	0.152653	0.164878	0.084450	0.219168

1. T_p as determined per Lag Time Calculations in Appendix C.5 of this report
2. P_6 as determined per Unadjusted Rainfall Depths in Appendix C.6 of this report
3. P_{6adj} represents the adjusted value of P_6 to be within 45-65% of the P_{24} value (if necessary)
4. P_{24} as determined per Unadjusted Rainfall Depths in Appendix C.6 of this report
5. Area represents the Basin area in square miles
6. $M = \ln(P_{6adj}/P_{24})/(\ln(360) - \ln(1440))$
7. $C = P_{6adj}/360^M$

Rainfall Depth-Area Adjustments for Jamul Creek

2003 San Diego County Hydrology Manual Table 4-1					
Watershed Area (mi^2)	**Rainfall Depth-Area Adjustment for Duration**				
	30 Minute	**1 Hour**	**3 Hour**	**6 Hour**	**24 Hour**
0	1.000	1.000	1.000	1.000	1.000
5	0.942	0.970	0.980	0.985	0.990
10	0.900	0.947	0.970	0.980	0.985
20	0.834	0.900	0.952	0.963	0.975
30	0.768	0.858	0.932	0.950	0.964
40	0.730	0.830	0.915	0.940	0.958
50	0.692	0.800	0.900	0.928	0.952
60	0.663	0.778	0.883	0.920	0.948
70	0.654	0.760	0.872	0.912	0.945
80	0.630	0.746	0.862	0.904	0.942
90	0.620	0.735	0.853	0.896	0.938
100	0.610	0.722	0.845	0.890	0.935
125	0.588	0.700	0.830	0.878	0.930
150	0.572	0.685	0.818	0.865	0.925
175	0.572	0.672	0.808	0.858	0.922
200	0.572	0.666	0.798	0.851	0.918
225	0.572	0.660	0.790	0.845	0.915
250	0.572	0.655	0.787	0.842	0.914
300	0.572	0.652	0.782	0.838	0.912
350	0.572	0.652	0.780	0.830	0.910
400	0.572	0.652	0.780	0.828	0.908

Rainfall Depth-Area Adjustments for Jamul Creek					
Watershed Area (mi^2)	**30 Minute**	**1 Hour**	**3 Hour**	**6 Hour**	**24 Hour**
70	0.654	0.76	0.872	0.912	0.945
70.1	**0.654**	**0.760**	**0.872**	**0.912**	**0.945**
80	0.63	0.746	0.862	0.904	0.942

1. Rainfall Depth-Area Adjustment factors associated with 30-minute, 1-hour, 3-hour, 6-hour, and 24-hour storms have been interoplated from the data on Table 4-1 of the 2003 SDCHM with respect to the basin area and the duration of the storm.

100 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.681	0.6538	0.445	193	0.445	1	0.012
10	0.871	0.6538	0.569	192	0.124	2	0.012
15	1.005	0.6538	0.657	191	0.088	3	0.012
20	1.113	0.6538	0.728	194	0.071	4	0.012
25	1.205	0.6538	0.788	190	0.060	5	0.012
30	1.286	**0.6538**	0.841	189	0.053	6	0.012
35	1.358	0.6714	0.912	195	0.071	7	0.012
40	1.424	0.6891	0.981	188	0.069	8	0.012
45	1.485	0.7068	1.049	187	0.068	9	0.012
50	1.541	0.7245	1.117	196	0.067	10	0.012
55	1.594	0.7422	1.183	186	0.067	11	0.012
60	1.644	**0.7599**	1.250	185	0.066	12	0.012
65	1.692	0.7645	1.293	197	0.044	13	0.012
70	1.737	0.7692	1.336	184	0.043	14	0.012
75	1.780	0.7739	1.378	183	0.041	15	0.012
80	1.821	0.7785	1.418	198	0.040	16	0.012
85	1.861	0.7832	1.457	182	0.040	17	0.012
90	1.899	0.7879	1.496	181	0.039	18	0.012
95	1.936	0.7925	1.534	199	0.038	19	0.012
100	1.971	0.7972	1.572	180	0.037	20	0.012
105	2.006	0.8019	1.608	179	0.037	21	0.012
110	2.039	0.8065	1.645	200	0.036	22	0.012
115	2.072	0.8112	1.681	178	0.036	23	0.012
120	2.103	0.8159	1.716	177	0.035	24	0.012
125	2.134	0.8205	1.751	201	0.035	25	0.012
130	2.164	0.8252	1.786	176	0.035	26	0.012
135	2.193	0.8299	1.820	175	0.034	27	0.012
140	2.222	0.8346	1.854	202	0.034	28	0.012
145	2.249	0.8392	1.888	174	0.034	29	0.012
150	2.277	0.8439	1.921	173	0.033	30	0.012
155	2.303	0.8486	1.954	203	0.033	31	0.012
160	2.329	0.8532	1.988	172	0.033	32	0.012
165	2.355	0.8579	2.020	171	0.033	33	0.012
170	2.380	0.8626	2.053	204	0.033	34	0.012
175	2.405	0.8672	2.085	170	0.032	35	0.012
180	2.429	**0.8719**	2.118	169	0.032	36	0.012
185	2.453	0.8730	2.141	205	0.023	37	0.012
190	2.476	0.8741	2.164	168	0.023	38	0.012
195	2.499	0.8752	2.187	167	0.023	39	0.013
200	2.521	0.8763	2.210	206	0.023	40	0.013
205	2.544	0.8775	2.232	166	0.022	41	0.013
210	2.565	0.8786	2.254	165	0.022	42	0.013
215	2.587	0.8797	2.276	207	0.022	43	0.013
220	2.608	0.8808	2.297	164	0.022	44	0.013
225	2.629	0.8819	2.319	163	0.021	45	0.013
230	2.650	0.8830	2.340	208	0.021	46	0.013
235	2.670	0.8841	2.361	162	0.021	47	0.013
240	2.690	0.8852	2.381	161	0.021	48	0.013
245	2.710	0.8864	2.402	209	0.021	49	0.013
250	2.729	0.8875	2.422	160	0.020	50	0.013
255	2.749	0.8886	2.442	159	0.020	51	0.013

100 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	2.768	0.8897	2.462	210	0.020	52	0.013
265	2.786	0.8908	2.482	158	0.020	53	0.013
270	2.805	0.8919	2.502	157	0.020	54	0.013
275	2.823	0.8930	2.521	211	0.019	55	0.013
280	2.841	0.8941	2.541	156	0.019	56	0.013
285	2.859	0.8952	2.560	155	0.019	57	0.013
290	2.877	0.8964	2.579	212	0.019	58	0.013
295	2.894	0.8975	2.598	154	0.019	59	0.013
300	2.912	0.8986	2.616	153	0.019	60	0.013
305	2.929	0.8997	2.635	213	0.019	61	0.013
310	2.946	0.9008	2.654	152	0.019	62	0.013
315	2.963	0.9019	2.672	151	0.018	63	0.013
320	2.979	0.9030	2.690	214	0.018	64	0.013
325	2.996	0.9041	2.709	150	0.018	65	0.013
330	3.012	0.9052	2.727	149	0.018	66	0.014
335	3.028	0.9064	2.745	215	0.018	67	0.014
340	3.044	0.9075	2.762	148	0.018	68	0.014
345	3.060	0.9086	2.780	147	0.018	69	0.014
350	3.076	0.9097	2.798	216	0.018	70	0.014
355	3.091	0.9108	2.815	146	0.018	71	0.014
360	**3.100**	**0.9119**	2.827	145	0.012	72	0.014
365	3.122	0.9121	2.847	217	0.020	73	0.014
370	3.144	0.9122	2.868	144	0.020	74	0.014
375	3.165	0.9124	2.888	143	0.020	75	0.014
380	3.187	0.9125	2.908	218	0.020	76	0.014
385	3.208	0.9127	2.928	142	0.020	77	0.014
390	3.230	0.9128	2.948	141	0.020	78	0.014
395	3.251	0.9130	2.968	219	0.020	79	0.014
400	3.272	0.9131	2.987	140	0.020	80	0.014
405	3.293	0.9133	3.007	139	0.020	81	0.014
410	3.313	0.9135	3.026	220	0.019	82	0.014
415	3.334	0.9136	3.046	138	0.019	83	0.014
420	3.354	0.9138	3.065	137	0.019	84	0.014
425	3.375	0.9139	3.084	221	0.019	85	0.014
430	3.395	0.9141	3.103	136	0.019	86	0.014
435	3.415	0.9142	3.122	135	0.019	87	0.015
440	3.435	0.9144	3.141	222	0.019	88	0.015
445	3.455	0.9145	3.160	134	0.019	89	0.015
450	3.475	0.9147	3.178	133	0.019	90	0.015
455	3.495	0.9148	3.197	223	0.019	91	0.015
460	3.514	0.9150	3.215	132	0.018	92	0.015
465	3.534	0.9151	3.234	131	0.018	93	0.015
470	3.553	0.9153	3.252	224	0.018	94	0.015
475	3.572	0.9154	3.270	130	0.018	95	0.015
480	3.591	0.9156	3.288	129	0.018	96	0.015
485	3.611	0.9157	3.306	225	0.018	97	0.015
490	3.630	0.9159	3.324	128	0.018	98	0.015
495	3.648	0.9161	3.342	127	0.018	99	0.015
500	3.667	0.9162	3.360	226	0.018	100	0.015
505	3.686	0.9164	3.378	126	0.018	101	0.015
510	3.705	0.9165	3.395	125	0.018	102	0.016
515	3.723	0.9167	3.413	227	0.018	103	0.016

100 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	3.742	0.9168	3.430	124	0.017	104	0.016
525	3.760	0.9170	3.448	123	0.017	105	0.016
530	3.778	0.9171	3.465	228	0.017	106	0.016
535	3.796	0.9173	3.482	122	0.017	107	0.016
540	3.815	0.9174	3.500	121	0.017	108	0.016
545	3.833	0.9176	3.517	229	0.017	109	0.016
550	3.850	0.9177	3.534	120	0.017	110	0.016
555	3.868	0.9179	3.551	119	0.017	111	0.016
560	3.886	0.9180	3.568	230	0.017	112	0.016
565	3.904	0.9182	3.584	118	0.017	113	0.016
570	3.921	0.9183	3.601	117	0.017	114	0.016
575	3.939	0.9185	3.618	231	0.017	115	0.017
580	3.957	0.9187	3.635	116	0.017	116	0.017
585	3.974	0.9188	3.651	115	0.017	117	0.017
590	3.991	0.9190	3.668	232	0.017	118	0.017
595	4.009	0.9191	3.684	114	0.016	119	0.017
600	4.026	0.9193	3.701	113	0.016	120	0.017
605	4.043	0.9194	3.717	233	0.016	121	0.017
610	4.060	0.9196	3.733	112	0.016	122	0.017
615	4.077	0.9197	3.750	111	0.016	123	0.017
620	4.094	0.9199	3.766	234	0.016	124	0.017
625	4.111	0.9200	3.782	110	0.016	125	0.018
630	4.127	0.9202	3.798	109	0.016	126	0.018
635	4.144	0.9203	3.814	235	0.016	127	0.018
640	4.161	0.9205	3.830	108	0.016	128	0.018
645	4.177	0.9206	3.846	107	0.016	129	0.018
650	4.194	0.9208	3.862	236	0.016	130	0.018
655	4.210	0.9209	3.878	106	0.016	131	0.018
660	4.227	0.9211	3.893	105	0.016	132	0.018
665	4.243	0.9213	3.909	237	0.016	133	0.019
670	4.260	0.9214	3.925	104	0.016	134	0.019
675	4.276	0.9216	3.940	103	0.016	135	0.019
680	4.292	0.9217	3.956	238	0.016	136	0.019
685	4.308	0.9219	3.971	102	0.016	137	0.019
690	4.324	0.9220	3.987	101	0.015	138	0.019
695	4.340	0.9222	4.002	239	0.015	139	0.020
700	4.356	0.9223	4.018	100	0.015	140	0.020
705	4.372	0.9225	4.033	99	0.015	141	0.020
710	4.388	0.9226	4.048	240	0.015	142	0.020
715	4.404	0.9228	4.064	98	0.015	143	0.020
720	4.419	0.9229	4.079	97	0.015	144	0.020
725	4.435	0.9231	4.094	241	0.015	145	0.012
730	4.451	0.9232	4.109	96	0.015	146	0.018
735	4.466	0.9234	4.124	95	0.015	147	0.018
740	4.482	0.9235	4.139	242	0.015	148	0.018
745	4.497	0.9237	4.154	94	0.015	149	0.018
750	4.513	0.9239	4.169	93	0.015	150	0.018
755	4.528	0.9240	4.184	243	0.015	151	0.018
760	4.543	0.9242	4.199	92	0.015	152	0.019
765	4.558	0.9243	4.213	91	0.015	153	0.019
770	4.574	0.9245	4.228	244	0.015	154	0.019
775	4.589	0.9246	4.243	90	0.015	155	0.019

100 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	4.604	0.9248	4.258	89	0.015	156	0.019
785	4.619	0.9249	4.272	245	0.015	157	0.020
790	4.634	0.9251	4.287	88	0.015	158	0.020
795	4.649	0.9252	4.301	87	0.015	159	0.020
800	4.664	0.9254	4.316	246	0.015	160	0.020
805	4.679	0.9255	4.330	86	0.014	161	0.021
810	4.694	0.9257	4.345	85	0.014	162	0.021
815	4.709	0.9258	4.359	247	0.014	163	0.021
820	4.723	0.9260	4.374	84	0.014	164	0.022
825	4.738	0.9261	4.388	83	0.014	165	0.022
830	4.753	0.9263	4.402	248	0.014	166	0.022
835	4.767	0.9265	4.417	82	0.014	167	0.023
840	4.782	0.9266	4.431	81	0.014	168	0.023
845	4.796	0.9268	4.445	249	0.014	169	0.032
850	4.811	0.9269	4.459	80	0.014	170	0.032
855	4.825	0.9271	4.473	79	0.014	171	0.033
860	4.840	0.9272	4.488	250	0.014	172	0.033
865	4.854	0.9274	4.502	78	0.014	173	0.033
870	4.868	0.9275	4.516	77	0.014	174	0.034
875	4.883	0.9277	4.530	251	0.014	175	0.034
880	4.897	0.9278	4.544	76	0.014	176	0.035
885	4.911	0.9280	4.558	75	0.014	177	0.035
890	4.925	0.9281	4.571	252	0.014	178	0.036
895	4.940	0.9283	4.585	74	0.014	179	0.037
900	4.954	0.9284	4.599	73	0.014	180	0.037
905	4.968	0.9286	4.613	253	0.014	181	0.039
910	4.982	0.9288	4.627	72	0.014	182	0.040
915	4.996	0.9289	4.641	71	0.014	183	0.041
920	5.010	0.9291	4.654	254	0.014	184	0.043
925	5.024	0.9292	4.668	70	0.014	185	0.066
930	5.037	0.9294	4.682	69	0.014	186	0.067
935	5.051	0.9295	4.695	255	0.014	187	0.068
940	5.065	0.9297	4.709	68	0.014	188	0.069
945	5.079	0.9298	4.722	67	0.014	189	0.053
950	5.093	0.9300	4.736	256	0.014	190	0.060
955	5.106	0.9301	4.749	66	0.014	191	0.088
960	5.120	0.9303	4.763	65	0.013	192	0.124
965	5.134	0.9304	4.776	257	0.013	193	0.445
970	5.147	0.9306	4.790	64	0.013	194	0.071
975	5.161	0.9307	4.803	63	0.013	195	0.071
980	5.174	0.9309	4.817	258	0.013	196	0.067
985	5.188	0.9310	4.830	62	0.013	197	0.044
990	5.201	0.9312	4.843	61	0.013	198	0.040
995	5.215	0.9314	4.857	259	0.013	199	0.038
1000	5.228	0.9315	4.870	60	0.013	200	0.036
1005	5.241	0.9317	4.883	59	0.013	201	0.035
1010	5.255	0.9318	4.896	260	0.013	202	0.034
1015	5.268	0.9320	4.910	58	0.013	203	0.033
1020	5.281	0.9321	4.923	57	0.013	204	0.033
1025	5.294	0.9323	4.936	261	0.013	205	0.023
1030	5.308	0.9324	4.949	56	0.013	206	0.023
1035	5.321	0.9326	4.962	55	0.013	207	0.022

100 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	5.334	0.9327	4.975	262	0.013	208	0.021
1045	5.347	0.9329	4.988	54	0.013	209	0.021
1050	5.360	0.9330	5.001	53	0.013	210	0.020
1055	5.373	0.9332	5.014	263	0.013	211	0.019
1060	5.386	0.9333	5.027	52	0.013	212	0.019
1065	5.399	0.9335	5.040	51	0.013	213	0.019
1070	5.412	0.9336	5.053	264	0.013	214	0.018
1075	5.425	0.9338	5.066	50	0.013	215	0.018
1080	5.438	0.9340	5.079	49	0.013	216	0.018
1085	5.451	0.9341	5.092	265	0.013	217	0.020
1090	5.464	0.9343	5.104	48	0.013	218	0.020
1095	5.476	0.9344	5.117	47	0.013	219	0.020
1100	5.489	0.9346	5.130	266	0.013	220	0.019
1105	5.502	0.9347	5.143	46	0.013	221	0.019
1110	5.515	0.9349	5.155	45	0.013	222	0.019
1115	5.527	0.9350	5.168	267	0.013	223	0.019
1120	5.540	0.9352	5.181	44	0.013	224	0.018
1125	5.553	0.9353	5.194	43	0.013	225	0.018
1130	5.565	0.9355	5.206	268	0.013	226	0.018
1135	5.578	0.9356	5.219	42	0.013	227	0.018
1140	5.590	0.9358	5.231	41	0.013	228	0.017
1145	5.603	0.9359	5.244	269	0.013	229	0.017
1150	5.615	0.9361	5.257	40	0.013	230	0.017
1155	5.628	0.9362	5.269	39	0.013	231	0.017
1160	5.640	0.9364	5.282	270	0.013	232	0.017
1165	5.653	0.9366	5.294	38	0.012	233	0.016
1170	5.665	0.9367	5.307	37	0.012	234	0.016
1175	5.678	0.9369	5.319	271	0.012	235	0.016
1180	5.690	0.9370	5.331	36	0.012	236	0.016
1185	5.702	0.9372	5.344	35	0.012	237	0.016
1190	5.714	0.9373	5.356	272	0.012	238	0.016
1195	5.727	0.9375	5.369	34	0.012	239	0.015
1200	5.739	0.9376	5.381	33	0.012	240	0.015
1205	5.751	0.9378	5.393	273	0.012	241	0.015
1210	5.763	0.9379	5.406	32	0.012	242	0.015
1215	5.776	0.9381	5.418	31	0.012	243	0.015
1220	5.788	0.9382	5.430	274	0.012	244	0.015
1225	5.800	0.9384	5.443	30	0.012	245	0.015
1230	5.812	0.9385	5.455	29	0.012	246	0.015
1235	5.824	0.9387	5.467	275	0.012	247	0.014
1240	5.836	0.9388	5.479	28	0.012	248	0.014
1245	5.848	0.9390	5.491	27	0.012	249	0.014
1250	5.860	0.9392	5.504	276	0.012	250	0.014
1255	5.872	0.9393	5.516	26	0.012	251	0.014
1260	5.884	0.9395	5.528	25	0.012	252	0.014
1265	5.896	0.9396	5.540	277	0.012	253	0.014
1270	5.908	0.9398	5.552	24	0.012	254	0.014
1275	5.920	0.9399	5.564	23	0.012	255	0.014
1280	5.932	0.9401	5.576	278	0.012	256	0.014
1285	5.943	0.9402	5.588	22	0.012	257	0.013
1290	5.955	0.9404	5.600	21	0.012	258	0.013
1295	5.967	0.9405	5.612	279	0.012	259	0.013

100 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	5.979	0.9407	5.624	20	0.012	260	0.013
1305	5.991	0.9408	5.636	19	0.012	261	0.013
1310	6.002	0.9410	5.648	280	0.012	262	0.013
1315	6.014	0.9411	5.660	18	0.012	263	0.013
1320	6.026	0.9413	5.672	17	0.012	264	0.013
1325	6.037	0.9415	5.684	281	0.012	265	0.013
1330	6.049	0.9416	5.696	16	0.012	266	0.013
1335	6.061	0.9418	5.708	15	0.012	267	0.013
1340	6.072	0.9419	5.720	282	0.012	268	0.013
1345	6.084	0.9421	5.731	14	0.012	269	0.013
1350	6.095	0.9422	5.743	13	0.012	270	0.013
1355	6.107	0.9424	5.755	283	0.012	271	0.012
1360	6.118	0.9425	5.767	12	0.012	272	0.012
1365	6.130	0.9427	5.779	11	0.012	273	0.012
1370	6.141	0.9428	5.790	284	0.012	274	0.012
1375	6.153	0.9430	5.802	10	0.012	275	0.012
1380	6.164	0.9431	5.814	9	0.012	276	0.012
1385	6.176	0.9433	5.825	285	0.012	277	0.012
1390	6.187	0.9434	5.837	8	0.012	278	0.012
1395	6.199	0.9436	5.849	7	0.012	279	0.012
1400	6.210	0.9437	5.861	286	0.012	280	0.012
1405	6.221	0.9439	5.872	6	0.012	281	0.012
1410	6.233	0.9441	5.884	5	0.012	282	0.012
1415	6.244	0.9442	5.895	287	0.012	283	0.012
1420	6.255	0.9444	5.907	4	0.012	284	0.012
1425	6.266	0.9445	5.919	3	0.012	285	0.012
1430	6.278	0.9447	5.930	288	0.012	286	0.012
1435	6.289	0.9448	5.942	2	0.012	287	0.012
1440	6.300	**0.9450**	5.953	1	0.012	288	0.012

10 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.439	0.6538	0.287	193	0.287	1	0.006
10	0.562	0.6538	0.367	192	0.080	2	0.006
15	0.649	0.6538	0.424	191	0.057	3	0.006
20	0.718	0.6538	0.470	194	0.046	4	0.006
25	0.778	0.6538	0.508	190	0.039	5	0.006
30	0.830	**0.6538**	0.542	189	0.034	6	0.006
35	0.876	0.6714	0.588	195	0.046	7	0.006
40	0.919	0.6891	0.633	188	0.045	8	0.006
45	0.958	0.7068	0.677	187	0.044	9	0.006
50	0.994	0.7245	0.720	196	0.043	10	0.006
55	1.029	0.7422	0.763	186	0.043	11	0.006
60	1.061	**0.7599**	0.806	185	0.043	12	0.006
65	1.092	0.7645	0.835	197	0.028	13	0.006
70	1.121	0.7692	0.862	184	0.027	14	0.006
75	1.148	0.7739	0.889	183	0.027	15	0.006
80	1.175	0.7785	0.915	198	0.026	16	0.006
85	1.201	0.7832	0.940	182	0.026	17	0.006
90	1.225	0.7879	0.965	181	0.025	18	0.006
95	1.249	0.7925	0.990	199	0.025	19	0.006
100	1.272	0.7972	1.014	180	0.024	20	0.006
105	1.294	0.8019	1.038	179	0.024	21	0.006
110	1.316	0.8065	1.061	200	0.023	22	0.006
115	1.337	0.8112	1.084	178	0.023	23	0.006
120	1.357	0.8159	1.107	177	0.023	24	0.006
125	1.377	0.8205	1.130	201	0.023	25	0.006
130	1.396	0.8252	1.152	176	0.022	26	0.006
135	1.415	0.8299	1.174	175	0.022	27	0.006
140	1.433	0.8346	1.196	202	0.022	28	0.006
145	1.451	0.8392	1.218	174	0.022	29	0.006
150	1.469	0.8439	1.240	173	0.022	30	0.006
155	1.486	0.8486	1.261	203	0.021	31	0.006
160	1.503	0.8532	1.282	172	0.021	32	0.006
165	1.519	0.8579	1.303	171	0.021	33	0.006
170	1.536	0.8626	1.325	204	0.021	34	0.006
175	1.551	0.8672	1.345	170	0.021	35	0.006
180	1.567	**0.8719**	1.366	169	0.021	36	0.006
185	1.582	0.8730	1.381	205	0.015	37	0.006
190	1.597	0.8741	1.396	168	0.015	38	0.006
195	1.612	0.8752	1.411	167	0.015	39	0.006
200	1.627	0.8763	1.426	206	0.015	40	0.006
205	1.641	0.8775	1.440	166	0.014	41	0.006
210	1.655	0.8786	1.454	165	0.014	42	0.006
215	1.669	0.8797	1.468	207	0.014	43	0.006
220	1.683	0.8808	1.482	164	0.014	44	0.006
225	1.696	0.8819	1.496	163	0.014	45	0.006
230	1.709	0.8830	1.510	208	0.014	46	0.006
235	1.723	0.8841	1.523	162	0.013	47	0.006
240	1.736	0.8852	1.536	161	0.013	48	0.006
245	1.748	0.8864	1.550	209	0.013	49	0.006
250	1.761	0.8875	1.563	160	0.013	50	0.006
255	1.773	0.8886	1.576	159	0.013	51	0.006

10 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.786	0.8897	1.589	210	0.013	52	0.006
265	1.798	0.8908	1.601	158	0.013	53	0.006
270	1.810	0.8919	1.614	157	0.013	54	0.006
275	1.821	0.8930	1.627	211	0.013	55	0.006
280	1.833	0.8941	1.639	156	0.012	56	0.006
285	1.845	0.8952	1.651	155	0.012	57	0.007
290	1.856	0.8964	1.664	212	0.012	58	0.007
295	1.867	0.8975	1.676	154	0.012	59	0.007
300	1.879	0.8986	1.688	153	0.012	60	0.007
305	1.890	0.8997	1.700	213	0.012	61	0.007
310	1.901	0.9008	1.712	152	0.012	62	0.007
315	1.911	0.9019	1.724	151	0.012	63	0.007
320	1.922	0.9030	1.736	214	0.012	64	0.007
325	1.933	0.9041	1.747	150	0.012	65	0.007
330	1.943	0.9052	1.759	149	0.012	66	0.007
335	1.954	0.9064	1.771	215	0.012	67	0.007
340	1.964	0.9075	1.782	148	0.012	68	0.007
345	1.974	0.9086	1.794	147	0.011	69	0.007
350	1.984	0.9097	1.805	216	0.011	70	0.007
355	1.994	0.9108	1.816	146	0.011	71	0.007
360	**2.000**	**0.9119**	1.824	145	0.007	72	0.007
365	2.012	0.9121	1.835	217	0.011	73	0.007
370	2.023	0.9122	1.846	144	0.011	74	0.007
375	2.035	0.9124	1.857	143	0.011	75	0.007
380	2.046	0.9125	1.867	218	0.011	76	0.007
385	2.058	0.9127	1.878	142	0.011	77	0.007
390	2.069	0.9128	1.889	141	0.011	78	0.007
395	2.080	0.9130	1.899	219	0.011	79	0.007
400	2.091	0.9131	1.910	140	0.010	80	0.007
405	2.102	0.9133	1.920	139	0.010	81	0.007
410	2.113	0.9135	1.930	220	0.010	82	0.007
415	2.124	0.9136	1.941	138	0.010	83	0.007
420	2.135	0.9138	1.951	137	0.010	84	0.007
425	2.146	0.9139	1.961	221	0.010	85	0.007
430	2.156	0.9141	1.971	136	0.010	86	0.007
435	2.167	0.9142	1.981	135	0.010	87	0.007
440	2.178	0.9144	1.991	222	0.010	88	0.007
445	2.188	0.9145	2.001	134	0.010	89	0.007
450	2.198	0.9147	2.011	133	0.010	90	0.007
455	2.209	0.9148	2.021	223	0.010	91	0.007
460	2.219	0.9150	2.030	132	0.010	92	0.008
465	2.229	0.9151	2.040	131	0.010	93	0.008
470	2.239	0.9153	2.050	224	0.010	94	0.008
475	2.249	0.9154	2.059	130	0.010	95	0.008
480	2.259	0.9156	2.069	129	0.010	96	0.008
485	2.269	0.9157	2.078	225	0.009	97	0.008
490	2.279	0.9159	2.088	128	0.009	98	0.008
495	2.289	0.9161	2.097	127	0.009	99	0.008
500	2.299	0.9162	2.106	226	0.009	100	0.008
505	2.309	0.9164	2.116	126	0.009	101	0.008
510	2.318	0.9165	2.125	125	0.009	102	0.008
515	2.328	0.9167	2.134	227	0.009	103	0.008

10 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	2.337	0.9168	2.143	124	0.009	104	0.008
525	2.347	0.9170	2.152	123	0.009	105	0.008
530	2.356	0.9171	2.161	228	0.009	106	0.008
535	2.366	0.9173	2.170	122	0.009	107	0.008
540	2.375	0.9174	2.179	121	0.009	108	0.008
545	2.384	0.9176	2.188	229	0.009	109	0.008
550	2.394	0.9177	2.197	120	0.009	110	0.008
555	2.403	0.9179	2.206	119	0.009	111	0.008
560	2.412	0.9180	2.214	230	0.009	112	0.008
565	2.421	0.9182	2.223	118	0.009	113	0.008
570	2.430	0.9183	2.232	117	0.009	114	0.009
575	2.439	0.9185	2.240	231	0.009	115	0.009
580	2.448	0.9187	2.249	116	0.009	116	0.009
585	2.457	0.9188	2.258	115	0.009	117	0.009
590	2.466	0.9190	2.266	232	0.009	118	0.009
595	2.475	0.9191	2.275	114	0.009	119	0.009
600	2.484	0.9193	2.283	113	0.008	120	0.009
605	2.492	0.9194	2.292	233	0.008	121	0.009
610	2.501	0.9196	2.300	112	0.008	122	0.009
615	2.510	0.9197	2.308	111	0.008	123	0.009
620	2.518	0.9199	2.317	234	0.008	124	0.009
625	2.527	0.9200	2.325	110	0.008	125	0.009
630	2.536	0.9202	2.333	109	0.008	126	0.009
635	2.544	0.9203	2.341	235	0.008	127	0.009
640	2.553	0.9205	2.350	108	0.008	128	0.009
645	2.561	0.9206	2.358	107	0.008	129	0.010
650	2.569	0.9208	2.366	236	0.008	130	0.010
655	2.578	0.9209	2.374	106	0.008	131	0.010
660	2.586	0.9211	2.382	105	0.008	132	0.010
665	2.594	0.9213	2.390	237	0.008	133	0.010
670	2.603	0.9214	2.398	104	0.008	134	0.010
675	2.611	0.9216	2.406	103	0.008	135	0.010
680	2.619	0.9217	2.414	238	0.008	136	0.010
685	2.627	0.9219	2.422	102	0.008	137	0.010
690	2.635	0.9220	2.430	101	0.008	138	0.010
695	2.643	0.9222	2.438	239	0.008	139	0.010
700	2.651	0.9223	2.445	100	0.008	140	0.010
705	2.659	0.9225	2.453	99	0.008	141	0.011
710	2.667	0.9226	2.461	240	0.008	142	0.011
715	2.675	0.9228	2.469	98	0.008	143	0.011
720	2.683	0.9229	2.476	97	0.008	144	0.011
725	2.691	0.9231	2.484	241	0.008	145	0.007
730	2.699	0.9232	2.492	96	0.008	146	0.011
735	2.707	0.9234	2.499	95	0.008	147	0.011
740	2.715	0.9235	2.507	242	0.008	148	0.012
745	2.722	0.9237	2.515	94	0.008	149	0.012
750	2.730	0.9239	2.522	93	0.008	150	0.012
755	2.738	0.9240	2.530	243	0.008	151	0.012
760	2.746	0.9242	2.537	92	0.008	152	0.012
765	2.753	0.9243	2.545	91	0.007	153	0.012
770	2.761	0.9245	2.552	244	0.007	154	0.012
775	2.768	0.9246	2.560	90	0.007	155	0.012

10 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	2.776	0.9248	2.567	89	0.007	156	0.012
785	2.783	0.9249	2.574	245	0.007	157	0.013
790	2.791	0.9251	2.582	88	0.007	158	0.013
795	2.798	0.9252	2.589	87	0.007	159	0.013
800	2.806	0.9254	2.597	246	0.007	160	0.013
805	2.813	0.9255	2.604	86	0.007	161	0.013
810	2.821	0.9257	2.611	85	0.007	162	0.013
815	2.828	0.9258	2.618	247	0.007	163	0.014
820	2.835	0.9260	2.626	84	0.007	164	0.014
825	2.843	0.9261	2.633	83	0.007	165	0.014
830	2.850	0.9263	2.640	248	0.007	166	0.014
835	2.857	0.9265	2.647	82	0.007	167	0.015
840	2.865	0.9266	2.654	81	0.007	168	0.015
845	2.872	0.9268	2.661	249	0.007	169	0.021
850	2.879	0.9269	2.669	80	0.007	170	0.021
855	2.886	0.9271	2.676	79	0.007	171	0.021
860	2.893	0.9272	2.683	250	0.007	172	0.021
865	2.900	0.9274	2.690	78	0.007	173	0.022
870	2.907	0.9275	2.697	77	0.007	174	0.022
875	2.915	0.9277	2.704	251	0.007	175	0.022
880	2.922	0.9278	2.711	76	0.007	176	0.022
885	2.929	0.9280	2.718	75	0.007	177	0.023
890	2.936	0.9281	2.725	252	0.007	178	0.023
895	2.943	0.9283	2.732	74	0.007	179	0.024
900	2.950	0.9284	2.738	73	0.007	180	0.024
905	2.956	0.9286	2.745	253	0.007	181	0.025
910	2.963	0.9288	2.752	72	0.007	182	0.026
915	2.970	0.9289	2.759	71	0.007	183	0.027
920	2.977	0.9291	2.766	254	0.007	184	0.027
925	2.984	0.9292	2.773	70	0.007	185	0.043
930	2.991	0.9294	2.780	69	0.007	186	0.043
935	2.998	0.9295	2.786	255	0.007	187	0.044
940	3.004	0.9297	2.793	68	0.007	188	0.045
945	3.011	0.9298	2.800	67	0.007	189	0.034
950	3.018	0.9300	2.807	256	0.007	190	0.039
955	3.025	0.9301	2.813	66	0.007	191	0.057
960	3.031	0.9303	2.820	65	0.007	192	0.080
965	3.038	0.9304	2.827	257	0.007	193	0.287
970	3.045	0.9306	2.833	64	0.007	194	0.046
975	3.051	0.9307	2.840	63	0.007	195	0.046
980	3.058	0.9309	2.847	258	0.007	196	0.043
985	3.065	0.9310	2.853	62	0.007	197	0.028
990	3.071	0.9312	2.860	61	0.007	198	0.026
995	3.078	0.9314	2.866	259	0.007	199	0.025
1000	3.084	0.9315	2.873	60	0.007	200	0.023
1005	3.091	0.9317	2.880	59	0.007	201	0.023
1010	3.097	0.9318	2.886	260	0.007	202	0.022
1015	3.104	0.9320	2.893	58	0.007	203	0.021
1020	3.110	0.9321	2.899	57	0.007	204	0.021
1025	3.117	0.9323	2.906	261	0.006	205	0.015
1030	3.123	0.9324	2.912	56	0.006	206	0.015
1035	3.130	0.9326	2.919	55	0.006	207	0.014

10 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	3.136	0.9327	2.925	262	0.006	208	0.014
1045	3.142	0.9329	2.931	54	0.006	209	0.013
1050	3.149	0.9330	2.938	53	0.006	210	0.013
1055	3.155	0.9332	2.944	263	0.006	211	0.013
1060	3.161	0.9333	2.951	52	0.006	212	0.012
1065	3.168	0.9335	2.957	51	0.006	213	0.012
1070	3.174	0.9336	2.963	264	0.006	214	0.012
1075	3.180	0.9338	2.970	50	0.006	215	0.012
1080	3.187	0.9340	2.976	49	0.006	216	0.011
1085	3.193	0.9341	2.982	265	0.006	217	0.011
1090	3.199	0.9343	2.989	48	0.006	218	0.011
1095	3.205	0.9344	2.995	47	0.006	219	0.011
1100	3.211	0.9346	3.001	266	0.006	220	0.010
1105	3.218	0.9347	3.008	46	0.006	221	0.010
1110	3.224	0.9349	3.014	45	0.006	222	0.010
1115	3.230	0.9350	3.020	267	0.006	223	0.010
1120	3.236	0.9352	3.026	44	0.006	224	0.010
1125	3.242	0.9353	3.033	43	0.006	225	0.009
1130	3.248	0.9355	3.039	268	0.006	226	0.009
1135	3.254	0.9356	3.045	42	0.006	227	0.009
1140	3.261	0.9358	3.051	41	0.006	228	0.009
1145	3.267	0.9359	3.057	269	0.006	229	0.009
1150	3.273	0.9361	3.063	40	0.006	230	0.009
1155	3.279	0.9362	3.070	39	0.006	231	0.009
1160	3.285	0.9364	3.076	270	0.006	232	0.009
1165	3.291	0.9366	3.082	38	0.006	233	0.008
1170	3.297	0.9367	3.088	37	0.006	234	0.008
1175	3.303	0.9369	3.094	271	0.006	235	0.008
1180	3.309	0.9370	3.100	36	0.006	236	0.008
1185	3.314	0.9372	3.106	35	0.006	237	0.008
1190	3.320	0.9373	3.112	272	0.006	238	0.008
1195	3.326	0.9375	3.118	34	0.006	239	0.008
1200	3.332	0.9376	3.124	33	0.006	240	0.008
1205	3.338	0.9378	3.130	273	0.006	241	0.008
1210	3.344	0.9379	3.136	32	0.006	242	0.008
1215	3.350	0.9381	3.142	31	0.006	243	0.008
1220	3.356	0.9382	3.148	274	0.006	244	0.007
1225	3.361	0.9384	3.154	30	0.006	245	0.007
1230	3.367	0.9385	3.160	29	0.006	246	0.007
1235	3.373	0.9387	3.166	275	0.006	247	0.007
1240	3.379	0.9388	3.172	28	0.006	248	0.007
1245	3.385	0.9390	3.178	27	0.006	249	0.007
1250	3.390	0.9392	3.184	276	0.006	250	0.007
1255	3.396	0.9393	3.190	26	0.006	251	0.007
1260	3.402	0.9395	3.196	25	0.006	252	0.007
1265	3.408	0.9396	3.202	277	0.006	253	0.007
1270	3.413	0.9398	3.208	24	0.006	254	0.007
1275	3.419	0.9399	3.214	23	0.006	255	0.007
1280	3.425	0.9401	3.219	278	0.006	256	0.007
1285	3.430	0.9402	3.225	22	0.006	257	0.007
1290	3.436	0.9404	3.231	21	0.006	258	0.007
1295	3.442	0.9405	3.237	279	0.006	259	0.007

10 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	3.447	0.9407	3.243	20	0.006	260	0.007
1305	3.453	0.9408	3.249	19	0.006	261	0.006
1310	3.458	0.9410	3.254	280	0.006	262	0.006
1315	3.464	0.9411	3.260	18	0.006	263	0.006
1320	3.470	0.9413	3.266	17	0.006	264	0.006
1325	3.475	0.9415	3.272	281	0.006	265	0.006
1330	3.481	0.9416	3.277	16	0.006	266	0.006
1335	3.486	0.9418	3.283	15	0.006	267	0.006
1340	3.492	0.9419	3.289	282	0.006	268	0.006
1345	3.497	0.9421	3.295	14	0.006	269	0.006
1350	3.503	0.9422	3.300	13	0.006	270	0.006
1355	3.508	0.9424	3.306	283	0.006	271	0.006
1360	3.514	0.9425	3.312	12	0.006	272	0.006
1365	3.519	0.9427	3.318	11	0.006	273	0.006
1370	3.525	0.9428	3.323	284	0.006	274	0.006
1375	3.530	0.9430	3.329	10	0.006	275	0.006
1380	3.536	0.9431	3.335	9	0.006	276	0.006
1385	3.541	0.9433	3.340	285	0.006	277	0.006
1390	3.546	0.9434	3.346	8	0.006	278	0.006
1395	3.552	0.9436	3.352	7	0.006	279	0.006
1400	3.557	0.9437	3.357	286	0.006	280	0.006
1405	3.563	0.9439	3.363	6	0.006	281	0.006
1410	3.568	0.9441	3.368	5	0.006	282	0.006
1415	3.573	0.9442	3.374	287	0.006	283	0.006
1420	3.579	0.9444	3.380	4	0.006	284	0.006
1425	3.584	0.9445	3.385	3	0.006	285	0.006
1430	3.589	0.9447	3.391	288	0.006	286	0.006
1435	3.595	0.9448	3.396	2	0.006	287	0.006
1440	3.600	**0.9450**	3.402	1	0.006	288	0.006

5 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.395	0.6538	0.258	193	0.258	1	0.007
10	0.505	0.6538	0.330	192	0.072	2	0.007
15	0.584	0.6538	0.382	191	0.051	3	0.007
20	0.646	0.6538	0.423	194	0.041	4	0.007
25	0.700	0.6538	0.457	190	0.035	5	0.007
30	0.747	**0.6538**	0.488	189	0.031	6	0.007
35	0.789	0.6714	0.529	195	0.041	7	0.007
40	0.827	0.6891	0.570	188	0.040	8	0.007
45	0.862	0.7068	0.609	187	0.040	9	0.007
50	0.895	0.7245	0.648	196	0.039	10	0.007
55	0.926	0.7422	0.687	186	0.039	11	0.007
60	0.955	**0.7599**	0.726	185	0.038	12	0.007
65	0.982	0.7645	0.751	197	0.025	13	0.007
70	1.009	0.7692	0.776	184	0.025	14	0.007
75	1.034	0.7739	0.800	183	0.024	15	0.007
80	1.058	0.7785	0.823	198	0.023	16	0.007
85	1.081	0.7832	0.846	182	0.023	17	0.007
90	1.103	0.7879	0.869	181	0.022	18	0.007
95	1.124	0.7925	0.891	199	0.022	19	0.007
100	1.145	0.7972	0.913	180	0.022	20	0.007
105	1.165	0.8019	0.934	179	0.021	21	0.007
110	1.184	0.8065	0.955	200	0.021	22	0.007
115	1.203	0.8112	0.976	178	0.021	23	0.007
120	1.221	0.8159	0.996	177	0.021	24	0.007
125	1.239	0.8205	1.017	201	0.020	25	0.007
130	1.256	0.8252	1.037	176	0.020	26	0.007
135	1.273	0.8299	1.057	175	0.020	27	0.007
140	1.290	0.8346	1.077	202	0.020	28	0.007
145	1.306	0.8392	1.096	174	0.020	29	0.007
150	1.322	0.8439	1.116	173	0.019	30	0.007
155	1.337	0.8486	1.135	203	0.019	31	0.007
160	1.353	0.8532	1.154	172	0.019	32	0.007
165	1.367	0.8579	1.173	171	0.019	33	0.007
170	1.382	0.8626	1.192	204	0.019	34	0.007
175	1.396	0.8672	1.211	170	0.019	35	0.007
180	1.410	**0.8719**	1.230	169	0.019	36	0.007
185	1.424	0.8730	1.243	205	0.014	37	0.007
190	1.438	0.8741	1.257	168	0.013	38	0.007
195	1.451	0.8752	1.270	167	0.013	39	0.007
200	1.464	0.8763	1.283	206	0.013	40	0.007
205	1.477	0.8775	1.296	166	0.013	41	0.007
210	1.490	0.8786	1.309	165	0.013	42	0.008
215	1.502	0.8797	1.321	207	0.013	43	0.008
220	1.514	0.8808	1.334	164	0.013	44	0.008
225	1.527	0.8819	1.346	163	0.012	45	0.008
230	1.539	0.8830	1.359	208	0.012	46	0.008
235	1.550	0.8841	1.371	162	0.012	47	0.008
240	1.562	0.8852	1.383	161	0.012	48	0.008
245	1.573	0.8864	1.395	209	0.012	49	0.008
250	1.585	0.8875	1.406	160	0.012	50	0.008
255	1.596	0.8886	1.418	159	0.012	51	0.008

5 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.607	0.8897	1.430	210	0.012	52	0.008
265	1.618	0.8908	1.441	158	0.011	53	0.008
270	1.629	0.8919	1.453	157	0.011	54	0.008
275	1.639	0.8930	1.464	211	0.011	55	0.008
280	1.650	0.8941	1.475	156	0.011	56	0.008
285	1.660	0.8952	1.486	155	0.011	57	0.008
290	1.670	0.8964	1.497	212	0.011	58	0.008
295	1.681	0.8975	1.508	154	0.011	59	0.008
300	1.691	0.8986	1.519	153	0.011	60	0.008
305	1.701	0.8997	1.530	213	0.011	61	0.008
310	1.711	0.9008	1.541	152	0.011	62	0.008
315	1.720	0.9019	1.552	151	0.011	63	0.008
320	1.730	0.9030	1.562	214	0.011	64	0.008
325	1.739	0.9041	1.573	150	0.011	65	0.008
330	1.749	0.9052	1.583	149	0.010	66	0.008
335	1.758	0.9064	1.594	215	0.010	67	0.008
340	1.768	0.9075	1.604	148	0.010	68	0.008
345	1.777	0.9086	1.614	147	0.010	69	0.008
350	1.786	0.9097	1.625	216	0.010	70	0.008
355	1.795	0.9108	1.635	146	0.010	71	0.008
360	**1.800**	**0.9119**	1.641	145	0.007	72	0.008
365	1.813	0.9121	1.654	217	0.012	73	0.008
370	1.826	0.9122	1.666	144	0.012	74	0.008
375	1.839	0.9124	1.678	143	0.012	75	0.008
380	1.851	0.9125	1.689	218	0.012	76	0.008
385	1.864	0.9127	1.701	142	0.012	77	0.008
390	1.876	0.9128	1.713	141	0.012	78	0.008
395	1.889	0.9130	1.725	219	0.012	79	0.008
400	1.901	0.9131	1.736	140	0.012	80	0.008
405	1.914	0.9133	1.748	139	0.012	81	0.008
410	1.926	0.9135	1.759	220	0.011	82	0.008
415	1.938	0.9136	1.771	138	0.011	83	0.009
420	1.950	0.9138	1.782	137	0.011	84	0.009
425	1.962	0.9139	1.793	221	0.011	85	0.009
430	1.974	0.9141	1.804	136	0.011	86	0.009
435	1.986	0.9142	1.816	135	0.011	87	0.009
440	1.998	0.9144	1.827	222	0.011	88	0.009
445	2.010	0.9145	1.838	134	0.011	89	0.009
450	2.021	0.9147	1.849	133	0.011	90	0.009
455	2.033	0.9148	1.860	223	0.011	91	0.009
460	2.045	0.9150	1.871	132	0.011	92	0.009
465	2.056	0.9151	1.882	131	0.011	93	0.009
470	2.068	0.9153	1.892	224	0.011	94	0.009
475	2.079	0.9154	1.903	130	0.011	95	0.009
480	2.090	0.9156	1.914	129	0.011	96	0.009
485	2.102	0.9157	1.925	225	0.011	97	0.009
490	2.113	0.9159	1.935	128	0.011	98	0.009
495	2.124	0.9161	1.946	127	0.011	99	0.009
500	2.135	0.9162	1.956	226	0.011	100	0.009
505	2.146	0.9164	1.967	126	0.010	101	0.009
510	2.157	0.9165	1.977	125	0.010	102	0.009
515	2.168	0.9167	1.988	227	0.010	103	0.009

5 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	2.179	0.9168	1.998	124	0.010	104	0.009
525	2.190	0.9170	2.008	123	0.010	105	0.009
530	2.201	0.9171	2.018	228	0.010	106	0.009
535	2.212	0.9173	2.029	122	0.010	107	0.009
540	2.222	0.9174	2.039	121	0.010	108	0.009
545	2.233	0.9176	2.049	229	0.010	109	0.010
550	2.244	0.9177	2.059	120	0.010	110	0.010
555	2.254	0.9179	2.069	119	0.010	111	0.010
560	2.265	0.9180	2.079	230	0.010	112	0.010
565	2.275	0.9182	2.089	118	0.010	113	0.010
570	2.286	0.9183	2.099	117	0.010	114	0.010
575	2.296	0.9185	2.109	231	0.010	115	0.010
580	2.306	0.9187	2.119	116	0.010	116	0.010
585	2.317	0.9188	2.129	115	0.010	117	0.010
590	2.327	0.9190	2.138	232	0.010	118	0.010
595	2.337	0.9191	2.148	114	0.010	119	0.010
600	2.347	0.9193	2.158	113	0.010	120	0.010
605	2.358	0.9194	2.168	233	0.010	121	0.010
610	2.368	0.9196	2.177	112	0.010	122	0.010
615	2.378	0.9197	2.187	111	0.010	123	0.010
620	2.388	0.9199	2.196	234	0.010	124	0.010
625	2.398	0.9200	2.206	110	0.010	125	0.010
630	2.408	0.9202	2.215	109	0.010	126	0.010
635	2.418	0.9203	2.225	235	0.009	127	0.011
640	2.427	0.9205	2.234	108	0.009	128	0.011
645	2.437	0.9206	2.244	107	0.009	129	0.011
650	2.447	0.9208	2.253	236	0.009	130	0.011
655	2.457	0.9209	2.263	106	0.009	131	0.011
660	2.467	0.9211	2.272	105	0.009	132	0.011
665	2.476	0.9213	2.281	237	0.009	133	0.011
670	2.486	0.9214	2.291	104	0.009	134	0.011
675	2.496	0.9216	2.300	103	0.009	135	0.011
680	2.505	0.9217	2.309	238	0.009	136	0.011
685	2.515	0.9219	2.318	102	0.009	137	0.011
690	2.524	0.9220	2.327	101	0.009	138	0.011
695	2.534	0.9222	2.337	239	0.009	139	0.012
700	2.543	0.9223	2.346	100	0.009	140	0.012
705	2.553	0.9225	2.355	99	0.009	141	0.012
710	2.562	0.9226	2.364	240	0.009	142	0.012
715	2.571	0.9228	2.373	98	0.009	143	0.012
720	2.581	0.9229	2.382	97	0.009	144	0.012
725	2.590	0.9231	2.391	241	0.009	145	0.007
730	2.599	0.9232	2.400	96	0.009	146	0.010
735	2.609	0.9234	2.409	95	0.009	147	0.010
740	2.618	0.9235	2.418	242	0.009	148	0.010
745	2.627	0.9237	2.426	94	0.009	149	0.010
750	2.636	0.9239	2.435	93	0.009	150	0.011
755	2.645	0.9240	2.444	243	0.009	151	0.011
760	2.654	0.9242	2.453	92	0.009	152	0.011
765	2.663	0.9243	2.462	91	0.009	153	0.011
770	2.672	0.9245	2.470	244	0.009	154	0.011
775	2.681	0.9246	2.479	90	0.009	155	0.011

5 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	2.690	0.9248	2.488	89	0.009	156	0.011
785	2.699	0.9249	2.497	245	0.009	157	0.011
790	2.708	0.9251	2.505	88	0.009	158	0.011
795	2.717	0.9252	2.514	87	0.009	159	0.012
800	2.726	0.9254	2.523	246	0.009	160	0.012
805	2.735	0.9255	2.531	86	0.009	161	0.012
810	2.744	0.9257	2.540	85	0.009	162	0.012
815	2.752	0.9258	2.548	247	0.009	163	0.012
820	2.761	0.9260	2.557	84	0.009	164	0.013
825	2.770	0.9261	2.565	83	0.009	165	0.013
830	2.779	0.9263	2.574	248	0.008	166	0.013
835	2.787	0.9265	2.582	82	0.008	167	0.013
840	2.796	0.9266	2.591	81	0.008	168	0.013
845	2.805	0.9268	2.599	249	0.008	169	0.019
850	2.813	0.9269	2.608	80	0.008	170	0.019
855	2.822	0.9271	2.616	79	0.008	171	0.019
860	2.830	0.9272	2.624	250	0.008	172	0.019
865	2.839	0.9274	2.633	78	0.008	173	0.019
870	2.847	0.9275	2.641	77	0.008	174	0.020
875	2.856	0.9277	2.649	251	0.008	175	0.020
880	2.864	0.9278	2.658	76	0.008	176	0.020
885	2.873	0.9280	2.666	75	0.008	177	0.021
890	2.881	0.9281	2.674	252	0.008	178	0.021
895	2.890	0.9283	2.682	74	0.008	179	0.021
900	2.898	0.9284	2.691	73	0.008	180	0.022
905	2.906	0.9286	2.699	253	0.008	181	0.022
910	2.915	0.9288	2.707	72	0.008	182	0.023
915	2.923	0.9289	2.715	71	0.008	183	0.024
920	2.931	0.9291	2.723	254	0.008	184	0.025
925	2.940	0.9292	2.732	70	0.008	185	0.038
930	2.948	0.9294	2.740	69	0.008	186	0.039
935	2.956	0.9295	2.748	255	0.008	187	0.040
940	2.964	0.9297	2.756	68	0.008	188	0.040
945	2.972	0.9298	2.764	67	0.008	189	0.031
950	2.981	0.9300	2.772	256	0.008	190	0.035
955	2.989	0.9301	2.780	66	0.008	191	0.051
960	2.997	0.9303	2.788	65	0.008	192	0.072
965	3.005	0.9304	2.796	257	0.008	193	0.258
970	3.013	0.9306	2.804	64	0.008	194	0.041
975	3.021	0.9307	2.812	63	0.008	195	0.041
980	3.029	0.9309	2.820	258	0.008	196	0.039
985	3.037	0.9310	2.828	62	0.008	197	0.025
990	3.045	0.9312	2.836	61	0.008	198	0.023
995	3.053	0.9314	2.844	259	0.008	199	0.022
1000	3.061	0.9315	2.852	60	0.008	200	0.021
1005	3.069	0.9317	2.859	59	0.008	201	0.020
1010	3.077	0.9318	2.867	260	0.008	202	0.020
1015	3.085	0.9320	2.875	58	0.008	203	0.019
1020	3.093	0.9321	2.883	57	0.008	204	0.019
1025	3.101	0.9323	2.891	261	0.008	205	0.014
1030	3.109	0.9324	2.899	56	0.008	206	0.013
1035	3.116	0.9326	2.906	55	0.008	207	0.013

5 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	3.124	0.9327	2.914	262	0.008	208	0.012
1045	3.132	0.9329	2.922	54	0.008	209	0.012
1050	3.140	0.9330	2.930	53	0.008	210	0.012
1055	3.148	0.9332	2.937	263	0.008	211	0.011
1060	3.155	0.9333	2.945	52	0.008	212	0.011
1065	3.163	0.9335	2.953	51	0.008	213	0.011
1070	3.171	0.9336	2.960	264	0.008	214	0.011
1075	3.178	0.9338	2.968	50	0.008	215	0.010
1080	3.186	0.9340	2.976	49	0.008	216	0.010
1085	3.194	0.9341	2.983	265	0.008	217	0.012
1090	3.201	0.9343	2.991	48	0.008	218	0.012
1095	3.209	0.9344	2.999	47	0.008	219	0.012
1100	3.217	0.9346	3.006	266	0.008	220	0.011
1105	3.224	0.9347	3.014	46	0.008	221	0.011
1110	3.232	0.9349	3.021	45	0.008	222	0.011
1115	3.239	0.9350	3.029	267	0.008	223	0.011
1120	3.247	0.9352	3.036	44	0.008	224	0.011
1125	3.254	0.9353	3.044	43	0.008	225	0.011
1130	3.262	0.9355	3.052	268	0.008	226	0.011
1135	3.269	0.9356	3.059	42	0.008	227	0.010
1140	3.277	0.9358	3.067	41	0.007	228	0.010
1145	3.284	0.9359	3.074	269	0.007	229	0.010
1150	3.292	0.9361	3.081	40	0.007	230	0.010
1155	3.299	0.9362	3.089	39	0.007	231	0.010
1160	3.307	0.9364	3.096	270	0.007	232	0.010
1165	3.314	0.9366	3.104	38	0.007	233	0.010
1170	3.321	0.9367	3.111	37	0.007	234	0.010
1175	3.329	0.9369	3.119	271	0.007	235	0.009
1180	3.336	0.9370	3.126	36	0.007	236	0.009
1185	3.344	0.9372	3.133	35	0.007	237	0.009
1190	3.351	0.9373	3.141	272	0.007	238	0.009
1195	3.358	0.9375	3.148	34	0.007	239	0.009
1200	3.365	0.9376	3.156	33	0.007	240	0.009
1205	3.373	0.9378	3.163	273	0.007	241	0.009
1210	3.380	0.9379	3.170	32	0.007	242	0.009
1215	3.387	0.9381	3.178	31	0.007	243	0.009
1220	3.395	0.9382	3.185	274	0.007	244	0.009
1225	3.402	0.9384	3.192	30	0.007	245	0.009
1230	3.409	0.9385	3.199	29	0.007	246	0.009
1235	3.416	0.9387	3.207	275	0.007	247	0.009
1240	3.423	0.9388	3.214	28	0.007	248	0.008
1245	3.430	0.9390	3.221	27	0.007	249	0.008
1250	3.438	0.9392	3.228	276	0.007	250	0.008
1255	3.445	0.9393	3.236	26	0.007	251	0.008
1260	3.452	0.9395	3.243	25	0.007	252	0.008
1265	3.459	0.9396	3.250	277	0.007	253	0.008
1270	3.466	0.9398	3.257	24	0.007	254	0.008
1275	3.473	0.9399	3.265	23	0.007	255	0.008
1280	3.480	0.9401	3.272	278	0.007	256	0.008
1285	3.487	0.9402	3.279	22	0.007	257	0.008
1290	3.494	0.9404	3.286	21	0.007	258	0.008
1295	3.501	0.9405	3.293	279	0.007	259	0.008

5 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	3.508	0.9407	3.300	20	0.007	260	0.008
1305	3.515	0.9408	3.307	19	0.007	261	0.008
1310	3.522	0.9410	3.315	280	0.007	262	0.008
1315	3.529	0.9411	3.322	18	0.007	263	0.008
1320	3.536	0.9413	3.329	17	0.007	264	0.008
1325	3.543	0.9415	3.336	281	0.007	265	0.008
1330	3.550	0.9416	3.343	16	0.007	266	0.008
1335	3.557	0.9418	3.350	15	0.007	267	0.008
1340	3.564	0.9419	3.357	282	0.007	268	0.008
1345	3.571	0.9421	3.364	14	0.007	269	0.007
1350	3.578	0.9422	3.371	13	0.007	270	0.007
1355	3.585	0.9424	3.378	283	0.007	271	0.007
1360	3.592	0.9425	3.385	12	0.007	272	0.007
1365	3.599	0.9427	3.392	11	0.007	273	0.007
1370	3.605	0.9428	3.399	284	0.007	274	0.007
1375	3.612	0.9430	3.406	10	0.007	275	0.007
1380	3.619	0.9431	3.413	9	0.007	276	0.007
1385	3.626	0.9433	3.420	285	0.007	277	0.007
1390	3.633	0.9434	3.427	8	0.007	278	0.007
1395	3.639	0.9436	3.434	7	0.007	279	0.007
1400	3.646	0.9437	3.441	286	0.007	280	0.007
1405	3.653	0.9439	3.448	6	0.007	281	0.007
1410	3.660	0.9441	3.455	5	0.007	282	0.007
1415	3.666	0.9442	3.462	287	0.007	283	0.007
1420	3.673	0.9444	3.469	4	0.007	284	0.007
1425	3.680	0.9445	3.476	3	0.007	285	0.007
1430	3.687	0.9447	3.483	288	0.007	286	0.007
1435	3.693	0.9448	3.490	2	0.007	287	0.007
1440	3.700	**0.9450**	3.496	1	0.007	288	0.007

2 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.300	0.6538	0.196	193	0.196	1	0.002
10	0.383	0.6538	0.251	192	0.055	2	0.002
15	0.443	0.6538	0.289	191	0.039	3	0.002
20	0.490	0.6538	0.321	194	0.031	4	0.002
25	0.531	0.6538	0.347	190	0.026	5	0.002
30	0.566	**0.6538**	0.370	189	0.023	6	0.002
35	0.598	0.6714	0.402	195	0.031	7	0.003
40	0.627	0.6891	0.432	188	0.031	8	0.003
45	0.654	0.7068	0.462	187	0.030	9	0.003
50	0.679	0.7245	0.492	196	0.030	10	0.003
55	0.702	0.7422	0.521	186	0.029	11	0.003
60	0.724	**0.7599**	0.550	185	0.029	12	0.003
65	0.745	0.7645	0.570	197	0.019	13	0.003
70	0.765	0.7692	0.588	184	0.019	14	0.003
75	0.784	0.7739	0.607	183	0.018	15	0.003
80	0.802	0.7785	0.624	198	0.018	16	0.003
85	0.819	0.7832	0.642	182	0.017	17	0.003
90	0.836	0.7879	0.659	181	0.017	18	0.003
95	0.852	0.7925	0.676	199	0.017	19	0.003
100	0.868	0.7972	0.692	180	0.016	20	0.003
105	0.883	0.8019	0.708	179	0.016	21	0.003
110	0.898	0.8065	0.724	200	0.016	22	0.003
115	0.912	0.8112	0.740	178	0.016	23	0.003
120	0.926	0.8159	0.756	177	0.016	24	0.003
125	0.940	0.8205	0.771	201	0.015	25	0.003
130	0.953	0.8252	0.786	176	0.015	26	0.003
135	0.966	0.8299	0.801	175	0.015	27	0.003
140	0.978	0.8346	0.816	202	0.015	28	0.003
145	0.990	0.8392	0.831	174	0.015	29	0.003
150	1.002	0.8439	0.846	173	0.015	30	0.003
155	1.014	0.8486	0.861	203	0.015	31	0.003
160	1.026	0.8532	0.875	172	0.015	32	0.003
165	1.037	0.8579	0.890	171	0.014	33	0.003
170	1.048	0.8626	0.904	204	0.014	34	0.003
175	1.059	0.8672	0.918	170	0.014	35	0.003
180	1.069	**0.8719**	0.932	169	0.014	36	0.003
185	1.080	0.8730	0.943	205	0.010	37	0.003
190	1.090	0.8741	0.953	168	0.010	38	0.003
195	1.100	0.8752	0.963	167	0.010	39	0.003
200	1.110	0.8763	0.973	206	0.010	40	0.003
205	1.120	0.8775	0.983	166	0.010	41	0.003
210	1.130	0.8786	0.992	165	0.010	42	0.003
215	1.139	0.8797	1.002	207	0.010	43	0.003
220	1.148	0.8808	1.012	164	0.009	44	0.003
225	1.158	0.8819	1.021	163	0.009	45	0.003
230	1.167	0.8830	1.030	208	0.009	46	0.003
235	1.176	0.8841	1.039	162	0.009	47	0.003
240	1.184	0.8852	1.049	161	0.009	48	0.003
245	1.193	0.8864	1.058	209	0.009	49	0.003
250	1.202	0.8875	1.067	160	0.009	50	0.003
255	1.210	0.8886	1.075	159	0.009	51	0.003

2 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.219	0.8897	1.084	210	0.009	52	0.003
265	1.227	0.8908	1.093	158	0.009	53	0.003
270	1.235	0.8919	1.102	157	0.009	54	0.003
275	1.243	0.8930	1.110	211	0.009	55	0.003
280	1.251	0.8941	1.119	156	0.009	56	0.003
285	1.259	0.8952	1.127	155	0.008	57	0.003
290	1.267	0.8964	1.135	212	0.008	58	0.003
295	1.275	0.8975	1.144	154	0.008	59	0.003
300	1.282	0.8986	1.152	153	0.008	60	0.003
305	1.290	0.8997	1.160	213	0.008	61	0.003
310	1.297	0.9008	1.168	152	0.008	62	0.003
315	1.305	0.9019	1.177	151	0.008	63	0.003
320	1.312	0.9030	1.185	214	0.008	64	0.003
325	1.319	0.9041	1.193	150	0.008	65	0.003
330	1.326	0.9052	1.201	149	0.008	66	0.003
335	1.333	0.9064	1.209	215	0.008	67	0.003
340	1.340	0.9075	1.216	148	0.008	68	0.003
345	1.347	0.9086	1.224	147	0.008	69	0.003
350	1.354	0.9097	1.232	216	0.008	70	0.003
355	1.361	0.9108	1.240	146	0.008	71	0.003
360	**1.365**	**0.9119**	1.245	145	0.005	72	0.003
365	1.371	0.9121	1.250	217	0.006	73	0.003
370	1.377	0.9122	1.256	144	0.006	74	0.003
375	1.382	0.9124	1.261	143	0.005	75	0.003
380	1.388	0.9125	1.267	218	0.005	76	0.003
385	1.394	0.9127	1.272	142	0.005	77	0.003
390	1.399	0.9128	1.277	141	0.005	78	0.003
395	1.405	0.9130	1.283	219	0.005	79	0.003
400	1.410	0.9131	1.288	140	0.005	80	0.003
405	1.416	0.9133	1.293	139	0.005	81	0.003
410	1.421	0.9135	1.298	220	0.005	82	0.003
415	1.427	0.9136	1.303	138	0.005	83	0.003
420	1.432	0.9138	1.308	137	0.005	84	0.003
425	1.437	0.9139	1.314	221	0.005	85	0.003
430	1.442	0.9141	1.319	136	0.005	86	0.003
435	1.448	0.9142	1.323	135	0.005	87	0.003
440	1.453	0.9144	1.328	222	0.005	88	0.003
445	1.458	0.9145	1.333	134	0.005	89	0.003
450	1.463	0.9147	1.338	133	0.005	90	0.003
455	1.468	0.9148	1.343	223	0.005	91	0.004
460	1.473	0.9150	1.348	132	0.005	92	0.004
465	1.478	0.9151	1.353	131	0.005	93	0.004
470	1.483	0.9153	1.357	224	0.005	94	0.004
475	1.488	0.9154	1.362	130	0.005	95	0.004
480	1.493	0.9156	1.367	129	0.005	96	0.004
485	1.497	0.9157	1.371	225	0.005	97	0.004
490	1.502	0.9159	1.376	128	0.005	98	0.004
495	1.507	0.9161	1.380	127	0.005	99	0.004
500	1.512	0.9162	1.385	226	0.005	100	0.004
505	1.516	0.9164	1.390	126	0.005	101	0.004
510	1.521	0.9165	1.394	125	0.004	102	0.004
515	1.526	0.9167	1.399	227	0.004	103	0.004

2 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	1.530	0.9168	1.403	124	0.004	104	0.004
525	1.535	0.9170	1.407	123	0.004	105	0.004
530	1.539	0.9171	1.412	228	0.004	106	0.004
535	1.544	0.9173	1.416	122	0.004	107	0.004
540	1.548	0.9174	1.420	121	0.004	108	0.004
545	1.553	0.9176	1.425	229	0.004	109	0.004
550	1.557	0.9177	1.429	120	0.004	110	0.004
555	1.562	0.9179	1.433	119	0.004	111	0.004
560	1.566	0.9180	1.438	230	0.004	112	0.004
565	1.570	0.9182	1.442	118	0.004	113	0.004
570	1.575	0.9183	1.446	117	0.004	114	0.004
575	1.579	0.9185	1.450	231	0.004	115	0.004
580	1.583	0.9187	1.454	116	0.004	116	0.004
585	1.587	0.9188	1.458	115	0.004	117	0.004
590	1.591	0.9190	1.463	232	0.004	118	0.004
595	1.596	0.9191	1.467	114	0.004	119	0.004
600	1.600	0.9193	1.471	113	0.004	120	0.004
605	1.604	0.9194	1.475	233	0.004	121	0.004
610	1.608	0.9196	1.479	112	0.004	122	0.004
615	1.612	0.9197	1.483	111	0.004	123	0.004
620	1.616	0.9199	1.487	234	0.004	124	0.004
625	1.620	0.9200	1.491	110	0.004	125	0.004
630	1.624	0.9202	1.495	109	0.004	126	0.005
635	1.628	0.9203	1.499	235	0.004	127	0.005
640	1.632	0.9205	1.502	108	0.004	128	0.005
645	1.636	0.9206	1.506	107	0.004	129	0.005
650	1.640	0.9208	1.510	236	0.004	130	0.005
655	1.644	0.9209	1.514	106	0.004	131	0.005
660	1.648	0.9211	1.518	105	0.004	132	0.005
665	1.652	0.9213	1.522	237	0.004	133	0.005
670	1.656	0.9214	1.526	104	0.004	134	0.005
675	1.659	0.9216	1.529	103	0.004	135	0.005
680	1.663	0.9217	1.533	238	0.004	136	0.005
685	1.667	0.9219	1.537	102	0.004	137	0.005
690	1.671	0.9220	1.541	101	0.004	138	0.005
695	1.675	0.9222	1.544	239	0.004	139	0.005
700	1.678	0.9223	1.548	100	0.004	140	0.005
705	1.682	0.9225	1.552	99	0.004	141	0.005
710	1.686	0.9226	1.555	240	0.004	142	0.005
715	1.689	0.9228	1.559	98	0.004	143	0.005
720	1.693	0.9229	1.563	97	0.004	144	0.006
725	1.697	0.9231	1.566	241	0.004	145	0.005
730	1.700	0.9232	1.570	96	0.004	146	0.008
735	1.704	0.9234	1.573	95	0.004	147	0.008
740	1.708	0.9235	1.577	242	0.004	148	0.008
745	1.711	0.9237	1.581	94	0.004	149	0.008
750	1.715	0.9239	1.584	93	0.004	150	0.008
755	1.718	0.9240	1.588	243	0.004	151	0.008
760	1.722	0.9242	1.591	92	0.004	152	0.008
765	1.725	0.9243	1.595	91	0.004	153	0.008
770	1.729	0.9245	1.598	244	0.003	154	0.008
775	1.732	0.9246	1.602	90	0.003	155	0.008

2 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	1.736	0.9248	1.605	89	0.003	156	0.009
785	1.739	0.9249	1.609	245	0.003	157	0.009
790	1.743	0.9251	1.612	88	0.003	158	0.009
795	1.746	0.9252	1.615	87	0.003	159	0.009
800	1.749	0.9254	1.619	246	0.003	160	0.009
805	1.753	0.9255	1.622	86	0.003	161	0.009
810	1.756	0.9257	1.626	85	0.003	162	0.009
815	1.760	0.9258	1.629	247	0.003	163	0.009
820	1.763	0.9260	1.632	84	0.003	164	0.009
825	1.766	0.9261	1.636	83	0.003	165	0.010
830	1.770	0.9263	1.639	248	0.003	166	0.010
835	1.773	0.9265	1.642	82	0.003	167	0.010
840	1.776	0.9266	1.646	81	0.003	168	0.010
845	1.779	0.9268	1.649	249	0.003	169	0.014
850	1.783	0.9269	1.652	80	0.003	170	0.014
855	1.786	0.9271	1.656	79	0.003	171	0.014
860	1.789	0.9272	1.659	250	0.003	172	0.015
865	1.792	0.9274	1.662	78	0.003	173	0.015
870	1.796	0.9275	1.665	77	0.003	174	0.015
875	1.799	0.9277	1.669	251	0.003	175	0.015
880	1.802	0.9278	1.672	76	0.003	176	0.015
885	1.805	0.9280	1.675	75	0.003	177	0.016
890	1.808	0.9281	1.678	252	0.003	178	0.016
895	1.812	0.9283	1.682	74	0.003	179	0.016
900	1.815	0.9284	1.685	73	0.003	180	0.016
905	1.818	0.9286	1.688	253	0.003	181	0.017
910	1.821	0.9288	1.691	72	0.003	182	0.017
915	1.824	0.9289	1.694	71	0.003	183	0.018
920	1.827	0.9291	1.697	254	0.003	184	0.019
925	1.830	0.9292	1.701	70	0.003	185	0.029
930	1.833	0.9294	1.704	69	0.003	186	0.029
935	1.836	0.9295	1.707	255	0.003	187	0.030
940	1.839	0.9297	1.710	68	0.003	188	0.031
945	1.842	0.9298	1.713	67	0.003	189	0.023
950	1.845	0.9300	1.716	256	0.003	190	0.026
955	1.848	0.9301	1.719	66	0.003	191	0.039
960	1.851	0.9303	1.722	65	0.003	192	0.055
965	1.854	0.9304	1.725	257	0.003	193	0.196
970	1.857	0.9306	1.728	64	0.003	194	0.031
975	1.860	0.9307	1.731	63	0.003	195	0.031
980	1.863	0.9309	1.735	258	0.003	196	0.030
985	1.866	0.9310	1.738	62	0.003	197	0.019
990	1.869	0.9312	1.741	61	0.003	198	0.018
995	1.872	0.9314	1.744	259	0.003	199	0.017
1000	1.875	0.9315	1.747	60	0.003	200	0.016
1005	1.878	0.9317	1.750	59	0.003	201	0.015
1010	1.881	0.9318	1.753	260	0.003	202	0.015
1015	1.884	0.9320	1.756	58	0.003	203	0.015
1020	1.887	0.9321	1.759	57	0.003	204	0.014
1025	1.889	0.9323	1.762	261	0.003	205	0.010
1030	1.892	0.9324	1.764	56	0.003	206	0.010
1035	1.895	0.9326	1.767	55	0.003	207	0.010

2 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	1.898	0.9327	1.770	262	0.003	208	0.009
1045	1.901	0.9329	1.773	54	0.003	209	0.009
1050	1.904	0.9330	1.776	53	0.003	210	0.009
1055	1.906	0.9332	1.779	263	0.003	211	0.009
1060	1.909	0.9333	1.782	52	0.003	212	0.008
1065	1.912	0.9335	1.785	51	0.003	213	0.008
1070	1.915	0.9336	1.788	264	0.003	214	0.008
1075	1.918	0.9338	1.791	50	0.003	215	0.008
1080	1.920	0.9340	1.794	49	0.003	216	0.008
1085	1.923	0.9341	1.796	265	0.003	217	0.006
1090	1.926	0.9343	1.799	48	0.003	218	0.005
1095	1.929	0.9344	1.802	47	0.003	219	0.005
1100	1.931	0.9346	1.805	266	0.003	220	0.005
1105	1.934	0.9347	1.808	46	0.003	221	0.005
1110	1.937	0.9349	1.811	45	0.003	222	0.005
1115	1.940	0.9350	1.814	267	0.003	223	0.005
1120	1.942	0.9352	1.816	44	0.003	224	0.005
1125	1.945	0.9353	1.819	43	0.003	225	0.005
1130	1.948	0.9355	1.822	268	0.003	226	0.005
1135	1.950	0.9356	1.825	42	0.003	227	0.004
1140	1.953	0.9358	1.828	41	0.003	228	0.004
1145	1.956	0.9359	1.830	269	0.003	229	0.004
1150	1.958	0.9361	1.833	40	0.003	230	0.004
1155	1.961	0.9362	1.836	39	0.003	231	0.004
1160	1.964	0.9364	1.839	270	0.003	232	0.004
1165	1.966	0.9366	1.841	38	0.003	233	0.004
1170	1.969	0.9367	1.844	37	0.003	234	0.004
1175	1.971	0.9369	1.847	271	0.003	235	0.004
1180	1.974	0.9370	1.850	36	0.003	236	0.004
1185	1.977	0.9372	1.852	35	0.003	237	0.004
1190	1.979	0.9373	1.855	272	0.003	238	0.004
1195	1.982	0.9375	1.858	34	0.003	239	0.004
1200	1.984	0.9376	1.861	33	0.003	240	0.004
1205	1.987	0.9378	1.863	273	0.003	241	0.004
1210	1.989	0.9379	1.866	32	0.003	242	0.004
1215	1.992	0.9381	1.869	31	0.003	243	0.004
1220	1.995	0.9382	1.871	274	0.003	244	0.003
1225	1.997	0.9384	1.874	30	0.003	245	0.003
1230	2.000	0.9385	1.877	29	0.003	246	0.003
1235	2.002	0.9387	1.879	275	0.003	247	0.003
1240	2.005	0.9388	1.882	28	0.003	248	0.003
1245	2.007	0.9390	1.885	27	0.003	249	0.003
1250	2.010	0.9392	1.887	276	0.003	250	0.003
1255	2.012	0.9393	1.890	26	0.003	251	0.003
1260	2.015	0.9395	1.893	25	0.003	252	0.003
1265	2.017	0.9396	1.895	277	0.003	253	0.003
1270	2.020	0.9398	1.898	24	0.003	254	0.003
1275	2.022	0.9399	1.901	23	0.003	255	0.003
1280	2.025	0.9401	1.903	278	0.003	256	0.003
1285	2.027	0.9402	1.906	22	0.003	257	0.003
1290	2.029	0.9404	1.908	21	0.003	258	0.003
1295	2.032	0.9405	1.911	279	0.003	259	0.003

2 Year Nested Storm Distribution for Jamul Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	2.034	0.9407	1.914	20	0.003	260	0.003
1305	2.037	0.9408	1.916	19	0.003	261	0.003
1310	2.039	0.9410	1.919	280	0.003	262	0.003
1315	2.042	0.9411	1.921	18	0.003	263	0.003
1320	2.044	0.9413	1.924	17	0.003	264	0.003
1325	2.046	0.9415	1.927	281	0.003	265	0.003
1330	2.049	0.9416	1.929	16	0.003	266	0.003
1335	2.051	0.9418	1.932	15	0.003	267	0.003
1340	2.054	0.9419	1.934	282	0.003	268	0.003
1345	2.056	0.9421	1.937	14	0.003	269	0.003
1350	2.058	0.9422	1.939	13	0.003	270	0.003
1355	2.061	0.9424	1.942	283	0.003	271	0.003
1360	2.063	0.9425	1.944	12	0.003	272	0.003
1365	2.065	0.9427	1.947	11	0.003	273	0.003
1370	2.068	0.9428	1.950	284	0.003	274	0.003
1375	2.070	0.9430	1.952	10	0.003	275	0.003
1380	2.072	0.9431	1.955	9	0.003	276	0.003
1385	2.075	0.9433	1.957	285	0.003	277	0.003
1390	2.077	0.9434	1.960	8	0.003	278	0.003
1395	2.079	0.9436	1.962	7	0.003	279	0.003
1400	2.082	0.9437	1.965	286	0.003	280	0.003
1405	2.084	0.9439	1.967	6	0.002	281	0.003
1410	2.086	0.9441	1.970	5	0.002	282	0.003
1415	2.089	0.9442	1.972	287	0.002	283	0.003
1420	2.091	0.9444	1.975	4	0.002	284	0.003
1425	2.093	0.9445	1.977	3	0.002	285	0.003
1430	2.095	0.9447	1.980	288	0.002	286	0.003
1435	2.098	0.9448	1.982	2	0.002	287	0.002
1440	2.100	**0.9450**	1.984	1	0.002	288	0.002

Notes for Nested Storm Distribution

Notes

1. Cumulative Rainfall Depths for durations between 0 and 6 hours are determined per Equations 4-25 and 4-26 of the 2003 SDCHM. Cumulative Rainfall Depths for durations between 6 and 24 hours are interpolated using log-log interpolation.

Eq 4-25: $I = 7.44\ p_6\ D^{-0.645}$ (0-6 hr durations)

Eq 4-26: $P = I\ (D/60)$ (0-6 hr durations)

Eq X-XX $P = C\ D^{M}$ (6-24 hr durations)

Where $C = p_{6adj}/360^{M}$

D = Time in minutes

$M = \ln(p_{6adj}/p_{24})/(\ln(360) - \ln(1440))$

2. Rainfall Depth-Area Adjustment Ratios are determined per linear interpolation between the values provided in Table 4-1 of the 2003 SDCHM.

3. Cumulative Adjusted Rainfall Depth is the Cumulative Rainfall Depth multiplied by the Rainfall Depth-Area Adjustment Ratio.

4. Ordinate Numbers provided by County of San Diego

5. Incremental Rainfall represents the difference in Cumulative Adjusted Rainfall Depths between consecutive rainfall ordinates.

6. Sorted Incremental Rainfall values are sorted by the Ordinate Numbers.

Nested Storm Distribution for Las Flores Creek

Nested Storm Inputs for Las Flores Creek

Variable	Units	100 yr	10 yr	5 yr	2 yr
T_p [1]	minutes	136.8	136.8	136.8	136.8
P_6 [2]	inches	3.0	1.9	1.7	1.3
P_{6adj} [3]	inches	3.0	1.9	1.7	1.2
P_{24} [4]	inches	4.8	3.3	2.8	1.9
Area [5]	mi^2	26.6	26.6	26.6	26.6
M [6]	-	0.339036	0.398233	0.359946	0.310744
C [7]	-	0.407796	0.182284	0.204323	0.198295

1. T_p as determined per Lag Time Calculations in Appendix C.5 of this report
2. P_6 as determined per Unadjusted Rainfall Depths in Appendix C.6 of this report
3. P_{6adj} represents the adjusted value of P_6 to be within 45-65% of the P_{24} value (if necessary)
4. P_{24} as determined per Unadjusted Rainfall Depths in Appendix C.6 of this report
5. Area represents the Basin area in square miles
6. $M = \ln(P_{6adj}/P_{24})/(\ln(360) - \ln(1440))$
7. $C = P_{6adj}/360^M$

Rainfall Depth-Area Adjustments for Las Flores Creek

2003 San Diego County Hydrology Manual Table 4-1					
Watershed Area (mi^2)	**Rainfall Depth-Area Adjustment for Duration**				
	30 Minute	**1 Hour**	**3 Hour**	**6 Hour**	**24 Hour**
0	1.000	1.000	1.000	1.000	1.000
5	0.942	0.970	0.980	0.985	0.990
10	0.900	0.947	0.970	0.980	0.985
20	0.834	0.900	0.952	0.963	0.975
30	0.768	0.858	0.932	0.950	0.964
40	0.730	0.830	0.915	0.940	0.958
50	0.692	0.800	0.900	0.928	0.952
60	0.663	0.778	0.883	0.920	0.948
70	0.654	0.760	0.872	0.912	0.945
80	0.630	0.746	0.862	0.904	0.942
90	0.620	0.735	0.853	0.896	0.938
100	0.610	0.722	0.845	0.890	0.935
125	0.588	0.700	0.830	0.878	0.930
150	0.572	0.685	0.818	0.865	0.925
175	0.572	0.672	0.808	0.858	0.922
200	0.572	0.666	0.798	0.851	0.918
225	0.572	0.660	0.790	0.845	0.915
250	0.572	0.655	0.787	0.842	0.914
300	0.572	0.652	0.782	0.838	0.912
350	0.572	0.652	0.780	0.830	0.910
400	0.572	0.652	0.780	0.828	0.908

Rainfall Depth-Area Adjustments for Las Flores Creek					
Watershed Area (mi^2)	**30 Minute**	**1 Hour**	**3 Hour**	**6 Hour**	**24 Hour**
20	0.834	0.900	0.952	0.963	0.975
26.6	**0.790**	**0.872**	**0.939**	**0.954**	**0.968**
30	0.768	0.858	0.932	0.950	0.964

1. Rainfall Depth-Area Adjustment factors associated with 30-minute, 1-hour, 3-hour, 6-hour, and 24-hour storms have been interoplated from the data on Table 4-1 of the 2003 SDCHM with respect to the basin area and the duration of the storm.

100 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.659	0.7904	0.521	193	0.521	1	0.006
10	0.842	0.7904	0.666	192	0.145	2	0.006
15	0.973	0.7904	0.769	191	0.103	3	0.006
20	1.077	0.7904	0.852	194	0.083	4	0.006
25	1.166	0.7904	0.922	190	0.070	5	0.006
30	1.244	**0.7904**	0.984	189	0.062	6	0.006
35	1.314	0.8041	1.057	195	0.073	7	0.006
40	1.378	0.8177	1.127	188	0.070	8	0.006
45	1.437	0.8314	1.195	187	0.068	9	0.006
50	1.492	0.8450	1.260	196	0.066	10	0.006
55	1.543	0.8586	1.325	186	0.064	11	0.006
60	1.591	**0.8723**	1.388	185	0.063	12	0.006
65	1.637	0.8751	1.433	197	0.045	13	0.006
70	1.681	0.8778	1.476	184	0.043	14	0.006
75	1.723	0.8806	1.517	183	0.041	15	0.006
80	1.763	0.8834	1.557	198	0.040	16	0.006
85	1.801	0.8861	1.596	182	0.039	17	0.006
90	1.838	0.8889	1.634	181	0.038	18	0.006
95	1.873	0.8917	1.670	199	0.037	19	0.006
100	1.908	0.8945	1.706	180	0.036	20	0.006
105	1.941	0.8972	1.742	179	0.035	21	0.006
110	1.974	0.9000	1.776	200	0.034	22	0.006
115	2.005	0.9028	1.810	178	0.034	23	0.006
120	2.035	0.9055	1.843	177	0.033	24	0.006
125	2.065	0.9083	1.876	201	0.033	25	0.006
130	2.094	0.9111	1.908	176	0.032	26	0.006
135	2.122	0.9139	1.939	175	0.032	27	0.006
140	2.150	0.9166	1.971	202	0.031	28	0.006
145	2.177	0.9194	2.001	174	0.031	29	0.006
150	2.203	0.9222	2.032	173	0.030	30	0.006
155	2.229	0.9249	2.062	203	0.030	31	0.006
160	2.254	0.9277	2.091	172	0.030	32	0.006
165	2.279	0.9305	2.121	171	0.029	33	0.006
170	2.303	0.9333	2.150	204	0.029	34	0.006
175	2.327	0.9360	2.178	170	0.029	35	0.006
180	2.351	**0.9388**	2.207	169	0.028	36	0.007
185	2.373	0.9392	2.229	205	0.023	37	0.007
190	2.396	0.9397	2.252	168	0.022	38	0.007
195	2.418	0.9401	2.273	167	0.022	39	0.007
200	2.440	0.9405	2.295	206	0.022	40	0.007
205	2.462	0.9410	2.316	166	0.021	41	0.007
210	2.483	0.9414	2.337	165	0.021	42	0.007
215	2.504	0.9418	2.358	207	0.021	43	0.007
220	2.524	0.9423	2.378	164	0.020	44	0.007
225	2.544	0.9427	2.399	163	0.020	45	0.007
230	2.564	0.9431	2.418	208	0.020	46	0.007
235	2.584	0.9436	2.438	162	0.020	47	0.007
240	2.603	0.9440	2.457	161	0.019	48	0.007
245	2.622	0.9444	2.477	209	0.019	49	0.007
250	2.641	0.9449	2.496	160	0.019	50	0.007
255	2.660	0.9453	2.514	159	0.019	51	0.007

100 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	2.678	0.9457	2.533	210	0.019	52	0.007
265	2.696	0.9462	2.551	158	0.018	53	0.007
270	2.714	0.9466	2.569	157	0.018	54	0.007
275	2.732	0.9470	2.587	211	0.018	55	0.007
280	2.750	0.9475	2.605	156	0.018	56	0.007
285	2.767	0.9479	2.623	155	0.018	57	0.007
290	2.784	0.9483	2.640	212	0.017	58	0.007
295	2.801	0.9488	2.658	154	0.017	59	0.007
300	2.818	0.9492	2.675	153	0.017	60	0.007
305	2.834	0.9496	2.692	213	0.017	61	0.007
310	2.851	0.9501	2.709	152	0.017	62	0.007
315	2.867	0.9505	2.725	151	0.017	63	0.007
320	2.883	0.9509	2.742	214	0.017	64	0.007
325	2.899	0.9514	2.758	150	0.016	65	0.007
330	2.915	0.9518	2.774	149	0.016	66	0.007
335	2.930	0.9523	2.791	215	0.016	67	0.007
340	2.946	0.9527	2.807	148	0.016	68	0.007
345	2.961	0.9531	2.822	147	0.016	69	0.008
350	2.976	0.9536	2.838	216	0.016	70	0.008
355	2.991	0.9540	2.854	146	0.016	71	0.008
360	**3.000**	**0.9544**	2.863	145	0.010	72	0.008
365	3.014	0.9545	2.877	217	0.014	73	0.008
370	3.028	0.9545	2.890	144	0.013	74	0.008
375	3.042	0.9546	2.904	143	0.013	75	0.008
380	3.055	0.9547	2.917	218	0.013	76	0.008
385	3.069	0.9547	2.930	142	0.013	77	0.008
390	3.083	0.9548	2.943	141	0.013	78	0.008
395	3.096	0.9549	2.956	219	0.013	79	0.008
400	3.109	0.9549	2.969	140	0.013	80	0.008
405	3.122	0.9550	2.982	139	0.013	81	0.008
410	3.135	0.9550	2.994	220	0.013	82	0.008
415	3.148	0.9551	3.007	138	0.013	83	0.008
420	3.161	0.9552	3.019	137	0.012	84	0.008
425	3.174	0.9552	3.032	221	0.012	85	0.008
430	3.186	0.9553	3.044	136	0.012	86	0.008
435	3.199	0.9553	3.056	135	0.012	87	0.008
440	3.211	0.9554	3.068	222	0.012	88	0.008
445	3.224	0.9555	3.080	134	0.012	89	0.008
450	3.236	0.9555	3.092	133	0.012	90	0.008
455	3.248	0.9556	3.104	223	0.012	91	0.008
460	3.260	0.9557	3.115	132	0.012	92	0.009
465	3.272	0.9557	3.127	131	0.012	93	0.009
470	3.284	0.9558	3.139	224	0.012	94	0.009
475	3.296	0.9558	3.150	130	0.011	95	0.009
480	3.307	0.9559	3.161	129	0.011	96	0.009
485	3.319	0.9560	3.173	225	0.011	97	0.009
490	3.331	0.9560	3.184	128	0.011	98	0.009
495	3.342	0.9561	3.195	127	0.011	99	0.009
500	3.353	0.9561	3.206	226	0.011	100	0.009
505	3.365	0.9562	3.217	126	0.011	101	0.009
510	3.376	0.9563	3.228	125	0.011	102	0.009
515	3.387	0.9563	3.239	227	0.011	103	0.009

100 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	3.398	0.9564	3.250	124	0.011	104	0.009
525	3.409	0.9565	3.261	123	0.011	105	0.009
530	3.420	0.9565	3.272	228	0.011	106	0.009
535	3.431	0.9566	3.282	122	0.011	107	0.009
540	3.442	0.9566	3.293	121	0.011	108	0.009
545	3.453	0.9567	3.303	229	0.011	109	0.010
550	3.464	0.9568	3.314	120	0.010	110	0.010
555	3.474	0.9568	3.324	119	0.010	111	0.010
560	3.485	0.9569	3.335	230	0.010	112	0.010
565	3.495	0.9569	3.345	118	0.010	113	0.010
570	3.506	0.9570	3.355	117	0.010	114	0.010
575	3.516	0.9571	3.365	231	0.010	115	0.010
580	3.527	0.9571	3.375	116	0.010	116	0.010
585	3.537	0.9572	3.385	115	0.010	117	0.010
590	3.547	0.9573	3.395	232	0.010	118	0.010
595	3.557	0.9573	3.405	114	0.010	119	0.010
600	3.567	0.9574	3.415	113	0.010	120	0.010
605	3.577	0.9574	3.425	233	0.010	121	0.011
610	3.587	0.9575	3.435	112	0.010	122	0.011
615	3.597	0.9576	3.445	111	0.010	123	0.011
620	3.607	0.9576	3.454	234	0.010	124	0.011
625	3.617	0.9577	3.464	110	0.010	125	0.011
630	3.627	0.9577	3.474	109	0.010	126	0.011
635	3.637	0.9578	3.483	235	0.010	127	0.011
640	3.646	0.9579	3.493	108	0.009	128	0.011
645	3.656	0.9579	3.502	107	0.009	129	0.011
650	3.665	0.9580	3.511	236	0.009	130	0.011
655	3.675	0.9581	3.521	106	0.009	131	0.012
660	3.684	0.9581	3.530	105	0.009	132	0.012
665	3.694	0.9582	3.539	237	0.009	133	0.012
670	3.703	0.9582	3.549	104	0.009	134	0.012
675	3.713	0.9583	3.558	103	0.009	135	0.012
680	3.722	0.9584	3.567	238	0.009	136	0.012
685	3.731	0.9584	3.576	102	0.009	137	0.012
690	3.740	0.9585	3.585	101	0.009	138	0.013
695	3.750	0.9586	3.594	239	0.009	139	0.013
700	3.759	0.9586	3.603	100	0.009	140	0.013
705	3.768	0.9587	3.612	99	0.009	141	0.013
710	3.777	0.9587	3.621	240	0.009	142	0.013
715	3.786	0.9588	3.630	98	0.009	143	0.013
720	3.795	0.9589	3.639	97	0.009	144	0.013
725	3.804	0.9589	3.647	241	0.009	145	0.010
730	3.813	0.9590	3.656	96	0.009	146	0.016
735	3.821	0.9590	3.665	95	0.009	147	0.016
740	3.830	0.9591	3.674	242	0.009	148	0.016
745	3.839	0.9592	3.682	94	0.009	149	0.016
750	3.848	0.9592	3.691	93	0.009	150	0.016
755	3.856	0.9593	3.699	243	0.009	151	0.017
760	3.865	0.9594	3.708	92	0.009	152	0.017
765	3.874	0.9594	3.716	91	0.008	153	0.017
770	3.882	0.9595	3.725	244	0.008	154	0.017
775	3.891	0.9595	3.733	90	0.008	155	0.018

100 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	3.899	0.9596	3.742	89	0.008	156	0.018
785	3.908	0.9597	3.750	245	0.008	157	0.018
790	3.916	0.9597	3.758	88	0.008	158	0.018
795	3.924	0.9598	3.767	87	0.008	159	0.019
800	3.933	0.9598	3.775	246	0.008	160	0.019
805	3.941	0.9599	3.783	86	0.008	161	0.019
810	3.949	0.9600	3.791	85	0.008	162	0.020
815	3.958	0.9600	3.799	247	0.008	163	0.020
820	3.966	0.9601	3.808	84	0.008	164	0.020
825	3.974	0.9602	3.816	83	0.008	165	0.021
830	3.982	0.9602	3.824	248	0.008	166	0.021
835	3.990	0.9603	3.832	82	0.008	167	0.022
840	3.998	0.9603	3.840	81	0.008	168	0.022
845	4.006	0.9604	3.848	249	0.008	169	0.028
850	4.014	0.9605	3.856	80	0.008	170	0.029
855	4.022	0.9605	3.864	79	0.008	171	0.029
860	4.030	0.9606	3.872	250	0.008	172	0.030
865	4.038	0.9606	3.879	78	0.008	173	0.030
870	4.046	0.9607	3.887	77	0.008	174	0.031
875	4.054	0.9608	3.895	251	0.008	175	0.032
880	4.062	0.9608	3.903	76	0.008	176	0.032
885	4.070	0.9609	3.911	75	0.008	177	0.033
890	4.077	0.9610	3.918	252	0.008	178	0.034
895	4.085	0.9610	3.926	74	0.008	179	0.035
900	4.093	0.9611	3.934	73	0.008	180	0.036
905	4.101	0.9611	3.941	253	0.008	181	0.038
910	4.108	0.9612	3.949	72	0.008	182	0.039
915	4.116	0.9613	3.957	71	0.008	183	0.041
920	4.124	0.9613	3.964	254	0.008	184	0.043
925	4.131	0.9614	3.972	70	0.008	185	0.063
930	4.139	0.9614	3.979	69	0.008	186	0.064
935	4.146	0.9615	3.987	255	0.007	187	0.068
940	4.154	0.9616	3.994	68	0.007	188	0.070
945	4.161	0.9616	4.002	67	0.007	189	0.062
950	4.169	0.9617	4.009	256	0.007	190	0.070
955	4.176	0.9618	4.016	66	0.007	191	0.103
960	4.184	0.9618	4.024	65	0.007	192	0.145
965	4.191	0.9619	4.031	257	0.007	193	0.521
970	4.198	0.9619	4.038	64	0.007	194	0.083
975	4.206	0.9620	4.046	63	0.007	195	0.073
980	4.213	0.9621	4.053	258	0.007	196	0.066
985	4.220	0.9621	4.060	62	0.007	197	0.045
990	4.227	0.9622	4.068	61	0.007	198	0.040
995	4.235	0.9623	4.075	259	0.007	199	0.037
1000	4.242	0.9623	4.082	60	0.007	200	0.034
1005	4.249	0.9624	4.089	59	0.007	201	0.033
1010	4.256	0.9624	4.096	260	0.007	202	0.031
1015	4.263	0.9625	4.103	58	0.007	203	0.030
1020	4.270	0.9626	4.110	57	0.007	204	0.029
1025	4.277	0.9626	4.118	261	0.007	205	0.023
1030	4.285	0.9627	4.125	56	0.007	206	0.022
1035	4.292	0.9627	4.132	55	0.007	207	0.021

100 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	4.299	0.9628	4.139	262	0.007	208	0.020
1045	4.306	0.9629	4.146	54	0.007	209	0.019
1050	4.313	0.9629	4.153	53	0.007	210	0.019
1055	4.320	0.9630	4.160	263	0.007	211	0.018
1060	4.326	0.9631	4.167	52	0.007	212	0.017
1065	4.333	0.9631	4.174	51	0.007	213	0.017
1070	4.340	0.9632	4.180	264	0.007	214	0.017
1075	4.347	0.9632	4.187	50	0.007	215	0.016
1080	4.354	0.9633	4.194	49	0.007	216	0.016
1085	4.361	0.9634	4.201	265	0.007	217	0.014
1090	4.368	0.9634	4.208	48	0.007	218	0.013
1095	4.374	0.9635	4.215	47	0.007	219	0.013
1100	4.381	0.9635	4.221	266	0.007	220	0.013
1105	4.388	0.9636	4.228	46	0.007	221	0.012
1110	4.395	0.9637	4.235	45	0.007	222	0.012
1115	4.401	0.9637	4.242	267	0.007	223	0.012
1120	4.408	0.9638	4.248	44	0.007	224	0.012
1125	4.415	0.9639	4.255	43	0.007	225	0.011
1130	4.421	0.9639	4.262	268	0.007	226	0.011
1135	4.428	0.9640	4.268	42	0.007	227	0.011
1140	4.434	0.9640	4.275	41	0.007	228	0.011
1145	4.441	0.9641	4.282	269	0.007	229	0.011
1150	4.448	0.9642	4.288	40	0.007	230	0.010
1155	4.454	0.9642	4.295	39	0.007	231	0.010
1160	4.461	0.9643	4.301	270	0.007	232	0.010
1165	4.467	0.9643	4.308	38	0.007	233	0.010
1170	4.474	0.9644	4.314	37	0.007	234	0.010
1175	4.480	0.9645	4.321	271	0.007	235	0.010
1180	4.487	0.9645	4.328	36	0.007	236	0.009
1185	4.493	0.9646	4.334	35	0.006	237	0.009
1190	4.499	0.9647	4.340	272	0.006	238	0.009
1195	4.506	0.9647	4.347	34	0.006	239	0.009
1200	4.512	0.9648	4.353	33	0.006	240	0.009
1205	4.519	0.9648	4.360	273	0.006	241	0.009
1210	4.525	0.9649	4.366	32	0.006	242	0.009
1215	4.531	0.9650	4.373	31	0.006	243	0.009
1220	4.538	0.9650	4.379	274	0.006	244	0.008
1225	4.544	0.9651	4.385	30	0.006	245	0.008
1230	4.550	0.9651	4.392	29	0.006	246	0.008
1235	4.556	0.9652	4.398	275	0.006	247	0.008
1240	4.563	0.9653	4.404	28	0.006	248	0.008
1245	4.569	0.9653	4.411	27	0.006	249	0.008
1250	4.575	0.9654	4.417	276	0.006	250	0.008
1255	4.581	0.9655	4.423	26	0.006	251	0.008
1260	4.588	0.9655	4.429	25	0.006	252	0.008
1265	4.594	0.9656	4.436	277	0.006	253	0.008
1270	4.600	0.9656	4.442	24	0.006	254	0.008
1275	4.606	0.9657	4.448	23	0.006	255	0.007
1280	4.612	0.9658	4.454	278	0.006	256	0.007
1285	4.618	0.9658	4.460	22	0.006	257	0.007
1290	4.624	0.9659	4.467	21	0.006	258	0.007
1295	4.630	0.9660	4.473	279	0.006	259	0.007

100 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	4.636	0.9660	4.479	20	0.006	260	0.007
1305	4.642	0.9661	4.485	19	0.006	261	0.007
1310	4.648	0.9661	4.491	280	0.006	262	0.007
1315	4.654	0.9662	4.497	18	0.006	263	0.007
1320	4.660	0.9663	4.503	17	0.006	264	0.007
1325	4.666	0.9663	4.509	281	0.006	265	0.007
1330	4.672	0.9664	4.515	16	0.006	266	0.007
1335	4.678	0.9664	4.521	15	0.006	267	0.007
1340	4.684	0.9665	4.527	282	0.006	268	0.007
1345	4.690	0.9666	4.533	14	0.006	269	0.007
1350	4.696	0.9666	4.539	13	0.006	270	0.007
1355	4.702	0.9667	4.545	283	0.006	271	0.007
1360	4.708	0.9668	4.551	12	0.006	272	0.006
1365	4.714	0.9668	4.557	11	0.006	273	0.006
1370	4.720	0.9669	4.563	284	0.006	274	0.006
1375	4.725	0.9669	4.569	10	0.006	275	0.006
1380	4.731	0.9670	4.575	9	0.006	276	0.006
1385	4.737	0.9671	4.581	285	0.006	277	0.006
1390	4.743	0.9671	4.587	8	0.006	278	0.006
1395	4.749	0.9672	4.593	7	0.006	279	0.006
1400	4.754	0.9672	4.599	286	0.006	280	0.006
1405	4.760	0.9673	4.605	6	0.006	281	0.006
1410	4.766	0.9674	4.610	5	0.006	282	0.006
1415	4.772	0.9674	4.616	287	0.006	283	0.006
1420	4.777	0.9675	4.622	4	0.006	284	0.006
1425	4.783	0.9676	4.628	3	0.006	285	0.006
1430	4.789	0.9676	4.634	288	0.006	286	0.006
1435	4.794	0.9677	4.639	2	0.006	287	0.006
1440	4.800	**0.9677**	4.645	1	0.006	288	0.006

10 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.417	0.7904	0.330	193	0.330	1	0.005
10	0.534	0.7904	0.422	192	0.092	2	0.005
15	0.616	0.7904	0.487	191	0.065	3	0.005
20	0.682	0.7904	0.539	194	0.052	4	0.005
25	0.739	0.7904	0.584	190	0.044	5	0.005
30	0.788	**0.7904**	0.623	189	0.039	6	0.005
35	0.832	0.8041	0.669	195	0.046	7	0.005
40	0.873	0.8177	0.714	188	0.044	8	0.005
45	0.910	0.8314	0.757	187	0.043	9	0.005
50	0.945	0.8450	0.798	196	0.042	10	0.005
55	0.977	0.8586	0.839	186	0.041	11	0.005
60	1.008	**0.8723**	0.879	185	0.040	12	0.005
65	1.037	0.8751	0.907	197	0.028	13	0.005
70	1.065	0.8778	0.935	184	0.027	14	0.005
75	1.091	0.8806	0.961	183	0.026	15	0.005
80	1.116	0.8834	0.986	198	0.025	16	0.005
85	1.141	0.8861	1.011	182	0.025	17	0.005
90	1.164	0.8889	1.035	181	0.024	18	0.005
95	1.186	0.8917	1.058	199	0.023	19	0.005
100	1.208	0.8945	1.081	180	0.023	20	0.005
105	1.229	0.8972	1.103	179	0.022	21	0.005
110	1.250	0.9000	1.125	200	0.022	22	0.005
115	1.270	0.9028	1.146	178	0.021	23	0.005
120	1.289	0.9055	1.167	177	0.021	24	0.005
125	1.308	0.9083	1.188	201	0.021	25	0.005
130	1.326	0.9111	1.208	176	0.020	26	0.005
135	1.344	0.9139	1.228	175	0.020	27	0.005
140	1.362	0.9166	1.248	202	0.020	28	0.005
145	1.379	0.9194	1.268	174	0.019	29	0.005
150	1.395	0.9222	1.287	173	0.019	30	0.005
155	1.412	0.9249	1.306	203	0.019	31	0.005
160	1.428	0.9277	1.324	172	0.019	32	0.005
165	1.443	0.9305	1.343	171	0.019	33	0.005
170	1.459	0.9333	1.361	204	0.018	34	0.005
175	1.474	0.9360	1.380	170	0.018	35	0.005
180	1.489	**0.9388**	1.398	169	0.018	36	0.005
185	1.503	0.9392	1.412	205	0.014	37	0.005
190	1.518	0.9397	1.426	168	0.014	38	0.005
195	1.532	0.9401	1.440	167	0.014	39	0.005
200	1.545	0.9405	1.454	206	0.014	40	0.005
205	1.559	0.9410	1.467	166	0.013	41	0.005
210	1.572	0.9414	1.480	165	0.013	42	0.005
215	1.586	0.9418	1.493	207	0.013	43	0.005
220	1.599	0.9423	1.506	164	0.013	44	0.005
225	1.611	0.9427	1.519	163	0.013	45	0.005
230	1.624	0.9431	1.532	208	0.013	46	0.005
235	1.636	0.9436	1.544	162	0.012	47	0.005
240	1.649	0.9440	1.556	161	0.012	48	0.005
245	1.661	0.9444	1.569	209	0.012	49	0.005
250	1.673	0.9449	1.581	160	0.012	50	0.005
255	1.685	0.9453	1.592	159	0.012	51	0.005

10 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.696	0.9457	1.604	210	0.012	52	0.005
265	1.708	0.9462	1.616	158	0.012	53	0.006
270	1.719	0.9466	1.627	157	0.012	54	0.006
275	1.730	0.9470	1.639	211	0.011	55	0.006
280	1.741	0.9475	1.650	156	0.011	56	0.006
285	1.752	0.9479	1.661	155	0.011	57	0.006
290	1.763	0.9483	1.672	212	0.011	58	0.006
295	1.774	0.9488	1.683	154	0.011	59	0.006
300	1.785	0.9492	1.694	153	0.011	60	0.006
305	1.795	0.9496	1.705	213	0.011	61	0.006
310	1.806	0.9501	1.715	152	0.011	62	0.006
315	1.816	0.9505	1.726	151	0.011	63	0.006
320	1.826	0.9509	1.736	214	0.010	64	0.006
325	1.836	0.9514	1.747	150	0.010	65	0.006
330	1.846	0.9518	1.757	149	0.010	66	0.006
335	1.856	0.9523	1.767	215	0.010	67	0.006
340	1.866	0.9527	1.777	148	0.010	68	0.006
345	1.875	0.9531	1.788	147	0.010	69	0.006
350	1.885	0.9536	1.797	216	0.010	70	0.006
355	1.895	0.9540	1.807	146	0.010	71	0.006
360	**1.900**	**0.9544**	1.813	145	0.006	72	0.006
365	1.910	0.9545	1.824	217	0.010	73	0.006
370	1.921	0.9545	1.834	144	0.010	74	0.006
375	1.931	0.9546	1.843	143	0.010	75	0.006
380	1.941	0.9547	1.853	218	0.010	76	0.006
385	1.951	0.9547	1.863	142	0.010	77	0.006
390	1.962	0.9548	1.873	141	0.010	78	0.006
395	1.972	0.9549	1.883	219	0.010	79	0.006
400	1.981	0.9549	1.892	140	0.010	80	0.006
405	1.991	0.9550	1.902	139	0.010	81	0.006
410	2.001	0.9550	1.911	220	0.009	82	0.006
415	2.011	0.9551	1.920	138	0.009	83	0.006
420	2.020	0.9552	1.930	137	0.009	84	0.006
425	2.030	0.9552	1.939	221	0.009	85	0.006
430	2.039	0.9553	1.948	136	0.009	86	0.006
435	2.049	0.9553	1.957	135	0.009	87	0.006
440	2.058	0.9554	1.966	222	0.009	88	0.006
445	2.067	0.9555	1.975	134	0.009	89	0.007
450	2.077	0.9555	1.984	133	0.009	90	0.007
455	2.086	0.9556	1.993	223	0.009	91	0.007
460	2.095	0.9557	2.002	132	0.009	92	0.007
465	2.104	0.9557	2.011	131	0.009	93	0.007
470	2.113	0.9558	2.019	224	0.009	94	0.007
475	2.122	0.9558	2.028	130	0.009	95	0.007
480	2.131	0.9559	2.037	129	0.009	96	0.007
485	2.139	0.9560	2.045	225	0.009	97	0.007
490	2.148	0.9560	2.054	128	0.009	98	0.007
495	2.157	0.9561	2.062	127	0.008	99	0.007
500	2.166	0.9561	2.071	226	0.008	100	0.007
505	2.174	0.9562	2.079	126	0.008	101	0.007
510	2.183	0.9563	2.087	125	0.008	102	0.007
515	2.191	0.9563	2.096	227	0.008	103	0.007

10 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	2.200	0.9564	2.104	124	0.008	104	0.007
525	2.208	0.9565	2.112	123	0.008	105	0.007
530	2.216	0.9565	2.120	228	0.008	106	0.007
535	2.225	0.9566	2.128	122	0.008	107	0.007
540	2.233	0.9566	2.136	121	0.008	108	0.007
545	2.241	0.9567	2.144	229	0.008	109	0.007
550	2.249	0.9568	2.152	120	0.008	110	0.007
555	2.257	0.9568	2.160	119	0.008	111	0.007
560	2.266	0.9569	2.168	230	0.008	112	0.007
565	2.274	0.9569	2.176	118	0.008	113	0.008
570	2.282	0.9570	2.183	117	0.008	114	0.008
575	2.289	0.9571	2.191	231	0.008	115	0.008
580	2.297	0.9571	2.199	116	0.008	116	0.008
585	2.305	0.9572	2.207	115	0.008	117	0.008
590	2.313	0.9573	2.214	232	0.008	118	0.008
595	2.321	0.9573	2.222	114	0.008	119	0.008
600	2.329	0.9574	2.229	113	0.008	120	0.008
605	2.336	0.9574	2.237	233	0.008	121	0.008
610	2.344	0.9575	2.244	112	0.007	122	0.008
615	2.352	0.9576	2.252	111	0.007	123	0.008
620	2.359	0.9576	2.259	234	0.007	124	0.008
625	2.367	0.9577	2.267	110	0.007	125	0.008
630	2.374	0.9577	2.274	109	0.007	126	0.008
635	2.382	0.9578	2.281	235	0.007	127	0.008
640	2.389	0.9579	2.289	108	0.007	128	0.009
645	2.397	0.9579	2.296	107	0.007	129	0.009
650	2.404	0.9580	2.303	236	0.007	130	0.009
655	2.411	0.9581	2.310	106	0.007	131	0.009
660	2.419	0.9581	2.317	105	0.007	132	0.009
665	2.426	0.9582	2.325	237	0.007	133	0.009
670	2.433	0.9582	2.332	104	0.007	134	0.009
675	2.440	0.9583	2.339	103	0.007	135	0.009
680	2.448	0.9584	2.346	238	0.007	136	0.009
685	2.455	0.9584	2.353	102	0.007	137	0.009
690	2.462	0.9585	2.360	101	0.007	138	0.009
695	2.469	0.9586	2.367	239	0.007	139	0.010
700	2.476	0.9586	2.374	100	0.007	140	0.010
705	2.483	0.9587	2.380	99	0.007	141	0.010
710	2.490	0.9587	2.387	240	0.007	142	0.010
715	2.497	0.9588	2.394	98	0.007	143	0.010
720	2.504	0.9589	2.401	97	0.007	144	0.010
725	2.511	0.9589	2.408	241	0.007	145	0.006
730	2.518	0.9590	2.415	96	0.007	146	0.010
735	2.525	0.9590	2.421	95	0.007	147	0.010
740	2.531	0.9591	2.428	242	0.007	148	0.010
745	2.538	0.9592	2.435	94	0.007	149	0.010
750	2.545	0.9592	2.441	93	0.007	150	0.010
755	2.552	0.9593	2.448	243	0.007	151	0.011
760	2.558	0.9594	2.455	92	0.007	152	0.011
765	2.565	0.9594	2.461	91	0.007	153	0.011
770	2.572	0.9595	2.468	244	0.007	154	0.011
775	2.578	0.9595	2.474	90	0.007	155	0.011

10 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	2.585	0.9596	2.481	89	0.007	156	0.011
785	2.592	0.9597	2.487	245	0.006	157	0.012
790	2.598	0.9597	2.494	88	0.006	158	0.012
795	2.605	0.9598	2.500	87	0.006	159	0.012
800	2.611	0.9598	2.506	246	0.006	160	0.012
805	2.618	0.9599	2.513	86	0.006	161	0.012
810	2.624	0.9600	2.519	85	0.006	162	0.012
815	2.631	0.9600	2.526	247	0.006	163	0.013
820	2.637	0.9601	2.532	84	0.006	164	0.013
825	2.643	0.9602	2.538	83	0.006	165	0.013
830	2.650	0.9602	2.544	248	0.006	166	0.013
835	2.656	0.9603	2.551	82	0.006	167	0.014
840	2.663	0.9603	2.557	81	0.006	168	0.014
845	2.669	0.9604	2.563	249	0.006	169	0.018
850	2.675	0.9605	2.569	80	0.006	170	0.018
855	2.681	0.9605	2.576	79	0.006	171	0.019
860	2.688	0.9606	2.582	250	0.006	172	0.019
865	2.694	0.9606	2.588	78	0.006	173	0.019
870	2.700	0.9607	2.594	77	0.006	174	0.019
875	2.706	0.9608	2.600	251	0.006	175	0.020
880	2.712	0.9608	2.606	76	0.006	176	0.020
885	2.718	0.9609	2.612	75	0.006	177	0.021
890	2.725	0.9610	2.618	252	0.006	178	0.021
895	2.731	0.9610	2.624	74	0.006	179	0.022
900	2.737	0.9611	2.630	73	0.006	180	0.023
905	2.743	0.9611	2.636	253	0.006	181	0.024
910	2.749	0.9612	2.642	72	0.006	182	0.025
915	2.755	0.9613	2.648	71	0.006	183	0.026
920	2.761	0.9613	2.654	254	0.006	184	0.027
925	2.767	0.9614	2.660	70	0.006	185	0.040
930	2.773	0.9614	2.666	69	0.006	186	0.041
935	2.779	0.9615	2.672	255	0.006	187	0.043
940	2.785	0.9616	2.678	68	0.006	188	0.044
945	2.790	0.9616	2.683	67	0.006	189	0.039
950	2.796	0.9617	2.689	256	0.006	190	0.044
955	2.802	0.9618	2.695	66	0.006	191	0.065
960	2.808	0.9618	2.701	65	0.006	192	0.092
965	2.814	0.9619	2.707	257	0.006	193	0.330
970	2.820	0.9619	2.712	64	0.006	194	0.052
975	2.825	0.9620	2.718	63	0.006	195	0.046
980	2.831	0.9621	2.724	258	0.006	196	0.042
985	2.837	0.9621	2.729	62	0.006	197	0.028
990	2.843	0.9622	2.735	61	0.006	198	0.025
995	2.848	0.9623	2.741	259	0.006	199	0.023
1000	2.854	0.9623	2.746	60	0.006	200	0.022
1005	2.860	0.9624	2.752	59	0.006	201	0.021
1010	2.865	0.9624	2.758	260	0.006	202	0.020
1015	2.871	0.9625	2.763	58	0.006	203	0.019
1020	2.877	0.9626	2.769	57	0.006	204	0.018
1025	2.882	0.9626	2.774	261	0.006	205	0.014
1030	2.888	0.9627	2.780	56	0.006	206	0.014
1035	2.893	0.9627	2.786	55	0.006	207	0.013

10 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	2.899	0.9628	2.791	262	0.006	208	0.013
1045	2.904	0.9629	2.797	54	0.006	209	0.012
1050	2.910	0.9629	2.802	53	0.006	210	0.012
1055	2.915	0.9630	2.808	263	0.005	211	0.011
1060	2.921	0.9631	2.813	52	0.005	212	0.011
1065	2.926	0.9631	2.819	51	0.005	213	0.011
1070	2.932	0.9632	2.824	264	0.005	214	0.010
1075	2.937	0.9632	2.829	50	0.005	215	0.010
1080	2.943	0.9633	2.835	49	0.005	216	0.010
1085	2.948	0.9634	2.840	265	0.005	217	0.010
1090	2.954	0.9634	2.846	48	0.005	218	0.010
1095	2.959	0.9635	2.851	47	0.005	219	0.010
1100	2.964	0.9635	2.856	266	0.005	220	0.009
1105	2.970	0.9636	2.862	46	0.005	221	0.009
1110	2.975	0.9637	2.867	45	0.005	222	0.009
1115	2.980	0.9637	2.872	267	0.005	223	0.009
1120	2.986	0.9638	2.878	44	0.005	224	0.009
1125	2.991	0.9639	2.883	43	0.005	225	0.009
1130	2.996	0.9639	2.888	268	0.005	226	0.008
1135	3.002	0.9640	2.893	42	0.005	227	0.008
1140	3.007	0.9640	2.899	41	0.005	228	0.008
1145	3.012	0.9641	2.904	269	0.005	229	0.008
1150	3.017	0.9642	2.909	40	0.005	230	0.008
1155	3.023	0.9642	2.914	39	0.005	231	0.008
1160	3.028	0.9643	2.920	270	0.005	232	0.008
1165	3.033	0.9643	2.925	38	0.005	233	0.008
1170	3.038	0.9644	2.930	37	0.005	234	0.007
1175	3.043	0.9645	2.935	271	0.005	235	0.007
1180	3.048	0.9645	2.940	36	0.005	236	0.007
1185	3.054	0.9646	2.945	35	0.005	237	0.007
1190	3.059	0.9647	2.951	272	0.005	238	0.007
1195	3.064	0.9647	2.956	34	0.005	239	0.007
1200	3.069	0.9648	2.961	33	0.005	240	0.007
1205	3.074	0.9648	2.966	273	0.005	241	0.007
1210	3.079	0.9649	2.971	32	0.005	242	0.007
1215	3.084	0.9650	2.976	31	0.005	243	0.007
1220	3.089	0.9650	2.981	274	0.005	244	0.007
1225	3.094	0.9651	2.986	30	0.005	245	0.006
1230	3.099	0.9651	2.991	29	0.005	246	0.006
1235	3.104	0.9652	2.996	275	0.005	247	0.006
1240	3.109	0.9653	3.001	28	0.005	248	0.006
1245	3.114	0.9653	3.006	27	0.005	249	0.006
1250	3.119	0.9654	3.011	276	0.005	250	0.006
1255	3.124	0.9655	3.016	26	0.005	251	0.006
1260	3.129	0.9655	3.021	25	0.005	252	0.006
1265	3.134	0.9656	3.026	277	0.005	253	0.006
1270	3.139	0.9656	3.031	24	0.005	254	0.006
1275	3.144	0.9657	3.036	23	0.005	255	0.006
1280	3.149	0.9658	3.041	278	0.005	256	0.006
1285	3.154	0.9658	3.046	22	0.005	257	0.006
1290	3.159	0.9659	3.051	21	0.005	258	0.006
1295	3.163	0.9660	3.056	279	0.005	259	0.006

