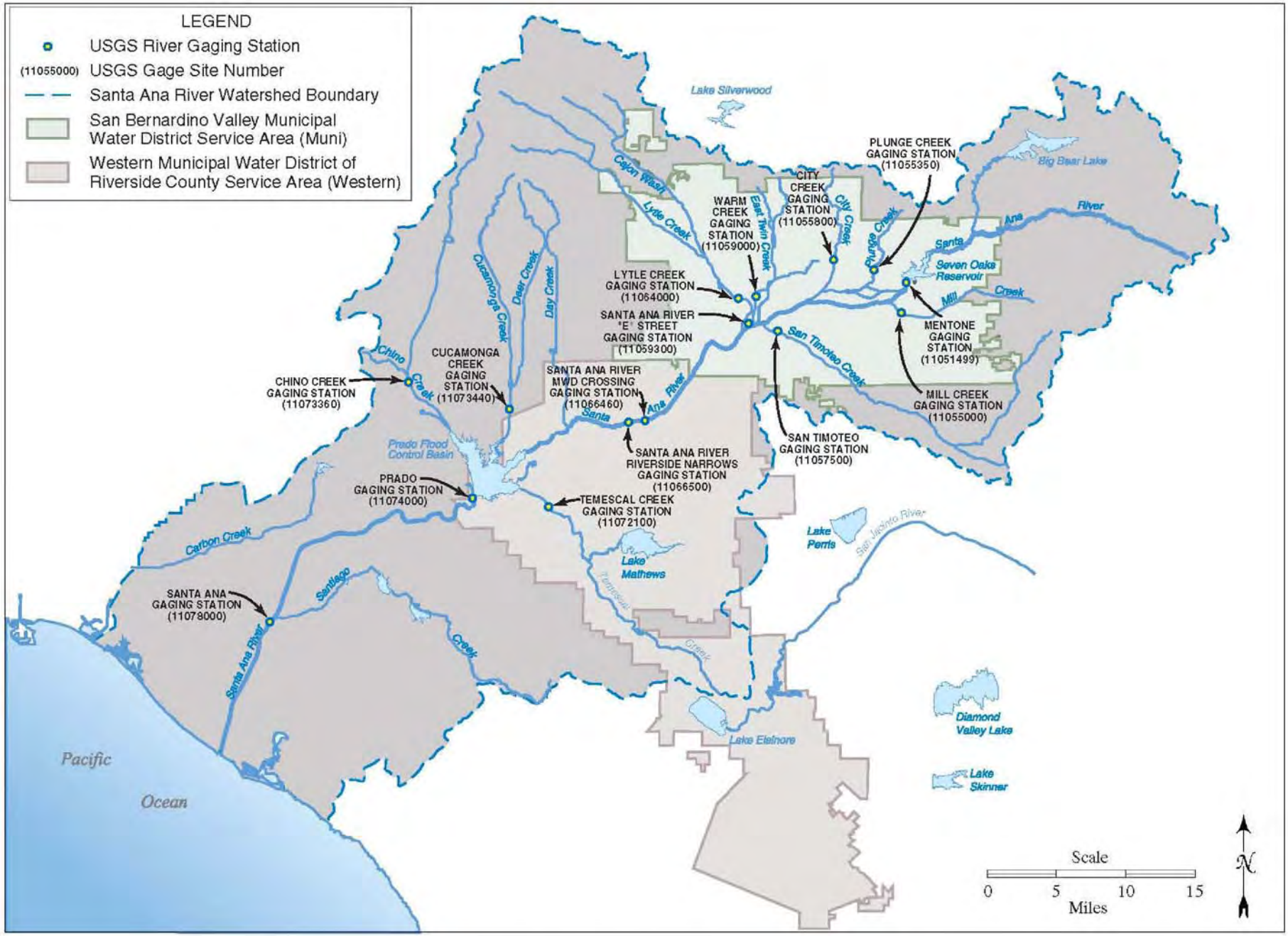
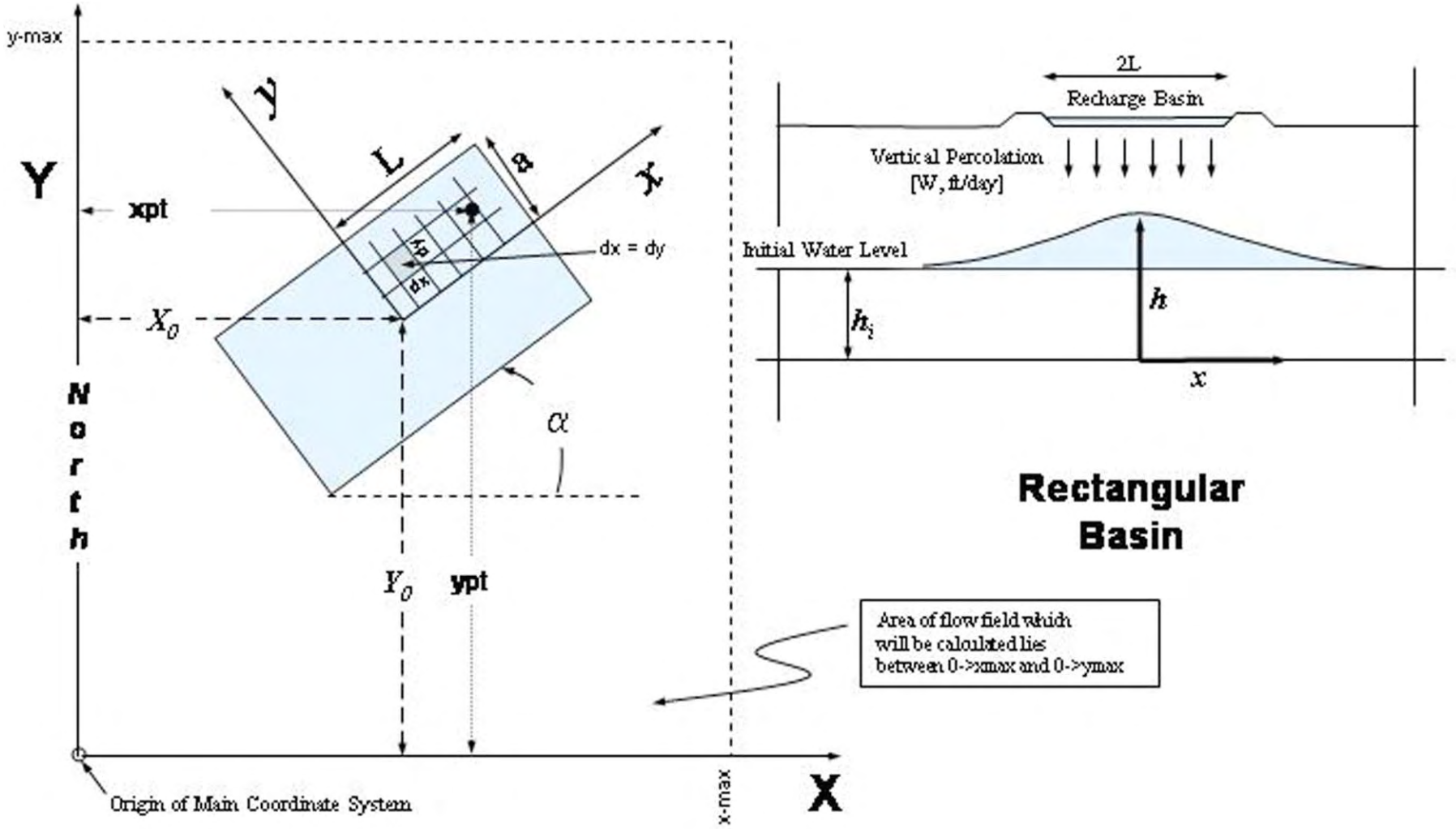
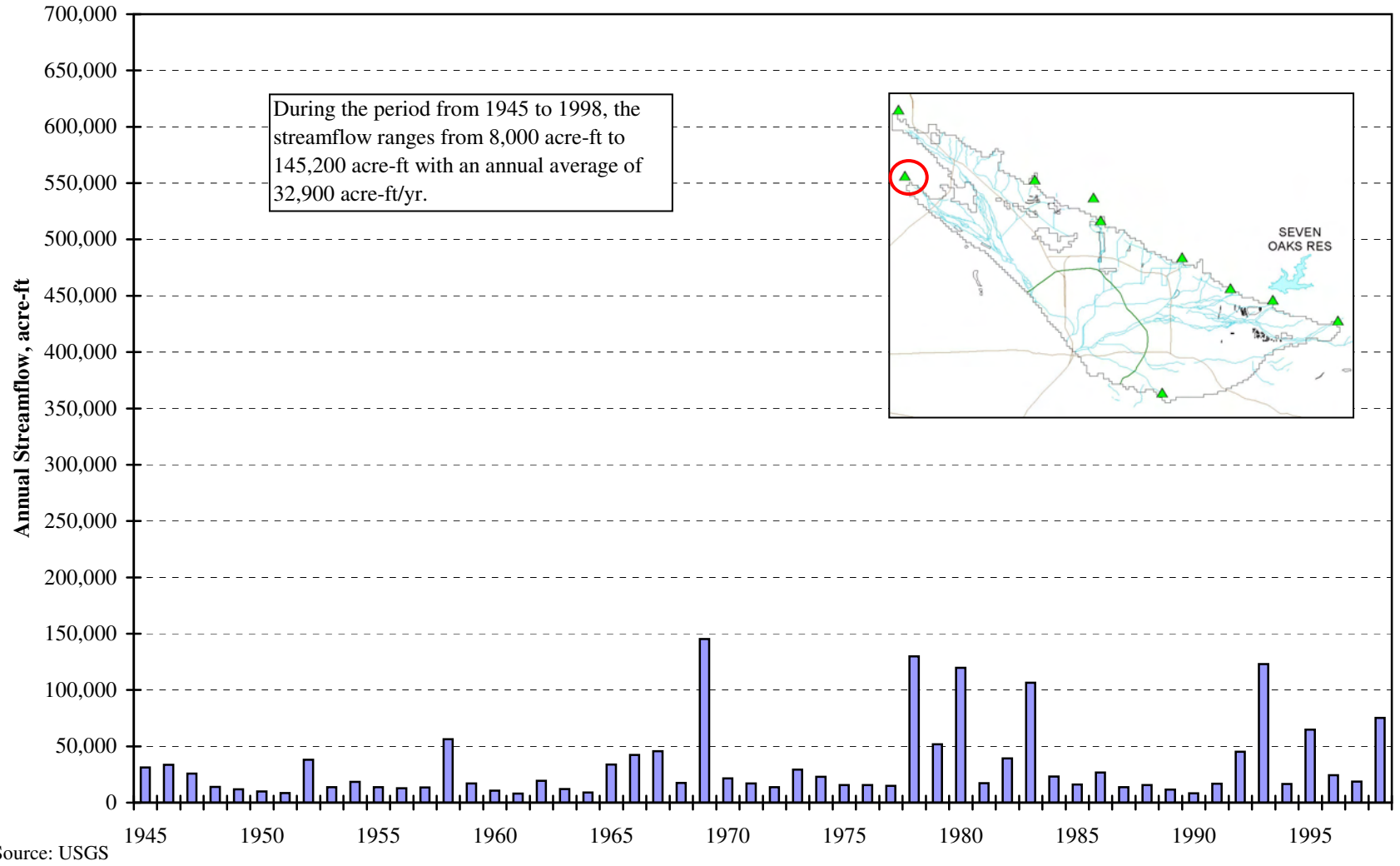


Figure 2.1-1. Santa Ana River Watershed, Gaging Stations, and Muni/Western Service Areas



Muni/Western Ex. 6-4	Drawn: DEW Checked: Approved: Date: 16-APR-07	SANTA ANA RIVER WATER RIGHTS HEARING - TESTIMONY OF DENNIS E. WILLIAMS ANALYTICAL METHOD - HANTUSH (1967)	GEOSCIENCE GEOSCIENCE Support Services, Incorporated P.O. Box 220, Claremont, CA 91711 Tel: (909)920-0707 Fax: (909)920-0403 www.gssiwater.com

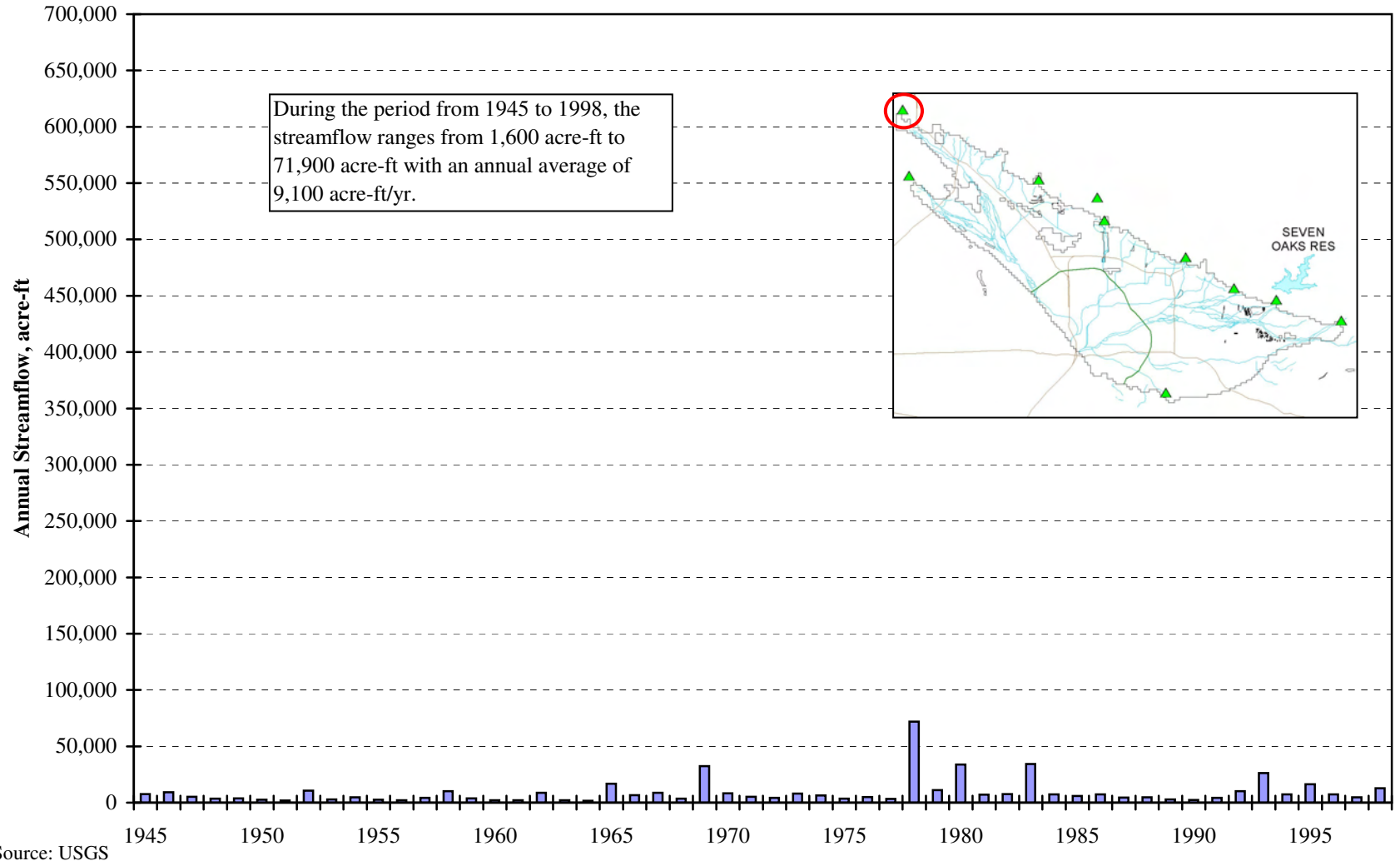
Annual Streamflow at Lytle Creek near Fontana Gaging Station 1945-1998



Source: USGS

Muni/Western Ex. 6-5
Figure B 1

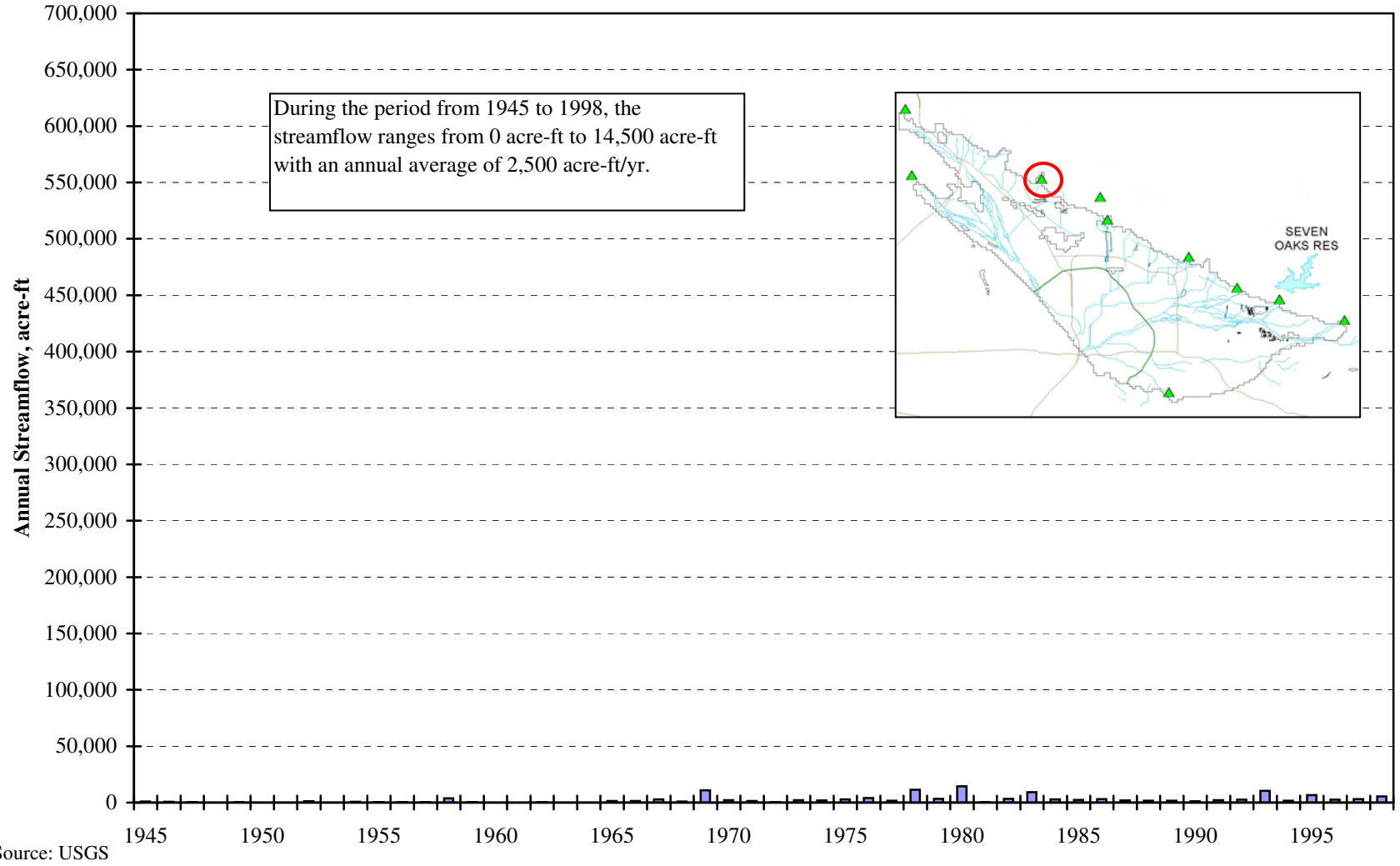
Annual Streamflow at Cajon Creek below Lone Pine Creek near Keenbrook Gaging Station 1945-1998



Source: USGS

Muni/Western Ex. 6-6
Figure B 2

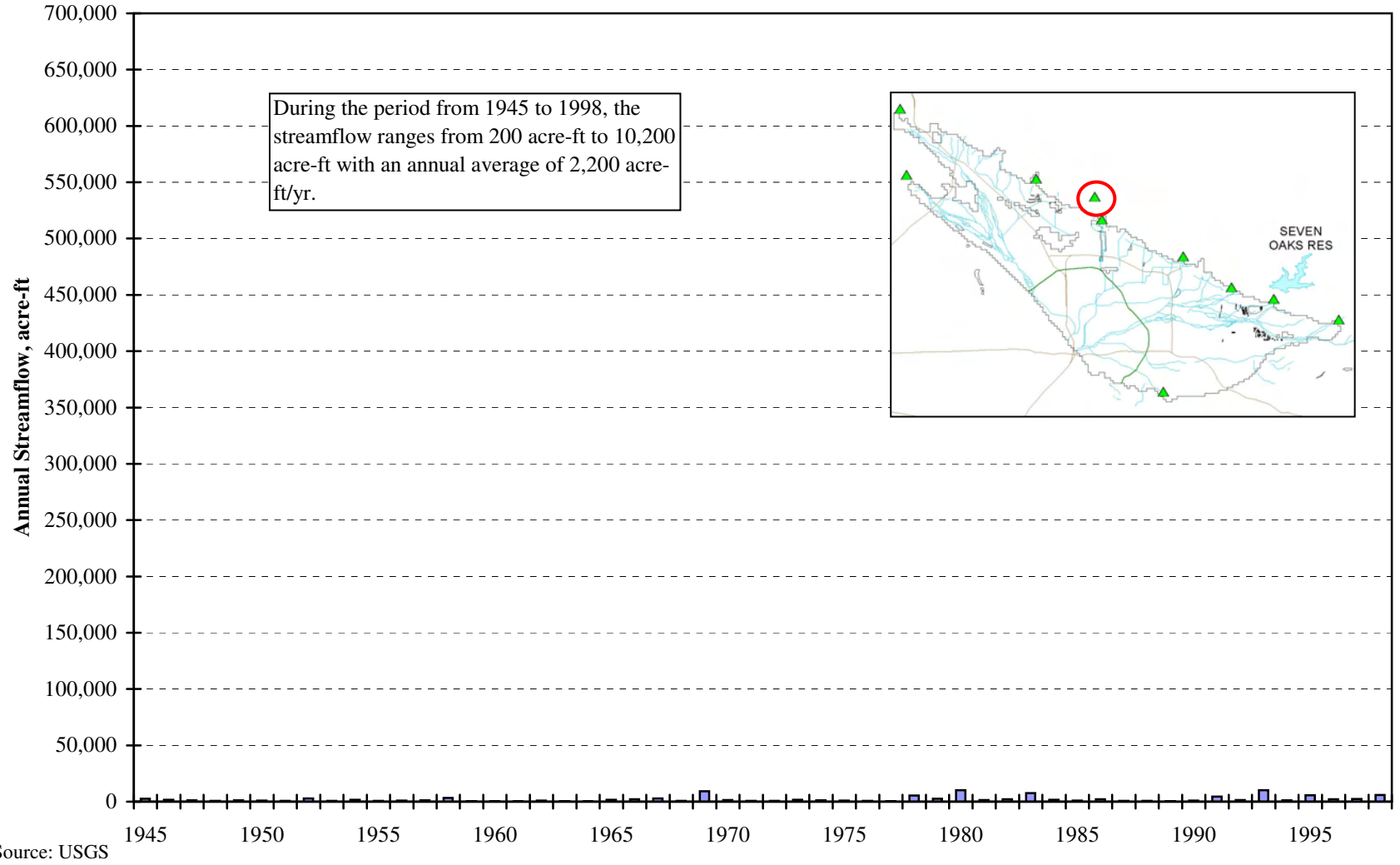
Annual Streamflow at Devil Canyon Creek near San Bernardino Gaging Station 1945-1998



Source: USGS

Muni/Western Ex. 6-7
Figure B 3

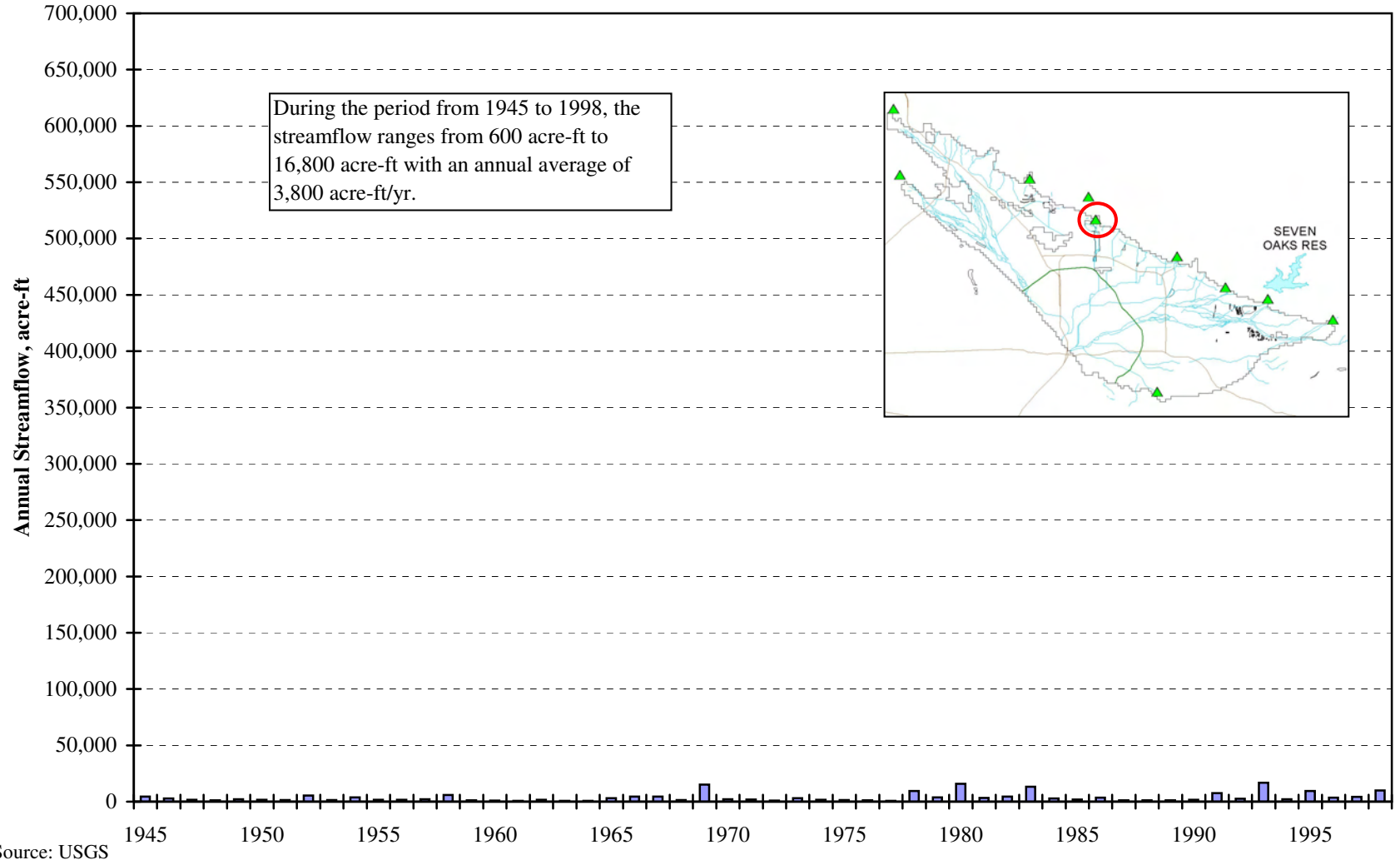
Annual Streamflow at Waterman Canyon Creek near Arrowhead Springs Gaging Station 1945-1998



Source: USGS

Muni/Western Ex. 6-8
Figure B 4

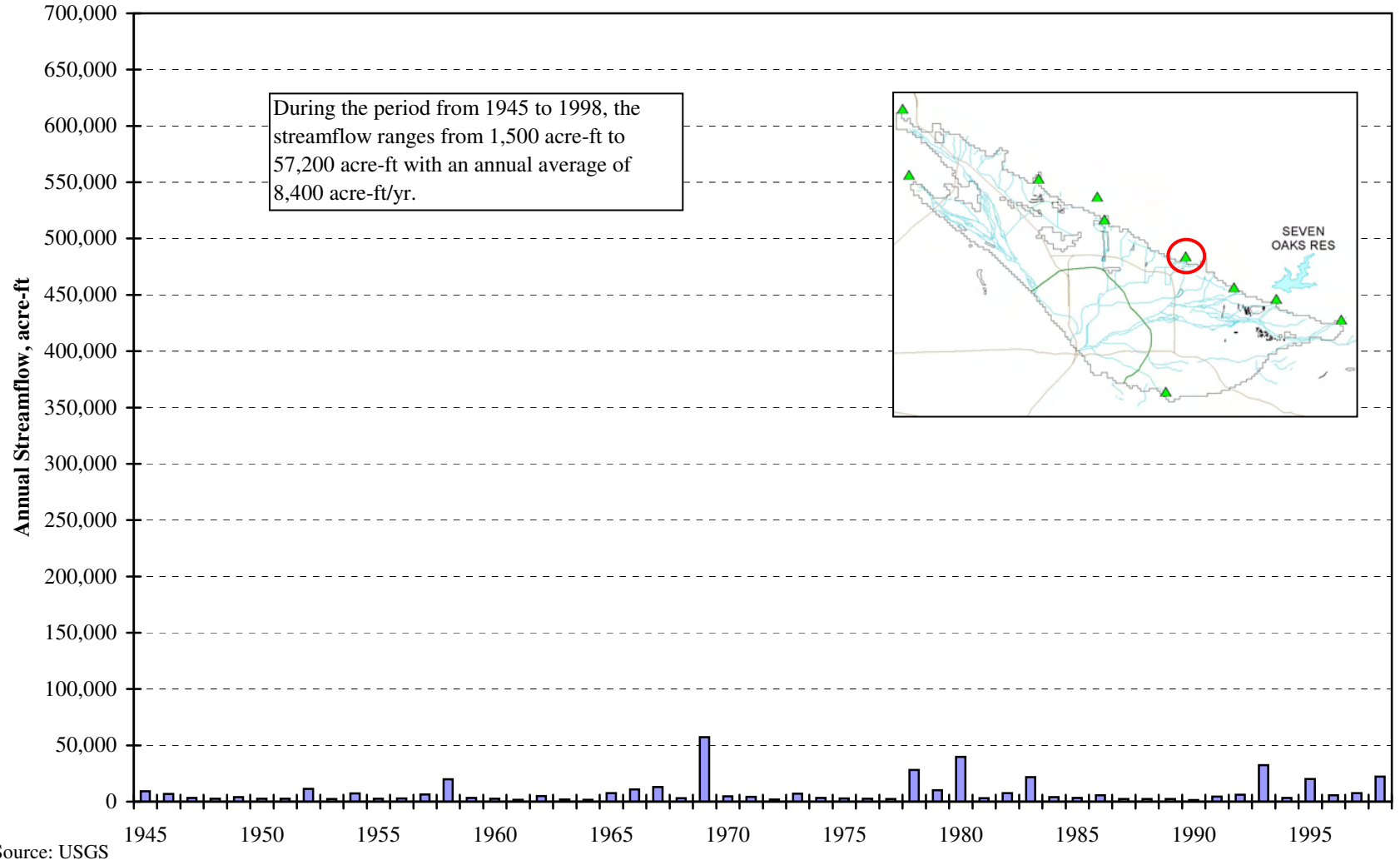
Annual Streamflow at East Twin Creek near Arrowhead Springs Gaging Station 1945-1998



Source: USGS

Muni/Western Ex. 6-9
Figure B 5

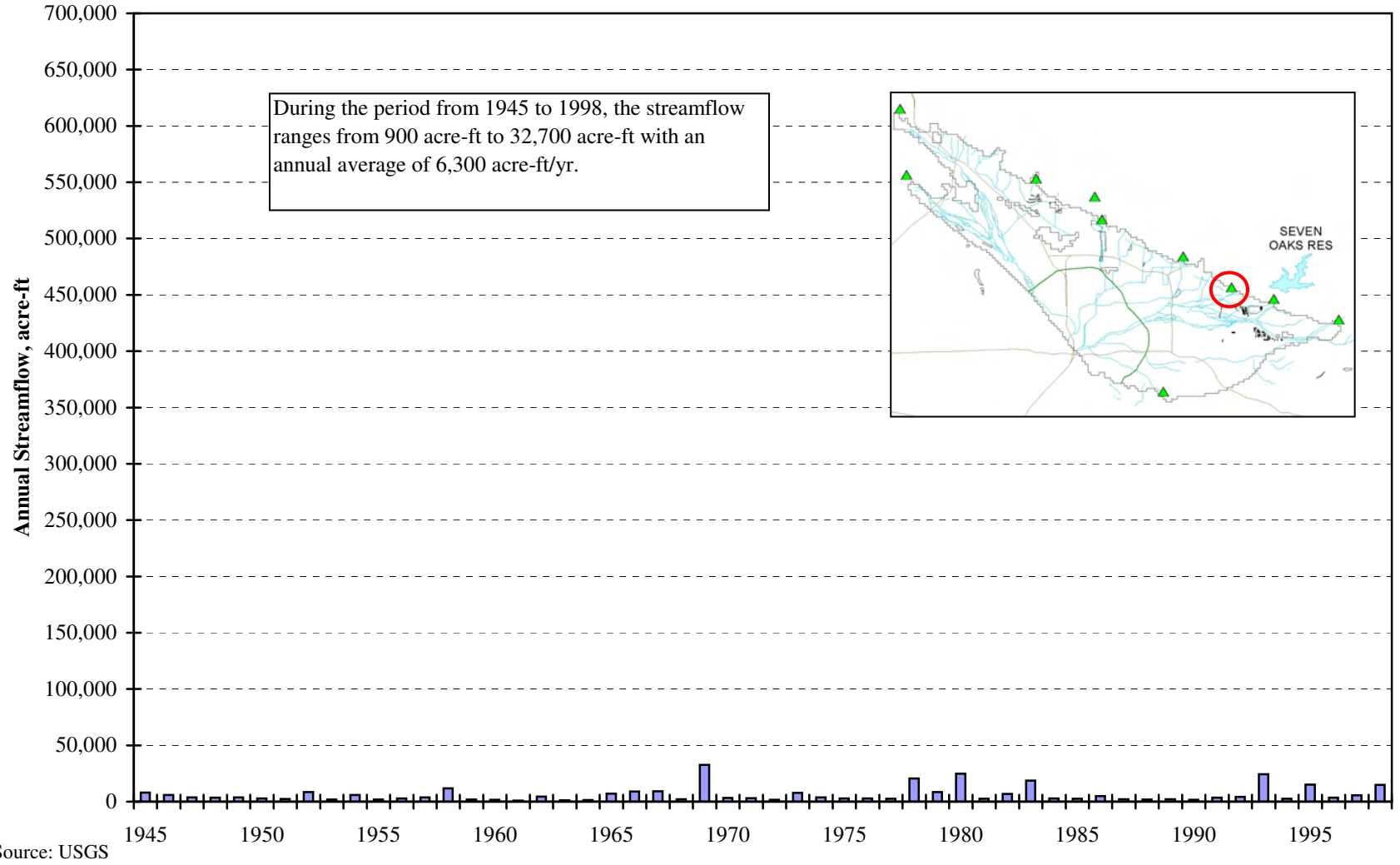
Annual Streamflow at City Creek near Highland Gaging Station 1945-1998



Source: USGS

Muni/Western Ex. 6-10
Figure B 6

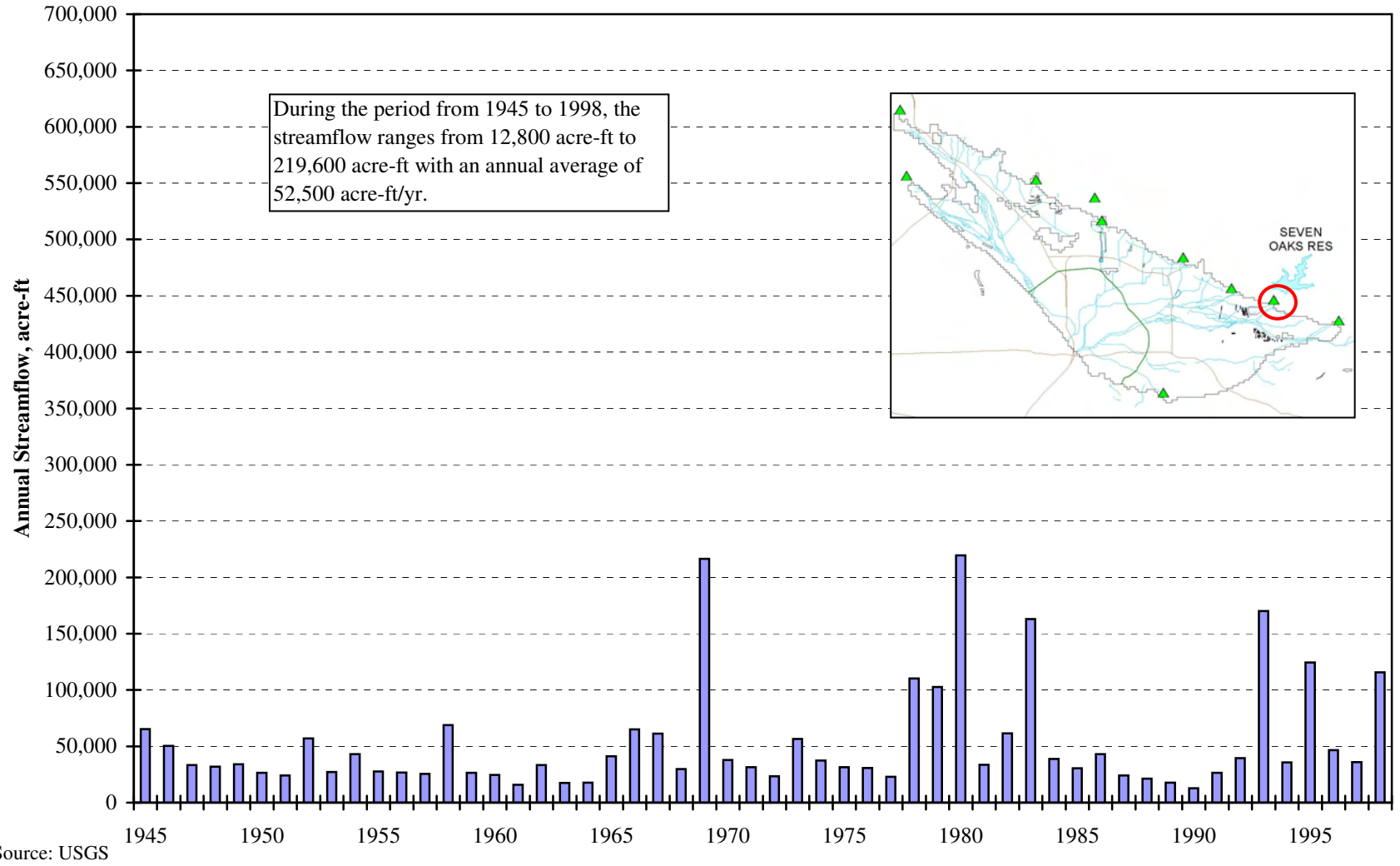
Annual Streamflow at Plunge Creek near East Highlands Gaging Station 1945-1998



Source: USGS

Muni/Western Ex. 6-11
Figure B 7

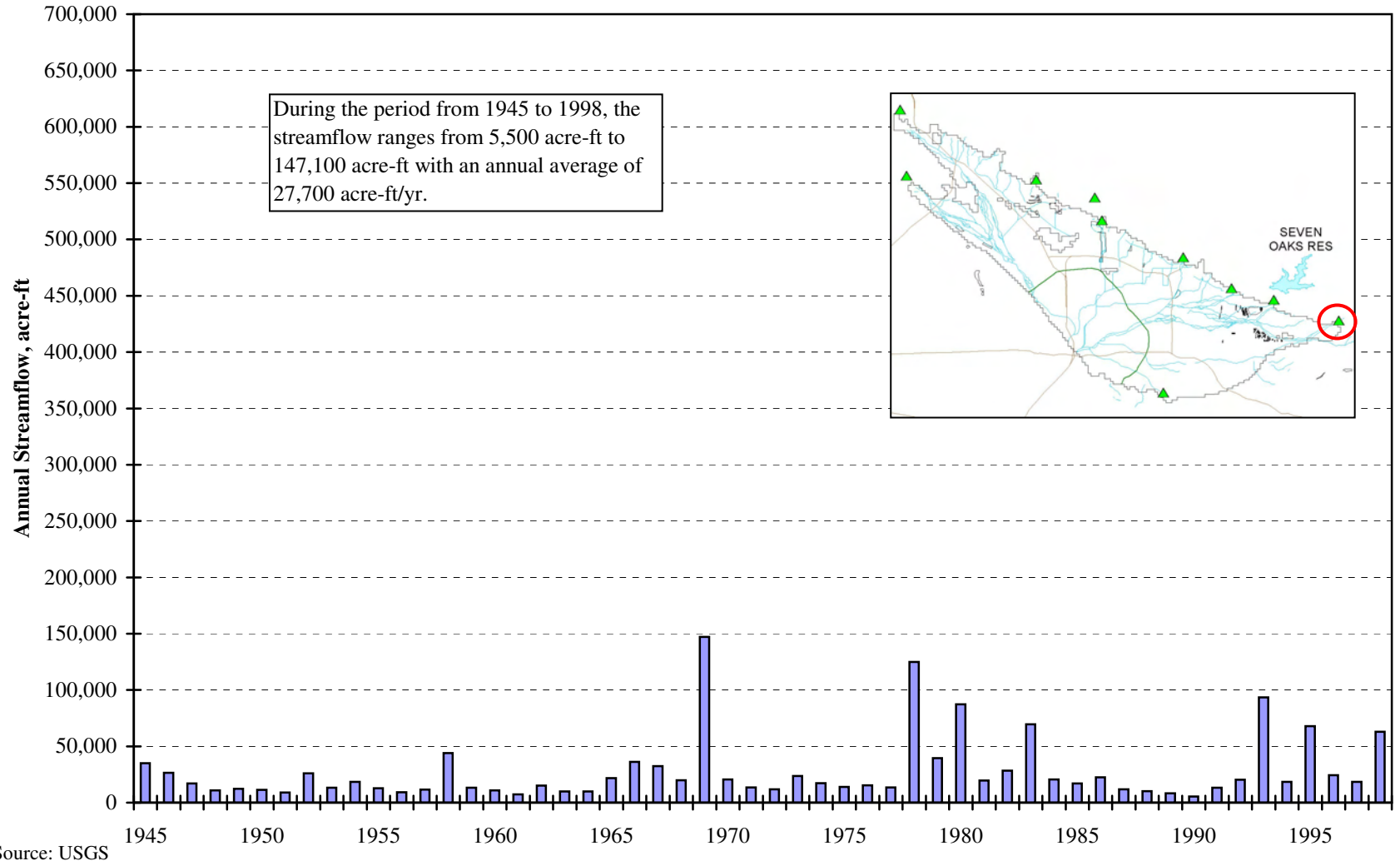
Annual Streamflow at Santa Ana River near Mentone Gaging Station 1945-1998



Source: USGS

Muni/Western Ex. 6-12
Figure B 8

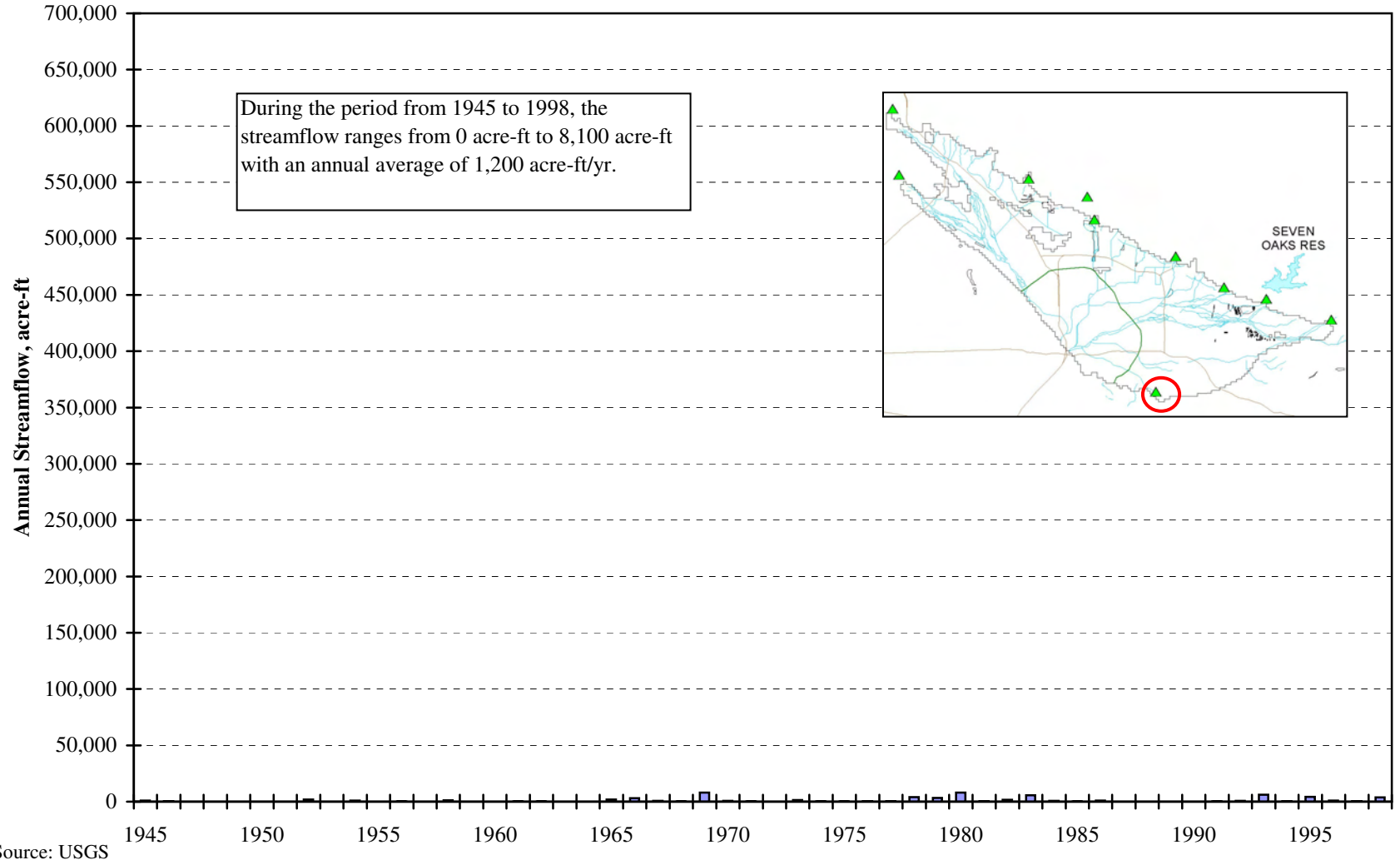
Annual Streamflow at Mill Creek near Yucaipa Gaging Station 1945-1998



Source: USGS

Muni/Western Ex. 6-13
Figure B 9

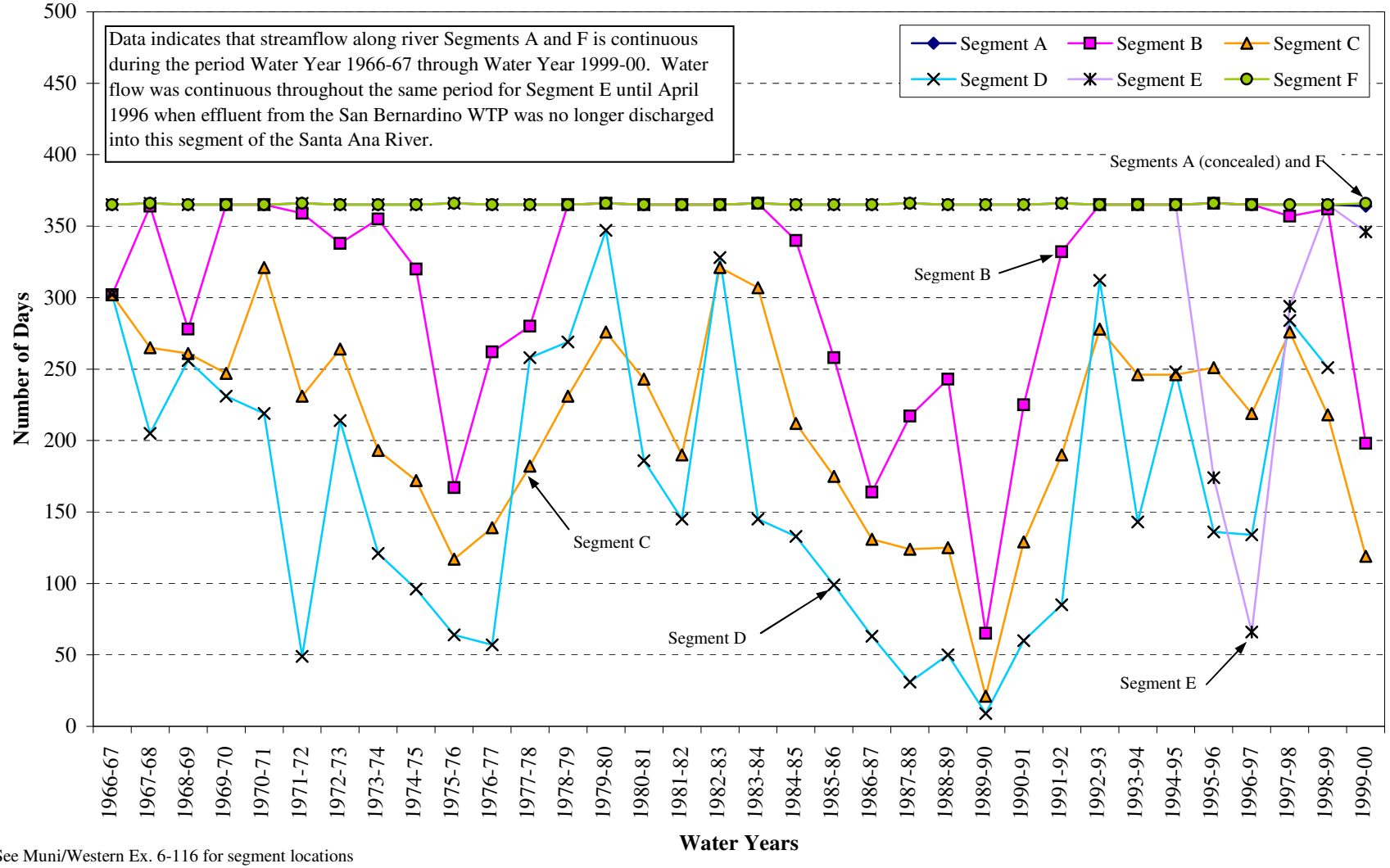
Annual Streamflow at San Timoteo Creek near Redlands Gaging Station 1945-1998



Source: USGS

Muni/Western Ex. 6-14
Figure B 10

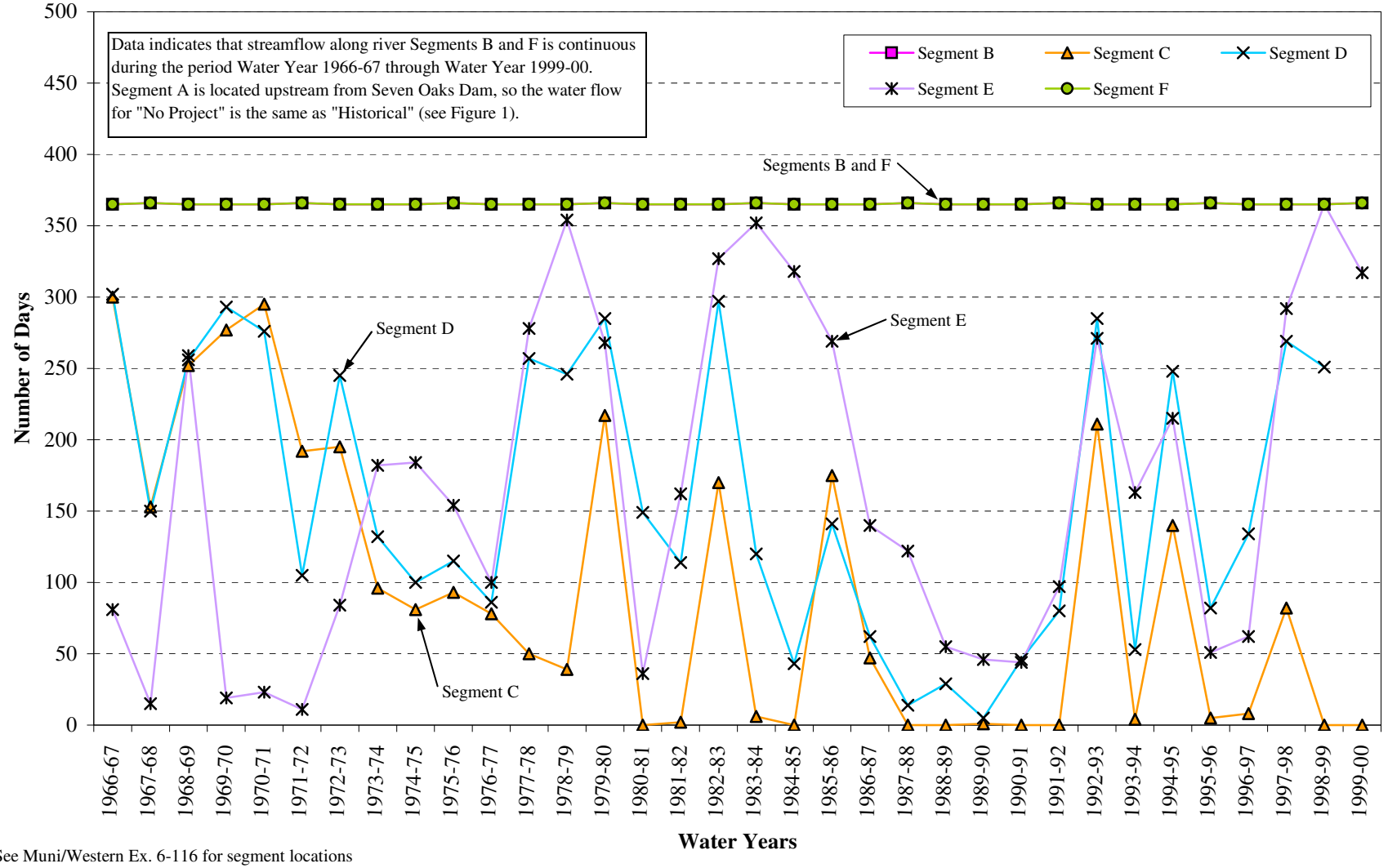
Upper Santa Ana River - Number of Days with Flow per Water Year
Historical Data
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-15

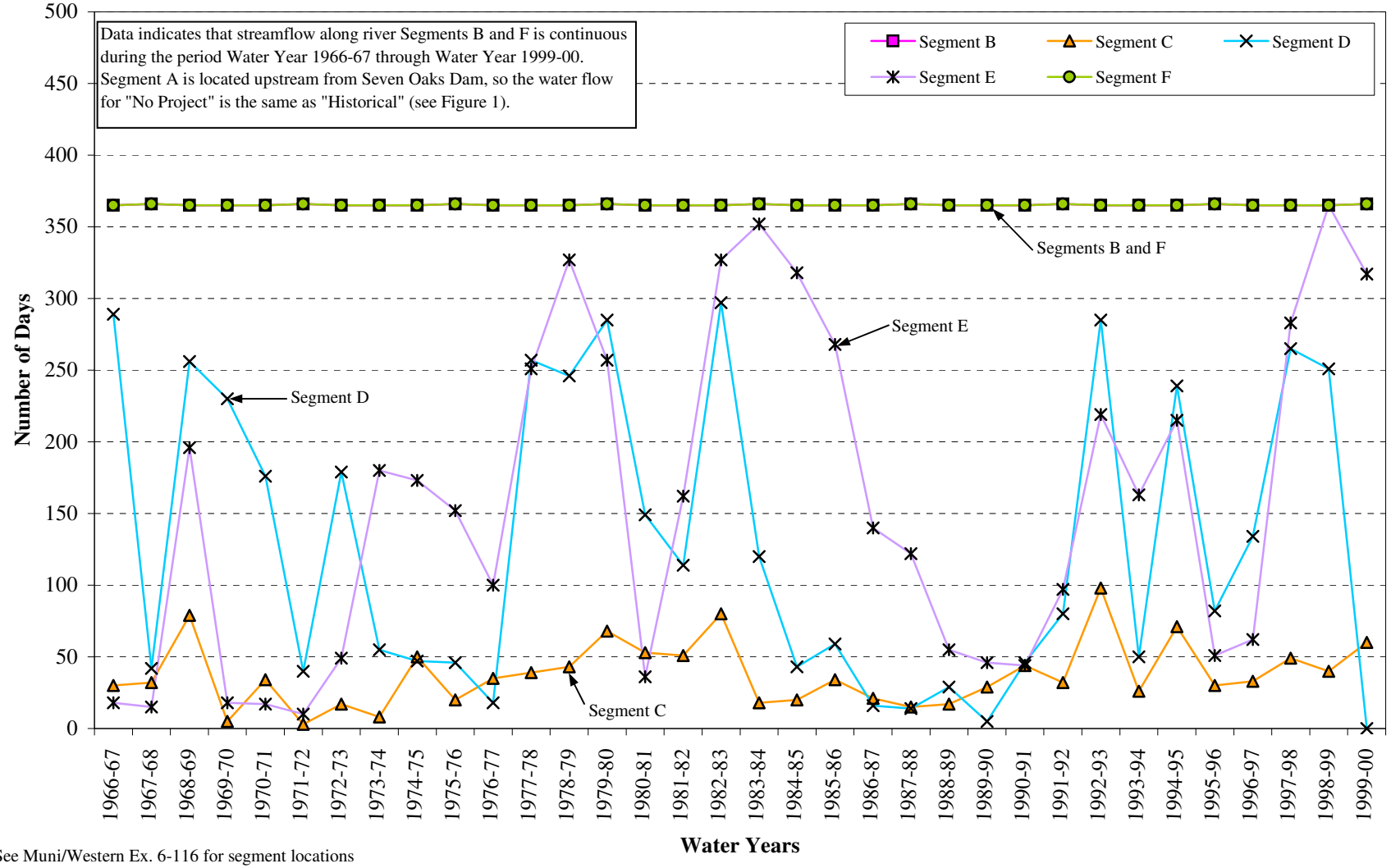
Upper Santa Ana River - Number of Days with Flow per Water Year
No Project Condition
Water Year 1966-67 through Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-16

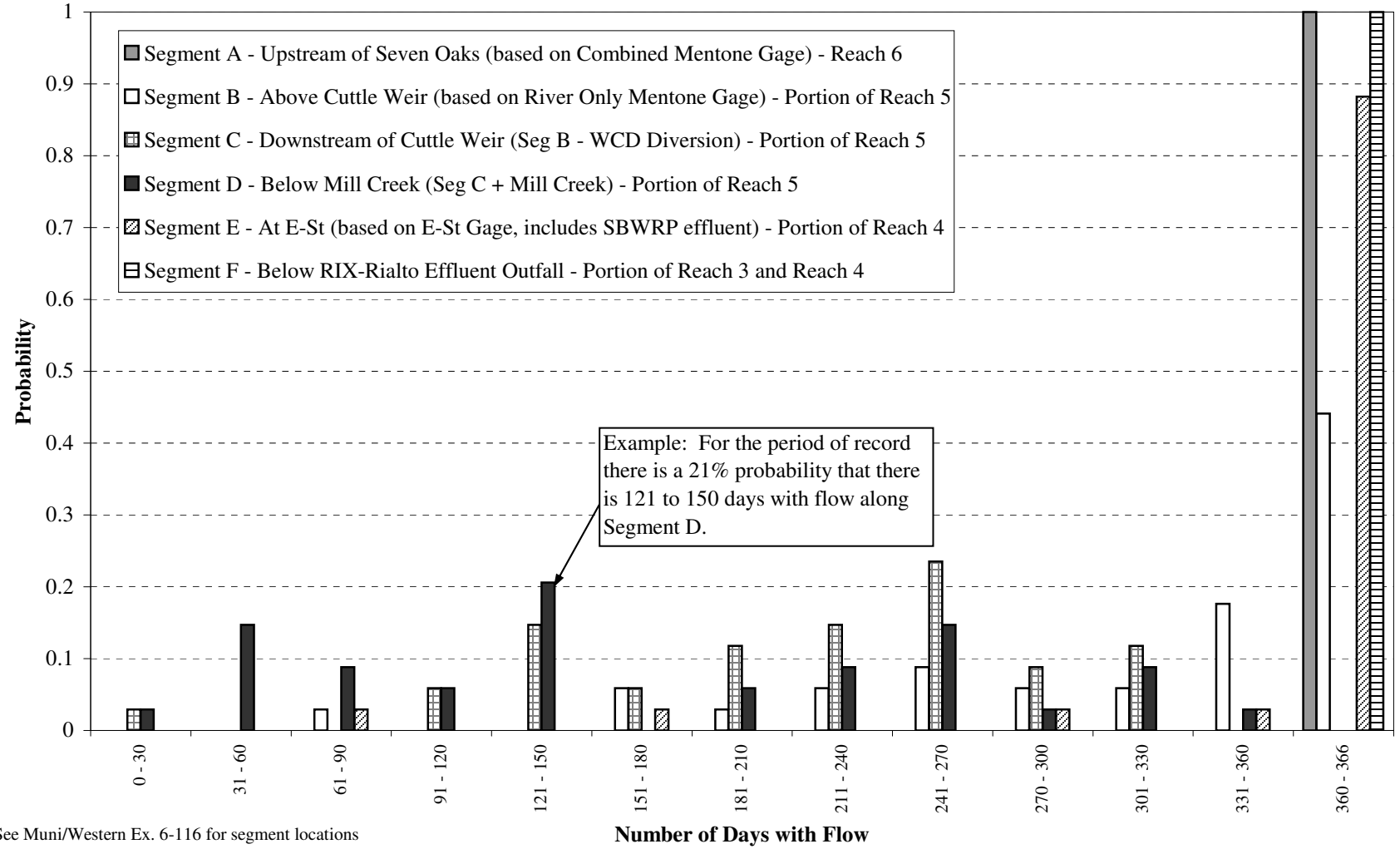
Upper Santa Ana River - Number of Days with Flow per Water Year
Project Scenario A
Data for Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-17

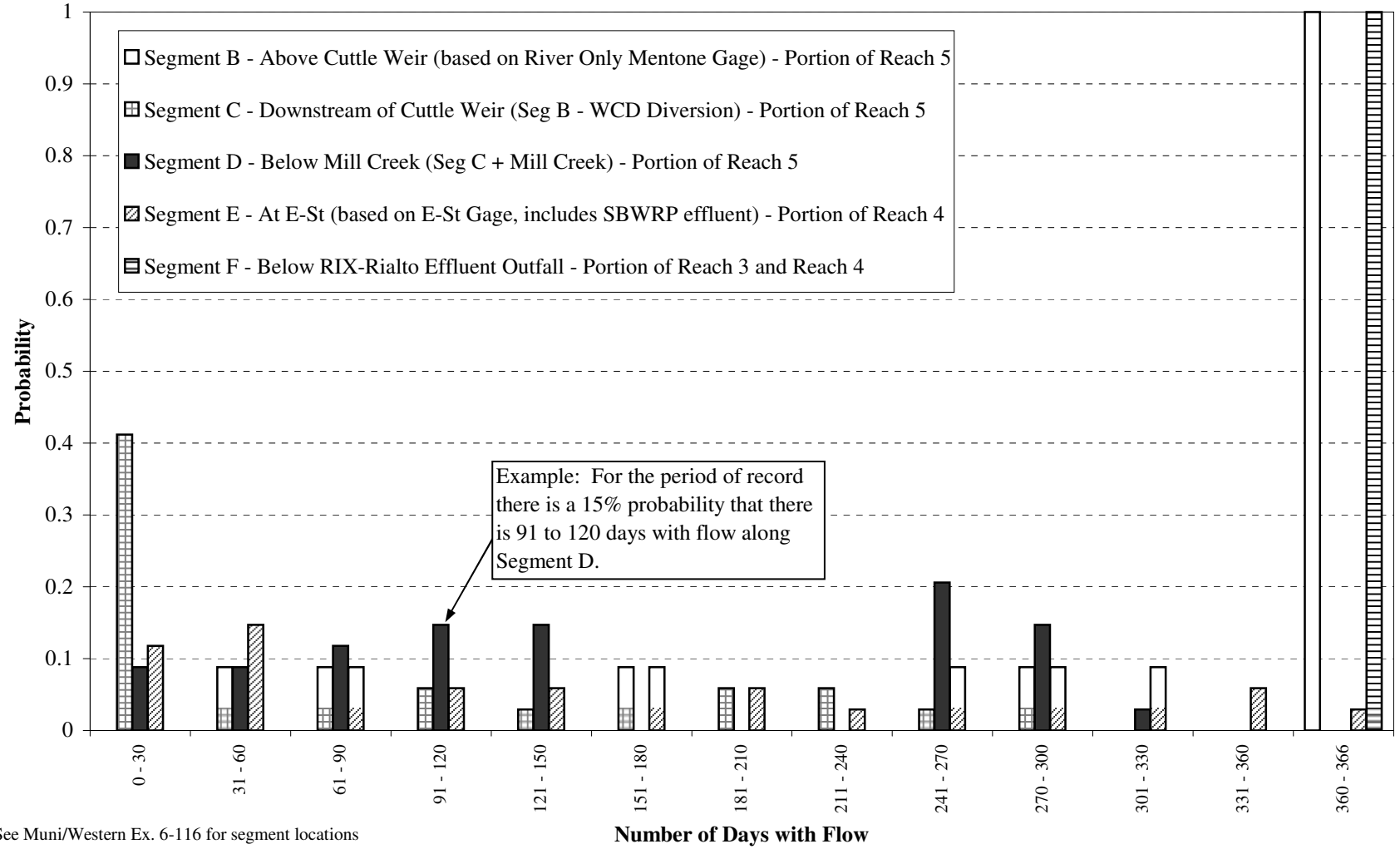
Upper Santa Ana River – Annual Number of Days with Flow Probability Distribution
Historical Data
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-18

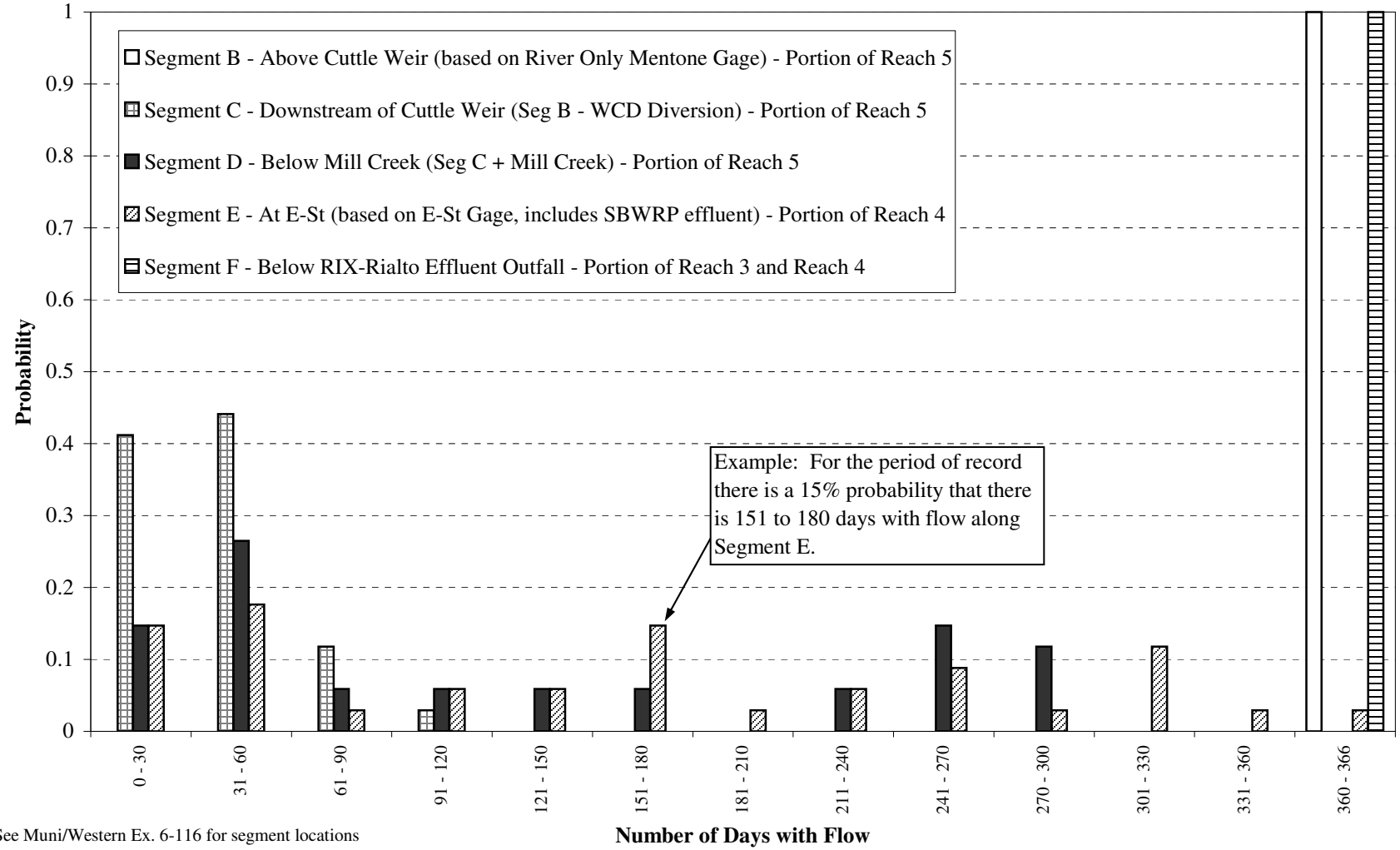
Upper Santa Ana River – Annual Number of Days with Flow Probability Distribution
No Project Condition
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-19

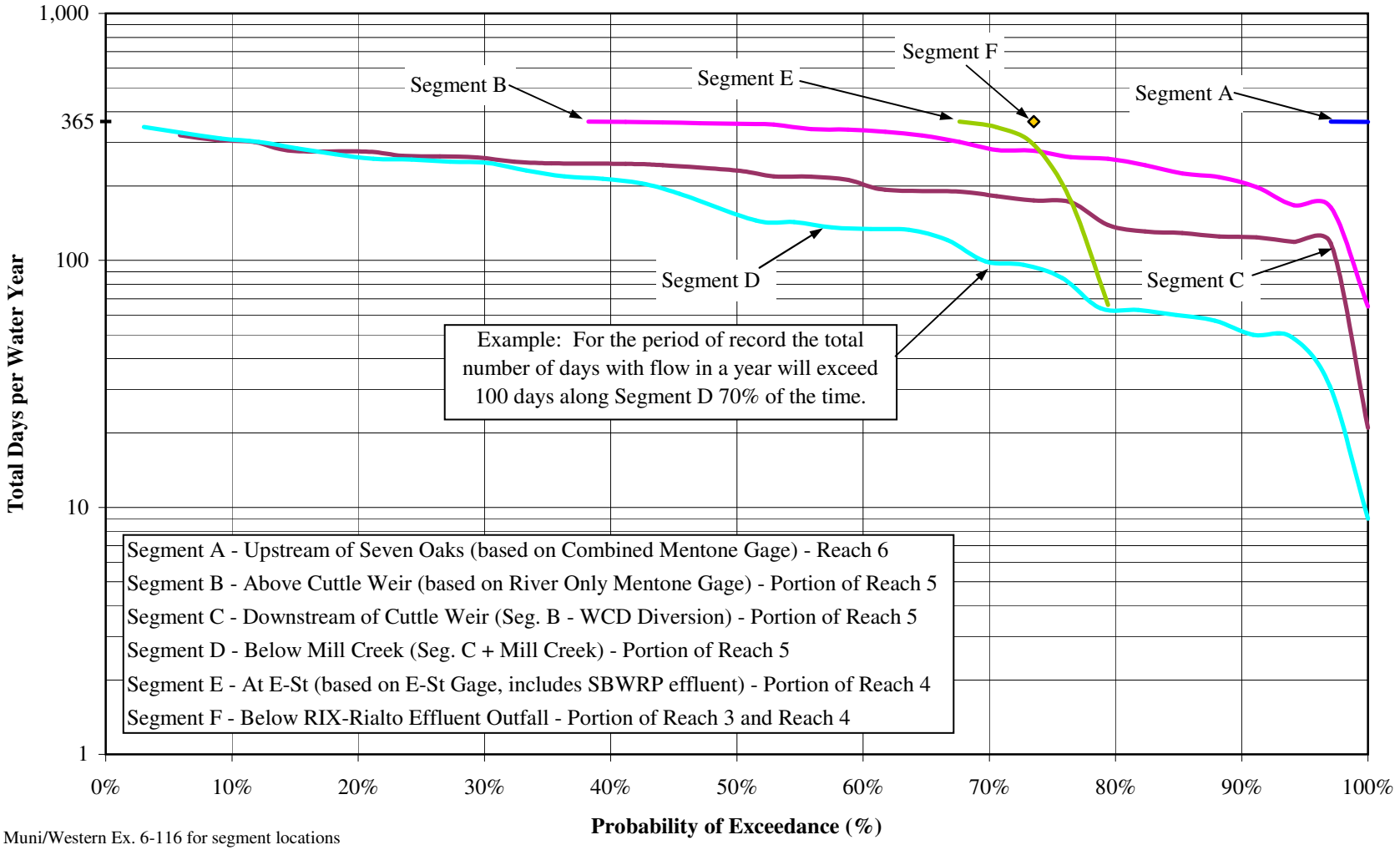
Upper Santa Ana River – Annual Number of Days with Flow Probability Distribution
Project Scenario A
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-20

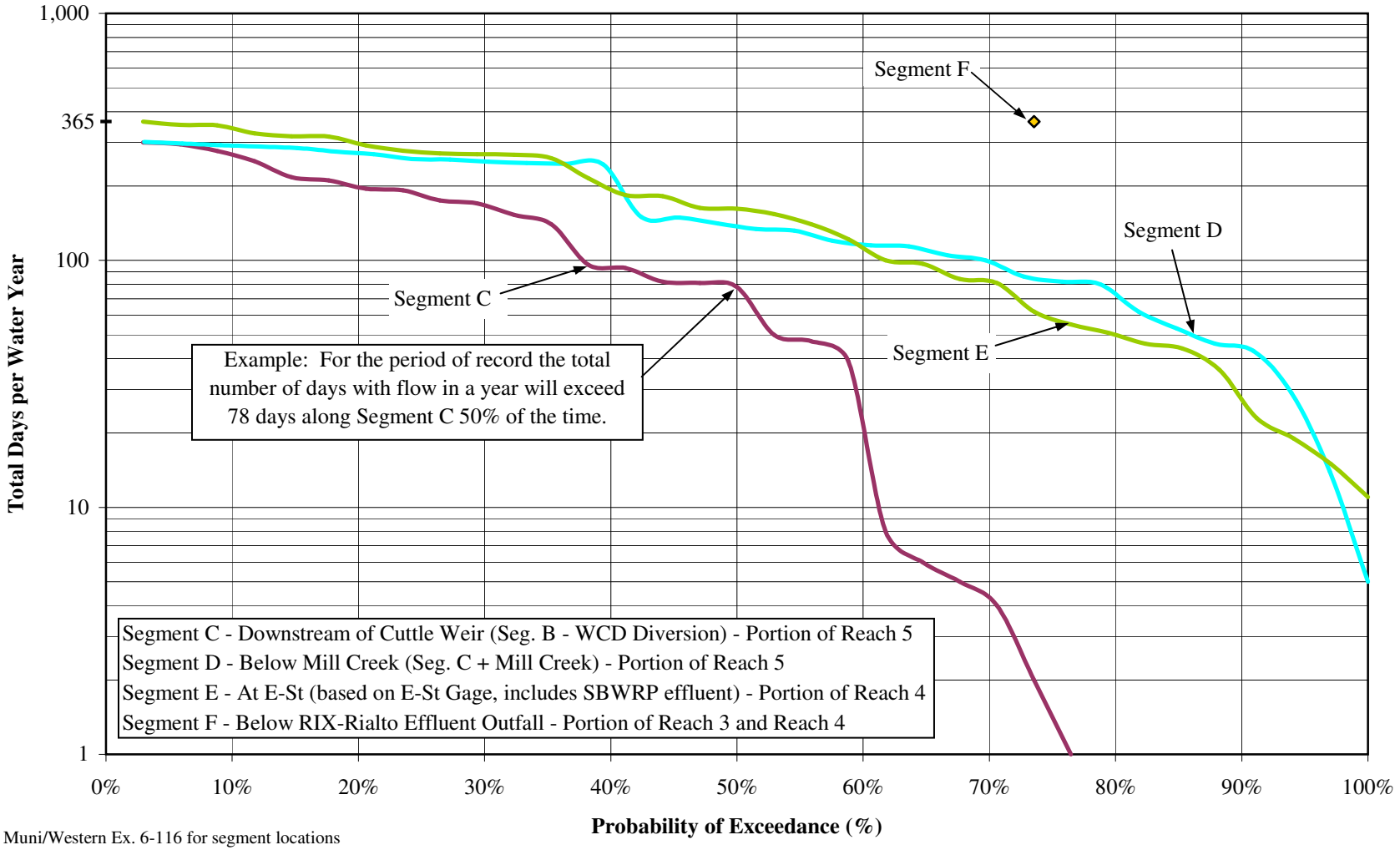
Upper Santa Ana River - Probability of Exceedance for Days with Flow per Water Year
Historical Data
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-21

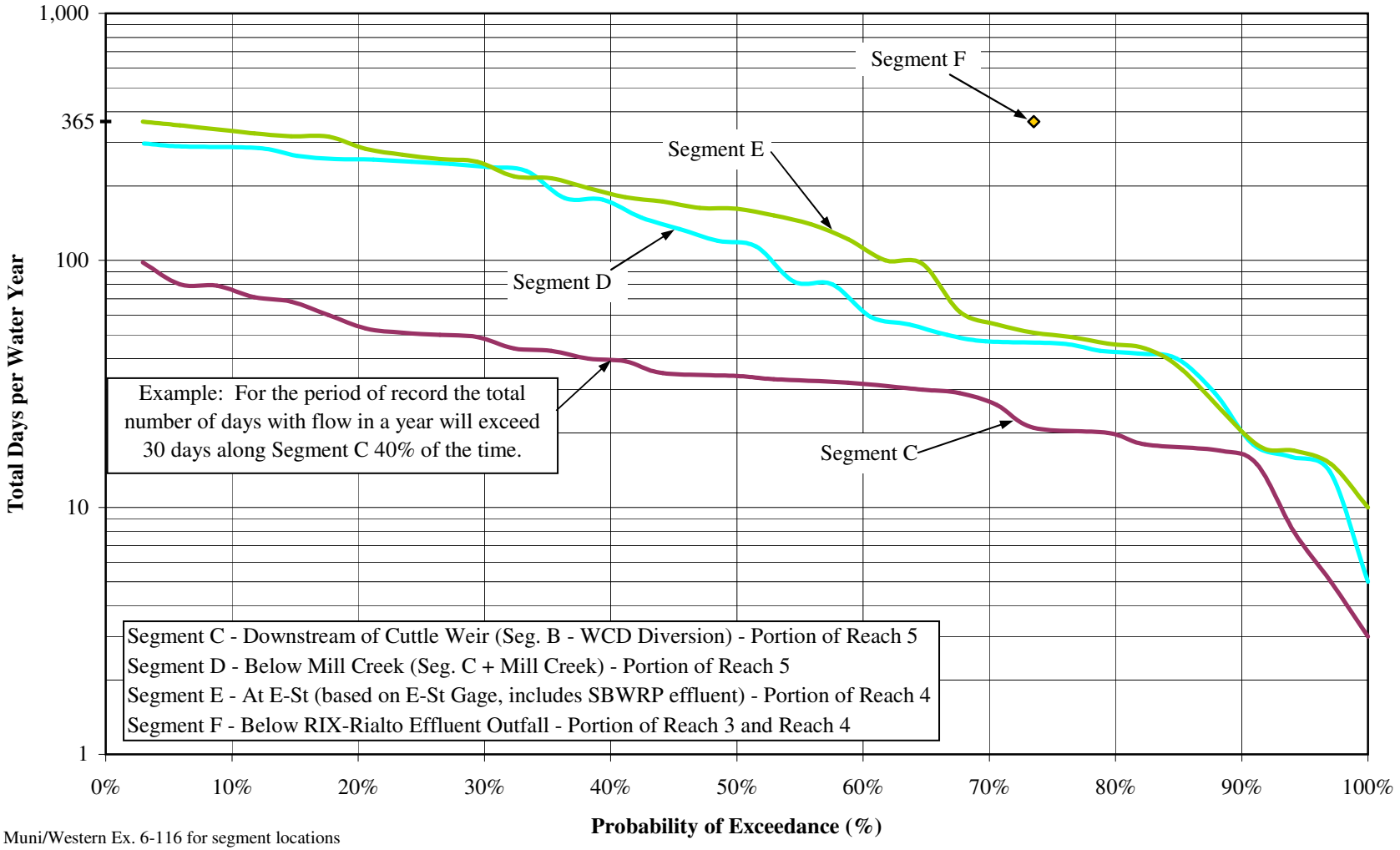
Upper Santa Ana River - Probability of Exceedance for Days with Flow per Water Year
No Project Condition
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-22

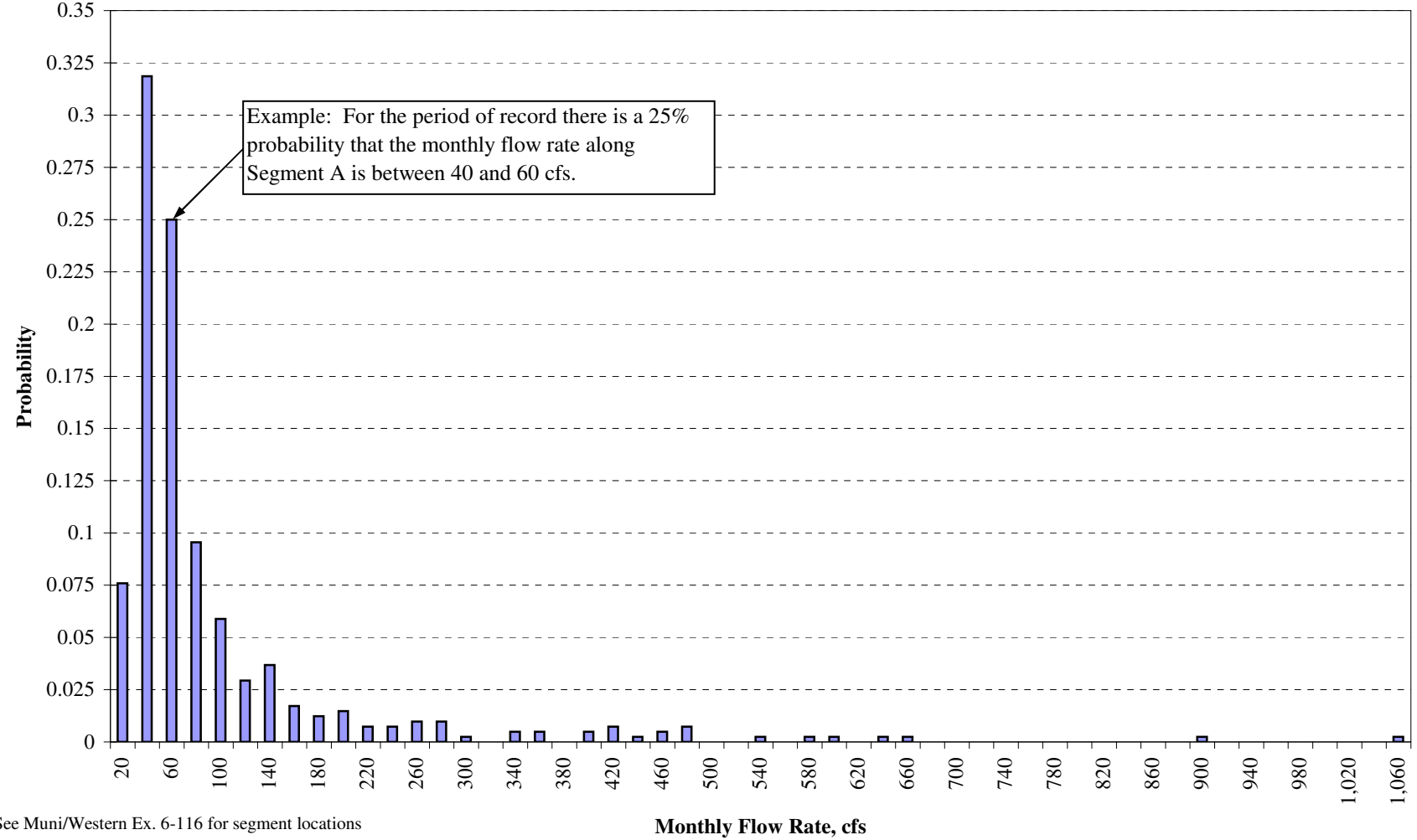
Upper Santa Ana River - Probability of Exceedance for Days with Flow per Water Year
Project Scenario A
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-23

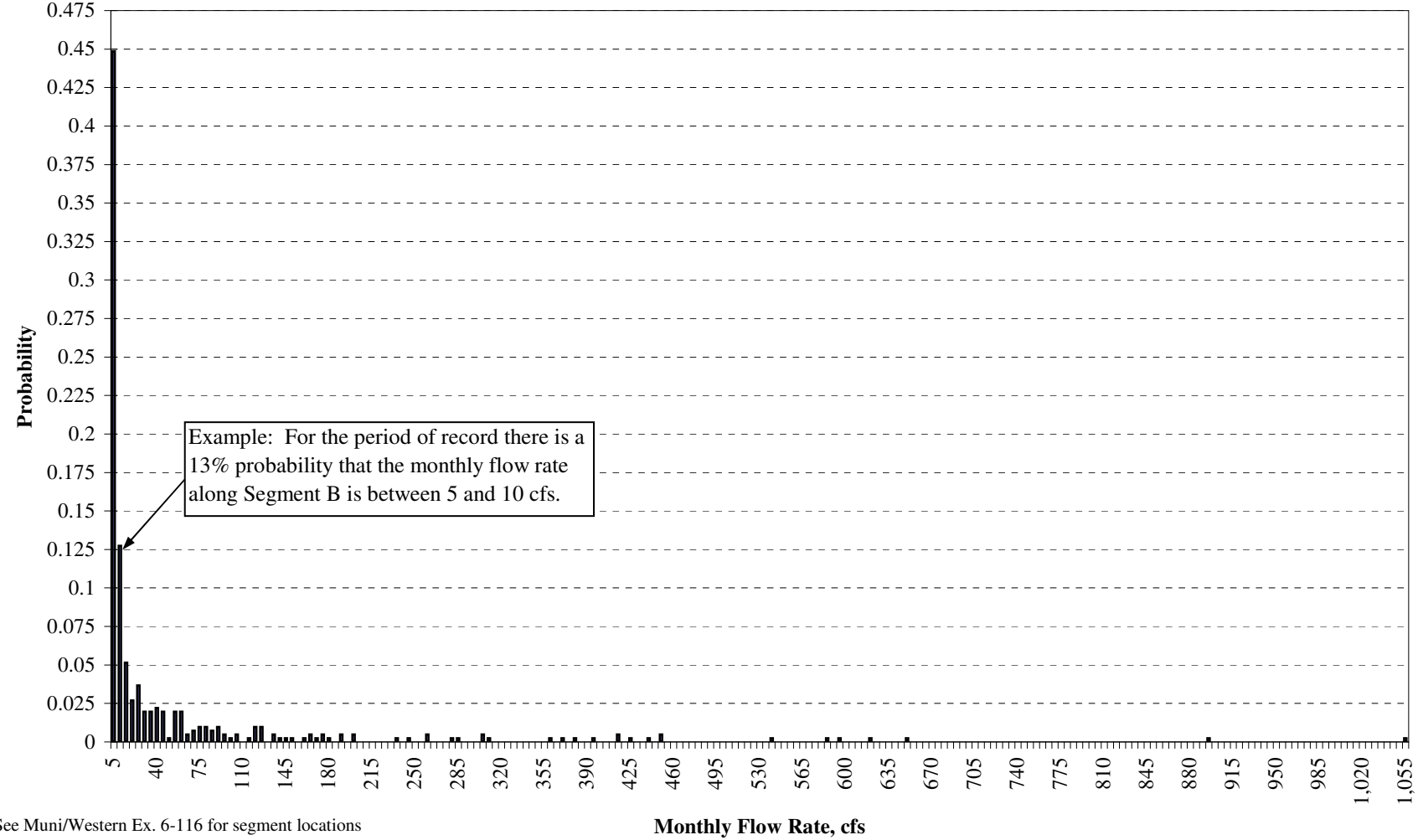
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Historical Data, No Project Condition, and Project Scenario A
Segment A: Upstream of Seven Oaks (Reach 6)



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-24

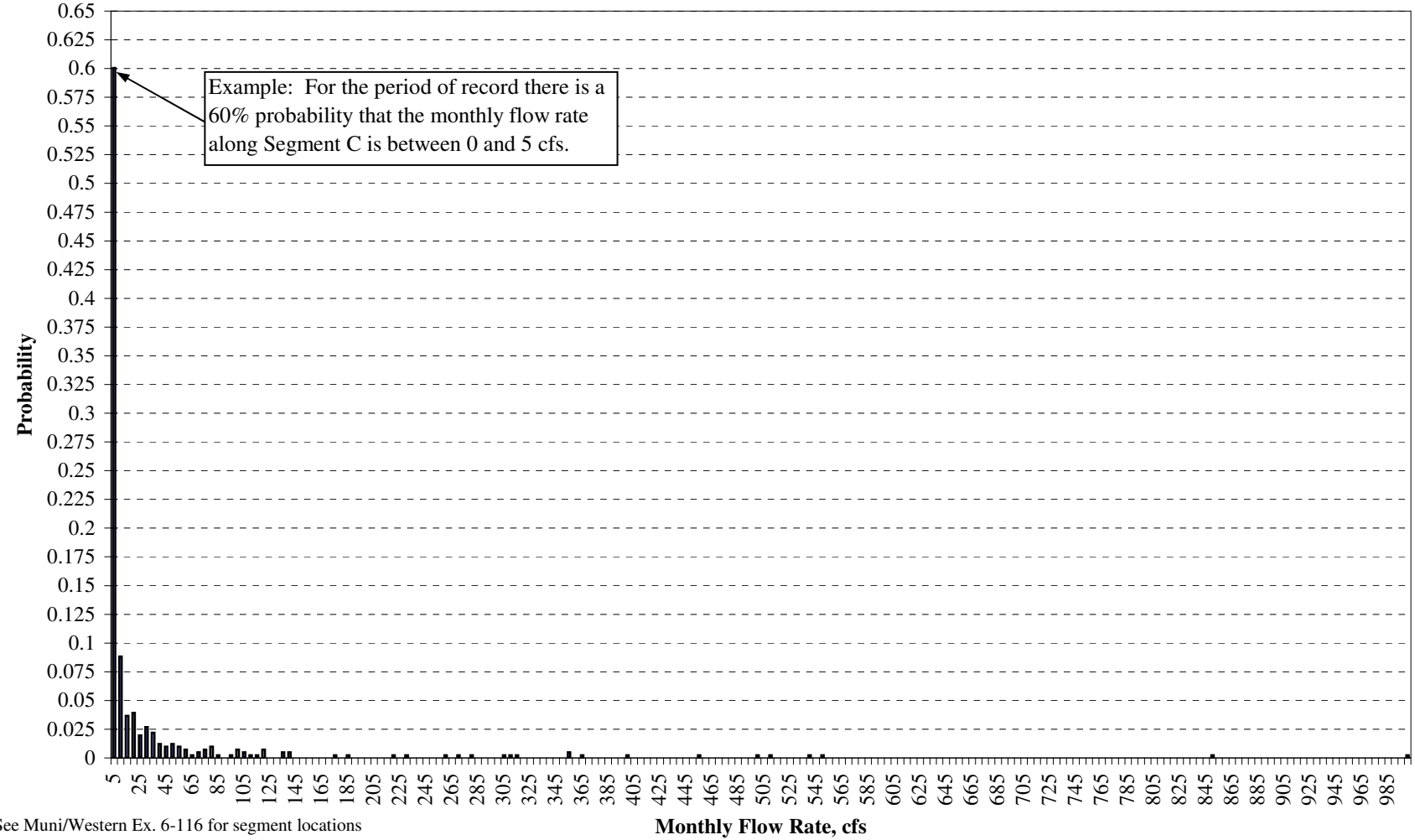
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Historical Data
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-25