10 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	3.168	0.9660	3.061	20	0.005	260	0.006
1305	3.173	0.9661	3.065	19	0.005	261	0.006
1310	3.178	0.9661	3.070	280	0.005	262	0.006
1315	3.183	0.9662	3.075	18	0.005	263	0.005
1320	3.188	0.9663	3.080	17	0.005	264	0.005
1325	3.192	0.9663	3.085	281	0.005	265	0.005
1330	3.197	0.9664	3.090	16	0.005	266	0.005
1335	3.202	0.9664	3.095	15	0.005	267	0.005
1340	3.207	0.9665	3.099	282	0.005	268	0.005
1345	3.212	0.9666	3.104	14	0.005	269	0.005
1350	3.216	0.9666	3.109	13	0.005	270	0.005
1355	3.221	0.9667	3.114	283	0.005	271	0.005
1360	3.226	0.9668	3.118	12	0.005	272	0.005
1365	3.230	0.9668	3.123	11	0.005	273	0.005
1370	3.235	0.9669	3.128	284	0.005	274	0.005
1375	3.240	0.9669	3.133	10	0.005	275	0.005
1380	3.245	0.9670	3.137	9	0.005	276	0.005
1385	3.249	0.9671	3.142	285	0.005	277	0.005
1390	3.254	0.9671	3.147	8	0.005	278	0.005
1395	3.259	0.9672	3.152	7	0.005	279	0.005
1400	3.263	0.9672	3.156	286	0.005	280	0.005
1405	3.268	0.9673	3.161	6	0.005	281	0.005
1410	3.272	0.9674	3.166	5	0.005	282	0.005
1415	3.277	0.9674	3.170	287	0.005	283	0.005
1420	3.282	0.9675	3.175	4	0.005	284	0.005
1425	3.286	0.9676	3.180	3	0.005	285	0.005
1430	3.291	0.9676	3.184	288	0.005	286	0.005
1435	3.295	0.9677	3.189	2	0.005	287	0.005
1440	3.300	**0.9677**	3.194	1	0.005	288	0.005

5 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.373	0.7904	0.295	193	0.295	1	0.004
10	0.477	0.7904	0.377	192	0.082	2	0.004
15	0.551	0.7904	0.436	191	0.058	3	0.004
20	0.611	0.7904	0.483	194	0.047	4	0.004
25	0.661	0.7904	0.522	190	0.040	5	0.004
30	0.705	**0.7904**	0.557	189	0.035	6	0.004
35	0.745	0.8041	0.599	195	0.042	7	0.004
40	0.781	0.8177	0.639	188	0.040	8	0.004
45	0.814	0.8314	0.677	187	0.038	9	0.004
50	0.845	0.8450	0.714	196	0.037	10	0.004
55	0.874	0.8586	0.751	186	0.037	11	0.004
60	0.902	**0.8723**	0.787	185	0.036	12	0.004
65	0.928	0.8751	0.812	197	0.025	13	0.004
70	0.953	0.8778	0.836	184	0.024	14	0.004
75	0.976	0.8806	0.860	183	0.023	15	0.004
80	0.999	0.8834	0.882	198	0.023	16	0.004
85	1.021	0.8861	0.904	182	0.022	17	0.004
90	1.041	0.8889	0.926	181	0.021	18	0.004
95	1.062	0.8917	0.947	199	0.021	19	0.004
100	1.081	0.8945	0.967	180	0.020	20	0.004
105	1.100	0.8972	0.987	179	0.020	21	0.004
110	1.118	0.9000	1.006	200	0.020	22	0.004
115	1.136	0.9028	1.026	178	0.019	23	0.004
120	1.153	0.9055	1.044	177	0.019	24	0.004
125	1.170	0.9083	1.063	201	0.018	25	0.004
130	1.187	0.9111	1.081	176	0.018	26	0.004
135	1.203	0.9139	1.099	175	0.018	27	0.004
140	1.218	0.9166	1.117	202	0.018	28	0.004
145	1.234	0.9194	1.134	174	0.017	29	0.004
150	1.248	0.9222	1.151	173	0.017	30	0.004
155	1.263	0.9249	1.168	203	0.017	31	0.004
160	1.277	0.9277	1.185	172	0.017	32	0.004
165	1.291	0.9305	1.202	171	0.017	33	0.004
170	1.305	0.9333	1.218	204	0.016	34	0.004
175	1.319	0.9360	1.234	170	0.016	35	0.004
180	1.332	**0.9388**	1.250	169	0.016	36	0.004
185	1.345	0.9392	1.263	205	0.013	37	0.004
190	1.358	0.9397	1.276	168	0.013	38	0.004
195	1.370	0.9401	1.288	167	0.012	39	0.004
200	1.383	0.9405	1.301	206	0.012	40	0.004
205	1.395	0.9410	1.313	166	0.012	41	0.004
210	1.407	0.9414	1.324	165	0.012	42	0.004
215	1.419	0.9418	1.336	207	0.012	43	0.004
220	1.430	0.9423	1.348	164	0.012	44	0.004
225	1.442	0.9427	1.359	163	0.011	45	0.004
230	1.453	0.9431	1.370	208	0.011	46	0.004
235	1.464	0.9436	1.382	162	0.011	47	0.004
240	1.475	0.9440	1.393	161	0.011	48	0.004
245	1.486	0.9444	1.403	209	0.011	49	0.004
250	1.497	0.9449	1.414	160	0.011	50	0.004
255	1.507	0.9453	1.425	159	0.011	51	0.004

5 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.518	0.9457	1.435	210	0.011	52	0.004
265	1.528	0.9462	1.446	158	0.010	53	0.004
270	1.538	0.9466	1.456	157	0.010	54	0.004
275	1.548	0.9470	1.466	211	0.010	55	0.004
280	1.558	0.9475	1.476	156	0.010	56	0.004
285	1.568	0.9479	1.486	155	0.010	57	0.004
290	1.578	0.9483	1.496	212	0.010	58	0.004
295	1.587	0.9488	1.506	154	0.010	59	0.004
300	1.597	0.9492	1.516	153	0.010	60	0.004
305	1.606	0.9496	1.525	213	0.010	61	0.004
310	1.615	0.9501	1.535	152	0.010	62	0.004
315	1.625	0.9505	1.544	151	0.009	63	0.004
320	1.634	0.9509	1.554	214	0.009	64	0.004
325	1.643	0.9514	1.563	150	0.009	65	0.005
330	1.652	0.9518	1.572	149	0.009	66	0.005
335	1.661	0.9523	1.581	215	0.009	67	0.005
340	1.669	0.9527	1.590	148	0.009	68	0.005
345	1.678	0.9531	1.599	147	0.009	69	0.005
350	1.687	0.9536	1.608	216	0.009	70	0.005
355	1.695	0.9540	1.617	146	0.009	71	0.005
360	**1.700**	**0.9544**	1.623	145	0.005	72	0.005
365	1.708	0.9545	1.631	217	0.008	73	0.005
370	1.717	0.9545	1.639	144	0.008	74	0.005
375	1.725	0.9546	1.647	143	0.008	75	0.005
380	1.733	0.9547	1.655	218	0.008	76	0.005
385	1.742	0.9547	1.663	142	0.008	77	0.005
390	1.750	0.9548	1.671	141	0.008	78	0.005
395	1.758	0.9549	1.678	219	0.008	79	0.005
400	1.766	0.9549	1.686	140	0.008	80	0.005
405	1.774	0.9550	1.694	139	0.008	81	0.005
410	1.781	0.9550	1.701	220	0.008	82	0.005
415	1.789	0.9551	1.709	138	0.008	83	0.005
420	1.797	0.9552	1.716	137	0.007	84	0.005
425	1.805	0.9552	1.724	221	0.007	85	0.005
430	1.812	0.9553	1.731	136	0.007	86	0.005
435	1.820	0.9553	1.739	135	0.007	87	0.005
440	1.827	0.9554	1.746	222	0.007	88	0.005
445	1.835	0.9555	1.753	134	0.007	89	0.005
450	1.842	0.9555	1.760	133	0.007	90	0.005
455	1.850	0.9556	1.767	223	0.007	91	0.005
460	1.857	0.9557	1.774	132	0.007	92	0.005
465	1.864	0.9557	1.781	131	0.007	93	0.005
470	1.871	0.9558	1.788	224	0.007	94	0.005
475	1.878	0.9558	1.795	130	0.007	95	0.005
480	1.885	0.9559	1.802	129	0.007	96	0.005
485	1.893	0.9560	1.809	225	0.007	97	0.005
490	1.900	0.9560	1.816	128	0.007	98	0.005
495	1.906	0.9561	1.823	127	0.007	99	0.005
500	1.913	0.9561	1.829	226	0.007	100	0.005
505	1.920	0.9562	1.836	126	0.007	101	0.006
510	1.927	0.9563	1.843	125	0.007	102	0.006
515	1.934	0.9563	1.849	227	0.007	103	0.006

5 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	1.941	0.9564	1.856	124	0.007	104	0.006
525	1.947	0.9565	1.862	123	0.007	105	0.006
530	1.954	0.9565	1.869	228	0.006	106	0.006
535	1.961	0.9566	1.875	122	0.006	107	0.006
540	1.967	0.9566	1.882	121	0.006	108	0.006
545	1.974	0.9567	1.888	229	0.006	109	0.006
550	1.980	0.9568	1.895	120	0.006	110	0.006
555	1.987	0.9568	1.901	119	0.006	111	0.006
560	1.993	0.9569	1.907	230	0.006	112	0.006
565	1.999	0.9569	1.913	118	0.006	113	0.006
570	2.006	0.9570	1.920	117	0.006	114	0.006
575	2.012	0.9571	1.926	231	0.006	115	0.006
580	2.018	0.9571	1.932	116	0.006	116	0.006
585	2.025	0.9572	1.938	115	0.006	117	0.006
590	2.031	0.9573	1.944	232	0.006	118	0.006
595	2.037	0.9573	1.950	114	0.006	119	0.006
600	2.043	0.9574	1.956	113	0.006	120	0.006
605	2.049	0.9574	1.962	233	0.006	121	0.006
610	2.055	0.9575	1.968	112	0.006	122	0.006
615	2.061	0.9576	1.974	111	0.006	123	0.007
620	2.067	0.9576	1.980	234	0.006	124	0.007
625	2.073	0.9577	1.986	110	0.006	125	0.007
630	2.079	0.9577	1.992	109	0.006	126	0.007
635	2.085	0.9578	1.997	235	0.006	127	0.007
640	2.091	0.9579	2.003	108	0.006	128	0.007
645	2.097	0.9579	2.009	107	0.006	129	0.007
650	2.103	0.9580	2.015	236	0.006	130	0.007
655	2.109	0.9581	2.020	106	0.006	131	0.007
660	2.114	0.9581	2.026	105	0.006	132	0.007
665	2.120	0.9582	2.032	237	0.006	133	0.007
670	2.126	0.9582	2.037	104	0.006	134	0.007
675	2.132	0.9583	2.043	103	0.006	135	0.007
680	2.137	0.9584	2.048	238	0.006	136	0.007
685	2.143	0.9584	2.054	102	0.006	137	0.007
690	2.149	0.9585	2.059	101	0.006	138	0.008
695	2.154	0.9586	2.065	239	0.005	139	0.008
700	2.160	0.9586	2.070	100	0.005	140	0.008
705	2.165	0.9587	2.076	99	0.005	141	0.008
710	2.171	0.9587	2.081	240	0.005	142	0.008
715	2.176	0.9588	2.087	98	0.005	143	0.008
720	2.182	0.9589	2.092	97	0.005	144	0.008
725	2.187	0.9589	2.097	241	0.005	145	0.005
730	2.193	0.9590	2.103	96	0.005	146	0.009
735	2.198	0.9590	2.108	95	0.005	147	0.009
740	2.203	0.9591	2.113	242	0.005	148	0.009
745	2.209	0.9592	2.119	94	0.005	149	0.009
750	2.214	0.9592	2.124	93	0.005	150	0.009
755	2.219	0.9593	2.129	243	0.005	151	0.009
760	2.225	0.9594	2.134	92	0.005	152	0.010
765	2.230	0.9594	2.139	91	0.005	153	0.010
770	2.235	0.9595	2.145	244	0.005	154	0.010
775	2.240	0.9595	2.150	90	0.005	155	0.010

5 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	2.246	0.9596	2.155	89	0.005	156	0.010
785	2.251	0.9597	2.160	245	0.005	157	0.010
790	2.256	0.9597	2.165	88	0.005	158	0.010
795	2.261	0.9598	2.170	87	0.005	159	0.011
800	2.266	0.9598	2.175	246	0.005	160	0.011
805	2.271	0.9599	2.180	86	0.005	161	0.011
810	2.276	0.9600	2.185	85	0.005	162	0.011
815	2.281	0.9600	2.190	247	0.005	163	0.011
820	2.286	0.9601	2.195	84	0.005	164	0.012
825	2.291	0.9602	2.200	83	0.005	165	0.012
830	2.296	0.9602	2.205	248	0.005	166	0.012
835	2.301	0.9603	2.210	82	0.005	167	0.012
840	2.306	0.9603	2.215	81	0.005	168	0.013
845	2.311	0.9604	2.220	249	0.005	169	0.016
850	2.316	0.9605	2.224	80	0.005	170	0.016
855	2.321	0.9605	2.229	79	0.005	171	0.017
860	2.326	0.9606	2.234	250	0.005	172	0.017
865	2.331	0.9606	2.239	78	0.005	173	0.017
870	2.336	0.9607	2.244	77	0.005	174	0.017
875	2.340	0.9608	2.249	251	0.005	175	0.018
880	2.345	0.9608	2.253	76	0.005	176	0.018
885	2.350	0.9609	2.258	75	0.005	177	0.019
890	2.355	0.9610	2.263	252	0.005	178	0.019
895	2.359	0.9610	2.267	74	0.005	179	0.020
900	2.364	0.9611	2.272	73	0.005	180	0.020
905	2.369	0.9611	2.277	253	0.005	181	0.021
910	2.374	0.9612	2.282	72	0.005	182	0.022
915	2.378	0.9613	2.286	71	0.005	183	0.023
920	2.383	0.9613	2.291	254	0.005	184	0.024
925	2.388	0.9614	2.295	70	0.005	185	0.036
930	2.392	0.9614	2.300	69	0.005	186	0.037
935	2.397	0.9615	2.305	255	0.005	187	0.038
940	2.402	0.9616	2.309	68	0.005	188	0.040
945	2.406	0.9616	2.314	67	0.005	189	0.035
950	2.411	0.9617	2.318	256	0.005	190	0.040
955	2.415	0.9618	2.323	66	0.005	191	0.058
960	2.420	0.9618	2.327	65	0.005	192	0.082
965	2.424	0.9619	2.332	257	0.005	193	0.295
970	2.429	0.9619	2.336	64	0.004	194	0.047
975	2.433	0.9620	2.341	63	0.004	195	0.042
980	2.438	0.9621	2.345	258	0.004	196	0.037
985	2.442	0.9621	2.350	62	0.004	197	0.025
990	2.447	0.9622	2.354	61	0.004	198	0.023
995	2.451	0.9623	2.359	259	0.004	199	0.021
1000	2.456	0.9623	2.363	60	0.004	200	0.020
1005	2.460	0.9624	2.367	59	0.004	201	0.018
1010	2.464	0.9624	2.372	260	0.004	202	0.018
1015	2.469	0.9625	2.376	58	0.004	203	0.017
1020	2.473	0.9626	2.381	57	0.004	204	0.016
1025	2.478	0.9626	2.385	261	0.004	205	0.013
1030	2.482	0.9627	2.389	56	0.004	206	0.012
1035	2.486	0.9627	2.394	55	0.004	207	0.012

5 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	2.491	0.9628	2.398	262	0.004	208	0.011
1045	2.495	0.9629	2.402	54	0.004	209	0.011
1050	2.499	0.9629	2.406	53	0.004	210	0.011
1055	2.503	0.9630	2.411	263	0.004	211	0.010
1060	2.508	0.9631	2.415	52	0.004	212	0.010
1065	2.512	0.9631	2.419	51	0.004	213	0.010
1070	2.516	0.9632	2.423	264	0.004	214	0.009
1075	2.520	0.9632	2.428	50	0.004	215	0.009
1080	2.525	0.9633	2.432	49	0.004	216	0.009
1085	2.529	0.9634	2.436	265	0.004	217	0.008
1090	2.533	0.9634	2.440	48	0.004	218	0.008
1095	2.537	0.9635	2.444	47	0.004	219	0.008
1100	2.541	0.9635	2.449	266	0.004	220	0.008
1105	2.545	0.9636	2.453	46	0.004	221	0.007
1110	2.550	0.9637	2.457	45	0.004	222	0.007
1115	2.554	0.9637	2.461	267	0.004	223	0.007
1120	2.558	0.9638	2.465	44	0.004	224	0.007
1125	2.562	0.9639	2.469	43	0.004	225	0.007
1130	2.566	0.9639	2.473	268	0.004	226	0.007
1135	2.570	0.9640	2.478	42	0.004	227	0.007
1140	2.574	0.9640	2.482	41	0.004	228	0.006
1145	2.578	0.9641	2.486	269	0.004	229	0.006
1150	2.582	0.9642	2.490	40	0.004	230	0.006
1155	2.586	0.9642	2.494	39	0.004	231	0.006
1160	2.590	0.9643	2.498	270	0.004	232	0.006
1165	2.594	0.9643	2.502	38	0.004	233	0.006
1170	2.598	0.9644	2.506	37	0.004	234	0.006
1175	2.602	0.9645	2.510	271	0.004	235	0.006
1180	2.606	0.9645	2.514	36	0.004	236	0.006
1185	2.610	0.9646	2.518	35	0.004	237	0.006
1190	2.614	0.9647	2.522	272	0.004	238	0.006
1195	2.618	0.9647	2.526	34	0.004	239	0.005
1200	2.622	0.9648	2.530	33	0.004	240	0.005
1205	2.626	0.9648	2.534	273	0.004	241	0.005
1210	2.630	0.9649	2.538	32	0.004	242	0.005
1215	2.634	0.9650	2.542	31	0.004	243	0.005
1220	2.638	0.9650	2.546	274	0.004	244	0.005
1225	2.642	0.9651	2.549	30	0.004	245	0.005
1230	2.646	0.9651	2.553	29	0.004	246	0.005
1235	2.649	0.9652	2.557	275	0.004	247	0.005
1240	2.653	0.9653	2.561	28	0.004	248	0.005
1245	2.657	0.9653	2.565	27	0.004	249	0.005
1250	2.661	0.9654	2.569	276	0.004	250	0.005
1255	2.665	0.9655	2.573	26	0.004	251	0.005
1260	2.669	0.9655	2.577	25	0.004	252	0.005
1265	2.672	0.9656	2.580	277	0.004	253	0.005
1270	2.676	0.9656	2.584	24	0.004	254	0.005
1275	2.680	0.9657	2.588	23	0.004	255	0.005
1280	2.684	0.9658	2.592	278	0.004	256	0.005
1285	2.688	0.9658	2.596	22	0.004	257	0.005
1290	2.691	0.9659	2.600	21	0.004	258	0.004
1295	2.695	0.9660	2.603	279	0.004	259	0.004

5 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	2.699	0.9660	2.607	20	0.004	260	0.004
1305	2.703	0.9661	2.611	19	0.004	261	0.004
1310	2.706	0.9661	2.615	280	0.004	262	0.004
1315	2.710	0.9662	2.618	18	0.004	263	0.004
1320	2.714	0.9663	2.622	17	0.004	264	0.004
1325	2.717	0.9663	2.626	281	0.004	265	0.004
1330	2.721	0.9664	2.630	16	0.004	266	0.004
1335	2.725	0.9664	2.633	15	0.004	267	0.004
1340	2.728	0.9665	2.637	282	0.004	268	0.004
1345	2.732	0.9666	2.641	14	0.004	269	0.004
1350	2.736	0.9666	2.644	13	0.004	270	0.004
1355	2.739	0.9667	2.648	283	0.004	271	0.004
1360	2.743	0.9668	2.652	12	0.004	272	0.004
1365	2.747	0.9668	2.655	11	0.004	273	0.004
1370	2.750	0.9669	2.659	284	0.004	274	0.004
1375	2.754	0.9669	2.663	10	0.004	275	0.004
1380	2.757	0.9670	2.666	9	0.004	276	0.004
1385	2.761	0.9671	2.670	285	0.004	277	0.004
1390	2.765	0.9671	2.674	8	0.004	278	0.004
1395	2.768	0.9672	2.677	7	0.004	279	0.004
1400	2.772	0.9672	2.681	286	0.004	280	0.004
1405	2.775	0.9673	2.685	6	0.004	281	0.004
1410	2.779	0.9674	2.688	5	0.004	282	0.004
1415	2.782	0.9674	2.692	287	0.004	283	0.004
1420	2.786	0.9675	2.695	4	0.004	284	0.004
1425	2.789	0.9676	2.699	3	0.004	285	0.004
1430	2.793	0.9676	2.703	288	0.004	286	0.004
1435	2.796	0.9677	2.706	2	0.004	287	0.004
1440	2.800	**0.9677**	2.710	1	0.004	288	0.004

2 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.271	0.7904	0.214	193	0.214	1	0.002
10	0.347	0.7904	0.274	192	0.060	2	0.002
15	0.400	0.7904	0.317	191	0.042	3	0.002
20	0.444	0.7904	0.351	194	0.034	4	0.002
25	0.480	0.7904	0.380	190	0.029	5	0.002
30	0.512	**0.7904**	0.405	189	0.025	6	0.002
35	0.541	0.8041	0.435	195	0.030	7	0.002
40	0.567	0.8177	0.464	188	0.029	8	0.002
45	0.592	0.8314	0.492	187	0.028	9	0.002
50	0.614	0.8450	0.519	196	0.027	10	0.002
55	0.635	0.8586	0.545	186	0.027	11	0.002
60	0.655	**0.8723**	0.571	185	0.026	12	0.002
65	0.674	0.8751	0.590	197	0.018	13	0.002
70	0.692	0.8778	0.607	184	0.018	14	0.002
75	0.709	0.8806	0.624	183	0.017	15	0.002
80	0.726	0.8834	0.641	198	0.016	16	0.002
85	0.741	0.8861	0.657	182	0.016	17	0.002
90	0.757	0.8889	0.673	181	0.016	18	0.002
95	0.771	0.8917	0.688	199	0.015	19	0.002
100	0.785	0.8945	0.703	180	0.015	20	0.002
105	0.799	0.8972	0.717	179	0.014	21	0.002
110	0.812	0.9000	0.731	200	0.014	22	0.002
115	0.825	0.9028	0.745	178	0.014	23	0.002
120	0.838	0.9055	0.759	177	0.014	24	0.002
125	0.850	0.9083	0.772	201	0.013	25	0.002
130	0.862	0.9111	0.785	176	0.013	26	0.002
135	0.874	0.9139	0.798	175	0.013	27	0.002
140	0.885	0.9166	0.811	202	0.013	28	0.002
145	0.896	0.9194	0.824	174	0.013	29	0.002
150	0.907	0.9222	0.836	173	0.012	30	0.002
155	0.918	0.9249	0.849	203	0.012	31	0.002
160	0.928	0.9277	0.861	172	0.012	32	0.002
165	0.938	0.9305	0.873	171	0.012	33	0.002
170	0.948	0.9333	0.885	204	0.012	34	0.002
175	0.958	0.9360	0.897	170	0.012	35	0.002
180	0.968	**0.9388**	0.908	169	0.012	36	0.002
185	0.977	0.9392	0.918	205	0.009	37	0.002
190	0.986	0.9397	0.927	168	0.009	38	0.002
195	0.996	0.9401	0.936	167	0.009	39	0.002
200	1.005	0.9405	0.945	206	0.009	40	0.002
205	1.013	0.9410	0.954	166	0.009	41	0.002
210	1.022	0.9414	0.962	165	0.009	42	0.002
215	1.031	0.9418	0.971	207	0.009	43	0.002
220	1.039	0.9423	0.979	164	0.008	44	0.002
225	1.047	0.9427	0.987	163	0.008	45	0.002
230	1.056	0.9431	0.996	208	0.008	46	0.002
235	1.064	0.9436	1.004	162	0.008	47	0.002
240	1.072	0.9440	1.012	161	0.008	48	0.003
245	1.080	0.9444	1.020	209	0.008	49	0.003
250	1.087	0.9449	1.027	160	0.008	50	0.003
255	1.095	0.9453	1.035	159	0.008	51	0.003

2 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.103	0.9457	1.043	210	0.008	52	0.003
265	1.110	0.9462	1.050	158	0.008	53	0.003
270	1.117	0.9466	1.058	157	0.007	54	0.003
275	1.125	0.9470	1.065	211	0.007	55	0.003
280	1.132	0.9475	1.073	156	0.007	56	0.003
285	1.139	0.9479	1.080	155	0.007	57	0.003
290	1.146	0.9483	1.087	212	0.007	58	0.003
295	1.153	0.9488	1.094	154	0.007	59	0.003
300	1.160	0.9492	1.101	153	0.007	60	0.003
305	1.167	0.9496	1.108	213	0.007	61	0.003
310	1.174	0.9501	1.115	152	0.007	62	0.003
315	1.180	0.9505	1.122	151	0.007	63	0.003
320	1.187	0.9509	1.129	214	0.007	64	0.003
325	1.193	0.9514	1.135	150	0.007	65	0.003
330	1.200	0.9518	1.142	149	0.007	66	0.003
335	1.206	0.9523	1.149	215	0.007	67	0.003
340	1.213	0.9527	1.155	148	0.007	68	0.003
345	1.219	0.9531	1.162	147	0.007	69	0.003
350	1.225	0.9536	1.168	216	0.006	70	0.003
355	1.231	0.9540	1.175	146	0.006	71	0.003
360	**1.235**	**0.9544**	1.179	145	0.004	72	0.003
365	1.240	0.9545	1.184	217	0.005	73	0.003
370	1.246	0.9545	1.189	144	0.005	74	0.003
375	1.251	0.9546	1.194	143	0.005	75	0.003
380	1.256	0.9547	1.199	218	0.005	76	0.003
385	1.261	0.9547	1.204	142	0.005	77	0.003
390	1.266	0.9548	1.209	141	0.005	78	0.003
395	1.271	0.9549	1.214	219	0.005	79	0.003
400	1.276	0.9549	1.219	140	0.005	80	0.003
405	1.281	0.9550	1.223	139	0.005	81	0.003
410	1.286	0.9550	1.228	220	0.005	82	0.003
415	1.291	0.9551	1.233	138	0.005	83	0.003
420	1.296	0.9552	1.238	137	0.005	84	0.003
425	1.300	0.9552	1.242	221	0.005	85	0.003
430	1.305	0.9553	1.247	136	0.005	86	0.003
435	1.310	0.9553	1.251	135	0.005	87	0.003
440	1.314	0.9554	1.256	222	0.005	88	0.003
445	1.319	0.9555	1.260	134	0.004	89	0.003
450	1.324	0.9555	1.265	133	0.004	90	0.003
455	1.328	0.9556	1.269	223	0.004	91	0.003
460	1.333	0.9557	1.274	132	0.004	92	0.003
465	1.337	0.9557	1.278	131	0.004	93	0.003
470	1.342	0.9558	1.282	224	0.004	94	0.003
475	1.346	0.9558	1.287	130	0.004	95	0.003
480	1.350	0.9559	1.291	129	0.004	96	0.003
485	1.355	0.9560	1.295	225	0.004	97	0.003
490	1.359	0.9560	1.299	128	0.004	98	0.003
495	1.363	0.9561	1.304	127	0.004	99	0.003
500	1.368	0.9561	1.308	226	0.004	100	0.003
505	1.372	0.9562	1.312	126	0.004	101	0.003
510	1.376	0.9563	1.316	125	0.004	102	0.003
515	1.380	0.9563	1.320	227	0.004	103	0.003

2 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	1.385	0.9564	1.324	124	0.004	104	0.003
525	1.389	0.9565	1.328	123	0.004	105	0.003
530	1.393	0.9565	1.332	228	0.004	106	0.003
535	1.397	0.9566	1.336	122	0.004	107	0.004
540	1.401	0.9566	1.340	121	0.004	108	0.004
545	1.405	0.9567	1.344	229	0.004	109	0.004
550	1.409	0.9568	1.348	120	0.004	110	0.004
555	1.413	0.9568	1.352	119	0.004	111	0.004
560	1.417	0.9569	1.356	230	0.004	112	0.004
565	1.421	0.9569	1.360	118	0.004	113	0.004
570	1.425	0.9570	1.363	117	0.004	114	0.004
575	1.428	0.9571	1.367	231	0.004	115	0.004
580	1.432	0.9571	1.371	116	0.004	116	0.004
585	1.436	0.9572	1.375	115	0.004	117	0.004
590	1.440	0.9573	1.378	232	0.004	118	0.004
595	1.444	0.9573	1.382	114	0.004	119	0.004
600	1.447	0.9574	1.386	113	0.004	120	0.004
605	1.451	0.9574	1.389	233	0.004	121	0.004
610	1.455	0.9575	1.393	112	0.004	122	0.004
615	1.459	0.9576	1.397	111	0.004	123	0.004
620	1.462	0.9576	1.400	234	0.004	124	0.004
625	1.466	0.9577	1.404	110	0.004	125	0.004
630	1.470	0.9577	1.407	109	0.004	126	0.004
635	1.473	0.9578	1.411	235	0.004	127	0.004
640	1.477	0.9579	1.415	108	0.004	128	0.004
645	1.480	0.9579	1.418	107	0.004	129	0.004
650	1.484	0.9580	1.422	236	0.003	130	0.004
655	1.487	0.9581	1.425	106	0.003	131	0.004
660	1.491	0.9581	1.429	105	0.003	132	0.004
665	1.494	0.9582	1.432	237	0.003	133	0.004
670	1.498	0.9582	1.435	104	0.003	134	0.004
675	1.501	0.9583	1.439	103	0.003	135	0.005
680	1.505	0.9584	1.442	238	0.003	136	0.005
685	1.508	0.9584	1.446	102	0.003	137	0.005
690	1.512	0.9585	1.449	101	0.003	138	0.005
695	1.515	0.9586	1.452	239	0.003	139	0.005
700	1.518	0.9586	1.456	100	0.003	140	0.005
705	1.522	0.9587	1.459	99	0.003	141	0.005
710	1.525	0.9587	1.462	240	0.003	142	0.005
715	1.529	0.9588	1.466	98	0.003	143	0.005
720	1.532	0.9589	1.469	97	0.003	144	0.005
725	1.535	0.9589	1.472	241	0.003	145	0.004
730	1.538	0.9590	1.475	96	0.003	146	0.006
735	1.542	0.9590	1.479	95	0.003	147	0.007
740	1.545	0.9591	1.482	242	0.003	148	0.007
745	1.548	0.9592	1.485	94	0.003	149	0.007
750	1.551	0.9592	1.488	93	0.003	150	0.007
755	1.555	0.9593	1.491	243	0.003	151	0.007
760	1.558	0.9594	1.494	92	0.003	152	0.007
765	1.561	0.9594	1.498	91	0.003	153	0.007
770	1.564	0.9595	1.501	244	0.003	154	0.007
775	1.567	0.9595	1.504	90	0.003	155	0.007

2 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	1.570	0.9596	1.507	89	0.003	156	0.007
785	1.574	0.9597	1.510	245	0.003	157	0.007
790	1.577	0.9597	1.513	88	0.003	158	0.008
795	1.580	0.9598	1.516	87	0.003	159	0.008
800	1.583	0.9598	1.519	246	0.003	160	0.008
805	1.586	0.9599	1.522	86	0.003	161	0.008
810	1.589	0.9600	1.525	85	0.003	162	0.008
815	1.592	0.9600	1.528	247	0.003	163	0.008
820	1.595	0.9601	1.531	84	0.003	164	0.008
825	1.598	0.9602	1.534	83	0.003	165	0.009
830	1.601	0.9602	1.537	248	0.003	166	0.009
835	1.604	0.9603	1.540	82	0.003	167	0.009
840	1.607	0.9603	1.543	81	0.003	168	0.009
845	1.610	0.9604	1.546	249	0.003	169	0.012
850	1.613	0.9605	1.549	80	0.003	170	0.012
855	1.616	0.9605	1.552	79	0.003	171	0.012
860	1.619	0.9606	1.555	250	0.003	172	0.012
865	1.622	0.9606	1.558	78	0.003	173	0.012
870	1.625	0.9607	1.561	77	0.003	174	0.013
875	1.628	0.9608	1.564	251	0.003	175	0.013
880	1.630	0.9608	1.567	76	0.003	176	0.013
885	1.633	0.9609	1.569	75	0.003	177	0.014
890	1.636	0.9610	1.572	252	0.003	178	0.014
895	1.639	0.9610	1.575	74	0.003	179	0.014
900	1.642	0.9611	1.578	73	0.003	180	0.015
905	1.645	0.9611	1.581	253	0.003	181	0.016
910	1.647	0.9612	1.584	72	0.003	182	0.016
915	1.650	0.9613	1.586	71	0.003	183	0.017
920	1.653	0.9613	1.589	254	0.003	184	0.018
925	1.656	0.9614	1.592	70	0.003	185	0.026
930	1.659	0.9614	1.595	69	0.003	186	0.027
935	1.661	0.9615	1.597	255	0.003	187	0.028
940	1.664	0.9616	1.600	68	0.003	188	0.029
945	1.667	0.9616	1.603	67	0.003	189	0.025
950	1.670	0.9617	1.606	256	0.003	190	0.029
955	1.672	0.9618	1.608	66	0.003	191	0.042
960	1.675	0.9618	1.611	65	0.003	192	0.060
965	1.678	0.9619	1.614	257	0.003	193	0.214
970	1.680	0.9619	1.617	64	0.003	194	0.034
975	1.683	0.9620	1.619	63	0.003	195	0.030
980	1.686	0.9621	1.622	258	0.003	196	0.027
985	1.689	0.9621	1.625	62	0.003	197	0.018
990	1.691	0.9622	1.627	61	0.003	198	0.016
995	1.694	0.9623	1.630	259	0.003	199	0.015
1000	1.696	0.9623	1.633	60	0.003	200	0.014
1005	1.699	0.9624	1.635	59	0.003	201	0.013
1010	1.702	0.9624	1.638	260	0.003	202	0.013
1015	1.704	0.9625	1.640	58	0.003	203	0.012
1020	1.707	0.9626	1.643	57	0.003	204	0.012
1025	1.710	0.9626	1.646	261	0.003	205	0.009
1030	1.712	0.9627	1.648	56	0.003	206	0.009
1035	1.715	0.9627	1.651	55	0.003	207	0.009

2 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	1.717	0.9628	1.653	262	0.003	208	0.008
1045	1.720	0.9629	1.656	54	0.003	209	0.008
1050	1.722	0.9629	1.659	53	0.003	210	0.008
1055	1.725	0.9630	1.661	263	0.003	211	0.007
1060	1.727	0.9631	1.664	52	0.003	212	0.007
1065	1.730	0.9631	1.666	51	0.003	213	0.007
1070	1.733	0.9632	1.669	264	0.003	214	0.007
1075	1.735	0.9632	1.671	50	0.003	215	0.007
1080	1.738	0.9633	1.674	49	0.003	216	0.006
1085	1.740	0.9634	1.676	265	0.003	217	0.005
1090	1.743	0.9634	1.679	48	0.003	218	0.005
1095	1.745	0.9635	1.681	47	0.002	219	0.005
1100	1.747	0.9635	1.684	266	0.002	220	0.005
1105	1.750	0.9636	1.686	46	0.002	221	0.005
1110	1.752	0.9637	1.689	45	0.002	222	0.005
1115	1.755	0.9637	1.691	267	0.002	223	0.004
1120	1.757	0.9638	1.694	44	0.002	224	0.004
1125	1.760	0.9639	1.696	43	0.002	225	0.004
1130	1.762	0.9639	1.699	268	0.002	226	0.004
1135	1.765	0.9640	1.701	42	0.002	227	0.004
1140	1.767	0.9640	1.703	41	0.002	228	0.004
1145	1.769	0.9641	1.706	269	0.002	229	0.004
1150	1.772	0.9642	1.708	40	0.002	230	0.004
1155	1.774	0.9642	1.711	39	0.002	231	0.004
1160	1.777	0.9643	1.713	270	0.002	232	0.004
1165	1.779	0.9643	1.715	38	0.002	233	0.004
1170	1.781	0.9644	1.718	37	0.002	234	0.004
1175	1.784	0.9645	1.720	271	0.002	235	0.004
1180	1.786	0.9645	1.723	36	0.002	236	0.003
1185	1.788	0.9646	1.725	35	0.002	237	0.003
1190	1.791	0.9647	1.727	272	0.002	238	0.003
1195	1.793	0.9647	1.730	34	0.002	239	0.003
1200	1.795	0.9648	1.732	33	0.002	240	0.003
1205	1.798	0.9648	1.734	273	0.002	241	0.003
1210	1.800	0.9649	1.737	32	0.002	242	0.003
1215	1.802	0.9650	1.739	31	0.002	243	0.003
1220	1.805	0.9650	1.741	274	0.002	244	0.003
1225	1.807	0.9651	1.744	30	0.002	245	0.003
1230	1.809	0.9651	1.746	29	0.002	246	0.003
1235	1.811	0.9652	1.748	275	0.002	247	0.003
1240	1.814	0.9653	1.751	28	0.002	248	0.003
1245	1.816	0.9653	1.753	27	0.002	249	0.003
1250	1.818	0.9654	1.755	276	0.002	250	0.003
1255	1.821	0.9655	1.758	26	0.002	251	0.003
1260	1.823	0.9655	1.760	25	0.002	252	0.003
1265	1.825	0.9656	1.762	277	0.002	253	0.003
1270	1.827	0.9656	1.764	24	0.002	254	0.003
1275	1.829	0.9657	1.767	23	0.002	255	0.003
1280	1.832	0.9658	1.769	278	0.002	256	0.003
1285	1.834	0.9658	1.771	22	0.002	257	0.003
1290	1.836	0.9659	1.774	21	0.002	258	0.003
1295	1.838	0.9660	1.776	279	0.002	259	0.003

2 Year Nested Storm Distribution for Las Flores Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	1.841	0.9660	1.778	20	0.002	260	0.003
1305	1.843	0.9661	1.780	19	0.002	261	0.003
1310	1.845	0.9661	1.782	280	0.002	262	0.003
1315	1.847	0.9662	1.785	18	0.002	263	0.003
1320	1.849	0.9663	1.787	17	0.002	264	0.003
1325	1.851	0.9663	1.789	281	0.002	265	0.003
1330	1.854	0.9664	1.791	16	0.002	266	0.002
1335	1.856	0.9664	1.794	15	0.002	267	0.002
1340	1.858	0.9665	1.796	282	0.002	268	0.002
1345	1.860	0.9666	1.798	14	0.002	269	0.002
1350	1.862	0.9666	1.800	13	0.002	270	0.002
1355	1.864	0.9667	1.802	283	0.002	271	0.002
1360	1.867	0.9668	1.804	12	0.002	272	0.002
1365	1.869	0.9668	1.807	11	0.002	273	0.002
1370	1.871	0.9669	1.809	284	0.002	274	0.002
1375	1.873	0.9669	1.811	10	0.002	275	0.002
1380	1.875	0.9670	1.813	9	0.002	276	0.002
1385	1.877	0.9671	1.815	285	0.002	277	0.002
1390	1.879	0.9671	1.817	8	0.002	278	0.002
1395	1.881	0.9672	1.820	7	0.002	279	0.002
1400	1.883	0.9672	1.822	286	0.002	280	0.002
1405	1.886	0.9673	1.824	6	0.002	281	0.002
1410	1.888	0.9674	1.826	5	0.002	282	0.002
1415	1.890	0.9674	1.828	287	0.002	283	0.002
1420	1.892	0.9675	1.830	4	0.002	284	0.002
1425	1.894	0.9676	1.832	3	0.002	285	0.002
1430	1.896	0.9676	1.834	288	0.002	286	0.002
1435	1.898	0.9677	1.837	2	0.002	287	0.002
1440	1.900	**0.9677**	1.839	1	0.002	288	0.002

Notes for Nested Storm Distribution

Notes

1. Cumulative Rainfall Depths for durations between 0 and 6 hours are determined per Equations 4-25 and 4-26 of the 2003 SDCHM. Cumulative Rainfall Depths for durations between 6 and 24 hours are interpolated using log-log interpolation.

Eq 4-25: $I = 7.44\ p_6\ D^{-0.645}$ (0-6 hr durations)

Eq 4-26: $P = I\ (D/60)$ (0-6 hr durations)

Eq X-XX $P = C\ D^{M}$ (6-24 hr durations)

Where $C = p_{6adj}/360^{M}$

D = Time in minutes

$M = \ln(p_{6adj}/p_{24})/(\ln(360) - \ln(1440))$

2. Rainfall Depth-Area Adjustment Ratios are determined per linear interpolation between the values provided in Table 4-1 of the 2003 SDCHM.

3. Cumulative Adjusted Rainfall Depth is the Cumulative Rainfall Depth multiplied by the Rainfall Depth-Area Adjustment Ratio.

4. Ordinate Numbers provided by County of San Diego

5. Incremental Rainfall represents the difference in Cumulative Adjusted Rainfall Depths between consecutive rainfall ordinates.

6. Sorted Incremental Rainfall values are sorted by the Ordinate Numbers.

Nested Storm Distribution for Los Coches Creek

Nested Storm Inputs for Los Coches Creek

Variable	Units	100 yr	10 yr	5 yr	2 yr
T_p [1]	minutes	114.4	114.4	114.4	114.4
P_6 [2]	inches	2.9	1.9	1.7	1.3
P_{6adj} [3]	inches	2.9	1.9	1.7	1.3
P_{24} [4]	inches	6.3	3.8	3.4	2.4
Area [5]	mi^2	12.2	12.2	12.2	12.2
M [6]	-	0.559649	0.500000	0.500000	0.442261
C [7]	-	0.107588	0.100139	0.089598	0.096247

1. T_p as determined per Lag Time Calculations in Appendix C.5 of this report
2. P_6 as determined per Unadjusted Rainfall Depths in Appendix C.6 of this report
3. P_{6adj} represents the adjusted value of P_6 to be within 45-65% of the P_{24} value (if necessary)
4. P_{24} as determined per Unadjusted Rainfall Depths in Appendix C.6 of this report
5. Area represents the Basin area in square miles
6. $M = \ln(P_{6adj}/P_{24})/(\ln(360) - \ln(1440))$
7. $C = P_{6adj}/360^M$

Rainfall Depth-Area Adjustments for Los Coches Creek

2003 San Diego County Hydrology Manual Table 4-1					
Watershed Area (mi^2)	**Rainfall Depth-Area Adjustment for Duration**				
	30 Minute	**1 Hour**	**3 Hour**	**6 Hour**	**24 Hour**
0	1.000	1.000	1.000	1.000	1.000
5	0.942	0.970	0.980	0.985	0.990
10	0.900	0.947	0.970	0.980	0.985
20	0.834	0.900	0.952	0.963	0.975
30	0.768	0.858	0.932	0.950	0.964
40	0.730	0.830	0.915	0.940	0.958
50	0.692	0.800	0.900	0.928	0.952
60	0.663	0.778	0.883	0.920	0.948
70	0.654	0.760	0.872	0.912	0.945
80	0.630	0.746	0.862	0.904	0.942
90	0.620	0.735	0.853	0.896	0.938
100	0.610	0.722	0.845	0.890	0.935
125	0.588	0.700	0.830	0.878	0.930
150	0.572	0.685	0.818	0.865	0.925
175	0.572	0.672	0.808	0.858	0.922
200	0.572	0.666	0.798	0.851	0.918
225	0.572	0.660	0.790	0.845	0.915
250	0.572	0.655	0.787	0.842	0.914
300	0.572	0.652	0.782	0.838	0.912
350	0.572	0.652	0.780	0.830	0.910
400	0.572	0.652	0.780	0.828	0.908

Rainfall Depth-Area Adjustments for Los Coches Creek					
Watershed Area (mi^2)	**30 Minute**	**1 Hour**	**3 Hour**	**6 Hour**	**24 Hour**
10	0.9	0.947	0.97	0.98	0.985
12.2	**0.885**	**0.937**	**0.966**	**0.976**	**0.983**
20	0.834	0.9	0.952	0.963	0.975

1. Rainfall Depth-Area Adjustment factors associated with 30-minute, 1-hour, 3-hour, 6-hour, and 24-hour storms have been interoplated from the data on Table 4-1 of the 2003 SDCHM with respect to the basin area and the duration of the storm.

100 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.637	0.8855	0.564	193	0.564	1	0.012
10	0.814	0.8855	0.721	192	0.157	2	0.012
15	0.940	0.8855	0.833	191	0.112	3	0.012
20	1.042	0.8855	0.922	194	0.090	4	0.012
25	1.127	0.8855	0.998	190	0.076	5	0.012
30	1.203	**0.8855**	1.065	189	0.067	6	0.012
35	1.270	0.8940	1.136	195	0.071	7	0.012
40	1.332	0.9025	1.202	188	0.067	8	0.012
45	1.389	0.9111	1.265	187	0.063	9	0.012
50	1.442	0.9196	1.326	196	0.061	10	0.012
55	1.492	0.9281	1.384	186	0.058	11	0.013
60	1.538	**0.9367**	1.441	185	0.057	12	0.013
65	1.583	0.9379	1.484	197	0.043	13	0.013
70	1.625	0.9391	1.526	184	0.042	14	0.013
75	1.665	0.9403	1.566	183	0.040	15	0.013
80	1.704	0.9416	1.604	198	0.038	16	0.013
85	1.741	0.9428	1.641	182	0.037	17	0.013
90	1.777	0.9440	1.677	181	0.036	18	0.013
95	1.811	0.9452	1.712	199	0.035	19	0.013
100	1.844	0.9465	1.745	180	0.034	20	0.013
105	1.876	0.9477	1.778	179	0.033	21	0.013
110	1.908	0.9489	1.810	200	0.032	22	0.013
115	1.938	0.9501	1.841	178	0.031	23	0.013
120	1.968	0.9514	1.872	177	0.030	24	0.013
125	1.996	0.9526	1.902	201	0.030	25	0.013
130	2.024	0.9538	1.931	176	0.029	26	0.013
135	2.052	0.9550	1.959	175	0.029	27	0.013
140	2.078	0.9562	1.987	202	0.028	28	0.013
145	2.104	0.9575	2.015	174	0.027	29	0.013
150	2.130	0.9587	2.042	173	0.027	30	0.013
155	2.155	0.9599	2.068	203	0.027	31	0.013
160	2.179	0.9611	2.094	172	0.026	32	0.013
165	2.203	0.9624	2.120	171	0.026	33	0.013
170	2.227	0.9636	2.145	204	0.025	34	0.013
175	2.250	0.9648	2.170	170	0.025	35	0.013
180	2.272	**0.9660**	2.195	169	0.025	36	0.013
185	2.294	0.9663	2.217	205	0.022	37	0.013
190	2.316	0.9666	2.239	168	0.022	38	0.013
195	2.338	0.9669	2.260	167	0.021	39	0.013
200	2.359	0.9672	2.281	206	0.021	40	0.013
205	2.380	0.9675	2.302	166	0.021	41	0.013
210	2.400	0.9677	2.323	165	0.020	42	0.014
215	2.420	0.9680	2.343	207	0.020	43	0.014
220	2.440	0.9683	2.363	164	0.020	44	0.014
225	2.459	0.9686	2.382	163	0.020	45	0.014
230	2.479	0.9689	2.402	208	0.019	46	0.014
235	2.498	0.9692	2.421	162	0.019	47	0.014
240	2.516	0.9694	2.440	161	0.019	48	0.014
245	2.535	0.9697	2.458	209	0.019	49	0.014
250	2.553	0.9700	2.477	160	0.018	50	0.014
255	2.571	0.9703	2.495	159	0.018	51	0.014

100 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	2.589	0.9706	2.513	210	0.018	52	0.014
265	2.607	0.9709	2.531	158	0.018	53	0.014
270	2.624	0.9712	2.548	157	0.018	54	0.014
275	2.641	0.9714	2.566	211	0.017	55	0.014
280	2.658	0.9717	2.583	156	0.017	56	0.014
285	2.675	0.9720	2.600	155	0.017	57	0.014
290	2.691	0.9723	2.617	212	0.017	58	0.014
295	2.708	0.9726	2.633	154	0.017	59	0.014
300	2.724	0.9729	2.650	153	0.017	60	0.014
305	2.740	0.9731	2.666	213	0.016	61	0.014
310	2.756	0.9734	2.683	152	0.016	62	0.014
315	2.772	0.9737	2.699	151	0.016	63	0.014
320	2.787	0.9740	2.715	214	0.016	64	0.014
325	2.802	0.9743	2.730	150	0.016	65	0.015
330	2.818	0.9746	2.746	149	0.016	66	0.015
335	2.833	0.9748	2.761	215	0.016	67	0.015
340	2.848	0.9751	2.777	148	0.015	68	0.015
345	2.862	0.9754	2.792	147	0.015	69	0.015
350	2.877	0.9757	2.807	216	0.015	70	0.015
355	2.892	0.9760	2.822	146	0.015	71	0.015
360	**2.900**	**0.9763**	2.831	145	0.009	72	0.015
365	2.922	0.9763	2.853	217	0.022	73	0.015
370	2.945	0.9763	2.875	144	0.022	74	0.015
375	2.967	0.9764	2.897	143	0.022	75	0.015
380	2.989	0.9764	2.918	218	0.022	76	0.015
385	3.011	0.9764	2.940	142	0.022	77	0.015
390	3.033	0.9764	2.961	141	0.021	78	0.015
395	3.055	0.9765	2.983	219	0.021	79	0.015
400	3.076	0.9765	3.004	140	0.021	80	0.015
405	3.098	0.9765	3.025	139	0.021	81	0.015
410	3.119	0.9766	3.046	220	0.021	82	0.015
415	3.140	0.9766	3.067	138	0.021	83	0.015
420	3.161	0.9766	3.087	137	0.021	84	0.016
425	3.182	0.9767	3.108	221	0.021	85	0.016
430	3.203	0.9767	3.129	136	0.021	86	0.016
435	3.224	0.9767	3.149	135	0.020	87	0.016
440	3.245	0.9767	3.169	222	0.020	88	0.016
445	3.265	0.9768	3.189	134	0.020	89	0.016
450	3.286	0.9768	3.210	133	0.020	90	0.016
455	3.306	0.9768	3.230	223	0.020	91	0.016
460	3.326	0.9769	3.249	132	0.020	92	0.016
465	3.347	0.9769	3.269	131	0.020	93	0.016
470	3.367	0.9769	3.289	224	0.020	94	0.016
475	3.387	0.9770	3.309	130	0.020	95	0.016
480	3.407	0.9770	3.328	129	0.020	96	0.016
485	3.426	0.9770	3.348	225	0.019	97	0.016
490	3.446	0.9770	3.367	128	0.019	98	0.016
495	3.466	0.9771	3.386	127	0.019	99	0.017
500	3.485	0.9771	3.406	226	0.019	100	0.017
505	3.505	0.9771	3.425	126	0.019	101	0.017
510	3.524	0.9772	3.444	125	0.019	102	0.017
515	3.543	0.9772	3.463	227	0.019	103	0.017

100 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	3.563	0.9772	3.482	124	0.019	104	0.017
525	3.582	0.9773	3.500	123	0.019	105	0.017
530	3.601	0.9773	3.519	228	0.019	106	0.017
535	3.620	0.9773	3.538	122	0.019	107	0.017
540	3.639	0.9773	3.556	121	0.019	108	0.017
545	3.658	0.9774	3.575	229	0.019	109	0.017
550	3.676	0.9774	3.593	120	0.018	110	0.017
555	3.695	0.9774	3.612	119	0.018	111	0.018
560	3.714	0.9775	3.630	230	0.018	112	0.018
565	3.732	0.9775	3.648	118	0.018	113	0.018
570	3.750	0.9775	3.666	117	0.018	114	0.018
575	3.769	0.9776	3.684	231	0.018	115	0.018
580	3.787	0.9776	3.702	116	0.018	116	0.018
585	3.805	0.9776	3.720	115	0.018	117	0.018
590	3.824	0.9777	3.738	232	0.018	118	0.018
595	3.842	0.9777	3.756	114	0.018	119	0.018
600	3.860	0.9777	3.774	113	0.018	120	0.018
605	3.878	0.9777	3.791	233	0.018	121	0.019
610	3.896	0.9778	3.809	112	0.018	122	0.019
615	3.913	0.9778	3.827	111	0.018	123	0.019
620	3.931	0.9778	3.844	234	0.017	124	0.019
625	3.949	0.9779	3.862	110	0.017	125	0.019
630	3.967	0.9779	3.879	109	0.017	126	0.019
635	3.984	0.9779	3.896	235	0.017	127	0.019
640	4.002	0.9780	3.913	108	0.017	128	0.019
645	4.019	0.9780	3.931	107	0.017	129	0.020
650	4.037	0.9780	3.948	236	0.017	130	0.020
655	4.054	0.9780	3.965	106	0.017	131	0.020
660	4.071	0.9781	3.982	105	0.017	132	0.020
665	4.088	0.9781	3.999	237	0.017	133	0.020
670	4.106	0.9781	4.016	104	0.017	134	0.020
675	4.123	0.9782	4.033	103	0.017	135	0.020
680	4.140	0.9782	4.050	238	0.017	136	0.021
685	4.157	0.9782	4.066	102	0.017	137	0.021
690	4.174	0.9783	4.083	101	0.017	138	0.021
695	4.191	0.9783	4.100	239	0.017	139	0.021
700	4.207	0.9783	4.116	100	0.017	140	0.021
705	4.224	0.9783	4.133	99	0.017	141	0.021
710	4.241	0.9784	4.149	240	0.017	142	0.022
715	4.258	0.9784	4.166	98	0.016	143	0.022
720	4.274	0.9784	4.182	97	0.016	144	0.022
725	4.291	0.9785	4.199	241	0.016	145	0.009
730	4.307	0.9785	4.215	96	0.016	146	0.015
735	4.324	0.9785	4.231	95	0.016	147	0.015
740	4.340	0.9786	4.247	242	0.016	148	0.015
745	4.357	0.9786	4.264	94	0.016	149	0.016
750	4.373	0.9786	4.280	93	0.016	150	0.016
755	4.389	0.9787	4.296	243	0.016	151	0.016
760	4.406	0.9787	4.312	92	0.016	152	0.016
765	4.422	0.9787	4.328	91	0.016	153	0.017
770	4.438	0.9787	4.344	244	0.016	154	0.017
775	4.454	0.9788	4.360	90	0.016	155	0.017

100 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	4.470	0.9788	4.375	89	0.016	156	0.017
785	4.486	0.9788	4.391	245	0.016	157	0.018
790	4.502	0.9789	4.407	88	0.016	158	0.018
795	4.518	0.9789	4.423	87	0.016	159	0.018
800	4.534	0.9789	4.438	246	0.016	160	0.018
805	4.550	0.9790	4.454	86	0.016	161	0.019
810	4.566	0.9790	4.470	85	0.016	162	0.019
815	4.581	0.9790	4.485	247	0.016	163	0.020
820	4.597	0.9790	4.501	84	0.016	164	0.020
825	4.613	0.9791	4.516	83	0.015	165	0.020
830	4.628	0.9791	4.532	248	0.015	166	0.021
835	4.644	0.9791	4.547	82	0.015	167	0.021
840	4.659	0.9792	4.562	81	0.015	168	0.022
845	4.675	0.9792	4.578	249	0.015	169	0.025
850	4.690	0.9792	4.593	80	0.015	170	0.025
855	4.706	0.9793	4.608	79	0.015	171	0.026
860	4.721	0.9793	4.623	250	0.015	172	0.026
865	4.737	0.9793	4.639	78	0.015	173	0.027
870	4.752	0.9793	4.654	77	0.015	174	0.027
875	4.767	0.9794	4.669	251	0.015	175	0.029
880	4.782	0.9794	4.684	76	0.015	176	0.029
885	4.798	0.9794	4.699	75	0.015	177	0.030
890	4.813	0.9795	4.714	252	0.015	178	0.031
895	4.828	0.9795	4.729	74	0.015	179	0.033
900	4.843	0.9795	4.744	73	0.015	180	0.034
905	4.858	0.9796	4.759	253	0.015	181	0.036
910	4.873	0.9796	4.773	72	0.015	182	0.037
915	4.888	0.9796	4.788	71	0.015	183	0.040
920	4.903	0.9797	4.803	254	0.015	184	0.042
925	4.918	0.9797	4.818	70	0.015	185	0.057
930	4.933	0.9797	4.833	69	0.015	186	0.058
935	4.947	0.9797	4.847	255	0.015	187	0.063
940	4.962	0.9798	4.862	68	0.015	188	0.067
945	4.977	0.9798	4.876	67	0.015	189	0.067
950	4.992	0.9798	4.891	256	0.015	190	0.076
955	5.006	0.9799	4.906	66	0.015	191	0.112
960	5.021	0.9799	4.920	65	0.015	192	0.157
965	5.036	0.9799	4.935	257	0.014	193	0.564
970	5.050	0.9800	4.949	64	0.014	194	0.090
975	5.065	0.9800	4.963	63	0.014	195	0.071
980	5.079	0.9800	4.978	258	0.014	196	0.061
985	5.094	0.9800	4.992	62	0.014	197	0.043
990	5.108	0.9801	5.006	61	0.014	198	0.038
995	5.123	0.9801	5.021	259	0.014	199	0.035
1000	5.137	0.9801	5.035	60	0.014	200	0.032
1005	5.151	0.9802	5.049	59	0.014	201	0.030
1010	5.166	0.9802	5.063	260	0.014	202	0.028
1015	5.180	0.9802	5.078	58	0.014	203	0.027
1020	5.194	0.9803	5.092	57	0.014	204	0.025
1025	5.209	0.9803	5.106	261	0.014	205	0.022
1030	5.223	0.9803	5.120	56	0.014	206	0.021
1035	5.237	0.9803	5.134	55	0.014	207	0.020

100 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	5.251	0.9804	5.148	262	0.014	208	0.019
1045	5.265	0.9804	5.162	54	0.014	209	0.019
1050	5.279	0.9804	5.176	53	0.014	210	0.018
1055	5.293	0.9805	5.190	263	0.014	211	0.017
1060	5.307	0.9805	5.204	52	0.014	212	0.017
1065	5.321	0.9805	5.218	51	0.014	213	0.016
1070	5.335	0.9806	5.232	264	0.014	214	0.016
1075	5.349	0.9806	5.245	50	0.014	215	0.016
1080	5.363	0.9806	5.259	49	0.014	216	0.015
1085	5.377	0.9807	5.273	265	0.014	217	0.022
1090	5.391	0.9807	5.287	48	0.014	218	0.022
1095	5.405	0.9807	5.300	47	0.014	219	0.021
1100	5.418	0.9807	5.314	266	0.014	220	0.021
1105	5.432	0.9808	5.328	46	0.014	221	0.021
1110	5.446	0.9808	5.341	45	0.014	222	0.020
1115	5.460	0.9808	5.355	267	0.014	223	0.020
1120	5.473	0.9809	5.369	44	0.014	224	0.020
1125	5.487	0.9809	5.382	43	0.014	225	0.019
1130	5.501	0.9809	5.396	268	0.014	226	0.019
1135	5.514	0.9810	5.409	42	0.014	227	0.019
1140	5.528	0.9810	5.423	41	0.013	228	0.019
1145	5.541	0.9810	5.436	269	0.013	229	0.019
1150	5.555	0.9810	5.450	40	0.013	230	0.018
1155	5.568	0.9811	5.463	39	0.013	231	0.018
1160	5.582	0.9811	5.476	270	0.013	232	0.018
1165	5.595	0.9811	5.490	38	0.013	233	0.018
1170	5.609	0.9812	5.503	37	0.013	234	0.017
1175	5.622	0.9812	5.517	271	0.013	235	0.017
1180	5.636	0.9812	5.530	36	0.013	236	0.017
1185	5.649	0.9813	5.543	35	0.013	237	0.017
1190	5.662	0.9813	5.556	272	0.013	238	0.017
1195	5.676	0.9813	5.570	34	0.013	239	0.017
1200	5.689	0.9813	5.583	33	0.013	240	0.017
1205	5.702	0.9814	5.596	273	0.013	241	0.016
1210	5.715	0.9814	5.609	32	0.013	242	0.016
1215	5.729	0.9814	5.622	31	0.013	243	0.016
1220	5.742	0.9815	5.635	274	0.013	244	0.016
1225	5.755	0.9815	5.648	30	0.013	245	0.016
1230	5.768	0.9815	5.661	29	0.013	246	0.016
1235	5.781	0.9816	5.675	275	0.013	247	0.016
1240	5.794	0.9816	5.688	28	0.013	248	0.015
1245	5.807	0.9816	5.701	27	0.013	249	0.015
1250	5.820	0.9816	5.714	276	0.013	250	0.015
1255	5.833	0.9817	5.726	26	0.013	251	0.015
1260	5.846	0.9817	5.739	25	0.013	252	0.015
1265	5.859	0.9817	5.752	277	0.013	253	0.015
1270	5.872	0.9818	5.765	24	0.013	254	0.015
1275	5.885	0.9818	5.778	23	0.013	255	0.015
1280	5.898	0.9818	5.791	278	0.013	256	0.015
1285	5.911	0.9819	5.804	22	0.013	257	0.014
1290	5.924	0.9819	5.817	21	0.013	258	0.014
1295	5.937	0.9819	5.829	279	0.013	259	0.014

100 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	5.950	0.9820	5.842	20	0.013	260	0.014
1305	5.962	0.9820	5.855	19	0.013	261	0.014
1310	5.975	0.9820	5.868	280	0.013	262	0.014
1315	5.988	0.9820	5.880	18	0.013	263	0.014
1320	6.001	0.9821	5.893	17	0.013	264	0.014
1325	6.013	0.9821	5.906	281	0.013	265	0.014
1330	6.026	0.9821	5.918	16	0.013	266	0.014
1335	6.039	0.9822	5.931	15	0.013	267	0.014
1340	6.051	0.9822	5.944	282	0.013	268	0.014
1345	6.064	0.9822	5.956	14	0.013	269	0.013
1350	6.077	0.9823	5.969	13	0.013	270	0.013
1355	6.089	0.9823	5.981	283	0.013	271	0.013
1360	6.102	0.9823	5.994	12	0.013	272	0.013
1365	6.114	0.9823	6.006	11	0.013	273	0.013
1370	6.127	0.9824	6.019	284	0.012	274	0.013
1375	6.139	0.9824	6.031	10	0.012	275	0.013
1380	6.152	0.9824	6.044	9	0.012	276	0.013
1385	6.164	0.9825	6.056	285	0.012	277	0.013
1390	6.177	0.9825	6.069	8	0.012	278	0.013
1395	6.189	0.9825	6.081	7	0.012	279	0.013
1400	6.201	0.9826	6.093	286	0.012	280	0.013
1405	6.214	0.9826	6.106	6	0.012	281	0.013
1410	6.226	0.9826	6.118	5	0.012	282	0.013
1415	6.239	0.9826	6.130	287	0.012	283	0.013
1420	6.251	0.9827	6.143	4	0.012	284	0.012
1425	6.263	0.9827	6.155	3	0.012	285	0.012
1430	6.275	0.9827	6.167	288	0.012	286	0.012
1435	6.288	0.9828	6.179	2	0.012	287	0.012
1440	6.300	**0.9828**	6.192	1	0.012	288	0.012

10 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.417	0.8855	0.369	193	0.369	1	0.007
10	0.534	0.8855	0.472	192	0.103	2	0.007
15	0.616	0.8855	0.546	191	0.073	3	0.007
20	0.682	0.8855	0.604	194	0.059	4	0.007
25	0.739	0.8855	0.654	190	0.050	5	0.007
30	0.788	**0.8855**	0.698	189	0.044	6	0.007
35	0.832	0.8940	0.744	195	0.046	7	0.007
40	0.873	0.9025	0.788	188	0.044	8	0.007
45	0.910	0.9111	0.829	187	0.041	9	0.007
50	0.945	0.9196	0.869	196	0.040	10	0.007
55	0.977	0.9281	0.907	186	0.038	11	0.007
60	1.008	**0.9367**	0.944	185	0.037	12	0.007
65	1.037	0.9379	0.973	197	0.028	13	0.007
70	1.065	0.9391	1.000	184	0.027	14	0.007
75	1.091	0.9403	1.026	183	0.026	15	0.007
80	1.116	0.9416	1.051	198	0.025	16	0.007
85	1.141	0.9428	1.075	182	0.024	17	0.007
90	1.164	0.9440	1.099	181	0.023	18	0.007
95	1.186	0.9452	1.122	199	0.023	19	0.007
100	1.208	0.9465	1.144	180	0.022	20	0.007
105	1.229	0.9477	1.165	179	0.021	21	0.007
110	1.250	0.9489	1.186	200	0.021	22	0.007
115	1.270	0.9501	1.206	178	0.020	23	0.007
120	1.289	0.9514	1.226	177	0.020	24	0.007
125	1.308	0.9526	1.246	201	0.020	25	0.007
130	1.326	0.9538	1.265	176	0.019	26	0.007
135	1.344	0.9550	1.284	175	0.019	27	0.007
140	1.362	0.9562	1.302	202	0.018	28	0.007
145	1.379	0.9575	1.320	174	0.018	29	0.007
150	1.395	0.9587	1.338	173	0.018	30	0.007
155	1.412	0.9599	1.355	203	0.017	31	0.007
160	1.428	0.9611	1.372	172	0.017	32	0.007
165	1.443	0.9624	1.389	171	0.017	33	0.007
170	1.459	0.9636	1.406	204	0.017	34	0.007
175	1.474	0.9648	1.422	170	0.016	35	0.007
180	1.489	**0.9660**	1.438	169	0.016	36	0.007
185	1.503	0.9663	1.453	205	0.014	37	0.007
190	1.518	0.9666	1.467	168	0.014	38	0.007
195	1.532	0.9669	1.481	167	0.014	39	0.007
200	1.545	0.9672	1.495	206	0.014	40	0.007
205	1.559	0.9675	1.508	166	0.014	41	0.007
210	1.572	0.9677	1.522	165	0.013	42	0.007
215	1.586	0.9680	1.535	207	0.013	43	0.007
220	1.599	0.9683	1.548	164	0.013	44	0.007
225	1.611	0.9686	1.561	163	0.013	45	0.007
230	1.624	0.9689	1.573	208	0.013	46	0.007
235	1.636	0.9692	1.586	162	0.013	47	0.008
240	1.649	0.9694	1.598	161	0.012	48	0.008
245	1.661	0.9697	1.611	209	0.012	49	0.008
250	1.673	0.9700	1.623	160	0.012	50	0.008
255	1.685	0.9703	1.635	159	0.012	51	0.008

10 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.696	0.9706	1.646	210	0.012	52	0.008
265	1.708	0.9709	1.658	158	0.012	53	0.008
270	1.719	0.9712	1.670	157	0.012	54	0.008
275	1.730	0.9714	1.681	211	0.011	55	0.008
280	1.741	0.9717	1.692	156	0.011	56	0.008
285	1.752	0.9720	1.703	155	0.011	57	0.008
290	1.763	0.9723	1.714	212	0.011	58	0.008
295	1.774	0.9726	1.725	154	0.011	59	0.008
300	1.785	0.9729	1.736	153	0.011	60	0.008
305	1.795	0.9731	1.747	213	0.011	61	0.008
310	1.806	0.9734	1.758	152	0.011	62	0.008
315	1.816	0.9737	1.768	151	0.011	63	0.008
320	1.826	0.9740	1.779	214	0.010	64	0.008
325	1.836	0.9743	1.789	150	0.010	65	0.008
330	1.846	0.9746	1.799	149	0.010	66	0.008
335	1.856	0.9748	1.809	215	0.010	67	0.008
340	1.866	0.9751	1.819	148	0.010	68	0.008
345	1.875	0.9754	1.829	147	0.010	69	0.008
350	1.885	0.9757	1.839	216	0.010	70	0.008
355	1.895	0.9760	1.849	146	0.010	71	0.008
360	**1.900**	**0.9763**	1.855	145	0.006	72	0.008
365	1.913	0.9763	1.868	217	0.013	73	0.008
370	1.926	0.9763	1.881	144	0.013	74	0.008
375	1.939	0.9764	1.893	143	0.013	75	0.008
380	1.952	0.9764	1.906	218	0.013	76	0.008
385	1.965	0.9764	1.919	142	0.013	77	0.008
390	1.978	0.9764	1.931	141	0.012	78	0.008
395	1.990	0.9765	1.943	219	0.012	79	0.008
400	2.003	0.9765	1.956	140	0.012	80	0.009
405	2.015	0.9765	1.968	139	0.012	81	0.009
410	2.028	0.9766	1.980	220	0.012	82	0.009
415	2.040	0.9766	1.992	138	0.012	83	0.009
420	2.052	0.9766	2.004	137	0.012	84	0.009
425	2.064	0.9767	2.016	221	0.012	85	0.009
430	2.077	0.9767	2.028	136	0.012	86	0.009
435	2.089	0.9767	2.040	135	0.012	87	0.009
440	2.101	0.9767	2.052	222	0.012	88	0.009
445	2.112	0.9768	2.063	134	0.012	89	0.009
450	2.124	0.9768	2.075	133	0.012	90	0.009
455	2.136	0.9768	2.087	223	0.012	91	0.009
460	2.148	0.9769	2.098	132	0.011	92	0.009
465	2.159	0.9769	2.109	131	0.011	93	0.009
470	2.171	0.9769	2.121	224	0.011	94	0.009
475	2.182	0.9770	2.132	130	0.011	95	0.009
480	2.194	0.9770	2.143	129	0.011	96	0.009
485	2.205	0.9770	2.155	225	0.011	97	0.009
490	2.217	0.9770	2.166	128	0.011	98	0.009
495	2.228	0.9771	2.177	127	0.011	99	0.009
500	2.239	0.9771	2.188	226	0.011	100	0.009
505	2.250	0.9771	2.199	126	0.011	101	0.009
510	2.261	0.9772	2.210	125	0.011	102	0.009
515	2.273	0.9772	2.221	227	0.011	103	0.010

10 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	2.284	0.9772	2.232	124	0.011	104	0.010
525	2.294	0.9773	2.242	123	0.011	105	0.010
530	2.305	0.9773	2.253	228	0.011	106	0.010
535	2.316	0.9773	2.264	122	0.011	107	0.010
540	2.327	0.9773	2.274	121	0.011	108	0.010
545	2.338	0.9774	2.285	229	0.011	109	0.010
550	2.348	0.9774	2.295	120	0.011	110	0.010
555	2.359	0.9774	2.306	119	0.010	111	0.010
560	2.370	0.9775	2.316	230	0.010	112	0.010
565	2.380	0.9775	2.327	118	0.010	113	0.010
570	2.391	0.9775	2.337	117	0.010	114	0.010
575	2.401	0.9776	2.347	231	0.010	115	0.010
580	2.412	0.9776	2.358	116	0.010	116	0.010
585	2.422	0.9776	2.368	115	0.010	117	0.010
590	2.432	0.9777	2.378	232	0.010	118	0.010
595	2.443	0.9777	2.388	114	0.010	119	0.010
600	2.453	0.9777	2.398	113	0.010	120	0.011
605	2.463	0.9777	2.408	233	0.010	121	0.011
610	2.473	0.9778	2.418	112	0.010	122	0.011
615	2.483	0.9778	2.428	111	0.010	123	0.011
620	2.493	0.9778	2.438	234	0.010	124	0.011
625	2.503	0.9779	2.448	110	0.010	125	0.011
630	2.513	0.9779	2.458	109	0.010	126	0.011
635	2.523	0.9779	2.468	235	0.010	127	0.011
640	2.533	0.9780	2.477	108	0.010	128	0.011
645	2.543	0.9780	2.487	107	0.010	129	0.011
650	2.553	0.9780	2.497	236	0.010	130	0.011
655	2.563	0.9780	2.507	106	0.010	131	0.011
660	2.573	0.9781	2.516	105	0.010	132	0.011
665	2.582	0.9781	2.526	237	0.010	133	0.012
670	2.592	0.9781	2.535	104	0.010	134	0.012
675	2.602	0.9782	2.545	103	0.010	135	0.012
680	2.611	0.9782	2.554	238	0.009	136	0.012
685	2.621	0.9782	2.564	102	0.009	137	0.012
690	2.630	0.9783	2.573	101	0.009	138	0.012
695	2.640	0.9783	2.583	239	0.009	139	0.012
700	2.649	0.9783	2.592	100	0.009	140	0.012
705	2.659	0.9783	2.601	99	0.009	141	0.012
710	2.668	0.9784	2.611	240	0.009	142	0.013
715	2.678	0.9784	2.620	98	0.009	143	0.013
720	2.687	0.9784	2.629	97	0.009	144	0.013
725	2.696	0.9785	2.638	241	0.009	145	0.006
730	2.706	0.9785	2.647	96	0.009	146	0.010
735	2.715	0.9785	2.657	95	0.009	147	0.010
740	2.724	0.9786	2.666	242	0.009	148	0.010
745	2.733	0.9786	2.675	94	0.009	149	0.010
750	2.742	0.9786	2.684	93	0.009	150	0.010
755	2.752	0.9787	2.693	243	0.009	151	0.011
760	2.761	0.9787	2.702	92	0.009	152	0.011
765	2.770	0.9787	2.711	91	0.009	153	0.011
770	2.779	0.9787	2.720	244	0.009	154	0.011
775	2.788	0.9788	2.729	90	0.009	155	0.011

10 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	2.797	0.9788	2.737	89	0.009	156	0.011
785	2.806	0.9788	2.746	245	0.009	157	0.012
790	2.815	0.9789	2.755	88	0.009	158	0.012
795	2.823	0.9789	2.764	87	0.009	159	0.012
800	2.832	0.9789	2.773	246	0.009	160	0.012
805	2.841	0.9790	2.781	86	0.009	161	0.012
810	2.850	0.9790	2.790	85	0.009	162	0.013
815	2.859	0.9790	2.799	247	0.009	163	0.013
820	2.868	0.9790	2.807	84	0.009	164	0.013
825	2.876	0.9791	2.816	83	0.009	165	0.013
830	2.885	0.9791	2.825	248	0.009	166	0.014
835	2.894	0.9791	2.833	82	0.009	167	0.014
840	2.902	0.9792	2.842	81	0.009	168	0.014
845	2.911	0.9792	2.850	249	0.009	169	0.016
850	2.920	0.9792	2.859	80	0.009	170	0.016
855	2.928	0.9793	2.867	79	0.008	171	0.017
860	2.937	0.9793	2.876	250	0.008	172	0.017
865	2.945	0.9793	2.884	78	0.008	173	0.018
870	2.954	0.9793	2.893	77	0.008	174	0.018
875	2.962	0.9794	2.901	251	0.008	175	0.019
880	2.971	0.9794	2.909	76	0.008	176	0.019
885	2.979	0.9794	2.918	75	0.008	177	0.020
890	2.987	0.9795	2.926	252	0.008	178	0.020
895	2.996	0.9795	2.934	74	0.008	179	0.021
900	3.004	0.9795	2.943	73	0.008	180	0.022
905	3.012	0.9796	2.951	253	0.008	181	0.023
910	3.021	0.9796	2.959	72	0.008	182	0.024
915	3.029	0.9796	2.967	71	0.008	183	0.026
920	3.037	0.9797	2.976	254	0.008	184	0.027
925	3.046	0.9797	2.984	70	0.008	185	0.037
930	3.054	0.9797	2.992	69	0.008	186	0.038
935	3.062	0.9797	3.000	255	0.008	187	0.041
940	3.070	0.9798	3.008	68	0.008	188	0.044
945	3.078	0.9798	3.016	67	0.008	189	0.044
950	3.086	0.9798	3.024	256	0.008	190	0.050
955	3.095	0.9799	3.032	66	0.008	191	0.073
960	3.103	0.9799	3.040	65	0.008	192	0.103
965	3.111	0.9799	3.048	257	0.008	193	0.369
970	3.119	0.9800	3.056	64	0.008	194	0.059
975	3.127	0.9800	3.064	63	0.008	195	0.046
980	3.135	0.9800	3.072	258	0.008	196	0.040
985	3.143	0.9800	3.080	62	0.008	197	0.028
990	3.151	0.9801	3.088	61	0.008	198	0.025
995	3.159	0.9801	3.096	259	0.008	199	0.023
1000	3.167	0.9801	3.104	60	0.008	200	0.021
1005	3.175	0.9802	3.112	59	0.008	201	0.020
1010	3.182	0.9802	3.119	260	0.008	202	0.018
1015	3.190	0.9802	3.127	58	0.008	203	0.017
1020	3.198	0.9803	3.135	57	0.008	204	0.017
1025	3.206	0.9803	3.143	261	0.008	205	0.014
1030	3.214	0.9803	3.151	56	0.008	206	0.014
1035	3.222	0.9803	3.158	55	0.008	207	0.013

10 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	3.229	0.9804	3.166	262	0.008	208	0.013
1045	3.237	0.9804	3.174	54	0.008	209	0.012
1050	3.245	0.9804	3.181	53	0.008	210	0.012
1055	3.253	0.9805	3.189	263	0.008	211	0.011
1060	3.260	0.9805	3.197	52	0.008	212	0.011
1065	3.268	0.9805	3.204	51	0.008	213	0.011
1070	3.276	0.9806	3.212	264	0.008	214	0.010
1075	3.283	0.9806	3.220	50	0.008	215	0.010
1080	3.291	0.9806	3.227	49	0.008	216	0.010
1085	3.299	0.9807	3.235	265	0.008	217	0.013
1090	3.306	0.9807	3.242	48	0.008	218	0.013
1095	3.314	0.9807	3.250	47	0.008	219	0.012
1100	3.321	0.9807	3.257	266	0.008	220	0.012
1105	3.329	0.9808	3.265	46	0.007	221	0.012
1110	3.336	0.9808	3.272	45	0.007	222	0.012
1115	3.344	0.9808	3.280	267	0.007	223	0.012
1120	3.351	0.9809	3.287	44	0.007	224	0.011
1125	3.359	0.9809	3.295	43	0.007	225	0.011
1130	3.366	0.9809	3.302	268	0.007	226	0.011
1135	3.374	0.9810	3.309	42	0.007	227	0.011
1140	3.381	0.9810	3.317	41	0.007	228	0.011
1145	3.388	0.9810	3.324	269	0.007	229	0.011
1150	3.396	0.9810	3.331	40	0.007	230	0.010
1155	3.403	0.9811	3.339	39	0.007	231	0.010
1160	3.411	0.9811	3.346	270	0.007	232	0.010
1165	3.418	0.9811	3.353	38	0.007	233	0.010
1170	3.425	0.9812	3.361	37	0.007	234	0.010
1175	3.433	0.9812	3.368	271	0.007	235	0.010
1180	3.440	0.9812	3.375	36	0.007	236	0.010
1185	3.447	0.9813	3.383	35	0.007	237	0.010
1190	3.454	0.9813	3.390	272	0.007	238	0.009
1195	3.462	0.9813	3.397	34	0.007	239	0.009
1200	3.469	0.9813	3.404	33	0.007	240	0.009
1205	3.476	0.9814	3.411	273	0.007	241	0.009
1210	3.483	0.9814	3.419	32	0.007	242	0.009
1215	3.491	0.9814	3.426	31	0.007	243	0.009
1220	3.498	0.9815	3.433	274	0.007	244	0.009
1225	3.505	0.9815	3.440	30	0.007	245	0.009
1230	3.512	0.9815	3.447	29	0.007	246	0.009
1235	3.519	0.9816	3.454	275	0.007	247	0.009
1240	3.526	0.9816	3.461	28	0.007	248	0.009
1245	3.533	0.9816	3.468	27	0.007	249	0.009
1250	3.540	0.9816	3.475	276	0.007	250	0.008
1255	3.548	0.9817	3.483	26	0.007	251	0.008
1260	3.555	0.9817	3.490	25	0.007	252	0.008
1265	3.562	0.9817	3.497	277	0.007	253	0.008
1270	3.569	0.9818	3.504	24	0.007	254	0.008
1275	3.576	0.9818	3.511	23	0.007	255	0.008
1280	3.583	0.9818	3.518	278	0.007	256	0.008
1285	3.590	0.9819	3.525	22	0.007	257	0.008
1290	3.597	0.9819	3.532	21	0.007	258	0.008
1295	3.604	0.9819	3.538	279	0.007	259	0.008

10 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	3.611	0.9820	3.545	20	0.007	260	0.008
1305	3.617	0.9820	3.552	19	0.007	261	0.008
1310	3.624	0.9820	3.559	280	0.007	262	0.008
1315	3.631	0.9820	3.566	18	0.007	263	0.008
1320	3.638	0.9821	3.573	17	0.007	264	0.008
1325	3.645	0.9821	3.580	281	0.007	265	0.008
1330	3.652	0.9821	3.587	16	0.007	266	0.008
1335	3.659	0.9822	3.594	15	0.007	267	0.007
1340	3.666	0.9822	3.600	282	0.007	268	0.007
1345	3.673	0.9822	3.607	14	0.007	269	0.007
1350	3.679	0.9823	3.614	13	0.007	270	0.007
1355	3.686	0.9823	3.621	283	0.007	271	0.007
1360	3.693	0.9823	3.628	12	0.007	272	0.007
1365	3.700	0.9823	3.634	11	0.007	273	0.007
1370	3.706	0.9824	3.641	284	0.007	274	0.007
1375	3.713	0.9824	3.648	10	0.007	275	0.007
1380	3.720	0.9824	3.655	9	0.007	276	0.007
1385	3.727	0.9825	3.661	285	0.007	277	0.007
1390	3.733	0.9825	3.668	8	0.007	278	0.007
1395	3.740	0.9825	3.675	7	0.007	279	0.007
1400	3.747	0.9826	3.681	286	0.007	280	0.007
1405	3.754	0.9826	3.688	6	0.007	281	0.007
1410	3.760	0.9826	3.695	5	0.007	282	0.007
1415	3.767	0.9826	3.702	287	0.007	283	0.007
1420	3.774	0.9827	3.708	4	0.007	284	0.007
1425	3.780	0.9827	3.715	3	0.007	285	0.007
1430	3.787	0.9827	3.721	288	0.007	286	0.007
1435	3.793	0.9828	3.728	2	0.007	287	0.007
1440	3.800	**0.9828**	3.735	1	0.007	288	0.007

5 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.373	0.8855	0.331	193	0.331	1	0.006
10	0.477	0.8855	0.423	192	0.092	2	0.006
15	0.551	0.8855	0.488	191	0.065	3	0.006
20	0.611	0.8855	0.541	194	0.052	4	0.006
25	0.661	0.8855	0.585	190	0.045	5	0.006
30	0.705	**0.8855**	0.624	189	0.039	6	0.006
35	0.745	0.8940	0.666	195	0.041	7	0.006
40	0.781	0.9025	0.705	188	0.039	8	0.006
45	0.814	0.9111	0.742	187	0.037	9	0.006
50	0.845	0.9196	0.777	196	0.035	10	0.006
55	0.874	0.9281	0.812	186	0.034	11	0.006
60	0.902	**0.9367**	0.845	185	0.033	12	0.006
65	0.928	0.9379	0.870	197	0.025	13	0.006
70	0.953	0.9391	0.895	184	0.024	14	0.006
75	0.976	0.9403	0.918	183	0.023	15	0.006
80	0.999	0.9416	0.940	198	0.022	16	0.006
85	1.021	0.9428	0.962	182	0.022	17	0.006
90	1.041	0.9440	0.983	181	0.021	18	0.006
95	1.062	0.9452	1.003	199	0.020	19	0.006
100	1.081	0.9465	1.023	180	0.020	20	0.006
105	1.100	0.9477	1.042	179	0.019	21	0.006
110	1.118	0.9489	1.061	200	0.019	22	0.006
115	1.136	0.9501	1.079	178	0.018	23	0.006
120	1.153	0.9514	1.097	177	0.018	24	0.006
125	1.170	0.9526	1.115	201	0.017	25	0.006
130	1.187	0.9538	1.132	176	0.017	26	0.006
135	1.203	0.9550	1.149	175	0.017	27	0.006
140	1.218	0.9562	1.165	202	0.016	28	0.006
145	1.234	0.9575	1.181	174	0.016	29	0.006
150	1.248	0.9587	1.197	173	0.016	30	0.006
155	1.263	0.9599	1.212	203	0.016	31	0.006
160	1.277	0.9611	1.228	172	0.015	32	0.006
165	1.291	0.9624	1.243	171	0.015	33	0.006
170	1.305	0.9636	1.258	204	0.015	34	0.006
175	1.319	0.9648	1.272	170	0.015	35	0.006
180	1.332	**0.9660**	1.287	169	0.014	36	0.006
185	1.345	0.9663	1.300	205	0.013	37	0.007
190	1.358	0.9666	1.312	168	0.013	38	0.007
195	1.370	0.9669	1.325	167	0.013	39	0.007
200	1.383	0.9672	1.337	206	0.012	40	0.007
205	1.395	0.9675	1.350	166	0.012	41	0.007
210	1.407	0.9677	1.362	165	0.012	42	0.007
215	1.419	0.9680	1.373	207	0.012	43	0.007
220	1.430	0.9683	1.385	164	0.012	44	0.007
225	1.442	0.9686	1.396	163	0.012	45	0.007
230	1.453	0.9689	1.408	208	0.011	46	0.007
235	1.464	0.9692	1.419	162	0.011	47	0.007
240	1.475	0.9694	1.430	161	0.011	48	0.007
245	1.486	0.9697	1.441	209	0.011	49	0.007
250	1.497	0.9700	1.452	160	0.011	50	0.007
255	1.507	0.9703	1.463	159	0.011	51	0.007

5 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.518	0.9706	1.473	210	0.011	52	0.007
265	1.528	0.9709	1.483	158	0.010	53	0.007
270	1.538	0.9712	1.494	157	0.010	54	0.007
275	1.548	0.9714	1.504	211	0.010	55	0.007
280	1.558	0.9717	1.514	156	0.010	56	0.007
285	1.568	0.9720	1.524	155	0.010	57	0.007
290	1.578	0.9723	1.534	212	0.010	58	0.007
295	1.587	0.9726	1.544	154	0.010	59	0.007
300	1.597	0.9729	1.553	153	0.010	60	0.007
305	1.606	0.9731	1.563	213	0.010	61	0.007
310	1.615	0.9734	1.573	152	0.010	62	0.007
315	1.625	0.9737	1.582	151	0.009	63	0.007
320	1.634	0.9740	1.591	214	0.009	64	0.007
325	1.643	0.9743	1.601	150	0.009	65	0.007
330	1.652	0.9746	1.610	149	0.009	66	0.007
335	1.661	0.9748	1.619	215	0.009	67	0.007
340	1.669	0.9751	1.628	148	0.009	68	0.007
345	1.678	0.9754	1.637	147	0.009	69	0.007
350	1.687	0.9757	1.646	216	0.009	70	0.007
355	1.695	0.9760	1.654	146	0.009	71	0.007
360	**1.700**	**0.9763**	1.660	145	0.005	72	0.007
365	1.712	0.9763	1.671	217	0.012	73	0.007
370	1.723	0.9763	1.683	144	0.011	74	0.007
375	1.735	0.9764	1.694	143	0.011	75	0.007
380	1.747	0.9764	1.705	218	0.011	76	0.007
385	1.758	0.9764	1.717	142	0.011	77	0.008
390	1.769	0.9764	1.728	141	0.011	78	0.008
395	1.781	0.9765	1.739	219	0.011	79	0.008
400	1.792	0.9765	1.750	140	0.011	80	0.008
405	1.803	0.9765	1.761	139	0.011	81	0.008
410	1.814	0.9766	1.772	220	0.011	82	0.008
415	1.825	0.9766	1.783	138	0.011	83	0.008
420	1.836	0.9766	1.793	137	0.011	84	0.008
425	1.847	0.9767	1.804	221	0.011	85	0.008
430	1.858	0.9767	1.815	136	0.011	86	0.008
435	1.869	0.9767	1.825	135	0.011	87	0.008
440	1.879	0.9767	1.836	222	0.011	88	0.008
445	1.890	0.9768	1.846	134	0.010	89	0.008
450	1.901	0.9768	1.857	133	0.010	90	0.008
455	1.911	0.9768	1.867	223	0.010	91	0.008
460	1.922	0.9769	1.877	132	0.010	92	0.008
465	1.932	0.9769	1.887	131	0.010	93	0.008
470	1.942	0.9769	1.898	224	0.010	94	0.008
475	1.953	0.9770	1.908	130	0.010	95	0.008
480	1.963	0.9770	1.918	129	0.010	96	0.008
485	1.973	0.9770	1.928	225	0.010	97	0.008
490	1.983	0.9770	1.938	128	0.010	98	0.008
495	1.993	0.9771	1.948	127	0.010	99	0.008
500	2.003	0.9771	1.958	226	0.010	100	0.008
505	2.013	0.9771	1.967	126	0.010	101	0.008
510	2.023	0.9772	1.977	125	0.010	102	0.008
515	2.033	0.9772	1.987	227	0.010	103	0.009

5 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	2.043	0.9772	1.997	124	0.010	104	0.009
525	2.053	0.9773	2.006	123	0.010	105	0.009
530	2.063	0.9773	2.016	228	0.010	106	0.009
535	2.072	0.9773	2.025	122	0.010	107	0.009
540	2.082	0.9773	2.035	121	0.010	108	0.009
545	2.092	0.9774	2.044	229	0.009	109	0.009
550	2.101	0.9774	2.054	120	0.009	110	0.009
555	2.111	0.9774	2.063	119	0.009	111	0.009
560	2.120	0.9775	2.073	230	0.009	112	0.009
565	2.130	0.9775	2.082	118	0.009	113	0.009
570	2.139	0.9775	2.091	117	0.009	114	0.009
575	2.148	0.9776	2.100	231	0.009	115	0.009
580	2.158	0.9776	2.109	116	0.009	116	0.009
585	2.167	0.9776	2.119	115	0.009	117	0.009
590	2.176	0.9777	2.128	232	0.009	118	0.009
595	2.186	0.9777	2.137	114	0.009	119	0.009
600	2.195	0.9777	2.146	113	0.009	120	0.009
605	2.204	0.9777	2.155	233	0.009	121	0.010
610	2.213	0.9778	2.164	112	0.009	122	0.010
615	2.222	0.9778	2.173	111	0.009	123	0.010
620	2.231	0.9778	2.182	234	0.009	124	0.010
625	2.240	0.9779	2.190	110	0.009	125	0.010
630	2.249	0.9779	2.199	109	0.009	126	0.010
635	2.258	0.9779	2.208	235	0.009	127	0.010
640	2.267	0.9780	2.217	108	0.009	128	0.010
645	2.276	0.9780	2.225	107	0.009	129	0.010
650	2.284	0.9780	2.234	236	0.009	130	0.010
655	2.293	0.9780	2.243	106	0.009	131	0.010
660	2.302	0.9781	2.251	105	0.009	132	0.010
665	2.311	0.9781	2.260	237	0.009	133	0.010
670	2.319	0.9781	2.268	104	0.009	134	0.010
675	2.328	0.9782	2.277	103	0.009	135	0.011
680	2.336	0.9782	2.285	238	0.008	136	0.011
685	2.345	0.9782	2.294	102	0.008	137	0.011
690	2.354	0.9783	2.302	101	0.008	138	0.011
695	2.362	0.9783	2.311	239	0.008	139	0.011
700	2.371	0.9783	2.319	100	0.008	140	0.011
705	2.379	0.9783	2.327	99	0.008	141	0.011
710	2.387	0.9784	2.336	240	0.008	142	0.011
715	2.396	0.9784	2.344	98	0.008	143	0.011
720	2.404	0.9784	2.352	97	0.008	144	0.011
725	2.412	0.9785	2.361	241	0.008	145	0.005
730	2.421	0.9785	2.369	96	0.008	146	0.009
735	2.429	0.9785	2.377	95	0.008	147	0.009
740	2.437	0.9786	2.385	242	0.008	148	0.009
745	2.446	0.9786	2.393	94	0.008	149	0.009
750	2.454	0.9786	2.401	93	0.008	150	0.009
755	2.462	0.9787	2.409	243	0.008	151	0.009
760	2.470	0.9787	2.417	92	0.008	152	0.010
765	2.478	0.9787	2.425	91	0.008	153	0.010
770	2.486	0.9787	2.433	244	0.008	154	0.010
775	2.494	0.9788	2.441	90	0.008	155	0.010

5 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	2.502	0.9788	2.449	89	0.008	156	0.010
785	2.510	0.9788	2.457	245	0.008	157	0.010
790	2.518	0.9789	2.465	88	0.008	158	0.010
795	2.526	0.9789	2.473	87	0.008	159	0.011
800	2.534	0.9789	2.481	246	0.008	160	0.011
805	2.542	0.9790	2.489	86	0.008	161	0.011
810	2.550	0.9790	2.496	85	0.008	162	0.011
815	2.558	0.9790	2.504	247	0.008	163	0.012
820	2.566	0.9790	2.512	84	0.008	164	0.012
825	2.574	0.9791	2.520	83	0.008	165	0.012
830	2.581	0.9791	2.527	248	0.008	166	0.012
835	2.589	0.9791	2.535	82	0.008	167	0.013
840	2.597	0.9792	2.543	81	0.008	168	0.013
845	2.605	0.9792	2.550	249	0.008	169	0.014
850	2.612	0.9792	2.558	80	0.008	170	0.015
855	2.620	0.9793	2.566	79	0.008	171	0.015
860	2.628	0.9793	2.573	250	0.008	172	0.015
865	2.635	0.9793	2.581	78	0.008	173	0.016
870	2.643	0.9793	2.588	77	0.008	174	0.016
875	2.650	0.9794	2.596	251	0.008	175	0.017
880	2.658	0.9794	2.603	76	0.007	176	0.017
885	2.665	0.9794	2.611	75	0.007	177	0.018
890	2.673	0.9795	2.618	252	0.007	178	0.018
895	2.680	0.9795	2.626	74	0.007	179	0.019
900	2.688	0.9795	2.633	73	0.007	180	0.020
905	2.695	0.9796	2.640	253	0.007	181	0.021
910	2.703	0.9796	2.648	72	0.007	182	0.022
915	2.710	0.9796	2.655	71	0.007	183	0.023
920	2.718	0.9797	2.662	254	0.007	184	0.024
925	2.725	0.9797	2.670	70	0.007	185	0.033
930	2.732	0.9797	2.677	69	0.007	186	0.034
935	2.740	0.9797	2.684	255	0.007	187	0.037
940	2.747	0.9798	2.691	68	0.007	188	0.039
945	2.754	0.9798	2.699	67	0.007	189	0.039
950	2.762	0.9798	2.706	256	0.007	190	0.045
955	2.769	0.9799	2.713	66	0.007	191	0.065
960	2.776	0.9799	2.720	65	0.007	192	0.092
965	2.783	0.9799	2.727	257	0.007	193	0.331
970	2.791	0.9800	2.735	64	0.007	194	0.052
975	2.798	0.9800	2.742	63	0.007	195	0.041
980	2.805	0.9800	2.749	258	0.007	196	0.035
985	2.812	0.9800	2.756	62	0.007	197	0.025
990	2.819	0.9801	2.763	61	0.007	198	0.022
995	2.826	0.9801	2.770	259	0.007	199	0.020
1000	2.833	0.9801	2.777	60	0.007	200	0.019
1005	2.840	0.9802	2.784	59	0.007	201	0.017
1010	2.847	0.9802	2.791	260	0.007	202	0.016
1015	2.855	0.9802	2.798	58	0.007	203	0.016
1020	2.862	0.9803	2.805	57	0.007	204	0.015
1025	2.869	0.9803	2.812	261	0.007	205	0.013
1030	2.876	0.9803	2.819	56	0.007	206	0.012
1035	2.882	0.9803	2.826	55	0.007	207	0.012

5 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	2.889	0.9804	2.833	262	0.007	208	0.011
1045	2.896	0.9804	2.840	54	0.007	209	0.011
1050	2.903	0.9804	2.847	53	0.007	210	0.011
1055	2.910	0.9805	2.853	263	0.007	211	0.010
1060	2.917	0.9805	2.860	52	0.007	212	0.010
1065	2.924	0.9805	2.867	51	0.007	213	0.010
1070	2.931	0.9806	2.874	264	0.007	214	0.009
1075	2.938	0.9806	2.881	50	0.007	215	0.009
1080	2.944	0.9806	2.887	49	0.007	216	0.009
1085	2.951	0.9807	2.894	265	0.007	217	0.012
1090	2.958	0.9807	2.901	48	0.007	218	0.011
1095	2.965	0.9807	2.908	47	0.007	219	0.011
1100	2.972	0.9807	2.914	266	0.007	220	0.011
1105	2.978	0.9808	2.921	46	0.007	221	0.011
1110	2.985	0.9808	2.928	45	0.007	222	0.011
1115	2.992	0.9808	2.934	267	0.007	223	0.010
1120	2.999	0.9809	2.941	44	0.007	224	0.010
1125	3.005	0.9809	2.948	43	0.007	225	0.010
1130	3.012	0.9809	2.954	268	0.007	226	0.010
1135	3.019	0.9810	2.961	42	0.007	227	0.010
1140	3.025	0.9810	2.968	41	0.007	228	0.010
1145	3.032	0.9810	2.974	269	0.007	229	0.009
1150	3.038	0.9810	2.981	40	0.007	230	0.009
1155	3.045	0.9811	2.987	39	0.007	231	0.009
1160	3.052	0.9811	2.994	270	0.007	232	0.009
1165	3.058	0.9811	3.000	38	0.007	233	0.009
1170	3.065	0.9812	3.007	37	0.007	234	0.009
1175	3.071	0.9812	3.014	271	0.007	235	0.009
1180	3.078	0.9812	3.020	36	0.006	236	0.009
1185	3.084	0.9813	3.026	35	0.006	237	0.009
1190	3.091	0.9813	3.033	272	0.006	238	0.008
1195	3.097	0.9813	3.039	34	0.006	239	0.008
1200	3.104	0.9813	3.046	33	0.006	240	0.008
1205	3.110	0.9814	3.052	273	0.006	241	0.008
1210	3.117	0.9814	3.059	32	0.006	242	0.008
1215	3.123	0.9814	3.065	31	0.006	243	0.008
1220	3.130	0.9815	3.072	274	0.006	244	0.008
1225	3.136	0.9815	3.078	30	0.006	245	0.008
1230	3.142	0.9815	3.084	29	0.006	246	0.008
1235	3.149	0.9816	3.091	275	0.006	247	0.008
1240	3.155	0.9816	3.097	28	0.006	248	0.008
1245	3.161	0.9816	3.103	27	0.006	249	0.008
1250	3.168	0.9816	3.110	276	0.006	250	0.008
1255	3.174	0.9817	3.116	26	0.006	251	0.008
1260	3.180	0.9817	3.122	25	0.006	252	0.007
1265	3.187	0.9817	3.129	277	0.006	253	0.007
1270	3.193	0.9818	3.135	24	0.006	254	0.007
1275	3.199	0.9818	3.141	23	0.006	255	0.007
1280	3.206	0.9818	3.147	278	0.006	256	0.007
1285	3.212	0.9819	3.154	22	0.006	257	0.007
1290	3.218	0.9819	3.160	21	0.006	258	0.007
1295	3.224	0.9819	3.166	279	0.006	259	0.007

5 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	3.230	0.9820	3.172	20	0.006	260	0.007
1305	3.237	0.9820	3.178	19	0.006	261	0.007
1310	3.243	0.9820	3.185	280	0.006	262	0.007
1315	3.249	0.9820	3.191	18	0.006	263	0.007
1320	3.255	0.9821	3.197	17	0.006	264	0.007
1325	3.261	0.9821	3.203	281	0.006	265	0.007
1330	3.268	0.9821	3.209	16	0.006	266	0.007
1335	3.274	0.9822	3.215	15	0.006	267	0.007
1340	3.280	0.9822	3.221	282	0.006	268	0.007
1345	3.286	0.9822	3.228	14	0.006	269	0.007
1350	3.292	0.9823	3.234	13	0.006	270	0.007
1355	3.298	0.9823	3.240	283	0.006	271	0.007
1360	3.304	0.9823	3.246	12	0.006	272	0.006
1365	3.310	0.9823	3.252	11	0.006	273	0.006
1370	3.316	0.9824	3.258	284	0.006	274	0.006
1375	3.322	0.9824	3.264	10	0.006	275	0.006
1380	3.328	0.9824	3.270	9	0.006	276	0.006
1385	3.334	0.9825	3.276	285	0.006	277	0.006
1390	3.340	0.9825	3.282	8	0.006	278	0.006
1395	3.346	0.9825	3.288	7	0.006	279	0.006
1400	3.352	0.9826	3.294	286	0.006	280	0.006
1405	3.358	0.9826	3.300	6	0.006	281	0.006
1410	3.364	0.9826	3.306	5	0.006	282	0.006
1415	3.370	0.9826	3.312	287	0.006	283	0.006
1420	3.376	0.9827	3.318	4	0.006	284	0.006
1425	3.382	0.9827	3.324	3	0.006	285	0.006
1430	3.388	0.9827	3.330	288	0.006	286	0.006
1435	3.394	0.9828	3.336	2	0.006	287	0.006
1440	3.400	**0.9828**	3.342	1	0.006	288	0.006

2 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.285	0.8855	0.253	193	0.253	1	0.004
10	0.365	0.8855	0.323	192	0.071	2	0.004
15	0.422	0.8855	0.373	191	0.050	3	0.004
20	0.467	0.8855	0.413	194	0.040	4	0.004
25	0.505	0.8855	0.448	190	0.034	5	0.004
30	0.539	**0.8855**	0.477	189	0.030	6	0.004
35	0.570	0.8940	0.509	195	0.032	7	0.004
40	0.597	0.9025	0.539	188	0.030	8	0.004
45	0.623	0.9111	0.567	187	0.028	9	0.004
50	0.646	0.9196	0.594	196	0.027	10	0.004
55	0.669	0.9281	0.621	186	0.026	11	0.004
60	0.690	**0.9367**	0.646	185	0.025	12	0.004
65	0.709	0.9379	0.665	197	0.019	13	0.004
70	0.728	0.9391	0.684	184	0.019	14	0.004
75	0.746	0.9403	0.702	183	0.018	15	0.004
80	0.764	0.9416	0.719	198	0.017	16	0.004
85	0.780	0.9428	0.736	182	0.017	17	0.004
90	0.796	0.9440	0.752	181	0.016	18	0.004
95	0.812	0.9452	0.767	199	0.016	19	0.004
100	0.827	0.9465	0.782	180	0.015	20	0.004
105	0.841	0.9477	0.797	179	0.015	21	0.004
110	0.855	0.9489	0.811	200	0.014	22	0.004
115	0.869	0.9501	0.825	178	0.014	23	0.004
120	0.882	0.9514	0.839	177	0.014	24	0.004
125	0.895	0.9526	0.852	201	0.013	25	0.004
130	0.907	0.9538	0.866	176	0.013	26	0.004
135	0.920	0.9550	0.878	175	0.013	27	0.004
140	0.932	0.9562	0.891	202	0.013	28	0.004
145	0.943	0.9575	0.903	174	0.012	29	0.004
150	0.955	0.9587	0.915	173	0.012	30	0.004
155	0.966	0.9599	0.927	203	0.012	31	0.004
160	0.977	0.9611	0.939	172	0.012	32	0.004
165	0.988	0.9624	0.950	171	0.012	33	0.004
170	0.998	0.9636	0.962	204	0.011	34	0.004
175	1.008	0.9648	0.973	170	0.011	35	0.004
180	1.019	**0.9660**	0.984	169	0.011	36	0.004
185	1.029	0.9663	0.994	205	0.010	37	0.004
190	1.038	0.9666	1.004	168	0.010	38	0.004
195	1.048	0.9669	1.013	167	0.010	39	0.004
200	1.057	0.9672	1.023	206	0.009	40	0.004
205	1.067	0.9675	1.032	166	0.009	41	0.004
210	1.076	0.9677	1.041	165	0.009	42	0.004
215	1.085	0.9680	1.050	207	0.009	43	0.004
220	1.094	0.9683	1.059	164	0.009	44	0.004
225	1.103	0.9686	1.068	163	0.009	45	0.004
230	1.111	0.9689	1.077	208	0.009	46	0.004
235	1.120	0.9692	1.085	162	0.009	47	0.004
240	1.128	0.9694	1.094	161	0.008	48	0.004
245	1.136	0.9697	1.102	209	0.008	49	0.004
250	1.145	0.9700	1.110	160	0.008	50	0.004
255	1.153	0.9703	1.118	159	0.008	51	0.004

2 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.161	0.9706	1.126	210	0.008	52	0.004
265	1.168	0.9709	1.134	158	0.008	53	0.004
270	1.176	0.9712	1.142	157	0.008	54	0.004
275	1.184	0.9714	1.150	211	0.008	55	0.004
280	1.192	0.9717	1.158	156	0.008	56	0.004
285	1.199	0.9720	1.165	155	0.008	57	0.004
290	1.206	0.9723	1.173	212	0.008	58	0.004
295	1.214	0.9726	1.181	154	0.007	59	0.004
300	1.221	0.9729	1.188	153	0.007	60	0.004
305	1.228	0.9731	1.195	213	0.007	61	0.005
310	1.235	0.9734	1.203	152	0.007	62	0.005
315	1.242	0.9737	1.210	151	0.007	63	0.005
320	1.249	0.9740	1.217	214	0.007	64	0.005
325	1.256	0.9743	1.224	150	0.007	65	0.005
330	1.263	0.9746	1.231	149	0.007	66	0.005
335	1.270	0.9748	1.238	215	0.007	67	0.005
340	1.277	0.9751	1.245	148	0.007	68	0.005
345	1.283	0.9754	1.252	147	0.007	69	0.005
350	1.290	0.9757	1.258	216	0.007	70	0.005
355	1.296	0.9760	1.265	146	0.007	71	0.005
360	**1.300**	**0.9763**	1.269	145	0.004	72	0.005
365	1.308	0.9763	1.277	217	0.008	73	0.005
370	1.316	0.9763	1.285	144	0.008	74	0.005
375	1.324	0.9764	1.292	143	0.008	75	0.005
380	1.331	0.9764	1.300	218	0.008	76	0.005
385	1.339	0.9764	1.308	142	0.008	77	0.005
390	1.347	0.9764	1.315	141	0.008	78	0.005
395	1.354	0.9765	1.323	219	0.007	79	0.005
400	1.362	0.9765	1.330	140	0.007	80	0.005
405	1.370	0.9765	1.337	139	0.007	81	0.005
410	1.377	0.9766	1.345	220	0.007	82	0.005
415	1.384	0.9766	1.352	138	0.007	83	0.005
420	1.392	0.9766	1.359	137	0.007	84	0.005
425	1.399	0.9767	1.366	221	0.007	85	0.005
430	1.406	0.9767	1.373	136	0.007	86	0.005
435	1.413	0.9767	1.381	135	0.007	87	0.005
440	1.421	0.9767	1.388	222	0.007	88	0.005
445	1.428	0.9768	1.395	134	0.007	89	0.005
450	1.435	0.9768	1.402	133	0.007	90	0.005
455	1.442	0.9768	1.408	223	0.007	91	0.005
460	1.449	0.9769	1.415	132	0.007	92	0.005
465	1.456	0.9769	1.422	131	0.007	93	0.005
470	1.463	0.9769	1.429	224	0.007	94	0.005
475	1.470	0.9770	1.436	130	0.007	95	0.005
480	1.476	0.9770	1.442	129	0.007	96	0.005
485	1.483	0.9770	1.449	225	0.007	97	0.005
490	1.490	0.9770	1.456	128	0.007	98	0.005
495	1.497	0.9771	1.462	127	0.007	99	0.005
500	1.503	0.9771	1.469	226	0.007	100	0.005
505	1.510	0.9771	1.475	126	0.007	101	0.005
510	1.517	0.9772	1.482	125	0.006	102	0.006
515	1.523	0.9772	1.488	227	0.006	103	0.006

2 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	1.530	0.9772	1.495	124	0.006	104	0.006
525	1.536	0.9773	1.501	123	0.006	105	0.006
530	1.543	0.9773	1.507	228	0.006	106	0.006
535	1.549	0.9773	1.514	122	0.006	107	0.006
540	1.555	0.9773	1.520	121	0.006	108	0.006
545	1.562	0.9774	1.526	229	0.006	109	0.006
550	1.568	0.9774	1.533	120	0.006	110	0.006
555	1.574	0.9774	1.539	119	0.006	111	0.006
560	1.581	0.9775	1.545	230	0.006	112	0.006
565	1.587	0.9775	1.551	118	0.006	113	0.006
570	1.593	0.9775	1.557	117	0.006	114	0.006
575	1.599	0.9776	1.563	231	0.006	115	0.006
580	1.605	0.9776	1.569	116	0.006	116	0.006
585	1.611	0.9776	1.575	115	0.006	117	0.006
590	1.617	0.9777	1.581	232	0.006	118	0.006
595	1.623	0.9777	1.587	114	0.006	119	0.006
600	1.630	0.9777	1.593	113	0.006	120	0.006
605	1.636	0.9777	1.599	233	0.006	121	0.006
610	1.641	0.9778	1.605	112	0.006	122	0.006
615	1.647	0.9778	1.611	111	0.006	123	0.006
620	1.653	0.9778	1.617	234	0.006	124	0.006
625	1.659	0.9779	1.622	110	0.006	125	0.006
630	1.665	0.9779	1.628	109	0.006	126	0.007
635	1.671	0.9779	1.634	235	0.006	127	0.007
640	1.677	0.9780	1.640	108	0.006	128	0.007
645	1.682	0.9780	1.645	107	0.006	129	0.007
650	1.688	0.9780	1.651	236	0.006	130	0.007
655	1.694	0.9780	1.657	106	0.006	131	0.007
660	1.700	0.9781	1.662	105	0.006	132	0.007
665	1.705	0.9781	1.668	237	0.006	133	0.007
670	1.711	0.9781	1.674	104	0.006	134	0.007
675	1.717	0.9782	1.679	103	0.006	135	0.007
680	1.722	0.9782	1.685	238	0.006	136	0.007
685	1.728	0.9782	1.690	102	0.006	137	0.007
690	1.733	0.9783	1.696	101	0.005	138	0.007
695	1.739	0.9783	1.701	239	0.005	139	0.007
700	1.744	0.9783	1.707	100	0.005	140	0.007
705	1.750	0.9783	1.712	99	0.005	141	0.008
710	1.755	0.9784	1.718	240	0.005	142	0.008
715	1.761	0.9784	1.723	98	0.005	143	0.008
720	1.766	0.9784	1.728	97	0.005	144	0.008
725	1.772	0.9785	1.734	241	0.005	145	0.004
730	1.777	0.9785	1.739	96	0.005	146	0.007
735	1.783	0.9785	1.744	95	0.005	147	0.007
740	1.788	0.9786	1.750	242	0.005	148	0.007
745	1.793	0.9786	1.755	94	0.005	149	0.007
750	1.799	0.9786	1.760	93	0.005	150	0.007
755	1.804	0.9787	1.765	243	0.005	151	0.007
760	1.809	0.9787	1.771	92	0.005	152	0.007
765	1.814	0.9787	1.776	91	0.005	153	0.007
770	1.820	0.9787	1.781	244	0.005	154	0.007
775	1.825	0.9788	1.786	90	0.005	155	0.008

2 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	1.830	0.9788	1.791	89	0.005	156	0.008
785	1.835	0.9788	1.796	245	0.005	157	0.008
790	1.840	0.9789	1.801	88	0.005	158	0.008
795	1.845	0.9789	1.807	87	0.005	159	0.008
800	1.851	0.9789	1.812	246	0.005	160	0.008
805	1.856	0.9790	1.817	86	0.005	161	0.008
810	1.861	0.9790	1.822	85	0.005	162	0.009
815	1.866	0.9790	1.827	247	0.005	163	0.009
820	1.871	0.9790	1.832	84	0.005	164	0.009
825	1.876	0.9791	1.837	83	0.005	165	0.009
830	1.881	0.9791	1.842	248	0.005	166	0.009
835	1.886	0.9791	1.847	82	0.005	167	0.010
840	1.891	0.9792	1.852	81	0.005	168	0.010
845	1.896	0.9792	1.857	249	0.005	169	0.011
850	1.901	0.9792	1.861	80	0.005	170	0.011
855	1.906	0.9793	1.866	79	0.005	171	0.012
860	1.911	0.9793	1.871	250	0.005	172	0.012
865	1.916	0.9793	1.876	78	0.005	173	0.012
870	1.921	0.9793	1.881	77	0.005	174	0.012
875	1.925	0.9794	1.886	251	0.005	175	0.013
880	1.930	0.9794	1.891	76	0.005	176	0.013
885	1.935	0.9794	1.895	75	0.005	177	0.014
890	1.940	0.9795	1.900	252	0.005	178	0.014
895	1.945	0.9795	1.905	74	0.005	179	0.015
900	1.950	0.9795	1.910	73	0.005	180	0.015
905	1.954	0.9796	1.914	253	0.005	181	0.016
910	1.959	0.9796	1.919	72	0.005	182	0.017
915	1.964	0.9796	1.924	71	0.005	183	0.018
920	1.969	0.9797	1.929	254	0.005	184	0.019
925	1.973	0.9797	1.933	70	0.005	185	0.025
930	1.978	0.9797	1.938	69	0.005	186	0.026
935	1.983	0.9797	1.943	255	0.005	187	0.028
940	1.987	0.9798	1.947	68	0.005	188	0.030
945	1.992	0.9798	1.952	67	0.005	189	0.030
950	1.997	0.9798	1.956	256	0.005	190	0.034
955	2.001	0.9799	1.961	66	0.005	191	0.050
960	2.006	0.9799	1.966	65	0.005	192	0.071
965	2.011	0.9799	1.970	257	0.005	193	0.253
970	2.015	0.9800	1.975	64	0.005	194	0.040
975	2.020	0.9800	1.979	63	0.005	195	0.032
980	2.024	0.9800	1.984	258	0.005	196	0.027
985	2.029	0.9800	1.988	62	0.005	197	0.019
990	2.033	0.9801	1.993	61	0.005	198	0.017
995	2.038	0.9801	1.997	259	0.005	199	0.016
1000	2.043	0.9801	2.002	60	0.004	200	0.014
1005	2.047	0.9802	2.006	59	0.004	201	0.013
1010	2.052	0.9802	2.011	260	0.004	202	0.013
1015	2.056	0.9802	2.015	58	0.004	203	0.012
1020	2.061	0.9803	2.020	57	0.004	204	0.011
1025	2.065	0.9803	2.024	261	0.004	205	0.010
1030	2.069	0.9803	2.029	56	0.004	206	0.009
1035	2.074	0.9803	2.033	55	0.004	207	0.009

2 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	2.078	0.9804	2.038	262	0.004	208	0.009
1045	2.083	0.9804	2.042	54	0.004	209	0.008
1050	2.087	0.9804	2.046	53	0.004	210	0.008
1055	2.091	0.9805	2.051	263	0.004	211	0.008
1060	2.096	0.9805	2.055	52	0.004	212	0.008
1065	2.100	0.9805	2.059	51	0.004	213	0.007
1070	2.105	0.9806	2.064	264	0.004	214	0.007
1075	2.109	0.9806	2.068	50	0.004	215	0.007
1080	2.113	0.9806	2.072	49	0.004	216	0.007
1085	2.118	0.9807	2.077	265	0.004	217	0.008
1090	2.122	0.9807	2.081	48	0.004	218	0.008
1095	2.126	0.9807	2.085	47	0.004	219	0.007
1100	2.130	0.9807	2.089	266	0.004	220	0.007
1105	2.135	0.9808	2.094	46	0.004	221	0.007
1110	2.139	0.9808	2.098	45	0.004	222	0.007
1115	2.143	0.9808	2.102	267	0.004	223	0.007
1120	2.148	0.9809	2.106	44	0.004	224	0.007
1125	2.152	0.9809	2.111	43	0.004	225	0.007
1130	2.156	0.9809	2.115	268	0.004	226	0.007
1135	2.160	0.9810	2.119	42	0.004	227	0.006
1140	2.164	0.9810	2.123	41	0.004	228	0.006
1145	2.169	0.9810	2.127	269	0.004	229	0.006
1150	2.173	0.9810	2.132	40	0.004	230	0.006
1155	2.177	0.9811	2.136	39	0.004	231	0.006
1160	2.181	0.9811	2.140	270	0.004	232	0.006
1165	2.185	0.9811	2.144	38	0.004	233	0.006
1170	2.189	0.9812	2.148	37	0.004	234	0.006
1175	2.194	0.9812	2.152	271	0.004	235	0.006
1180	2.198	0.9812	2.156	36	0.004	236	0.006
1185	2.202	0.9813	2.161	35	0.004	237	0.006
1190	2.206	0.9813	2.165	272	0.004	238	0.006
1195	2.210	0.9813	2.169	34	0.004	239	0.005
1200	2.214	0.9813	2.173	33	0.004	240	0.005
1205	2.218	0.9814	2.177	273	0.004	241	0.005
1210	2.222	0.9814	2.181	32	0.004	242	0.005
1215	2.226	0.9814	2.185	31	0.004	243	0.005
1220	2.230	0.9815	2.189	274	0.004	244	0.005
1225	2.234	0.9815	2.193	30	0.004	245	0.005
1230	2.238	0.9815	2.197	29	0.004	246	0.005
1235	2.242	0.9816	2.201	275	0.004	247	0.005
1240	2.246	0.9816	2.205	28	0.004	248	0.005
1245	2.250	0.9816	2.209	27	0.004	249	0.005
1250	2.254	0.9816	2.213	276	0.004	250	0.005
1255	2.258	0.9817	2.217	26	0.004	251	0.005
1260	2.262	0.9817	2.221	25	0.004	252	0.005
1265	2.266	0.9817	2.225	277	0.004	253	0.005
1270	2.270	0.9818	2.229	24	0.004	254	0.005
1275	2.274	0.9818	2.233	23	0.004	255	0.005
1280	2.278	0.9818	2.237	278	0.004	256	0.005
1285	2.282	0.9819	2.241	22	0.004	257	0.005
1290	2.286	0.9819	2.245	21	0.004	258	0.005
1295	2.290	0.9819	2.249	279	0.004	259	0.005

2 Year Nested Storm Distribution for Los Coches Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	2.294	0.9820	2.252	20	0.004	260	0.004
1305	2.298	0.9820	2.256	19	0.004	261	0.004
1310	2.302	0.9820	2.260	280	0.004	262	0.004
1315	2.306	0.9820	2.264	18	0.004	263	0.004
1320	2.309	0.9821	2.268	17	0.004	264	0.004
1325	2.313	0.9821	2.272	281	0.004	265	0.004
1330	2.317	0.9821	2.276	16	0.004	266	0.004
1335	2.321	0.9822	2.280	15	0.004	267	0.004
1340	2.325	0.9822	2.283	282	0.004	268	0.004
1345	2.329	0.9822	2.287	14	0.004	269	0.004
1350	2.332	0.9823	2.291	13	0.004	270	0.004
1355	2.336	0.9823	2.295	283	0.004	271	0.004
1360	2.340	0.9823	2.299	12	0.004	272	0.004
1365	2.344	0.9823	2.303	11	0.004	273	0.004
1370	2.348	0.9824	2.306	284	0.004	274	0.004
1375	2.351	0.9824	2.310	10	0.004	275	0.004
1380	2.355	0.9824	2.314	9	0.004	276	0.004
1385	2.359	0.9825	2.318	285	0.004	277	0.004
1390	2.363	0.9825	2.321	8	0.004	278	0.004
1395	2.367	0.9825	2.325	7	0.004	279	0.004
1400	2.370	0.9826	2.329	286	0.004	280	0.004
1405	2.374	0.9826	2.333	6	0.004	281	0.004
1410	2.378	0.9826	2.336	5	0.004	282	0.004
1415	2.381	0.9826	2.340	287	0.004	283	0.004
1420	2.385	0.9827	2.344	4	0.004	284	0.004
1425	2.389	0.9827	2.348	3	0.004	285	0.004
1430	2.393	0.9827	2.351	288	0.004	286	0.004
1435	2.396	0.9828	2.355	2	0.004	287	0.004
1440	2.400	**0.9828**	2.359	1	0.004	288	0.004

Notes for Nested Storm Distribution

Notes

1. Cumulative Rainfall Depths for durations between 0 and 6 hours are determined per Equations 4-25 and 4-26 of the 2003 SDCHM. Cumulative Rainfall Depths for durations between 6 and 24 hours are interpolated using log-log interpolation.

Eq 4-25: $I = 7.44\ p_6\ D^{-0.645}$ (0-6 hr durations)

Eq 4-26: $P = I\ (D/60)$ (0-6 hr durations)

Eq X-XX $P = C\ D^{M}$ (6-24 hr durations)

Where $C = p_{6adj}/360^{M}$

D = Time in minutes

$M = \ln(p_{6adj}/p_{24})/(\ln(360) - \ln(1440))$

2. Rainfall Depth-Area Adjustment Ratios are determined per linear interpolation between the values provided in Table 4-1 of the 2003 SDCHM.

3. Cumulative Adjusted Rainfall Depth is the Cumulative Rainfall Depth multiplied by the Rainfall Depth-Area Adjustment Ratio.

4. Ordinate Numbers provided by County of San Diego

5. Incremental Rainfall represents the difference in Cumulative Adjusted Rainfall Depths between consecutive rainfall ordinates.

6. Sorted Incremental Rainfall values are sorted by the Ordinate Numbers.

Nested Storm Distribution for Santa Maria Creek

Nested Storm Inputs for Santa Maria Creek

Variable	Units	100 yr	10 yr	5 yr	2 yr
T_p [1]	minutes	308.4	308.4	308.4	308.4
P_6 [2]	inches	3.5	2.4	2.0	1.6
P_{6adj} [3]	inches	3.5	2.4	2.0	1.6
P_{24} [4]	inches	6.0	4.0	3.5	2.5
Area [5]	mi^2	57.0	57.0	57.0	57.0
M [6]	-	0.388804	0.368483	0.403677	0.321928
C [7]	-	0.354951	0.274320	0.185827	0.240533

1. T_p as determined per Lag Time Calculations in Appendix C.5 of this report
2. P_6 as determined per Unadjusted Rainfall Depths in Appendix C.6 of this report
3. P_{6adj} represents the adjusted value of P_6 to be within 45-65% of the P_{24} value (if necessary)
4. P_{24} as determined per Unadjusted Rainfall Depths in Appendix C.6 of this report
5. Area represents the Basin area in square miles
6. $M = \ln(P_{6adj}/P_{24})/(\ln(360) - \ln(1440))$
7. $C = P_{6adj}/360^M$

Rainfall Depth-Area Adjustments for Santa Maria Creek

2003 San Diego County Hydrology Manual Table 4-1					
Watershed Area (mi^2)	**Rainfall Depth-Area Adjustment for Duration**				
	30 Minute	**1 Hour**	**3 Hour**	**6 Hour**	**24 Hour**
0	1.000	1.000	1.000	1.000	1.000
5	0.942	0.970	0.980	0.985	0.990
10	0.900	0.947	0.970	0.980	0.985
20	0.834	0.900	0.952	0.963	0.975
30	0.768	0.858	0.932	0.950	0.964
40	0.730	0.830	0.915	0.940	0.958
50	0.692	0.800	0.900	0.928	0.952
60	0.663	0.778	0.883	0.920	0.948
70	0.654	0.760	0.872	0.912	0.945
80	0.630	0.746	0.862	0.904	0.942
90	0.620	0.735	0.853	0.896	0.938
100	0.610	0.722	0.845	0.890	0.935
125	0.588	0.700	0.830	0.878	0.930
150	0.572	0.685	0.818	0.865	0.925
175	0.572	0.672	0.808	0.858	0.922
200	0.572	0.666	0.798	0.851	0.918
225	0.572	0.660	0.790	0.845	0.915
250	0.572	0.655	0.787	0.842	0.914
300	0.572	0.652	0.782	0.838	0.912
350	0.572	0.652	0.780	0.830	0.910
400	0.572	0.652	0.780	0.828	0.908

Rainfall Depth-Area Adjustments for Santa Maria Creek					
Watershed Area (mi^2)	**30 Minute**	**1 Hour**	**3 Hour**	**6 Hour**	**24 Hour**
50	0.692	0.8	0.9	0.928	0.952
57	**0.672**	**0.785**	**0.888**	**0.922**	**0.949**
60	0.663	0.778	0.883	0.92	0.948

1. Rainfall Depth-Area Adjustment factors associated with 30-minute, 1-hour, 3-hour, 6-hour, and 24-hour storms have been interoplated from the data on Table 4-1 of the 2003 SDCHM with respect to the basin area and the duration of the storm.

100 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.768	0.6717	0.516	193	0.516	1	0.008
10	0.983	0.6717	0.660	192	0.144	2	0.008
15	1.135	0.6717	0.762	191	0.102	3	0.008
20	1.257	0.6717	0.844	194	0.082	4	0.008
25	1.361	0.6717	0.914	190	0.070	5	0.009
30	1.452	**0.6717**	0.975	189	0.061	6	0.009
35	1.533	0.6905	1.059	195	0.084	7	0.009
40	1.608	0.7093	1.140	188	0.082	8	0.009
45	1.676	0.7282	1.221	187	0.080	9	0.009
50	1.740	0.7470	1.300	196	0.079	10	0.009
55	1.800	0.7658	1.379	186	0.079	11	0.009
60	1.857	**0.7846**	1.457	185	0.078	12	0.009
65	1.910	0.7889	1.507	197	0.050	13	0.009
70	1.961	0.7932	1.556	184	0.049	14	0.009
75	2.010	0.7975	1.603	183	0.047	15	0.009
80	2.056	0.8019	1.649	198	0.046	16	0.009
85	2.101	0.8062	1.694	182	0.045	17	0.009
90	2.144	0.8105	1.738	181	0.044	18	0.009
95	2.186	0.8148	1.781	199	0.043	19	0.009
100	2.226	0.8191	1.823	180	0.042	20	0.009
105	2.265	0.8234	1.865	179	0.042	21	0.009
110	2.302	0.8277	1.906	200	0.041	22	0.009
115	2.339	0.8320	1.946	178	0.040	23	0.009
120	2.375	0.8363	1.986	177	0.040	24	0.009
125	2.409	0.8407	2.025	201	0.039	25	0.009
130	2.443	0.8450	2.064	176	0.039	26	0.009
135	2.476	0.8493	2.103	175	0.039	27	0.009
140	2.508	0.8536	2.141	202	0.038	28	0.009
145	2.540	0.8579	2.179	174	0.038	29	0.009
150	2.570	0.8622	2.216	173	0.037	30	0.009
155	2.601	0.8665	2.253	203	0.037	31	0.009
160	2.630	0.8708	2.290	172	0.037	32	0.009
165	2.659	0.8752	2.327	171	0.037	33	0.009
170	2.687	0.8795	2.363	204	0.036	34	0.009
175	2.715	0.8838	2.399	170	0.036	35	0.009
180	2.742	**0.8881**	2.435	169	0.036	36	0.009
185	2.769	0.8891	2.462	205	0.026	37	0.009
190	2.795	0.8900	2.488	168	0.026	38	0.009
195	2.821	0.8910	2.514	167	0.026	39	0.009
200	2.847	0.8919	2.539	206	0.025	40	0.009
205	2.872	0.8929	2.564	166	0.025	41	0.009
210	2.897	0.8938	2.589	165	0.025	42	0.010
215	2.921	0.8948	2.613	207	0.024	43	0.010
220	2.945	0.8957	2.638	164	0.024	44	0.010
225	2.968	0.8967	2.662	163	0.024	45	0.010
230	2.992	0.8976	2.685	208	0.024	46	0.010
235	3.015	0.8986	2.709	162	0.023	47	0.010
240	3.037	0.8995	2.732	161	0.023	48	0.010
245	3.059	0.9005	2.755	209	0.023	49	0.010
250	3.081	0.9014	2.778	160	0.023	50	0.010
255	3.103	0.9024	2.800	159	0.023	51	0.010

100 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	3.125	0.9033	2.823	210	0.022	52	0.010
265	3.146	0.9043	2.845	158	0.022	53	0.010
270	3.167	0.9053	2.867	157	0.022	54	0.010
275	3.188	0.9062	2.889	211	0.022	55	0.010
280	3.208	0.9072	2.910	156	0.022	56	0.010
285	3.228	0.9081	2.932	155	0.021	57	0.010
290	3.248	0.9091	2.953	212	0.021	58	0.010
295	3.268	0.9100	2.974	154	0.021	59	0.010
300	3.288	0.9110	2.995	153	0.021	60	0.010
305	3.307	0.9119	3.016	213	0.021	61	0.010
310	3.326	0.9129	3.036	152	0.021	62	0.010
315	3.345	0.9138	3.057	151	0.020	63	0.010
320	3.364	0.9148	3.077	214	0.020	64	0.010
325	3.382	0.9157	3.097	150	0.020	65	0.010
330	3.401	0.9167	3.117	149	0.020	66	0.010
335	3.419	0.9176	3.137	215	0.020	67	0.010
340	3.437	0.9186	3.157	148	0.020	68	0.010
345	3.455	0.9195	3.177	147	0.020	69	0.011
350	3.472	0.9205	3.196	216	0.020	70	0.011
355	3.490	0.9214	3.216	146	0.019	71	0.011
360	**3.500**	**0.9224**	3.228	145	0.013	72	0.011
365	3.519	0.9225	3.246	217	0.018	73	0.011
370	3.537	0.9226	3.264	144	0.018	74	0.011
375	3.556	0.9228	3.281	143	0.018	75	0.011
380	3.574	0.9229	3.299	218	0.017	76	0.011
385	3.593	0.9230	3.316	142	0.017	77	0.011
390	3.611	0.9231	3.333	141	0.017	78	0.011
395	3.629	0.9233	3.350	219	0.017	79	0.011
400	3.646	0.9234	3.367	140	0.017	80	0.011
405	3.664	0.9235	3.384	139	0.017	81	0.011
410	3.682	0.9236	3.400	220	0.017	82	0.011
415	3.699	0.9238	3.417	138	0.017	83	0.011
420	3.716	0.9239	3.433	137	0.016	84	0.011
425	3.733	0.9240	3.450	221	0.016	85	0.011
430	3.750	0.9241	3.466	136	0.016	86	0.011
435	3.767	0.9243	3.482	135	0.016	87	0.011
440	3.784	0.9244	3.498	222	0.016	88	0.012
445	3.801	0.9245	3.514	134	0.016	89	0.012
450	3.817	0.9246	3.530	133	0.016	90	0.012
455	3.834	0.9248	3.545	223	0.016	91	0.012
460	3.850	0.9249	3.561	132	0.016	92	0.012
465	3.866	0.9250	3.576	131	0.015	93	0.012
470	3.882	0.9251	3.592	224	0.015	94	0.012
475	3.898	0.9253	3.607	130	0.015	95	0.012
480	3.914	0.9254	3.622	129	0.015	96	0.012
485	3.930	0.9255	3.637	225	0.015	97	0.012
490	3.946	0.9256	3.652	128	0.015	98	0.012
495	3.961	0.9258	3.667	127	0.015	99	0.012
500	3.977	0.9259	3.682	226	0.015	100	0.012
505	3.992	0.9260	3.697	126	0.015	101	0.012
510	4.008	0.9261	3.712	125	0.015	102	0.012
515	4.023	0.9262	3.726	227	0.015	103	0.013

100 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	4.038	0.9264	3.741	124	0.015	104	0.013
525	4.053	0.9265	3.755	123	0.014	105	0.013
530	4.068	0.9266	3.769	228	0.014	106	0.013
535	4.083	0.9267	3.784	122	0.014	107	0.013
540	4.098	0.9269	3.798	121	0.014	108	0.013
545	4.112	0.9270	3.812	229	0.014	109	0.013
550	4.127	0.9271	3.826	120	0.014	110	0.013
555	4.142	0.9272	3.840	119	0.014	111	0.013
560	4.156	0.9274	3.854	230	0.014	112	0.013
565	4.170	0.9275	3.868	118	0.014	113	0.013
570	4.185	0.9276	3.882	117	0.014	114	0.013
575	4.199	0.9277	3.895	231	0.014	115	0.014
580	4.213	0.9279	3.909	116	0.014	116	0.014
585	4.227	0.9280	3.923	115	0.014	117	0.014
590	4.241	0.9281	3.936	232	0.014	118	0.014
595	4.255	0.9282	3.950	114	0.013	119	0.014
600	4.269	0.9284	3.963	113	0.013	120	0.014
605	4.283	0.9285	3.976	233	0.013	121	0.014
610	4.296	0.9286	3.990	112	0.013	122	0.014
615	4.310	0.9287	4.003	111	0.013	123	0.014
620	4.324	0.9289	4.016	234	0.013	124	0.015
625	4.337	0.9290	4.029	110	0.013	125	0.015
630	4.351	0.9291	4.042	109	0.013	126	0.015
635	4.364	0.9292	4.055	235	0.013	127	0.015
640	4.377	0.9293	4.068	108	0.013	128	0.015
645	4.391	0.9295	4.081	107	0.013	129	0.015
650	4.404	0.9296	4.094	236	0.013	130	0.015
655	4.417	0.9297	4.107	106	0.013	131	0.015
660	4.430	0.9298	4.119	105	0.013	132	0.016
665	4.443	0.9300	4.132	237	0.013	133	0.016
670	4.456	0.9301	4.145	104	0.013	134	0.016
675	4.469	0.9302	4.157	103	0.013	135	0.016
680	4.482	0.9303	4.170	238	0.013	136	0.016
685	4.495	0.9305	4.182	102	0.012	137	0.016
690	4.507	0.9306	4.195	101	0.012	138	0.017
695	4.520	0.9307	4.207	239	0.012	139	0.017
700	4.533	0.9308	4.219	100	0.012	140	0.017
705	4.545	0.9310	4.231	99	0.012	141	0.017
710	4.558	0.9311	4.244	240	0.012	142	0.017
715	4.570	0.9312	4.256	98	0.012	143	0.018
720	4.583	0.9313	4.268	97	0.012	144	0.018
725	4.595	0.9315	4.280	241	0.012	145	0.013
730	4.607	0.9316	4.292	96	0.012	146	0.019
735	4.619	0.9317	4.304	95	0.012	147	0.020
740	4.632	0.9318	4.316	242	0.012	148	0.020
745	4.644	0.9320	4.328	94	0.012	149	0.020
750	4.656	0.9321	4.340	93	0.012	150	0.020
755	4.668	0.9322	4.351	243	0.012	151	0.020
760	4.680	0.9323	4.363	92	0.012	152	0.021
765	4.692	0.9325	4.375	91	0.012	153	0.021
770	4.704	0.9326	4.387	244	0.012	154	0.021
775	4.716	0.9327	4.398	90	0.012	155	0.021

100 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	4.727	0.9328	4.410	89	0.012	156	0.022
785	4.739	0.9329	4.421	245	0.012	157	0.022
790	4.751	0.9331	4.433	88	0.012	158	0.022
795	4.763	0.9332	4.444	87	0.011	159	0.023
800	4.774	0.9333	4.456	246	0.011	160	0.023
805	4.786	0.9334	4.467	86	0.011	161	0.023
810	4.797	0.9336	4.479	85	0.011	162	0.023
815	4.809	0.9337	4.490	247	0.011	163	0.024
820	4.820	0.9338	4.501	84	0.011	164	0.024
825	4.832	0.9339	4.512	83	0.011	165	0.025
830	4.843	0.9341	4.524	248	0.011	166	0.025
835	4.854	0.9342	4.535	82	0.011	167	0.026
840	4.866	0.9343	4.546	81	0.011	168	0.026
845	4.877	0.9344	4.557	249	0.011	169	0.036
850	4.888	0.9346	4.568	80	0.011	170	0.036
855	4.899	0.9347	4.579	79	0.011	171	0.037
860	4.910	0.9348	4.590	250	0.011	172	0.037
865	4.921	0.9349	4.601	78	0.011	173	0.037
870	4.932	0.9351	4.612	77	0.011	174	0.038
875	4.943	0.9352	4.623	251	0.011	175	0.039
880	4.954	0.9353	4.634	76	0.011	176	0.039
885	4.965	0.9354	4.645	75	0.011	177	0.040
890	4.976	0.9356	4.656	252	0.011	178	0.040
895	4.987	0.9357	4.666	74	0.011	179	0.042
900	4.998	0.9358	4.677	73	0.011	180	0.042
905	5.009	0.9359	4.688	253	0.011	181	0.044
910	5.019	0.9360	4.698	72	0.011	182	0.045
915	5.030	0.9362	4.709	71	0.011	183	0.047
920	5.041	0.9363	4.720	254	0.011	184	0.049
925	5.051	0.9364	4.730	70	0.011	185	0.078
930	5.062	0.9365	4.741	69	0.011	186	0.079
935	5.073	0.9367	4.751	255	0.011	187	0.080
940	5.083	0.9368	4.762	68	0.010	188	0.082
945	5.094	0.9369	4.772	67	0.010	189	0.061
950	5.104	0.9370	4.783	256	0.010	190	0.070
955	5.115	0.9372	4.793	66	0.010	191	0.102
960	5.125	0.9373	4.804	65	0.010	192	0.144
965	5.135	0.9374	4.814	257	0.010	193	0.516
970	5.146	0.9375	4.824	64	0.010	194	0.082
975	5.156	0.9377	4.834	63	0.010	195	0.084
980	5.166	0.9378	4.845	258	0.010	196	0.079
985	5.176	0.9379	4.855	62	0.010	197	0.050
990	5.187	0.9380	4.865	61	0.010	198	0.046
995	5.197	0.9382	4.875	259	0.010	199	0.043
1000	5.207	0.9383	4.886	60	0.010	200	0.041
1005	5.217	0.9384	4.896	59	0.010	201	0.039
1010	5.227	0.9385	4.906	260	0.010	202	0.038
1015	5.237	0.9387	4.916	58	0.010	203	0.037
1020	5.247	0.9388	4.926	57	0.010	204	0.036
1025	5.257	0.9389	4.936	261	0.010	205	0.026
1030	5.267	0.9390	4.946	56	0.010	206	0.025
1035	5.277	0.9392	4.956	55	0.010	207	0.024

100 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	5.287	0.9393	4.966	262	0.010	208	0.024
1045	5.297	0.9394	4.976	54	0.010	209	0.023
1050	5.307	0.9395	4.986	53	0.010	210	0.022
1055	5.316	0.9396	4.996	263	0.010	211	0.022
1060	5.326	0.9398	5.005	52	0.010	212	0.021
1065	5.336	0.9399	5.015	51	0.010	213	0.021
1070	5.346	0.9400	5.025	264	0.010	214	0.020
1075	5.355	0.9401	5.035	50	0.010	215	0.020
1080	5.365	0.9403	5.045	49	0.010	216	0.020
1085	5.375	0.9404	5.054	265	0.010	217	0.018
1090	5.384	0.9405	5.064	48	0.010	218	0.017
1095	5.394	0.9406	5.074	47	0.010	219	0.017
1100	5.403	0.9408	5.083	266	0.010	220	0.017
1105	5.413	0.9409	5.093	46	0.010	221	0.016
1110	5.423	0.9410	5.103	45	0.010	222	0.016
1115	5.432	0.9411	5.112	267	0.010	223	0.016
1120	5.441	0.9413	5.122	44	0.010	224	0.015
1125	5.451	0.9414	5.131	43	0.010	225	0.015
1130	5.460	0.9415	5.141	268	0.010	226	0.015
1135	5.470	0.9416	5.150	42	0.010	227	0.015
1140	5.479	0.9418	5.160	41	0.009	228	0.014
1145	5.488	0.9419	5.169	269	0.009	229	0.014
1150	5.498	0.9420	5.179	40	0.009	230	0.014
1155	5.507	0.9421	5.188	39	0.009	231	0.014
1160	5.516	0.9423	5.198	270	0.009	232	0.014
1165	5.525	0.9424	5.207	38	0.009	233	0.013
1170	5.535	0.9425	5.216	37	0.009	234	0.013
1175	5.544	0.9426	5.226	271	0.009	235	0.013
1180	5.553	0.9427	5.235	36	0.009	236	0.013
1185	5.562	0.9429	5.244	35	0.009	237	0.013
1190	5.571	0.9430	5.254	272	0.009	238	0.013
1195	5.580	0.9431	5.263	34	0.009	239	0.012
1200	5.589	0.9432	5.272	33	0.009	240	0.012
1205	5.598	0.9434	5.281	273	0.009	241	0.012
1210	5.607	0.9435	5.291	32	0.009	242	0.012
1215	5.616	0.9436	5.300	31	0.009	243	0.012
1220	5.625	0.9437	5.309	274	0.009	244	0.012
1225	5.634	0.9439	5.318	30	0.009	245	0.012
1230	5.643	0.9440	5.327	29	0.009	246	0.011
1235	5.652	0.9441	5.336	275	0.009	247	0.011
1240	5.661	0.9442	5.345	28	0.009	248	0.011
1245	5.670	0.9444	5.355	27	0.009	249	0.011
1250	5.679	0.9445	5.364	276	0.009	250	0.011
1255	5.688	0.9446	5.373	26	0.009	251	0.011
1260	5.696	0.9447	5.382	25	0.009	252	0.011
1265	5.705	0.9449	5.391	277	0.009	253	0.011
1270	5.714	0.9450	5.400	24	0.009	254	0.011
1275	5.723	0.9451	5.409	23	0.009	255	0.011
1280	5.731	0.9452	5.418	278	0.009	256	0.010
1285	5.740	0.9454	5.426	22	0.009	257	0.010
1290	5.749	0.9455	5.435	21	0.009	258	0.010
1295	5.757	0.9456	5.444	279	0.009	259	0.010

100 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	5.766	0.9457	5.453	20	0.009	260	0.010
1305	5.775	0.9459	5.462	19	0.009	261	0.010
1310	5.783	0.9460	5.471	280	0.009	262	0.010
1315	5.792	0.9461	5.480	18	0.009	263	0.010
1320	5.800	0.9462	5.488	17	0.009	264	0.010
1325	5.809	0.9463	5.497	281	0.009	265	0.010
1330	5.817	0.9465	5.506	16	0.009	266	0.010
1335	5.826	0.9466	5.515	15	0.009	267	0.010
1340	5.834	0.9467	5.524	282	0.009	268	0.010
1345	5.843	0.9468	5.532	14	0.009	269	0.009
1350	5.851	0.9470	5.541	13	0.009	270	0.009
1355	5.860	0.9471	5.550	283	0.009	271	0.009
1360	5.868	0.9472	5.558	12	0.009	272	0.009
1365	5.877	0.9473	5.567	11	0.009	273	0.009
1370	5.885	0.9475	5.576	284	0.009	274	0.009
1375	5.893	0.9476	5.584	10	0.009	275	0.009
1380	5.902	0.9477	5.593	9	0.009	276	0.009
1385	5.910	0.9478	5.602	285	0.009	277	0.009
1390	5.918	0.9480	5.610	8	0.009	278	0.009
1395	5.926	0.9481	5.619	7	0.009	279	0.009
1400	5.935	0.9482	5.627	286	0.009	280	0.009
1405	5.943	0.9483	5.636	6	0.009	281	0.009
1410	5.951	0.9485	5.644	5	0.009	282	0.009
1415	5.959	0.9486	5.653	287	0.009	283	0.009
1420	5.967	0.9487	5.661	4	0.008	284	0.009
1425	5.976	0.9488	5.670	3	0.008	285	0.009
1430	5.984	0.9490	5.678	288	0.008	286	0.009
1435	5.992	0.9491	5.687	2	0.008	287	0.009
1440	6.000	**0.9492**	5.695	1	0.008	288	0.008

10 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.527	0.6717	0.354	193	0.354	1	0.005
10	0.674	0.6717	0.453	192	0.099	2	0.005
15	0.778	0.6717	0.523	191	0.070	3	0.005
20	0.862	0.6717	0.579	194	0.056	4	0.005
25	0.933	0.6717	0.627	190	0.048	5	0.005
30	0.995	**0.6717**	0.669	189	0.042	6	0.005
35	1.051	0.6905	0.726	195	0.057	7	0.005
40	1.102	0.7093	0.782	188	0.056	8	0.005
45	1.150	0.7282	0.837	187	0.055	9	0.005
50	1.193	0.7470	0.891	196	0.054	10	0.005
55	1.234	0.7658	0.945	186	0.054	11	0.006
60	1.273	**0.7846**	0.999	185	0.054	12	0.006
65	1.310	0.7889	1.033	197	0.034	13	0.006
70	1.345	0.7932	1.067	184	0.033	14	0.006
75	1.378	0.7975	1.099	183	0.032	15	0.006
80	1.410	0.8019	1.131	198	0.032	16	0.006
85	1.441	0.8062	1.161	182	0.031	17	0.006
90	1.470	0.8105	1.192	181	0.030	18	0.006
95	1.499	0.8148	1.221	199	0.030	19	0.006
100	1.526	0.8191	1.250	180	0.029	20	0.006
105	1.553	0.8234	1.279	179	0.029	21	0.006
110	1.579	0.8277	1.307	200	0.028	22	0.006
115	1.604	0.8320	1.335	178	0.028	23	0.006
120	1.628	0.8363	1.362	177	0.027	24	0.006
125	1.652	0.8407	1.389	201	0.027	25	0.006
130	1.675	0.8450	1.416	176	0.027	26	0.006
135	1.698	0.8493	1.442	175	0.026	27	0.006
140	1.720	0.8536	1.468	202	0.026	28	0.006
145	1.741	0.8579	1.494	174	0.026	29	0.006
150	1.763	0.8622	1.520	173	0.026	30	0.006
155	1.783	0.8665	1.545	203	0.025	31	0.006
160	1.803	0.8708	1.571	172	0.025	32	0.006
165	1.823	0.8752	1.596	171	0.025	33	0.006
170	1.843	0.8795	1.621	204	0.025	34	0.006
175	1.862	0.8838	1.645	170	0.025	35	0.006
180	1.880	**0.8881**	1.670	169	0.025	36	0.006
185	1.899	0.8891	1.688	205	0.018	37	0.006
190	1.917	0.8900	1.706	168	0.018	38	0.006
195	1.935	0.8910	1.724	167	0.018	39	0.006
200	1.952	0.8919	1.741	206	0.017	40	0.006
205	1.969	0.8929	1.758	166	0.017	41	0.006
210	1.986	0.8938	1.775	165	0.017	42	0.006
215	2.003	0.8948	1.792	207	0.017	43	0.006
220	2.019	0.8957	1.809	164	0.017	44	0.006
225	2.035	0.8967	1.825	163	0.016	45	0.006
230	2.051	0.8976	1.841	208	0.016	46	0.006
235	2.067	0.8986	1.857	162	0.016	47	0.006
240	2.083	0.8995	1.873	161	0.016	48	0.006
245	2.098	0.9005	1.889	209	0.016	49	0.006
250	2.113	0.9014	1.905	160	0.016	50	0.006
255	2.128	0.9024	1.920	159	0.015	51	0.006

10 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	2.143	0.9033	1.936	210	0.015	52	0.006
265	2.157	0.9043	1.951	158	0.015	53	0.006
270	2.172	0.9053	1.966	157	0.015	54	0.006
275	2.186	0.9062	1.981	211	0.015	55	0.006
280	2.200	0.9072	1.996	156	0.015	56	0.006
285	2.214	0.9081	2.010	155	0.015	57	0.006
290	2.227	0.9091	2.025	212	0.015	58	0.006
295	2.241	0.9100	2.039	154	0.014	59	0.006
300	2.254	0.9110	2.054	153	0.014	60	0.006
305	2.268	0.9119	2.068	213	0.014	61	0.007
310	2.281	0.9129	2.082	152	0.014	62	0.007
315	2.294	0.9138	2.096	151	0.014	63	0.007
320	2.307	0.9148	2.110	214	0.014	64	0.007
325	2.319	0.9157	2.124	150	0.014	65	0.007
330	2.332	0.9167	2.138	149	0.014	66	0.007
335	2.344	0.9176	2.151	215	0.014	67	0.007
340	2.357	0.9186	2.165	148	0.014	68	0.007
345	2.369	0.9195	2.178	147	0.014	69	0.007
350	2.381	0.9205	2.192	216	0.013	70	0.007
355	2.393	0.9214	2.205	146	0.013	71	0.007
360	**2.400**	**0.9224**	2.214	145	0.009	72	0.007
365	2.412	0.9225	2.225	217	0.012	73	0.007
370	2.424	0.9226	2.237	144	0.011	74	0.007
375	2.436	0.9228	2.248	143	0.011	75	0.007
380	2.448	0.9229	2.260	218	0.011	76	0.007
385	2.460	0.9230	2.271	142	0.011	77	0.007
390	2.472	0.9231	2.282	141	0.011	78	0.007
395	2.483	0.9233	2.293	219	0.011	79	0.007
400	2.495	0.9234	2.304	140	0.011	80	0.007
405	2.506	0.9235	2.315	139	0.011	81	0.007
410	2.518	0.9236	2.326	220	0.011	82	0.007
415	2.529	0.9238	2.336	138	0.011	83	0.007
420	2.540	0.9239	2.347	137	0.011	84	0.007
425	2.551	0.9240	2.358	221	0.011	85	0.007
430	2.562	0.9241	2.368	136	0.011	86	0.007
435	2.573	0.9243	2.378	135	0.010	87	0.007
440	2.584	0.9244	2.389	222	0.010	88	0.007
445	2.595	0.9245	2.399	134	0.010	89	0.007
450	2.606	0.9246	2.409	133	0.010	90	0.007
455	2.616	0.9248	2.419	223	0.010	91	0.008
460	2.627	0.9249	2.430	132	0.010	92	0.008
465	2.637	0.9250	2.440	131	0.010	93	0.008
470	2.648	0.9251	2.450	224	0.010	94	0.008
475	2.658	0.9253	2.459	130	0.010	95	0.008
480	2.668	0.9254	2.469	129	0.010	96	0.008
485	2.679	0.9255	2.479	225	0.010	97	0.008
490	2.689	0.9256	2.489	128	0.010	98	0.008
495	2.699	0.9258	2.498	127	0.010	99	0.008
500	2.709	0.9259	2.508	226	0.010	100	0.008
505	2.719	0.9260	2.518	126	0.010	101	0.008
510	2.729	0.9261	2.527	125	0.009	102	0.008
515	2.738	0.9262	2.537	227	0.009	103	0.008

10 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	2.748	0.9264	2.546	124	0.009	104	0.008
525	2.758	0.9265	2.555	123	0.009	105	0.008
530	2.768	0.9266	2.565	228	0.009	106	0.008
535	2.777	0.9267	2.574	122	0.009	107	0.008
540	2.787	0.9269	2.583	121	0.009	108	0.008
545	2.796	0.9270	2.592	229	0.009	109	0.008
550	2.806	0.9271	2.601	120	0.009	110	0.008
555	2.815	0.9272	2.610	119	0.009	111	0.009
560	2.824	0.9274	2.619	230	0.009	112	0.009
565	2.834	0.9275	2.628	118	0.009	113	0.009
570	2.843	0.9276	2.637	117	0.009	114	0.009
575	2.852	0.9277	2.646	231	0.009	115	0.009
580	2.861	0.9279	2.655	116	0.009	116	0.009
585	2.870	0.9280	2.663	115	0.009	117	0.009
590	2.879	0.9281	2.672	232	0.009	118	0.009
595	2.888	0.9282	2.681	114	0.009	119	0.009
600	2.897	0.9284	2.690	113	0.009	120	0.009
605	2.906	0.9285	2.698	233	0.009	121	0.009
610	2.915	0.9286	2.707	112	0.009	122	0.009
615	2.924	0.9287	2.715	111	0.009	123	0.009
620	2.932	0.9289	2.724	234	0.008	124	0.009
625	2.941	0.9290	2.732	110	0.008	125	0.009
630	2.950	0.9291	2.740	109	0.008	126	0.010
635	2.958	0.9292	2.749	235	0.008	127	0.010
640	2.967	0.9293	2.757	108	0.008	128	0.010
645	2.975	0.9295	2.765	107	0.008	129	0.010
650	2.984	0.9296	2.774	236	0.008	130	0.010
655	2.992	0.9297	2.782	106	0.008	131	0.010
660	3.001	0.9298	2.790	105	0.008	132	0.010
665	3.009	0.9300	2.798	237	0.008	133	0.010
670	3.017	0.9301	2.806	104	0.008	134	0.010
675	3.026	0.9302	2.814	103	0.008	135	0.010
680	3.034	0.9303	2.822	238	0.008	136	0.011
685	3.042	0.9305	2.830	102	0.008	137	0.011
690	3.050	0.9306	2.838	101	0.008	138	0.011
695	3.058	0.9307	2.846	239	0.008	139	0.011
700	3.066	0.9308	2.854	100	0.008	140	0.011
705	3.074	0.9310	2.862	99	0.008	141	0.011
710	3.082	0.9311	2.870	240	0.008	142	0.011
715	3.090	0.9312	2.878	98	0.008	143	0.011
720	3.098	0.9313	2.886	97	0.008	144	0.011
725	3.106	0.9315	2.893	241	0.008	145	0.009
730	3.114	0.9316	2.901	96	0.008	146	0.013
735	3.122	0.9317	2.909	95	0.008	147	0.014
740	3.130	0.9318	2.916	242	0.008	148	0.014
745	3.138	0.9320	2.924	94	0.008	149	0.014
750	3.145	0.9321	2.932	93	0.008	150	0.014
755	3.153	0.9322	2.939	243	0.008	151	0.014
760	3.161	0.9323	2.947	92	0.008	152	0.014
765	3.168	0.9325	2.954	91	0.008	153	0.014
770	3.176	0.9326	2.962	244	0.007	154	0.014
775	3.184	0.9327	2.969	90	0.007	155	0.015

10 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	3.191	0.9328	2.977	89	0.007	156	0.015
785	3.199	0.9329	2.984	245	0.007	157	0.015
790	3.206	0.9331	2.992	88	0.007	158	0.015
795	3.214	0.9332	2.999	87	0.007	159	0.015
800	3.221	0.9333	3.006	246	0.007	160	0.016
805	3.228	0.9334	3.014	86	0.007	161	0.016
810	3.236	0.9336	3.021	85	0.007	162	0.016
815	3.243	0.9337	3.028	247	0.007	163	0.016
820	3.250	0.9338	3.035	84	0.007	164	0.017
825	3.258	0.9339	3.043	83	0.007	165	0.017
830	3.265	0.9341	3.050	248	0.007	166	0.017
835	3.272	0.9342	3.057	82	0.007	167	0.018
840	3.279	0.9343	3.064	81	0.007	168	0.018
845	3.287	0.9344	3.071	249	0.007	169	0.025
850	3.294	0.9346	3.078	80	0.007	170	0.025
855	3.301	0.9347	3.085	79	0.007	171	0.025
860	3.308	0.9348	3.092	250	0.007	172	0.025
865	3.315	0.9349	3.099	78	0.007	173	0.026
870	3.322	0.9351	3.106	77	0.007	174	0.026
875	3.329	0.9352	3.113	251	0.007	175	0.026
880	3.336	0.9353	3.120	76	0.007	176	0.027
885	3.343	0.9354	3.127	75	0.007	177	0.027
890	3.350	0.9356	3.134	252	0.007	178	0.028
895	3.357	0.9357	3.141	74	0.007	179	0.029
900	3.364	0.9358	3.148	73	0.007	180	0.029
905	3.371	0.9359	3.155	253	0.007	181	0.030
910	3.378	0.9360	3.162	72	0.007	182	0.031
915	3.384	0.9362	3.168	71	0.007	183	0.032
920	3.391	0.9363	3.175	254	0.007	184	0.033
925	3.398	0.9364	3.182	70	0.007	185	0.054
930	3.405	0.9365	3.189	69	0.007	186	0.054
935	3.412	0.9367	3.195	255	0.007	187	0.055
940	3.418	0.9368	3.202	68	0.007	188	0.056
945	3.425	0.9369	3.209	67	0.007	189	0.042
950	3.432	0.9370	3.216	256	0.007	190	0.048
955	3.438	0.9372	3.222	66	0.007	191	0.070
960	3.445	0.9373	3.229	65	0.007	192	0.099
965	3.451	0.9374	3.235	257	0.007	193	0.354
970	3.458	0.9375	3.242	64	0.007	194	0.056
975	3.465	0.9377	3.249	63	0.007	195	0.057
980	3.471	0.9378	3.255	258	0.007	196	0.054
985	3.478	0.9379	3.262	62	0.007	197	0.034
990	3.484	0.9380	3.268	61	0.007	198	0.032
995	3.491	0.9382	3.275	259	0.007	199	0.030
1000	3.497	0.9383	3.281	60	0.006	200	0.028
1005	3.504	0.9384	3.288	59	0.006	201	0.027
1010	3.510	0.9385	3.294	260	0.006	202	0.026
1015	3.516	0.9387	3.301	58	0.006	203	0.025
1020	3.523	0.9388	3.307	57	0.006	204	0.025
1025	3.529	0.9389	3.313	261	0.006	205	0.018
1030	3.535	0.9390	3.320	56	0.006	206	0.017
1035	3.542	0.9392	3.326	55	0.006	207	0.017

10 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	3.548	0.9393	3.333	262	0.006	208	0.016
1045	3.554	0.9394	3.339	54	0.006	209	0.016
1050	3.561	0.9395	3.345	53	0.006	210	0.015
1055	3.567	0.9396	3.351	263	0.006	211	0.015
1060	3.573	0.9398	3.358	52	0.006	212	0.015
1065	3.579	0.9399	3.364	51	0.006	213	0.014
1070	3.585	0.9400	3.370	264	0.006	214	0.014
1075	3.592	0.9401	3.377	50	0.006	215	0.014
1080	3.598	0.9403	3.383	49	0.006	216	0.013
1085	3.604	0.9404	3.389	265	0.006	217	0.012
1090	3.610	0.9405	3.395	48	0.006	218	0.011
1095	3.616	0.9406	3.401	47	0.006	219	0.011
1100	3.622	0.9408	3.408	266	0.006	220	0.011
1105	3.628	0.9409	3.414	46	0.006	221	0.011
1110	3.634	0.9410	3.420	45	0.006	222	0.010
1115	3.640	0.9411	3.426	267	0.006	223	0.010
1120	3.646	0.9413	3.432	44	0.006	224	0.010
1125	3.652	0.9414	3.438	43	0.006	225	0.010
1130	3.658	0.9415	3.444	268	0.006	226	0.010
1135	3.664	0.9416	3.450	42	0.006	227	0.009
1140	3.670	0.9418	3.456	41	0.006	228	0.009
1145	3.676	0.9419	3.462	269	0.006	229	0.009
1150	3.682	0.9420	3.468	40	0.006	230	0.009
1155	3.688	0.9421	3.474	39	0.006	231	0.009
1160	3.694	0.9423	3.480	270	0.006	232	0.009
1165	3.700	0.9424	3.486	38	0.006	233	0.009
1170	3.705	0.9425	3.492	37	0.006	234	0.008
1175	3.711	0.9426	3.498	271	0.006	235	0.008
1180	3.717	0.9427	3.504	36	0.006	236	0.008
1185	3.723	0.9429	3.510	35	0.006	237	0.008
1190	3.729	0.9430	3.516	272	0.006	238	0.008
1195	3.734	0.9431	3.522	34	0.006	239	0.008
1200	3.740	0.9432	3.528	33	0.006	240	0.008
1205	3.746	0.9434	3.534	273	0.006	241	0.008
1210	3.752	0.9435	3.540	32	0.006	242	0.008
1215	3.757	0.9436	3.545	31	0.006	243	0.008
1220	3.763	0.9437	3.551	274	0.006	244	0.007
1225	3.769	0.9439	3.557	30	0.006	245	0.007
1230	3.774	0.9440	3.563	29	0.006	246	0.007
1235	3.780	0.9441	3.569	275	0.006	247	0.007
1240	3.786	0.9442	3.574	28	0.006	248	0.007
1245	3.791	0.9444	3.580	27	0.006	249	0.007
1250	3.797	0.9445	3.586	276	0.006	250	0.007
1255	3.802	0.9446	3.592	26	0.006	251	0.007
1260	3.808	0.9447	3.597	25	0.006	252	0.007
1265	3.814	0.9449	3.603	277	0.006	253	0.007
1270	3.819	0.9450	3.609	24	0.006	254	0.007
1275	3.825	0.9451	3.615	23	0.006	255	0.007
1280	3.830	0.9452	3.620	278	0.006	256	0.007
1285	3.836	0.9454	3.626	22	0.006	257	0.007
1290	3.841	0.9455	3.632	21	0.006	258	0.007
1295	3.847	0.9456	3.637	279	0.006	259	0.007

10 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	3.852	0.9457	3.643	20	0.006	260	0.006
1305	3.858	0.9459	3.649	19	0.006	261	0.006
1310	3.863	0.9460	3.654	280	0.006	262	0.006
1315	3.868	0.9461	3.660	18	0.006	263	0.006
1320	3.874	0.9462	3.665	17	0.006	264	0.006
1325	3.879	0.9463	3.671	281	0.006	265	0.006
1330	3.885	0.9465	3.677	16	0.006	266	0.006
1335	3.890	0.9466	3.682	15	0.006	267	0.006
1340	3.895	0.9467	3.688	282	0.006	268	0.006
1345	3.901	0.9468	3.693	14	0.006	269	0.006
1350	3.906	0.9470	3.699	13	0.006	270	0.006
1355	3.911	0.9471	3.704	283	0.006	271	0.006
1360	3.917	0.9472	3.710	12	0.006	272	0.006
1365	3.922	0.9473	3.715	11	0.006	273	0.006
1370	3.927	0.9475	3.721	284	0.005	274	0.006
1375	3.932	0.9476	3.726	10	0.005	275	0.006
1380	3.938	0.9477	3.732	9	0.005	276	0.006
1385	3.943	0.9478	3.737	285	0.005	277	0.006
1390	3.948	0.9480	3.743	8	0.005	278	0.006
1395	3.953	0.9481	3.748	7	0.005	279	0.006
1400	3.959	0.9482	3.754	286	0.005	280	0.006
1405	3.964	0.9483	3.759	6	0.005	281	0.006
1410	3.969	0.9485	3.765	5	0.005	282	0.006
1415	3.974	0.9486	3.770	287	0.005	283	0.006
1420	3.979	0.9487	3.775	4	0.005	284	0.005
1425	3.985	0.9488	3.781	3	0.005	285	0.005
1430	3.990	0.9490	3.786	288	0.005	286	0.005
1435	3.995	0.9491	3.791	2	0.005	287	0.005
1440	4.000	**0.9492**	3.797	1	0.005	288	0.005

5 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.439	0.6717	0.295	193	0.295	1	0.005
10	0.562	0.6717	0.377	192	0.082	2	0.005
15	0.649	0.6717	0.436	191	0.058	3	0.005
20	0.718	0.6717	0.482	194	0.047	4	0.005
25	0.778	0.6717	0.522	190	0.040	5	0.005
30	0.830	**0.6717**	0.557	189	0.035	6	0.005
35	0.876	0.6905	0.605	195	0.048	7	0.005
40	0.919	0.7093	0.652	188	0.047	8	0.005
45	0.958	0.7282	0.698	187	0.046	9	0.005
50	0.994	0.7470	0.743	196	0.045	10	0.005
55	1.029	0.7658	0.788	186	0.045	11	0.005
60	1.061	**0.7846**	0.832	185	0.045	12	0.005
65	1.092	0.7889	0.861	197	0.029	13	0.005
70	1.121	0.7932	0.889	184	0.028	14	0.005
75	1.148	0.7975	0.916	183	0.027	15	0.005
80	1.175	0.8019	0.942	198	0.026	16	0.005
85	1.201	0.8062	0.968	182	0.026	17	0.005
90	1.225	0.8105	0.993	181	0.025	18	0.005
95	1.249	0.8148	1.018	199	0.025	19	0.005
100	1.272	0.8191	1.042	180	0.024	20	0.005
105	1.294	0.8234	1.066	179	0.024	21	0.005
110	1.316	0.8277	1.089	200	0.023	22	0.005
115	1.337	0.8320	1.112	178	0.023	23	0.005
120	1.357	0.8363	1.135	177	0.023	24	0.005
125	1.377	0.8407	1.157	201	0.023	25	0.005
130	1.396	0.8450	1.180	176	0.022	26	0.005
135	1.415	0.8493	1.202	175	0.022	27	0.005
140	1.433	0.8536	1.223	202	0.022	28	0.005
145	1.451	0.8579	1.245	174	0.022	29	0.006
150	1.469	0.8622	1.266	173	0.021	30	0.006
155	1.486	0.8665	1.288	203	0.021	31	0.006
160	1.503	0.8708	1.309	172	0.021	32	0.006
165	1.519	0.8752	1.330	171	0.021	33	0.006
170	1.536	0.8795	1.350	204	0.021	34	0.006
175	1.551	0.8838	1.371	170	0.021	35	0.006
180	1.567	**0.8881**	1.392	169	0.021	36	0.006
185	1.582	0.8891	1.407	205	0.015	37	0.006
190	1.597	0.8900	1.422	168	0.015	38	0.006
195	1.612	0.8910	1.436	167	0.015	39	0.006
200	1.627	0.8919	1.451	206	0.015	40	0.006
205	1.641	0.8929	1.465	166	0.014	41	0.006
210	1.655	0.8938	1.479	165	0.014	42	0.006
215	1.669	0.8948	1.493	207	0.014	43	0.006
220	1.683	0.8957	1.507	164	0.014	44	0.006
225	1.696	0.8967	1.521	163	0.014	45	0.006
230	1.709	0.8976	1.534	208	0.014	46	0.006
235	1.723	0.8986	1.548	162	0.013	47	0.006
240	1.736	0.8995	1.561	161	0.013	48	0.006
245	1.748	0.9005	1.574	209	0.013	49	0.006
250	1.761	0.9014	1.587	160	0.013	50	0.006
255	1.773	0.9024	1.600	159	0.013	51	0.006

5 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.786	0.9033	1.613	210	0.013	52	0.006
265	1.798	0.9043	1.626	158	0.013	53	0.006
270	1.810	0.9053	1.638	157	0.013	54	0.006
275	1.821	0.9062	1.651	211	0.012	55	0.006
280	1.833	0.9072	1.663	156	0.012	56	0.006
285	1.845	0.9081	1.675	155	0.012	57	0.006
290	1.856	0.9091	1.687	212	0.012	58	0.006
295	1.867	0.9100	1.699	154	0.012	59	0.006
300	1.879	0.9110	1.711	153	0.012	60	0.006
305	1.890	0.9119	1.723	213	0.012	61	0.006
310	1.901	0.9129	1.735	152	0.012	62	0.006
315	1.911	0.9138	1.747	151	0.012	63	0.006
320	1.922	0.9148	1.758	214	0.012	64	0.006
325	1.933	0.9157	1.770	150	0.012	65	0.006
330	1.943	0.9167	1.781	149	0.011	66	0.006
335	1.954	0.9176	1.793	215	0.011	67	0.006
340	1.964	0.9186	1.804	148	0.011	68	0.006
345	1.974	0.9195	1.815	147	0.011	69	0.006
350	1.984	0.9205	1.826	216	0.011	70	0.006
355	1.994	0.9214	1.838	146	0.011	71	0.006
360	**2.000**	**0.9224**	1.845	145	0.007	72	0.006
365	2.011	0.9225	1.855	217	0.011	73	0.006
370	2.022	0.9226	1.866	144	0.010	74	0.006
375	2.033	0.9228	1.876	143	0.010	75	0.007
380	2.044	0.9229	1.887	218	0.010	76	0.007
385	2.055	0.9230	1.897	142	0.010	77	0.007
390	2.066	0.9231	1.907	141	0.010	78	0.007
395	2.076	0.9233	1.917	219	0.010	79	0.007
400	2.087	0.9234	1.927	140	0.010	80	0.007
405	2.097	0.9235	1.937	139	0.010	81	0.007
410	2.108	0.9236	1.947	220	0.010	82	0.007
415	2.118	0.9238	1.957	138	0.010	83	0.007
420	2.128	0.9239	1.966	137	0.010	84	0.007
425	2.139	0.9240	1.976	221	0.010	85	0.007
430	2.149	0.9241	1.986	136	0.010	86	0.007
435	2.159	0.9243	1.995	135	0.010	87	0.007
440	2.169	0.9244	2.005	222	0.009	88	0.007
445	2.179	0.9245	2.014	134	0.009	89	0.007
450	2.189	0.9246	2.024	133	0.009	90	0.007
455	2.198	0.9248	2.033	223	0.009	91	0.007
460	2.208	0.9249	2.042	132	0.009	92	0.007
465	2.218	0.9250	2.051	131	0.009	93	0.007
470	2.227	0.9251	2.061	224	0.009	94	0.007
475	2.237	0.9253	2.070	130	0.009	95	0.007
480	2.246	0.9254	2.079	129	0.009	96	0.007
485	2.256	0.9255	2.088	225	0.009	97	0.007
490	2.265	0.9256	2.097	128	0.009	98	0.007
495	2.274	0.9258	2.105	127	0.009	99	0.007
500	2.284	0.9259	2.114	226	0.009	100	0.007
505	2.293	0.9260	2.123	126	0.009	101	0.007
510	2.302	0.9261	2.132	125	0.009	102	0.007
515	2.311	0.9262	2.141	227	0.009	103	0.008

5 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	2.320	0.9264	2.149	124	0.009	104	0.008
525	2.329	0.9265	2.158	123	0.009	105	0.008
530	2.338	0.9266	2.166	228	0.009	106	0.008
535	2.347	0.9267	2.175	122	0.009	107	0.008
540	2.356	0.9269	2.183	121	0.008	108	0.008
545	2.364	0.9270	2.192	229	0.008	109	0.008
550	2.373	0.9271	2.200	120	0.008	110	0.008
555	2.382	0.9272	2.209	119	0.008	111	0.008
560	2.391	0.9274	2.217	230	0.008	112	0.008
565	2.399	0.9275	2.225	118	0.008	113	0.008
570	2.408	0.9276	2.233	117	0.008	114	0.008
575	2.416	0.9277	2.242	231	0.008	115	0.008
580	2.425	0.9279	2.250	116	0.008	116	0.008
585	2.433	0.9280	2.258	115	0.008	117	0.008
590	2.441	0.9281	2.266	232	0.008	118	0.008
595	2.450	0.9282	2.274	114	0.008	119	0.008
600	2.458	0.9284	2.282	113	0.008	120	0.008
605	2.466	0.9285	2.290	233	0.008	121	0.008
610	2.474	0.9286	2.298	112	0.008	122	0.009
615	2.483	0.9287	2.306	111	0.008	123	0.009
620	2.491	0.9289	2.314	234	0.008	124	0.009
625	2.499	0.9290	2.321	110	0.008	125	0.009
630	2.507	0.9291	2.329	109	0.008	126	0.009
635	2.515	0.9292	2.337	235	0.008	127	0.009
640	2.523	0.9293	2.345	108	0.008	128	0.009
645	2.531	0.9295	2.352	107	0.008	129	0.009
650	2.539	0.9296	2.360	236	0.008	130	0.009
655	2.547	0.9297	2.368	106	0.008	131	0.009
660	2.554	0.9298	2.375	105	0.008	132	0.009
665	2.562	0.9300	2.383	237	0.008	133	0.009
670	2.570	0.9301	2.390	104	0.008	134	0.009
675	2.578	0.9302	2.398	103	0.008	135	0.010
680	2.585	0.9303	2.405	238	0.007	136	0.010
685	2.593	0.9305	2.413	102	0.007	137	0.010
690	2.601	0.9306	2.420	101	0.007	138	0.010
695	2.608	0.9307	2.428	239	0.007	139	0.010
700	2.616	0.9308	2.435	100	0.007	140	0.010
705	2.623	0.9310	2.442	99	0.007	141	0.010
710	2.631	0.9311	2.450	240	0.007	142	0.010
715	2.638	0.9312	2.457	98	0.007	143	0.010
720	2.646	0.9313	2.464	97	0.007	144	0.010
725	2.653	0.9315	2.471	241	0.007	145	0.007
730	2.661	0.9316	2.478	96	0.007	146	0.011
735	2.668	0.9317	2.486	95	0.007	147	0.011
740	2.675	0.9318	2.493	242	0.007	148	0.011
745	2.682	0.9320	2.500	94	0.007	149	0.011
750	2.690	0.9321	2.507	93	0.007	150	0.012
755	2.697	0.9322	2.514	243	0.007	151	0.012
760	2.704	0.9323	2.521	92	0.007	152	0.012
765	2.711	0.9325	2.528	91	0.007	153	0.012
770	2.718	0.9326	2.535	244	0.007	154	0.012
775	2.726	0.9327	2.542	90	0.007	155	0.012

5 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	2.733	0.9328	2.549	89	0.007	156	0.012
785	2.740	0.9329	2.556	245	0.007	157	0.013
790	2.747	0.9331	2.563	88	0.007	158	0.013
795	2.754	0.9332	2.570	87	0.007	159	0.013
800	2.761	0.9333	2.577	246	0.007	160	0.013
805	2.768	0.9334	2.583	86	0.007	161	0.013
810	2.775	0.9336	2.590	85	0.007	162	0.013
815	2.781	0.9337	2.597	247	0.007	163	0.014
820	2.788	0.9338	2.604	84	0.007	164	0.014
825	2.795	0.9339	2.611	83	0.007	165	0.014
830	2.802	0.9341	2.617	248	0.007	166	0.014
835	2.809	0.9342	2.624	82	0.007	167	0.015
840	2.816	0.9343	2.631	81	0.007	168	0.015
845	2.822	0.9344	2.637	249	0.007	169	0.021
850	2.829	0.9346	2.644	80	0.007	170	0.021
855	2.836	0.9347	2.651	79	0.007	171	0.021
860	2.842	0.9348	2.657	250	0.007	172	0.021
865	2.849	0.9349	2.664	78	0.007	173	0.021
870	2.856	0.9351	2.670	77	0.007	174	0.022
875	2.862	0.9352	2.677	251	0.007	175	0.022
880	2.869	0.9353	2.683	76	0.007	176	0.022
885	2.876	0.9354	2.690	75	0.007	177	0.023
890	2.882	0.9356	2.696	252	0.006	178	0.023
895	2.889	0.9357	2.703	74	0.006	179	0.024
900	2.895	0.9358	2.709	73	0.006	180	0.024
905	2.902	0.9359	2.716	253	0.006	181	0.025
910	2.908	0.9360	2.722	72	0.006	182	0.026
915	2.915	0.9362	2.728	71	0.006	183	0.027
920	2.921	0.9363	2.735	254	0.006	184	0.028
925	2.927	0.9364	2.741	70	0.006	185	0.045
930	2.934	0.9365	2.748	69	0.006	186	0.045
935	2.940	0.9367	2.754	255	0.006	187	0.046
940	2.946	0.9368	2.760	68	0.006	188	0.047
945	2.953	0.9369	2.766	67	0.006	189	0.035
950	2.959	0.9370	2.773	256	0.006	190	0.040
955	2.965	0.9372	2.779	66	0.006	191	0.058
960	2.972	0.9373	2.785	65	0.006	192	0.082
965	2.978	0.9374	2.791	257	0.006	193	0.295
970	2.984	0.9375	2.798	64	0.006	194	0.047
975	2.990	0.9377	2.804	63	0.006	195	0.048
980	2.996	0.9378	2.810	258	0.006	196	0.045
985	3.003	0.9379	2.816	62	0.006	197	0.029
990	3.009	0.9380	2.822	61	0.006	198	0.026
995	3.015	0.9382	2.828	259	0.006	199	0.025
1000	3.021	0.9383	2.834	60	0.006	200	0.023
1005	3.027	0.9384	2.841	59	0.006	201	0.023
1010	3.033	0.9385	2.847	260	0.006	202	0.022
1015	3.039	0.9387	2.853	58	0.006	203	0.021
1020	3.045	0.9388	2.859	57	0.006	204	0.021
1025	3.051	0.9389	2.865	261	0.006	205	0.015
1030	3.057	0.9390	2.871	56	0.006	206	0.015
1035	3.063	0.9392	2.877	55	0.006	207	0.014

5 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	3.069	0.9393	2.883	262	0.006	208	0.014
1045	3.075	0.9394	2.889	54	0.006	209	0.013
1050	3.081	0.9395	2.895	53	0.006	210	0.013
1055	3.087	0.9396	2.901	263	0.006	211	0.012
1060	3.093	0.9398	2.907	52	0.006	212	0.012
1065	3.099	0.9399	2.912	51	0.006	213	0.012
1070	3.105	0.9400	2.918	264	0.006	214	0.012
1075	3.110	0.9401	2.924	50	0.006	215	0.011
1080	3.116	0.9403	2.930	49	0.006	216	0.011
1085	3.122	0.9404	2.936	265	0.006	217	0.011
1090	3.128	0.9405	2.942	48	0.006	218	0.010
1095	3.134	0.9406	2.948	47	0.006	219	0.010
1100	3.139	0.9408	2.953	266	0.006	220	0.010
1105	3.145	0.9409	2.959	46	0.006	221	0.010
1110	3.151	0.9410	2.965	45	0.006	222	0.009
1115	3.157	0.9411	2.971	267	0.006	223	0.009
1120	3.162	0.9413	2.977	44	0.006	224	0.009
1125	3.168	0.9414	2.982	43	0.006	225	0.009
1130	3.174	0.9415	2.988	268	0.006	226	0.009
1135	3.179	0.9416	2.994	42	0.006	227	0.009
1140	3.185	0.9418	3.000	41	0.006	228	0.009
1145	3.191	0.9419	3.005	269	0.006	229	0.008
1150	3.196	0.9420	3.011	40	0.006	230	0.008
1155	3.202	0.9421	3.017	39	0.006	231	0.008
1160	3.207	0.9423	3.022	270	0.006	232	0.008
1165	3.213	0.9424	3.028	38	0.006	233	0.008
1170	3.219	0.9425	3.034	37	0.006	234	0.008
1175	3.224	0.9426	3.039	271	0.006	235	0.008
1180	3.230	0.9427	3.045	36	0.006	236	0.008
1185	3.235	0.9429	3.050	35	0.006	237	0.008
1190	3.241	0.9430	3.056	272	0.006	238	0.007
1195	3.246	0.9431	3.062	34	0.006	239	0.007
1200	3.252	0.9432	3.067	33	0.006	240	0.007
1205	3.257	0.9434	3.073	273	0.006	241	0.007
1210	3.263	0.9435	3.078	32	0.006	242	0.007
1215	3.268	0.9436	3.084	31	0.006	243	0.007
1220	3.273	0.9437	3.089	274	0.006	244	0.007
1225	3.279	0.9439	3.095	30	0.006	245	0.007
1230	3.284	0.9440	3.100	29	0.006	246	0.007
1235	3.290	0.9441	3.106	275	0.005	247	0.007
1240	3.295	0.9442	3.111	28	0.005	248	0.007
1245	3.300	0.9444	3.117	27	0.005	249	0.007
1250	3.306	0.9445	3.122	276	0.005	250	0.007
1255	3.311	0.9446	3.128	26	0.005	251	0.007
1260	3.316	0.9447	3.133	25	0.005	252	0.006
1265	3.322	0.9449	3.138	277	0.005	253	0.006
1270	3.327	0.9450	3.144	24	0.005	254	0.006
1275	3.332	0.9451	3.149	23	0.005	255	0.006
1280	3.337	0.9452	3.155	278	0.005	256	0.006
1285	3.343	0.9454	3.160	22	0.005	257	0.006
1290	3.348	0.9455	3.165	21	0.005	258	0.006
1295	3.353	0.9456	3.171	279	0.005	259	0.006

5 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	3.358	0.9457	3.176	20	0.005	260	0.006
1305	3.364	0.9459	3.182	19	0.005	261	0.006
1310	3.369	0.9460	3.187	280	0.005	262	0.006
1315	3.374	0.9461	3.192	18	0.005	263	0.006
1320	3.379	0.9462	3.197	17	0.005	264	0.006
1325	3.384	0.9463	3.203	281	0.005	265	0.006
1330	3.390	0.9465	3.208	16	0.005	266	0.006
1335	3.395	0.9466	3.213	15	0.005	267	0.006
1340	3.400	0.9467	3.219	282	0.005	268	0.006
1345	3.405	0.9468	3.224	14	0.005	269	0.006
1350	3.410	0.9470	3.229	13	0.005	270	0.006
1355	3.415	0.9471	3.234	283	0.005	271	0.006
1360	3.420	0.9472	3.240	12	0.005	272	0.006
1365	3.425	0.9473	3.245	11	0.005	273	0.006
1370	3.430	0.9475	3.250	284	0.005	274	0.006
1375	3.435	0.9476	3.255	10	0.005	275	0.005
1380	3.440	0.9477	3.260	9	0.005	276	0.005
1385	3.445	0.9478	3.266	285	0.005	277	0.005
1390	3.450	0.9480	3.271	8	0.005	278	0.005
1395	3.455	0.9481	3.276	7	0.005	279	0.005
1400	3.460	0.9482	3.281	286	0.005	280	0.005
1405	3.465	0.9483	3.286	6	0.005	281	0.005
1410	3.470	0.9485	3.292	5	0.005	282	0.005
1415	3.475	0.9486	3.297	287	0.005	283	0.005
1420	3.480	0.9487	3.302	4	0.005	284	0.005
1425	3.485	0.9488	3.307	3	0.005	285	0.005
1430	3.490	0.9490	3.312	288	0.005	286	0.005
1435	3.495	0.9491	3.317	2	0.005	287	0.005
1440	3.500	**0.9492**	3.322	1	0.005	288	0.005

2 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.351	0.6717	0.236	193	0.236	1	0.003
10	0.449	0.6717	0.302	192	0.066	2	0.003
15	0.519	0.6717	0.349	191	0.047	3	0.003
20	0.575	0.6717	0.386	194	0.037	4	0.003
25	0.622	0.6717	0.418	190	0.032	5	0.003
30	0.664	**0.6717**	0.446	189	0.028	6	0.003
35	0.701	0.6905	0.484	195	0.038	7	0.003
40	0.735	0.7093	0.521	188	0.037	8	0.003
45	0.766	0.7282	0.558	187	0.037	9	0.003
50	0.796	0.7470	0.594	196	0.036	10	0.003
55	0.823	0.7658	0.630	186	0.036	11	0.003
60	0.849	**0.7846**	0.666	185	0.036	12	0.003
65	0.873	0.7889	0.689	197	0.023	13	0.003
70	0.897	0.7932	0.711	184	0.022	14	0.003
75	0.919	0.7975	0.733	183	0.022	15	0.003
80	0.940	0.8019	0.754	198	0.021	16	0.003
85	0.960	0.8062	0.774	182	0.021	17	0.003
90	0.980	0.8105	0.794	181	0.020	18	0.003
95	0.999	0.8148	0.814	199	0.020	19	0.003
100	1.018	0.8191	0.833	180	0.019	20	0.003
105	1.035	0.8234	0.852	179	0.019	21	0.003
110	1.053	0.8277	0.871	200	0.019	22	0.003
115	1.069	0.8320	0.890	178	0.018	23	0.003
120	1.086	0.8363	0.908	177	0.018	24	0.003
125	1.101	0.8407	0.926	201	0.018	25	0.003
130	1.117	0.8450	0.944	176	0.018	26	0.003
135	1.132	0.8493	0.961	175	0.018	27	0.003
140	1.147	0.8536	0.979	202	0.017	28	0.003
145	1.161	0.8579	0.996	174	0.017	29	0.003
150	1.175	0.8622	1.013	173	0.017	30	0.003
155	1.189	0.8665	1.030	203	0.017	31	0.003
160	1.202	0.8708	1.047	172	0.017	32	0.003
165	1.215	0.8752	1.064	171	0.017	33	0.003
170	1.228	0.8795	1.080	204	0.017	34	0.003
175	1.241	0.8838	1.097	170	0.017	35	0.003
180	1.254	**0.8881**	1.113	169	0.016	36	0.003
185	1.266	0.8891	1.125	205	0.012	37	0.003
190	1.278	0.8900	1.137	168	0.012	38	0.003
195	1.290	0.8910	1.149	167	0.012	39	0.003
200	1.301	0.8919	1.161	206	0.012	40	0.003
205	1.313	0.8929	1.172	166	0.011	41	0.003
210	1.324	0.8938	1.184	165	0.011	42	0.003
215	1.335	0.8948	1.195	207	0.011	43	0.003
220	1.346	0.8957	1.206	164	0.011	44	0.003
225	1.357	0.8967	1.217	163	0.011	45	0.003
230	1.368	0.8976	1.228	208	0.011	46	0.003
235	1.378	0.8986	1.238	162	0.011	47	0.003
240	1.388	0.8995	1.249	161	0.011	48	0.003
245	1.399	0.9005	1.259	209	0.011	49	0.003
250	1.409	0.9014	1.270	160	0.010	50	0.003
255	1.419	0.9024	1.280	159	0.010	51	0.004

2 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.428	0.9033	1.290	210	0.010	52	0.004
265	1.438	0.9043	1.300	158	0.010	53	0.004
270	1.448	0.9053	1.311	157	0.010	54	0.004
275	1.457	0.9062	1.320	211	0.010	55	0.004
280	1.467	0.9072	1.330	156	0.010	56	0.004
285	1.476	0.9081	1.340	155	0.010	57	0.004
290	1.485	0.9091	1.350	212	0.010	58	0.004
295	1.494	0.9100	1.359	154	0.010	59	0.004
300	1.503	0.9110	1.369	153	0.010	60	0.004
305	1.512	0.9119	1.379	213	0.009	61	0.004
310	1.520	0.9129	1.388	152	0.009	62	0.004
315	1.529	0.9138	1.397	151	0.009	63	0.004
320	1.538	0.9148	1.407	214	0.009	64	0.004
325	1.546	0.9157	1.416	150	0.009	65	0.004
330	1.555	0.9167	1.425	149	0.009	66	0.004
335	1.563	0.9176	1.434	215	0.009	67	0.004
340	1.571	0.9186	1.443	148	0.009	68	0.004
345	1.579	0.9195	1.452	147	0.009	69	0.004
350	1.587	0.9205	1.461	216	0.009	70	0.004
355	1.595	0.9214	1.470	146	0.009	71	0.004
360	**1.600**	**0.9224**	1.476	145	0.006	72	0.004
365	1.607	0.9225	1.483	217	0.007	73	0.004
370	1.614	0.9226	1.489	144	0.007	74	0.004
375	1.621	0.9228	1.496	143	0.007	75	0.004
380	1.628	0.9229	1.503	218	0.007	76	0.004
385	1.635	0.9230	1.509	142	0.007	77	0.004
390	1.642	0.9231	1.516	141	0.006	78	0.004
395	1.649	0.9233	1.522	219	0.006	79	0.004
400	1.655	0.9234	1.528	140	0.006	80	0.004
405	1.662	0.9235	1.535	139	0.006	81	0.004
410	1.668	0.9236	1.541	220	0.006	82	0.004
415	1.675	0.9238	1.547	138	0.006	83	0.004
420	1.681	0.9239	1.553	137	0.006	84	0.004
425	1.688	0.9240	1.560	221	0.006	85	0.004
430	1.694	0.9241	1.566	136	0.006	86	0.004
435	1.701	0.9243	1.572	135	0.006	87	0.004
440	1.707	0.9244	1.578	222	0.006	88	0.004
445	1.713	0.9245	1.584	134	0.006	89	0.004
450	1.719	0.9246	1.590	133	0.006	90	0.004
455	1.725	0.9248	1.595	223	0.006	91	0.004
460	1.731	0.9249	1.601	132	0.006	92	0.004
465	1.737	0.9250	1.607	131	0.006	93	0.004
470	1.743	0.9251	1.613	224	0.006	94	0.004
475	1.749	0.9253	1.619	130	0.006	95	0.004
480	1.755	0.9254	1.624	129	0.006	96	0.004
485	1.761	0.9255	1.630	225	0.006	97	0.004
490	1.767	0.9256	1.636	128	0.006	98	0.004
495	1.773	0.9258	1.641	127	0.006	99	0.004
500	1.778	0.9259	1.647	226	0.006	100	0.004
505	1.784	0.9260	1.652	126	0.006	101	0.005
510	1.790	0.9261	1.658	125	0.005	102	0.005
515	1.795	0.9262	1.663	227	0.005	103	0.005

2 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	1.801	0.9264	1.668	124	0.005	104	0.005
525	1.807	0.9265	1.674	123	0.005	105	0.005
530	1.812	0.9266	1.679	228	0.005	106	0.005
535	1.818	0.9267	1.684	122	0.005	107	0.005
540	1.823	0.9269	1.690	121	0.005	108	0.005
545	1.829	0.9270	1.695	229	0.005	109	0.005
550	1.834	0.9271	1.700	120	0.005	110	0.005
555	1.839	0.9272	1.705	119	0.005	111	0.005
560	1.845	0.9274	1.711	230	0.005	112	0.005
565	1.850	0.9275	1.716	118	0.005	113	0.005
570	1.855	0.9276	1.721	117	0.005	114	0.005
575	1.860	0.9277	1.726	231	0.005	115	0.005
580	1.866	0.9279	1.731	116	0.005	116	0.005
585	1.871	0.9280	1.736	115	0.005	117	0.005
590	1.876	0.9281	1.741	232	0.005	118	0.005
595	1.881	0.9282	1.746	114	0.005	119	0.005
600	1.886	0.9284	1.751	113	0.005	120	0.005
605	1.891	0.9285	1.756	233	0.005	121	0.005
610	1.896	0.9286	1.761	112	0.005	122	0.005
615	1.901	0.9287	1.766	111	0.005	123	0.005
620	1.906	0.9289	1.770	234	0.005	124	0.005
625	1.911	0.9290	1.775	110	0.005	125	0.005
630	1.916	0.9291	1.780	109	0.005	126	0.006
635	1.921	0.9292	1.785	235	0.005	127	0.006
640	1.926	0.9293	1.790	108	0.005	128	0.006
645	1.930	0.9295	1.794	107	0.005	129	0.006
650	1.935	0.9296	1.799	236	0.005	130	0.006
655	1.940	0.9297	1.804	106	0.005	131	0.006
660	1.945	0.9298	1.808	105	0.005	132	0.006
665	1.949	0.9300	1.813	237	0.005	133	0.006
670	1.954	0.9301	1.818	104	0.005	134	0.006
675	1.959	0.9302	1.822	103	0.005	135	0.006
680	1.964	0.9303	1.827	238	0.005	136	0.006
685	1.968	0.9305	1.831	102	0.005	137	0.006
690	1.973	0.9306	1.836	101	0.005	138	0.006
695	1.977	0.9307	1.840	239	0.005	139	0.006
700	1.982	0.9308	1.845	100	0.004	140	0.006
705	1.986	0.9310	1.849	99	0.004	141	0.006
710	1.991	0.9311	1.854	240	0.004	142	0.007
715	1.996	0.9312	1.858	98	0.004	143	0.007
720	2.000	0.9313	1.863	97	0.004	144	0.007
725	2.004	0.9315	1.867	241	0.004	145	0.006
730	2.009	0.9316	1.871	96	0.004	146	0.009
735	2.013	0.9317	1.876	95	0.004	147	0.009
740	2.018	0.9318	1.880	242	0.004	148	0.009
745	2.022	0.9320	1.885	94	0.004	149	0.009
750	2.026	0.9321	1.889	93	0.004	150	0.009
755	2.031	0.9322	1.893	243	0.004	151	0.009
760	2.035	0.9323	1.897	92	0.004	152	0.009
765	2.039	0.9325	1.902	91	0.004	153	0.010
770	2.044	0.9326	1.906	244	0.004	154	0.010
775	2.048	0.9327	1.910	90	0.004	155	0.010

2 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	2.052	0.9328	1.914	89	0.004	156	0.010
785	2.056	0.9329	1.919	245	0.004	157	0.010
790	2.061	0.9331	1.923	88	0.004	158	0.010
795	2.065	0.9332	1.927	87	0.004	159	0.010
800	2.069	0.9333	1.931	246	0.004	160	0.010
805	2.073	0.9334	1.935	86	0.004	161	0.011
810	2.077	0.9336	1.939	85	0.004	162	0.011
815	2.081	0.9337	1.943	247	0.004	163	0.011
820	2.086	0.9338	1.947	84	0.004	164	0.011
825	2.090	0.9339	1.952	83	0.004	165	0.011
830	2.094	0.9341	1.956	248	0.004	166	0.011
835	2.098	0.9342	1.960	82	0.004	167	0.012
840	2.102	0.9343	1.964	81	0.004	168	0.012
845	2.106	0.9344	1.968	249	0.004	169	0.016
850	2.110	0.9346	1.972	80	0.004	170	0.017
855	2.114	0.9347	1.976	79	0.004	171	0.017
860	2.118	0.9348	1.980	250	0.004	172	0.017
865	2.122	0.9349	1.984	78	0.004	173	0.017
870	2.126	0.9351	1.988	77	0.004	174	0.017
875	2.130	0.9352	1.992	251	0.004	175	0.018
880	2.133	0.9353	1.995	76	0.004	176	0.018
885	2.137	0.9354	1.999	75	0.004	177	0.018
890	2.141	0.9356	2.003	252	0.004	178	0.018
895	2.145	0.9357	2.007	74	0.004	179	0.019
900	2.149	0.9358	2.011	73	0.004	180	0.019
905	2.153	0.9359	2.015	253	0.004	181	0.020
910	2.157	0.9360	2.019	72	0.004	182	0.021
915	2.160	0.9362	2.023	71	0.004	183	0.022
920	2.164	0.9363	2.026	254	0.004	184	0.022
925	2.168	0.9364	2.030	70	0.004	185	0.036
930	2.172	0.9365	2.034	69	0.004	186	0.036
935	2.176	0.9367	2.038	255	0.004	187	0.037
940	2.179	0.9368	2.042	68	0.004	188	0.037
945	2.183	0.9369	2.045	67	0.004	189	0.028
950	2.187	0.9370	2.049	256	0.004	190	0.032
955	2.190	0.9372	2.053	66	0.004	191	0.047
960	2.194	0.9373	2.056	65	0.004	192	0.066
965	2.198	0.9374	2.060	257	0.004	193	0.236
970	2.201	0.9375	2.064	64	0.004	194	0.037
975	2.205	0.9377	2.068	63	0.004	195	0.038
980	2.209	0.9378	2.071	258	0.004	196	0.036
985	2.212	0.9379	2.075	62	0.004	197	0.023
990	2.216	0.9380	2.079	61	0.004	198	0.021
995	2.220	0.9382	2.082	259	0.004	199	0.020
1000	2.223	0.9383	2.086	60	0.004	200	0.019
1005	2.227	0.9384	2.090	59	0.004	201	0.018
1010	2.230	0.9385	2.093	260	0.004	202	0.017
1015	2.234	0.9387	2.097	58	0.004	203	0.017
1020	2.237	0.9388	2.100	57	0.004	204	0.017
1025	2.241	0.9389	2.104	261	0.004	205	0.012
1030	2.244	0.9390	2.108	56	0.004	206	0.012
1035	2.248	0.9392	2.111	55	0.004	207	0.011

2 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	2.251	0.9393	2.115	262	0.004	208	0.011
1045	2.255	0.9394	2.118	54	0.004	209	0.011
1050	2.258	0.9395	2.122	53	0.004	210	0.010
1055	2.262	0.9396	2.125	263	0.004	211	0.010
1060	2.265	0.9398	2.129	52	0.004	212	0.010
1065	2.269	0.9399	2.132	51	0.004	213	0.009
1070	2.272	0.9400	2.136	264	0.003	214	0.009
1075	2.275	0.9401	2.139	50	0.003	215	0.009
1080	2.279	0.9403	2.143	49	0.003	216	0.009
1085	2.282	0.9404	2.146	265	0.003	217	0.007
1090	2.286	0.9405	2.150	48	0.003	218	0.007
1095	2.289	0.9406	2.153	47	0.003	219	0.006
1100	2.292	0.9408	2.157	266	0.003	220	0.006
1105	2.296	0.9409	2.160	46	0.003	221	0.006
1110	2.299	0.9410	2.163	45	0.003	222	0.006
1115	2.302	0.9411	2.167	267	0.003	223	0.006
1120	2.306	0.9413	2.170	44	0.003	224	0.006
1125	2.309	0.9414	2.174	43	0.003	225	0.006
1130	2.312	0.9415	2.177	268	0.003	226	0.006
1135	2.316	0.9416	2.180	42	0.003	227	0.005
1140	2.319	0.9418	2.184	41	0.003	228	0.005
1145	2.322	0.9419	2.187	269	0.003	229	0.005
1150	2.325	0.9420	2.191	40	0.003	230	0.005
1155	2.329	0.9421	2.194	39	0.003	231	0.005
1160	2.332	0.9423	2.197	270	0.003	232	0.005
1165	2.335	0.9424	2.201	38	0.003	233	0.005
1170	2.338	0.9425	2.204	37	0.003	234	0.005
1175	2.342	0.9426	2.207	271	0.003	235	0.005
1180	2.345	0.9427	2.211	36	0.003	236	0.005
1185	2.348	0.9429	2.214	35	0.003	237	0.005
1190	2.351	0.9430	2.217	272	0.003	238	0.005
1195	2.354	0.9431	2.220	34	0.003	239	0.005
1200	2.357	0.9432	2.224	33	0.003	240	0.004
1205	2.361	0.9434	2.227	273	0.003	241	0.004
1210	2.364	0.9435	2.230	32	0.003	242	0.004
1215	2.367	0.9436	2.233	31	0.003	243	0.004
1220	2.370	0.9437	2.237	274	0.003	244	0.004
1225	2.373	0.9439	2.240	30	0.003	245	0.004
1230	2.376	0.9440	2.243	29	0.003	246	0.004
1235	2.379	0.9441	2.246	275	0.003	247	0.004
1240	2.383	0.9442	2.250	28	0.003	248	0.004
1245	2.386	0.9444	2.253	27	0.003	249	0.004
1250	2.389	0.9445	2.256	276	0.003	250	0.004
1255	2.392	0.9446	2.259	26	0.003	251	0.004
1260	2.395	0.9447	2.262	25	0.003	252	0.004
1265	2.398	0.9449	2.266	277	0.003	253	0.004
1270	2.401	0.9450	2.269	24	0.003	254	0.004
1275	2.404	0.9451	2.272	23	0.003	255	0.004
1280	2.407	0.9452	2.275	278	0.003	256	0.004
1285	2.410	0.9454	2.278	22	0.003	257	0.004
1290	2.413	0.9455	2.281	21	0.003	258	0.004
1295	2.416	0.9456	2.285	279	0.003	259	0.004

2 Year Nested Storm Distribution for Santa Maria Creek

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	2.419	0.9457	2.288	20	0.003	260	0.004
1305	2.422	0.9459	2.291	19	0.003	261	0.004
1310	2.425	0.9460	2.294	280	0.003	262	0.004
1315	2.428	0.9461	2.297	18	0.003	263	0.004
1320	2.431	0.9462	2.300	17	0.003	264	0.003
1325	2.434	0.9463	2.303	281	0.003	265	0.003
1330	2.437	0.9465	2.306	16	0.003	266	0.003
1335	2.440	0.9466	2.310	15	0.003	267	0.003
1340	2.443	0.9467	2.313	282	0.003	268	0.003
1345	2.446	0.9468	2.316	14	0.003	269	0.003
1350	2.449	0.9470	2.319	13	0.003	270	0.003
1355	2.452	0.9471	2.322	283	0.003	271	0.003
1360	2.454	0.9472	2.325	12	0.003	272	0.003
1365	2.457	0.9473	2.328	11	0.003	273	0.003
1370	2.460	0.9475	2.331	284	0.003	274	0.003
1375	2.463	0.9476	2.334	10	0.003	275	0.003
1380	2.466	0.9477	2.337	9	0.003	276	0.003
1385	2.469	0.9478	2.340	285	0.003	277	0.003
1390	2.472	0.9480	2.343	8	0.003	278	0.003
1395	2.475	0.9481	2.346	7	0.003	279	0.003
1400	2.477	0.9482	2.349	286	0.003	280	0.003
1405	2.480	0.9483	2.352	6	0.003	281	0.003
1410	2.483	0.9485	2.355	5	0.003	282	0.003
1415	2.486	0.9486	2.358	287	0.003	283	0.003
1420	2.489	0.9487	2.361	4	0.003	284	0.003
1425	2.492	0.9488	2.364	3	0.003	285	0.003
1430	2.494	0.9490	2.367	288	0.003	286	0.003
1435	2.497	0.9491	2.370	2	0.003	287	0.003
1440	2.500	**0.9492**	2.373	1	0.003	288	0.003

Notes for Nested Storm Distribution

Notes

1. Cumulative Rainfall Depths for durations between 0 and 6 hours are determined per Equations 4-25 and 4-26 of the 2003 SDCHM. Cumulative Rainfall Depths for durations between 6 and 24 hours are interpolated using log-log interpolation.

Eq 4-25: $I = 7.44\ p_6\ D^{-0.645}$ (0-6 hr durations)

Eq 4-26: $P = I\ (D/60)$ (0-6 hr durations)

Eq X-XX $P = C\ D^{M}$ (6-24 hr durations)

Where $C = p_{6adj}/360^{M}$

D = Time in minutes

$M = \ln(p_{6adj}/p_{24})/(\ln(360) - \ln(1440))$

2. Rainfall Depth-Area Adjustment Ratios are determined per linear interpolation between the values provided in Table 4-1 of the 2003 SDCHM.

3. Cumulative Adjusted Rainfall Depth is the Cumulative Rainfall Depth multiplied by the Rainfall Depth-Area Adjustment Ratio.

4. Ordinate Numbers provided by County of San Diego

5. Incremental Rainfall represents the difference in Cumulative Adjusted Rainfall Depths between consecutive rainfall ordinates.

6. Sorted Incremental Rainfall values are sorted by the Ordinate Numbers.

Nested Storm Distribution for Sweetwater River

Nested Storm Inputs for Sweetwater River

Variable	Units	100 yr	10 yr	5 yr	2 yr
T_p [1]	minutes	193.0	193.0	193.0	193.0
P_6 [2]	inches	5.0	3.5	3.0	2.2
P_{6adj} [3]	inches	5.4	3.5	3.0	2.2
P_{24} [4]	inches	11.9	7.0	6.0	4.5
Area [5]	mi^2	44.5	44.5	44.5	44.5
M [6]	-	0.576002	0.500000	0.500000	0.516211
C [7]	-	0.180437	0.184466	0.158114	0.105398

1. T_p as determined per Lag Time Calculations in Appendix C.5 of this report
2. P_6 as determined per Unadjusted Rainfall Depths in Appendix C.6 of this report
3. P_{6adj} represents the adjusted value of P_6 to be within 45-65% of the P_{24} value (if necessary)
4. P_{24} as determined per Unadjusted Rainfall Depths in Appendix C.6 of this report
5. Area represents the Basin area in square miles
6. $M = \ln(P_{6adj}/P_{24})/(\ln(360) - \ln(1440))$
7. $C = P_{6adj}/360^M$

Rainfall Depth-Area Adjustments for Sweetwater River

2003 San Diego County Hydrology Manual Table 4-1					
Watershed Area (mi^2)	**Rainfall Depth-Area Adjustment for Duration**				
	30 Minute	**1 Hour**	**3 Hour**	**6 Hour**	**24 Hour**
0	1.000	1.000	1.000	1.000	1.000
5	0.942	0.970	0.980	0.985	0.990
10	0.900	0.947	0.970	0.980	0.985
20	0.834	0.900	0.952	0.963	0.975
30	0.768	0.858	0.932	0.950	0.964
40	0.730	0.830	0.915	0.940	0.958
50	0.692	0.800	0.900	0.928	0.952
60	0.663	0.778	0.883	0.920	0.948
70	0.654	0.760	0.872	0.912	0.945
80	0.630	0.746	0.862	0.904	0.942
90	0.620	0.735	0.853	0.896	0.938
100	0.610	0.722	0.845	0.890	0.935
125	0.588	0.700	0.830	0.878	0.930
150	0.572	0.685	0.818	0.865	0.925
175	0.572	0.672	0.808	0.858	0.922
200	0.572	0.666	0.798	0.851	0.918
225	0.572	0.660	0.790	0.845	0.915
250	0.572	0.655	0.787	0.842	0.914
300	0.572	0.652	0.782	0.838	0.912
350	0.572	0.652	0.780	0.830	0.910
400	0.572	0.652	0.780	0.828	0.908

Rainfall Depth-Area Adjustments for Sweetwater River					
Watershed Area (mi^2)	**30 Minute**	**1 Hour**	**3 Hour**	**6 Hour**	**24 Hour**
40	0.73	0.83	0.915	0.94	0.958
44.5	**0.713**	**0.817**	**0.908**	**0.935**	**0.955**
50	0.692	0.8	0.9	0.928	0.952

1. Rainfall Depth-Area Adjustment factors associated with 30-minute, 1-hour, 3-hour, 6-hour, and 24-hour storms have been interoplated from the data on Table 4-1 of the 2003 SDCHM with respect to the basin area and the duration of the storm.

100 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	1.176	0.7129	0.838	193	0.838	1	0.024
10	1.504	0.7129	1.072	192	0.234	2	0.024
15	1.737	0.7129	1.238	191	0.166	3	0.024
20	1.923	0.7129	1.371	194	0.133	4	0.024
25	2.082	0.7129	1.484	190	0.113	5	0.024
30	2.221	**0.7129**	1.583	189	0.099	6	0.024
35	2.346	0.7302	1.713	195	0.130	7	0.024
40	2.460	0.7474	1.839	188	0.126	8	0.024
45	2.565	0.7647	1.961	187	0.123	9	0.024
50	2.663	0.7820	2.082	196	0.121	10	0.024
55	2.754	0.7992	2.201	186	0.119	11	0.024
60	2.841	**0.8165**	2.319	185	0.118	12	0.024
65	2.923	0.8203	2.397	197	0.078	13	0.024
70	3.000	0.8241	2.473	184	0.075	14	0.024
75	3.075	0.8280	2.546	183	0.073	15	0.025
80	3.146	0.8318	2.617	198	0.071	16	0.025
85	3.215	0.8356	2.686	182	0.069	17	0.025
90	3.280	0.8394	2.754	181	0.068	18	0.025
95	3.344	0.8433	2.820	199	0.066	19	0.025
100	3.406	0.8471	2.885	180	0.065	20	0.025
105	3.465	0.8509	2.948	179	0.064	21	0.025
110	3.523	0.8547	3.011	200	0.063	22	0.025
115	3.579	0.8586	3.073	178	0.062	23	0.025
120	3.633	0.8624	3.133	177	0.061	24	0.025
125	3.686	0.8662	3.193	201	0.060	25	0.025
130	3.738	0.8700	3.252	176	0.059	26	0.025
135	3.788	0.8738	3.310	175	0.058	27	0.025
140	3.838	0.8777	3.368	202	0.058	28	0.025
145	3.886	0.8815	3.425	174	0.057	29	0.025
150	3.933	0.8853	3.482	173	0.057	30	0.025
155	3.979	0.8891	3.538	203	0.056	31	0.025
160	4.024	0.8930	3.593	172	0.055	32	0.025
165	4.068	0.8968	3.648	171	0.055	33	0.025
170	4.111	0.9006	3.703	204	0.055	34	0.026
175	4.154	0.9044	3.757	170	0.054	35	0.026
180	4.196	**0.9083**	3.811	169	0.054	36	0.026
185	4.237	0.9090	3.851	205	0.040	37	0.026
190	4.277	0.9097	3.891	168	0.040	38	0.026
195	4.317	0.9104	3.930	167	0.039	39	0.026
200	4.356	0.9112	3.969	206	0.039	40	0.026
205	4.394	0.9119	4.007	166	0.038	41	0.026
210	4.432	0.9126	4.045	165	0.038	42	0.026
215	4.469	0.9134	4.082	207	0.037	43	0.026
220	4.505	0.9141	4.118	164	0.037	44	0.026
225	4.542	0.9148	4.155	163	0.036	45	0.026
230	4.577	0.9156	4.191	208	0.036	46	0.026
235	4.612	0.9163	4.226	162	0.035	47	0.026
240	4.647	0.9170	4.261	161	0.035	48	0.026
245	4.681	0.9178	4.296	209	0.035	49	0.026
250	4.715	0.9185	4.330	160	0.034	50	0.027
255	4.748	0.9192	4.364	159	0.034	51	0.027

100 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	4.781	0.9200	4.398	210	0.034	52	0.027
265	4.813	0.9207	4.431	158	0.033	53	0.027
270	4.845	0.9214	4.465	157	0.033	54	0.027
275	4.877	0.9222	4.497	211	0.033	55	0.027
280	4.908	0.9229	4.530	156	0.032	56	0.027
285	4.939	0.9236	4.562	155	0.032	57	0.027
290	4.970	0.9244	4.594	212	0.032	58	0.027
295	5.000	0.9251	4.625	154	0.032	59	0.027
300	5.030	0.9258	4.657	153	0.031	60	0.027
305	5.060	0.9265	4.688	213	0.031	61	0.027
310	5.089	0.9273	4.719	152	0.031	62	0.027
315	5.118	0.9280	4.749	151	0.031	63	0.028
320	5.146	0.9287	4.780	214	0.030	64	0.028
325	5.175	0.9295	4.810	150	0.030	65	0.028
330	5.203	0.9302	4.840	149	0.030	66	0.028
335	5.231	0.9309	4.870	215	0.030	67	0.028
340	5.258	0.9317	4.899	148	0.030	68	0.028
345	5.286	0.9324	4.928	147	0.029	69	0.028
350	5.313	0.9331	4.958	216	0.029	70	0.028
355	5.340	0.9339	4.987	146	0.029	71	0.028
360	**5.355**	**0.9346**	5.005	145	0.018	72	0.028
365	5.398	0.9347	5.045	217	0.040	73	0.028
370	5.440	0.9348	5.085	144	0.040	74	0.028
375	5.482	0.9349	5.125	143	0.040	75	0.029
380	5.524	0.9350	5.165	218	0.040	76	0.029
385	5.566	0.9351	5.205	142	0.040	77	0.029
390	5.608	0.9352	5.244	141	0.039	78	0.029
395	5.649	0.9353	5.283	219	0.039	79	0.029
400	5.690	0.9354	5.322	140	0.039	80	0.029
405	5.731	0.9355	5.361	139	0.039	81	0.029
410	5.772	0.9356	5.400	220	0.039	82	0.029
415	5.812	0.9357	5.438	138	0.038	83	0.029
420	5.852	0.9358	5.476	137	0.038	84	0.029
425	5.892	0.9358	5.514	221	0.038	85	0.030
430	5.932	0.9359	5.552	136	0.038	86	0.030
435	5.972	0.9360	5.590	135	0.038	87	0.030
440	6.011	0.9361	5.627	222	0.037	88	0.030
445	6.050	0.9362	5.665	134	0.037	89	0.030
450	6.089	0.9363	5.702	133	0.037	90	0.030
455	6.128	0.9364	5.739	223	0.037	91	0.030
460	6.167	0.9365	5.776	132	0.037	92	0.030
465	6.206	0.9366	5.812	131	0.037	93	0.030
470	6.244	0.9367	5.849	224	0.037	94	0.030
475	6.282	0.9368	5.885	130	0.036	95	0.031
480	6.320	0.9369	5.921	129	0.036	96	0.031
485	6.358	0.9370	5.957	225	0.036	97	0.031
490	6.396	0.9371	5.993	128	0.036	98	0.031
495	6.433	0.9372	6.029	127	0.036	99	0.031
500	6.470	0.9373	6.065	226	0.036	100	0.031
505	6.508	0.9374	6.100	126	0.035	101	0.031
510	6.545	0.9375	6.135	125	0.035	102	0.031
515	6.582	0.9376	6.171	227	0.035	103	0.032

100 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	6.618	0.9377	6.206	124	0.035	104	0.032
525	6.655	0.9378	6.241	123	0.035	105	0.032
530	6.691	0.9379	6.276	228	0.035	106	0.032
535	6.728	0.9380	6.310	122	0.035	107	0.032
540	6.764	0.9380	6.345	121	0.035	108	0.032
545	6.800	0.9381	6.379	229	0.034	109	0.033
550	6.836	0.9382	6.413	120	0.034	110	0.033
555	6.871	0.9383	6.448	119	0.034	111	0.033
560	6.907	0.9384	6.482	230	0.034	112	0.033
565	6.942	0.9385	6.516	118	0.034	113	0.033
570	6.978	0.9386	6.549	117	0.034	114	0.033
575	7.013	0.9387	6.583	231	0.034	115	0.033
580	7.048	0.9388	6.617	116	0.034	116	0.034
585	7.083	0.9389	6.650	115	0.033	117	0.034
590	7.118	0.9390	6.684	232	0.033	118	0.034
595	7.152	0.9391	6.717	114	0.033	119	0.034
600	7.187	0.9392	6.750	113	0.033	120	0.034
605	7.221	0.9393	6.783	233	0.033	121	0.035
610	7.256	0.9394	6.816	112	0.033	122	0.035
615	7.290	0.9395	6.849	111	0.033	123	0.035
620	7.324	0.9396	6.881	234	0.033	124	0.035
625	7.358	0.9397	6.914	110	0.033	125	0.035
630	7.392	0.9398	6.947	109	0.033	126	0.035
635	7.426	0.9399	6.979	235	0.032	127	0.036
640	7.459	0.9400	7.011	108	0.032	128	0.036
645	7.493	0.9401	7.044	107	0.032	129	0.036
650	7.526	0.9402	7.076	236	0.032	130	0.036
655	7.559	0.9403	7.108	106	0.032	131	0.037
660	7.593	0.9403	7.140	105	0.032	132	0.037
665	7.626	0.9404	7.171	237	0.032	133	0.037
670	7.659	0.9405	7.203	104	0.032	134	0.037
675	7.691	0.9406	7.235	103	0.032	135	0.038
680	7.724	0.9407	7.266	238	0.032	136	0.038
685	7.757	0.9408	7.298	102	0.031	137	0.038
690	7.789	0.9409	7.329	101	0.031	138	0.038
695	7.822	0.9410	7.361	239	0.031	139	0.039
700	7.854	0.9411	7.392	100	0.031	140	0.039
705	7.887	0.9412	7.423	99	0.031	141	0.039
710	7.919	0.9413	7.454	240	0.031	142	0.040
715	7.951	0.9414	7.485	98	0.031	143	0.040
720	7.983	0.9415	7.516	97	0.031	144	0.040
725	8.015	0.9416	7.547	241	0.031	145	0.018
730	8.046	0.9417	7.577	96	0.031	146	0.029
735	8.078	0.9418	7.608	95	0.031	147	0.029
740	8.110	0.9419	7.638	242	0.031	148	0.030
745	8.141	0.9420	7.669	94	0.030	149	0.030
750	8.173	0.9421	7.699	93	0.030	150	0.030
755	8.204	0.9422	7.730	243	0.030	151	0.031
760	8.235	0.9423	7.760	92	0.030	152	0.031
765	8.266	0.9424	7.790	91	0.030	153	0.031
770	8.298	0.9425	7.820	244	0.030	154	0.032
775	8.329	0.9426	7.850	90	0.030	155	0.032

100 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	8.359	0.9426	7.880	89	0.030	156	0.032
785	8.390	0.9427	7.910	245	0.030	157	0.033
790	8.421	0.9428	7.940	88	0.030	158	0.033
795	8.452	0.9429	7.969	87	0.030	159	0.034
800	8.482	0.9430	7.999	246	0.030	160	0.034
805	8.513	0.9431	8.029	86	0.030	161	0.035
810	8.543	0.9432	8.058	85	0.030	162	0.035
815	8.573	0.9433	8.088	247	0.029	163	0.036
820	8.604	0.9434	8.117	84	0.029	164	0.037
825	8.634	0.9435	8.146	83	0.029	165	0.038
830	8.664	0.9436	8.175	248	0.029	166	0.038
835	8.694	0.9437	8.205	82	0.029	167	0.039
840	8.724	0.9438	8.234	81	0.029	168	0.040
845	8.754	0.9439	8.263	249	0.029	169	0.054
850	8.784	0.9440	8.292	80	0.029	170	0.054
855	8.813	0.9441	8.321	79	0.029	171	0.055
860	8.843	0.9442	8.349	250	0.029	172	0.055
865	8.873	0.9443	8.378	78	0.029	173	0.057
870	8.902	0.9444	8.407	77	0.029	174	0.057
875	8.932	0.9445	8.436	251	0.029	175	0.058
880	8.961	0.9446	8.464	76	0.029	176	0.059
885	8.990	0.9447	8.493	75	0.029	177	0.061
890	9.019	0.9448	8.521	252	0.028	178	0.062
895	9.049	0.9449	8.550	74	0.028	179	0.064
900	9.078	0.9449	8.578	73	0.028	180	0.065
905	9.107	0.9450	8.606	253	0.028	181	0.068
910	9.136	0.9451	8.634	72	0.028	182	0.069
915	9.164	0.9452	8.663	71	0.028	183	0.073
920	9.193	0.9453	8.691	254	0.028	184	0.075
925	9.222	0.9454	8.719	70	0.028	185	0.118
930	9.251	0.9455	8.747	69	0.028	186	0.119
935	9.279	0.9456	8.775	255	0.028	187	0.123
940	9.308	0.9457	8.803	68	0.028	188	0.126
945	9.336	0.9458	8.830	67	0.028	189	0.099
950	9.365	0.9459	8.858	256	0.028	190	0.113
955	9.393	0.9460	8.886	66	0.028	191	0.166
960	9.421	0.9461	8.914	65	0.028	192	0.234
965	9.450	0.9462	8.941	257	0.028	193	0.838
970	9.478	0.9463	8.969	64	0.028	194	0.133
975	9.506	0.9464	8.996	63	0.028	195	0.130
980	9.534	0.9465	9.024	258	0.027	196	0.121
985	9.562	0.9466	9.051	62	0.027	197	0.078
990	9.590	0.9467	9.079	61	0.027	198	0.071
995	9.618	0.9468	9.106	259	0.027	199	0.066
1000	9.646	0.9469	9.133	60	0.027	200	0.063
1005	9.673	0.9470	9.160	59	0.027	201	0.060
1010	9.701	0.9471	9.187	260	0.027	202	0.058
1015	9.729	0.9472	9.215	58	0.027	203	0.056
1020	9.756	0.9472	9.242	57	0.027	204	0.055
1025	9.784	0.9473	9.269	261	0.027	205	0.040
1030	9.811	0.9474	9.296	56	0.027	206	0.039
1035	9.839	0.9475	9.322	55	0.027	207	0.037

100 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	9.866	0.9476	9.349	262	0.027	208	0.036
1045	9.893	0.9477	9.376	54	0.027	209	0.035
1050	9.921	0.9478	9.403	53	0.027	210	0.034
1055	9.948	0.9479	9.430	263	0.027	211	0.033
1060	9.975	0.9480	9.456	52	0.027	212	0.032
1065	10.002	0.9481	9.483	51	0.027	213	0.031
1070	10.029	0.9482	9.510	264	0.027	214	0.030
1075	10.056	0.9483	9.536	50	0.027	215	0.030
1080	10.083	0.9484	9.563	49	0.026	216	0.029
1085	10.110	0.9485	9.589	265	0.026	217	0.040
1090	10.136	0.9486	9.615	48	0.026	218	0.040
1095	10.163	0.9487	9.642	47	0.026	219	0.039
1100	10.190	0.9488	9.668	266	0.026	220	0.039
1105	10.217	0.9489	9.694	46	0.026	221	0.038
1110	10.243	0.9490	9.721	45	0.026	222	0.037
1115	10.270	0.9491	9.747	267	0.026	223	0.037
1120	10.296	0.9492	9.773	44	0.026	224	0.037
1125	10.323	0.9493	9.799	43	0.026	225	0.036
1130	10.349	0.9494	9.825	268	0.026	226	0.036
1135	10.375	0.9495	9.851	42	0.026	227	0.035
1140	10.402	0.9495	9.877	41	0.026	228	0.035
1145	10.428	0.9496	9.903	269	0.026	229	0.034
1150	10.454	0.9497	9.929	40	0.026	230	0.034
1155	10.480	0.9498	9.955	39	0.026	231	0.034
1160	10.506	0.9499	9.980	270	0.026	232	0.033
1165	10.533	0.9500	10.006	38	0.026	233	0.033
1170	10.559	0.9501	10.032	37	0.026	234	0.033
1175	10.585	0.9502	10.058	271	0.026	235	0.032
1180	10.610	0.9503	10.083	36	0.026	236	0.032
1185	10.636	0.9504	10.109	35	0.026	237	0.032
1190	10.662	0.9505	10.134	272	0.026	238	0.032
1195	10.688	0.9506	10.160	34	0.026	239	0.031
1200	10.714	0.9507	10.185	33	0.025	240	0.031
1205	10.739	0.9508	10.211	273	0.025	241	0.031
1210	10.765	0.9509	10.236	32	0.025	242	0.031
1215	10.791	0.9510	10.262	31	0.025	243	0.030
1220	10.816	0.9511	10.287	274	0.025	244	0.030
1225	10.842	0.9512	10.312	30	0.025	245	0.030
1230	10.867	0.9513	10.338	29	0.025	246	0.030
1235	10.893	0.9514	10.363	275	0.025	247	0.029
1240	10.918	0.9515	10.388	28	0.025	248	0.029
1245	10.943	0.9516	10.413	27	0.025	249	0.029
1250	10.969	0.9517	10.438	276	0.025	250	0.029
1255	10.994	0.9518	10.463	26	0.025	251	0.029
1260	11.019	0.9518	10.488	25	0.025	252	0.028
1265	11.044	0.9519	10.513	277	0.025	253	0.028
1270	11.069	0.9520	10.538	24	0.025	254	0.028
1275	11.094	0.9521	10.563	23	0.025	255	0.028
1280	11.119	0.9522	10.588	278	0.025	256	0.028
1285	11.144	0.9523	10.613	22	0.025	257	0.028
1290	11.169	0.9524	10.638	21	0.025	258	0.027
1295	11.194	0.9525	10.663	279	0.025	259	0.027

100 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	11.219	0.9526	10.688	20	0.025	260	0.027
1305	11.244	0.9527	10.712	19	0.025	261	0.027
1310	11.269	0.9528	10.737	280	0.025	262	0.027
1315	11.294	0.9529	10.762	18	0.025	263	0.027
1320	11.318	0.9530	10.786	17	0.025	264	0.027
1325	11.343	0.9531	10.811	281	0.025	265	0.026
1330	11.368	0.9532	10.835	16	0.025	266	0.026
1335	11.392	0.9533	10.860	15	0.025	267	0.026
1340	11.417	0.9534	10.885	282	0.025	268	0.026
1345	11.441	0.9535	10.909	14	0.024	269	0.026
1350	11.466	0.9536	10.933	13	0.024	270	0.026
1355	11.490	0.9537	10.958	283	0.024	271	0.026
1360	11.515	0.9538	10.982	12	0.024	272	0.026
1365	11.539	0.9539	11.007	11	0.024	273	0.025
1370	11.563	0.9540	11.031	284	0.024	274	0.025
1375	11.588	0.9541	11.055	10	0.024	275	0.025
1380	11.612	0.9541	11.079	9	0.024	276	0.025
1385	11.636	0.9542	11.104	285	0.024	277	0.025
1390	11.660	0.9543	11.128	8	0.024	278	0.025
1395	11.684	0.9544	11.152	7	0.024	279	0.025
1400	11.708	0.9545	11.176	286	0.024	280	0.025
1405	11.733	0.9546	11.200	6	0.024	281	0.025
1410	11.757	0.9547	11.224	5	0.024	282	0.025
1415	11.781	0.9548	11.248	287	0.024	283	0.024
1420	11.805	0.9549	11.272	4	0.024	284	0.024
1425	11.828	0.9550	11.296	3	0.024	285	0.024
1430	11.852	0.9551	11.320	288	0.024	286	0.024
1435	11.876	0.9552	11.344	2	0.024	287	0.024
1440	11.900	**0.9553**	11.368	1	0.024	288	0.024

10 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.768	0.7129	0.548	193	0.548	1	0.012
10	0.983	0.7129	0.701	192	0.153	2	0.012
15	1.135	0.7129	0.809	191	0.108	3	0.012
20	1.257	0.7129	0.896	194	0.087	4	0.012
25	1.361	0.7129	0.970	190	0.074	5	0.012
30	1.452	**0.7129**	1.035	189	0.065	6	0.012
35	1.533	0.7302	1.120	195	0.085	7	0.012
40	1.608	0.7474	1.202	188	0.082	8	0.012
45	1.676	0.7647	1.282	187	0.080	9	0.013
50	1.740	0.7820	1.361	196	0.079	10	0.013
55	1.800	0.7992	1.439	186	0.078	11	0.013
60	1.857	**0.8165**	1.516	185	0.077	12	0.013
65	1.910	0.8203	1.567	197	0.051	13	0.013
70	1.961	0.8241	1.616	184	0.049	14	0.013
75	2.010	0.8280	1.664	183	0.048	15	0.013
80	2.056	0.8318	1.710	198	0.046	16	0.013
85	2.101	0.8356	1.756	182	0.045	17	0.013
90	2.144	0.8394	1.800	181	0.044	18	0.013
95	2.186	0.8433	1.843	199	0.043	19	0.013
100	2.226	0.8471	1.885	180	0.042	20	0.013
105	2.265	0.8509	1.927	179	0.042	21	0.013
110	2.302	0.8547	1.968	200	0.041	22	0.013
115	2.339	0.8586	2.008	178	0.040	23	0.013
120	2.375	0.8624	2.048	177	0.040	24	0.013
125	2.409	0.8662	2.087	201	0.039	25	0.013
130	2.443	0.8700	2.126	176	0.039	26	0.013
135	2.476	0.8738	2.164	175	0.038	27	0.013
140	2.508	0.8777	2.201	202	0.038	28	0.013
145	2.540	0.8815	2.239	174	0.037	29	0.013
150	2.570	0.8853	2.276	173	0.037	30	0.013
155	2.601	0.8891	2.312	203	0.037	31	0.013
160	2.630	0.8930	2.348	172	0.036	32	0.013
165	2.659	0.8968	2.384	171	0.036	33	0.013
170	2.687	0.9006	2.420	204	0.036	34	0.013
175	2.715	0.9044	2.456	170	0.035	35	0.013
180	2.742	**0.9083**	2.491	169	0.035	36	0.013
185	2.769	0.9090	2.517	205	0.026	37	0.013
190	2.795	0.9097	2.543	168	0.026	38	0.013
195	2.821	0.9104	2.569	167	0.026	39	0.014
200	2.847	0.9112	2.594	206	0.025	40	0.014
205	2.872	0.9119	2.619	166	0.025	41	0.014
210	2.897	0.9126	2.643	165	0.025	42	0.014
215	2.921	0.9134	2.668	207	0.024	43	0.014
220	2.945	0.9141	2.692	164	0.024	44	0.014
225	2.968	0.9148	2.716	163	0.024	45	0.014
230	2.992	0.9156	2.739	208	0.023	46	0.014
235	3.015	0.9163	2.762	162	0.023	47	0.014
240	3.037	0.9170	2.785	161	0.023	48	0.014
245	3.059	0.9178	2.808	209	0.023	49	0.014
250	3.081	0.9185	2.830	160	0.022	50	0.014
255	3.103	0.9192	2.853	159	0.022	51	0.014

10 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	3.125	0.9200	2.875	210	0.022	52	0.014
265	3.146	0.9207	2.896	158	0.022	53	0.014
270	3.167	0.9214	2.918	157	0.022	54	0.014
275	3.188	0.9222	2.939	211	0.021	55	0.014
280	3.208	0.9229	2.961	156	0.021	56	0.014
285	3.228	0.9236	2.982	155	0.021	57	0.014
290	3.248	0.9244	3.002	212	0.021	58	0.014
295	3.268	0.9251	3.023	154	0.021	59	0.014
300	3.288	0.9258	3.044	153	0.020	60	0.014
305	3.307	0.9265	3.064	213	0.020	61	0.014
310	3.326	0.9273	3.084	152	0.020	62	0.014
315	3.345	0.9280	3.104	151	0.020	63	0.015
320	3.364	0.9287	3.124	214	0.020	64	0.015
325	3.382	0.9295	3.144	150	0.020	65	0.015
330	3.401	0.9302	3.163	149	0.020	66	0.015
335	3.419	0.9309	3.183	215	0.019	67	0.015
340	3.437	0.9317	3.202	148	0.019	68	0.015
345	3.455	0.9324	3.221	147	0.019	69	0.015
350	3.472	0.9331	3.240	216	0.019	70	0.015
355	3.490	0.9339	3.259	146	0.019	71	0.015
360	**3.500**	**0.9346**	3.271	145	0.012	72	0.015
365	3.524	0.9347	3.294	217	0.023	73	0.015
370	3.548	0.9348	3.317	144	0.023	74	0.015
375	3.572	0.9349	3.340	143	0.023	75	0.015
380	3.596	0.9350	3.362	218	0.023	76	0.015
385	3.619	0.9351	3.385	142	0.022	77	0.015
390	3.643	0.9352	3.407	141	0.022	78	0.015
395	3.666	0.9353	3.429	219	0.022	79	0.015
400	3.689	0.9354	3.451	140	0.022	80	0.015
405	3.712	0.9355	3.473	139	0.022	81	0.016
410	3.735	0.9356	3.494	220	0.022	82	0.016
415	3.758	0.9357	3.516	138	0.022	83	0.016
420	3.780	0.9358	3.538	137	0.021	84	0.016
425	3.803	0.9358	3.559	221	0.021	85	0.016
430	3.825	0.9359	3.580	136	0.021	86	0.016
435	3.847	0.9360	3.601	135	0.021	87	0.016
440	3.869	0.9361	3.622	222	0.021	88	0.016
445	3.891	0.9362	3.643	134	0.021	89	0.016
450	3.913	0.9363	3.664	133	0.021	90	0.016
455	3.935	0.9364	3.685	223	0.021	91	0.016
460	3.956	0.9365	3.705	132	0.021	92	0.016
465	3.978	0.9366	3.726	131	0.020	93	0.016
470	3.999	0.9367	3.746	224	0.020	94	0.016
475	4.020	0.9368	3.766	130	0.020	95	0.017
480	4.041	0.9369	3.786	129	0.020	96	0.017
485	4.062	0.9370	3.806	225	0.020	97	0.017
490	4.083	0.9371	3.826	128	0.020	98	0.017
495	4.104	0.9372	3.846	127	0.020	99	0.017
500	4.125	0.9373	3.866	226	0.020	100	0.017
505	4.145	0.9374	3.886	126	0.020	101	0.017
510	4.166	0.9375	3.905	125	0.020	102	0.017
515	4.186	0.9376	3.925	227	0.019	103	0.017

10 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	4.206	0.9377	3.944	124	0.019	104	0.017
525	4.227	0.9378	3.964	123	0.019	105	0.017
530	4.247	0.9379	3.983	228	0.019	106	0.017
535	4.267	0.9380	4.002	122	0.019	107	0.018
540	4.287	0.9380	4.021	121	0.019	108	0.018
545	4.306	0.9381	4.040	229	0.019	109	0.018
550	4.326	0.9382	4.059	120	0.019	110	0.018
555	4.346	0.9383	4.078	119	0.019	111	0.018
560	4.365	0.9384	4.097	230	0.019	112	0.018
565	4.385	0.9385	4.115	118	0.019	113	0.018
570	4.404	0.9386	4.134	117	0.019	114	0.018
575	4.423	0.9387	4.152	231	0.019	115	0.018
580	4.443	0.9388	4.171	116	0.018	116	0.018
585	4.462	0.9389	4.189	115	0.018	117	0.019
590	4.481	0.9390	4.207	232	0.018	118	0.019
595	4.500	0.9391	4.226	114	0.018	119	0.019
600	4.518	0.9392	4.244	113	0.018	120	0.019
605	4.537	0.9393	4.262	233	0.018	121	0.019
610	4.556	0.9394	4.280	112	0.018	122	0.019
615	4.575	0.9395	4.298	111	0.018	123	0.019
620	4.593	0.9396	4.316	234	0.018	124	0.019
625	4.612	0.9397	4.333	110	0.018	125	0.020
630	4.630	0.9398	4.351	109	0.018	126	0.020
635	4.648	0.9399	4.369	235	0.018	127	0.020
640	4.667	0.9400	4.387	108	0.018	128	0.020
645	4.685	0.9401	4.404	107	0.018	129	0.020
650	4.703	0.9402	4.422	236	0.017	130	0.020
655	4.721	0.9403	4.439	106	0.017	131	0.020
660	4.739	0.9403	4.456	105	0.017	132	0.021
665	4.757	0.9404	4.474	237	0.017	133	0.021
670	4.775	0.9405	4.491	104	0.017	134	0.021
675	4.793	0.9406	4.508	103	0.017	135	0.021
680	4.810	0.9407	4.525	238	0.017	136	0.021
685	4.828	0.9408	4.542	102	0.017	137	0.021
690	4.846	0.9409	4.559	101	0.017	138	0.022
695	4.863	0.9410	4.576	239	0.017	139	0.022
700	4.881	0.9411	4.593	100	0.017	140	0.022
705	4.898	0.9412	4.610	99	0.017	141	0.022
710	4.915	0.9413	4.627	240	0.017	142	0.022
715	4.933	0.9414	4.644	98	0.017	143	0.023
720	4.950	0.9415	4.660	97	0.017	144	0.023
725	4.967	0.9416	4.677	241	0.017	145	0.012
730	4.984	0.9417	4.693	96	0.017	146	0.019
735	5.001	0.9418	4.710	95	0.017	147	0.019
740	5.018	0.9419	4.726	242	0.016	148	0.019
745	5.035	0.9420	4.743	94	0.016	149	0.020
750	5.052	0.9421	4.759	93	0.016	150	0.020
755	5.069	0.9422	4.776	243	0.016	151	0.020
760	5.085	0.9423	4.792	92	0.016	152	0.020
765	5.102	0.9424	4.808	91	0.016	153	0.020
770	5.119	0.9425	4.824	244	0.016	154	0.021
775	5.135	0.9426	4.840	90	0.016	155	0.021

10 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	5.152	0.9426	4.856	89	0.016	156	0.021
785	5.168	0.9427	4.872	245	0.016	157	0.022
790	5.185	0.9428	4.888	88	0.016	158	0.022
795	5.201	0.9429	4.904	87	0.016	159	0.022
800	5.217	0.9430	4.920	246	0.016	160	0.022
805	5.234	0.9431	4.936	86	0.016	161	0.023
810	5.250	0.9432	4.952	85	0.016	162	0.023
815	5.266	0.9433	4.968	247	0.016	163	0.024
820	5.282	0.9434	4.983	84	0.016	164	0.024
825	5.298	0.9435	4.999	83	0.016	165	0.025
830	5.314	0.9436	5.015	248	0.016	166	0.025
835	5.330	0.9437	5.030	82	0.016	167	0.026
840	5.346	0.9438	5.046	81	0.016	168	0.026
845	5.362	0.9439	5.061	249	0.016	169	0.035
850	5.378	0.9440	5.077	80	0.015	170	0.035
855	5.394	0.9441	5.092	79	0.015	171	0.036
860	5.410	0.9442	5.108	250	0.015	172	0.036
865	5.425	0.9443	5.123	78	0.015	173	0.037
870	5.441	0.9444	5.138	77	0.015	174	0.037
875	5.457	0.9445	5.154	251	0.015	175	0.038
880	5.472	0.9446	5.169	76	0.015	176	0.039
885	5.488	0.9447	5.184	75	0.015	177	0.040
890	5.503	0.9448	5.199	252	0.015	178	0.040
895	5.519	0.9449	5.214	74	0.015	179	0.042
900	5.534	0.9449	5.229	73	0.015	180	0.042
905	5.549	0.9450	5.244	253	0.015	181	0.044
910	5.565	0.9451	5.259	72	0.015	182	0.045
915	5.580	0.9452	5.274	71	0.015	183	0.048
920	5.595	0.9453	5.289	254	0.015	184	0.049
925	5.610	0.9454	5.304	70	0.015	185	0.077
930	5.625	0.9455	5.319	69	0.015	186	0.078
935	5.641	0.9456	5.334	255	0.015	187	0.080
940	5.656	0.9457	5.349	68	0.015	188	0.082
945	5.671	0.9458	5.363	67	0.015	189	0.065
950	5.686	0.9459	5.378	256	0.015	190	0.074
955	5.701	0.9460	5.393	66	0.015	191	0.108
960	5.715	0.9461	5.407	65	0.015	192	0.153
965	5.730	0.9462	5.422	257	0.015	193	0.548
970	5.745	0.9463	5.437	64	0.015	194	0.087
975	5.760	0.9464	5.451	63	0.015	195	0.085
980	5.775	0.9465	5.466	258	0.015	196	0.079
985	5.789	0.9466	5.480	62	0.014	197	0.051
990	5.804	0.9467	5.495	61	0.014	198	0.046
995	5.819	0.9468	5.509	259	0.014	199	0.043
1000	5.833	0.9469	5.523	60	0.014	200	0.041
1005	5.848	0.9470	5.538	59	0.014	201	0.039
1010	5.862	0.9471	5.552	260	0.014	202	0.038
1015	5.877	0.9472	5.566	58	0.014	203	0.037
1020	5.891	0.9472	5.581	57	0.014	204	0.036
1025	5.906	0.9473	5.595	261	0.014	205	0.026
1030	5.920	0.9474	5.609	56	0.014	206	0.025
1035	5.935	0.9475	5.623	55	0.014	207	0.024