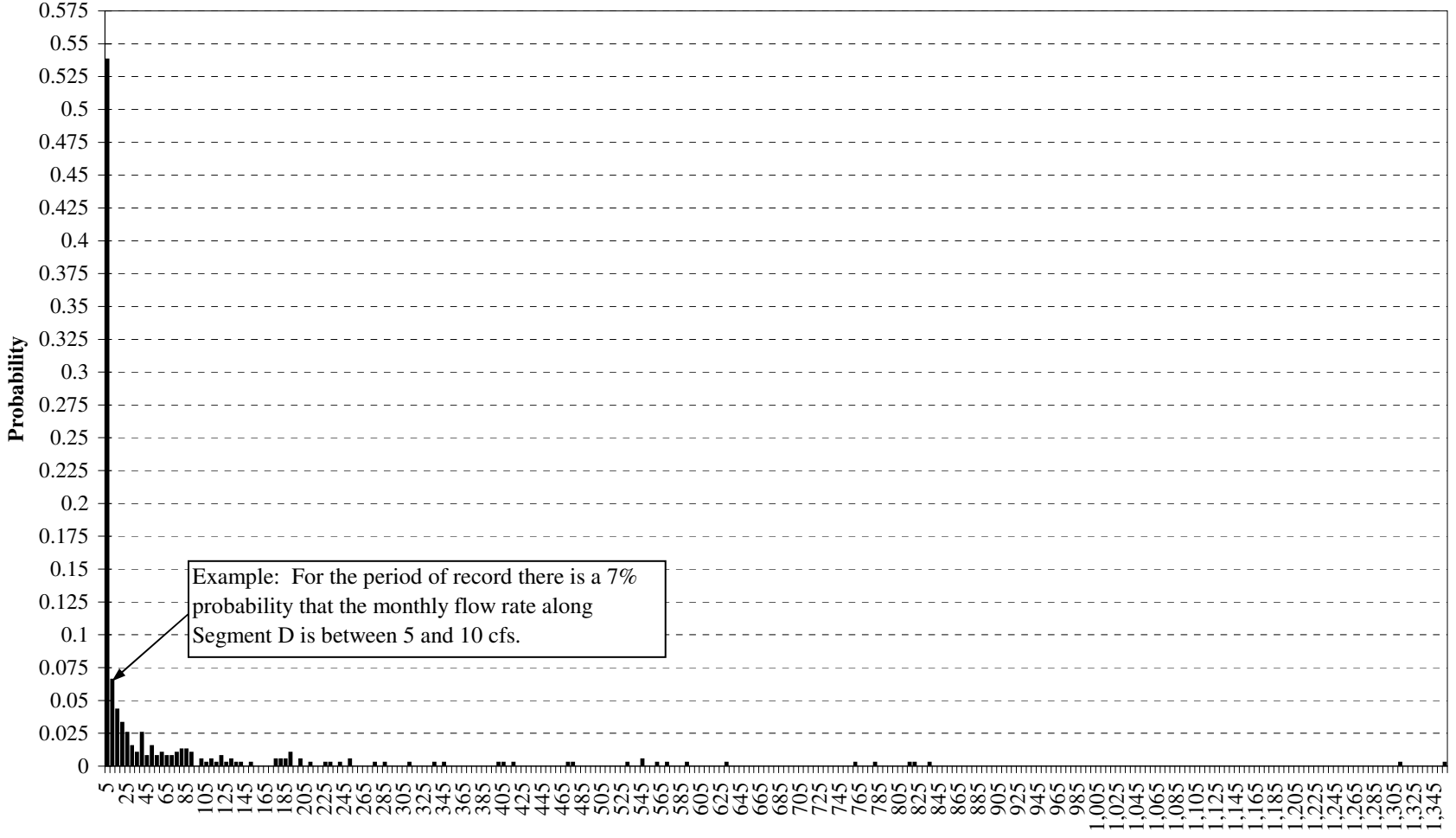
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Historical Data
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-26

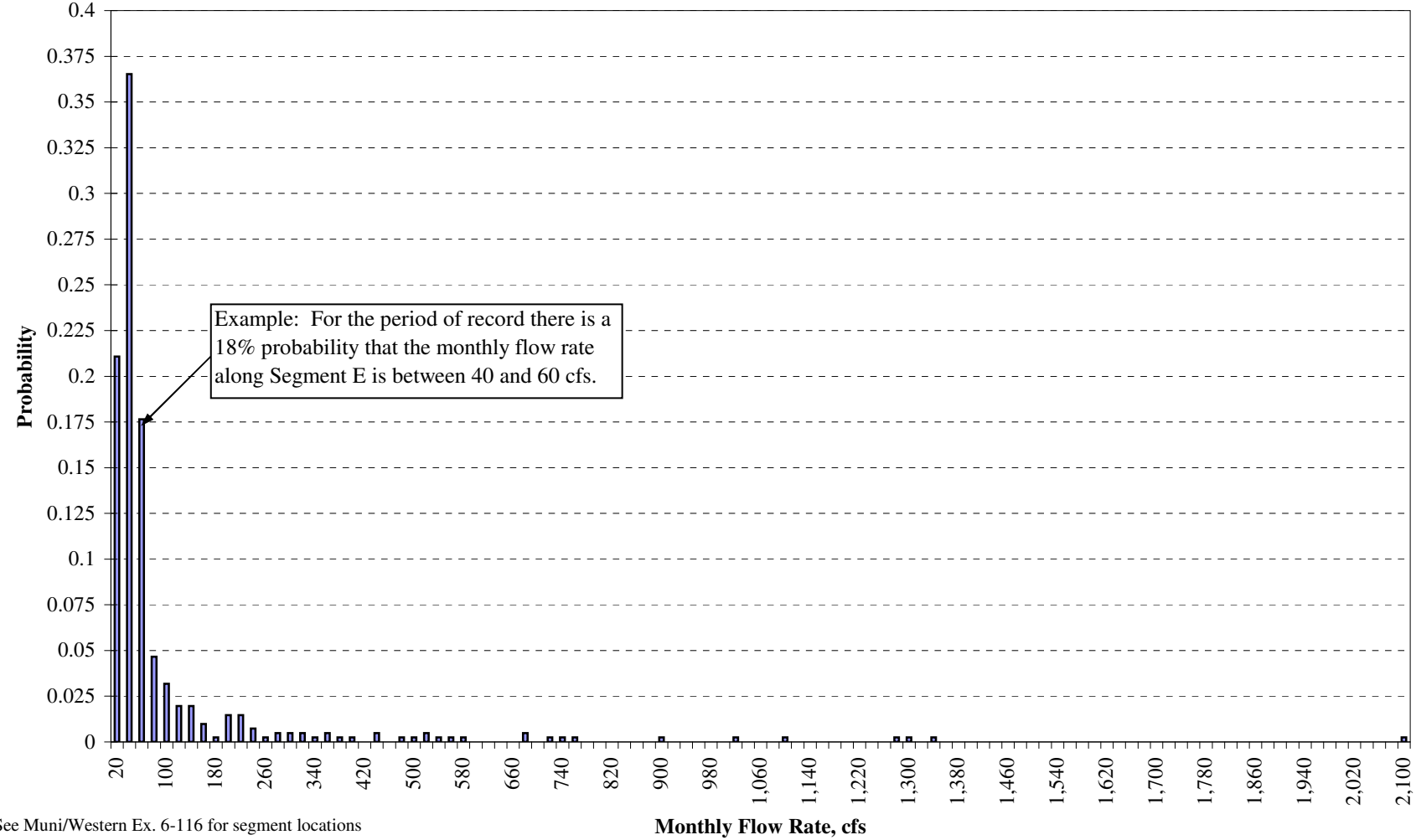
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1998-99
Historical Data
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-27

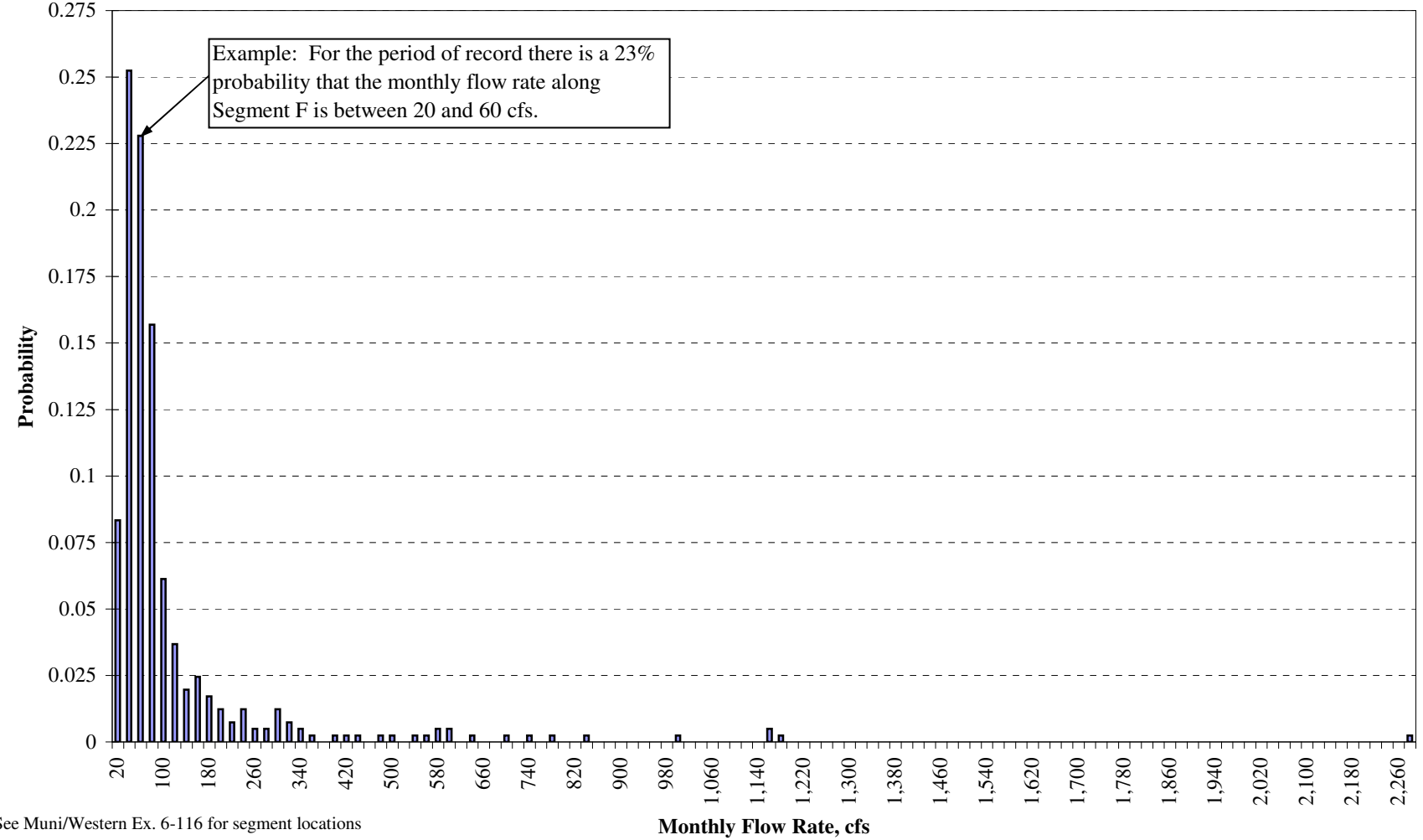
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Historical Data
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-28

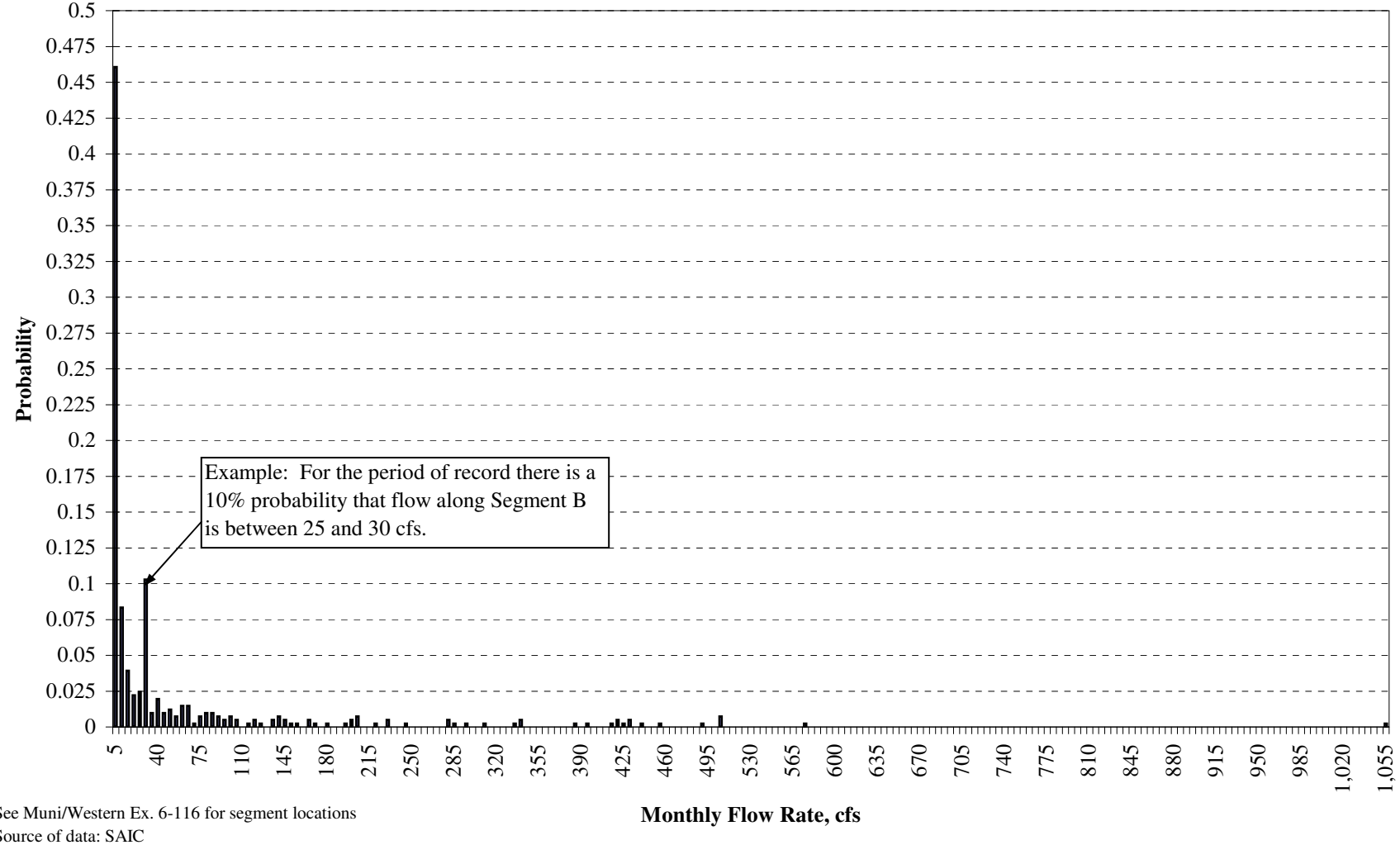
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Historical Data
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-29

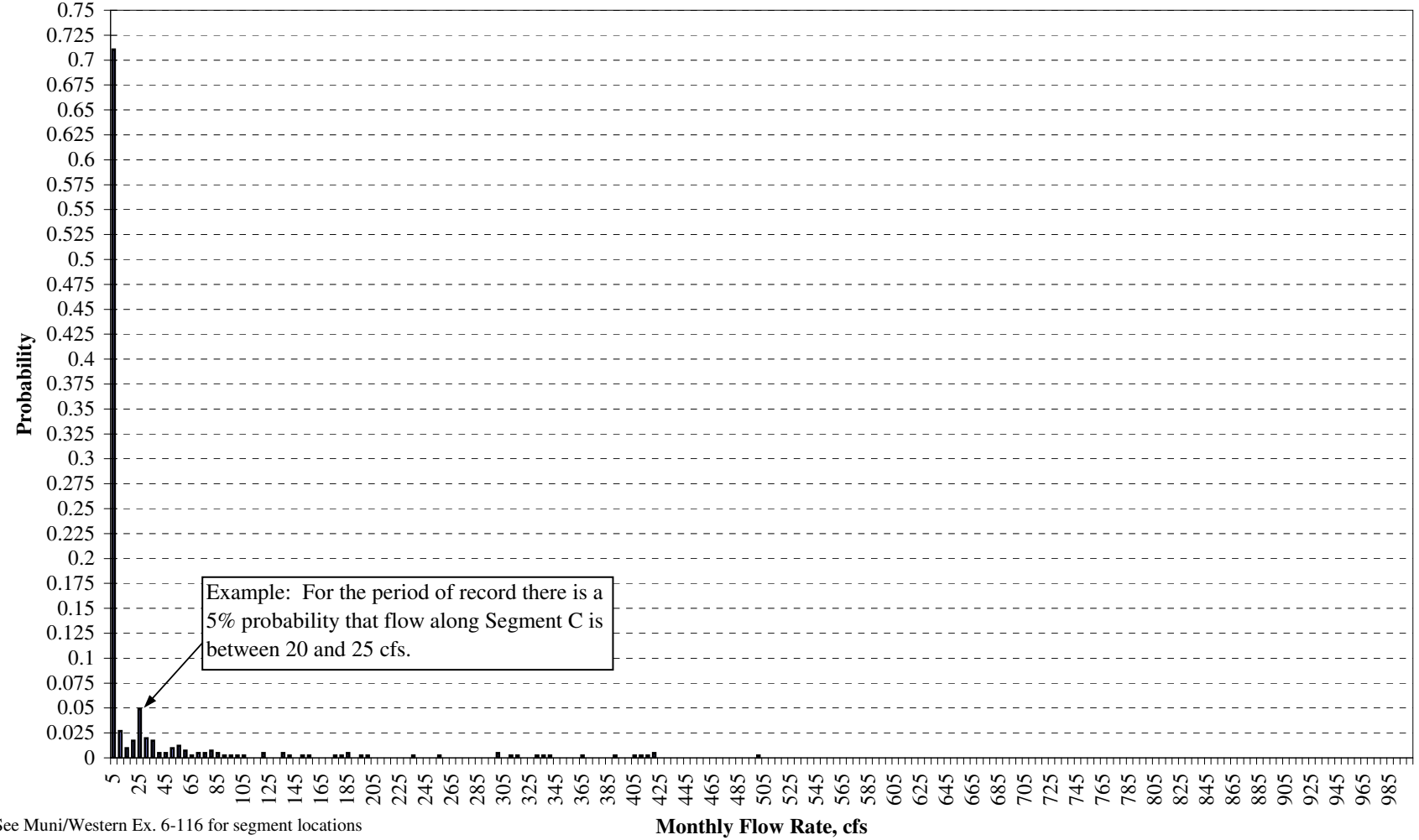
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
No Project Condition
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-30

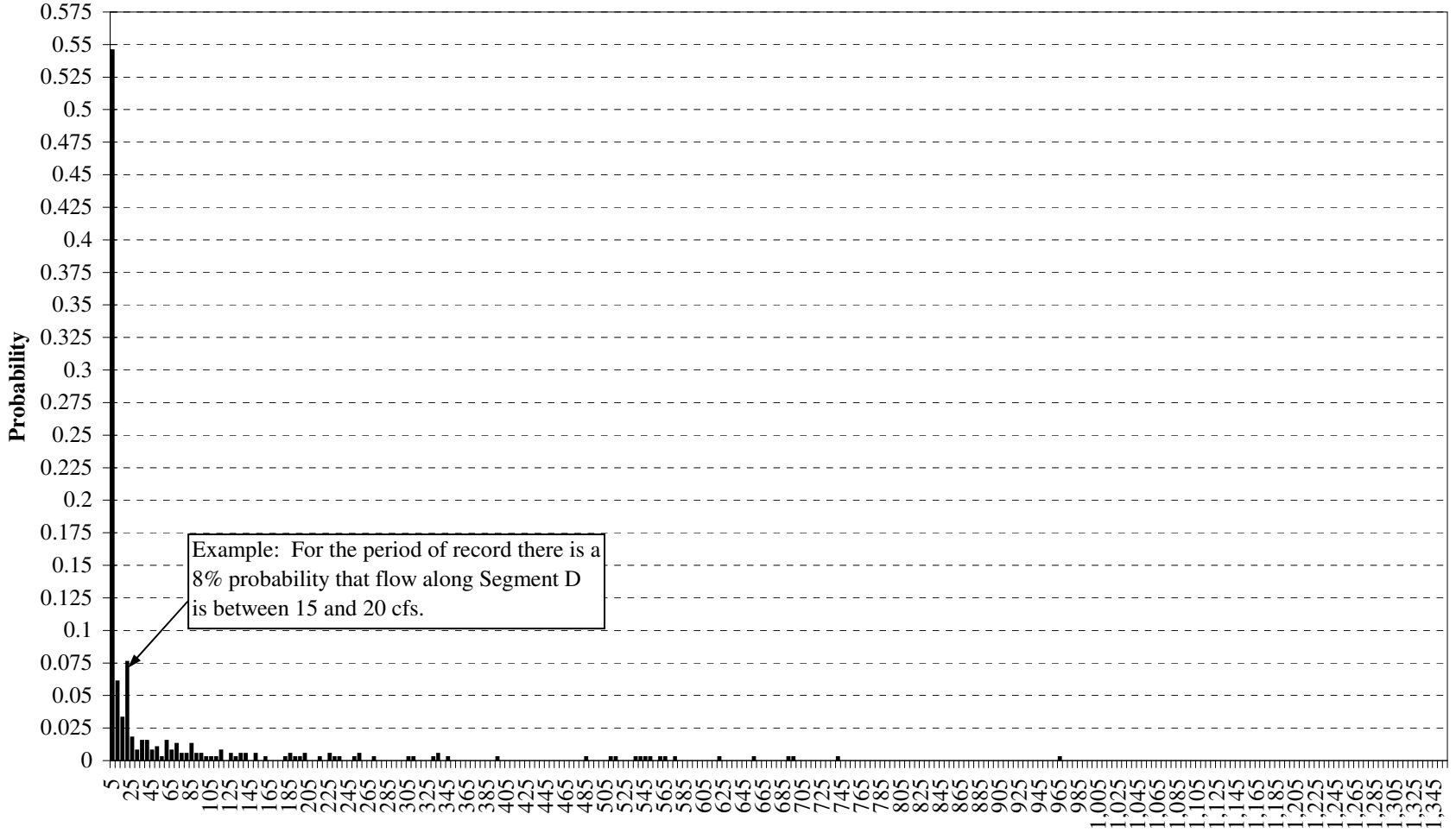
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
No Project Condition
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-31

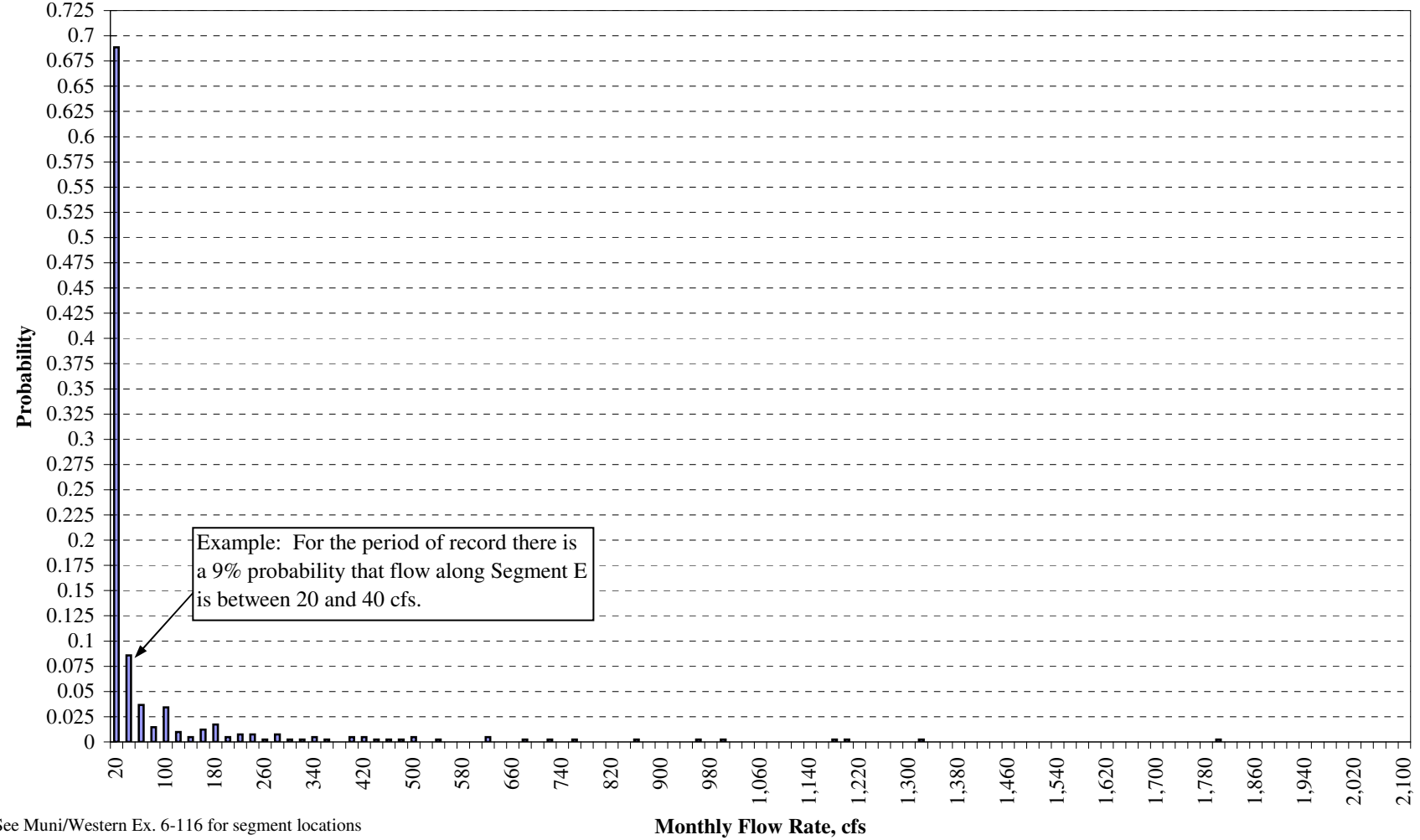
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1998-99
No Project Condition
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-32

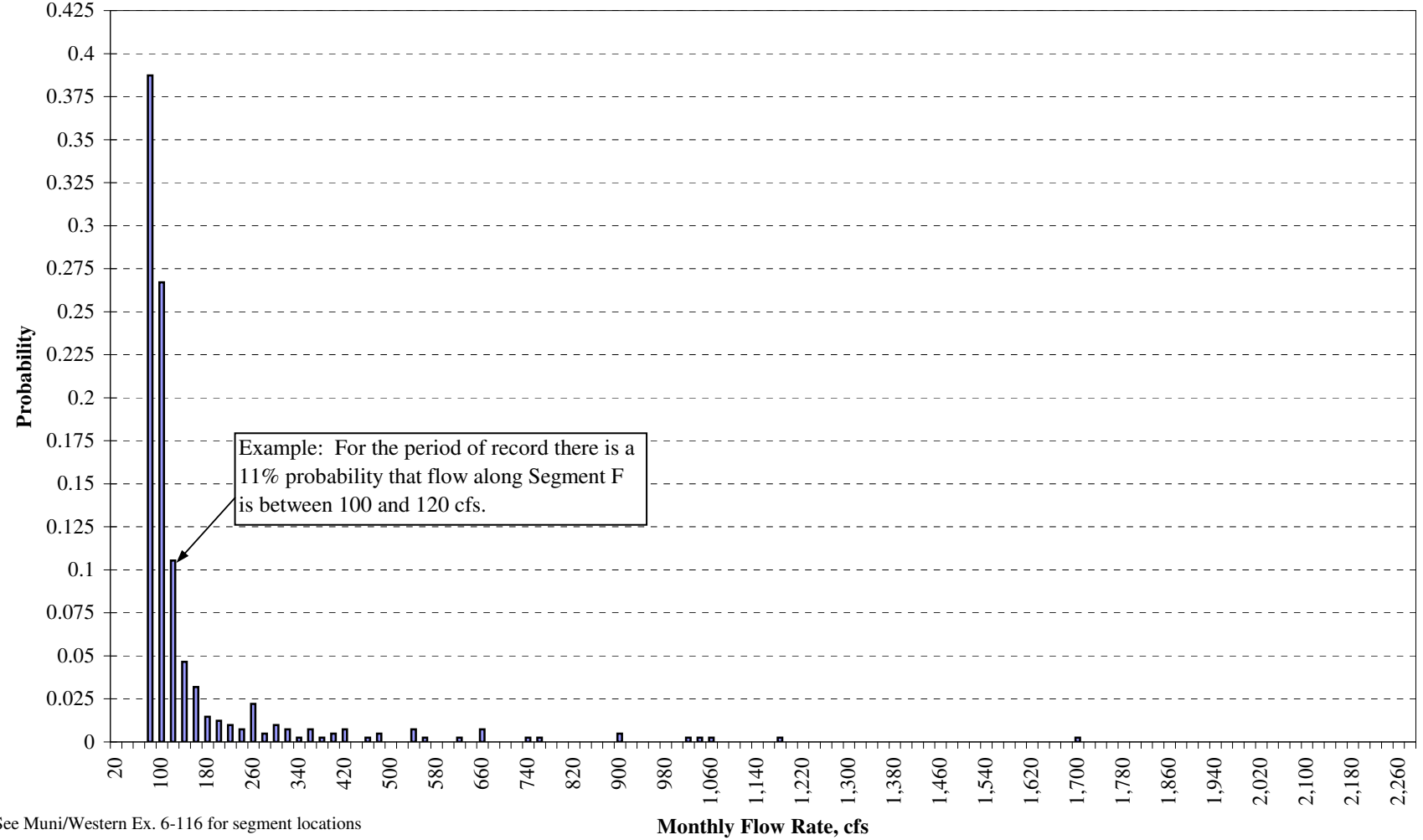
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
No Project Condition
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-33

Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
No Project Condition
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

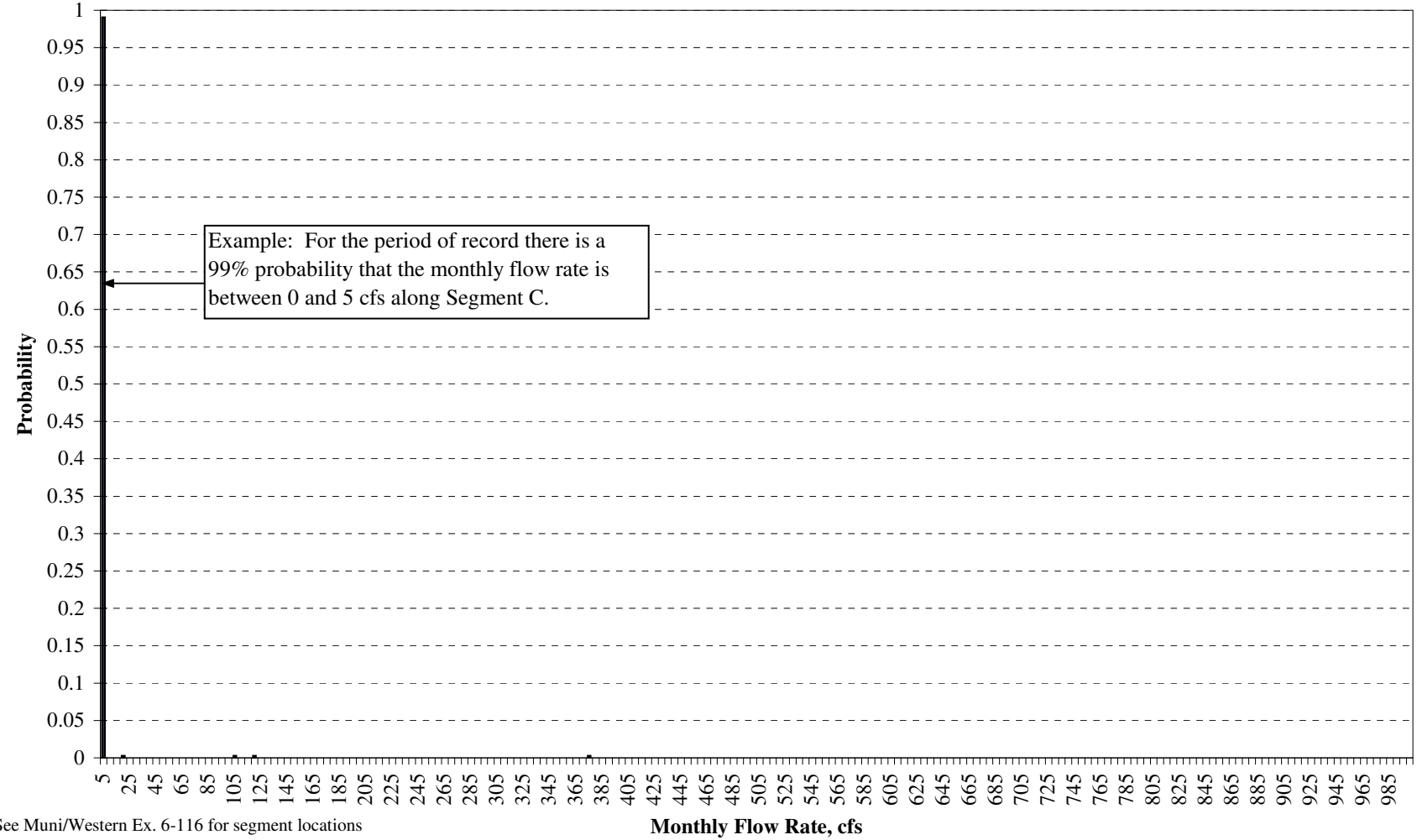
Muni/Western Ex. 6-34

Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Project Scenario A
Segment B: Above Cuttle Weir (Portion of Reach 5)

See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-35

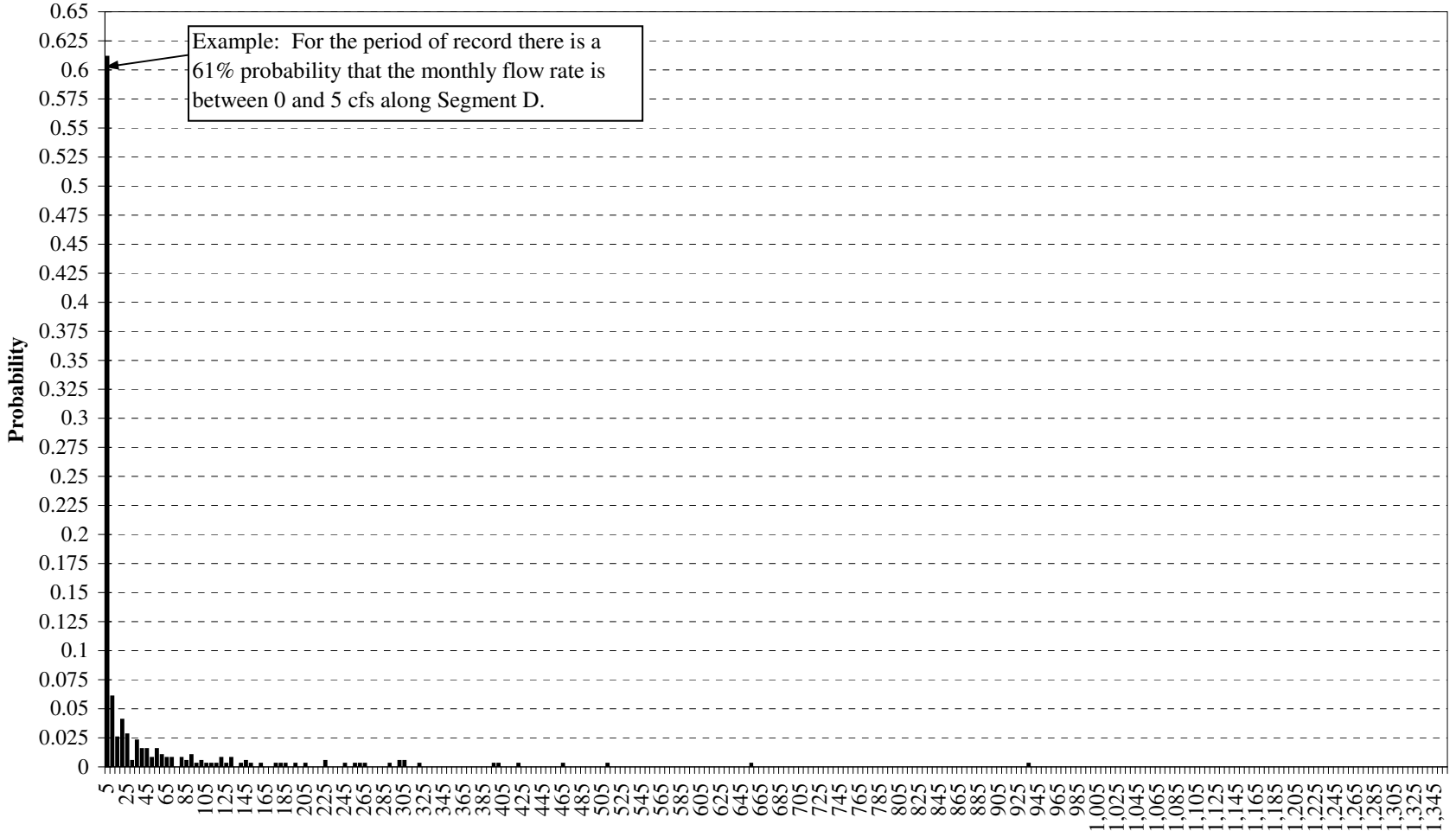
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Project Scenario A
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-36

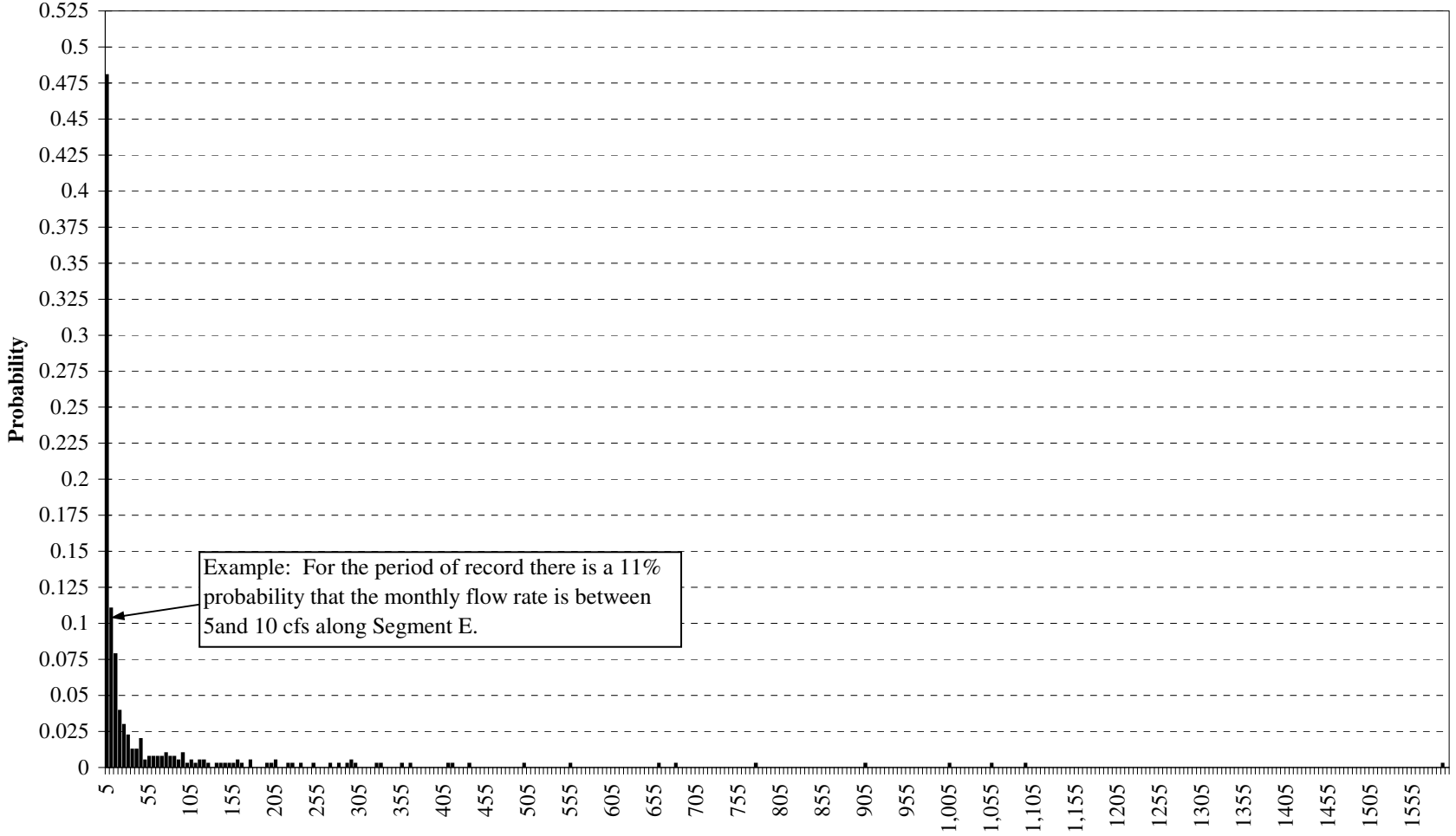
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1998-99
Project Scenario A
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-37

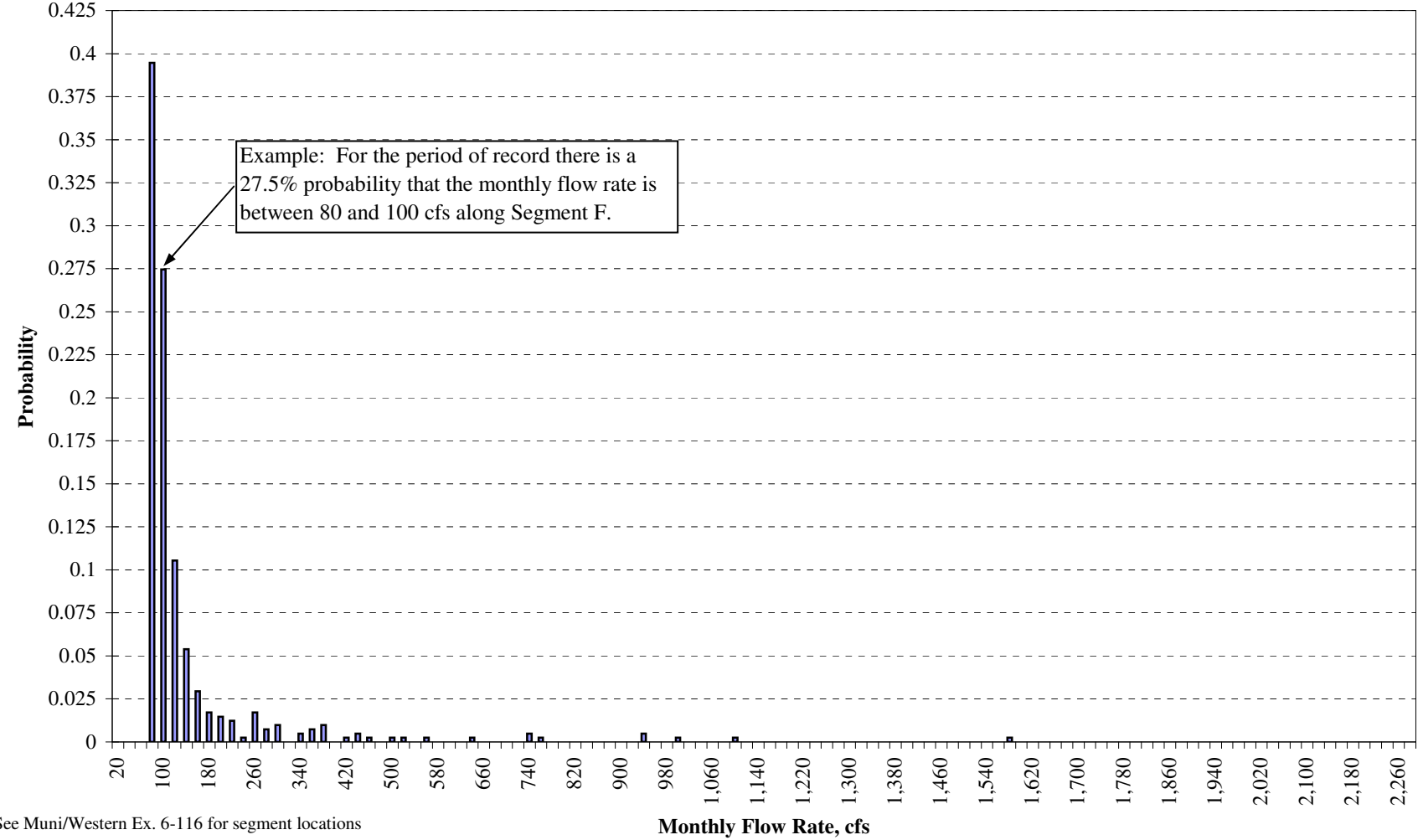
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Project Scenario A
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-38

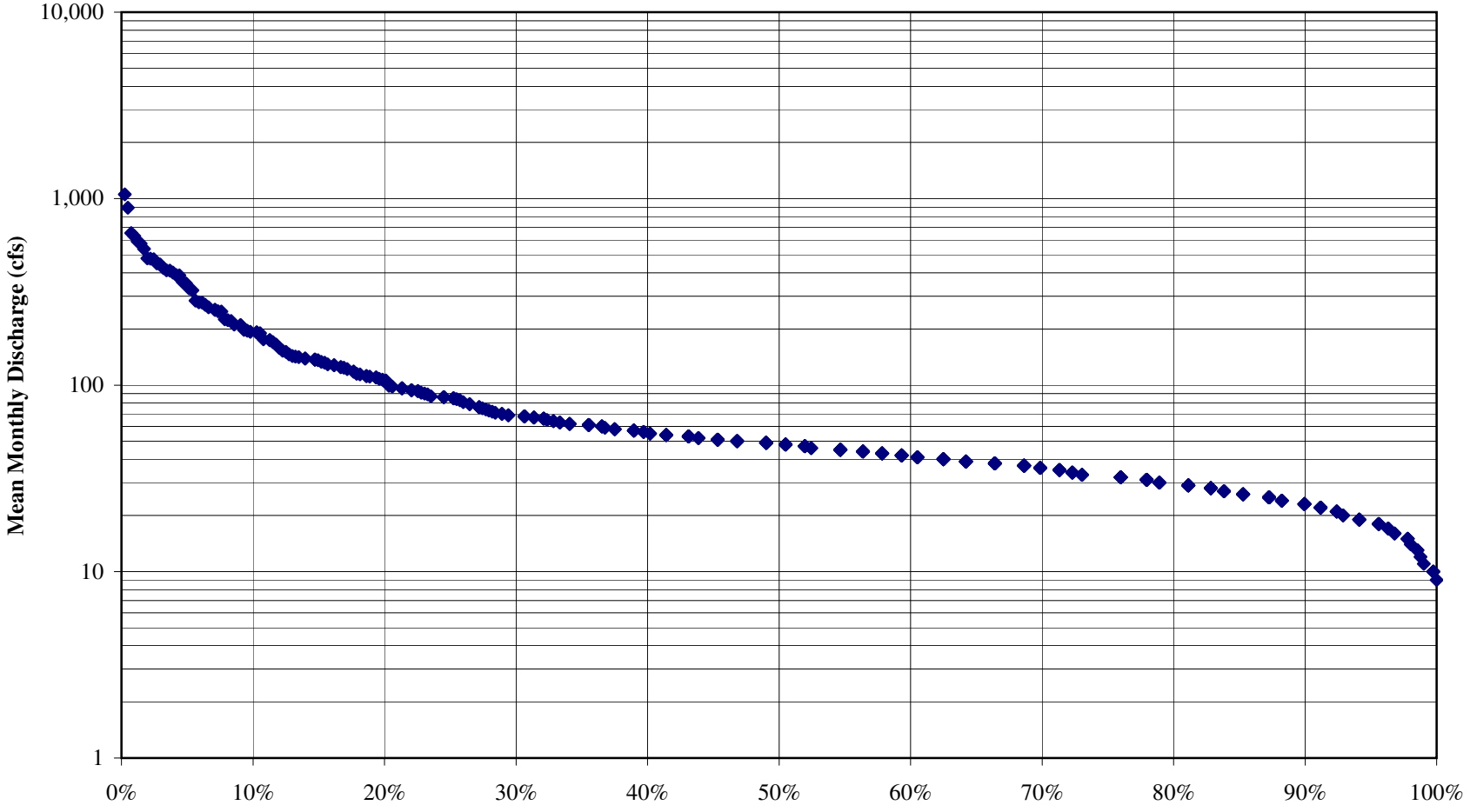
Upper Santa Ana River - Monthly Flow Rate Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Project Scenario A
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-39

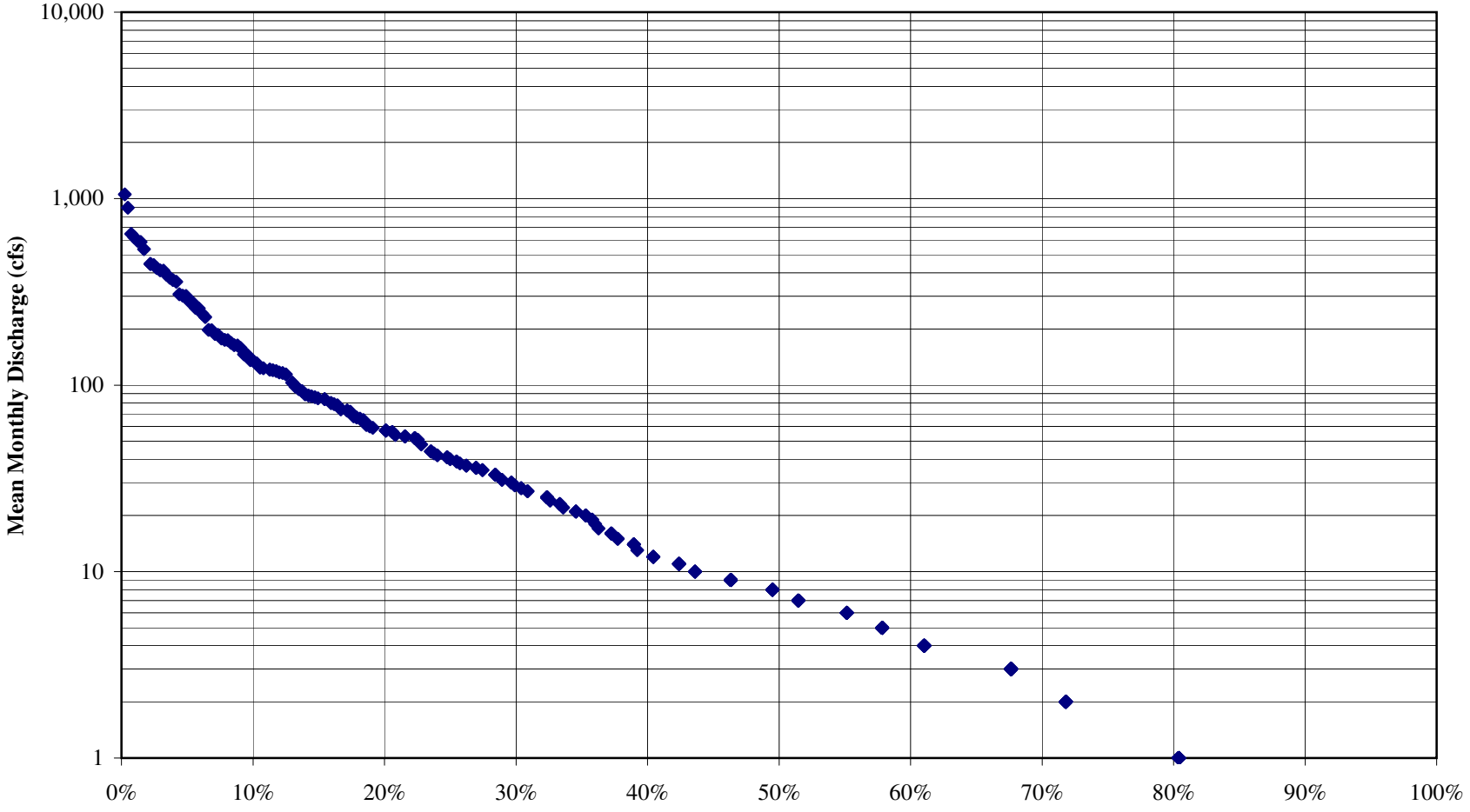
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment A: Upstream of Seven Oaks (Reach 6)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-40

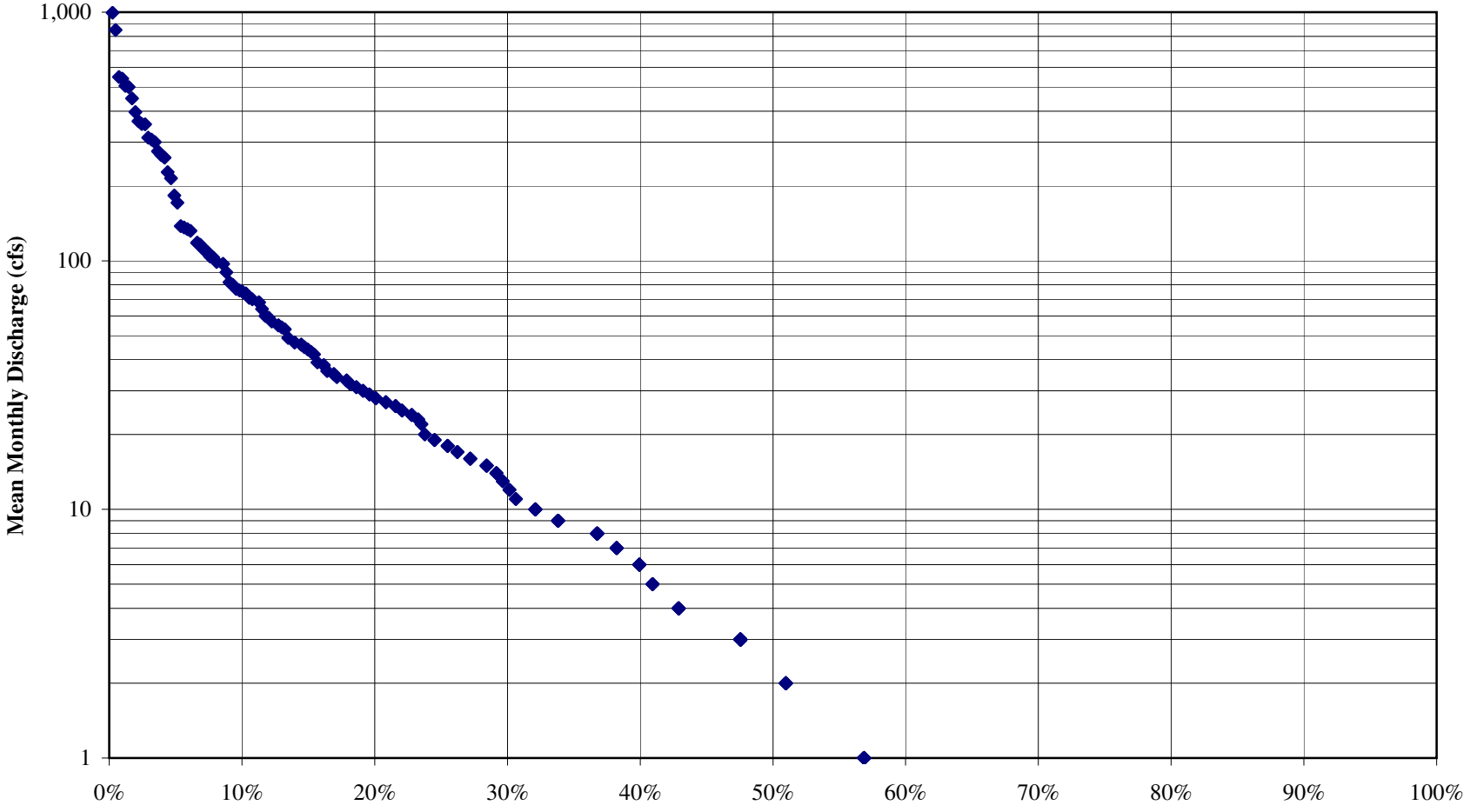
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-41

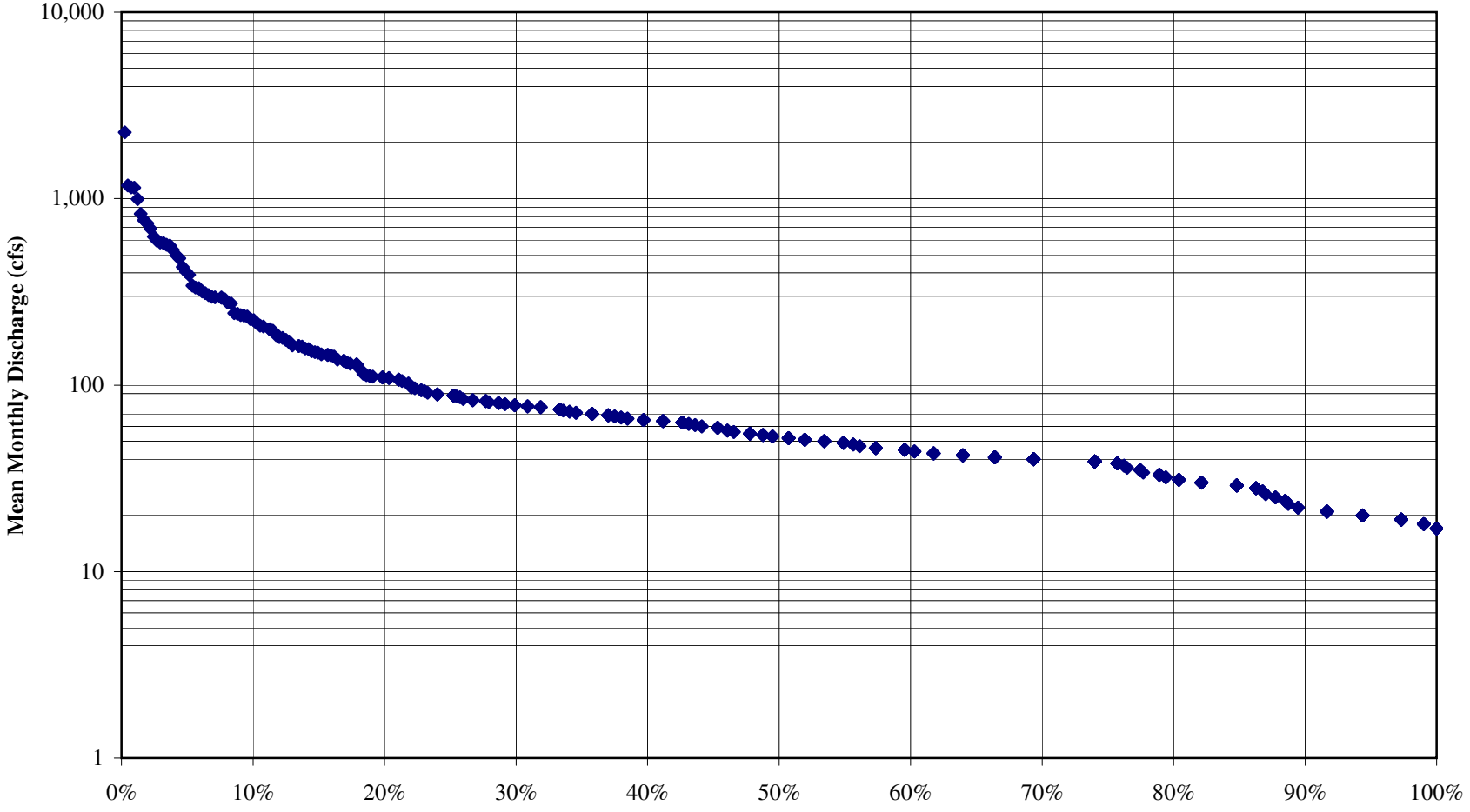
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-42

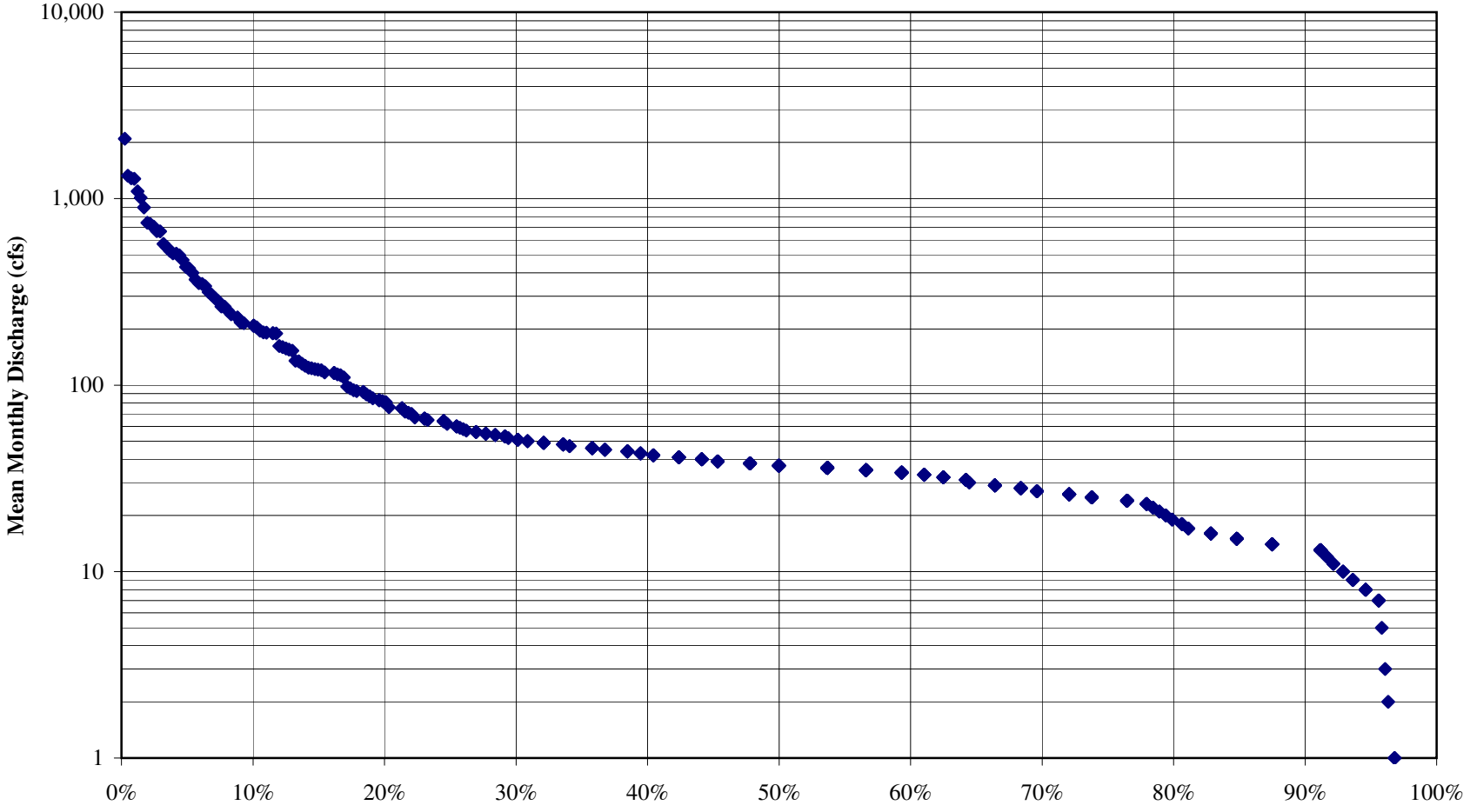
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1998-1999
Historical Data
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-43

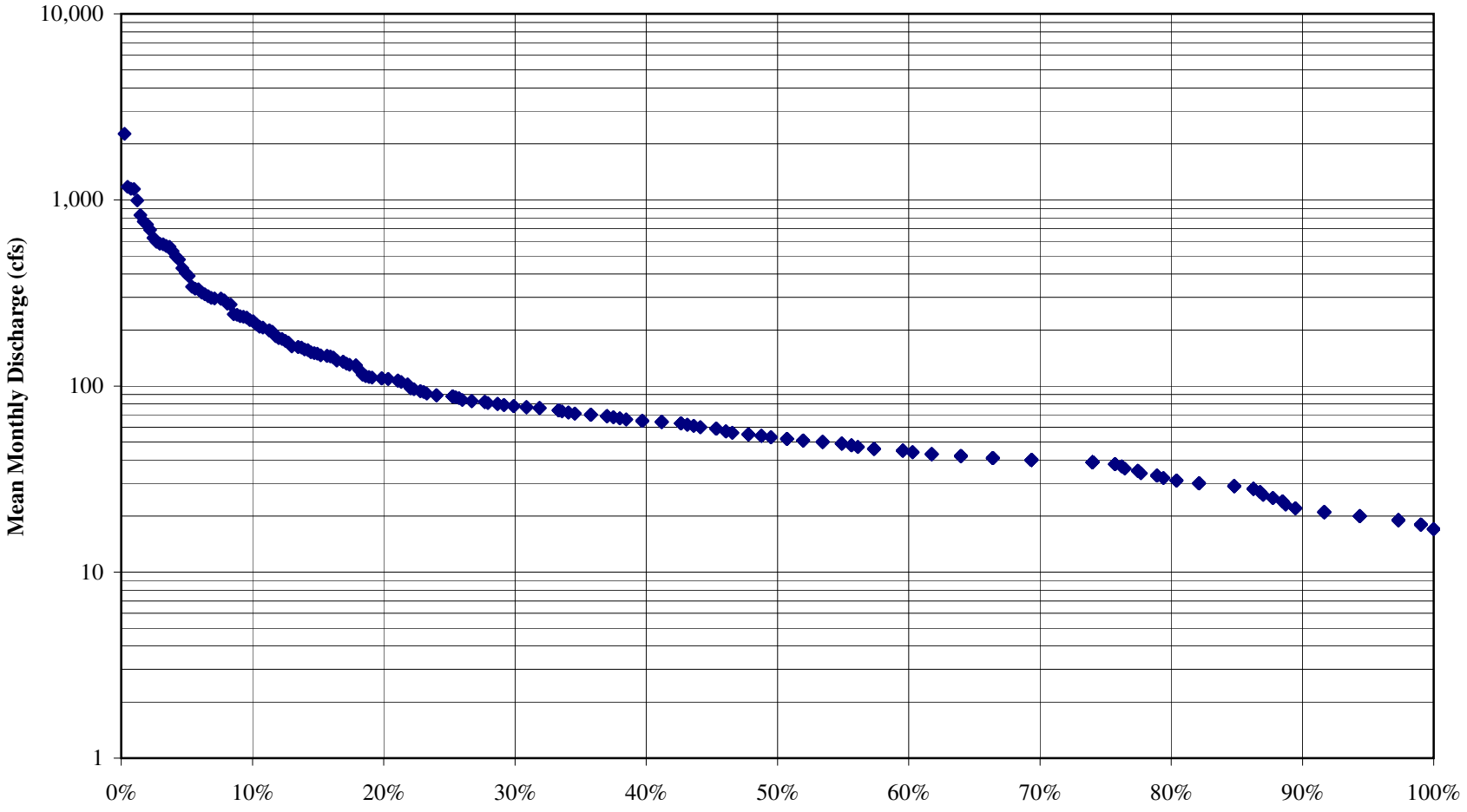
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-44

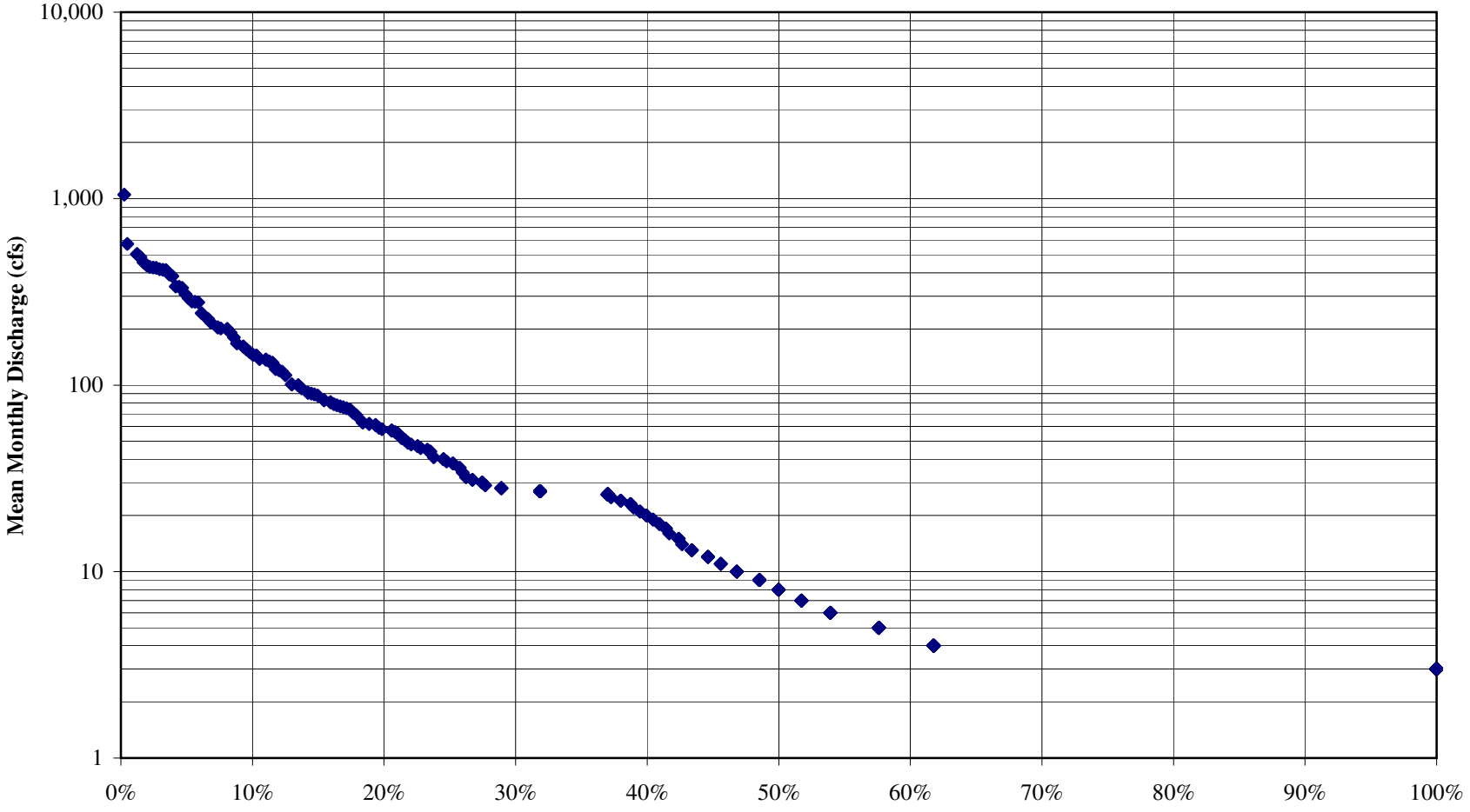
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-45

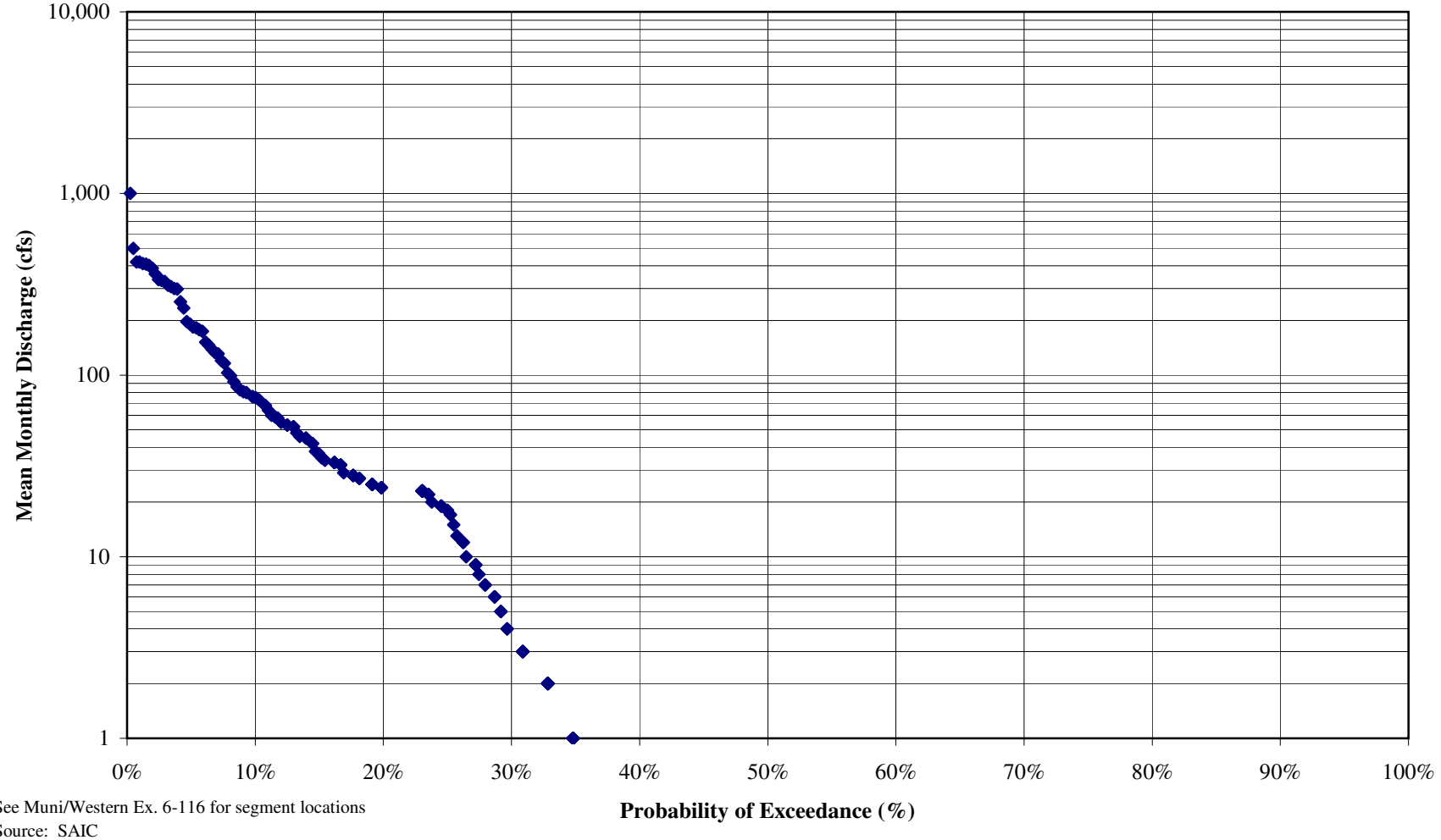
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
No Project Condition
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-46

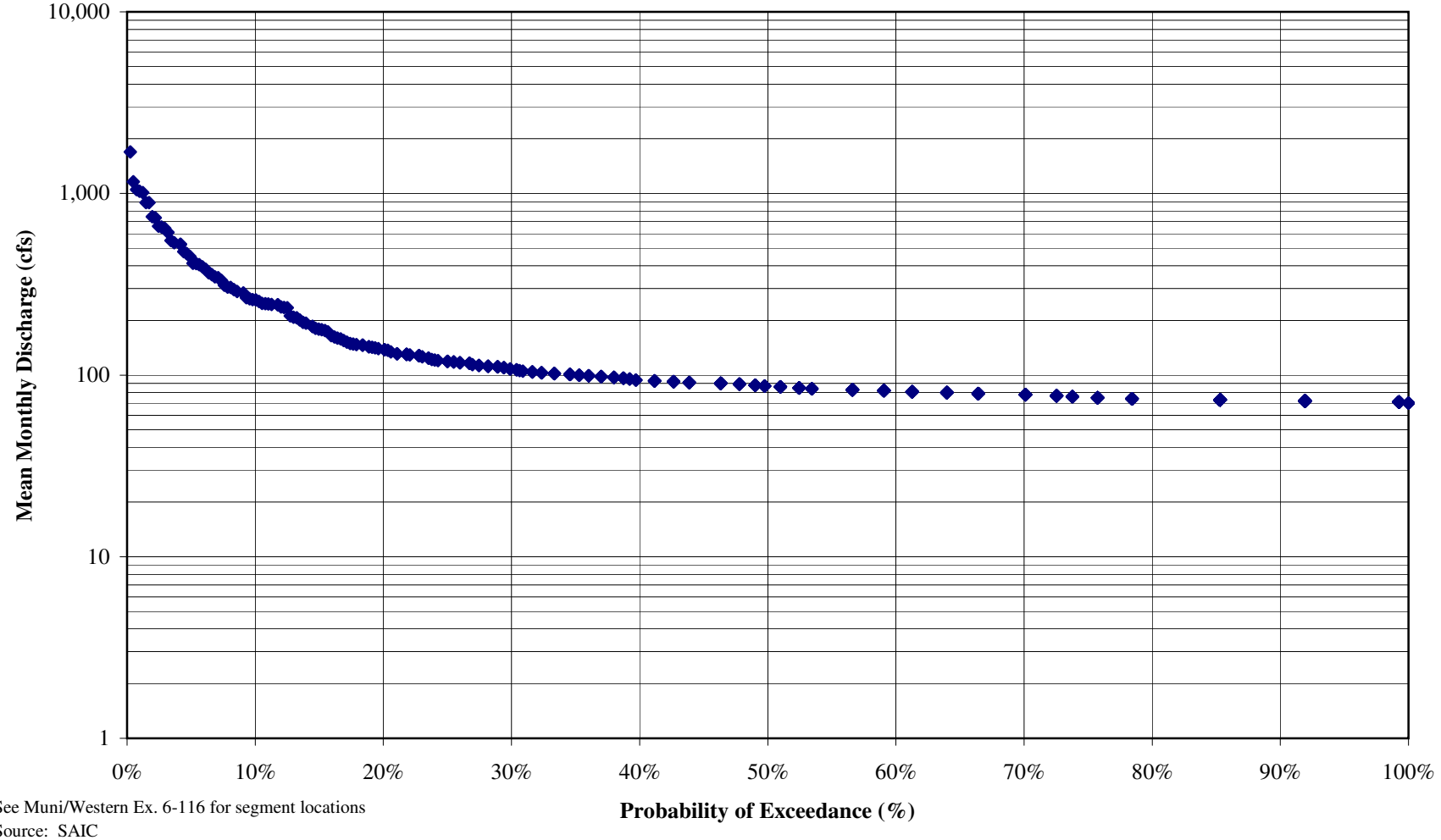
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
No Project Condition
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-47

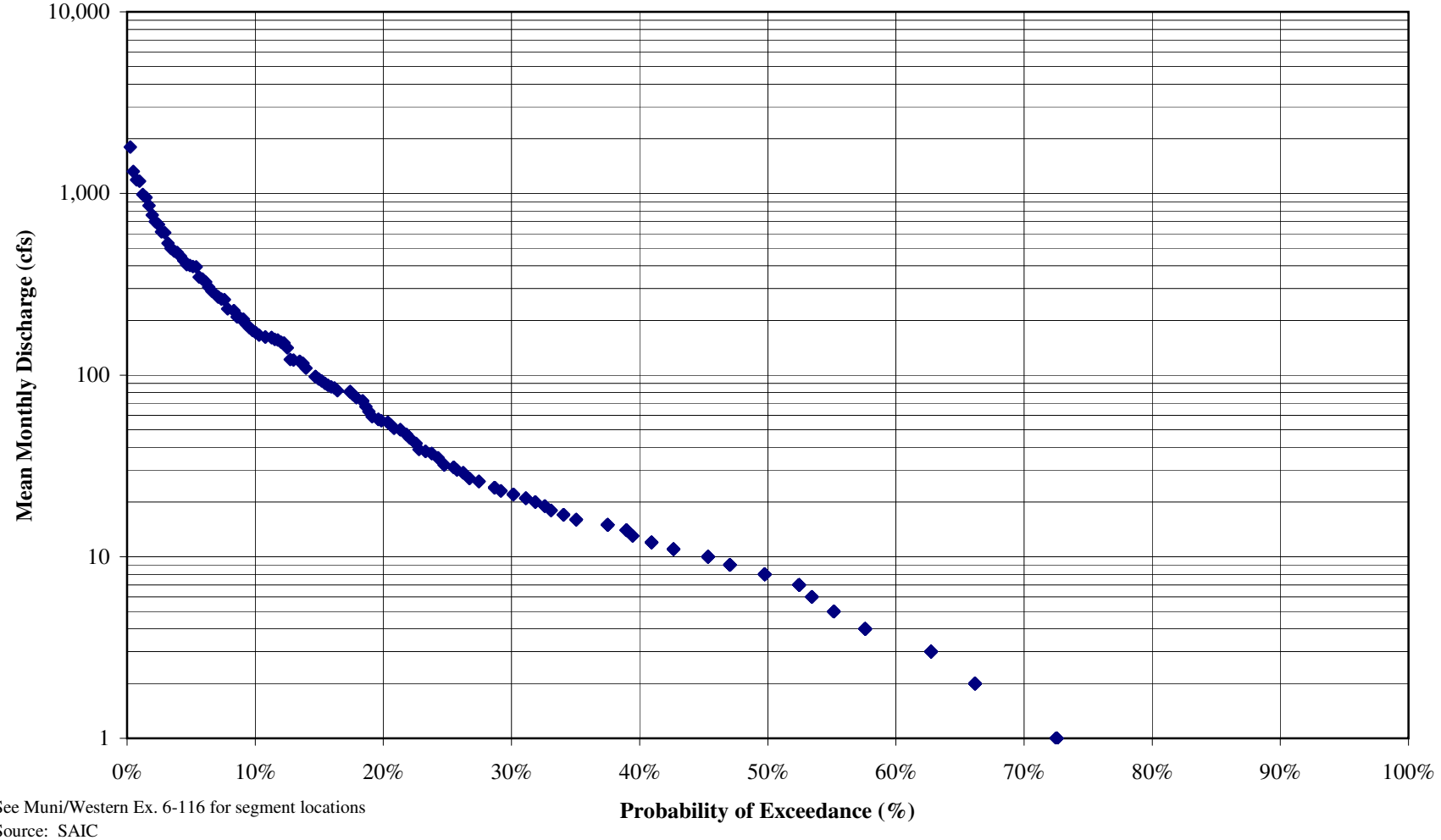
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1998-1999
No Project Condition
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-48

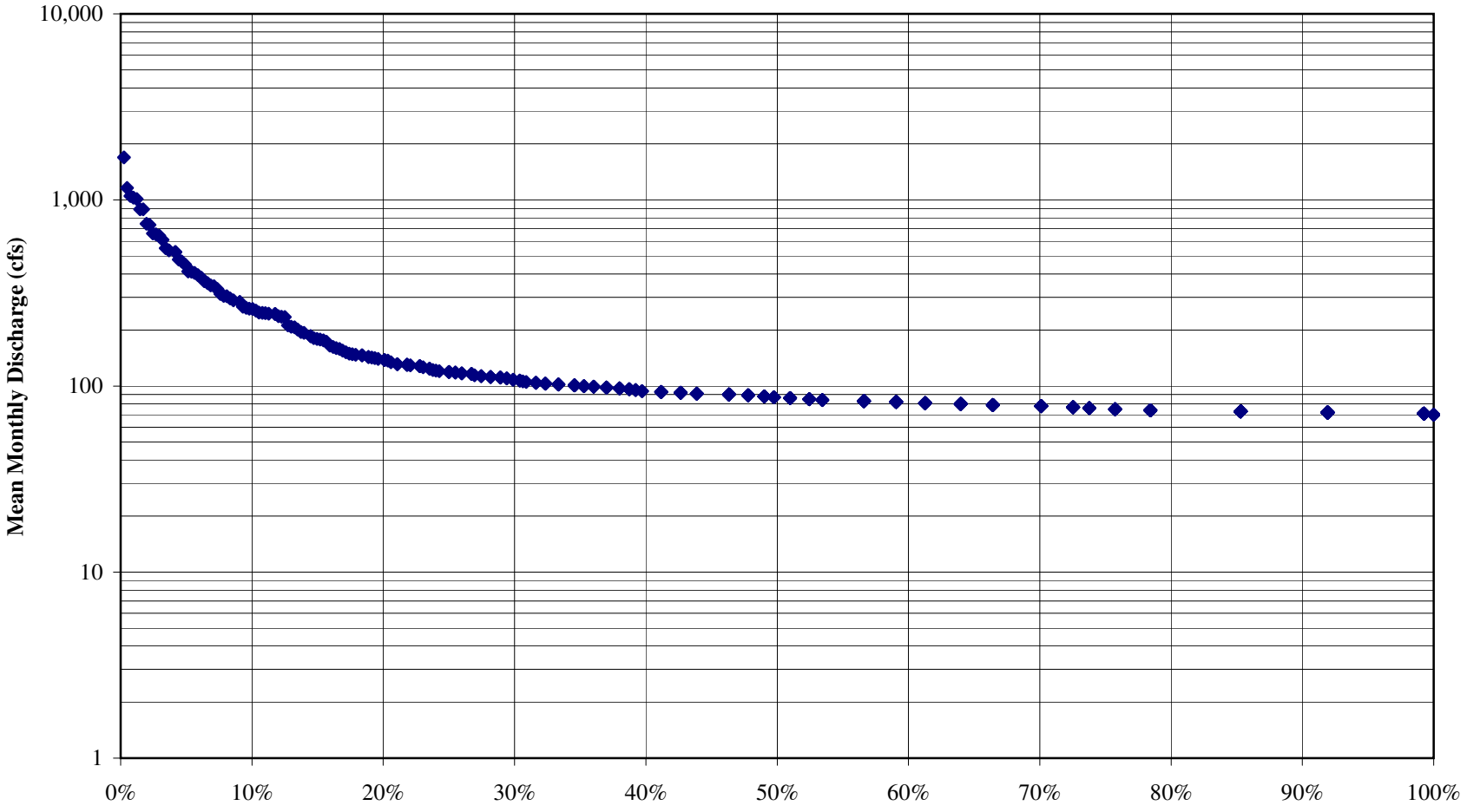
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
No Project Condition
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-49

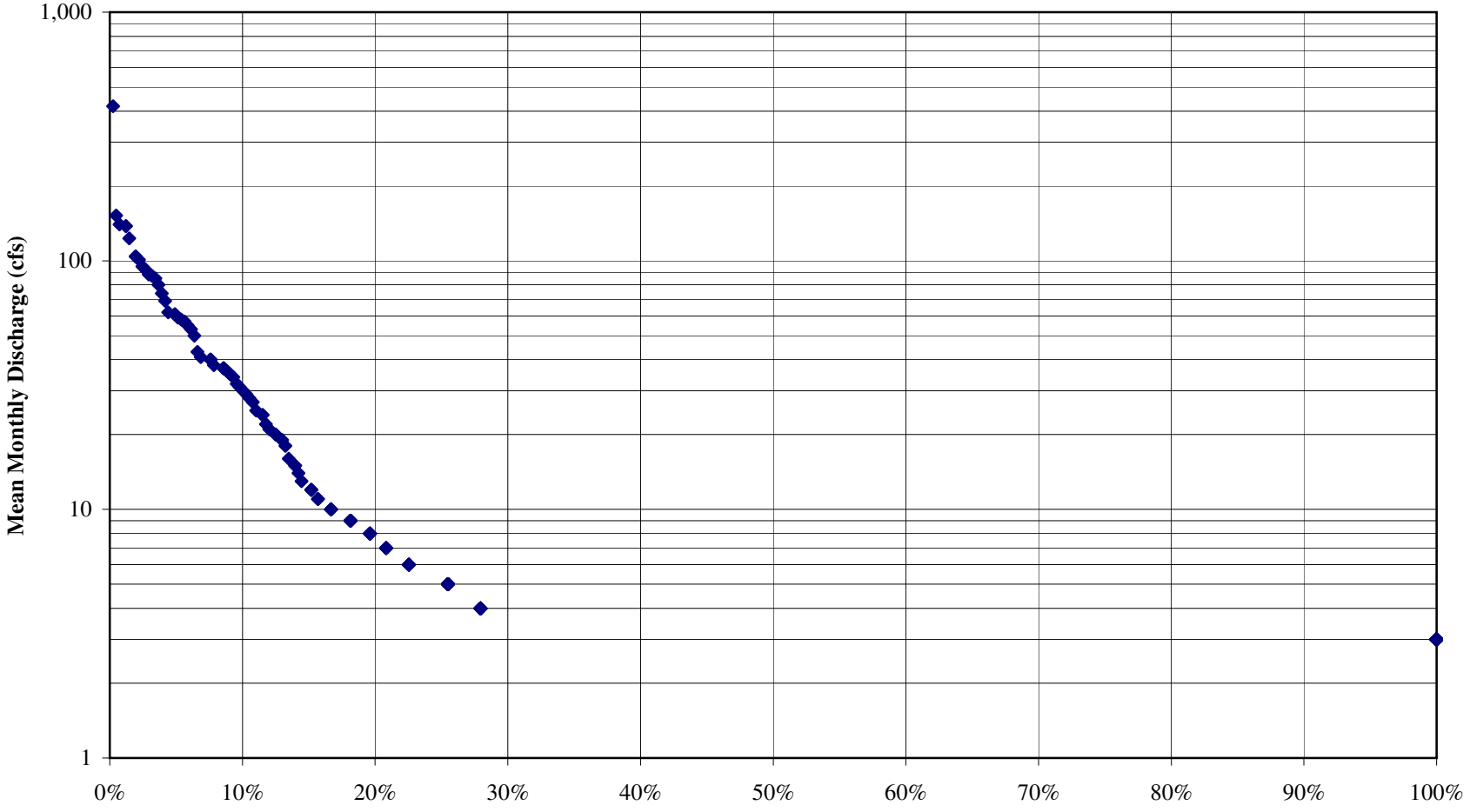
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
No Project Condition
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-50

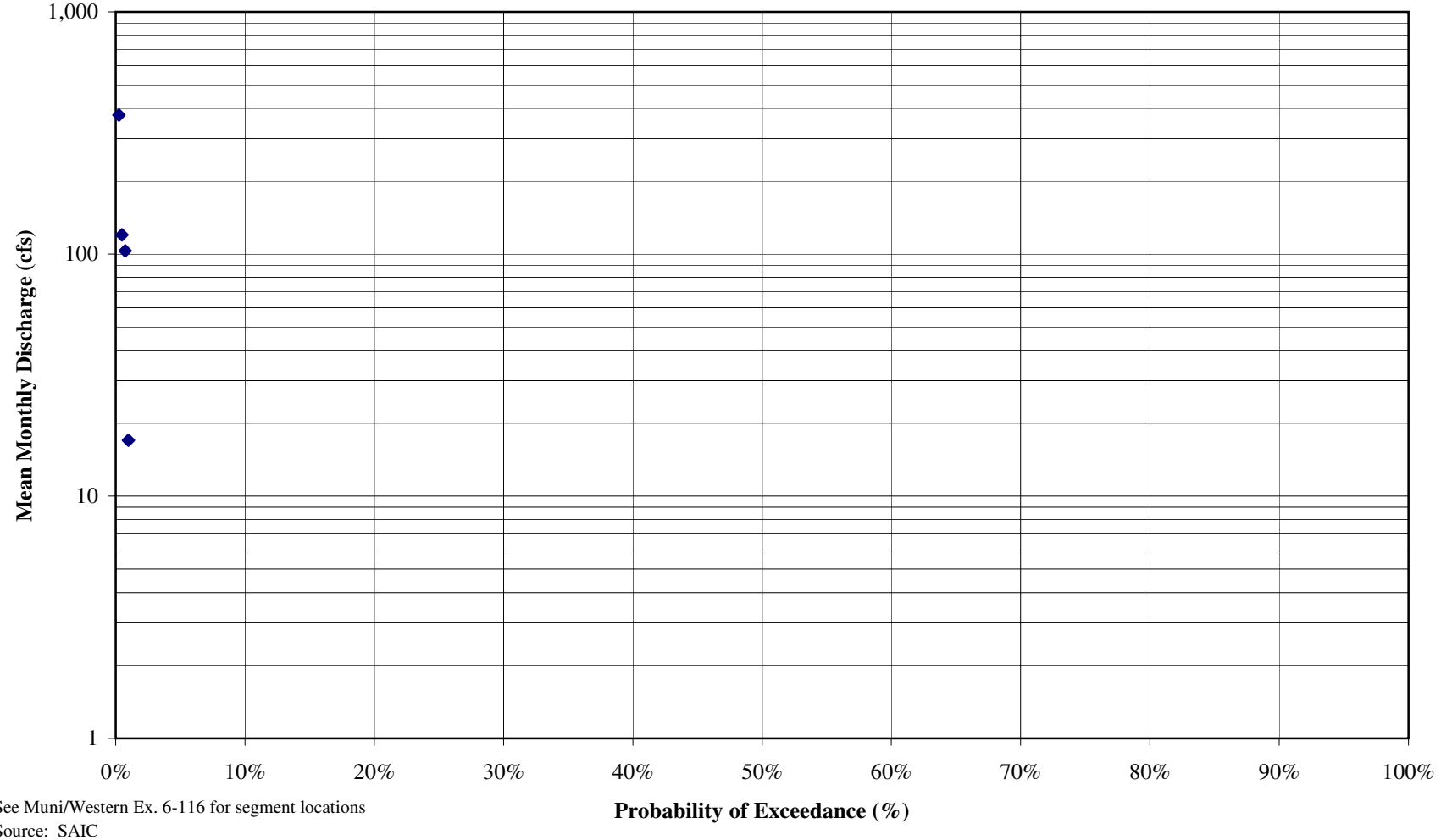
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
Project Scenario A
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-51

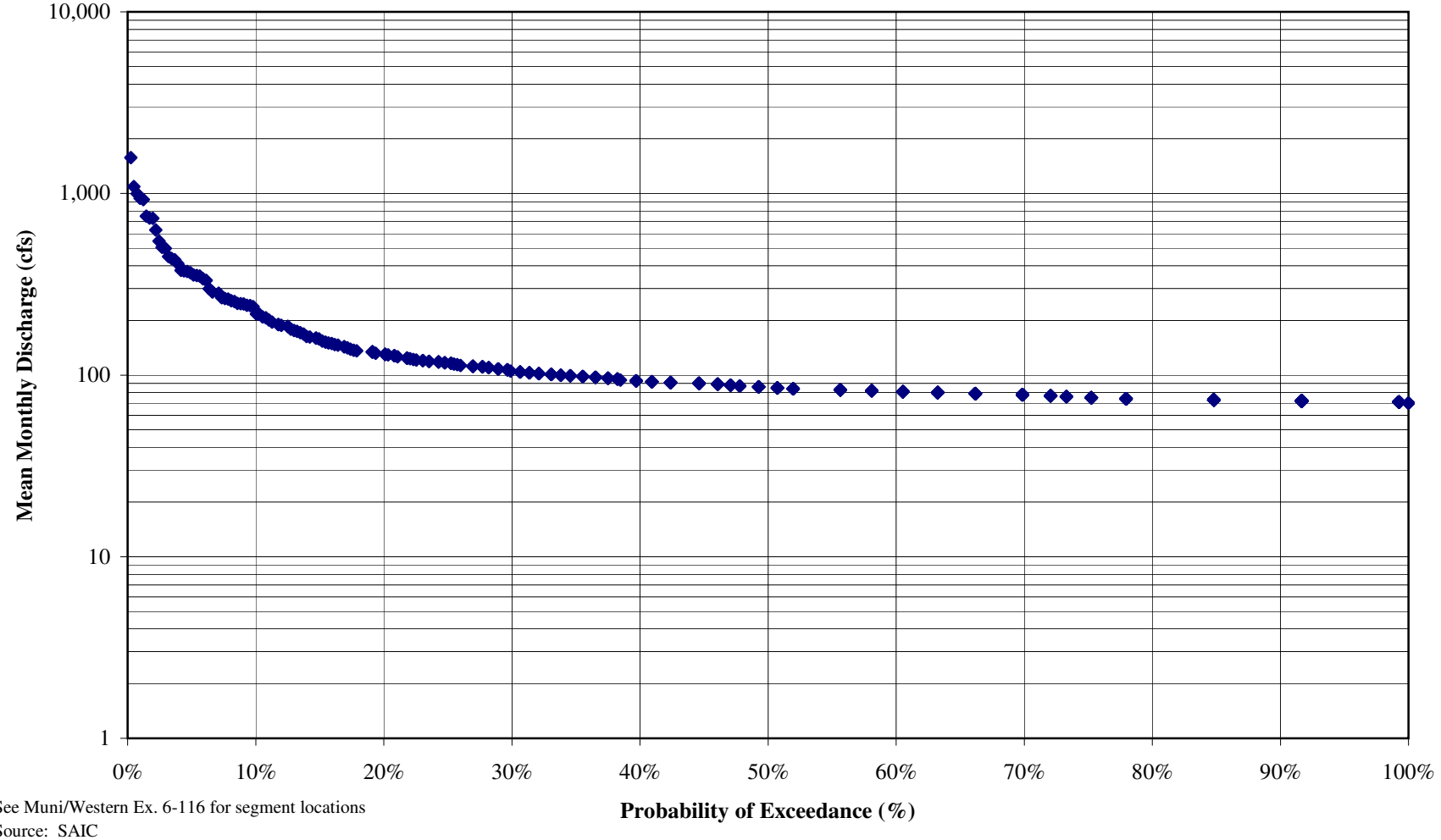
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
Project Scenario A
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-52

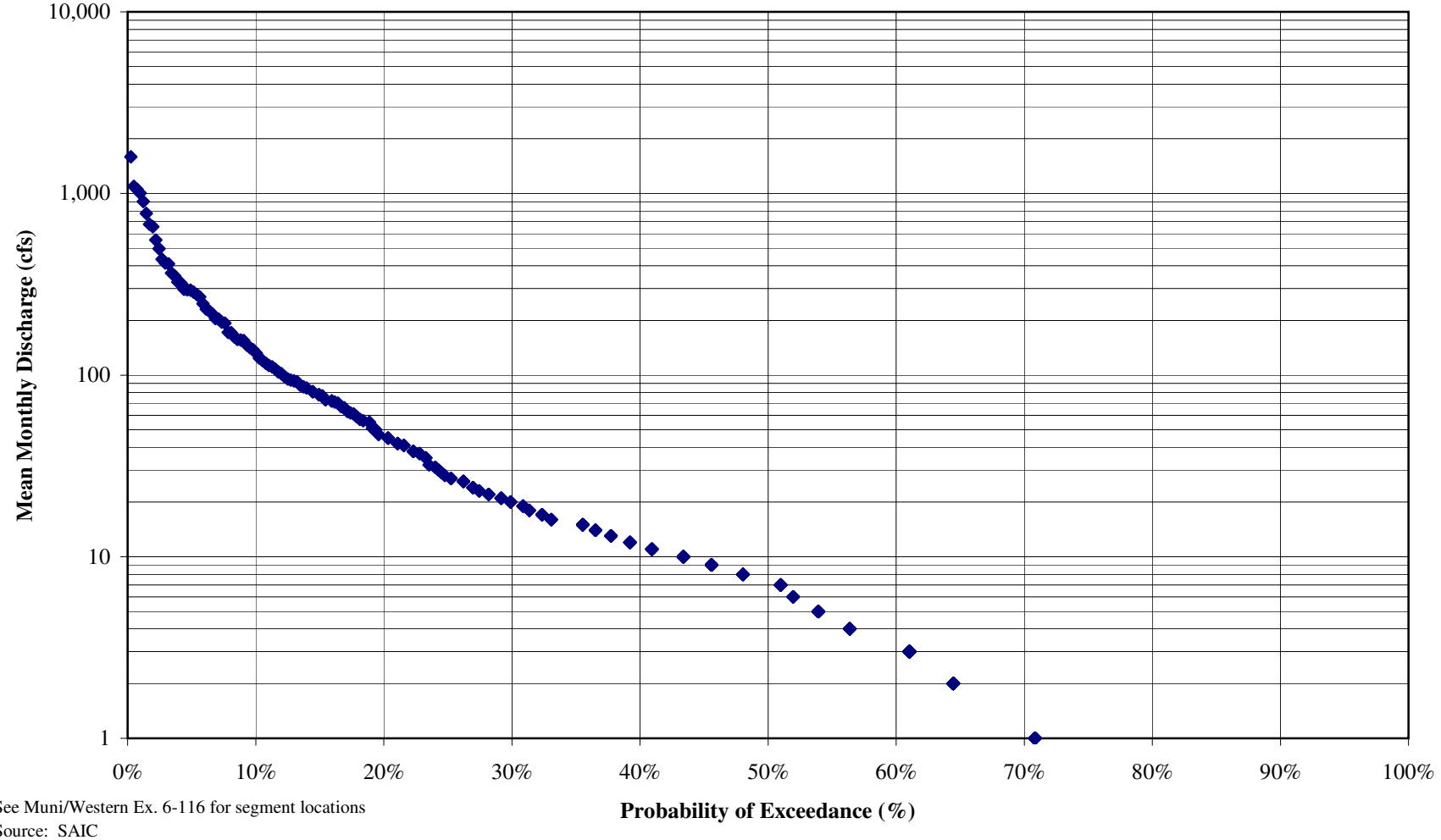
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1998-1999
Project Scenario A
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-53

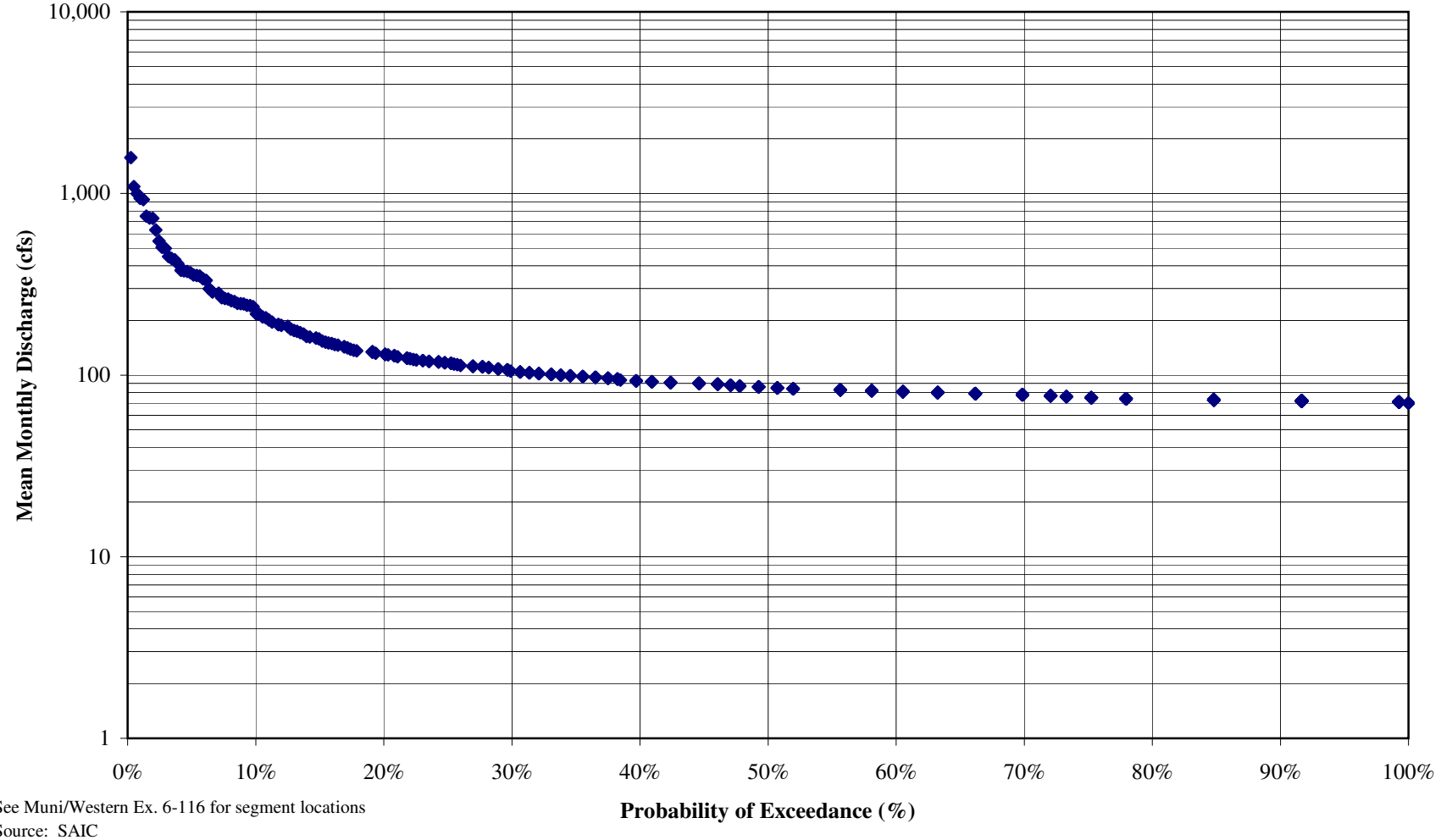
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
Project Scenario A
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-54

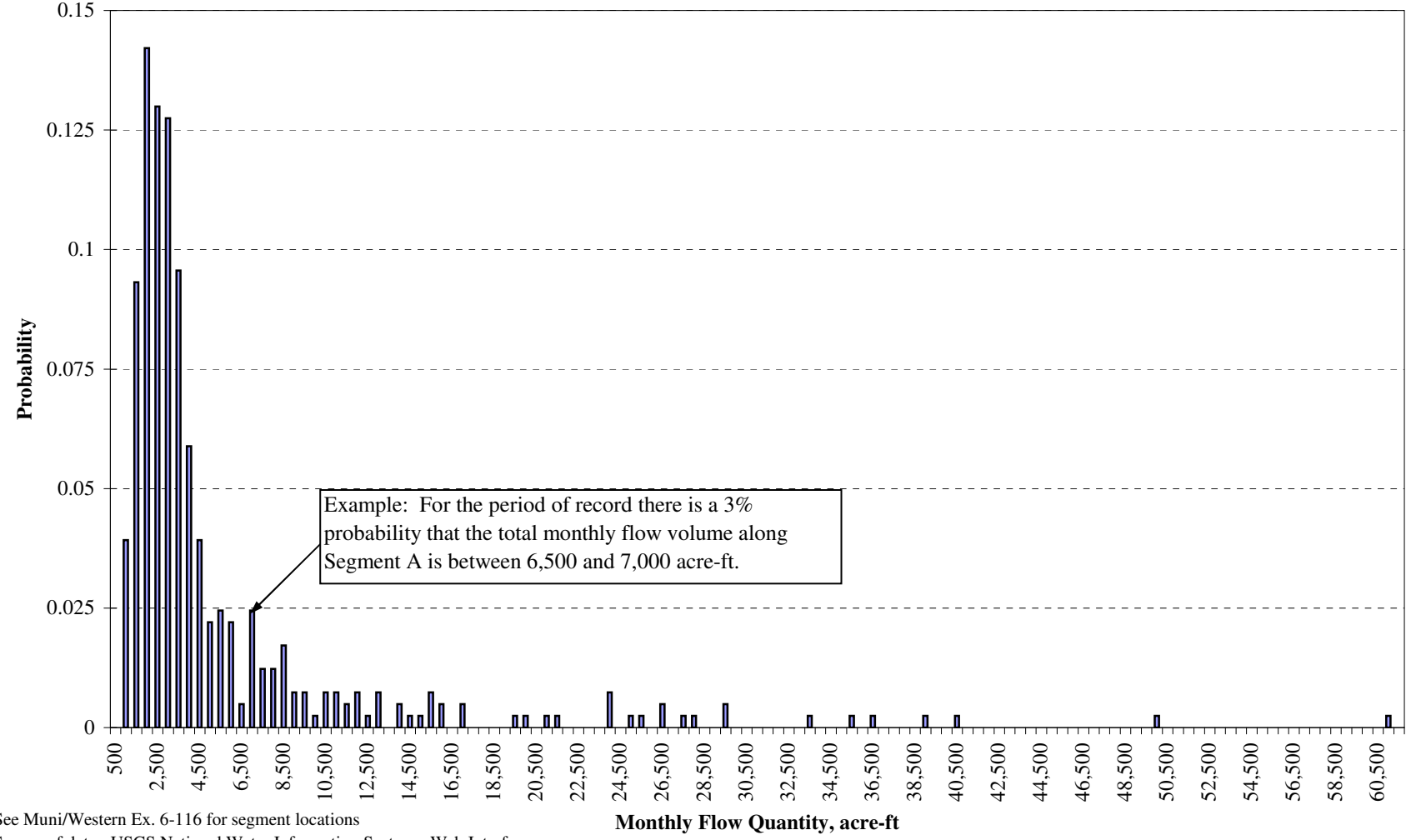
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Rates
Water Year 1966-67 to Water Year 1999-2000
Project Scenario A
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-55

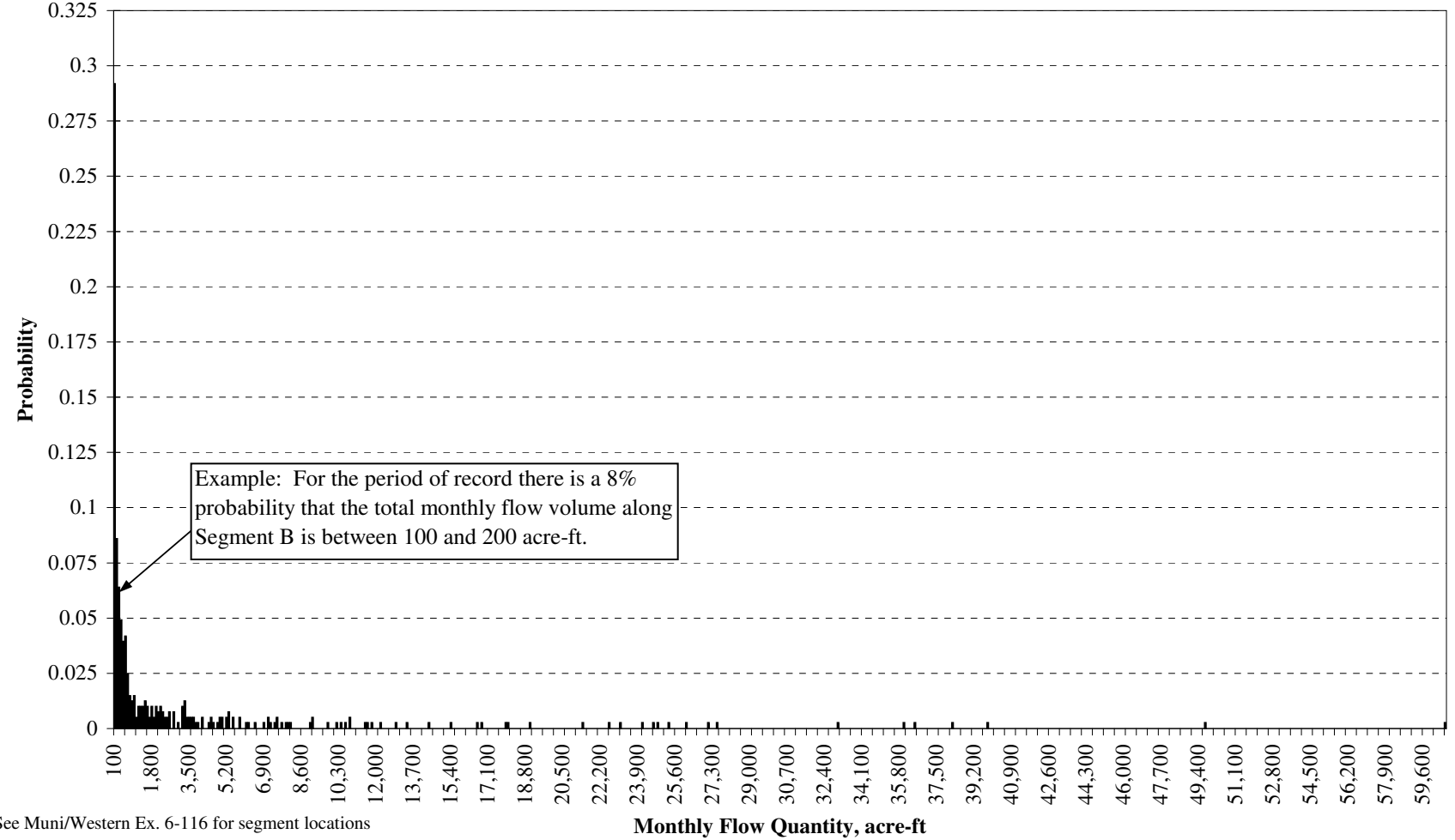
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Historical Data
Segment A: Upstream of Seven Oaks (Reach 6)



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-56

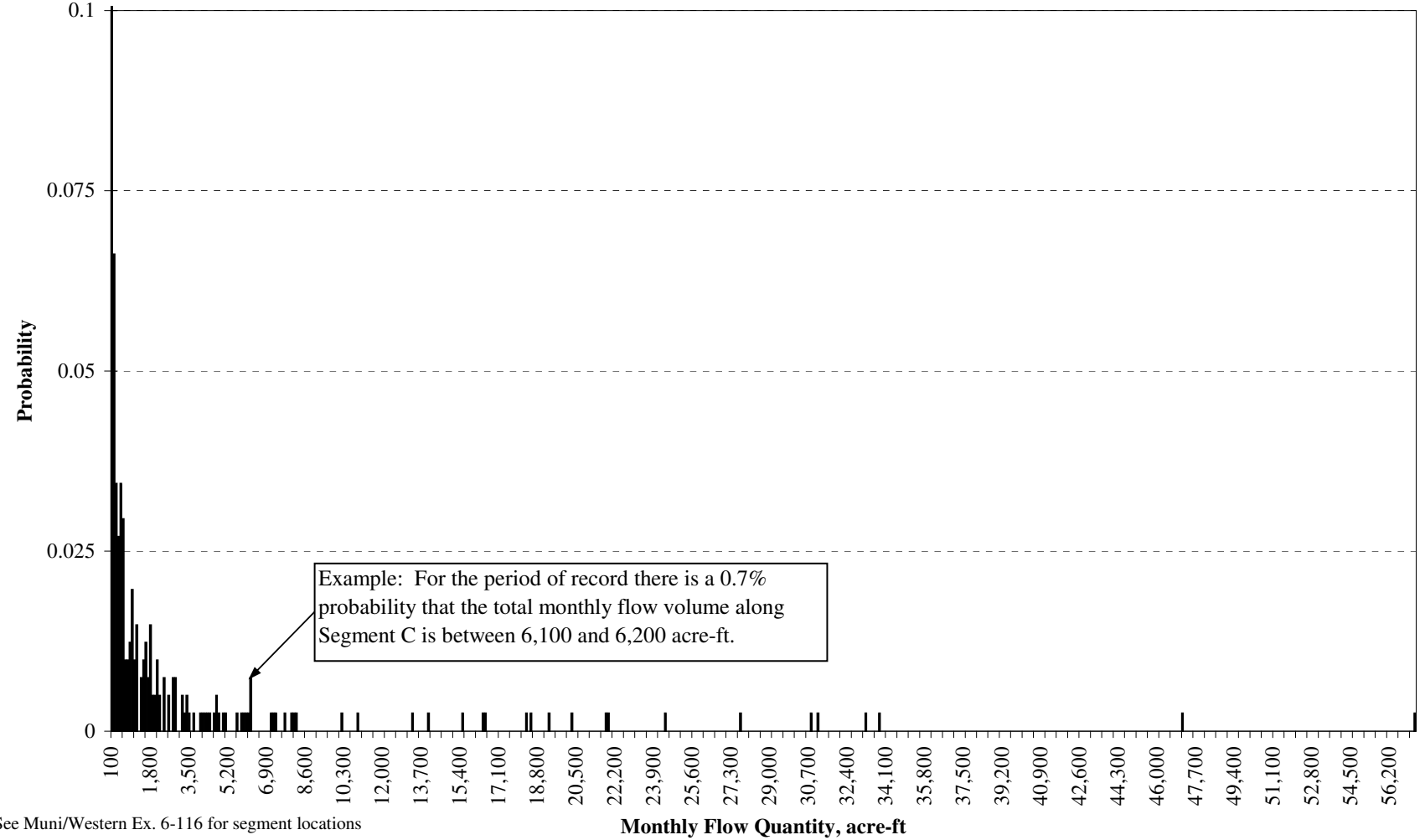
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Historical Data
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-57

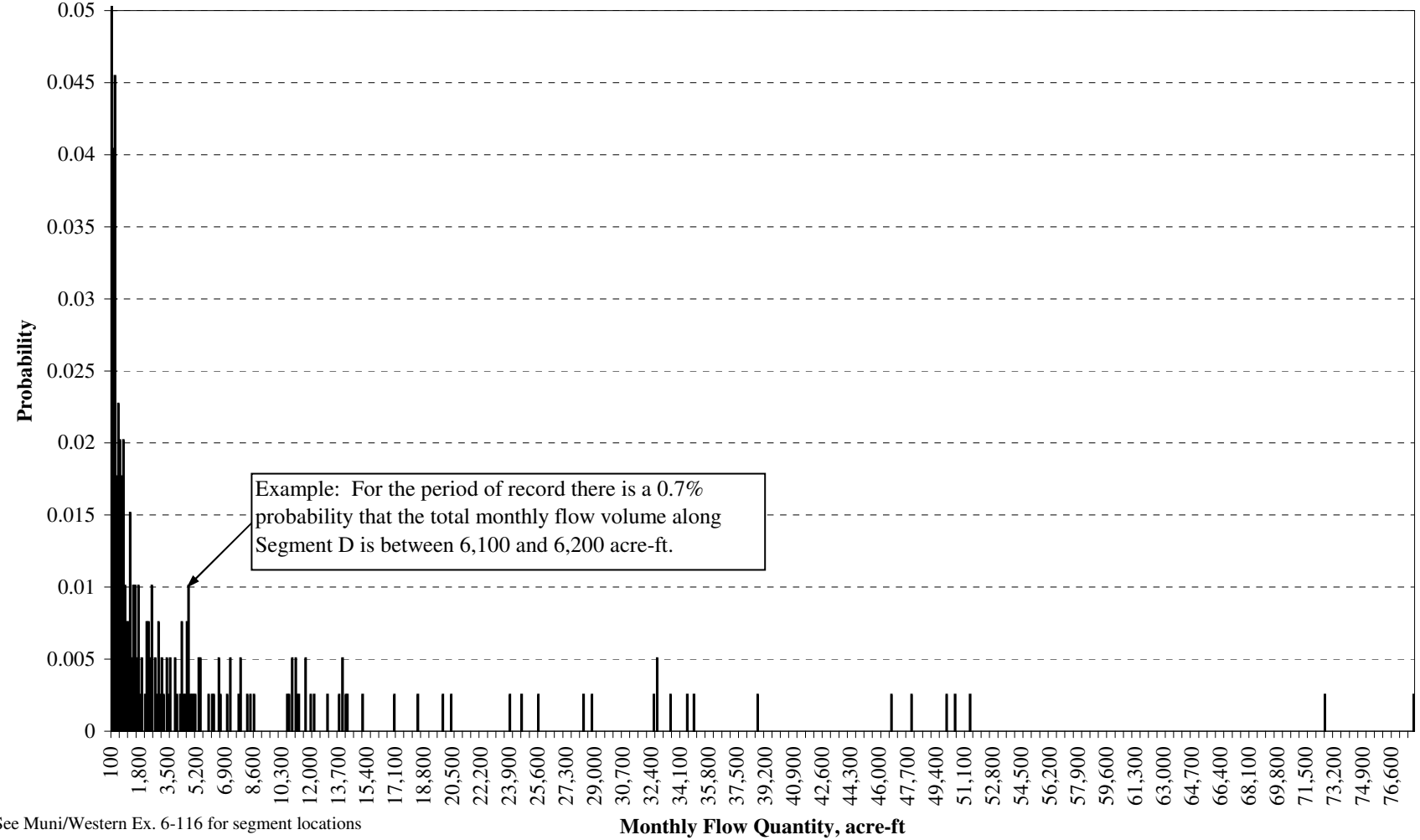
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Historical Data
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-58

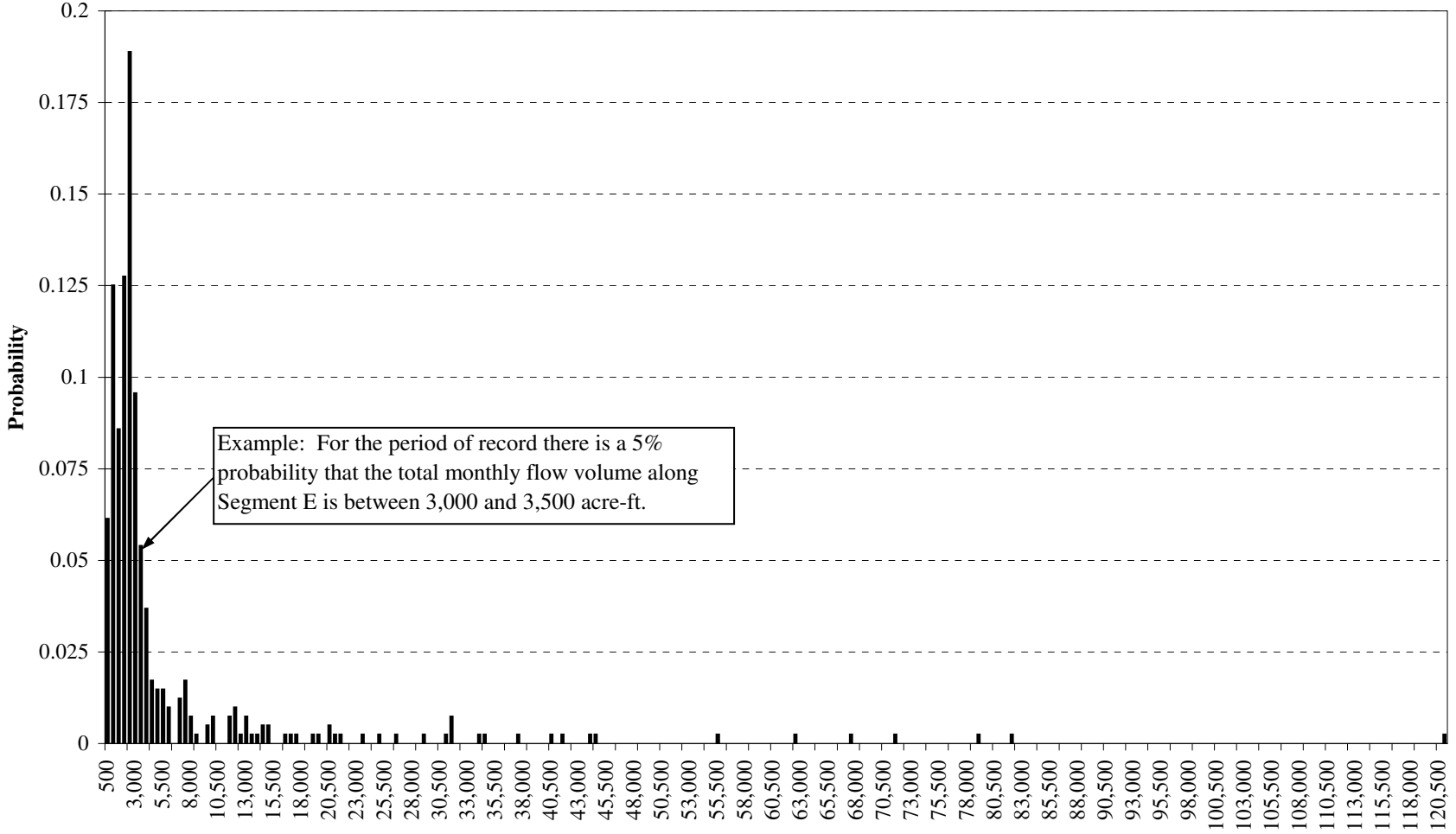
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1998-99
Historical Data
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-59

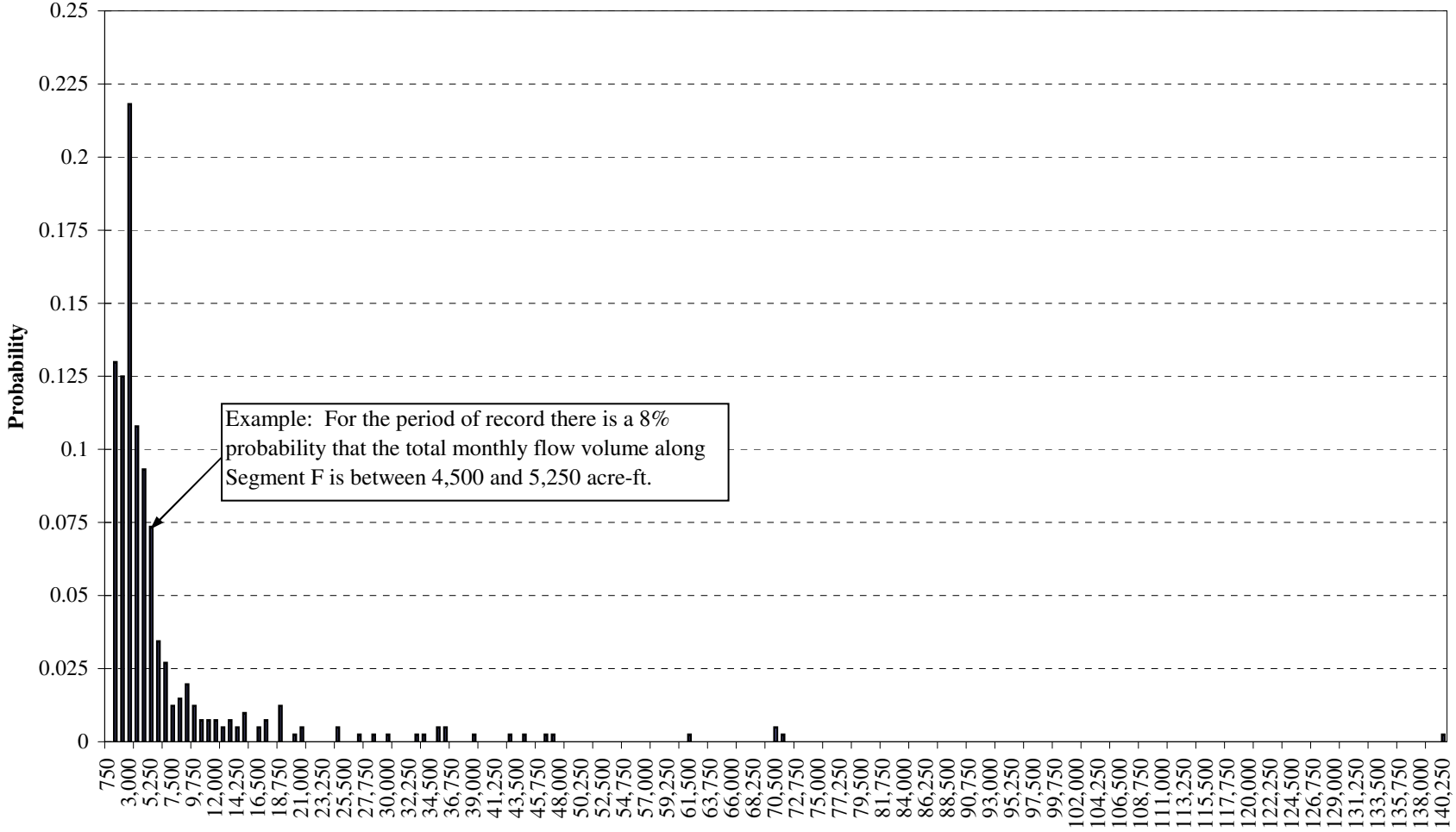
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Historical Data
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-60

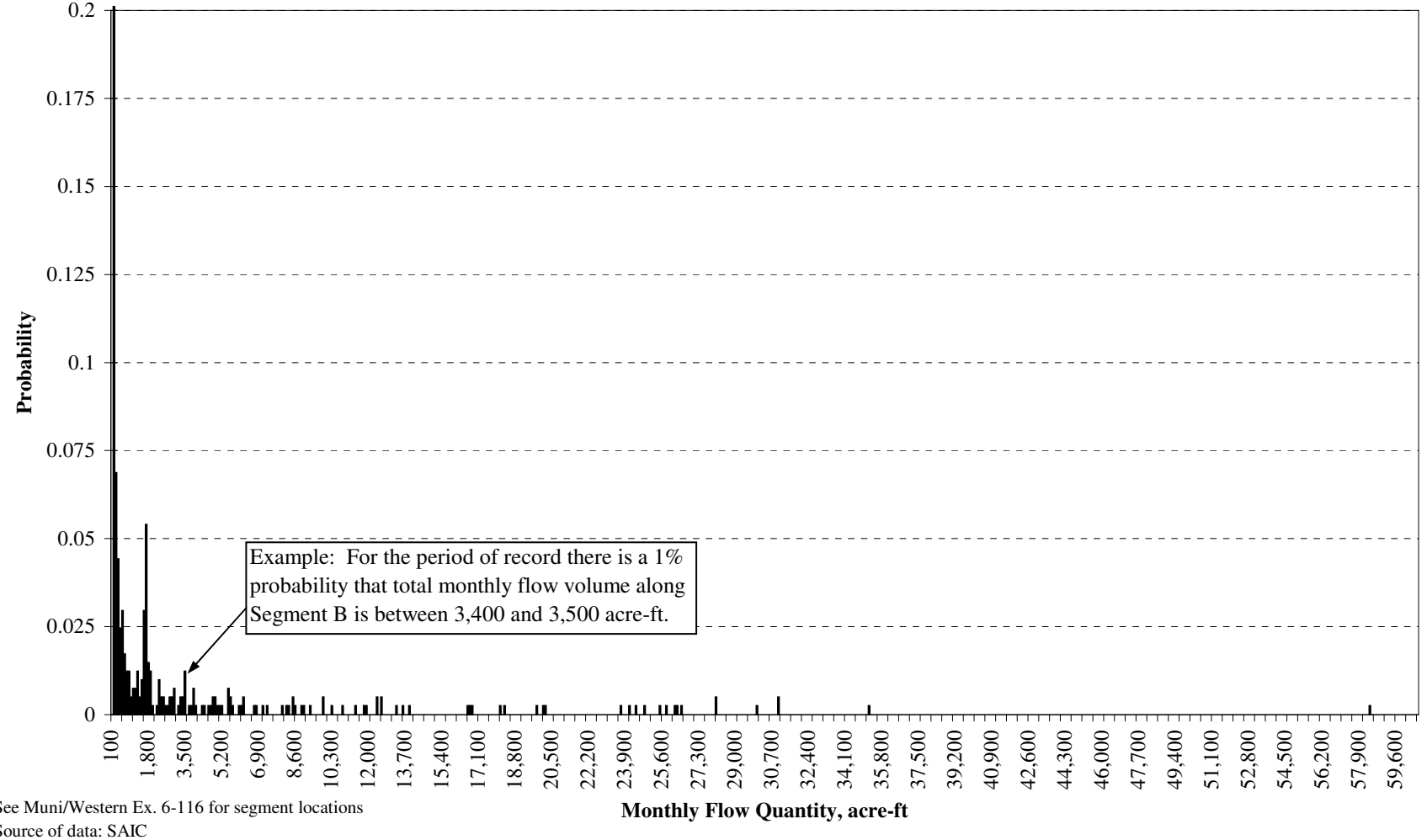
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Historical Data
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-61

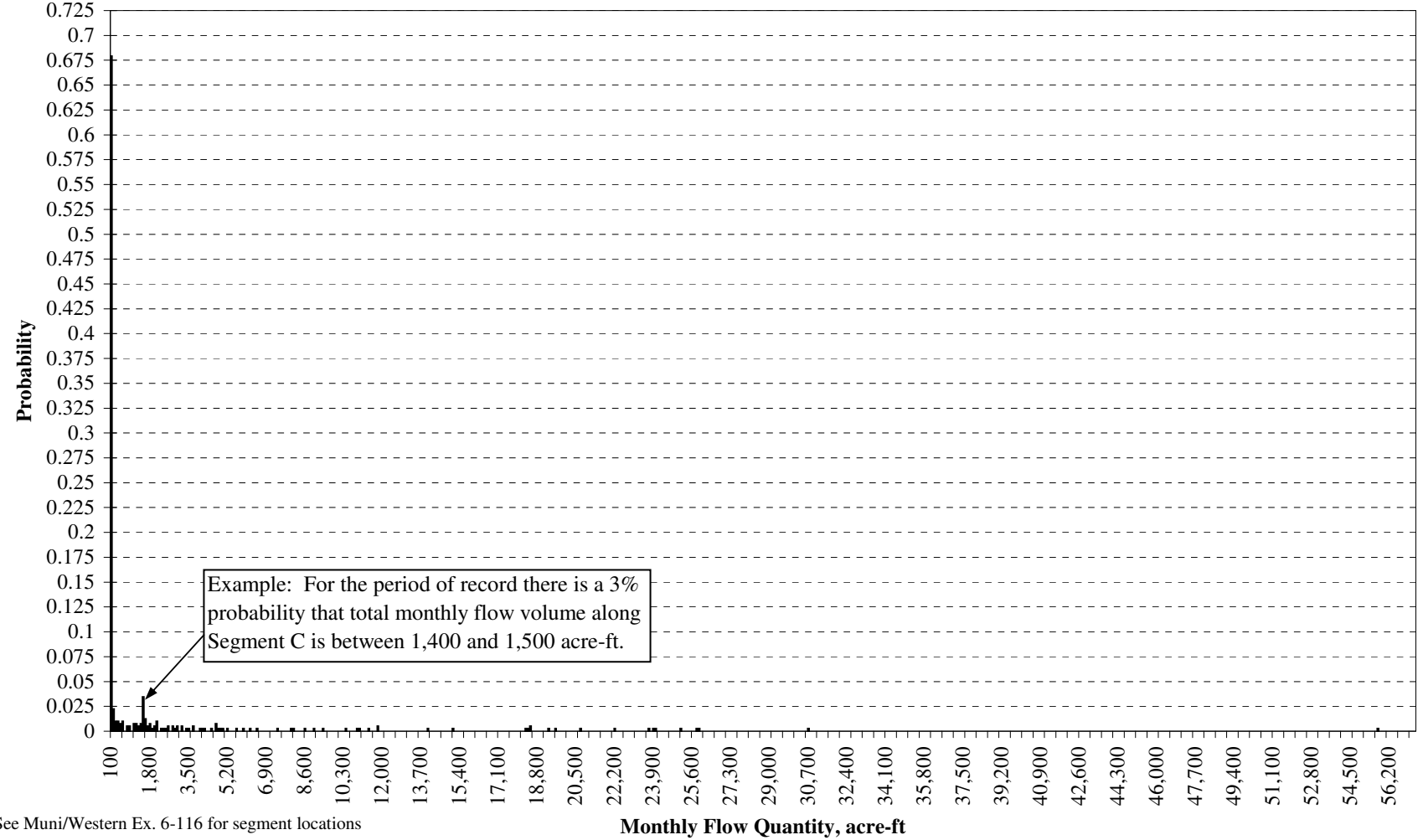
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
No Project Condition
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-62

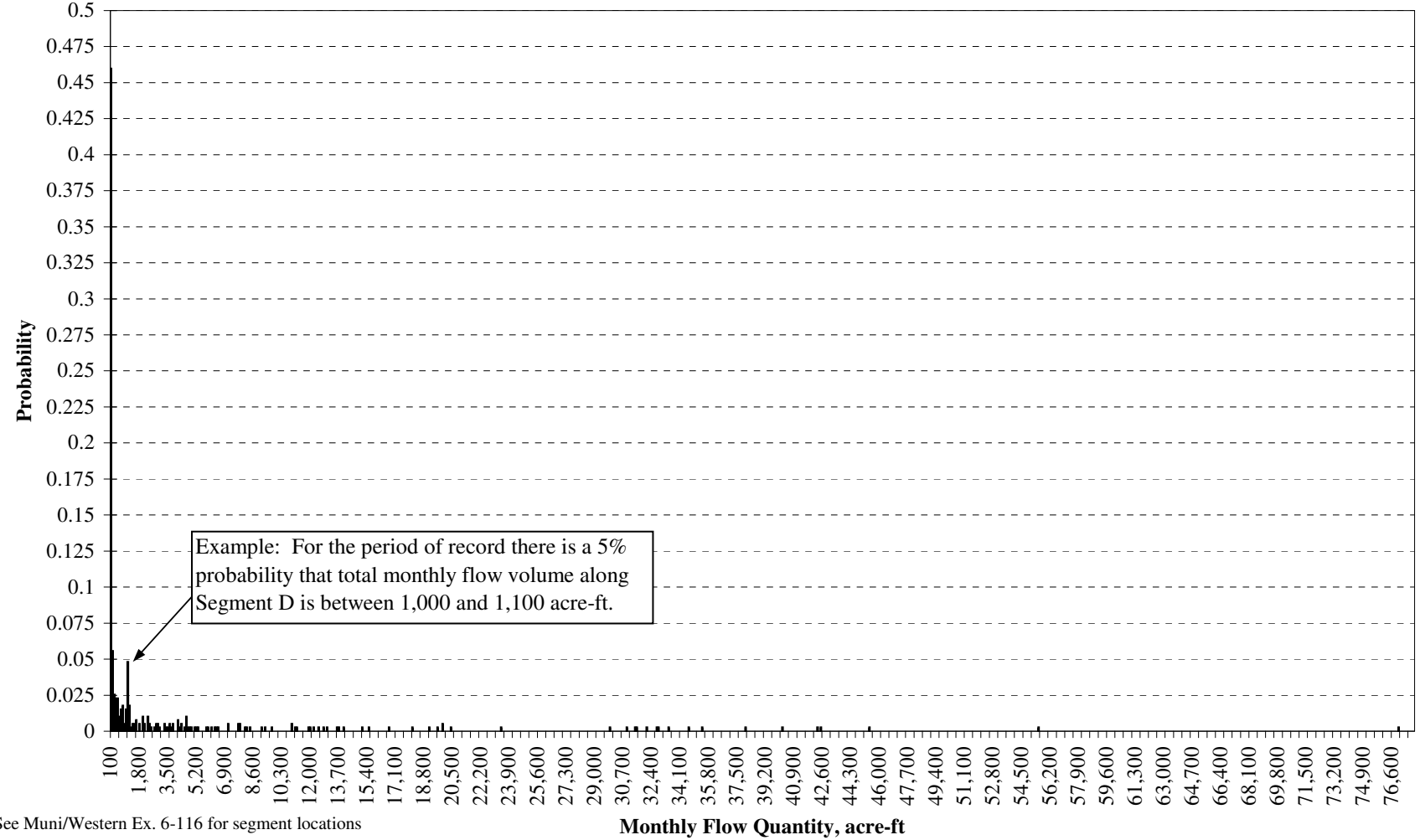
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
No Project Condition
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-63

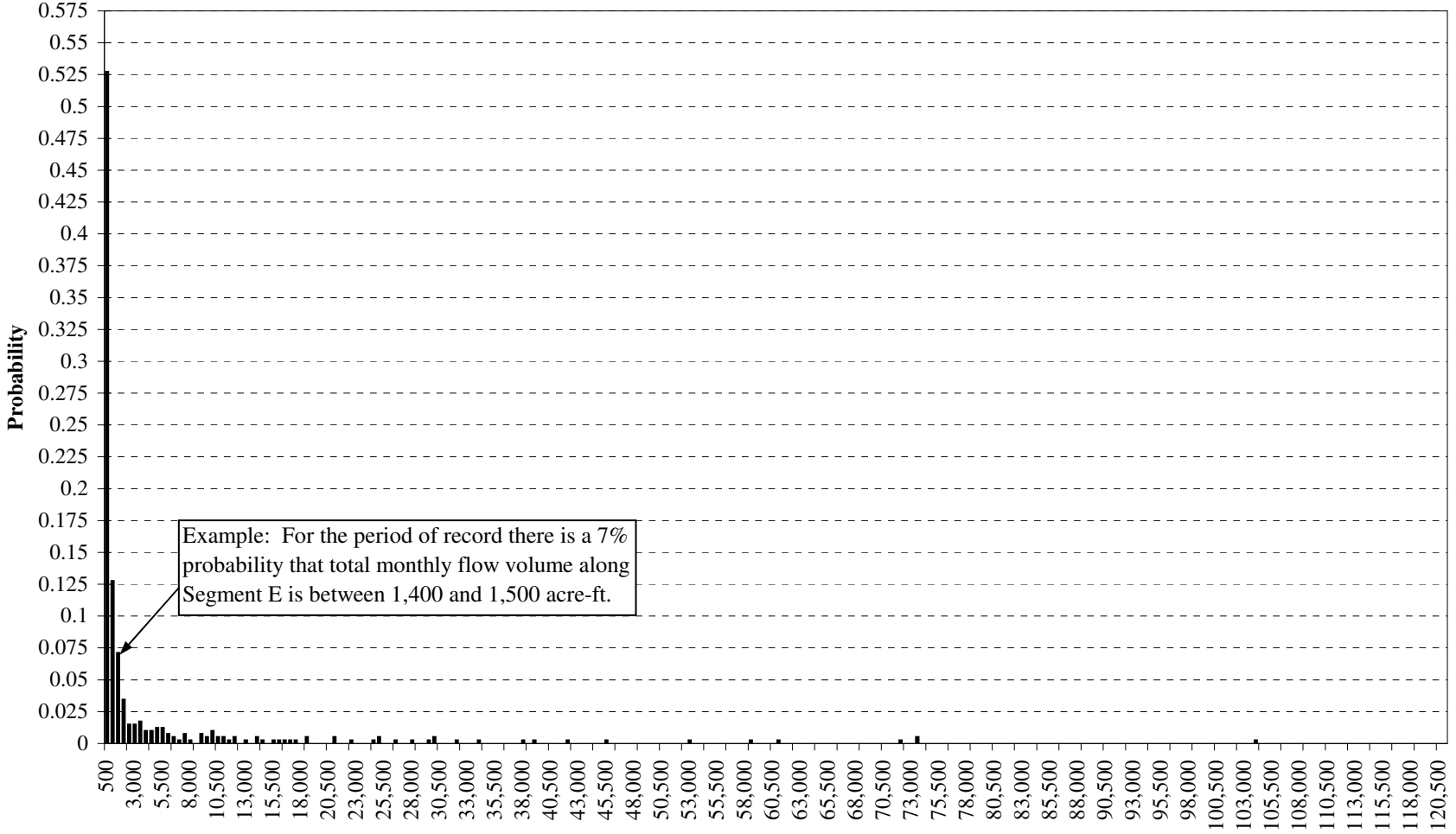
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1998-99
No Project Condition
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-64

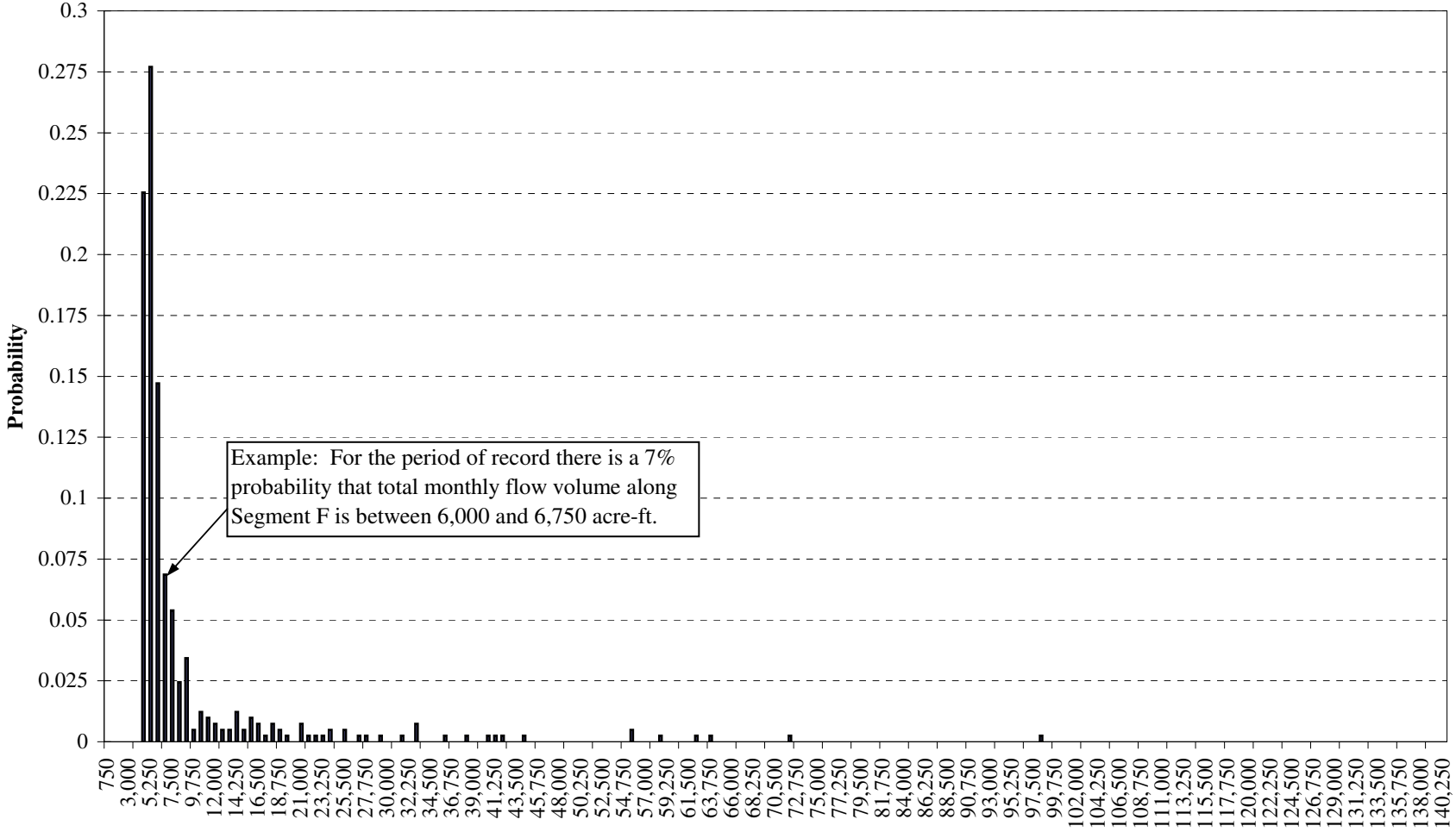
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
No Project Condition
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-65

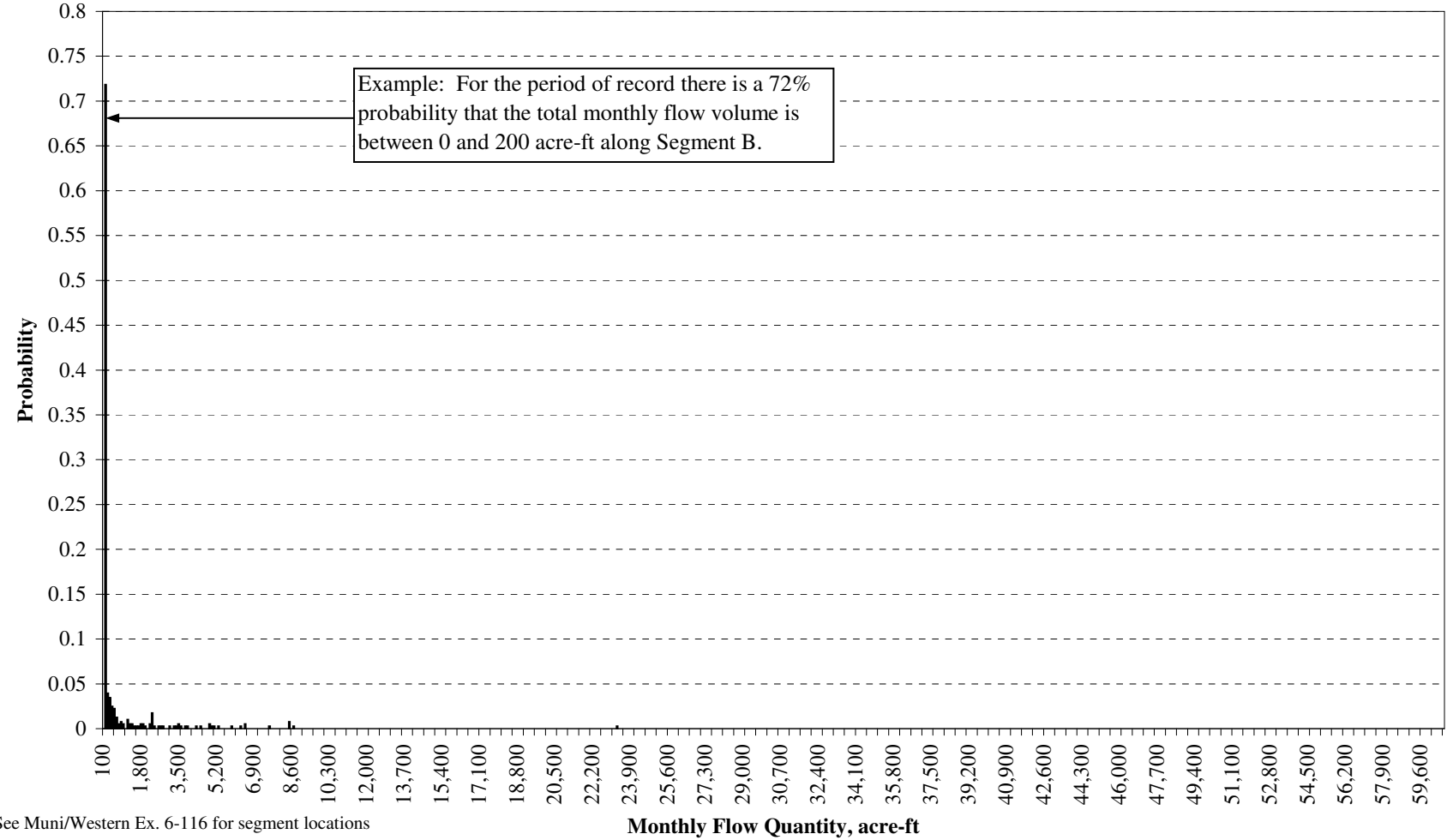
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
No Project Condition
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-66

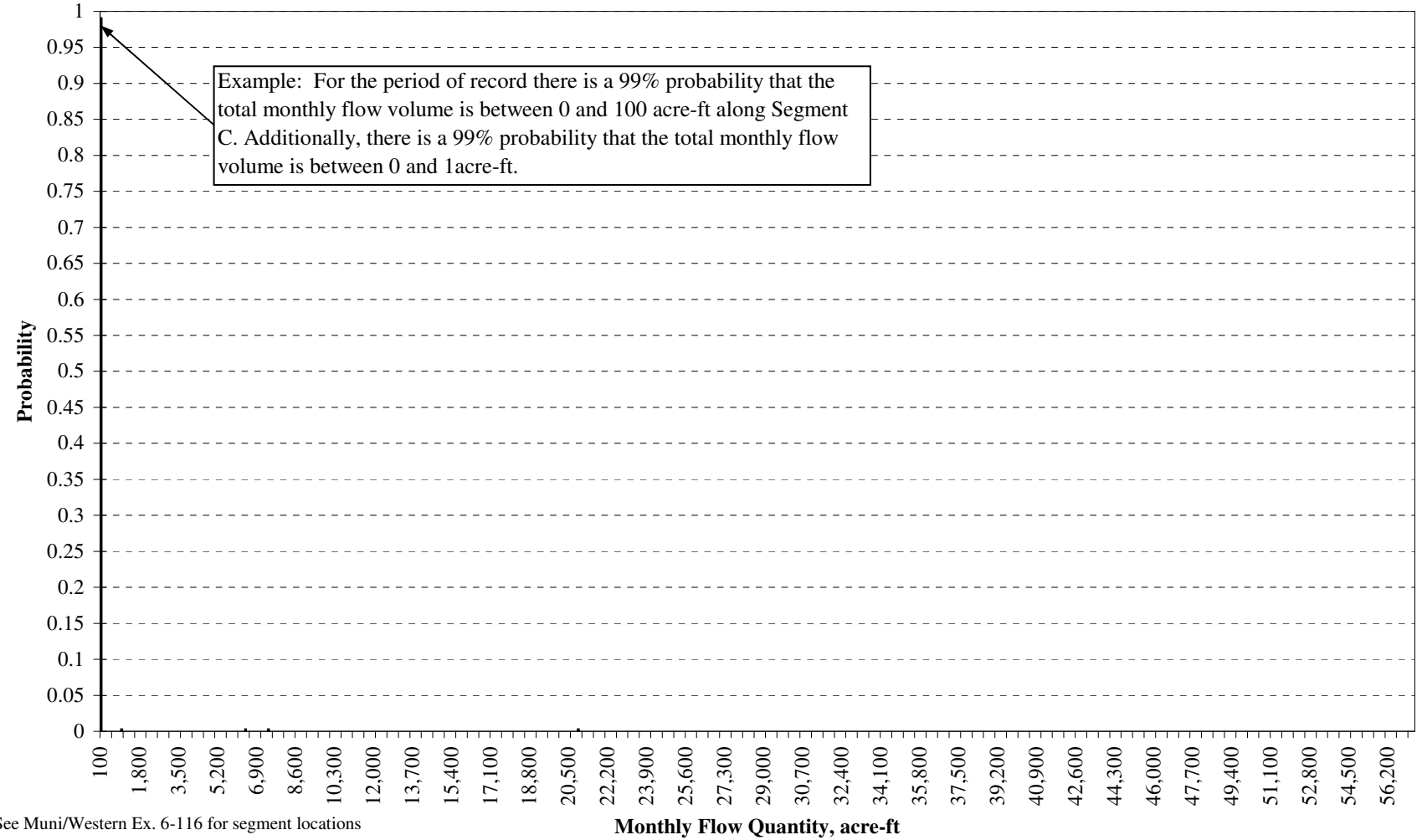
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Project Scenario A
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-67

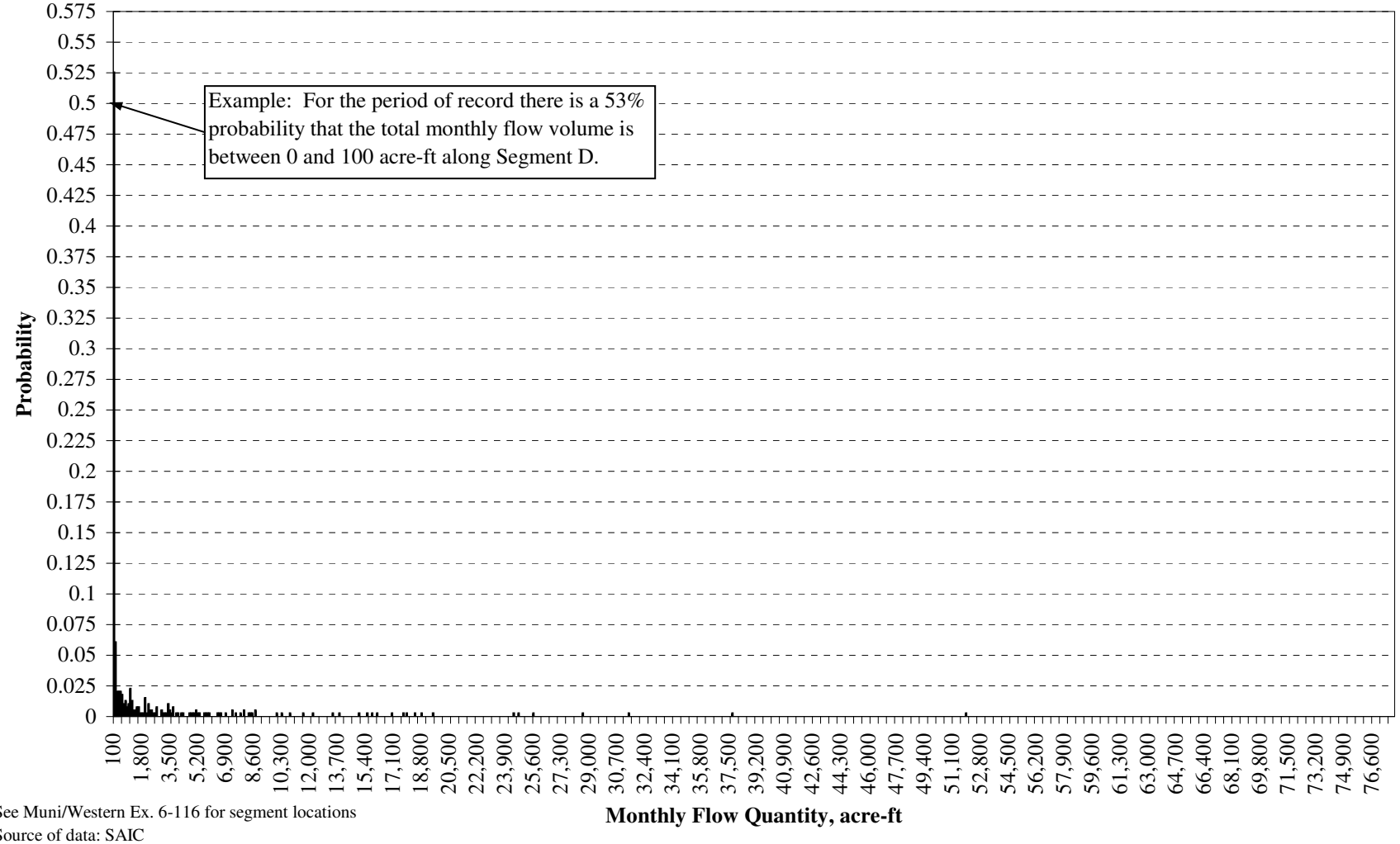
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Project Scenario A
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-68

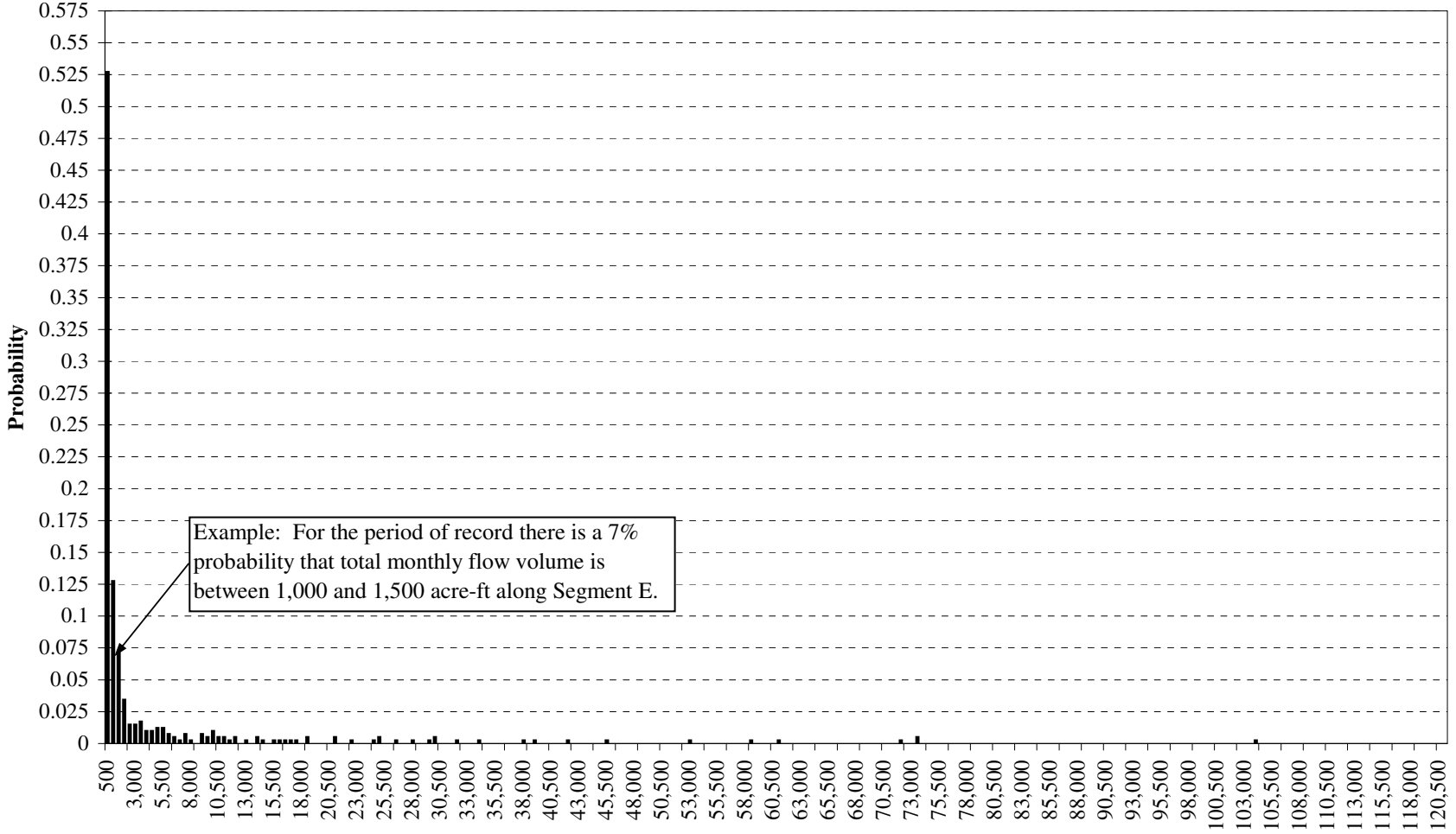
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1998-99
Project Scenario A
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-69

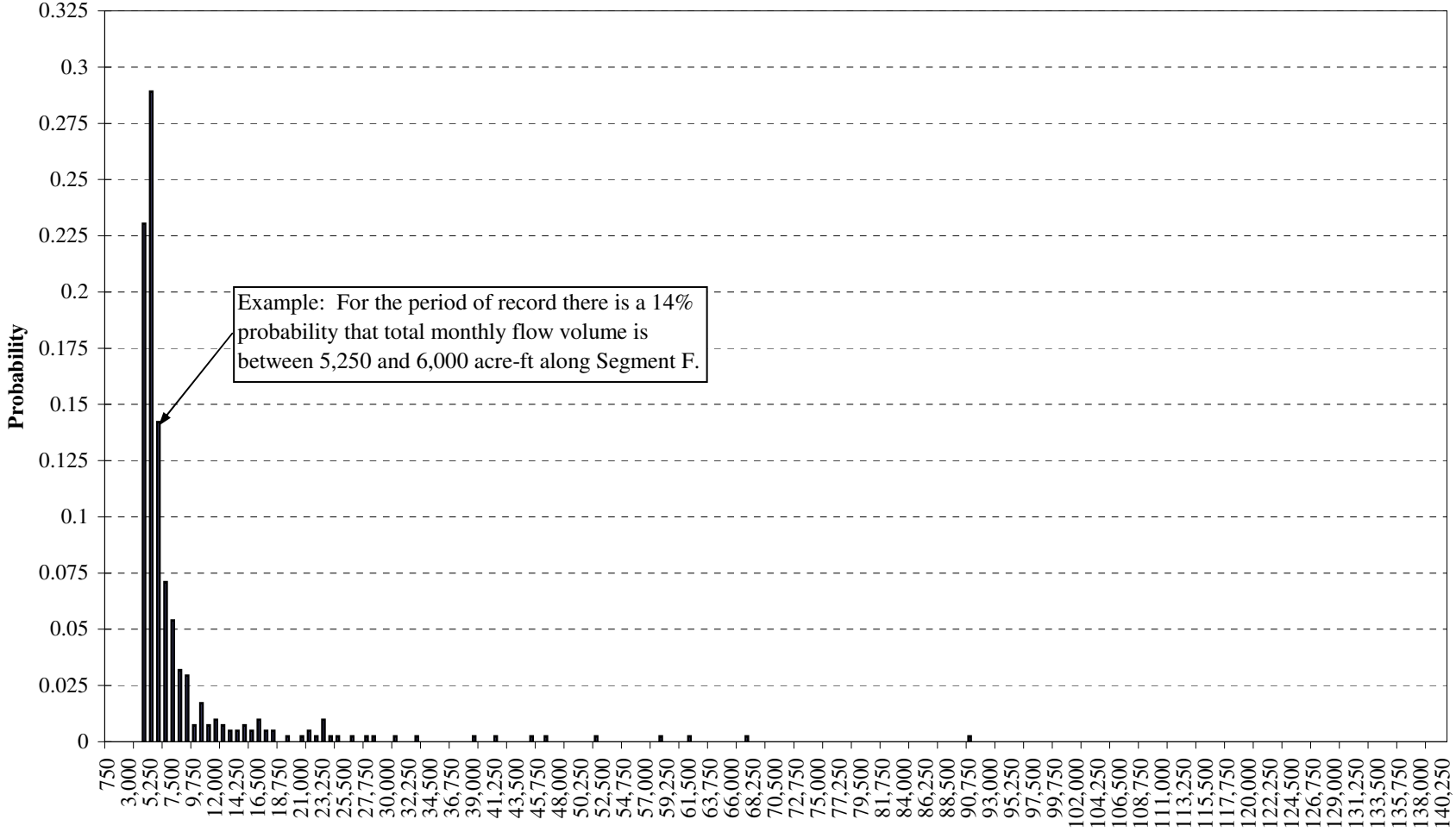
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Project Scenario A
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-70

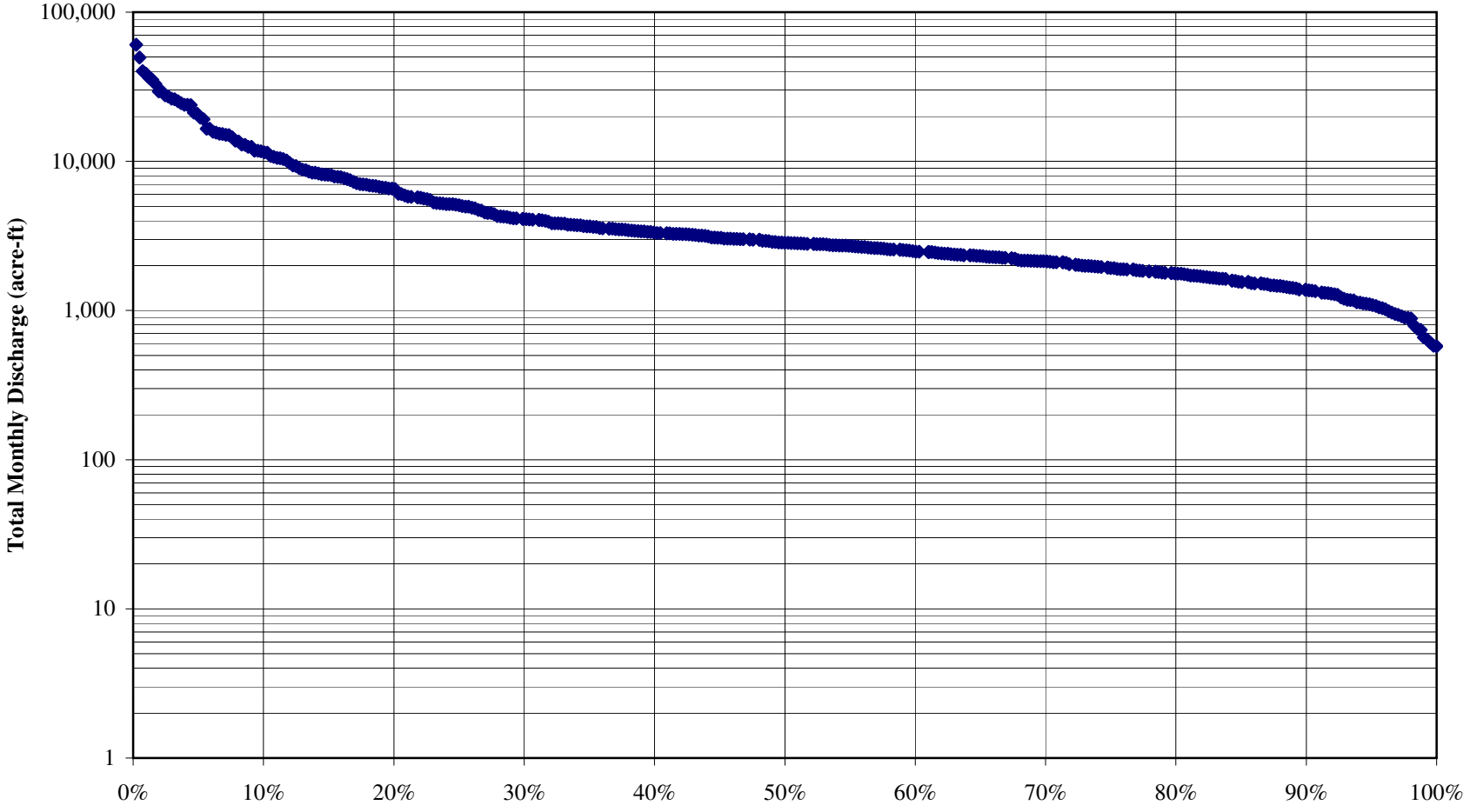
Upper Santa Ana River - Monthly Flow Quantity Probability Distribution
Water Year 1966-67 to Water Year 1999-00
Project Scenario A
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-71

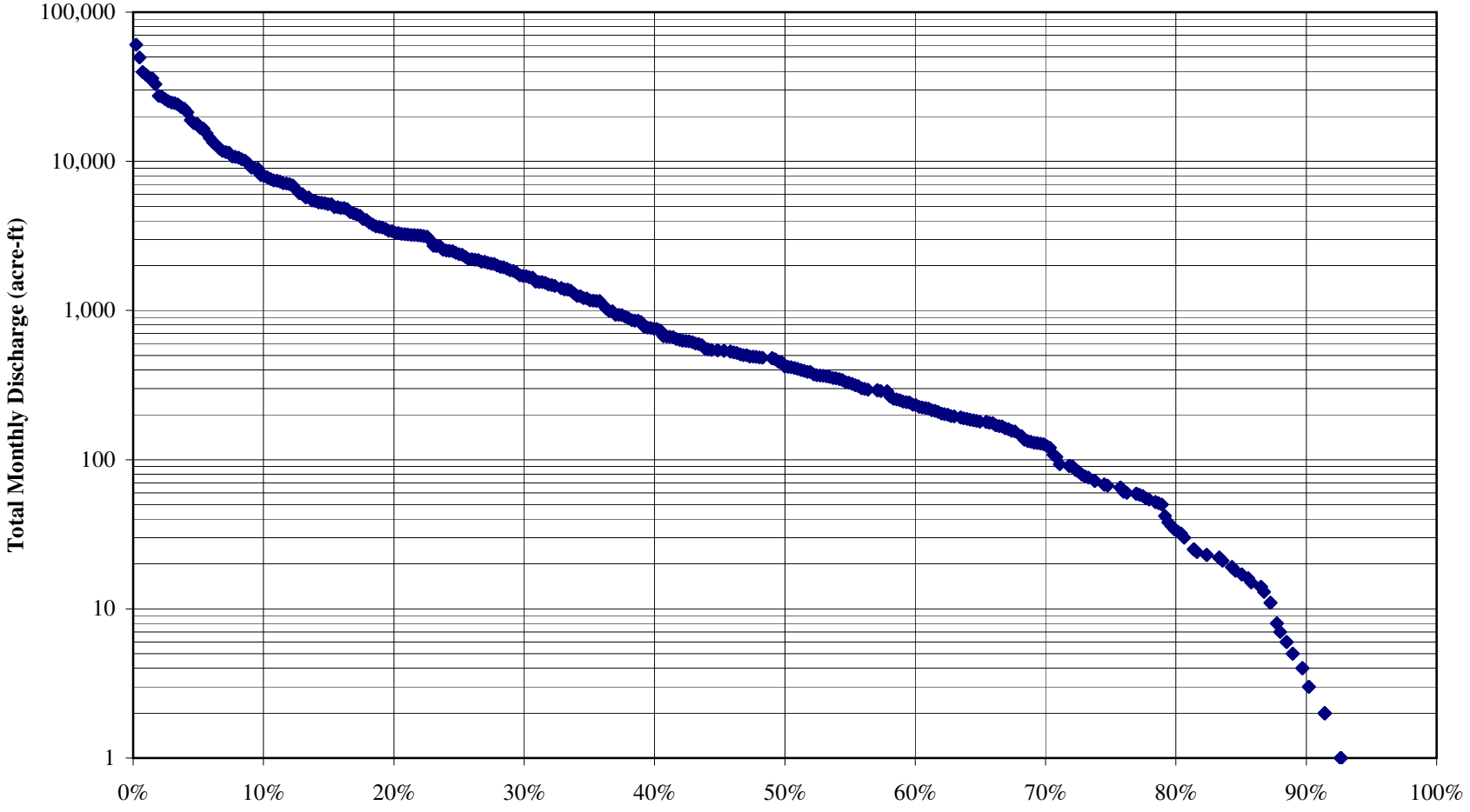
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment A: Upstream of Seven Oaks (Reach 6)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-72

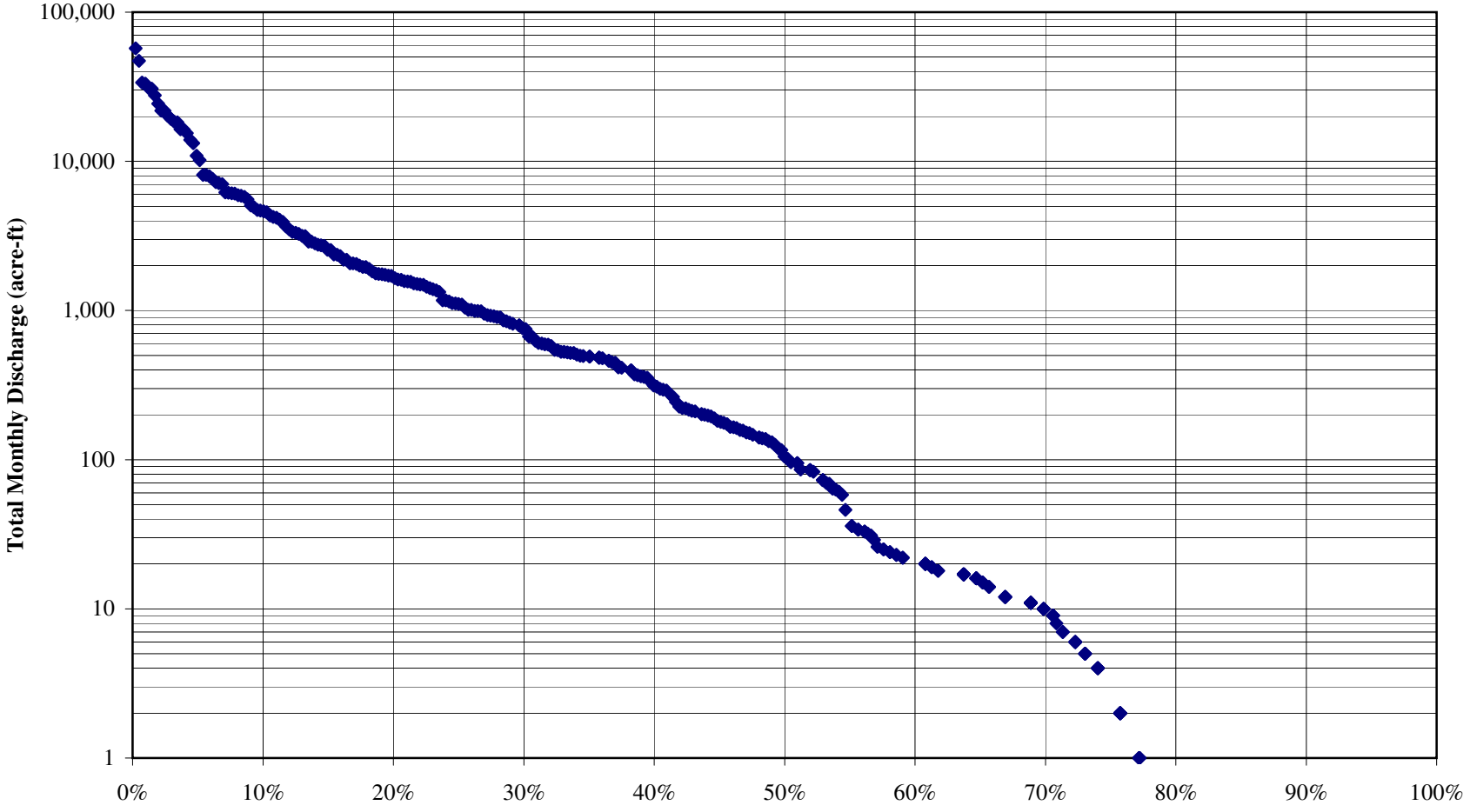
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-73

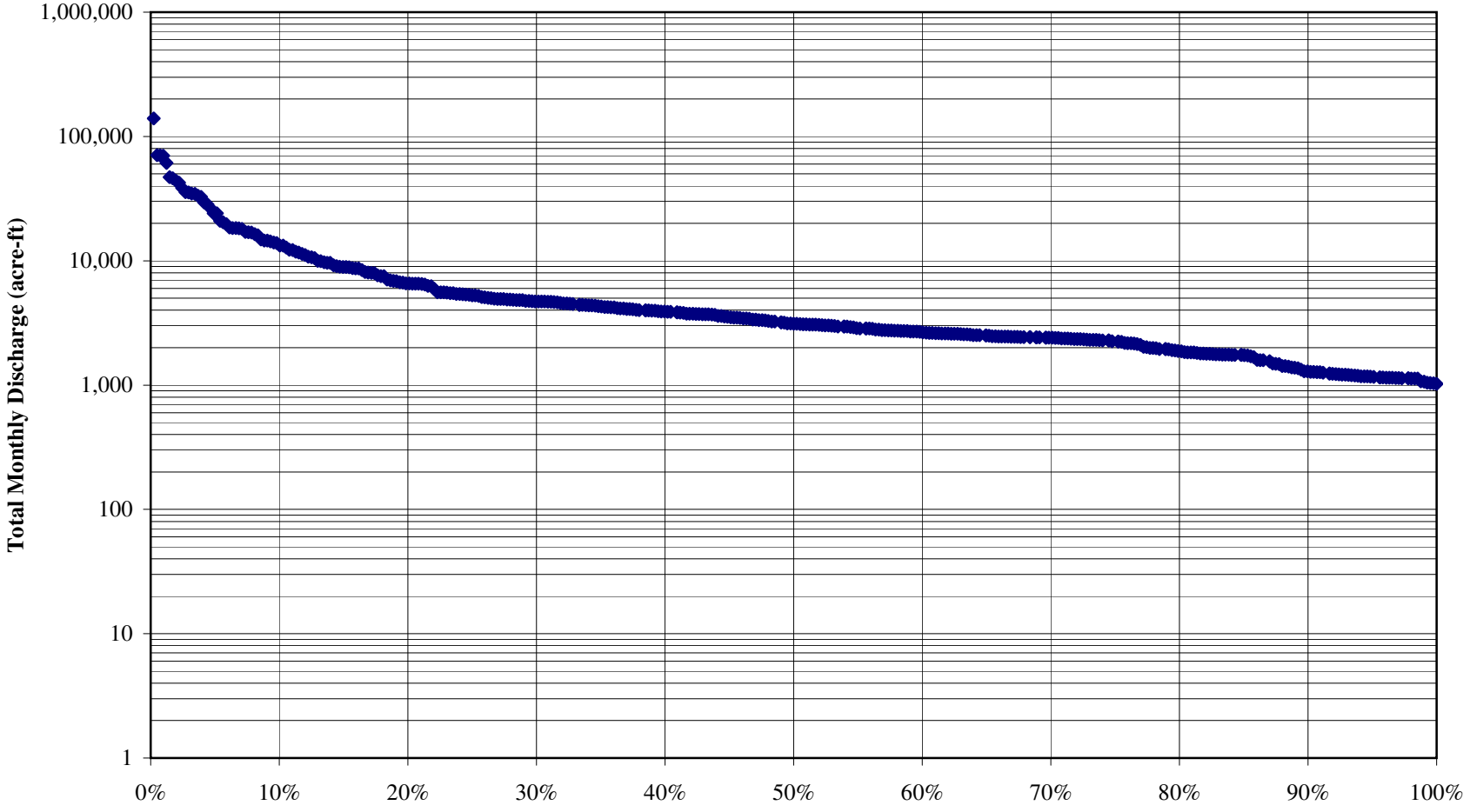
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-74

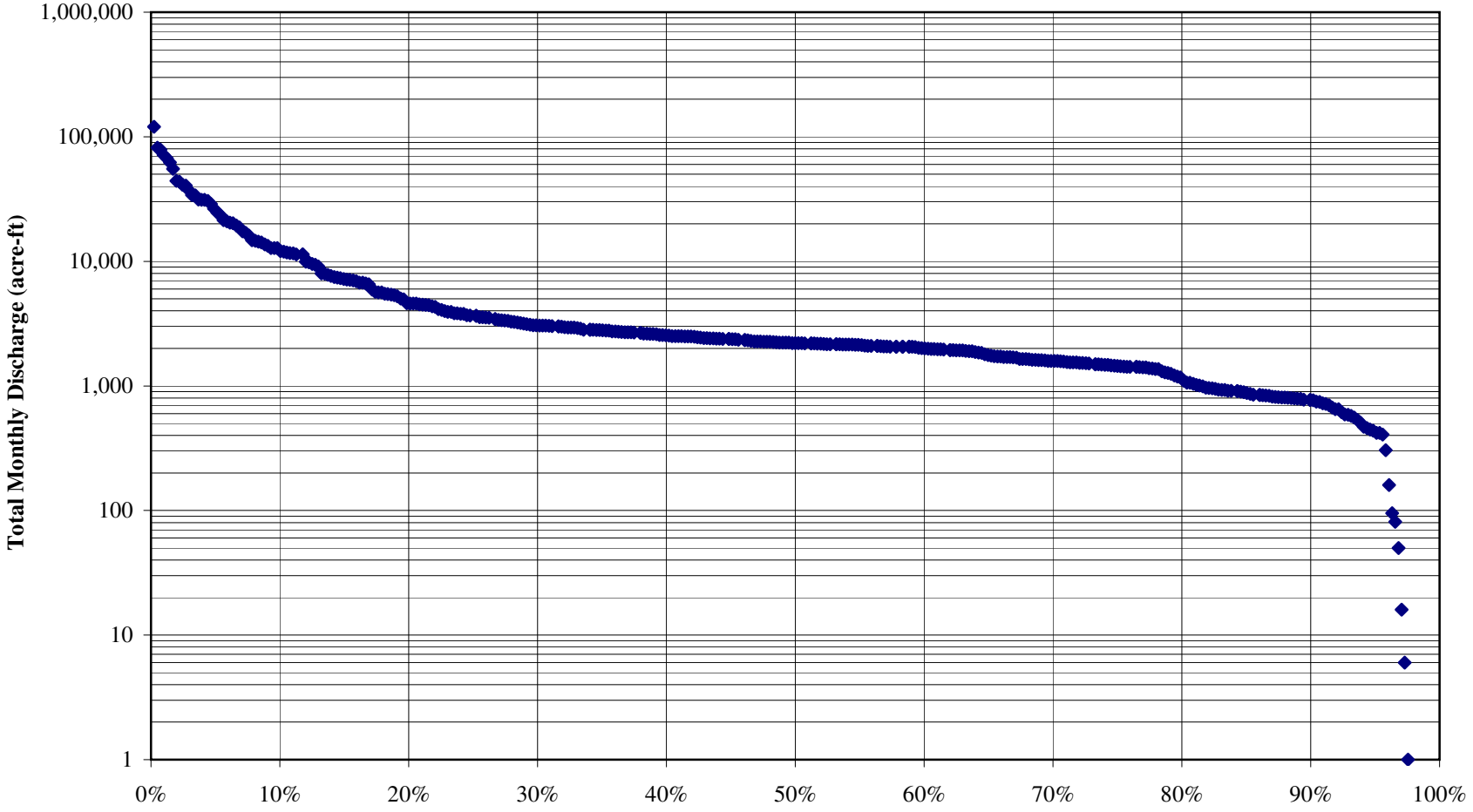
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1998-1999
Historical Data
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-75

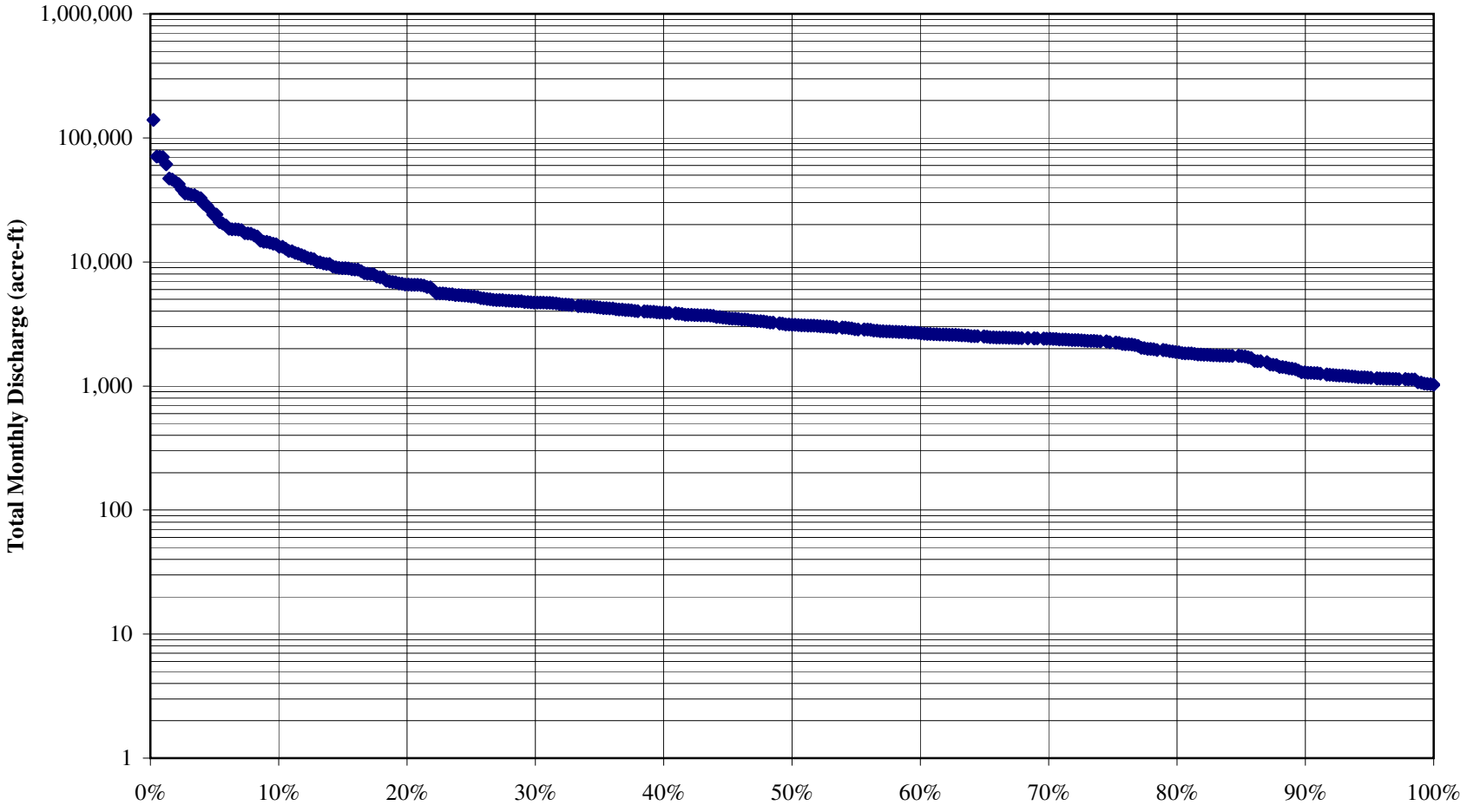
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-76