10 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	5.949	0.9476	5.637	262	0.014	208	0.023
1045	5.963	0.9477	5.651	54	0.014	209	0.023
1050	5.977	0.9478	5.666	53	0.014	210	0.022
1055	5.992	0.9479	5.680	263	0.014	211	0.021
1060	6.006	0.9480	5.694	52	0.014	212	0.021
1065	6.020	0.9481	5.708	51	0.014	213	0.020
1070	6.034	0.9482	5.722	264	0.014	214	0.020
1075	6.048	0.9483	5.735	50	0.014	215	0.019
1080	6.062	0.9484	5.749	49	0.014	216	0.019
1085	6.076	0.9485	5.763	265	0.014	217	0.023
1090	6.090	0.9486	5.777	48	0.014	218	0.023
1095	6.104	0.9487	5.791	47	0.014	219	0.022
1100	6.118	0.9488	5.805	266	0.014	220	0.022
1105	6.132	0.9489	5.818	46	0.014	221	0.021
1110	6.146	0.9490	5.832	45	0.014	222	0.021
1115	6.160	0.9491	5.846	267	0.014	223	0.021
1120	6.173	0.9492	5.860	44	0.014	224	0.020
1125	6.187	0.9493	5.873	43	0.014	225	0.020
1130	6.201	0.9494	5.887	268	0.014	226	0.020
1135	6.215	0.9495	5.900	42	0.014	227	0.019
1140	6.228	0.9495	5.914	41	0.014	228	0.019
1145	6.242	0.9496	5.928	269	0.014	229	0.019
1150	6.256	0.9497	5.941	40	0.014	230	0.019
1155	6.269	0.9498	5.955	39	0.014	231	0.019
1160	6.283	0.9499	5.968	270	0.013	232	0.018
1165	6.296	0.9500	5.982	38	0.013	233	0.018
1170	6.310	0.9501	5.995	37	0.013	234	0.018
1175	6.323	0.9502	6.008	271	0.013	235	0.018
1180	6.337	0.9503	6.022	36	0.013	236	0.017
1185	6.350	0.9504	6.035	35	0.013	237	0.017
1190	6.363	0.9505	6.048	272	0.013	238	0.017
1195	6.377	0.9506	6.062	34	0.013	239	0.017
1200	6.390	0.9507	6.075	33	0.013	240	0.017
1205	6.403	0.9508	6.088	273	0.013	241	0.017
1210	6.417	0.9509	6.102	32	0.013	242	0.016
1215	6.430	0.9510	6.115	31	0.013	243	0.016
1220	6.443	0.9511	6.128	274	0.013	244	0.016
1225	6.456	0.9512	6.141	30	0.013	245	0.016
1230	6.469	0.9513	6.154	29	0.013	246	0.016
1235	6.483	0.9514	6.167	275	0.013	247	0.016
1240	6.496	0.9515	6.180	28	0.013	248	0.016
1245	6.509	0.9516	6.194	27	0.013	249	0.016
1250	6.522	0.9517	6.207	276	0.013	250	0.015
1255	6.535	0.9518	6.220	26	0.013	251	0.015
1260	6.548	0.9518	6.233	25	0.013	252	0.015
1265	6.561	0.9519	6.246	277	0.013	253	0.015
1270	6.574	0.9520	6.259	24	0.013	254	0.015
1275	6.587	0.9521	6.272	23	0.013	255	0.015
1280	6.600	0.9522	6.284	278	0.013	256	0.015
1285	6.613	0.9523	6.297	22	0.013	257	0.015
1290	6.625	0.9524	6.310	21	0.013	258	0.015
1295	6.638	0.9525	6.323	279	0.013	259	0.014

10 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	6.651	0.9526	6.336	20	0.013	260	0.014
1305	6.664	0.9527	6.349	19	0.013	261	0.014
1310	6.677	0.9528	6.361	280	0.013	262	0.014
1315	6.689	0.9529	6.374	18	0.013	263	0.014
1320	6.702	0.9530	6.387	17	0.013	264	0.014
1325	6.715	0.9531	6.400	281	0.013	265	0.014
1330	6.727	0.9532	6.412	16	0.013	266	0.014
1335	6.740	0.9533	6.425	15	0.013	267	0.014
1340	6.753	0.9534	6.438	282	0.013	268	0.014
1345	6.765	0.9535	6.450	14	0.013	269	0.014
1350	6.778	0.9536	6.463	13	0.013	270	0.013
1355	6.790	0.9537	6.476	283	0.013	271	0.013
1360	6.803	0.9538	6.488	12	0.013	272	0.013
1365	6.815	0.9539	6.501	11	0.013	273	0.013
1370	6.828	0.9540	6.513	284	0.013	274	0.013
1375	6.840	0.9541	6.526	10	0.013	275	0.013
1380	6.853	0.9541	6.538	9	0.013	276	0.013
1385	6.865	0.9542	6.551	285	0.012	277	0.013
1390	6.877	0.9543	6.563	8	0.012	278	0.013
1395	6.890	0.9544	6.576	7	0.012	279	0.013
1400	6.902	0.9545	6.588	286	0.012	280	0.013
1405	6.914	0.9546	6.601	6	0.012	281	0.013
1410	6.927	0.9547	6.613	5	0.012	282	0.013
1415	6.939	0.9548	6.625	287	0.012	283	0.013
1420	6.951	0.9549	6.638	4	0.012	284	0.013
1425	6.963	0.9550	6.650	3	0.012	285	0.012
1430	6.976	0.9551	6.663	288	0.012	286	0.012
1435	6.988	0.9552	6.675	2	0.012	287	0.012
1440	7.000	**0.9553**	6.687	1	0.012	288	0.012

5 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.659	0.7129	0.470	193	0.470	1	0.011
10	0.842	0.7129	0.601	192	0.131	2	0.011
15	0.973	0.7129	0.694	191	0.093	3	0.011
20	1.077	0.7129	0.768	194	0.075	4	0.011
25	1.166	0.7129	0.831	190	0.063	5	0.011
30	1.244	**0.7129**	0.887	189	0.056	6	0.011
35	1.314	0.7302	0.960	195	0.073	7	0.011
40	1.378	0.7474	1.030	188	0.070	8	0.011
45	1.437	0.7647	1.099	187	0.069	9	0.011
50	1.492	0.7820	1.166	196	0.068	10	0.011
55	1.543	0.7992	1.233	186	0.067	11	0.011
60	1.591	**0.8165**	1.299	185	0.066	12	0.011
65	1.637	0.8203	1.343	197	0.044	13	0.011
70	1.681	0.8241	1.385	184	0.042	14	0.011
75	1.723	0.8280	1.426	183	0.041	15	0.011
80	1.763	0.8318	1.466	198	0.040	16	0.011
85	1.801	0.8356	1.505	182	0.039	17	0.011
90	1.838	0.8394	1.543	181	0.038	18	0.011
95	1.873	0.8433	1.580	199	0.037	19	0.011
100	1.908	0.8471	1.616	180	0.036	20	0.011
105	1.941	0.8509	1.652	179	0.036	21	0.011
110	1.974	0.8547	1.687	200	0.035	22	0.011
115	2.005	0.8586	1.721	178	0.034	23	0.011
120	2.035	0.8624	1.755	177	0.034	24	0.011
125	2.065	0.8662	1.789	201	0.034	25	0.011
130	2.094	0.8700	1.822	176	0.033	26	0.011
135	2.122	0.8738	1.855	175	0.033	27	0.011
140	2.150	0.8777	1.887	202	0.032	28	0.011
145	2.177	0.8815	1.919	174	0.032	29	0.011
150	2.203	0.8853	1.951	173	0.032	30	0.011
155	2.229	0.8891	1.982	203	0.031	31	0.011
160	2.254	0.8930	2.013	172	0.031	32	0.011
165	2.279	0.8968	2.044	171	0.031	33	0.011
170	2.303	0.9006	2.074	204	0.031	34	0.011
175	2.327	0.9044	2.105	170	0.030	35	0.011
180	2.351	**0.9083**	2.135	169	0.030	36	0.011
185	2.373	0.9090	2.157	205	0.023	37	0.012
190	2.396	0.9097	2.180	168	0.022	38	0.012
195	2.418	0.9104	2.202	167	0.022	39	0.012
200	2.440	0.9112	2.223	206	0.022	40	0.012
205	2.462	0.9119	2.245	166	0.021	41	0.012
210	2.483	0.9126	2.266	165	0.021	42	0.012
215	2.504	0.9134	2.287	207	0.021	43	0.012
220	2.524	0.9141	2.307	164	0.021	44	0.012
225	2.544	0.9148	2.328	163	0.020	45	0.012
230	2.564	0.9156	2.348	208	0.020	46	0.012
235	2.584	0.9163	2.368	162	0.020	47	0.012
240	2.603	0.9170	2.387	161	0.020	48	0.012
245	2.622	0.9178	2.407	209	0.019	49	0.012
250	2.641	0.9185	2.426	160	0.019	50	0.012
255	2.660	0.9192	2.445	159	0.019	51	0.012

5 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	2.678	0.9200	2.464	210	0.019	52	0.012
265	2.696	0.9207	2.483	158	0.019	53	0.012
270	2.714	0.9214	2.501	157	0.019	54	0.012
275	2.732	0.9222	2.519	211	0.018	55	0.012
280	2.750	0.9229	2.538	156	0.018	56	0.012
285	2.767	0.9236	2.556	155	0.018	57	0.012
290	2.784	0.9244	2.574	212	0.018	58	0.012
295	2.801	0.9251	2.591	154	0.018	59	0.012
300	2.818	0.9258	2.609	153	0.018	60	0.012
305	2.834	0.9265	2.626	213	0.017	61	0.012
310	2.851	0.9273	2.644	152	0.017	62	0.012
315	2.867	0.9280	2.661	151	0.017	63	0.012
320	2.883	0.9287	2.678	214	0.017	64	0.012
325	2.899	0.9295	2.695	150	0.017	65	0.013
330	2.915	0.9302	2.711	149	0.017	66	0.013
335	2.930	0.9309	2.728	215	0.017	67	0.013
340	2.946	0.9317	2.745	148	0.017	68	0.013
345	2.961	0.9324	2.761	147	0.016	69	0.013
350	2.976	0.9331	2.777	216	0.016	70	0.013
355	2.991	0.9339	2.794	146	0.016	71	0.013
360	**3.000**	**0.9346**	2.804	145	0.010	72	0.013
365	3.021	0.9347	2.823	217	0.020	73	0.013
370	3.041	0.9348	2.843	144	0.020	74	0.013
375	3.062	0.9349	2.862	143	0.019	75	0.013
380	3.082	0.9350	2.882	218	0.019	76	0.013
385	3.102	0.9351	2.901	142	0.019	77	0.013
390	3.122	0.9352	2.920	141	0.019	78	0.013
395	3.142	0.9353	2.939	219	0.019	79	0.013
400	3.162	0.9354	2.958	140	0.019	80	0.013
405	3.182	0.9355	2.977	139	0.019	81	0.013
410	3.202	0.9356	2.995	220	0.019	82	0.013
415	3.221	0.9357	3.014	138	0.019	83	0.013
420	3.240	0.9358	3.032	137	0.018	84	0.013
425	3.260	0.9358	3.050	221	0.018	85	0.014
430	3.279	0.9359	3.069	136	0.018	86	0.014
435	3.298	0.9360	3.087	135	0.018	87	0.014
440	3.317	0.9361	3.105	222	0.018	88	0.014
445	3.335	0.9362	3.123	134	0.018	89	0.014
450	3.354	0.9363	3.141	133	0.018	90	0.014
455	3.373	0.9364	3.158	223	0.018	91	0.014
460	3.391	0.9365	3.176	132	0.018	92	0.014
465	3.410	0.9366	3.193	131	0.018	93	0.014
470	3.428	0.9367	3.211	224	0.017	94	0.014
475	3.446	0.9368	3.228	130	0.017	95	0.014
480	3.464	0.9369	3.246	129	0.017	96	0.014
485	3.482	0.9370	3.263	225	0.017	97	0.014
490	3.500	0.9371	3.280	128	0.017	98	0.014
495	3.518	0.9372	3.297	127	0.017	99	0.014
500	3.536	0.9373	3.314	226	0.017	100	0.014
505	3.553	0.9374	3.331	126	0.017	101	0.015
510	3.571	0.9375	3.347	125	0.017	102	0.015
515	3.588	0.9376	3.364	227	0.017	103	0.015

5 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	3.606	0.9377	3.381	124	0.017	104	0.015
525	3.623	0.9378	3.397	123	0.017	105	0.015
530	3.640	0.9379	3.414	228	0.016	106	0.015
535	3.657	0.9380	3.430	122	0.016	107	0.015
540	3.674	0.9380	3.447	121	0.016	108	0.015
545	3.691	0.9381	3.463	229	0.016	109	0.015
550	3.708	0.9382	3.479	120	0.016	110	0.015
555	3.725	0.9383	3.495	119	0.016	111	0.015
560	3.742	0.9384	3.511	230	0.016	112	0.015
565	3.758	0.9385	3.527	118	0.016	113	0.016
570	3.775	0.9386	3.543	117	0.016	114	0.016
575	3.791	0.9387	3.559	231	0.016	115	0.016
580	3.808	0.9388	3.575	116	0.016	116	0.016
585	3.824	0.9389	3.591	115	0.016	117	0.016
590	3.841	0.9390	3.606	232	0.016	118	0.016
595	3.857	0.9391	3.622	114	0.016	119	0.016
600	3.873	0.9392	3.638	113	0.016	120	0.016
605	3.889	0.9393	3.653	233	0.015	121	0.016
610	3.905	0.9394	3.668	112	0.015	122	0.016
615	3.921	0.9395	3.684	111	0.015	123	0.017
620	3.937	0.9396	3.699	234	0.015	124	0.017
625	3.953	0.9397	3.714	110	0.015	125	0.017
630	3.969	0.9398	3.730	109	0.015	126	0.017
635	3.984	0.9399	3.745	235	0.015	127	0.017
640	4.000	0.9400	3.760	108	0.015	128	0.017
645	4.016	0.9401	3.775	107	0.015	129	0.017
650	4.031	0.9402	3.790	236	0.015	130	0.017
655	4.047	0.9403	3.805	106	0.015	131	0.018
660	4.062	0.9403	3.820	105	0.015	132	0.018
665	4.077	0.9404	3.835	237	0.015	133	0.018
670	4.093	0.9405	3.849	104	0.015	134	0.018
675	4.108	0.9406	3.864	103	0.015	135	0.018
680	4.123	0.9407	3.879	238	0.015	136	0.018
685	4.138	0.9408	3.893	102	0.015	137	0.018
690	4.153	0.9409	3.908	101	0.015	138	0.019
695	4.168	0.9410	3.922	239	0.015	139	0.019
700	4.183	0.9411	3.937	100	0.014	140	0.019
705	4.198	0.9412	3.951	99	0.014	141	0.019
710	4.213	0.9413	3.966	240	0.014	142	0.019
715	4.228	0.9414	3.980	98	0.014	143	0.019
720	4.243	0.9415	3.994	97	0.014	144	0.020
725	4.257	0.9416	4.009	241	0.014	145	0.010
730	4.272	0.9417	4.023	96	0.014	146	0.016
735	4.287	0.9418	4.037	95	0.014	147	0.016
740	4.301	0.9419	4.051	242	0.014	148	0.017
745	4.316	0.9420	4.065	94	0.014	149	0.017
750	4.330	0.9421	4.079	93	0.014	150	0.017
755	4.345	0.9422	4.093	243	0.014	151	0.017
760	4.359	0.9423	4.107	92	0.014	152	0.017
765	4.373	0.9424	4.121	91	0.014	153	0.018
770	4.387	0.9425	4.135	244	0.014	154	0.018
775	4.402	0.9426	4.149	90	0.014	155	0.018

5 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	4.416	0.9426	4.163	89	0.014	156	0.018
785	4.430	0.9427	4.176	245	0.014	157	0.019
790	4.444	0.9428	4.190	88	0.014	158	0.019
795	4.458	0.9429	4.204	87	0.014	159	0.019
800	4.472	0.9430	4.217	246	0.014	160	0.019
805	4.486	0.9431	4.231	86	0.014	161	0.020
810	4.500	0.9432	4.245	85	0.014	162	0.020
815	4.514	0.9433	4.258	247	0.014	163	0.020
820	4.528	0.9434	4.272	84	0.013	164	0.021
825	4.541	0.9435	4.285	83	0.013	165	0.021
830	4.555	0.9436	4.298	248	0.013	166	0.021
835	4.569	0.9437	4.312	82	0.013	167	0.022
840	4.583	0.9438	4.325	81	0.013	168	0.022
845	4.596	0.9439	4.338	249	0.013	169	0.030
850	4.610	0.9440	4.352	80	0.013	170	0.030
855	4.623	0.9441	4.365	79	0.013	171	0.031
860	4.637	0.9442	4.378	250	0.013	172	0.031
865	4.650	0.9443	4.391	78	0.013	173	0.032
870	4.664	0.9444	4.404	77	0.013	174	0.032
875	4.677	0.9445	4.417	251	0.013	175	0.033
880	4.690	0.9446	4.430	76	0.013	176	0.033
885	4.704	0.9447	4.443	75	0.013	177	0.034
890	4.717	0.9448	4.456	252	0.013	178	0.034
895	4.730	0.9449	4.469	74	0.013	179	0.036
900	4.743	0.9449	4.482	73	0.013	180	0.036
905	4.757	0.9450	4.495	253	0.013	181	0.038
910	4.770	0.9451	4.508	72	0.013	182	0.039
915	4.783	0.9452	4.521	71	0.013	183	0.041
920	4.796	0.9453	4.534	254	0.013	184	0.042
925	4.809	0.9454	4.546	70	0.013	185	0.066
930	4.822	0.9455	4.559	69	0.013	186	0.067
935	4.835	0.9456	4.572	255	0.013	187	0.069
940	4.848	0.9457	4.585	68	0.013	188	0.070
945	4.861	0.9458	4.597	67	0.013	189	0.056
950	4.873	0.9459	4.610	256	0.013	190	0.063
955	4.886	0.9460	4.622	66	0.013	191	0.093
960	4.899	0.9461	4.635	65	0.013	192	0.131
965	4.912	0.9462	4.647	257	0.013	193	0.470
970	4.924	0.9463	4.660	64	0.012	194	0.075
975	4.937	0.9464	4.672	63	0.012	195	0.073
980	4.950	0.9465	4.685	258	0.012	196	0.068
985	4.962	0.9466	4.697	62	0.012	197	0.044
990	4.975	0.9467	4.710	61	0.012	198	0.040
995	4.987	0.9468	4.722	259	0.012	199	0.037
1000	5.000	0.9469	4.734	60	0.012	200	0.035
1005	5.012	0.9470	4.747	59	0.012	201	0.034
1010	5.025	0.9471	4.759	260	0.012	202	0.032
1015	5.037	0.9472	4.771	58	0.012	203	0.031
1020	5.050	0.9472	4.783	57	0.012	204	0.031
1025	5.062	0.9473	4.796	261	0.012	205	0.023
1030	5.074	0.9474	4.808	56	0.012	206	0.022
1035	5.087	0.9475	4.820	55	0.012	207	0.021

5 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	5.099	0.9476	4.832	262	0.012	208	0.020
1045	5.111	0.9477	4.844	54	0.012	209	0.019
1050	5.123	0.9478	4.856	53	0.012	210	0.019
1055	5.136	0.9479	4.868	263	0.012	211	0.018
1060	5.148	0.9480	4.880	52	0.012	212	0.018
1065	5.160	0.9481	4.892	51	0.012	213	0.017
1070	5.172	0.9482	4.904	264	0.012	214	0.017
1075	5.184	0.9483	4.916	50	0.012	215	0.017
1080	5.196	0.9484	4.928	49	0.012	216	0.016
1085	5.208	0.9485	4.940	265	0.012	217	0.020
1090	5.220	0.9486	4.952	48	0.012	218	0.019
1095	5.232	0.9487	4.964	47	0.012	219	0.019
1100	5.244	0.9488	4.975	266	0.012	220	0.019
1105	5.256	0.9489	4.987	46	0.012	221	0.018
1110	5.268	0.9490	4.999	45	0.012	222	0.018
1115	5.280	0.9491	5.011	267	0.012	223	0.018
1120	5.292	0.9492	5.023	44	0.012	224	0.017
1125	5.303	0.9493	5.034	43	0.012	225	0.017
1130	5.315	0.9494	5.046	268	0.012	226	0.017
1135	5.327	0.9495	5.058	42	0.012	227	0.017
1140	5.339	0.9495	5.069	41	0.012	228	0.016
1145	5.350	0.9496	5.081	269	0.012	229	0.016
1150	5.362	0.9497	5.092	40	0.012	230	0.016
1155	5.374	0.9498	5.104	39	0.012	231	0.016
1160	5.385	0.9499	5.116	270	0.012	232	0.016
1165	5.397	0.9500	5.127	38	0.012	233	0.015
1170	5.408	0.9501	5.139	37	0.012	234	0.015
1175	5.420	0.9502	5.150	271	0.011	235	0.015
1180	5.431	0.9503	5.162	36	0.011	236	0.015
1185	5.443	0.9504	5.173	35	0.011	237	0.015
1190	5.454	0.9505	5.184	272	0.011	238	0.015
1195	5.466	0.9506	5.196	34	0.011	239	0.015
1200	5.477	0.9507	5.207	33	0.011	240	0.014
1205	5.489	0.9508	5.219	273	0.011	241	0.014
1210	5.500	0.9509	5.230	32	0.011	242	0.014
1215	5.511	0.9510	5.241	31	0.011	243	0.014
1220	5.523	0.9511	5.253	274	0.011	244	0.014
1225	5.534	0.9512	5.264	30	0.011	245	0.014
1230	5.545	0.9513	5.275	29	0.011	246	0.014
1235	5.557	0.9514	5.286	275	0.011	247	0.014
1240	5.568	0.9515	5.298	28	0.011	248	0.013
1245	5.579	0.9516	5.309	27	0.011	249	0.013
1250	5.590	0.9517	5.320	276	0.011	250	0.013
1255	5.601	0.9518	5.331	26	0.011	251	0.013
1260	5.612	0.9518	5.342	25	0.011	252	0.013
1265	5.624	0.9519	5.353	277	0.011	253	0.013
1270	5.635	0.9520	5.364	24	0.011	254	0.013
1275	5.646	0.9521	5.376	23	0.011	255	0.013
1280	5.657	0.9522	5.387	278	0.011	256	0.013
1285	5.668	0.9523	5.398	22	0.011	257	0.013
1290	5.679	0.9524	5.409	21	0.011	258	0.012
1295	5.690	0.9525	5.420	279	0.011	259	0.012

5 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	5.701	0.9526	5.431	20	0.011	260	0.012
1305	5.712	0.9527	5.442	19	0.011	261	0.012
1310	5.723	0.9528	5.453	280	0.011	262	0.012
1315	5.734	0.9529	5.464	18	0.011	263	0.012
1320	5.745	0.9530	5.475	17	0.011	264	0.012
1325	5.755	0.9531	5.485	281	0.011	265	0.012
1330	5.766	0.9532	5.496	16	0.011	266	0.012
1335	5.777	0.9533	5.507	15	0.011	267	0.012
1340	5.788	0.9534	5.518	282	0.011	268	0.012
1345	5.799	0.9535	5.529	14	0.011	269	0.012
1350	5.809	0.9536	5.540	13	0.011	270	0.012
1355	5.820	0.9537	5.551	283	0.011	271	0.011
1360	5.831	0.9538	5.561	12	0.011	272	0.011
1365	5.842	0.9539	5.572	11	0.011	273	0.011
1370	5.852	0.9540	5.583	284	0.011	274	0.011
1375	5.863	0.9541	5.594	10	0.011	275	0.011
1380	5.874	0.9541	5.604	9	0.011	276	0.011
1385	5.884	0.9542	5.615	285	0.011	277	0.011
1390	5.895	0.9543	5.626	8	0.011	278	0.011
1395	5.906	0.9544	5.636	7	0.011	279	0.011
1400	5.916	0.9545	5.647	286	0.011	280	0.011
1405	5.927	0.9546	5.658	6	0.011	281	0.011
1410	5.937	0.9547	5.668	5	0.011	282	0.011
1415	5.948	0.9548	5.679	287	0.011	283	0.011
1420	5.958	0.9549	5.690	4	0.011	284	0.011
1425	5.969	0.9550	5.700	3	0.011	285	0.011
1430	5.979	0.9551	5.711	288	0.011	286	0.011
1435	5.990	0.9552	5.721	2	0.011	287	0.011
1440	6.000	**0.9553**	5.732	1	0.011	288	0.011

2 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
0							
5	0.483	0.7129	0.344	193	0.344	1	0.008
10	0.618	0.7129	0.440	192	0.096	2	0.008
15	0.713	0.7129	0.509	191	0.068	3	0.008
20	0.790	0.7129	0.563	194	0.055	4	0.008
25	0.855	0.7129	0.610	190	0.046	5	0.008
30	0.912	**0.7129**	0.651	189	0.041	6	0.008
35	0.964	0.7302	0.704	195	0.053	7	0.008
40	1.011	0.7474	0.755	188	0.052	8	0.008
45	1.054	0.7647	0.806	187	0.050	9	0.008
50	1.094	0.7820	0.855	196	0.050	10	0.008
55	1.132	0.7992	0.904	186	0.049	11	0.008
60	1.167	**0.8165**	0.953	185	0.049	12	0.008
65	1.201	0.8203	0.985	197	0.032	13	0.008
70	1.233	0.8241	1.016	184	0.031	14	0.008
75	1.263	0.8280	1.046	183	0.030	15	0.008
80	1.293	0.8318	1.075	198	0.029	16	0.008
85	1.321	0.8356	1.104	182	0.028	17	0.008
90	1.348	0.8394	1.131	181	0.028	18	0.008
95	1.374	0.8433	1.159	199	0.027	19	0.008
100	1.399	0.8471	1.185	180	0.027	20	0.008
105	1.424	0.8509	1.211	179	0.026	21	0.009
110	1.447	0.8547	1.237	200	0.026	22	0.009
115	1.470	0.8586	1.262	178	0.025	23	0.009
120	1.493	0.8624	1.287	177	0.025	24	0.009
125	1.514	0.8662	1.312	201	0.025	25	0.009
130	1.536	0.8700	1.336	176	0.024	26	0.009
135	1.556	0.8738	1.360	175	0.024	27	0.009
140	1.577	0.8777	1.384	202	0.024	28	0.009
145	1.596	0.8815	1.407	174	0.023	29	0.009
150	1.616	0.8853	1.430	173	0.023	30	0.009
155	1.635	0.8891	1.453	203	0.023	31	0.009
160	1.653	0.8930	1.476	172	0.023	32	0.009
165	1.671	0.8968	1.499	171	0.023	33	0.009
170	1.689	0.9006	1.521	204	0.022	34	0.009
175	1.707	0.9044	1.543	170	0.022	35	0.009
180	1.724	**0.9083**	1.566	169	0.022	36	0.009
185	1.741	0.9090	1.582	205	0.017	37	0.009
190	1.757	0.9097	1.598	168	0.016	38	0.009
195	1.773	0.9104	1.615	167	0.016	39	0.009
200	1.789	0.9112	1.630	206	0.016	40	0.009
205	1.805	0.9119	1.646	166	0.016	41	0.009
210	1.821	0.9126	1.662	165	0.015	42	0.009
215	1.836	0.9134	1.677	207	0.015	43	0.009
220	1.851	0.9141	1.692	164	0.015	44	0.009
225	1.866	0.9148	1.707	163	0.015	45	0.009
230	1.880	0.9156	1.722	208	0.015	46	0.009
235	1.895	0.9163	1.736	162	0.015	47	0.009
240	1.909	0.9170	1.751	161	0.014	48	0.009
245	1.923	0.9178	1.765	209	0.014	49	0.009
250	1.937	0.9185	1.779	160	0.014	50	0.009
255	1.951	0.9192	1.793	159	0.014	51	0.009

2 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
260	1.964	0.9200	1.807	210	0.014	52	0.009
265	1.977	0.9207	1.821	158	0.014	53	0.009
270	1.991	0.9214	1.834	157	0.014	54	0.009
275	2.004	0.9222	1.848	211	0.013	55	0.009
280	2.016	0.9229	1.861	156	0.013	56	0.009
285	2.029	0.9236	1.874	155	0.013	57	0.009
290	2.042	0.9244	1.887	212	0.013	58	0.009
295	2.054	0.9251	1.900	154	0.013	59	0.009
300	2.066	0.9258	1.913	153	0.013	60	0.009
305	2.079	0.9265	1.926	213	0.013	61	0.010
310	2.091	0.9273	1.939	152	0.013	62	0.010
315	2.103	0.9280	1.951	151	0.013	63	0.010
320	2.114	0.9287	1.964	214	0.012	64	0.010
325	2.126	0.9295	1.976	150	0.012	65	0.010
330	2.138	0.9302	1.988	149	0.012	66	0.010
335	2.149	0.9309	2.001	215	0.012	67	0.010
340	2.160	0.9317	2.013	148	0.012	68	0.010
345	2.172	0.9324	2.025	147	0.012	69	0.010
350	2.183	0.9331	2.037	216	0.012	70	0.010
355	2.194	0.9339	2.049	146	0.012	71	0.010
360	**2.200**	**0.9346**	2.056	145	0.008	72	0.010
365	2.216	0.9347	2.071	217	0.015	73	0.010
370	2.231	0.9348	2.086	144	0.015	74	0.010
375	2.247	0.9349	2.101	143	0.015	75	0.010
380	2.262	0.9350	2.115	218	0.015	76	0.010
385	2.278	0.9351	2.130	142	0.015	77	0.010
390	2.293	0.9352	2.144	141	0.014	78	0.010
395	2.308	0.9353	2.159	219	0.014	79	0.010
400	2.323	0.9354	2.173	140	0.014	80	0.010
405	2.338	0.9355	2.187	139	0.014	81	0.010
410	2.353	0.9356	2.201	220	0.014	82	0.010
415	2.368	0.9357	2.215	138	0.014	83	0.010
420	2.382	0.9358	2.229	137	0.014	84	0.010
425	2.397	0.9358	2.243	221	0.014	85	0.010
430	2.411	0.9359	2.257	136	0.014	86	0.010
435	2.426	0.9360	2.271	135	0.014	87	0.010
440	2.440	0.9361	2.284	222	0.014	88	0.010
445	2.454	0.9362	2.298	134	0.014	89	0.011
450	2.469	0.9363	2.311	133	0.014	90	0.011
455	2.483	0.9364	2.325	223	0.013	91	0.011
460	2.497	0.9365	2.338	132	0.013	92	0.011
465	2.511	0.9366	2.352	131	0.013	93	0.011
470	2.525	0.9367	2.365	224	0.013	94	0.011
475	2.538	0.9368	2.378	130	0.013	95	0.011
480	2.552	0.9369	2.391	129	0.013	96	0.011
485	2.566	0.9370	2.404	225	0.013	97	0.011
490	2.580	0.9371	2.417	128	0.013	98	0.011
495	2.593	0.9372	2.430	127	0.013	99	0.011
500	2.607	0.9373	2.443	226	0.013	100	0.011
505	2.620	0.9374	2.456	126	0.013	101	0.011
510	2.633	0.9375	2.469	125	0.013	102	0.011
515	2.647	0.9376	2.481	227	0.013	103	0.011

2 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
520	2.660	0.9377	2.494	124	0.013	104	0.011
525	2.673	0.9378	2.507	123	0.013	105	0.011
530	2.686	0.9379	2.519	228	0.013	106	0.011
535	2.699	0.9380	2.532	122	0.012	107	0.011
540	2.712	0.9380	2.544	121	0.012	108	0.012
545	2.725	0.9381	2.557	229	0.012	109	0.012
550	2.738	0.9382	2.569	120	0.012	110	0.012
555	2.751	0.9383	2.581	119	0.012	111	0.012
560	2.764	0.9384	2.593	230	0.012	112	0.012
565	2.776	0.9385	2.606	118	0.012	113	0.012
570	2.789	0.9386	2.618	117	0.012	114	0.012
575	2.802	0.9387	2.630	231	0.012	115	0.012
580	2.814	0.9388	2.642	116	0.012	116	0.012
585	2.827	0.9389	2.654	115	0.012	117	0.012
590	2.839	0.9390	2.666	232	0.012	118	0.012
595	2.851	0.9391	2.678	114	0.012	119	0.012
600	2.864	0.9392	2.690	113	0.012	120	0.012
605	2.876	0.9393	2.702	233	0.012	121	0.012
610	2.888	0.9394	2.713	112	0.012	122	0.012
615	2.901	0.9395	2.725	111	0.012	123	0.013
620	2.913	0.9396	2.737	234	0.012	124	0.013
625	2.925	0.9397	2.748	110	0.012	125	0.013
630	2.937	0.9398	2.760	109	0.012	126	0.013
635	2.949	0.9399	2.772	235	0.012	127	0.013
640	2.961	0.9400	2.783	108	0.012	128	0.013
645	2.973	0.9401	2.795	107	0.011	129	0.013
650	2.985	0.9402	2.806	236	0.011	130	0.013
655	2.996	0.9403	2.817	106	0.011	131	0.013
660	3.008	0.9403	2.829	105	0.011	132	0.013
665	3.020	0.9404	2.840	237	0.011	133	0.014
670	3.032	0.9405	2.851	104	0.011	134	0.014
675	3.043	0.9406	2.863	103	0.011	135	0.014
680	3.055	0.9407	2.874	238	0.011	136	0.014
685	3.067	0.9408	2.885	102	0.011	137	0.014
690	3.078	0.9409	2.896	101	0.011	138	0.014
695	3.090	0.9410	2.907	239	0.011	139	0.014
700	3.101	0.9411	2.918	100	0.011	140	0.014
705	3.112	0.9412	2.929	99	0.011	141	0.014
710	3.124	0.9413	2.940	240	0.011	142	0.015
715	3.135	0.9414	2.951	98	0.011	143	0.015
720	3.146	0.9415	2.962	97	0.011	144	0.015
725	3.158	0.9416	2.973	241	0.011	145	0.008
730	3.169	0.9417	2.984	96	0.011	146	0.012
735	3.180	0.9418	2.995	95	0.011	147	0.012
740	3.191	0.9419	3.006	242	0.011	148	0.012
745	3.202	0.9420	3.017	94	0.011	149	0.012
750	3.213	0.9421	3.027	93	0.011	150	0.012
755	3.224	0.9422	3.038	243	0.011	151	0.013
760	3.235	0.9423	3.049	92	0.011	152	0.013
765	3.246	0.9424	3.059	91	0.011	153	0.013
770	3.257	0.9425	3.070	244	0.011	154	0.013
775	3.268	0.9426	3.081	90	0.011	155	0.013

2 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
780	3.279	0.9426	3.091	89	0.011	156	0.013
785	3.290	0.9427	3.102	245	0.011	157	0.014
790	3.301	0.9428	3.112	88	0.010	158	0.014
795	3.312	0.9429	3.123	87	0.010	159	0.014
800	3.322	0.9430	3.133	246	0.010	160	0.014
805	3.333	0.9431	3.143	86	0.010	161	0.014
810	3.344	0.9432	3.154	85	0.010	162	0.015
815	3.354	0.9433	3.164	247	0.010	163	0.015
820	3.365	0.9434	3.175	84	0.010	164	0.015
825	3.375	0.9435	3.185	83	0.010	165	0.015
830	3.386	0.9436	3.195	248	0.010	166	0.016
835	3.397	0.9437	3.205	82	0.010	167	0.016
840	3.407	0.9438	3.216	81	0.010	168	0.016
845	3.417	0.9439	3.226	249	0.010	169	0.022
850	3.428	0.9440	3.236	80	0.010	170	0.022
855	3.438	0.9441	3.246	79	0.010	171	0.023
860	3.449	0.9442	3.256	250	0.010	172	0.023
865	3.459	0.9443	3.266	78	0.010	173	0.023
870	3.469	0.9444	3.276	77	0.010	174	0.023
875	3.480	0.9445	3.286	251	0.010	175	0.024
880	3.490	0.9446	3.296	76	0.010	176	0.024
885	3.500	0.9447	3.306	75	0.010	177	0.025
890	3.510	0.9448	3.316	252	0.010	178	0.025
895	3.520	0.9449	3.326	74	0.010	179	0.026
900	3.531	0.9449	3.336	73	0.010	180	0.027
905	3.541	0.9450	3.346	253	0.010	181	0.028
910	3.551	0.9451	3.356	72	0.010	182	0.028
915	3.561	0.9452	3.366	71	0.010	183	0.030
920	3.571	0.9453	3.376	254	0.010	184	0.031
925	3.581	0.9454	3.385	70	0.010	185	0.049
930	3.591	0.9455	3.395	69	0.010	186	0.049
935	3.601	0.9456	3.405	255	0.010	187	0.050
940	3.611	0.9457	3.415	68	0.010	188	0.052
945	3.621	0.9458	3.424	67	0.010	189	0.041
950	3.630	0.9459	3.434	256	0.010	190	0.046
955	3.640	0.9460	3.444	66	0.010	191	0.068
960	3.650	0.9461	3.453	65	0.010	192	0.096
965	3.660	0.9462	3.463	257	0.010	193	0.344
970	3.670	0.9463	3.473	64	0.010	194	0.055
975	3.679	0.9464	3.482	63	0.010	195	0.053
980	3.689	0.9465	3.492	258	0.010	196	0.050
985	3.699	0.9466	3.501	62	0.010	197	0.032
990	3.709	0.9467	3.511	61	0.010	198	0.029
995	3.718	0.9468	3.520	259	0.009	199	0.027
1000	3.728	0.9469	3.530	60	0.009	200	0.026
1005	3.738	0.9470	3.539	59	0.009	201	0.025
1010	3.747	0.9471	3.549	260	0.009	202	0.024
1015	3.757	0.9472	3.558	58	0.009	203	0.023
1020	3.766	0.9472	3.568	57	0.009	204	0.022
1025	3.776	0.9473	3.577	261	0.009	205	0.017
1030	3.785	0.9474	3.586	56	0.009	206	0.016
1035	3.795	0.9475	3.596	55	0.009	207	0.015

2 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1040	3.804	0.9476	3.605	262	0.009	208	0.015
1045	3.814	0.9477	3.614	54	0.009	209	0.014
1050	3.823	0.9478	3.624	53	0.009	210	0.014
1055	3.832	0.9479	3.633	263	0.009	211	0.013
1060	3.842	0.9480	3.642	52	0.009	212	0.013
1065	3.851	0.9481	3.651	51	0.009	213	0.013
1070	3.860	0.9482	3.660	264	0.009	214	0.012
1075	3.870	0.9483	3.670	50	0.009	215	0.012
1080	3.879	0.9484	3.679	49	0.009	216	0.012
1085	3.888	0.9485	3.688	265	0.009	217	0.015
1090	3.897	0.9486	3.697	48	0.009	218	0.015
1095	3.907	0.9487	3.706	47	0.009	219	0.014
1100	3.916	0.9488	3.715	266	0.009	220	0.014
1105	3.925	0.9489	3.724	46	0.009	221	0.014
1110	3.934	0.9490	3.733	45	0.009	222	0.014
1115	3.943	0.9491	3.743	267	0.009	223	0.013
1120	3.952	0.9492	3.752	44	0.009	224	0.013
1125	3.962	0.9493	3.761	43	0.009	225	0.013
1130	3.971	0.9494	3.770	268	0.009	226	0.013
1135	3.980	0.9495	3.779	42	0.009	227	0.013
1140	3.989	0.9495	3.788	41	0.009	228	0.013
1145	3.998	0.9496	3.796	269	0.009	229	0.012
1150	4.007	0.9497	3.805	40	0.009	230	0.012
1155	4.016	0.9498	3.814	39	0.009	231	0.012
1160	4.025	0.9499	3.823	270	0.009	232	0.012
1165	4.034	0.9500	3.832	38	0.009	233	0.012
1170	4.043	0.9501	3.841	37	0.009	234	0.012
1175	4.052	0.9502	3.850	271	0.009	235	0.012
1180	4.060	0.9503	3.859	36	0.009	236	0.011
1185	4.069	0.9504	3.868	35	0.009	237	0.011
1190	4.078	0.9505	3.876	272	0.009	238	0.011
1195	4.087	0.9506	3.885	34	0.009	239	0.011
1200	4.096	0.9507	3.894	33	0.009	240	0.011
1205	4.105	0.9508	3.903	273	0.009	241	0.011
1210	4.113	0.9509	3.911	32	0.009	242	0.011
1215	4.122	0.9510	3.920	31	0.009	243	0.011
1220	4.131	0.9511	3.929	274	0.009	244	0.011
1225	4.140	0.9512	3.938	30	0.009	245	0.011
1230	4.148	0.9513	3.946	29	0.009	246	0.010
1235	4.157	0.9514	3.955	275	0.009	247	0.010
1240	4.166	0.9515	3.964	28	0.009	248	0.010
1245	4.174	0.9516	3.972	27	0.009	249	0.010
1250	4.183	0.9517	3.981	276	0.009	250	0.010
1255	4.192	0.9518	3.989	26	0.009	251	0.010
1260	4.200	0.9518	3.998	25	0.009	252	0.010
1265	4.209	0.9519	4.007	277	0.009	253	0.010
1270	4.217	0.9520	4.015	24	0.009	254	0.010
1275	4.226	0.9521	4.024	23	0.009	255	0.010
1280	4.235	0.9522	4.032	278	0.009	256	0.010
1285	4.243	0.9523	4.041	22	0.009	257	0.010
1290	4.252	0.9524	4.049	21	0.009	258	0.010
1295	4.260	0.9525	4.058	279	0.009	259	0.009

2 Year Nested Storm Distribution for Sweetwater River

Time (minutes)	Cumulative Rainfall Depth P [1] (inches)	Rainfall Depth-Area Adjustment Ratio [2]	Cumulative Adjusted Rainfall Depth [3]	Unsorted		Sorted [6]	
				Ordinate Number [4]	Incremental Rainfall (inches) [5]	Ordinate Number	Incremental Rainfall (inches)
1300	4.269	0.9526	4.066	20	0.008	260	0.009
1305	4.277	0.9527	4.075	19	0.008	261	0.009
1310	4.285	0.9528	4.083	280	0.008	262	0.009
1315	4.294	0.9529	4.092	18	0.008	263	0.009
1320	4.302	0.9530	4.100	17	0.008	264	0.009
1325	4.311	0.9531	4.109	281	0.008	265	0.009
1330	4.319	0.9532	4.117	16	0.008	266	0.009
1335	4.328	0.9533	4.125	15	0.008	267	0.009
1340	4.336	0.9534	4.134	282	0.008	268	0.009
1345	4.344	0.9535	4.142	14	0.008	269	0.009
1350	4.353	0.9536	4.150	13	0.008	270	0.009
1355	4.361	0.9537	4.159	283	0.008	271	0.009
1360	4.369	0.9538	4.167	12	0.008	272	0.009
1365	4.377	0.9539	4.175	11	0.008	273	0.009
1370	4.386	0.9540	4.184	284	0.008	274	0.009
1375	4.394	0.9541	4.192	10	0.008	275	0.009
1380	4.402	0.9541	4.200	9	0.008	276	0.009
1385	4.410	0.9542	4.209	285	0.008	277	0.009
1390	4.419	0.9543	4.217	8	0.008	278	0.009
1395	4.427	0.9544	4.225	7	0.008	279	0.009
1400	4.435	0.9545	4.233	286	0.008	280	0.008
1405	4.443	0.9546	4.242	6	0.008	281	0.008
1410	4.451	0.9547	4.250	5	0.008	282	0.008
1415	4.460	0.9548	4.258	287	0.008	283	0.008
1420	4.468	0.9549	4.266	4	0.008	284	0.008
1425	4.476	0.9550	4.274	3	0.008	285	0.008
1430	4.484	0.9551	4.283	288	0.008	286	0.008
1435	4.492	0.9552	4.291	2	0.008	287	0.008
1440	4.500	**0.9553**	4.299	1	0.008	288	0.008

Notes for Nested Storm Distribution

Notes

1. Cumulative Rainfall Depths for durations between 0 and 6 hours are determined per Equations 4-25 and 4-26 of the 2003 SDCHM. Cumulative Rainfall Depths for durations between 6 and 24 hours are interpolated using log-log interpolation.

Eq 4-25: $I = 7.44\ p_6\ D^{-0.645}$ (0-6 hr durations)

Eq 4-26: $P = I\ (D/60)$ (0-6 hr durations)

Eq X-XX $P = C\ D^{M}$ (6-24 hr durations)

Where $C = p_{6adj}/360^{M}$

D = Time in minutes

$M = \ln(p_{6adj}/p_{24})/(\ln(360) - \ln(1440))$

2. Rainfall Depth-Area Adjustment Ratios are determined per linear interpolation between the values provided in Table 4-1 of the 2003 SDCHM.

3. Cumulative Adjusted Rainfall Depth is the Cumulative Rainfall Depth multiplied by the Rainfall Depth-Area Adjustment Ratio.

4. Ordinate Numbers provided by County of San Diego

5. Incremental Rainfall represents the difference in Cumulative Adjusted Rainfall Depths between consecutive rainfall ordinates.

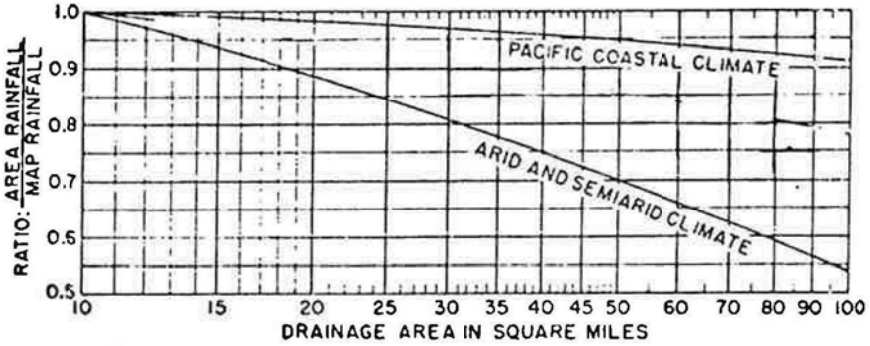
6. Sorted Incremental Rainfall values are sorted by the Ordinate Numbers.

This page is intentionally left blank to facilitate 2-sided printing.

Appendix C.11

1993 vs 2003 San Diego County Hydrology Manual

This page is intentionally left blank to facilitate 2-sided printing.

1993 SDCHM (Used for Type 1 and Type B Storm Distributions)	2003 SDCHM (Used for the Nested Storm Distribution)
Adjusting Rainfall Depths • Interpolated rainfall depths from Isopluvial maps in Appendix B of the 2003 Manual o *The 2003 Isopluvial Maps were used as they can be read more clearly.* • Adjusted rainfall depths based on watershed area have been visually determined per the adjustment factors illustrated in Figure II-B-2(a) of the 1993 Manual. Adjustment factors determined from this figure were found to correspond with the 24-Hour tabulated adjustment factors provided in Table 4-1 of the 2003 Manual.  (a) RAINFALL RATIOS FOR DRAINAGE AREAS OF 10 TO 100 SQUARE MILES	**Adjusting Rainfall Depths** • Interpolated rainfall depths from Isopluvial Maps in Appendix B of the 2003 Manual. • Adjusted rainfall depths based on watershed area and storm duration with values from Table 4-1 as described in Section 4.3.2 of the 2003 Manual. **Table 4-1** **RAINFALL DEPTH-AREA ADJUSTMENT DATA POINTS** | Watershed Area (square miles)	Rainfall Depth-Area Adjustment for Duration				
---	---	---	---	---	---
	30-Minute	1-Hour	3-Hour	6-Hour	24-Hour
0	1.000	1.000	1.000	1.000	1.000
5	0.942	0.970	0.980	0.985	0.990
10	0.900	0.947	0.970	0.980	0.985
20	0.834	0.900	0.952	0.963	0.975
30	0.768	0.858	0.932	0.950	0.964
40	0.730	0.830	0.915	0.940	0.958
50	0.692	0.800	0.900	0.928	0.952
60	0.663	0.778	0.883	0.920	0.948
70	0.645	0.760	0.872	0.912	0.945
80	0.630	0.746	0.862	0.904	0.942
90	0.620	0.735	0.853	0.896	0.938
100	0.610	0.722	0.845	0.890	0.935
125	0.588	0.700	0.830	0.878	0.930
150	0.572	0.685	0.818	0.865	0.925
175	0.572	0.672	0.808	0.858	0.922
200	0.572	0.666	0.798	0.851	0.918
225	0.572	0.660	0.790	0.845	0.915
250	0.572	0.655	0.787	0.842	0.914
300	0.572	0.652	0.782	0.838	0.912
350	0.572	0.652	0.780	0.830	0.910
400	0.572	0.652	0.780	0.828	0.908	

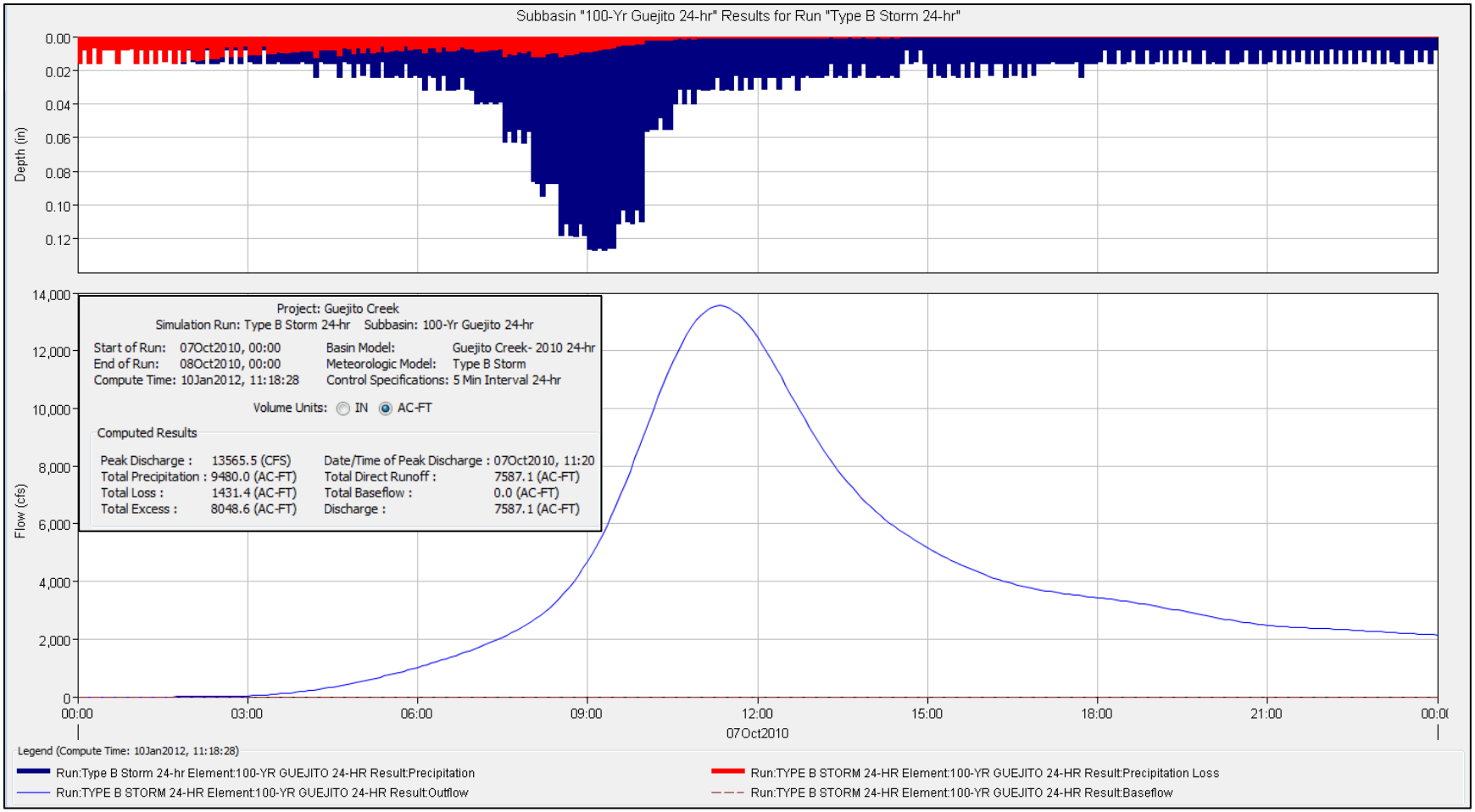
1993 SDCHM (Used for Type 1 and Type B Storm Distributions)	2003 SDCHM (Used for the Nested Storm Distribution)
Adjusting CN Values • Determined unadjusted CN values per Table 4-2 of 2003 Manual. • Determined CN_1, CN_2, CN_3 values per Table 4-10 of the 2003 Manual. o *CN adjustment values between Table I-A-5 of the 1993 Manual and Table 4-10 of the 2003 Manual are almost identical. The CN adjustment values related to CN_2 equal to 55 and 56 are slightly different; however, this has no effect on the results herein.* • Interpolated PZN values for basins per PZN Map in Appendix C of the 2003 Manual. o *PZN Maps for 1993 and 2003 SDCHM are identical.* • Interpolated PZN Adjustment Factor per Table 4-6 of the 2003 Manual. o *PZN Adjustment Factors from 1993 and 2003 manuals are identical.* • Interpolated Adjusted CN per Table 4-10 of the 2003 Manual.	**Adjusting CN Values** • Determined unadjusted CN values per Table 4-2 of 2003 Manual. • Determined CN_1, CN_2, CN_3 values per Table 4-10 of the 2003 Manual. • Interpolated PZN value for basins per PZN Map in Appendix C of the 2003 Manual. • Interpolated PZN Adjustment Factor per Table 4-6 of the 2003 Manual. • Interpolated Adjusted CN per Table 4-10 of the 2003 Manual.

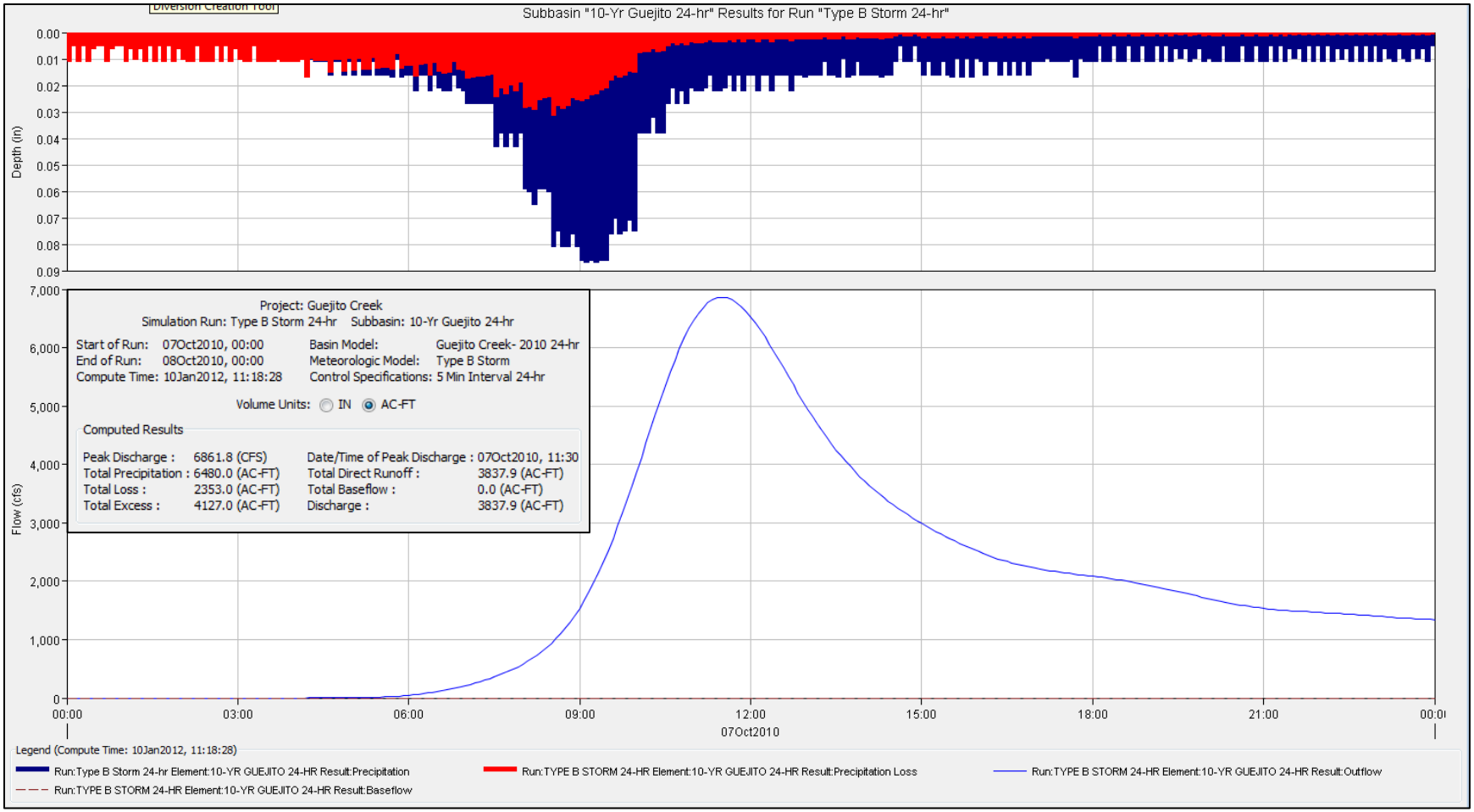
Appendix C.12

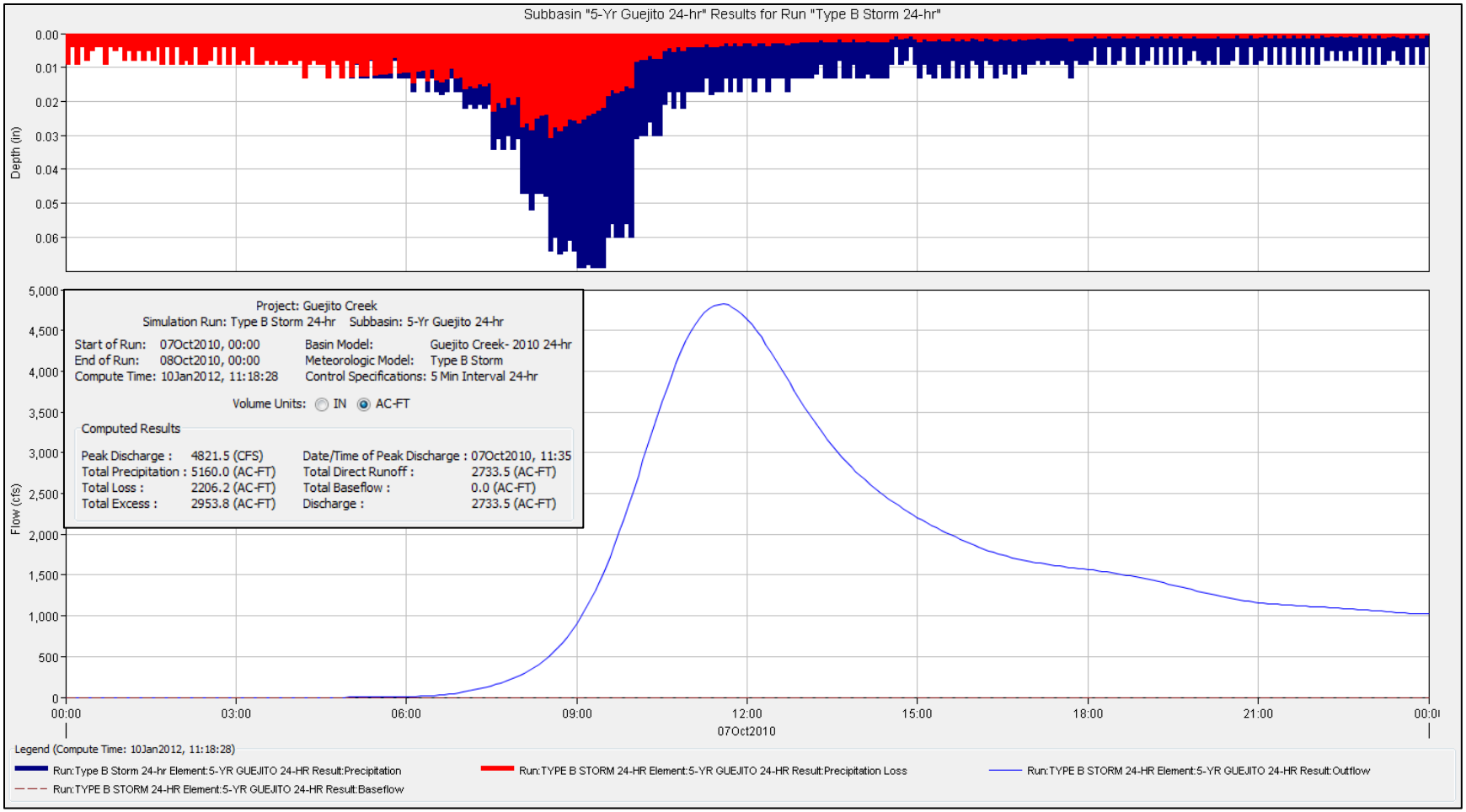
HEC-HMS Outputs

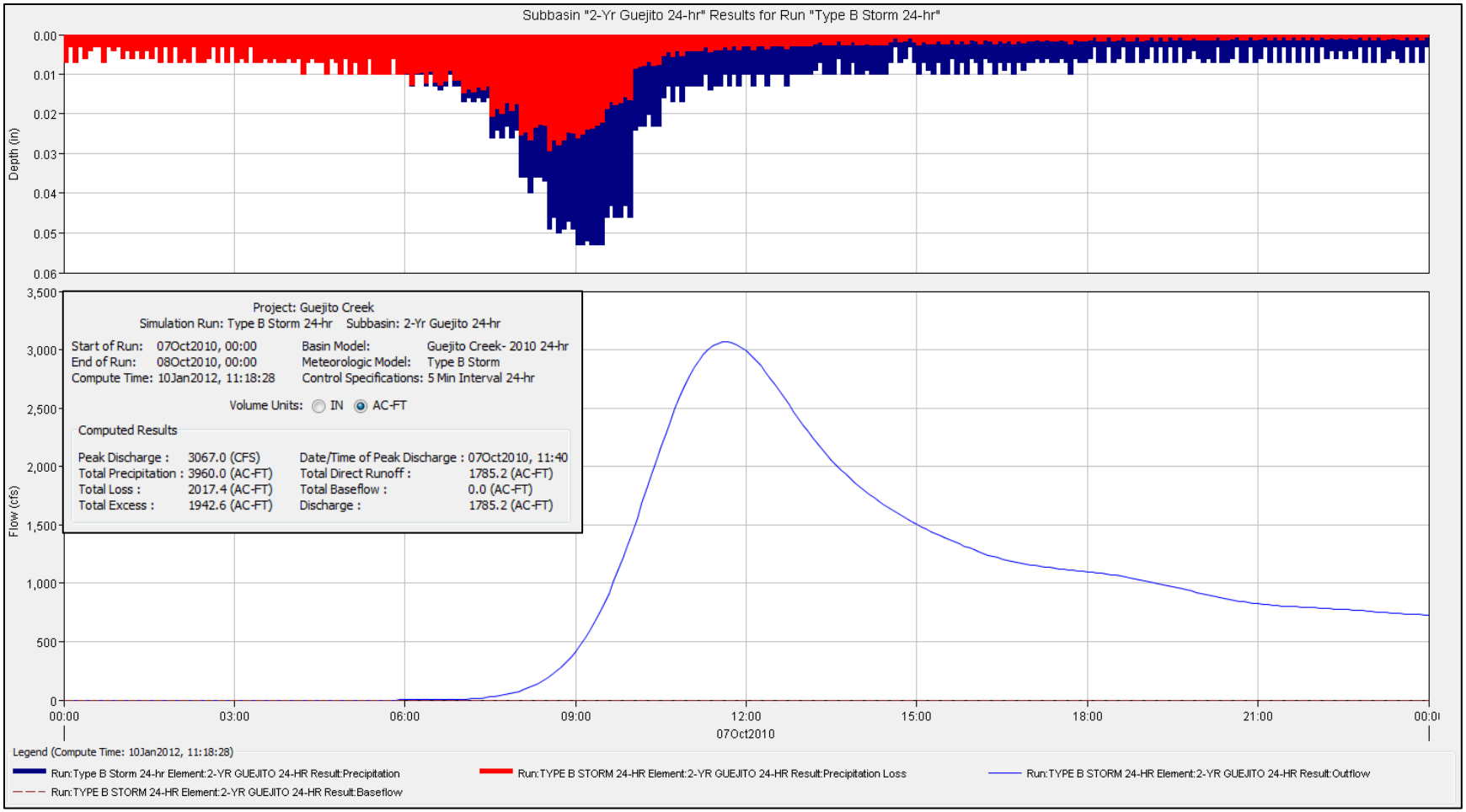
This page is intentionally left blank to facilitate 2-sided printing.

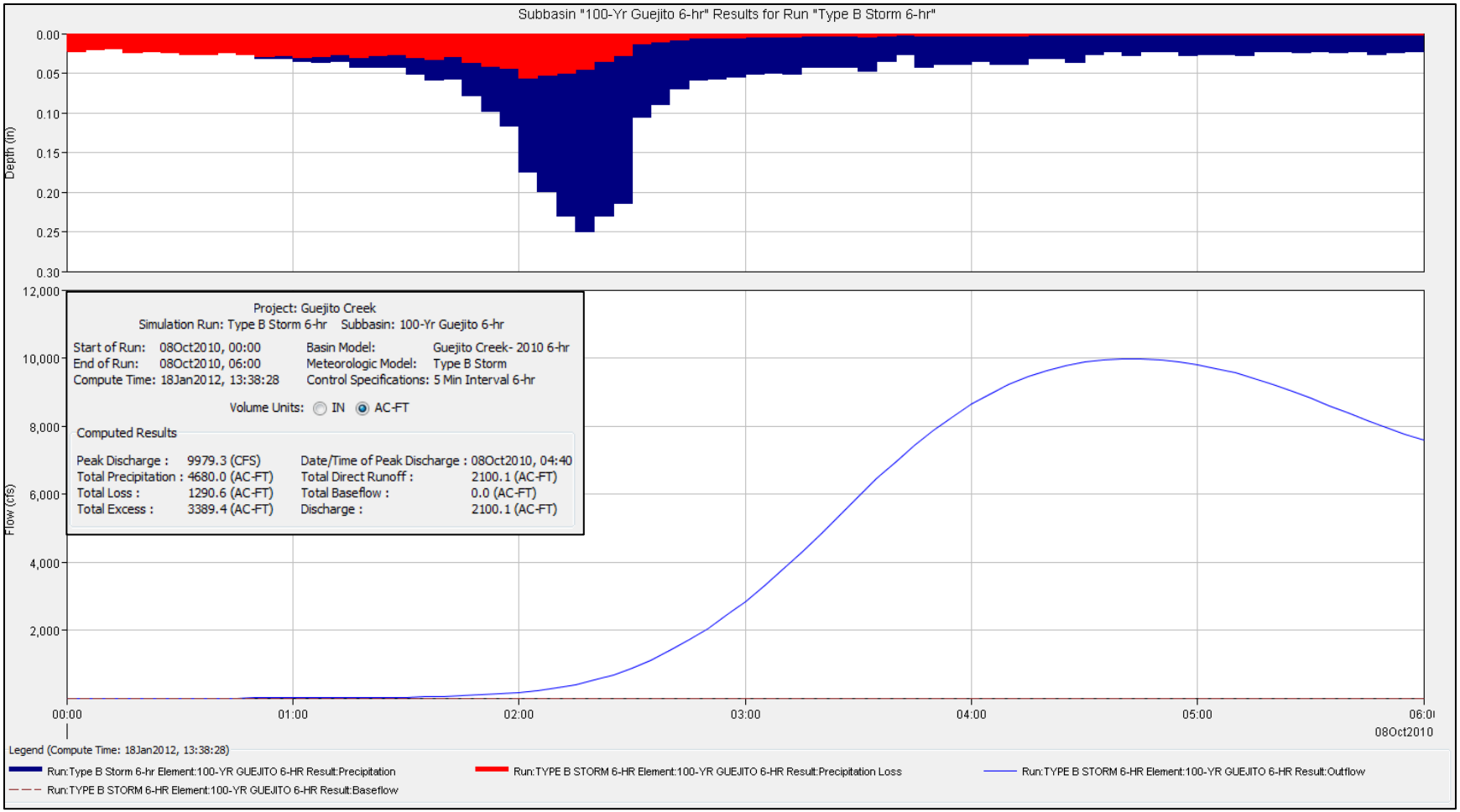
Guejito Creek HEC-HMS Outputs

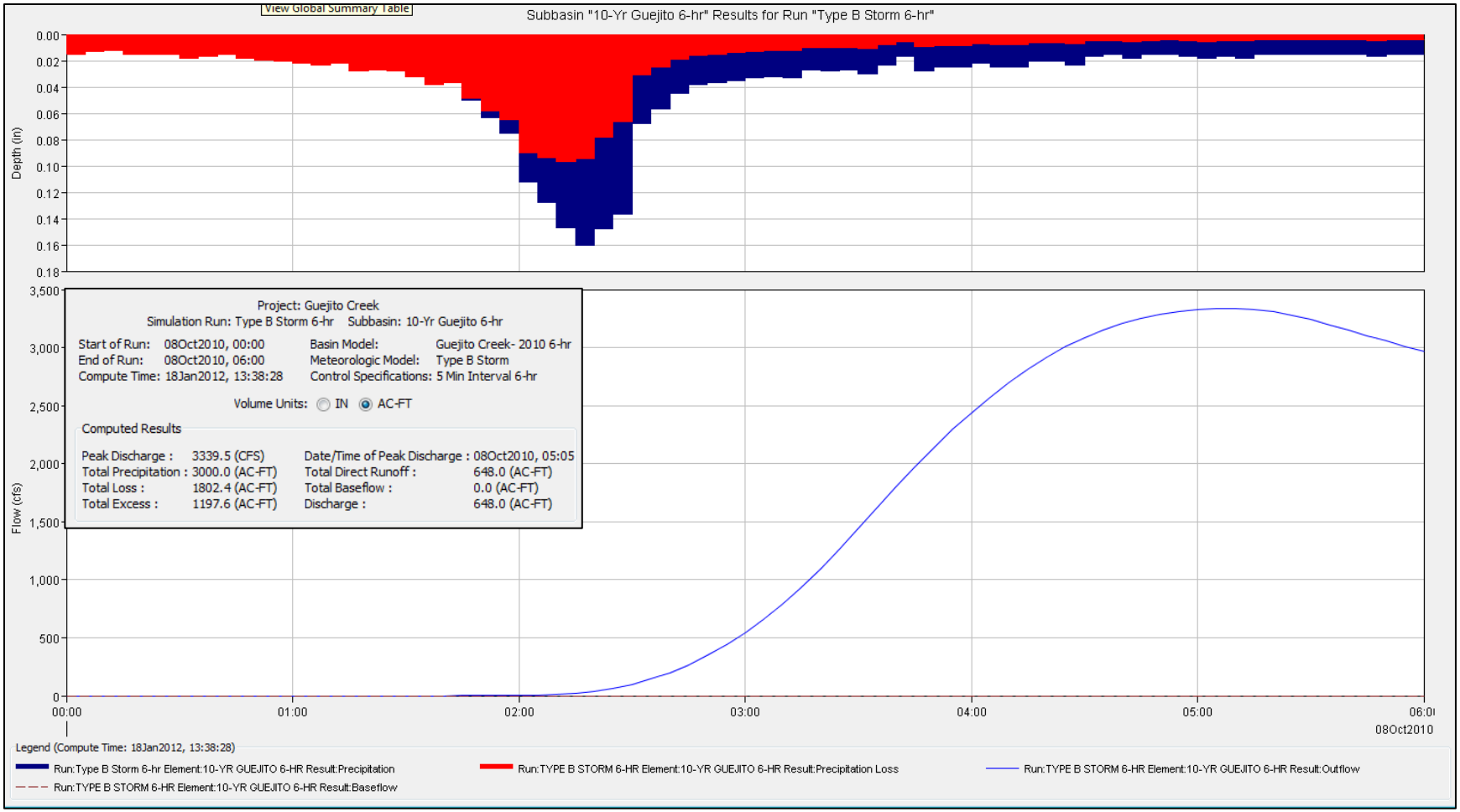

Subbasin "100-Yr Guejito 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Flow (cfs)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Project: Guejito Creek
Simulation Run: Type B Storm 24-hr Subbasin: 100-Yr Guejito 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:18:28
Basin Model: Guejito Creek- 2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 13565.5 (CFS)
Total Precipitation : 9480.0 (AC-FT)
Total Loss : 1431.4 (AC-FT)
Total Excess : 8048.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 11:20
Total Direct Runoff : 7587.1 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 7587.1 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
07Oct2010
Legend (Compute Time: 10Jan2012, 11:18:28)
Run:Type B Storm 24-hr Element:100-YR GUEJITO 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:100-YR GUEJITO 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:100-YR GUEJITO 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:100-YR GUEJITO 24-HR Result:Baseflow

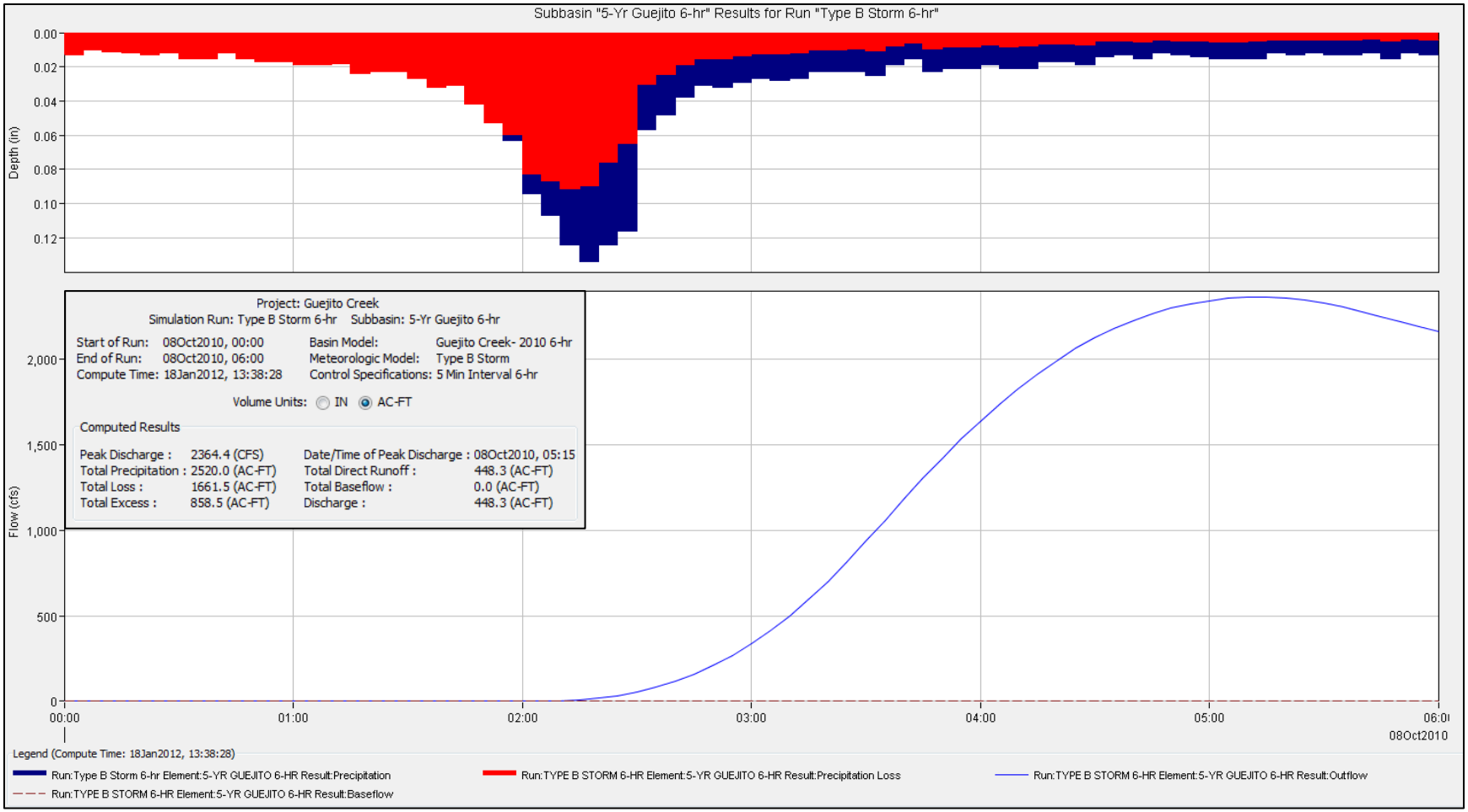

Diversion Creation Tool
Subbasin "10-Yr Guejito 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
Flow (cfs)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Project: Guejito Creek
Simulation Run: Type B Storm 24-hr Subbasin: 10-Yr Guejito 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:18:28
Basin Model: Guejito Creek- 2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 6861.8 (CFS)
Total Precipitation : 6480.0 (AC-FT)
Total Loss : 2353.0 (AC-FT)
Total Excess : 4127.0 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 11:30
Total Direct Runoff : 3837.9 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 3837.9 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Legend (Compute Time: 10Jan2012, 11:18:28)
Run:Type B Storm 24-hr Element:10-YR GUEJITO 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:10-YR GUEJITO 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:10-YR GUEJITO 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:10-YR GUEJITO 24-HR Result:Baseflow

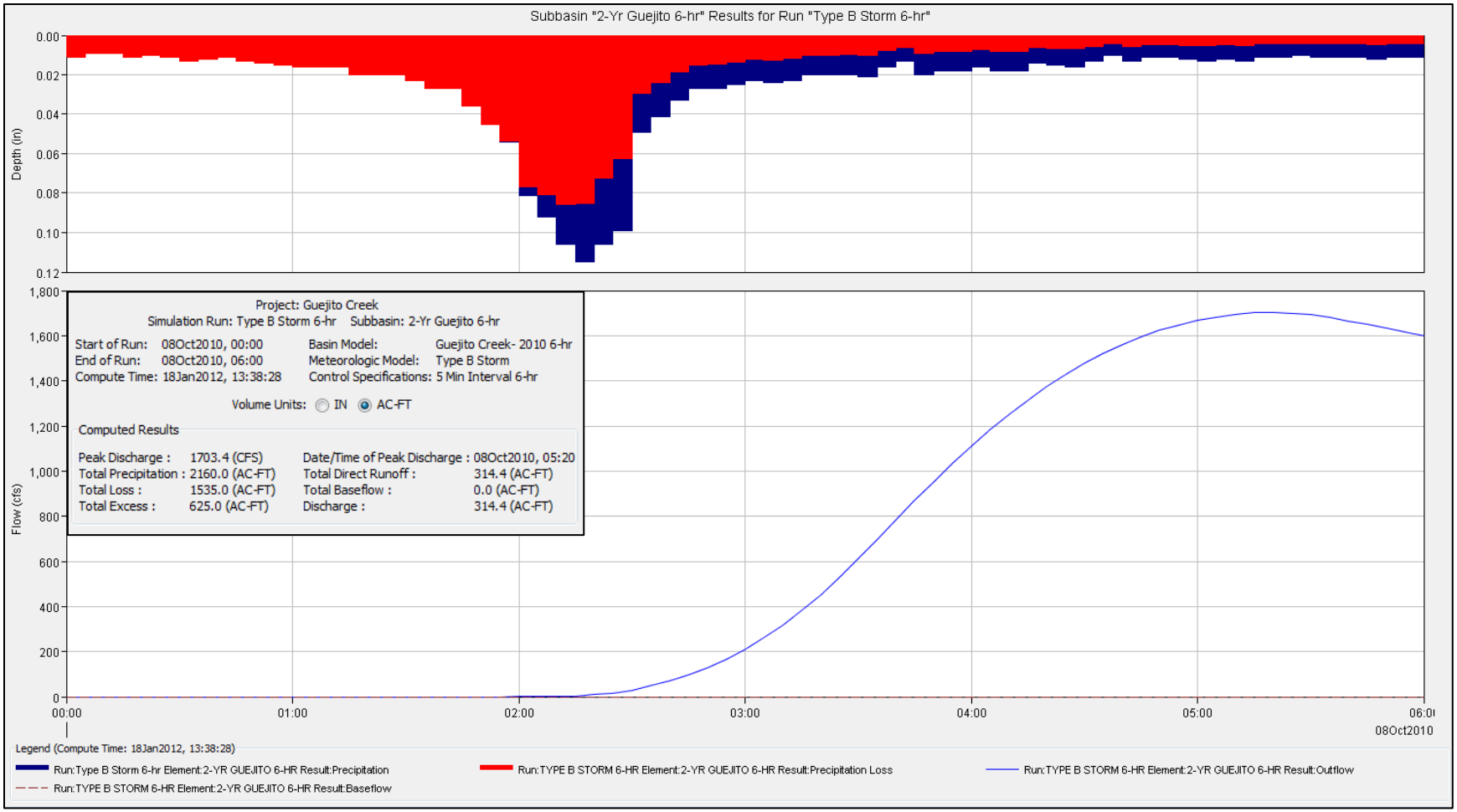

Subbasin "5-Yr Guejito 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
Flow (cfs)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Project: Guejito Creek
Simulation Run: Type B Storm 24-hr Subbasin: 5-Yr Guejito 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:18:28
Basin Model: Guejito Creek- 2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 4821.5 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 11:35
Total Precipitation : 5160.0 (AC-FT)
Total Direct Runoff : 2733.5 (AC-FT)
Total Loss : 2206.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 2953.8 (AC-FT)
Discharge : 2733.5 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Legend (Compute Time: 10Jan2012, 11:18:28)
Run:Type B Storm 24-hr Element:5-YR GUEJITO 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:5-YR GUEJITO 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:5-YR GUEJITO 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:5-YR GUEJITO 24-HR Result:Baseflow

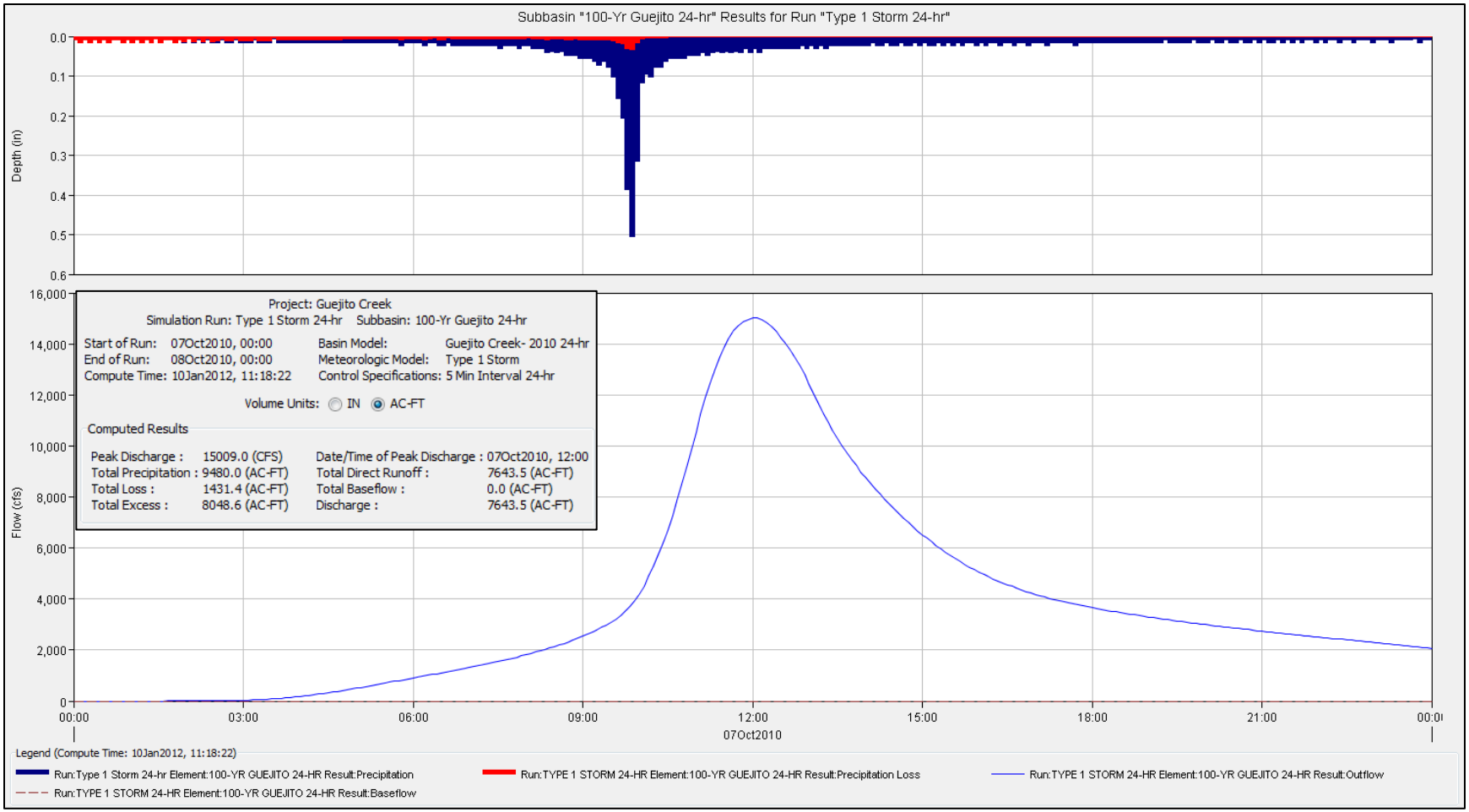

Subbasin "2-Yr Guejito 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
Flow (cfs)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Project: Guejito Creek
Simulation Run: Type B Storm 24-hr Subbasin: 2-Yr Guejito 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:18:28
Basin Model: Guejito Creek- 2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 3067.0 (CFS)
Total Precipitation : 3960.0 (AC-FT)
Total Loss : 2017.4 (AC-FT)
Total Excess : 1942.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 11:40
Total Direct Runoff : 1785.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1785.2 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Legend (Compute Time: 10Jan2012, 11:18:28)
Run:Type B Storm 24-hr Element:2-YR GUEJITO 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:2-YR GUEJITO 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:2-YR GUEJITO 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:2-YR GUEJITO 24-HR Result:Baseflow

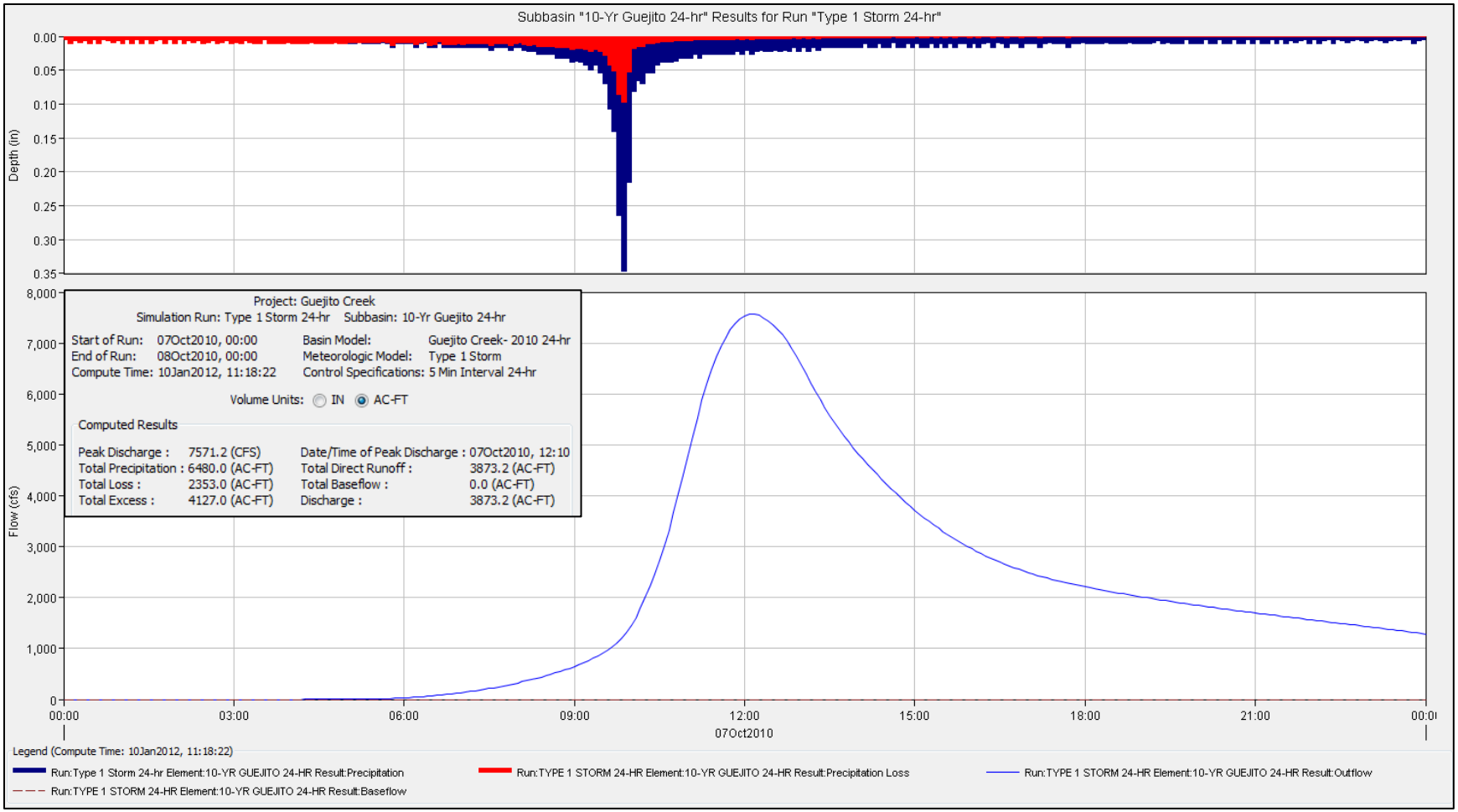

Subbasin "100-Yr Guejito 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Flow (cfs)
12,000
10,000
8,000
6,000
4,000
2,000
Project: Guejito Creek
Simulation Run: Type B Storm 6-hr Subbasin: 100-Yr Guejito 6-hr
Start of Run: 08Oct2010, 00:00
End of Run: 08Oct2010, 06:00
Compute Time: 18Jan2012, 13:38:28
Basin Model: Guejito Creek- 2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 9979.3 (CFS)
Total Precipitation : 4680.0 (AC-FT)
Total Loss : 1290.6 (AC-FT)
Total Excess : 3389.4 (AC-FT)
Date/Time of Peak Discharge : 08Oct2010, 04:40
Total Direct Runoff : 2100.1 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 2100.1 (AC-FT)
00:00
01:00
02:00
03:00
04:00
05:00
08Oct2010
Legend (Compute Time: 18Jan2012, 13:38:28)
Run:Type B Storm 6-hr Element:100-YR GUEJITO 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:100-YR GUEJITO 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:100-YR GUEJITO 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:100-YR GUEJITO 6-HR Result:Baseflow

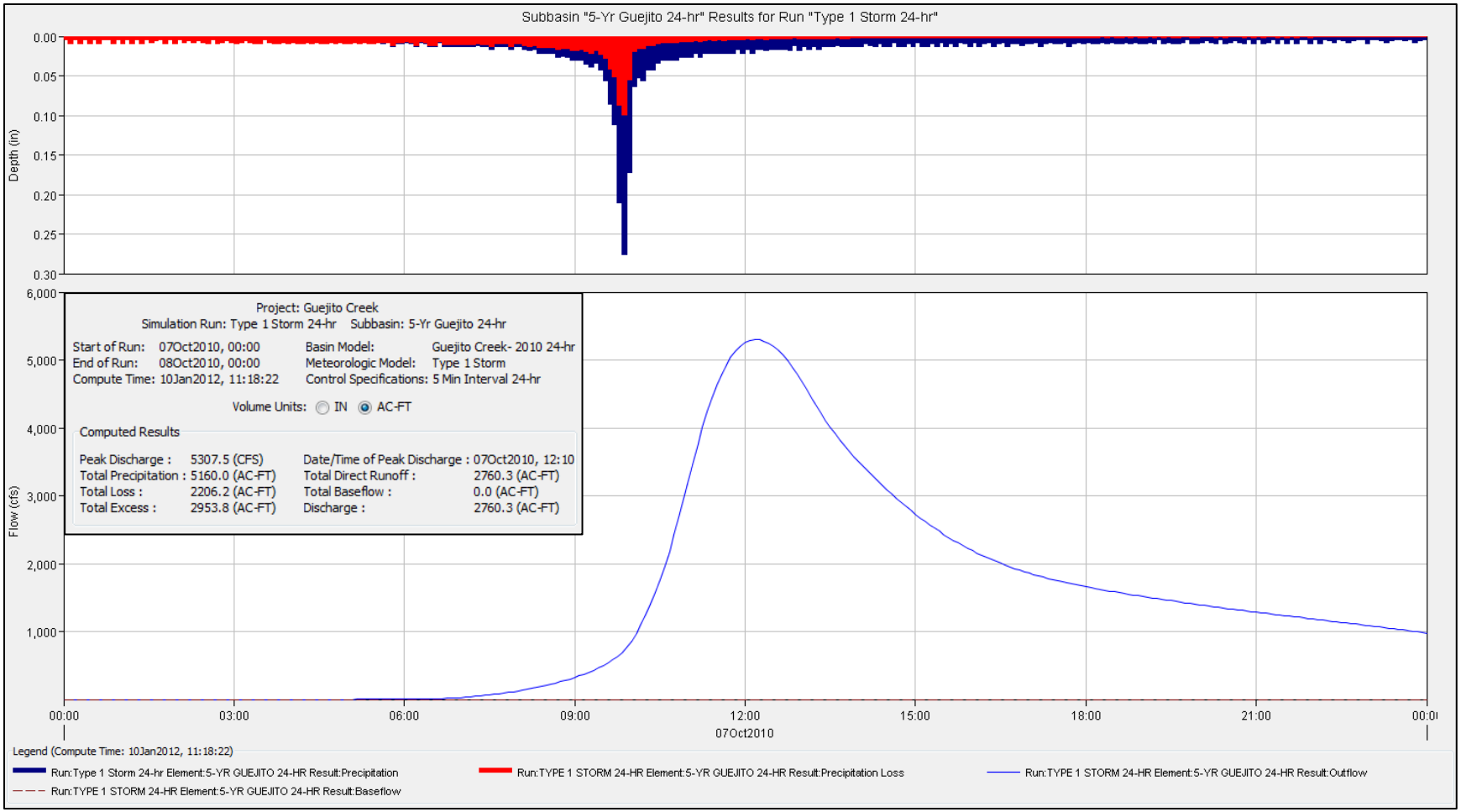

View Global Summary Table
Subbasin "10-Yr Guejito 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
Flow (cfs)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
08Oct2010
Project: Guejito Creek
Simulation Run: Type B Storm 6-hr Subbasin: 10-Yr Guejito 6-hr
Start of Run: 08Oct2010, 00:00
End of Run: 08Oct2010, 06:00
Compute Time: 18Jan2012, 13:38:28
Basin Model: Guejito Creek- 2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 3339.5 (CFS)
Total Precipitation : 3000.0 (AC-FT)
Total Loss : 1802.4 (AC-FT)
Total Excess : 1197.6 (AC-FT)
Date/Time of Peak Discharge : 08Oct2010, 05:05
Total Direct Runoff : 648.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 648.0 (AC-FT)
Legend (Compute Time: 18Jan2012, 13:38:28)
Run:Type B Storm 6-hr Element:10-YR GUEJITO 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:10-YR GUEJITO 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:10-YR GUEJITO 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:10-YR GUEJITO 6-HR Result:Baseflow

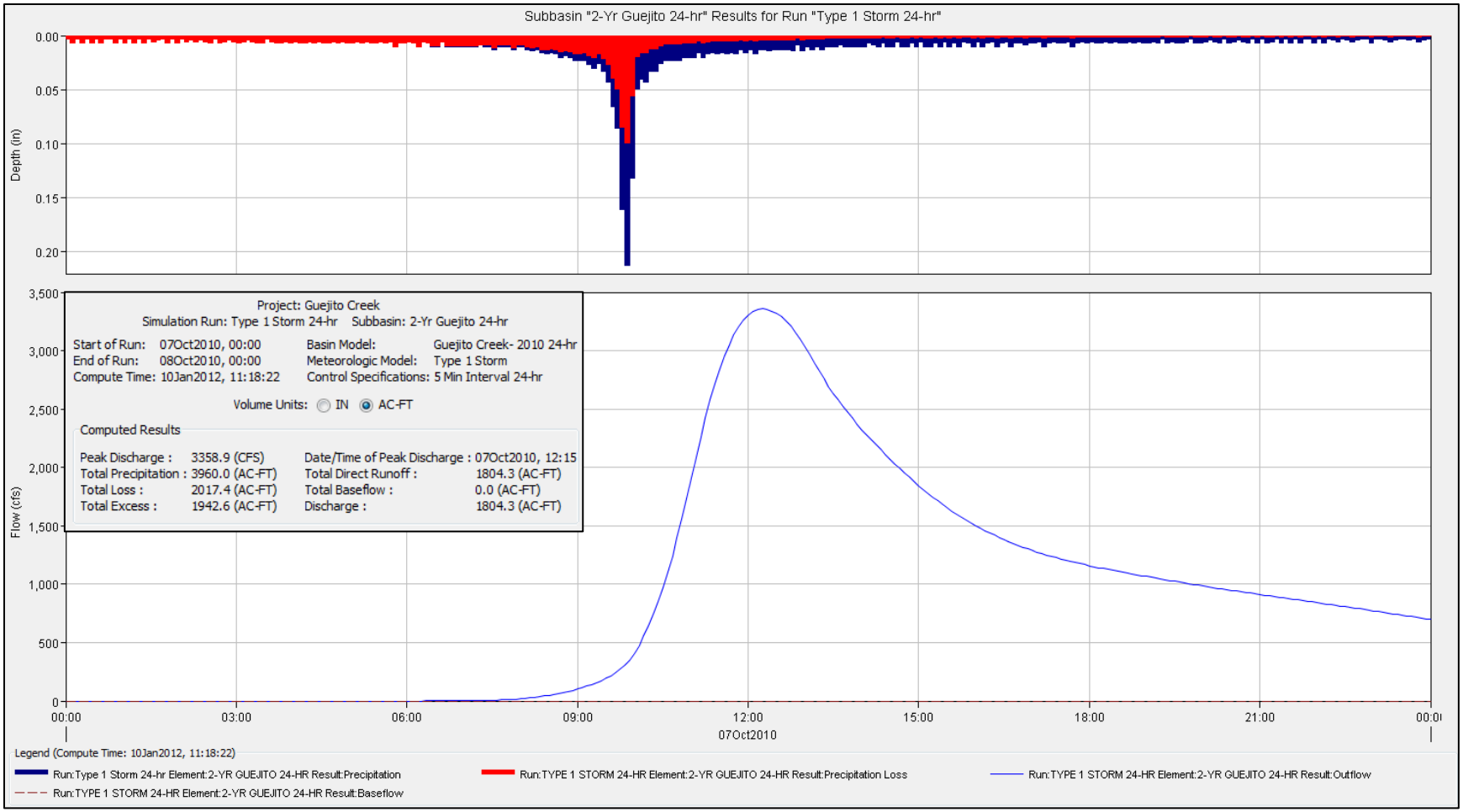

Subbasin "5-Yr Guejito 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Project: Guejito Creek
Simulation Run: Type B Storm 6-hr Subbasin: 5-Yr Guejito 6-hr
Start of Run: 08Oct2010, 00:00
End of Run: 08Oct2010, 06:00
Compute Time: 18Jan2012, 13:38:28
Basin Model: Guejito Creek- 2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2364.4 (CFS)
Total Precipitation : 2520.0 (AC-FT)
Total Loss : 1661.5 (AC-FT)
Total Excess : 858.5 (AC-FT)
Date/Time of Peak Discharge : 08Oct2010, 05:15
Total Direct Runoff : 448.3 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 448.3 (AC-FT)
Flow (cfs)
2,000
1,500
1,000
500
0
00:00
01:00
02:00
03:00
04:00
05:00
08Oct2010
Legend (Compute Time: 18Jan2012, 13:38:28)
Run:Type B Storm 6-hr Element:5-YR GUEJITO 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:5-YR GUEJITO 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:5-YR GUEJITO 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:5-YR GUEJITO 6-HR Result:Baseflow

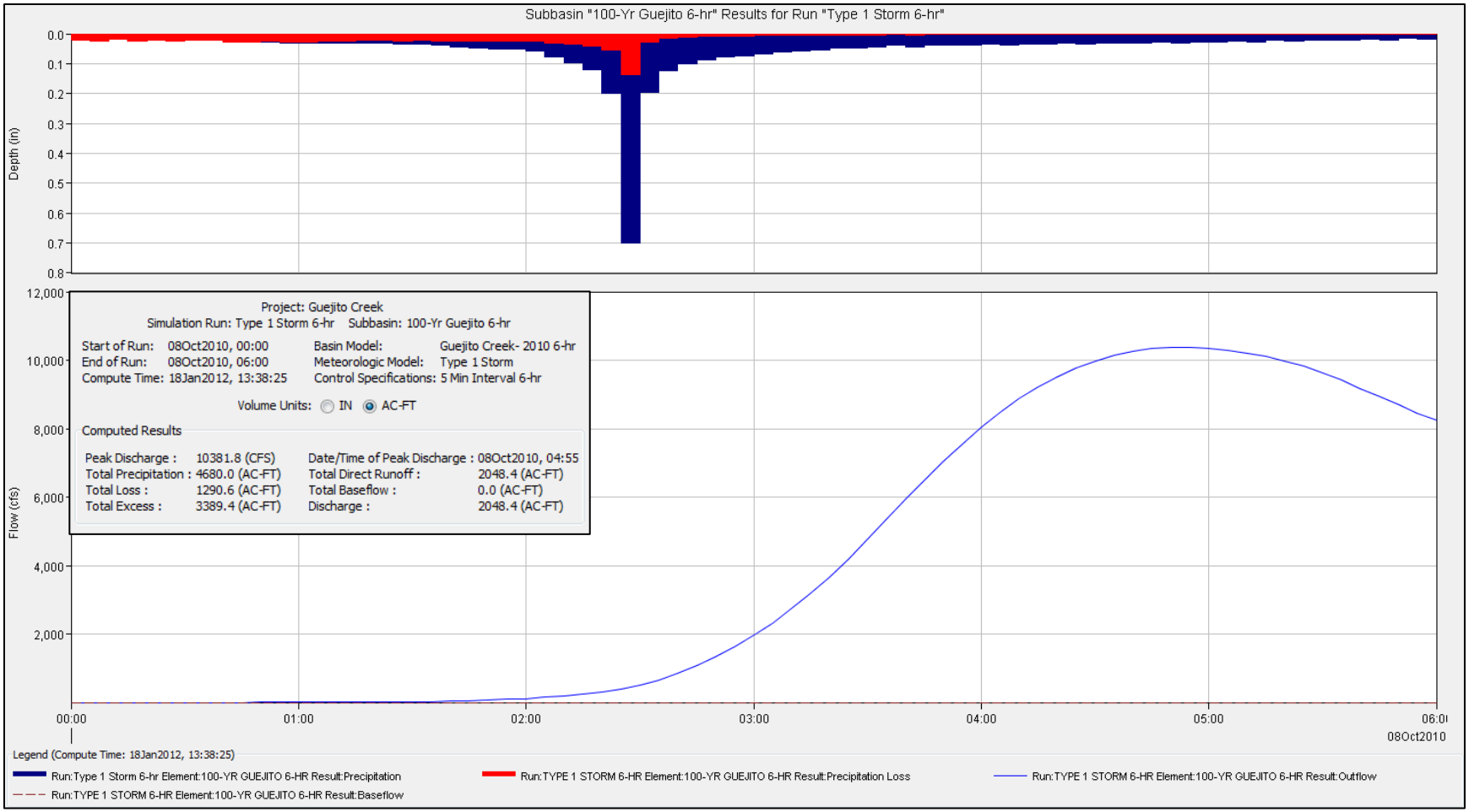

Subbasin "2-Yr Guejito 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Flow (cfs)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Project: Guejito Creek
Simulation Run: Type B Storm 6-hr Subbasin: 2-Yr Guejito 6-hr
Start of Run: 08Oct2010, 00:00
End of Run: 08Oct2010, 06:00
Compute Time: 18Jan2012, 13:38:28
Basin Model: Guejito Creek- 2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1703.4 (CFS)
Total Precipitation : 2160.0 (AC-FT)
Total Loss : 1535.0 (AC-FT)
Total Excess : 625.0 (AC-FT)
Date/Time of Peak Discharge : 08Oct2010, 05:20
Total Direct Runoff : 314.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 314.4 (AC-FT)
00:00
01:00
02:00
03:00
04:00
05:00
08Oct2010
Legend (Compute Time: 18Jan2012, 13:38:28)
Run:Type B Storm 6-hr Element:2-YR GUEJITO 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:2-YR GUEJITO 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:2-YR GUEJITO 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:2-YR GUEJITO 6-HR Result:Baseflow

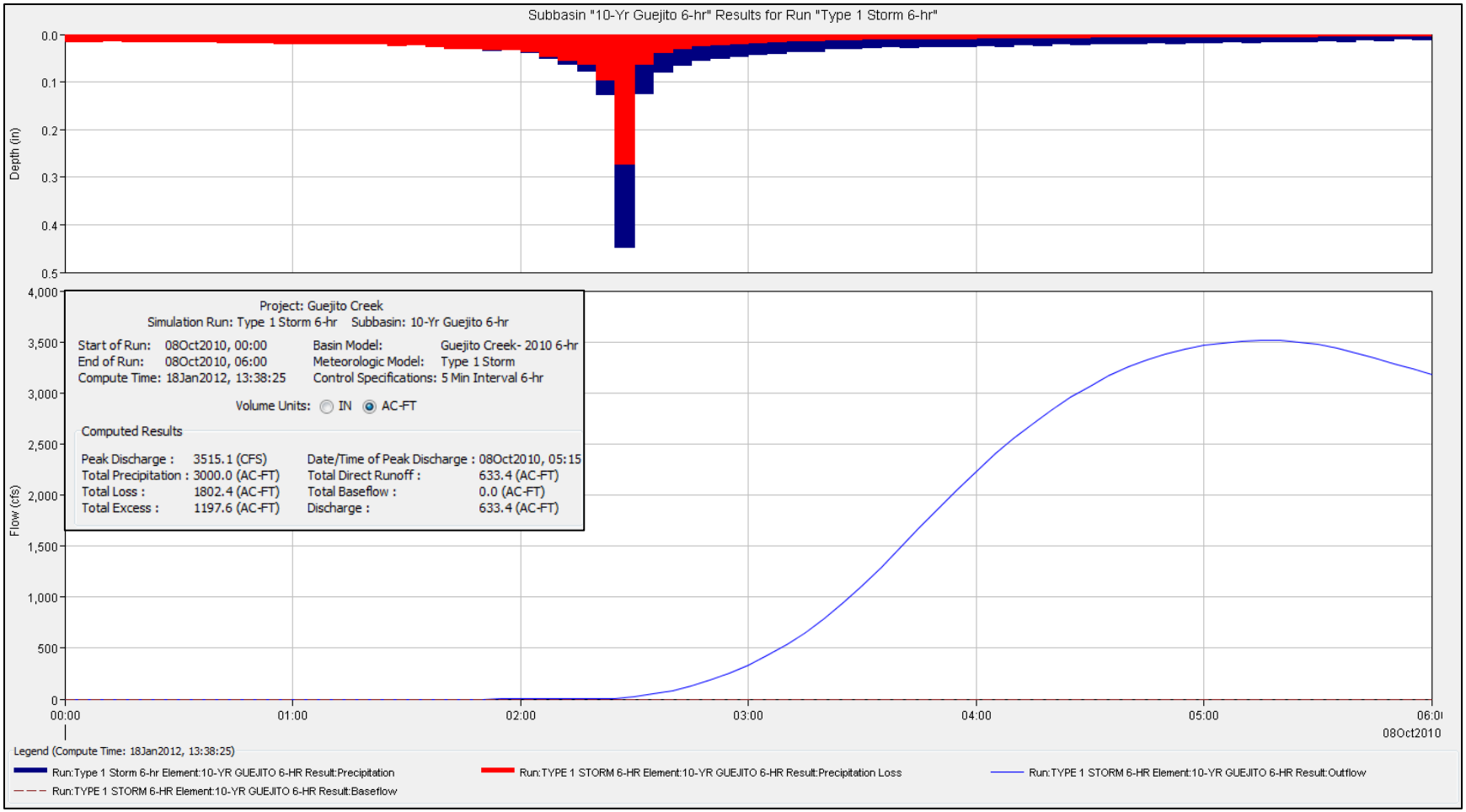

Subbasin "100-Yr Guejito 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Flow (cfs)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Project: Guejito Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 100-Yr Guejito 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:18:22
Basin Model: Guejito Creek- 2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 15009.0 (CFS)
Total Precipitation : 9480.0 (AC-FT)
Total Loss : 1431.4 (AC-FT)
Total Excess : 8048.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:00
Total Direct Runoff : 7643.5 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 7643.5 (AC-FT)
Legend (Compute Time: 10Jan2012, 11:18:22)
Run:Type 1 Storm 24-hr Element:100-YR GUEJITO 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:100-YR GUEJITO 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:100-YR GUEJITO 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:100-YR GUEJITO 24-HR Result:Baseflow

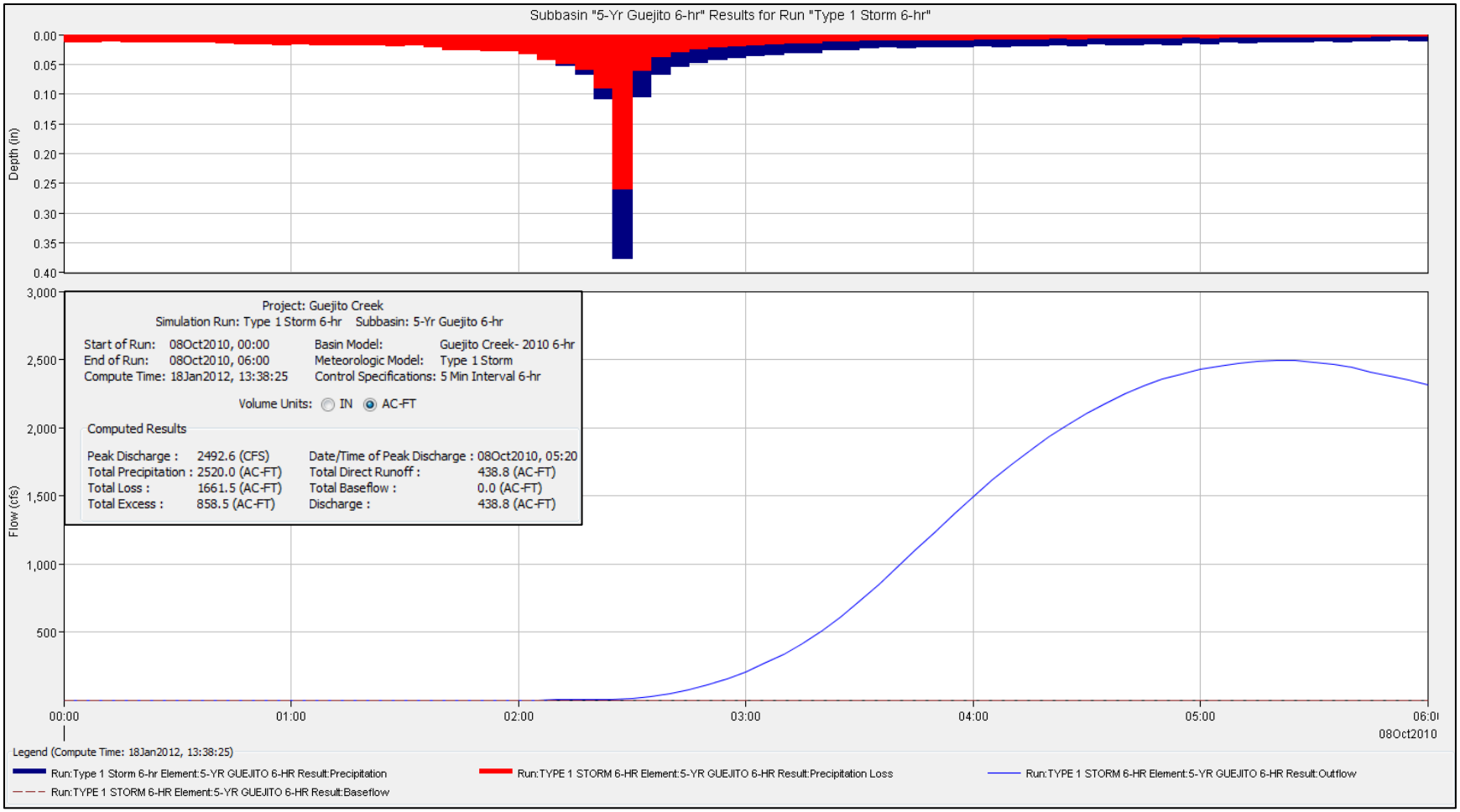

Subbasin "10-Yr Guejito 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Flow (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Project: Guejito Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 10-Yr Guejito 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:18:22
Basin Model: Guejito Creek- 2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 7571.2 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 12:10
Total Precipitation : 6480.0 (AC-FT)
Total Direct Runoff : 3873.2 (AC-FT)
Total Loss : 2353.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 4127.0 (AC-FT)
Discharge : 3873.2 (AC-FT)
Legend (Compute Time: 10Jan2012, 11:18:22)
Run:Type 1 Storm 24-hr Element:10-YR GUEJITO 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:10-YR GUEJITO 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:10-YR GUEJITO 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:10-YR GUEJITO 24-HR Result:Baseflow

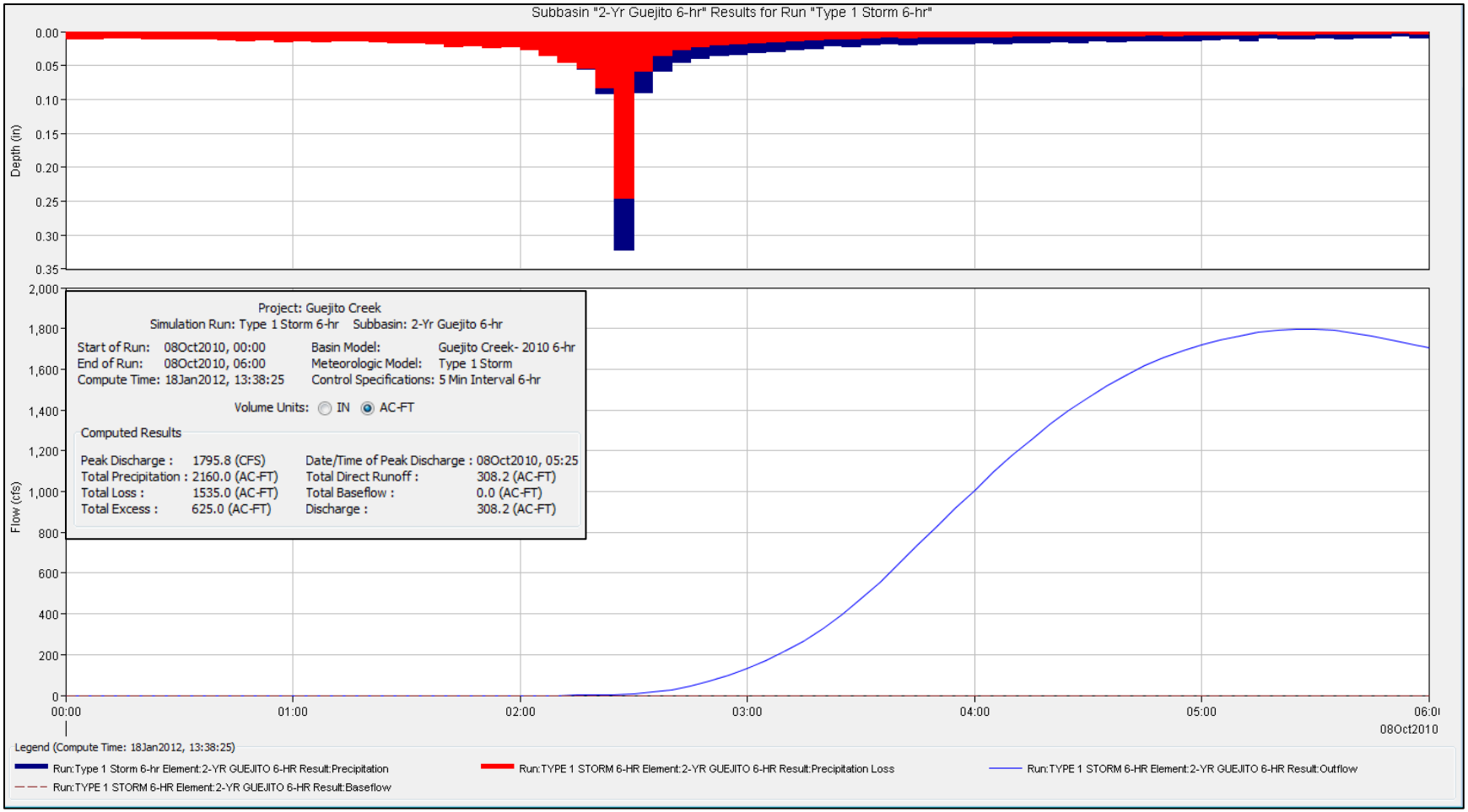

Subbasin "5-Yr Guejito 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
Project: Guejito Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 5-Yr Guejito 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:18:22
Basin Model: Guejito Creek- 2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 5307.5 (CFS)
Total Precipitation : 5160.0 (AC-FT)
Total Loss : 2206.2 (AC-FT)
Total Excess : 2953.8 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:10
Total Direct Runoff : 2760.3 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 2760.3 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Legend (Compute Time: 10Jan2012, 11:18:22)
Run:Type 1 Storm 24-hr Element:5-YR GUEJITO 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:5-YR GUEJITO 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:5-YR GUEJITO 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:5-YR GUEJITO 24-HR Result:Baseflow