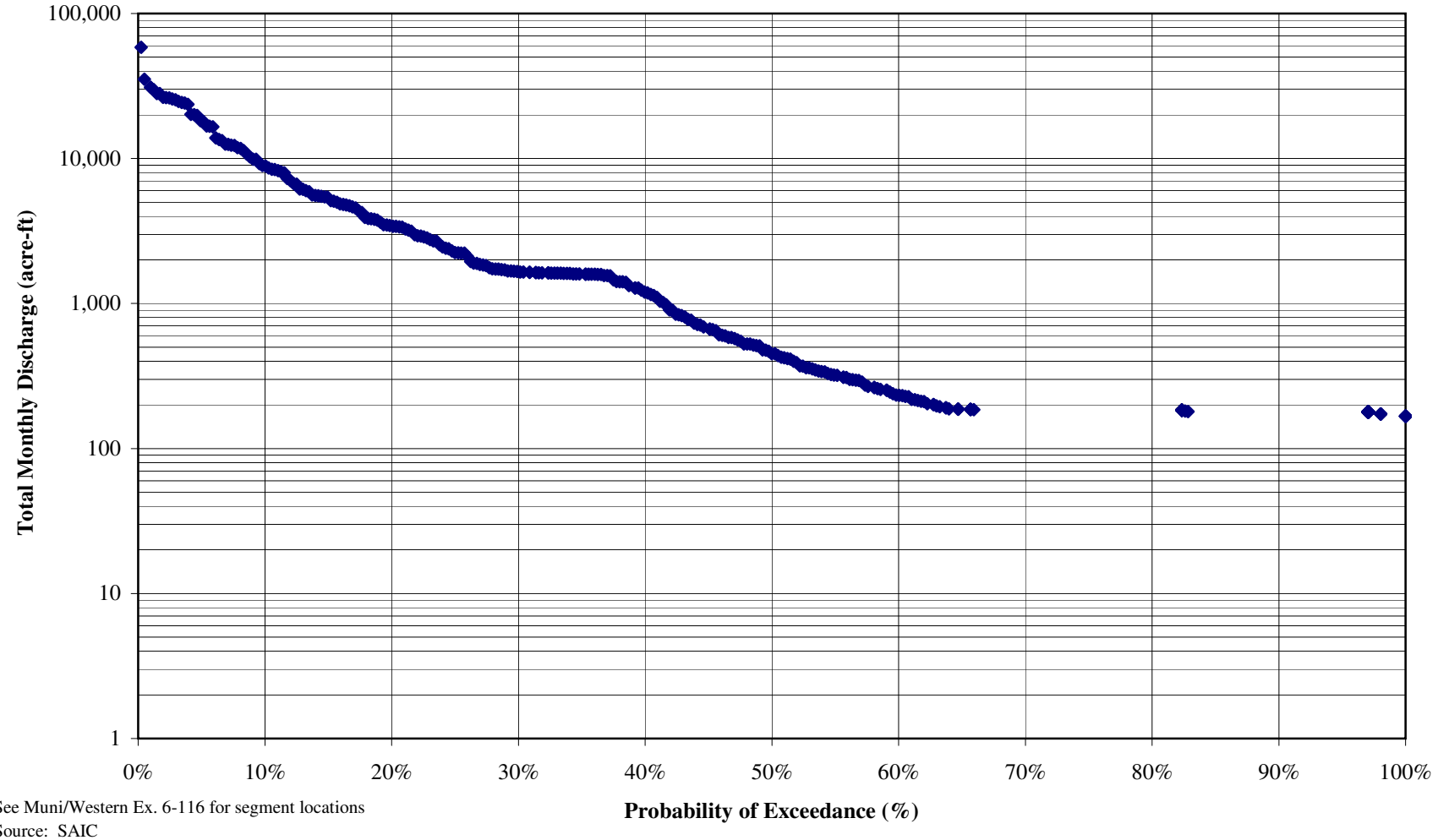
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-77

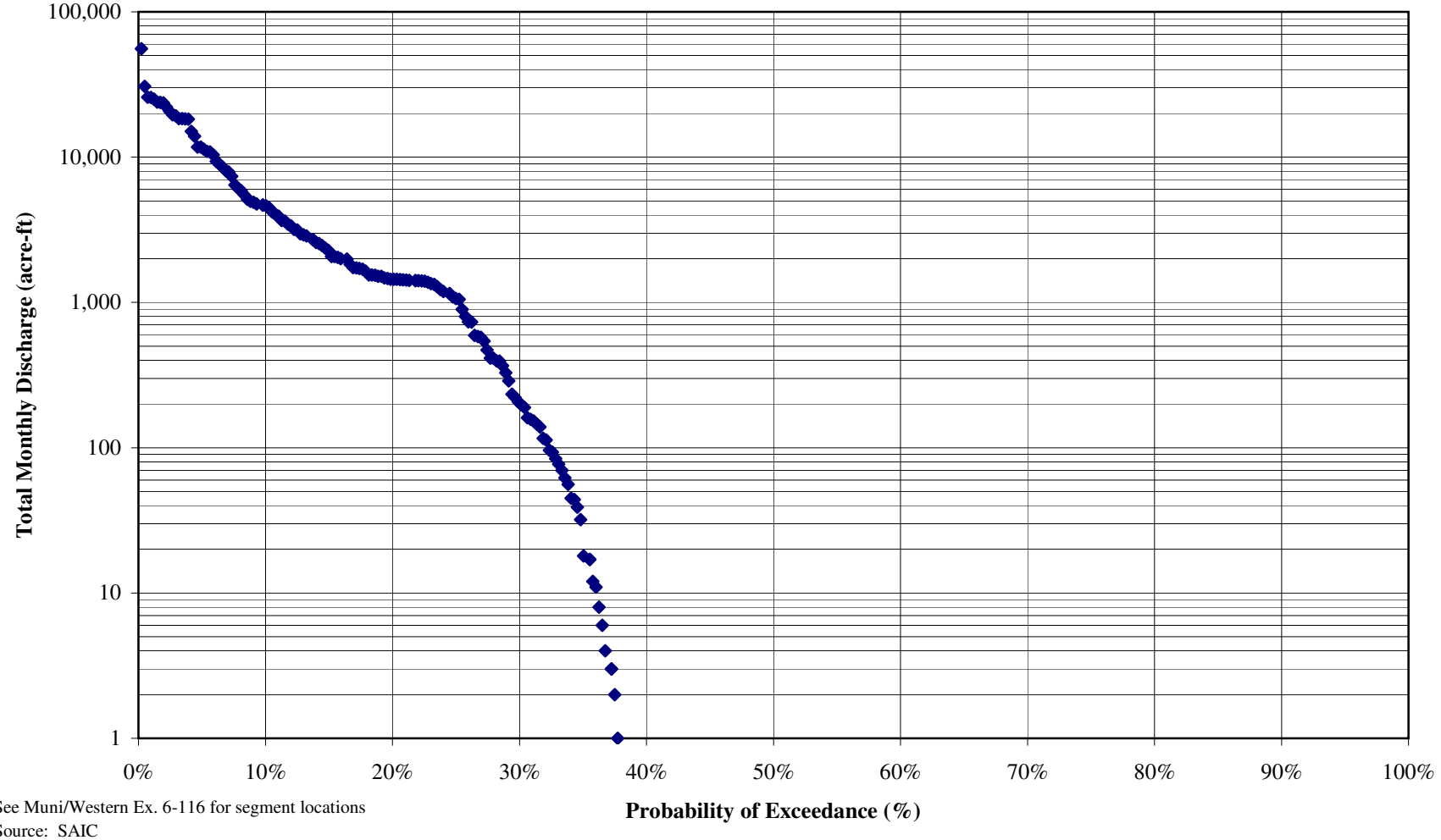
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
No Project Condition
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-78

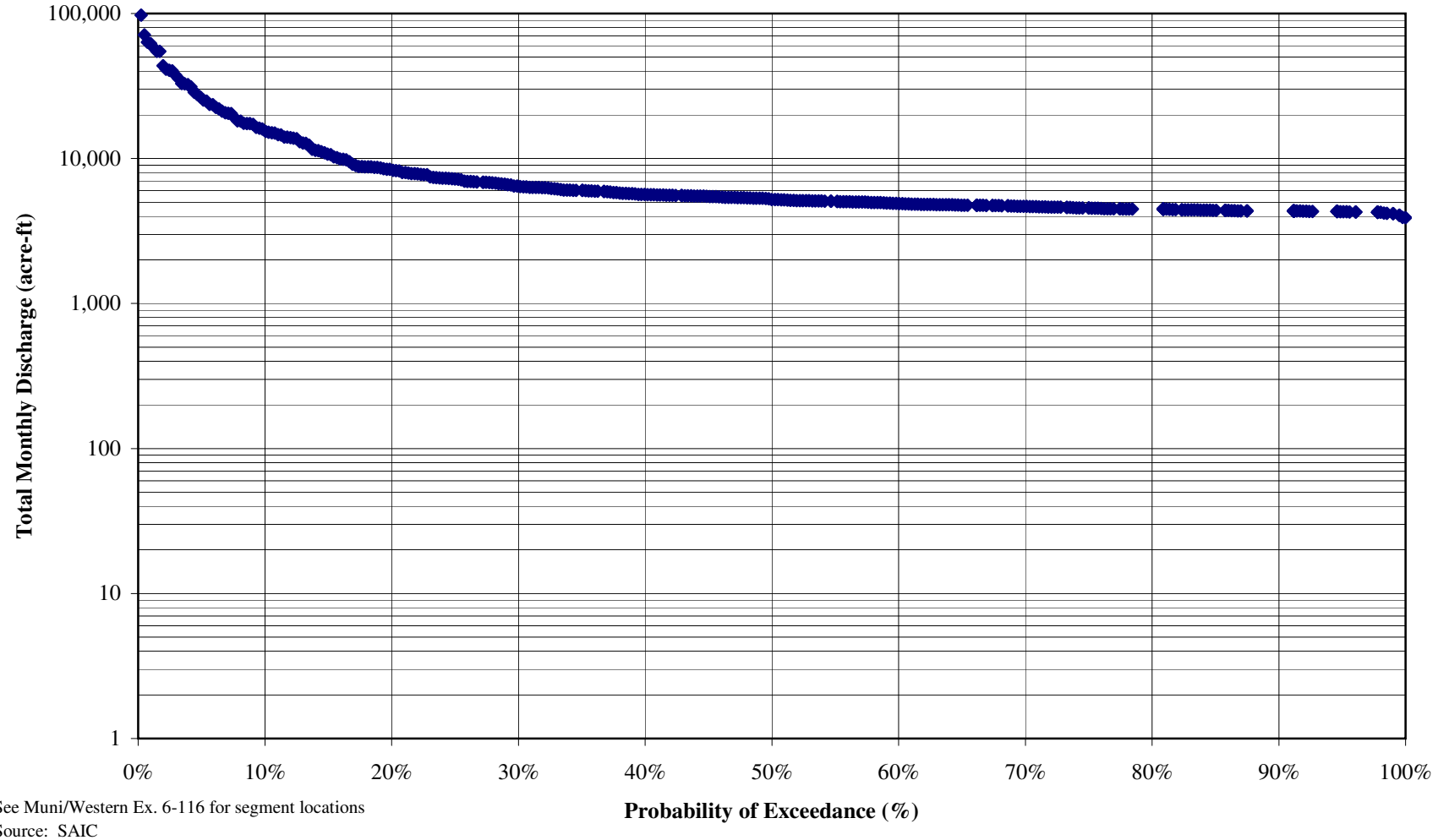
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
No Project Condition
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-79

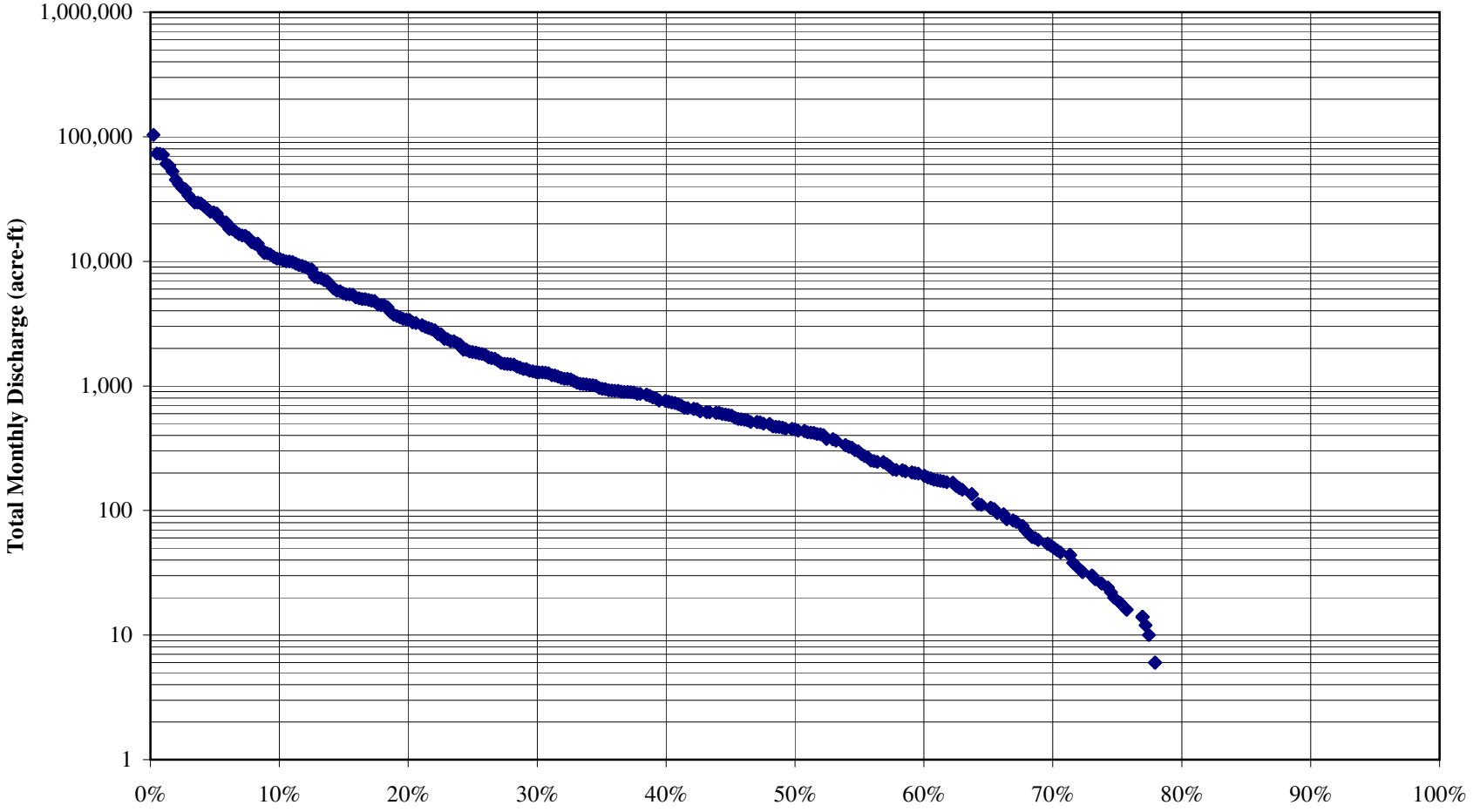
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1998-1999
No Project Condition
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-80

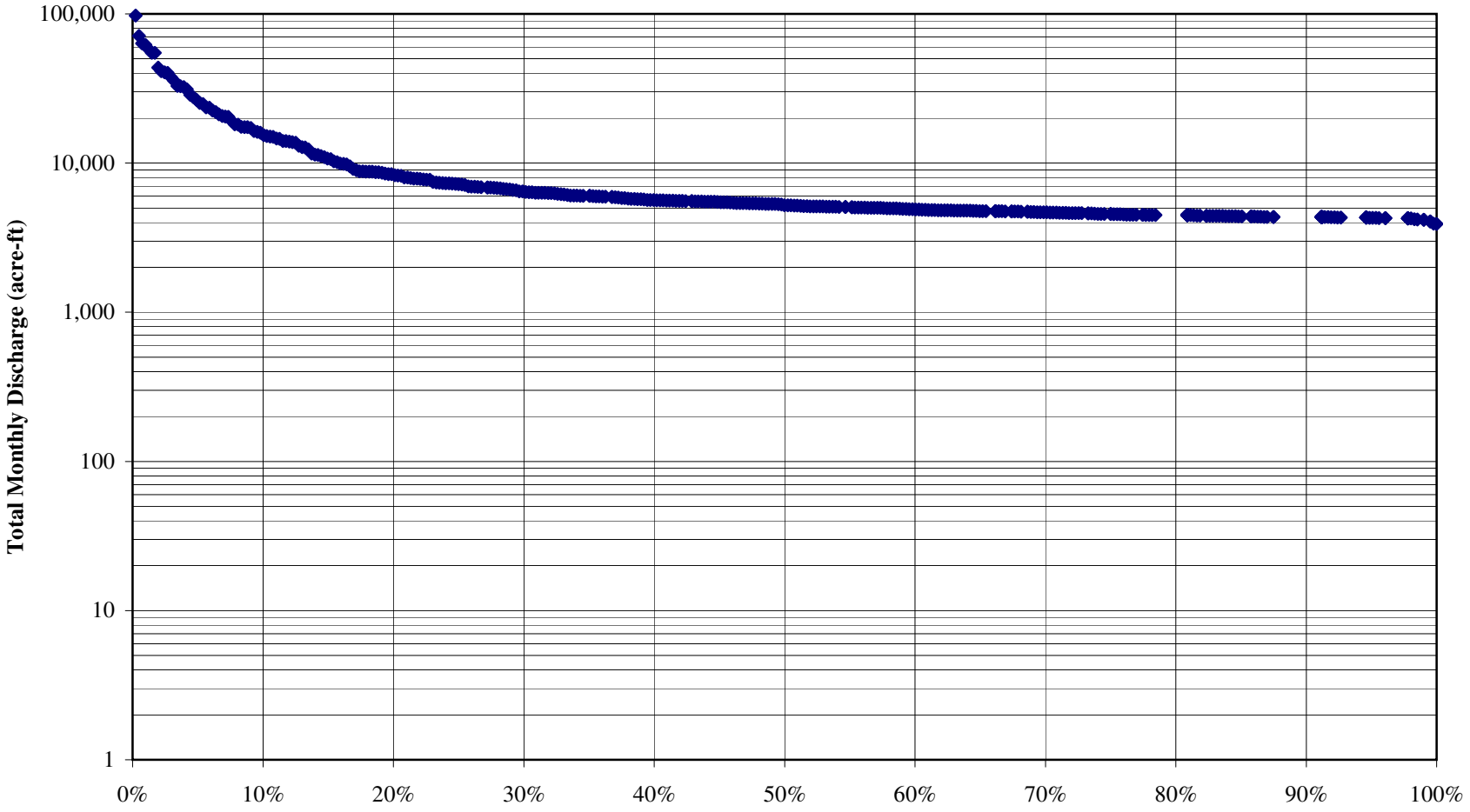
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
No Project Condition
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-81

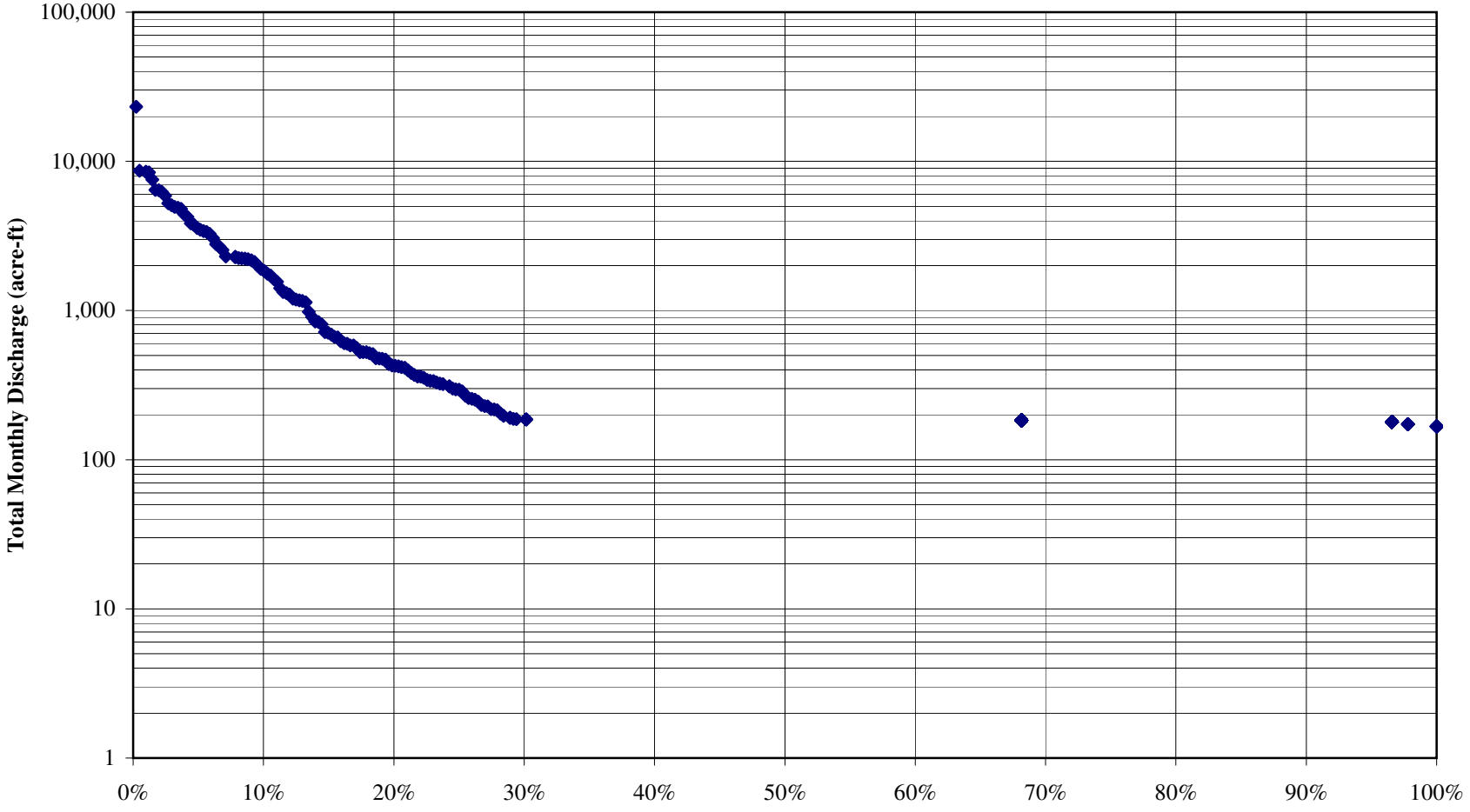
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
No Project Condition
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-82

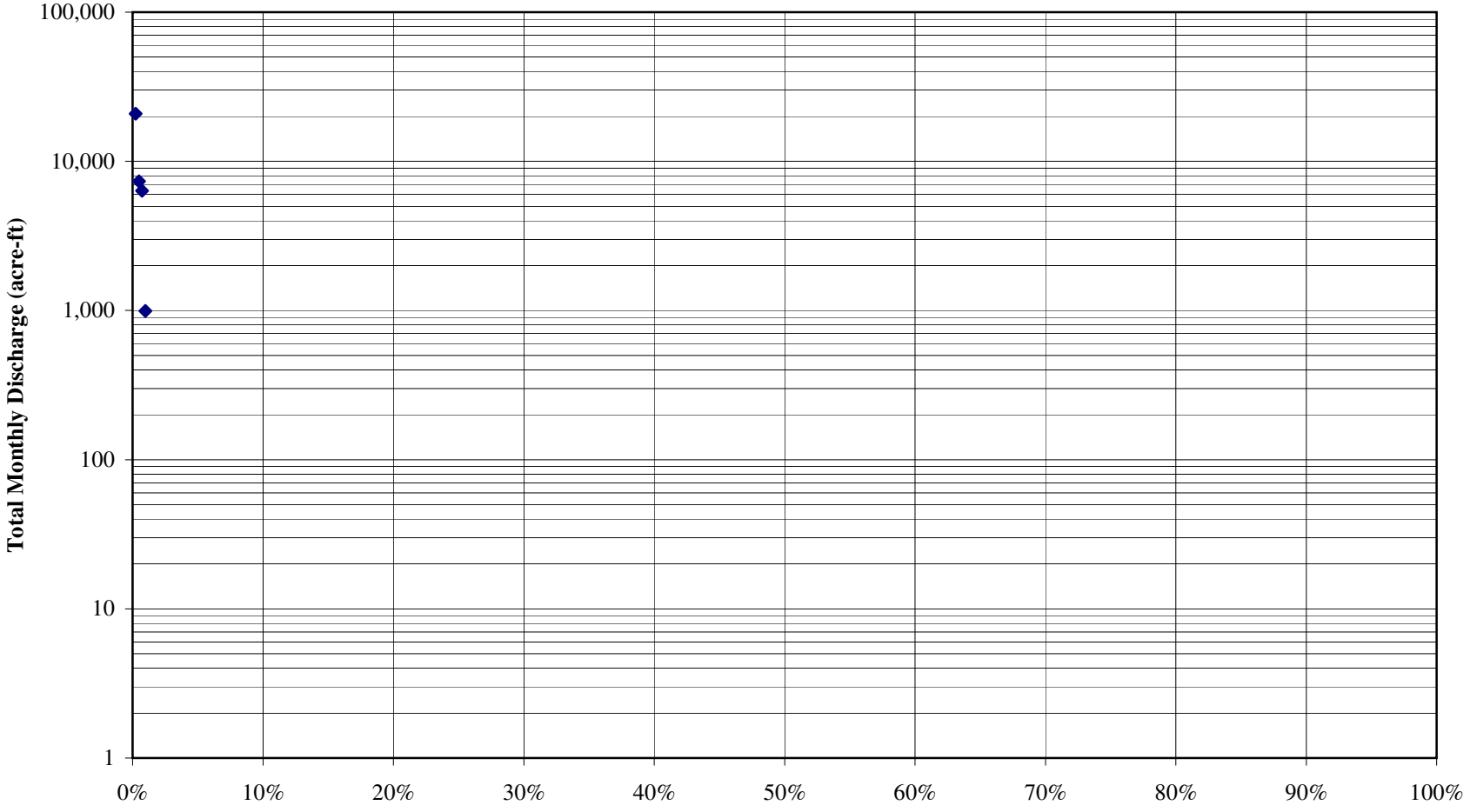
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Project Scenario A
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-83

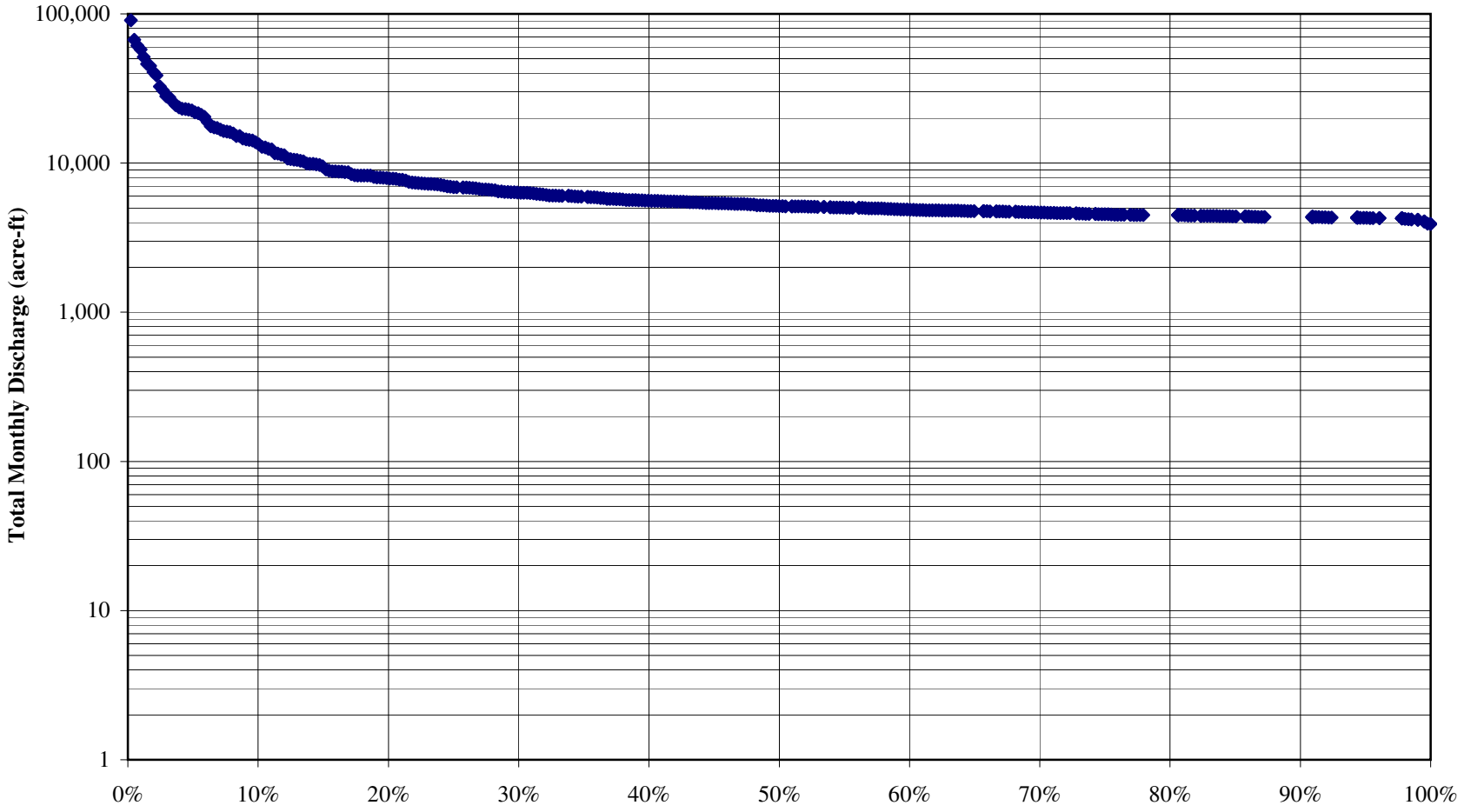
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Project Scenario A
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-84

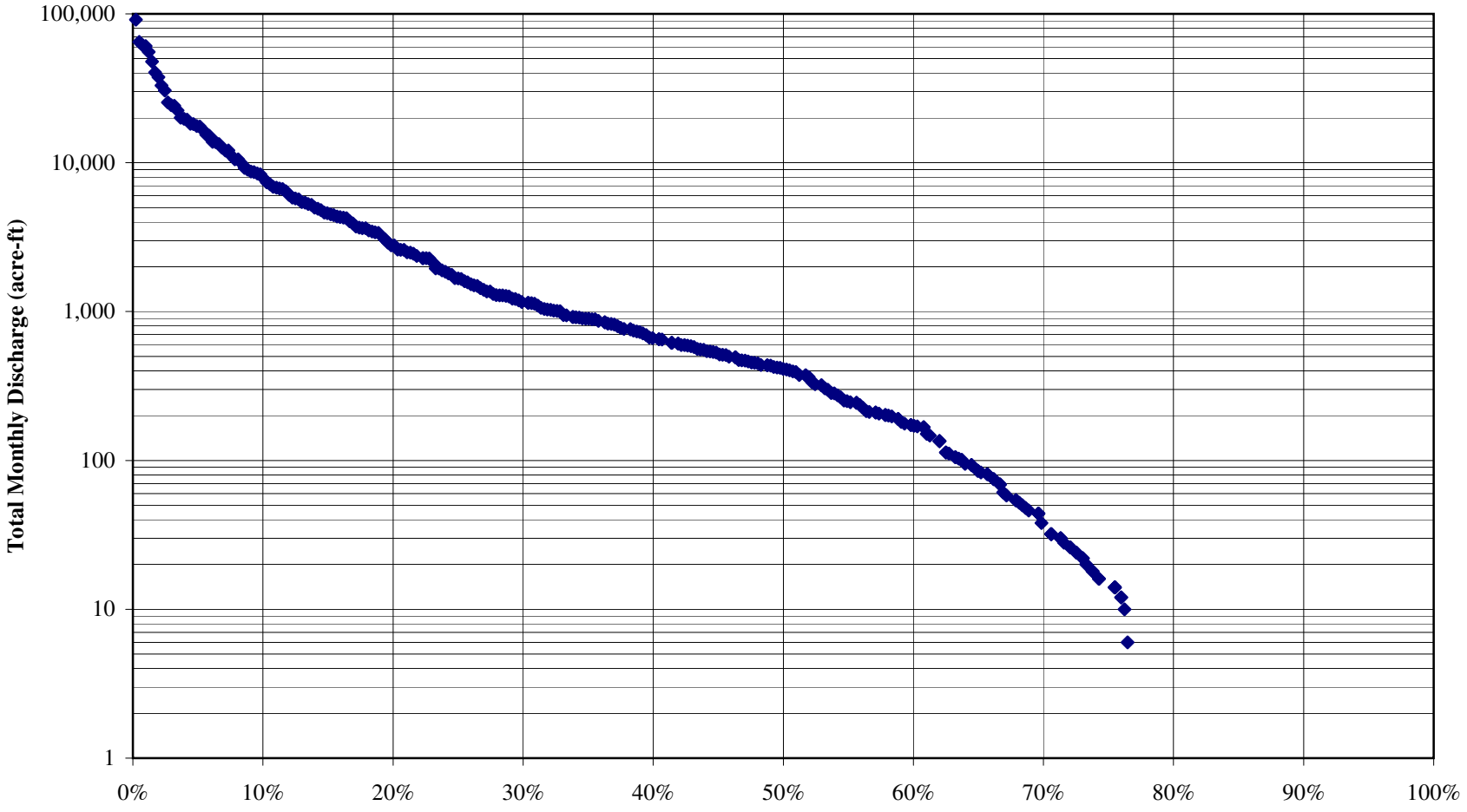
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1998-1999
Project Scenario A
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-85

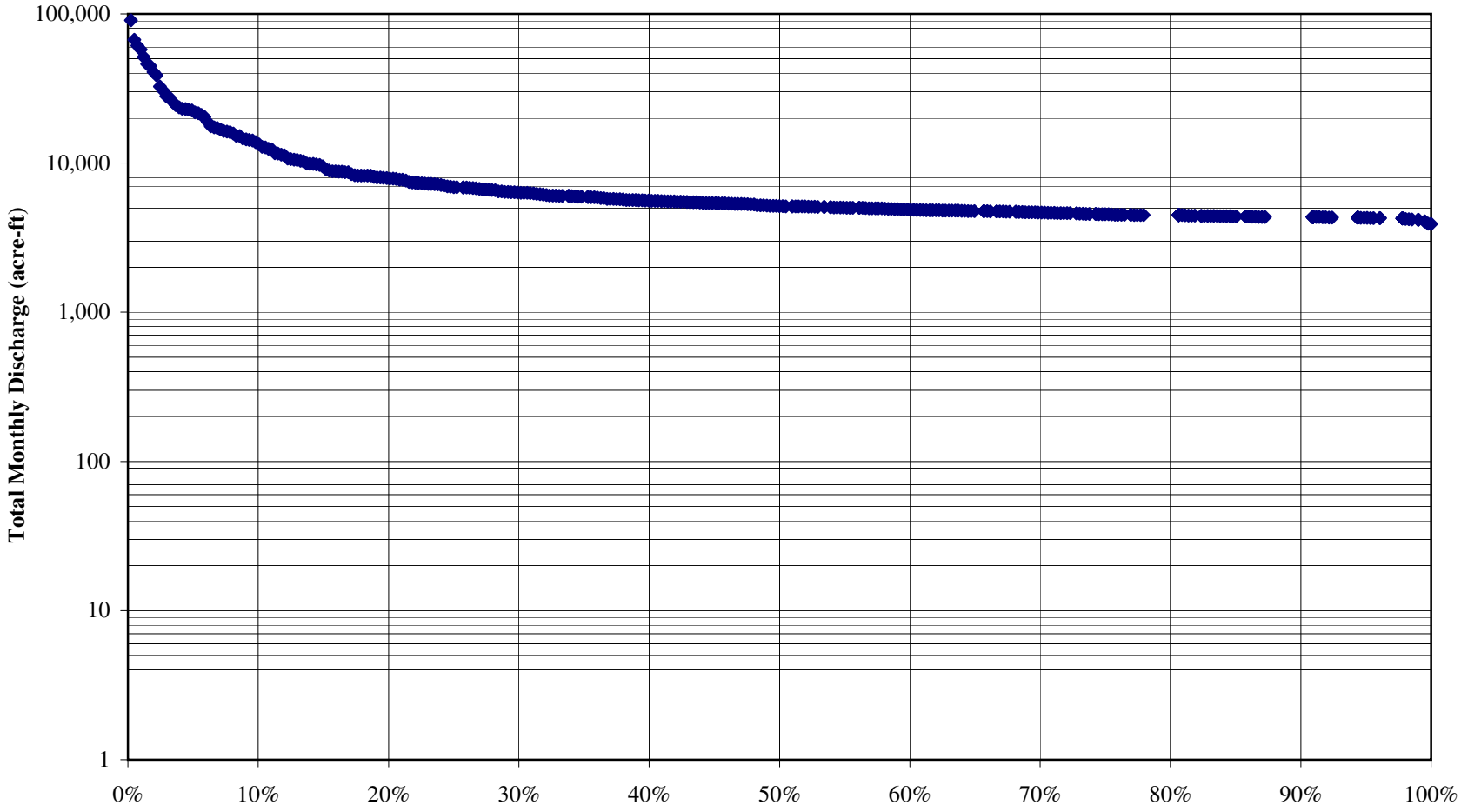
Upper Santa Ana River - Probability of Exceedance for Monthly Total Volumes
Water Year 1966-67 to Water Year 1999-2000
Project Scenario A
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-86

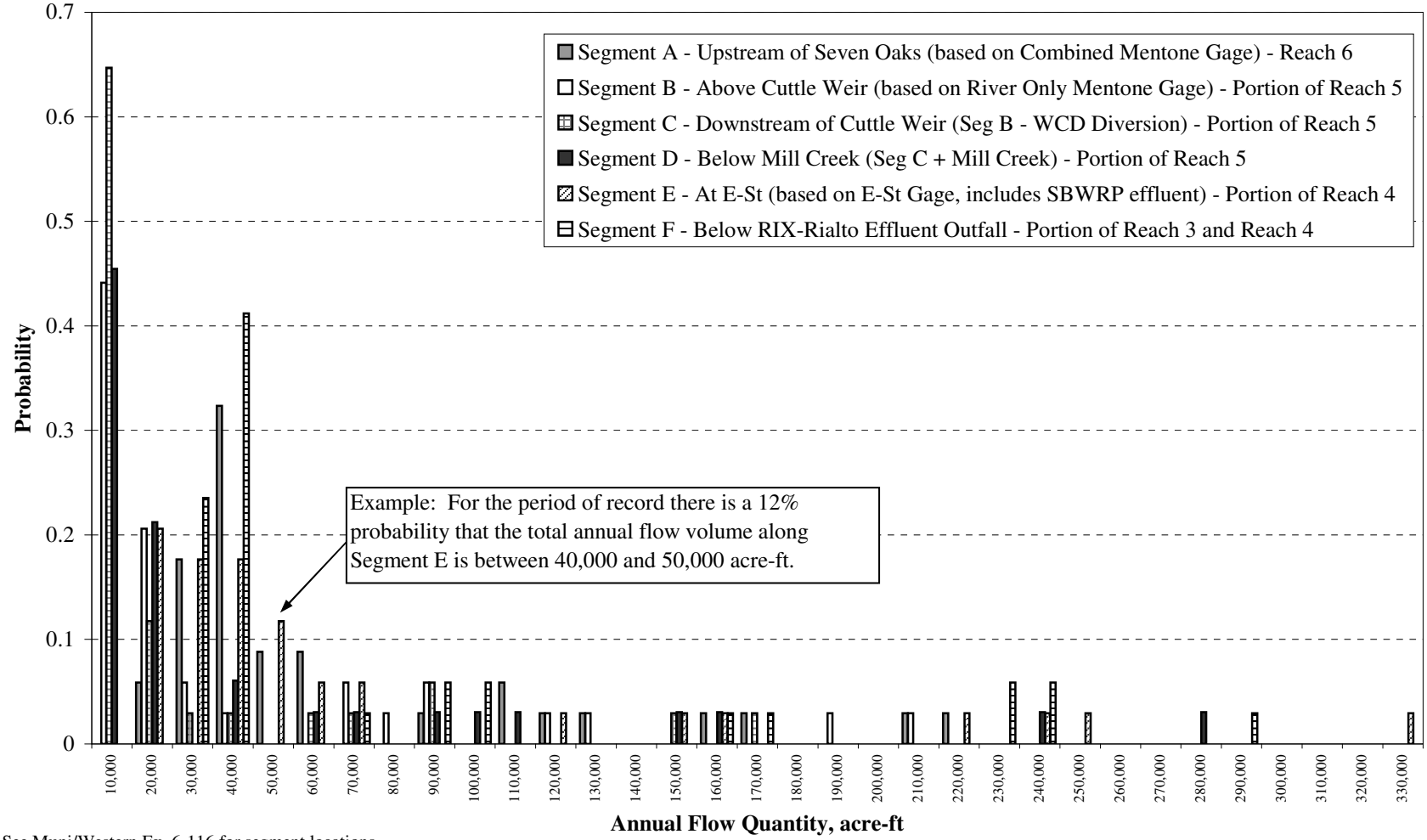
Upper Santa Ana River - Probability of Exceedance for Monthly Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Project Scenario A
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-87

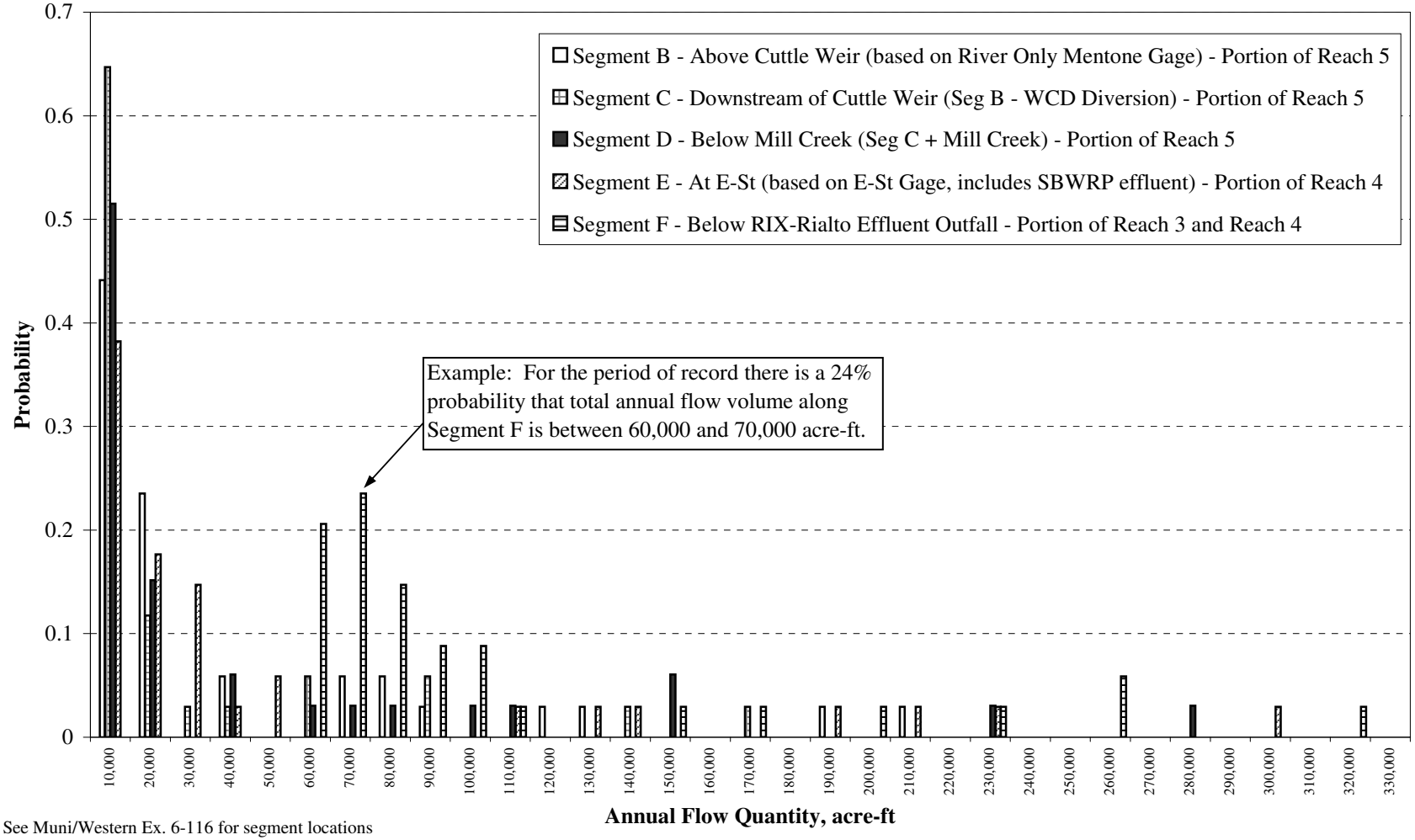
Upper Santa Ana River – Annual Flow Quantity Probability Distribution
Historical Data
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-88

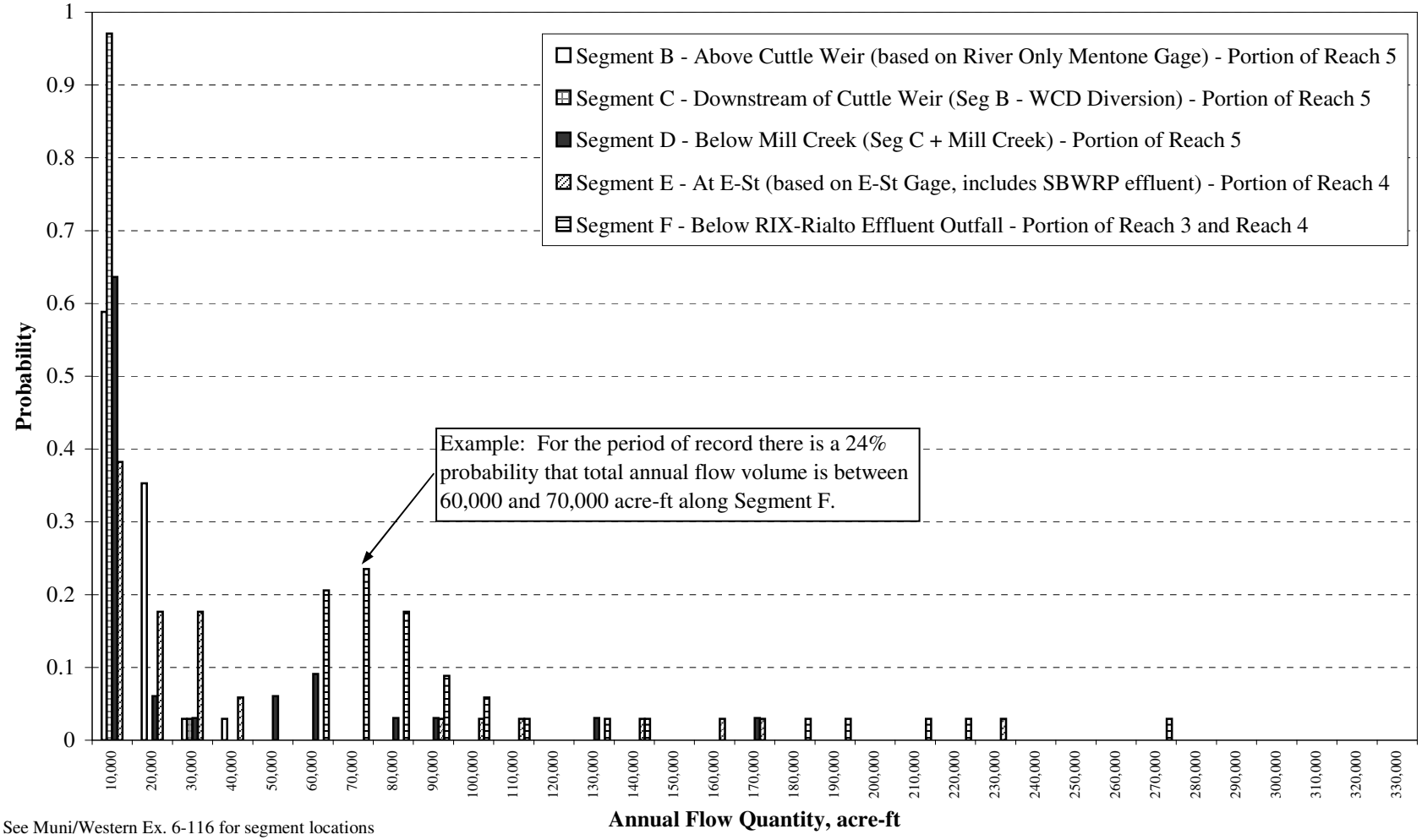
Upper Santa Ana River – Annual Flow Quantity Probability Distribution
No Project Condition
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-89

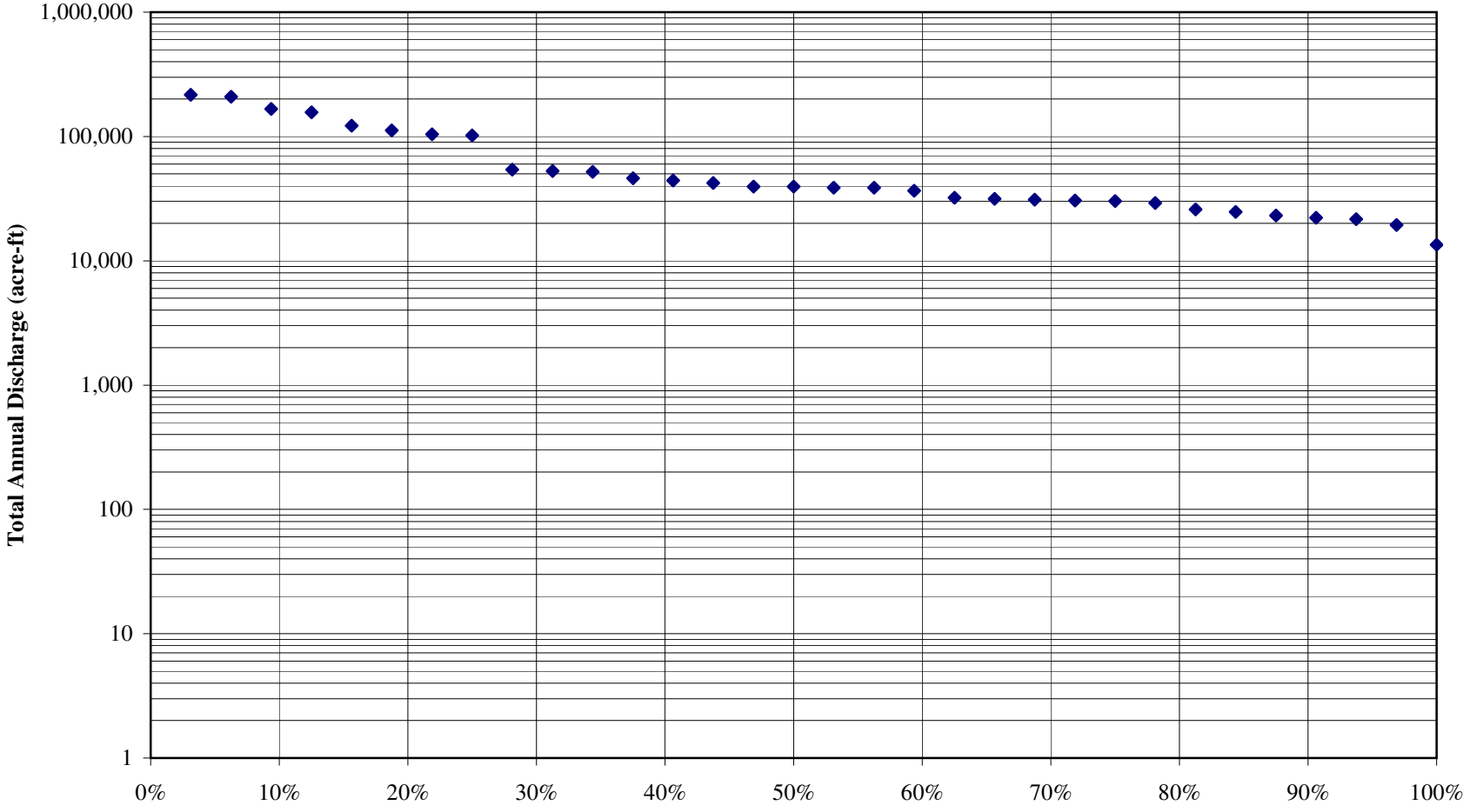
Upper Santa Ana River – Annual Flow Quantity Probability Distribution
Project Scenario A
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-90

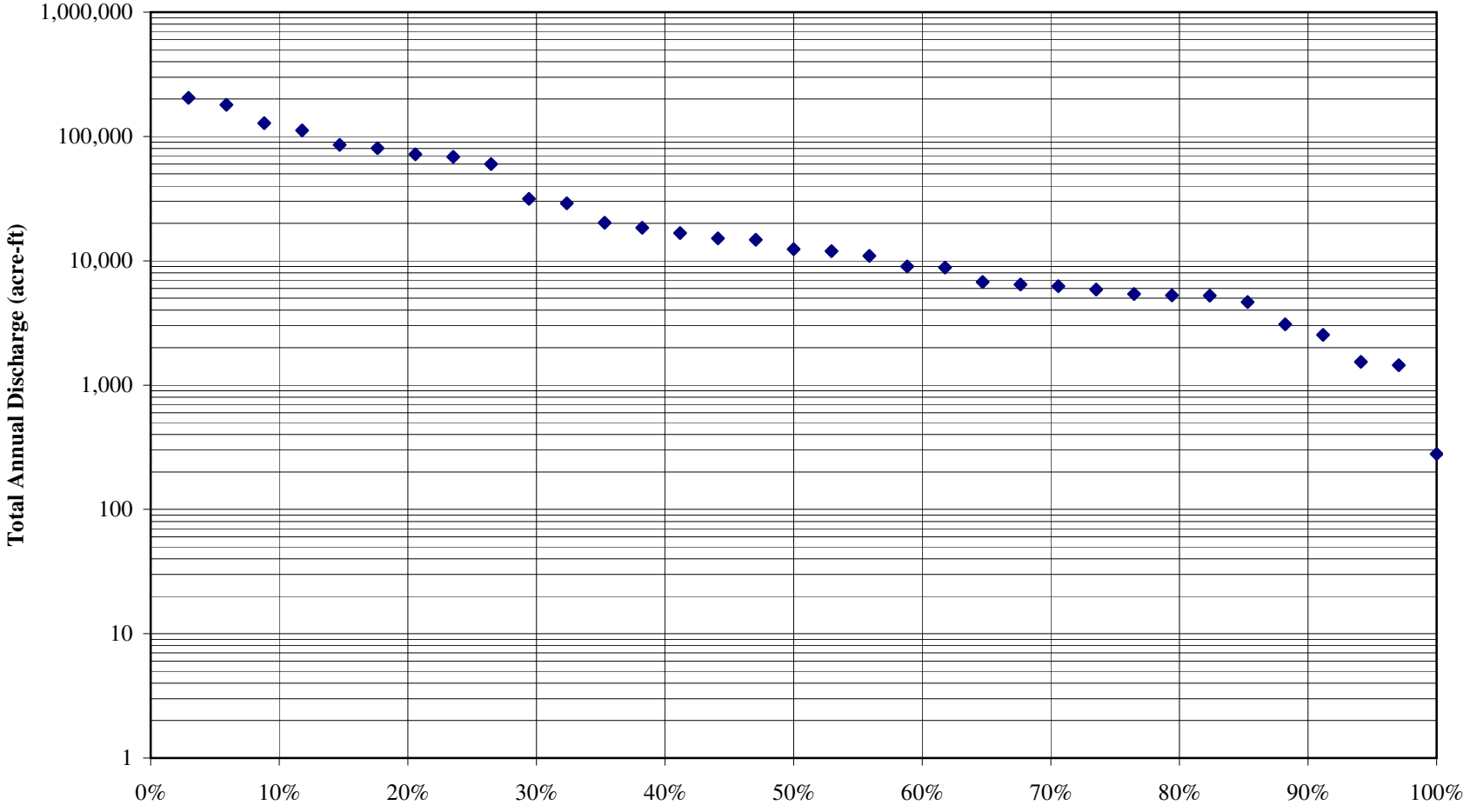
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment A: Upstream of Seven Oaks (Reach 6)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-91

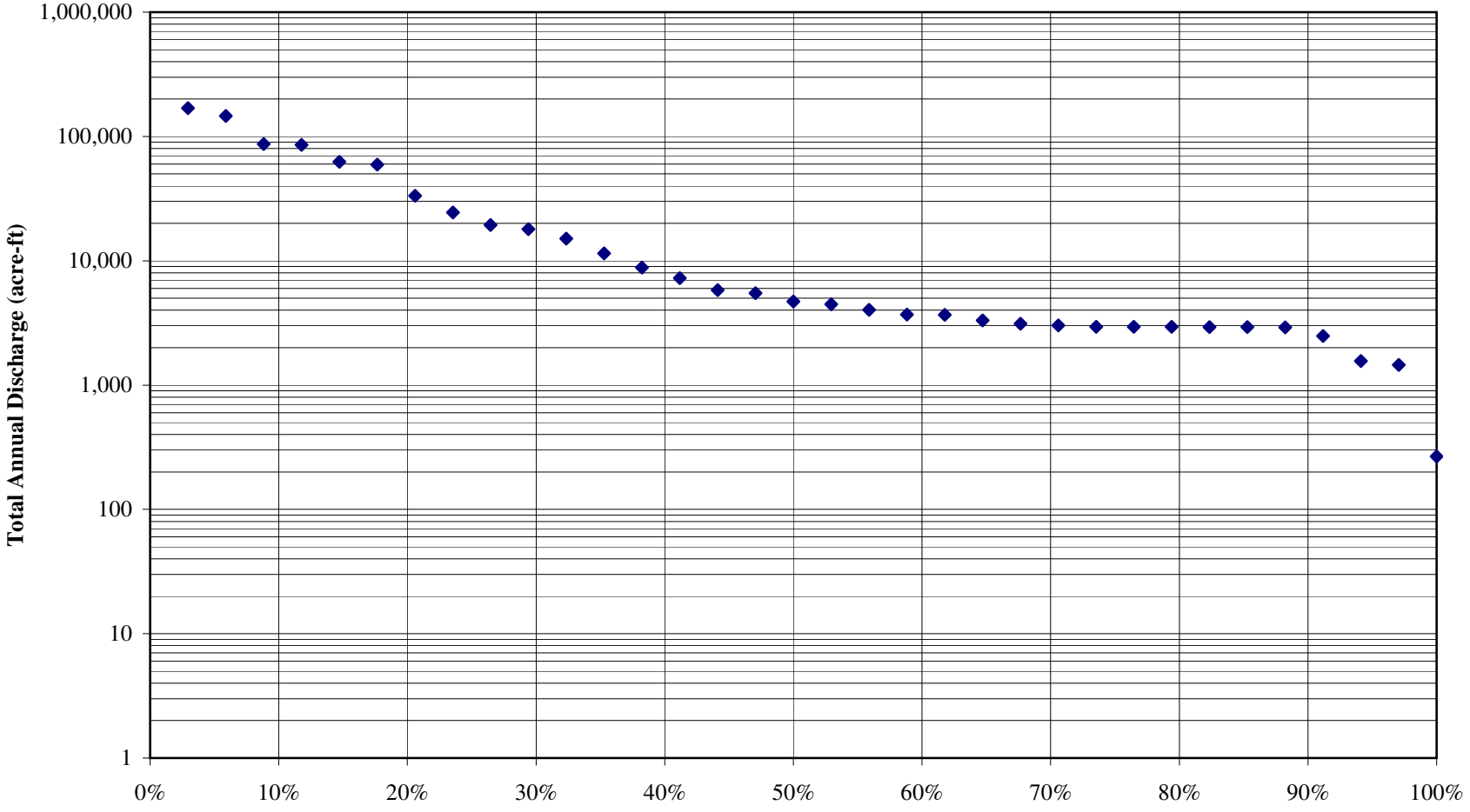
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-92

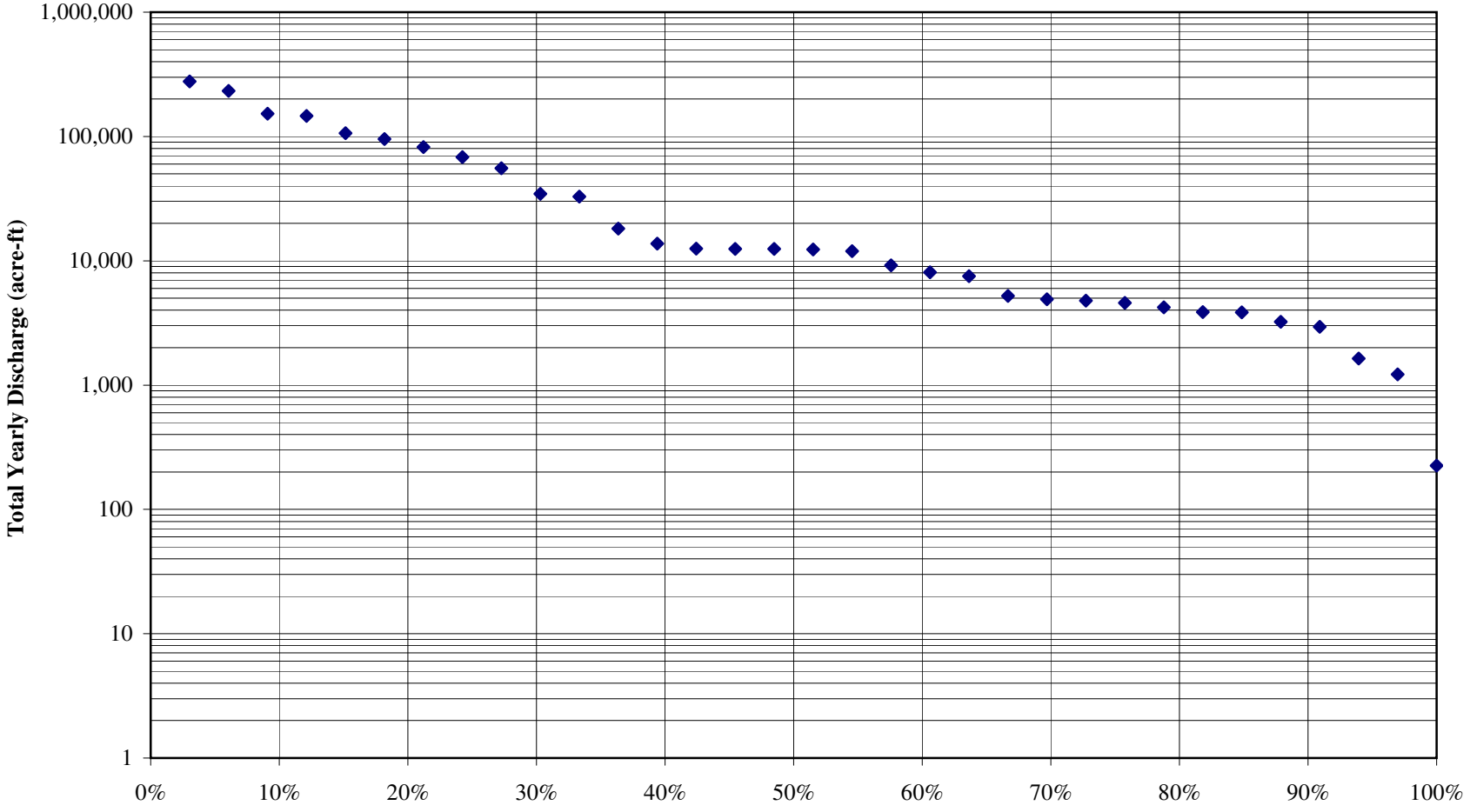
Upper Santa Ana River - Probability of Exceedance for Monthly Total Volumes
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-93

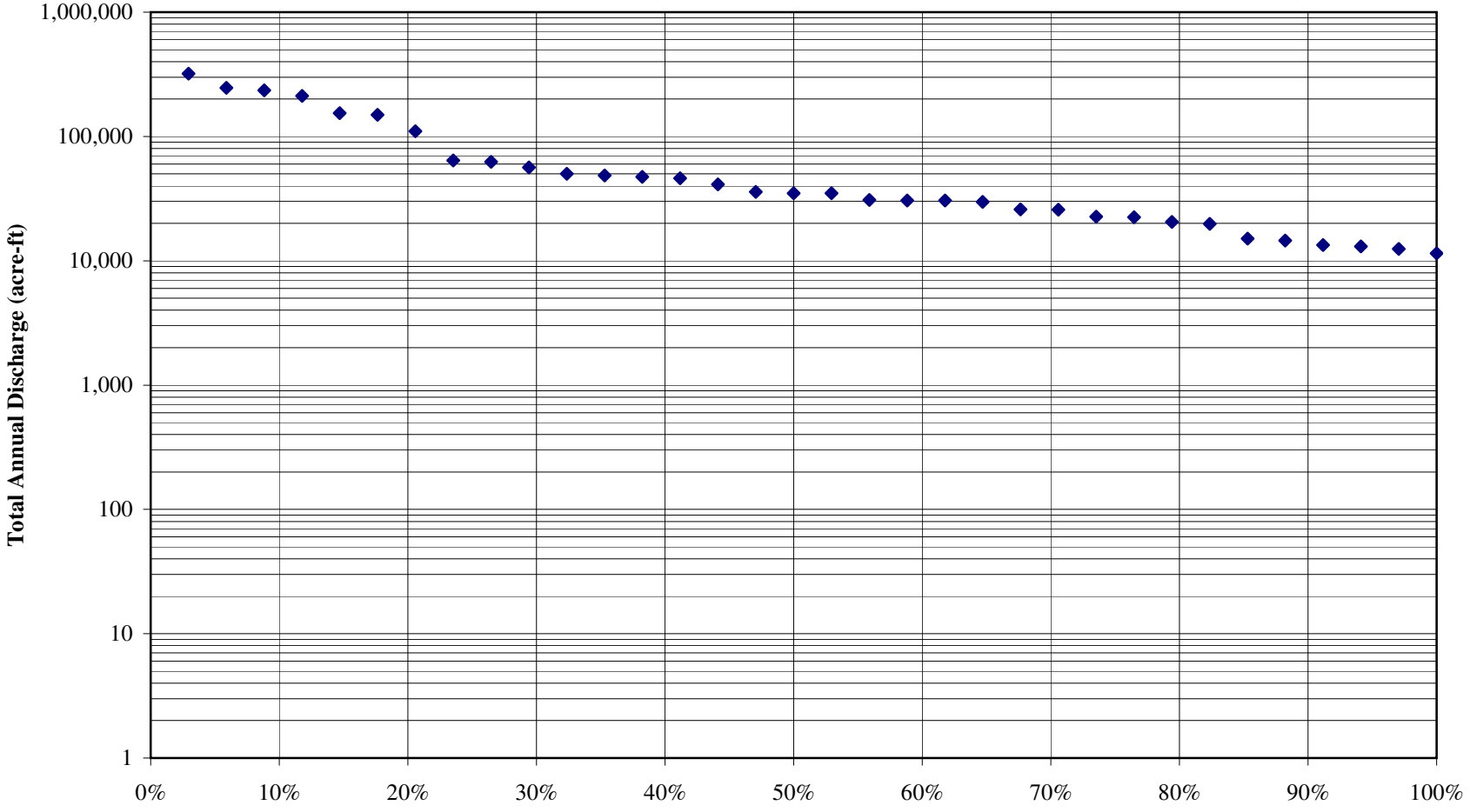
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1998-1999
Historical Data
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-94

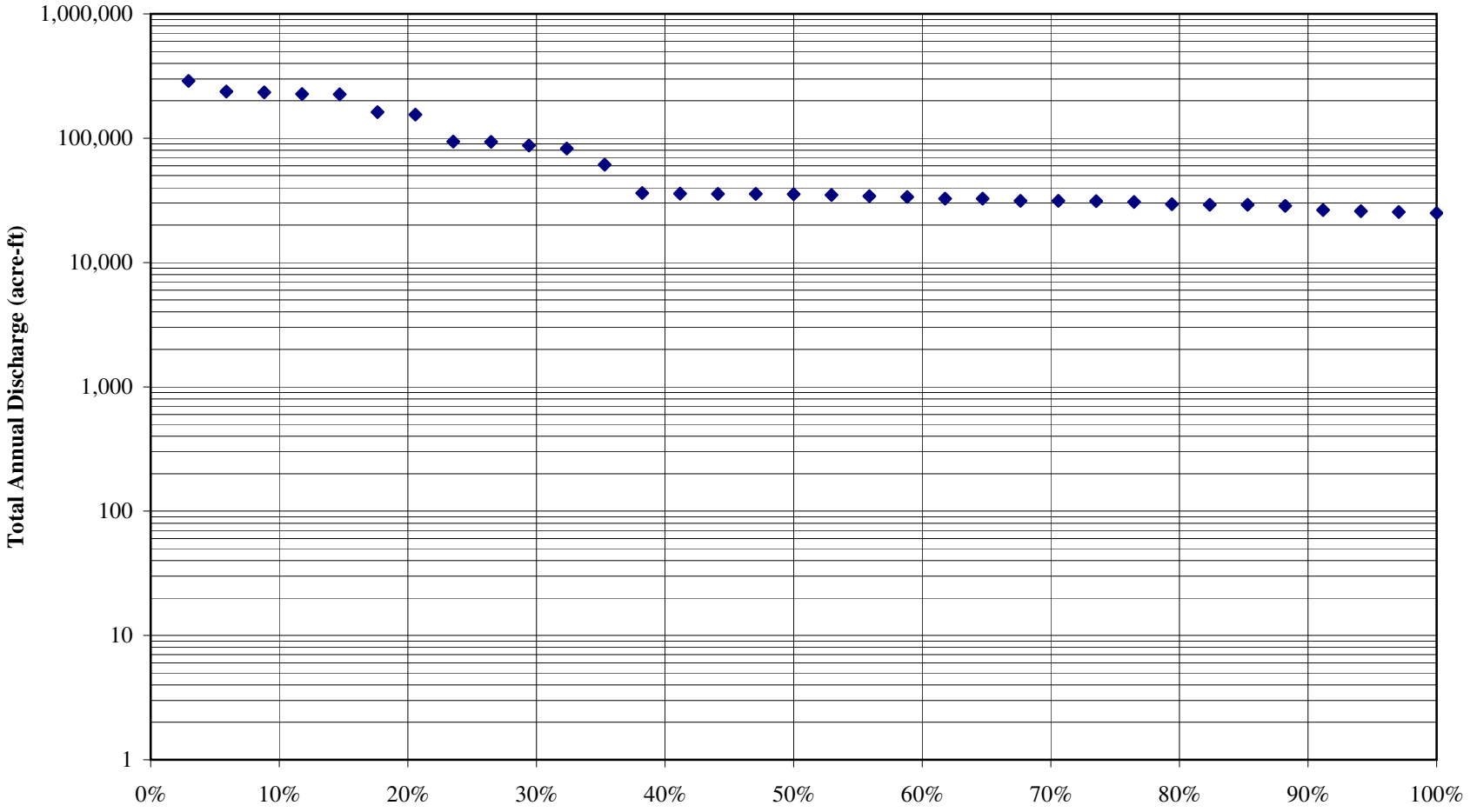
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-95

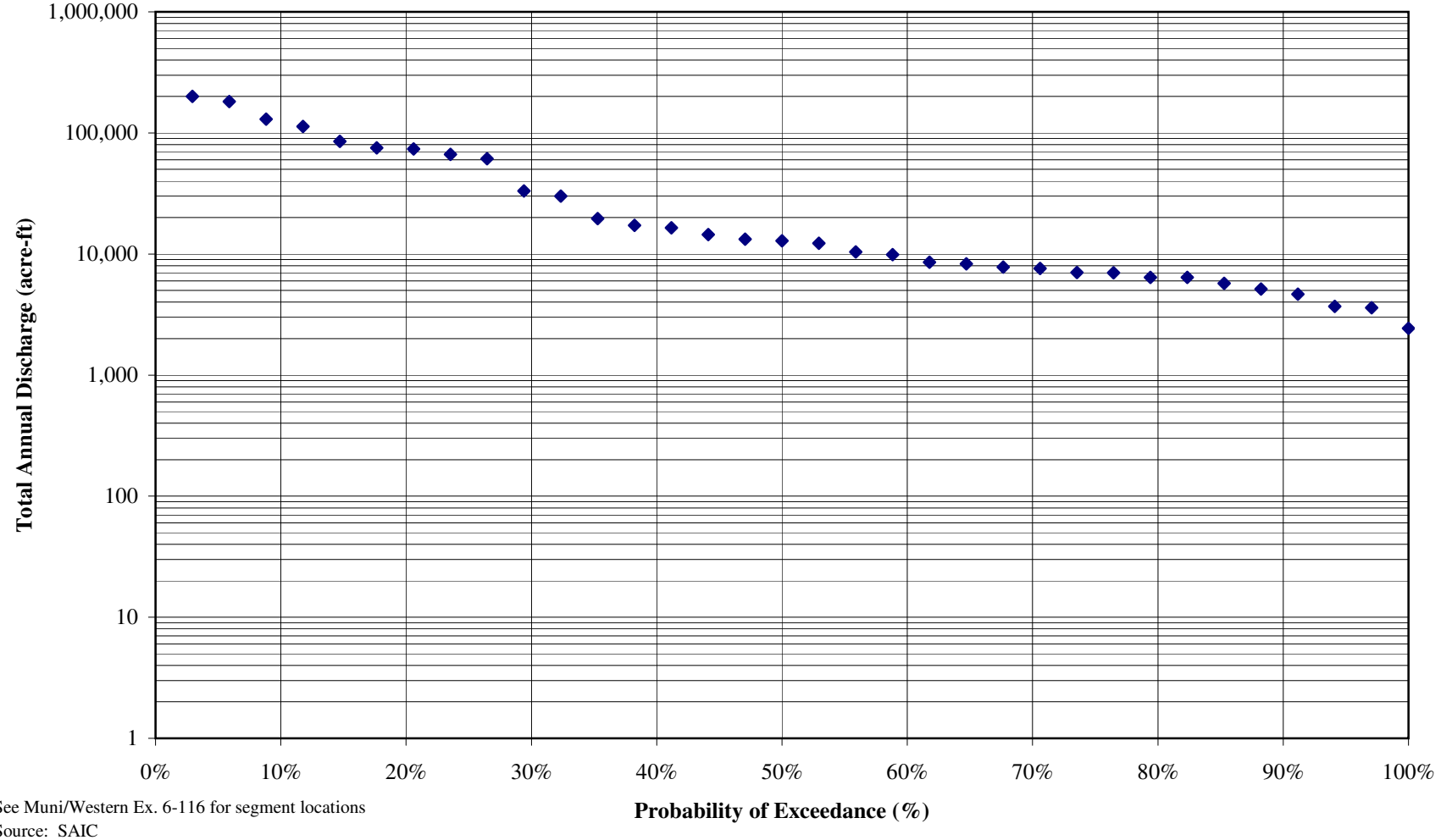
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Historical Data
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-96

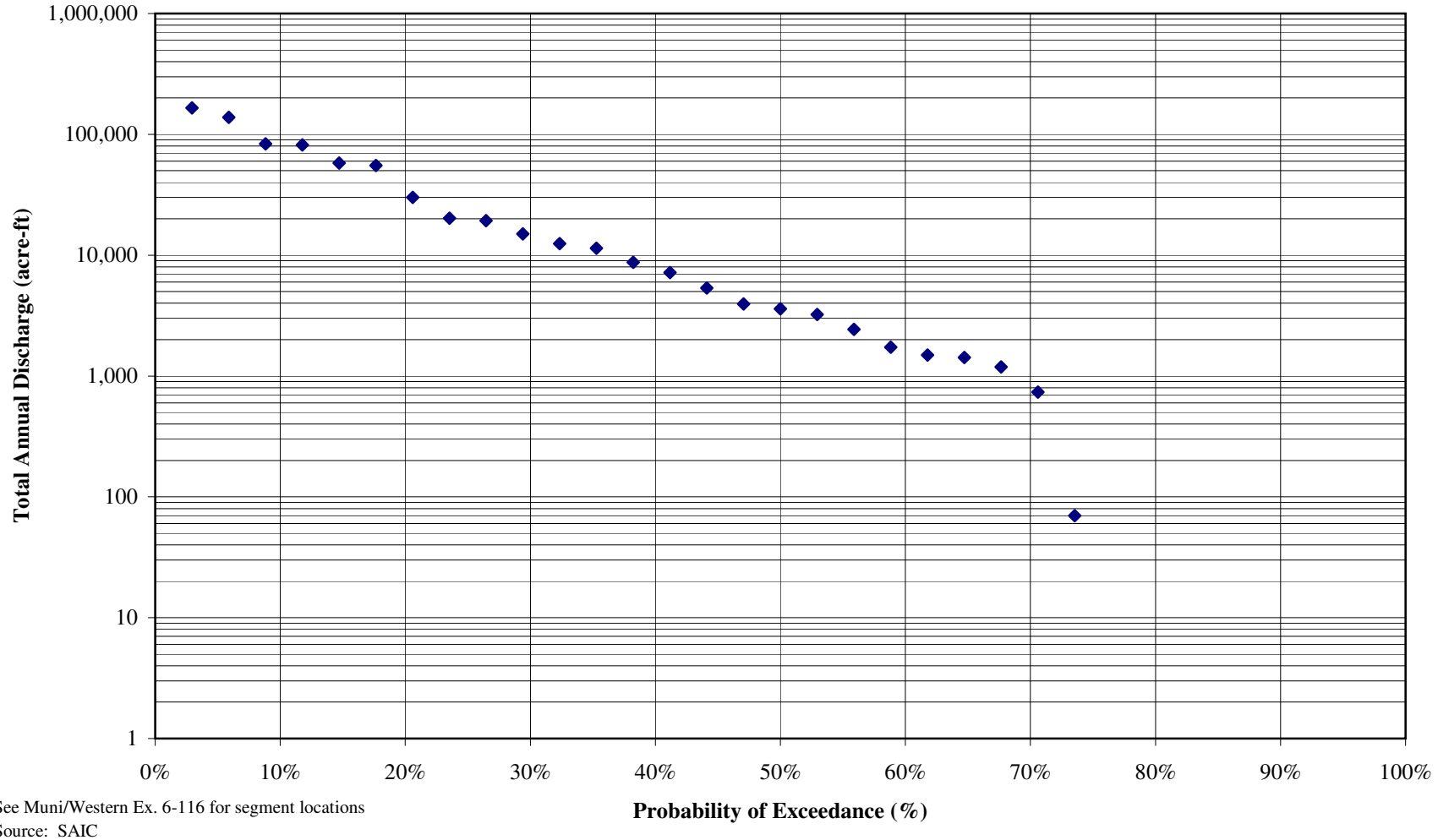
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
No Project Condition
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-97

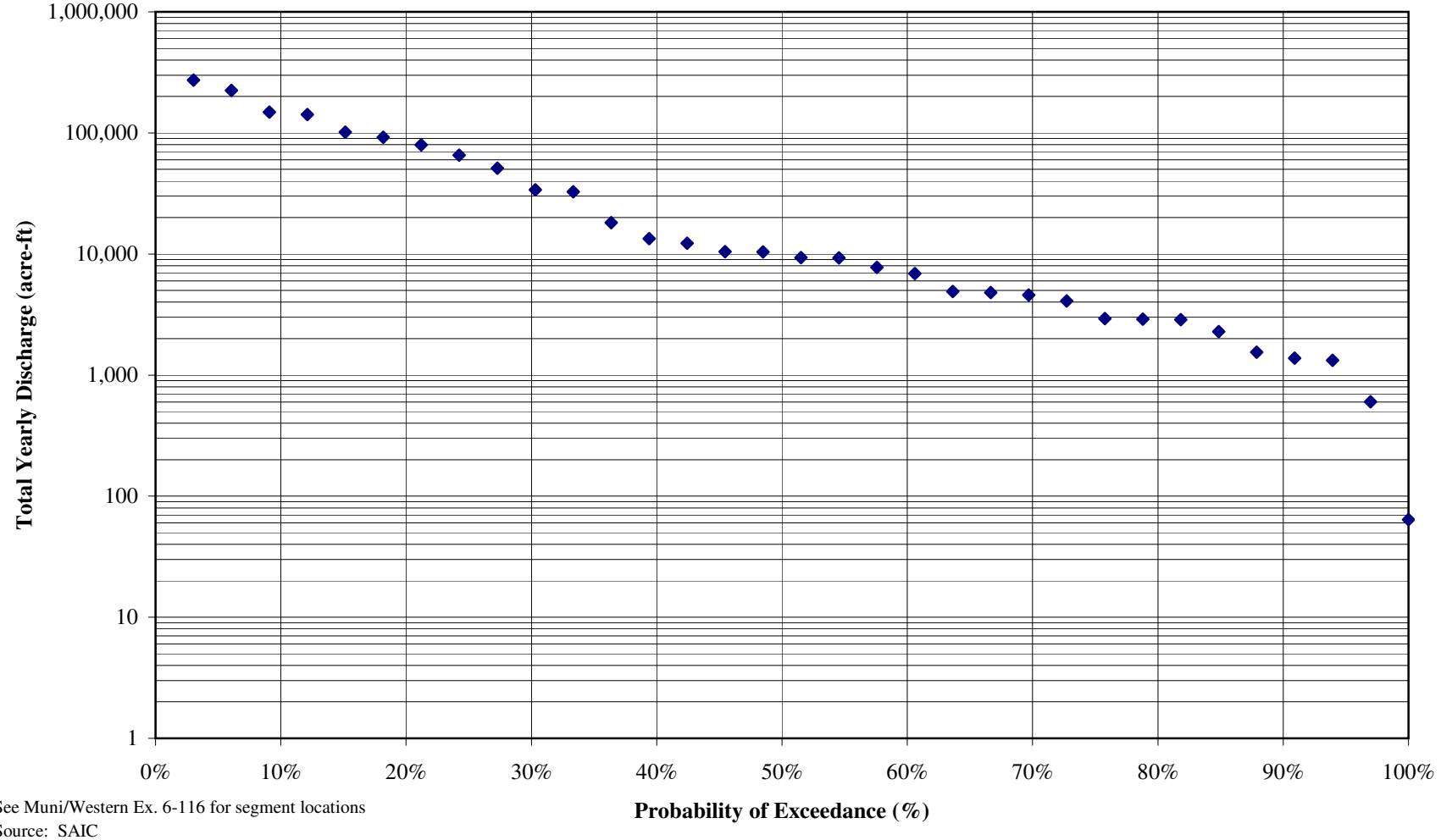
Upper Santa Ana River - Probability of Exceedance for Monthly Total Volumes
Water Year 1966-67 to Water Year 1999-2000
No Project Condition
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-98

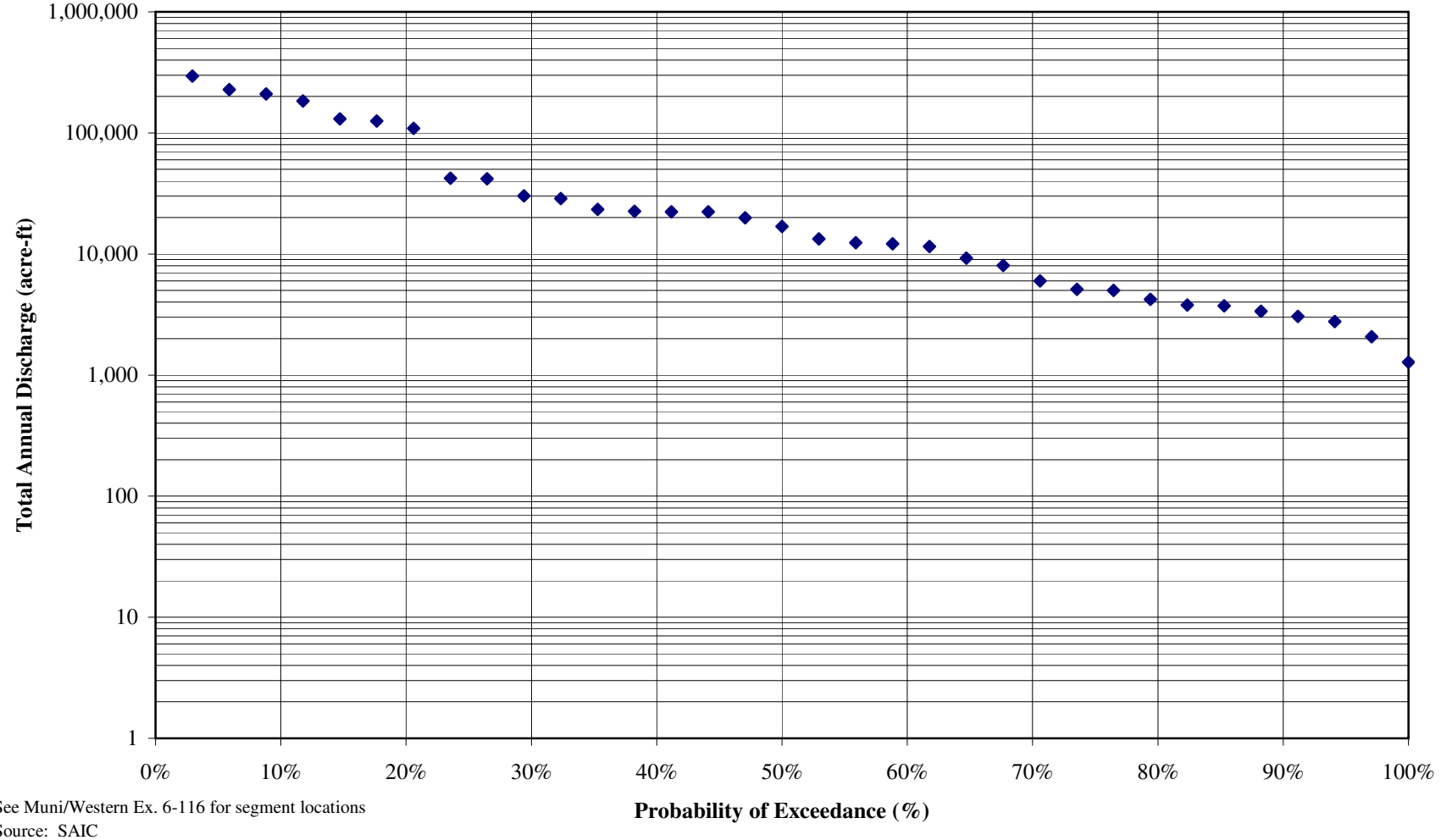
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1998-1999
No Project Condition
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-99

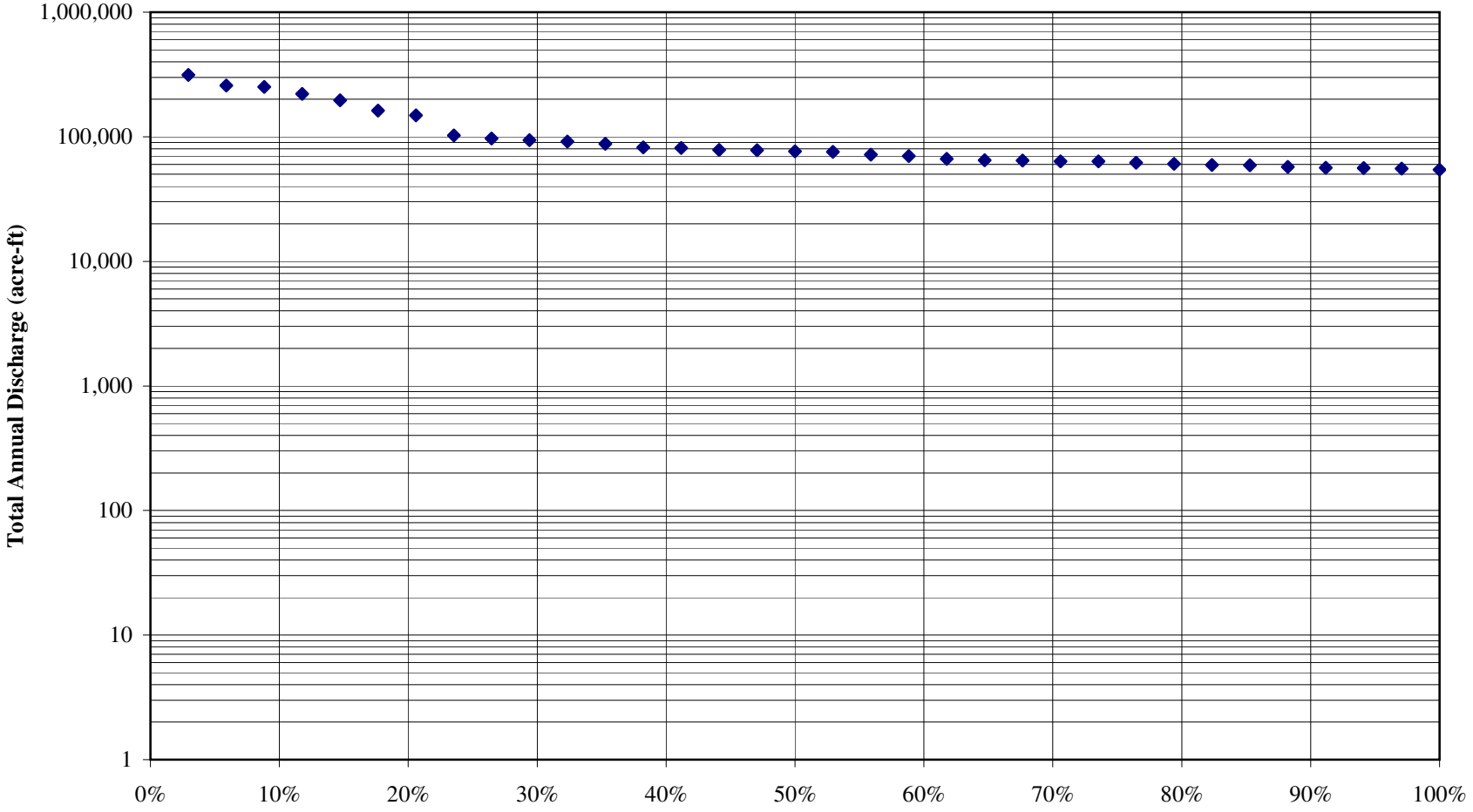
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
No Project Condition
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-100

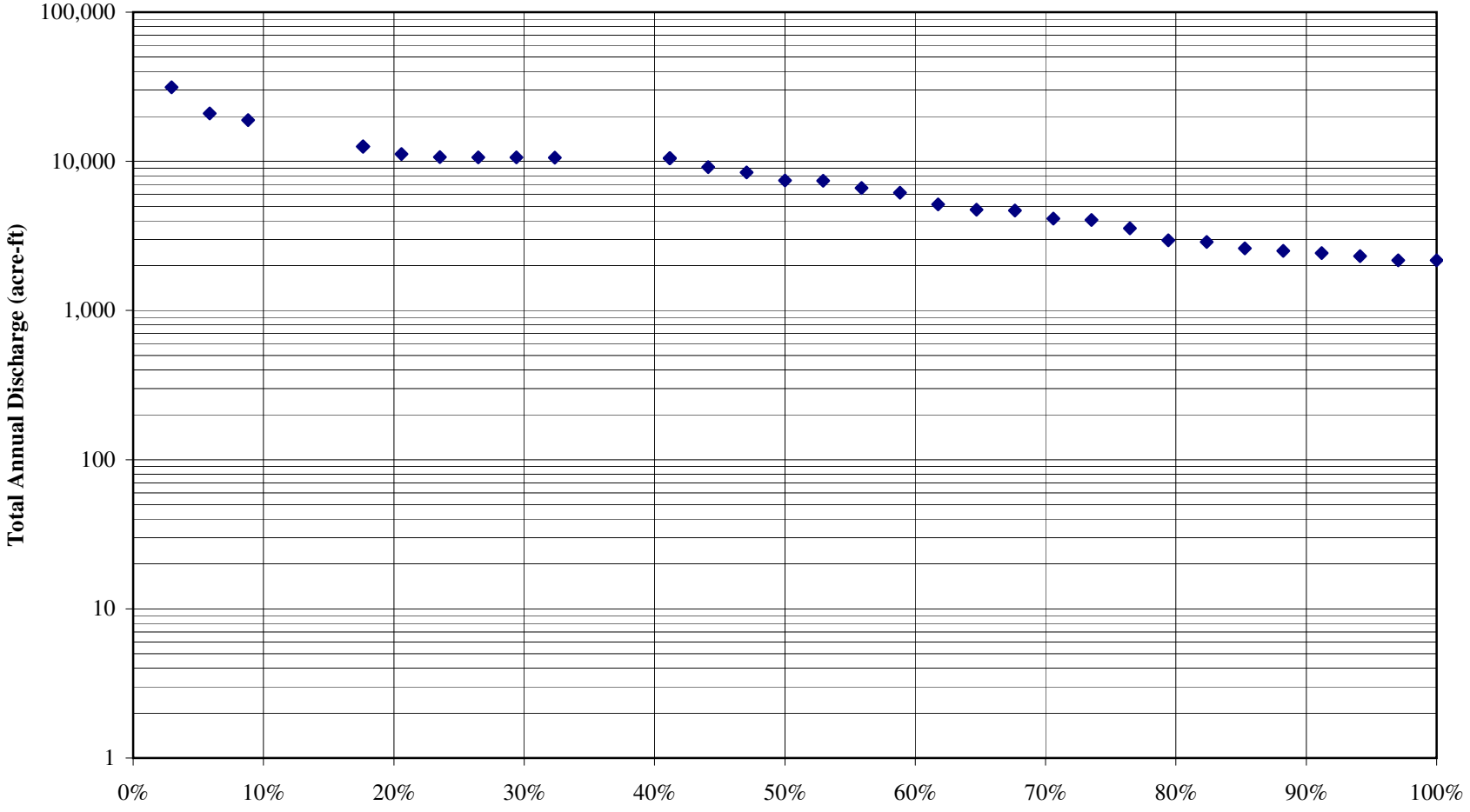
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
No Project Condition
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-101