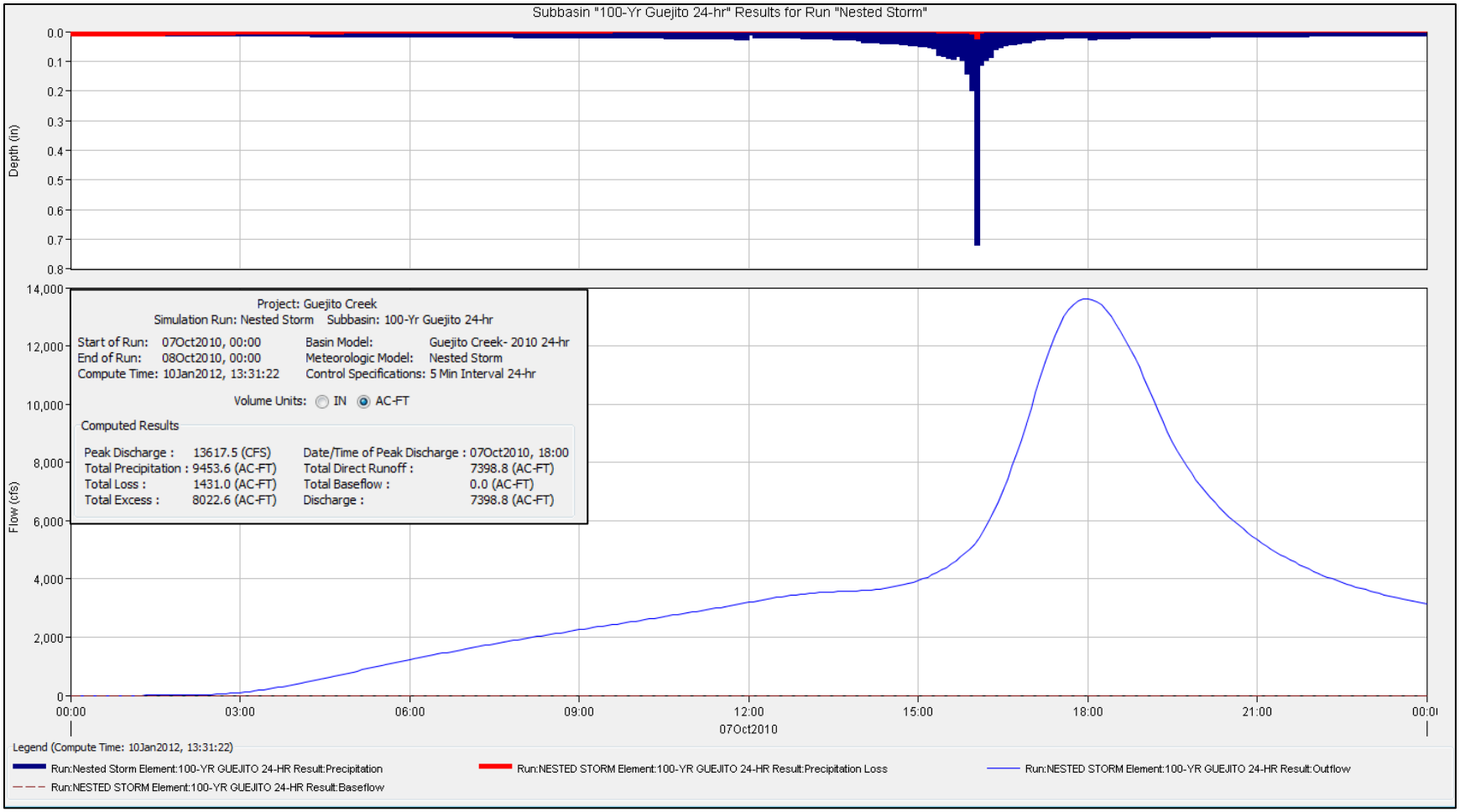

Subbasin "2-Yr Guejito 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
Flow (cfs)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Project: Guejito Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 2-Yr Guejito 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:18:22
Basin Model: Guejito Creek- 2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 3358.9 (CFS)
Total Precipitation : 3960.0 (AC-FT)
Total Loss : 2017.4 (AC-FT)
Total Excess : 1942.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:15
Total Direct Runoff : 1804.3 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1804.3 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Legend (Compute Time: 10Jan2012, 11:18:22)
Run:Type 1 Storm 24-hr Element:2-YR GUEJITO 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:2-YR GUEJITO 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:2-YR GUEJITO 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:2-YR GUEJITO 24-HR Result:Baseflow

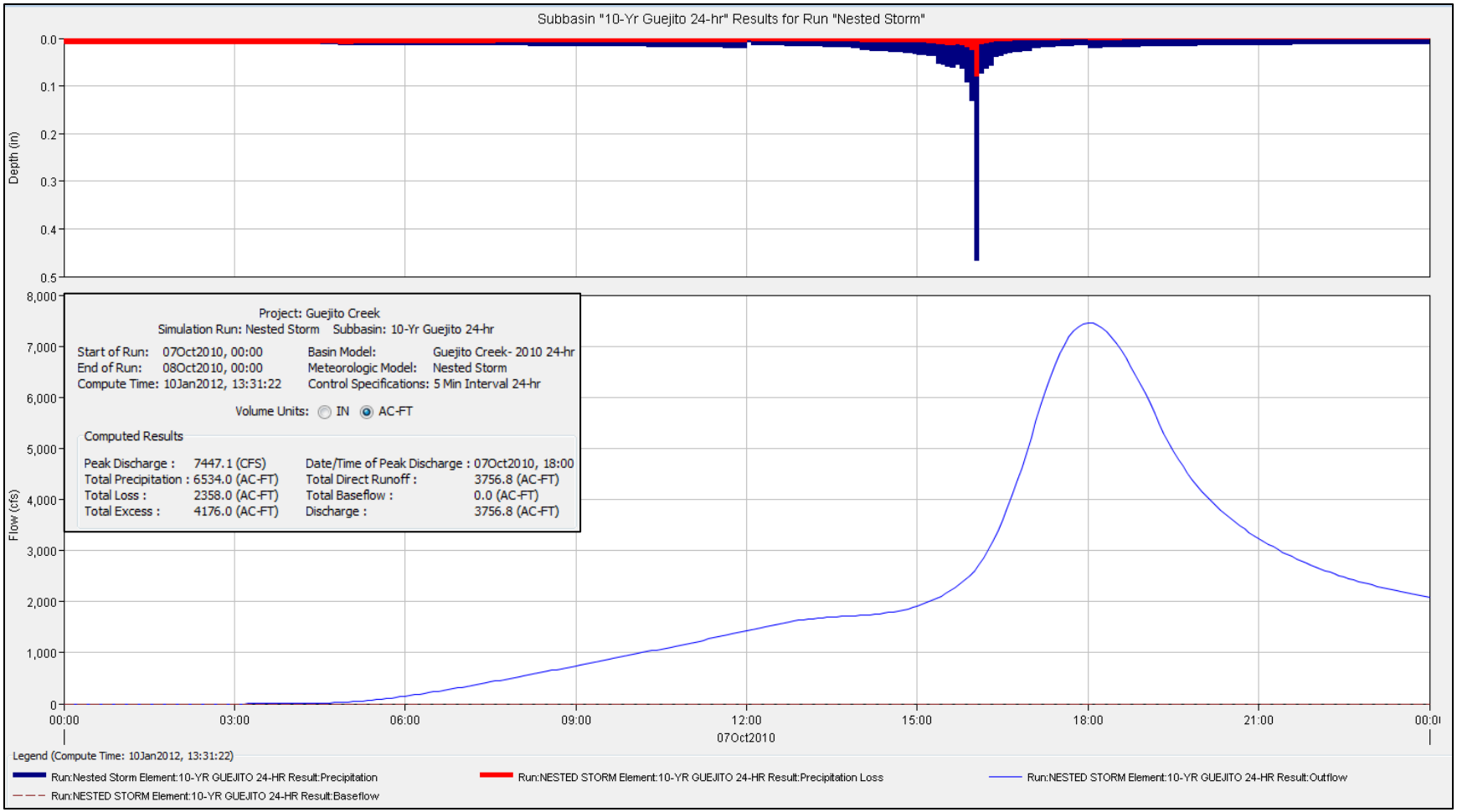

Subbasin "100-Yr Guejito 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Flow (cfs)
12,000
10,000
8,000
6,000
4,000
2,000
Project: Guejito Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 100-Yr Guejito 6-hr
Start of Run: 08Oct2010, 00:00
End of Run: 08Oct2010, 06:00
Compute Time: 18Jan2012, 13:38:25
Basin Model: Guejito Creek- 2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 10381.8 (CFS)
Total Precipitation : 4680.0 (AC-FT)
Total Loss : 1290.6 (AC-FT)
Total Excess : 3389.4 (AC-FT)
Date/Time of Peak Discharge : 08Oct2010, 04:55
Total Direct Runoff : 2048.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 2048.4 (AC-FT)
00:00
01:00
02:00
03:00
04:00
05:00
08Oct2010
Legend (Compute Time: 18Jan2012, 13:38:25)
Run:Type 1 Storm 6-hr Element:100-YR GUEJITO 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:100-YR GUEJITO 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:100-YR GUEJITO 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:100-YR GUEJITO 6-HR Result:Baseflow

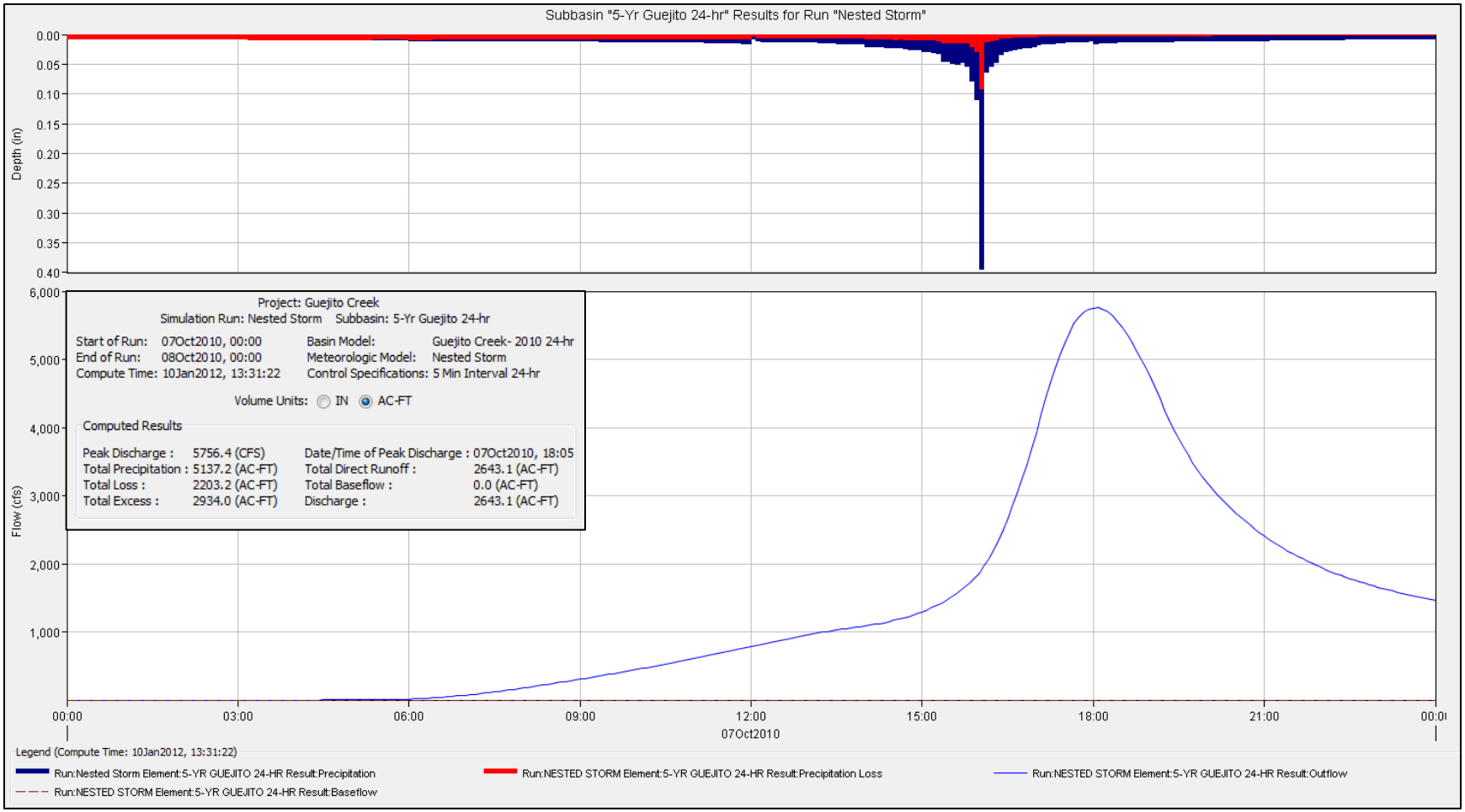

Subbasin "10-Yr Guejito 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
Flow (cfs)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
08Oct2010
Project: Guejito Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 10-Yr Guejito 6-hr
Start of Run: 08Oct2010, 00:00
End of Run: 08Oct2010, 06:00
Compute Time: 18Jan2012, 13:38:25
Basin Model: Guejito Creek- 2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 3515.1 (CFS)
Total Precipitation : 3000.0 (AC-FT)
Total Loss : 1802.4 (AC-FT)
Total Excess : 1197.6 (AC-FT)
Date/Time of Peak Discharge : 08Oct2010, 05:15
Total Direct Runoff : 633.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 633.4 (AC-FT)
Legend (Compute Time: 18Jan2012, 13:38:25)
Run:Type 1 Storm 6-hr Element:10-YR GUEJITO 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:10-YR GUEJITO 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:10-YR GUEJITO 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:10-YR GUEJITO 6-HR Result:Baseflow

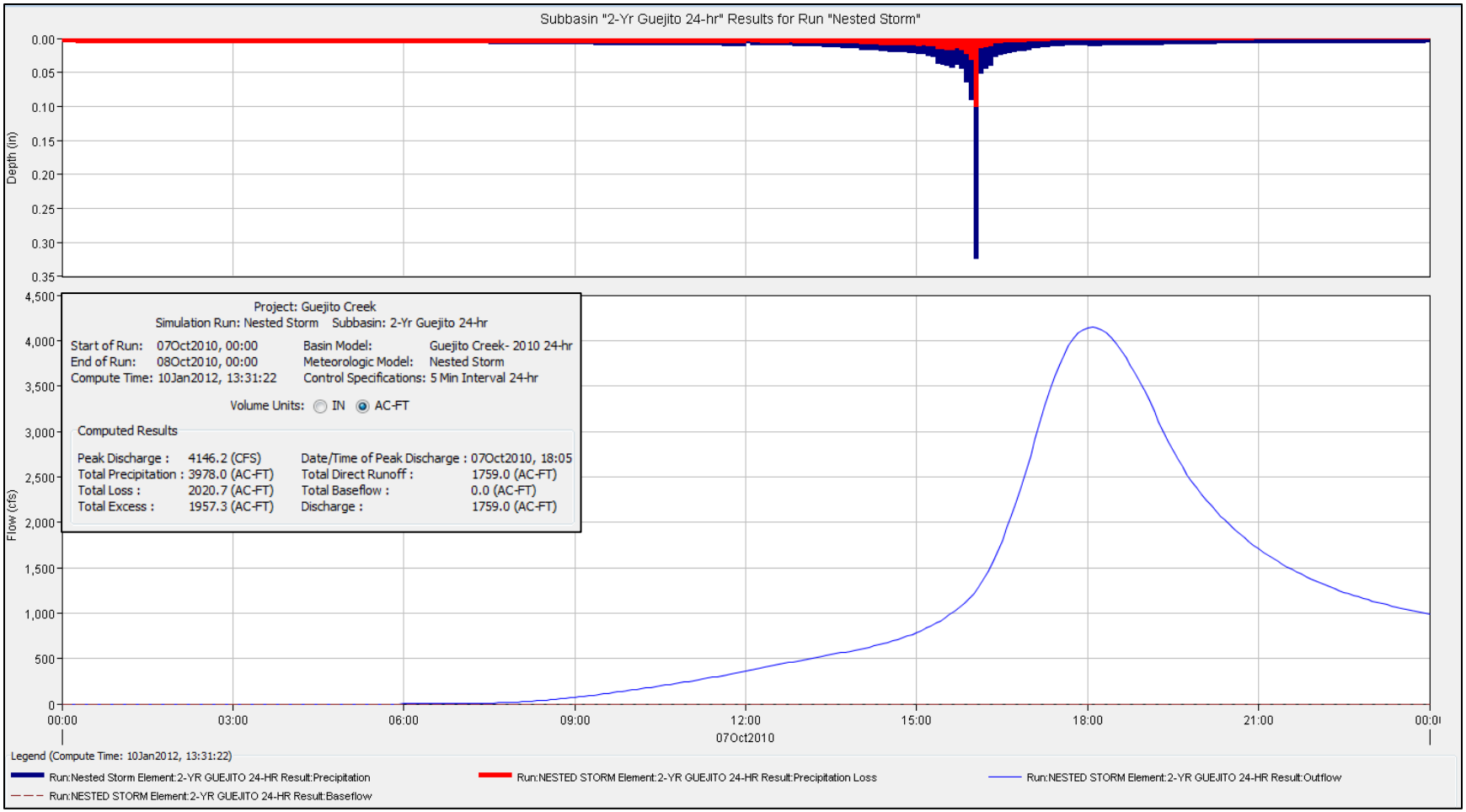

Subbasin "5-Yr Guejito 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
Flow (cfs)
3,000
2,500
2,000
1,500
1,000
500
Project: Guejito Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 5-Yr Guejito 6-hr
Start of Run: 08Oct2010, 00:00
End of Run: 08Oct2010, 06:00
Compute Time: 18Jan2012, 13:38:25
Basin Model: Guejito Creek- 2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2492.6 (CFS)
Total Precipitation : 2520.0 (AC-FT)
Total Loss : 1661.5 (AC-FT)
Total Excess : 858.5 (AC-FT)
Date/Time of Peak Discharge : 08Oct2010, 05:20
Total Direct Runoff : 438.8 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 438.8 (AC-FT)
00:00
01:00
02:00
03:00
04:00
05:00
06:0
08Oct2010
Legend (Compute Time: 18Jan2012, 13:38:25)
Run:Type 1 Storm 6-hr Element:5-YR GUEJITO 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:5-YR GUEJITO 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:5-YR GUEJITO 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:5-YR GUEJITO 6-HR Result:Baseflow


Subbasin "2-Yr Guejito 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Flow (cfs)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Project: Guejito Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 2-Yr Guejito 6-hr
Start of Run: 08Oct2010, 00:00
End of Run: 08Oct2010, 06:00
Compute Time: 18Jan2012, 13:38:25
Basin Model: Guejito Creek- 2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1795.8 (CFS)
Total Precipitation : 2160.0 (AC-FT)
Total Loss : 1535.0 (AC-FT)
Total Excess : 625.0 (AC-FT)
Date/Time of Peak Discharge : 08Oct2010, 05:25
Total Direct Runoff : 308.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 308.2 (AC-FT)
00:00
01:00
02:00
03:00
04:00
05:00
08Oct2010
Legend (Compute Time: 18Jan2012, 13:38:25)
Run:Type 1 Storm 6-hr Element:2-YR GUEJITO 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:2-YR GUEJITO 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:2-YR GUEJITO 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:2-YR GUEJITO 6-HR Result:Baseflow

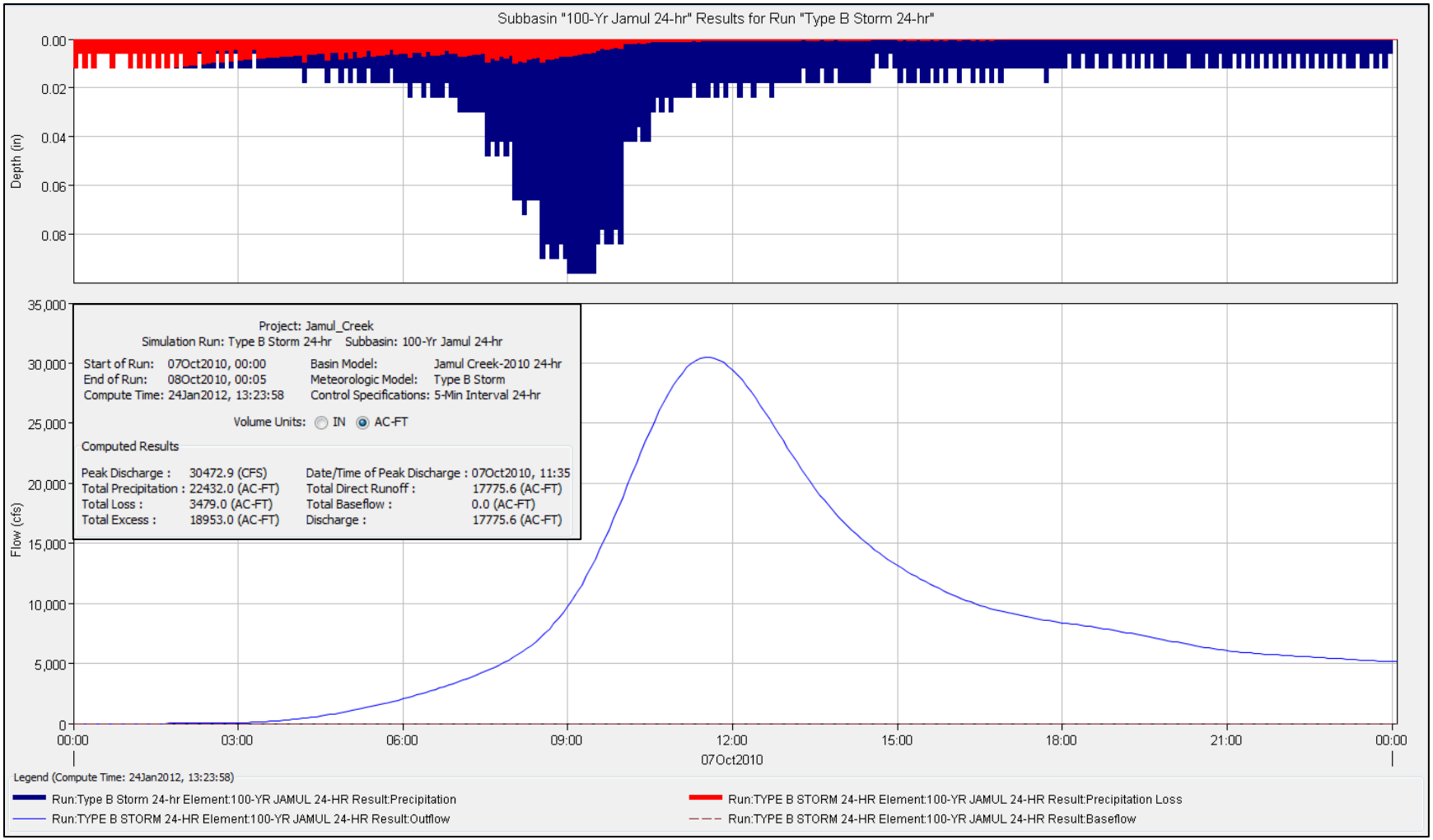

Subbasin "100-Yr Guejito 24-hr" Results for Run "Nested Storm"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Flow (cfs)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Project: Guejito Creek
Simulation Run: Nested Storm Subbasin: 100-Yr Guejito 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 13:31:22
Basin Model: Guejito Creek- 2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 13617.5 (CFS)
Total Precipitation : 9453.6 (AC-FT)
Total Loss : 1431.0 (AC-FT)
Total Excess : 8022.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 18:00
Total Direct Runoff : 7398.8 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 7398.8 (AC-FT)
Legend (Compute Time: 10Jan2012, 13:31:22)
Run:Nested Storm Element:100-YR GUEJITO 24-HR Result:Precipitation
Run:NESTED STORM Element:100-YR GUEJITO 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:100-YR GUEJITO 24-HR Result:Outflow
Run:NESTED STORM Element:100-YR GUEJITO 24-HR Result:Baseflow

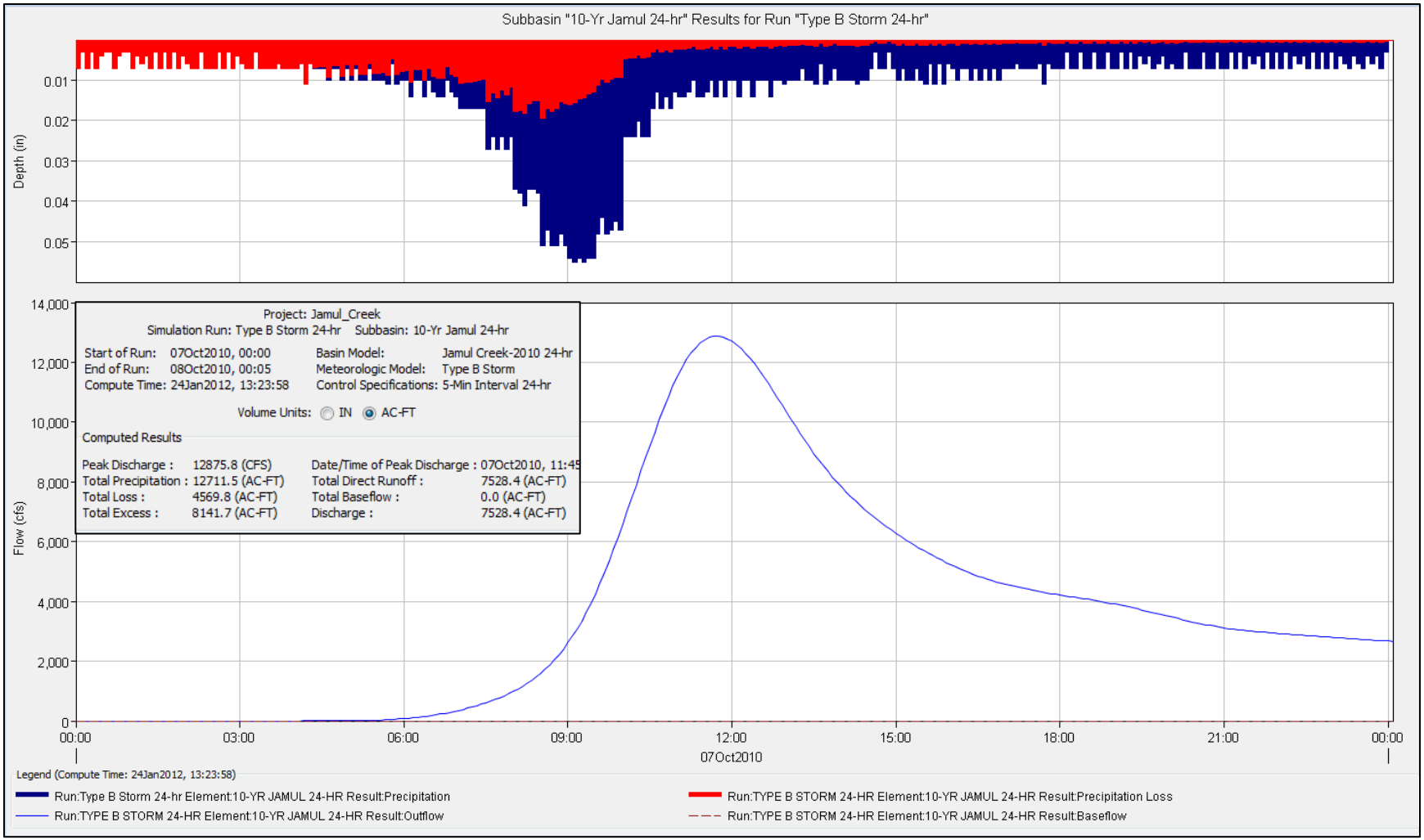

Subbasin "10-Yr Guejito 24-hr" Results for Run "Nested Storm"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
Flow (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Project: Guejito Creek
Simulation Run: Nested Storm Subbasin: 10-Yr Guejito 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 13:31:22
Basin Model: Guejito Creek- 2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 7447.1 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 18:00
Total Precipitation : 6534.0 (AC-FT)
Total Direct Runoff : 3756.8 (AC-FT)
Total Loss : 2358.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 4176.0 (AC-FT)
Discharge : 3756.8 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Legend (Compute Time: 10Jan2012, 13:31:22)
Run:Nested Storm Element:10-YR GUEJITO 24-HR Result:Precipitation
Run:NESTED STORM Element:10-YR GUEJITO 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:10-YR GUEJITO 24-HR Result:Outflow
Run:NESTED STORM Element:10-YR GUEJITO 24-HR Result:Baseflow

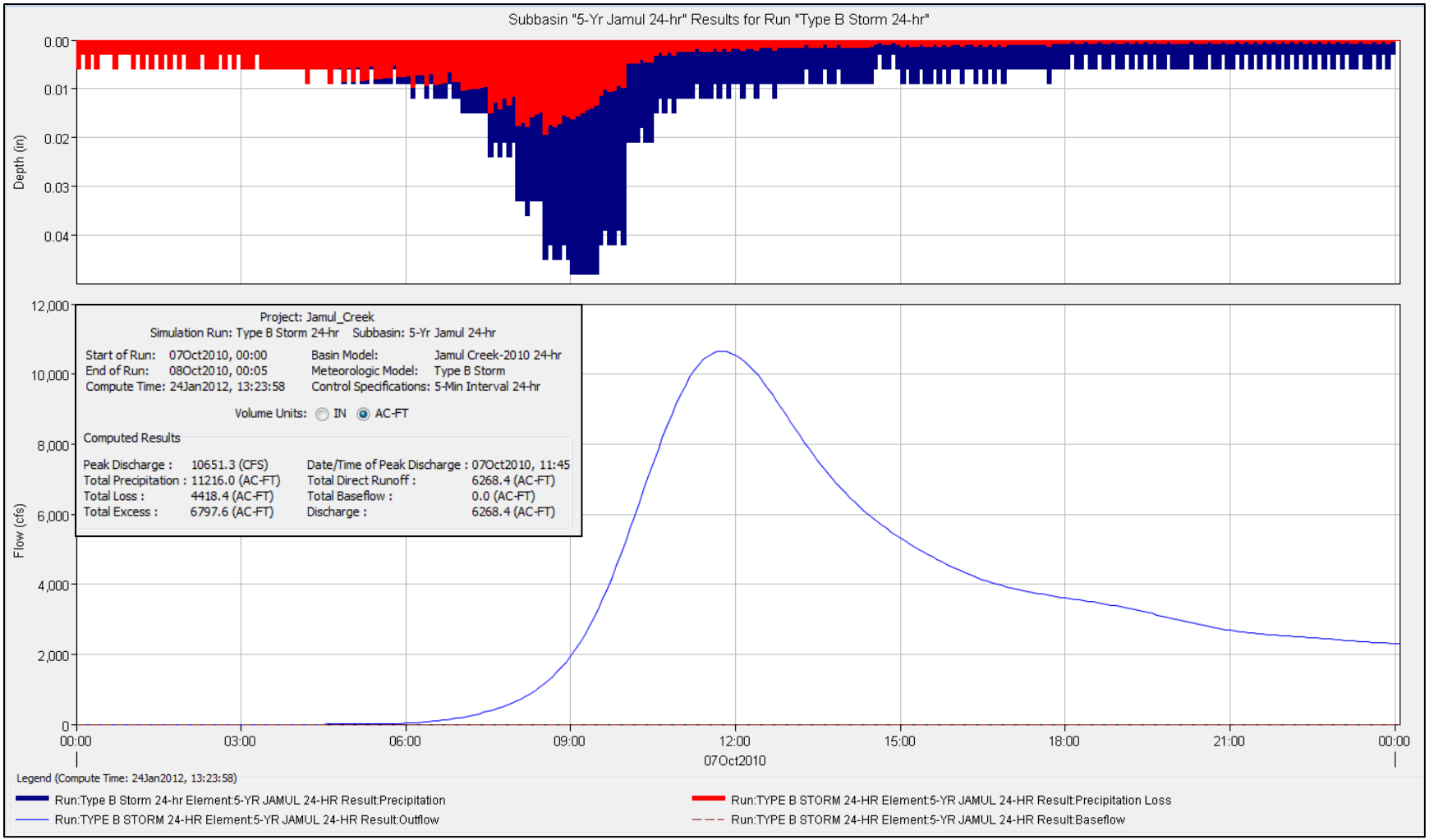

Subbasin "5-Yr Guejito 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
Project: Guejito Creek
Simulation Run: Nested Storm Subbasin: 5-Yr Guejito 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 13:31:22
Basin Model: Guejito Creek- 2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 5756.4 (CFS)
Total Precipitation : 5137.2 (AC-FT)
Total Loss : 2203.2 (AC-FT)
Total Excess : 2934.0 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 18:05
Total Direct Runoff : 2643.1 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 2643.1 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Legend (Compute Time: 10Jan2012, 13:31:22)
Run:Nested Storm Element:5-YR GUEJITO 24-HR Result:Precipitation
Run:NESTED STORM Element:5-YR GUEJITO 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:5-YR GUEJITO 24-HR Result:Outflow
Run:NESTED STORM Element:5-YR GUEJITO 24-HR Result:Baseflow

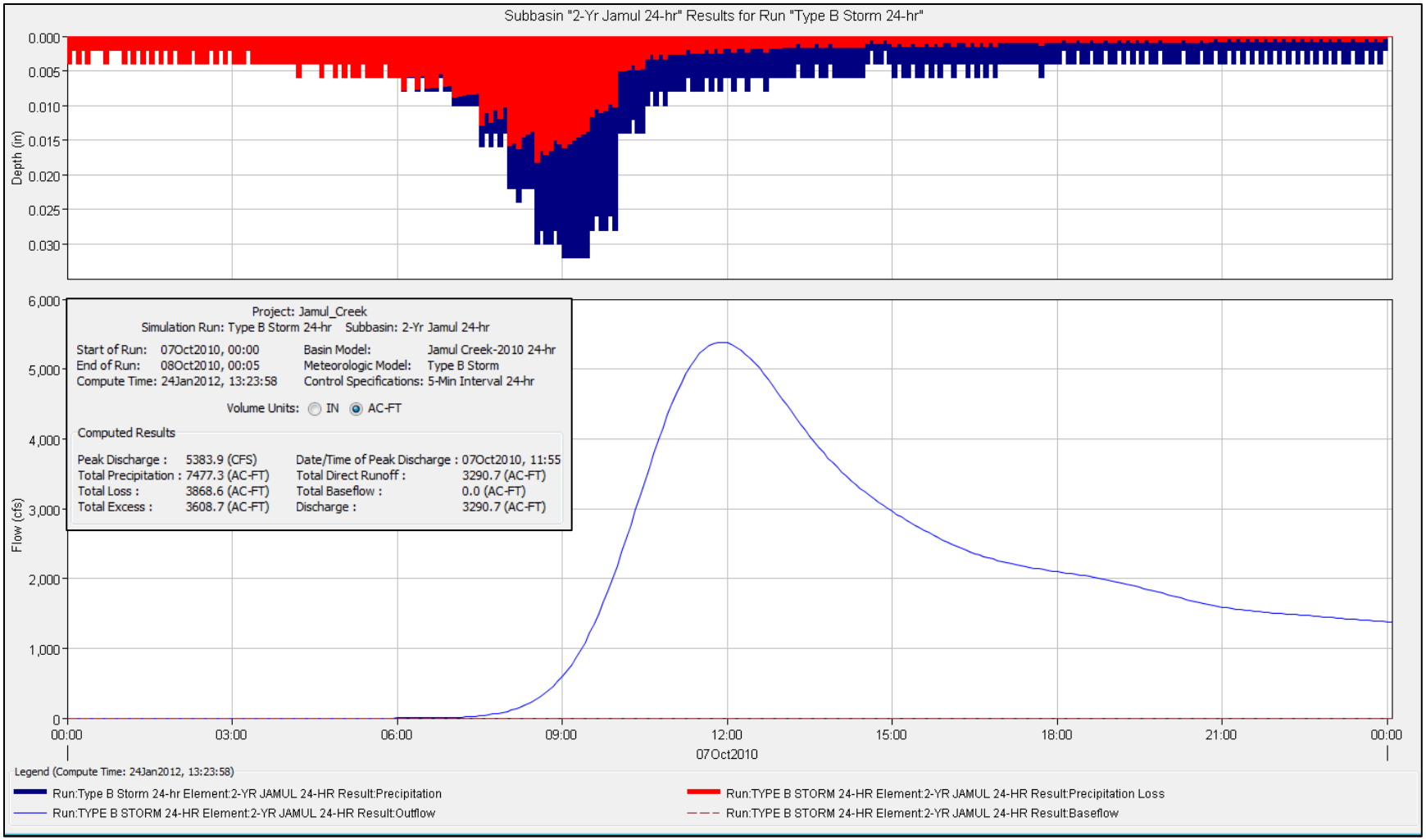

Subbasin "2-Yr Guejito 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Flow (cfs)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Project: Guejito Creek
Simulation Run: Nested Storm Subbasin: 2-Yr Guejito 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 13:31:22
Basin Model: Guejito Creek- 2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 4146.2 (CFS)
Total Precipitation : 3978.0 (AC-FT)
Total Loss : 2020.7 (AC-FT)
Total Excess : 1957.3 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 18:05
Total Direct Runoff : 1759.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1759.0 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Legend (Compute Time: 10Jan2012, 13:31:22)
Run:Nested Storm Element:2-YR GUEJITO 24-HR Result:Precipitation
Run:NESTED STORM Element:2-YR GUEJITO 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:2-YR GUEJITO 24-HR Result:Outflow
Run:NESTED STORM Element:2-YR GUEJITO 24-HR Result:Baseflow

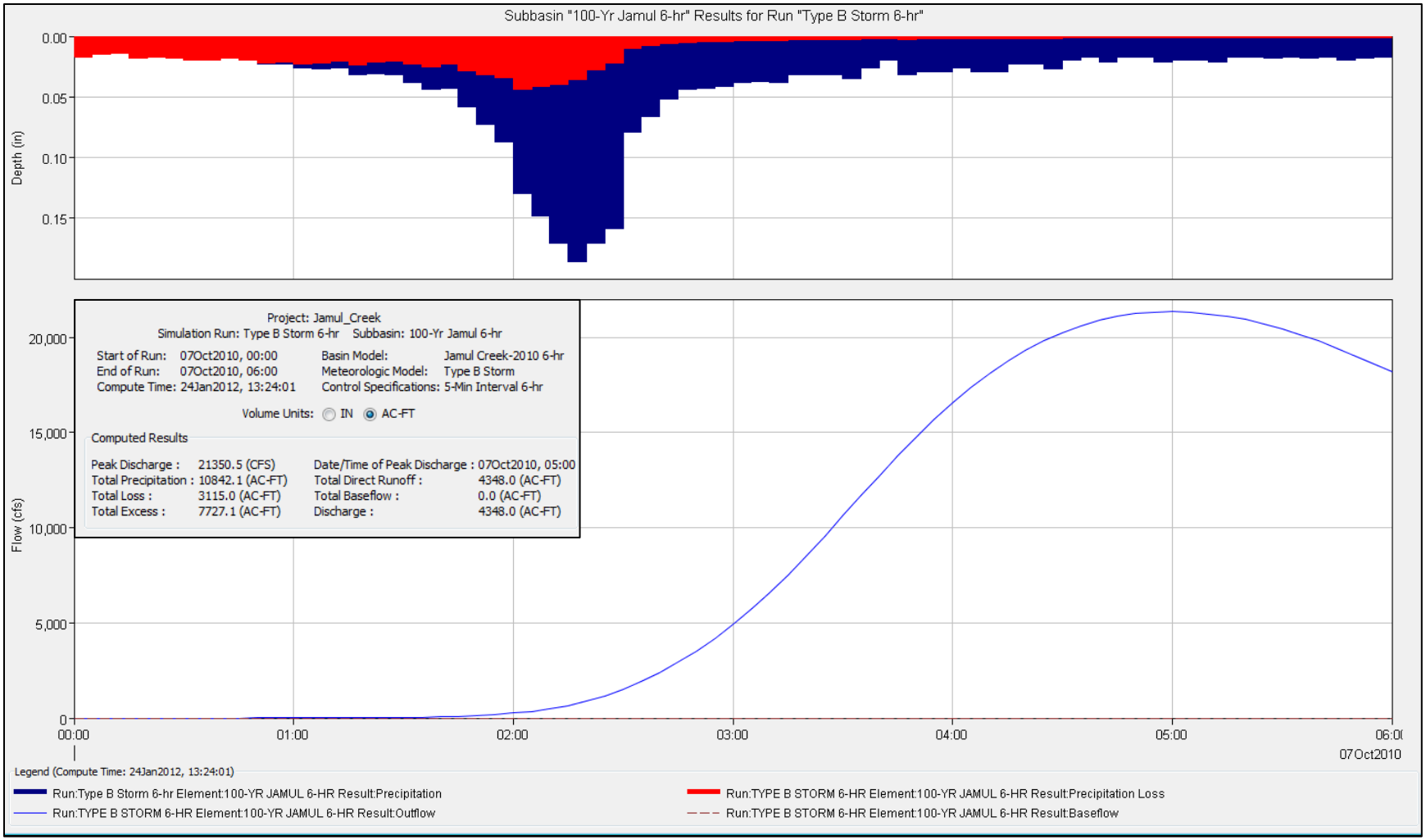
Jamul Creek HEC-HMS Outputs

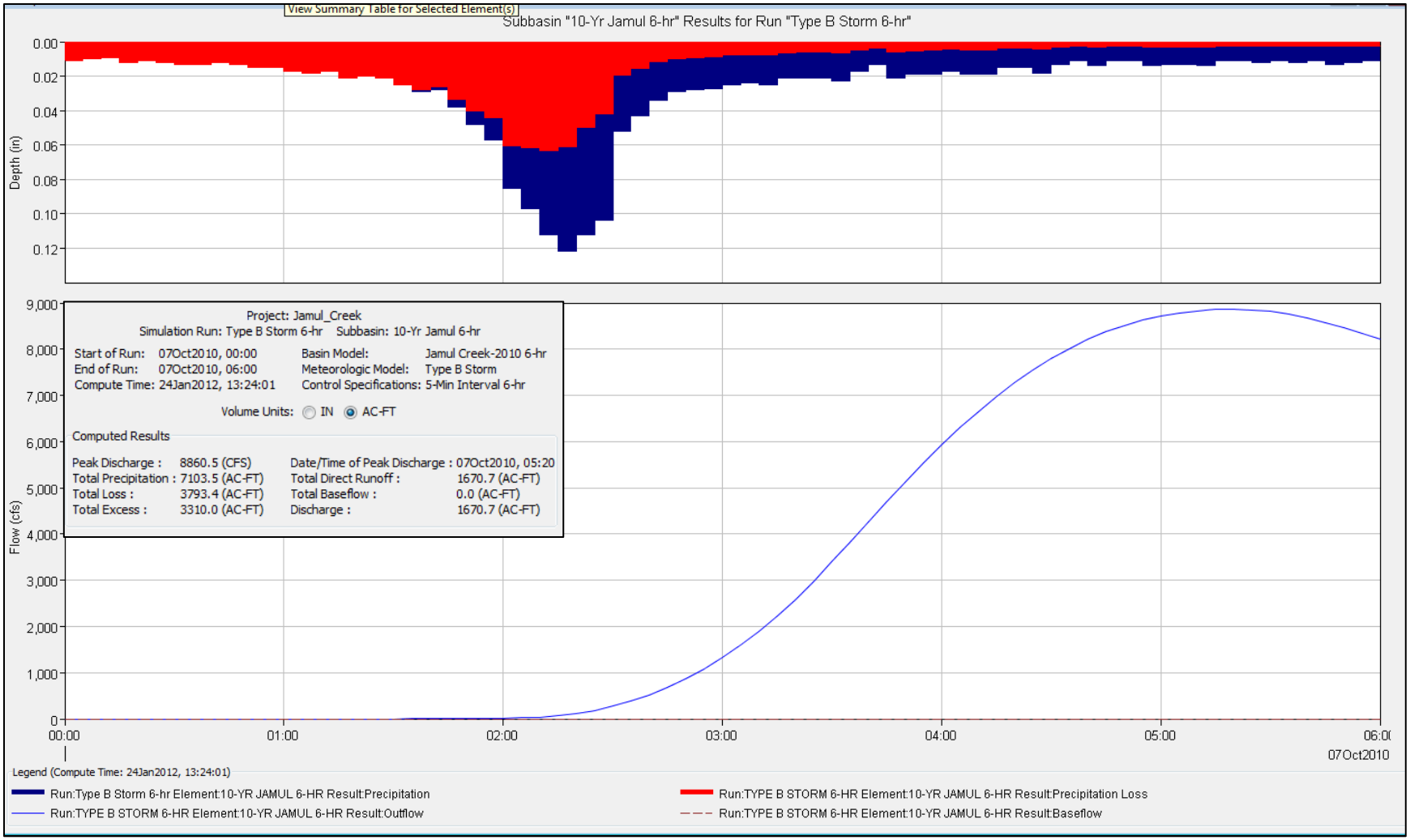

Subbasin "100-Yr Jamul 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
Project: Jamul_Creek
Simulation Run: Type B Storm 24-hr Subbasin: 100-Yr Jamul 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 24Jan2012, 13:23:58
Basin Model: Jamul Creek-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 30472.9 (CFS)
Total Precipitation : 22432.0 (AC-FT)
Total Loss : 3479.0 (AC-FT)
Total Excess : 18953.0 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 11:35
Total Direct Runoff : 17775.6 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 17775.6 (AC-FT)
Flow (cfs)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:23:58)
Run:Type B Storm 24-hr Element:100-YR JAMUL 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:100-YR JAMUL 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:100-YR JAMUL 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:100-YR JAMUL 24-HR Result:Baseflow

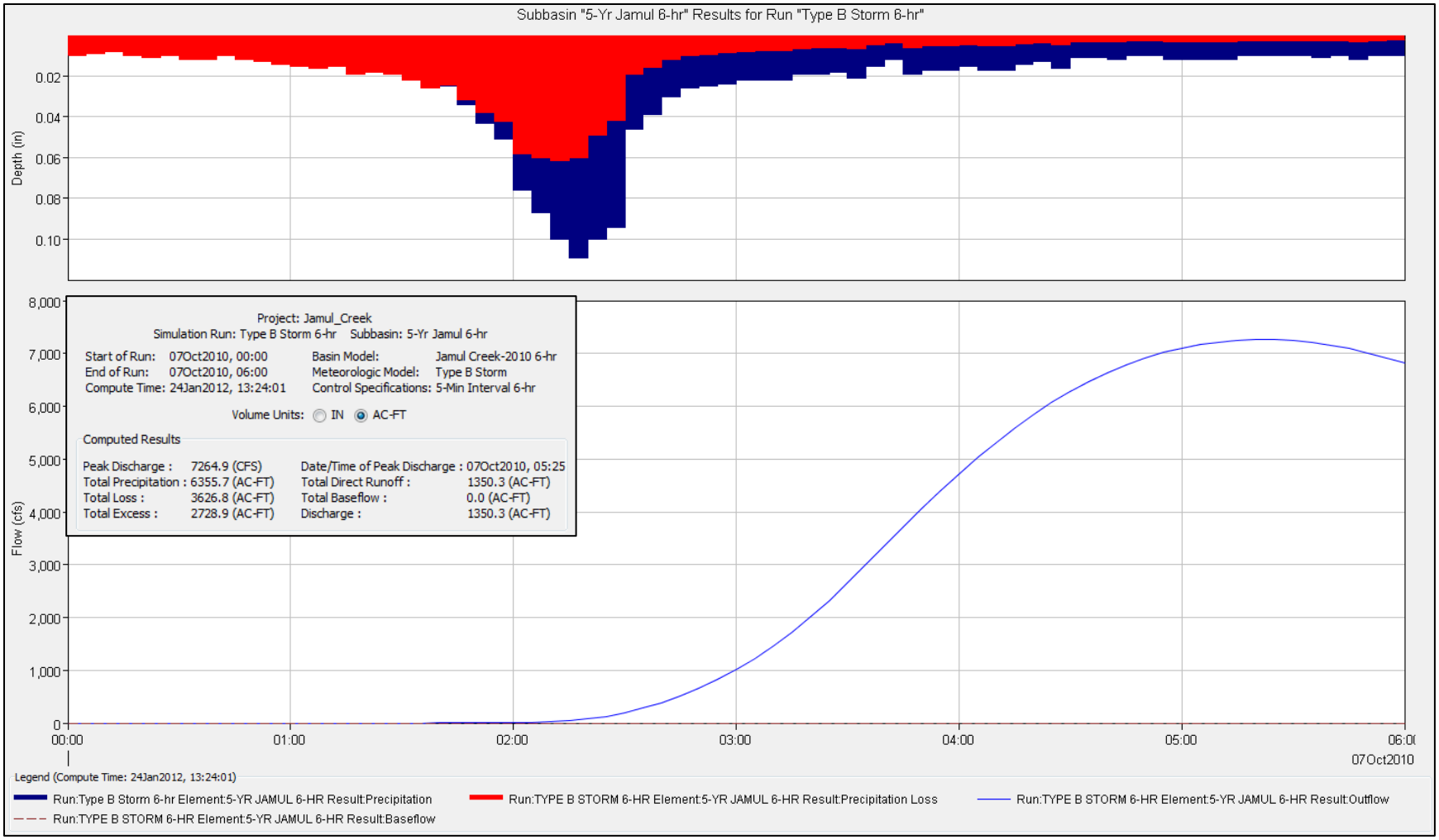

Subbasin "10-Yr Jamul 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.01
0.02
0.03
0.04
0.05
Flow (cfs)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Project: Jamul_Creek
Simulation Run: Type B Storm 24-hr Subbasin: 10-Yr Jamul 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 24Jan2012, 13:23:58
Basin Model: Jamul Creek-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 12875.8 (CFS)
Total Precipitation : 12711.5 (AC-FT)
Total Loss : 4569.8 (AC-FT)
Total Excess : 8141.7 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 11:45
Total Direct Runoff : 7528.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 7528.4 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:23:58)
Run:Type B Storm 24-hr Element:10-YR JAMUL 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:10-YR JAMUL 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:10-YR JAMUL 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:10-YR JAMUL 24-HR Result:Baseflow

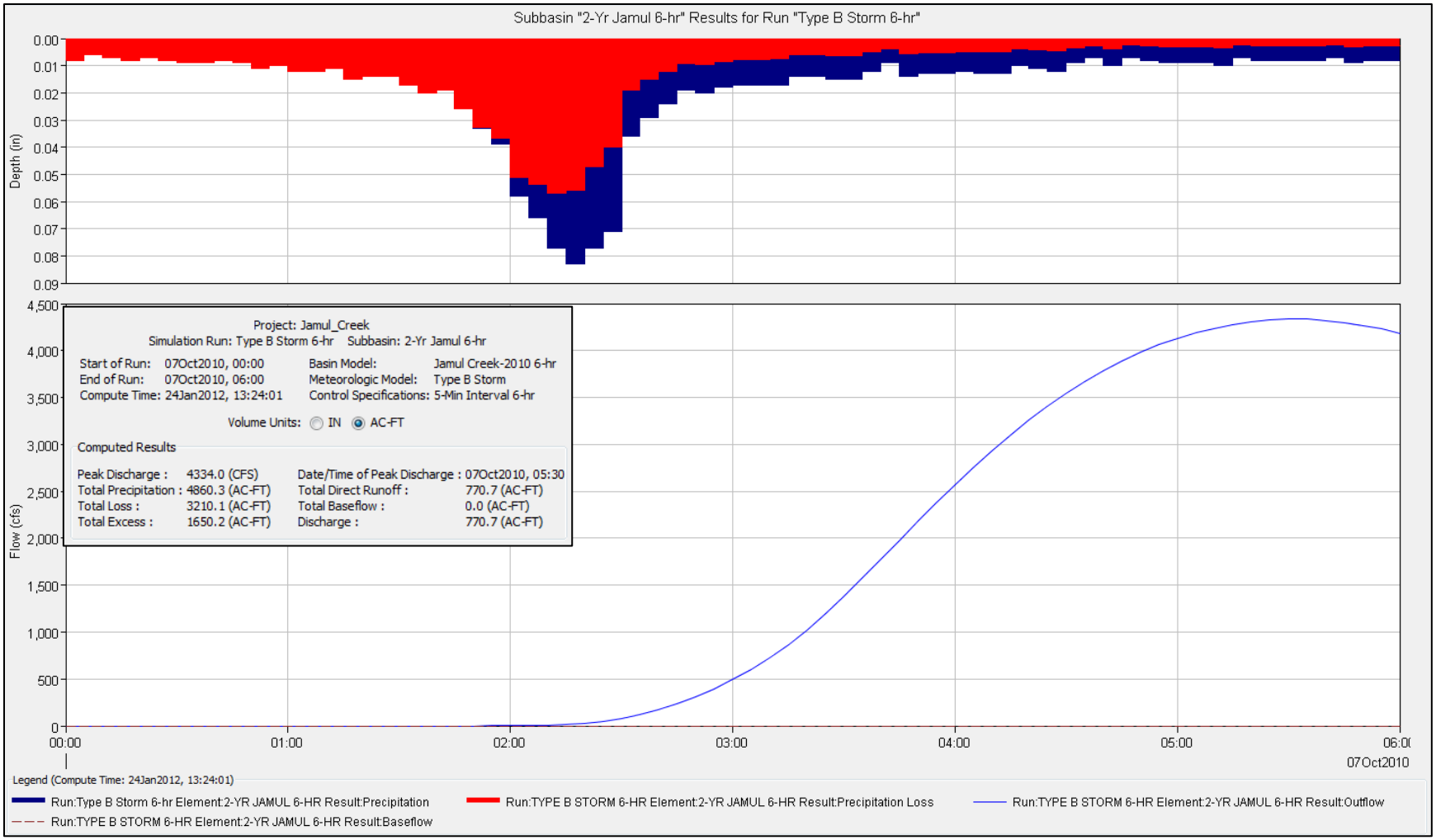

Subbasin "5-Yr Jamul 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
Flow (cfs)
12,000
10,000
8,000
6,000
4,000
2,000
0
Project: Jamul_Creek
Simulation Run: Type B Storm 24-hr Subbasin: 5-Yr Jamul 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 24Jan2012, 13:23:58
Basin Model: Jamul Creek-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 10651.3 (CFS)
Total Precipitation : 11216.0 (AC-FT)
Total Loss : 4418.4 (AC-FT)
Total Excess : 6797.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 11:45
Total Direct Runoff : 6268.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 6268.4 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:23:58)
Run:Type B Storm 24-hr Element:5-YR JAMUL 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:5-YR JAMUL 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:5-YR JAMUL 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:5-YR JAMUL 24-HR Result:Baseflow

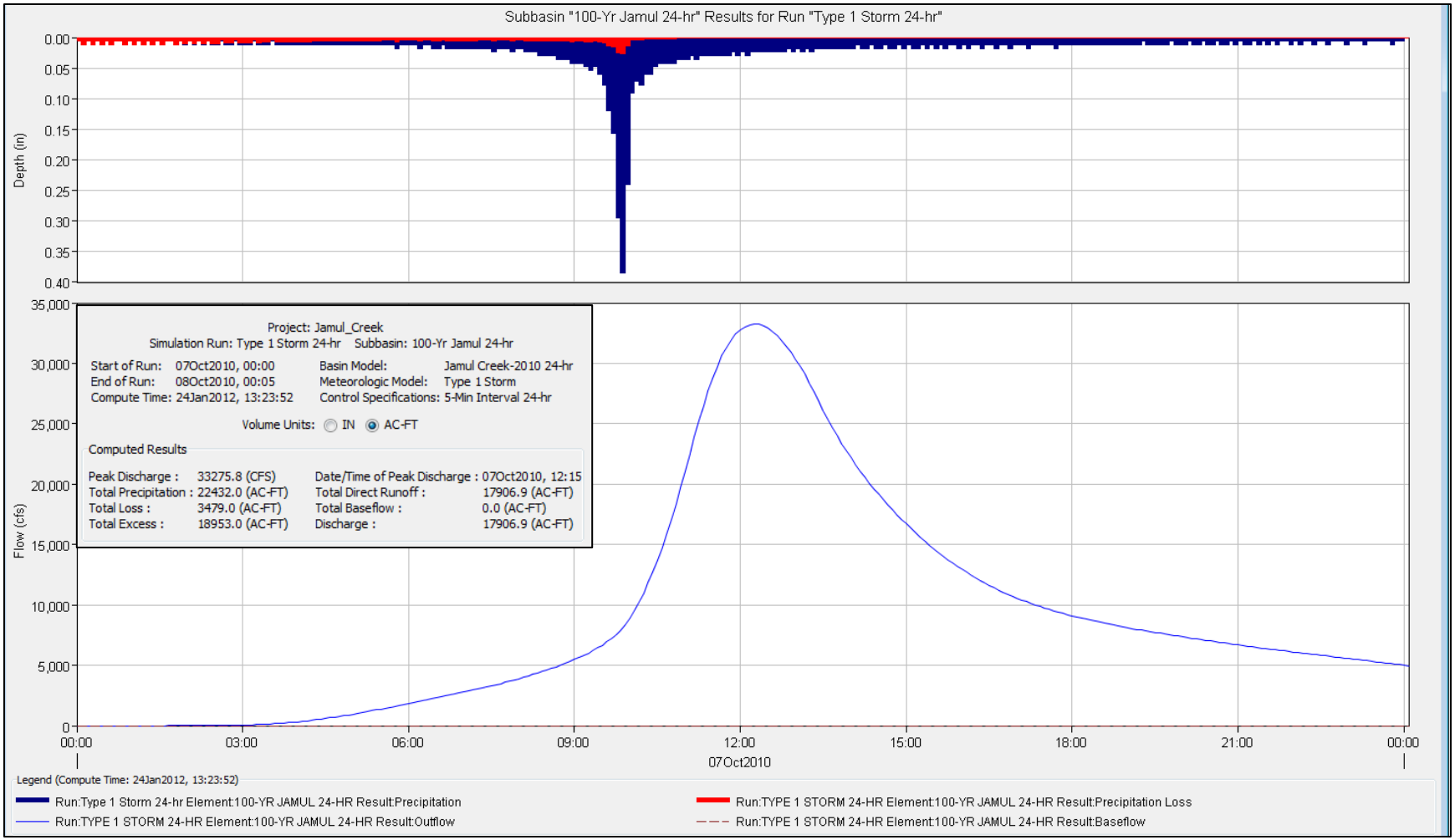

Subbasin "2-Yr Jamul 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.000
0.005
0.010
0.015
0.020
0.025
0.030
Project: Jamul_Creek
Simulation Run: Type B Storm 24-hr Subbasin: 2-Yr Jamul 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 24Jan2012, 13:23:58
Basin Model: Jamul Creek-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 5383.9 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 11:55
Total Precipitation : 7477.3 (AC-FT)
Total Direct Runoff : 3290.7 (AC-FT)
Total Loss : 3868.6 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 3608.7 (AC-FT)
Discharge : 3290.7 (AC-FT)
Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:23:58)
Run:Type B Storm 24-hr Element:2-YR JAMUL 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:2-YR JAMUL 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:2-YR JAMUL 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:2-YR JAMUL 24-HR Result:Baseflow

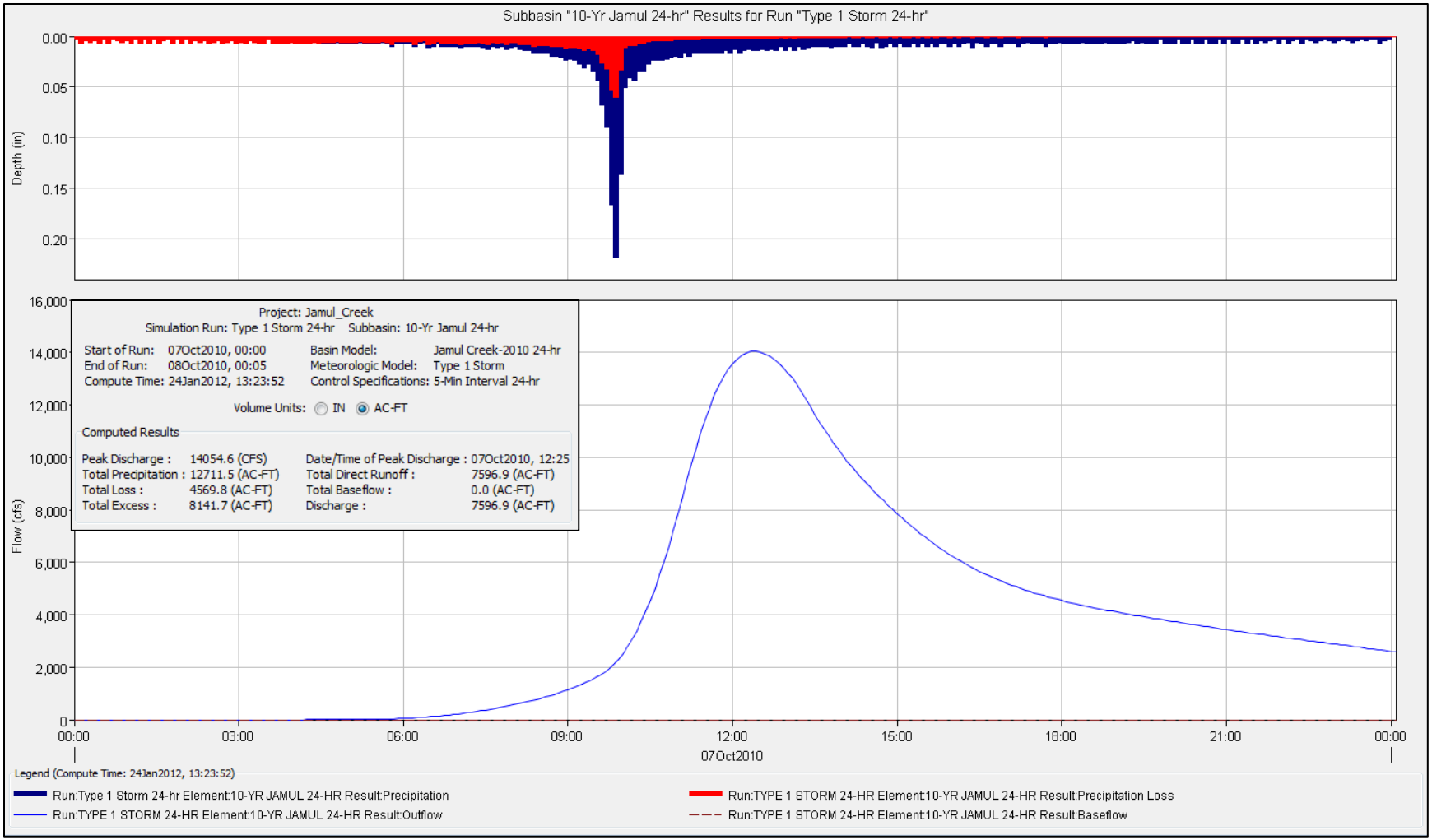

Subbasin "100-Yr Jamul 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
Project: Jamul_Creek
Simulation Run: Type B Storm 6-hr Subbasin: 100-Yr Jamul 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 24Jan2012, 13:24:01
Basin Model: Jamul Creek-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 21350.5 (CFS)
Total Precipitation : 10842.1 (AC-FT)
Total Loss : 3115.0 (AC-FT)
Total Excess : 7727.1 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:00
Total Direct Runoff : 4348.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 4348.0 (AC-FT)
Flow (cfs)
20,000
15,000
10,000
5,000
0
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:24:01)
Run:Type B Storm 6-hr Element:100-YR JAMUL 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:100-YR JAMUL 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:100-YR JAMUL 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:100-YR JAMUL 6-HR Result:Baseflow

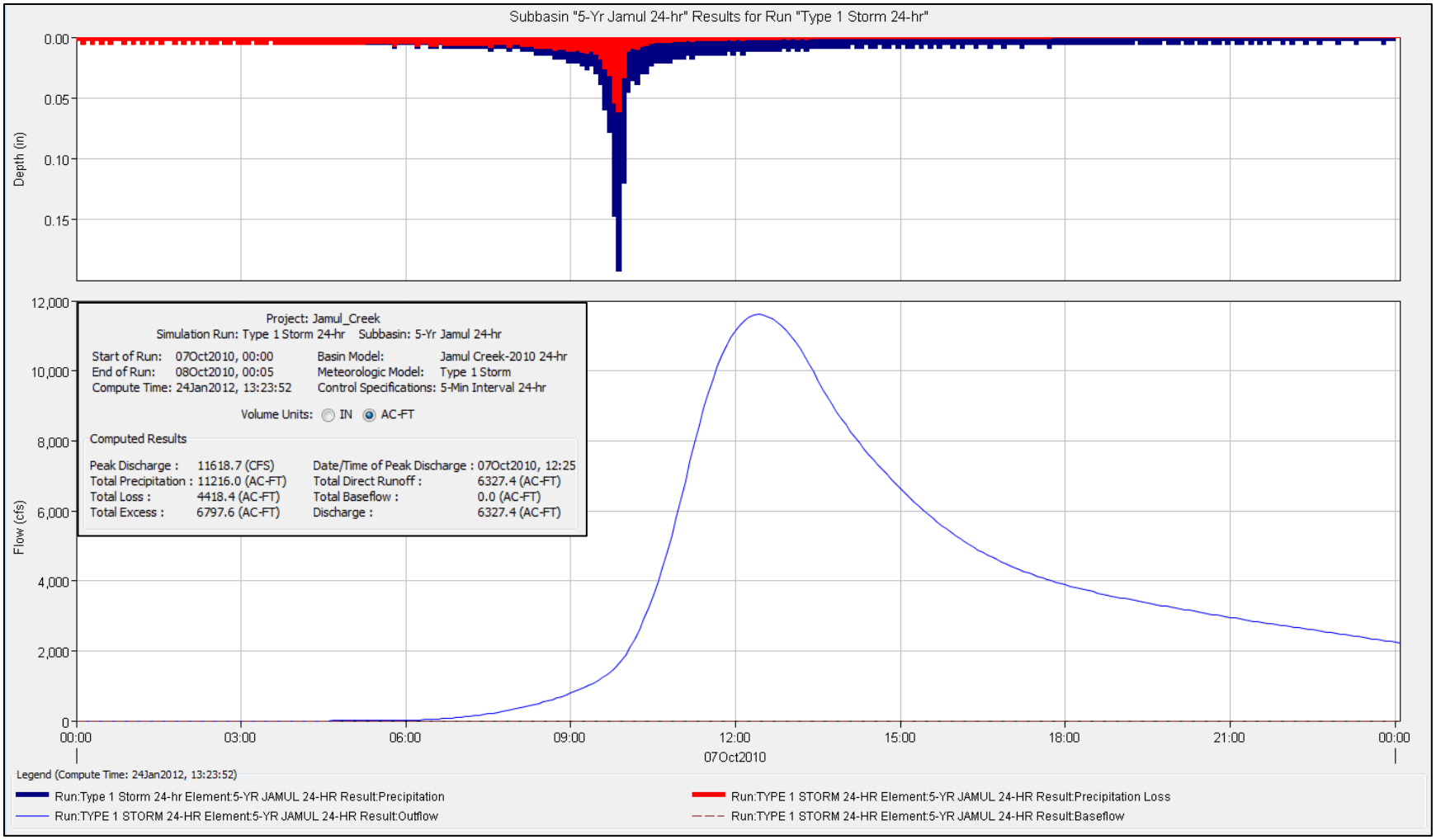

View Summary Table for Selected Element(s)
Subbasin "10-Yr Jamul 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Project: Jamul_Creek
Simulation Run: Type B Storm 6-hr Subbasin: 10-Yr Jamul 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 24Jan2012, 13:24:01
Basin Model: Jamul Creek-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 8860.5 (CFS)
Total Precipitation : 7103.5 (AC-FT)
Total Loss : 3793.4 (AC-FT)
Total Excess : 3310.0 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:20
Total Direct Runoff : 1670.7 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1670.7 (AC-FT)
Flow (cfs)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:24:01)
Run:Type B Storm 6-hr Element:10-YR JAMUL 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:10-YR JAMUL 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:10-YR JAMUL 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:10-YR JAMUL 6-HR Result:Baseflow

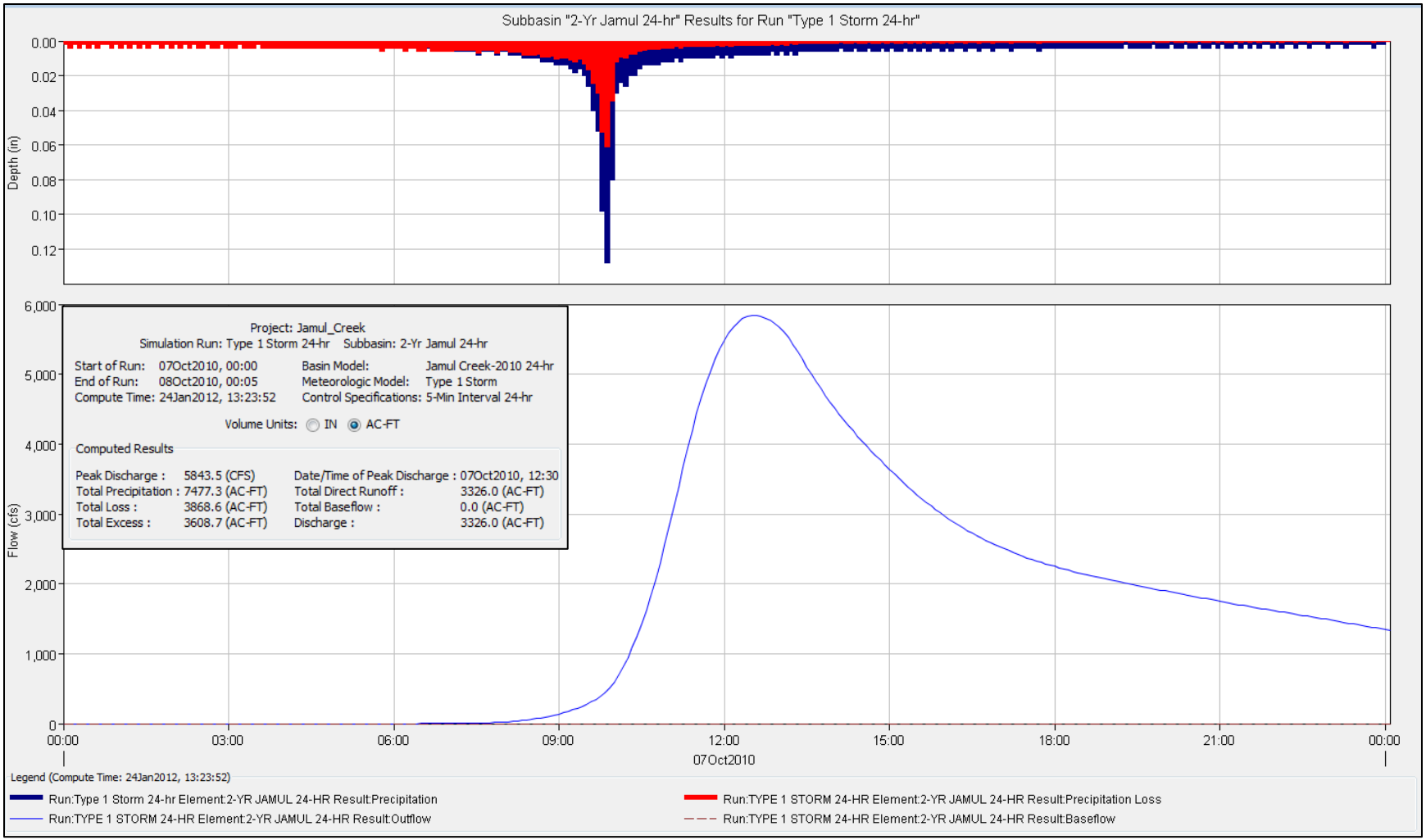

Subbasin "5-Yr Jamul 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.02
0.04
0.06
0.08
0.10
Project: Jamul_Creek
Simulation Run: Type B Storm 6-hr Subbasin: 5-Yr Jamul 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 24Jan2012, 13:24:01
Basin Model: Jamul Creek-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 7264.9 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 05:25
Total Precipitation : 6355.7 (AC-FT)
Total Direct Runoff : 1350.3 (AC-FT)
Total Loss : 3626.8 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 2728.9 (AC-FT)
Discharge : 1350.3 (AC-FT)
Flow (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:24:01)
Run:Type B Storm 6-hr Element:5-YR JAMUL 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:5-YR JAMUL 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:5-YR JAMUL 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:5-YR JAMUL 6-HR Result:Baseflow

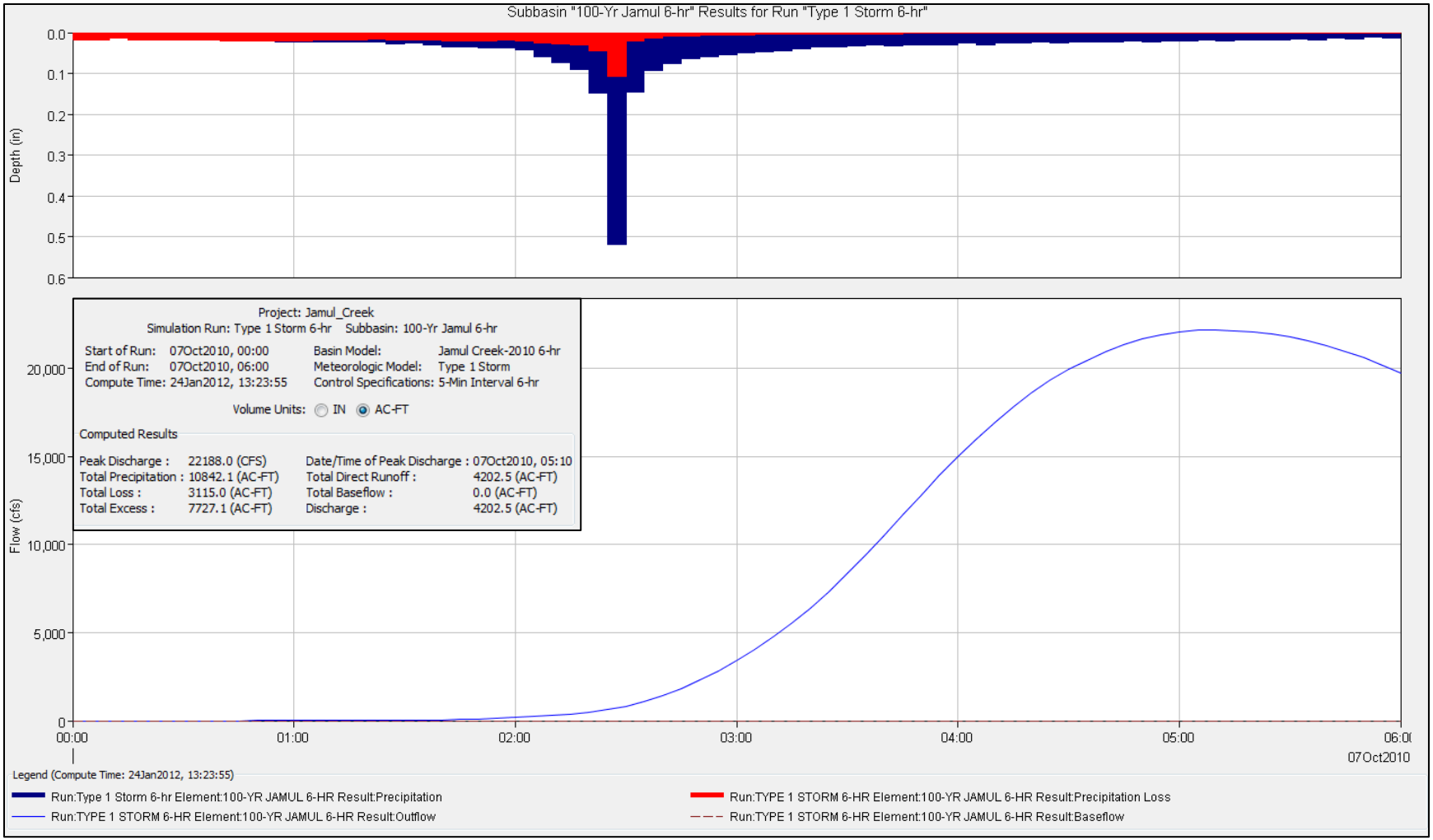

Subbasin "2-Yr Jamul 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
Flow (cfs)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07Oct2010
Project: Jamul_Creek
Simulation Run: Type B Storm 6-hr Subbasin: 2-Yr Jamul 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 24Jan2012, 13:24:01
Basin Model: Jamul Creek-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 4334.0 (CFS)
Total Precipitation : 4860.3 (AC-FT)
Total Loss : 3210.1 (AC-FT)
Total Excess : 1650.2 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:30
Total Direct Runoff : 770.7 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 770.7 (AC-FT)
Legend (Compute Time: 24Jan2012, 13:24:01)
Run:Type B Storm 6-hr Element:2-YR JAMUL 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:2-YR JAMUL 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:2-YR JAMUL 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:2-YR JAMUL 6-HR Result:Baseflow

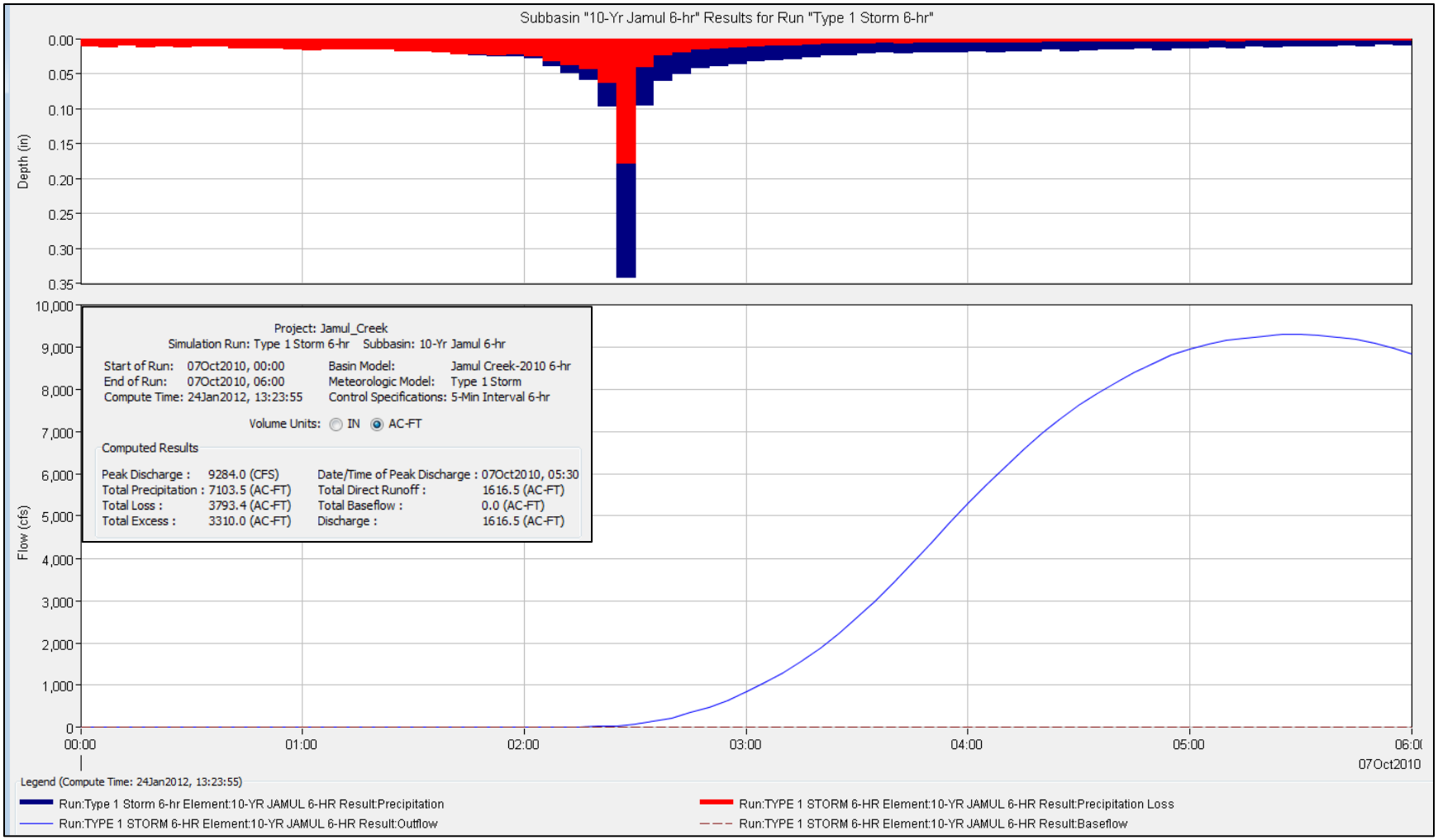

Subbasin "100-Yr Jamul 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
Flow (cfs)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Jamul_Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 100-Yr Jamul 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 24Jan2012, 13:23:52
Basin Model: Jamul Creek-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 33275.8 (CFS)
Total Precipitation : 22432.0 (AC-FT)
Total Loss : 3479.0 (AC-FT)
Total Excess : 18953.0 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:15
Total Direct Runoff : 17906.9 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 17906.9 (AC-FT)
Legend (Compute Time: 24Jan2012, 13:23:52)
Run:Type 1 Storm 24-hr Element:100-YR JAMUL 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:100-YR JAMUL 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:100-YR JAMUL 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:100-YR JAMUL 24-HR Result:Baseflow

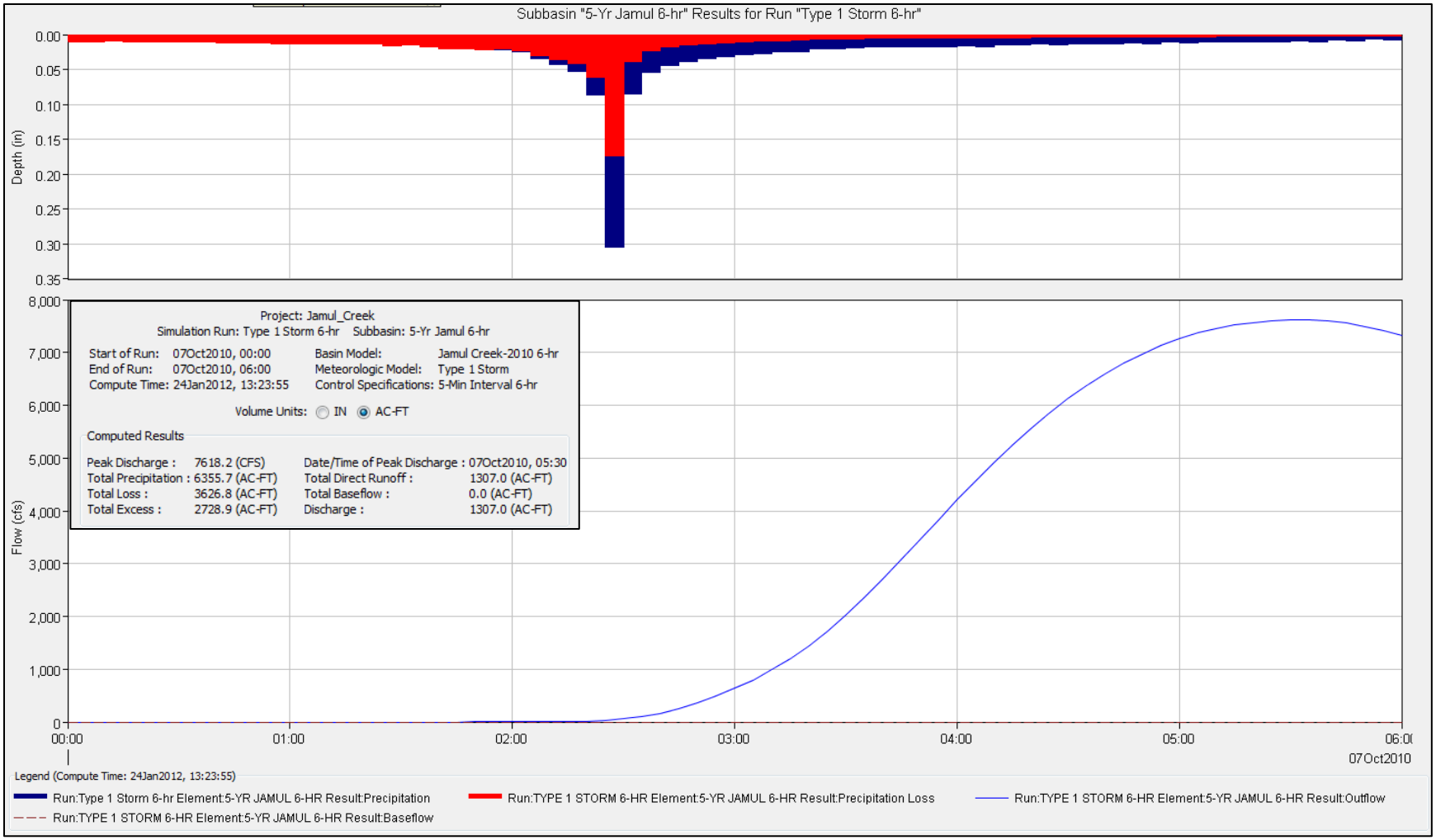

Subbasin "10-Yr Jamul 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
Project: Jamul_Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 10-Yr Jamul 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 24Jan2012, 13:23:52
Basin Model: Jamul Creek-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 14054.6 (CFS)
Total Precipitation : 12711.5 (AC-FT)
Total Loss : 4569.8 (AC-FT)
Total Excess : 8141.7 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:25
Total Direct Runoff : 7596.9 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 7596.9 (AC-FT)
Flow (cfs)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:23:52)
Run:Type 1 Storm 24-hr Element:10-YR JAMUL 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:10-YR JAMUL 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:10-YR JAMUL 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:10-YR JAMUL 24-HR Result:Baseflow

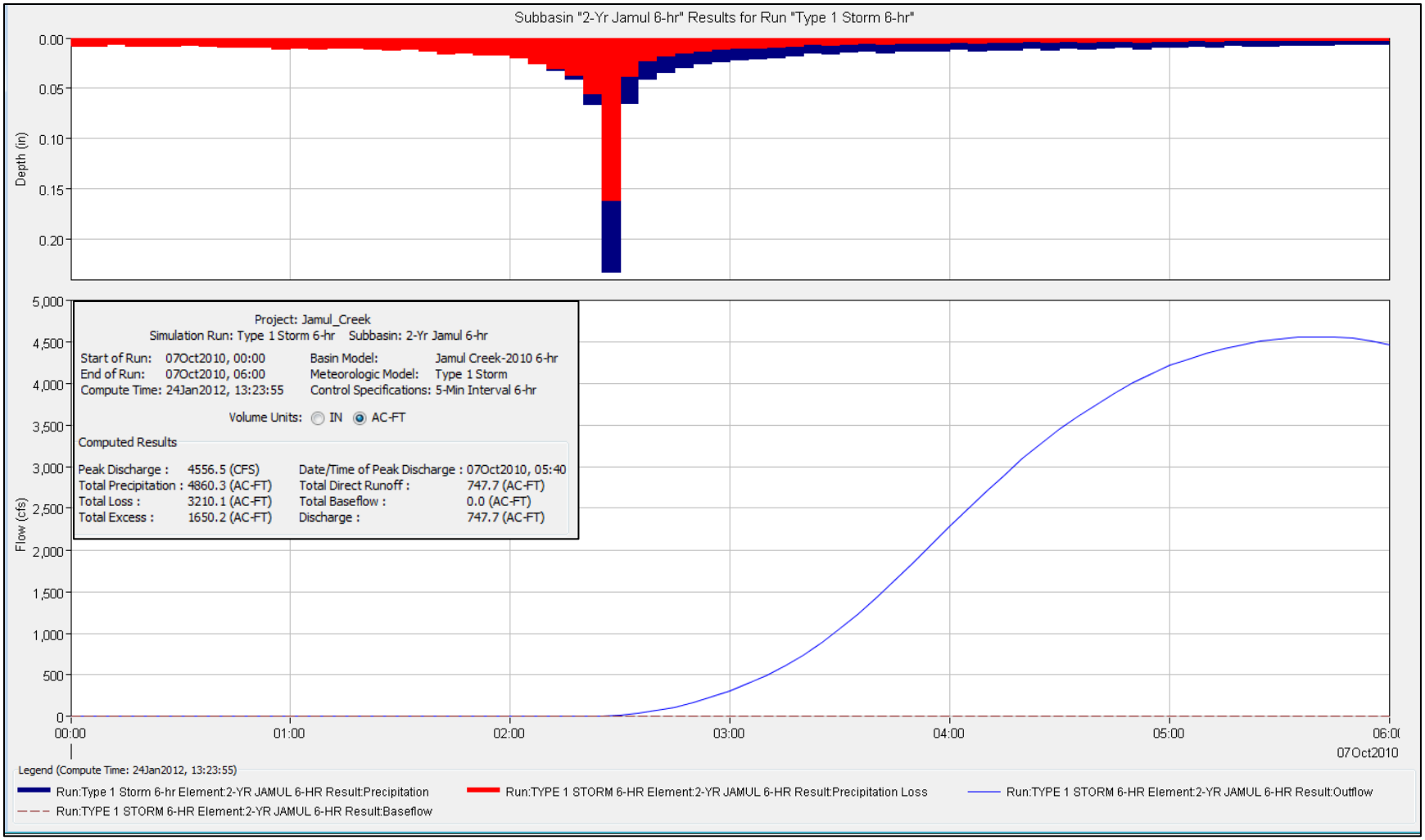

Subbasin "5-Yr Jamul 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
Flow (cfs)
12,000
10,000
8,000
6,000
4,000
2,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Jamul_Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 5-Yr Jamul 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 24Jan2012, 13:23:52
Basin Model: Jamul Creek-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 11618.7 (CFS)
Total Precipitation : 11216.0 (AC-FT)
Total Loss : 4418.4 (AC-FT)
Total Excess : 6797.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:25
Total Direct Runoff : 6327.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 6327.4 (AC-FT)
Legend (Compute Time: 24Jan2012, 13:23:52)
Run:Type 1 Storm 24-hr Element:5-YR JAMUL 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:5-YR JAMUL 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:5-YR JAMUL 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:5-YR JAMUL 24-HR Result:Baseflow

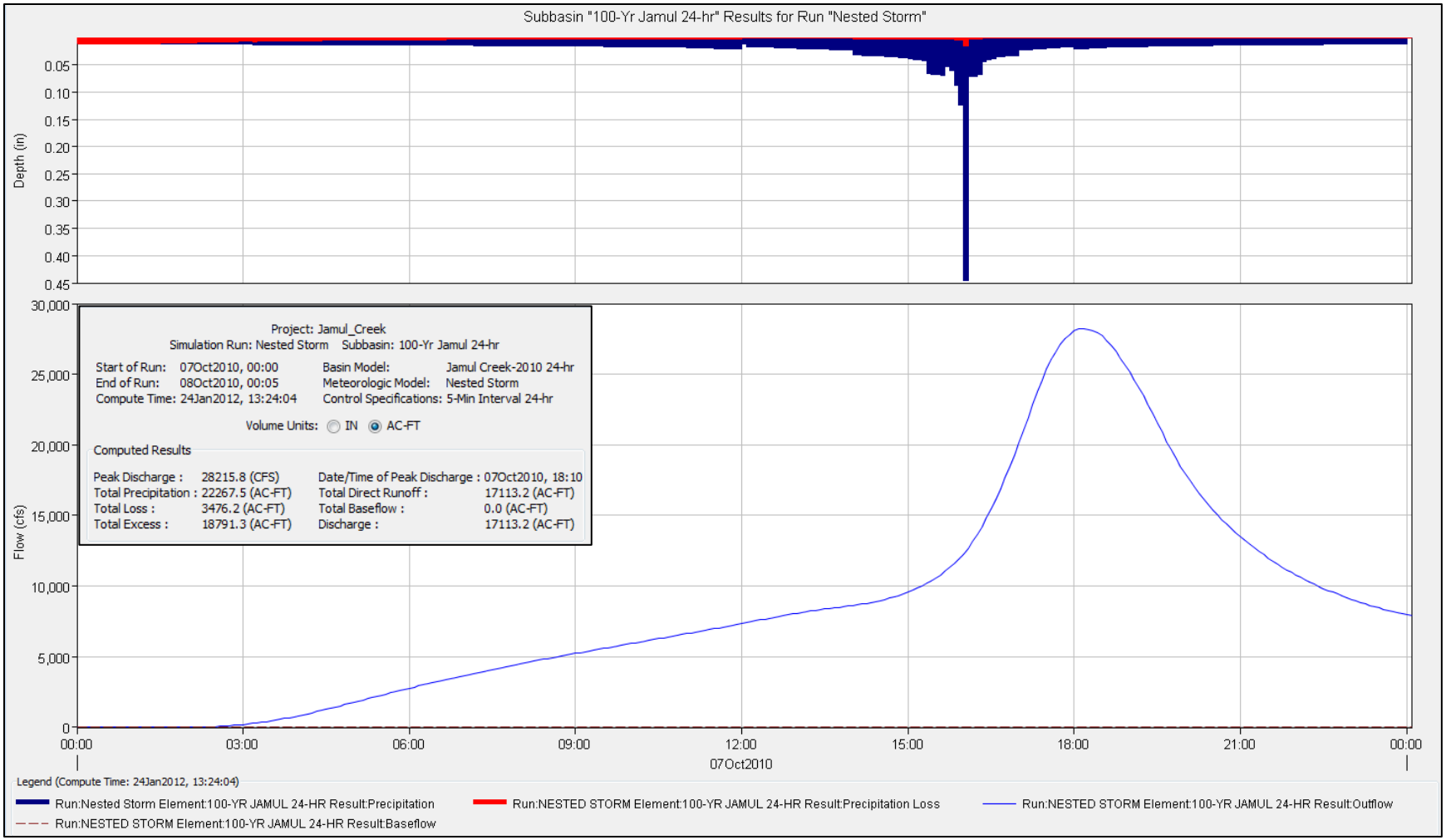

Subbasin "2-Yr Jamul 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
Project: Jamul_Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 2-Yr Jamul 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 24Jan2012, 13:23:52
Basin Model: Jamul Creek-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 5843.5 (CFS)
Total Precipitation : 7477.3 (AC-FT)
Total Loss : 3868.6 (AC-FT)
Total Excess : 3608.7 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:30
Total Direct Runoff : 3326.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 3326.0 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:23:52)
Run:Type 1 Storm 24-hr Element:2-YR JAMUL 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:2-YR JAMUL 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:2-YR JAMUL 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:2-YR JAMUL 24-HR Result:Baseflow

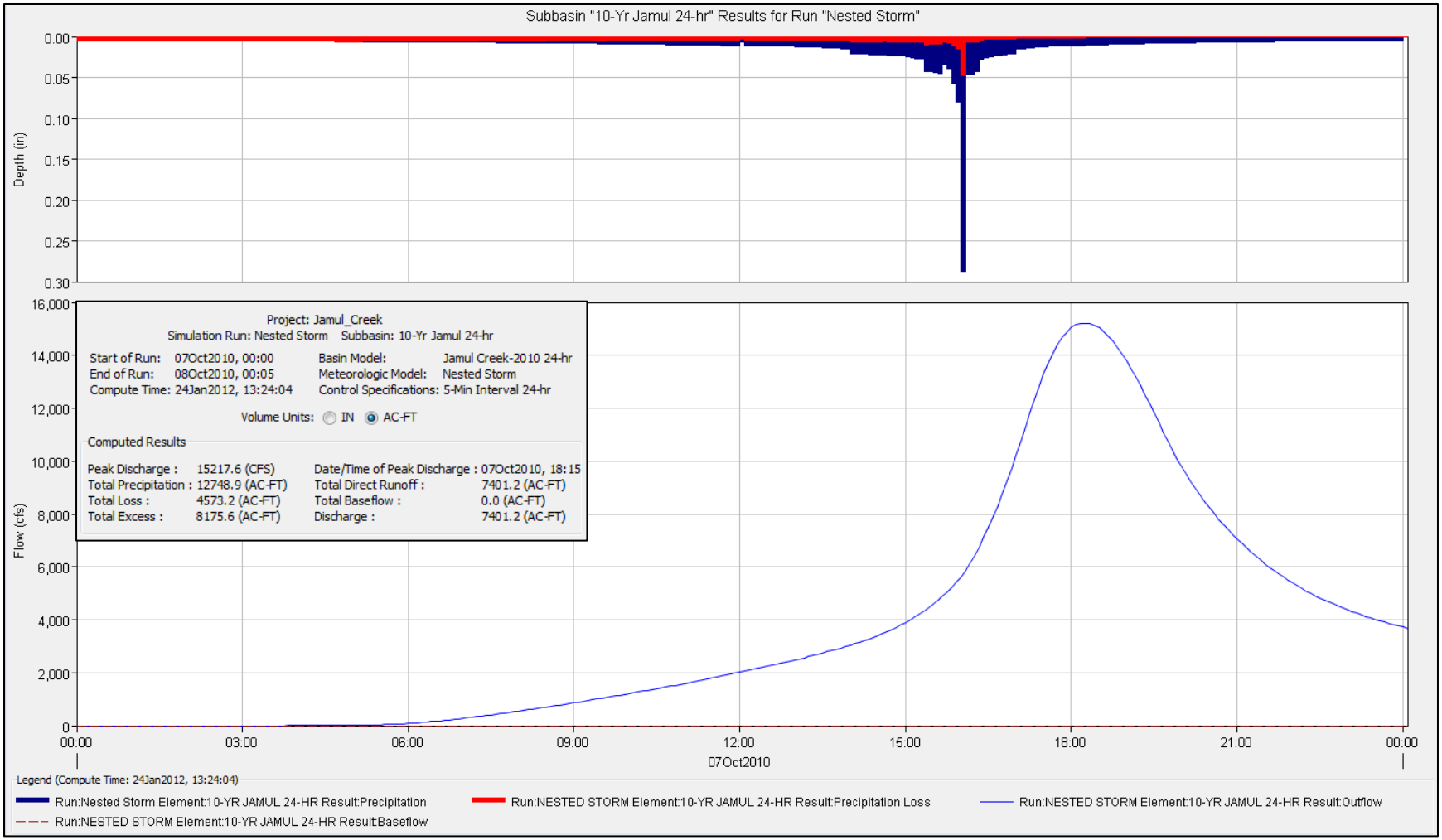

Subbasin "100-Yr Jamul 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Project: Jamul_Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 100-Yr Jamul 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 24Jan2012, 13:23:55
Basin Model: Jamul Creek-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 22188.0 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 05:10
Total Precipitation : 10842.1 (AC-FT)
Total Direct Runoff : 4202.5 (AC-FT)
Total Loss : 3115.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 7727.1 (AC-FT)
Discharge : 4202.5 (AC-FT)
Flow (cfs)
20,000
15,000
10,000
5,000
0
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:23:55)
Run:Type 1 Storm 6-hr Element:100-YR JAMUL 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:100-YR JAMUL 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:100-YR JAMUL 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:100-YR JAMUL 6-HR Result:Baseflow

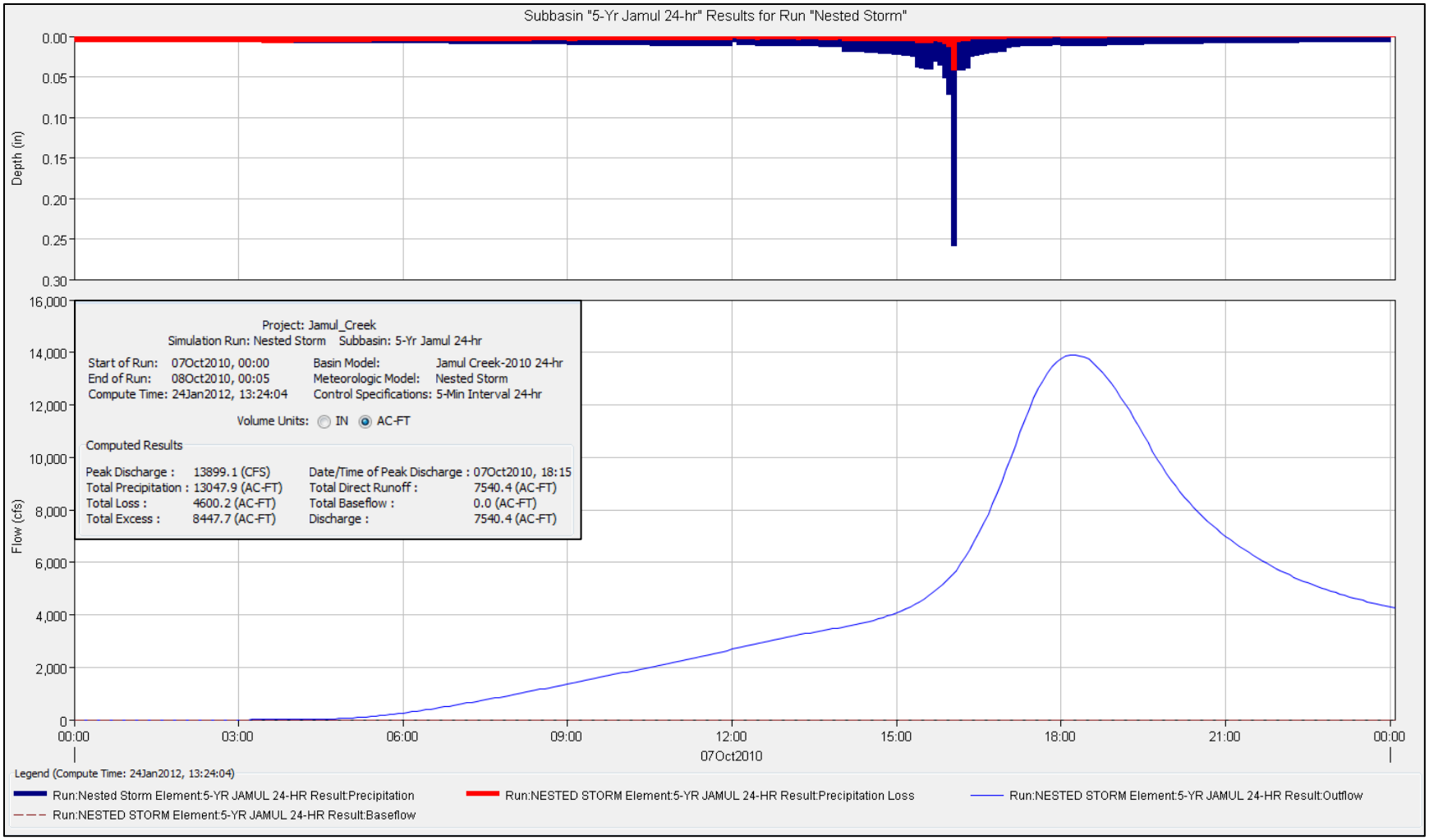

Subbasin "10-Yr Jamul 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Flow (cfs)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0(
07Oct2010
Project: Jamul_Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 10-Yr Jamul 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 24Jan2012, 13:23:55
Basin Model: Jamul Creek-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 9284.0 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 05:30
Total Precipitation : 7103.5 (AC-FT)
Total Direct Runoff : 1616.5 (AC-FT)
Total Loss : 3793.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 3310.0 (AC-FT)
Discharge : 1616.5 (AC-FT)
Legend (Compute Time: 24Jan2012, 13:23:55)
Run:Type 1 Storm 6-hr Element:10-YR JAMUL 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:10-YR JAMUL 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:10-YR JAMUL 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:10-YR JAMUL 6-HR Result:Baseflow

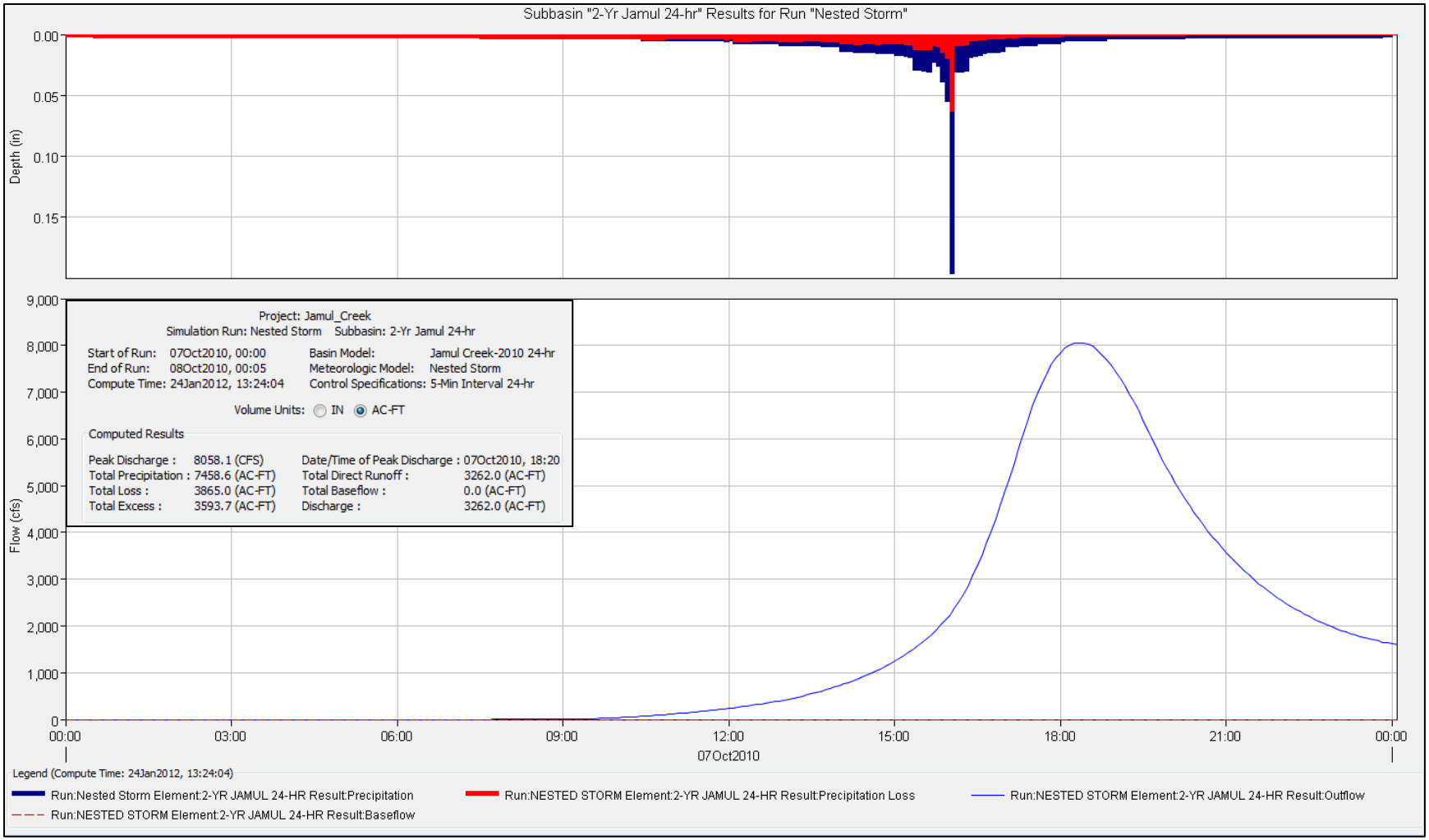

Subbasin "5-Yr Jamul 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Project: Jamul_Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 5-Yr Jamul 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 24Jan2012, 13:23:55
Basin Model: Jamul Creek-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 7618.2 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 05:30
Total Precipitation : 6355.7 (AC-FT)
Total Direct Runoff : 1307.0 (AC-FT)
Total Loss : 3626.8 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 2728.9 (AC-FT)
Discharge : 1307.0 (AC-FT)
Flow (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:23:55)
Run:Type 1 Storm 6-hr Element:5-YR JAMUL 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:5-YR JAMUL 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:5-YR JAMUL 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:5-YR JAMUL 6-HR Result:Baseflow


Subbasin "2-Yr Jamul 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
Flow (cfs)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Project: Jamul_Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 2-Yr Jamul 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 24Jan2012, 13:23:55
Basin Model: Jamul Creek-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 4556.5 (CFS)
Total Precipitation : 4860.3 (AC-FT)
Total Loss : 3210.1 (AC-FT)
Total Excess : 1650.2 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:40
Total Direct Runoff : 747.7 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 747.7 (AC-FT)
Legend (Compute Time: 24Jan2012, 13:23:55)
Run:Type 1 Storm 6-hr Element:2-YR JAMUL 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:2-YR JAMUL 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:2-YR JAMUL 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:2-YR JAMUL 6-HR Result:Baseflow

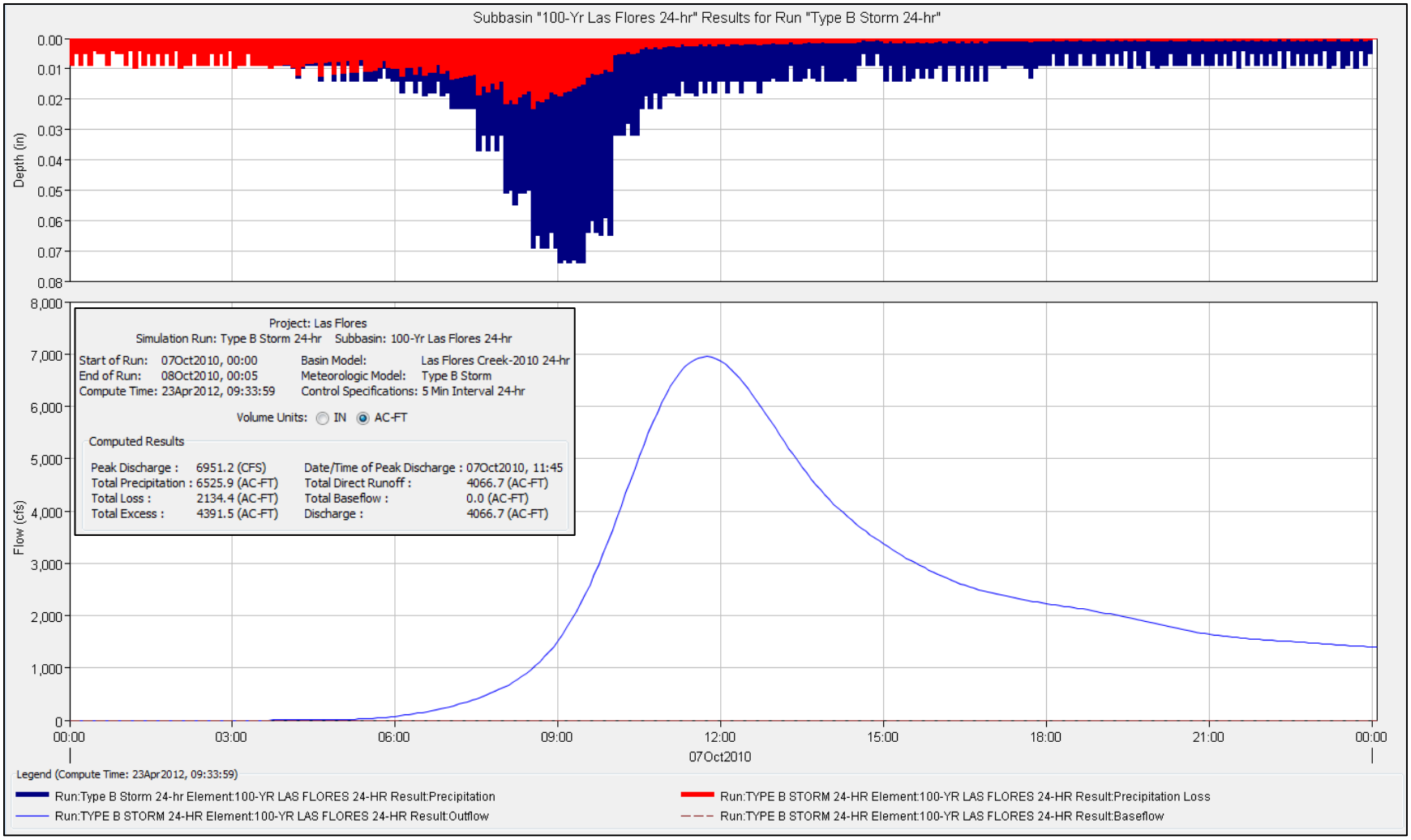

Subbasin "100-Yr Jamul 24-hr" Results for Run "Nested Storm"
Depth (in)
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
Flow (cfs)
30,000
25,000
20,000
15,000
10,000
5,000
0
Project: Jamul_Creek
Simulation Run: Nested Storm Subbasin: 100-Yr Jamul 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 24Jan2012, 13:24:04
Basin Model: Jamul Creek-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 28215.8 (CFS)
Total Precipitation : 22267.5 (AC-FT)
Total Loss : 3476.2 (AC-FT)
Total Excess : 18791.3 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 18:10
Total Direct Runoff : 17113.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 17113.2 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:24:04)
Run:Nested Storm Element:100-YR JAMUL 24-HR Result:Precipitation
Run:NESTED STORM Element:100-YR JAMUL 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:100-YR JAMUL 24-HR Result:Outflow
Run:NESTED STORM Element:100-YR JAMUL 24-HR Result:Baseflow

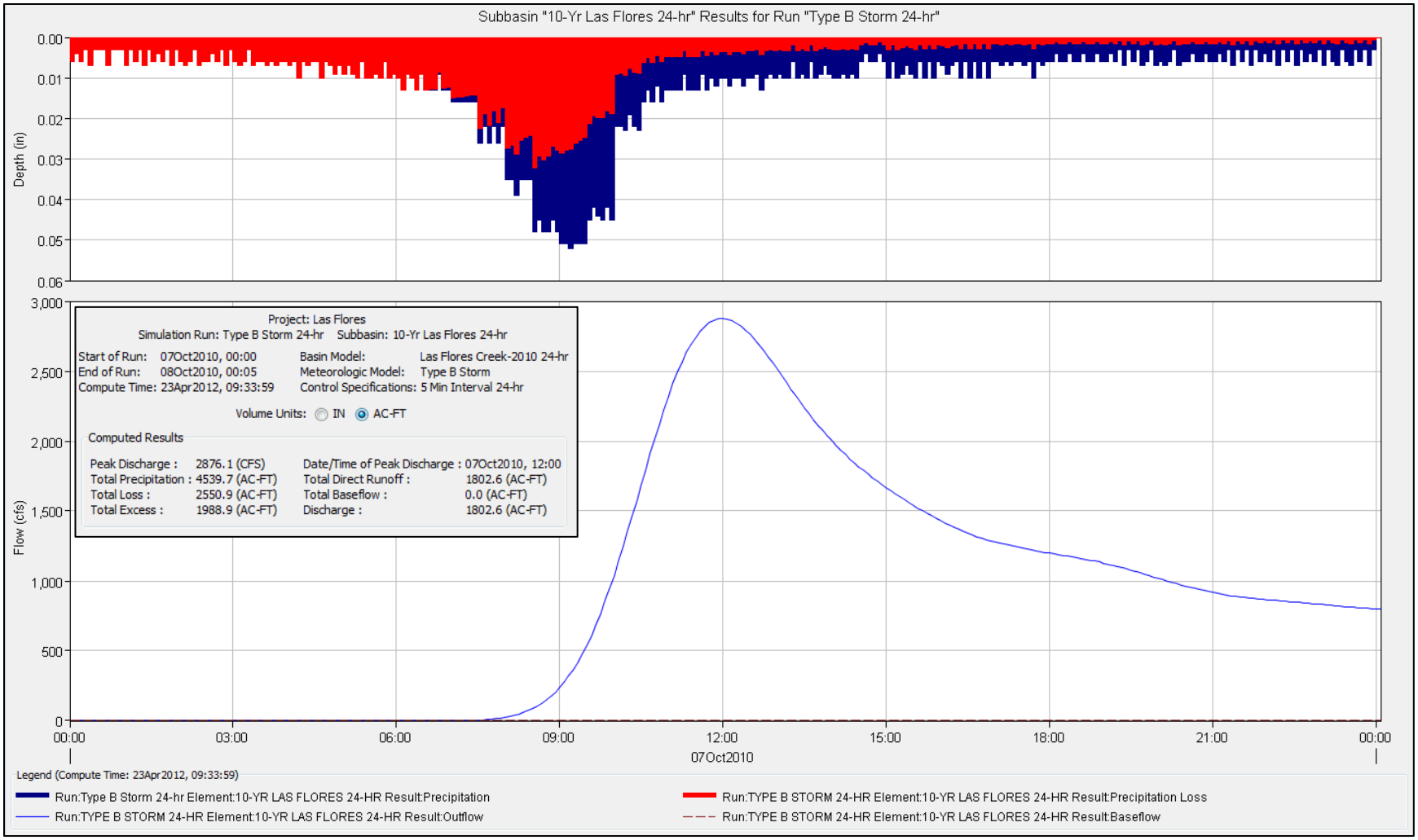

Subbasin "10-Yr Jamul 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Flow (cfs)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Jamul_Creek
Simulation Run: Nested Storm Subbasin: 10-Yr Jamul 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 24Jan2012, 13:24:04
Basin Model: Jamul Creek-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 15217.6 (CFS)
Total Precipitation : 12748.9 (AC-FT)
Total Loss : 4573.2 (AC-FT)
Total Excess : 8175.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 18:15
Total Direct Runoff : 7401.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 7401.2 (AC-FT)
Legend (Compute Time: 24Jan2012, 13:24:04)
Run:Nested Storm Element:10-YR JAMUL 24-HR Result:Precipitation
Run:NESTED STORM Element:10-YR JAMUL 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:10-YR JAMUL 24-HR Result:Outflow
Run:NESTED STORM Element:10-YR JAMUL 24-HR Result:Baseflow

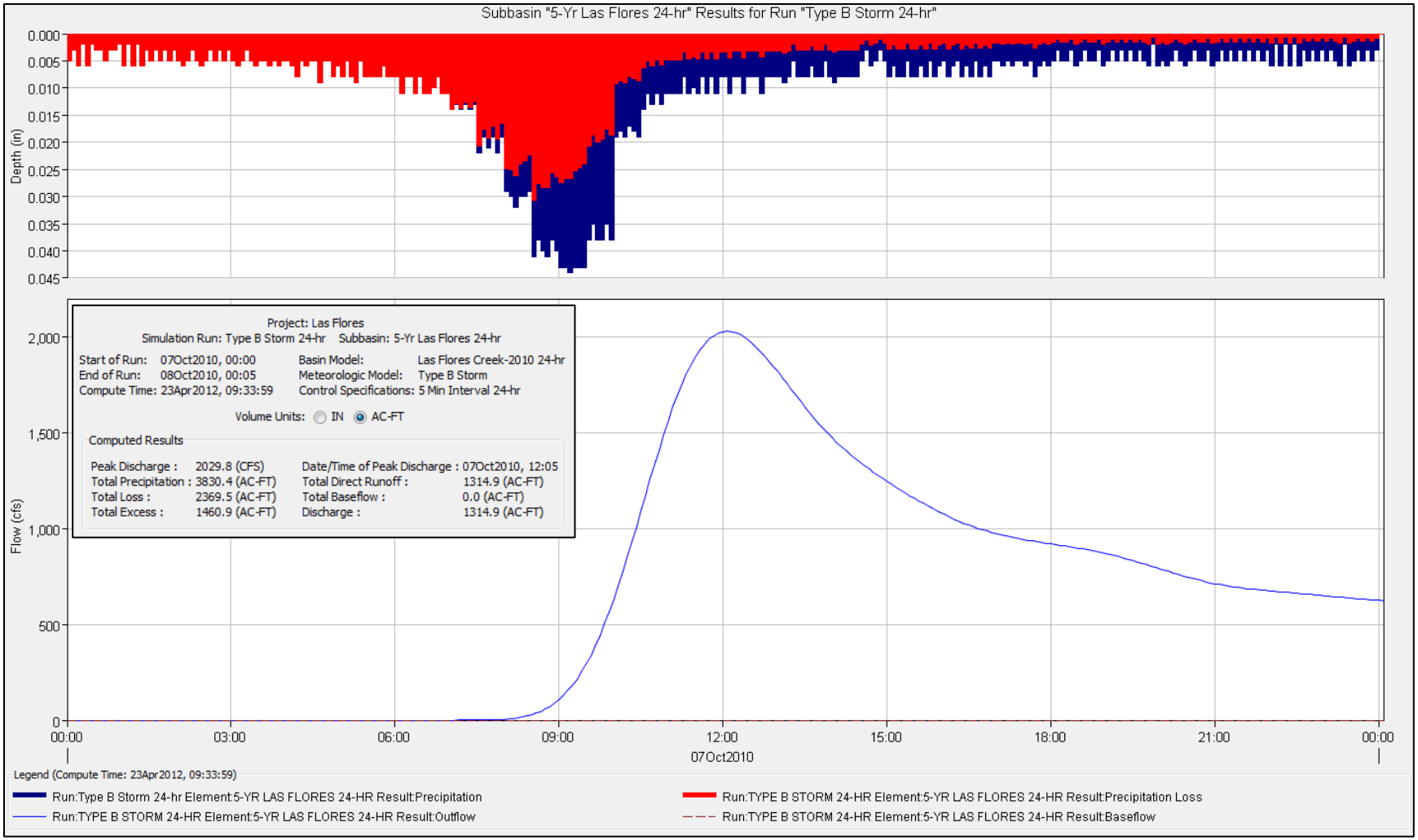

Subbasin "5-Yr Jamul 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Flow (cfs)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Project: Jamul_Creek
Simulation Run: Nested Storm Subbasin: 5-Yr Jamul 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 24Jan2012, 13:24:04
Basin Model: Jamul Creek-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 13899.1 (CFS)
Total Precipitation : 13047.9 (AC-FT)
Total Loss : 4600.2 (AC-FT)
Total Excess : 8447.7 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 18:15
Total Direct Runoff : 7540.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 7540.4 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 24Jan2012, 13:24:04)
Run:Nested Storm Element:5-YR JAMUL 24-HR Result:Precipitation
Run:NESTED STORM Element:5-YR JAMUL 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:5-YR JAMUL 24-HR Result:Outflow
Run:NESTED STORM Element:5-YR JAMUL 24-HR Result:Baseflow

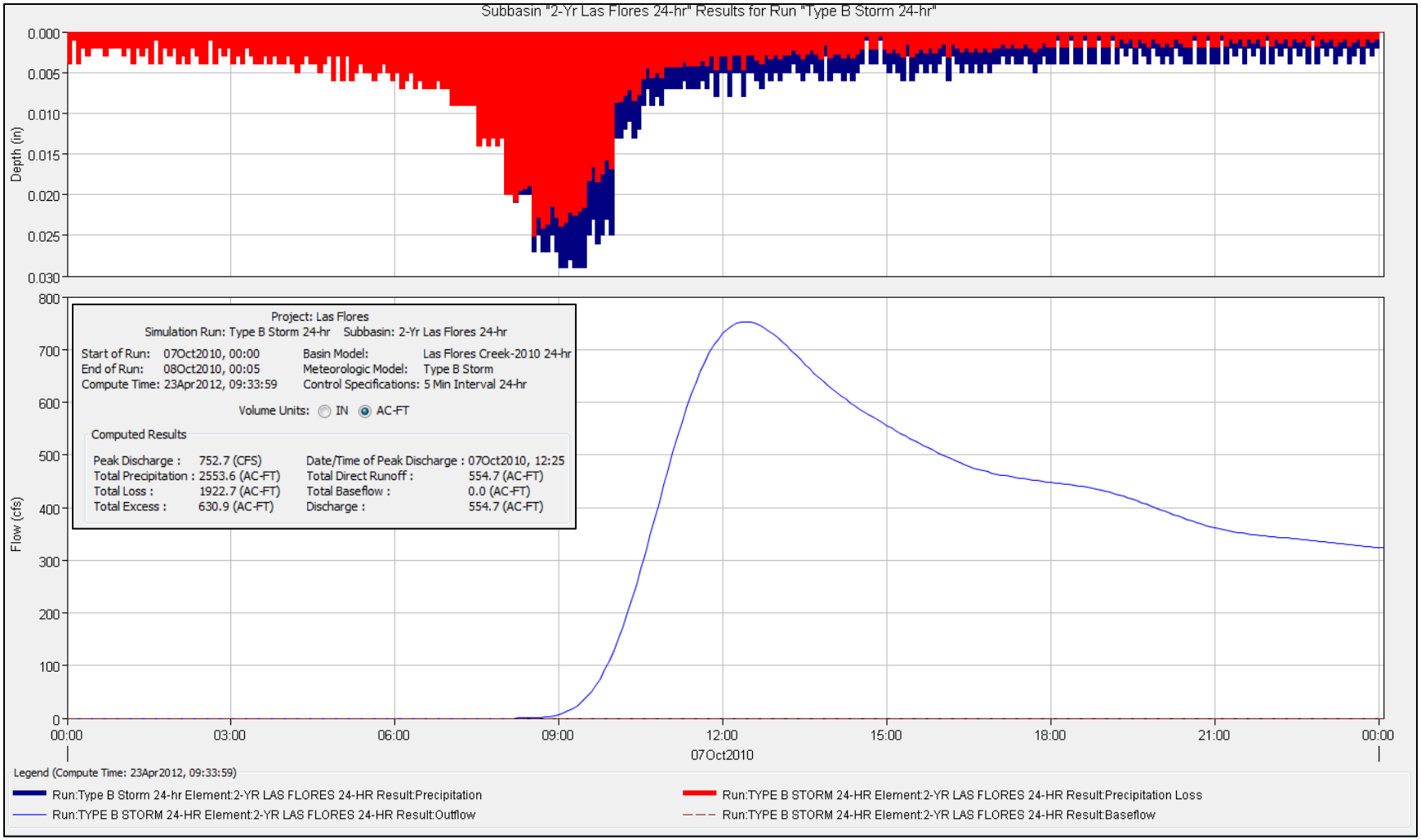

Subbasin "2-Yr Jamul 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
Flow (cfs)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Jamul_Creek
Simulation Run: Nested Storm Subbasin: 2-Yr Jamul 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 24Jan2012, 13:24:04
Basin Model: Jamul Creek-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 8058.1 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 18:20
Total Precipitation : 7458.6 (AC-FT)
Total Direct Runoff : 3262.0 (AC-FT)
Total Loss : 3865.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 3593.7 (AC-FT)
Discharge : 3262.0 (AC-FT)
Legend (Compute Time: 24Jan2012, 13:24:04)
Run:Nested Storm Element:2-YR JAMUL 24-HR Result:Precipitation
Run:NESTED STORM Element:2-YR JAMUL 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:2-YR JAMUL 24-HR Result:Outflow
Run:NESTED STORM Element:2-YR JAMUL 24-HR Result:Baseflow

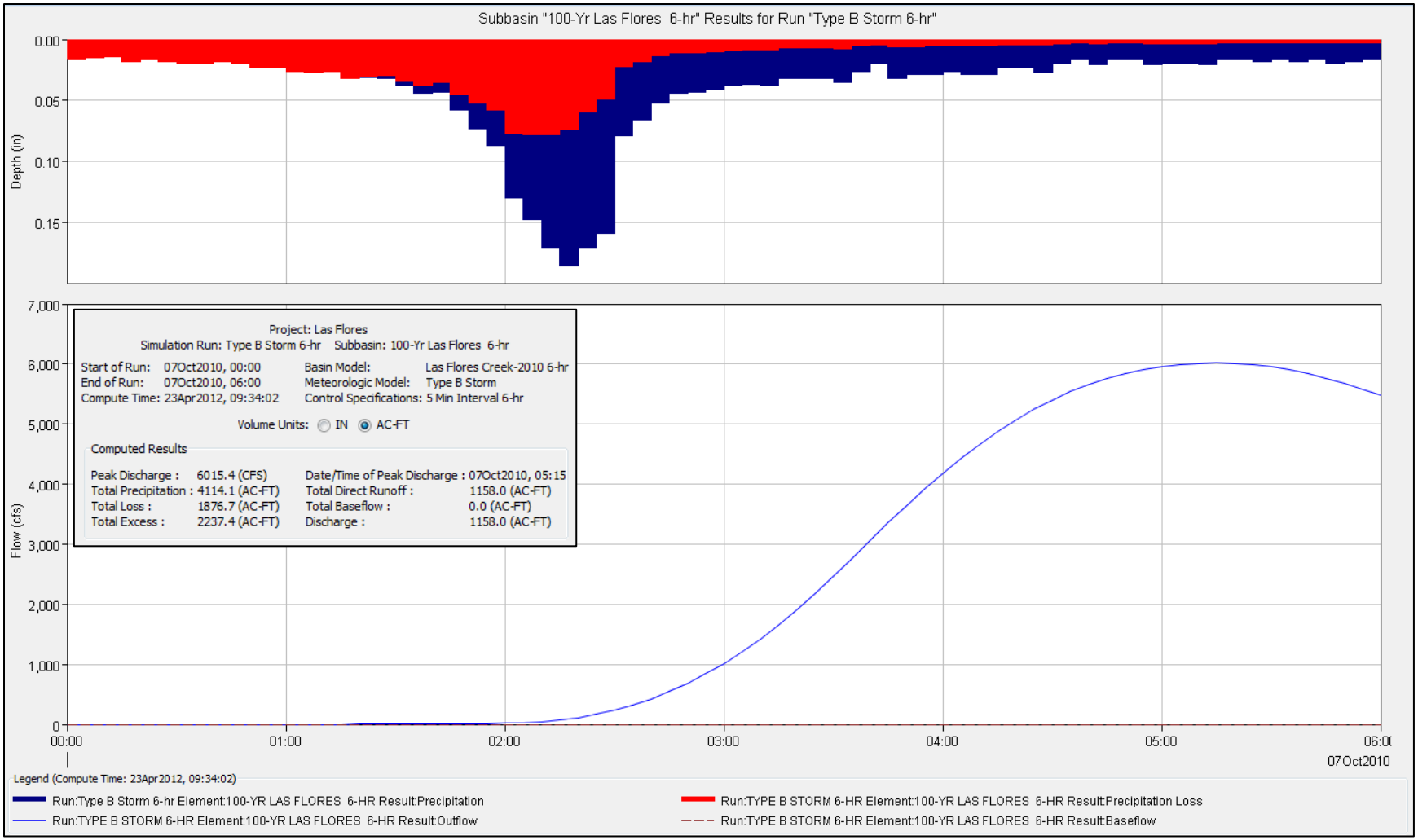
Las Flores Creek HEC-HMS Outputs

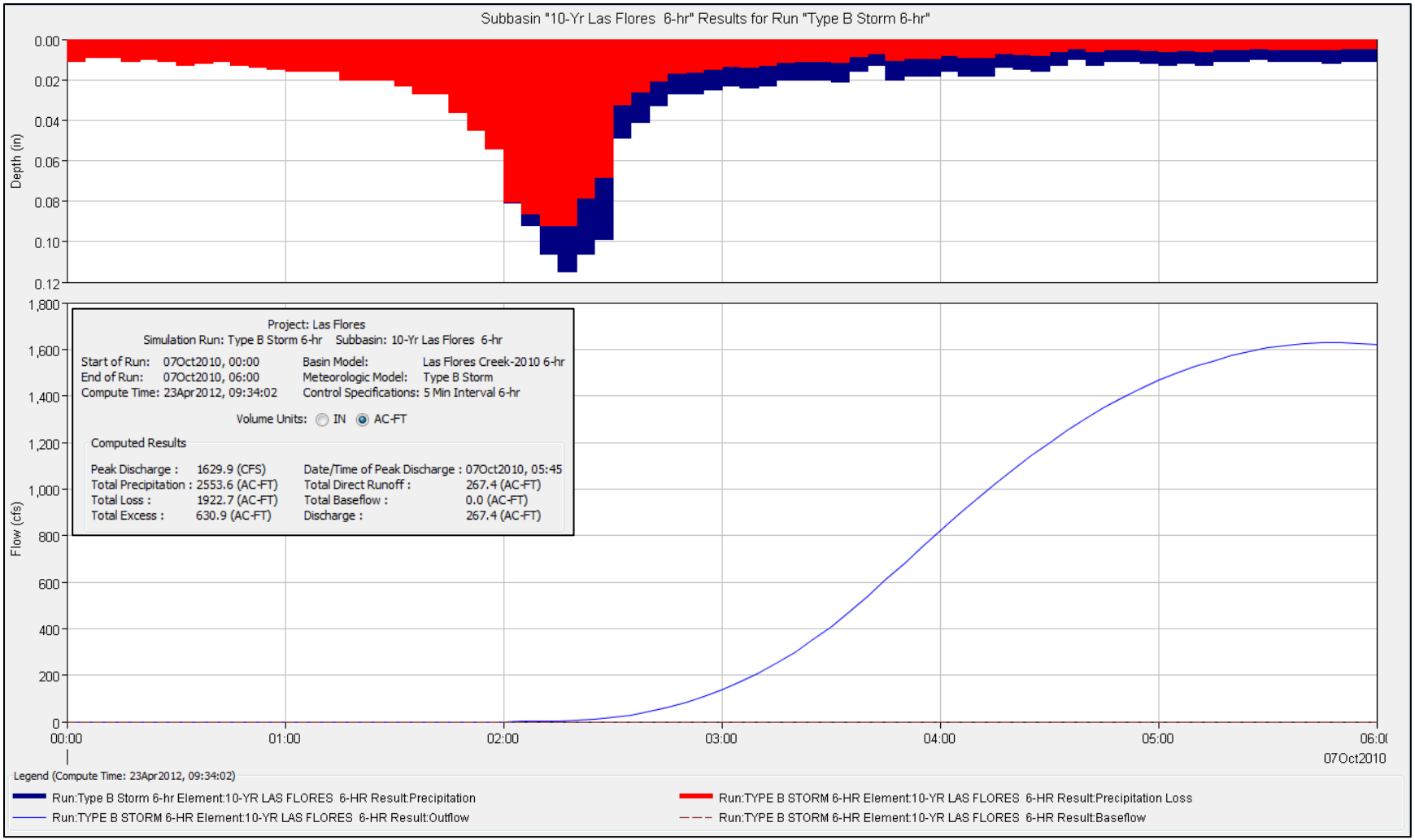

Subbasin "100-Yr Las Flores 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
Flow (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Las Flores
Simulation Run: Type B Storm 24-hr Subbasin: 100-Yr Las Flores 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 23Apr2012, 09:33:59
Basin Model: Las Flores Creek-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 6951.2 (CFS)
Total Precipitation : 6525.9 (AC-FT)
Total Loss : 2134.4 (AC-FT)
Total Excess : 4391.5 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 11:45
Total Direct Runoff : 4066.7 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 4066.7 (AC-FT)
Legend (Compute Time: 23Apr2012, 09:33:59)
Run:Type B Storm 24-hr Element:100-YR LAS FLORES 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:100-YR LAS FLORES 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:100-YR LAS FLORES 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:100-YR LAS FLORES 24-HR Result:Baseflow

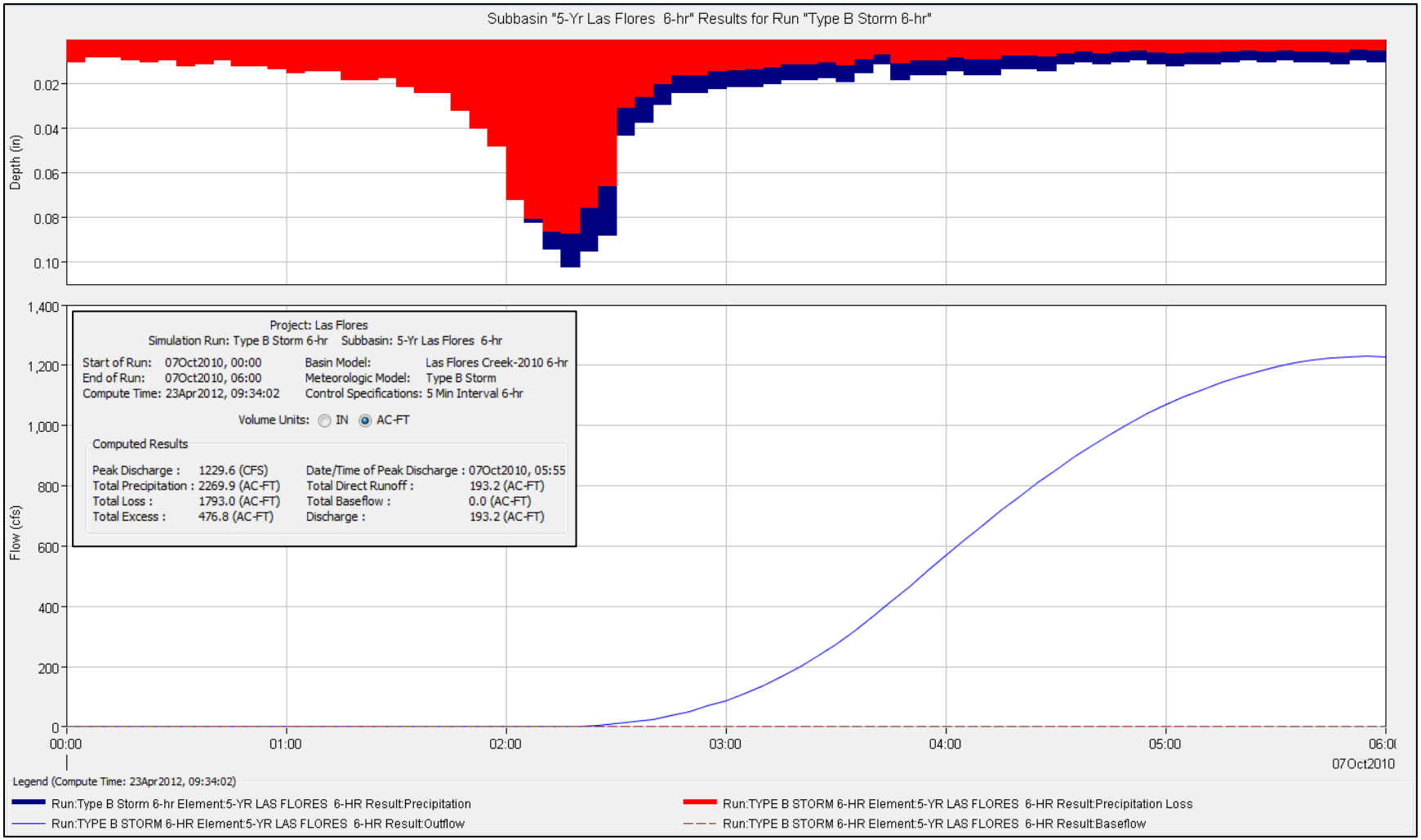

Subbasin "10-Yr Las Flores 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
Flow (cfs)
3,000
2,500
2,000
1,500
1,000
500
0
Project: Las Flores
Simulation Run: Type B Storm 24-hr Subbasin: 10-Yr Las Flores 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 23Apr2012, 09:33:59
Basin Model: Las Flores Creek-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2876.1 (CFS)
Total Precipitation : 4539.7 (AC-FT)
Total Loss : 2550.9 (AC-FT)
Total Excess : 1988.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:00
Total Direct Runoff : 1802.6 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1802.6 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 23Apr2012, 09:33:59)
Run:Type B Storm 24-hr Element:10-YR LAS FLORES 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:10-YR LAS FLORES 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:10-YR LAS FLORES 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:10-YR LAS FLORES 24-HR Result:Baseflow

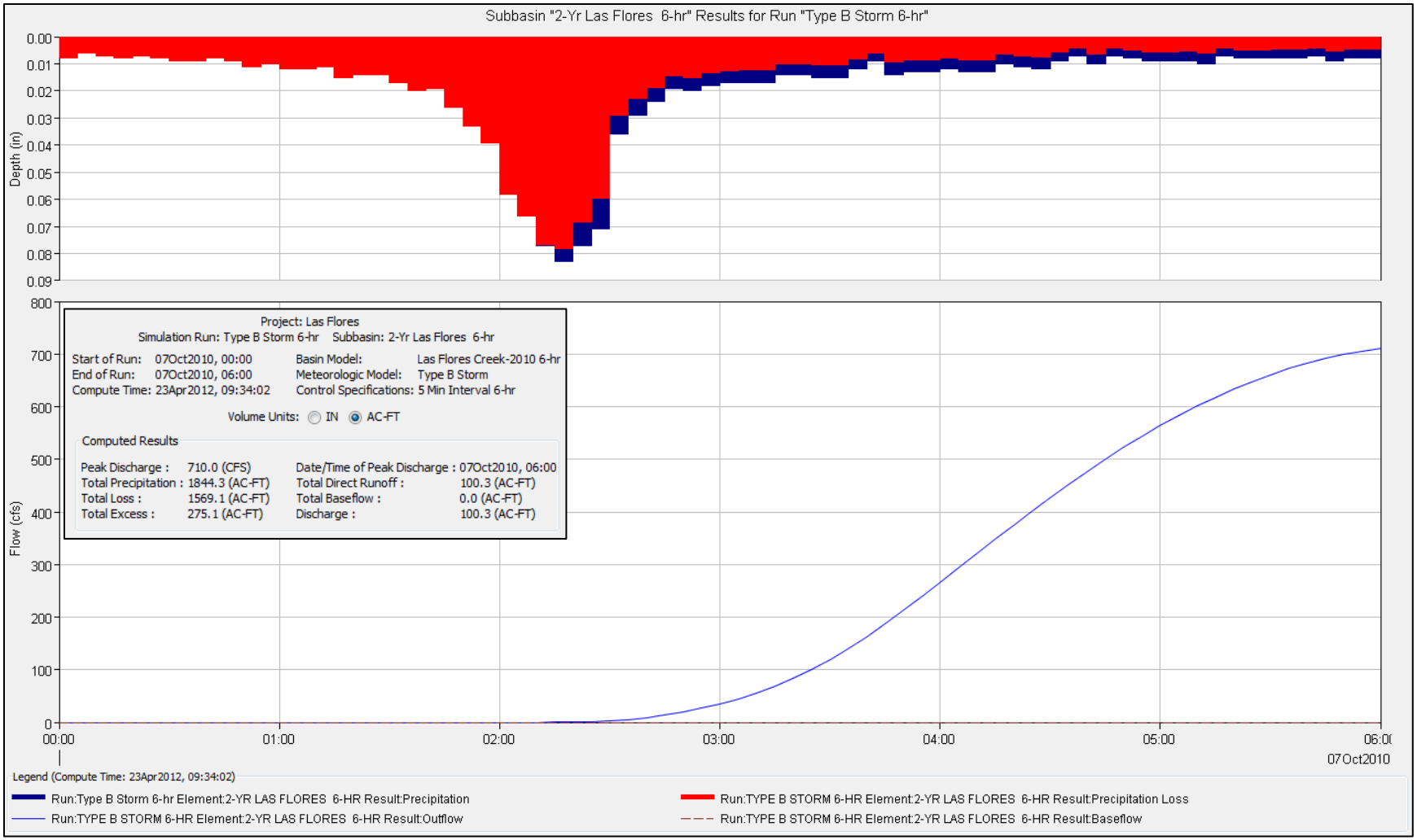

Subbasin "5-Yr Las Flores 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
0.040
0.045
Project: Las Flores
Simulation Run: Type B Storm 24-hr Subbasin: 5-Yr Las Flores 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 23Apr2012, 09:33:59
Basin Model: Las Flores Creek-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2029.8 (CFS)
Total Precipitation : 3830.4 (AC-FT)
Total Loss : 2369.5 (AC-FT)
Total Excess : 1460.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:05
Total Direct Runoff : 1314.9 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1314.9 (AC-FT)
Flow (cfs)
2,000
1,500
1,000
500
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 23Apr2012, 09:33:59)
Run:Type B Storm 24-hr Element:5-YR LAS FLORES 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:5-YR LAS FLORES 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:5-YR LAS FLORES 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:5-YR LAS FLORES 24-HR Result:Baseflow

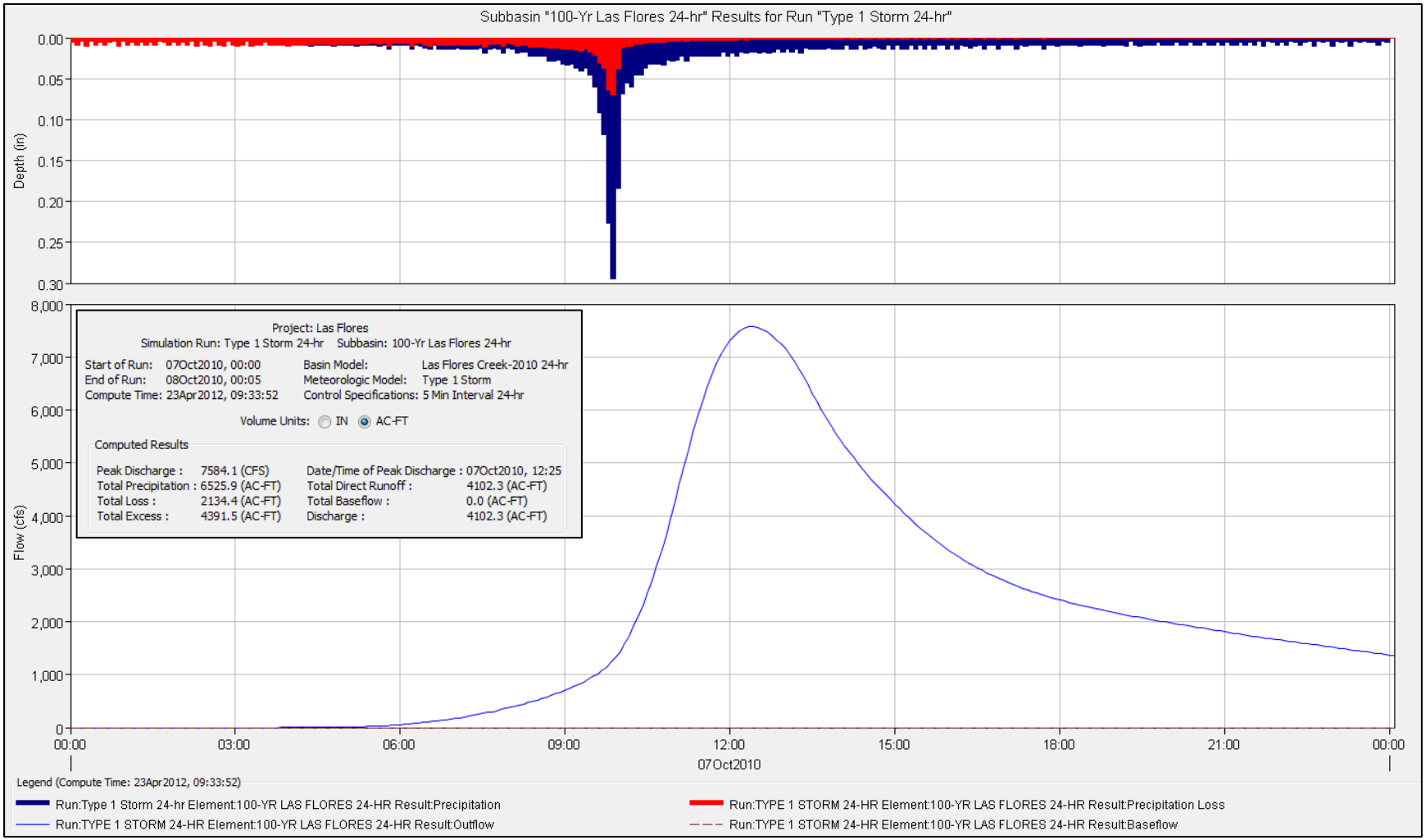

Subbasin "2-Yr Las Flores 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.000
0.005
0.010
0.015
0.020
0.025
0.030
Flow (cfs)
800
700
600
500
400
300
200
100
0
Project: Las Flores
Simulation Run: Type B Storm 24-hr Subbasin: 2-Yr Las Flores 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 23Apr2012, 09:33:59
Basin Model: Las Flores Creek-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 752.7 (CFS)
Total Precipitation : 2553.6 (AC-FT)
Total Loss : 1922.7 (AC-FT)
Total Excess : 630.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:25
Total Direct Runoff : 554.7 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 554.7 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 23Apr2012, 09:33:59)
Run:Type B Storm 24-hr Element:2-YR LAS FLORES 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:2-YR LAS FLORES 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:2-YR LAS FLORES 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:2-YR LAS FLORES 24-HR Result:Baseflow

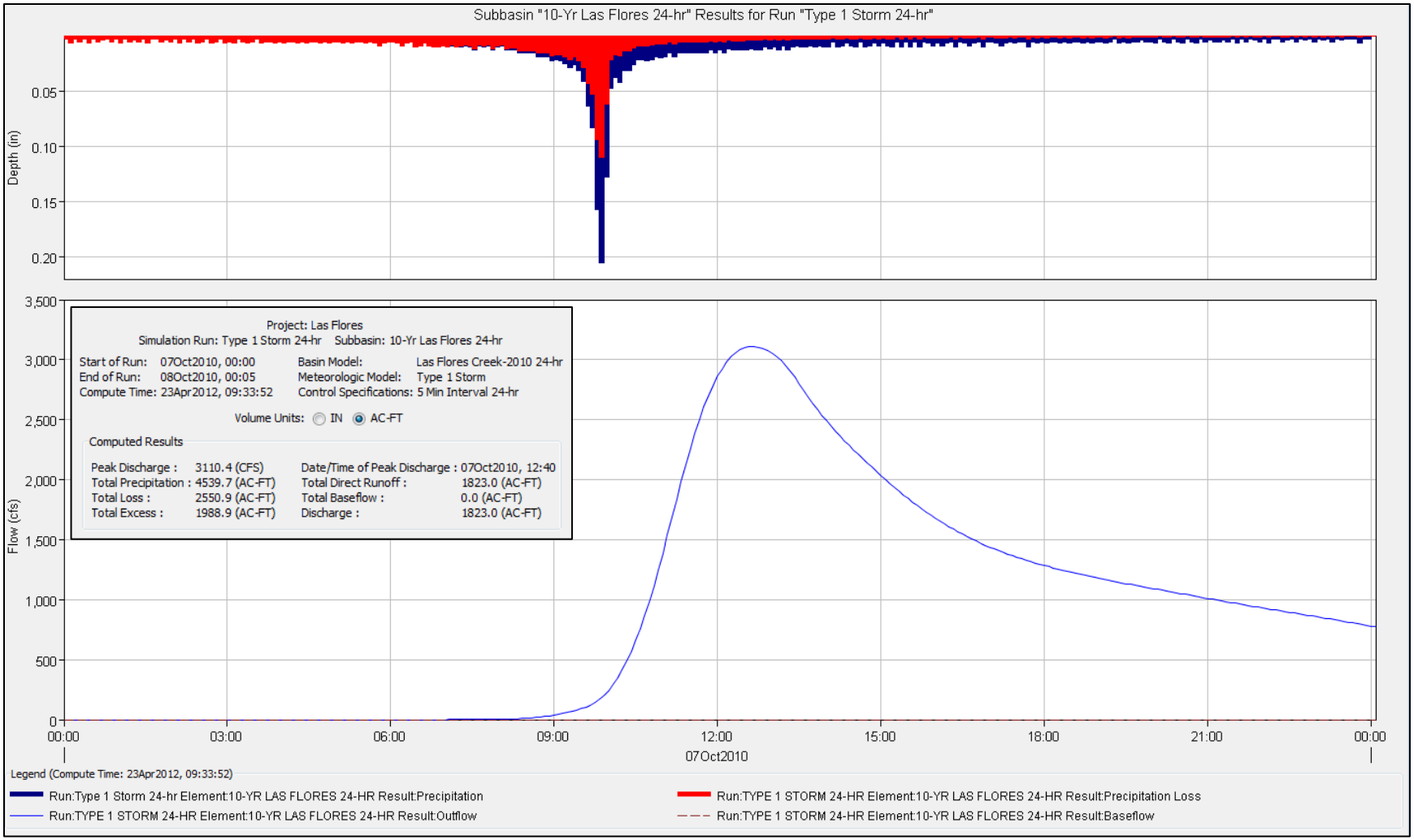

Subbasin "100-Yr Las Flores 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
Flow (cfs)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Project: Las Flores
Simulation Run: Type B Storm 6-hr Subbasin: 100-Yr Las Flores 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 23Apr2012, 09:34:02
Basin Model: Las Flores Creek-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 6015.4 (CFS)
Total Precipitation : 4114.1 (AC-FT)
Total Loss : 1876.7 (AC-FT)
Total Excess : 2237.4 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:15
Total Direct Runoff : 1158.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1158.0 (AC-FT)
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Legend (Compute Time: 23Apr2012, 09:34:02)
Run:Type B Storm 6-hr Element:100-YR LAS FLORES 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:100-YR LAS FLORES 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:100-YR LAS FLORES 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:100-YR LAS FLORES 6-HR Result:Baseflow

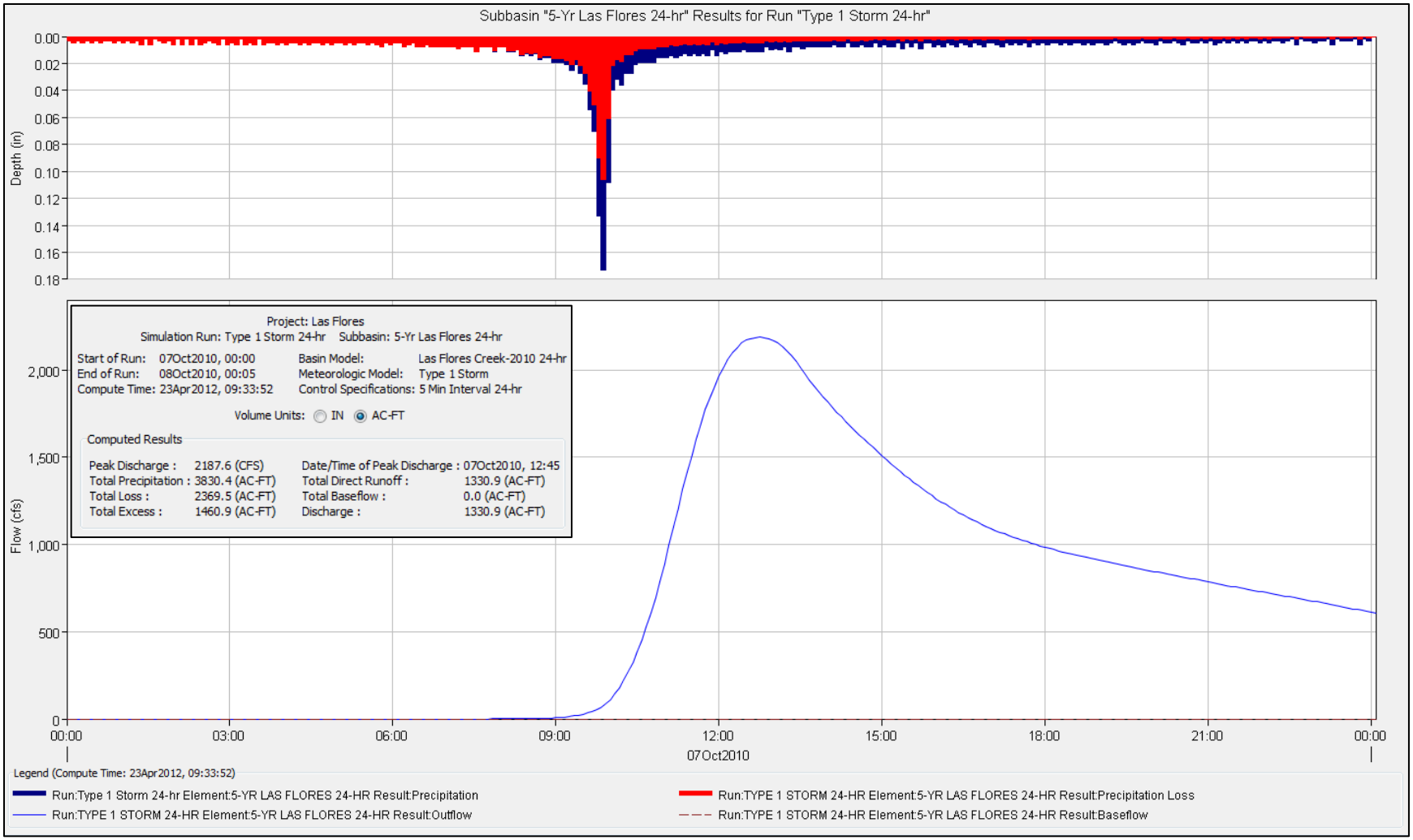

Subbasin "10-Yr Las Flores 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Flow (cfs)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Project: Las Flores
Simulation Run: Type B Storm 6-hr Subbasin: 10-Yr Las Flores 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 23Apr2012, 09:34:02
Basin Model: Las Flores Creek-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1629.9 (CFS)
Total Precipitation : 2553.6 (AC-FT)
Total Loss : 1922.7 (AC-FT)
Total Excess : 630.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:45
Total Direct Runoff : 267.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 267.4 (AC-FT)
Legend (Compute Time: 23Apr2012, 09:34:02)
Run:Type B Storm 6-hr Element:10-YR LAS FLORES 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:10-YR LAS FLORES 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:10-YR LAS FLORES 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:10-YR LAS FLORES 6-HR Result:Baseflow

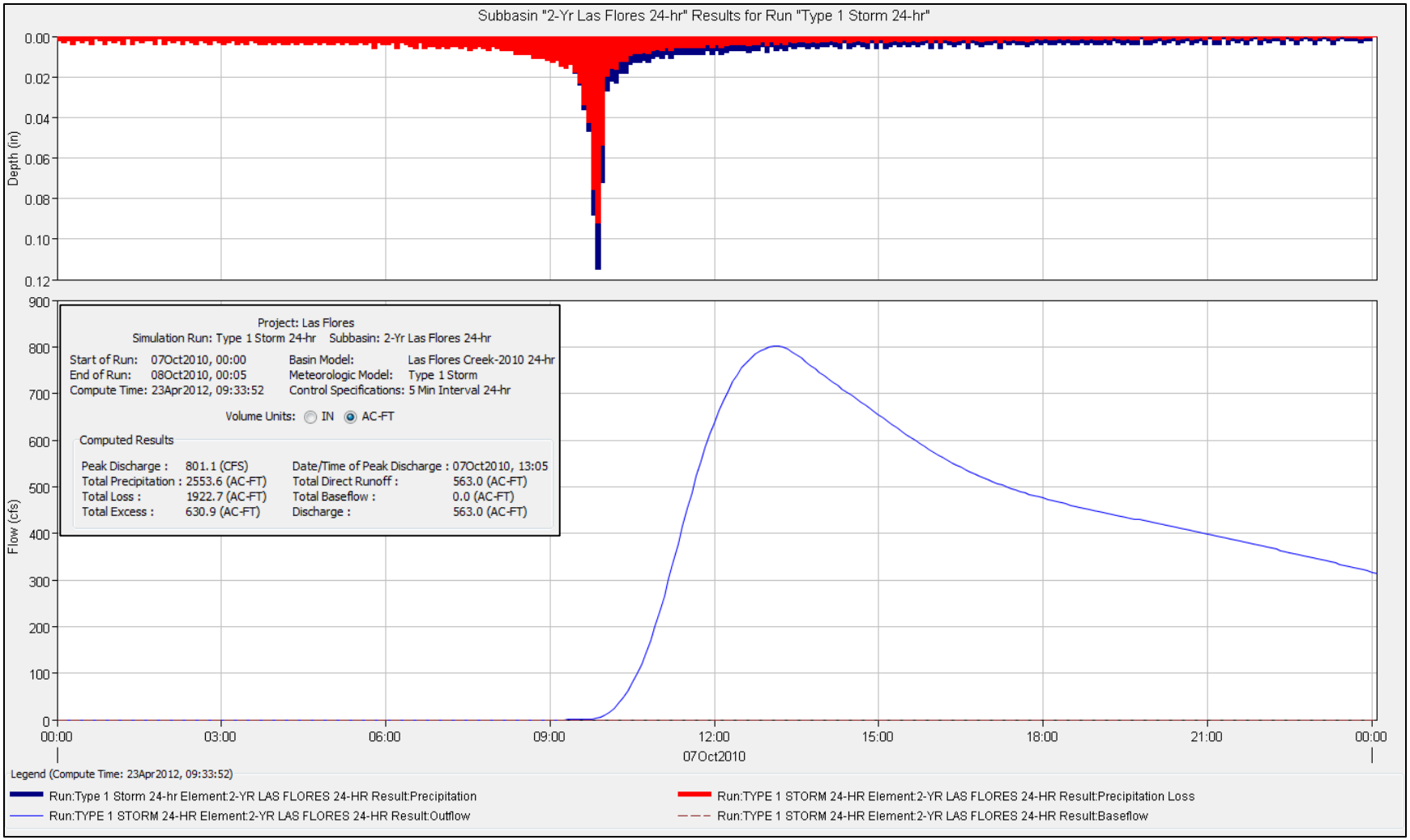

Subbasin "5-Yr Las Flores 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.02
0.04
0.06
0.08
0.10
Flow (cfs)
1,400
1,200
1,000
800
600
400
200
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07Oct2010
Project: Las Flores
Simulation Run: Type B Storm 6-hr Subbasin: 5-Yr Las Flores 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 23Apr2012, 09:34:02
Basin Model: Las Flores Creek-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1229.6 (CFS)
Total Precipitation : 2269.9 (AC-FT)
Total Loss : 1793.0 (AC-FT)
Total Excess : 476.8 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:55
Total Direct Runoff : 193.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 193.2 (AC-FT)
Legend (Compute Time: 23Apr2012, 09:34:02)
Run:Type B Storm 6-hr Element:5-YR LAS FLORES 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:5-YR LAS FLORES 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:5-YR LAS FLORES 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:5-YR LAS FLORES 6-HR Result:Baseflow

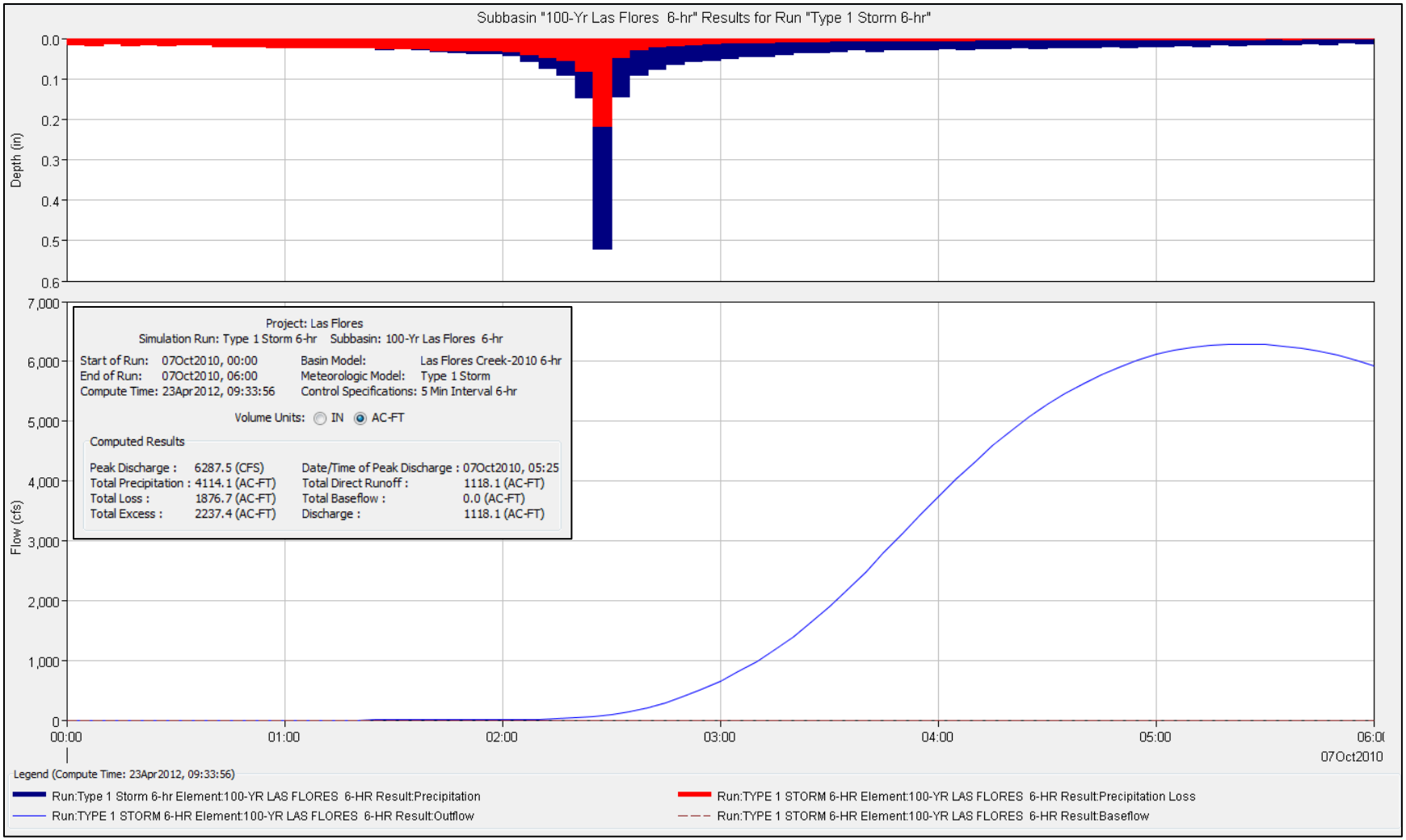

Subbasin "2-Yr Las Flores 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
Flow (cfs)
800
700
600
500
400
300
200
100
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Las Flores
Simulation Run: Type B Storm 6-hr Subbasin: 2-Yr Las Flores 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 23Apr2012, 09:34:02
Basin Model: Las Flores Creek-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 710.0 (CFS)
Total Precipitation : 1844.3 (AC-FT)
Total Loss : 1569.1 (AC-FT)
Total Excess : 275.1 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 100.3 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 100.3 (AC-FT)
Legend (Compute Time: 23Apr2012, 09:34:02)
Run:Type B Storm 6-hr Element:2-YR LAS FLORES 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:2-YR LAS FLORES 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:2-YR LAS FLORES 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:2-YR LAS FLORES 6-HR Result:Baseflow

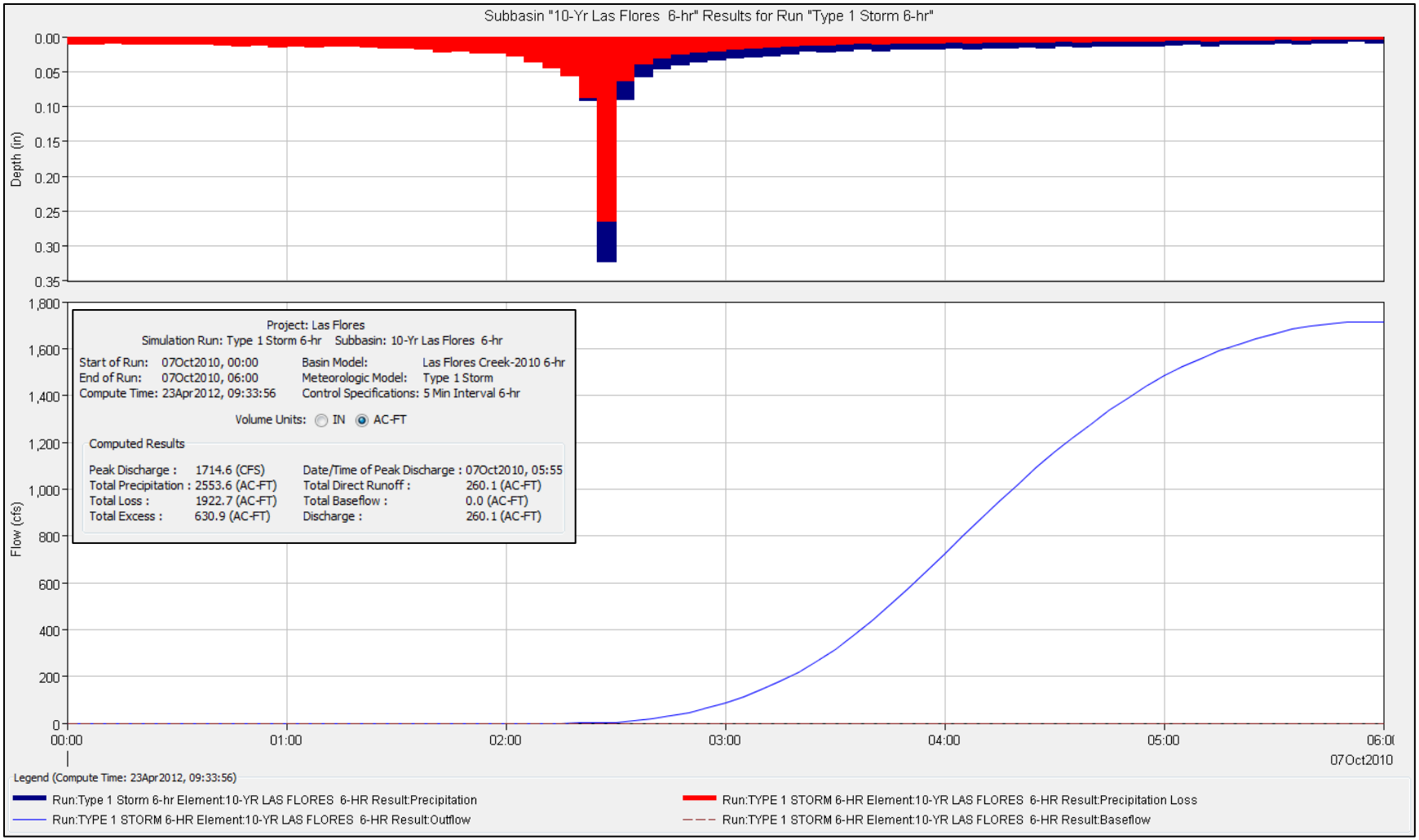

Subbasin "100-Yr Las Flores 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Flow (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Las Flores
Simulation Run: Type 1 Storm 24-hr Subbasin: 100-Yr Las Flores 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 23Apr2012, 09:33:52
Basin Model: Las Flores Creek-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 7584.1 (CFS)
Total Precipitation : 6525.9 (AC-FT)
Total Loss : 2134.4 (AC-FT)
Total Excess : 4391.5 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:25
Total Direct Runoff : 4102.3 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 4102.3 (AC-FT)
Legend (Compute Time: 23Apr2012, 09:33:52)
Run:Type 1 Storm 24-hr Element:100-YR LAS FLORES 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:100-YR LAS FLORES 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:100-YR LAS FLORES 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:100-YR LAS FLORES 24-HR Result:Baseflow

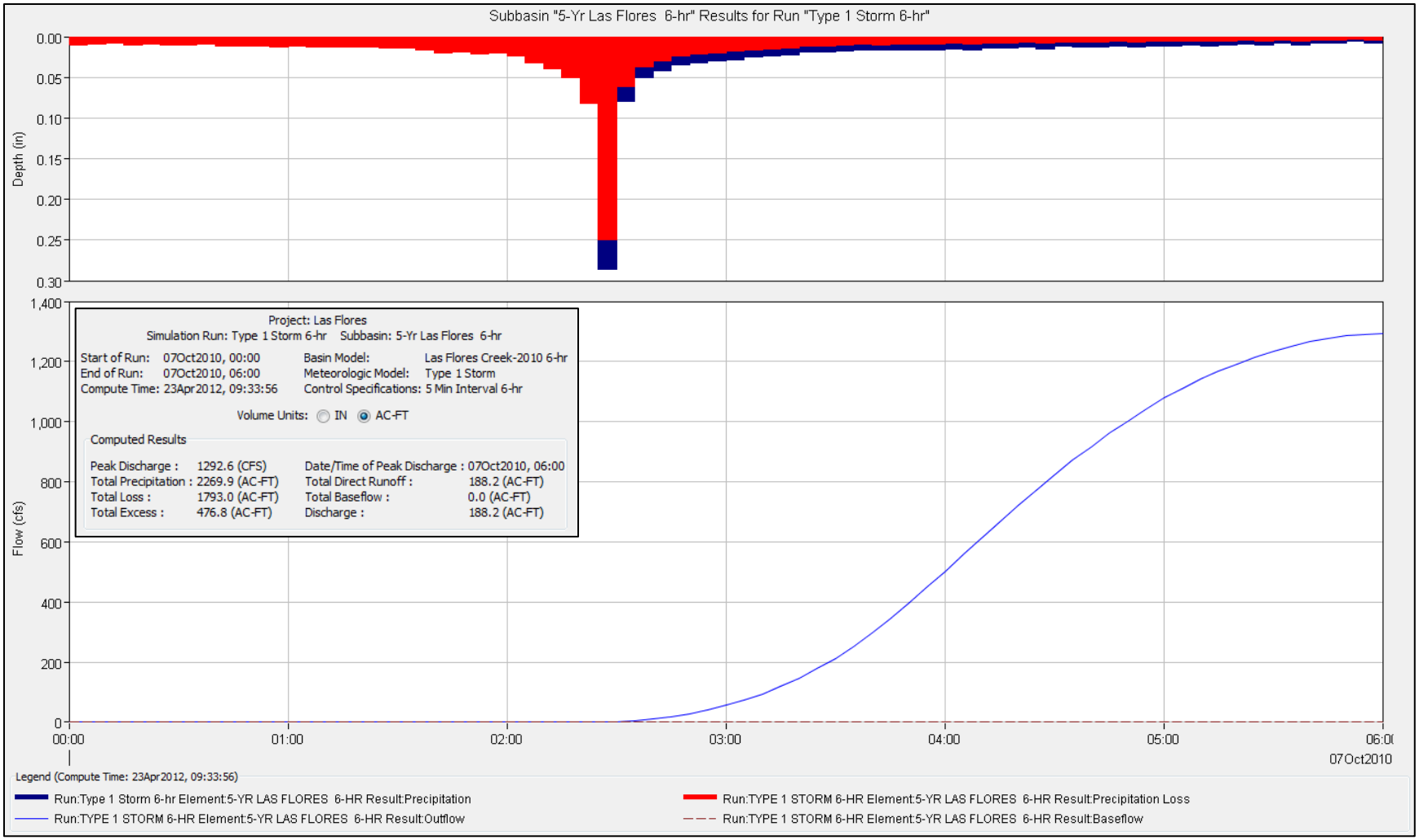

Subbasin "10-Yr Las Flores 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.05
0.10
0.15
0.20
Flow (cfs)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Project: Las Flores
Simulation Run: Type 1 Storm 24-hr Subbasin: 10-Yr Las Flores 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 23Apr2012, 09:33:52
Basin Model: Las Flores Creek-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 3110.4 (CFS)
Total Precipitation : 4539.7 (AC-FT)
Total Loss : 2550.9 (AC-FT)
Total Excess : 1988.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:40
Total Direct Runoff : 1823.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1823.0 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 23Apr2012, 09:33:52)
Run:Type 1 Storm 24-hr Element:10-YR LAS FLORES 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:10-YR LAS FLORES 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:10-YR LAS FLORES 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:10-YR LAS FLORES 24-HR Result:Baseflow

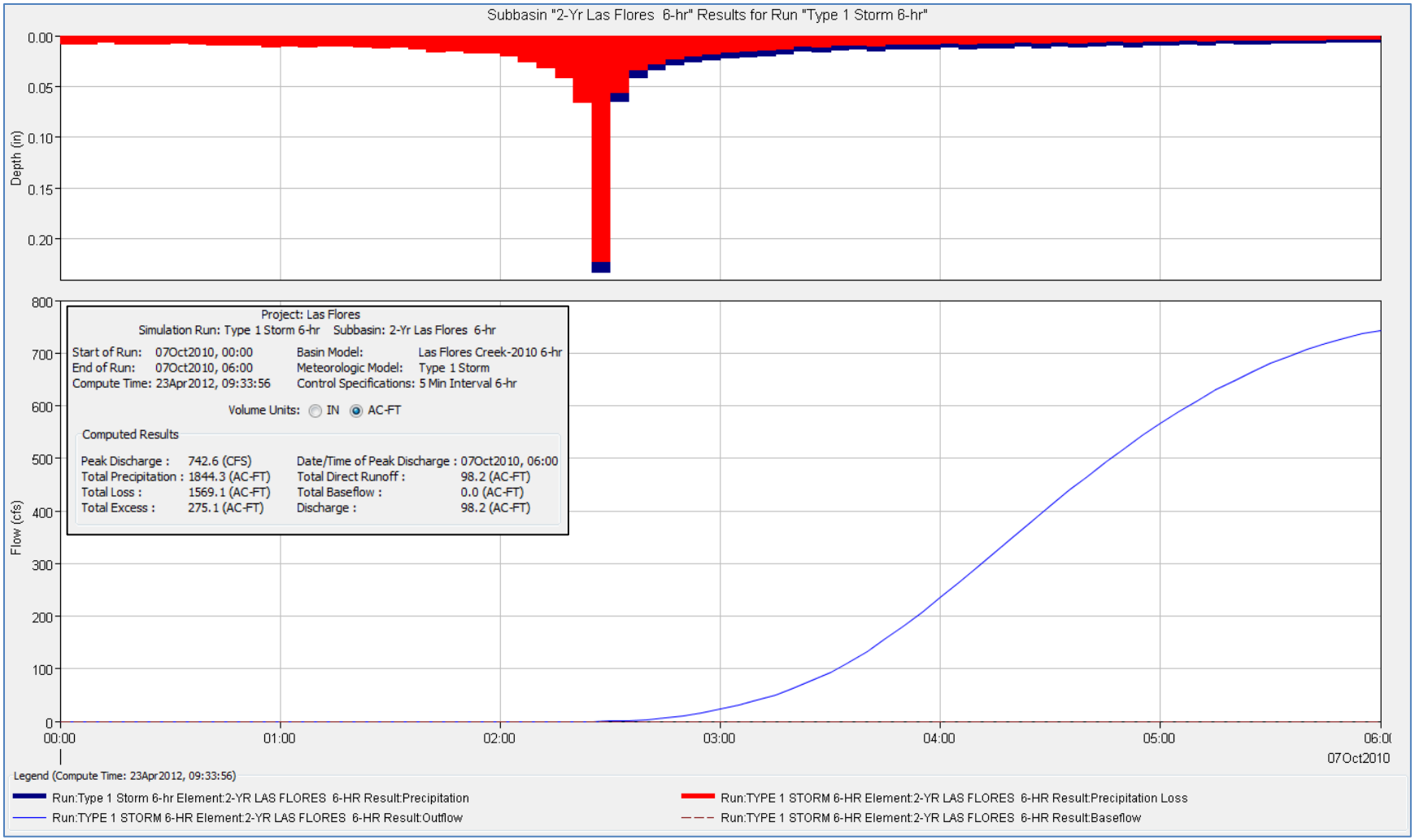

Subbasin "5-Yr Las Flores 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
Project: Las Flores
Simulation Run: Type 1 Storm 24-hr Subbasin: 5-Yr Las Flores 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 23Apr2012, 09:33:52
Basin Model: Las Flores Creek-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2187.6 (CFS)
Total Precipitation : 3830.4 (AC-FT)
Total Loss : 2369.5 (AC-FT)
Total Excess : 1460.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:45
Total Direct Runoff : 1330.9 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1330.9 (AC-FT)
Flow (cfs)
2,000
1,500
1,000
500
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 23Apr2012, 09:33:52)
Run:Type 1 Storm 24-hr Element:5-YR LAS FLORES 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:5-YR LAS FLORES 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:5-YR LAS FLORES 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:5-YR LAS FLORES 24-HR Result:Baseflow

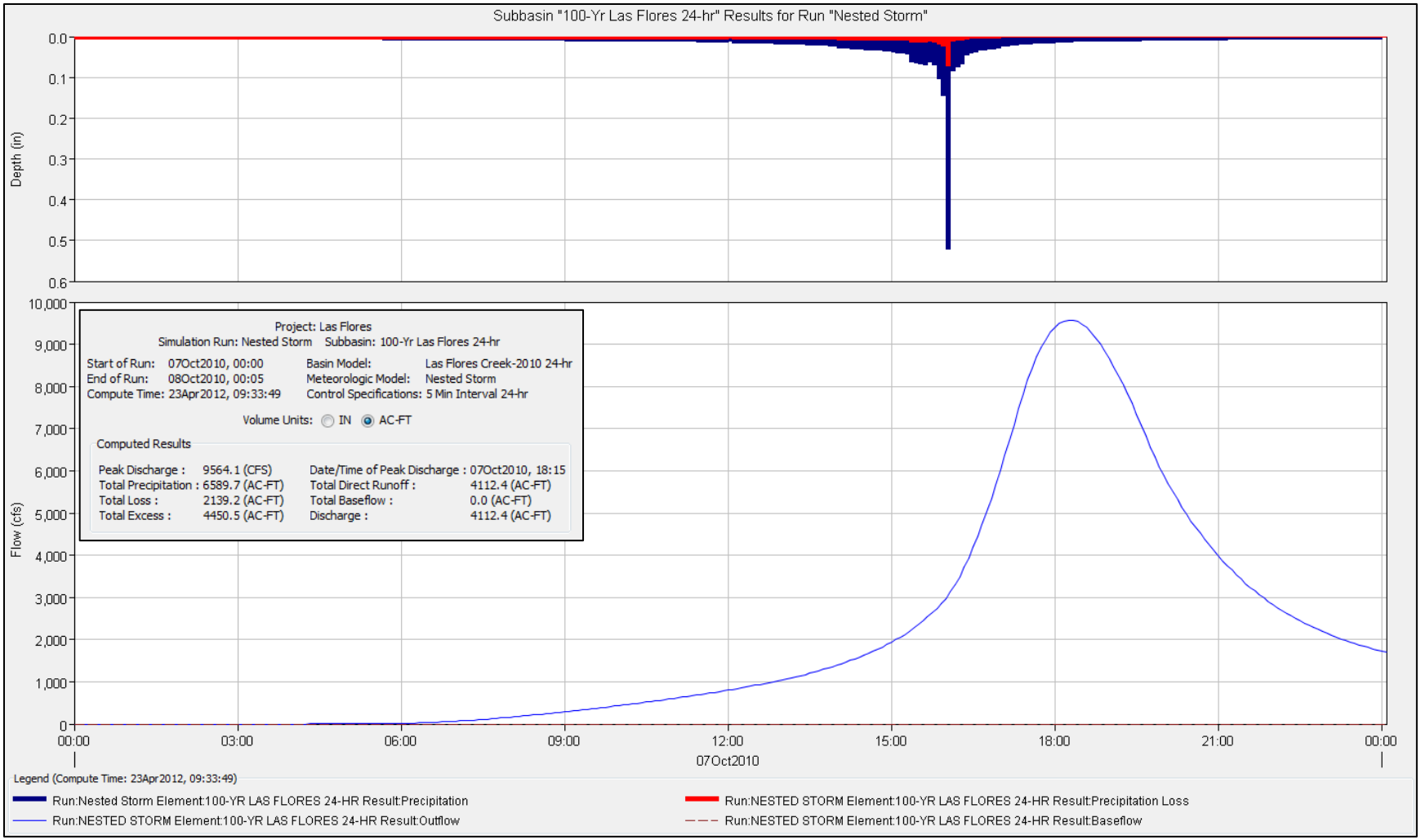

Subbasin "2-Yr Las Flores 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Flow (cfs)
900
800
700
600
500
400
300
200
100
0
Project: Las Flores
Simulation Run: Type 1 Storm 24-hr Subbasin: 2-Yr Las Flores 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 23Apr2012, 09:33:52
Basin Model: Las Flores Creek-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 801.1 (CFS)
Total Precipitation : 2553.6 (AC-FT)
Total Loss : 1922.7 (AC-FT)
Total Excess : 630.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 13:05
Total Direct Runoff : 563.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 563.0 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 23Apr2012, 09:33:52)
Run:Type 1 Storm 24-hr Element:2-YR LAS FLORES 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:2-YR LAS FLORES 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:2-YR LAS FLORES 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:2-YR LAS FLORES 24-HR Result:Baseflow

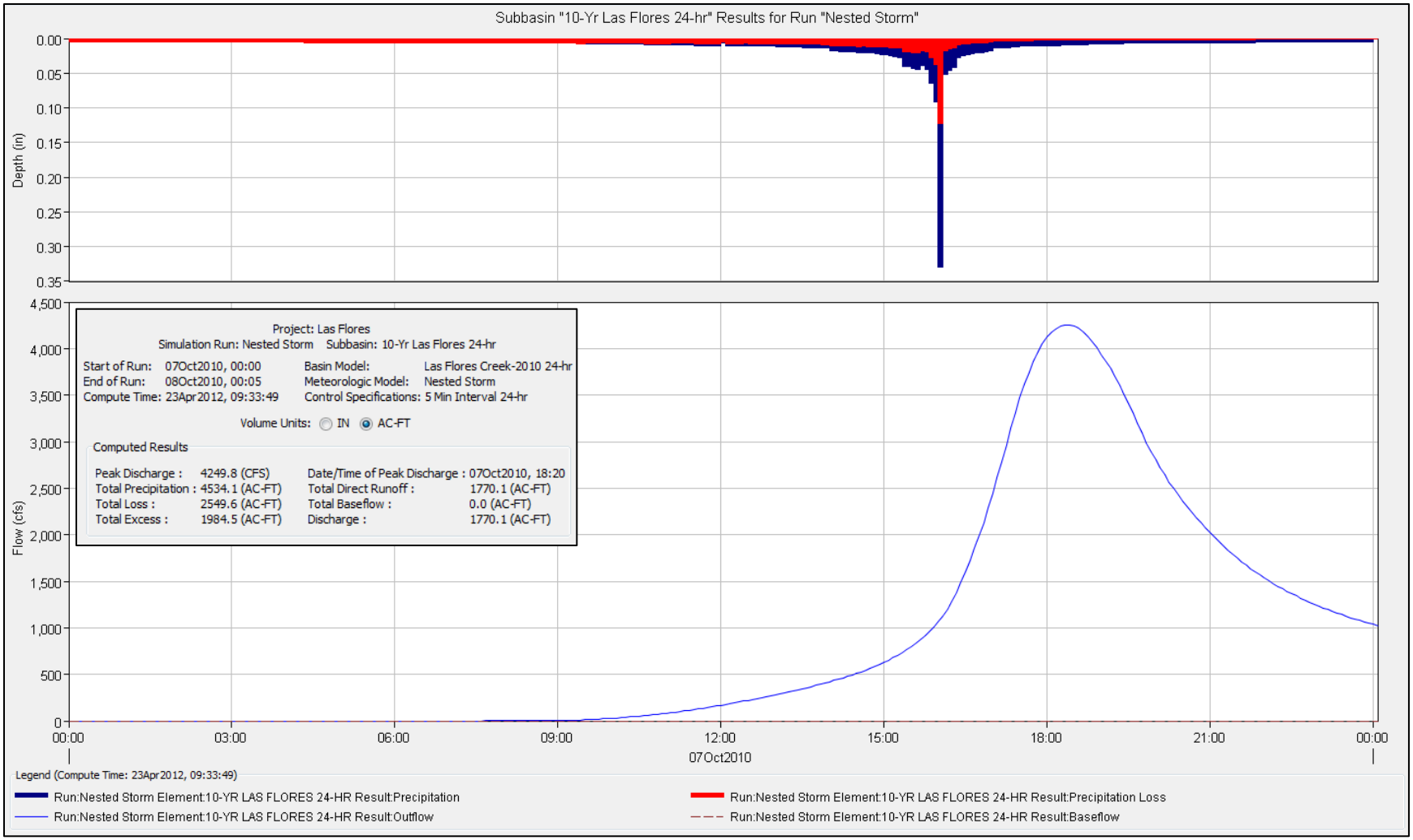

Subbasin "100-Yr Las Flores 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Flow (cfs)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0(
07Oct2010
Project: Las Flores
Simulation Run: Type 1 Storm 6-hr Subbasin: 100-Yr Las Flores 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 23Apr2012, 09:33:56
Basin Model: Las Flores Creek-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 6287.5 (CFS)
Total Precipitation : 4114.1 (AC-FT)
Total Loss : 1876.7 (AC-FT)
Total Excess : 2237.4 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:25
Total Direct Runoff : 1118.1 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1118.1 (AC-FT)
Legend (Compute Time: 23Apr2012, 09:33:56)
Run:Type 1 Storm 6-hr Element:100-YR LAS FLORES 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:100-YR LAS FLORES 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:100-YR LAS FLORES 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:100-YR LAS FLORES 6-HR Result:Baseflow

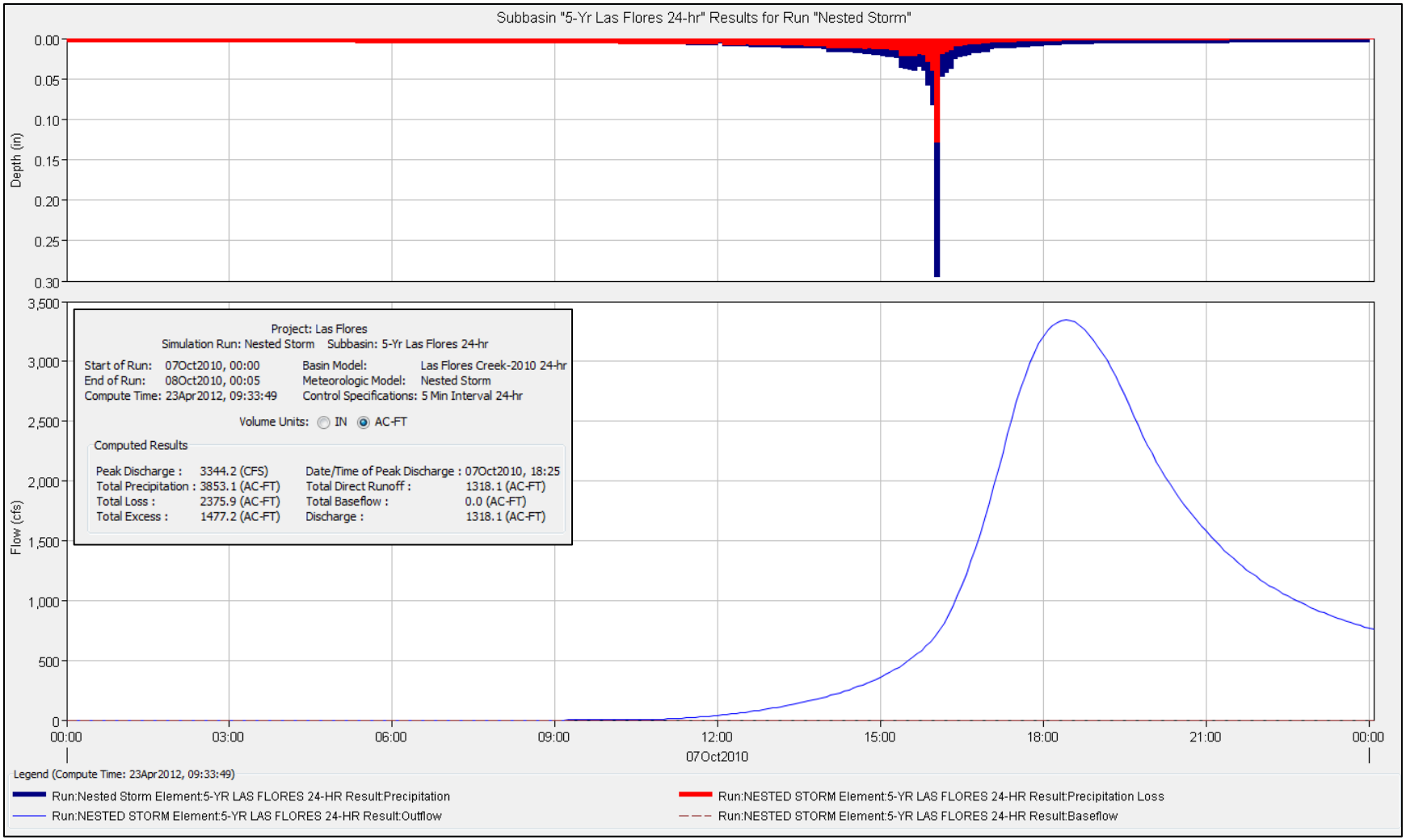

Subbasin "10-Yr Las Flores 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Flow (cfs)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0(
07Oct2010
Project: Las Flores
Simulation Run: Type 1 Storm 6-hr Subbasin: 10-Yr Las Flores 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 23Apr2012, 09:33:56
Basin Model: Las Flores Creek-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1714.6 (CFS)
Total Precipitation : 2553.6 (AC-FT)
Total Loss : 1922.7 (AC-FT)
Total Excess : 630.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:55
Total Direct Runoff : 260.1 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 260.1 (AC-FT)
Legend (Compute Time: 23Apr2012, 09:33:56)
Run:Type 1 Storm 6-hr Element:10-YR LAS FLORES 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:10-YR LAS FLORES 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:10-YR LAS FLORES 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:10-YR LAS FLORES 6-HR Result:Baseflow

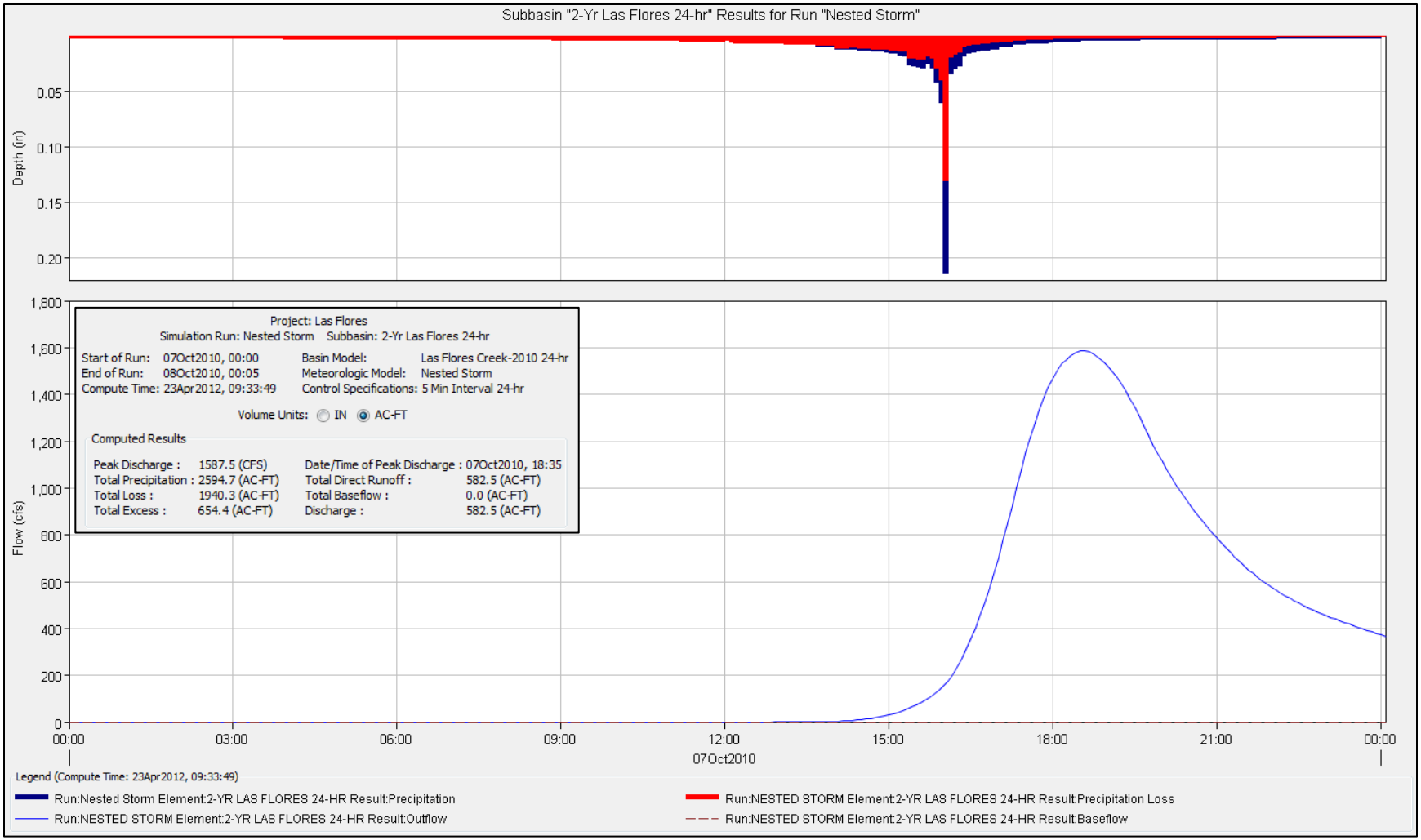

Subbasin "5-Yr Las Flores 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Flow (cfs)
1,400
1,200
1,000
800
600
400
200
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Las Flores
Simulation Run: Type 1 Storm 6-hr Subbasin: 5-Yr Las Flores 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 23Apr2012, 09:33:56
Basin Model: Las Flores Creek-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1292.6 (CFS)
Total Precipitation : 2269.9 (AC-FT)
Total Loss : 1793.0 (AC-FT)
Total Excess : 476.8 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 188.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 188.2 (AC-FT)
Legend (Compute Time: 23Apr2012, 09:33:56)
Run:Type 1 Storm 6-hr Element:5-YR LAS FLORES 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:5-YR LAS FLORES 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:5-YR LAS FLORES 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:5-YR LAS FLORES 6-HR Result:Baseflow


Subbasin "2-Yr Las Flores 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
Flow (cfs)
800
700
600
500
400
300
200
100
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Las Flores
Simulation Run: Type 1 Storm 6-hr Subbasin: 2-Yr Las Flores 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 23Apr2012, 09:33:56
Basin Model: Las Flores Creek-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 742.6 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Precipitation : 1844.3 (AC-FT)
Total Direct Runoff : 98.2 (AC-FT)
Total Loss : 1569.1 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 275.1 (AC-FT)
Discharge : 98.2 (AC-FT)
Legend (Compute Time: 23Apr2012, 09:33:56)
Run:Type 1 Storm 6-hr Element:2-YR LAS FLORES 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:2-YR LAS FLORES 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:2-YR LAS FLORES 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:2-YR LAS FLORES 6-HR Result:Baseflow

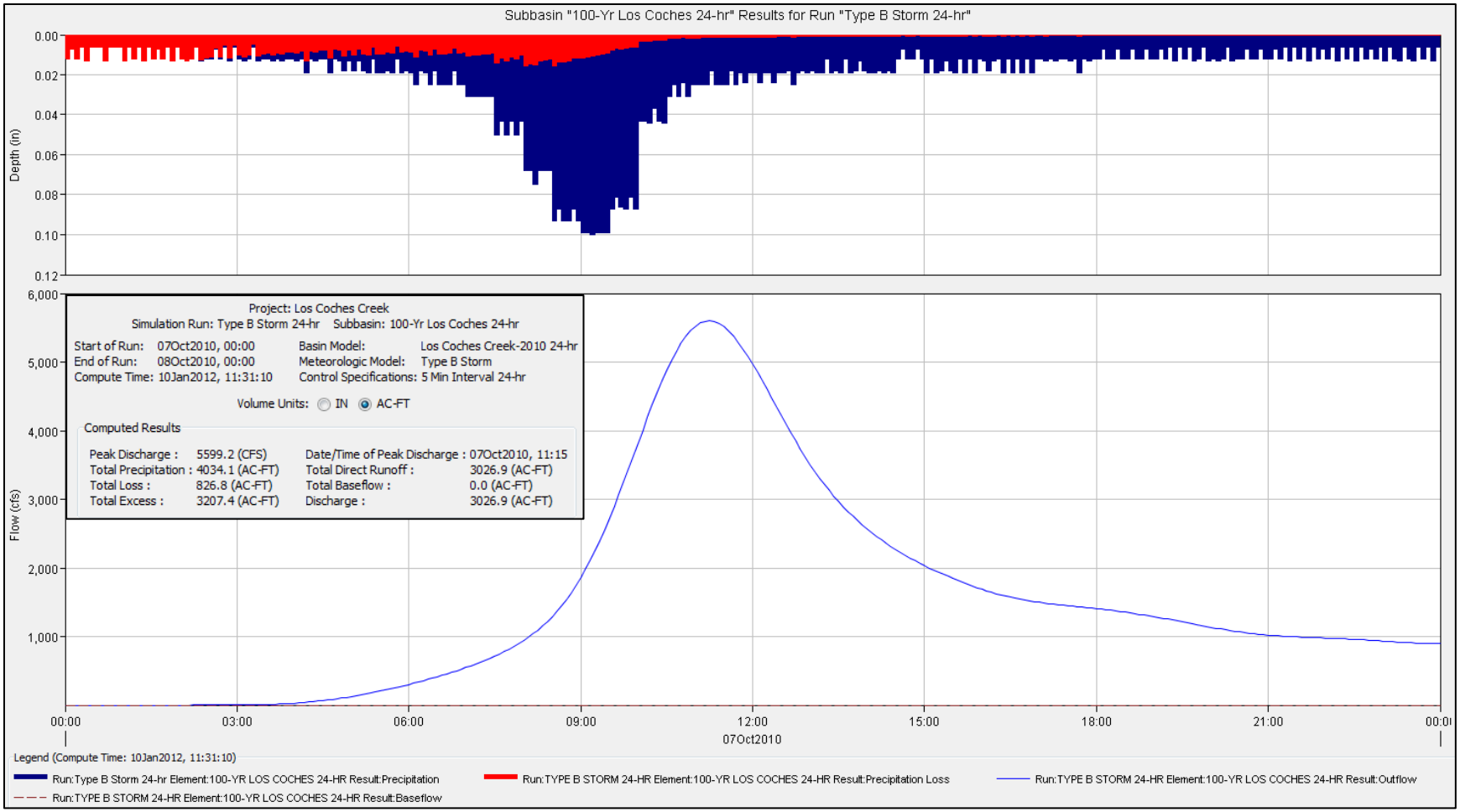

Subbasin "100-Yr Las Flores 24-hr" Results for Run "Nested Storm"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Flow (cfs)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Las Flores
Simulation Run: Nested Storm Subbasin: 100-Yr Las Flores 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 23Apr2012, 09:33:49
Basin Model: Las Flores Creek-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 9564.1 (CFS)
Total Precipitation : 6589.7 (AC-FT)
Total Loss : 2139.2 (AC-FT)
Total Excess : 4450.5 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 18:15
Total Direct Runoff : 4112.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 4112.4 (AC-FT)
Legend (Compute Time: 23Apr2012, 09:33:49)
Run:Nested Storm Element:100-YR LAS FLORES 24-HR Result:Precipitation
Run:NESTED STORM Element:100-YR LAS FLORES 24-HR Result:Outflow
Run:NESTED STORM Element:100-YR LAS FLORES 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:100-YR LAS FLORES 24-HR Result:Baseflow

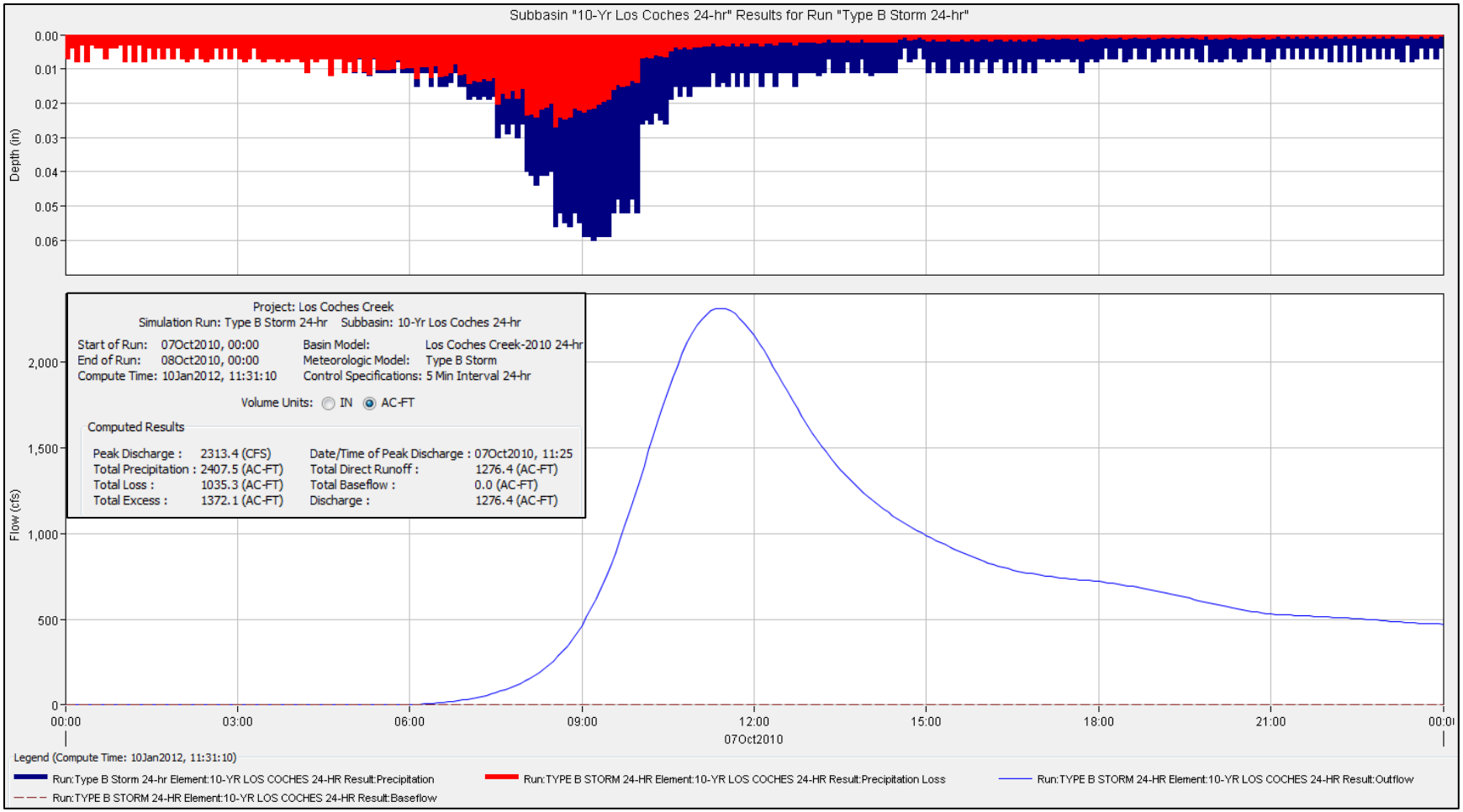

Subbasin "10-Yr Las Flores 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Flow (cfs)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Project: Las Flores
Simulation Run: Nested Storm Subbasin: 10-Yr Las Flores 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 23Apr2012, 09:33:49
Basin Model: Las Flores Creek-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 4249.8 (CFS)
Total Precipitation : 4534.1 (AC-FT)
Total Loss : 2549.6 (AC-FT)
Total Excess : 1984.5 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 18:20
Total Direct Runoff : 1770.1 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1770.1 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 23Apr2012, 09:33:49)
Run:Nested Storm Element:10-YR LAS FLORES 24-HR Result:Precipitation
Run:Nested Storm Element:10-YR LAS FLORES 24-HR Result:Precipitation Loss
Run:Nested Storm Element:10-YR LAS FLORES 24-HR Result:Outflow
Run:Nested Storm Element:10-YR LAS FLORES 24-HR Result:Baseflow

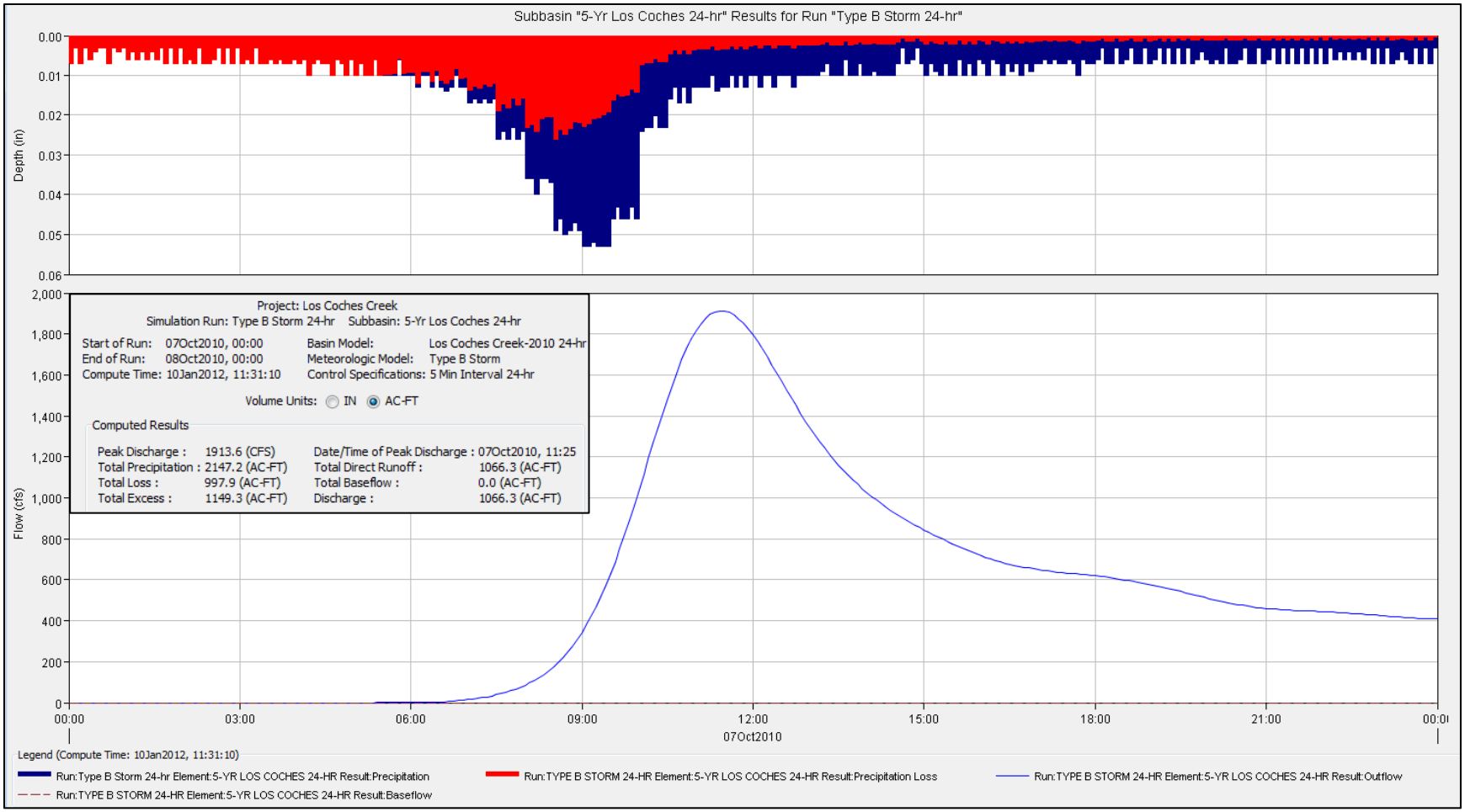

Subbasin "5-Yr Las Flores 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Flow (cfs)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Project: Las Flores
Simulation Run: Nested Storm Subbasin: 5-Yr Las Flores 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 23Apr2012, 09:33:49
Basin Model: Las Flores Creek-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 3344.2 (CFS)
Total Precipitation : 3853.1 (AC-FT)
Total Loss : 2375.9 (AC-FT)
Total Excess : 1477.2 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 18:25
Total Direct Runoff : 1318.1 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1318.1 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 23Apr2012, 09:33:49)
Run:Nested Storm Element:5-YR LAS FLORES 24-HR Result:Precipitation
Run:NESTED STORM Element:5-YR LAS FLORES 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:5-YR LAS FLORES 24-HR Result:Outflow
Run:NESTED STORM Element:5-YR LAS FLORES 24-HR Result:Baseflow

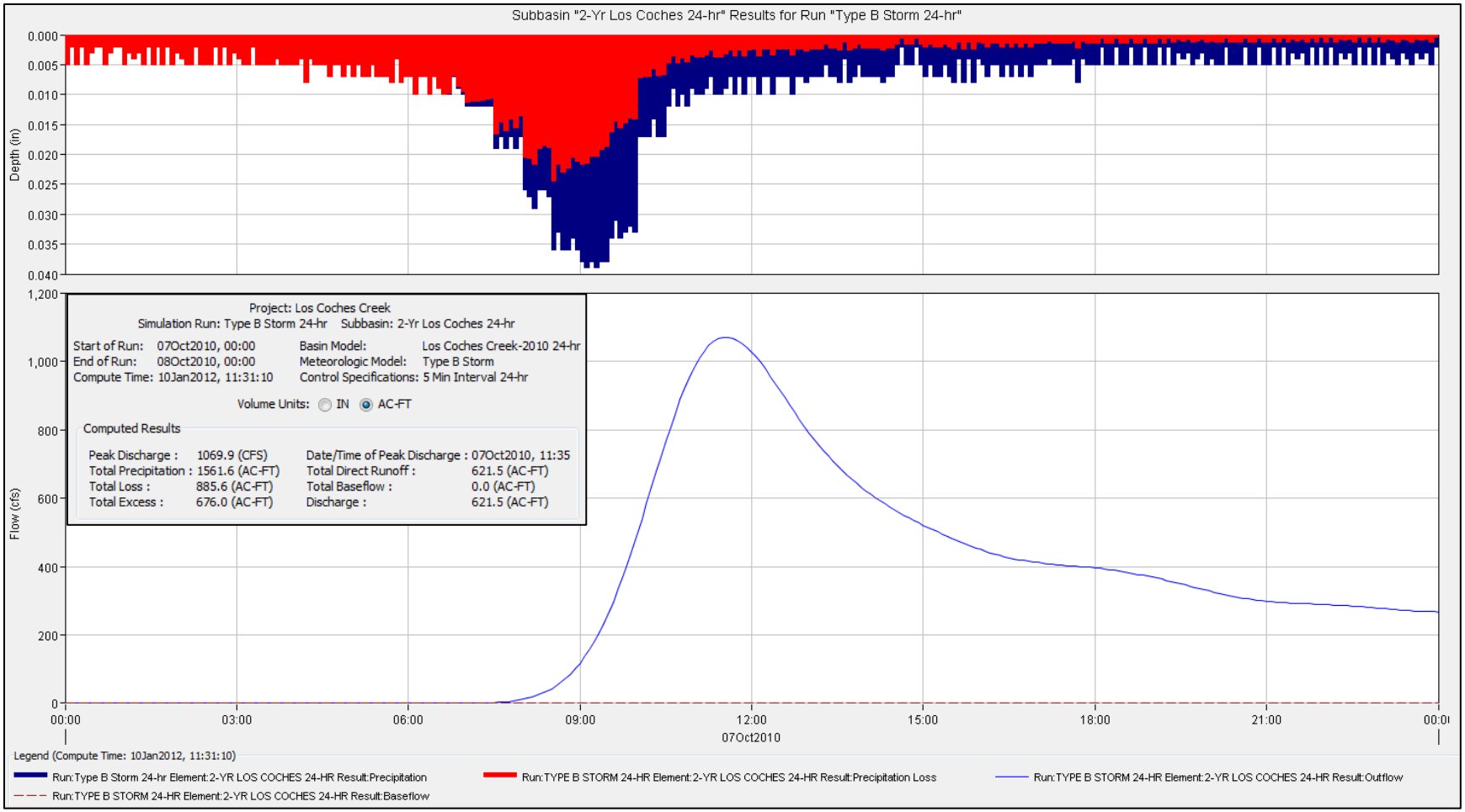

Subbasin "2-Yr Las Flores 24-hr" Results for Run "Nested Storm"
Depth (in)
0.05
0.10
0.15
0.20
Flow (cfs)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Project: Las Flores
Simulation Run: Nested Storm Subbasin: 2-Yr Las Flores 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 23Apr2012, 09:33:49
Basin Model: Las Flores Creek-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1587.5 (CFS)
Total Precipitation : 2594.7 (AC-FT)
Total Loss : 1940.3 (AC-FT)
Total Excess : 654.4 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 18:35
Total Direct Runoff : 582.5 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 582.5 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 23Apr2012, 09:33:49)
Run:Nested Storm Element:2-YR LAS FLORES 24-HR Result:Precipitation
Run:NESTED STORM Element:2-YR LAS FLORES 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:2-YR LAS FLORES 24-HR Result:Outflow
Run:NESTED STORM Element:2-YR LAS FLORES 24-HR Result:Baseflow

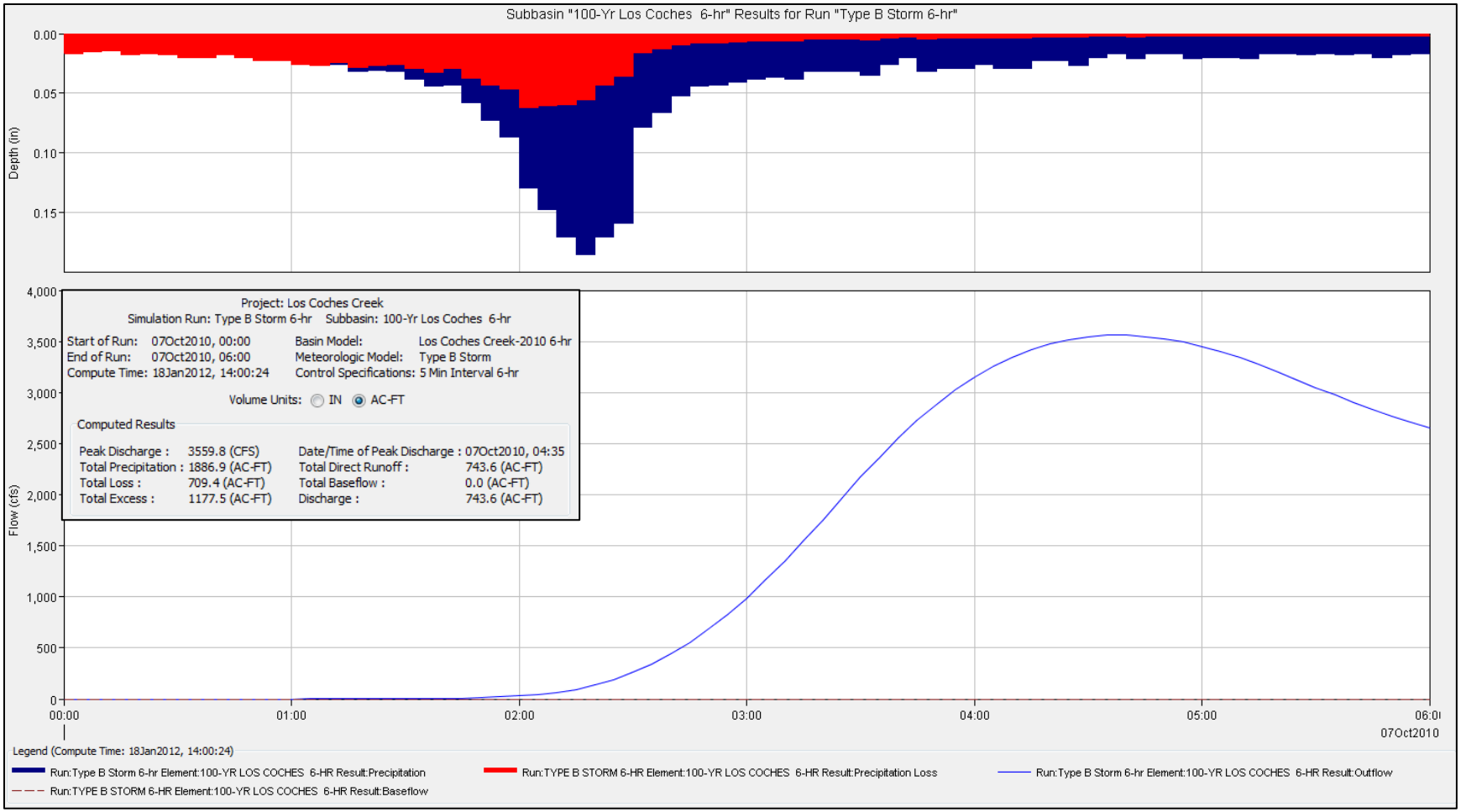
Los Coches Creek HEC-HMS Outputs

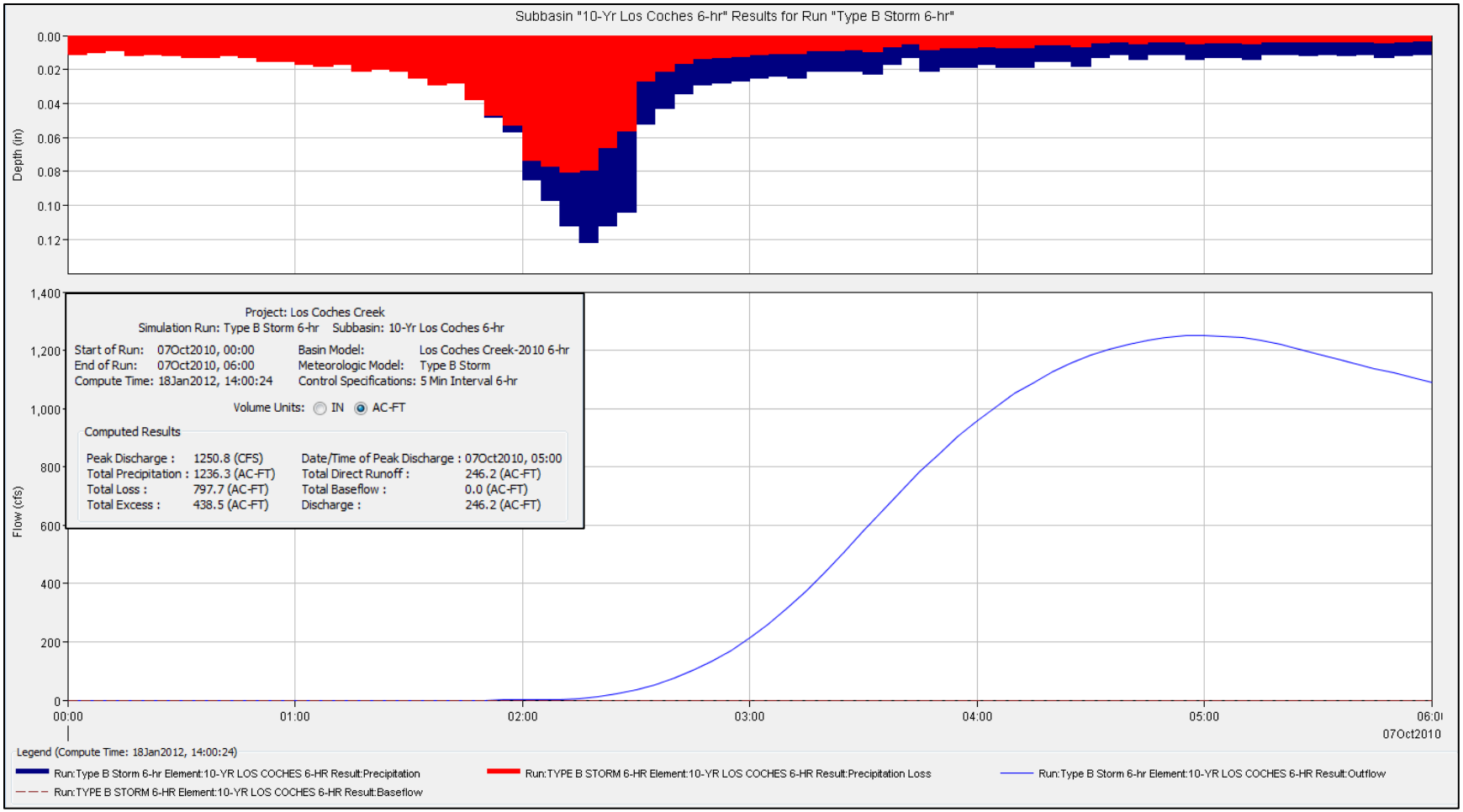

Subbasin "100-Yr Los Coches 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
Project: Los Coches Creek
Simulation Run: Type B Storm 24-hr Subbasin: 100-Yr Los Coches 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:31:10
Basin Model: Los Coches Creek-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 5599.2 (CFS)
Total Precipitation : 4034.1 (AC-FT)
Total Loss : 826.8 (AC-FT)
Total Excess : 3207.4 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 11:15
Total Direct Runoff : 3026.9 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 3026.9 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 11:31:10)
Run:Type B Storm 24-hr Element:100-YR LOS COCHES 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:100-YR LOS COCHES 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:100-YR LOS COCHES 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:100-YR LOS COCHES 24-HR Result:Baseflow

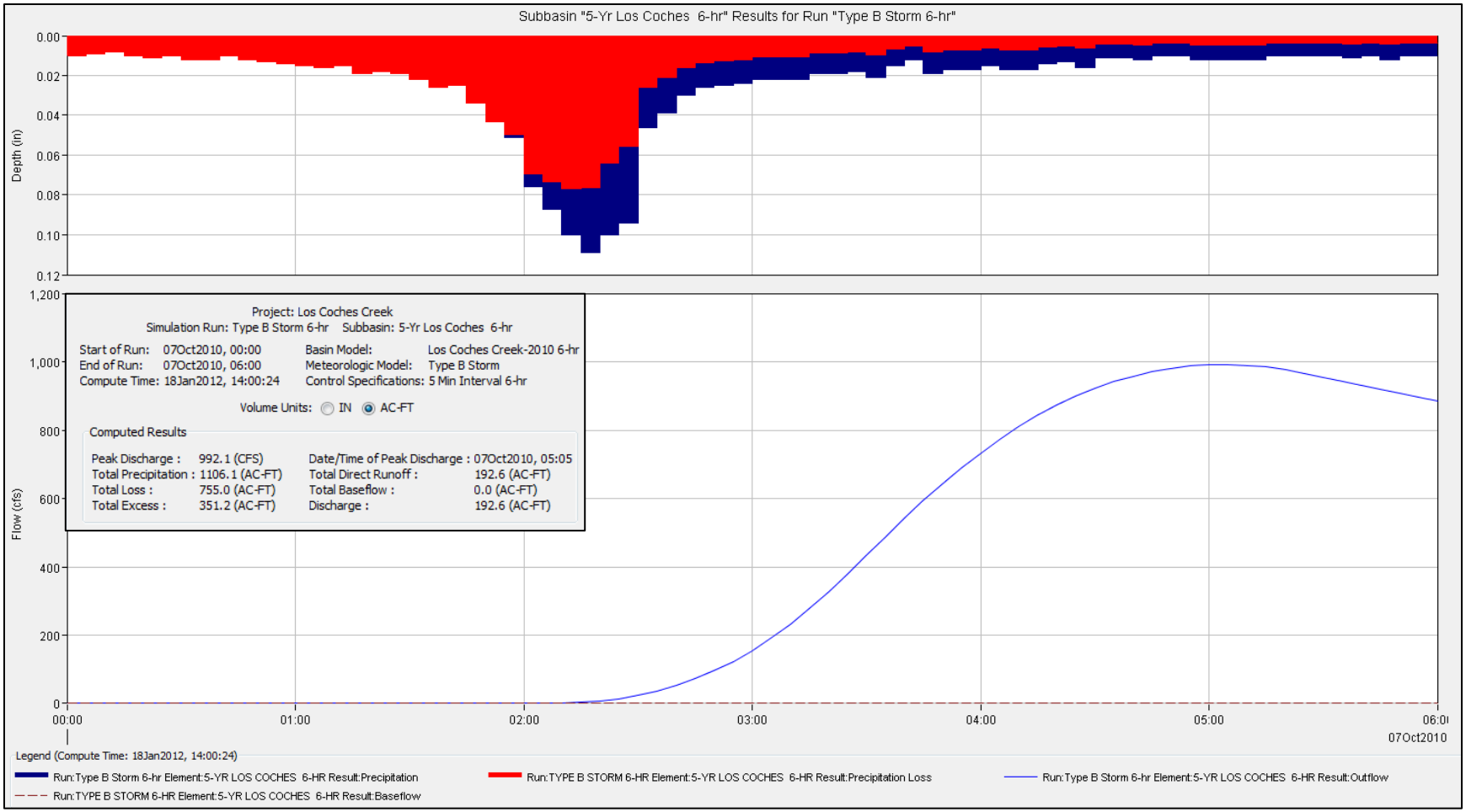

Subbasin "10-Yr Los Coches 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
Project: Los Coches Creek
Simulation Run: Type B Storm 24-hr Subbasin: 10-Yr Los Coches 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:31:10
Basin Model: Los Coches Creek-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2313.4 (CFS)
Total Precipitation : 2407.5 (AC-FT)
Total Loss : 1035.3 (AC-FT)
Total Excess : 1372.1 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 11:25
Total Direct Runoff : 1276.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1276.4 (AC-FT)
Flow (cfs)
2,000
1,500
1,000
500
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 11:31:10)
Run:Type B Storm 24-hr Element:10-YR LOS COCHES 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:10-YR LOS COCHES 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:10-YR LOS COCHES 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:10-YR LOS COCHES 24-HR Result:Baseflow

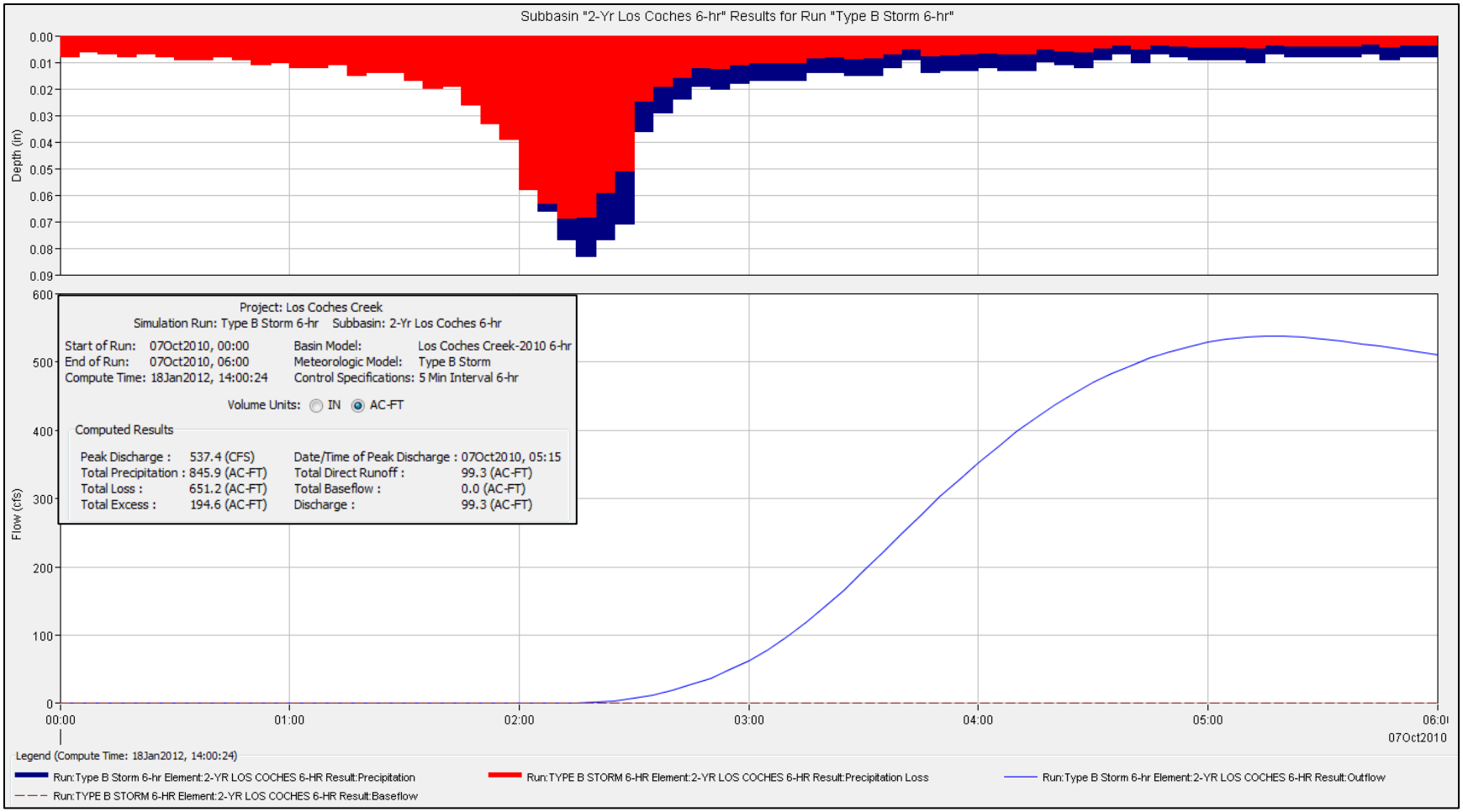

Subbasin "5-Yr Los Coches 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
Flow (cfs)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Project: Los Coches Creek
Simulation Run: Type B Storm 24-hr Subbasin: 5-Yr Los Coches 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:31:10
Basin Model: Los Coches Creek-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1913.6 (CFS)
Total Precipitation : 2147.2 (AC-FT)
Total Loss : 997.9 (AC-FT)
Total Excess : 1149.3 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 11:25
Total Direct Runoff : 1066.3 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1066.3 (AC-FT)
Legend (Compute Time: 10Jan2012, 11:31:10)
Run:Type B Storm 24-hr Element:5-YR LOS COCHES 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:5-YR LOS COCHES 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:5-YR LOS COCHES 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:5-YR LOS COCHES 24-HR Result:Baseflow

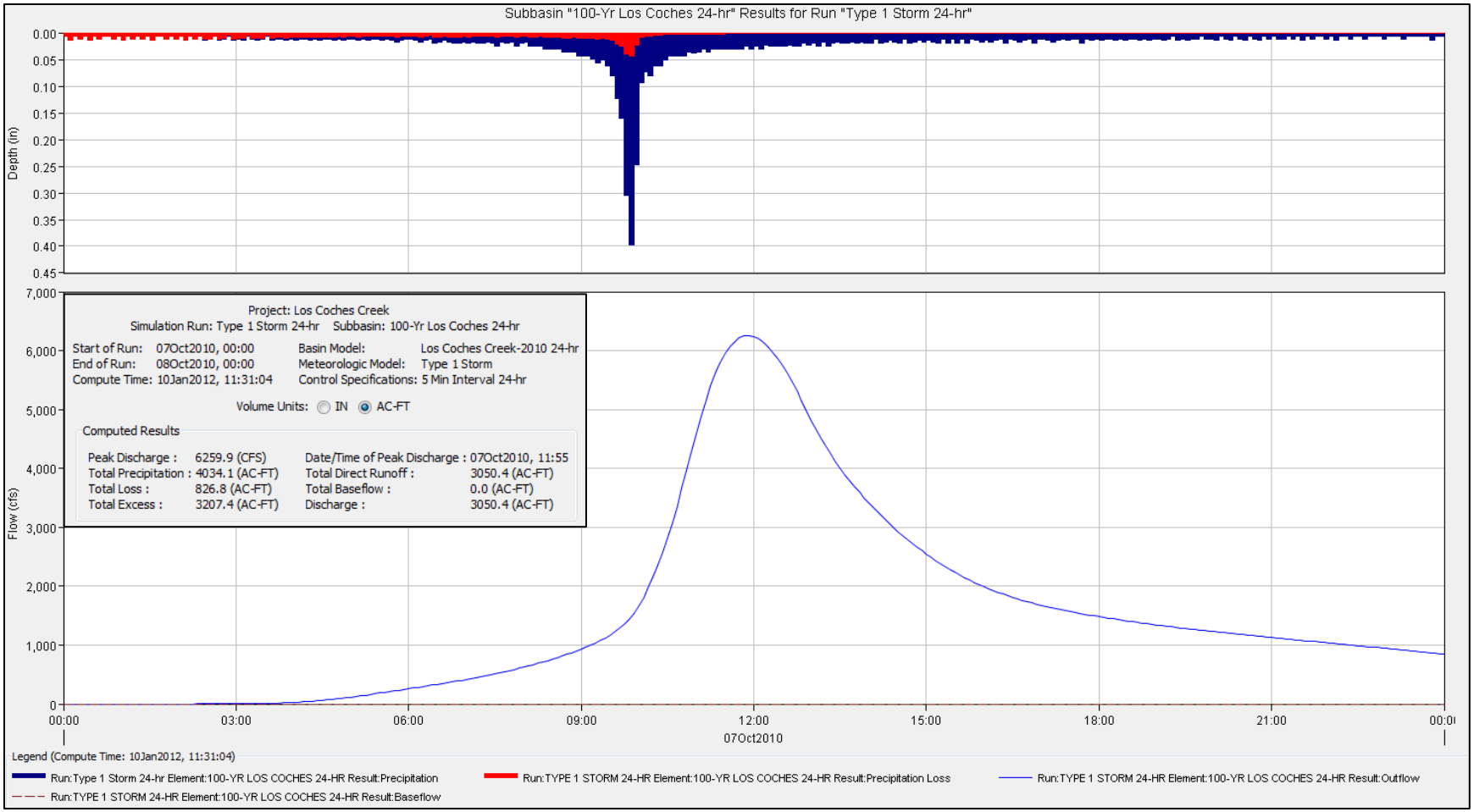

Subbasin "2-Yr Los Coches 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
0.040
Project: Los Coches Creek
Simulation Run: Type B Storm 24-hr Subbasin: 2-Yr Los Coches 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:31:10
Basin Model: Los Coches Creek-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1069.9 (CFS)
Total Precipitation : 1561.6 (AC-FT)
Total Loss : 885.6 (AC-FT)
Total Excess : 676.0 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 11:35
Total Direct Runoff : 621.5 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 621.5 (AC-FT)
Flow (cfs)
1,200
1,000
800
600
400
200
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Legend (Compute Time: 10Jan2012, 11:31:10)
Run:Type B Storm 24-hr Element:2-YR LOS COCHES 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:2-YR LOS COCHES 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:2-YR LOS COCHES 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:2-YR LOS COCHES 24-HR Result:Baseflow