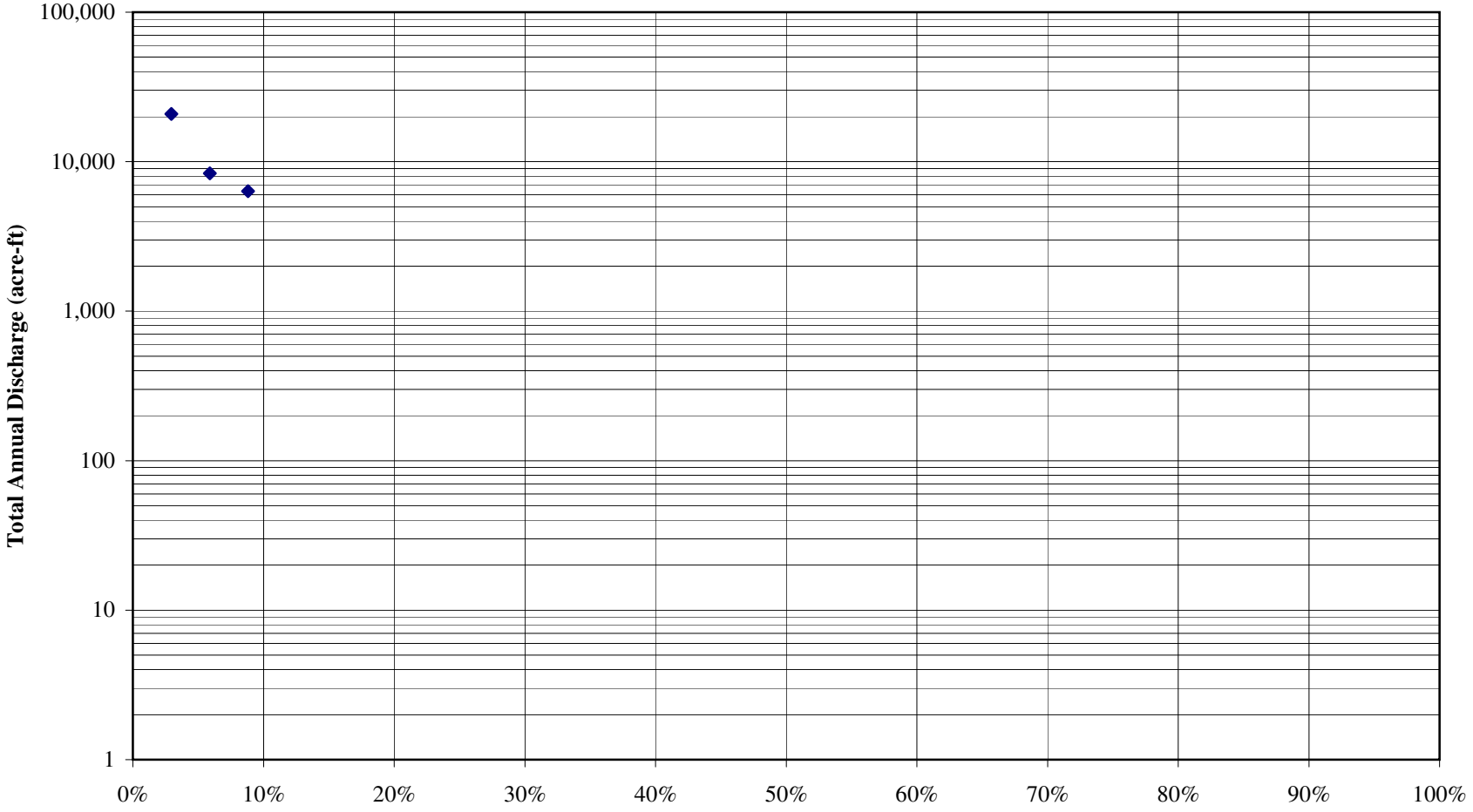
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Project Scenario A
Segment B: Above Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-102

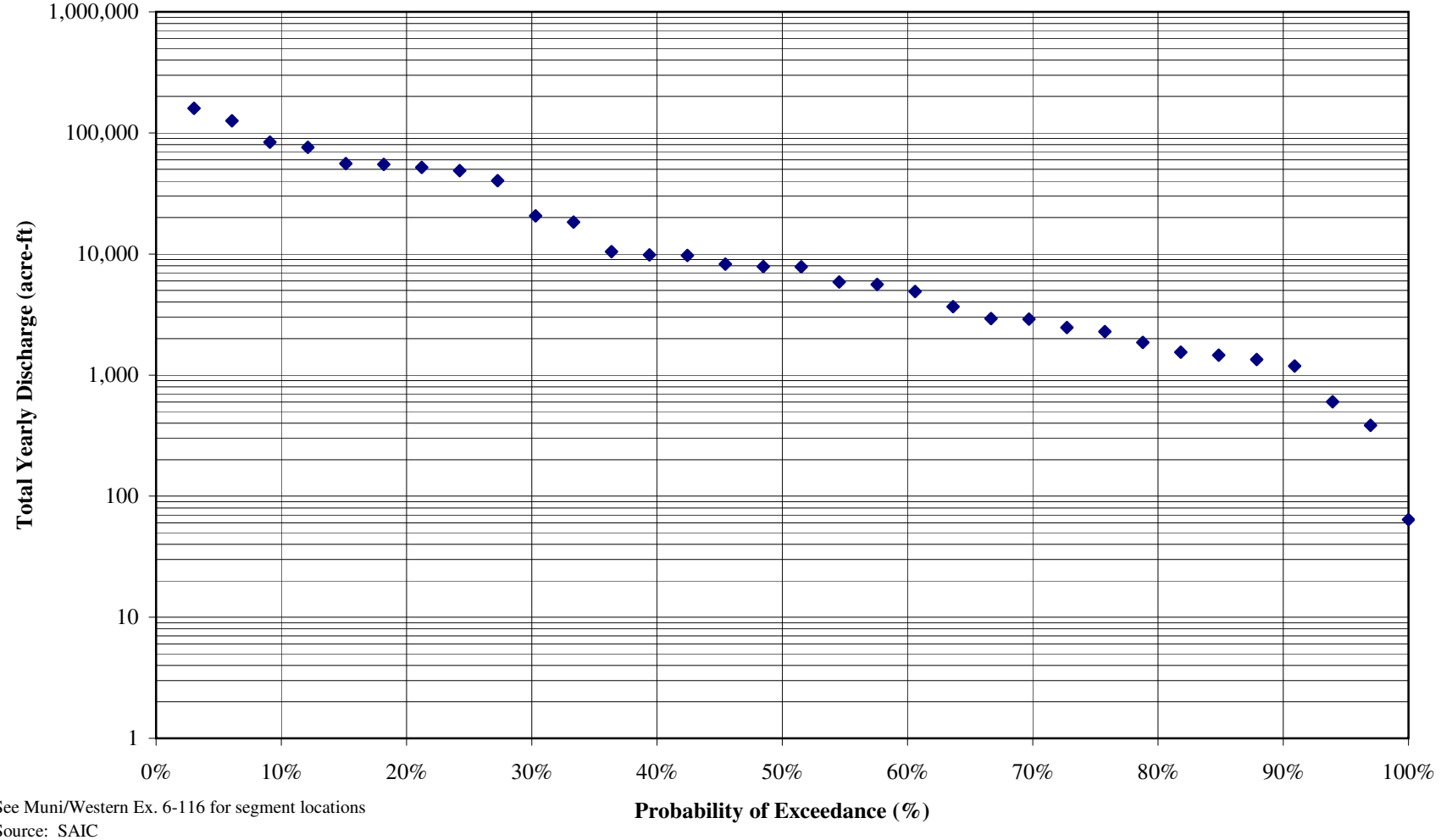
Upper Santa Ana River - Probability of Exceedance for Monthly Total Volumes
Water Year 1966-67 to Water Year 1999-2000
Project Scenario A
Segment C: Downstream of Cuttle Weir (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-103

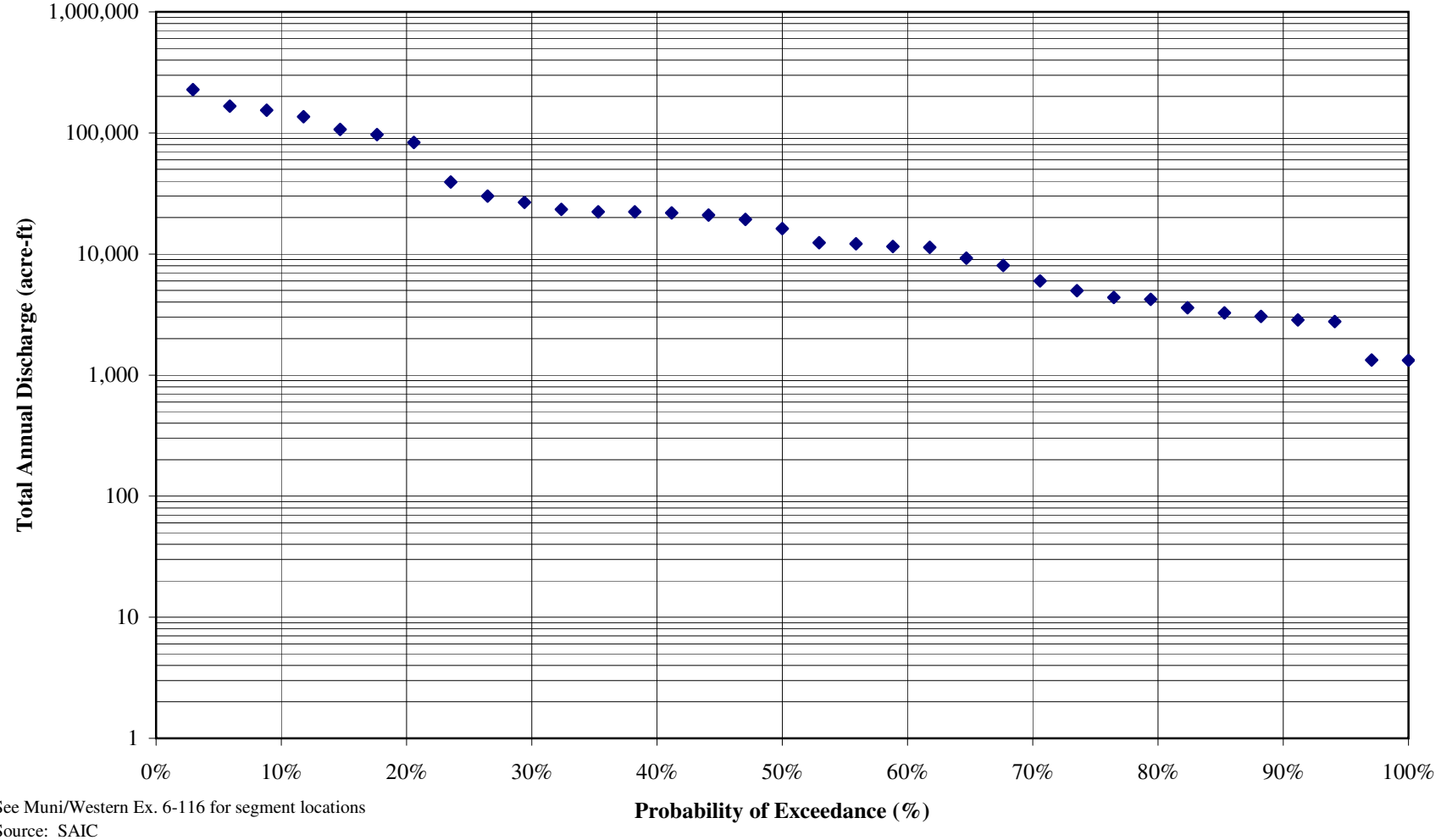
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1998-1999
Project Scenario A
Segment D: Below Mill Creek (Portion of Reach 5)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-104

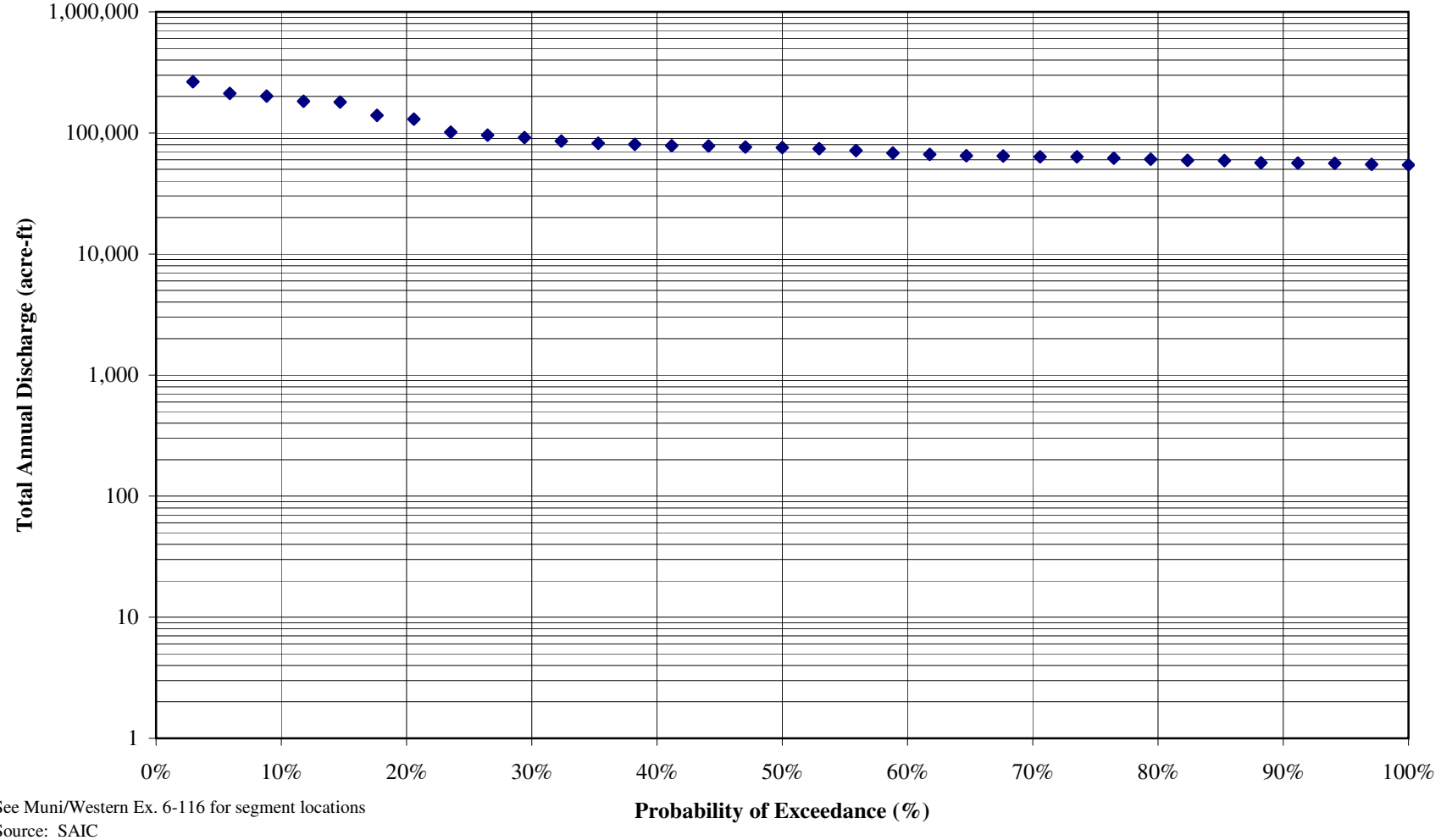
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Project Scenario A
Segment E: At E-Street Based on E-Street Gage (Portion of Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-105

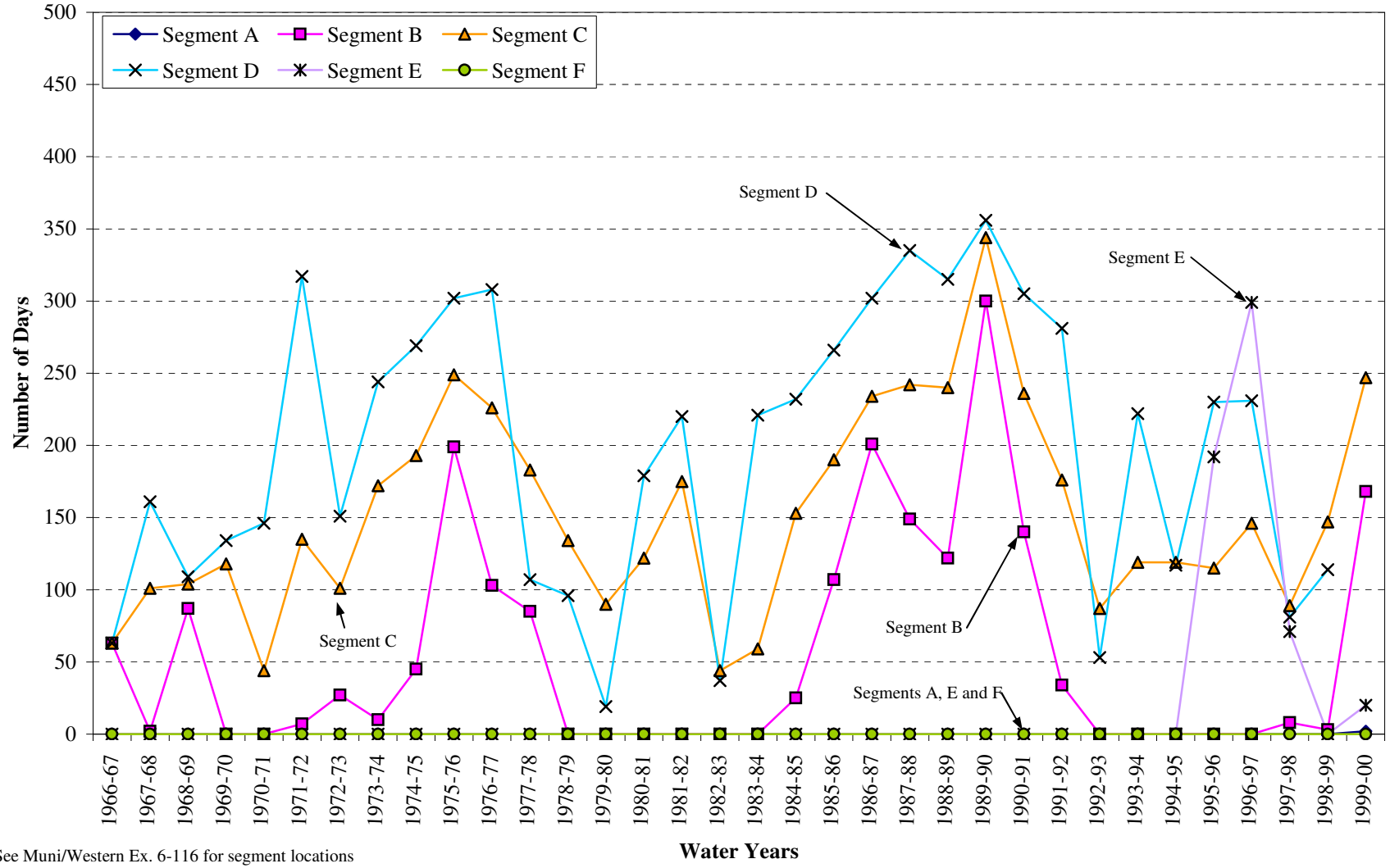
Upper Santa Ana River - Probability of Exceedance for Annual Flow Quantity
Water Year 1966-67 to Water Year 1999-2000
Project Scenario A
Segment F: Below RIX-Rialto Effluent Outfall (Portion of Reach 3 and Reach 4)



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-106

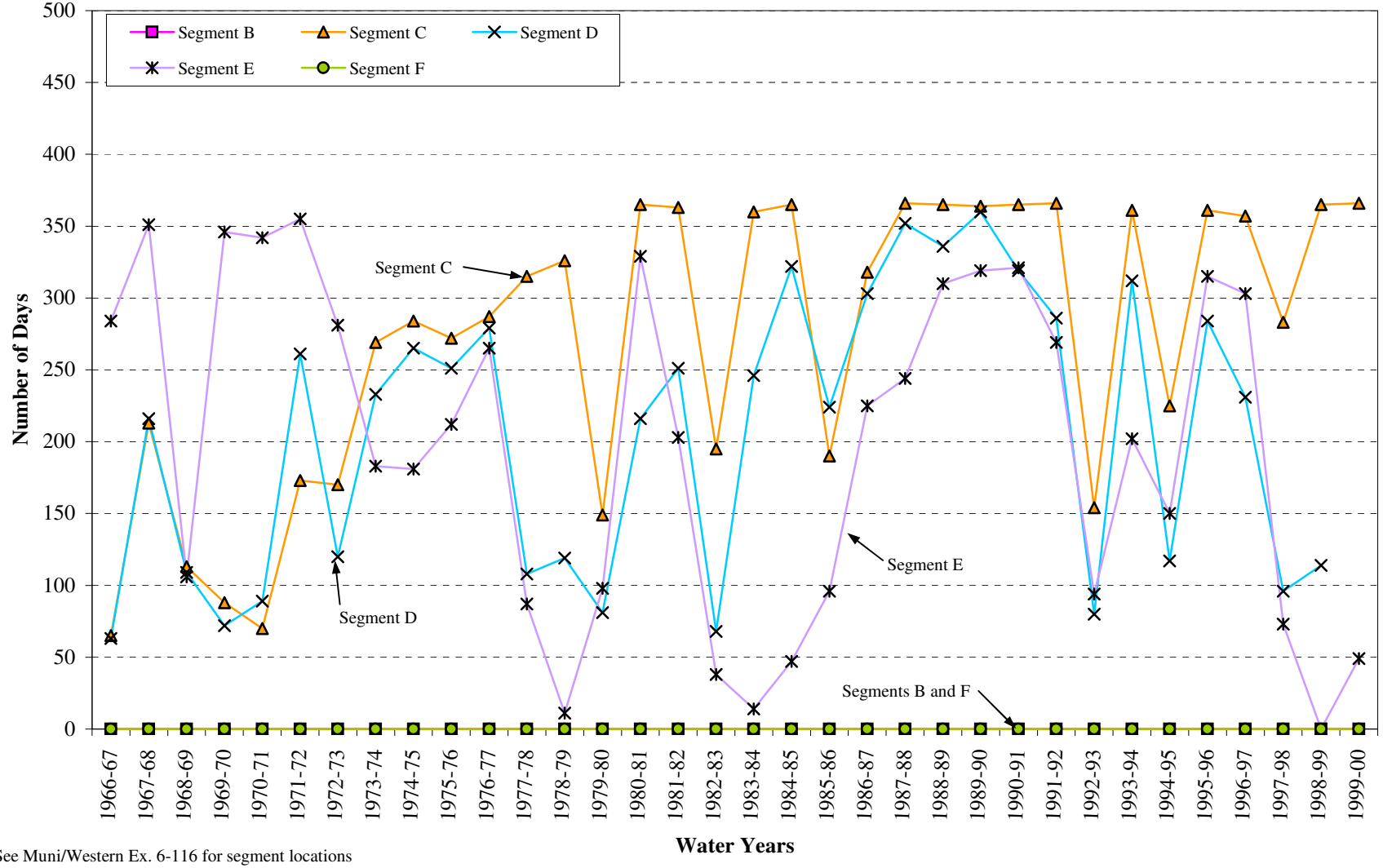
Upper Santa Ana River - Number of Days without Flow per Water Year
Historical Data
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-107

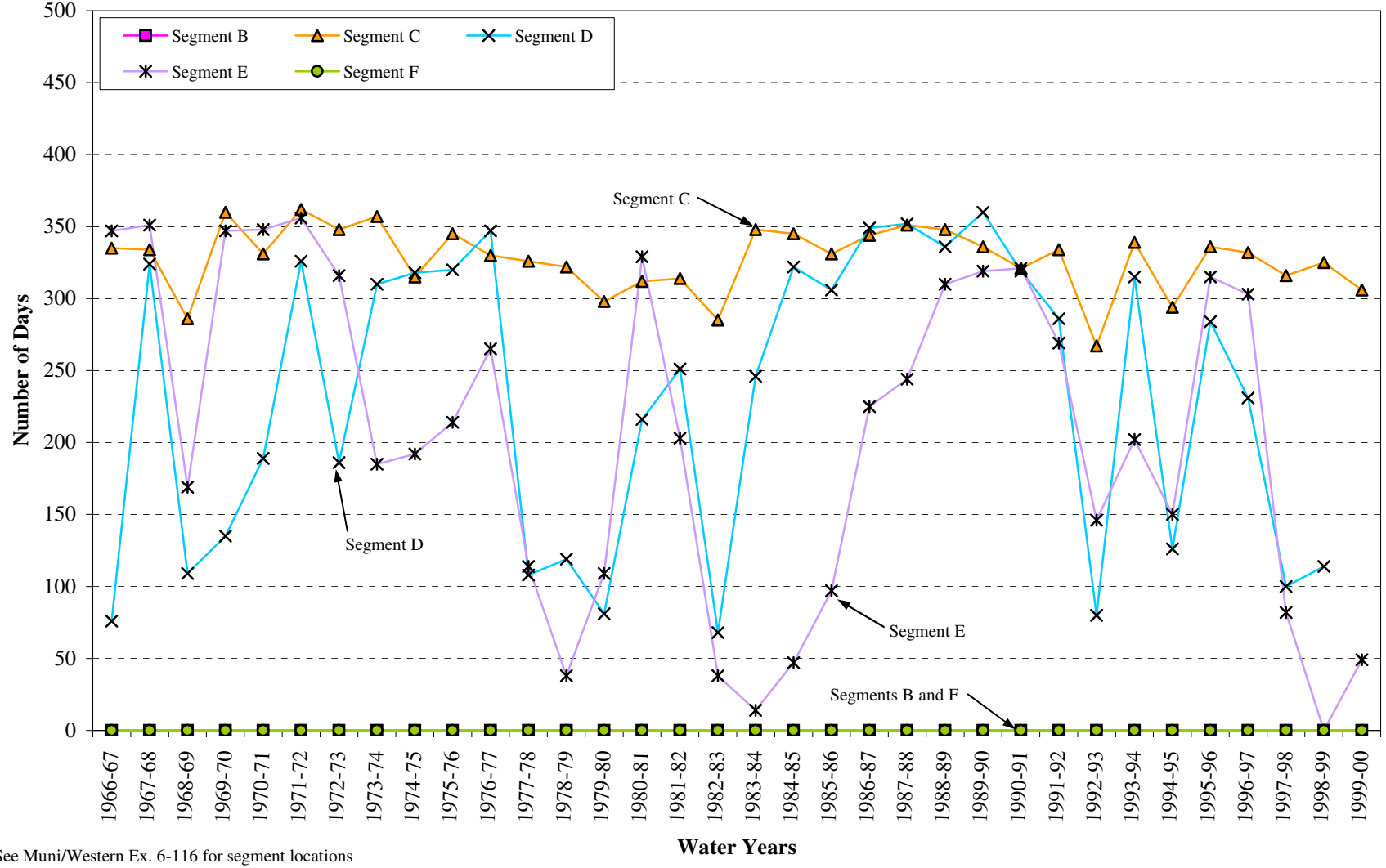
Upper Santa Ana River - Number of Days without Flow per Water Year
No Project Condition
Data For Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-108

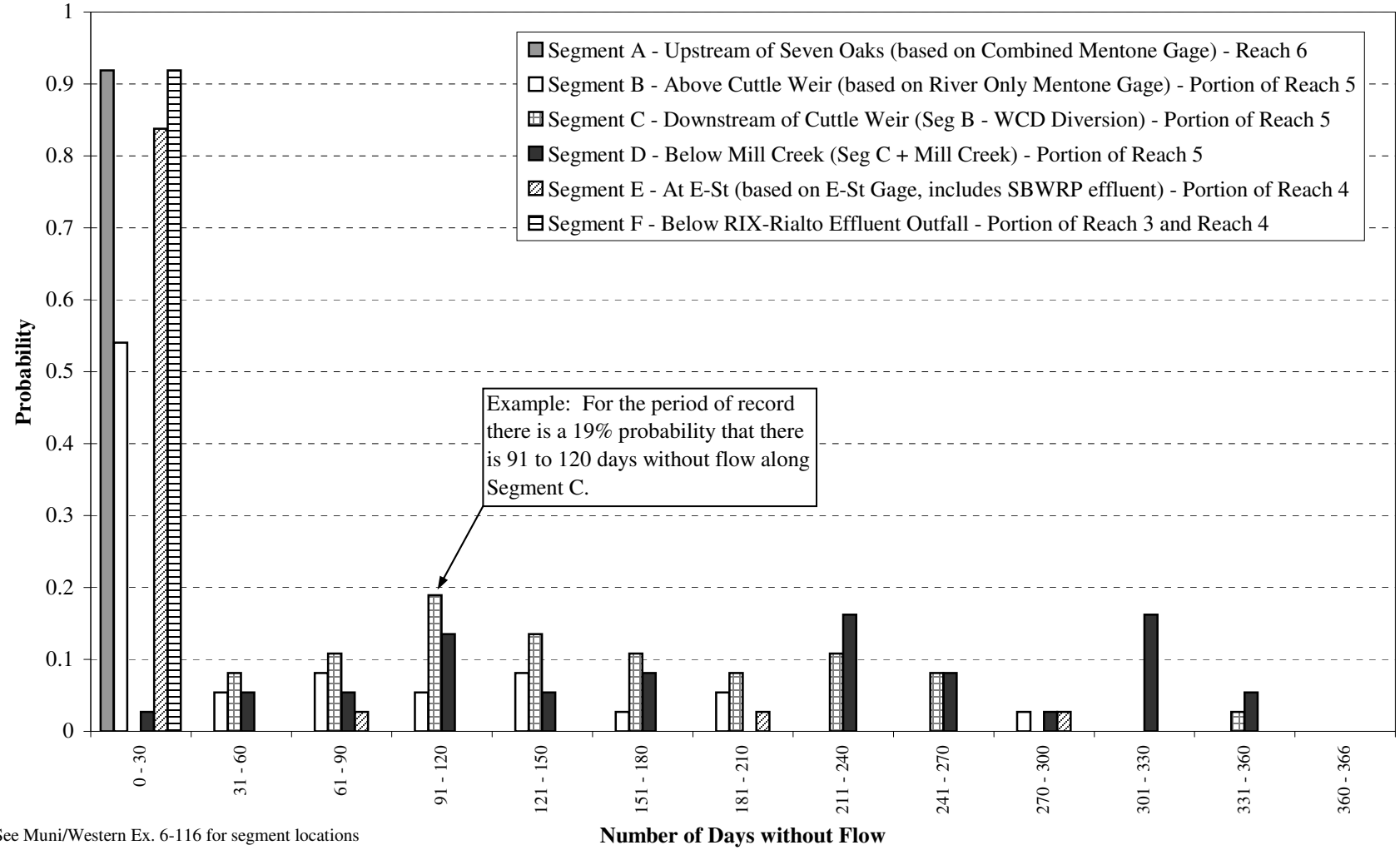
Upper Santa Ana River - Number of Days without Flow per Water Year
Project Scenario A
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-109

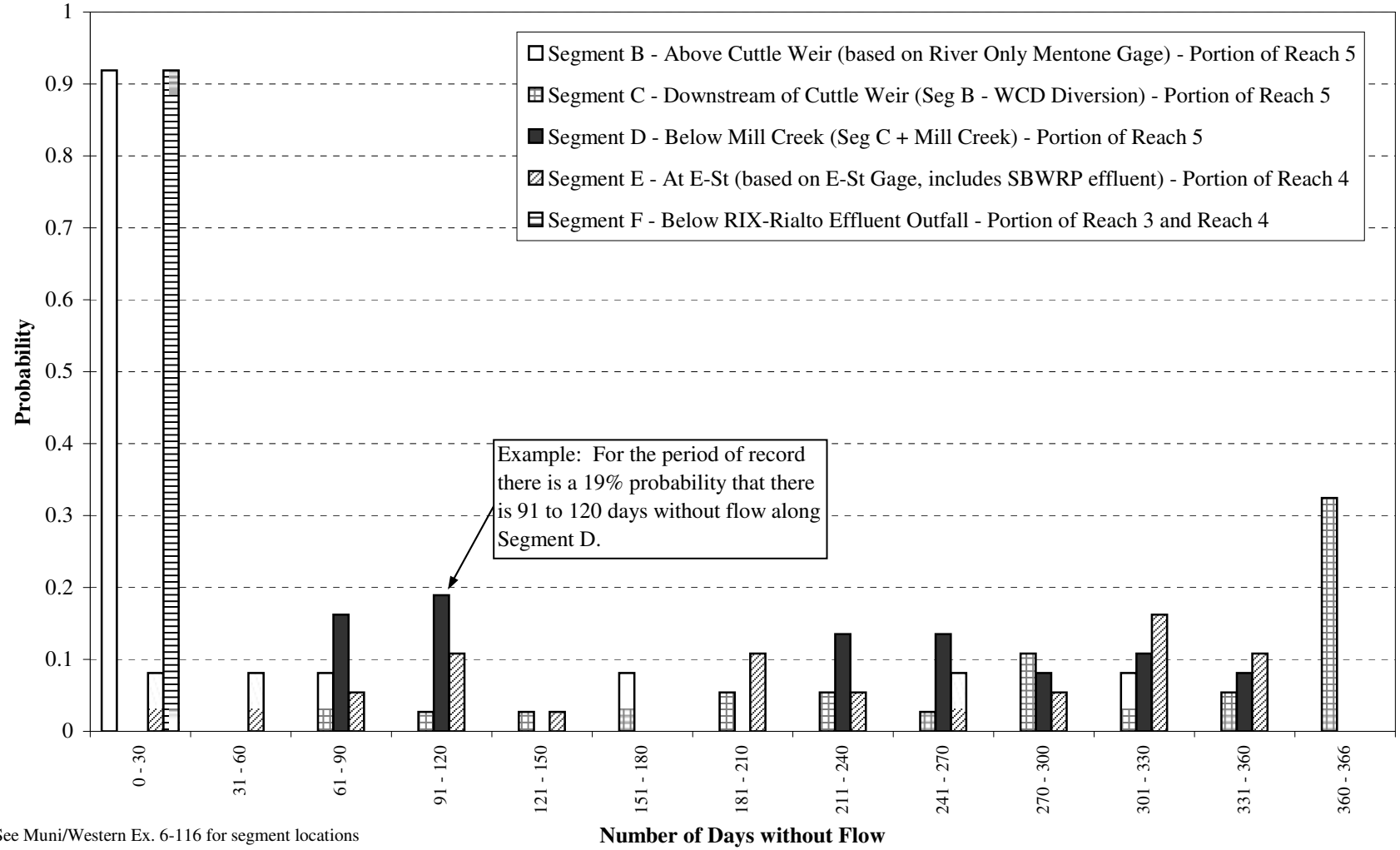
Upper Santa Ana River – Annual Number of Days without Flow Probability Distribution
Historical Data
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-110

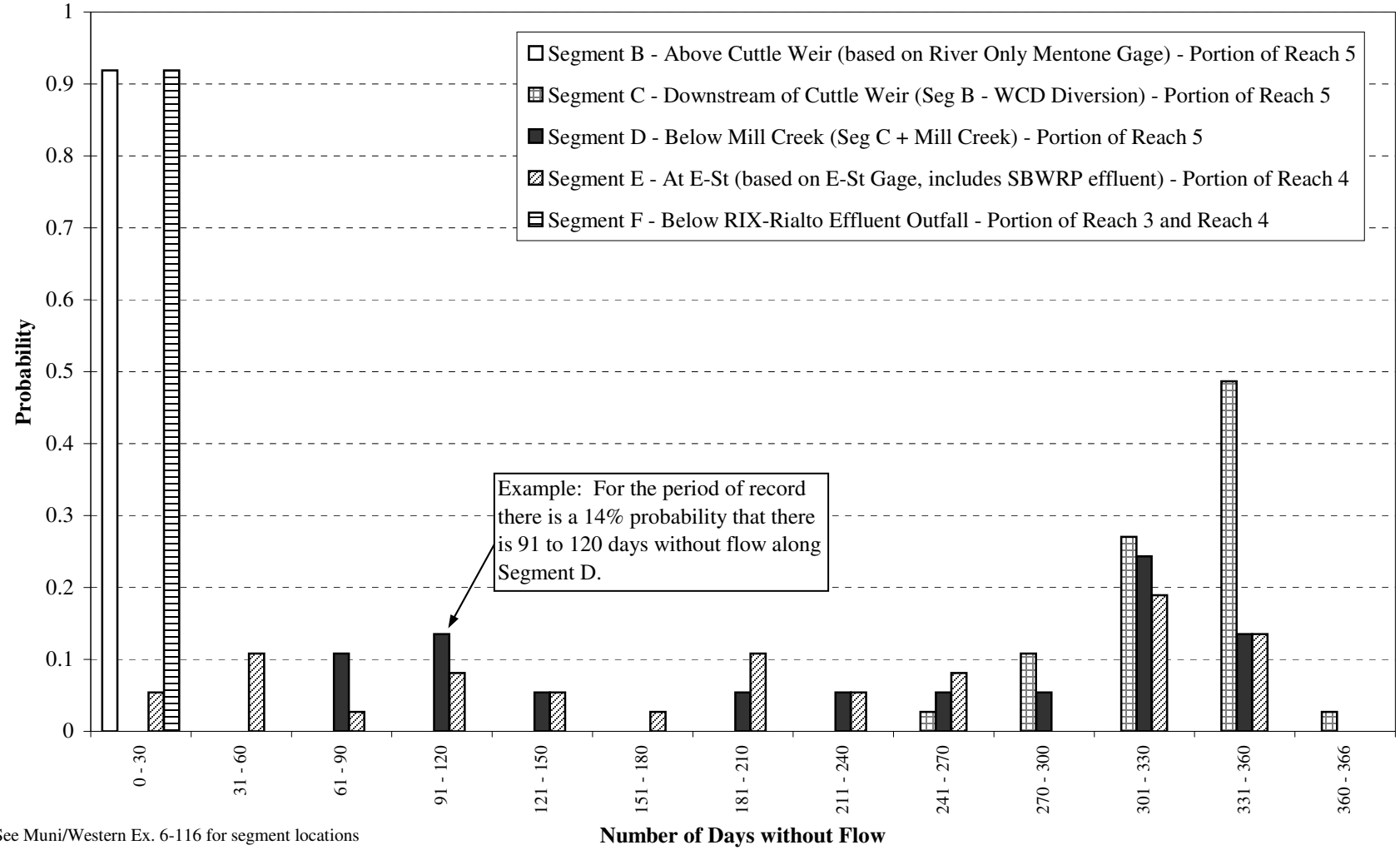
Upper Santa Ana River – Annual Number of Days without Flow Probability Distribution
No Project Condition
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-111

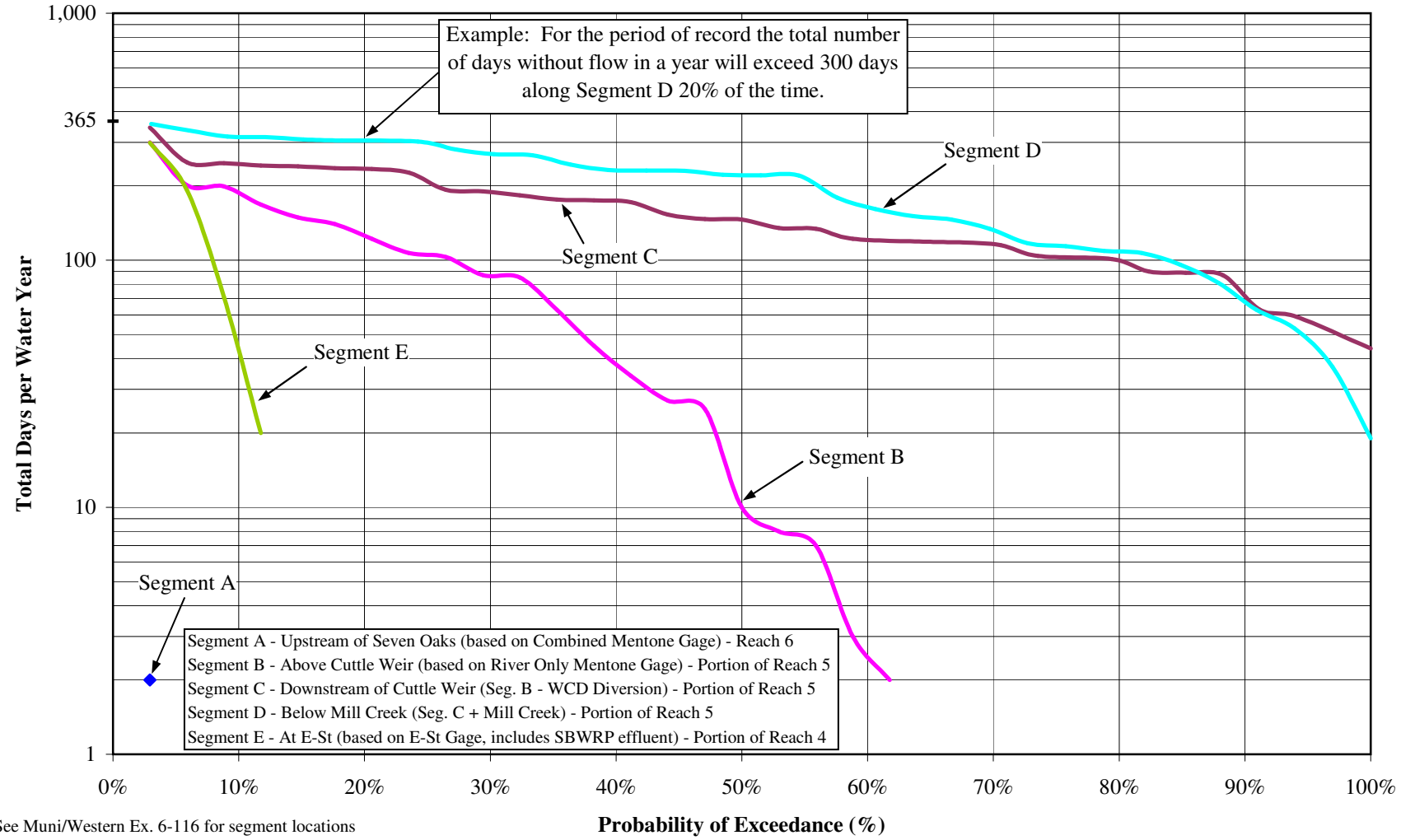
Upper Santa Ana River – Annual Number of Days without Flow Probability Distribution
Project Scenario A
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source of data: SAIC

Muni/Western Ex. 6-112

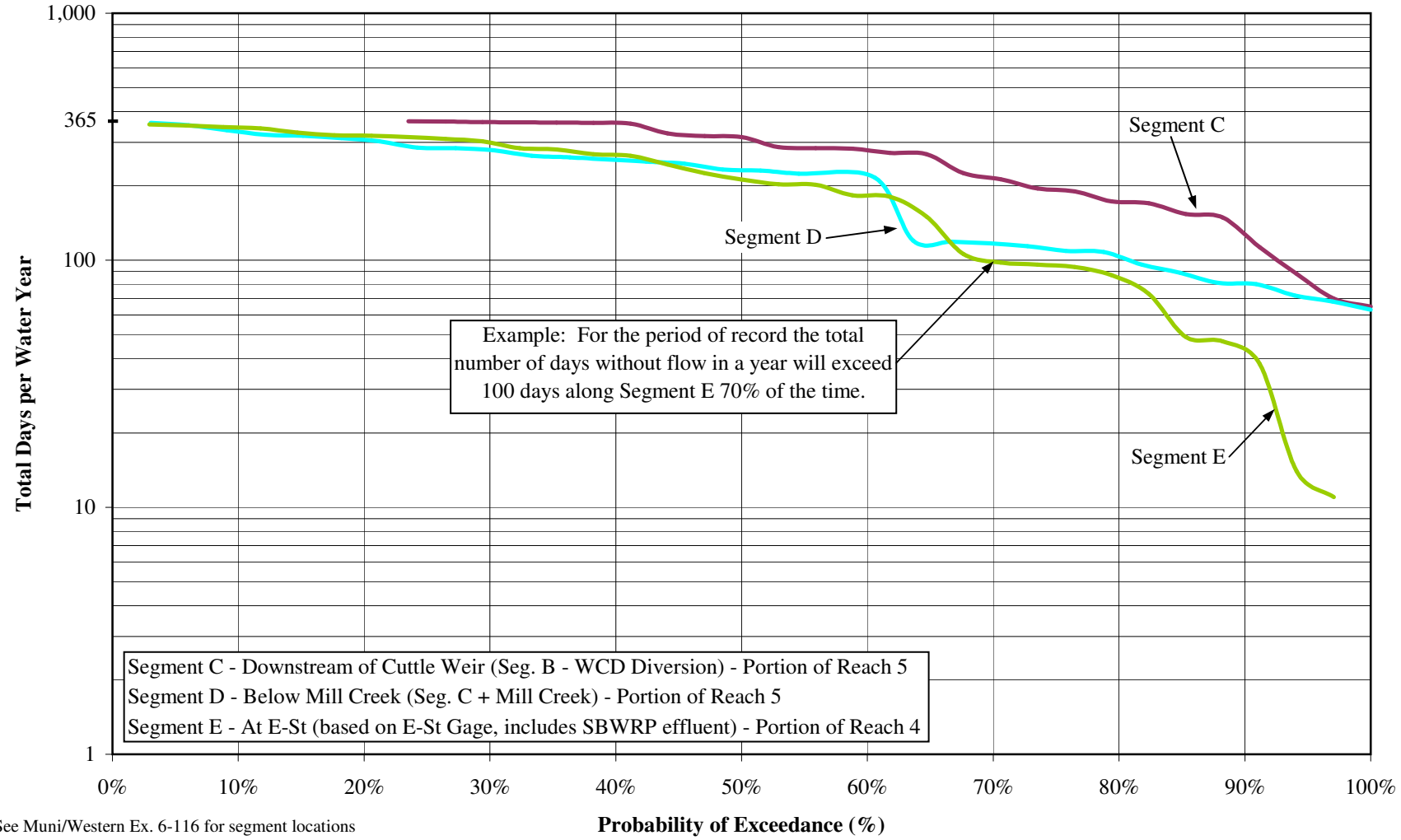
Upper Santa Ana River - Probability of Exceedance for Days without Flow per Water Year
Historical Data
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source: USGS National Water Information System - Web Interface

Muni/Western Ex. 6-113

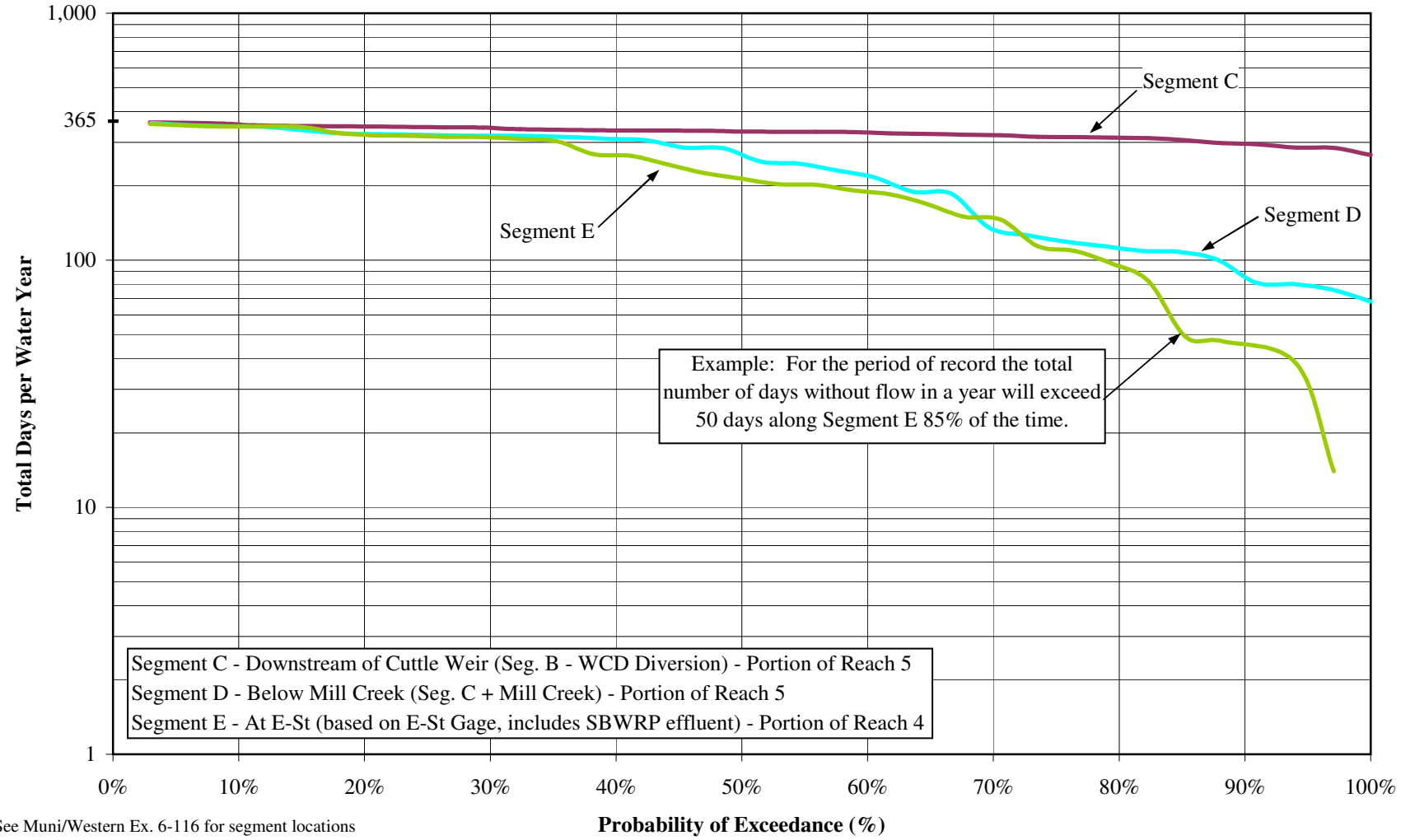
Upper Santa Ana River - Probability of Exceedance for Days without Flow per Water Year
No Project Condition
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-114

Upper Santa Ana River - Probability of Exceedance for Days without Flow per Water Year
Project Scenario A
Water Year 1966-67 to Water Year 1999-00



See Muni/Western Ex. 6-116 for segment locations
Source: SAIC

Muni/Western Ex. 6-115

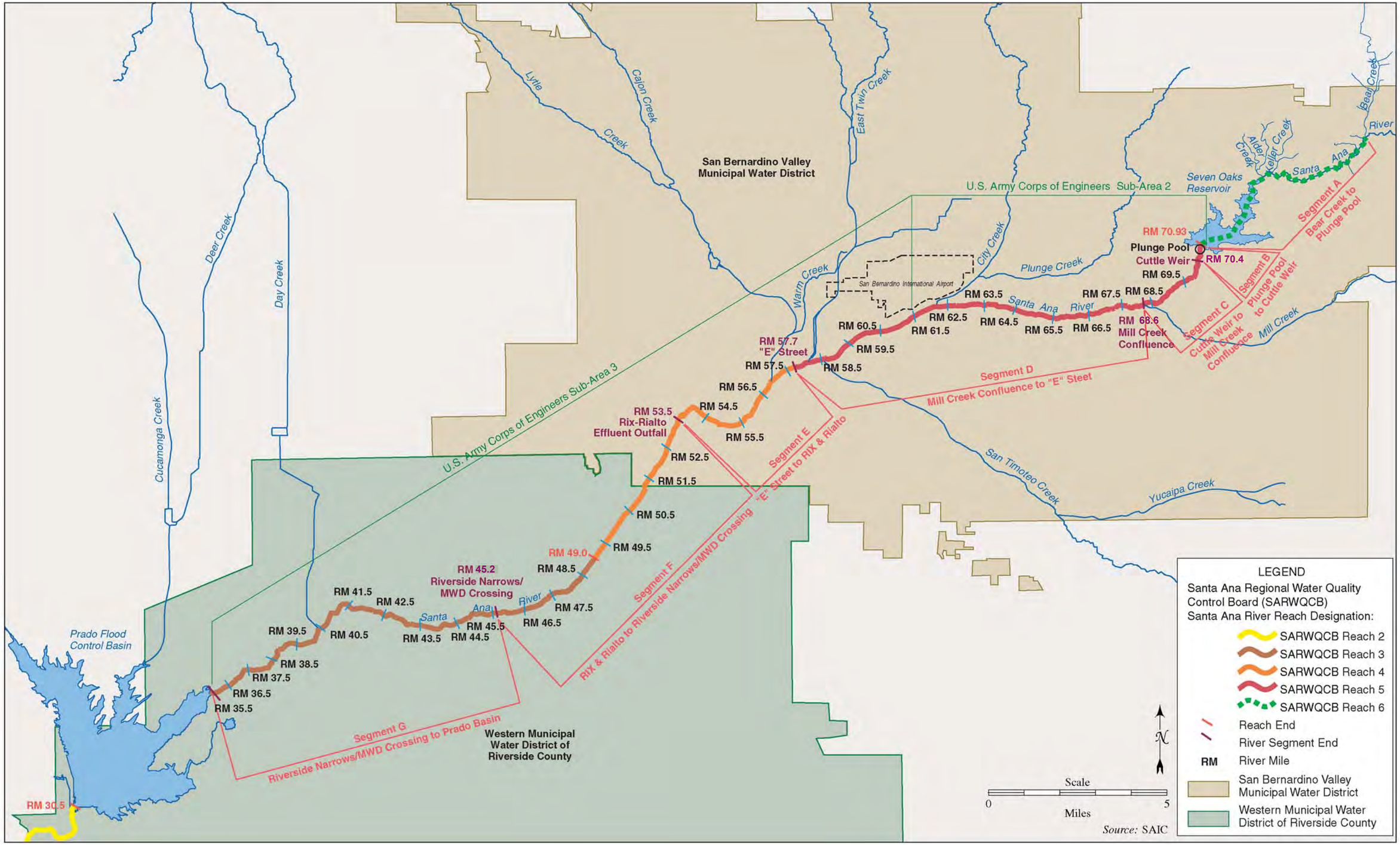


Figure 3.1-6. Santa Ana River, Tributaries, Reaches, and Segment Indicators

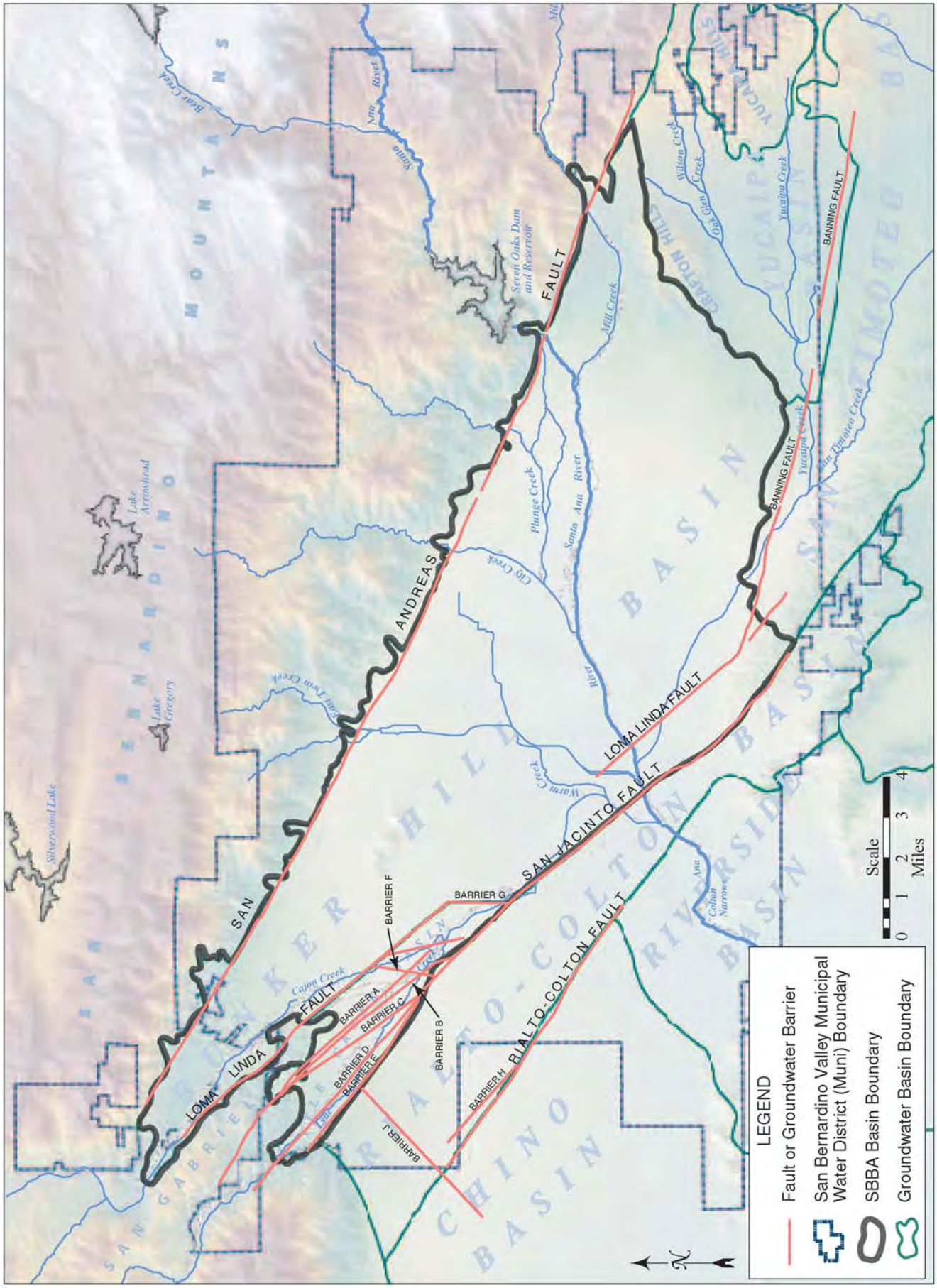


Figure 3.2-2. San Bernardino Basin Area (SBBA)

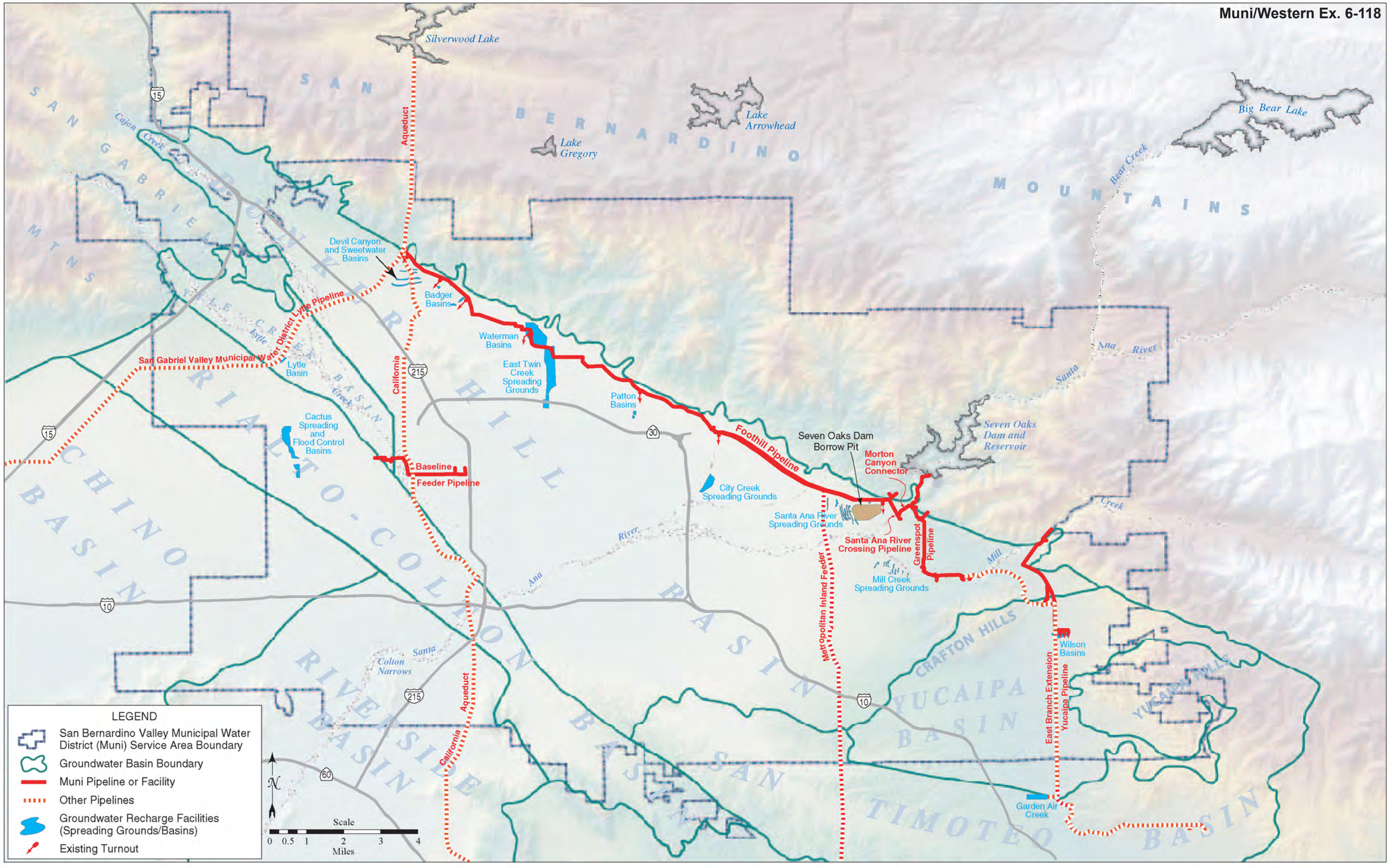


Figure 3.2-1. Groundwater Basins and Recharge Facilities

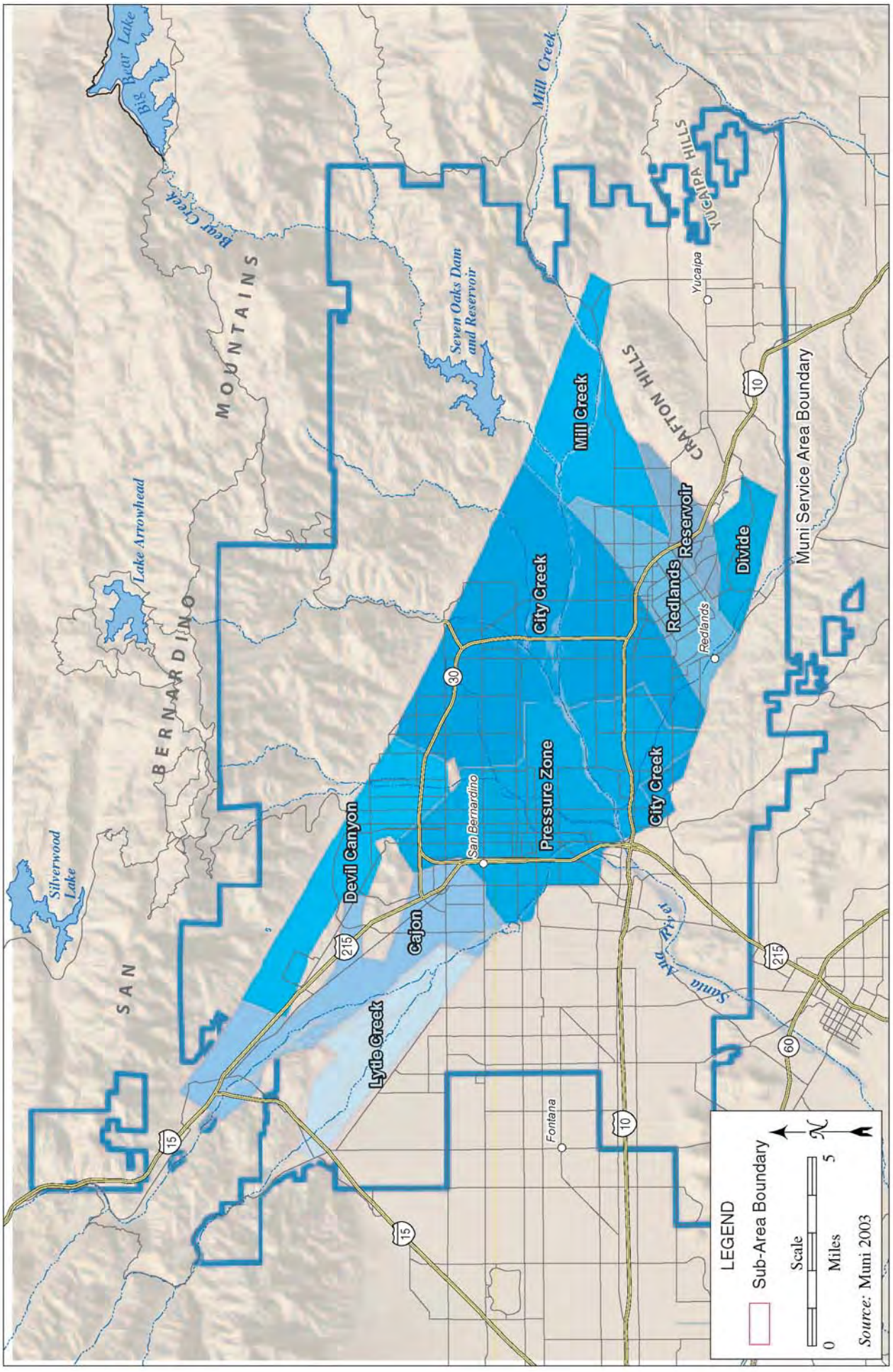


Figure 3.2-3. San Bernardino Basin Area (SBBA): Sub-Areas

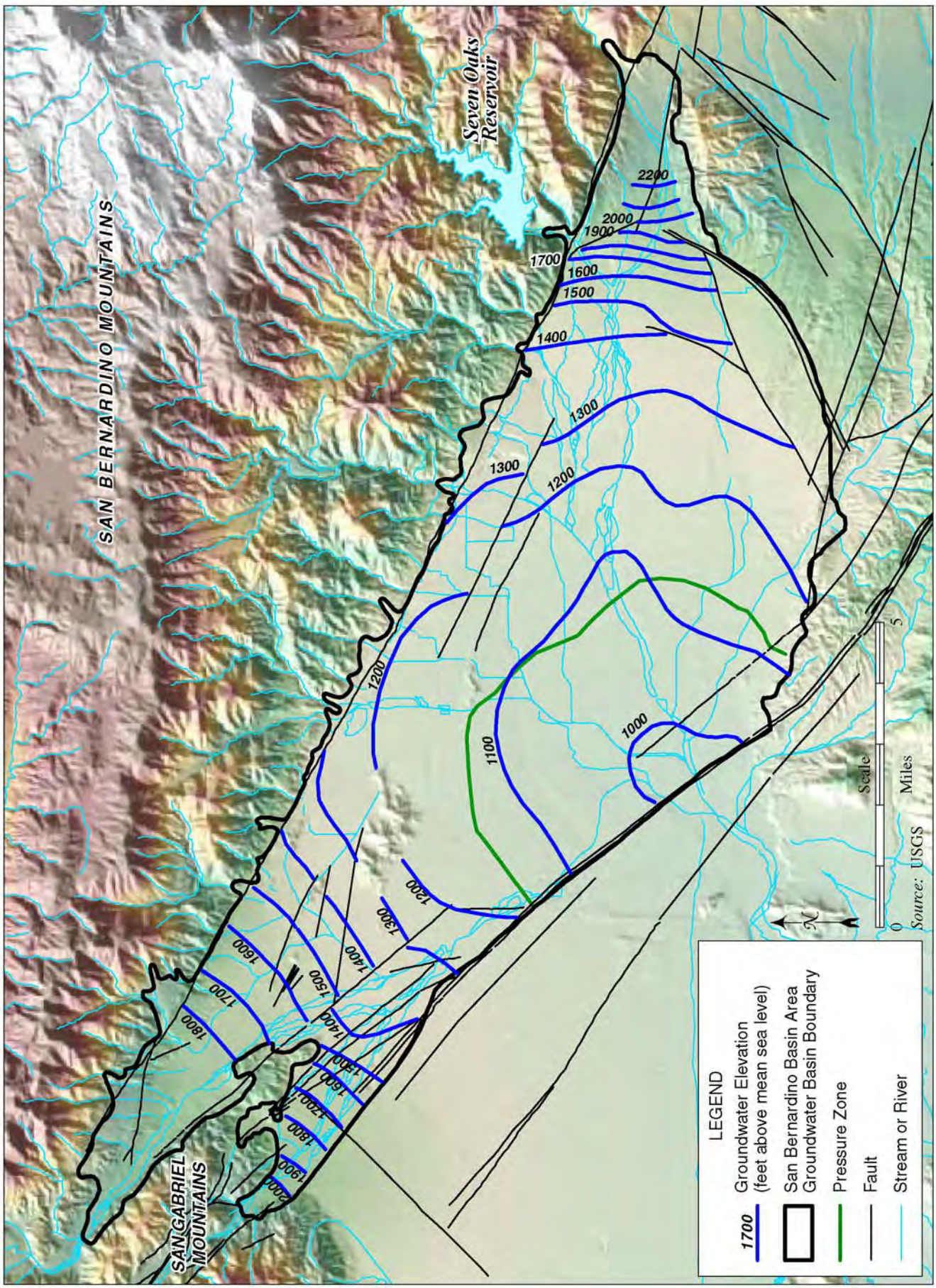
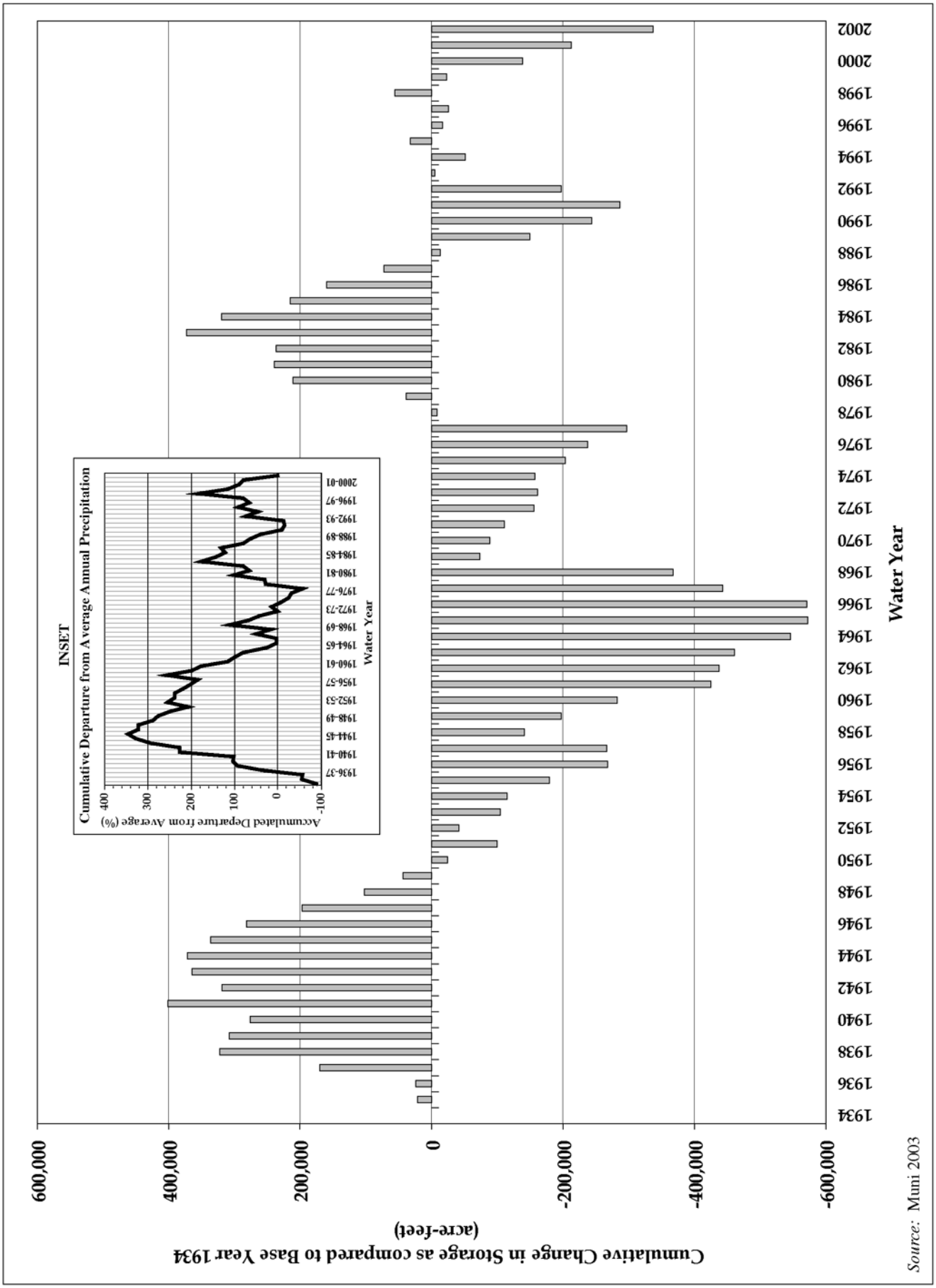


Figure 3.2-4. San Bernardino Basin Area (SBBA) Groundwater Elevation Contours - 1994



Source: Muni 2003

Figure 3.2-5. Cumulative Change in Groundwater Storage for the SBBA, WY 1934-35 to WY 2001-02

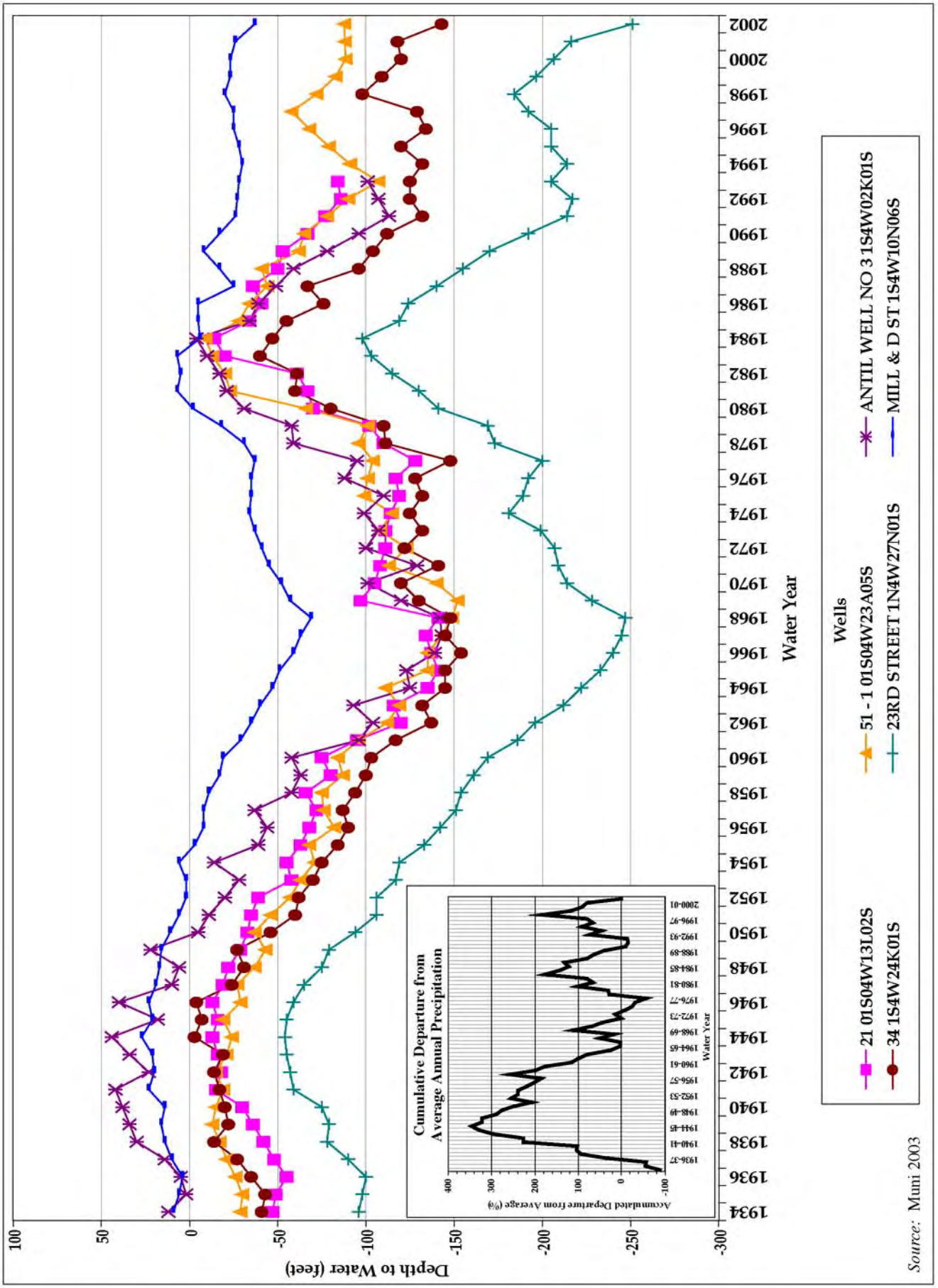


Figure 3.2-12. Groundwater Level Hydrographs for Selected Wells in the Pressure Zone Sub-Basin, WY 1934-35 to WY 2001-02

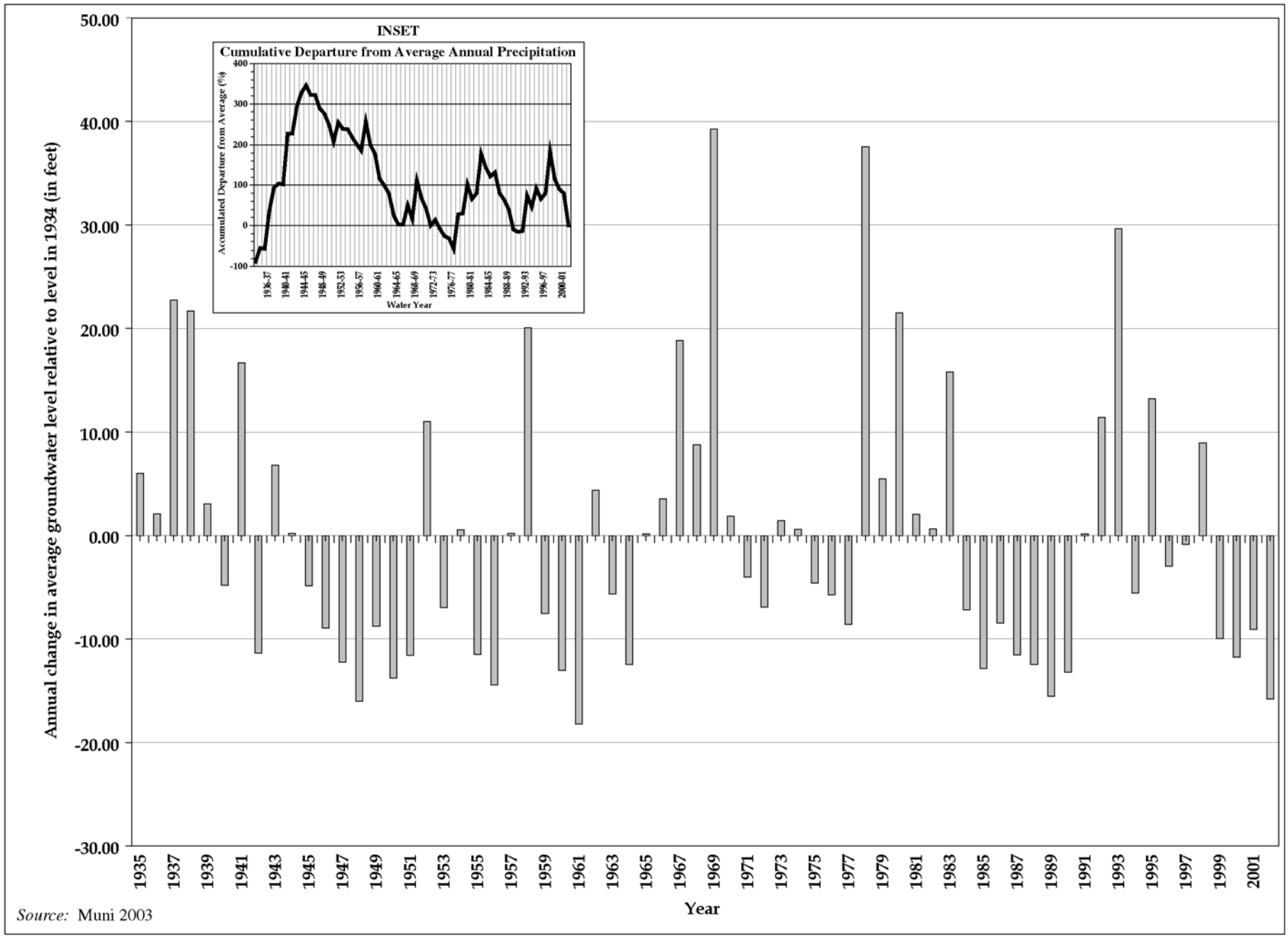


Figure 3.2-6. Average Change in Depth to Groundwater in the SBBA

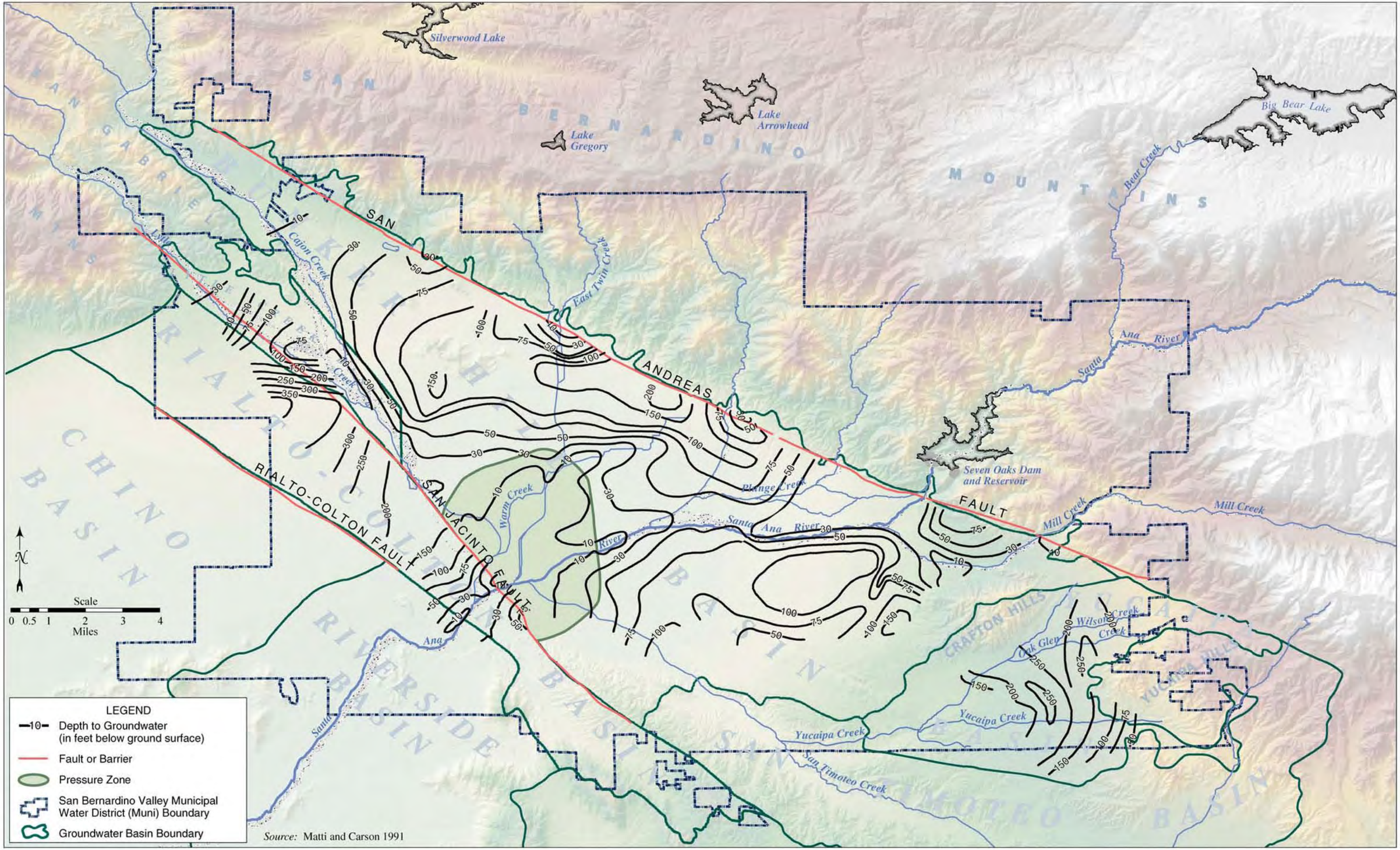


Figure 3.2-7. San Bernardino Basin Area (SBBA) Depth to Groundwater in 1991

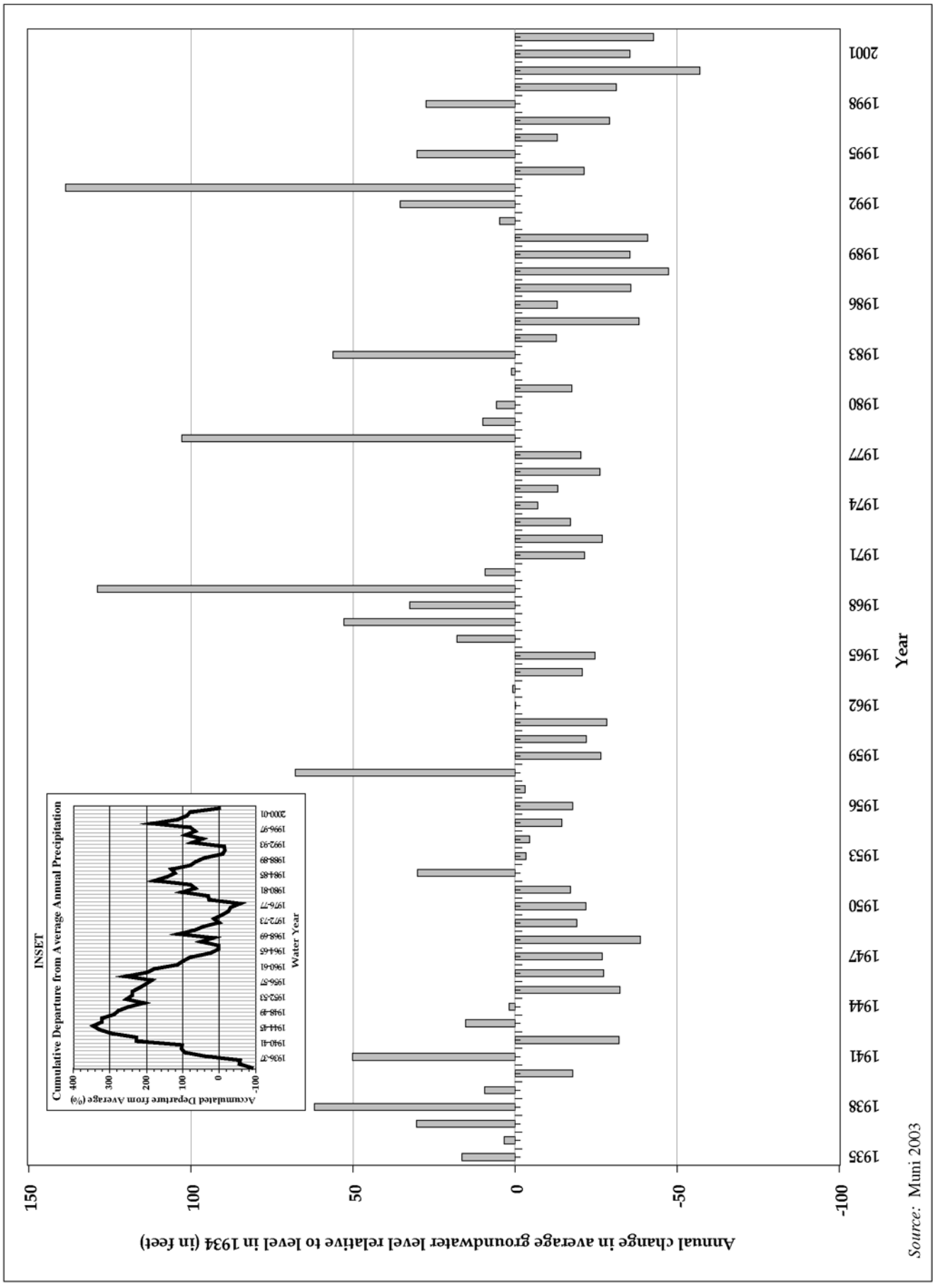


Figure 3.2-8. Average Change in Depth to Groundwater in the Lytle Creek Basin

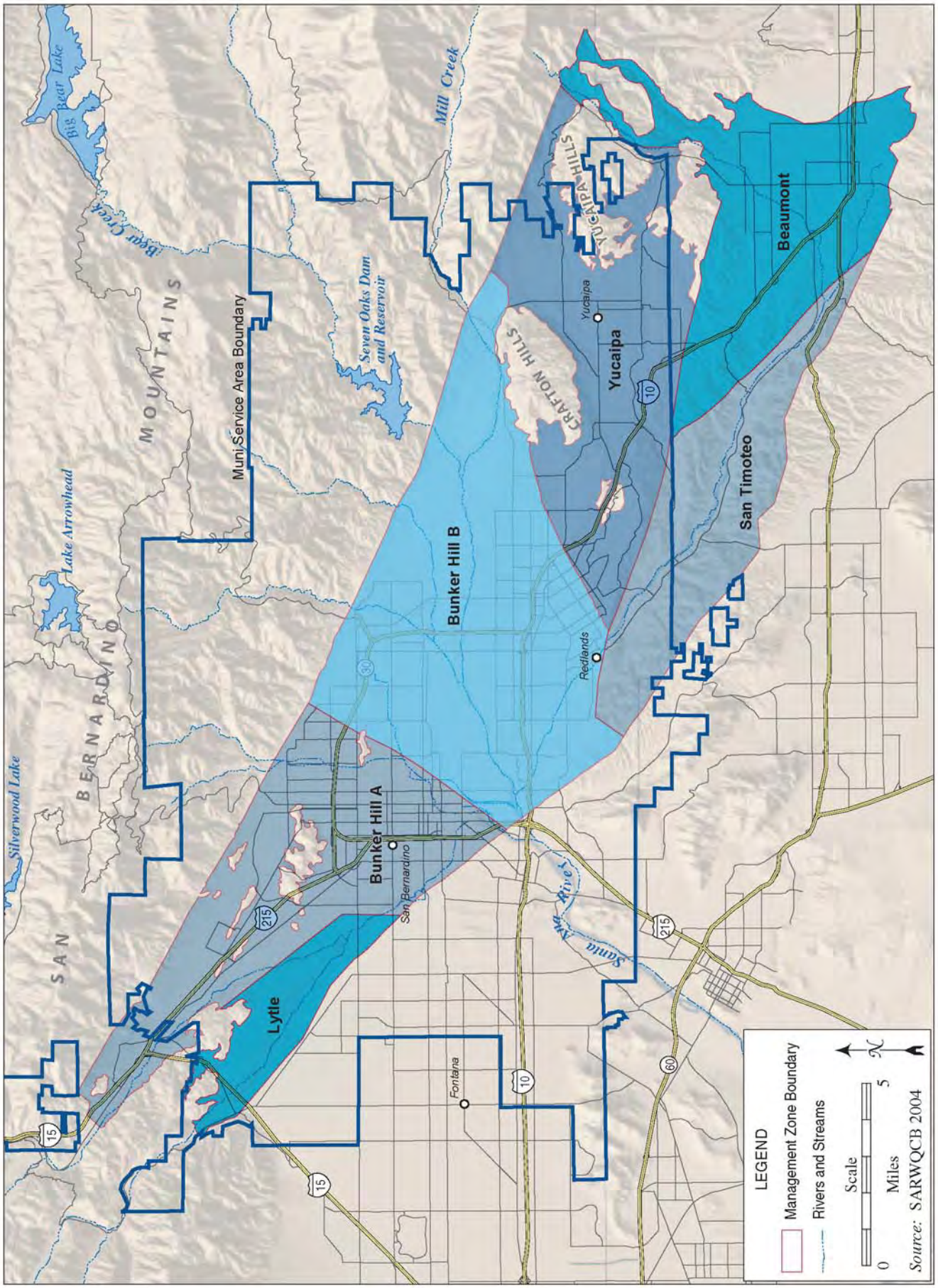


Figure 3.2-10. Proposed SARWQCB Management Zone Boundaries

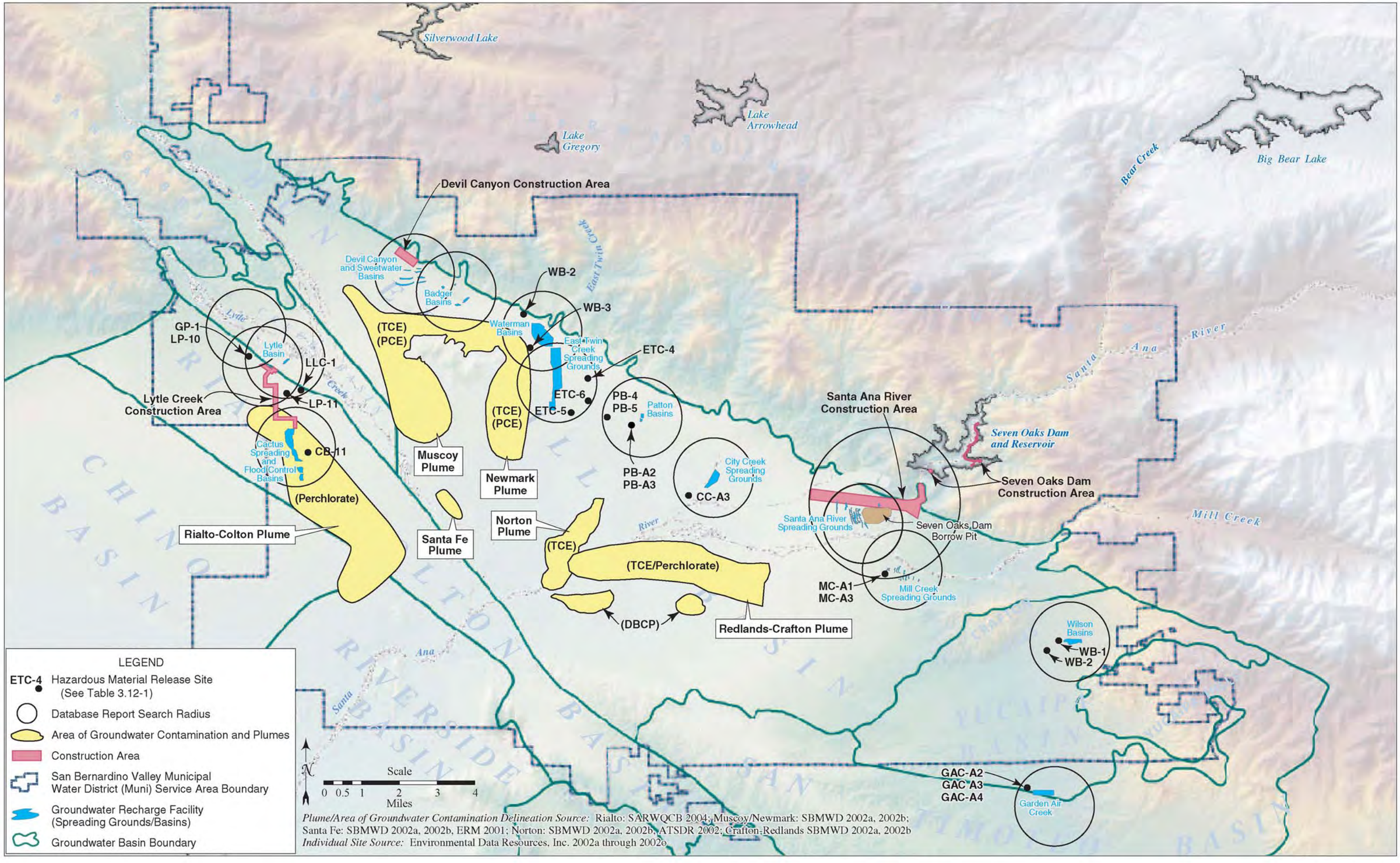


Figure 3.12-1. Known Contamination Plumes and Sites

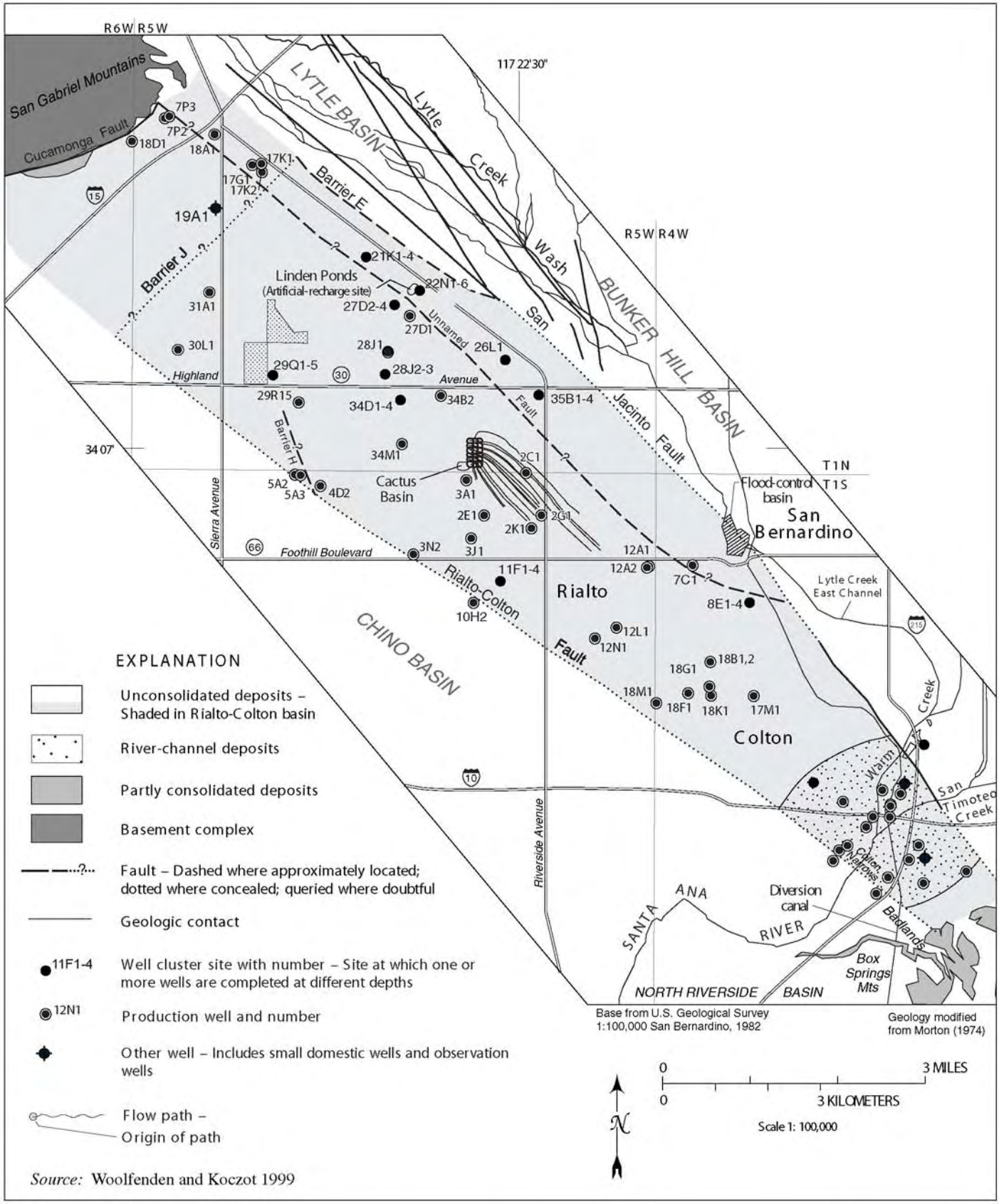
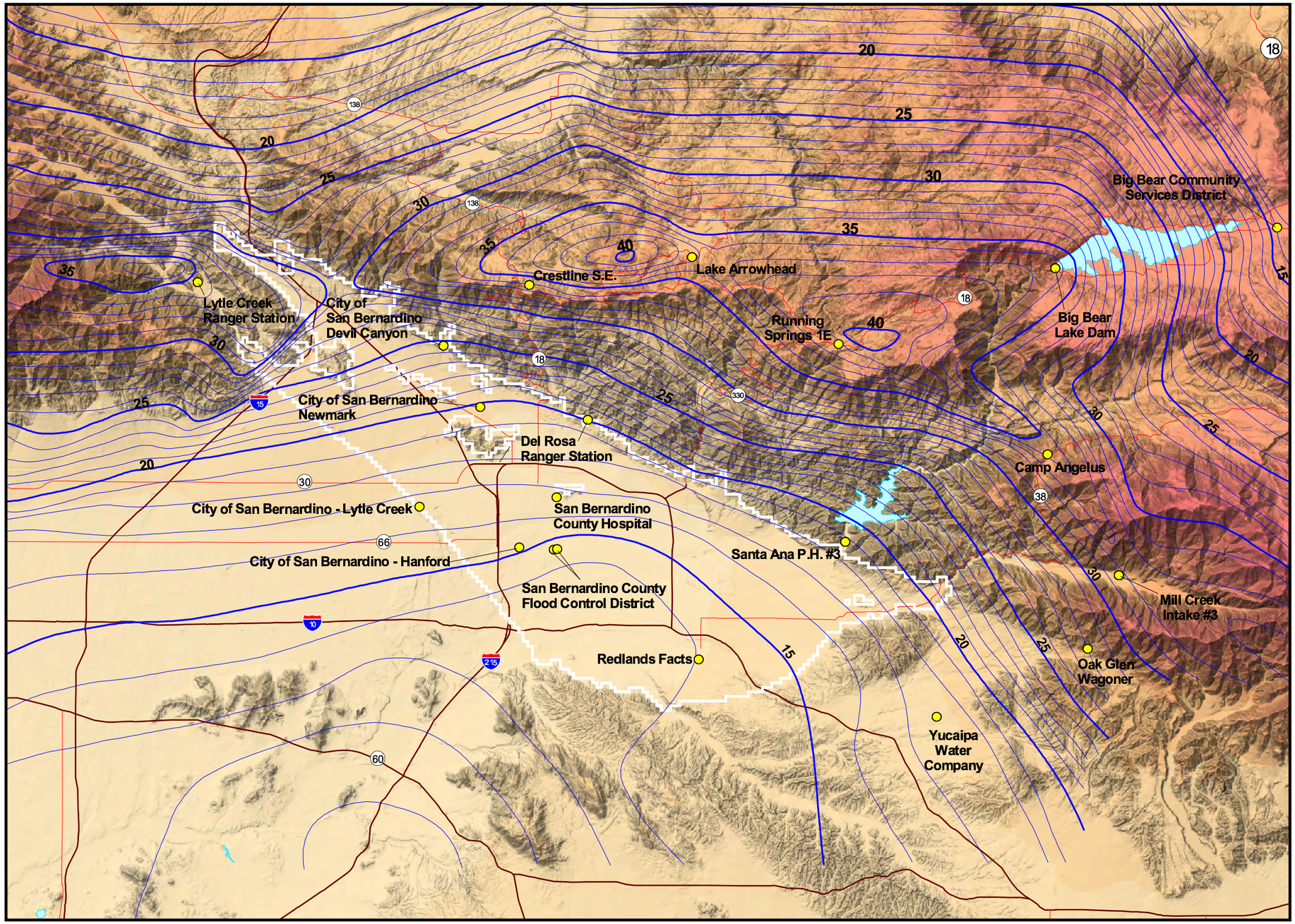