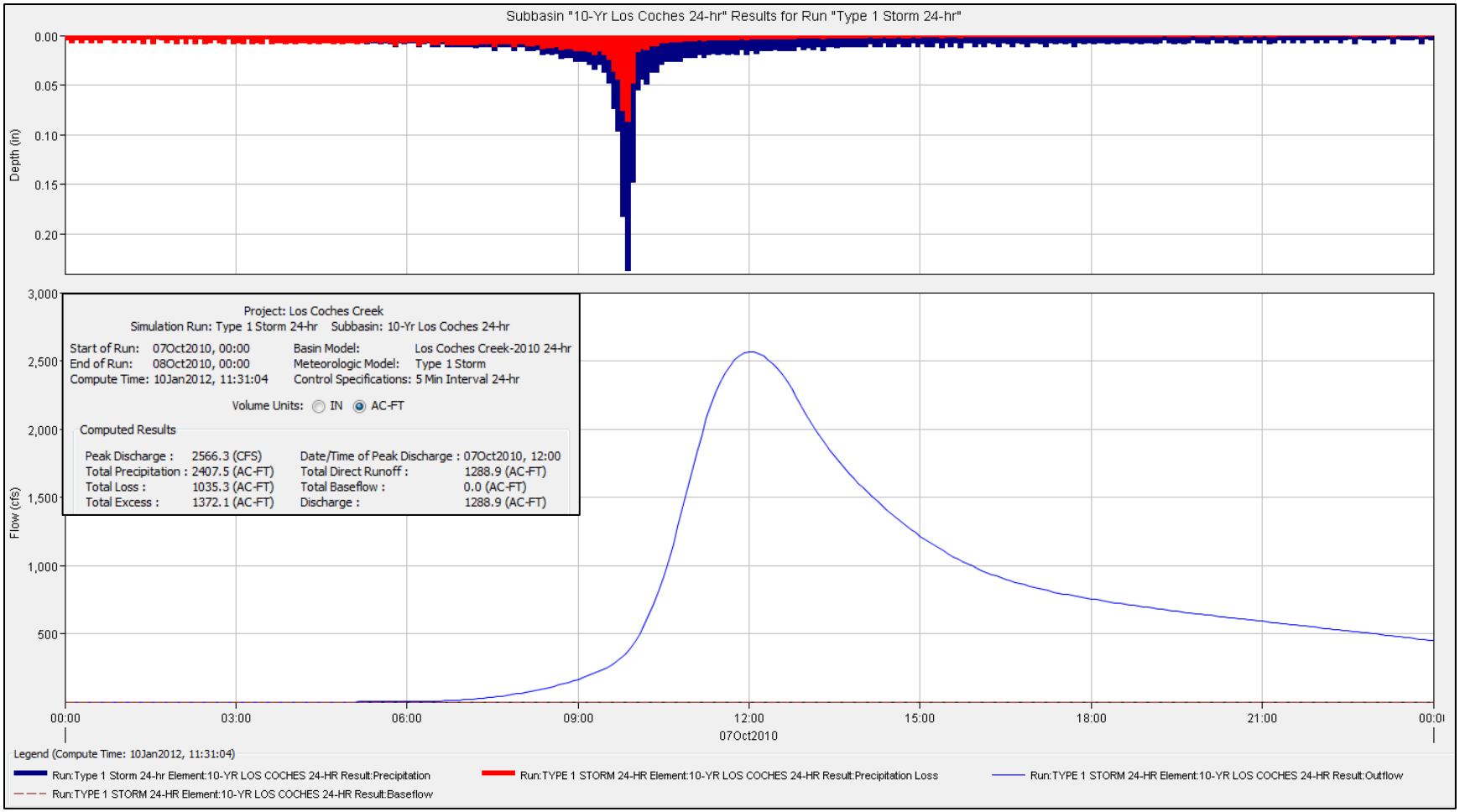

Subbasin "100-Yr Los Coches 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
Flow (cfs)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Los Coches Creek
Simulation Run: Type B Storm 6-hr Subbasin: 100-Yr Los Coches 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:00:24
Basin Model: Los Coches Creek-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 3559.8 (CFS)
Total Precipitation : 1886.9 (AC-FT)
Total Loss : 709.4 (AC-FT)
Total Excess : 1177.5 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 04:35
Total Direct Runoff : 743.6 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 743.6 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:00:24)
Run:Type B Storm 6-hr Element:100-YR LOS COCHES 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:100-YR LOS COCHES 6-HR Result:Precipitation Loss
Run:Type B Storm 6-hr Element:100-YR LOS COCHES 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:100-YR LOS COCHES 6-HR Result:Baseflow

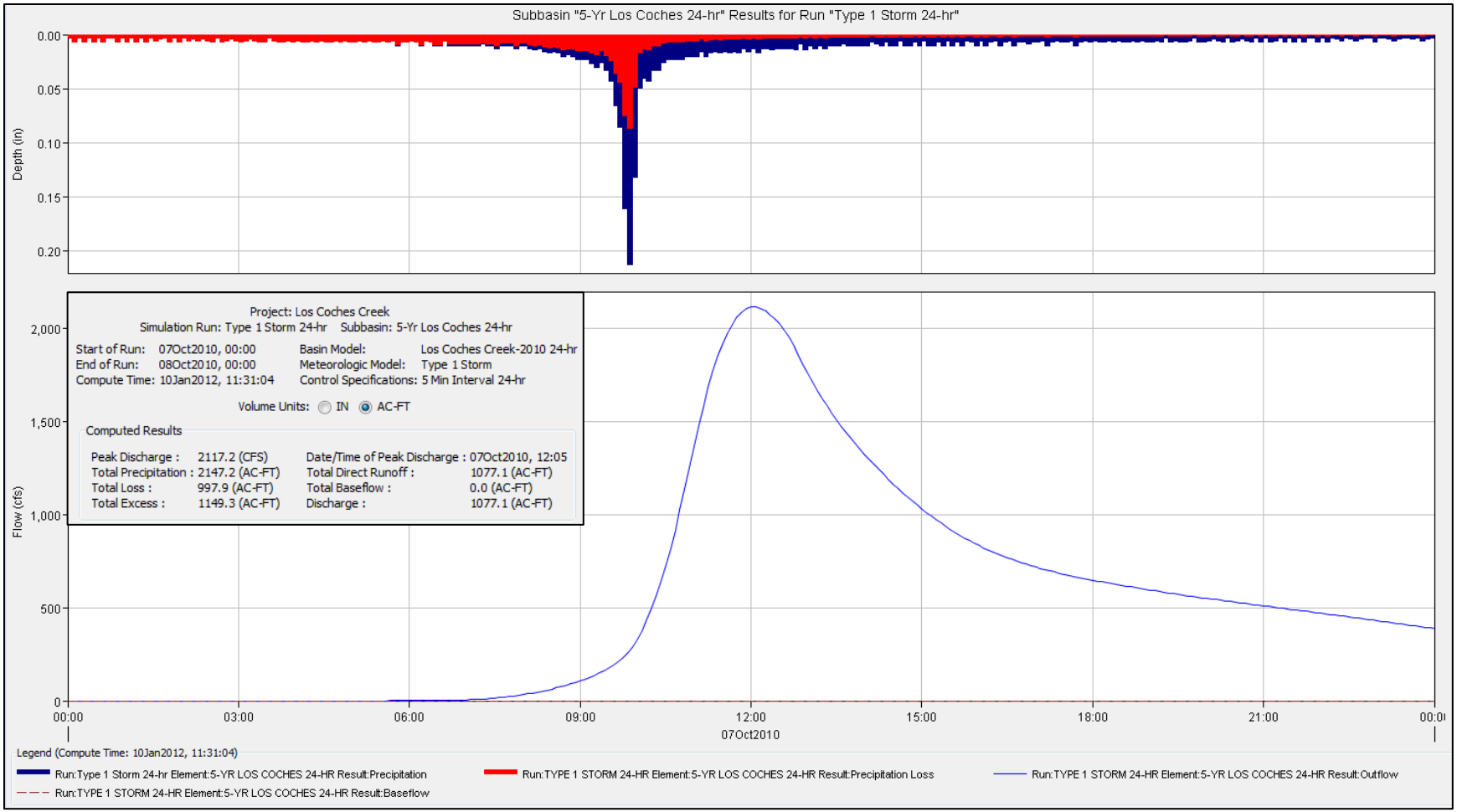

Subbasin "10-Yr Los Coches 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Flow (cfs)
1,400
1,200
1,000
800
600
400
200
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Los Coches Creek
Simulation Run: Type B Storm 6-hr Subbasin: 10-Yr Los Coches 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:00:24
Basin Model: Los Coches Creek-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1250.8 (CFS)
Total Precipitation : 1236.3 (AC-FT)
Total Loss : 797.7 (AC-FT)
Total Excess : 438.5 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:00
Total Direct Runoff : 246.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 246.2 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:00:24)
Run:Type B Storm 6-hr Element:10-YR LOS COCHES 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:10-YR LOS COCHES 6-HR Result:Precipitation Loss
Run:Type B Storm 6-hr Element:10-YR LOS COCHES 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:10-YR LOS COCHES 6-HR Result:Baseflow

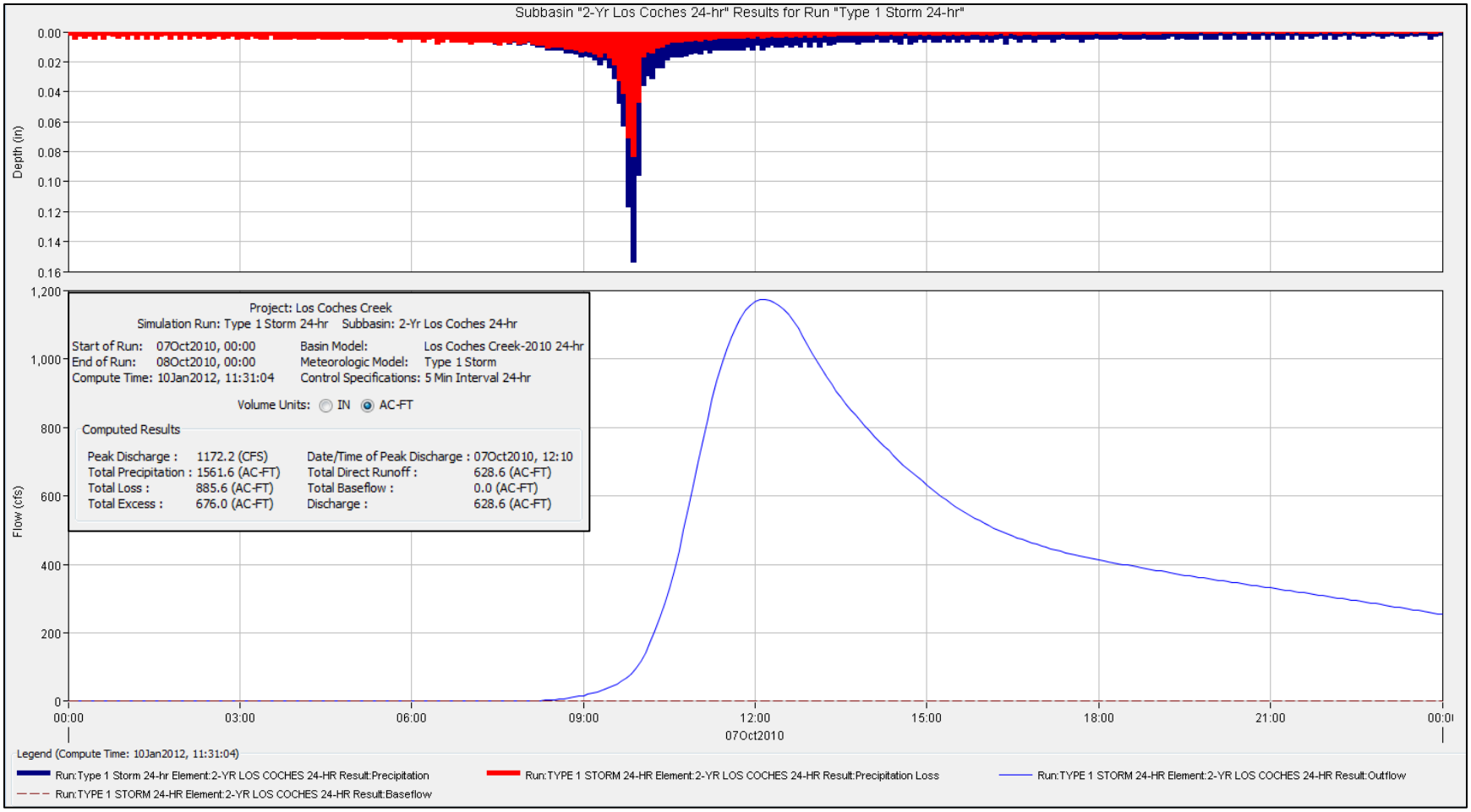

Subbasin "5-Yr Los Coches 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Flow (cfs)
1,200
1,000
800
600
400
200
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Los Coches Creek
Simulation Run: Type B Storm 6-hr Subbasin: 5-Yr Los Coches 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:00:24
Basin Model: Los Coches Creek-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 992.1 (CFS)
Total Precipitation : 1106.1 (AC-FT)
Total Loss : 755.0 (AC-FT)
Total Excess : 351.2 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:05
Total Direct Runoff : 192.6 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 192.6 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:00:24)
Run:Type B Storm 6-hr Element:5-YR LOS COCHES 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:5-YR LOS COCHES 6-HR Result:Precipitation Loss
Run:Type B Storm 6-hr Element:5-YR LOS COCHES 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:5-YR LOS COCHES 6-HR Result:Baseflow

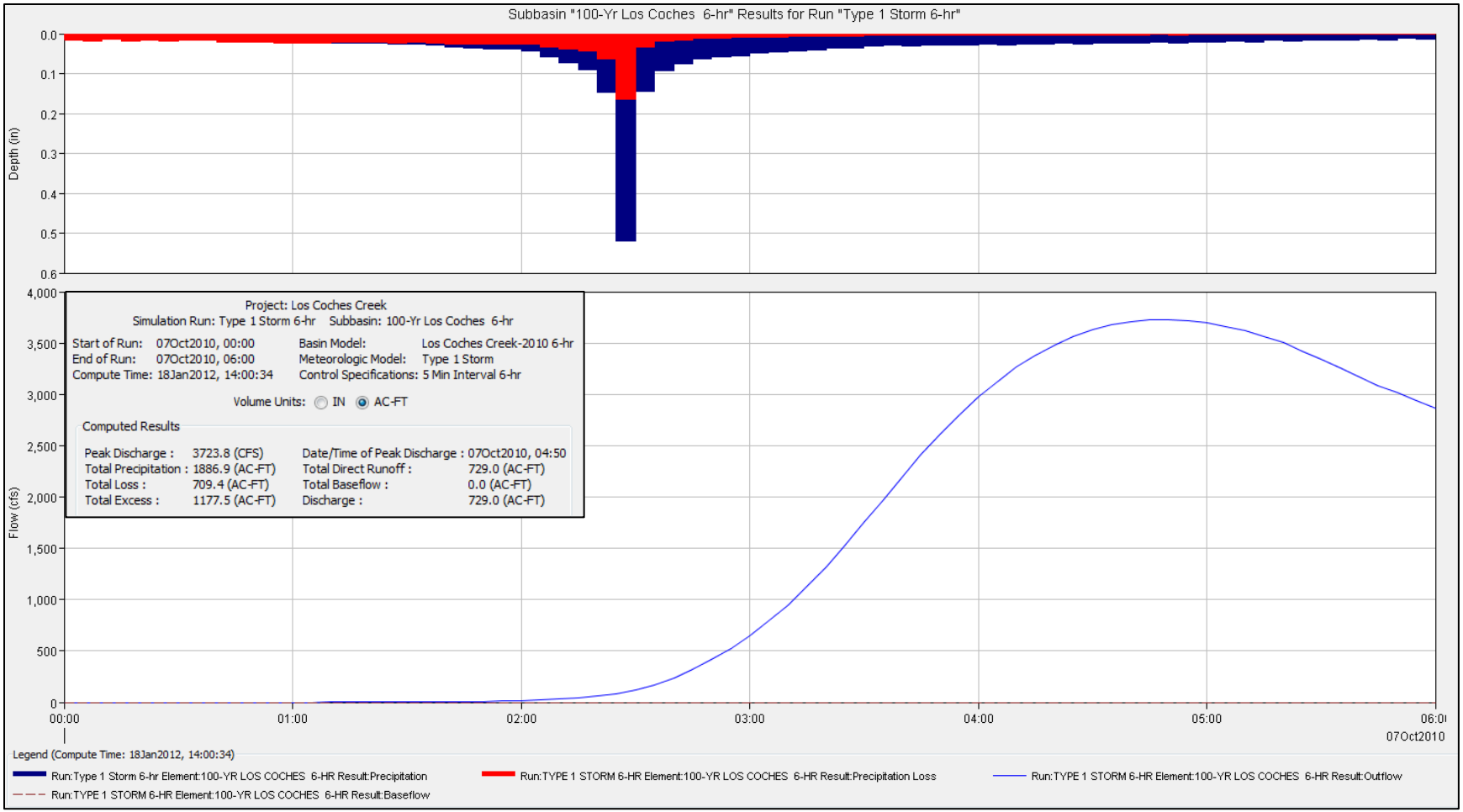

Subbasin "2-Yr Los Coches 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
Project: Los Coches Creek
Simulation Run: Type B Storm 6-hr Subbasin: 2-Yr Los Coches 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:00:24
Basin Model: Los Coches Creek-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 537.4 (CFS)
Total Precipitation : 845.9 (AC-FT)
Total Loss : 651.2 (AC-FT)
Total Excess : 194.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:15
Total Direct Runoff : 99.3 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 99.3 (AC-FT)
Flow (cfs)
600
500
400
300
200
100
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Legend (Compute Time: 18Jan2012, 14:00:24)
Run:Type B Storm 6-hr Element:2-YR LOS COCHES 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:2-YR LOS COCHES 6-HR Result:Precipitation Loss
Run:Type B Storm 6-hr Element:2-YR LOS COCHES 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:2-YR LOS COCHES 6-HR Result:Baseflow

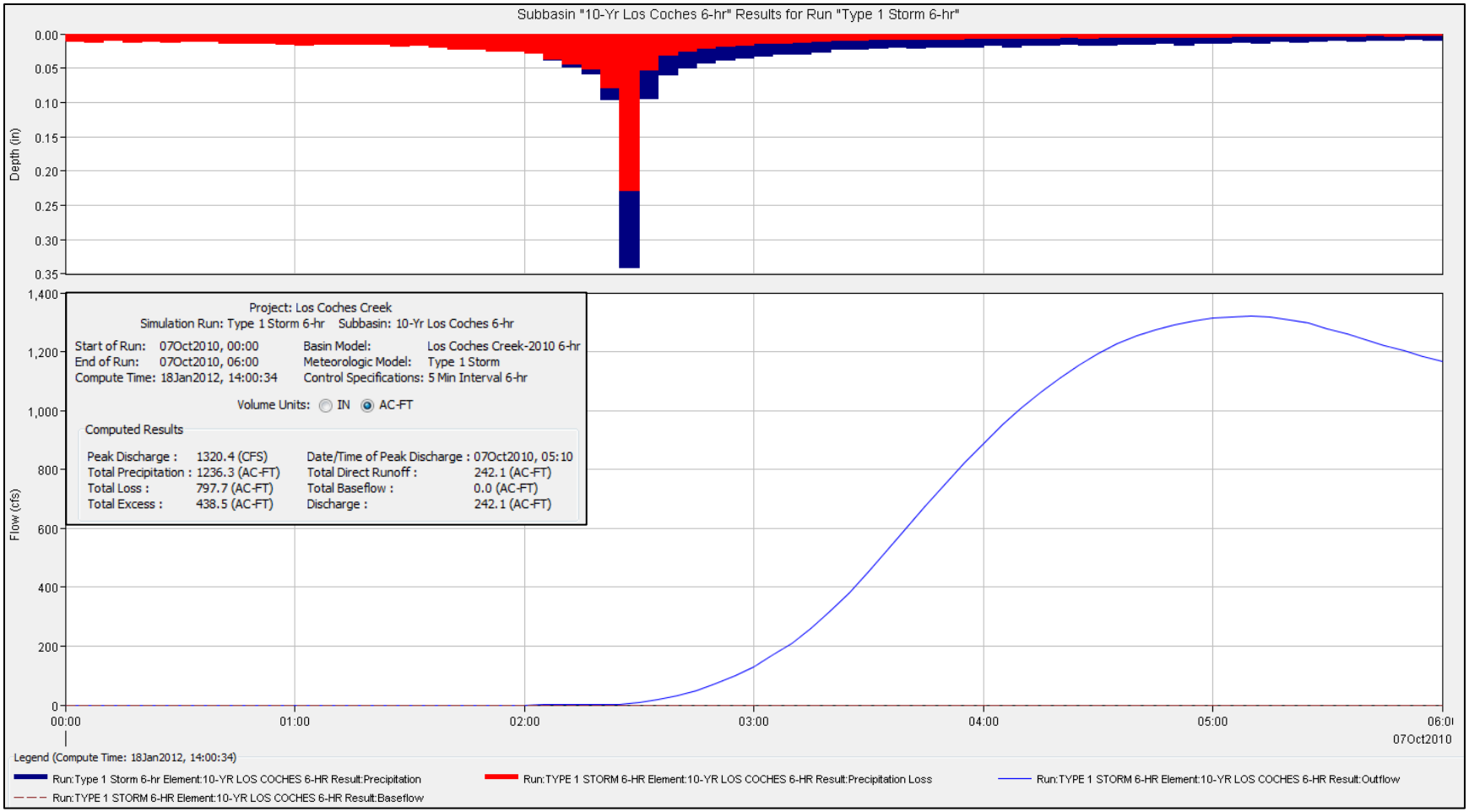

Subbasin "100-Yr Los Coches 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
Flow (cfs)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
07Oct2010
Project: Los Coches Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 100-Yr Los Coches 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:31:04
Basin Model: Los Coches Creek-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 6259.9 (CFS)
Total Precipitation : 4034.1 (AC-FT)
Total Loss : 826.8 (AC-FT)
Total Excess : 3207.4 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 11:55
Total Direct Runoff : 3050.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 3050.4 (AC-FT)
Legend (Compute Time: 10Jan2012, 11:31:04)
Run:Type 1 Storm 24-hr Element:100-YR LOS COCHES 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:100-YR LOS COCHES 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:100-YR LOS COCHES 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:100-YR LOS COCHES 24-HR Result:Baseflow

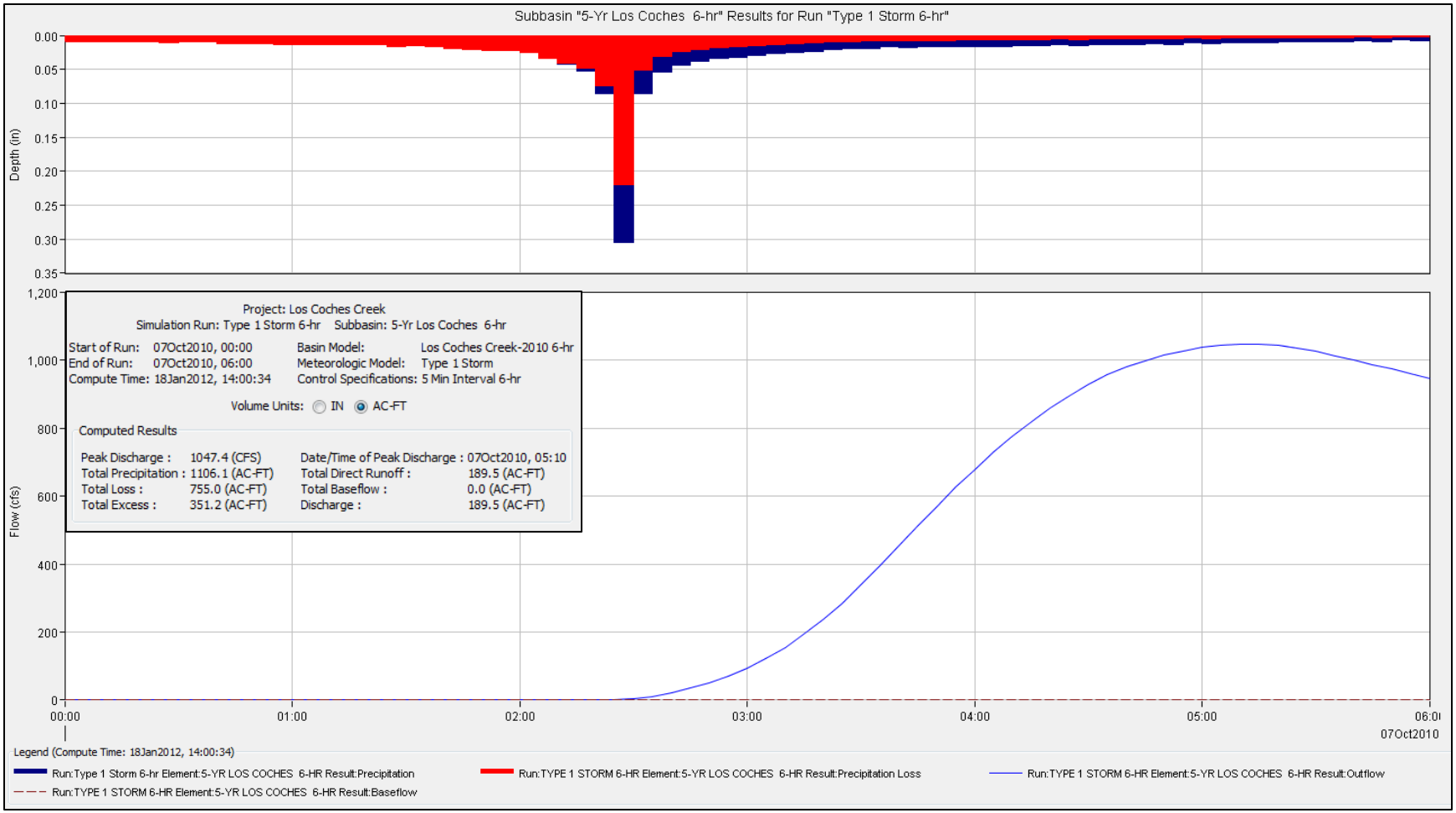

Subbasin "10-Yr Los Coches 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
Flow (cfs)
3,000
2,500
2,000
1,500
1,000
500
Project: Los Coches Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 10-Yr Los Coches 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:31:04
Basin Model: Los Coches Creek-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2566.3 (CFS)
Total Precipitation : 2407.5 (AC-FT)
Total Loss : 1035.3 (AC-FT)
Total Excess : 1372.1 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:00
Total Direct Runoff : 1288.9 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1288.9 (AC-FT)
00:00
03:00
06:00
09:00
12:00
07Oct2010
15:00
18:00
21:00
Legend (Compute Time: 10Jan2012, 11:31:04)
Run:Type 1 Storm 24-hr Element:10-YR LOS COCHES 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:10-YR LOS COCHES 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:10-YR LOS COCHES 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:10-YR LOS COCHES 24-HR Result:Baseflow

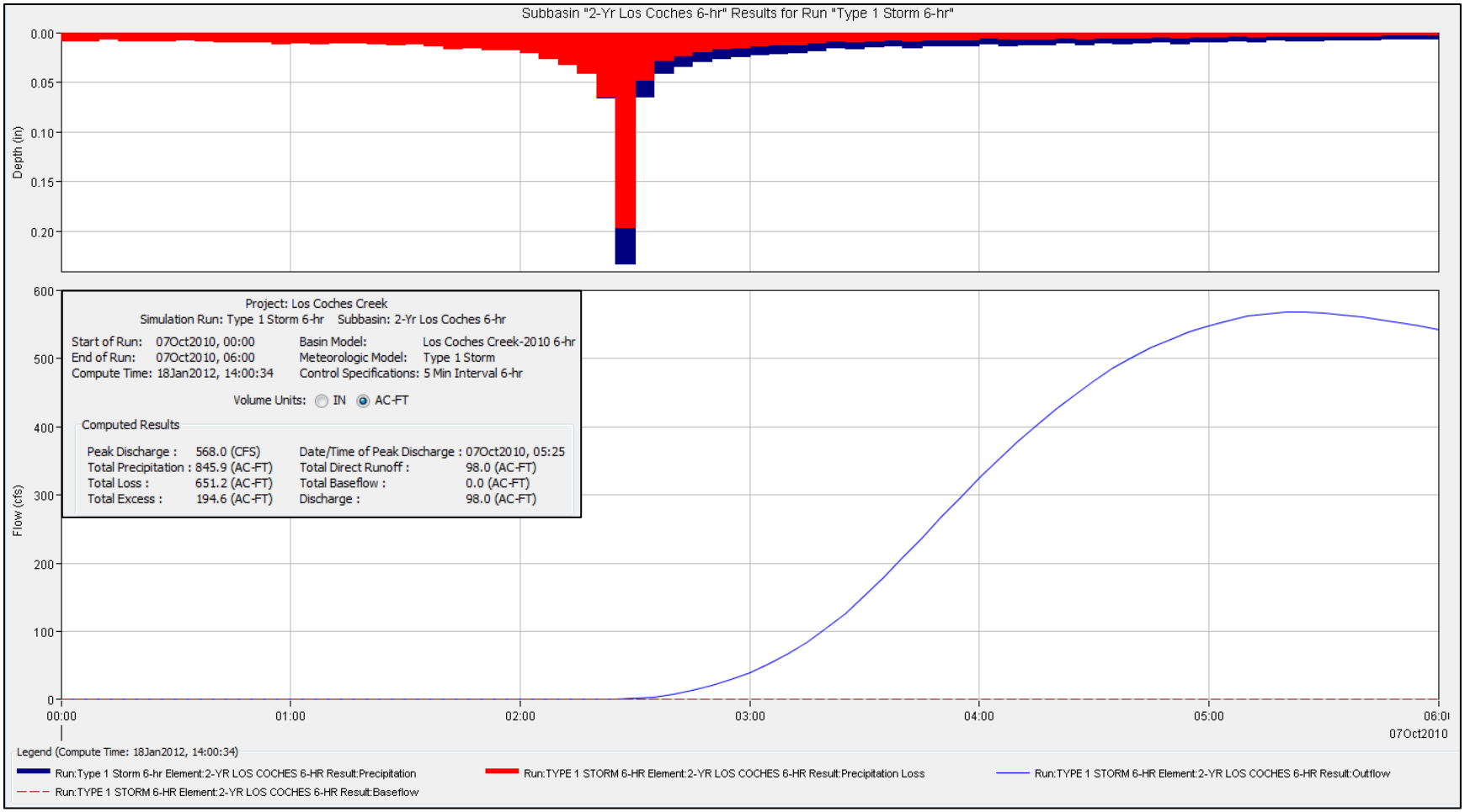

Subbasin "5-Yr Los Coches 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
Project: Los Coches Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 5-Yr Los Coches 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:31:04
Basin Model: Los Coches Creek-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2117.2 (CFS)
Total Precipitation : 2147.2 (AC-FT)
Total Loss : 997.9 (AC-FT)
Total Excess : 1149.3 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:05
Total Direct Runoff : 1077.1 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1077.1 (AC-FT)
Flow (cfs)
2,000
1,500
1,000
500
0
00:00
03:00
06:00
09:00
12:00
07Oct2010
15:00
18:00
21:00
Legend (Compute Time: 10Jan2012, 11:31:04)
Run:Type 1 Storm 24-hr Element:5-YR LOS COCHES 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:5-YR LOS COCHES 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:5-YR LOS COCHES 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:5-YR LOS COCHES 24-HR Result:Baseflow

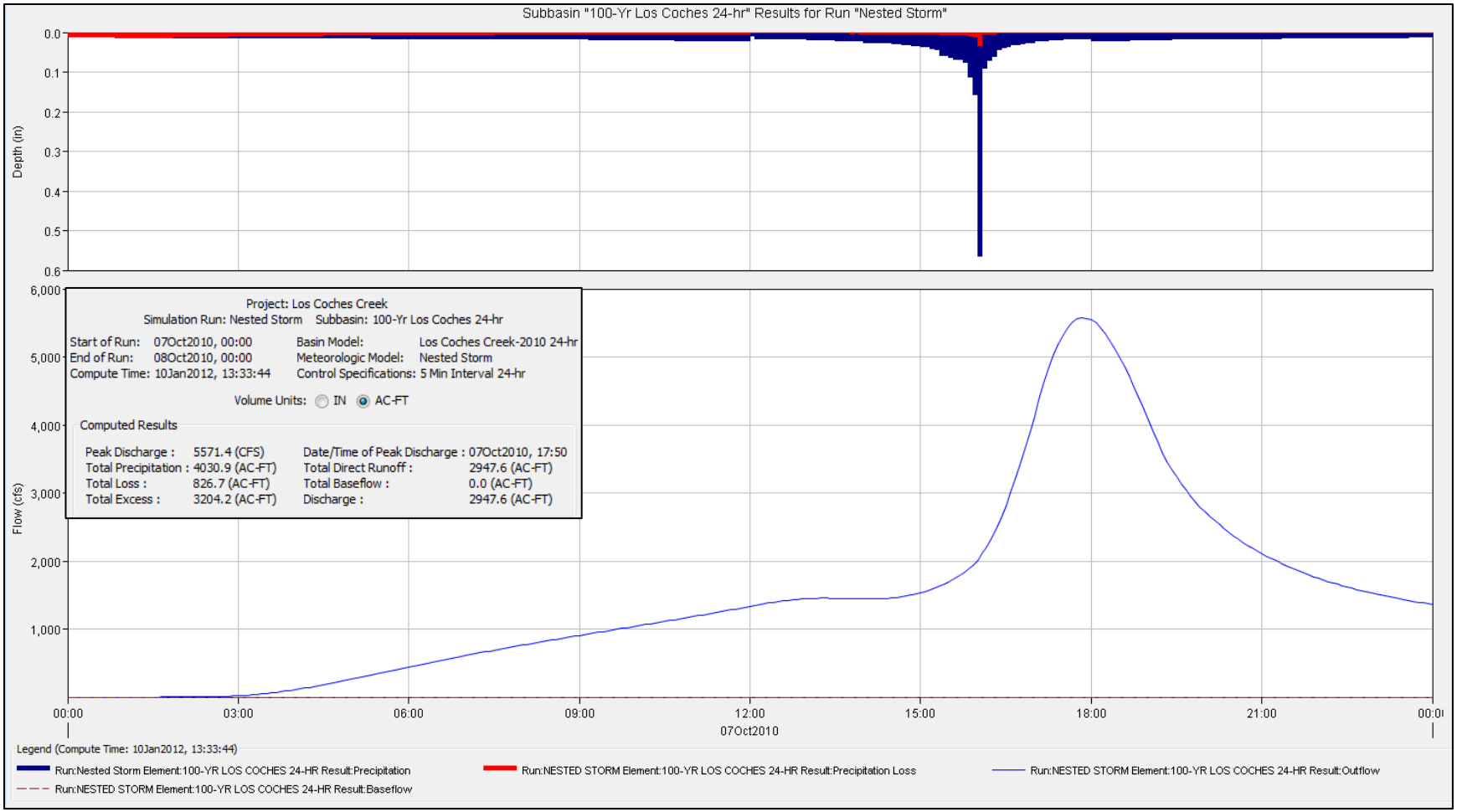

Subbasin "2-Yr Los Coches 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
Project: Los Coches Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 2-Yr Los Coches 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 11:31:04
Basin Model: Los Coches Creek-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1172.2 (CFS)
Total Precipitation : 1561.6 (AC-FT)
Total Loss : 885.6 (AC-FT)
Total Excess : 676.0 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:10
Total Direct Runoff : 628.6 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 628.6 (AC-FT)
Flow (cfs)
1,200
1,000
800
600
400
200
0
00:00
03:00
06:00
09:00
12:00
07Oct2010
15:00
18:00
21:00
Legend (Compute Time: 10Jan2012, 11:31:04)
Run:Type 1 Storm 24-hr Element:2-YR LOS COCHES 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:2-YR LOS COCHES 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:2-YR LOS COCHES 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:2-YR LOS COCHES 24-HR Result:Baseflow

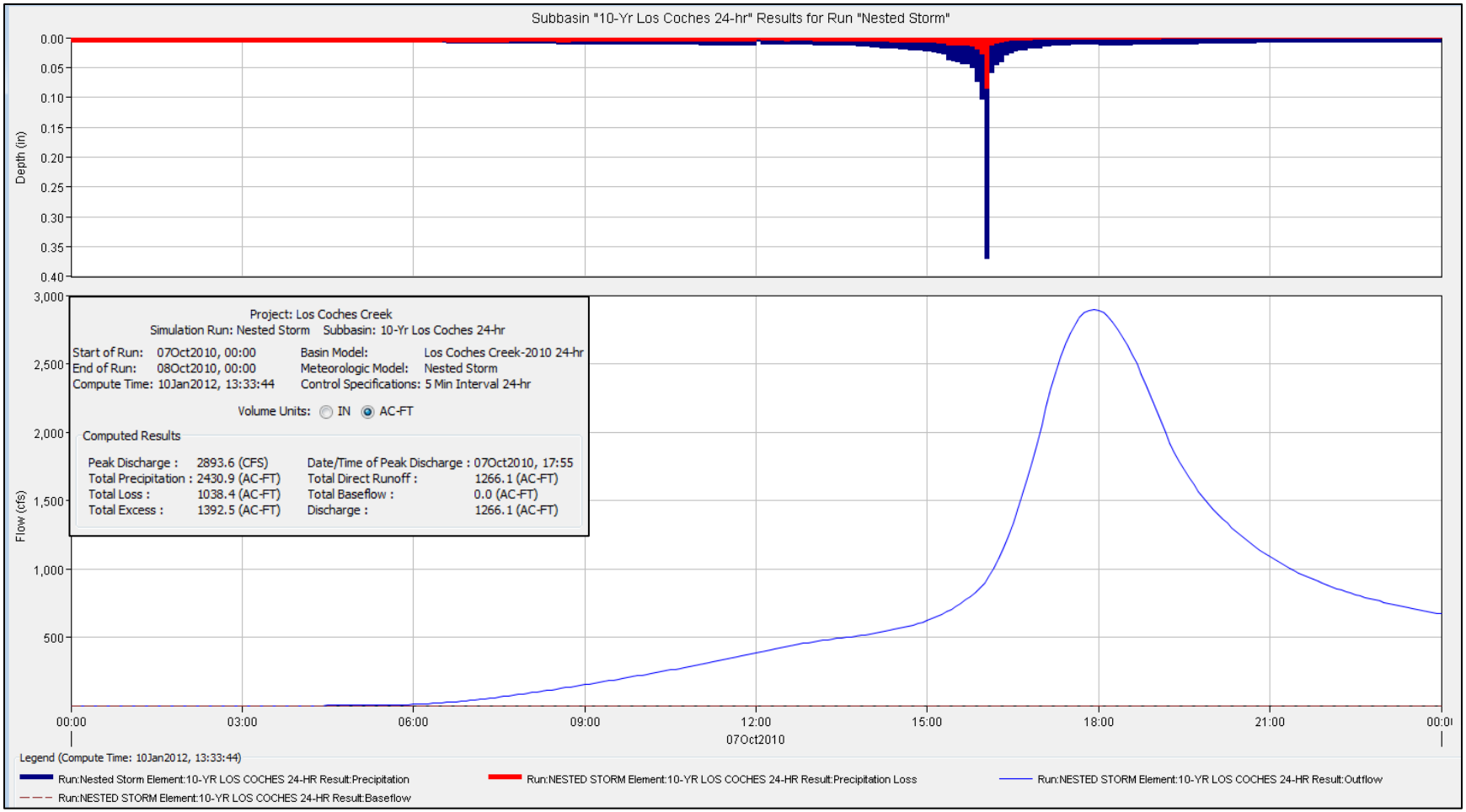

Subbasin "100-Yr Los Coches 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Project: Los Coches Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 100-Yr Los Coches 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:00:34
Basin Model: Los Coches Creek-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 3723.8 (CFS)
Total Precipitation : 1886.9 (AC-FT)
Total Loss : 709.4 (AC-FT)
Total Excess : 1177.5 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 04:50
Total Direct Runoff : 729.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 729.0 (AC-FT)
Flow (cfs)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Legend (Compute Time: 18Jan2012, 14:00:34)
Run:Type 1 Storm 6-hr Element:100-YR LOS COCHES 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:100-YR LOS COCHES 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:100-YR LOS COCHES 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:100-YR LOS COCHES 6-HR Result:Baseflow

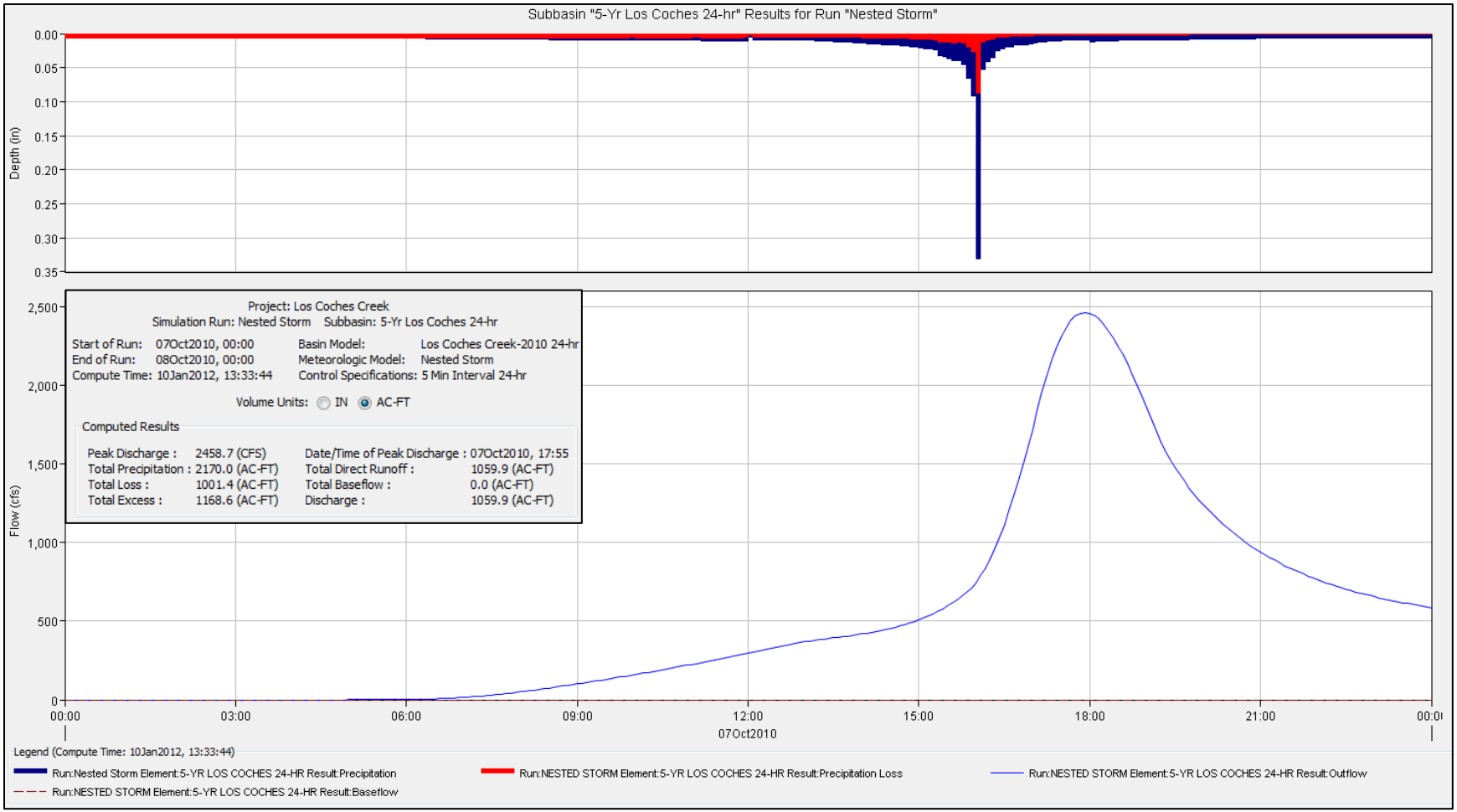

Subbasin "10-Yr Los Coches 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Flow (cfs)
1,400
1,200
1,000
800
600
400
200
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Los Coches Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 10-Yr Los Coches 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:00:34
Basin Model: Los Coches Creek-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1320.4 (CFS)
Total Precipitation : 1236.3 (AC-FT)
Total Loss : 797.7 (AC-FT)
Total Excess : 438.5 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:10
Total Direct Runoff : 242.1 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 242.1 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:00:34)
Run:Type 1 Storm 6-hr Element:10-YR LOS COCHES 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:10-YR LOS COCHES 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:10-YR LOS COCHES 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:10-YR LOS COCHES 6-HR Result:Baseflow

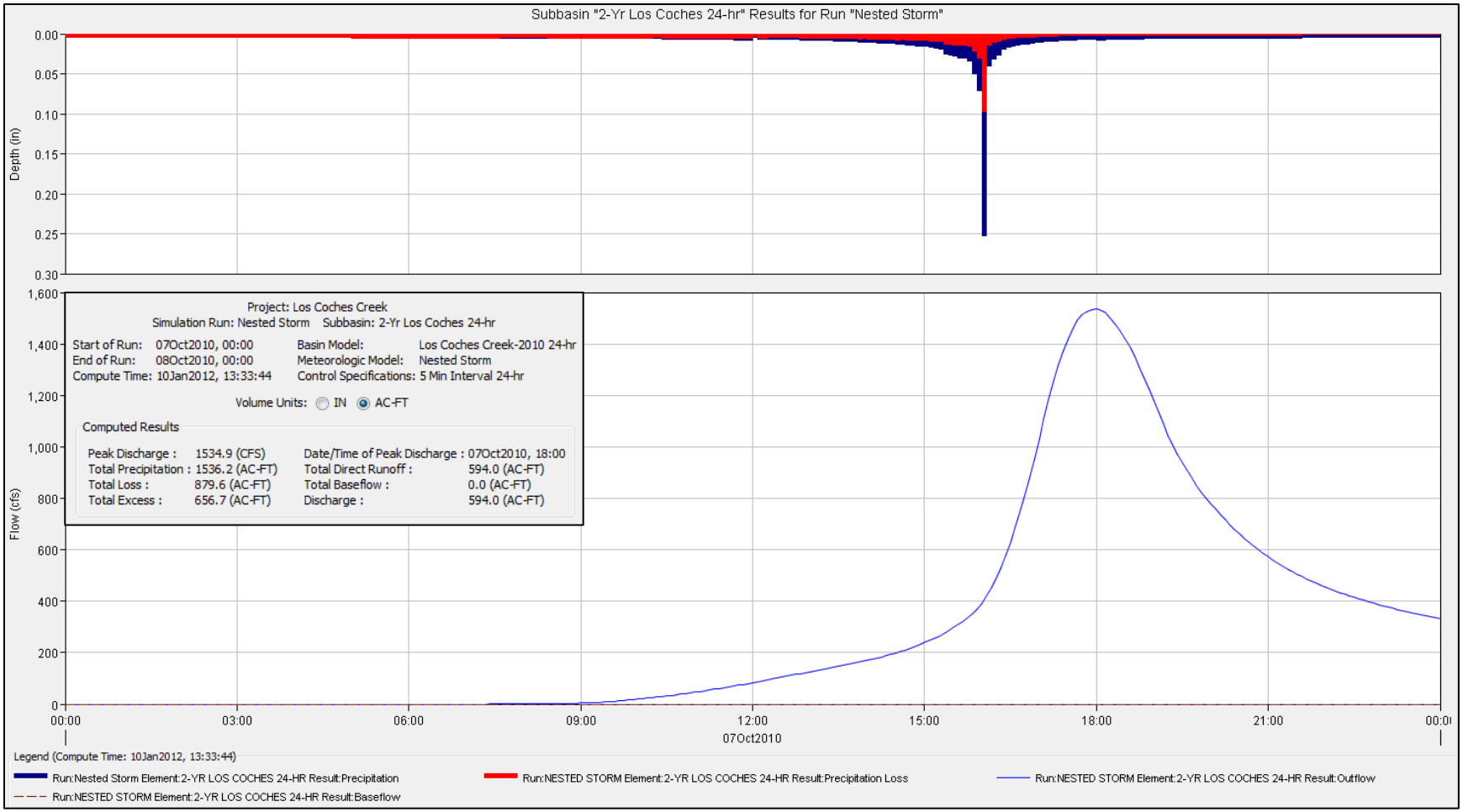

Subbasin "5-Yr Los Coches 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Flow (cfs)
1,200
1,000
800
600
400
200
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Los Coches Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 5-Yr Los Coches 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:00:34
Basin Model: Los Coches Creek-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1047.4 (CFS)
Total Precipitation : 1106.1 (AC-FT)
Total Loss : 755.0 (AC-FT)
Total Excess : 351.2 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:10
Total Direct Runoff : 189.5 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 189.5 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:00:34)
Run:Type 1 Storm 6-hr Element:5-YR LOS COCHES 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:5-YR LOS COCHES 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:5-YR LOS COCHES 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:5-YR LOS COCHES 6-HR Result:Baseflow


Subbasin "2-Yr Los Coches 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
Project: Los Coches Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 2-Yr Los Coches 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:00:34
Basin Model: Los Coches Creek-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 568.0 (CFS)
Total Precipitation : 845.9 (AC-FT)
Total Loss : 651.2 (AC-FT)
Total Excess : 194.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 05:25
Total Direct Runoff : 98.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 98.0 (AC-FT)
Flow (cfs)
600
500
400
300
200
100
0
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Legend (Compute Time: 18Jan2012, 14:00:34)
Run:Type 1 Storm 6-hr Element:2-YR LOS COCHES 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:2-YR LOS COCHES 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:2-YR LOS COCHES 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:2-YR LOS COCHES 6-HR Result:Baseflow

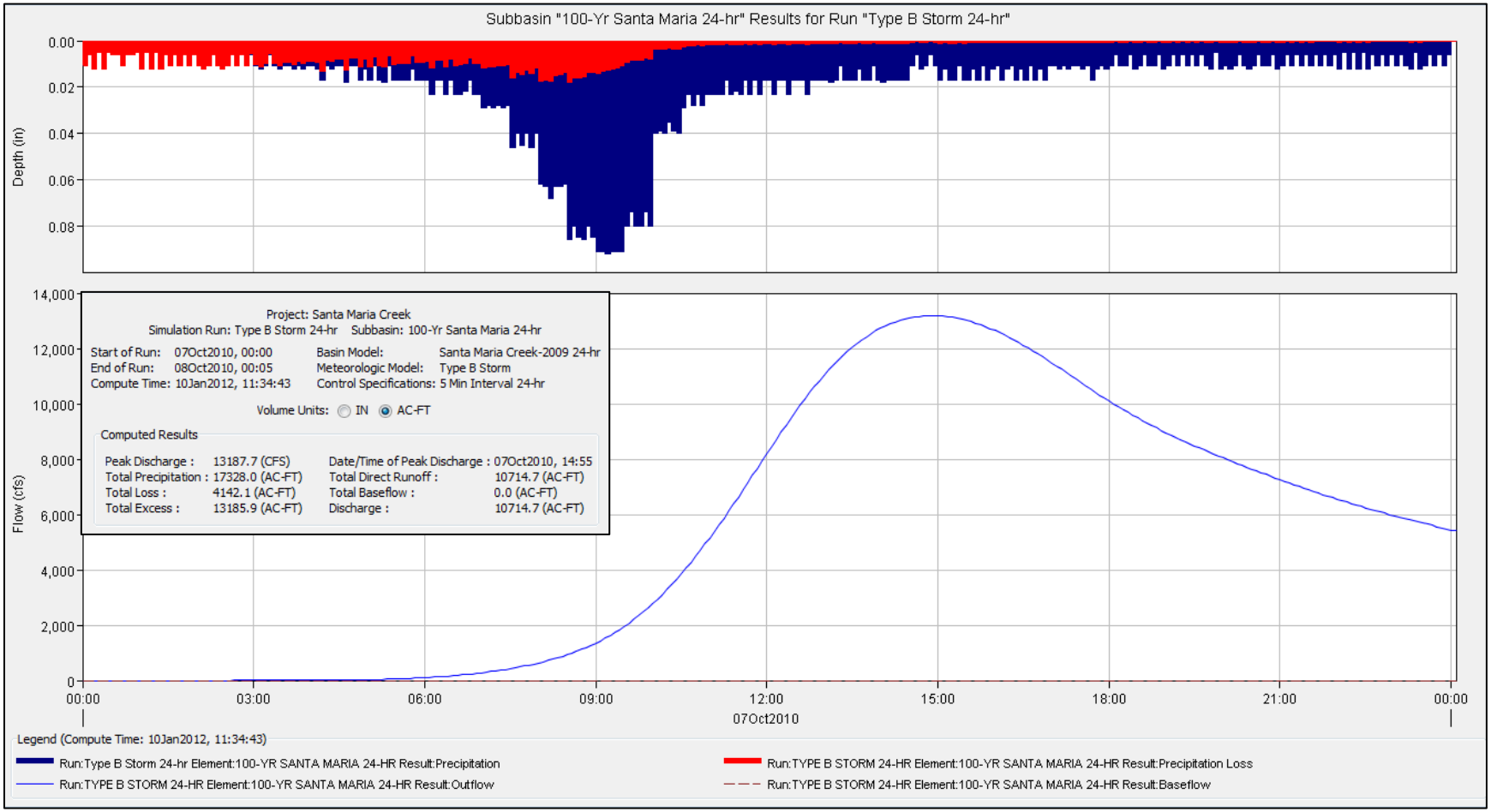

Subbasin "100-Yr Los Coches 24-hr" Results for Run "Nested Storm"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
Project: Los Coches Creek
Simulation Run: Nested Storm Subbasin: 100-Yr Los Coches 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 13:33:44
Basin Model: Los Coches Creek-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 5571.4 (CFS)
Total Precipitation : 4030.9 (AC-FT)
Total Loss : 826.7 (AC-FT)
Total Excess : 3204.2 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 17:50
Total Direct Runoff : 2947.6 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 2947.6 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
07Oct2010
Legend (Compute Time: 10Jan2012, 13:33:44)
Run:Nested Storm Element:100-YR LOS COCHES 24-HR Result:Precipitation
Run:NESTED STORM Element:100-YR LOS COCHES 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:100-YR LOS COCHES 24-HR Result:Outflow
Run:NESTED STORM Element:100-YR LOS COCHES 24-HR Result:Baseflow

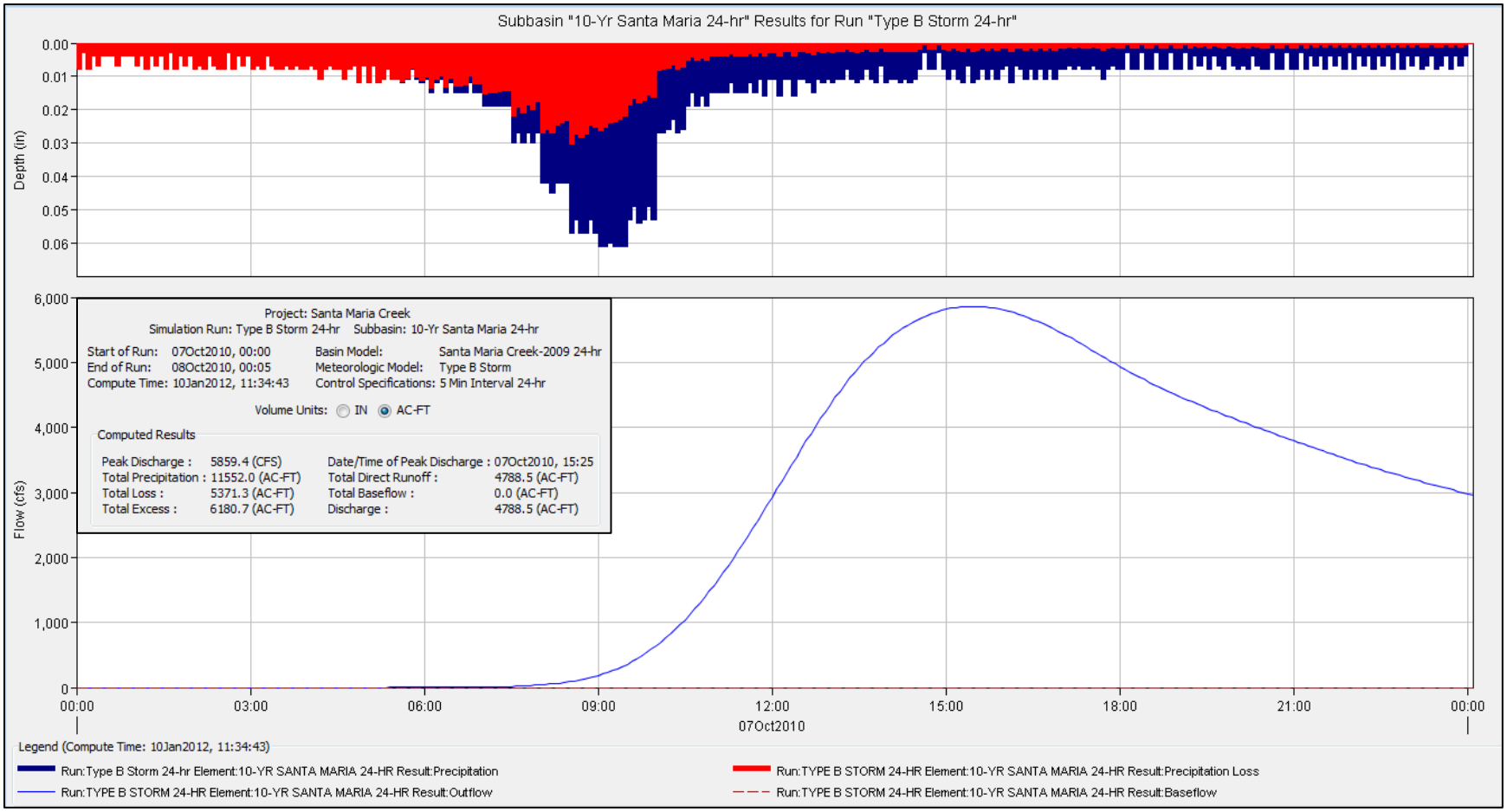

Subbasin "10-Yr Los Coches 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
Flow (cfs)
3,000
2,500
2,000
1,500
1,000
500
Project: Los Coches Creek
Simulation Run: Nested Storm Subbasin: 10-Yr Los Coches 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 13:33:44
Basin Model: Los Coches Creek-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2893.6 (CFS)
Total Precipitation : 2430.9 (AC-FT)
Total Loss : 1038.4 (AC-FT)
Total Excess : 1392.5 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 17:55
Total Direct Runoff : 1266.1 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1266.1 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Legend (Compute Time: 10Jan2012, 13:33:44)
Run:Nested Storm Element:10-YR LOS COCHES 24-HR Result:Precipitation
Run:NESTED STORM Element:10-YR LOS COCHES 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:10-YR LOS COCHES 24-HR Result:Outflow
Run:NESTED STORM Element:10-YR LOS COCHES 24-HR Result:Baseflow

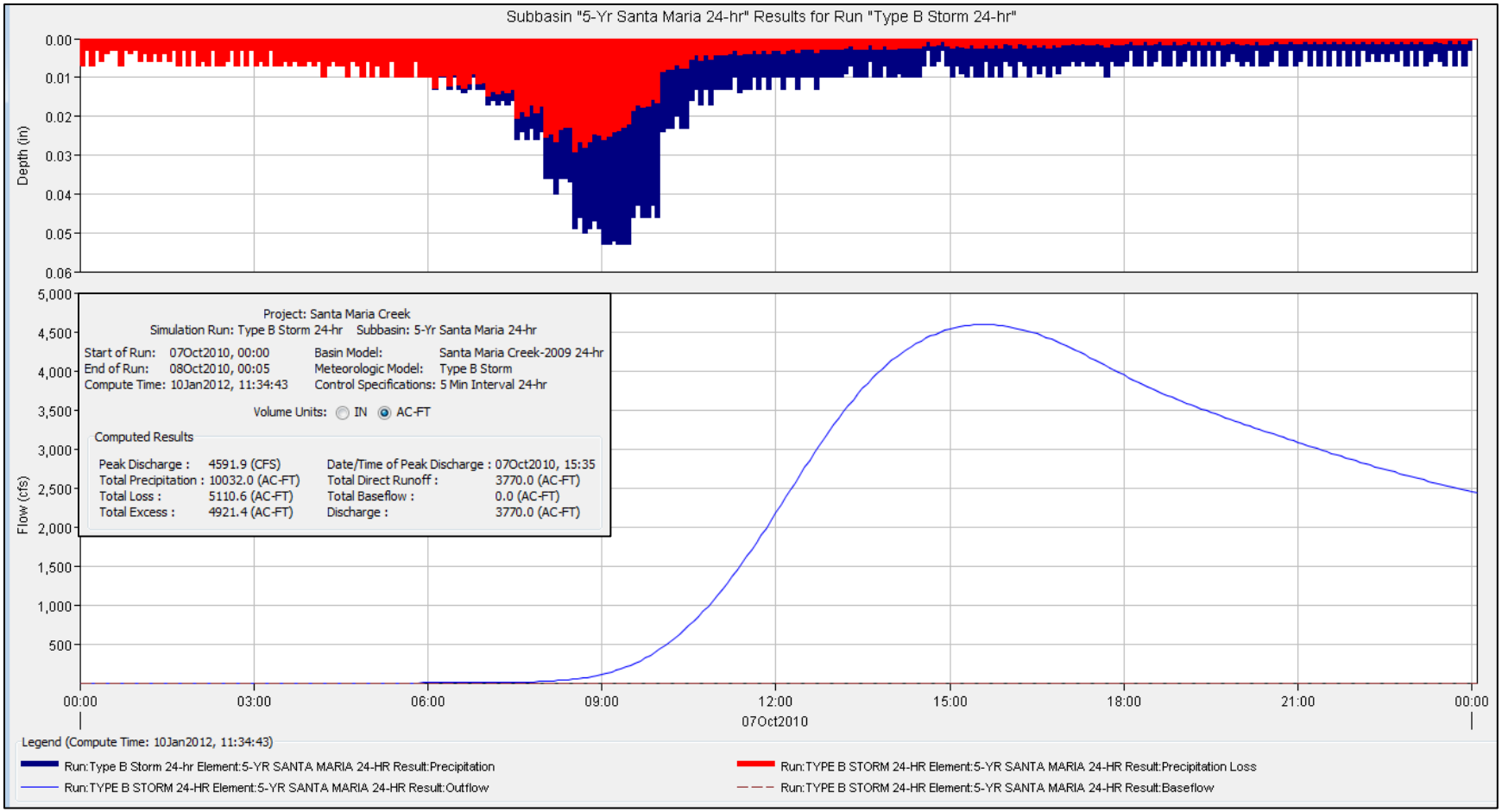

Subbasin "5-Yr Los Coches 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Flow (cfs)
2,500
2,000
1,500
1,000
500
0
Project: Los Coches Creek
Simulation Run: Nested Storm Subbasin: 5-Yr Los Coches 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 13:33:44
Basin Model: Los Coches Creek-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2458.7 (CFS)
Total Precipitation : 2170.0 (AC-FT)
Total Loss : 1001.4 (AC-FT)
Total Excess : 1168.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 17:55
Total Direct Runoff : 1059.9 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1059.9 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 13:33:44)
Run:Nested Storm Element:5-YR LOS COCHES 24-HR Result:Precipitation
Run:NESTED STORM Element:5-YR LOS COCHES 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:5-YR LOS COCHES 24-HR Result:Outflow
Run:NESTED STORM Element:5-YR LOS COCHES 24-HR Result:Baseflow

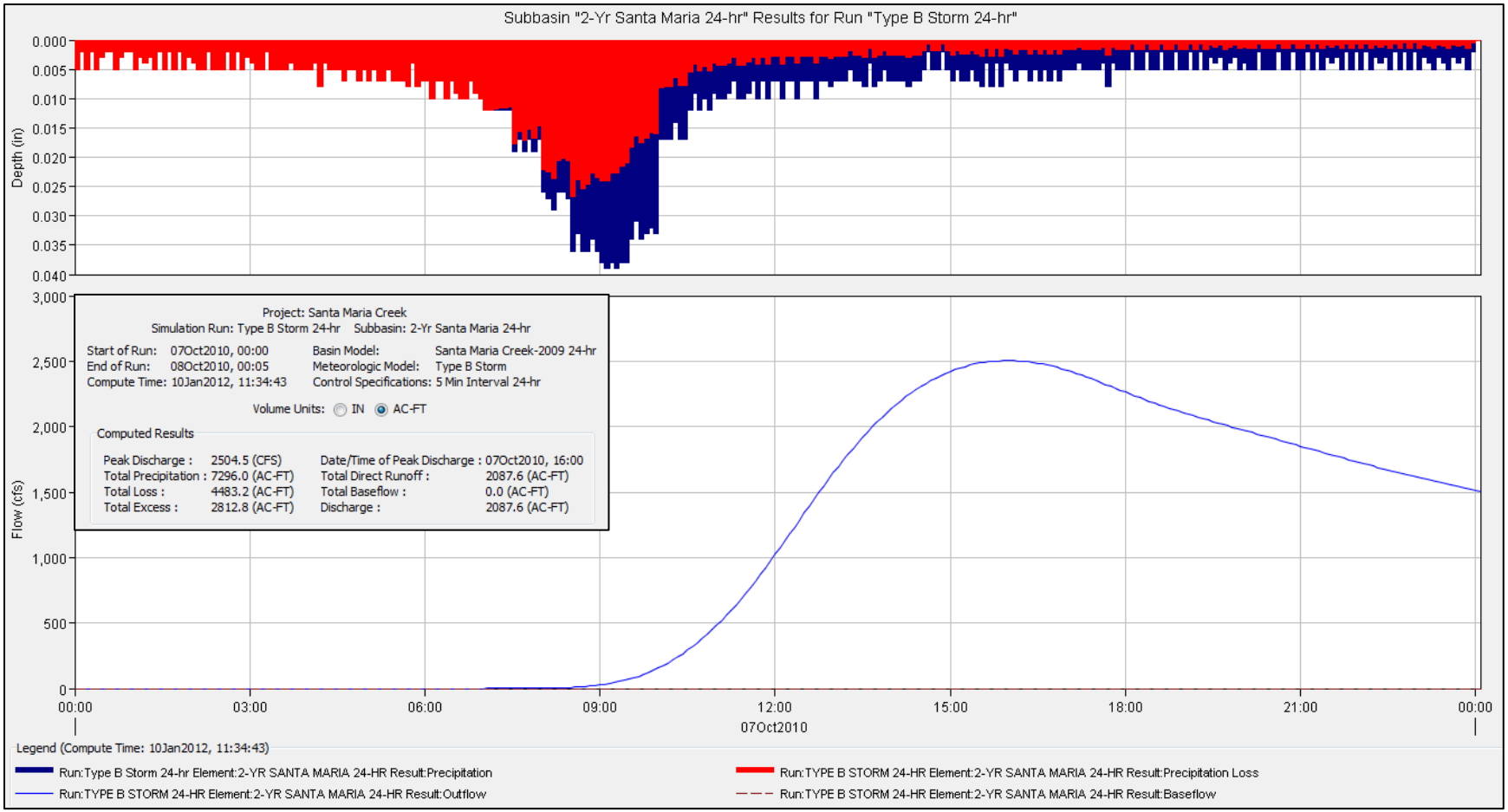

Subbasin "2-Yr Los Coches 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Flow (cfs)
1,600
1,400
1,200
1,000
800
600
400
200
0
Project: Los Coches Creek
Simulation Run: Nested Storm Subbasin: 2-Yr Los Coches 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:00
Compute Time: 10Jan2012, 13:33:44
Basin Model: Los Coches Creek-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1534.9 (CFS)
Total Precipitation : 1536.2 (AC-FT)
Total Loss : 879.6 (AC-FT)
Total Excess : 656.7 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 18:00
Total Direct Runoff : 594.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 594.0 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:0
07Oct2010
Legend (Compute Time: 10Jan2012, 13:33:44)
Run:Nested Storm Element:2-YR LOS COCHES 24-HR Result:Precipitation
Run:NESTED STORM Element:2-YR LOS COCHES 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:2-YR LOS COCHES 24-HR Result:Outflow
Run:NESTED STORM Element:2-YR LOS COCHES 24-HR Result:Baseflow

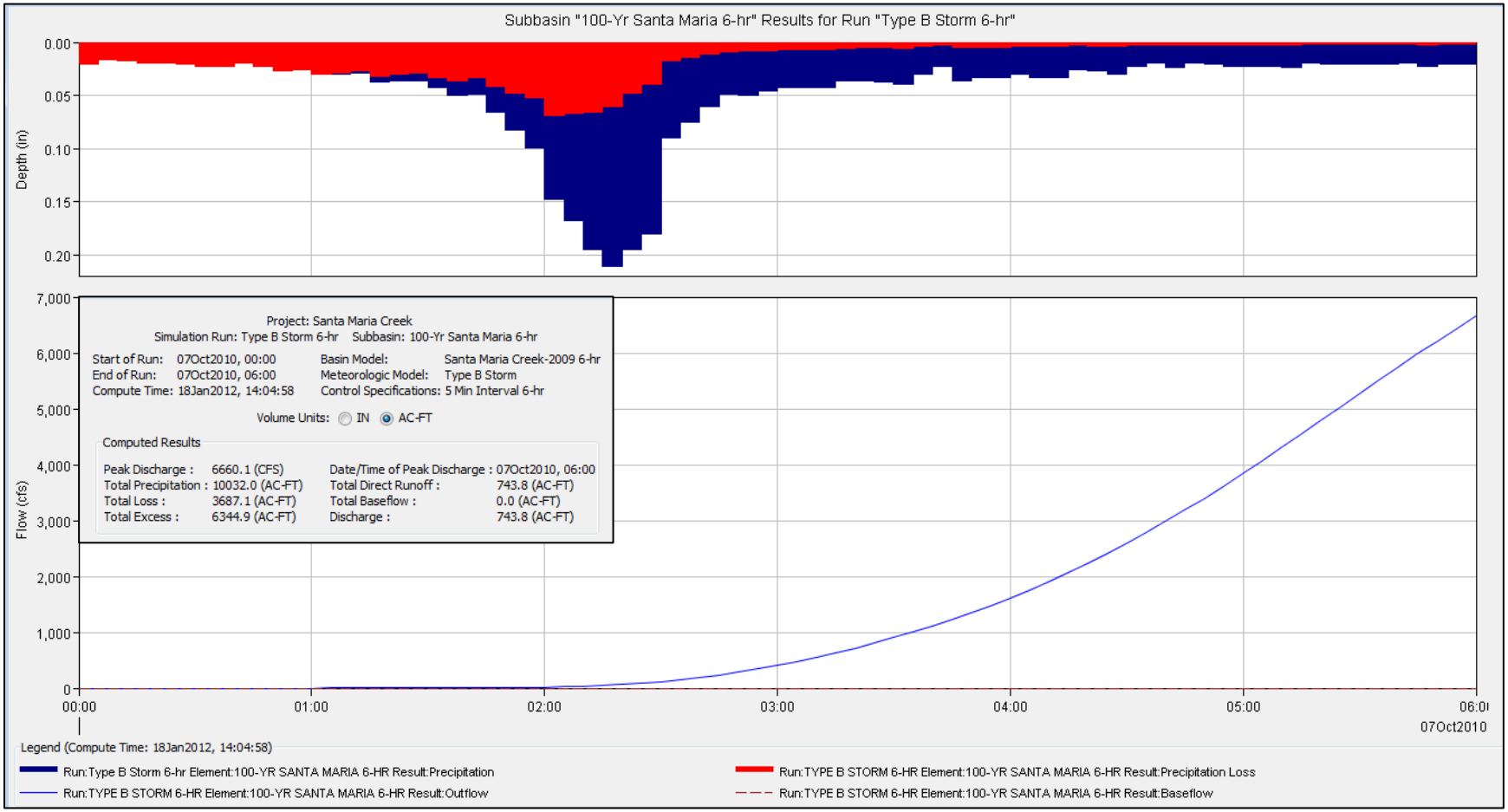
Santa Maria Creek HEC-HMS Outputs

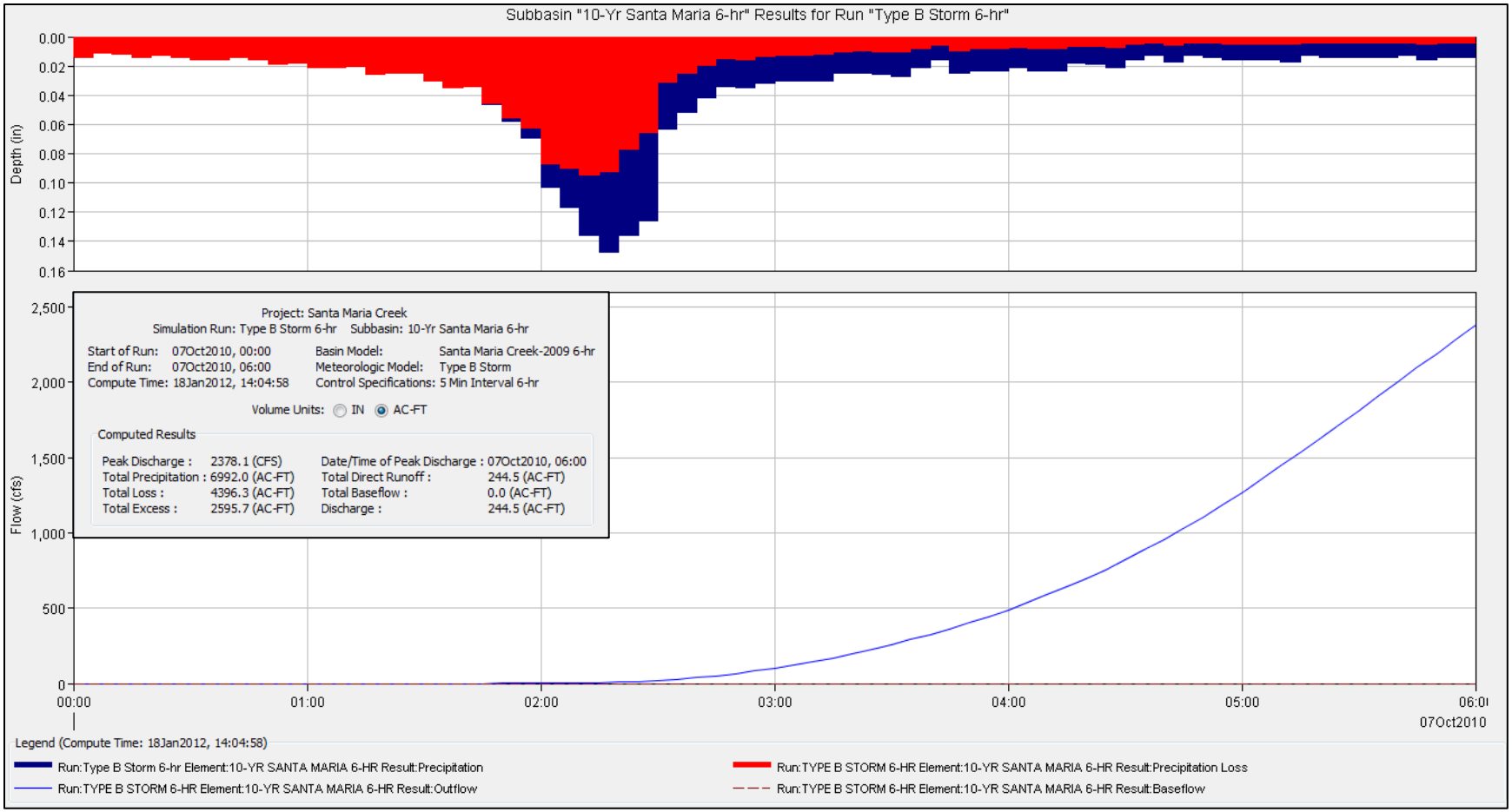

Subbasin "100-Yr Santa Maria 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
Flow (cfs)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Santa Maria Creek
Simulation Run: Type B Storm 24-hr Subbasin: 100-Yr Santa Maria 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 11:34:43
Basin Model: Santa Maria Creek-2009 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 13187.7 (CFS)
Total Precipitation : 17328.0 (AC-FT)
Total Loss : 4142.1 (AC-FT)
Total Excess : 13185.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 14:55
Total Direct Runoff : 10714.7 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 10714.7 (AC-FT)
Legend (Compute Time: 10Jan2012, 11:34:43)
Run:Type B Storm 24-hr Element:100-YR SANTA MARIA 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:100-YR SANTA MARIA 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:100-YR SANTA MARIA 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:100-YR SANTA MARIA 24-HR Result:Baseflow

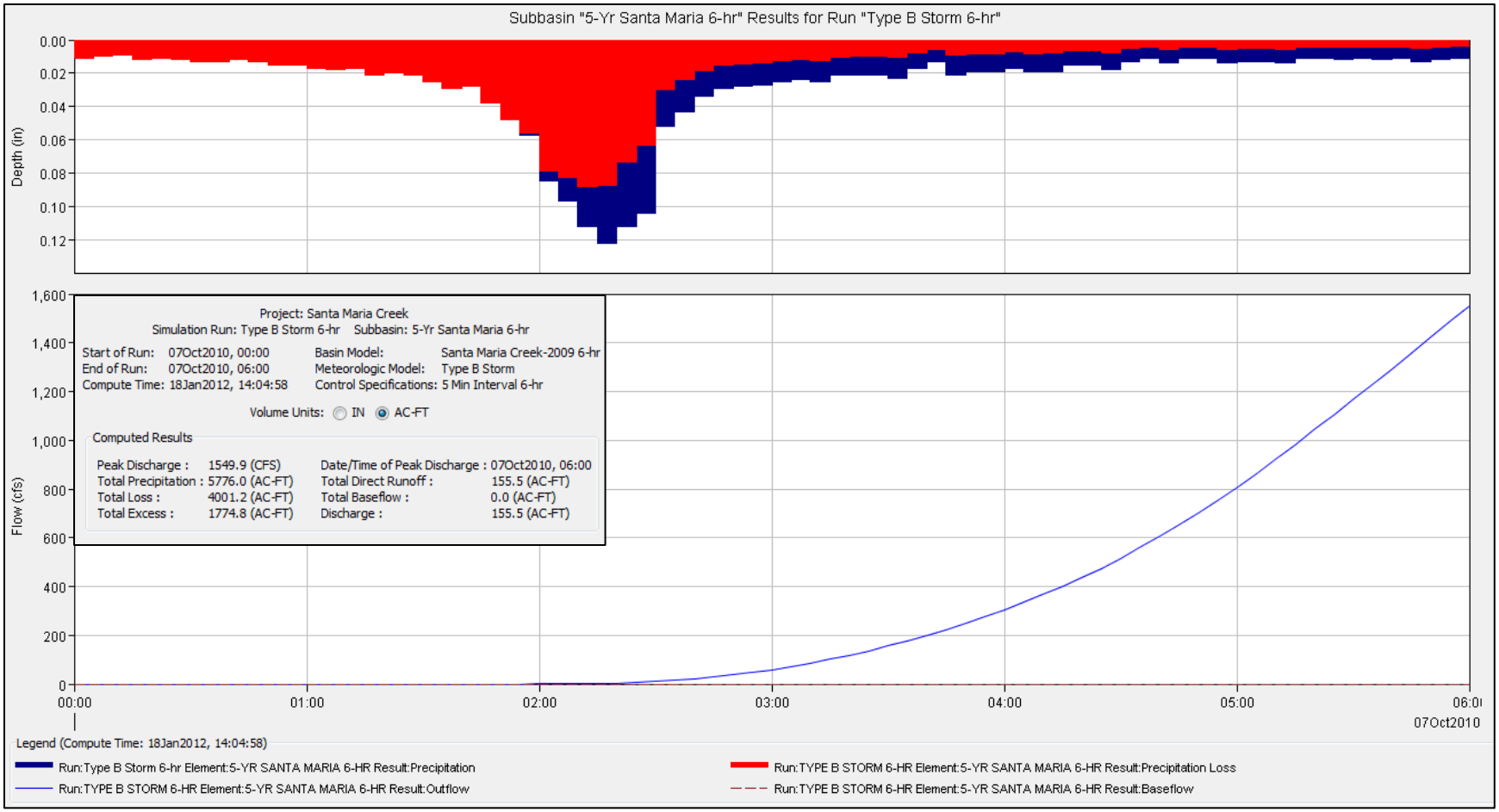

Subbasin "10-Yr Santa Maria 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
Project: Santa Maria Creek
Simulation Run: Type B Storm 24-hr Subbasin: 10-Yr Santa Maria 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 11:34:43
Basin Model: Santa Maria Creek-2009 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 5859.4 (CFS)
Total Precipitation : 11552.0 (AC-FT)
Total Loss : 5371.3 (AC-FT)
Total Excess : 6180.7 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 15:25
Total Direct Runoff : 4788.5 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 4788.5 (AC-FT)
00:00
03:00
06:00
09:00
12:00
07Oct2010
15:00
18:00
21:00
00:00
Legend (Compute Time: 10Jan2012, 11:34:43)
Run:Type B Storm 24-hr Element:10-YR SANTA MARIA 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:10-YR SANTA MARIA 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:10-YR SANTA MARIA 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:10-YR SANTA MARIA 24-HR Result:Baseflow

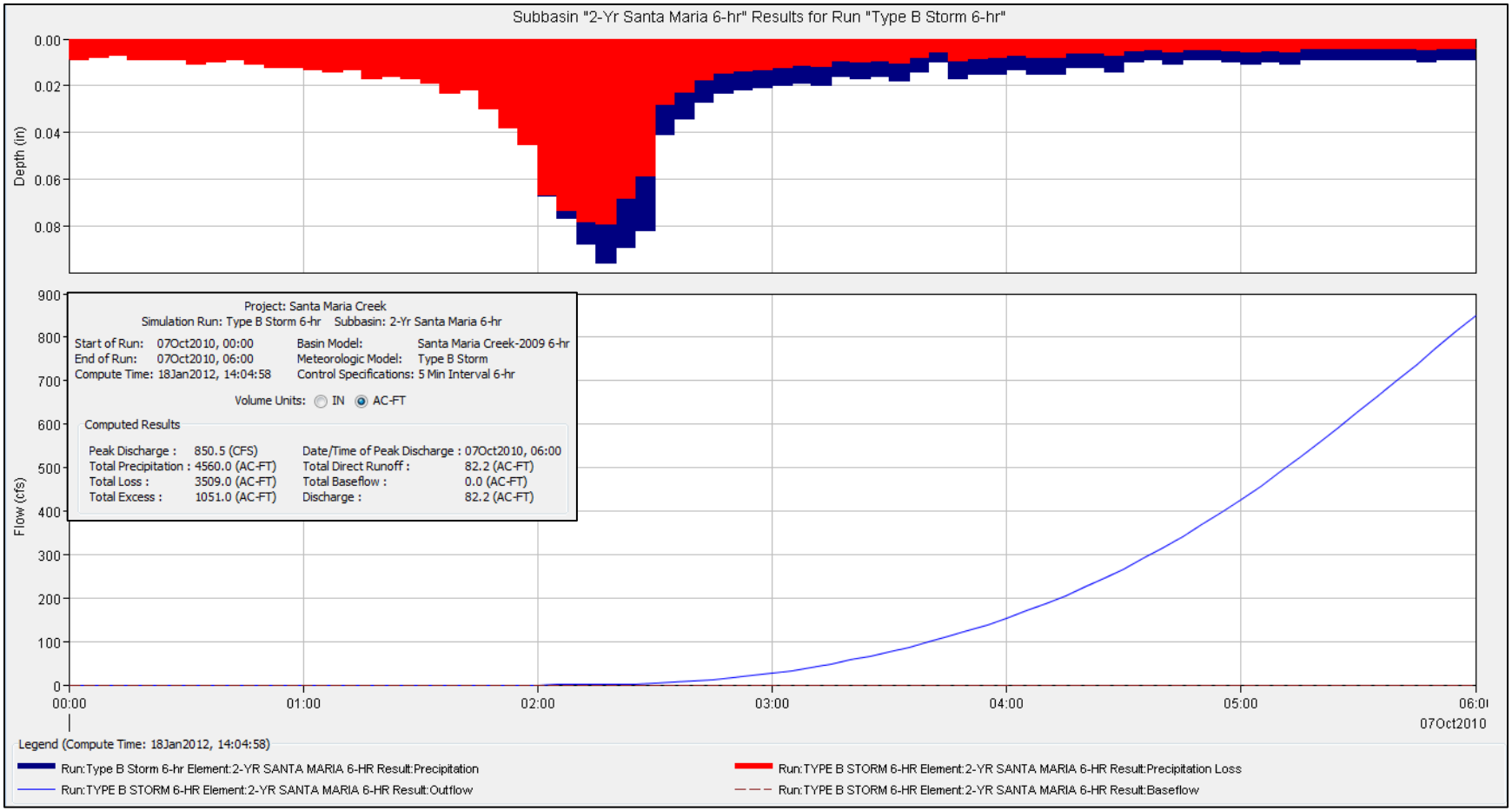

Subbasin "5-Yr Santa Maria 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
Flow (cfs)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
Project: Santa Maria Creek
Simulation Run: Type B Storm 24-hr Subbasin: 5-Yr Santa Maria 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 11:34:43
Basin Model: Santa Maria Creek-2009 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 4591.9 (CFS)
Total Precipitation : 10032.0 (AC-FT)
Total Loss : 5110.6 (AC-FT)
Total Excess : 4921.4 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 15:35
Total Direct Runoff : 3770.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 3770.0 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 11:34:43)
Run:Type B Storm 24-hr Element:5-YR SANTA MARIA 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:5-YR SANTA MARIA 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:5-YR SANTA MARIA 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:5-YR SANTA MARIA 24-HR Result:Baseflow

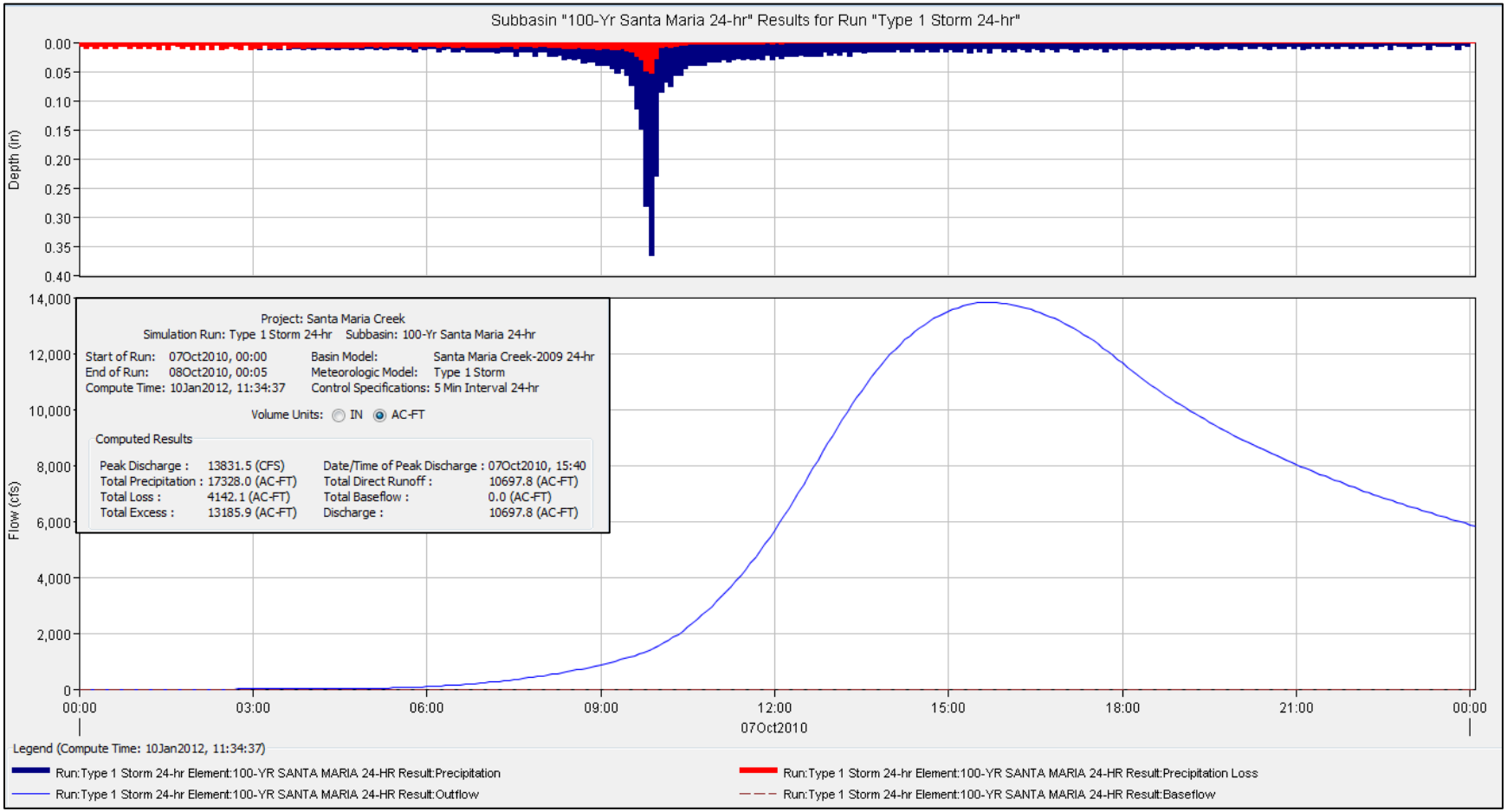

Subbasin "2-Yr Santa Maria 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
0.040
Flow (cfs)
3,000
2,500
2,000
1,500
1,000
500
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Santa Maria Creek
Simulation Run: Type B Storm 24-hr Subbasin: 2-Yr Santa Maria 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 11:34:43
Basin Model: Santa Maria Creek-2009 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2504.5 (CFS)
Total Precipitation : 7296.0 (AC-FT)
Total Loss : 4483.2 (AC-FT)
Total Excess : 2812.8 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 16:00
Total Direct Runoff : 2087.6 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 2087.6 (AC-FT)
Legend (Compute Time: 10Jan2012, 11:34:43)
Run:Type B Storm 24-hr Element:2-YR SANTA MARIA 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:2-YR SANTA MARIA 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:2-YR SANTA MARIA 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:2-YR SANTA MARIA 24-HR Result:Baseflow

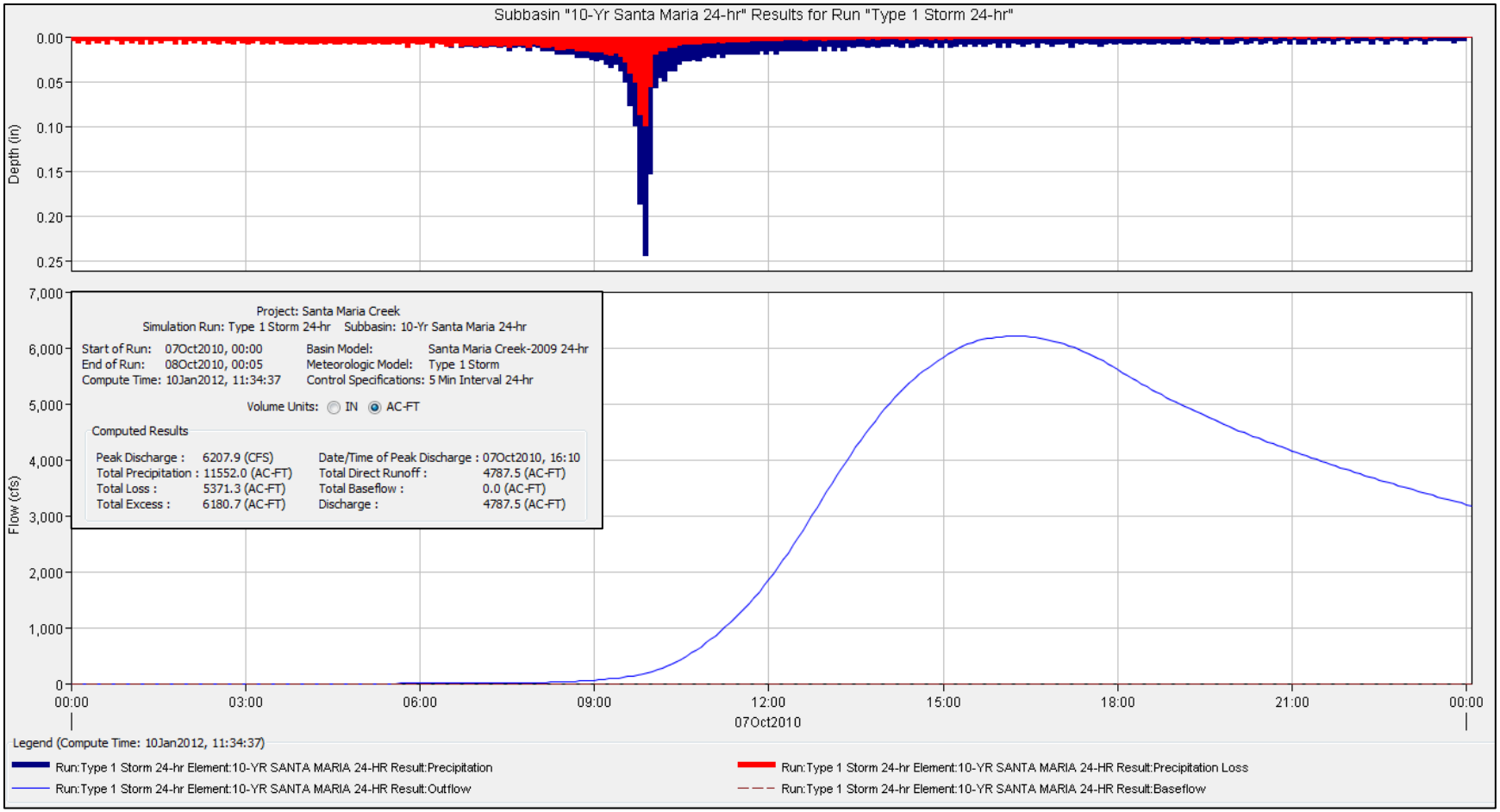

Subbasin "100-Yr Santa Maria 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
Flow (cfs)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Santa Maria Creek
Simulation Run: Type B Storm 6-hr Subbasin: 100-Yr Santa Maria 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:04:58
Basin Model: Santa Maria Creek-2009 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 6660.1 (CFS)
Total Precipitation : 10032.0 (AC-FT)
Total Loss : 3687.1 (AC-FT)
Total Excess : 6344.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 743.8 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 743.8 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:04:58)
Run:Type B Storm 6-hr Element:100-YR SANTA MARIA 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:100-YR SANTA MARIA 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:100-YR SANTA MARIA 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:100-YR SANTA MARIA 6-HR Result:Baseflow

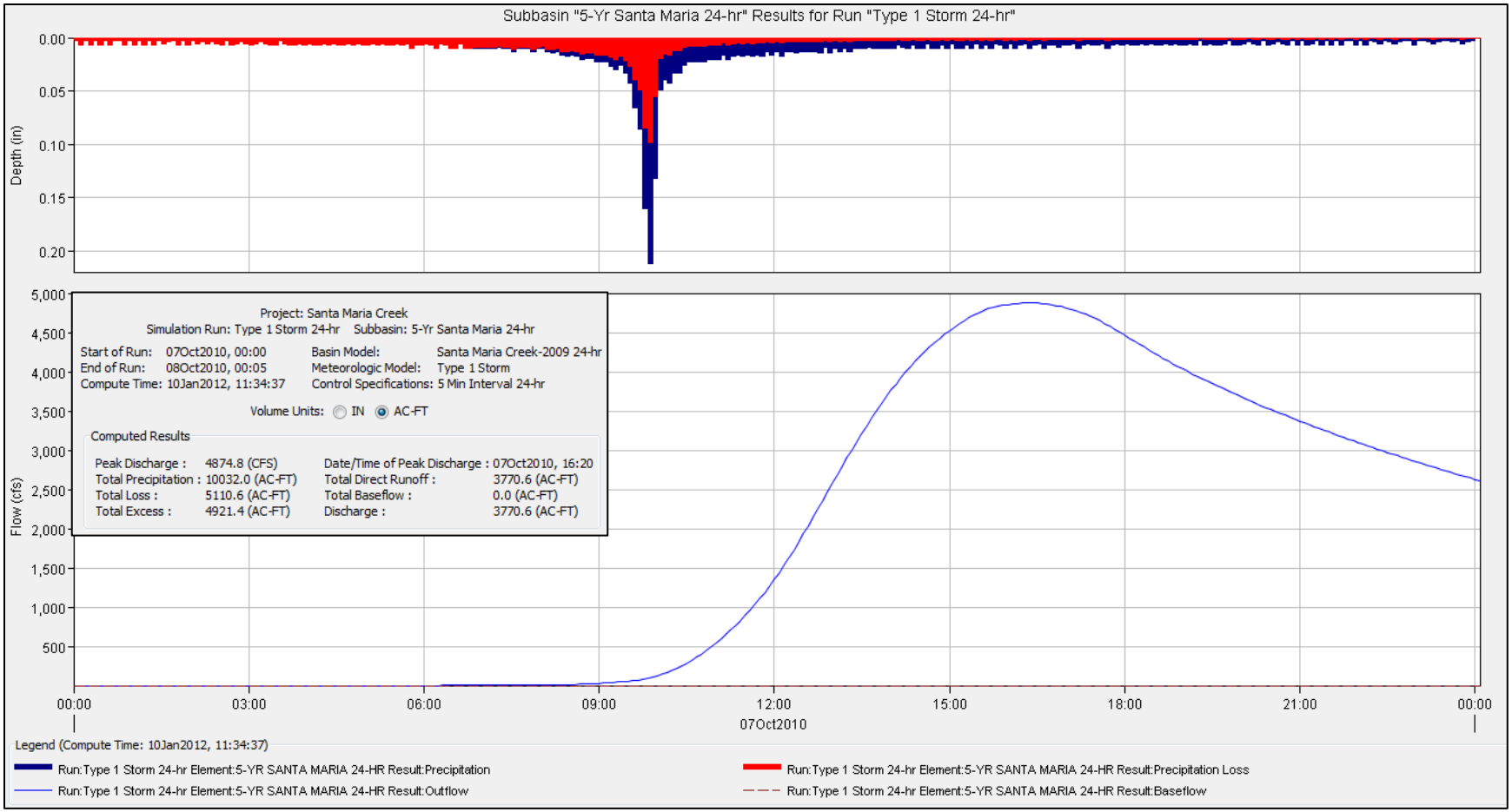

Subbasin "10-Yr Santa Maria 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
Flow (cfs)
2,500
2,000
1,500
1,000
500
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07Oct2010
Project: Santa Maria Creek
Simulation Run: Type B Storm 6-hr Subbasin: 10-Yr Santa Maria 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:04:58
Basin Model: Santa Maria Creek-2009 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2378.1 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Precipitation : 6992.0 (AC-FT)
Total Direct Runoff : 244.5 (AC-FT)
Total Loss : 4396.3 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 2595.7 (AC-FT)
Discharge : 244.5 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:04:58)
Run:Type B Storm 6-hr Element:10-YR SANTA MARIA 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:10-YR SANTA MARIA 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:10-YR SANTA MARIA 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:10-YR SANTA MARIA 6-HR Result:Baseflow

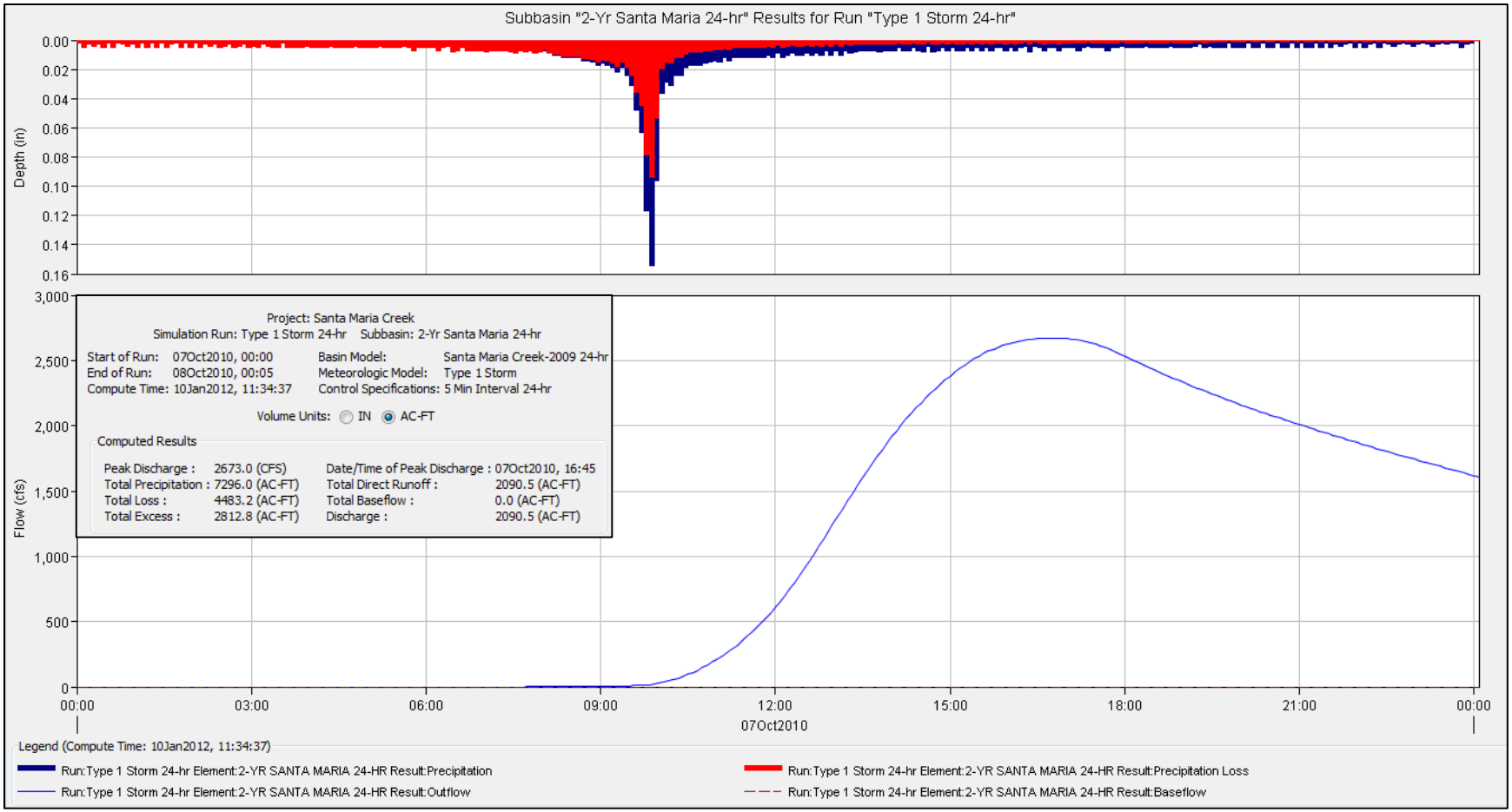

Subbasin "5-Yr Santa Maria 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Flow (cfs)
1,600
1,400
1,200
1,000
800
600
400
200
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Santa Maria Creek
Simulation Run: Type B Storm 6-hr Subbasin: 5-Yr Santa Maria 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:04:58
Basin Model: Santa Maria Creek-2009 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1549.9 (CFS)
Total Precipitation : 5776.0 (AC-FT)
Total Loss : 4001.2 (AC-FT)
Total Excess : 1774.8 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 155.5 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 155.5 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:04:58)
Run:Type B Storm 6-hr Element:5-YR SANTA MARIA 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:5-YR SANTA MARIA 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:5-YR SANTA MARIA 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:5-YR SANTA MARIA 6-HR Result:Baseflow

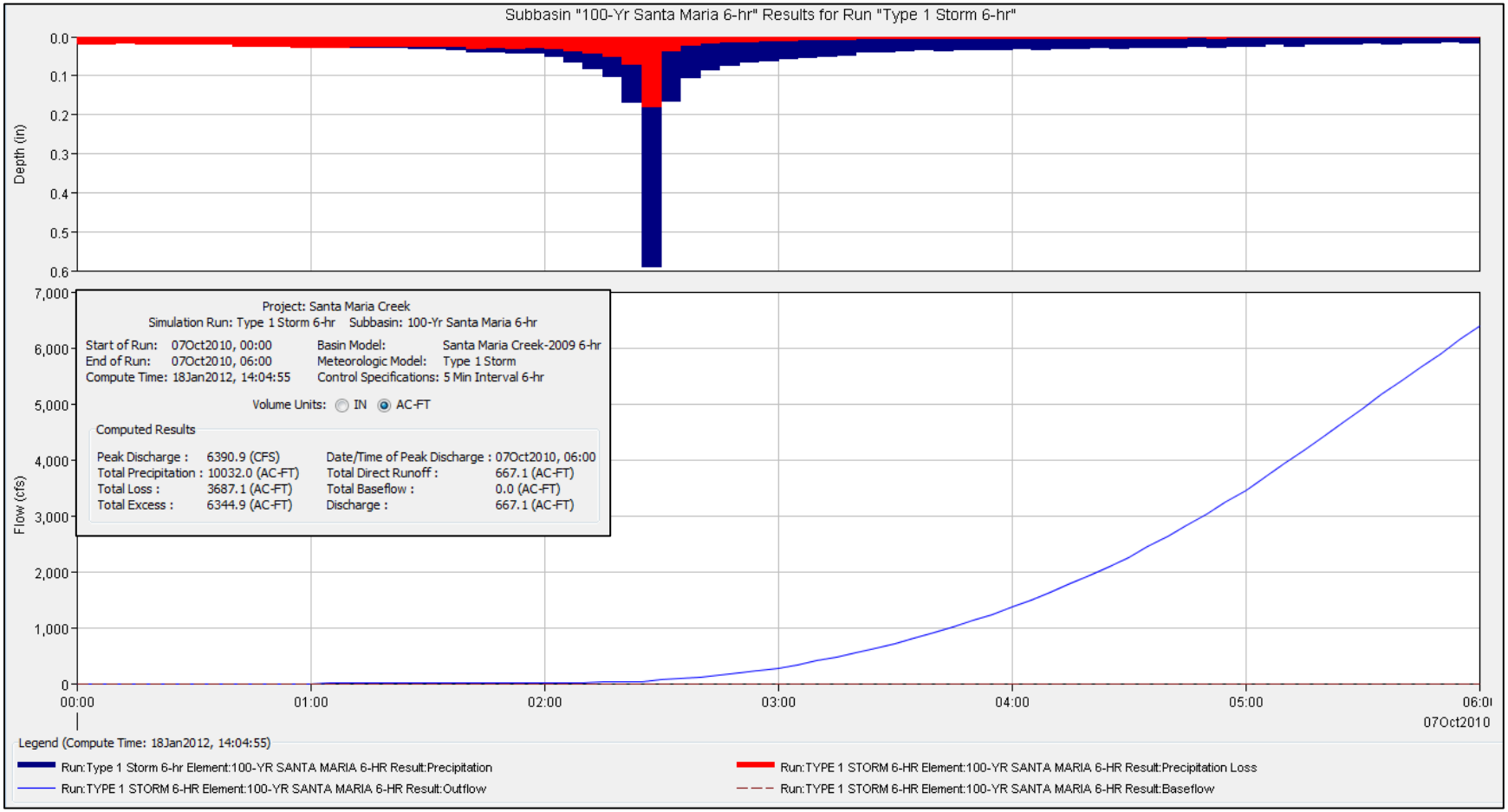

Subbasin "2-Yr Santa Maria 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
Project: Santa Maria Creek
Simulation Run: Type B Storm 6-hr Subbasin: 2-Yr Santa Maria 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:04:58
Basin Model: Santa Maria Creek-2009 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 850.5 (CFS)
Total Precipitation : 4560.0 (AC-FT)
Total Loss : 3509.0 (AC-FT)
Total Excess : 1051.0 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 82.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 82.2 (AC-FT)
Flow (cfs)
900
800
700
600
500
400
300
200
100
0
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Legend (Compute Time: 18Jan2012, 14:04:58)
Run:Type B Storm 6-hr Element:2-YR SANTA MARIA 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:2-YR SANTA MARIA 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:2-YR SANTA MARIA 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:2-YR SANTA MARIA 6-HR Result:Baseflow

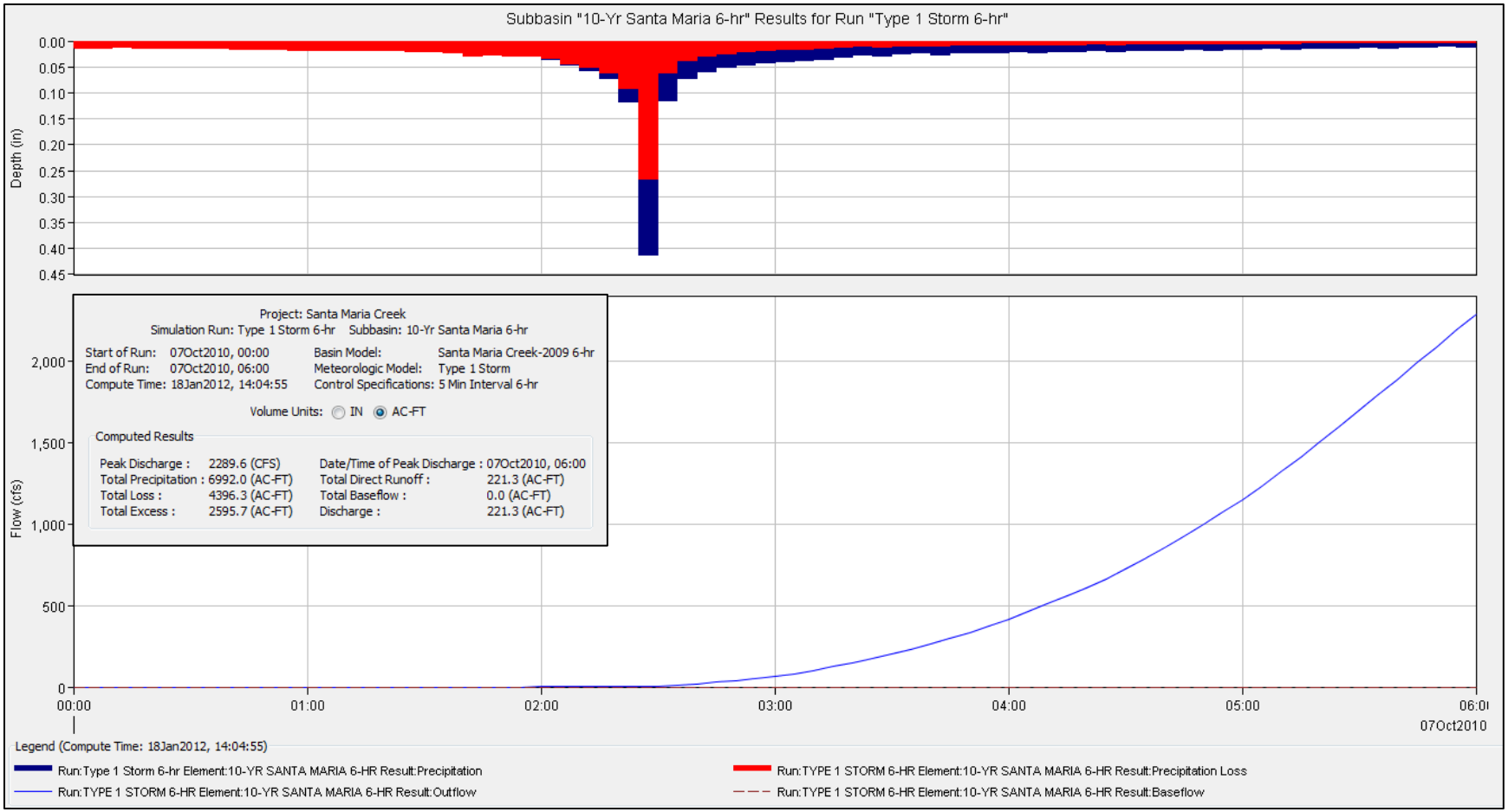

Subbasin "100-Yr Santa Maria 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
Flow (cfs)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Santa Maria Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 100-Yr Santa Maria 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 11:34:37
Basin Model: Santa Maria Creek-2009 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 13831.5 (CFS)
Total Precipitation : 17328.0 (AC-FT)
Total Loss : 4142.1 (AC-FT)
Total Excess : 13185.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 15:40
Total Direct Runoff : 10697.8 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 10697.8 (AC-FT)
Legend (Compute Time: 10Jan2012, 11:34:37)
Run:Type 1 Storm 24-hr Element:100-YR SANTA MARIA 24-HR Result:Precipitation
Run:Type 1 Storm 24-hr Element:100-YR SANTA MARIA 24-HR Result:Precipitation Loss
Run:Type 1 Storm 24-hr Element:100-YR SANTA MARIA 24-HR Result:Outflow
Run:Type 1 Storm 24-hr Element:100-YR SANTA MARIA 24-HR Result:Baseflow

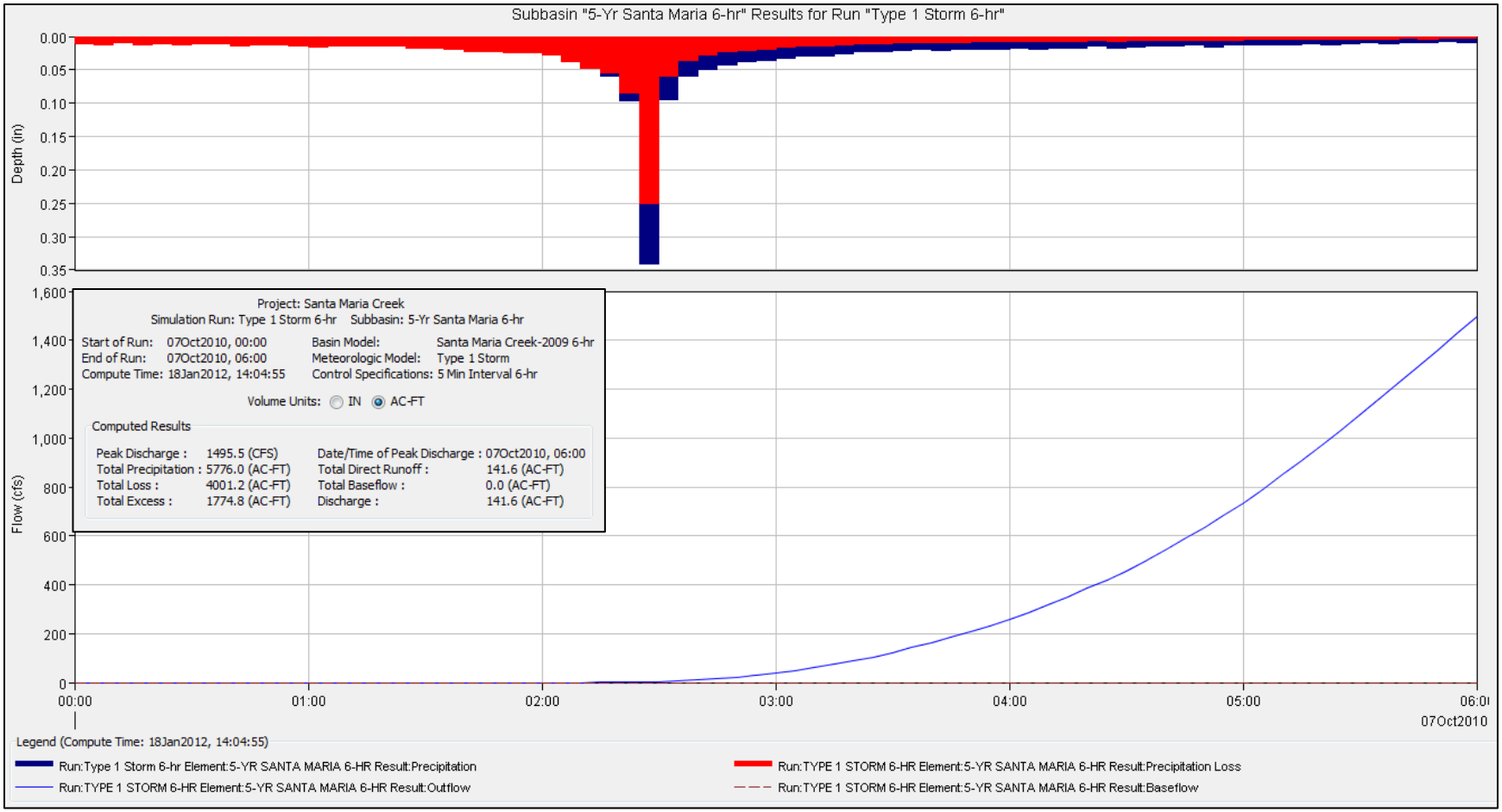

Subbasin "10-Yr Santa Maria 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
Flow (cfs)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Project: Santa Maria Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 10-Yr Santa Maria 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 11:34:37
Basin Model: Santa Maria Creek-2009 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 6207.9 (CFS)
Total Precipitation : 11552.0 (AC-FT)
Total Loss : 5371.3 (AC-FT)
Total Excess : 6180.7 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 16:10
Total Direct Runoff : 4787.5 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 4787.5 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 11:34:37)
Run:Type 1 Storm 24-hr Element:10-YR SANTA MARIA 24-HR Result:Precipitation
Run:Type 1 Storm 24-hr Element:10-YR SANTA MARIA 24-HR Result:Precipitation Loss
Run:Type 1 Storm 24-hr Element:10-YR SANTA MARIA 24-HR Result:Outflow
Run:Type 1 Storm 24-hr Element:10-YR SANTA MARIA 24-HR Result:Baseflow

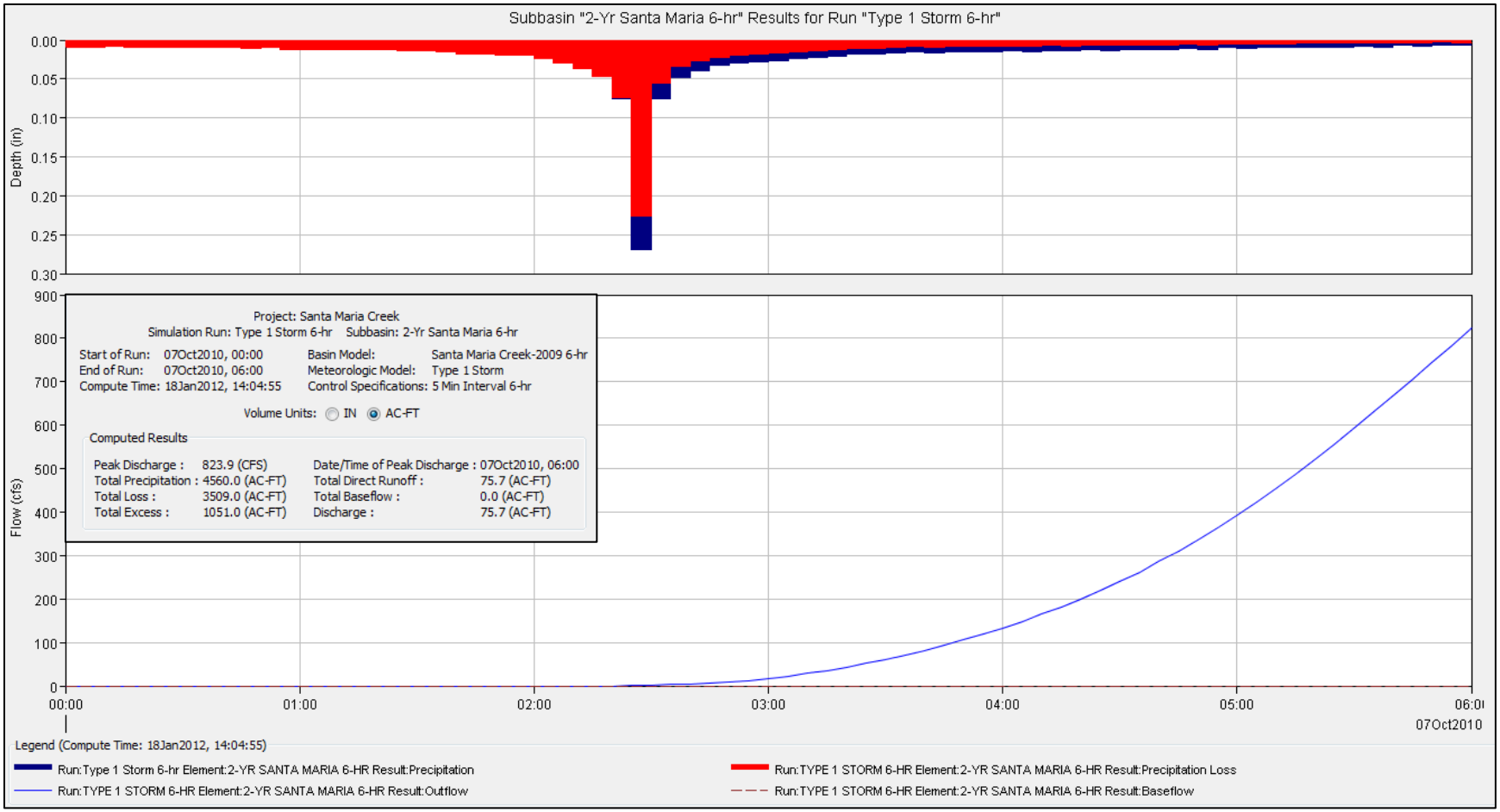

Subbasin "5-Yr Santa Maria 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
Flow (cfs)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
Project: Santa Maria Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 5-Yr Santa Maria 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 11:34:37
Basin Model: Santa Maria Creek-2009 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 4874.8 (CFS)
Total Precipitation : 10032.0 (AC-FT)
Total Loss : 5110.6 (AC-FT)
Total Excess : 4921.4 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 16:20
Total Direct Runoff : 3770.6 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 3770.6 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 11:34:37)
Run:Type 1 Storm 24-hr Element:5-YR SANTA MARIA 24-HR Result:Precipitation
Run:Type 1 Storm 24-hr Element:5-YR SANTA MARIA 24-HR Result:Outflow
Run:Type 1 Storm 24-hr Element:5-YR SANTA MARIA 24-HR Result:Precipitation Loss
Run:Type 1 Storm 24-hr Element:5-YR SANTA MARIA 24-HR Result:Baseflow

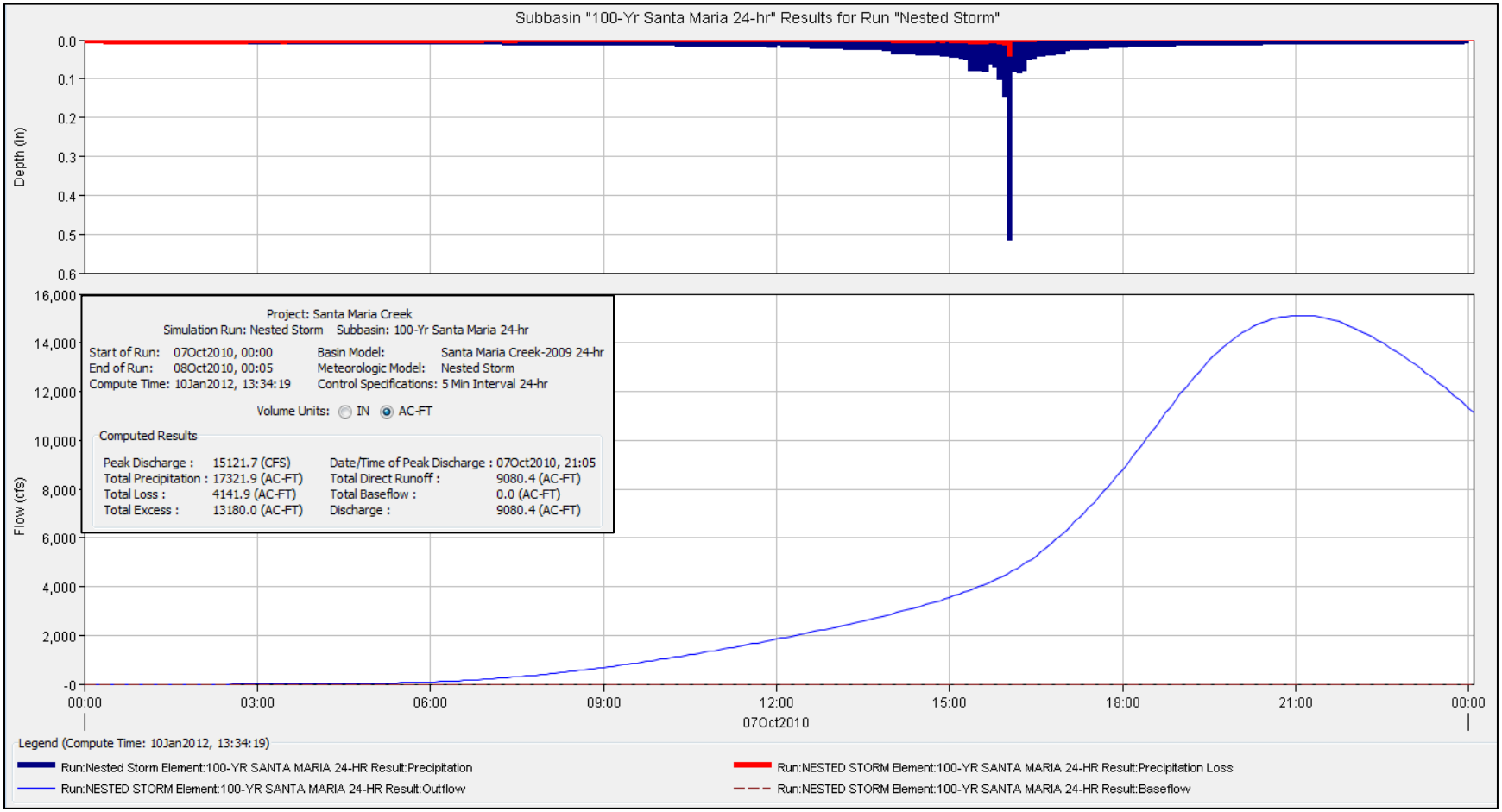

Subbasin "2-Yr Santa Maria 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
Flow (cfs)
3,000
2,500
2,000
1,500
1,000
500
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Santa Maria Creek
Simulation Run: Type 1 Storm 24-hr Subbasin: 2-Yr Santa Maria 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 11:34:37
Basin Model: Santa Maria Creek-2009 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2673.0 (CFS)
Total Precipitation : 7296.0 (AC-FT)
Total Loss : 4483.2 (AC-FT)
Total Excess : 2812.8 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 16:45
Total Direct Runoff : 2090.5 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 2090.5 (AC-FT)
Legend (Compute Time: 10Jan2012, 11:34:37)
Run:Type 1 Storm 24-hr Element:2-YR SANTA MARIA 24-HR Result:Precipitation
Run:Type 1 Storm 24-hr Element:2-YR SANTA MARIA 24-HR Result:Precipitation Loss
Run:Type 1 Storm 24-hr Element:2-YR SANTA MARIA 24-HR Result:Outflow
Run:Type 1 Storm 24-hr Element:2-YR SANTA MARIA 24-HR Result:Baseflow

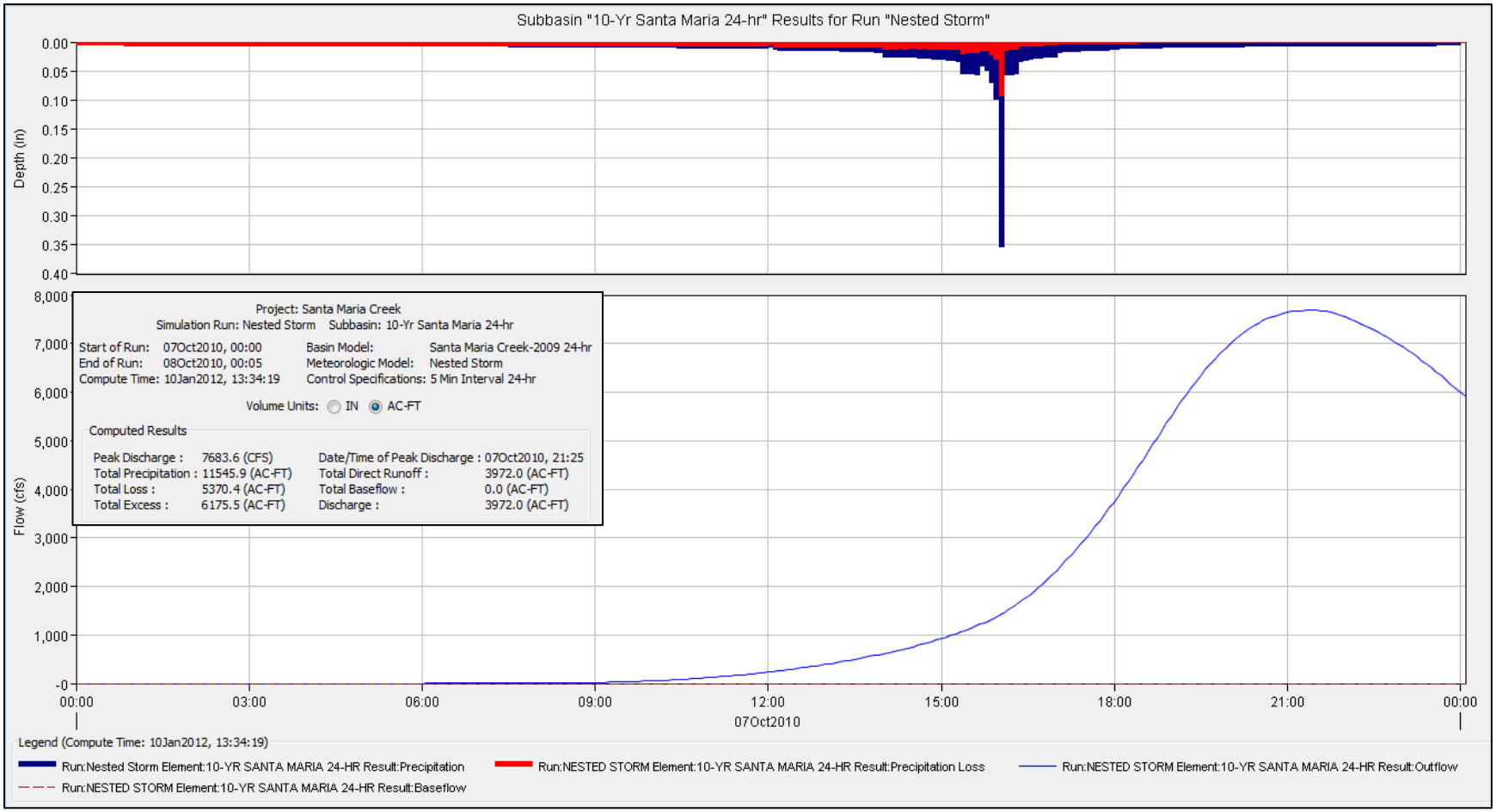

Subbasin "100-Yr Santa Maria 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Flow (cfs)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Santa Maria Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 100-Yr Santa Maria 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:04:55
Basin Model: Santa Maria Creek-2009 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 6390.9 (CFS)
Total Precipitation : 10032.0 (AC-FT)
Total Loss : 3687.1 (AC-FT)
Total Excess : 6344.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 667.1 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 667.1 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:04:55)
Run:Type 1 Storm 6-hr Element:100-YR SANTA MARIA 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:100-YR SANTA MARIA 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:100-YR SANTA MARIA 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:100-YR SANTA MARIA 6-HR Result:Baseflow

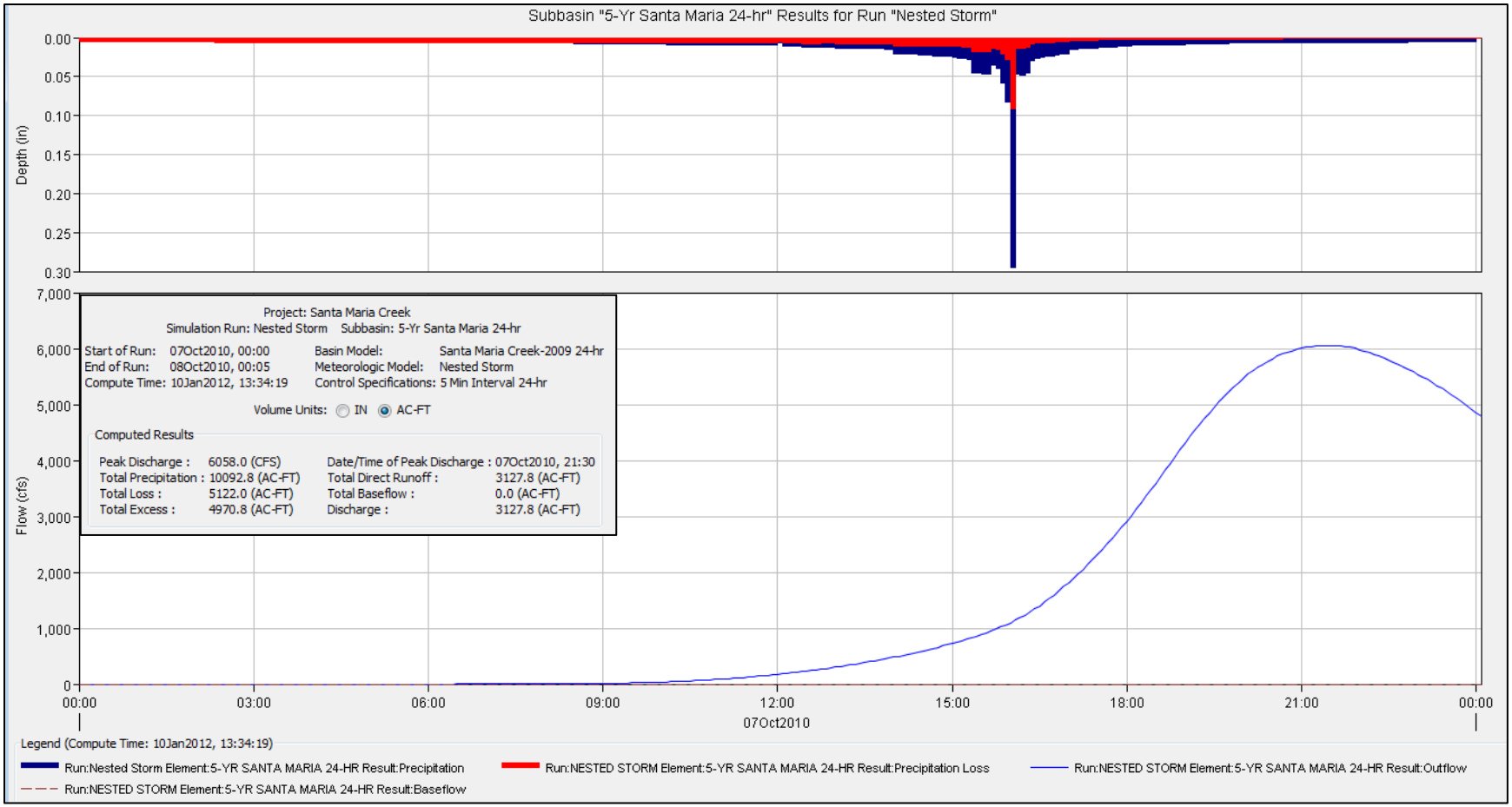

Subbasin "10-Yr Santa Maria 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
Project: Santa Maria Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 10-Yr Santa Maria 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:04:55
Basin Model: Santa Maria Creek-2009 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2289.6 (CFS)
Total Precipitation : 6992.0 (AC-FT)
Total Loss : 4396.3 (AC-FT)
Total Excess : 2595.7 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 221.3 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 221.3 (AC-FT)
Flow (cfs)
2,000
1,500
1,000
500
0
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Legend (Compute Time: 18Jan2012, 14:04:55)
Run:Type 1 Storm 6-hr Element:10-YR SANTA MARIA 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:10-YR SANTA MARIA 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:10-YR SANTA MARIA 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:10-YR SANTA MARIA 6-HR Result:Baseflow

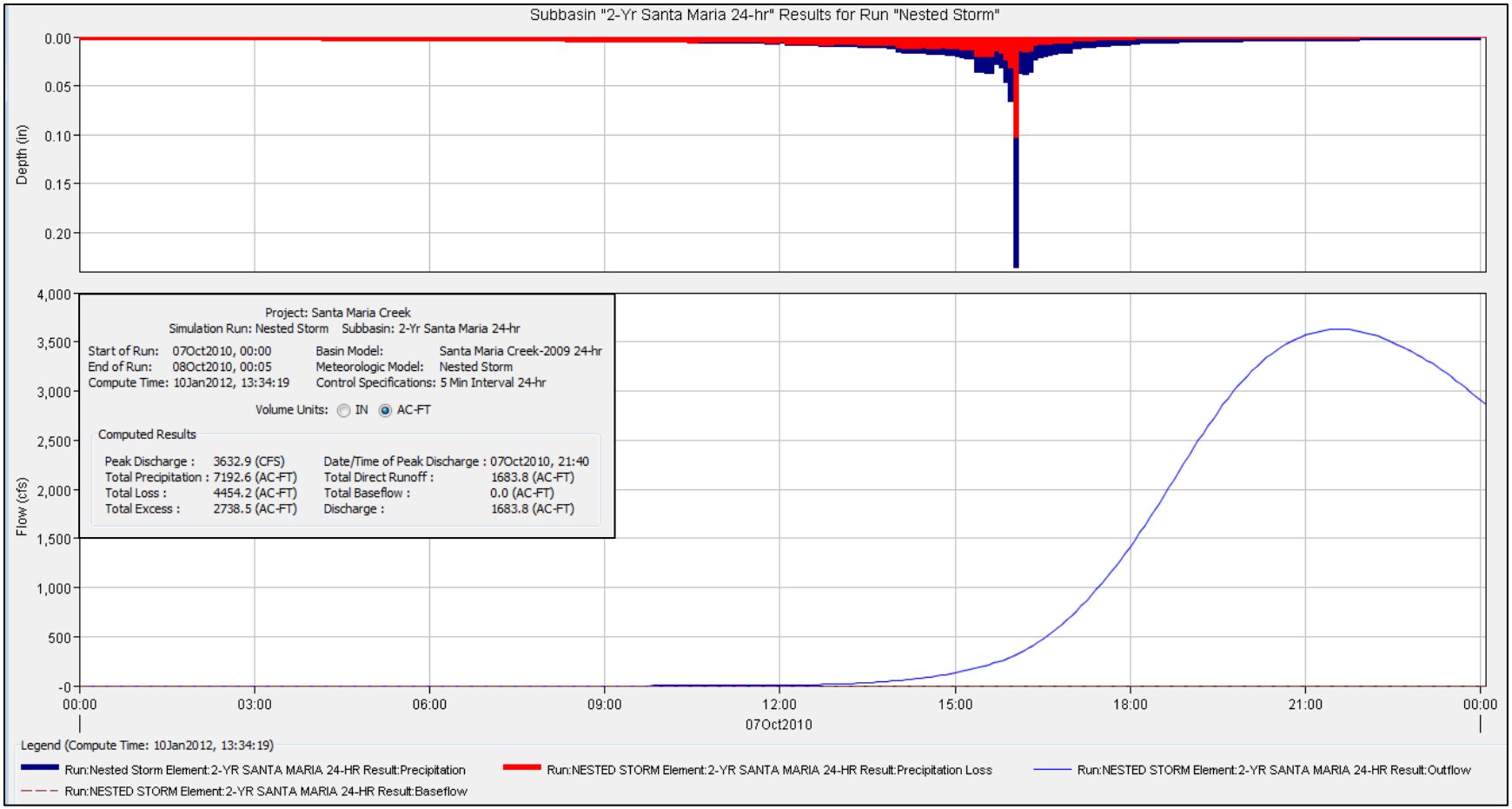

Subbasin "5-Yr Santa Maria 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Flow (cfs)
1,600
1,400
1,200
1,000
800
600
400
200
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Santa Maria Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 5-Yr Santa Maria 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:04:55
Basin Model: Santa Maria Creek-2009 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 1495.5 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Precipitation : 5776.0 (AC-FT)
Total Direct Runoff : 141.6 (AC-FT)
Total Loss : 4001.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 1774.8 (AC-FT)
Discharge : 141.6 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:04:55)
Run:Type 1 Storm 6-hr Element:5-YR SANTA MARIA 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:5-YR SANTA MARIA 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:5-YR SANTA MARIA 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:5-YR SANTA MARIA 6-HR Result:Baseflow


Subbasin "2-Yr Santa Maria 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Flow (cfs)
900
800
700
600
500
400
300
200
100
0
Project: Santa Maria Creek
Simulation Run: Type 1 Storm 6-hr Subbasin: 2-Yr Santa Maria 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:04:55
Basin Model: Santa Maria Creek-2009 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5 Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 823.9 (CFS)
Total Precipitation : 4560.0 (AC-FT)
Total Loss : 3509.0 (AC-FT)
Total Excess : 1051.0 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 75.7 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 75.7 (AC-FT)
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Legend (Compute Time: 18Jan2012, 14:04:55)
Run:Type 1 Storm 6-hr Element:2-YR SANTA MARIA 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:2-YR SANTA MARIA 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:2-YR SANTA MARIA 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:2-YR SANTA MARIA 6-HR Result:Baseflow

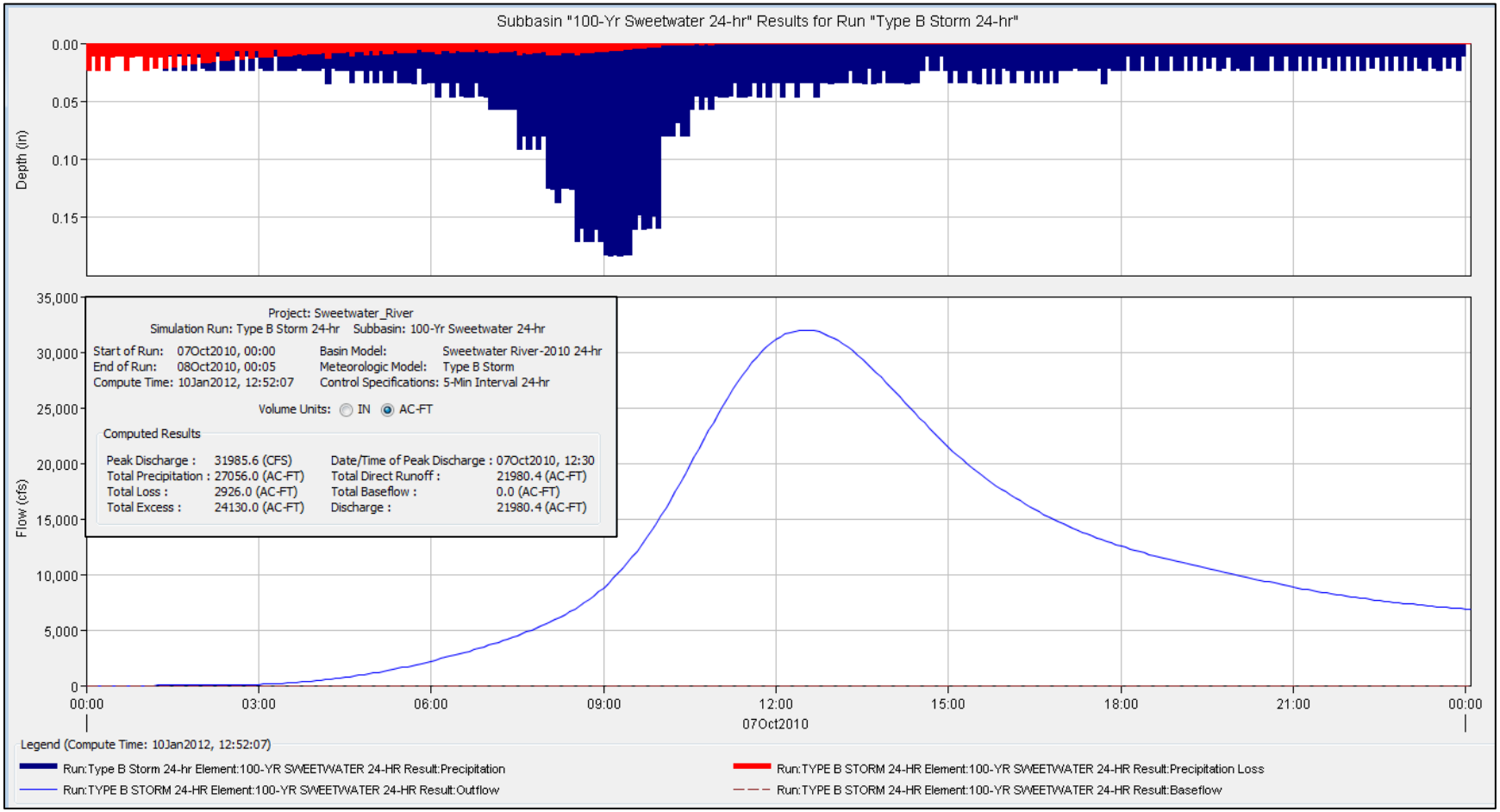

Subbasin "100-Yr Santa Maria 24-hr" Results for Run "Nested Storm"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Flow (cfs)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
-0
Project: Santa Maria Creek
Simulation Run: Nested Storm Subbasin: 100-Yr Santa Maria 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 13:34:19
Basin Model: Santa Maria Creek-2009 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 15121.7 (CFS)
Total Precipitation : 17321.9 (AC-FT)
Total Loss : 4141.9 (AC-FT)
Total Excess : 13180.0 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 21:05
Total Direct Runoff : 9080.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 9080.4 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 13:34:19)
Run:Nested Storm Element:100-YR SANTA MARIA 24-HR Result:Precipitation
Run:NESTED STORM Element:100-YR SANTA MARIA 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:100-YR SANTA MARIA 24-HR Result:Outflow
Run:NESTED STORM Element:100-YR SANTA MARIA 24-HR Result:Baseflow

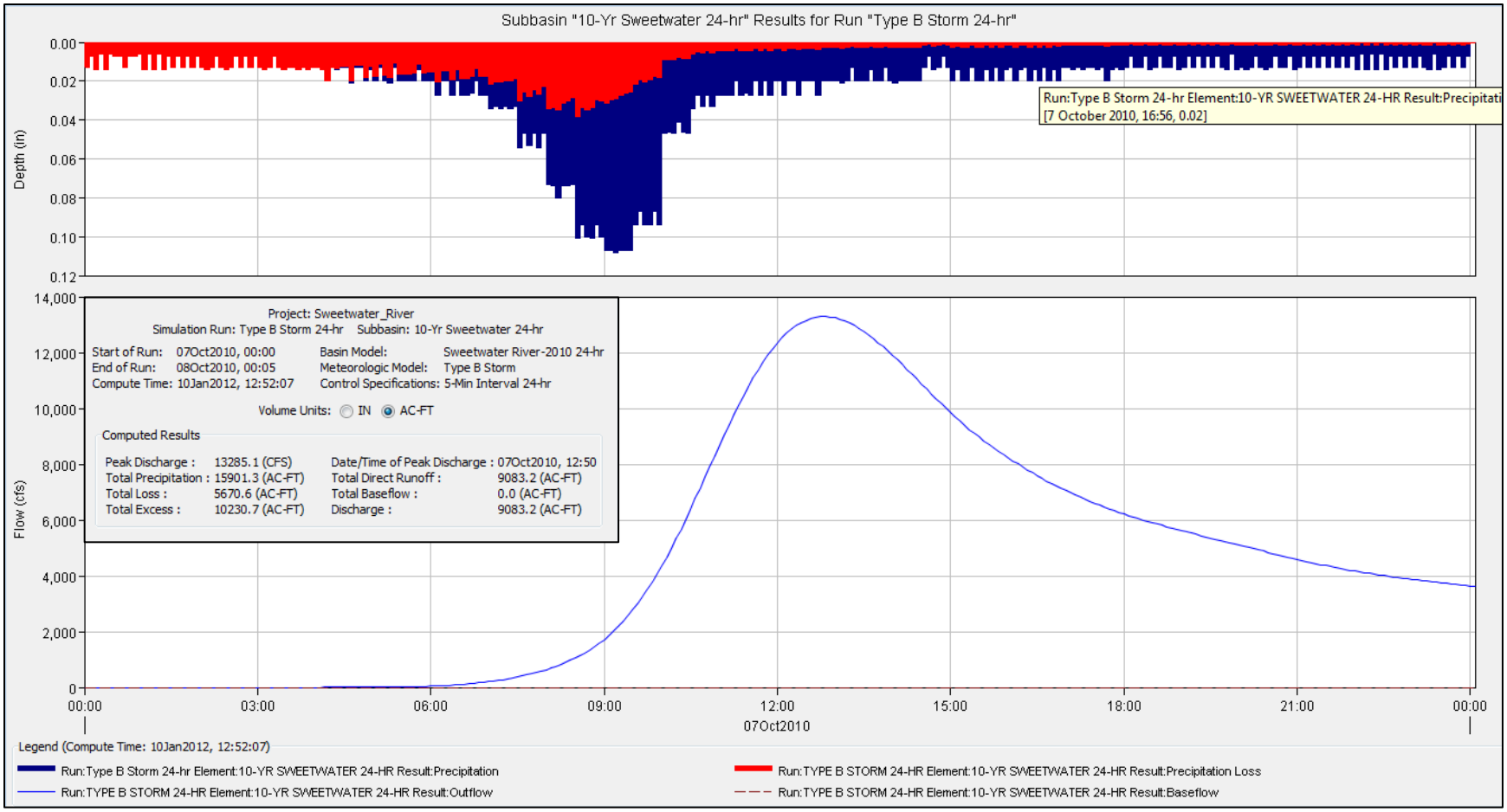

Subbasin "10-Yr Santa Maria 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
Flow (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-0
Project: Santa Maria Creek
Simulation Run: Nested Storm Subbasin: 10-Yr Santa Maria 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 13:34:19
Basin Model: Santa Maria Creek-2009 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 7683.6 (CFS)
Total Precipitation : 11545.9 (AC-FT)
Total Loss : 5370.4 (AC-FT)
Total Excess : 6175.5 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 21:25
Total Direct Runoff : 3972.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 3972.0 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 13:34:19)
Run:Nested Storm Element:10-YR SANTA MARIA 24-HR Result:Precipitation
Run:NESTED STORM Element:10-YR SANTA MARIA 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:10-YR SANTA MARIA 24-HR Result:Outflow
Run:NESTED STORM Element:10-YR SANTA MARIA 24-HR Result:Baseflow

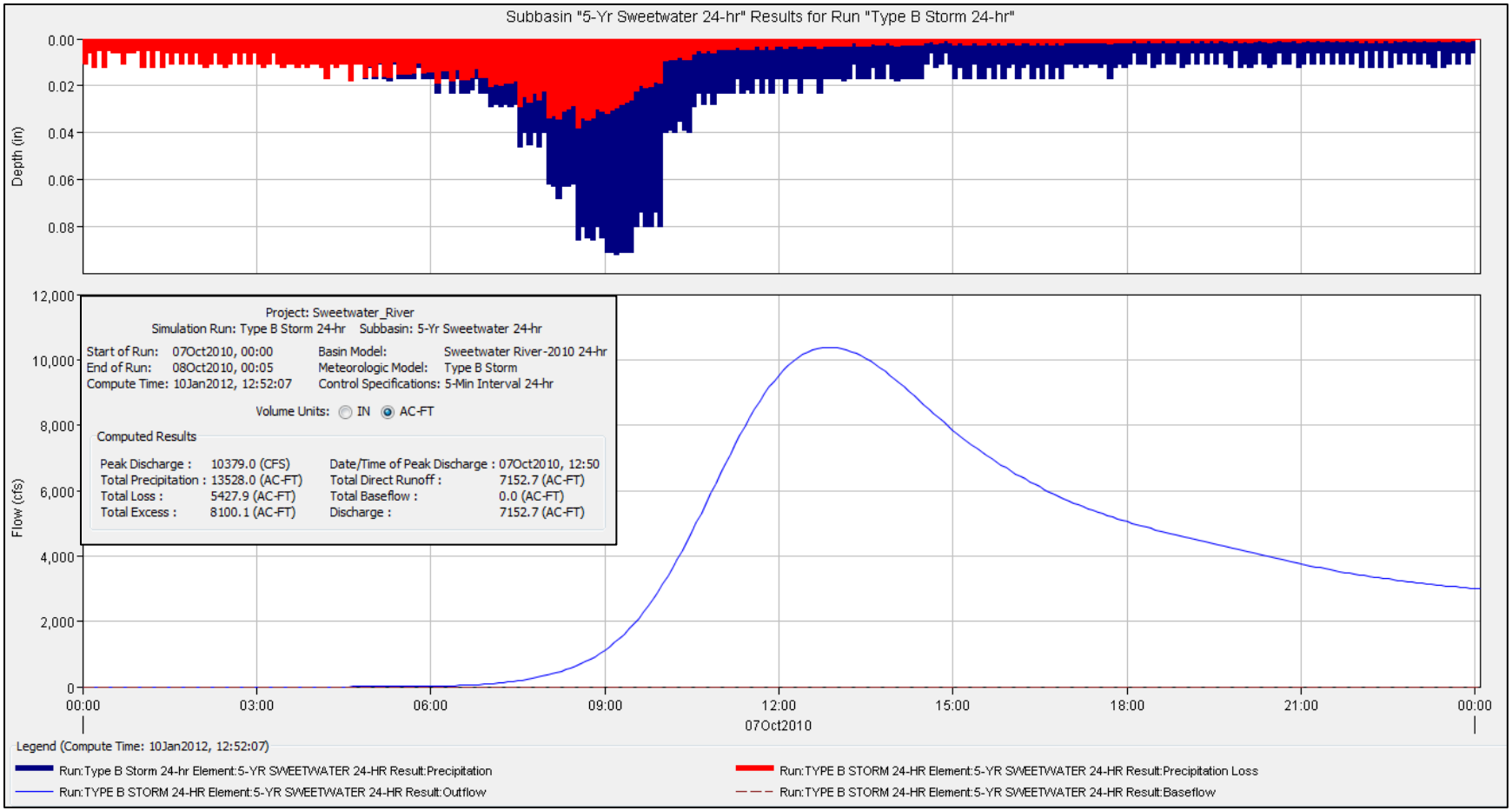

Subbasin "5-Yr Santa Maria 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Flow (cfs)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Project: Santa Maria Creek
Simulation Run: Nested Storm Subbasin: 5-Yr Santa Maria 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 13:34:19
Basin Model: Santa Maria Creek-2009 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 6058.0 (CFS)
Total Precipitation : 10092.8 (AC-FT)
Total Loss : 5122.0 (AC-FT)
Total Excess : 4970.8 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 21:30
Total Direct Runoff : 3127.8 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 3127.8 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 13:34:19)
Run:Nested Storm Element:5-YR SANTA MARIA 24-HR Result:Precipitation
Run:NESTED STORM Element:5-YR SANTA MARIA 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:5-YR SANTA MARIA 24-HR Result:Outflow
Run:NESTED STORM Element:5-YR SANTA MARIA 24-HR Result:Baseflow

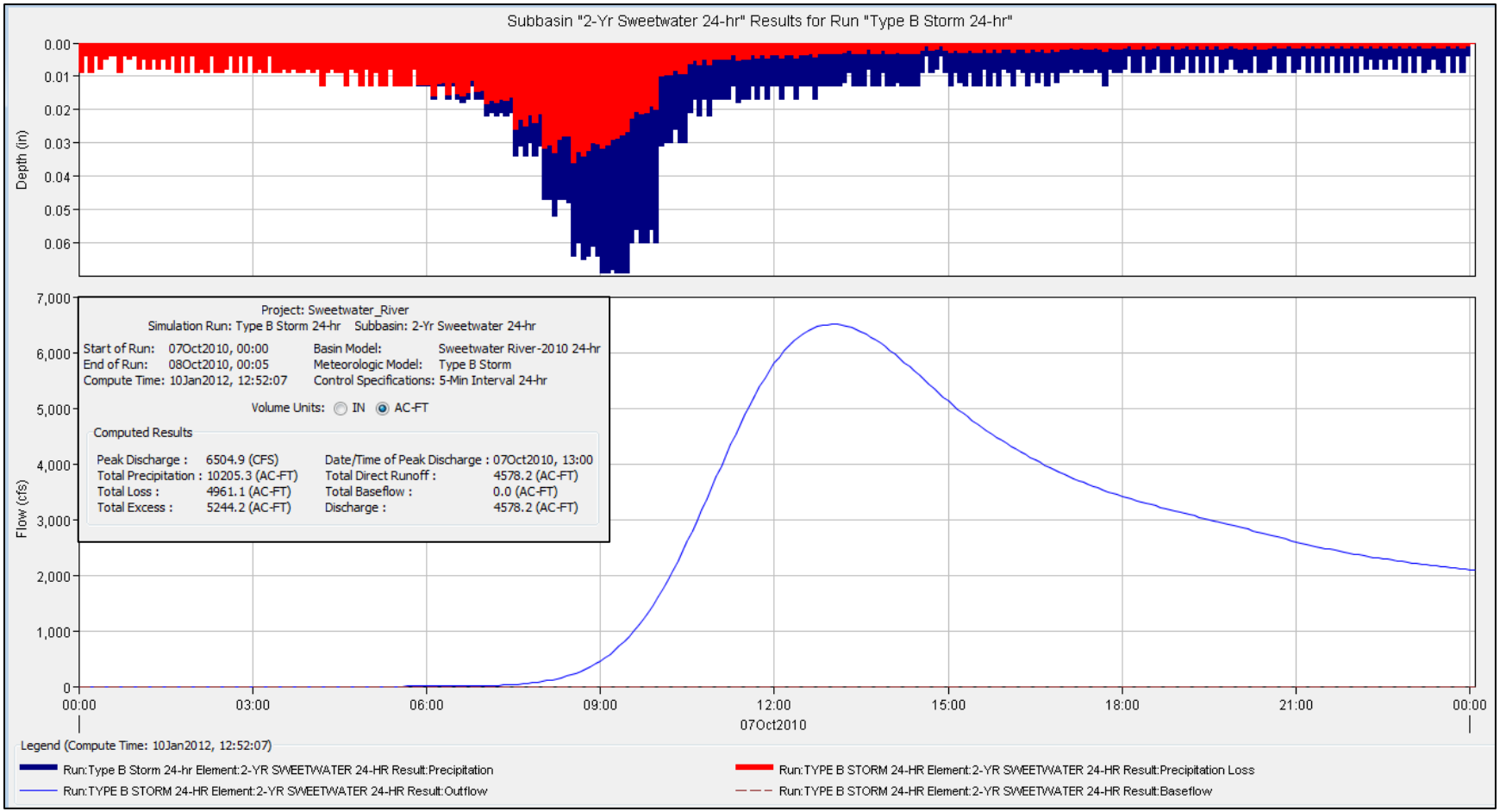

Subbasin "2-Yr Santa Maria 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
Flow (cfs)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
-0
Project: Santa Maria Creek
Simulation Run: Nested Storm Subbasin: 2-Yr Santa Maria 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 13:34:19
Basin Model: Santa Maria Creek-2009 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5 Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 3632.9 (CFS)
Total Precipitation : 7192.6 (AC-FT)
Total Loss : 4454.2 (AC-FT)
Total Excess : 2738.5 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 21:40
Total Direct Runoff : 1683.8 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 1683.8 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 13:34:19)
Run:Nested Storm Element:2-YR SANTA MARIA 24-HR Result:Precipitation
Run:NESTED STORM Element:2-YR SANTA MARIA 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:2-YR SANTA MARIA 24-HR Result:Outflow
Run:NESTED STORM Element:2-YR SANTA MARIA 24-HR Result:Baseflow

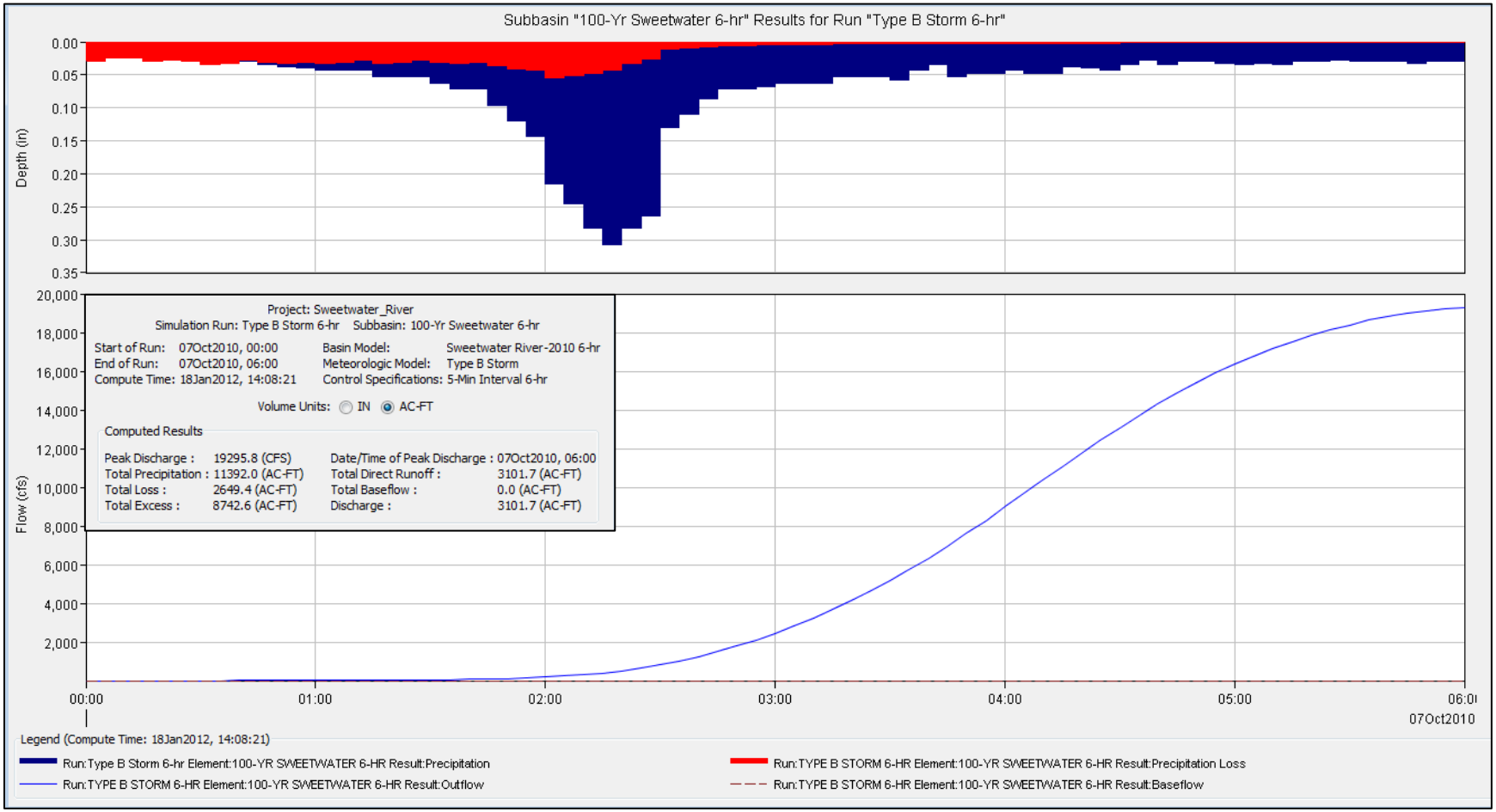
Sweetwater River HEC-HMS Outputs

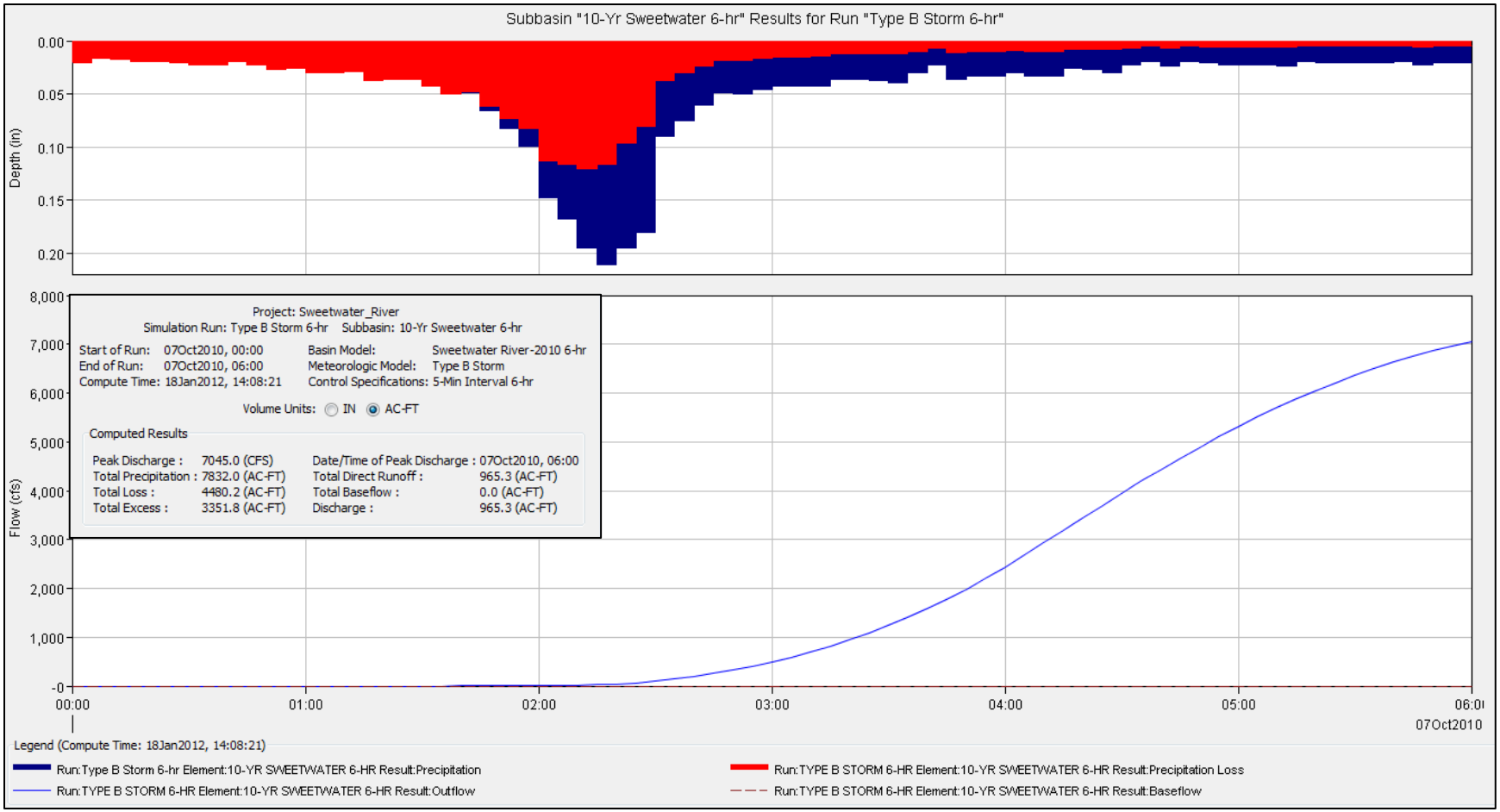

Subbasin "100-Yr Sweetwater 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
Flow (cfs)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Project: Sweetwater_River
Simulation Run: Type B Storm 24-hr Subbasin: 100-Yr Sweetwater 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 12:52:07
Basin Model: Sweetwater River-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 31985.6 (CFS)
Total Precipitation : 27056.0 (AC-FT)
Total Loss : 2926.0 (AC-FT)
Total Excess : 24130.0 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:30
Total Direct Runoff : 21980.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 21980.4 (AC-FT)
00:00
03:00
06:00
09:00
12:00
07Oct2010
15:00
18:00
21:00
00:00
Legend (Compute Time: 10Jan2012, 12:52:07)
Run:Type B Storm 24-hr Element:100-YR SWEETWATER 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:100-YR SWEETWATER 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:100-YR SWEETWATER 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:100-YR SWEETWATER 24-HR Result:Baseflow

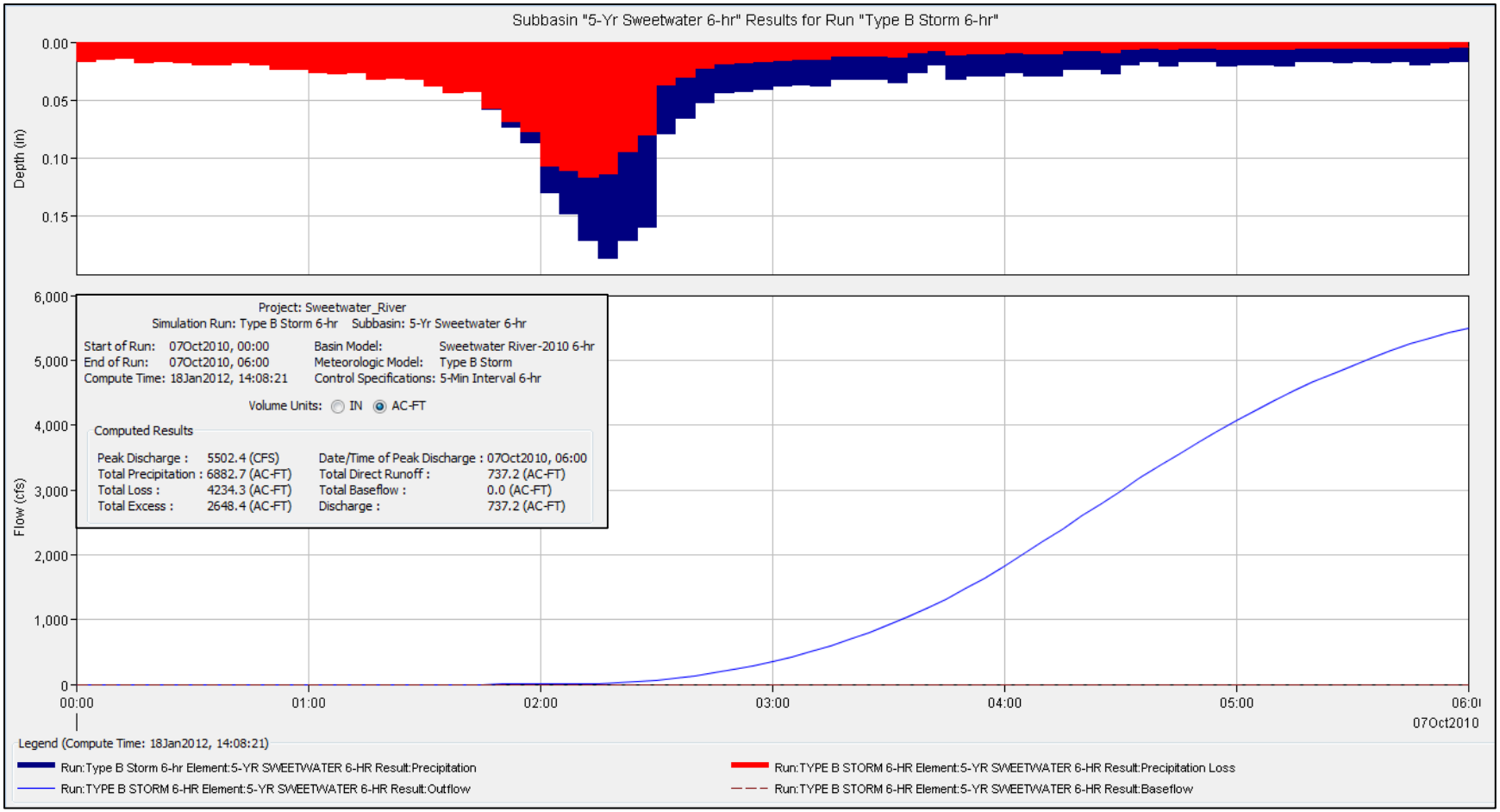

Subbasin "10-Yr Sweetwater 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Run:Type B Storm 24-hr Element:10-YR SWEETWATER 24-HR Result:Precipitati
[7 October 2010, 16:56, 0.02]
Flow (cfs)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Project: Sweetwater_River
Simulation Run: Type B Storm 24-hr Subbasin: 10-Yr Sweetwater 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 12:52:07
Basin Model: Sweetwater River-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 13285.1 (CFS)
Total Precipitation : 15901.3 (AC-FT)
Total Loss : 5670.6 (AC-FT)
Total Excess : 10230.7 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:50
Total Direct Runoff : 9083.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 9083.2 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 12:52:07)
Run:Type B Storm 24-hr Element:10-YR SWEETWATER 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:10-YR SWEETWATER 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:10-YR SWEETWATER 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:10-YR SWEETWATER 24-HR Result:Baseflow

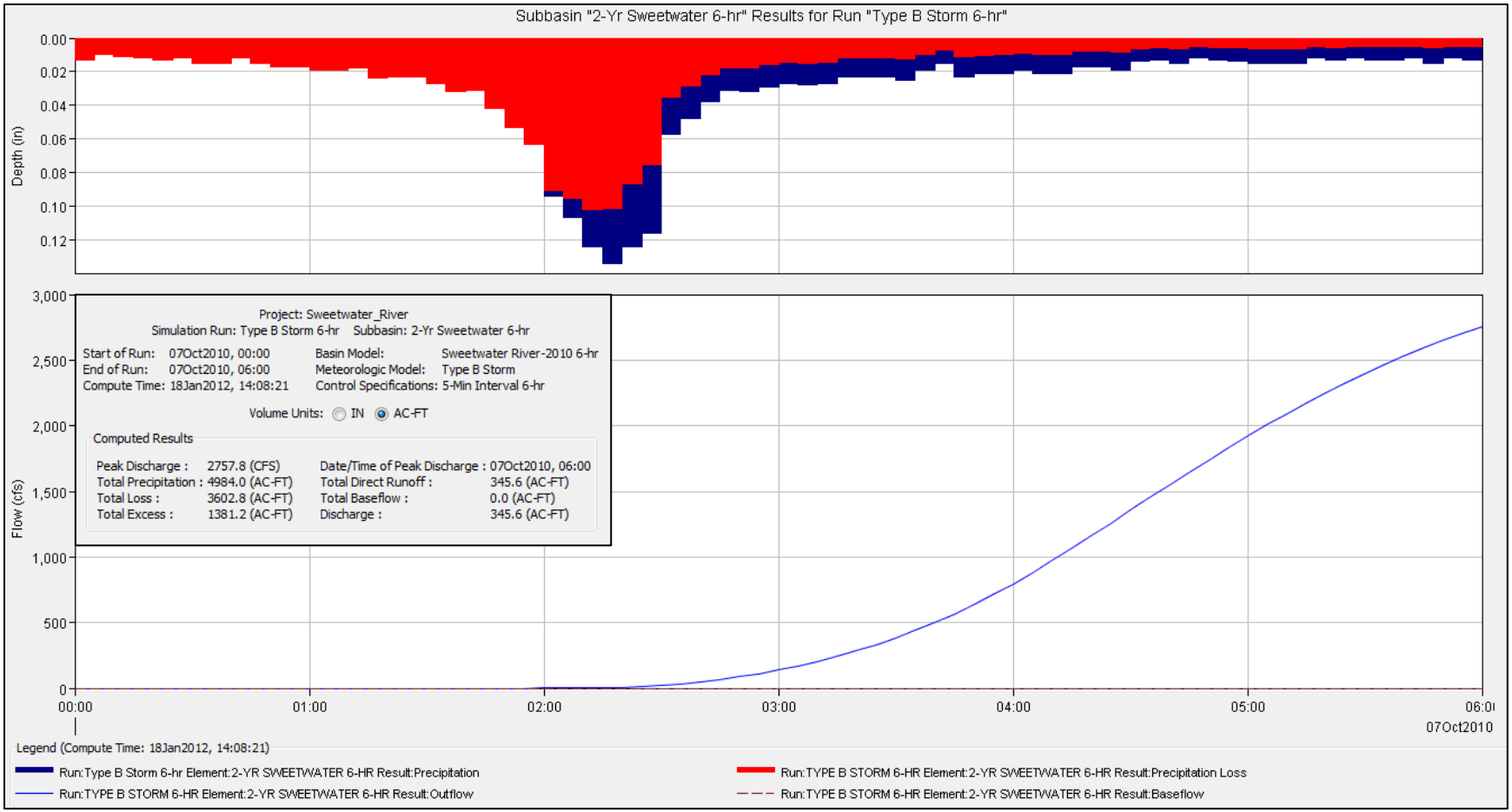

Subbasin "5-Yr Sweetwater 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
Flow (cfs)
12,000
10,000
8,000
6,000
4,000
2,000
0
Project: Sweetwater_River
Simulation Run: Type B Storm 24-hr Subbasin: 5-Yr Sweetwater 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 12:52:07
Basin Model: Sweetwater River-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 10379.0 (CFS)
Total Precipitation : 13528.0 (AC-FT)
Total Loss : 5427.9 (AC-FT)
Total Excess : 8100.1 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 12:50
Total Direct Runoff : 7152.7 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 7152.7 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 12:52:07)
Run:Type B Storm 24-hr Element:5-YR SWEETWATER 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:5-YR SWEETWATER 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:5-YR SWEETWATER 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:5-YR SWEETWATER 24-HR Result:Baseflow

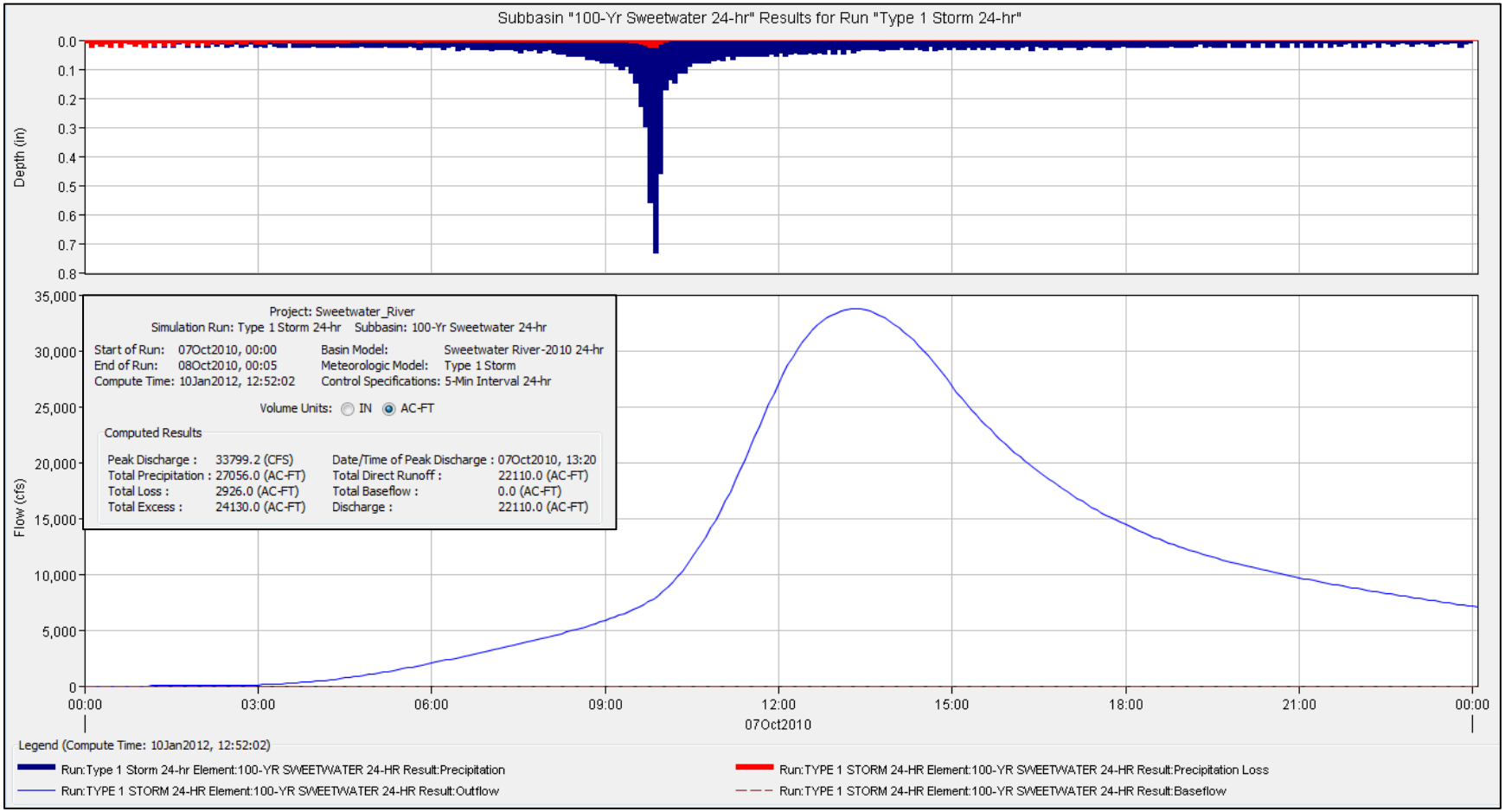

Subbasin "2-Yr Sweetwater 24-hr" Results for Run "Type B Storm 24-hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
Project: Sweetwater_River
Simulation Run: Type B Storm 24-hr Subbasin: 2-Yr Sweetwater 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 12:52:07
Basin Model: Sweetwater River-2010 24-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 6504.9 (CFS)
Total Precipitation : 10205.3 (AC-FT)
Total Loss : 4961.1 (AC-FT)
Total Excess : 5244.2 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 13:00
Total Direct Runoff : 4578.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 4578.2 (AC-FT)
Flow (cfs)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 12:52:07)
Run:Type B Storm 24-hr Element:2-YR SWEETWATER 24-HR Result:Precipitation
Run:TYPE B STORM 24-HR Element:2-YR SWEETWATER 24-HR Result:Outflow
Run:TYPE B STORM 24-HR Element:2-YR SWEETWATER 24-HR Result:Precipitation Loss
Run:TYPE B STORM 24-HR Element:2-YR SWEETWATER 24-HR Result:Baseflow

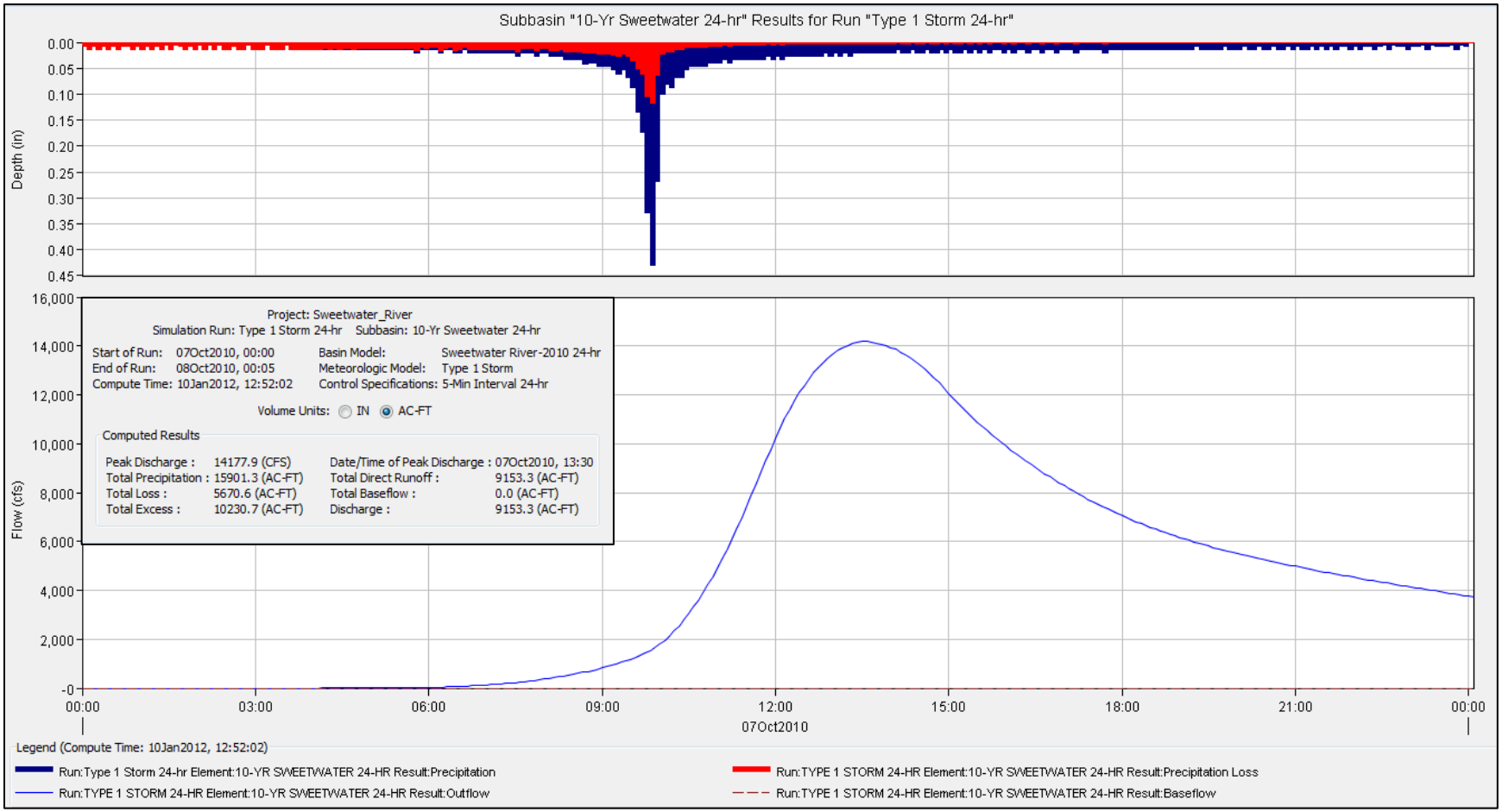

Subbasin "100-Yr Sweetwater 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Flow (cfs)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Sweetwater_River
Simulation Run: Type B Storm 6-hr Subbasin: 100-Yr Sweetwater 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:08:21
Basin Model: Sweetwater River-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 19295.8 (CFS)
Total Precipitation : 11392.0 (AC-FT)
Total Loss : 2649.4 (AC-FT)
Total Excess : 8742.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 3101.7 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 3101.7 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:08:21)
Run:Type B Storm 6-hr Element:100-YR SWEETWATER 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:100-YR SWEETWATER 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:100-YR SWEETWATER 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:100-YR SWEETWATER 6-HR Result:Baseflow

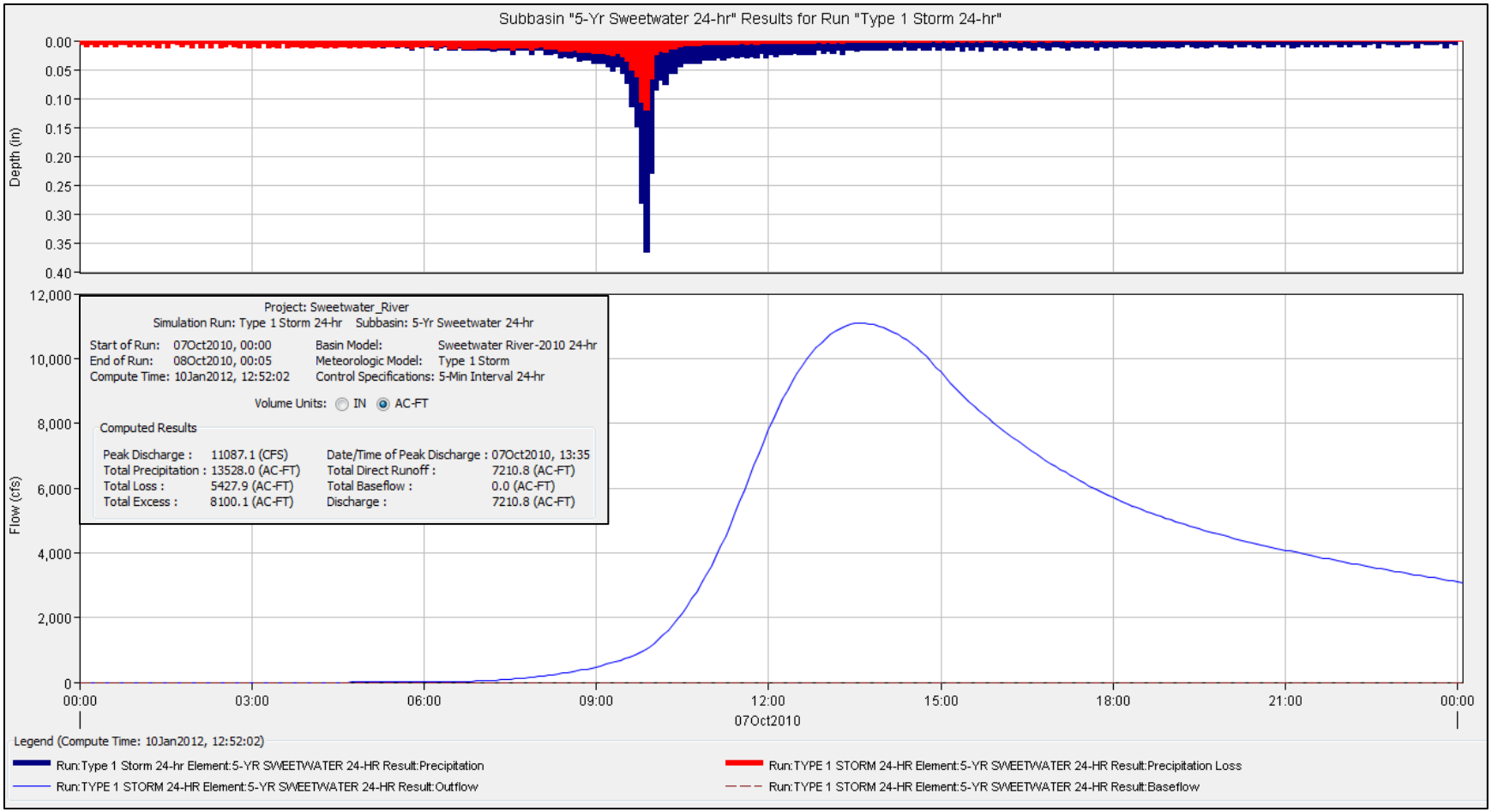

Subbasin "10-Yr Sweetwater 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
Flow (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Sweetwater_River
Simulation Run: Type B Storm 6-hr Subbasin: 10-Yr Sweetwater 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:08:21
Basin Model: Sweetwater River-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 7045.0 (CFS)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Precipitation : 7832.0 (AC-FT)
Total Direct Runoff : 965.3 (AC-FT)
Total Loss : 4480.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Total Excess : 3351.8 (AC-FT)
Discharge : 965.3 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:08:21)
Run:Type B Storm 6-hr Element:10-YR SWEETWATER 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:10-YR SWEETWATER 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:10-YR SWEETWATER 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:10-YR SWEETWATER 6-HR Result:Baseflow

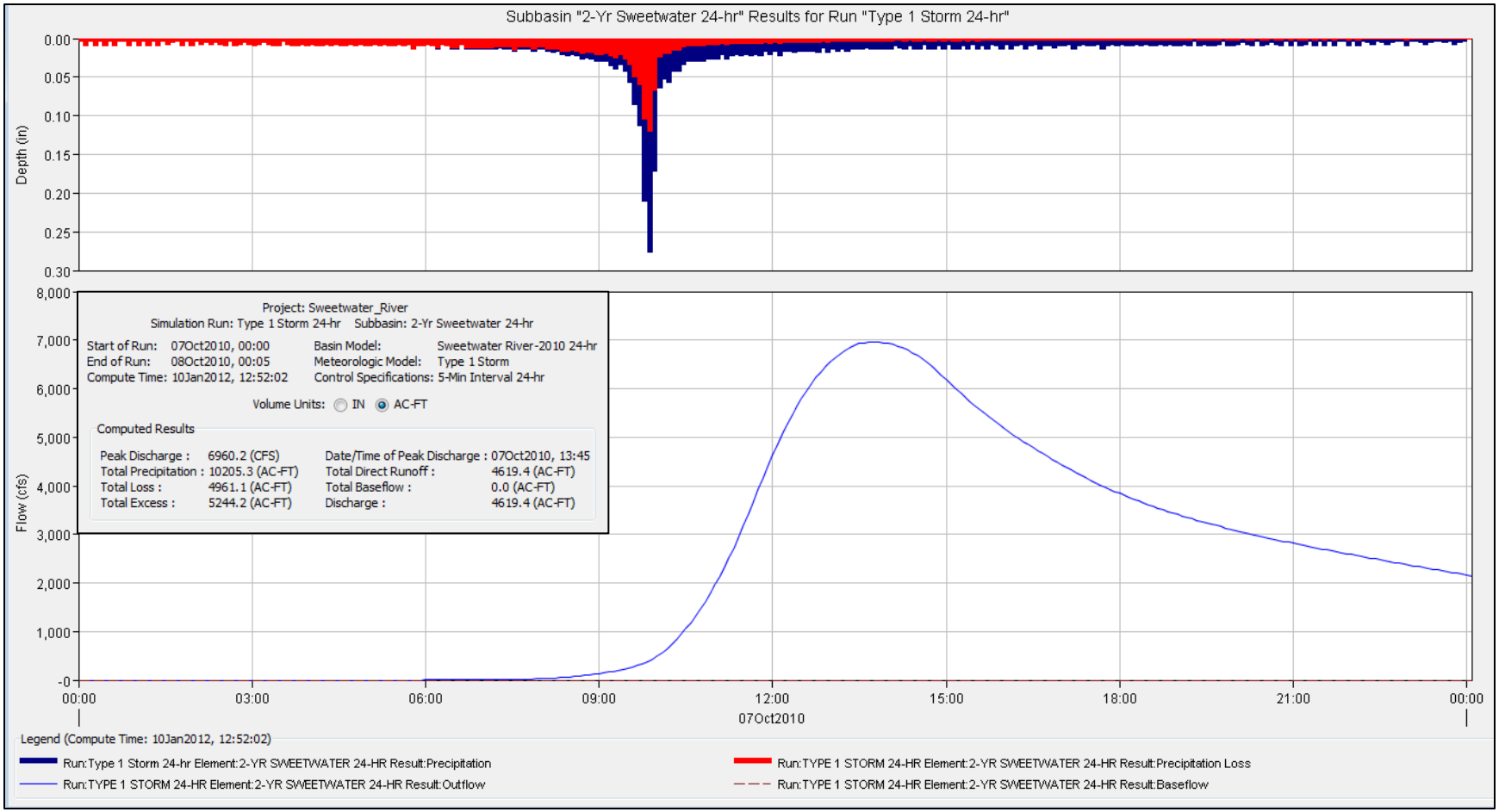

Subbasin "5-Yr Sweetwater 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
Project: Sweetwater_River
Simulation Run: Type B Storm 6-hr Subbasin: 5-Yr Sweetwater 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:08:21
Basin Model: Sweetwater River-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 5502.4 (CFS)
Total Precipitation : 6882.7 (AC-FT)
Total Loss : 4234.3 (AC-FT)
Total Excess : 2648.4 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 737.2 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 737.2 (AC-FT)
Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Legend (Compute Time: 18Jan2012, 14:08:21)
Run:Type B Storm 6-hr Element:5-YR SWEETWATER 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:5-YR SWEETWATER 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:5-YR SWEETWATER 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:5-YR SWEETWATER 6-HR Result:Baseflow

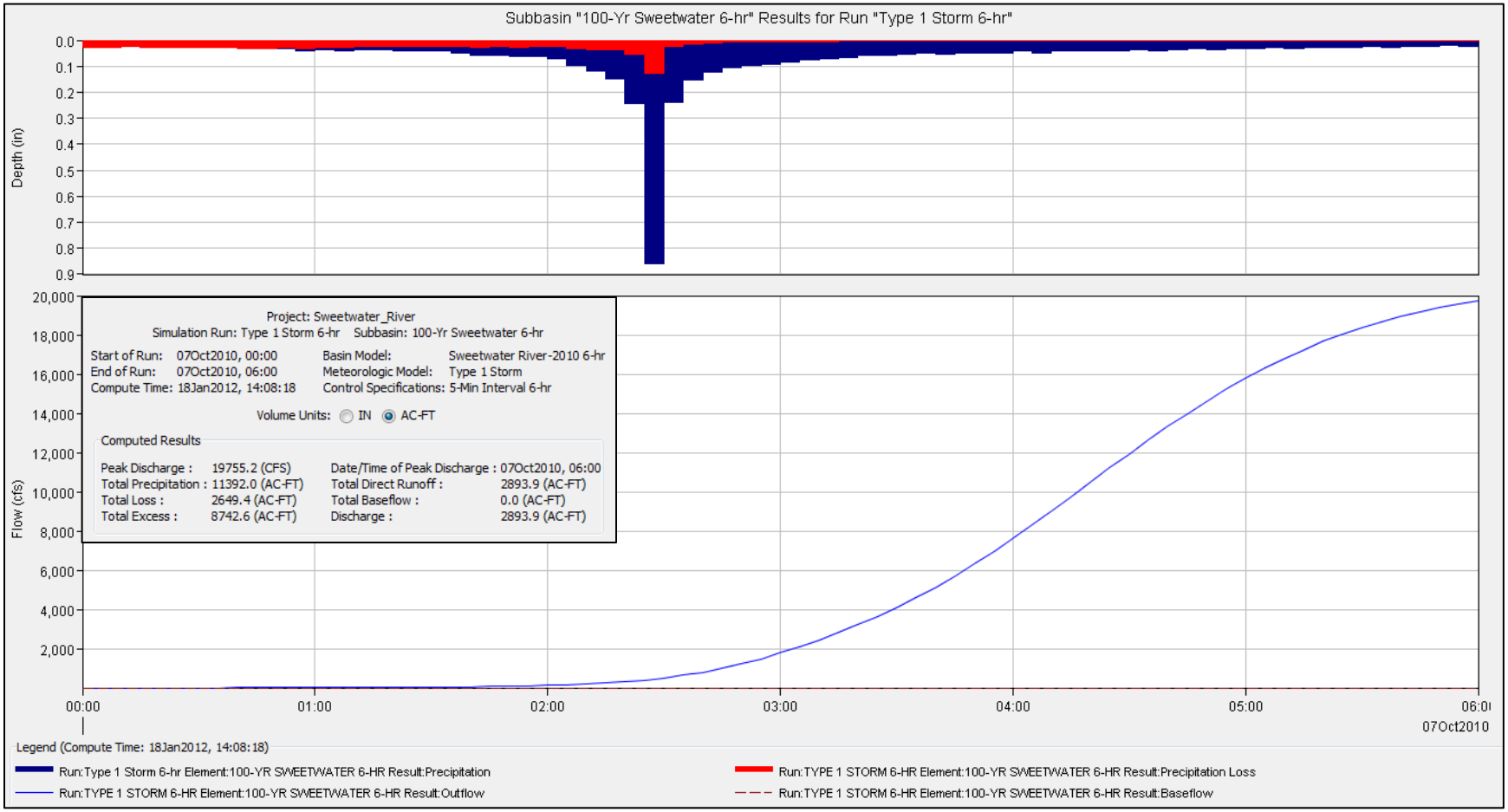

Subbasin "2-Yr Sweetwater 6-hr" Results for Run "Type B Storm 6-hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Flow (cfs)
3,000
2,500
2,000
1,500
1,000
500
0
Project: Sweetwater_River
Simulation Run: Type B Storm 6-hr Subbasin: 2-Yr Sweetwater 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:08:21
Basin Model: Sweetwater River-2010 6-hr
Meteorologic Model: Type B Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2757.8 (CFS)
Total Precipitation : 4984.0 (AC-FT)
Total Loss : 3602.8 (AC-FT)
Total Excess : 1381.2 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 345.6 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 345.6 (AC-FT)
00:00
01:00
02:00
03:00
04:00
05:00
07Oct2010
Legend (Compute Time: 18Jan2012, 14:08:21)
Run:Type B Storm 6-hr Element:2-YR SWEETWATER 6-HR Result:Precipitation
Run:TYPE B STORM 6-HR Element:2-YR SWEETWATER 6-HR Result:Precipitation Loss
Run:TYPE B STORM 6-HR Element:2-YR SWEETWATER 6-HR Result:Outflow
Run:TYPE B STORM 6-HR Element:2-YR SWEETWATER 6-HR Result:Baseflow

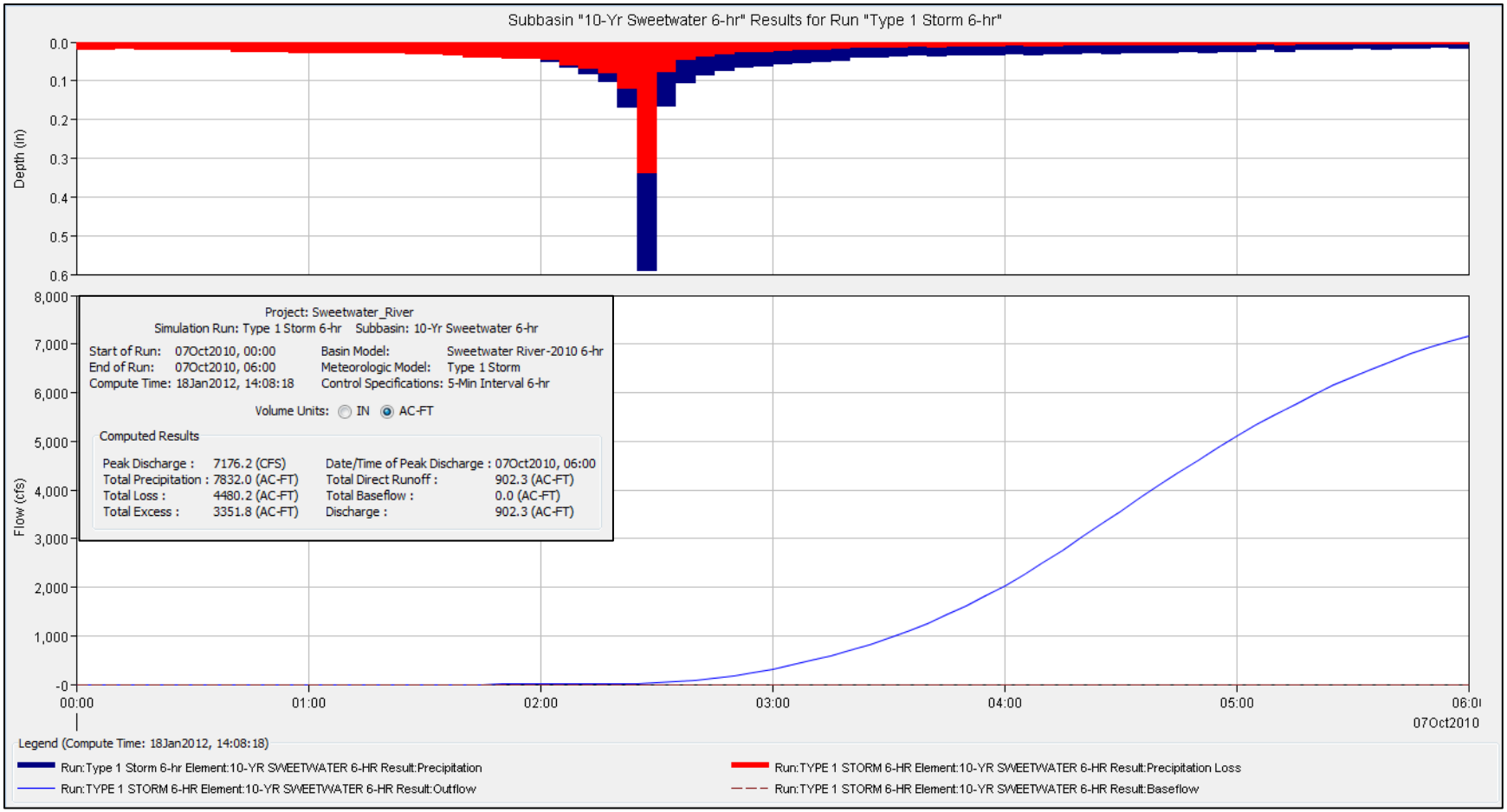

Subbasin "100-Yr Sweetwater 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Flow (cfs)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Project: Sweetwater_River
Simulation Run: Type 1 Storm 24-hr Subbasin: 100-Yr Sweetwater 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 12:52:02
Basin Model: Sweetwater River-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 33799.2 (CFS)
Total Precipitation : 27056.0 (AC-FT)
Total Loss : 2926.0 (AC-FT)
Total Excess : 24130.0 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 13:20
Total Direct Runoff : 22110.0 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 22110.0 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 12:52:02)
Run:Type 1 Storm 24-hr Element:100-YR SWEETWATER 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:100-YR SWEETWATER 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:100-YR SWEETWATER 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:100-YR SWEETWATER 24-HR Result:Baseflow

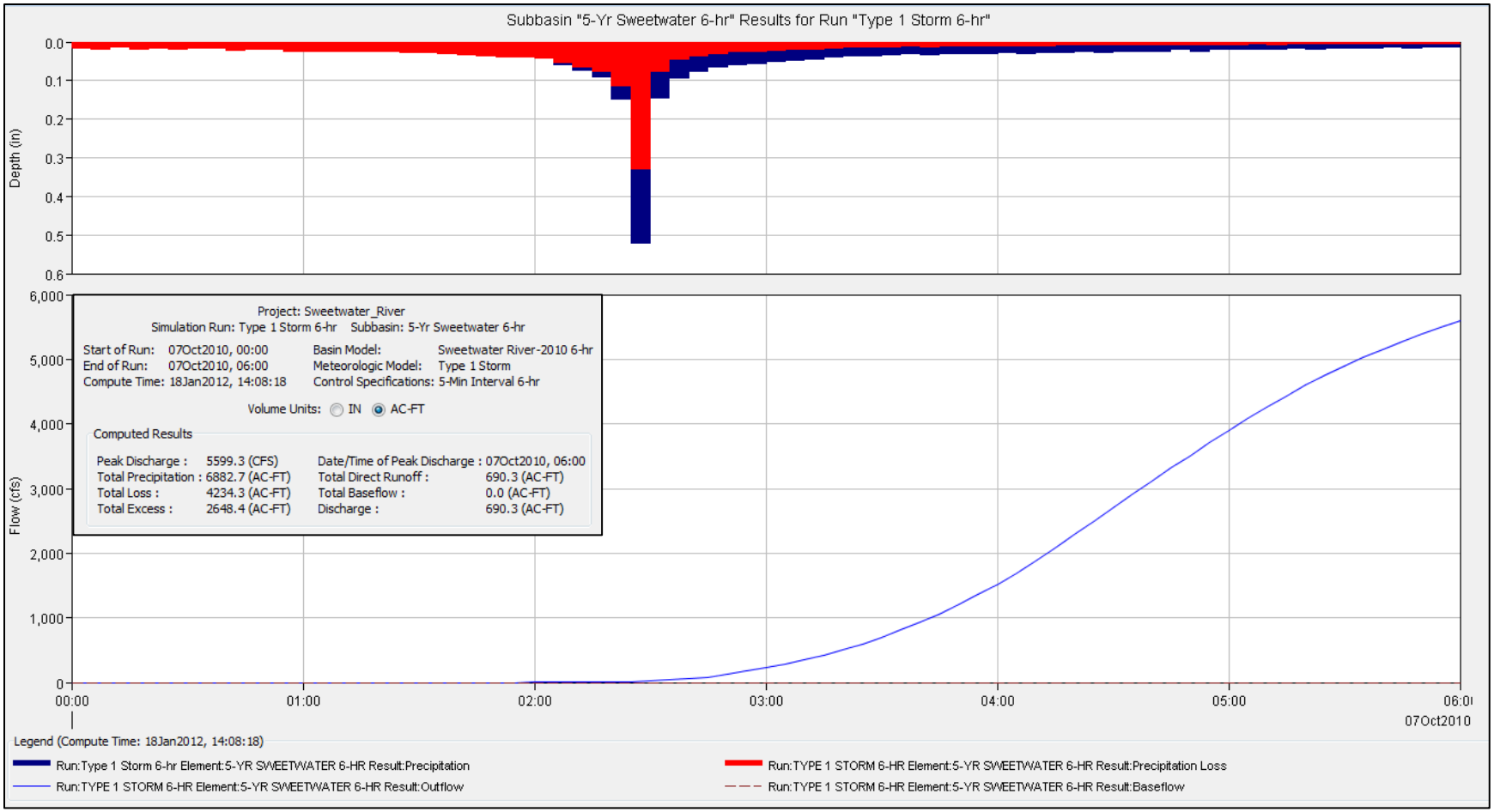

Subbasin "10-Yr Sweetwater 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
Flow (cfs)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
-0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Sweetwater_River
Simulation Run: Type 1 Storm 24-hr Subbasin: 10-Yr Sweetwater 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 12:52:02
Basin Model: Sweetwater River-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 14177.9 (CFS)
Total Precipitation : 15901.3 (AC-FT)
Total Loss : 5670.6 (AC-FT)
Total Excess : 10230.7 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 13:30
Total Direct Runoff : 9153.3 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 9153.3 (AC-FT)
Legend (Compute Time: 10Jan2012, 12:52:02)
Run:Type 1 Storm 24-hr Element:10-YR SWEETWATER 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:10-YR SWEETWATER 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:10-YR SWEETWATER 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:10-YR SWEETWATER 24-HR Result:Baseflow

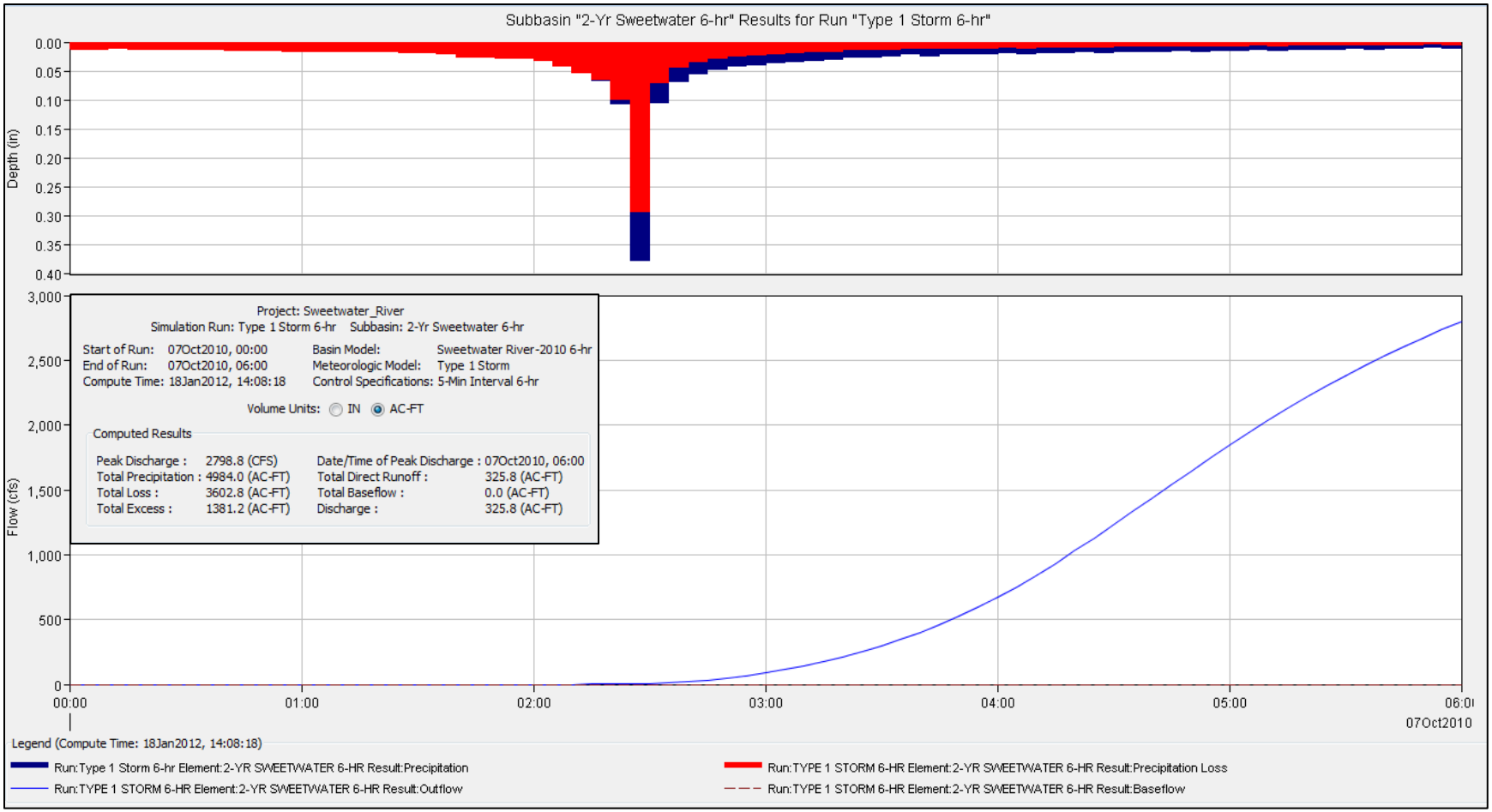

Subbasin "5-Yr Sweetwater 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
Flow (cfs)
12,000
10,000
8,000
6,000
4,000
2,000
0
Project: Sweetwater_River
Simulation Run: Type 1 Storm 24-hr Subbasin: 5-Yr Sweetwater 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 12:52:02
Basin Model: Sweetwater River-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 11087.1 (CFS)
Total Precipitation : 13528.0 (AC-FT)
Total Loss : 5427.9 (AC-FT)
Total Excess : 8100.1 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 13:35
Total Direct Runoff : 7210.8 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 7210.8 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 12:52:02)
Run:Type 1 Storm 24-hr Element:5-YR SWEETWATER 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:5-YR SWEETWATER 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:5-YR SWEETWATER 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:5-YR SWEETWATER 24-HR Result:Baseflow

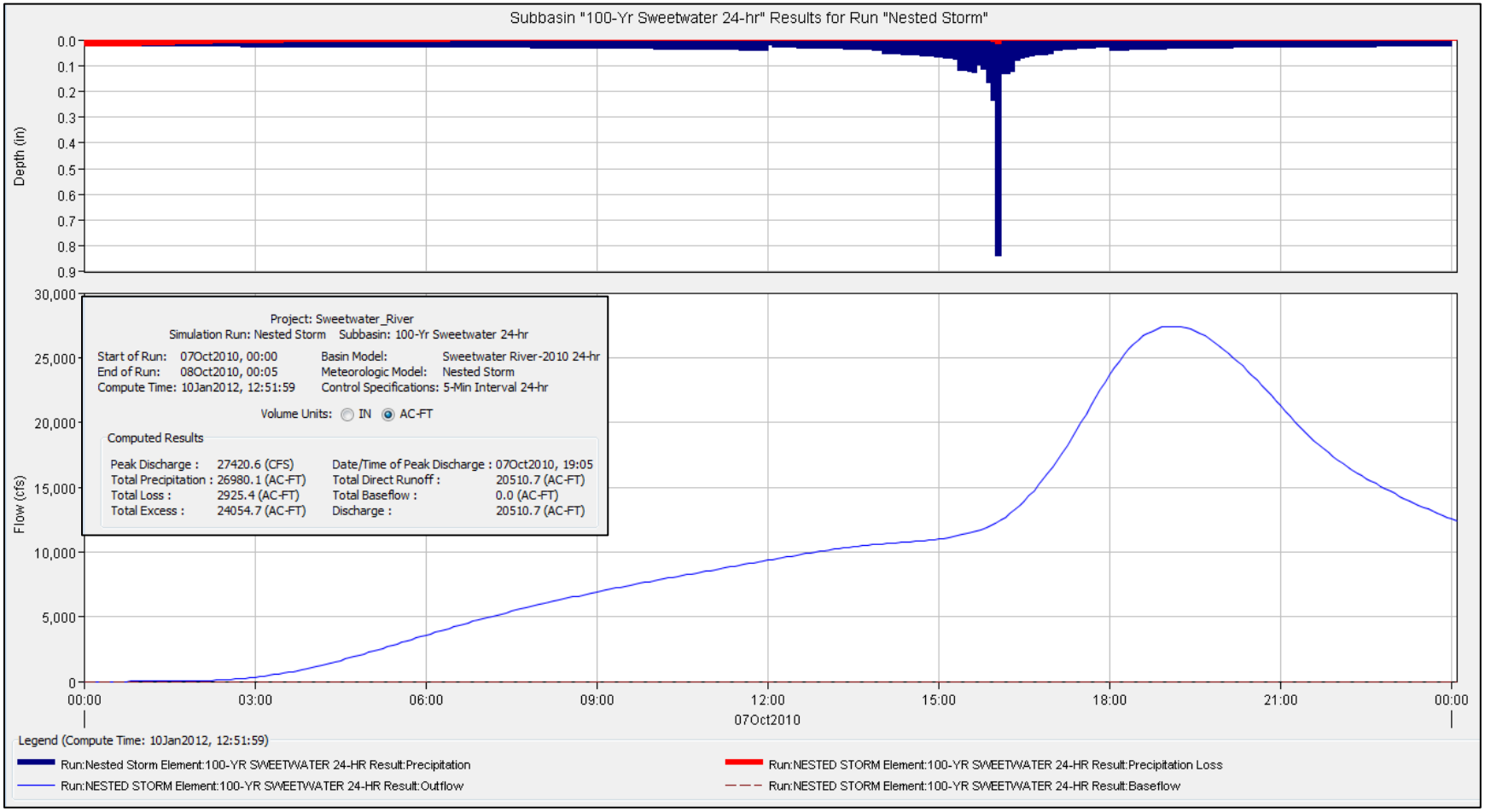

Subbasin "2-Yr Sweetwater 24-hr" Results for Run "Type 1 Storm 24-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Flow (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Sweetwater_River
Simulation Run: Type 1 Storm 24-hr Subbasin: 2-Yr Sweetwater 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 12:52:02
Basin Model: Sweetwater River-2010 24-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 6960.2 (CFS)
Total Precipitation : 10205.3 (AC-FT)
Total Loss : 4961.1 (AC-FT)
Total Excess : 5244.2 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 13:45
Total Direct Runoff : 4619.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 4619.4 (AC-FT)
Legend (Compute Time: 10Jan2012, 12:52:02)
Run:Type 1 Storm 24-hr Element:2-YR SWEETWATER 24-HR Result:Precipitation
Run:TYPE 1 STORM 24-HR Element:2-YR SWEETWATER 24-HR Result:Precipitation Loss
Run:TYPE 1 STORM 24-HR Element:2-YR SWEETWATER 24-HR Result:Outflow
Run:TYPE 1 STORM 24-HR Element:2-YR SWEETWATER 24-HR Result:Baseflow

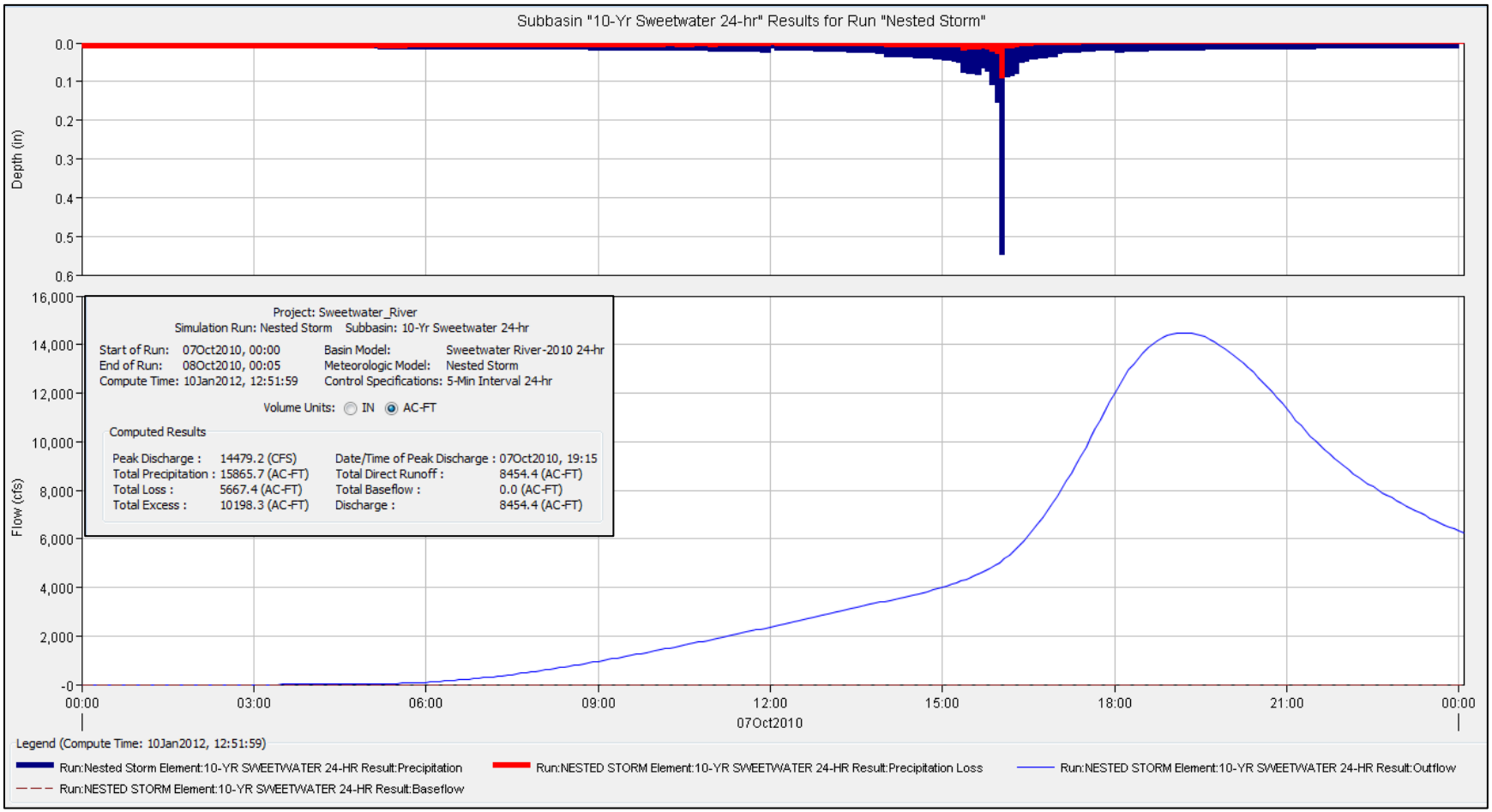

Subbasin "100-Yr Sweetwater 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Flow (cfs)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07Oct2010
Project: Sweetwater_River
Simulation Run: Type 1 Storm 6-hr Subbasin: 100-Yr Sweetwater 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:08:18
Basin Model: Sweetwater River-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 19755.2 (CFS)
Total Precipitation : 11392.0 (AC-FT)
Total Loss : 2649.4 (AC-FT)
Total Excess : 8742.6 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 2893.9 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 2893.9 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:08:18)
Run:Type 1 Storm 6-hr Element:100-YR SWEETWATER 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:100-YR SWEETWATER 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:100-YR SWEETWATER 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:100-YR SWEETWATER 6-HR Result:Baseflow

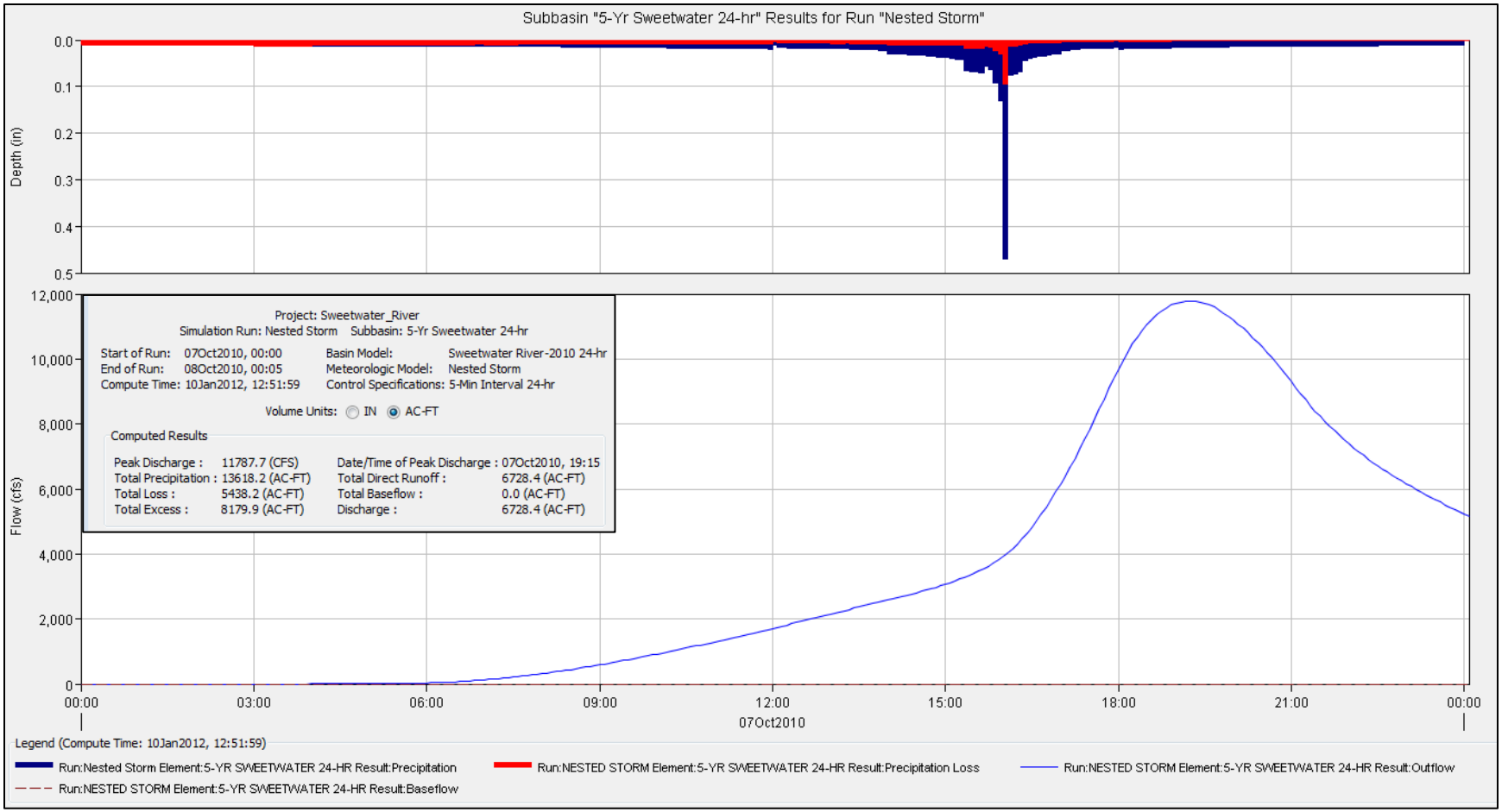

Subbasin "10-Yr Sweetwater 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Flow (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Sweetwater_River
Simulation Run: Type 1 Storm 6-hr Subbasin: 10-Yr Sweetwater 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:08:18
Basin Model: Sweetwater River-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 7176.2 (CFS)
Total Precipitation : 7832.0 (AC-FT)
Total Loss : 4480.2 (AC-FT)
Total Excess : 3351.8 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 902.3 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 902.3 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:08:18)
Run:Type 1 Storm 6-hr Element:10-YR SWEETWATER 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:10-YR SWEETWATER 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:10-YR SWEETWATER 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:10-YR SWEETWATER 6-HR Result:Baseflow

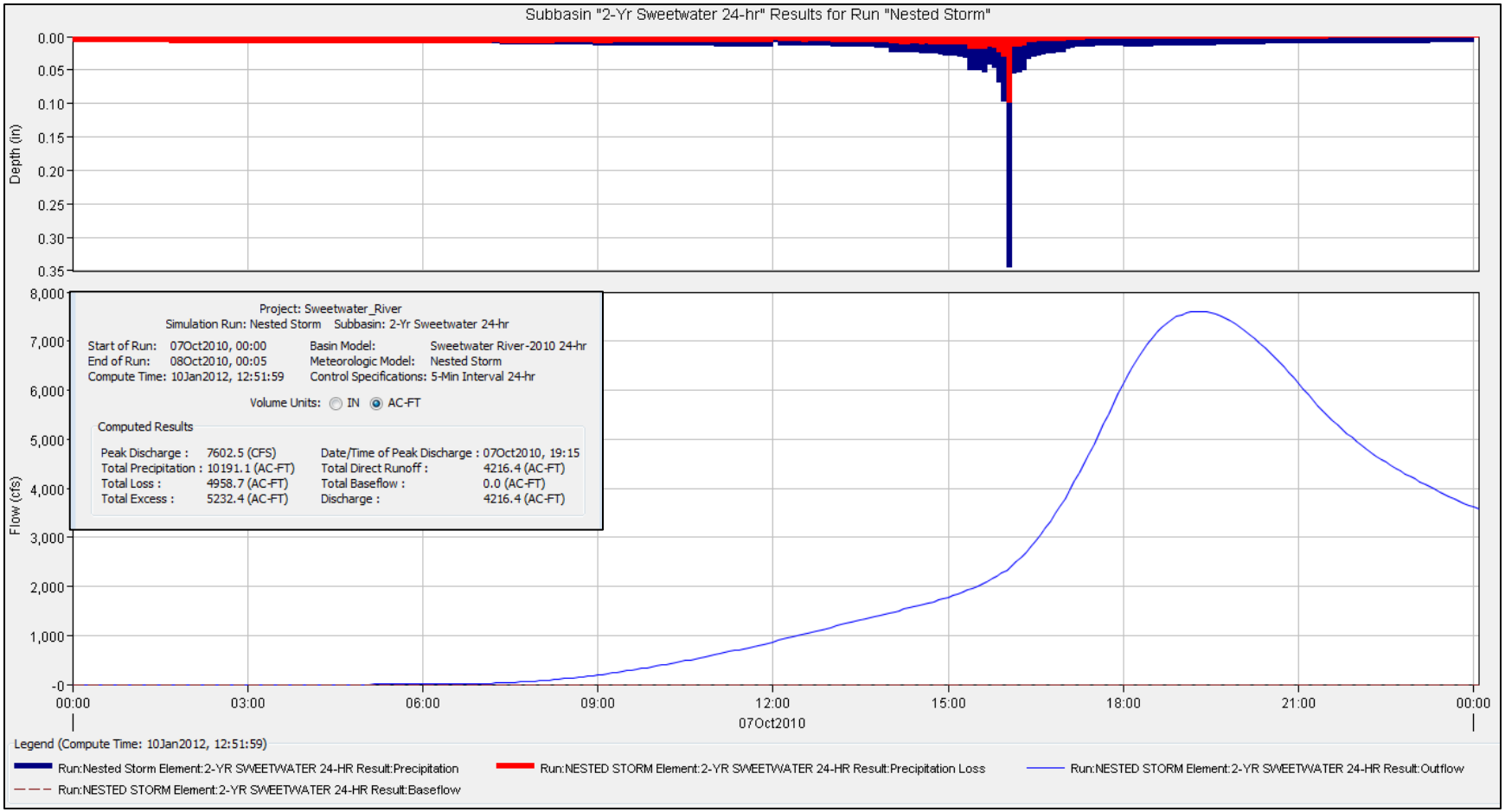

Subbasin "5-Yr Sweetwater 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
Project: Sweetwater_River
Simulation Run: Type 1 Storm 6-hr Subbasin: 5-Yr Sweetwater 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:08:18
Basin Model: Sweetwater River-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 5599.3 (CFS)
Total Precipitation : 6882.7 (AC-FT)
Total Loss : 4234.3 (AC-FT)
Total Excess : 2648.4 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 690.3 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 690.3 (AC-FT)
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Legend (Compute Time: 18Jan2012, 14:08:18)
Run:Type 1 Storm 6-hr Element:5-YR SWEETWATER 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:5-YR SWEETWATER 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:5-YR SWEETWATER 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:5-YR SWEETWATER 6-HR Result:Baseflow


Subbasin "2-Yr Sweetwater 6-hr" Results for Run "Type 1 Storm 6-hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
Flow (cfs)
3,000
2,500
2,000
1,500
1,000
500
0
00:00
01:00
02:00
03:00
04:00
05:00
06:0
07Oct2010
Project: Sweetwater_River
Simulation Run: Type 1 Storm 6-hr Subbasin: 2-Yr Sweetwater 6-hr
Start of Run: 07Oct2010, 00:00
End of Run: 07Oct2010, 06:00
Compute Time: 18Jan2012, 14:08:18
Basin Model: Sweetwater River-2010 6-hr
Meteorologic Model: Type 1 Storm
Control Specifications: 5-Min Interval 6-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 2798.8 (CFS)
Total Precipitation : 4984.0 (AC-FT)
Total Loss : 3602.8 (AC-FT)
Total Excess : 1381.2 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 06:00
Total Direct Runoff : 325.8 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 325.8 (AC-FT)
Legend (Compute Time: 18Jan2012, 14:08:18)
Run:Type 1 Storm 6-hr Element:2-YR SWEETWATER 6-HR Result:Precipitation
Run:TYPE 1 STORM 6-HR Element:2-YR SWEETWATER 6-HR Result:Outflow
Run:TYPE 1 STORM 6-HR Element:2-YR SWEETWATER 6-HR Result:Precipitation Loss
Run:TYPE 1 STORM 6-HR Element:2-YR SWEETWATER 6-HR Result:Baseflow


Subbasin "100-Yr Sweetwater 24-hr" Results for Run "Nested Storm"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Flow (cfs)
30,000
25,000
20,000
15,000
10,000
5,000
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Sweetwater_River
Simulation Run: Nested Storm Subbasin: 100-Yr Sweetwater 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 12:51:59
Basin Model: Sweetwater River-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 27420.6 (CFS)
Total Precipitation : 26980.1 (AC-FT)
Total Loss : 2925.4 (AC-FT)
Total Excess : 24054.7 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 19:05
Total Direct Runoff : 20510.7 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 20510.7 (AC-FT)
Legend (Compute Time: 10Jan2012, 12:51:59)
Run:Nested Storm Element:100-YR SWEETWATER 24-HR Result:Precipitation
Run:NESTED STORM Element:100-YR SWEETWATER 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:100-YR SWEETWATER 24-HR Result:Outflow
Run:NESTED STORM Element:100-YR SWEETWATER 24-HR Result:Baseflow


Subbasin "10-Yr Sweetwater 24-hr" Results for Run "Nested Storm"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Flow (cfs)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
-0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Project: Sweetwater_River
Simulation Run: Nested Storm Subbasin: 10-Yr Sweetwater 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 12:51:59
Basin Model: Sweetwater River-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 14479.2 (CFS)
Total Precipitation : 15865.7 (AC-FT)
Total Loss : 5667.4 (AC-FT)
Total Excess : 10198.3 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 19:15
Total Direct Runoff : 8454.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 8454.4 (AC-FT)
Legend (Compute Time: 10Jan2012, 12:51:59)
Run:Nested Storm Element:10-YR SWEETWATER 24-HR Result:Precipitation
Run:NESTED STORM Element:10-YR SWEETWATER 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:10-YR SWEETWATER 24-HR Result:Outflow
Run:NESTED STORM Element:10-YR SWEETWATER 24-HR Result:Baseflow


Subbasin "5-Yr Sweetwater 24-hr" Results for Run "Nested Storm"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
Flow (cfs)
12,000
10,000
8,000
6,000
4,000
2,000
0
Project: Sweetwater_River
Simulation Run: Nested Storm Subbasin: 5-Yr Sweetwater 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 12:51:59
Basin Model: Sweetwater River-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 11787.7 (CFS)
Total Precipitation : 13618.2 (AC-FT)
Total Loss : 5438.2 (AC-FT)
Total Excess : 8179.9 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 19:15
Total Direct Runoff : 6728.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 6728.4 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 12:51:59)
Run:Nested Storm Element:5-YR SWEETWATER 24-HR Result:Precipitation
Run:NESTED STORM Element:5-YR SWEETWATER 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:5-YR SWEETWATER 24-HR Result:Outflow
Run:NESTED STORM Element:5-YR SWEETWATER 24-HR Result:Baseflow


Subbasin "2-Yr Sweetwater 24-hr" Results for Run "Nested Storm"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Flow (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-0
Project: Sweetwater_River
Simulation Run: Nested Storm Subbasin: 2-Yr Sweetwater 24-hr
Start of Run: 07Oct2010, 00:00
End of Run: 08Oct2010, 00:05
Compute Time: 10Jan2012, 12:51:59
Basin Model: Sweetwater River-2010 24-hr
Meteorologic Model: Nested Storm
Control Specifications: 5-Min Interval 24-hr
Volume Units: IN AC-FT
Computed Results
Peak Discharge : 7602.5 (CFS)
Total Precipitation : 10191.1 (AC-FT)
Total Loss : 4958.7 (AC-FT)
Total Excess : 5232.4 (AC-FT)
Date/Time of Peak Discharge : 07Oct2010, 19:15
Total Direct Runoff : 4216.4 (AC-FT)
Total Baseflow : 0.0 (AC-FT)
Discharge : 4216.4 (AC-FT)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
07Oct2010
Legend (Compute Time: 10Jan2012, 12:51:59)
Run:Nested Storm Element:2-YR SWEETWATER 24-HR Result:Precipitation
Run:NESTED STORM Element:2-YR SWEETWATER 24-HR Result:Precipitation Loss
Run:NESTED STORM Element:2-YR SWEETWATER 24-HR Result:Outflow
Run:NESTED STORM Element:2-YR SWEETWATER 24-HR Result:Baseflow