Figure 3.2-13. Simulated Flow Pattern (1982-2027) with Historical Recharge in Cactus Basin

SANTA ANA RIVER WATER RIGHTS HEARING
TESTIMONY OF DENNIS E. WILLIAMS



ANNUAL PRECIPITATION ISOHYETAL AND PRECIPITATION STATIONS

EXPLANATION

- Precipitation Station With Long Term Records
- 30 — Isohyetal (lines of equal precipitation; 1870 - 1970) *Source: San Bernardino County Flood Control District*
- white line — Model Boundary
- Body of Water
- Highway
- Freeway

CONFIDENTIAL DRAFT
Attorney-Client Work Product

Map Projection:
UTM 1927 (Zone 11)
Central Meridian: -117 degrees

NORTH
0 3 6 Miles

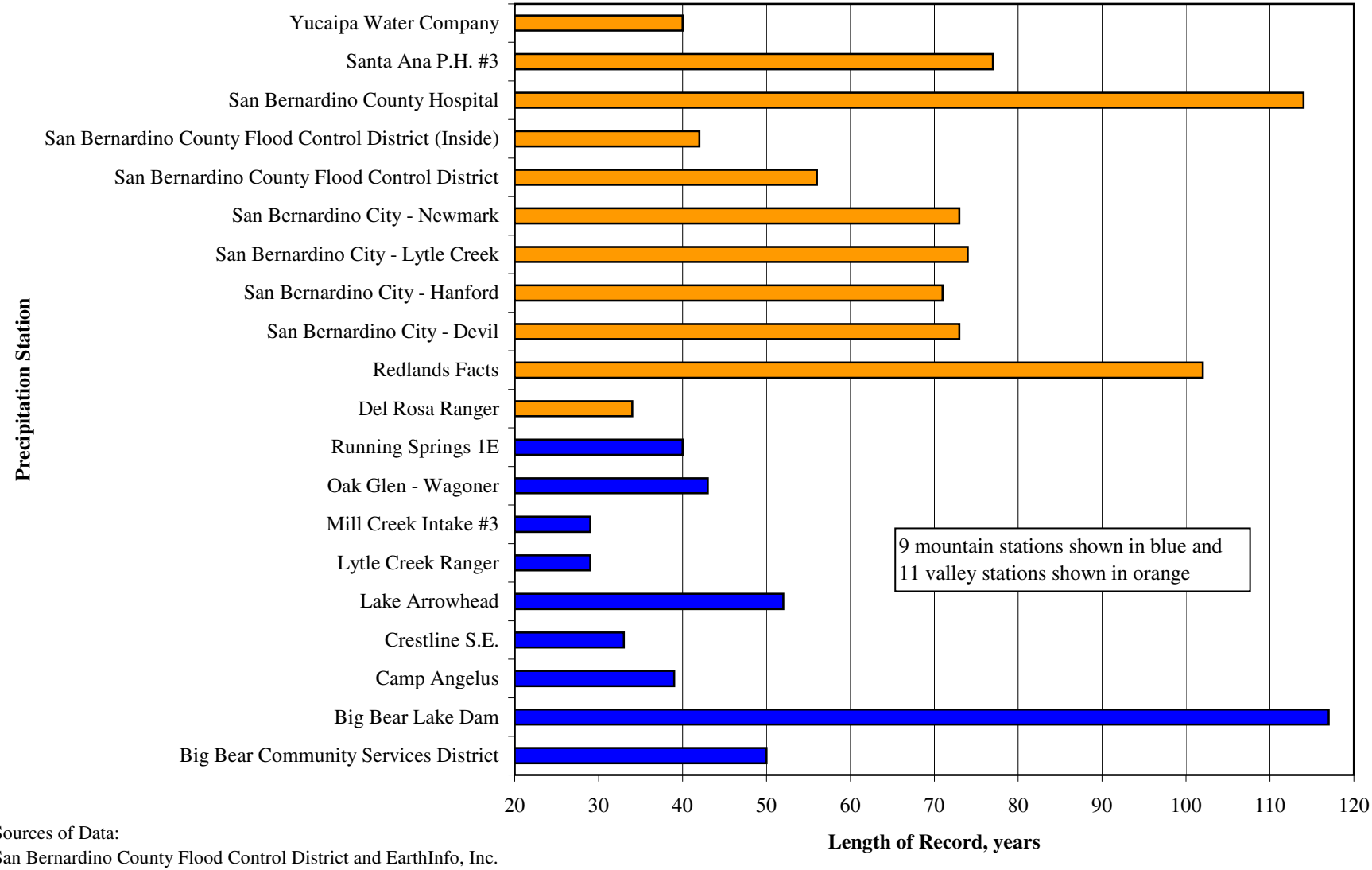
16-APR-07
Prepared by: JDK

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 920-0707 Fax: (909) 920-0403
www.gssiwater.com

Muni/Western Ex. 6-129

GIS_proj\muni_western_drainage\muni_western_drainage_fig.apr

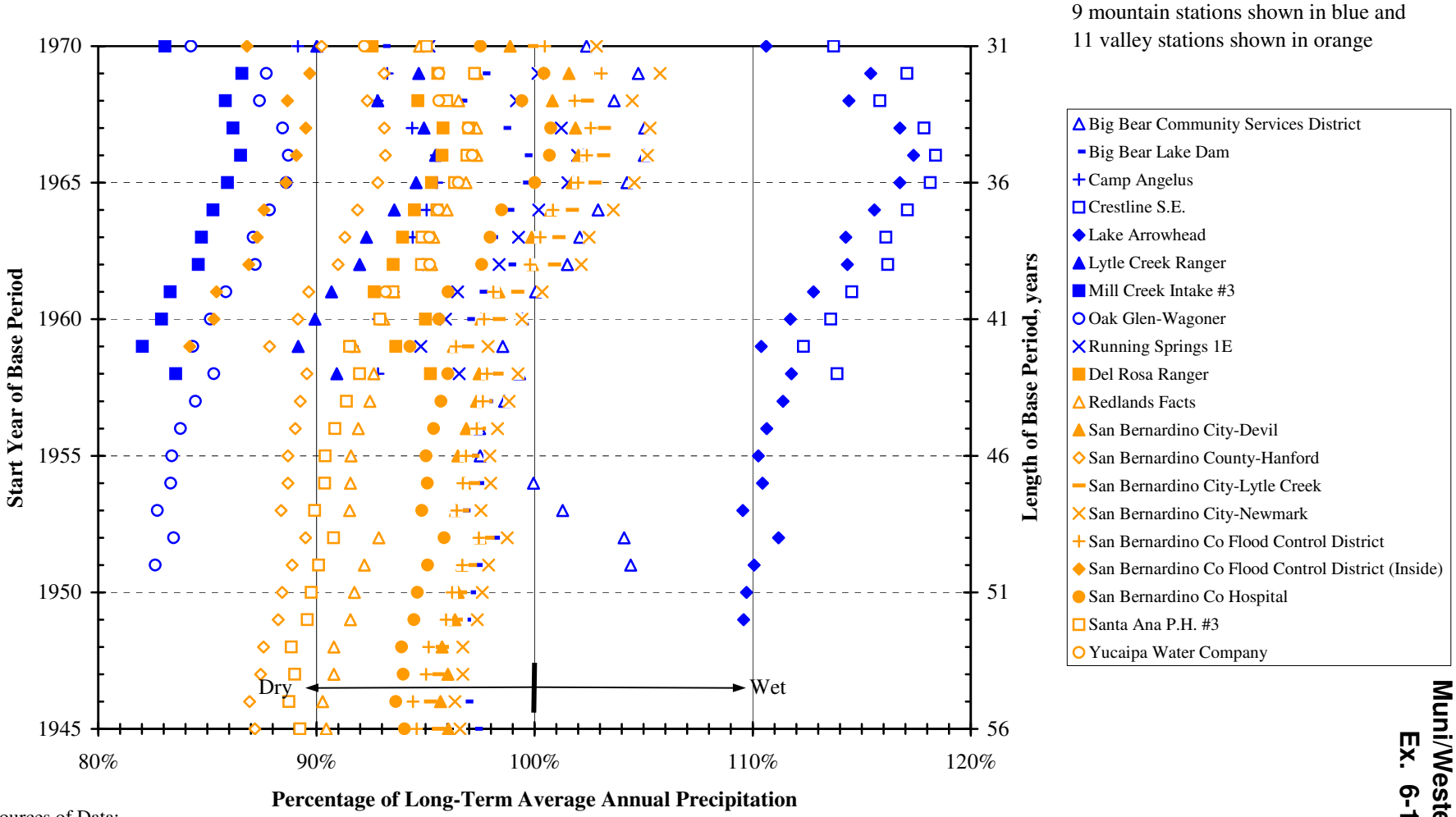
Length of Record for Precipitation Stations



Sources of Data:
San Bernardino County Flood Control District and EarthInfo, Inc.

Muni/Western Ex. 6-130

Station Base Period vs. Percentage of San Bernardino County Flood Control District Long-Term Average Annual Precipitation* (1870-1970 Isohyetal Map)
(All Years are Water Years, Oct 1 - Sep 30)

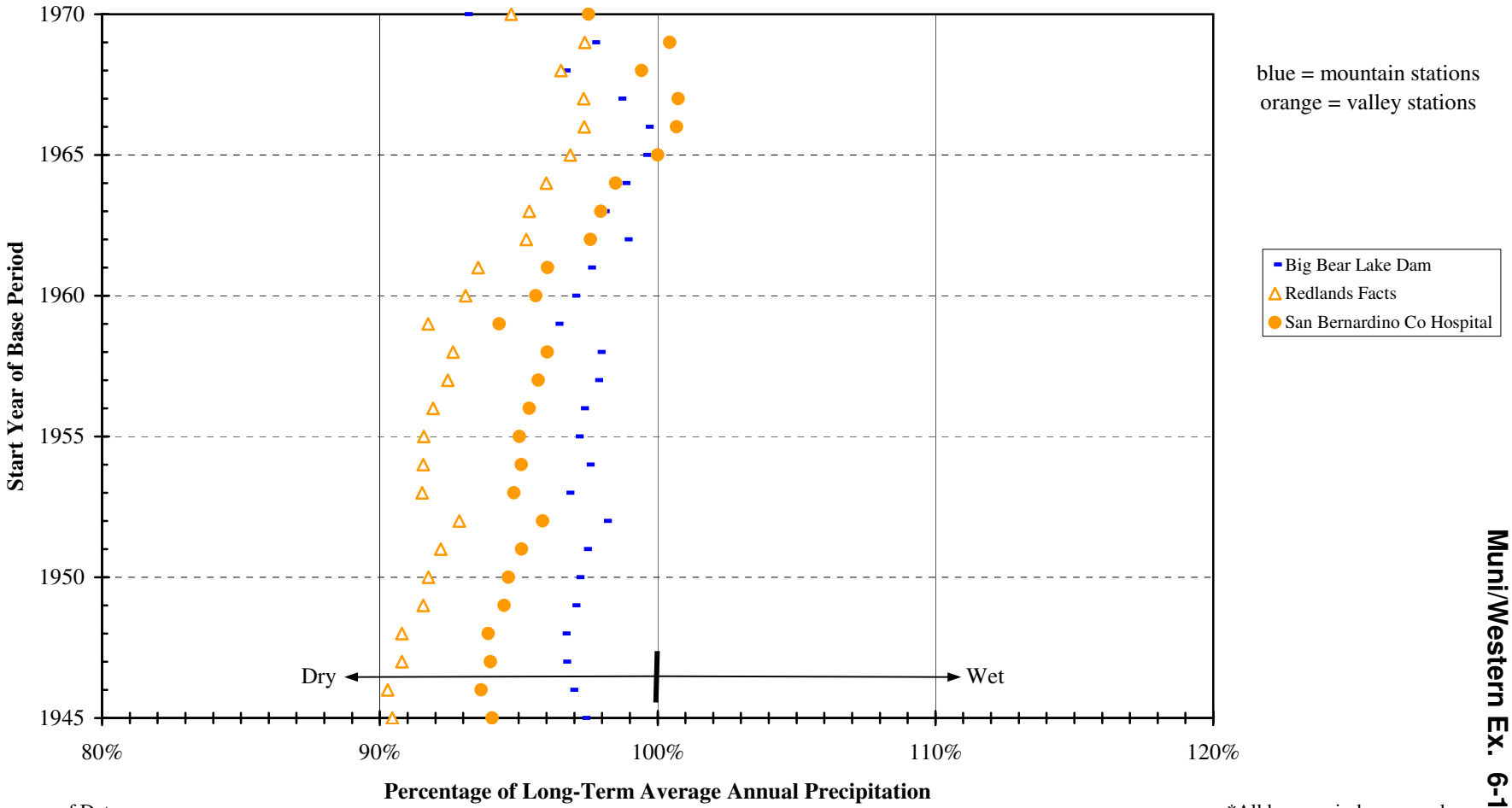


Sources of Data:
San Bernardino County Flood Control District and EarthInfo, Inc.

*All base periods assumed to end 30-Sep-2000

Muni/Western Ex. 6-131

Station Base Period vs. Percentage of San Bernardino County Flood Control District Long-Term Average Annual Precipitation* (1870-1970 Isohyetal Map) (Precipitation Stations with 100+ Years of Available Data)

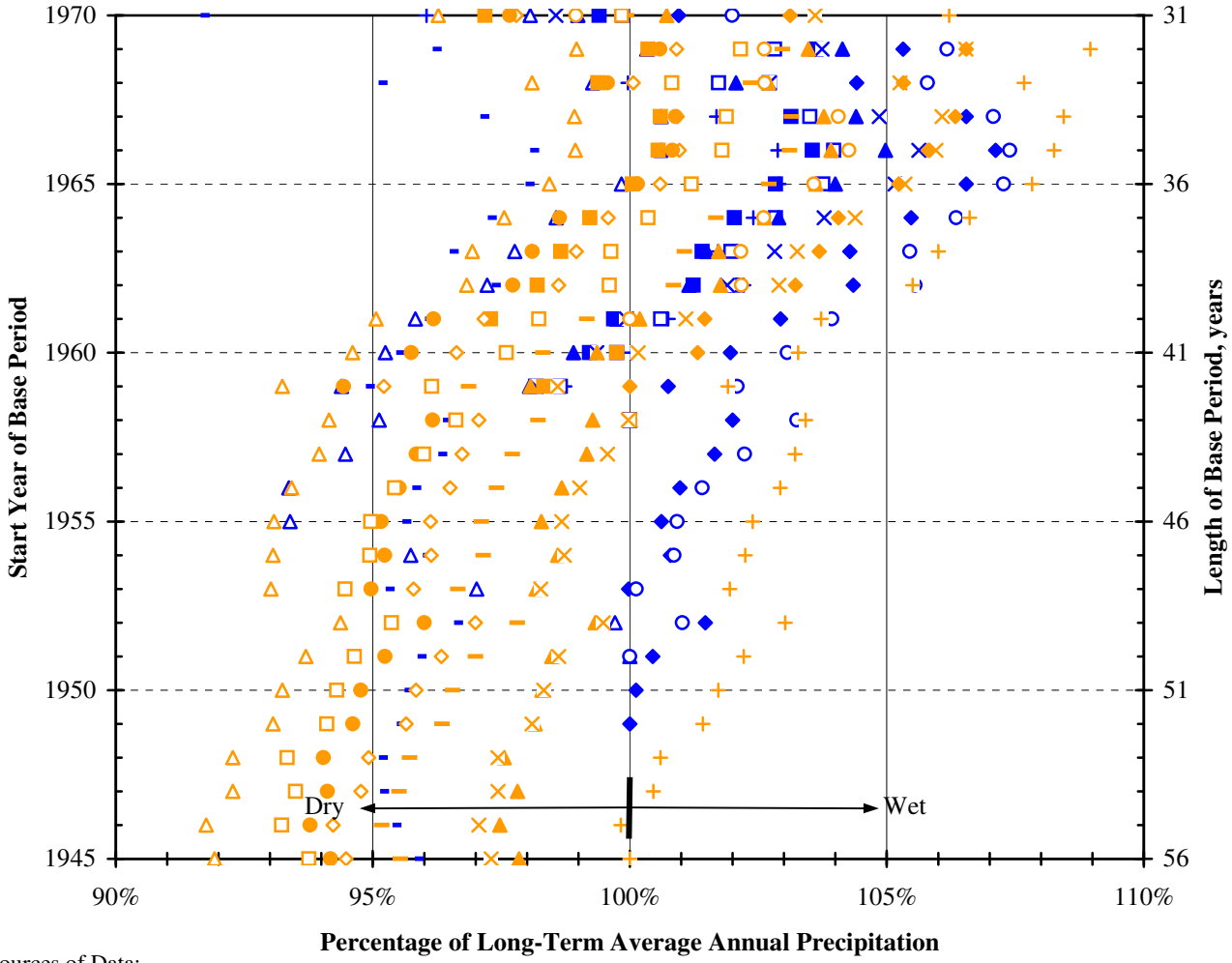


Sources of Data:
San Bernardino County Flood Control District and EarthInfo, Inc.

*All base periods assumed to end 30-Sep-2000

Muni/Western Ex. 6-132

Station Base Period vs. Percentage of Station Long-Term Average Measured Annual Precipitation*
(All Years are Water Years, Oct 1 - Sep 30)



9 mountain stations shown in blue and
11 valley stations shown in orange

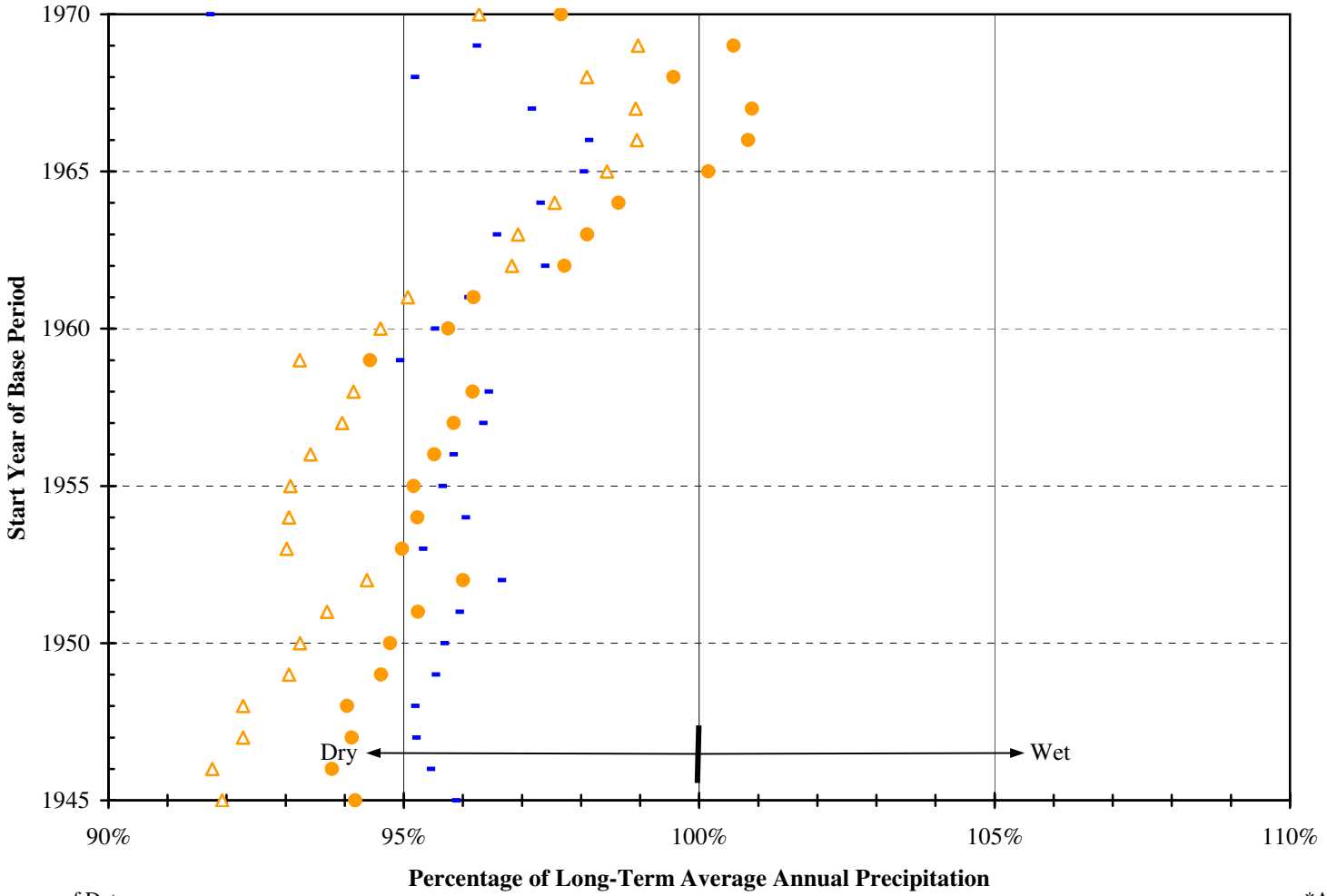
- Big Bear Community Services District
- Big Bear Lake Dam
- Camp Angelus
- Crestline S.E.
- Lake Arrowhead
- Lytle Creek Ranger
- Mill Creek Intake #3
- Oak Glen-Wagoner
- Running Springs 1E
- Del Rosa Ranger
- Redlands Facts
- San Bernardino City-Devil
- San Bernardino City-Hanford
- San Bernardino City-Lytle Creek
- San Bernardino City-Newmark
- San Bernardino Co Flood Control District
- San Bernardino Co Flood Control District (Inside)
- San Bernardino Co Hospital
- Santa Ana P.H. #3
- Yucaipa Water Company

Sources of Data:
San Bernardino County Flood Control District and EarthInfo, Inc.

*All base periods assumed to end 30-Sep-2000

Muni/Western Ex. 6-133

Station Base Period vs. Percentage of Station Long-Term Average Measured Annual Precipitation*
(Precipitation Stations with 100+ Years of Available Data)

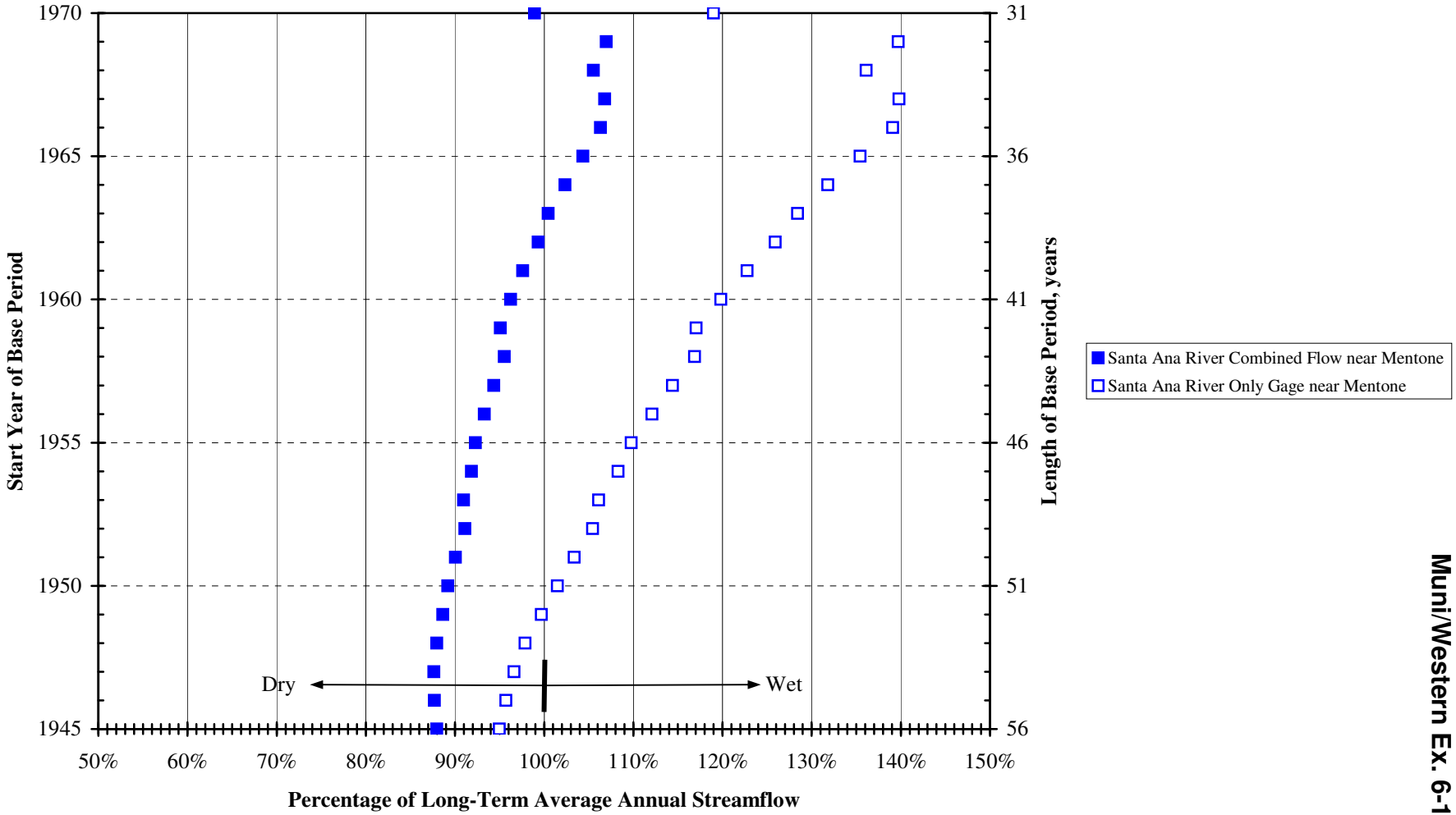


Sources of Data:
San Bernardino County Flood Control District and EarthInfo, Inc.

*All base periods assumed to end 30-Sep-2000

Muni/Western Ex. 6-134

Station Base Period vs. Percentage of Long-Term Average Annual Streamflow
(All Years are Water Years, Oct 1 - Sep 30)

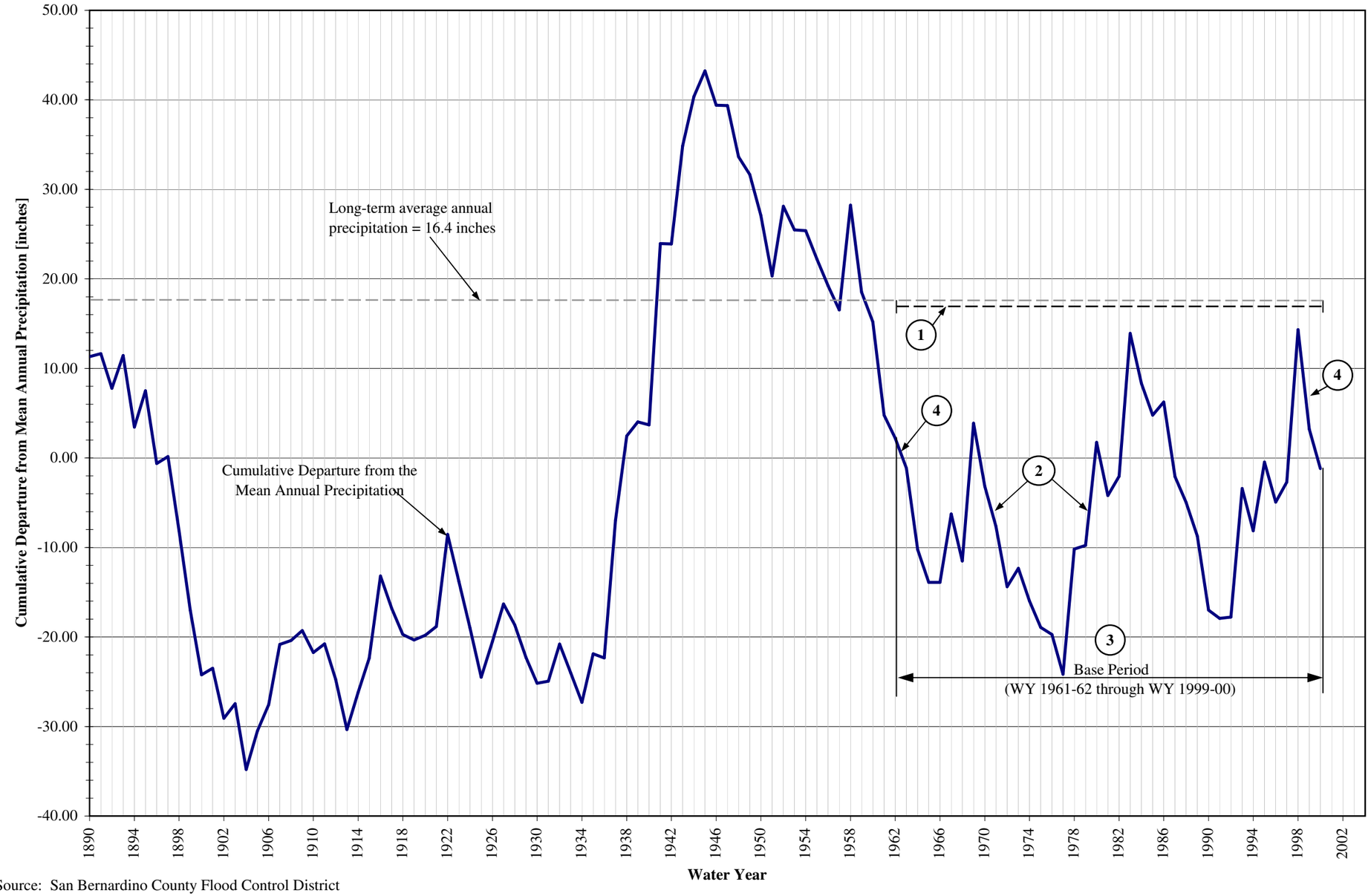


Sources: USGS and SAIC

*All base periods assumed to end 30-Sep-2000

Muni/Western Ex. 6-135

Cumulative Departure from Mean Annual Precipitation for the San Bernardino County Hospital Station and Criteria for Base Period Selection



Source: San Bernardino County Flood Control District

(1) Average precipitation of the base period (16 in.) is approximately equal to the average precipitation of the long-term (1890-2000) record of 16.4 inches.

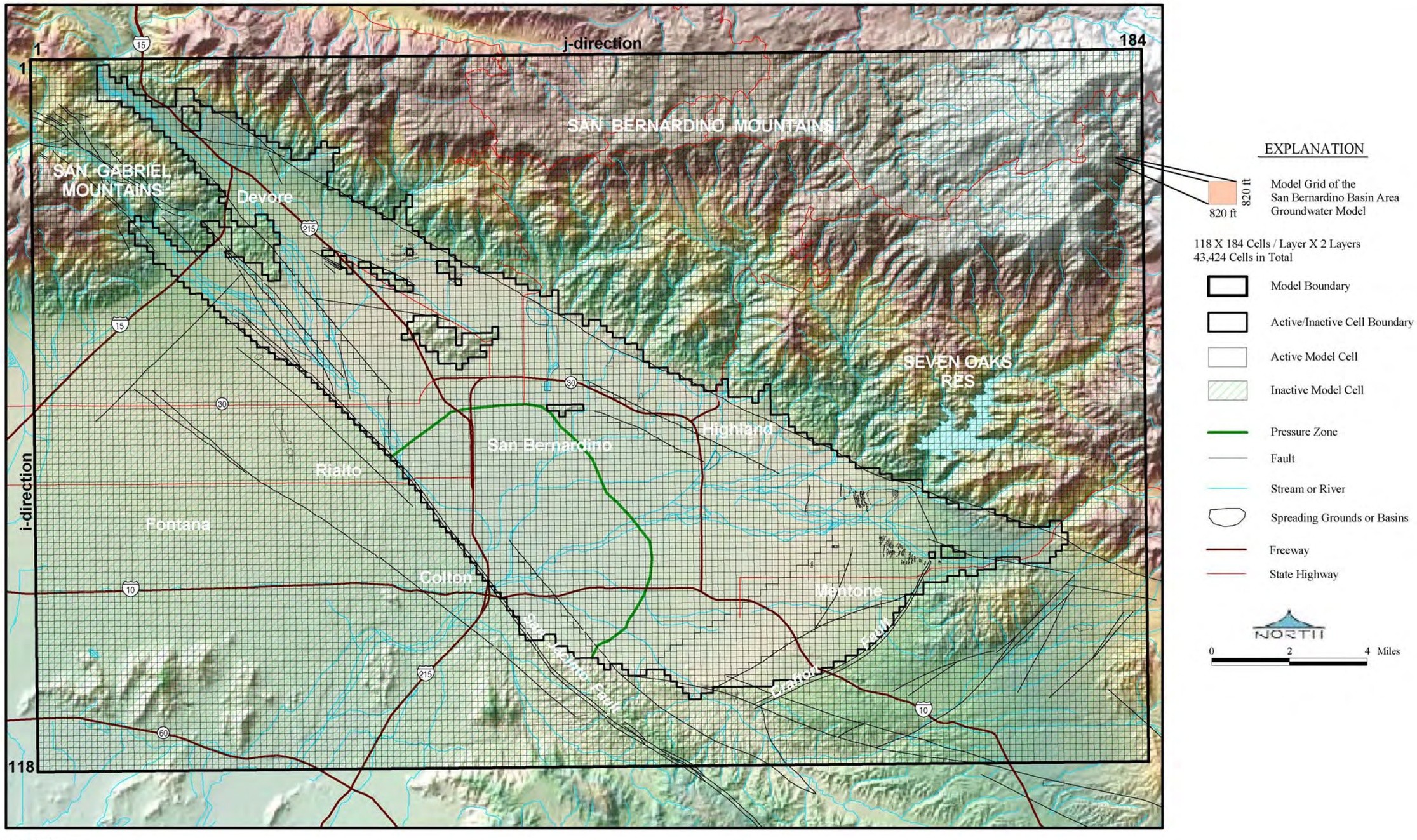
(2) Base period contains periods of wet, dry and average hydrologic conditions.

(3) Base period is sufficiently long (39 years) to contain data representative of the averages, deviations from the averages, and extreme values of the historical period from 1890 to 2000.

Base period is representative of recent and cultural conditions (e.g., land use, urbanization, etc.) for the purpose of using the base period in forecasting models.

(4) Base period contains a dry trend at both the beginning and end of the period.

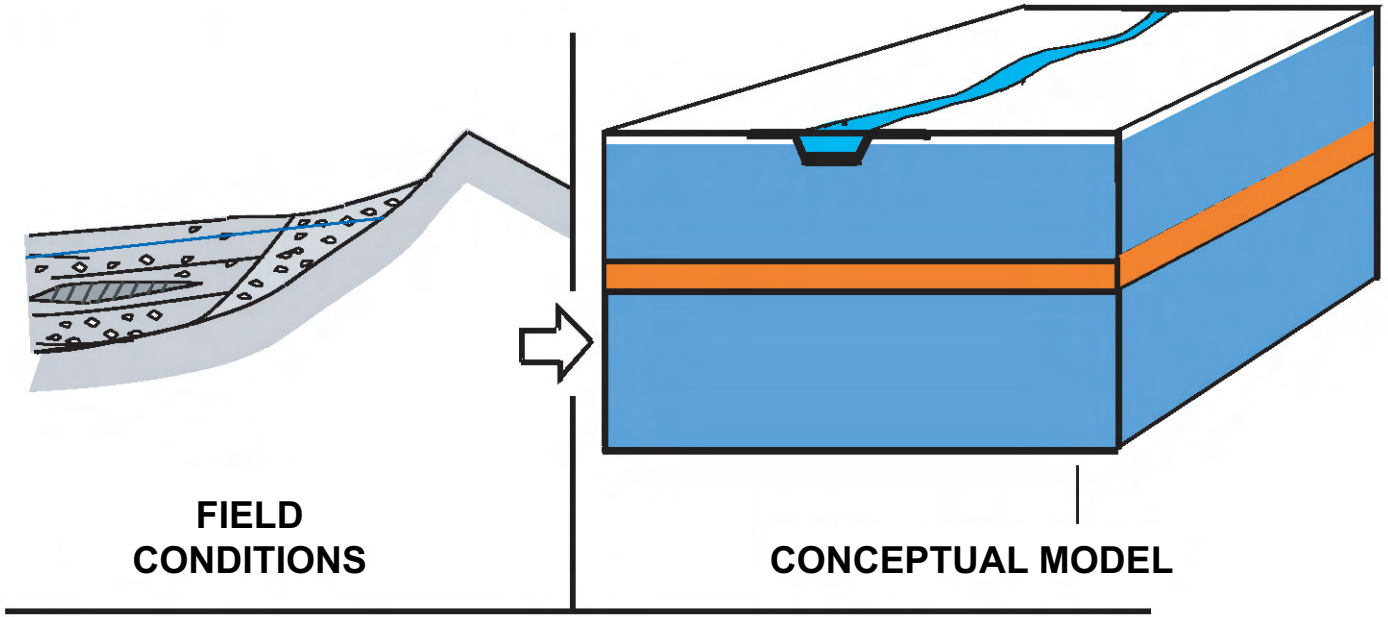
Muni/Western Ex. 6-136



Map Projection:
State Plane 1927 (California Zone V)

Figure 6.2-1. Model Grid of the San Bernardino Basin Area Groundwater Model

Conceptual Model

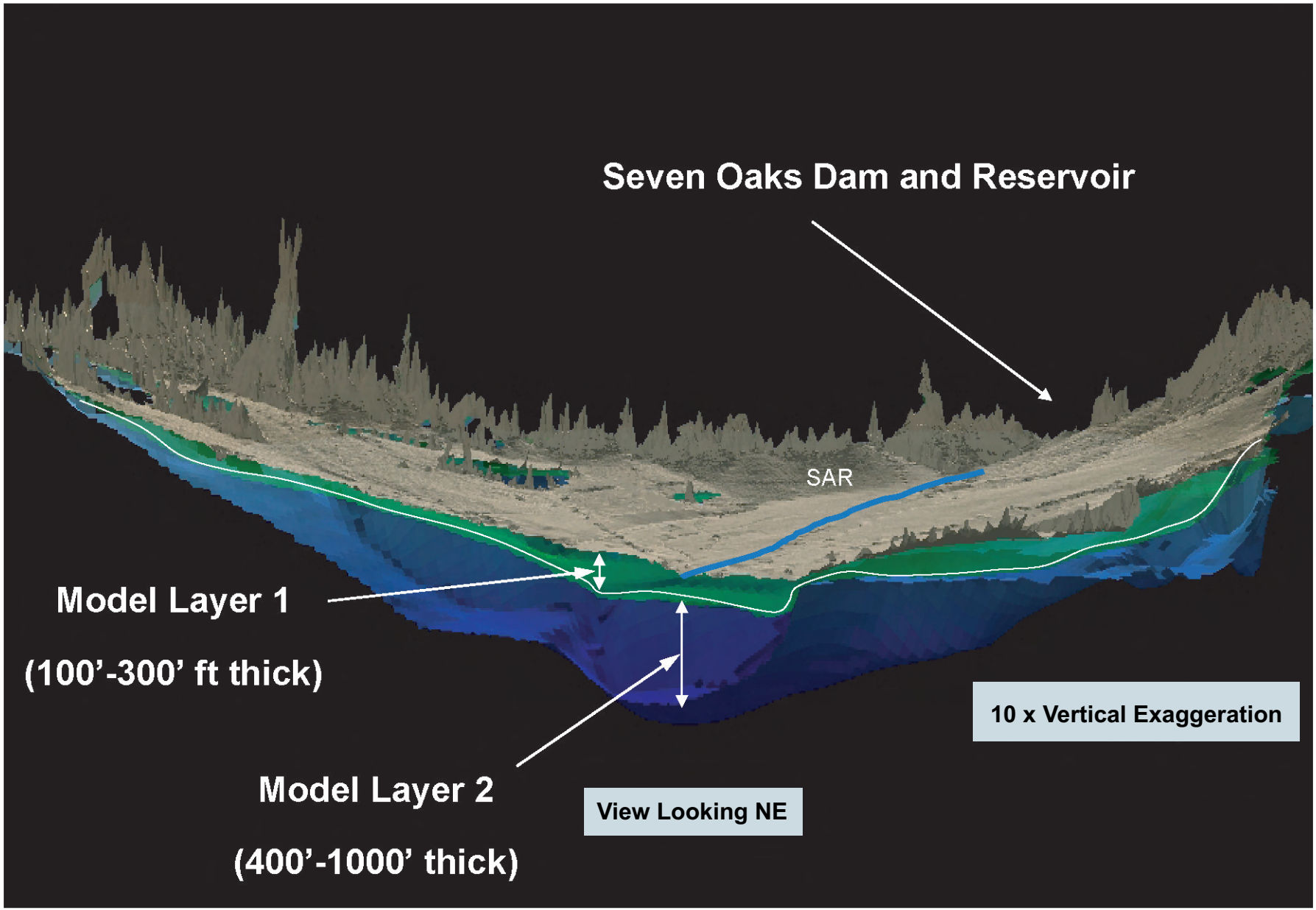


The groundwater flow model was developed for the valley-fill aquifer (1,500 ft deep) and includes both unconsolidated and partly consolidated deposits.

Consolidated rocks underlying and surrounding the valley-fill aquifer are assumed to be non-water bearing.

Two Layered Groundwater Model

Muni/Western Ex. 6-138	Drawn: DEW Checked: Approved: Date: 16-APR-07	SANTA ANA RIVER WATER RIGHTS HEARING - TESTIMONY OF DENNIS E. WILLIAMS MODEL CONCEPTUALIZATION	GEOSCIENCE GEOSCIENCE Support Services, Incorporated P.O. Box 220, Claremont, CA 91711 Tel: (909)920-0707 Fax: (909)920-0403 www.gssiwater.com



Muni/Western Ex. 6-139	Drawn: DEW Checked: Approved: Date: 16-APR-07	SANTA ANA RIVER WATER RIGHTS HEARING - TESTIMONY OF DENNIS E. WILLIAMS USGS MODEL LAYERS	GEOSCIENCE GEOSCIENCE Support Services, Incorporated P.O. Box 220, Claremont, CA 91711 Tel: (909)920-0707 Fax: (909)920-0403 www.gssiwater.com

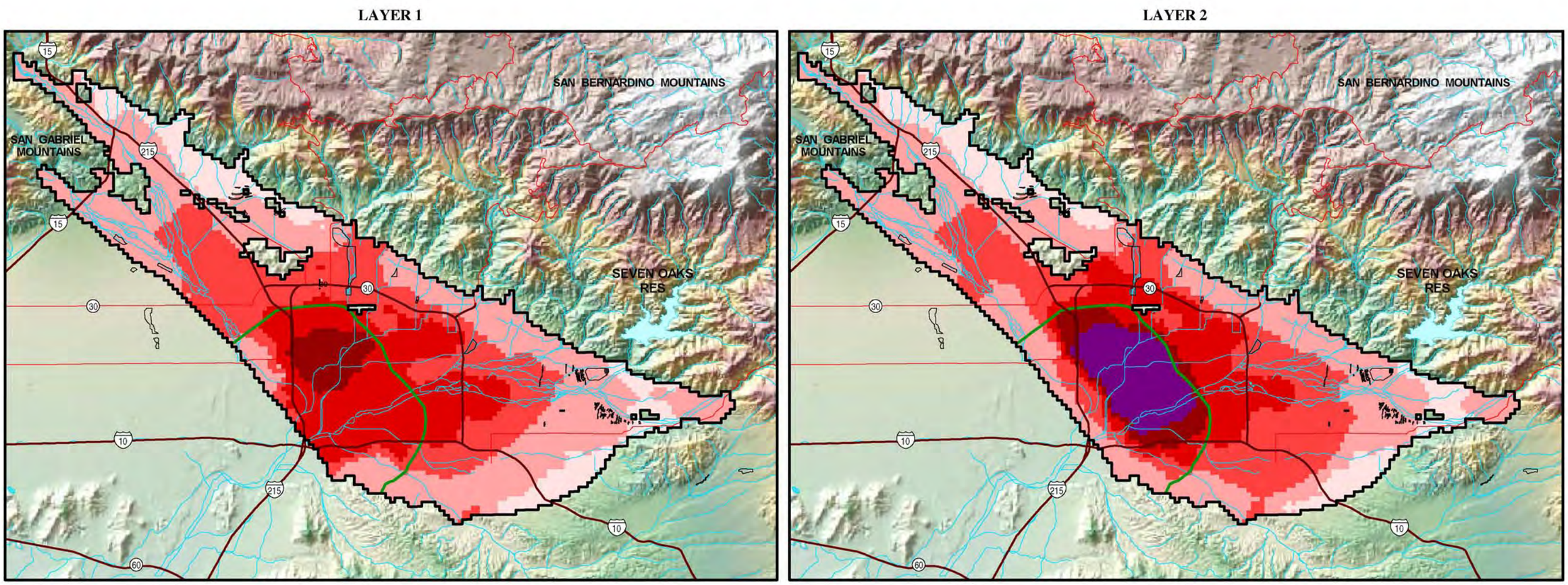
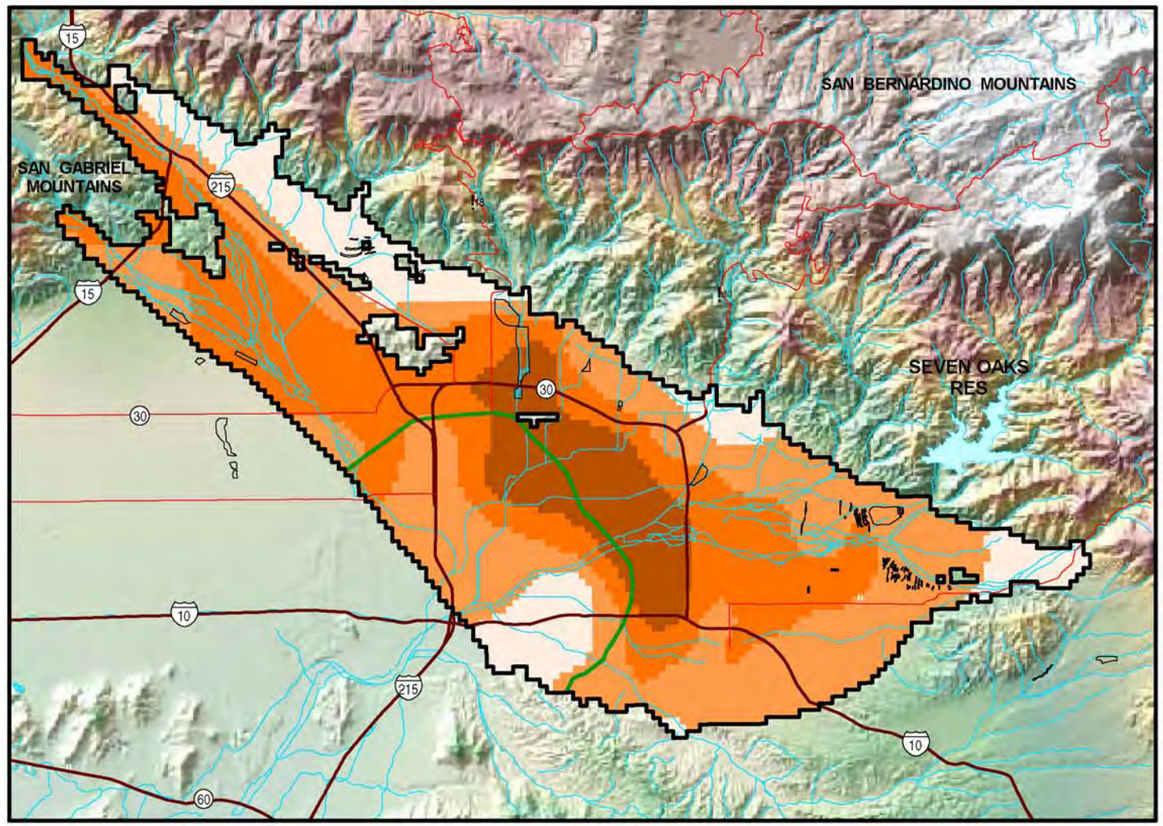
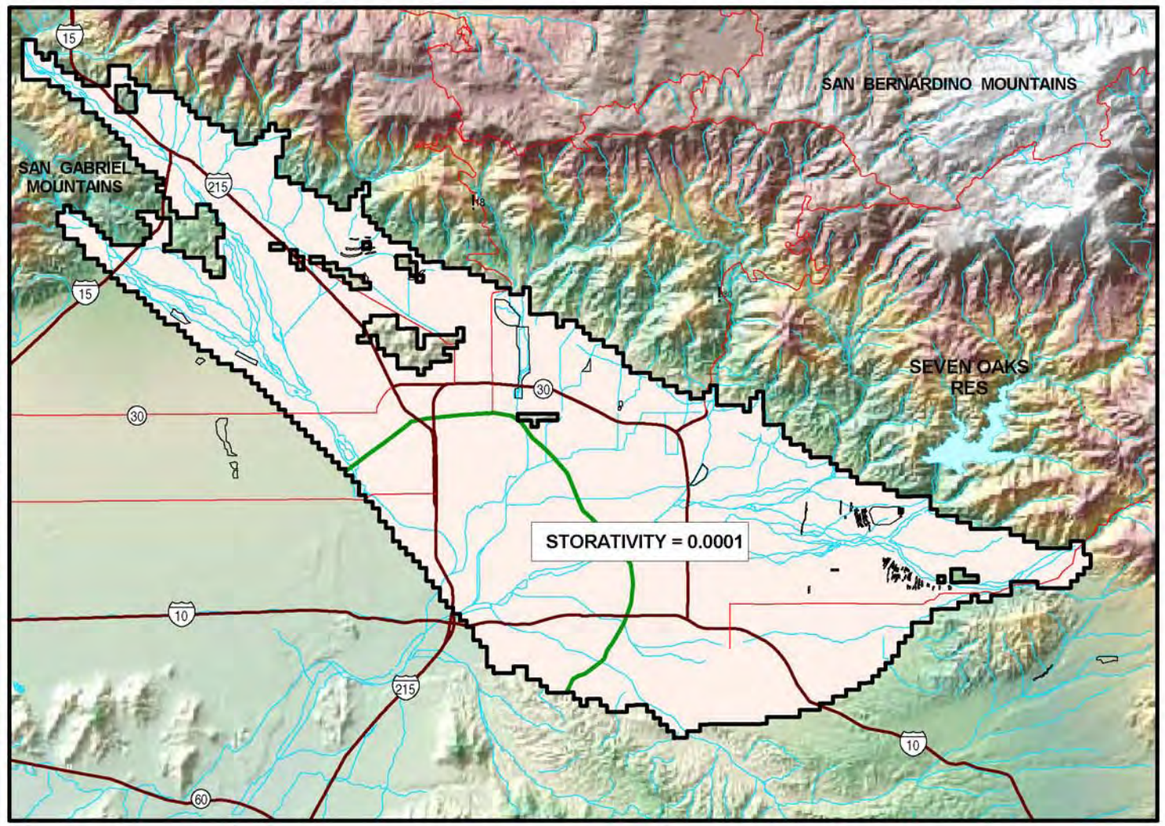


Figure 6.2-2. Transmissivity of Model Layers

LAYER 1



LAYER 2



EXPLANATION

Storativity *

- 0.04 - 0.07
- 0.07 - 0.10
- 0.10 - 0.13
- 0.13 - 0.17

* = equivalent to specific yield or effective porosity

- Active/Inactive Cell Boundary
- Pressure Zone
- Stream or River
- Spreading Grounds or Basins
- Freeway
- State Highway

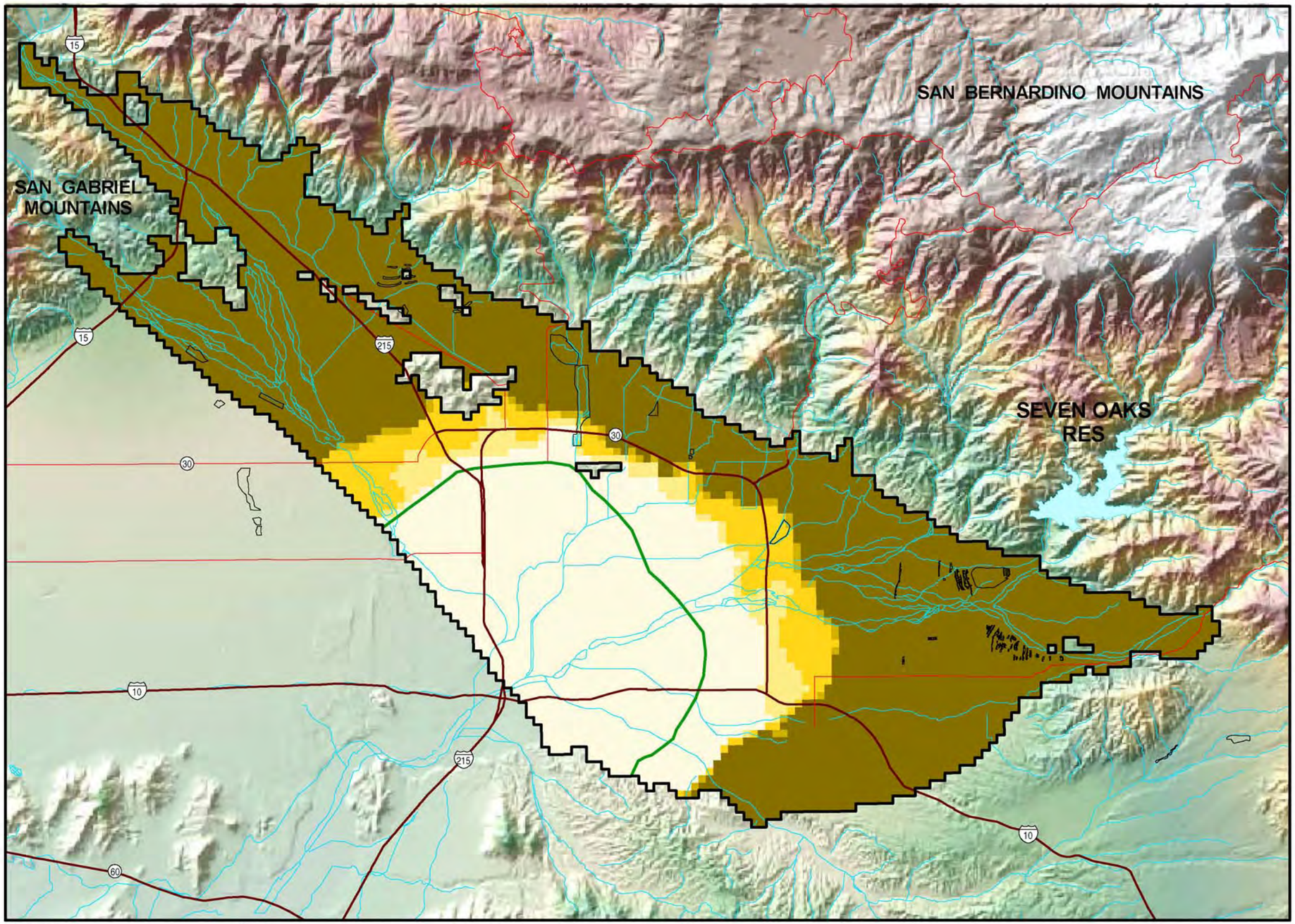
Source:
Danskin, W.R., McPherson, K.R., and Woolfenden, L.R.,
"Hydrology, description of computer models, and evaluation of selected water-management alternatives in the San Bernardino area, California"
US. Geological Survey, draft in preparation.

Map Projection:
State Plane 1927 (California Zone V)

NORTH

0 3 6 Miles

Figure 6.2-3. Storativity of Model Layers

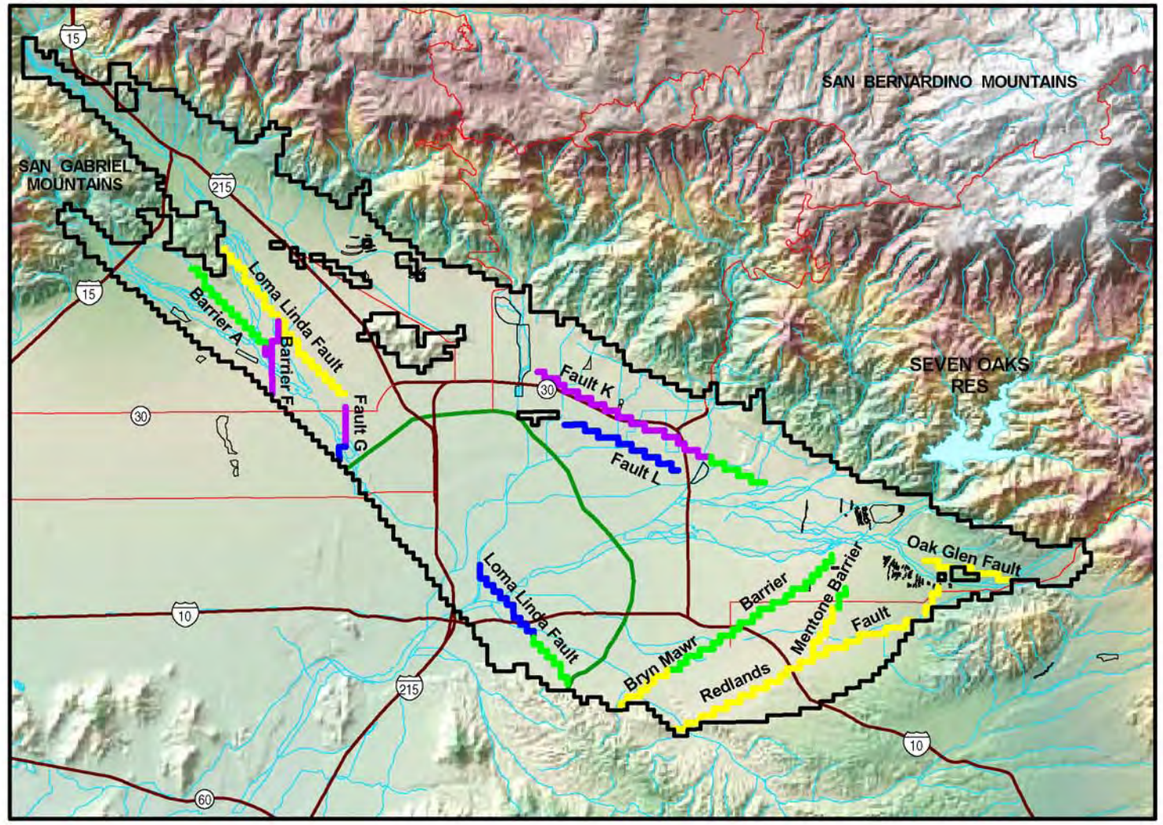


Map Projection:
State Plane 1927 (California Zone V)

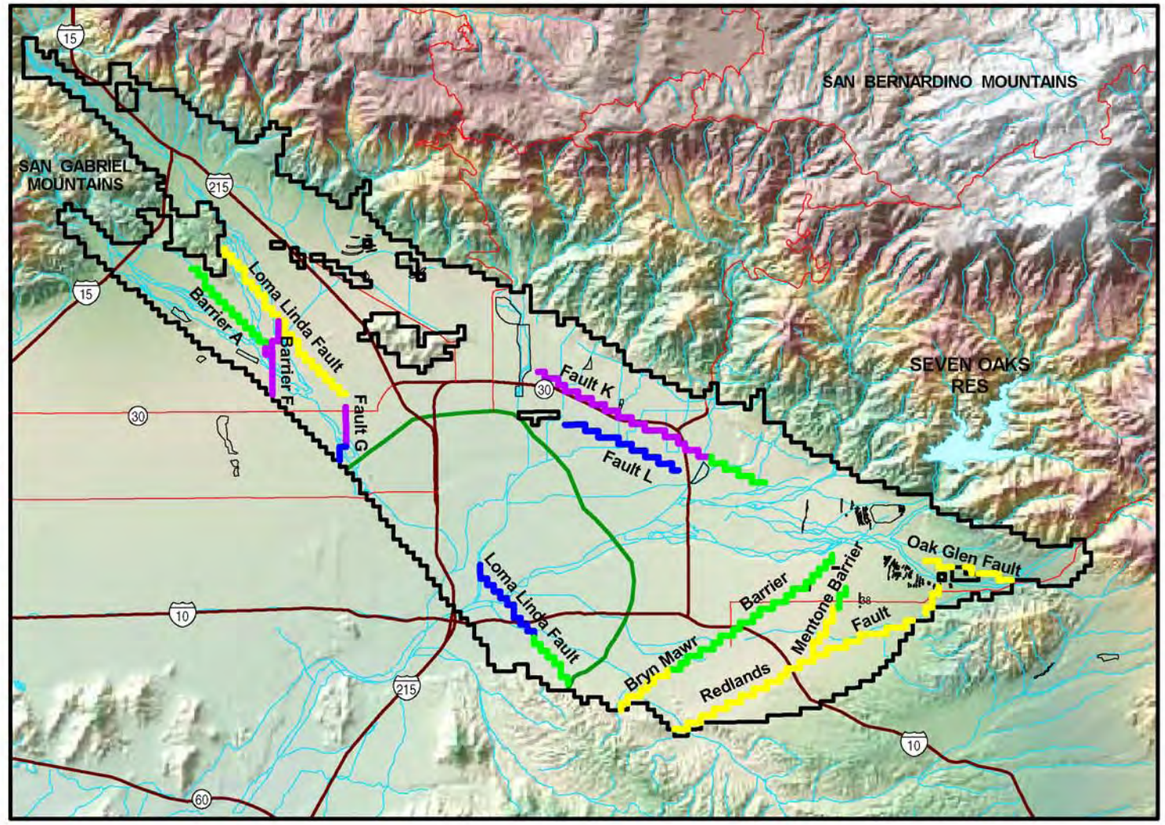
Source:
Danskin, W.R., McPherson, K.R., and Woolfenden, L.R., "Hydrology, description of computer models, and evaluation of selected water-management alternatives in the San Bernardino area, California" US. Geological Survey, draft in preparation.

Figure 6.2-4. Vertical Leakance Values Between Model Layer 1 and Model Layer 2

LAYER 1



LAYER 2



EXPLANATION

Hydraulic Characteristic of Groundwater Barrier (ft/day)

- <1
- 1 - 5
- 5 - 10
- 10 - 25

- Active/Inactive Cell Boundary
- Pressure Zone
- Stream or River
- Spreading Grounds or Basins
- Freeway
- State Highway

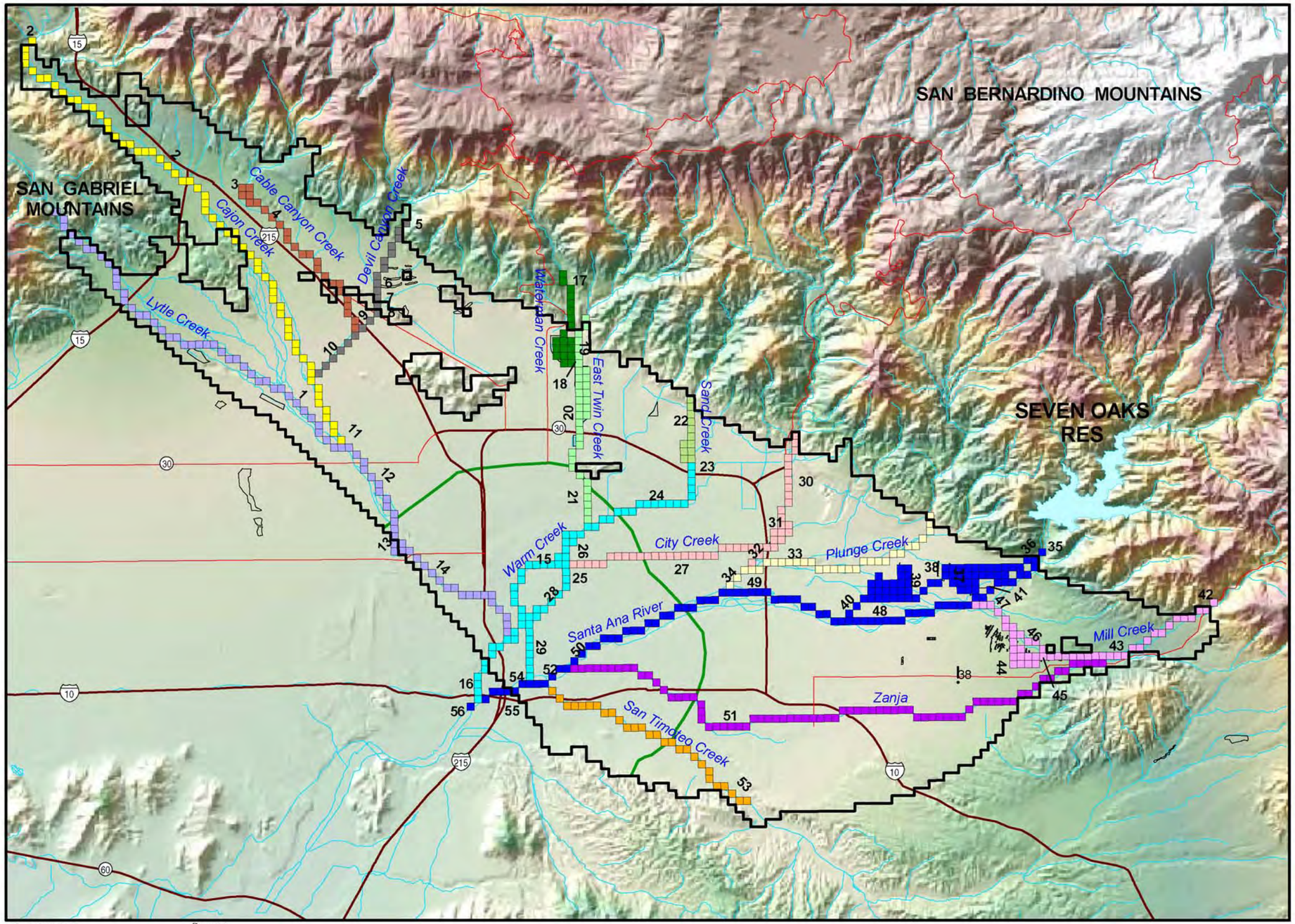
Map Projection:
State Plane 1927 (California Zone V)

Source:
Danskin, W.R., McPherson, K.R., and Woolfenden, L.R.,
"Hydrology, description of computer models, and evaluation of selected water-management alternatives in the San Bernardino area, California"
US. Geological Survey, draft in preparation.

NORTH

0 3 6 Miles

Figure 6.2-5. Hydraulic Characteristics of Groundwater Barriers (Horizontal-Flow Barrier Values Package)

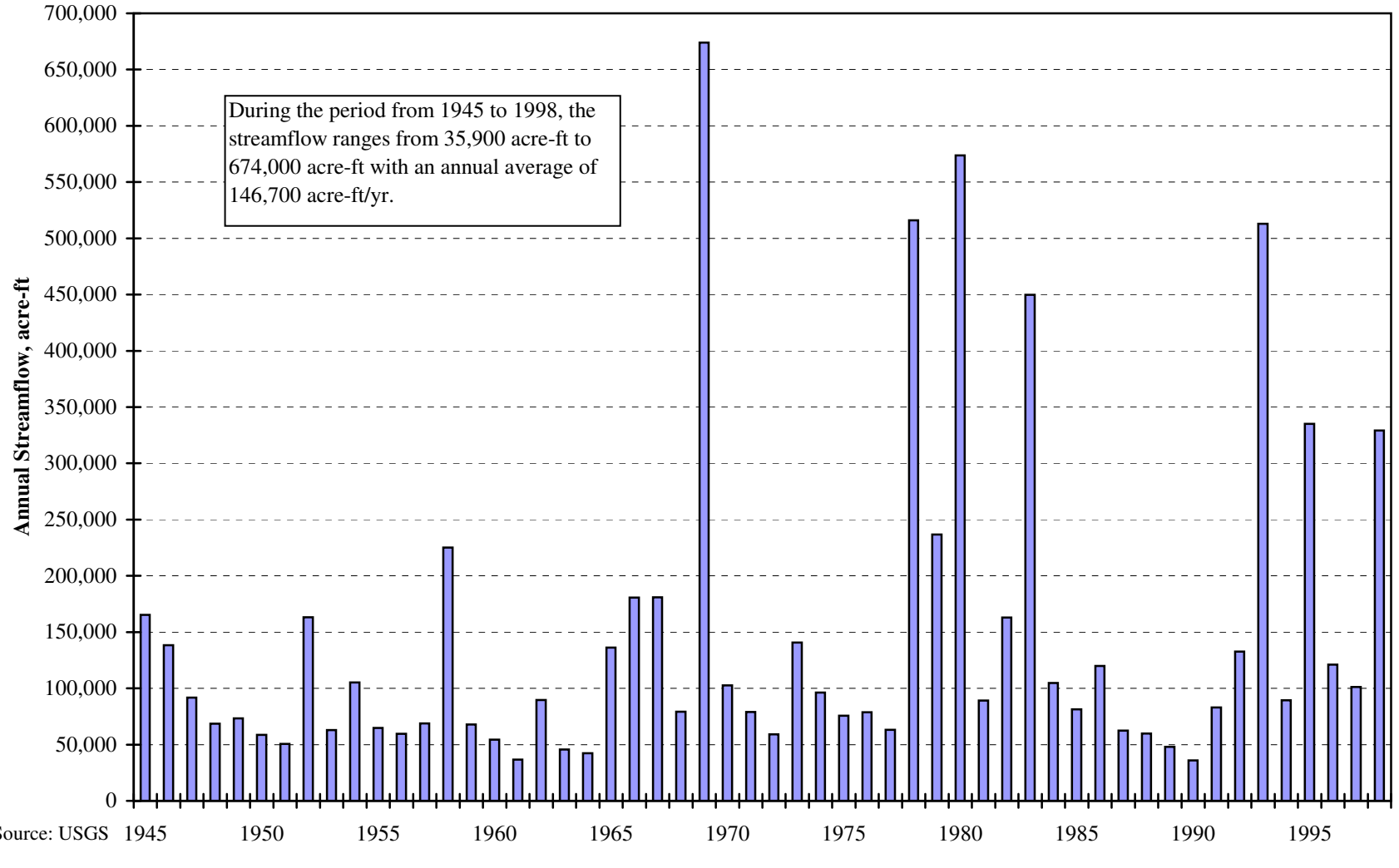


Map Projection:
State Plane 1927 (California Zone V)

Source:
Danskin, W.R., McPherson, K.R., and Woolfenden, L.R., "Hydrology, description of computer models, and evaluation of selected water-management alternatives in the San Bernardino area, California" US. Geological Survey, draft in preparation.

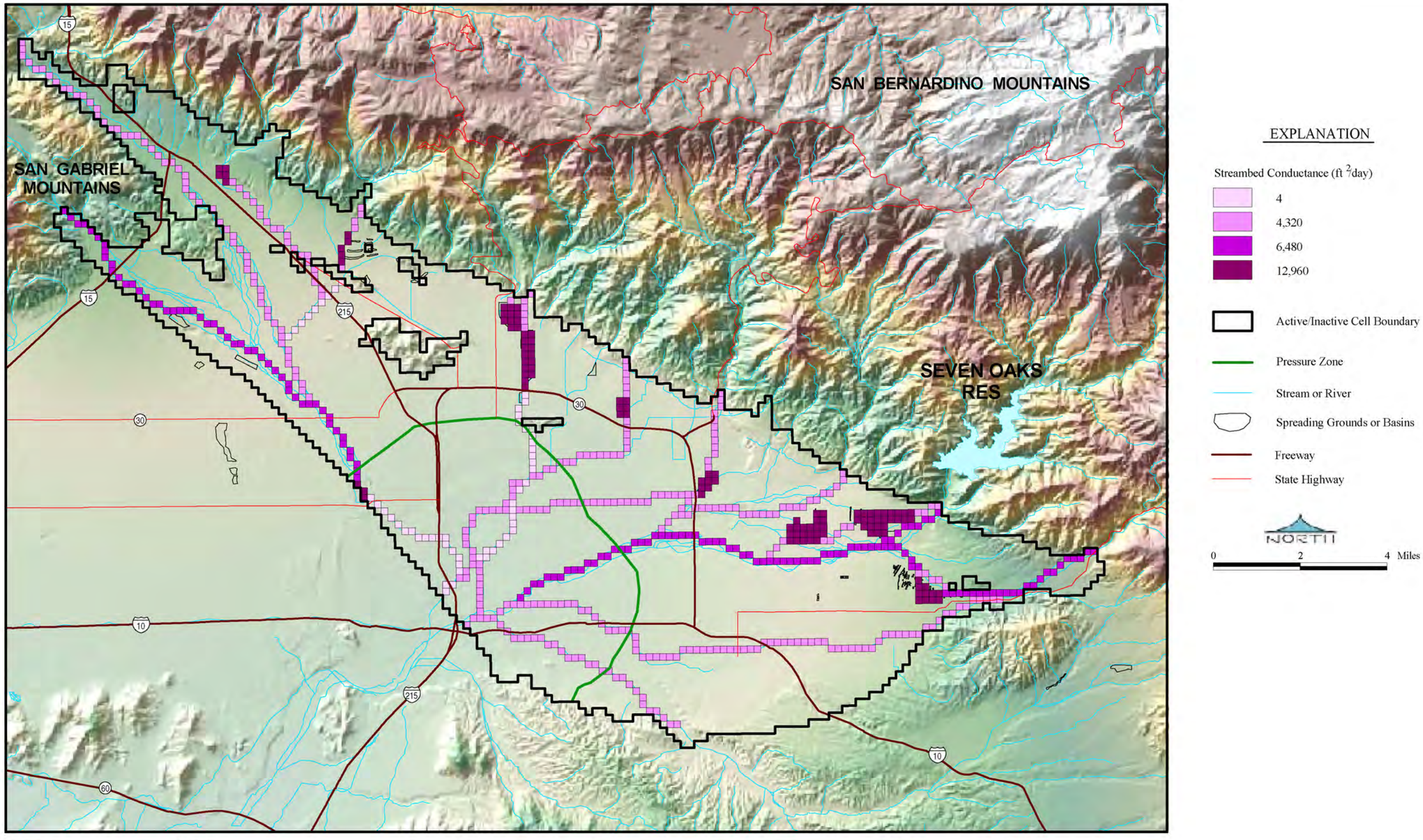
Figure 6.2-6. Locations of Stream Segments

Total Annual Streamflow Inflow for the SBBA
1945-1998



Source: USGS

Muni/Western Ex. 6-145
Figure 6.2-7

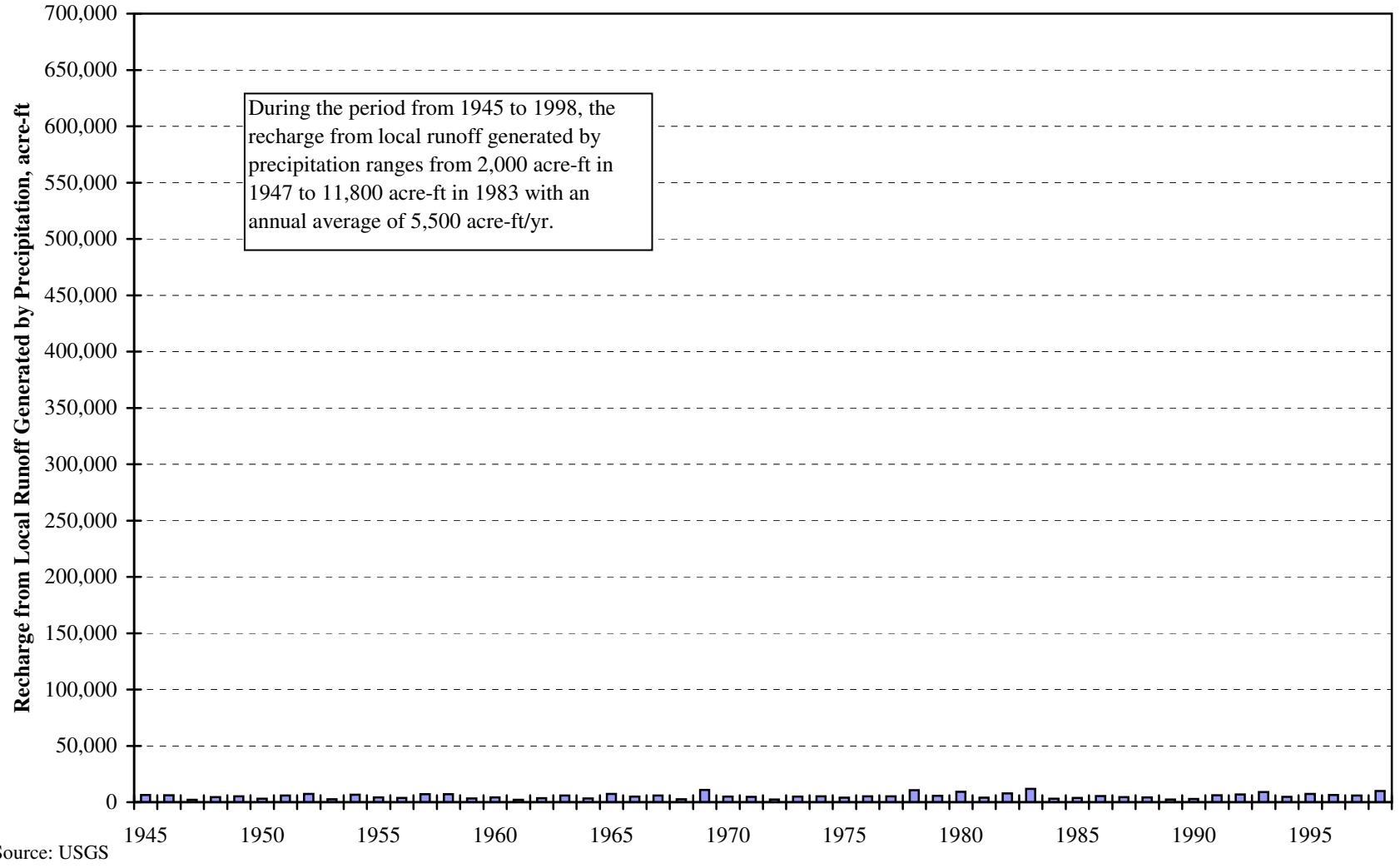


Map Projection:
State Plane 1927 (California Zone V)

Source:
Danskin, W.R., McPherson, K.R., and Woolfenden, L.R., "Hydrology, description of computer models, and evaluation of selected water-management alternatives in the San Bernardino area, California" US. Geological Survey, draft in preparation.

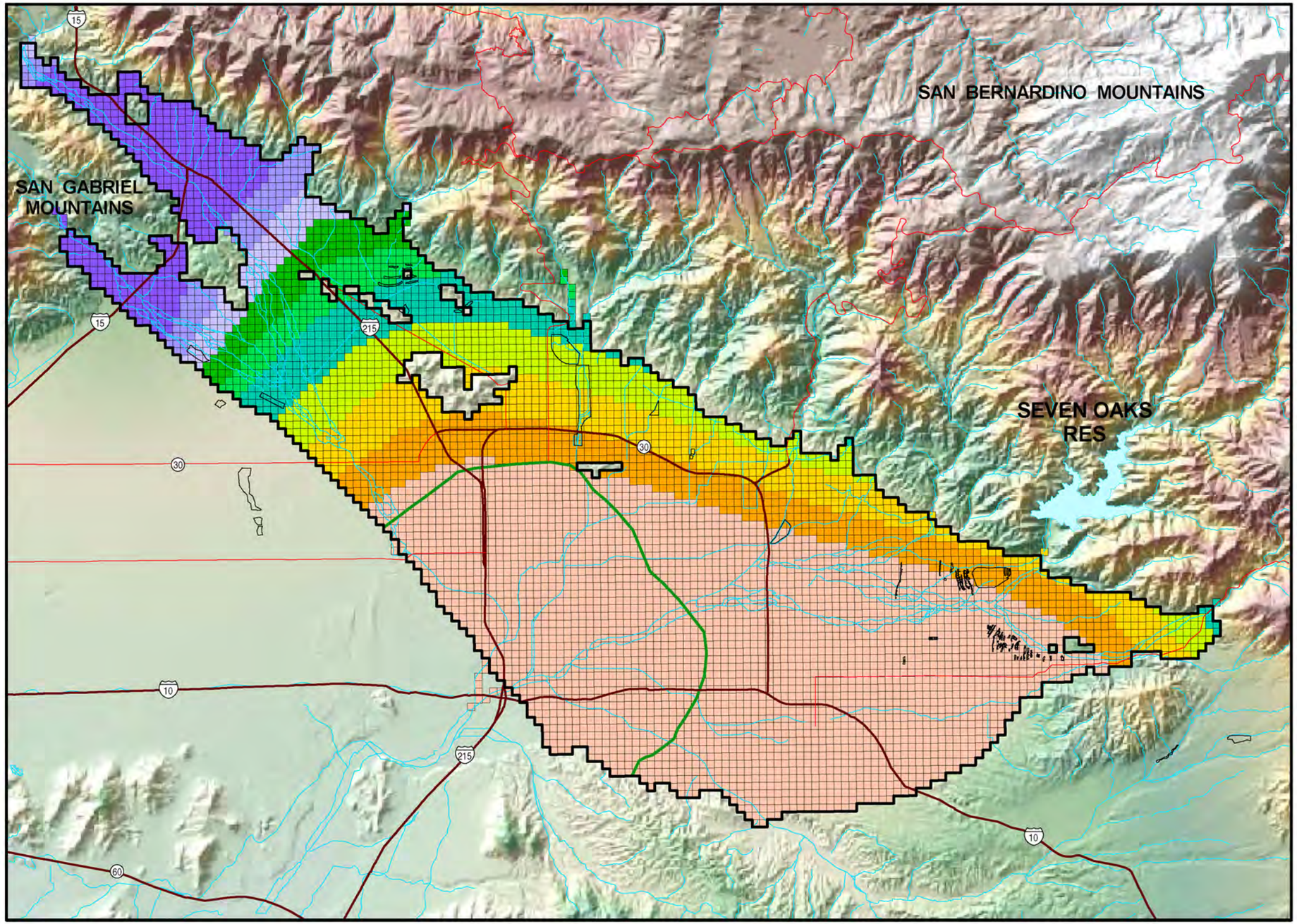
Figure 6.2-8. Streambed Conductance Values for Stream Segments

Recharge from Local Runoff Generated by Precipitation for the SBBA 1945-1998



Source: USGS

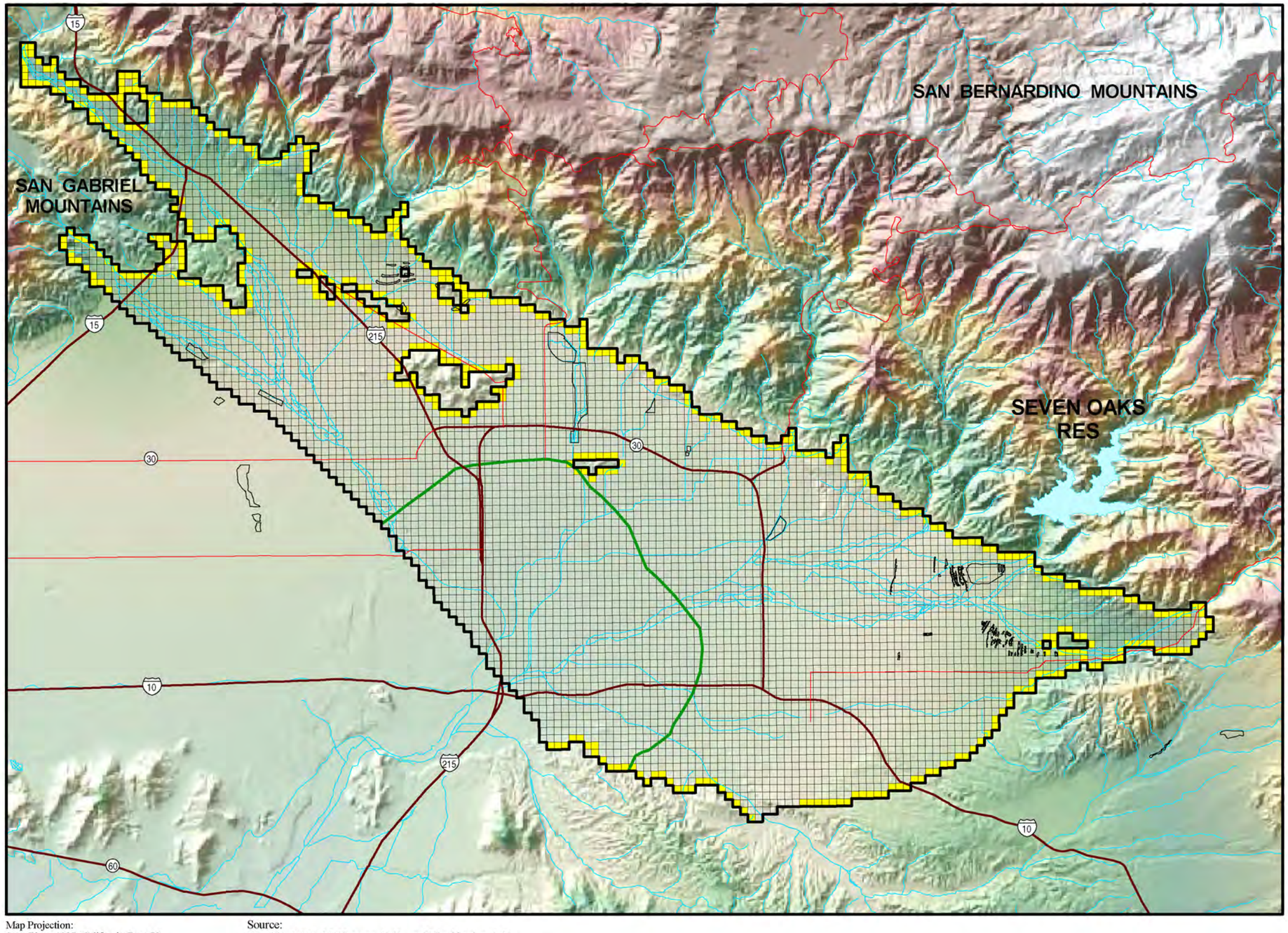
Muni/Western Ex. 6-147
Figure 6.2-9



Map Projection:
State Plane 1927 (California Zone V)

Source:
Danskin, W.R., McPherson, K.R., and Woolfenden, L.R., "Hydrology, description of computer models, and evaluation of selected water-management alternatives in the San Bernardino area, California" US. Geological Survey, draft in preparation.

Figure 6.2-10. Average Annual Precipitation for the San Bernardino Basin Area

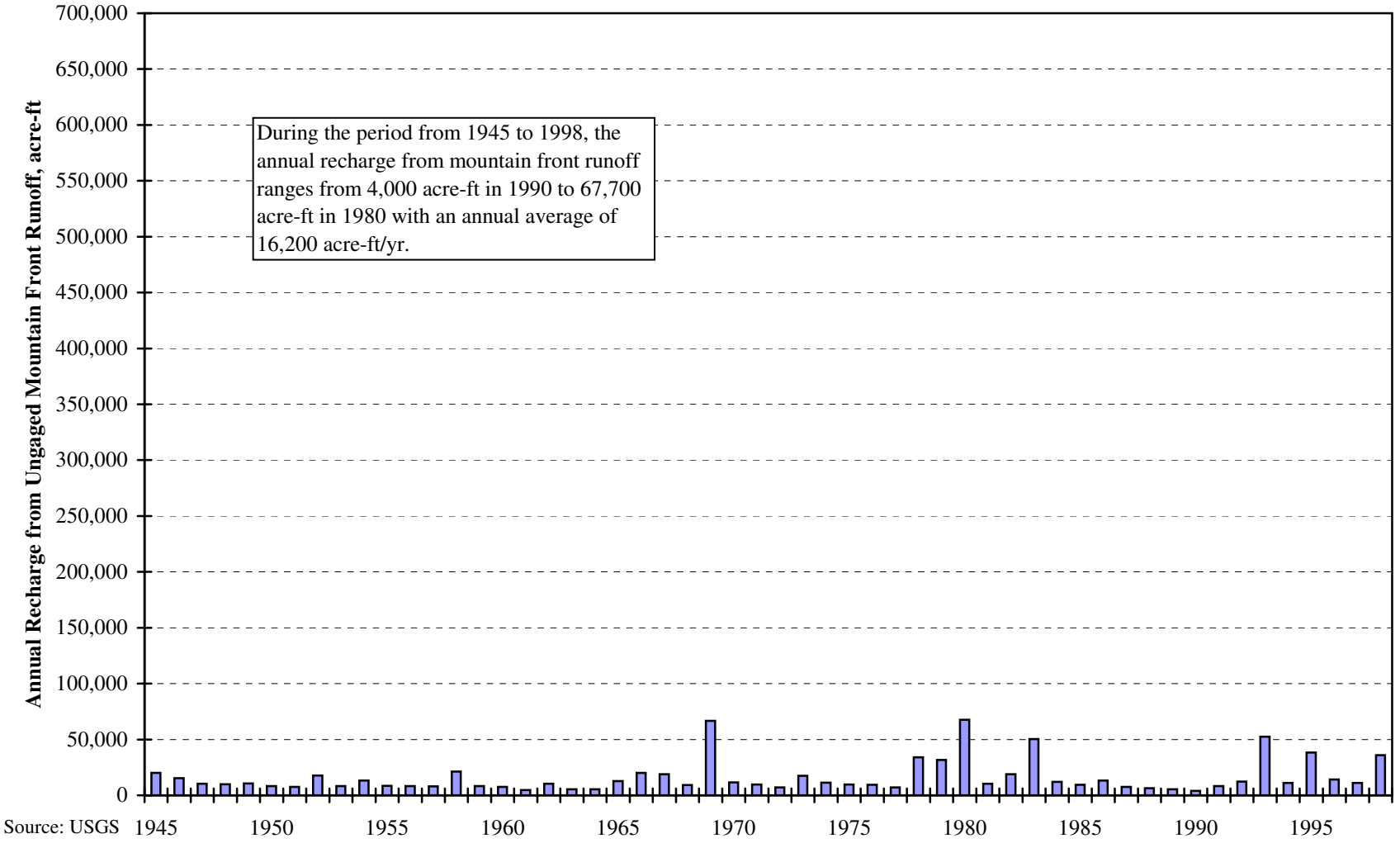


Map Projection:
State Plane 1927 (California Zone V)

Source:
Danskin, W.R., McPherson, K.R., and Woolfenden, L.R., "Hydrology, description of computer models, and evaluation of selected water-management alternatives in the San Bernardino area, California" US. Geological Survey, draft in preparation.

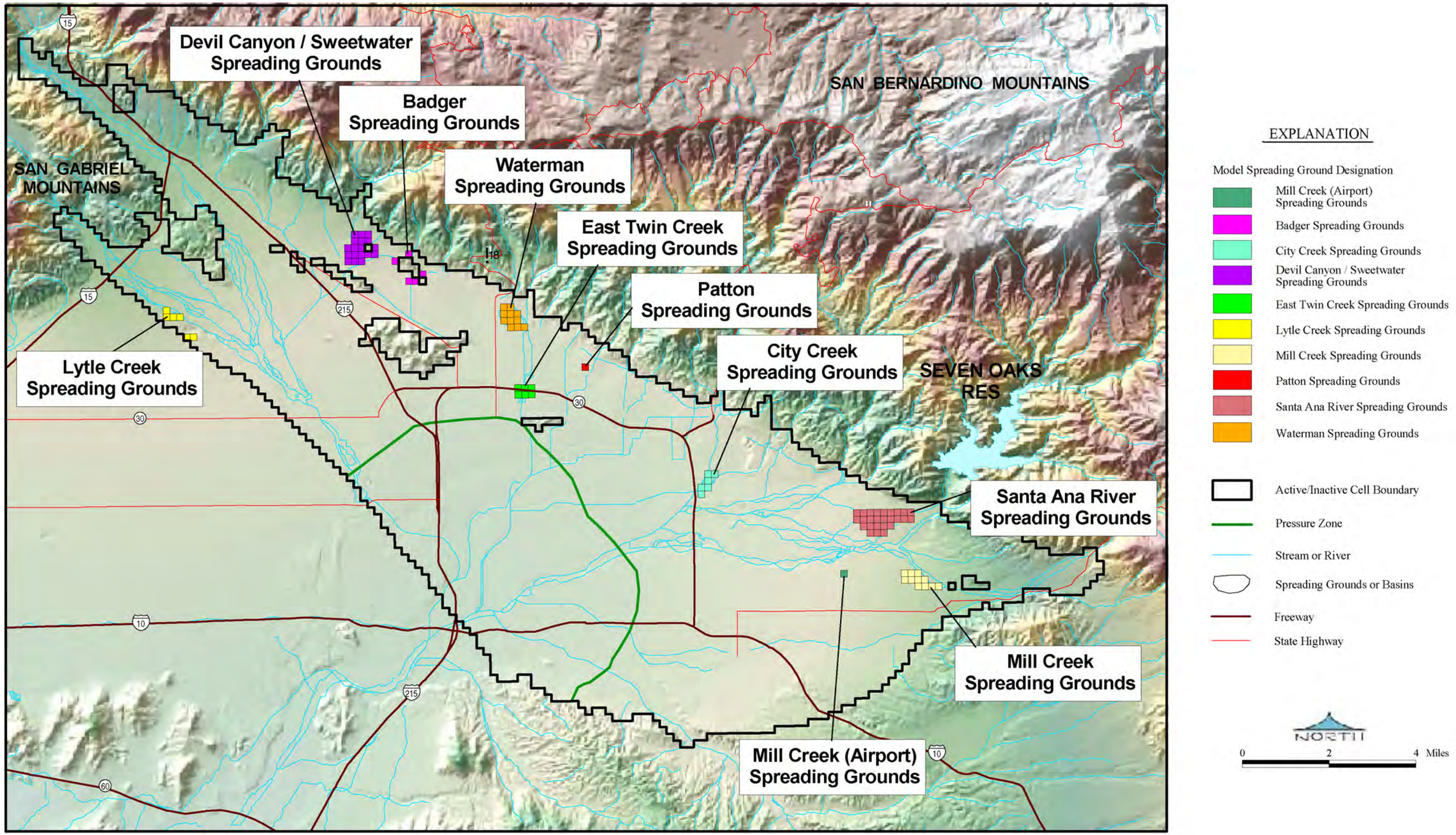
Figure 6.2-11. Locations of Recharge from Mountain Front Runoff

Annual Recharge from Mountain Front Runoff for the SBBA 1945-1998



Source: USGS

Muni/Western Ex. 6-150
Figure 6.2-12

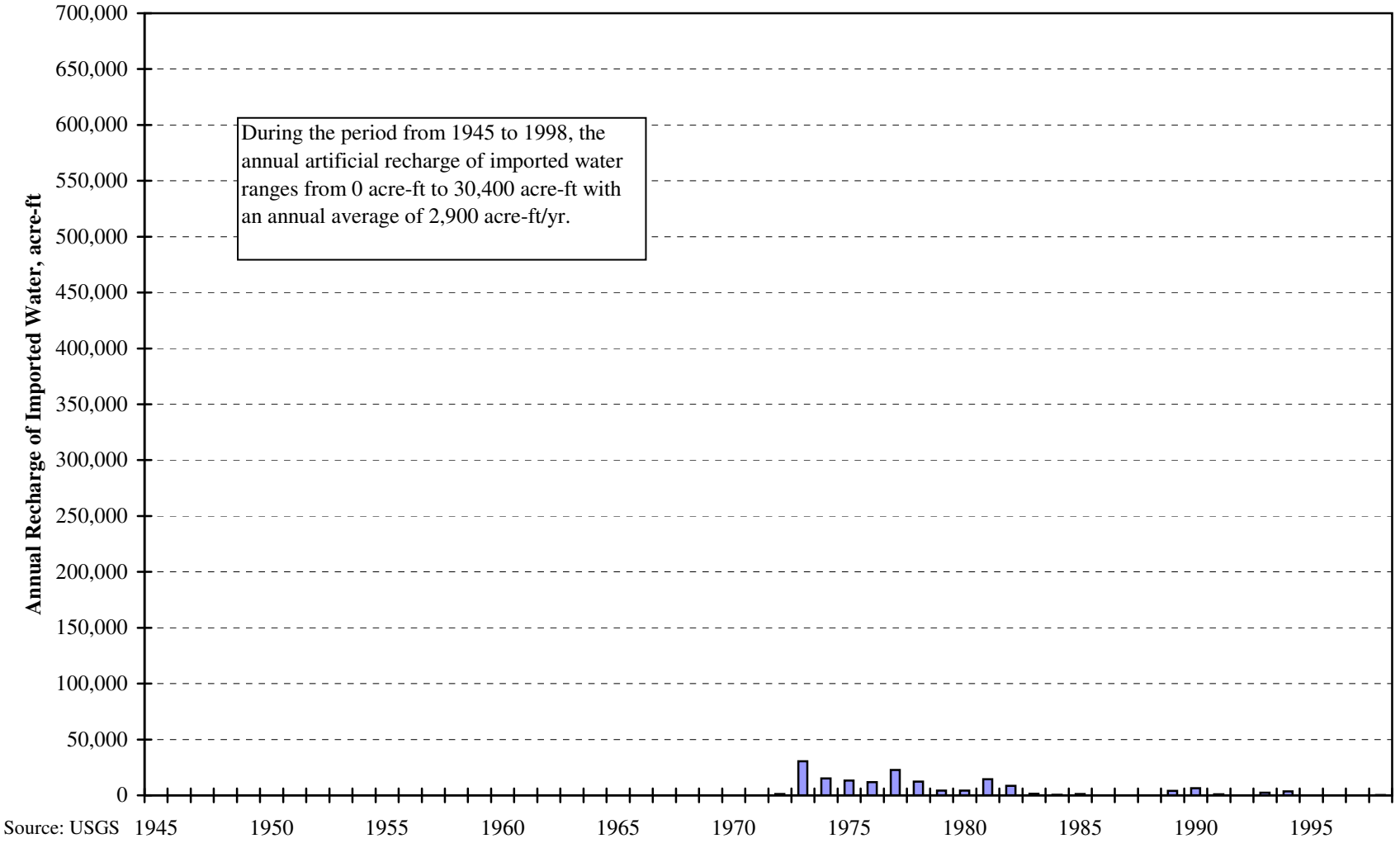


Map Projection:
State Plane 1927 (California Zone V)

Source:
Danskin, W.R., McPherson, K.R., and Woolfenden, L.R., "Hydrology, description of computer models, and evaluation of selected water-management alternatives in the San Bernardino area, California" US. Geological Survey, draft in preparation.

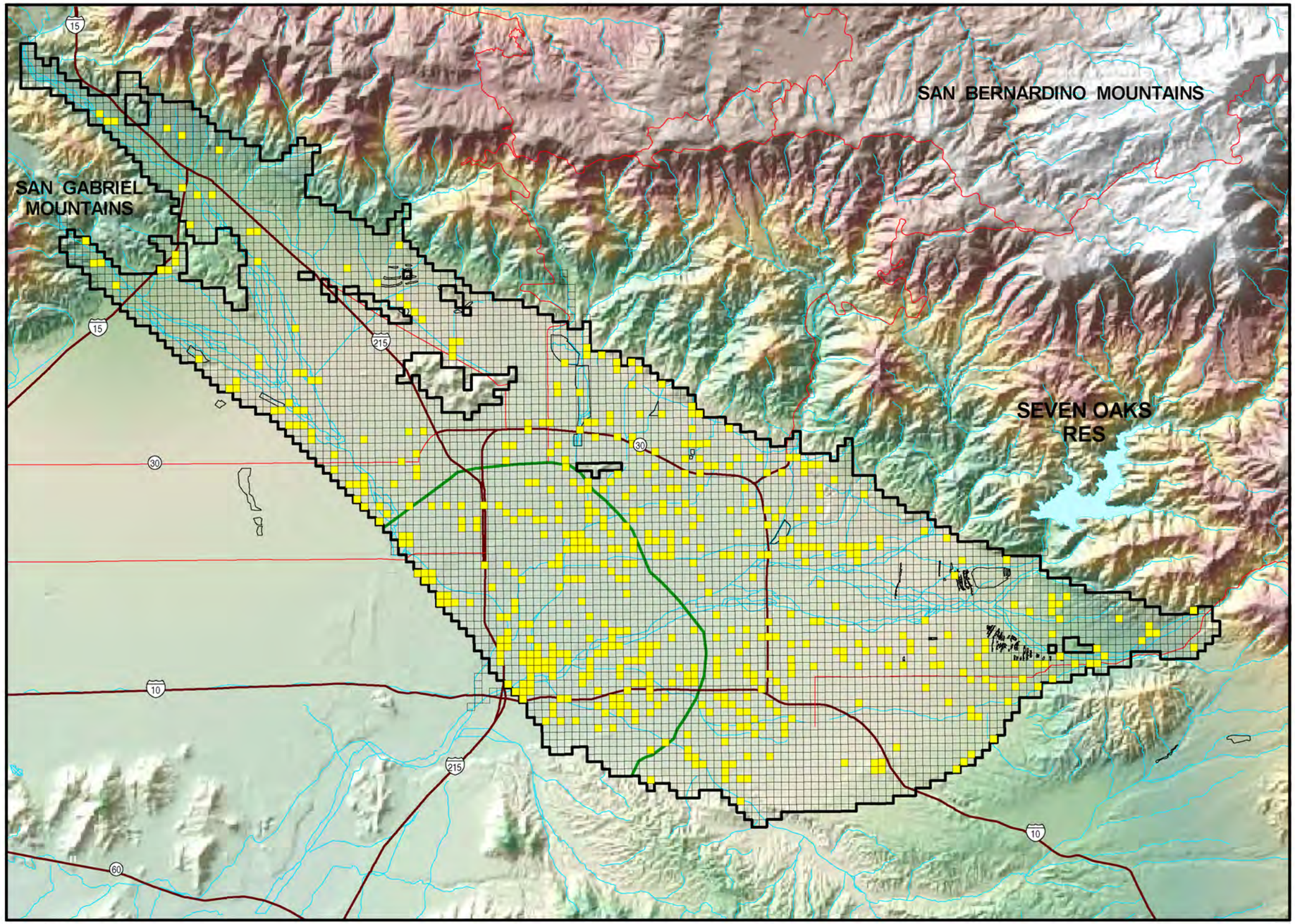
Figure 6.2-13. Locations of Artificial Recharge of Imported Water

Annual Artificial Recharge of Imported Water for the SBBA
1945-1998



Source: USGS

Muni/Western Ex. 6-152
Figure 6.2-14

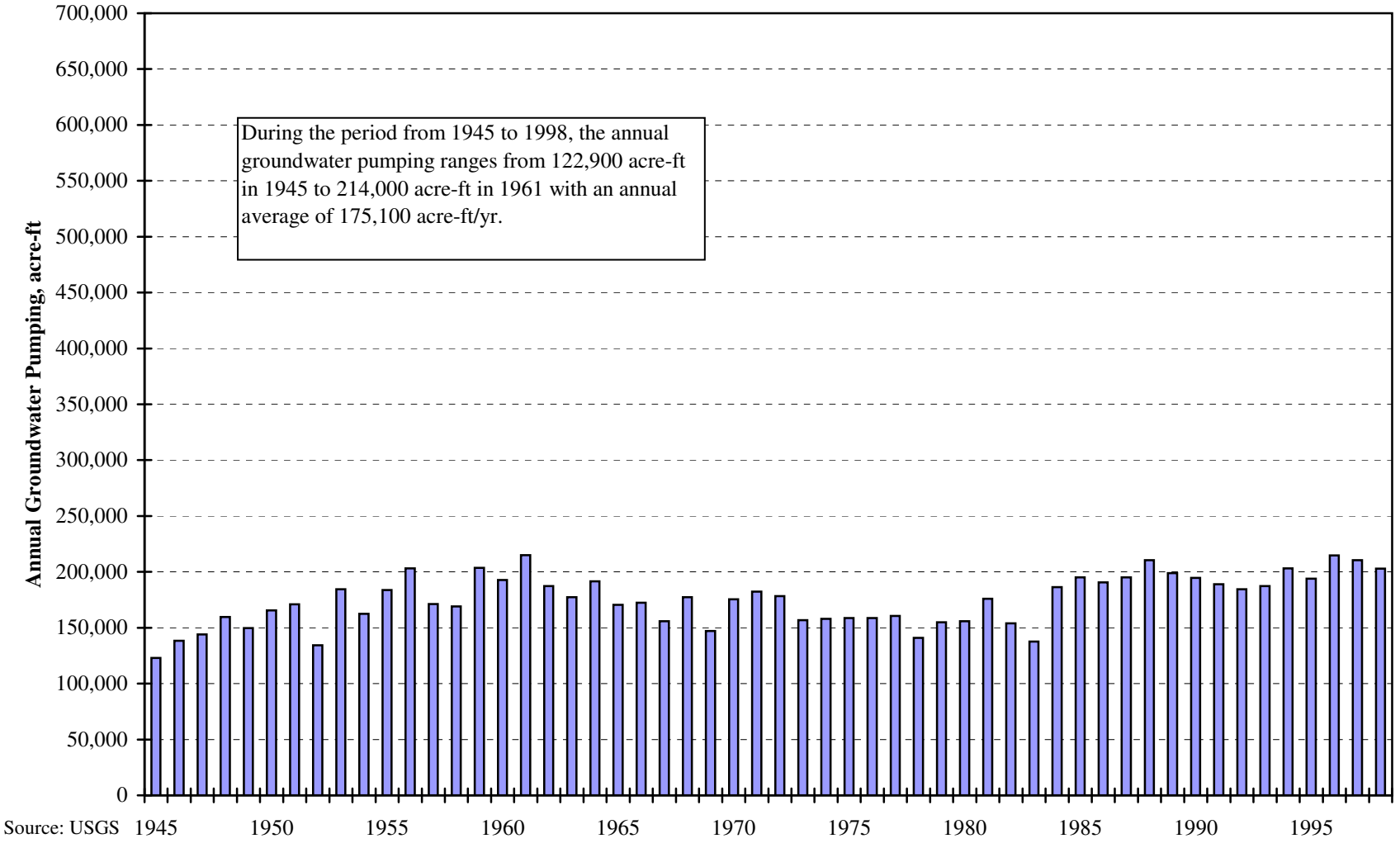


Map Projection:
State Plane 1927 (California Zone V)

Source:
Danskin, W.R., McPherson, K.R., and Woolfenden, L.R., "Hydrology, description of computer models, and evaluation of selected water-management alternatives in the San Bernardino area, California" US. Geological Survey, draft in preparation.

Figure 6.2-15. Locations of Groundwater Pumping Wells

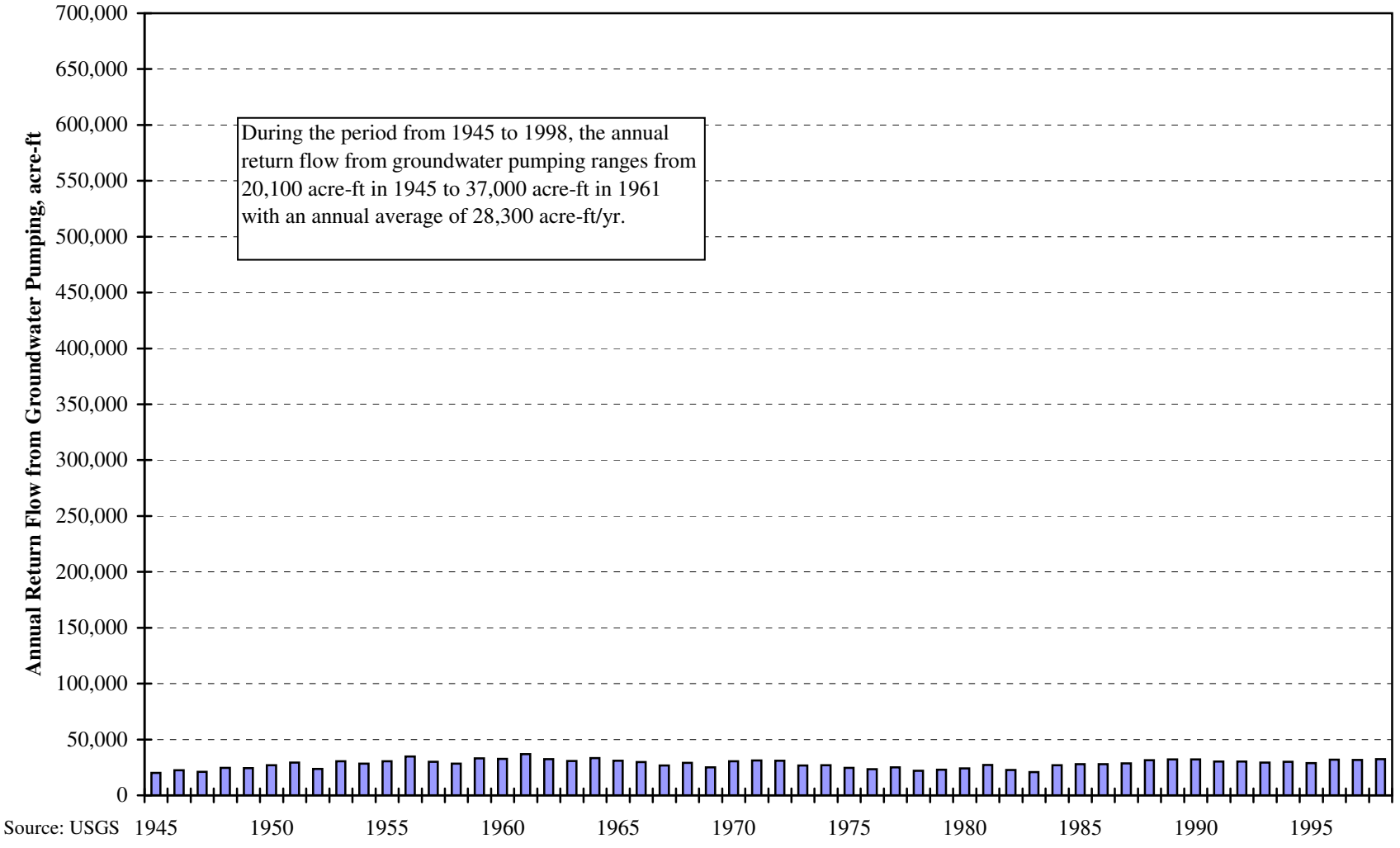
Annual Groundwater Pumping of the SBBA
1945-1998



Source: USGS

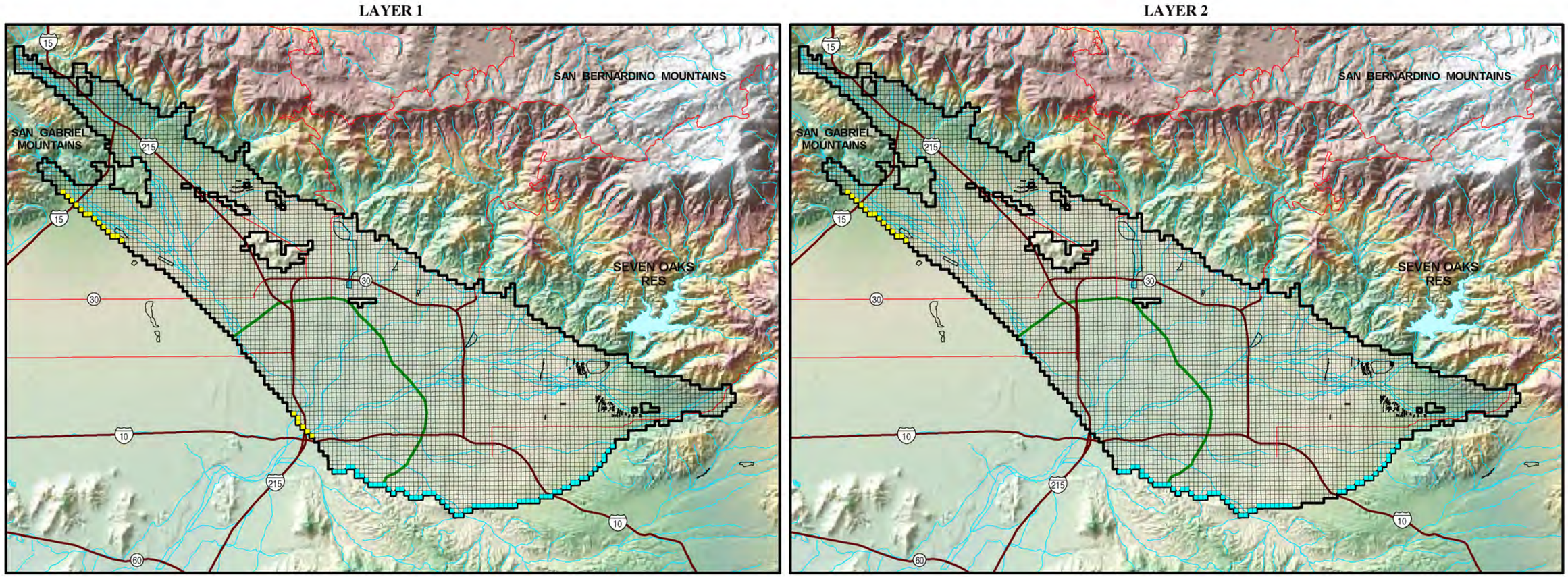
Muni/Western Ex. 6-154
Figure 6.2-16

Annual Return Flow from Groundwater Pumping of the SBBA
1945-1998



Source: USGS

Muni/Western Ex. 6-155
Figure 6.2-17

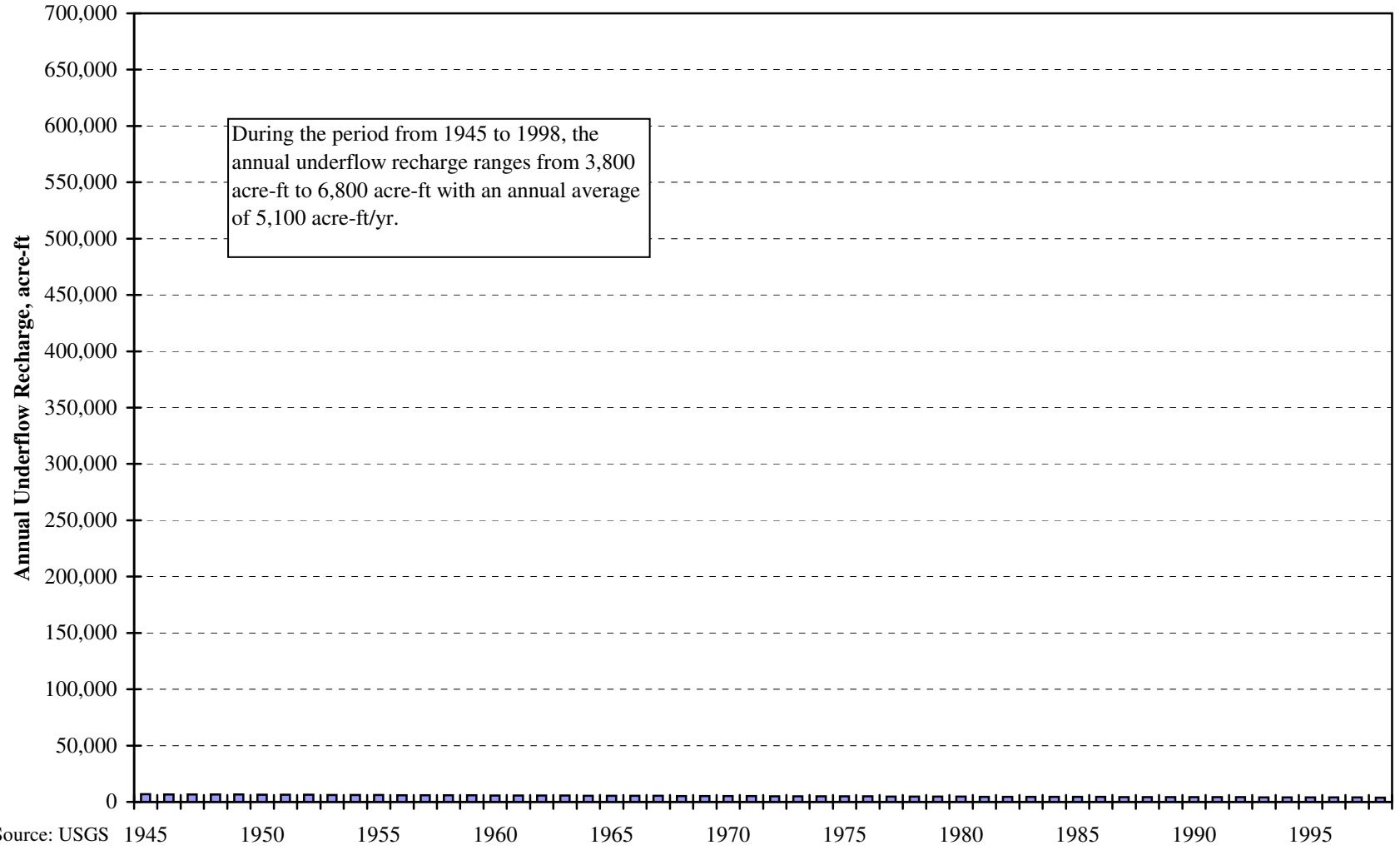


Map Projection:
State Plane 1927 (California Zone V)

Source:
Danskin, W.R., McPherson, K.R., and Woolfenden, L.R., "Hydrology, description of computer models, and evaluation of selected water-management alternatives in the San Bernardino area, California" US. Geological Survey, draft in preparation.

Figure 6.2-18. Locations of Underflow Recharge and Discharge

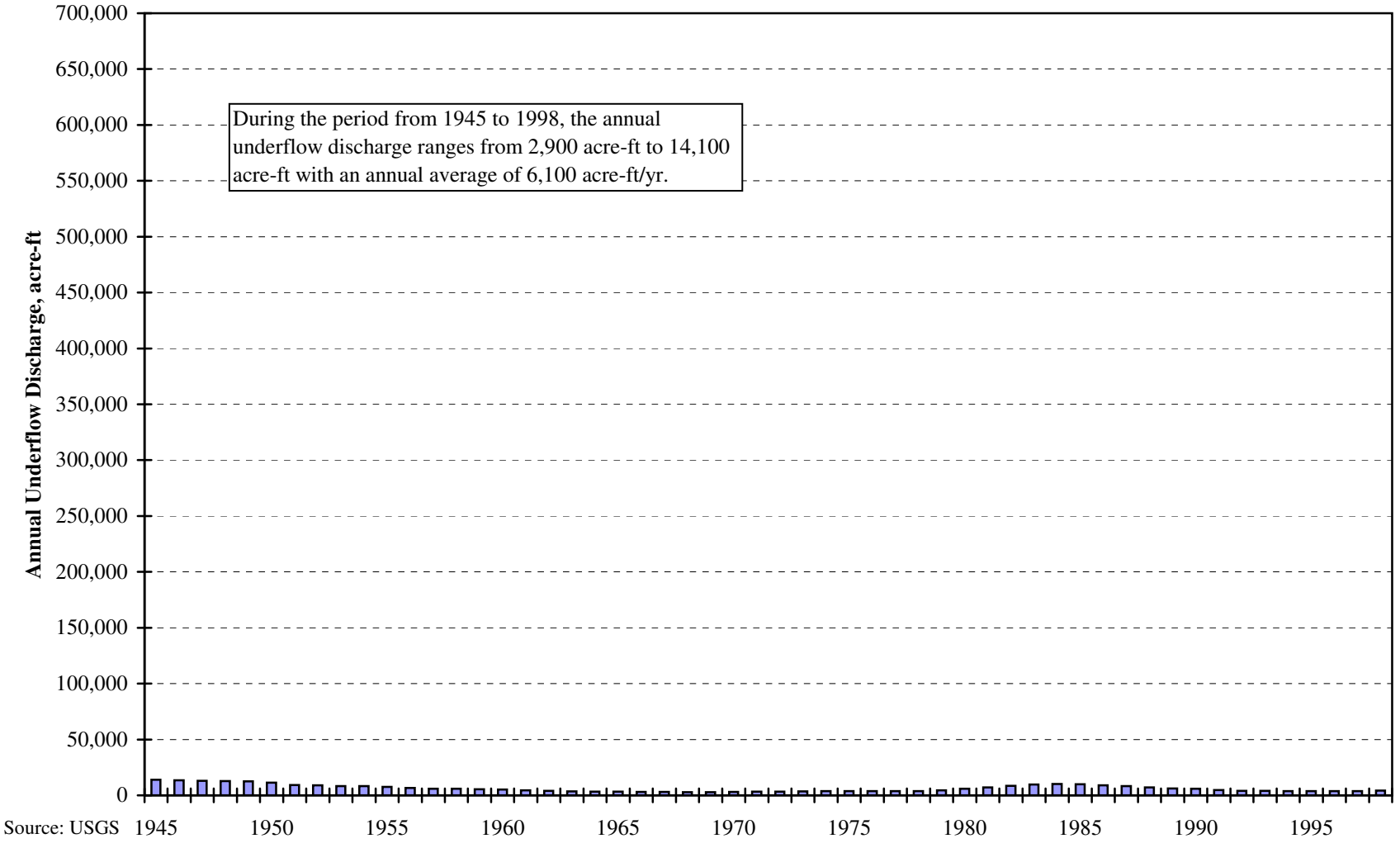
Annual Underflow Recharge of the SBBA
1945-1998



Source: USGS

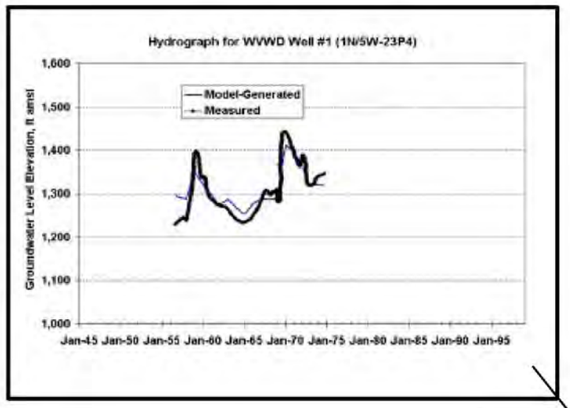
Muni/Western Ex. 6-157
Figure 6.2-19

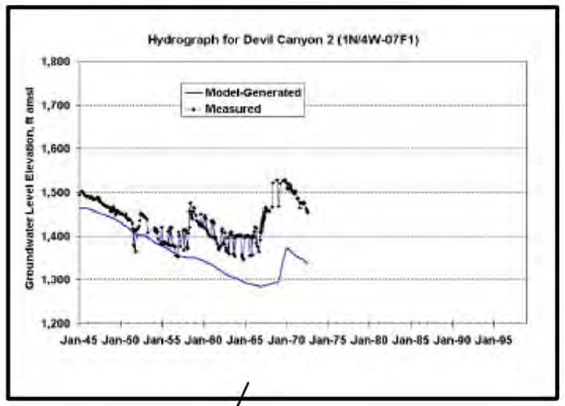
Annual Underflow Discharge of the SBBA
1945-1998

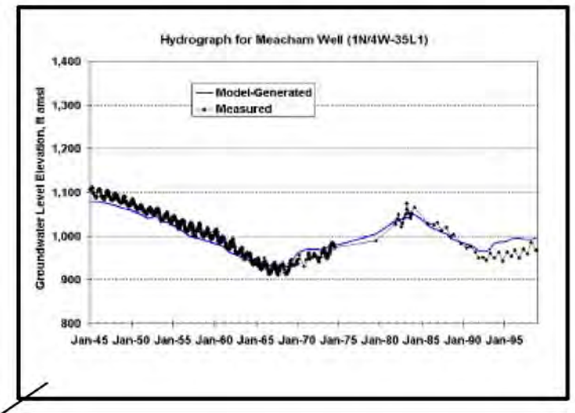


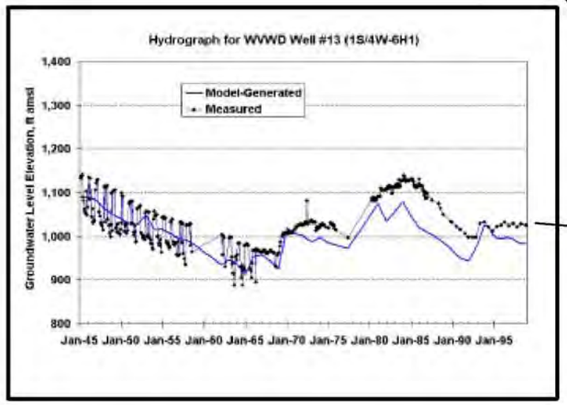
Source: USGS

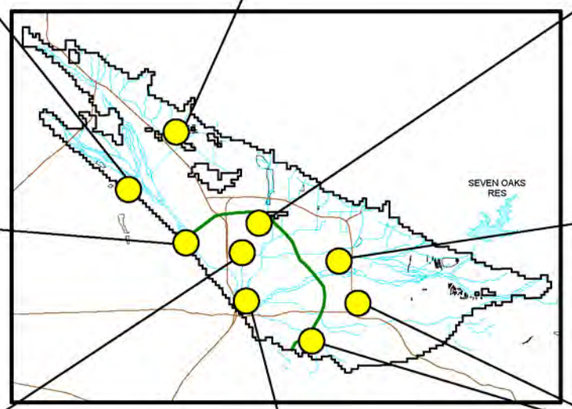
Muni/Western Ex. 6-158
Figure 6.2-20

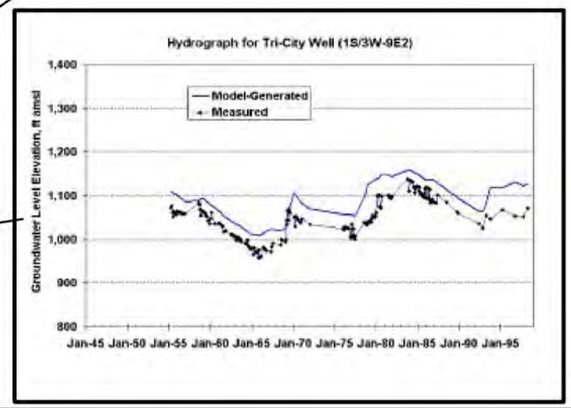










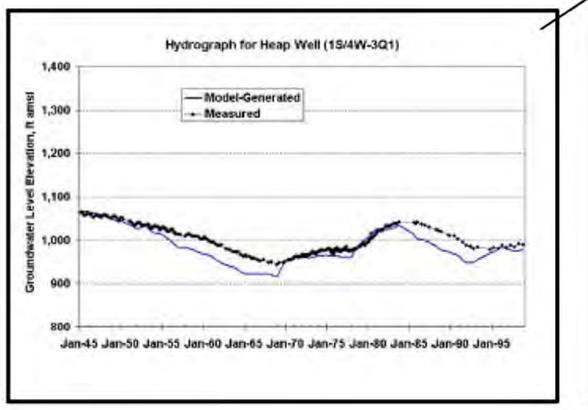


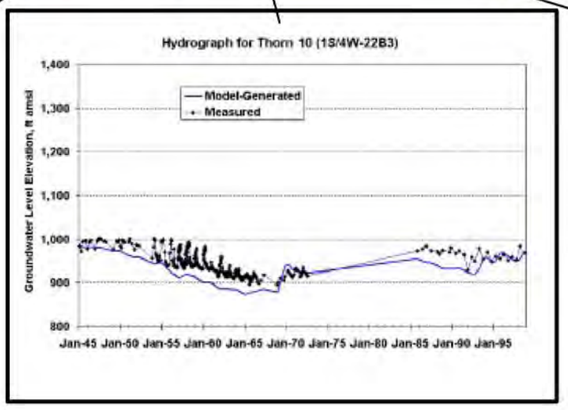
EXPLANATION

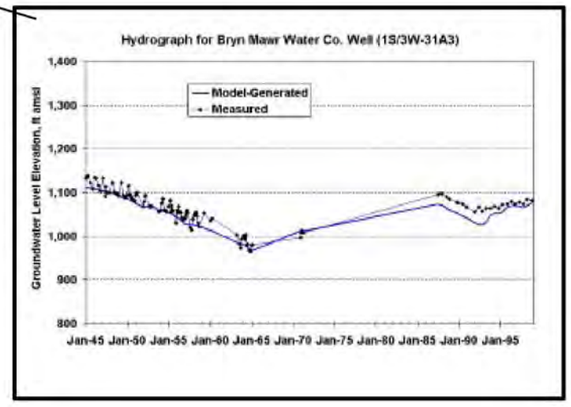
- Selected Well
- Pressure Zone
- Model Grid of the San Bernardino Basin Area Groundwater Model
- Streams or Rivers Within Groundwater Basin Boundary
- Spreading Grounds or Basins
- Freeway

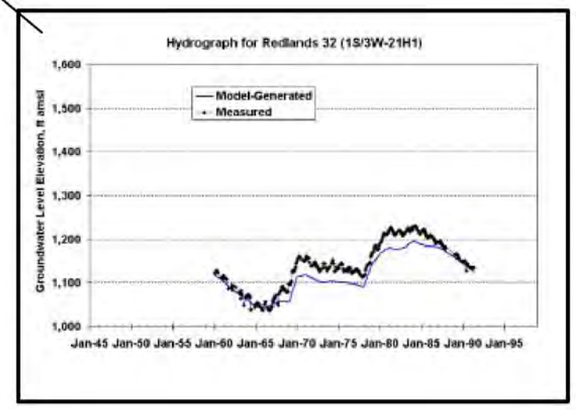
NORTH

0 5 10 Miles





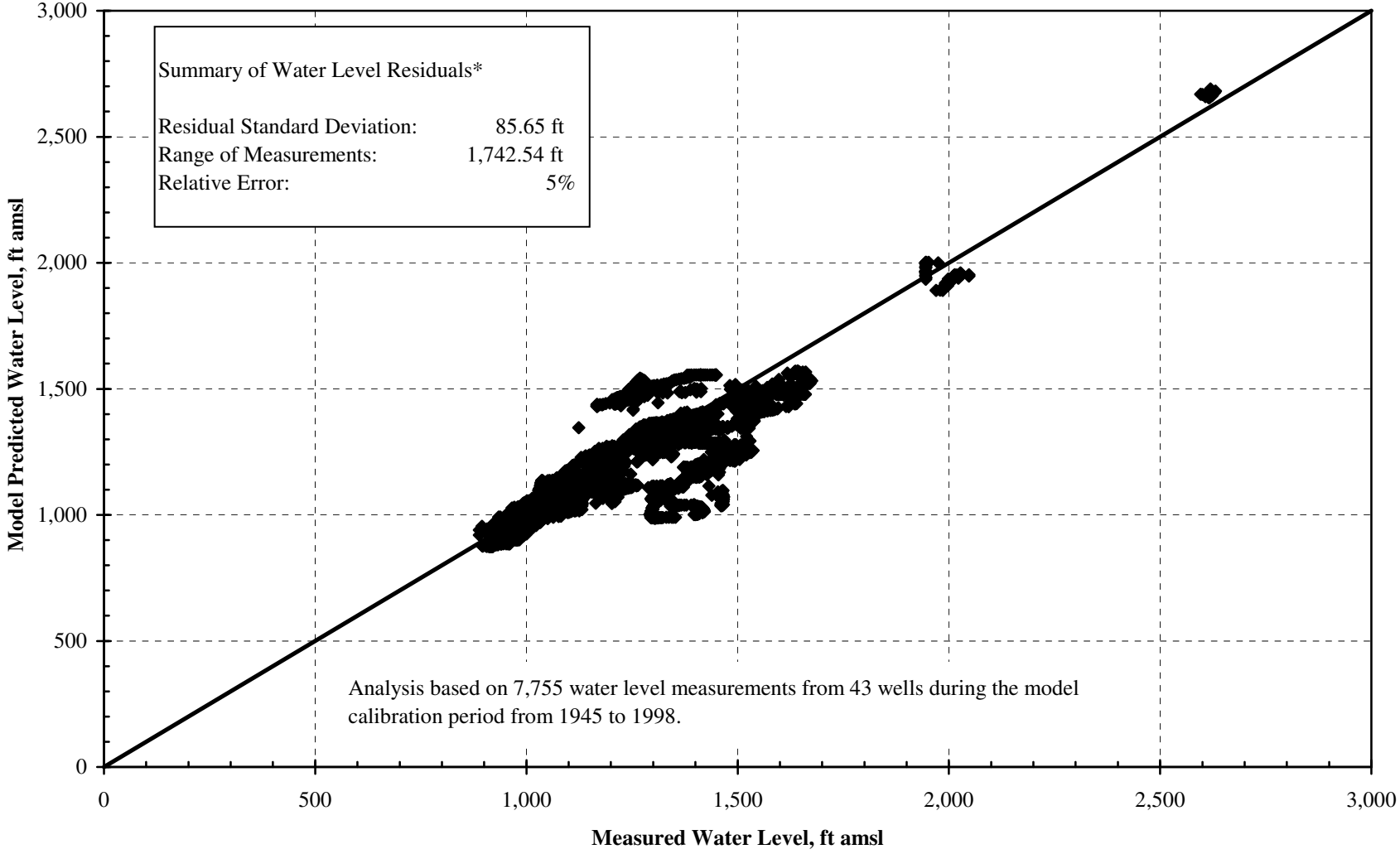




Map Projection:
State Plane 1927 (California Zone V)

Figure 6.2-21. Selected Hydrographs Flow Model Calibration (1945 - 1998)

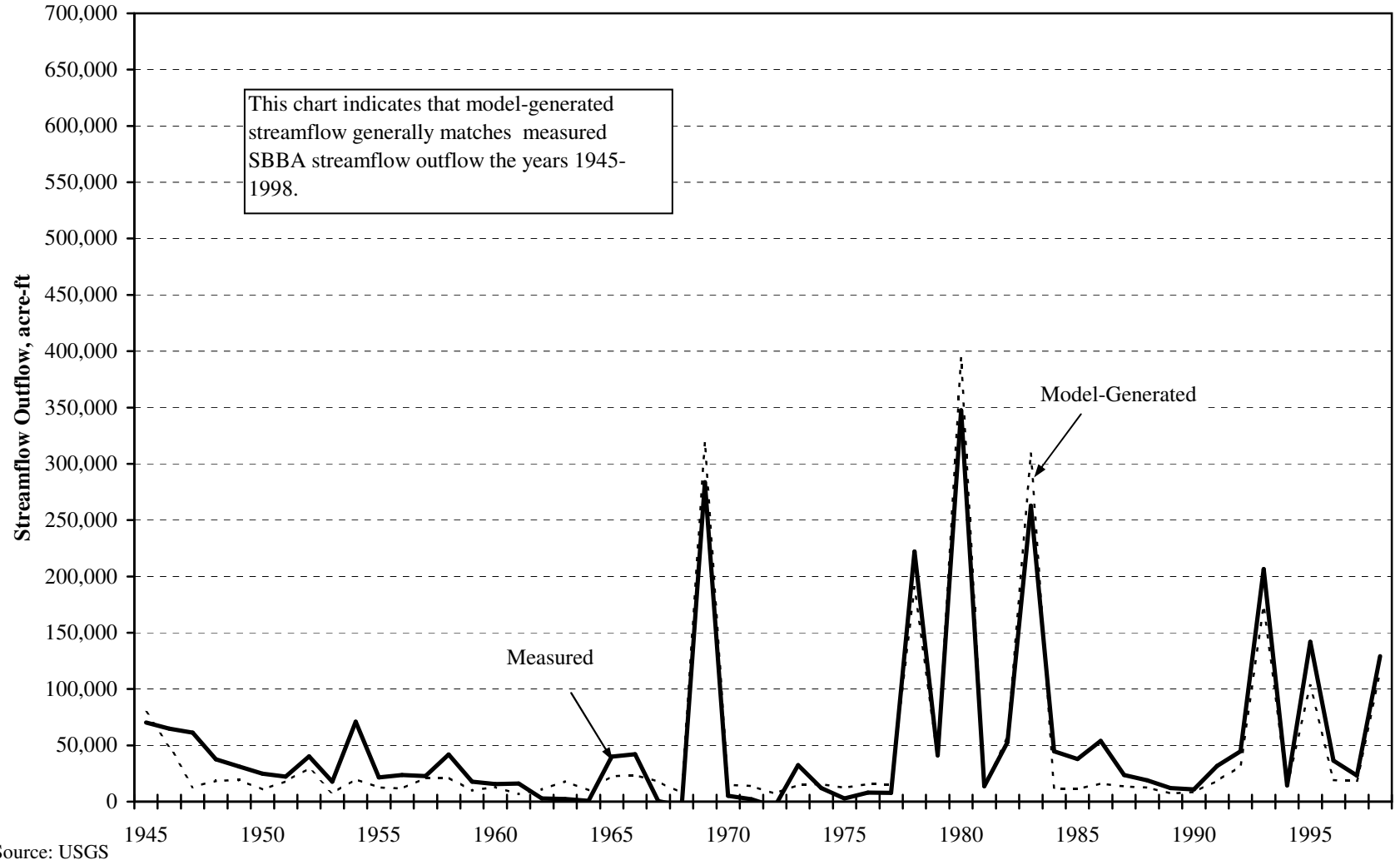
Comparison of Measured and Model-Generated Groundwater Levels
Model Calibration (1945-1998)



Muni/Western Ex. 6-160
Figure 6.2-22

* Residual = Measured Water Level - Model Predicted Water Level

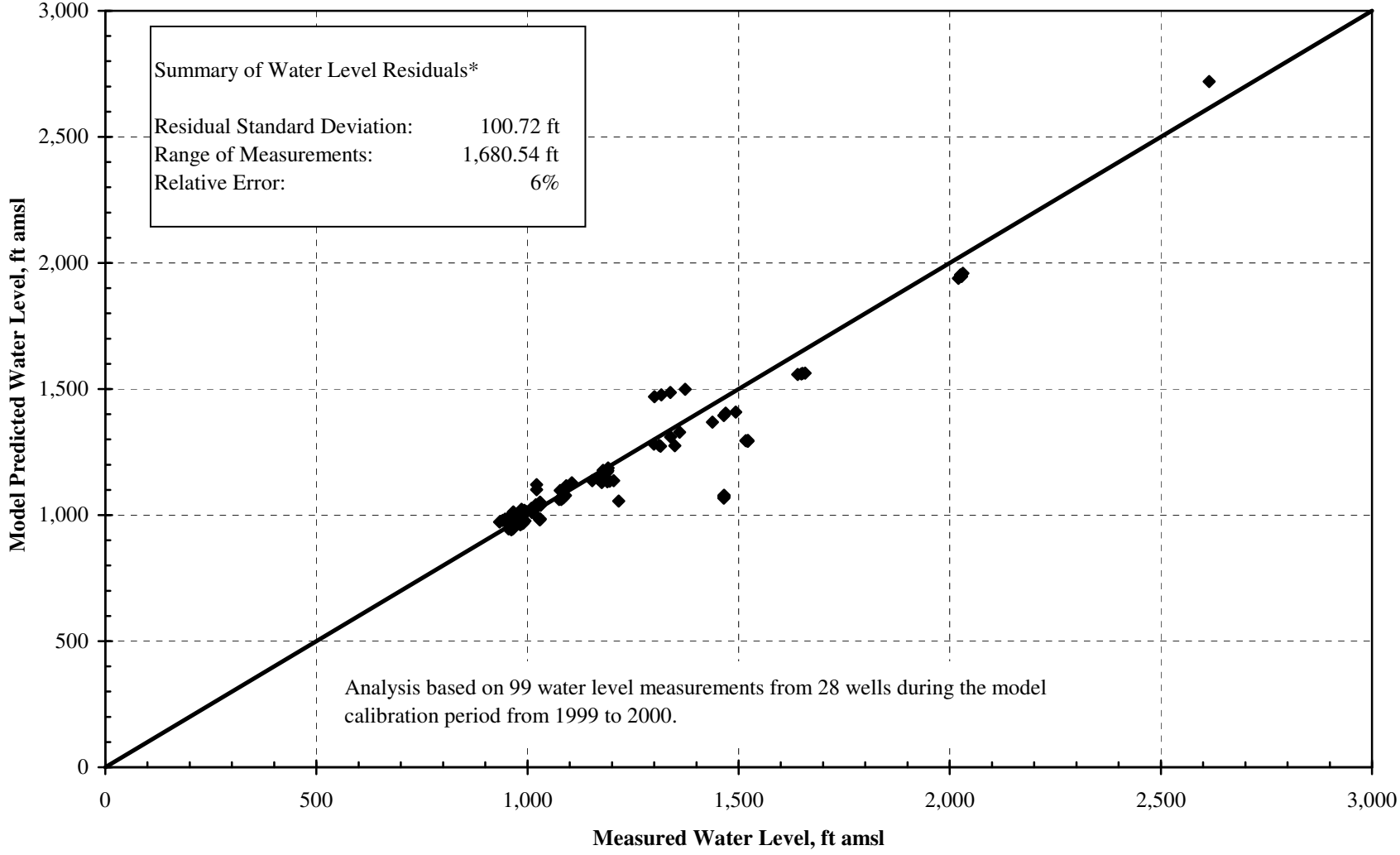
Comparison of Measured and Model-Generated SBBA Streamflow Outflow
Model Calibration 1945-1998



Source: USGS

Muni/Western Ex. 6-161
Figure 6.2-23

Comparison of Measured and Model-Generated Groundwater Levels
Model Verification (1999-2000)



Muni/Western Ex. 6-162
Figure 6.2-24

* Residual = Measured Water Level - Model Predicted Water Level

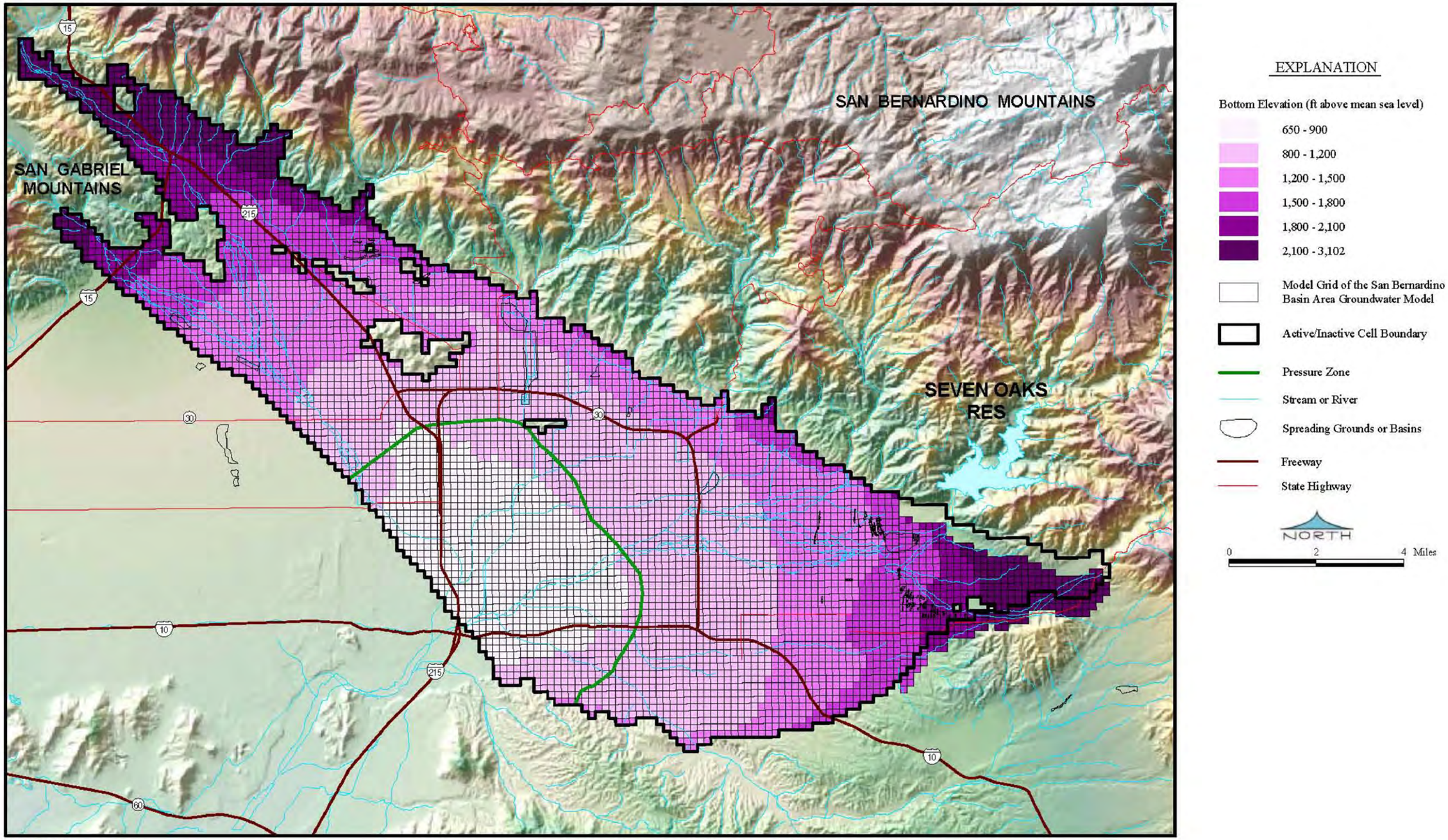
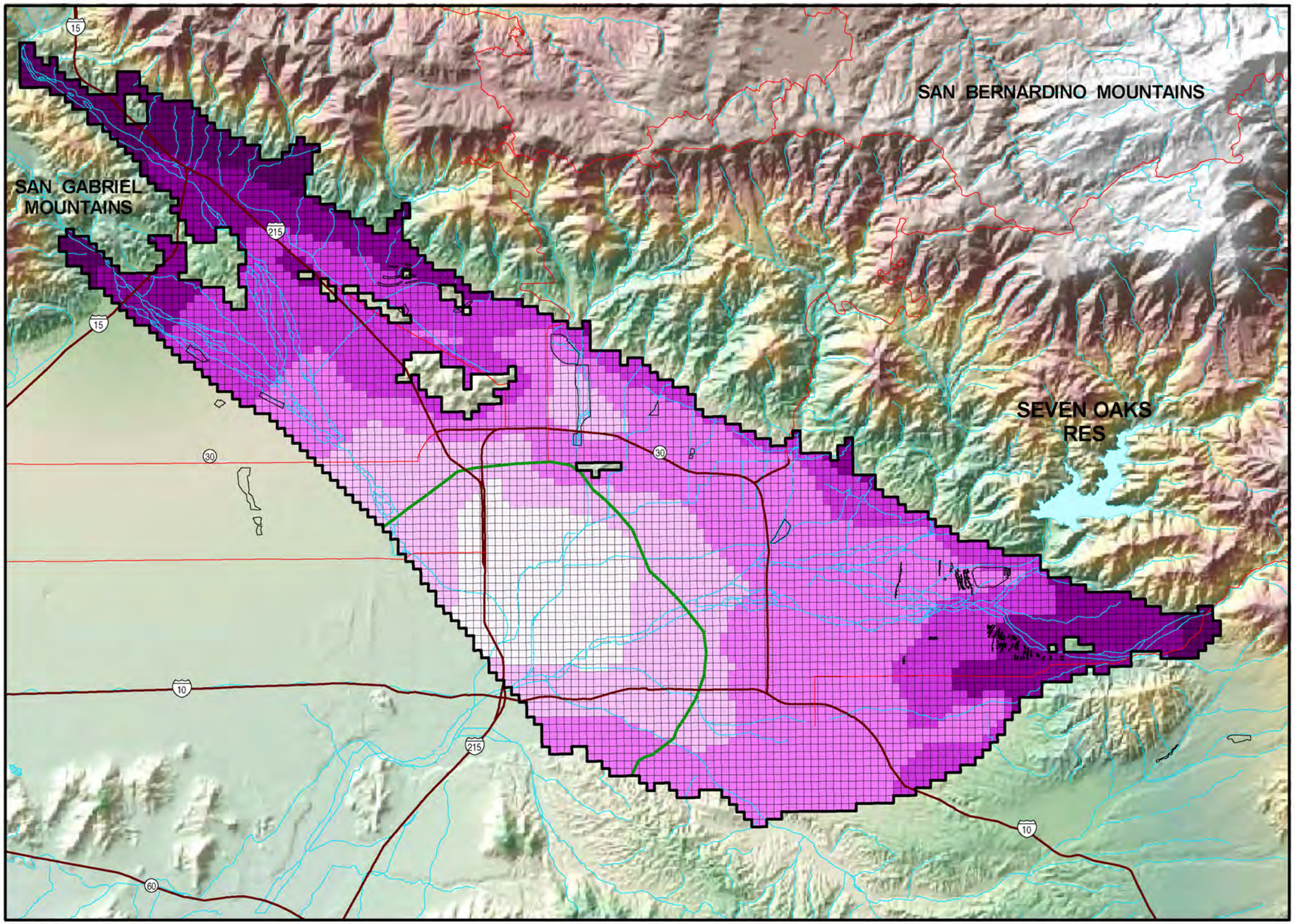
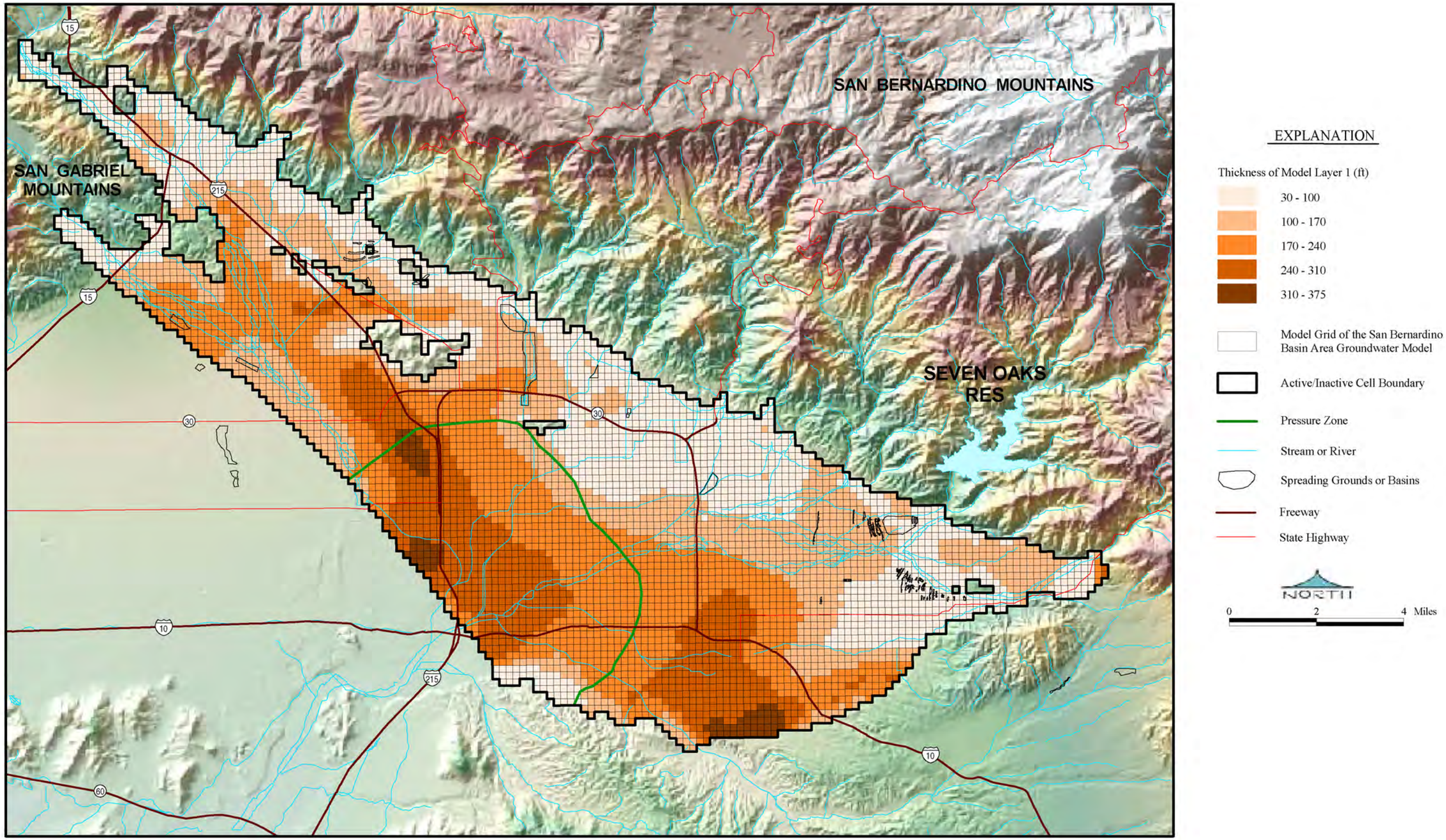


Figure 6.3-1. Bottom Elevation of Model Layer 1



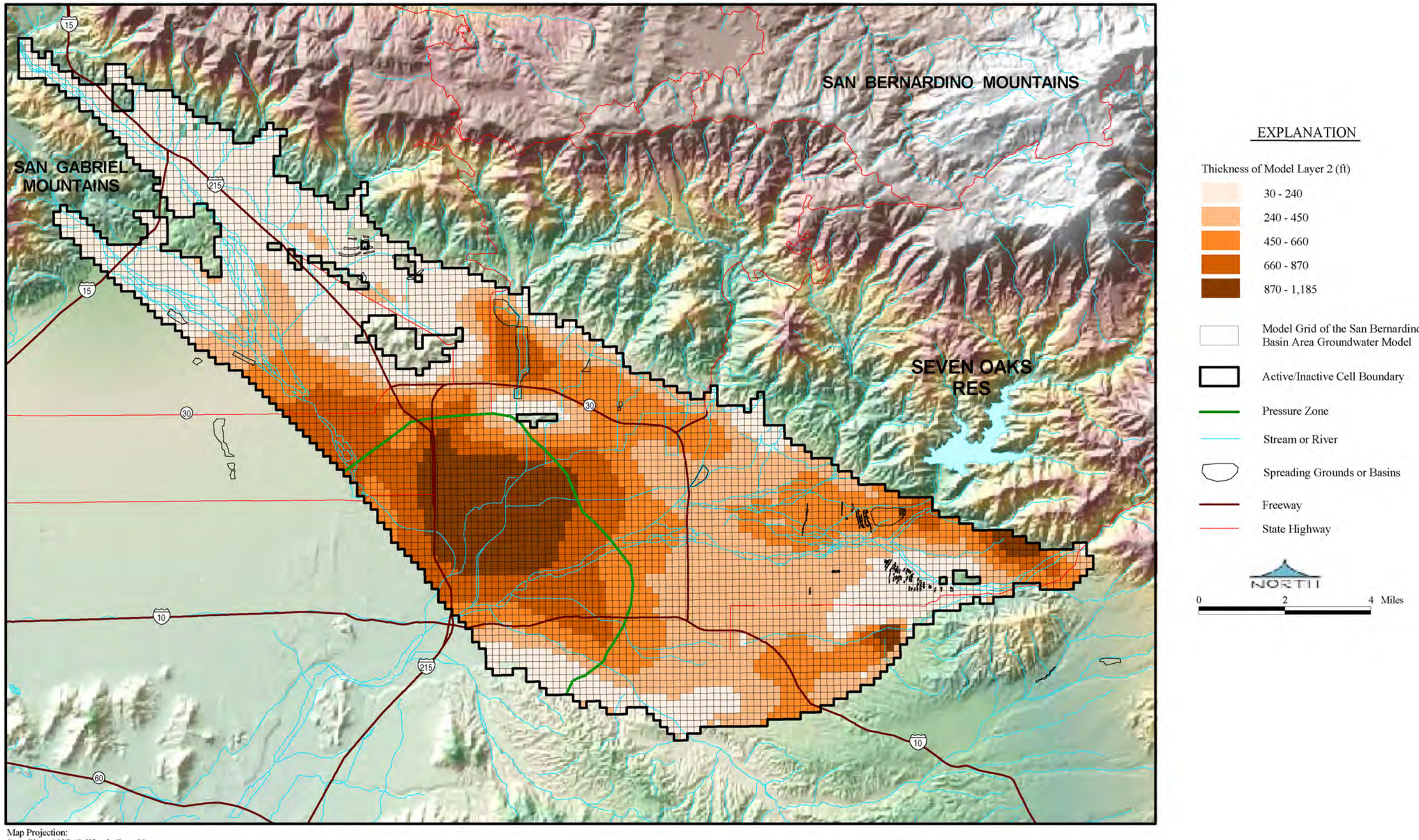
Map Projection:
State Plane 1927 (California Zone V)

Figure 6.3-2. Bottom Elevation of Model Layer 2



Map Projection:
State Plane 1927 (California Zone V)

Figure 6.3-3. Thickness of Model Layer 1



Map Projection:
State Plane 1927 (California Zone V)

Figure 6.3-4. Thickness of Model Layer 2

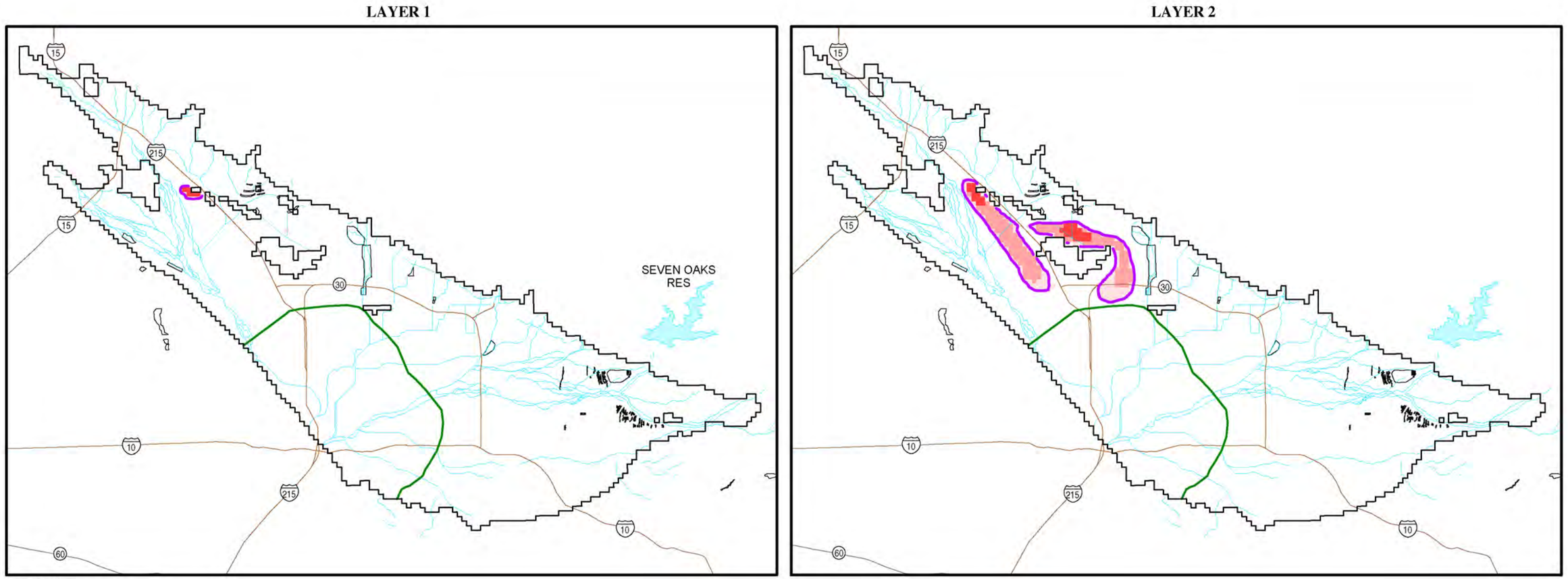


Figure 6.4-1. Initial PCE Concentrations for Model Calibration

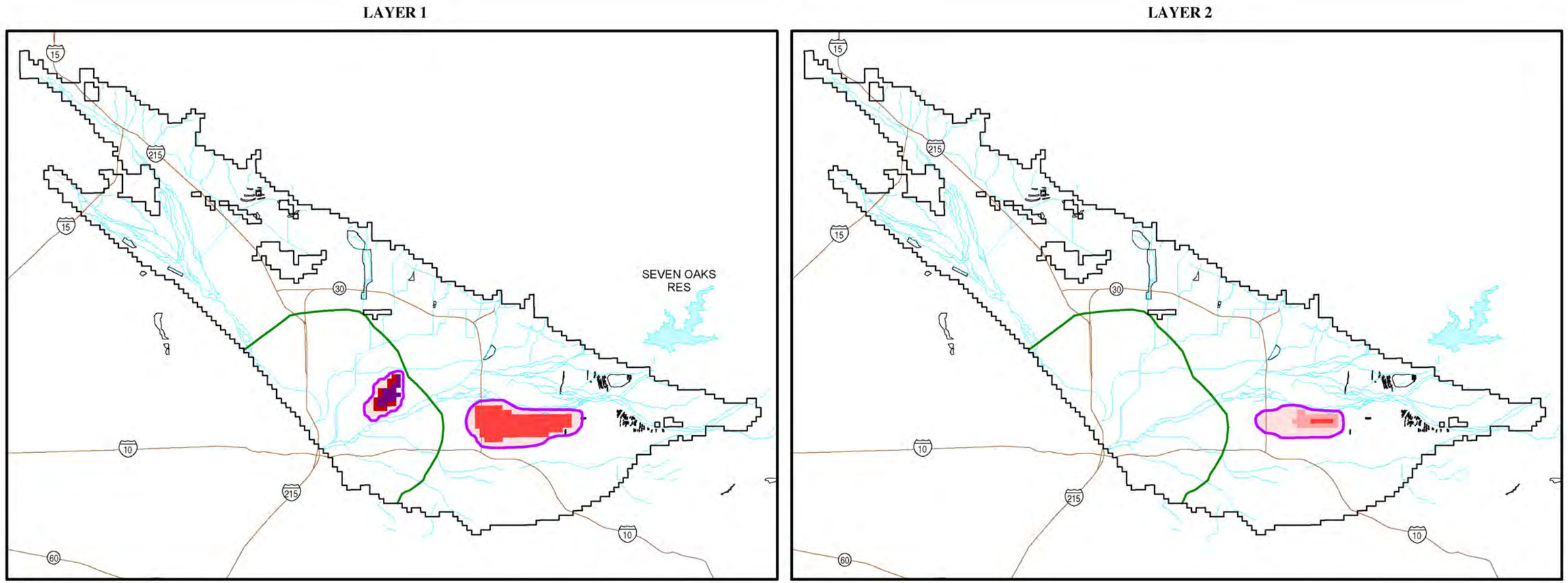
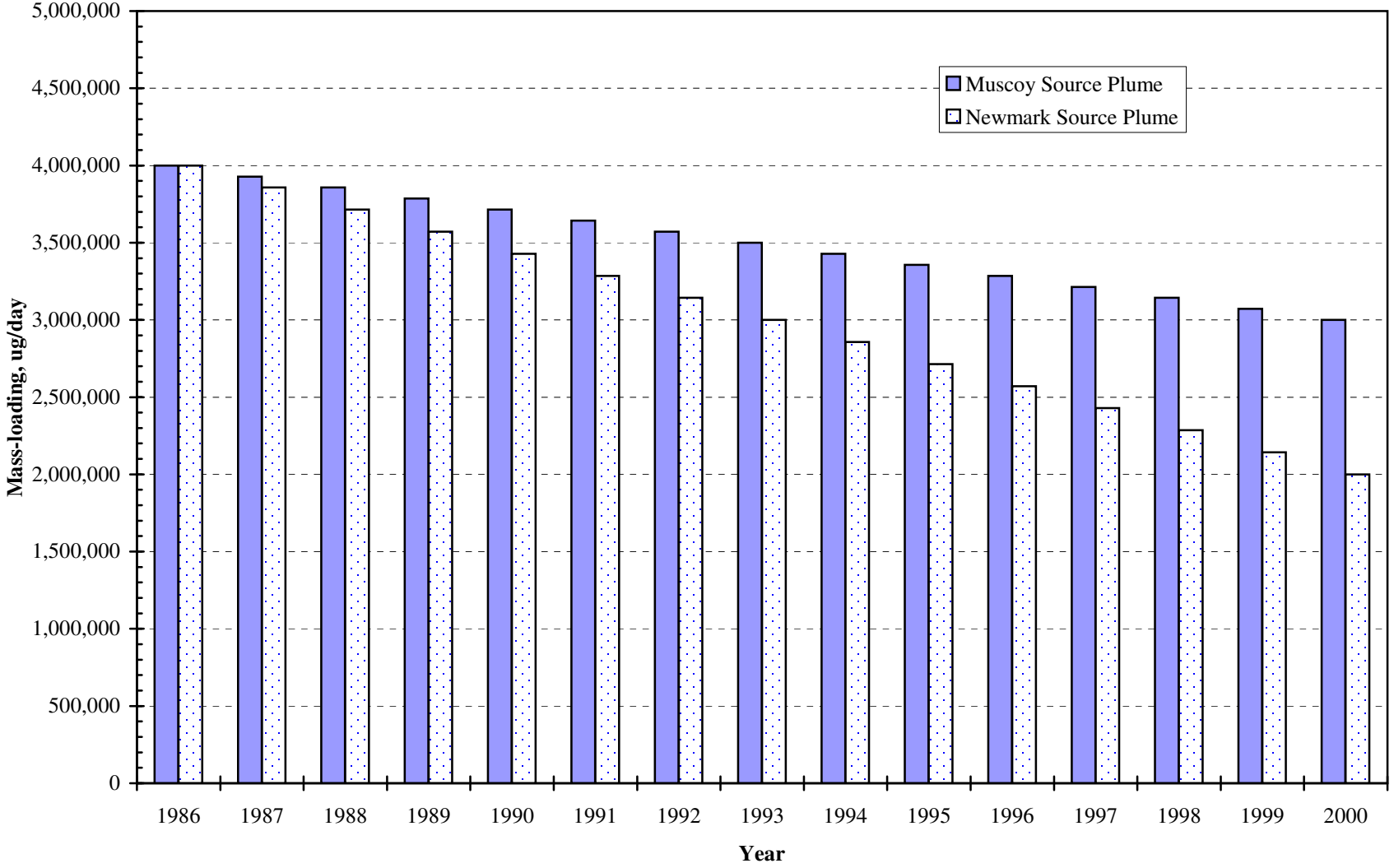


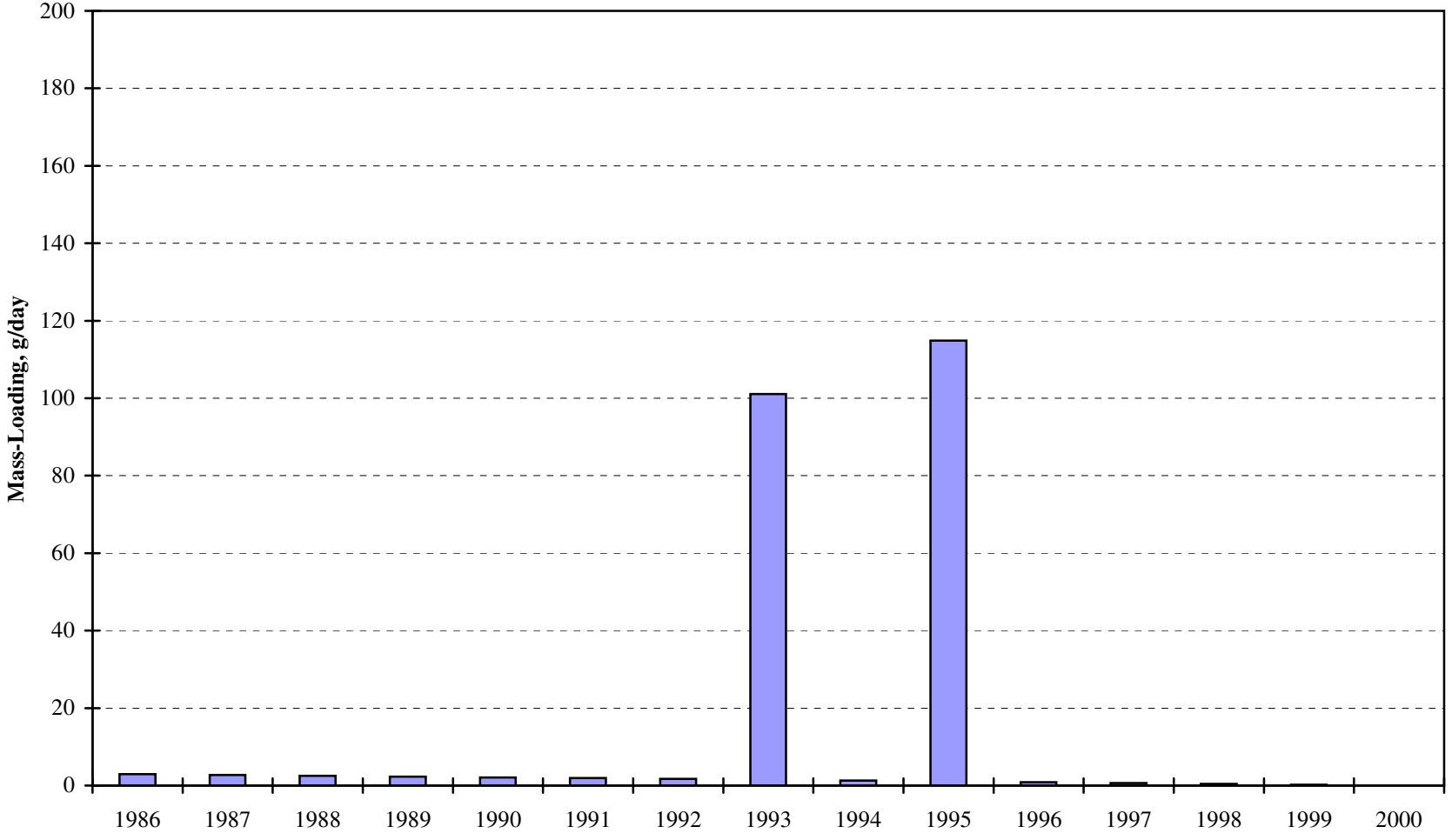
Figure 6.4-2. Initial TCE Concentrations for Model Calibration

Mass-Loading for PCE Calibration Model



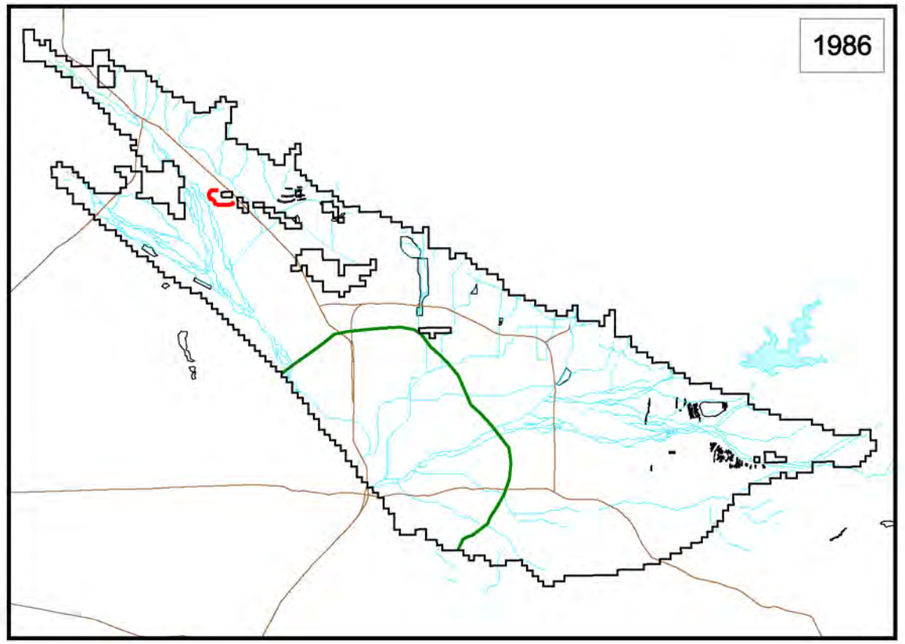
Muni/Western Ex. 6-169
Figure 6.4-3

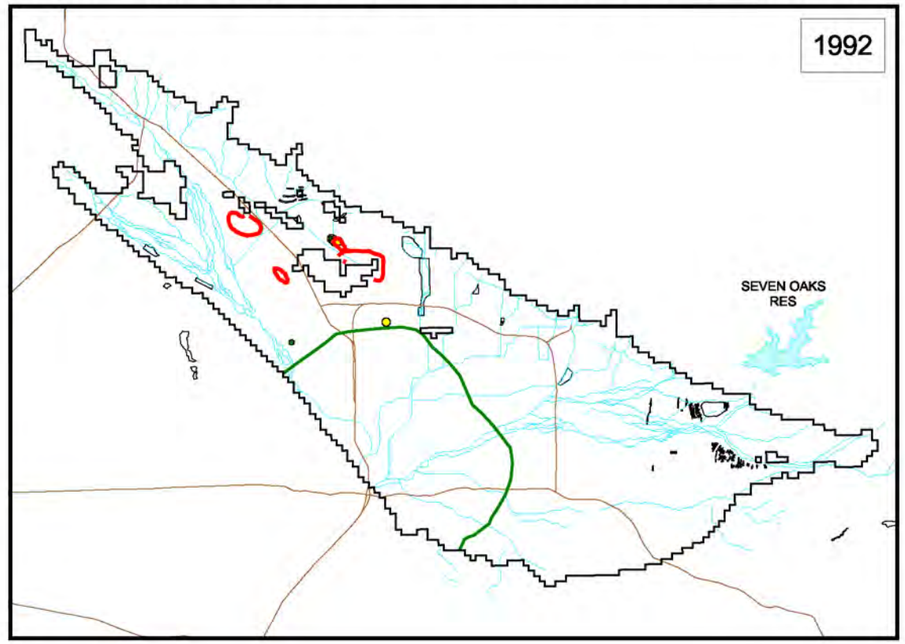
Mass-Loading for TCE Model Calibration
1986-2000

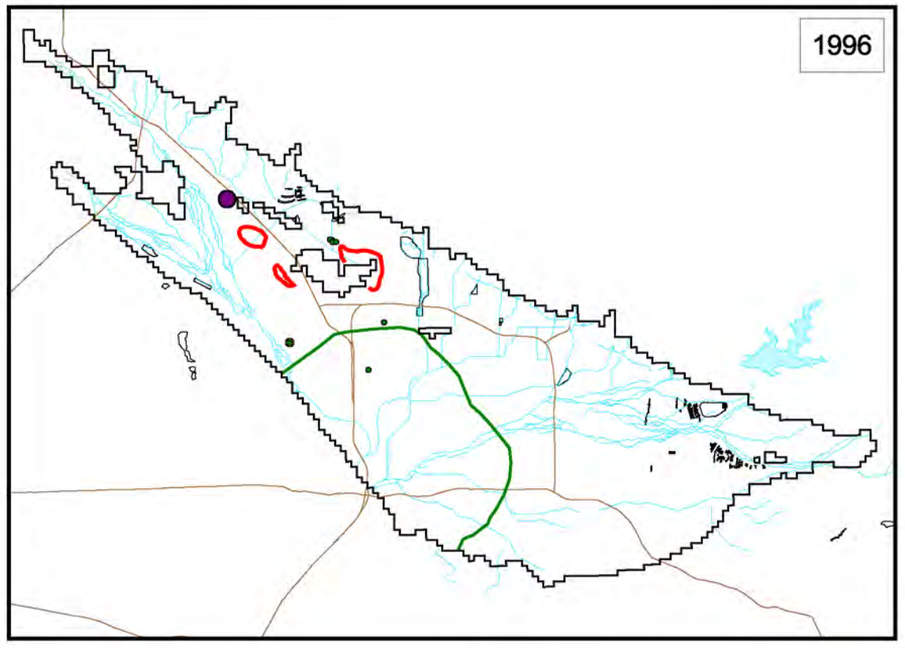


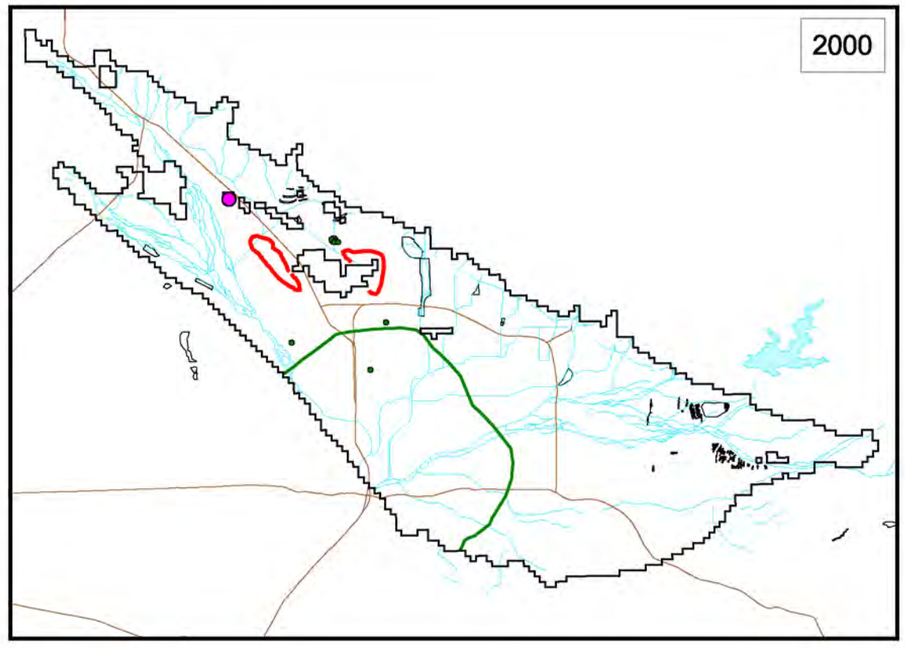
Muni/Western Ex. 6-170
Figure 6.4-4

GROUNDWATER TECHNICAL APPENDIX
SAR WATER RIGHT APPLICATIONS FOR SUPPLEMENTAL WATER SUPPLY EIR









MEASURED AND MODEL-GENERATED PLUME BOUNDARIES FOR PCE MODEL LAYER 1

EXPLANATION

Measured PCE Concentration (ug/L)

- 0
- <5
- 5 - 10
- 10 - 50
- 50 - 500
- >500

Model-Generated PCE Plume (5 ug/L)

2000 Model Year

Pressure Zone

Model Grid of the San Bernardino Basin Area Groundwater Model

Streams or Rivers Within Groundwater Basin Boundary

Spreading Grounds or Basins

Freeway

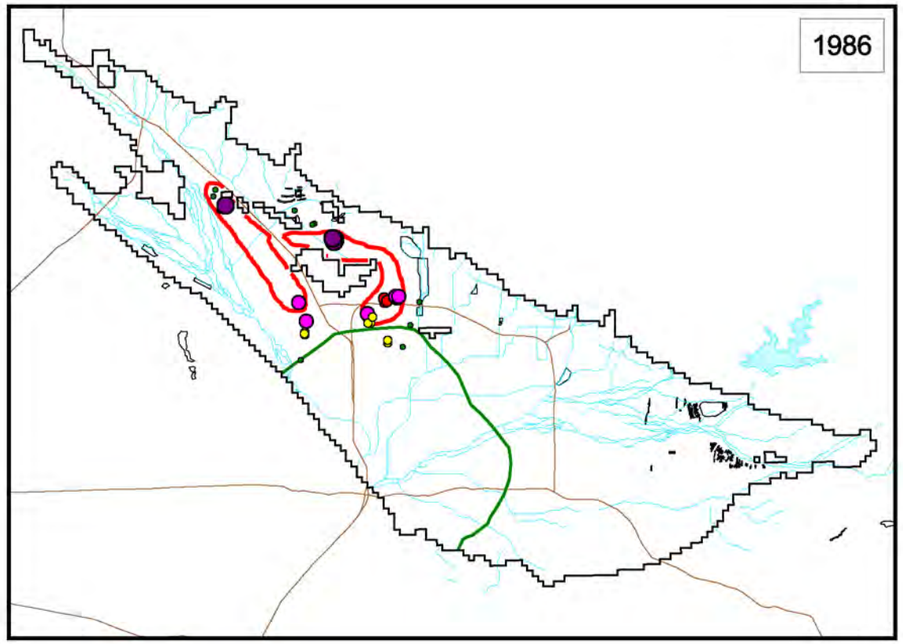
NORTH

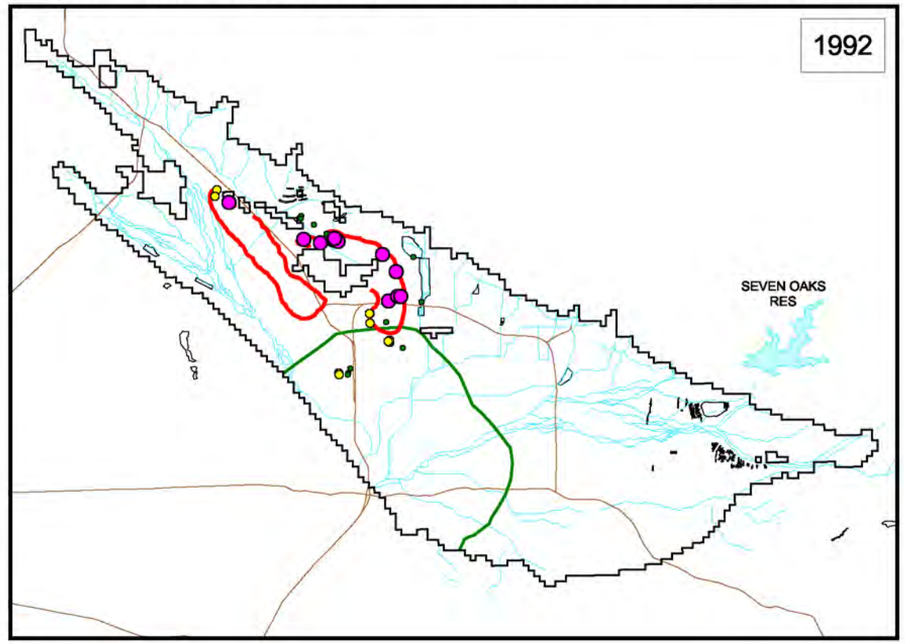
0 3 6 Miles

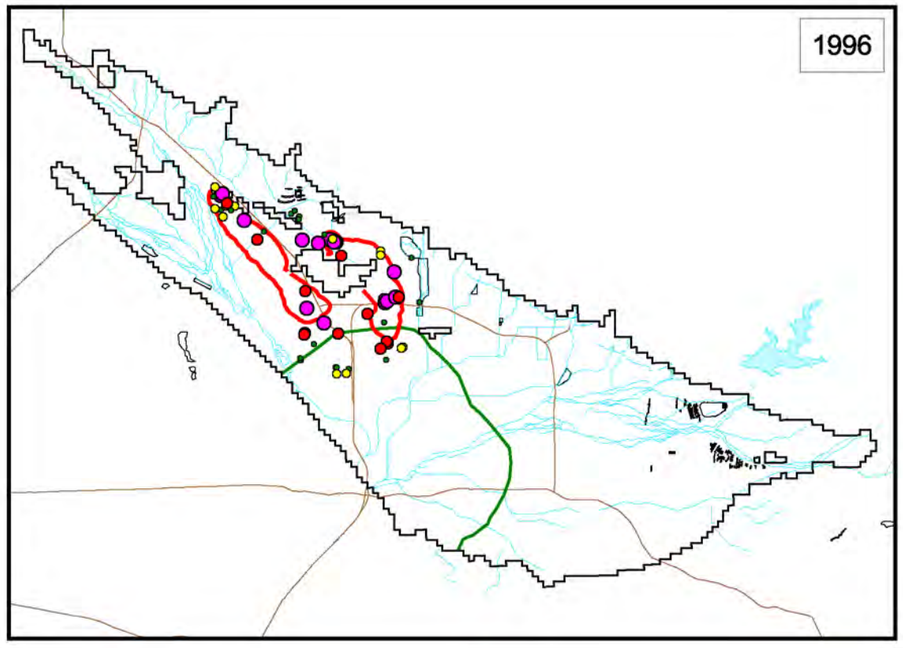
Map Projection:
State Plane 1927 (California Zone V)

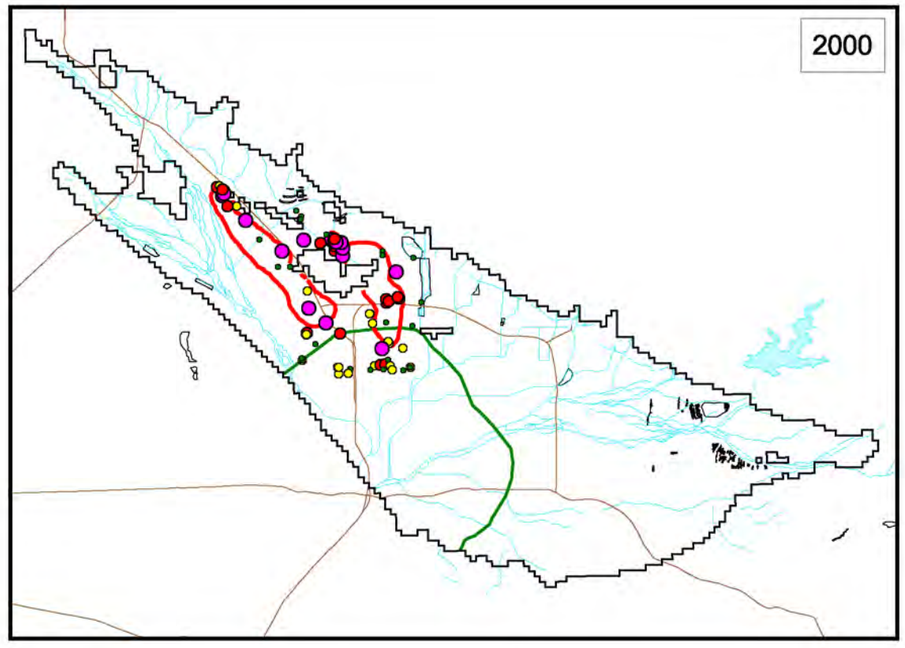
Figure B 50

GROUNDWATER TECHNICAL APPENDIX
SAR WATER RIGHT APPLICATIONS FOR SUPPLEMENTAL WATER SUPPLY EIR









MEASURED AND MODEL-GENERATED PLUME BOUNDARIES FOR PCE MODEL LAYER 2

EXPLANATION

Measured PCE Concentration (ug/L)

- 0
- <5
- 5 - 10
- 10 - 50
- 50 - 500
- >500

Model-Generated PCE Plume (5 ug/L)

2000 Model Year

Pressure Zone

Model Grid of the San Bernardino Basin Area Groundwater Model

Streams or Rivers Within Groundwater Basin Boundary

Spreading Grounds or Basins

Freeway

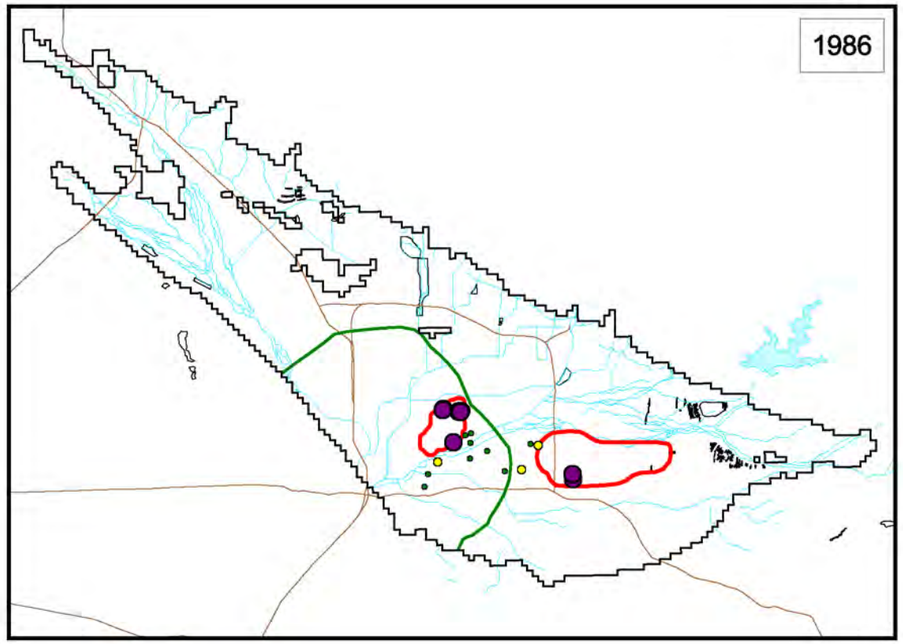
NORTH

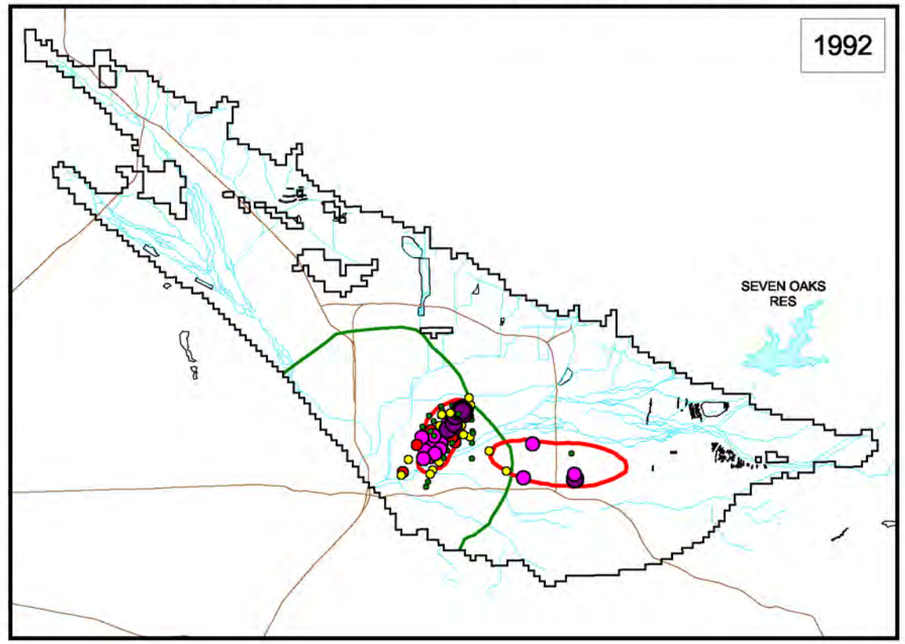
0 3 6 Miles

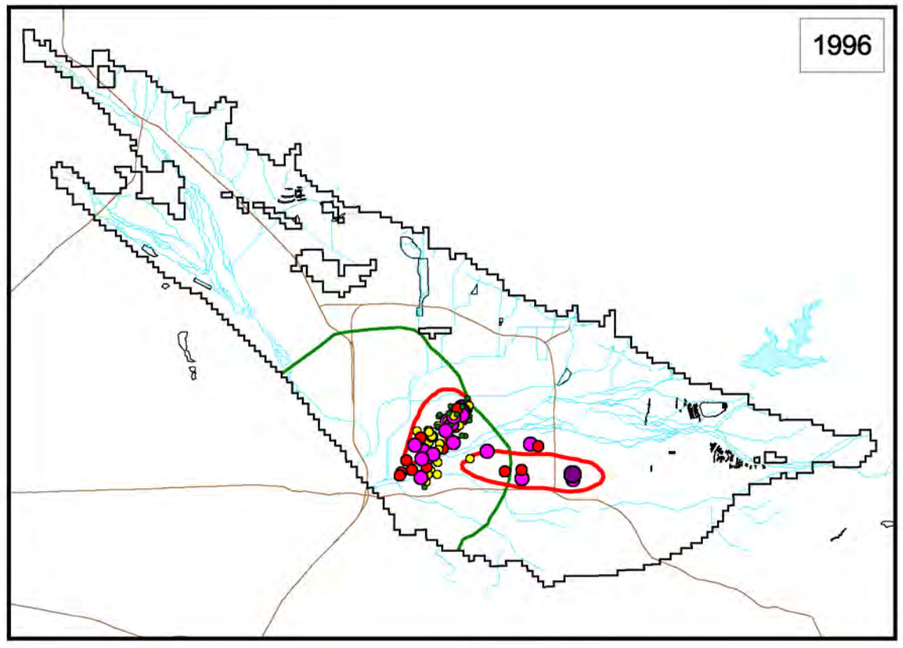
Map Projection:
State Plane 1927 (California Zone V)

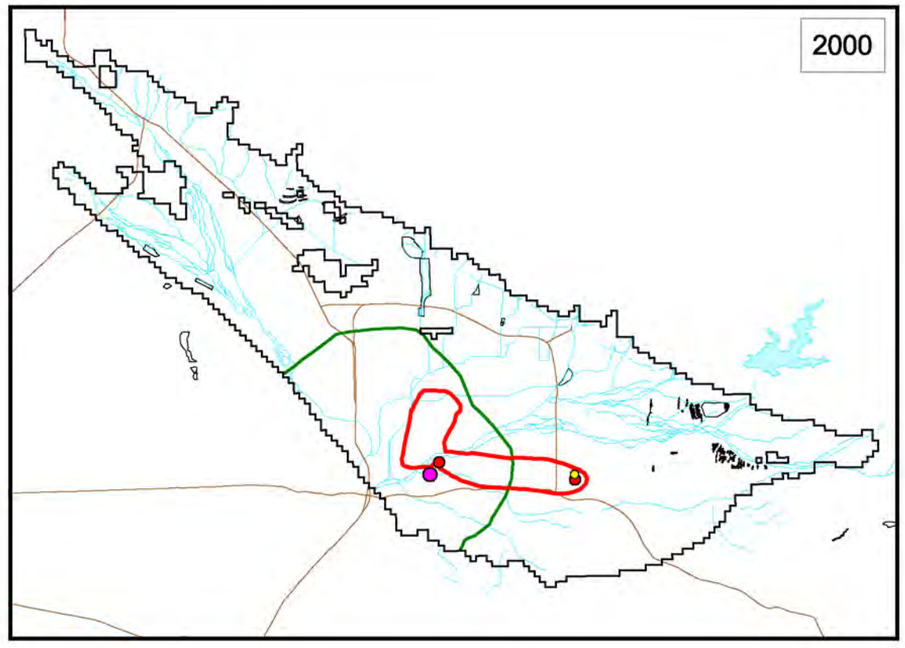
Figure B 51

GROUNDWATER TECHNICAL APPENDIX
SAR WATER RIGHT APPLICATIONS FOR SUPPLEMENTAL WATER SUPPLY EIR









MEASURED AND MODEL-GENERATED PLUME BOUNDARIES FOR TCE MODEL LAYER 1

EXPLANATION

Measured TCE Concentration (ug/L)

- 0
- <5
- 5 - 10
- 10 - 50
- 50 - 500
- >500

Model-Generated TCE Plume (5 ug/L)

2000 Model Year

Pressure Zone

Model Grid of the San Bernardino Basin Area Groundwater Model

Streams or Rivers Within Groundwater Basin Boundary

Spreading Grounds or Basins

Freeway

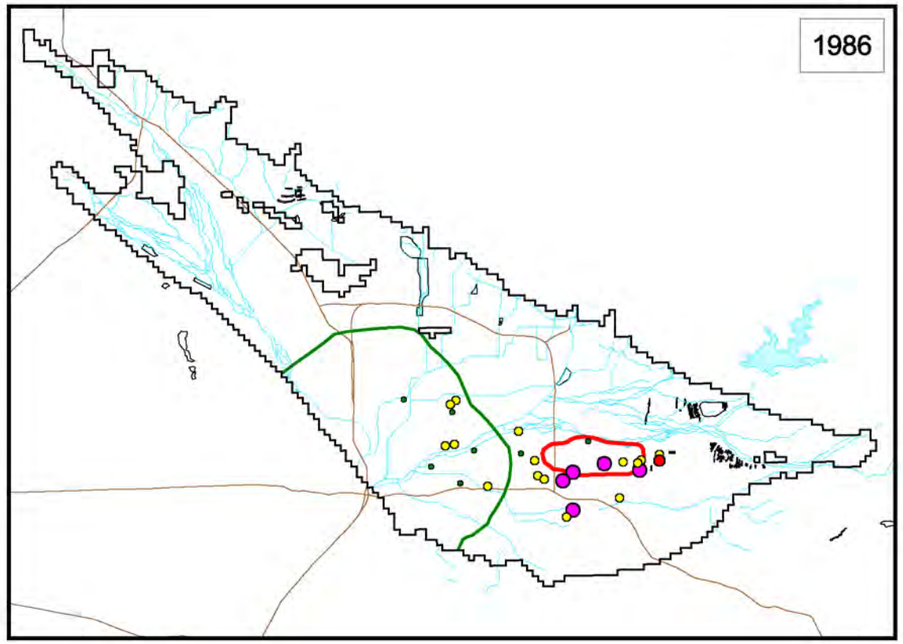
NORTH

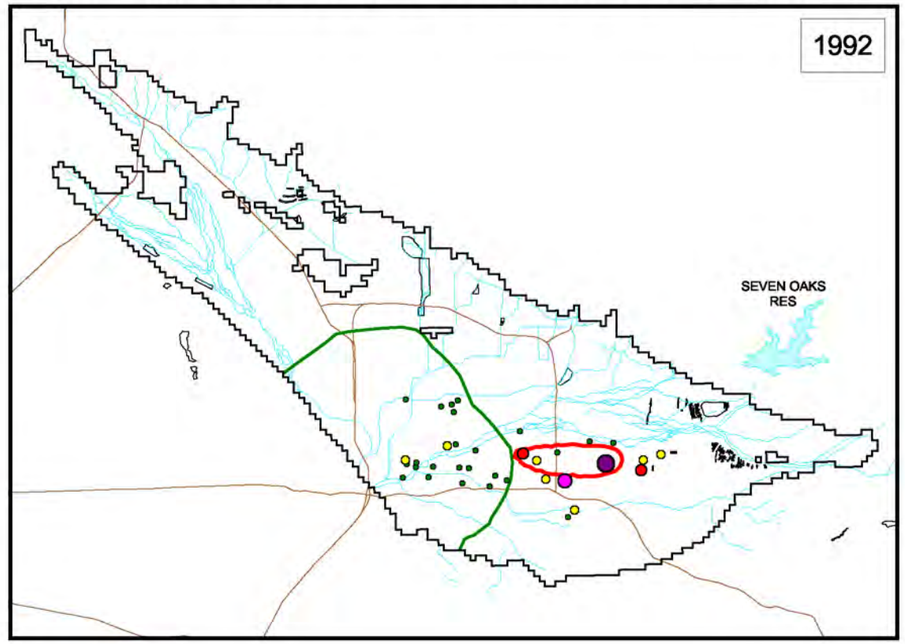
0 3 6 Miles

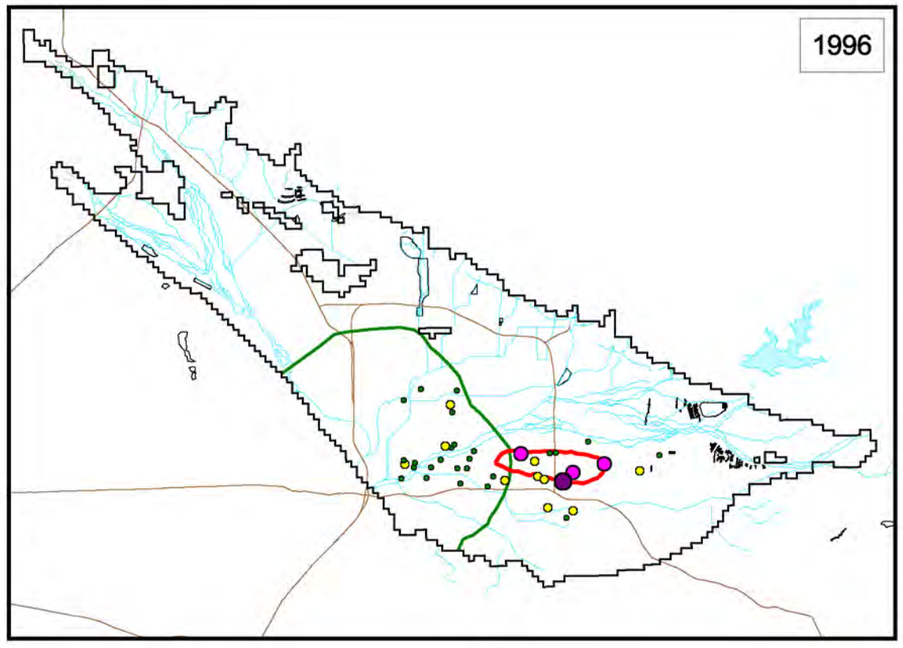
Map Projection:
State Plane 1927 (California Zone V)

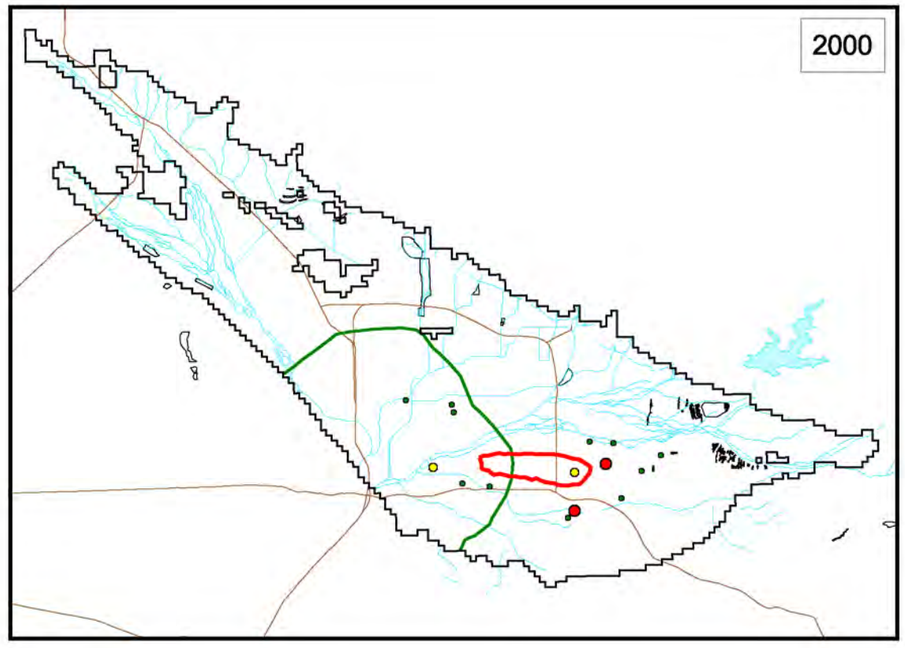
Figure B 52

GROUNDWATER TECHNICAL APPENDIX
SAR WATER RIGHT APPLICATIONS FOR SUPPLEMENTAL WATER SUPPLY EIR









NORTH

0 3 6 Miles

Map Projection:
State Plane 1927 (California Zone V)

MEASURED AND MODEL-GENERATED PLUME BOUNDARIES FOR TCE MODEL LAYER 2

EXPLANATION

Measured TCE Concentration (ug/L)

- 0
- <5
- 5 - 10
- 10 - 50
- 50 - 500
- >500

Model-Generated TCE Plume (5 ug/L)

2000 Model Year

Pressure Zone

Model Grid of the San Bernardino Basin Area Groundwater Model

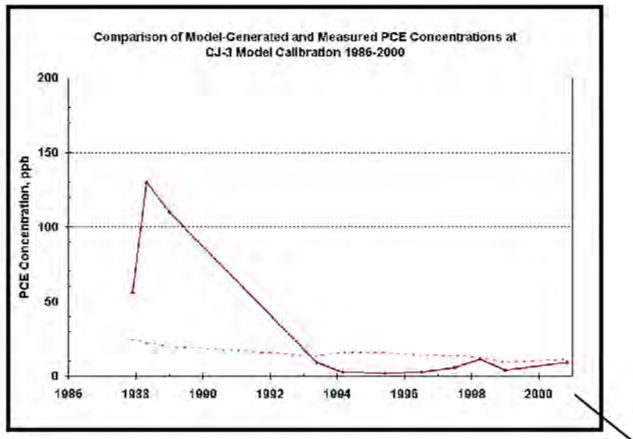
Streams or Rivers Within Groundwater Basin Boundary

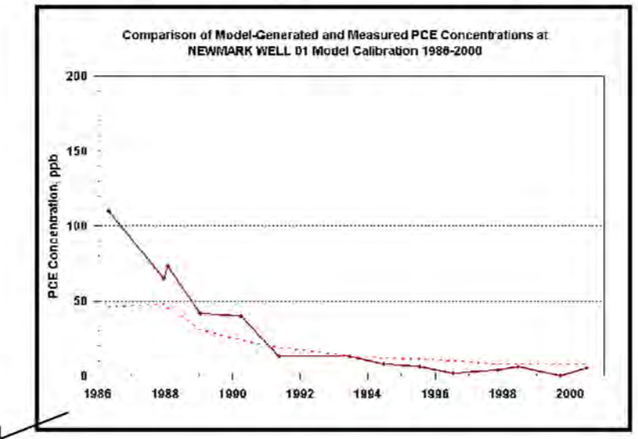
Spreading Grounds or Basins

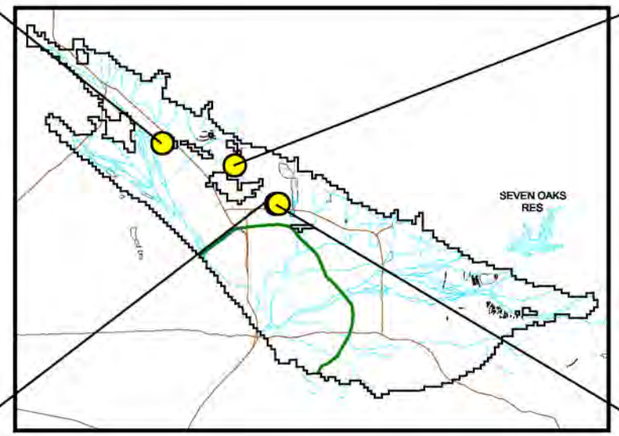
Freeway

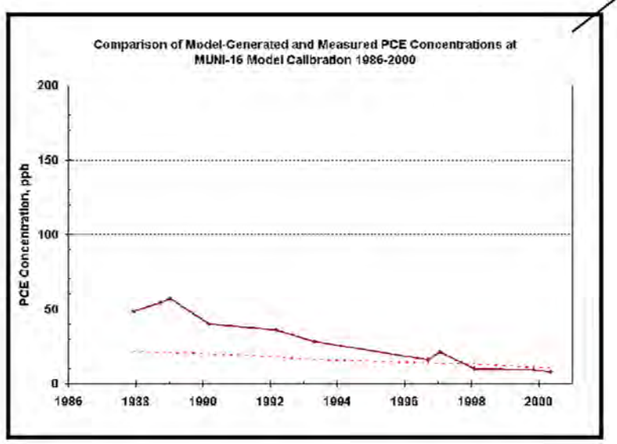
Figure B 53

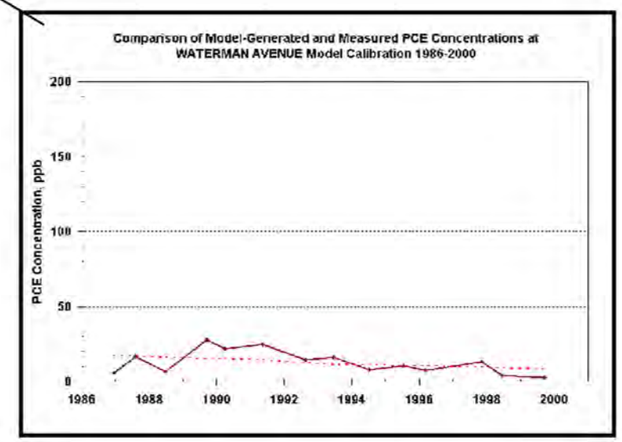
GROUNDWATER TECHNICAL APPENDIX
SAR WATER RIGHT APPLICATIONS FOR SUPPLEMENTAL WATER SUPPLY EIR











MEASURED VERSUS MODEL-GENERATED PCE CONCENTRATIONS AT SELECTED LOCATIONS

EXPLANATION

- Selected Well
- Measured PCE Concentration (ug/L)
- Model-Generated PCE Concentration (ug/L)
- Pressure Zone
- Model Grid of the San Bernardino Basin Area Groundwater Model
- Streams or Rivers Within Groundwater Basin Boundary
- Spreading Grounds or Basins
- Freeway

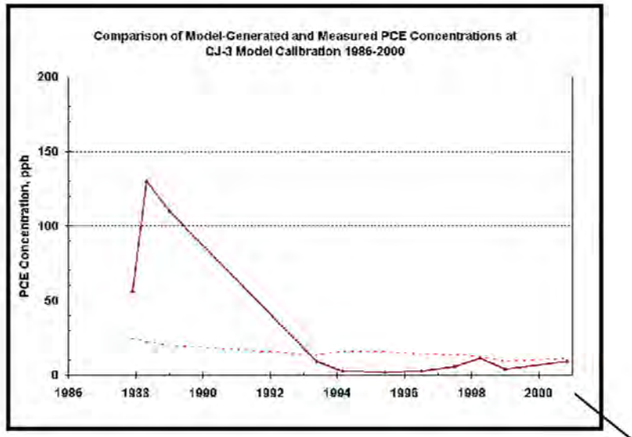
NORTH

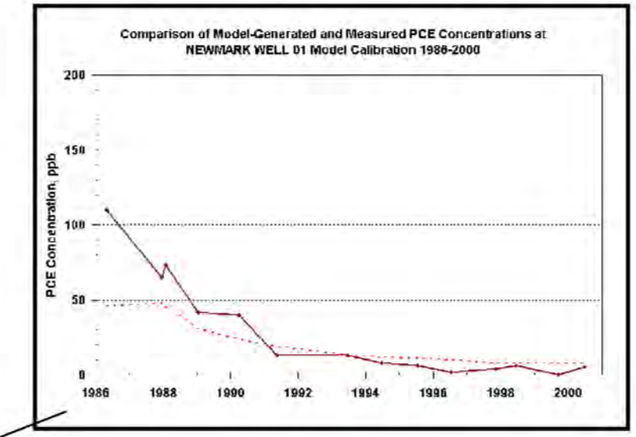
0 5 10 Miles

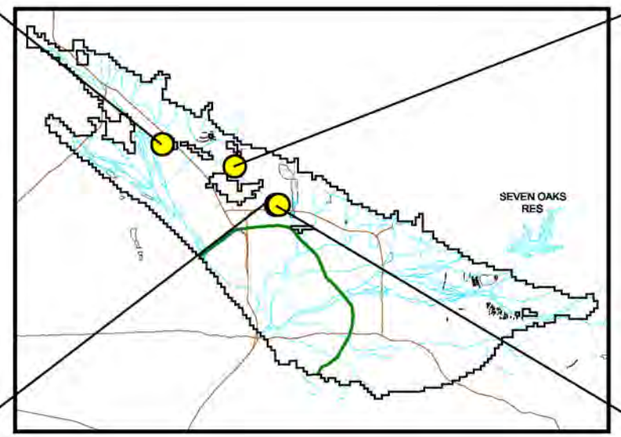
Map Projection:
State Plane 1927 (California Zone V)

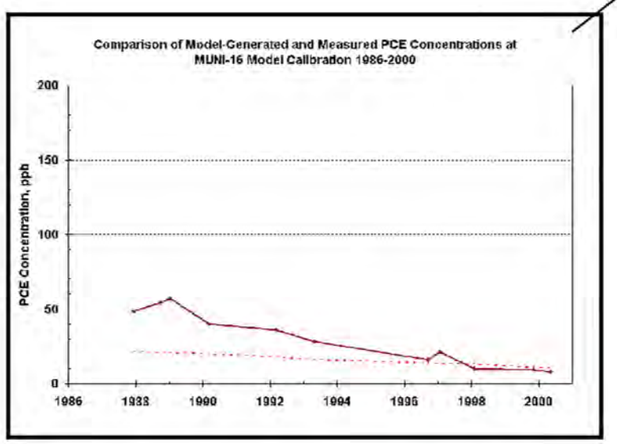
Figure B 54

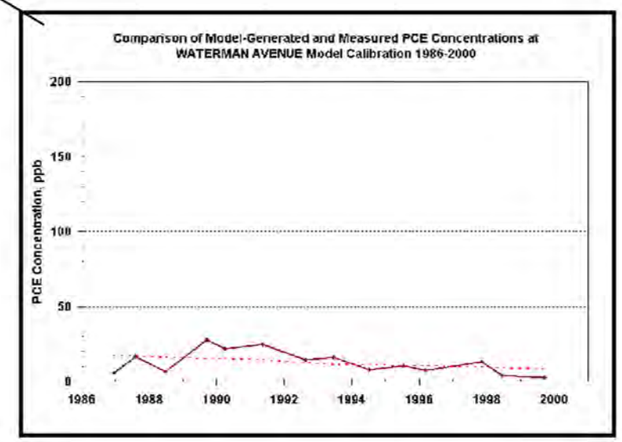
GROUNDWATER TECHNICAL APPENDIX
SAR WATER RIGHT APPLICATIONS FOR SUPPLEMENTAL WATER SUPPLY EIR











MEASURED VERSUS MODEL-GENERATED PCE CONCENTRATIONS AT SELECTED LOCATIONS

EXPLANATION

- Selected Well
- Measured PCE Concentration (ug/L)
- Model-Generated PCE Concentration (ug/L)
- Pressure Zone
- Model Grid of the San Bernardino Basin Area Groundwater Model
- Streams or Rivers Within Groundwater Basin Boundary
- Spreading Grounds or Basins
- Freeway

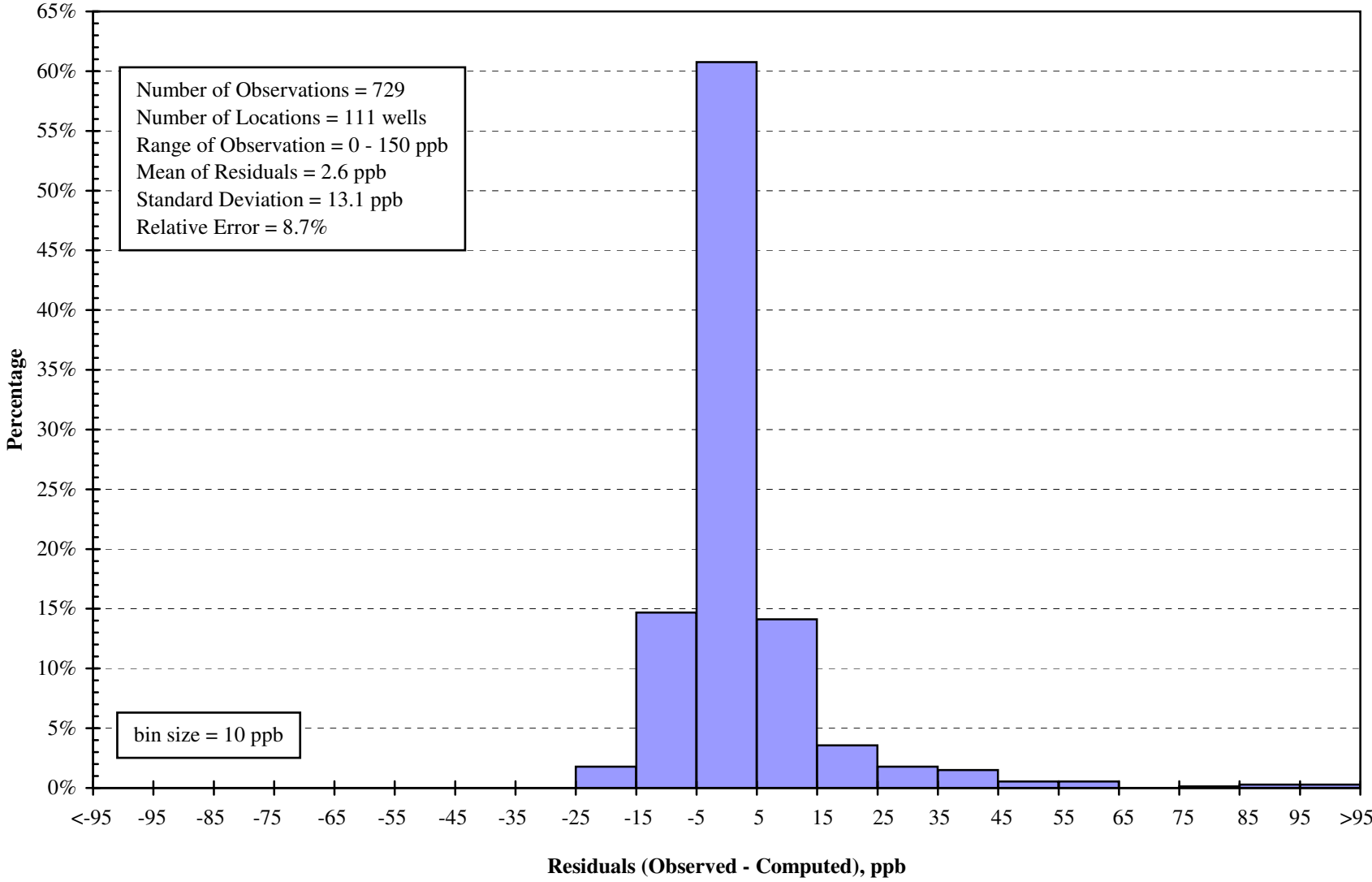
NORTH

0 5 10 Miles

Map Projection:
State Plane 1927 (California Zone V)

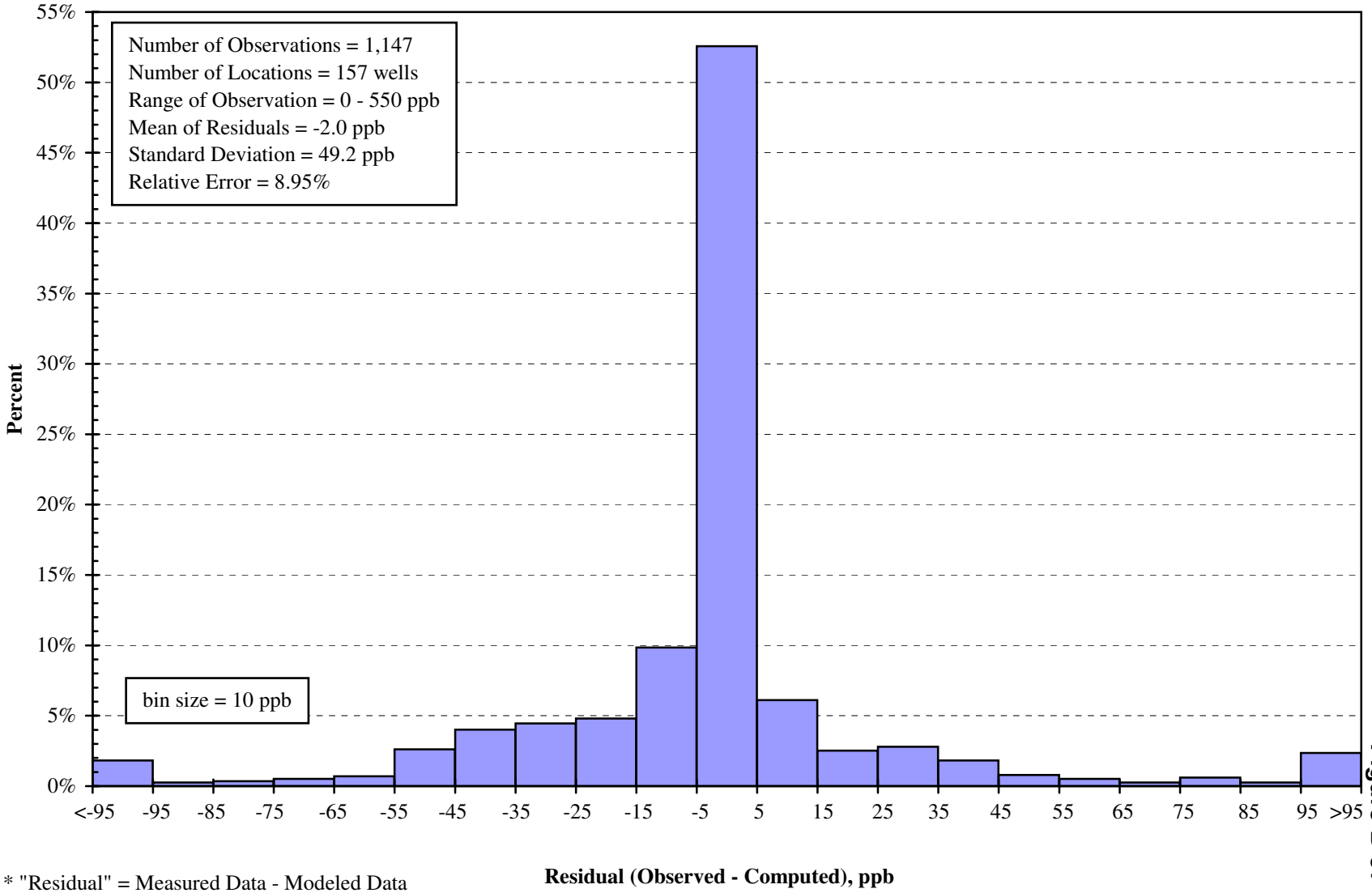
Figure B 54

Histogram of PCE Calibration Residuals



Muni/Western Ex. 6-177
Figure B 56

Histogram of TCE Residuals* for Model Calibration - 1986 to 2000

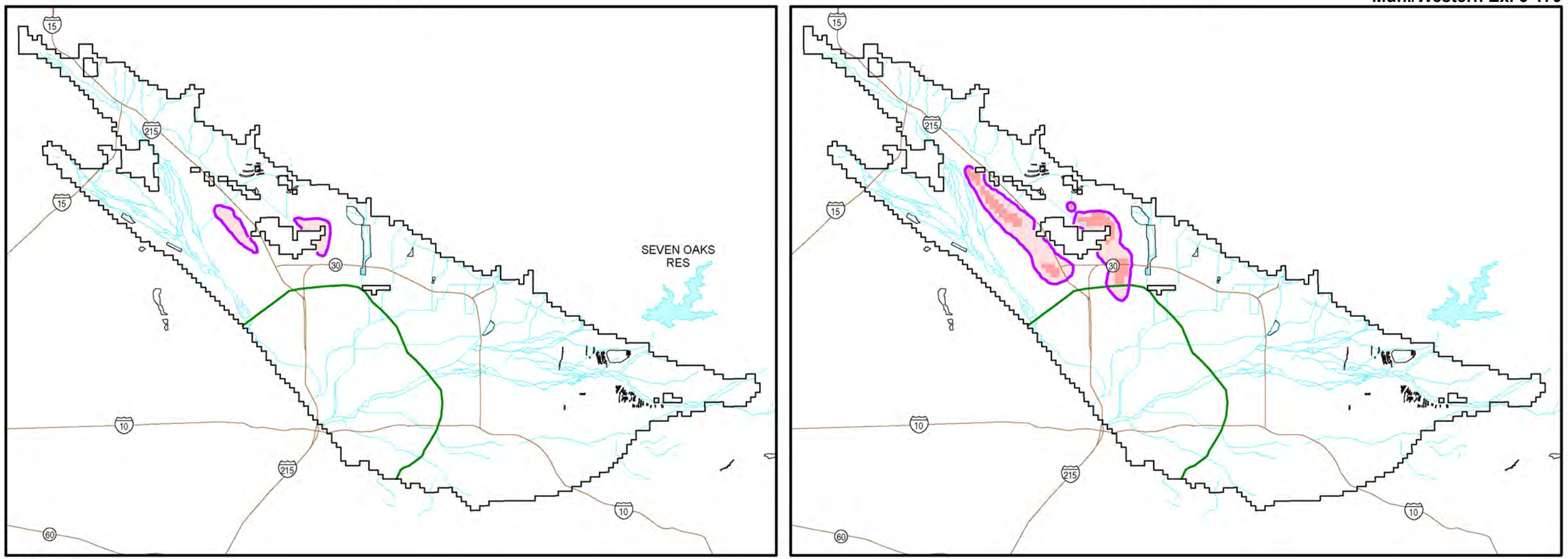


* "Residual" = Measured Data - Modeled Data

Muni/Western Ex. 6-178
Figure B 57

LAYER 1

LAYER 2



Map Projection:
State Plane 1927 (California Zone V)

EXPLANATION

2001 PCE Plume Boundary (5 µg/L)

Note: PCE MCL = 5 µg/L

Initial Model PCE Concentration (µg/L)

- 0-5
- 5 - 10
- 10 - 25
- >25

Pressure Zone

Model Grid of the San Bernardino Basin Area Groundwater Model

Streams or Rivers Within Groundwater Basin Boundary

Spreading Grounds or Basins

Freeway

NORTH

0 3 6 Miles

Figure 6.4-5. Initial PCE Concentrations for Model Scenarios - Layers 1 and 2

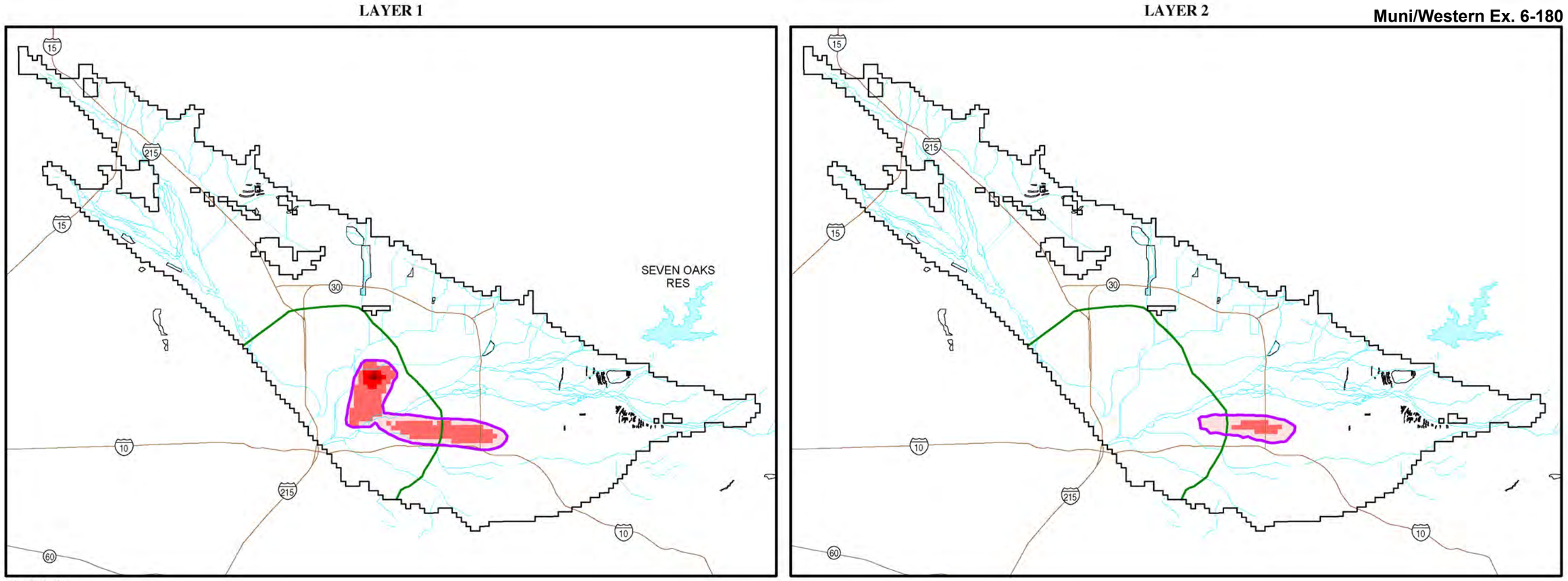


Figure 6.4-6. Initial TCE Concentrations for Model Scenarios - Layers 1 and 2

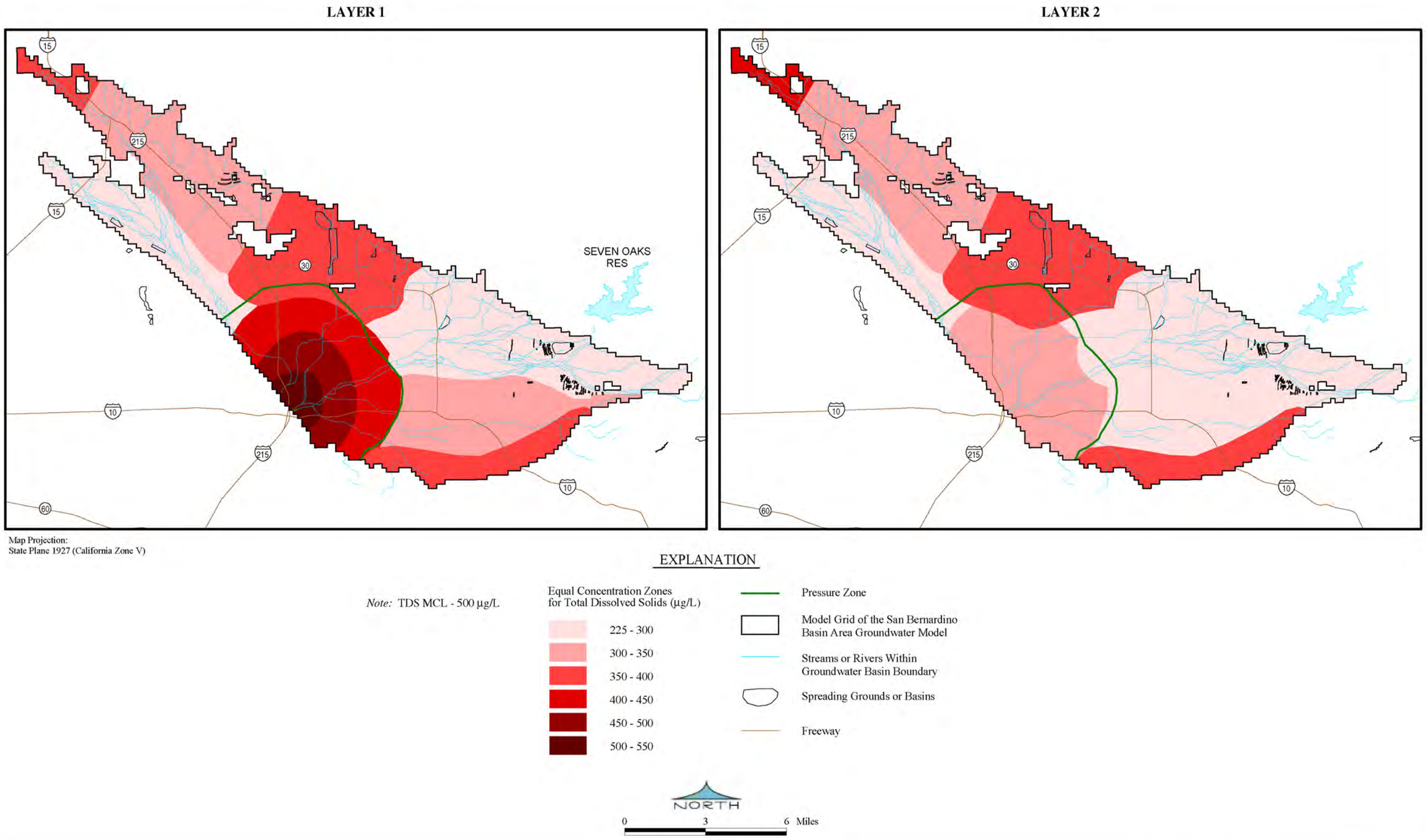


Figure 6.4-7. Equal Concentration Zones for TDS Layers 1 and 2

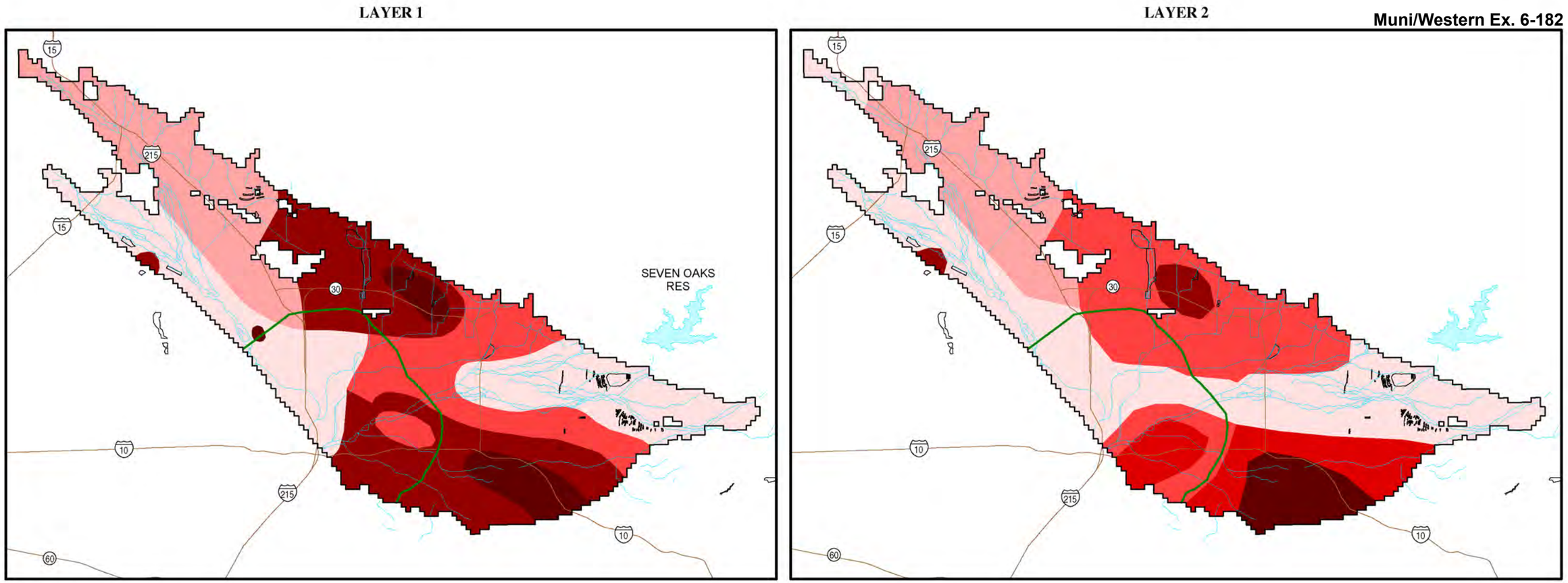


Figure 6.4-8. Equal Concentration Zones for Nitrate (as NO3) - Layers 1 and 2

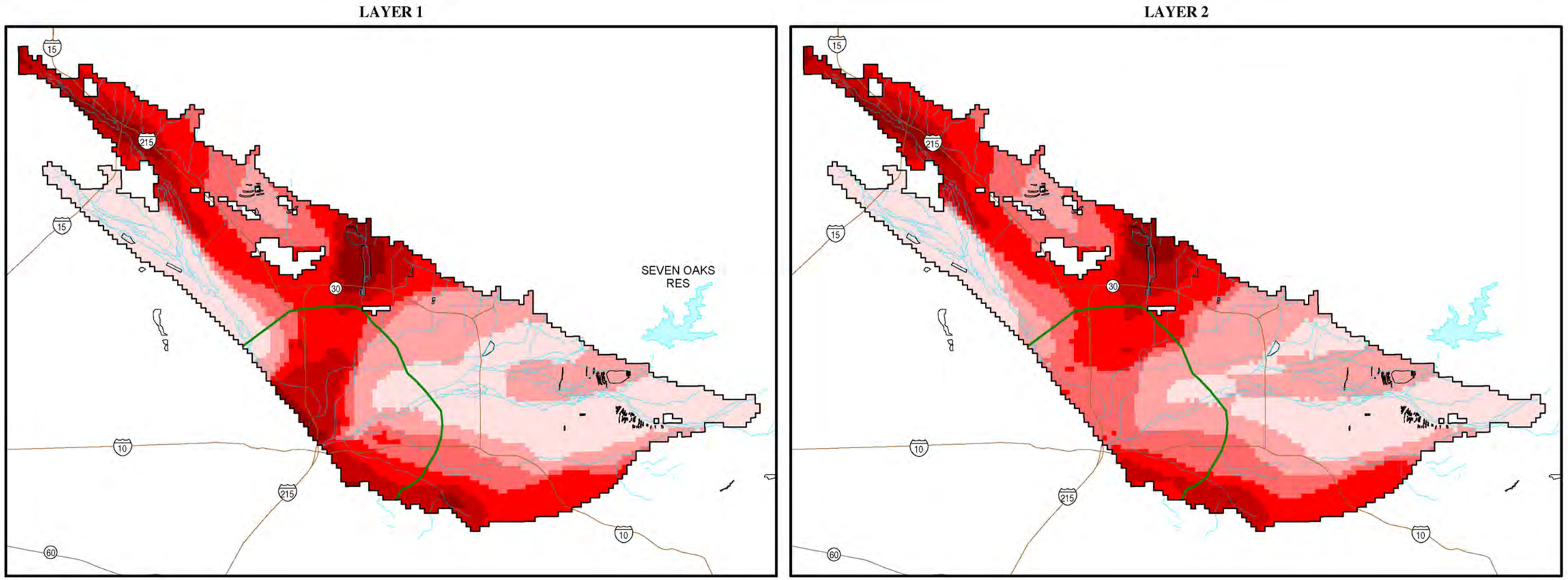


Figure 6.4-9. Initial TDS Concentrations for Model Scenarios - Layers 1 and 2

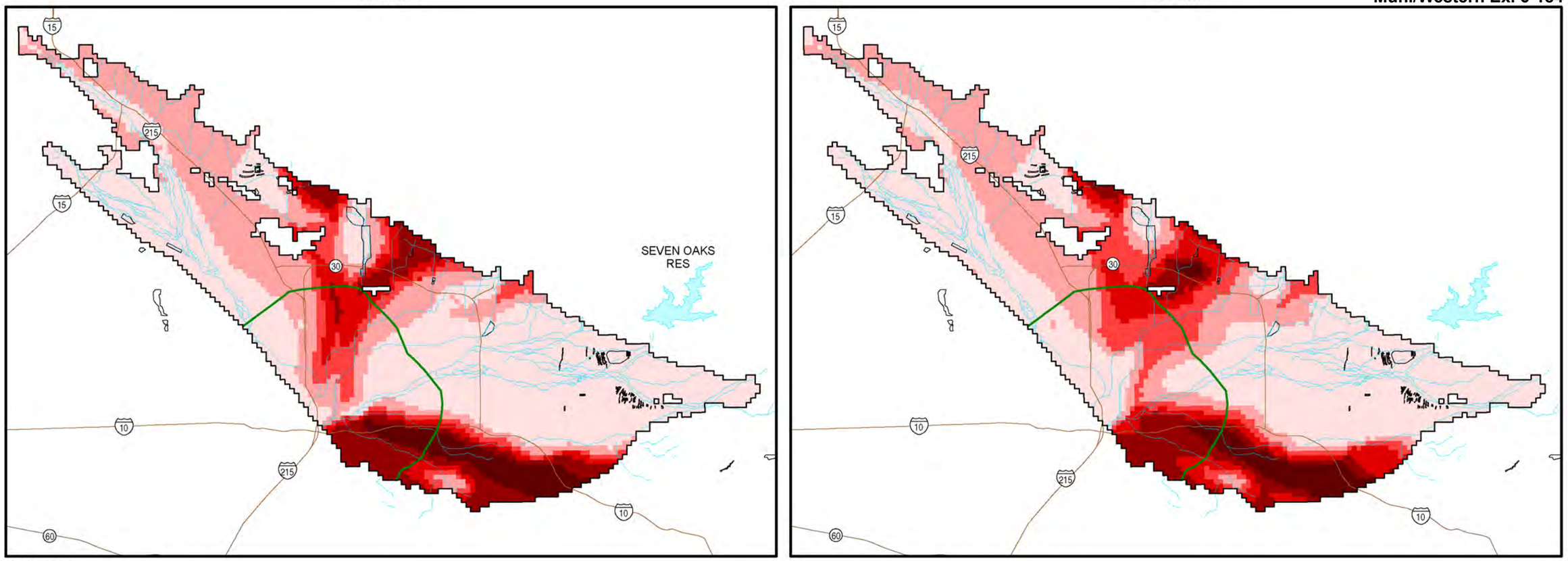


Figure 6.4-10. Initial Nitrate (as NO3) Concentrations for Model Scenarios - Layers 1 and 2

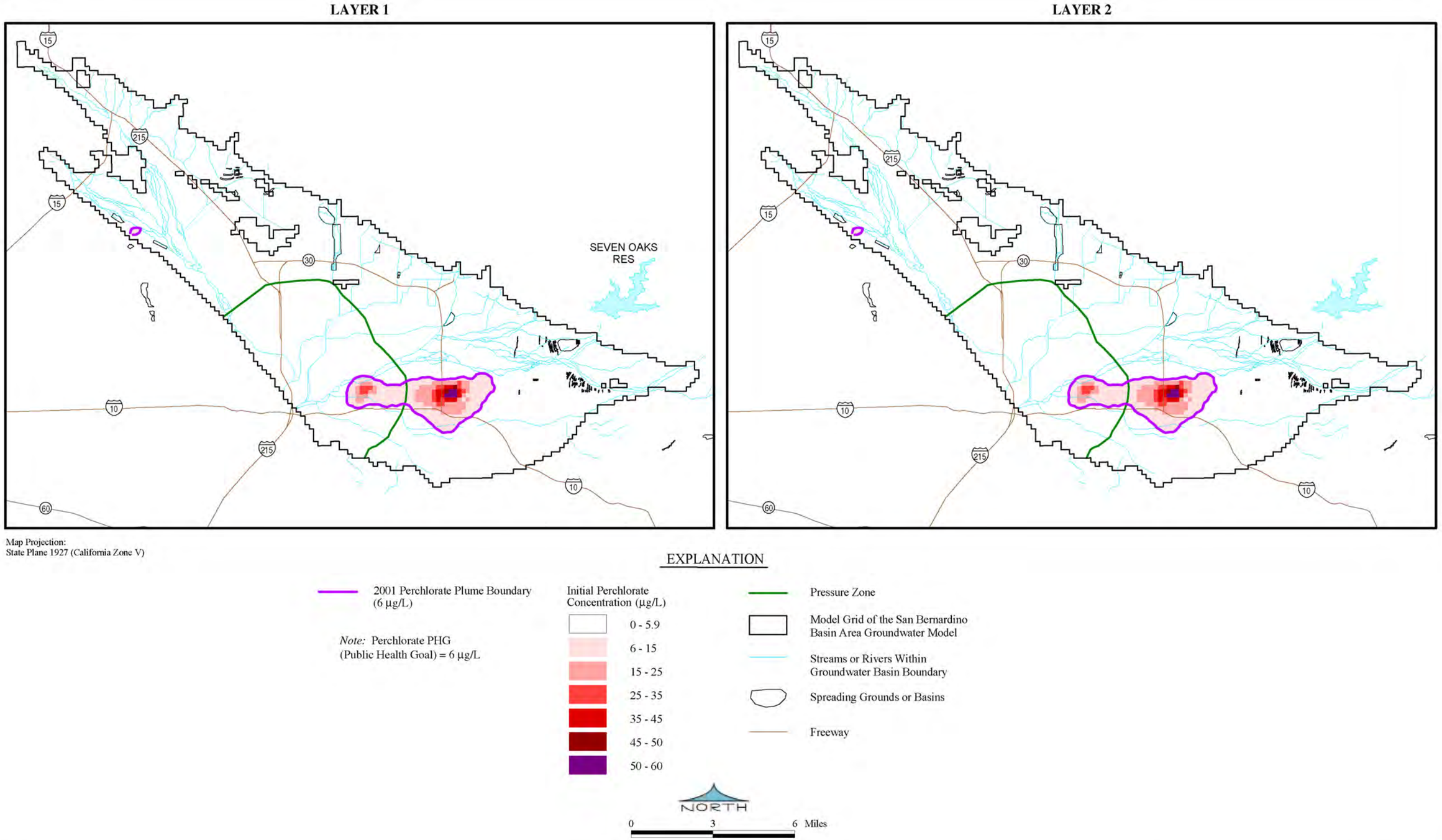
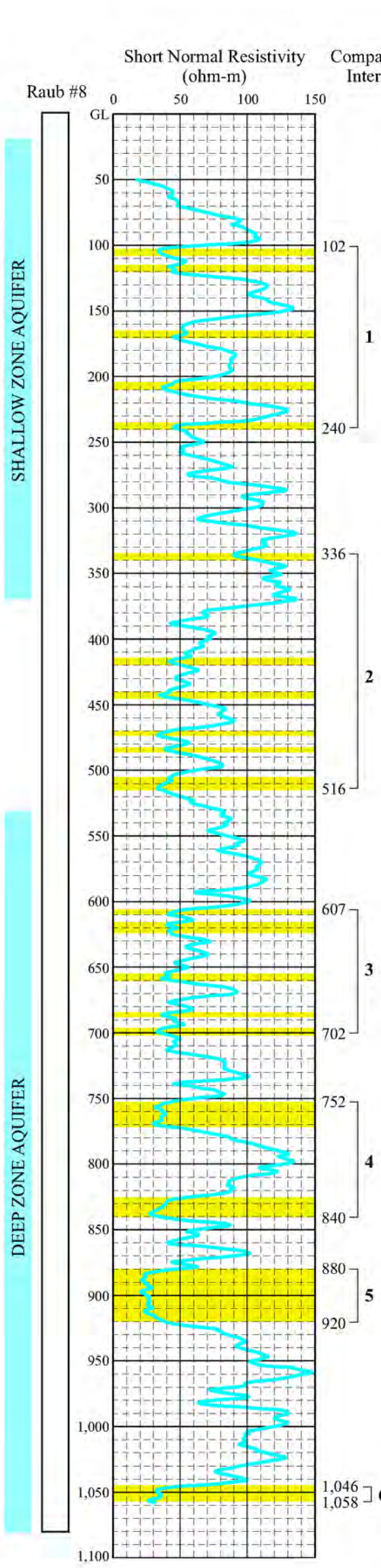


Figure 6.4-11. Initial Perchlorate Concentrations for Model Scenarios - Layers 1 and 2



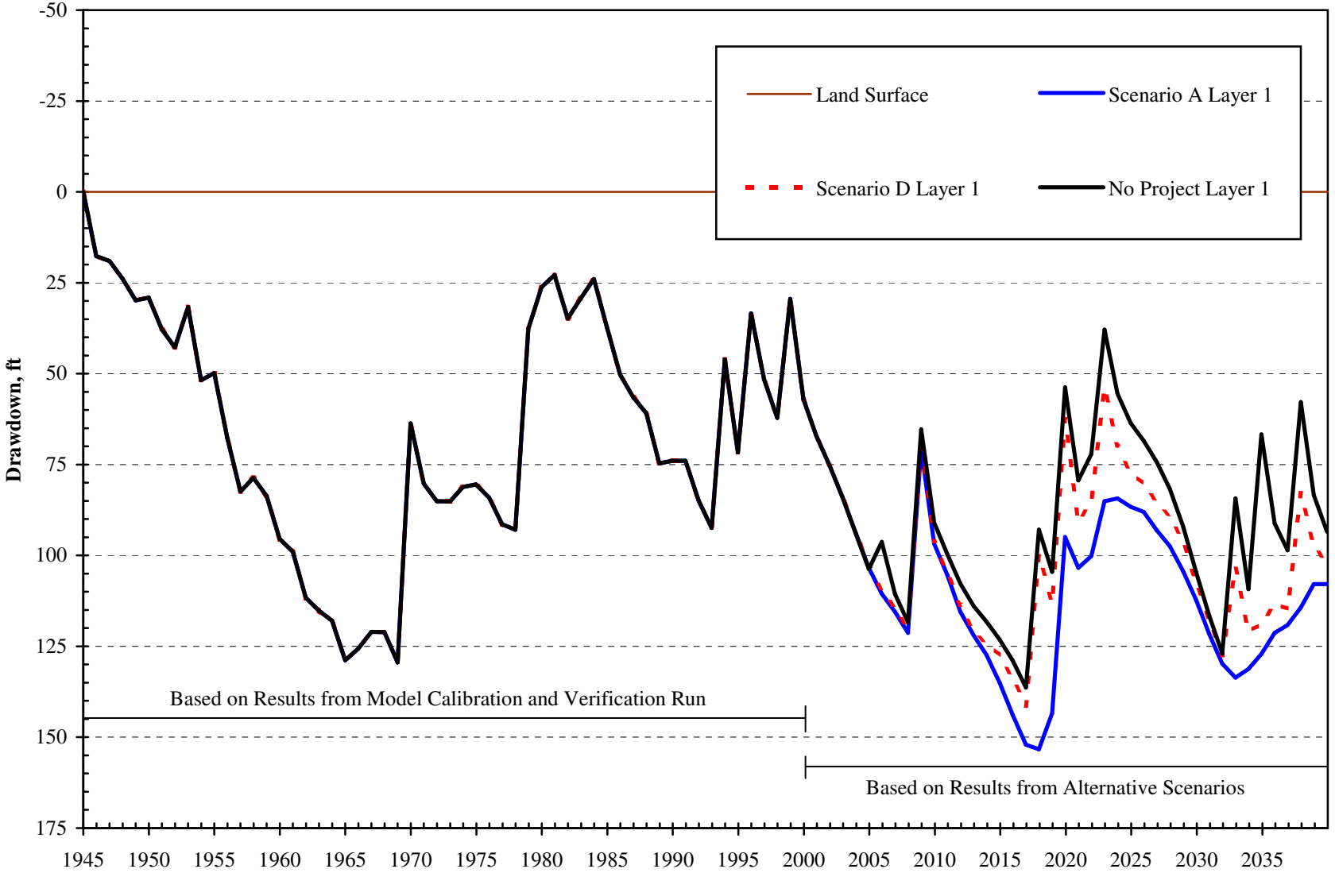
	Total Thickness of Clay Layers (ft)	Thickness of Equivalent Clay Layer (ft)	Vertical Hydraulic Conductivity (ft/yr)	Virgin Compressibility (1/ft)	Elastic Compressibility (1/ft)
1	27	5.5			
2	30	5.6			
			1.16×10^{-3}	1.24×10^{-4}	5.59×10^{-6}
3	24	5.2			
4	34	17.3			
5	40	40			
6	12	12			

Clay Layer

IDEALIZED LITHOLOGIC LOG
FOR WELL RAUB #8

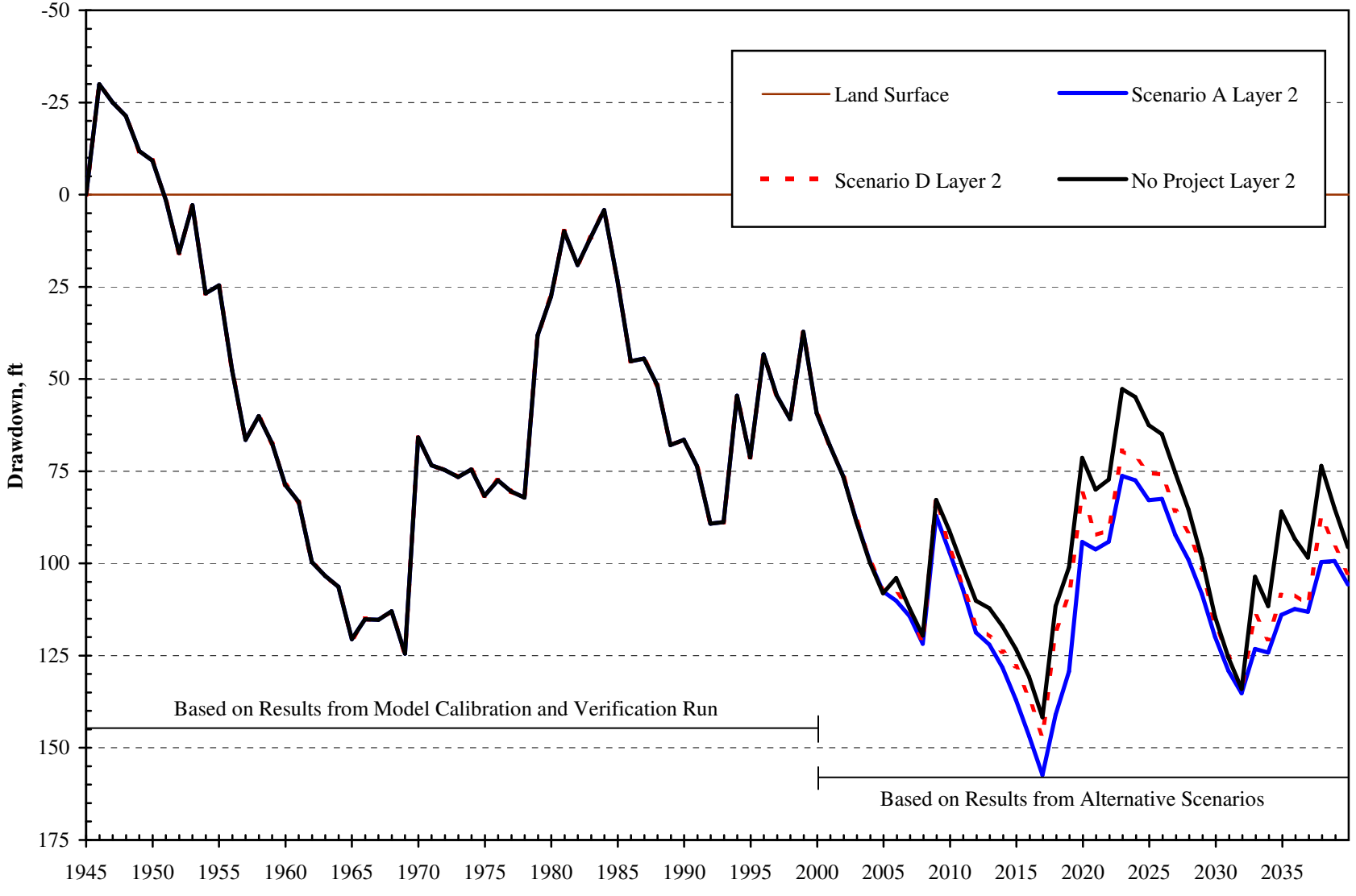
Figure
B 88

Drawdown Loading Function at Raub #8 in Model Layer 1



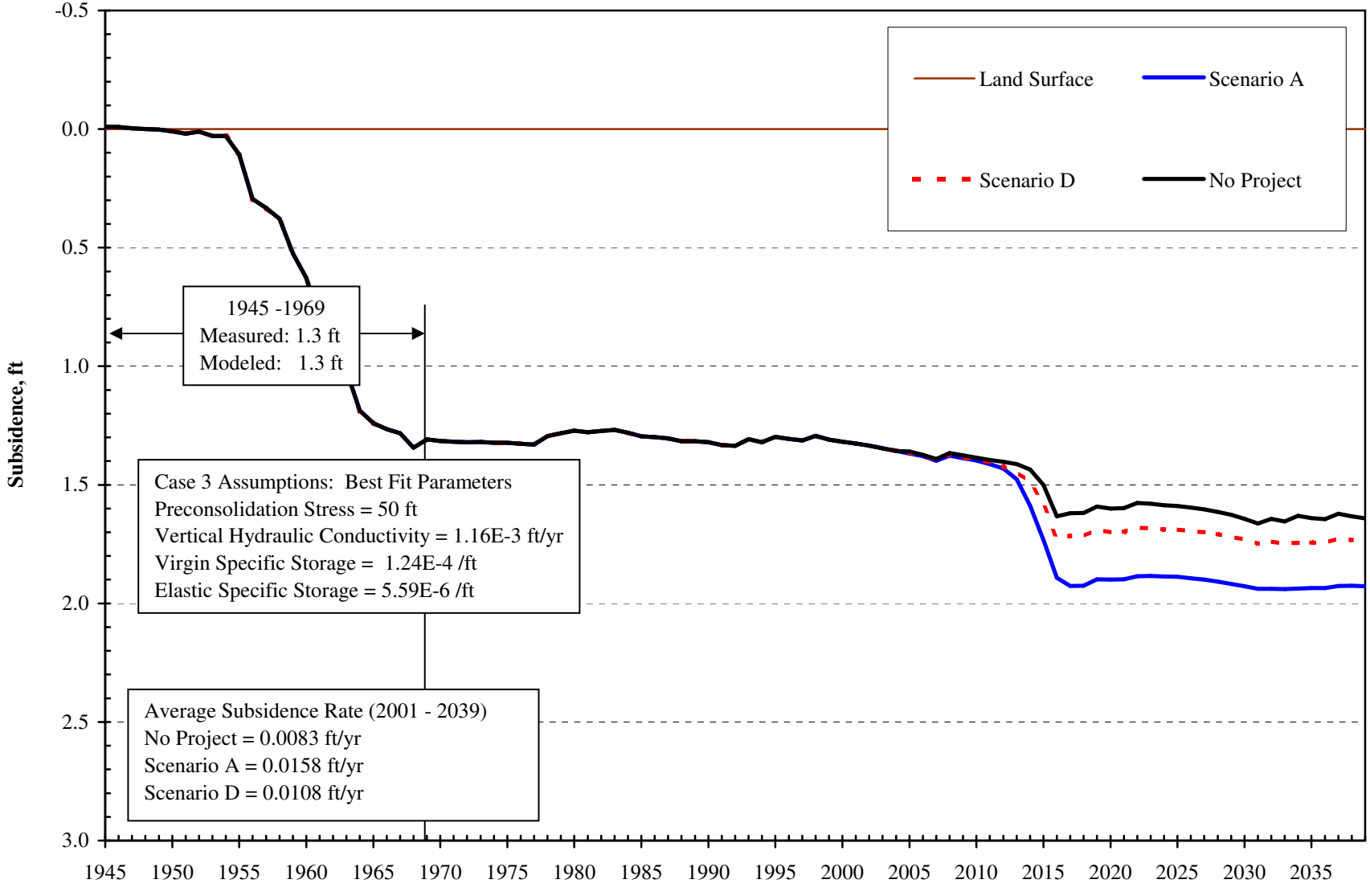
Muni/Western Ex. 6-187
Figure B 89

Drawdown Loading Function at Raub #8 in Model Layer 2



Muni/Western Ex. 6-188
Figure B 90

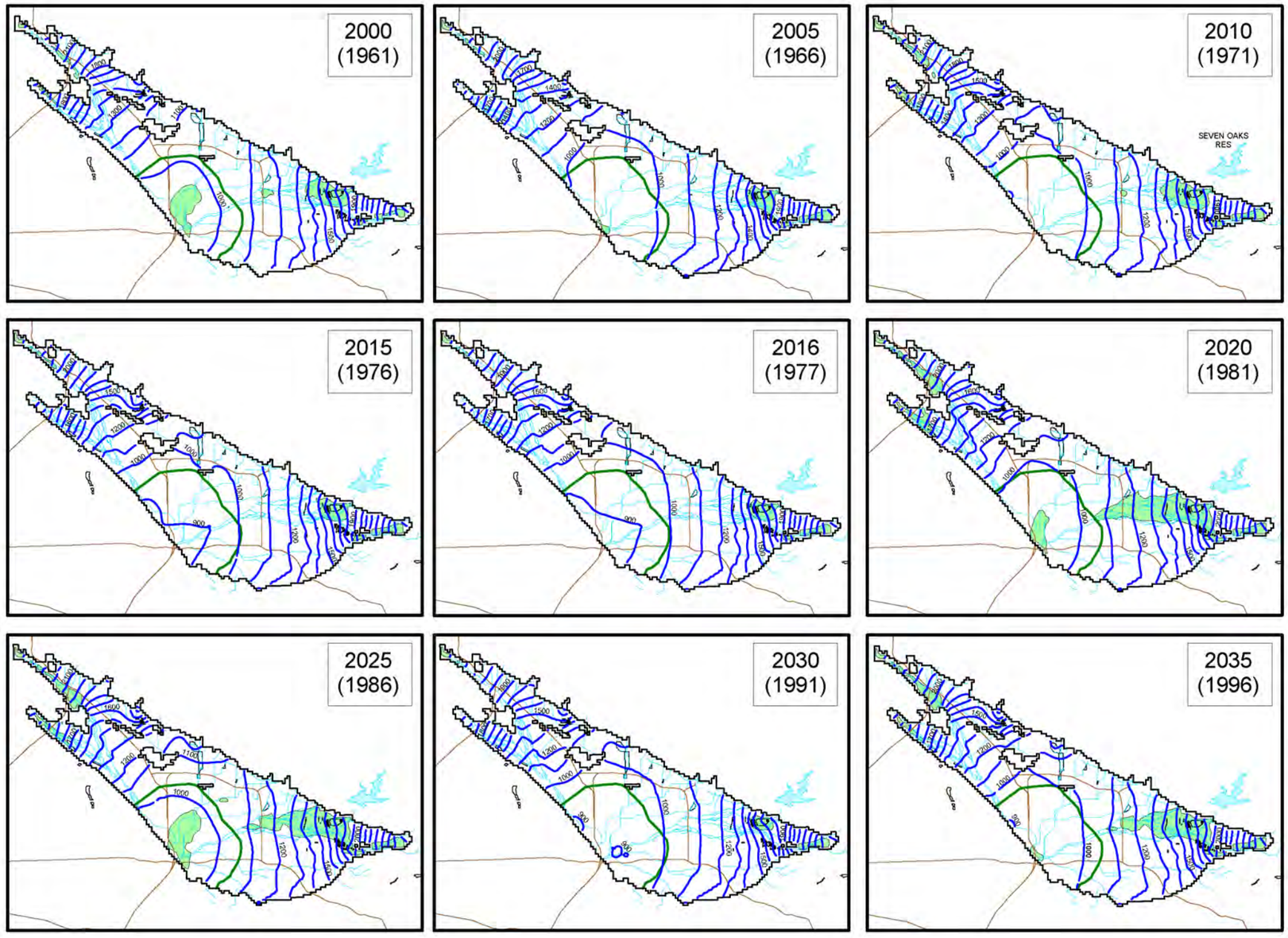
Model Predicted Subsidence at Raub #8



Muni/Western Ex. 6-189
Figure B 91

GROUNDWATER TECHNICAL APPENDIX
SAR WATER RIGHT APPLICATIONS FOR SUPPLEMENTAL WATER SUPPLY EIR

GROUNDWATER ELEVATIONS AND AREAS OF DEPTH TO WATER LESS THAN 50 FT FROM LAND SURFACE LAYER 1 NO PROJECT CONDITION



EXPLANATION

- Depth to Water Less Than 50 ft From Land Surface
- 1000 — Groundwater Contour (100 ft interval) (ft above mean sea level)
- 2000 (1961) — Model Year (Hydrological Year)
- Pressure Zone
- Model Grid of the San Bernardino Basin Area Groundwater Model
- Streams or Rivers Within Groundwater Basin Boundary
- Spreading Grounds or Basins
- Freeway

Area with Depth to Water less than 50 ft from land surface (acres)

Year	SBBA	PZ*
2001	7,301	1,204
2002	4,214	664
2003	2,640	154
2004	2,547	0
2005	3,597	139
2006	7,487	0
2007	5,372	0
2008	14,726	1,544
2009	8,706	201
2010	5,387	15
2011	3,983	0
2012	5,619	0
2013	5,063	0
2014	3,797	0
2015	3,118	0
2016	2,547	0
2017	9,925	93
2018	11,747	262
2019	20,299	3,226
2020	12,009	726
2021	11,747	1,019
2022	25,516	5,835
2023	20,391	4,739
2024	12,920	2,516
2025	12,071	1,976
2026	7,533	1,343
2027	5,094	849
2028	3,365	309
2029	1,652	0
2030	1,899	0
2031	2,146	0
2032	11,052	309
2033	5,989	0
2034	14,387	1,451
2035	8,860	170
2036	6,869	15
2037	16,903	2,686
2038	8,104	602
2039	4,384	139
Total	320,964	32,184

SBBA = San Bernardino Basin Area
PZ = Pressure Zone, not including river channels

NORTH

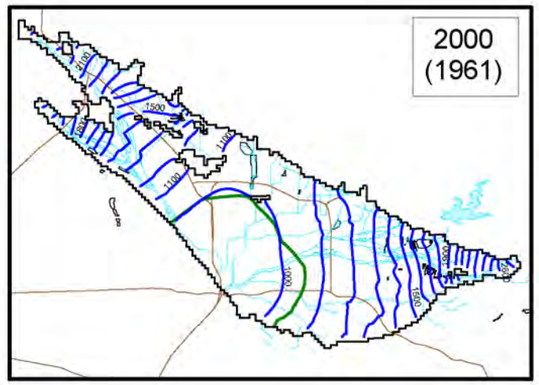
0 5 10 Miles

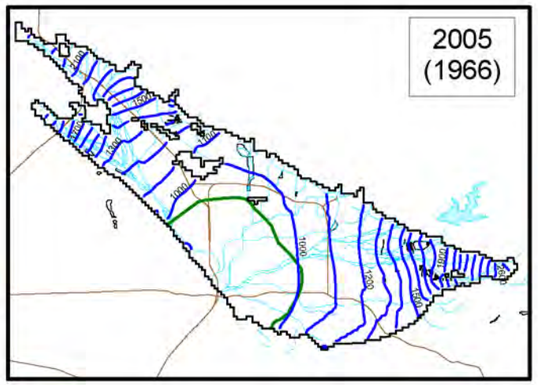
Map Projection:
State Plane 1927 (California Zone V)

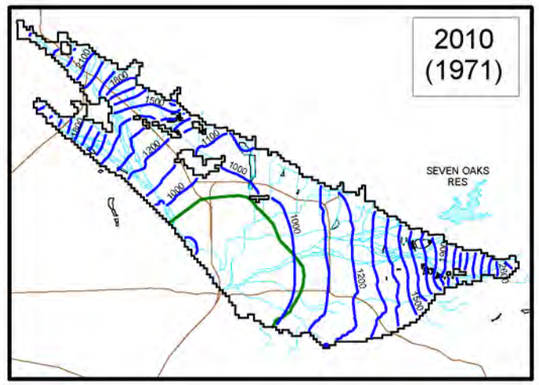
Figure B 11

GROUNDWATER TECHNICAL APPENDIX
SAR WATER RIGHT APPLICATIONS FOR SUPPLEMENTAL WATER SUPPLY EIR

GROUNDWATER ELEVATIONS
LAYER 2
NO PROJECT CONDITION







EXPLANATION

1000 — Groundwater Contour (100 ft interval) (ft above mean sea level)

2000 (1961) — Model Year (Hydrological Year)

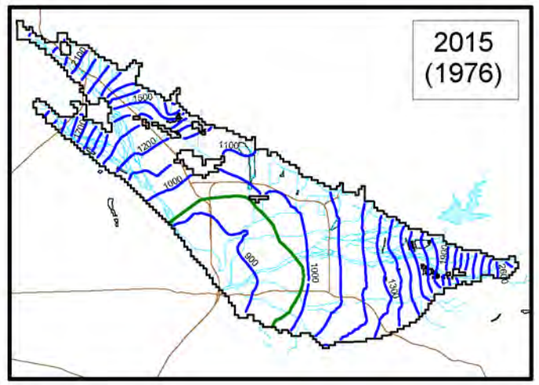
Pressure Zone

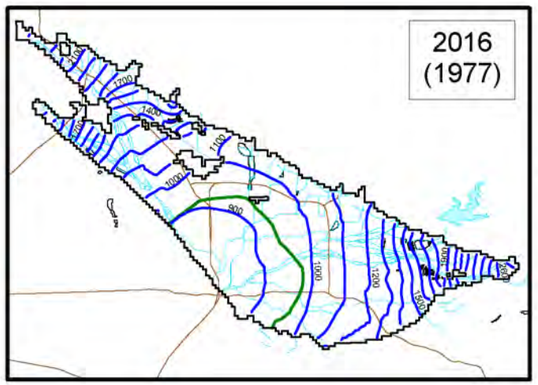
Model Grid of the San Bernardino Basin Area Groundwater Model

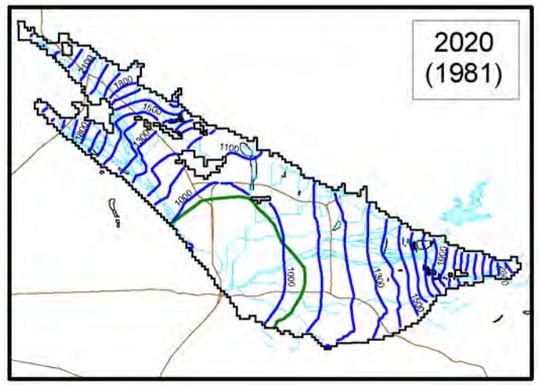
Streams or Rivers Within Groundwater Basin Boundary

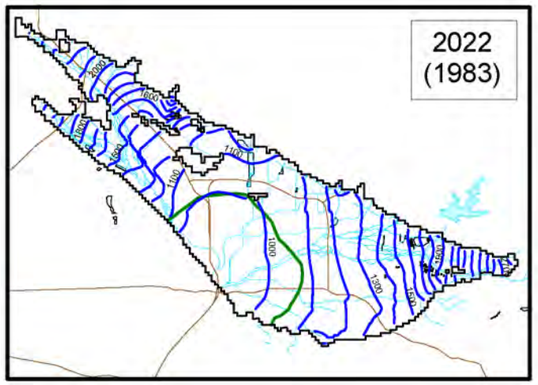
Spreading Grounds or Basins

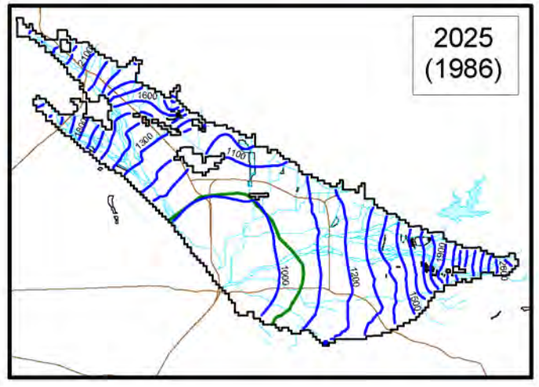
Freeway

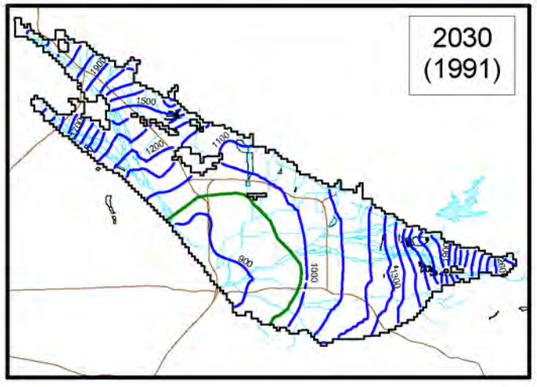


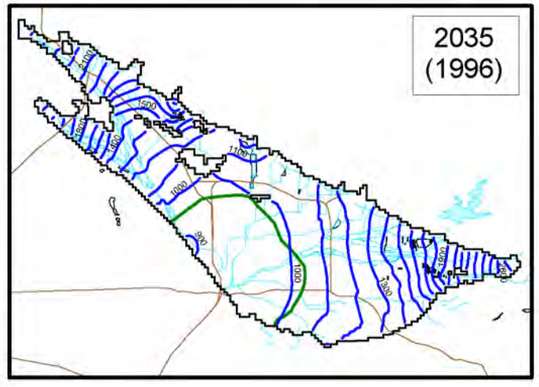


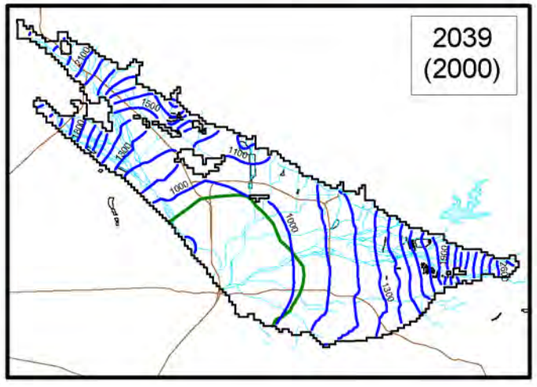










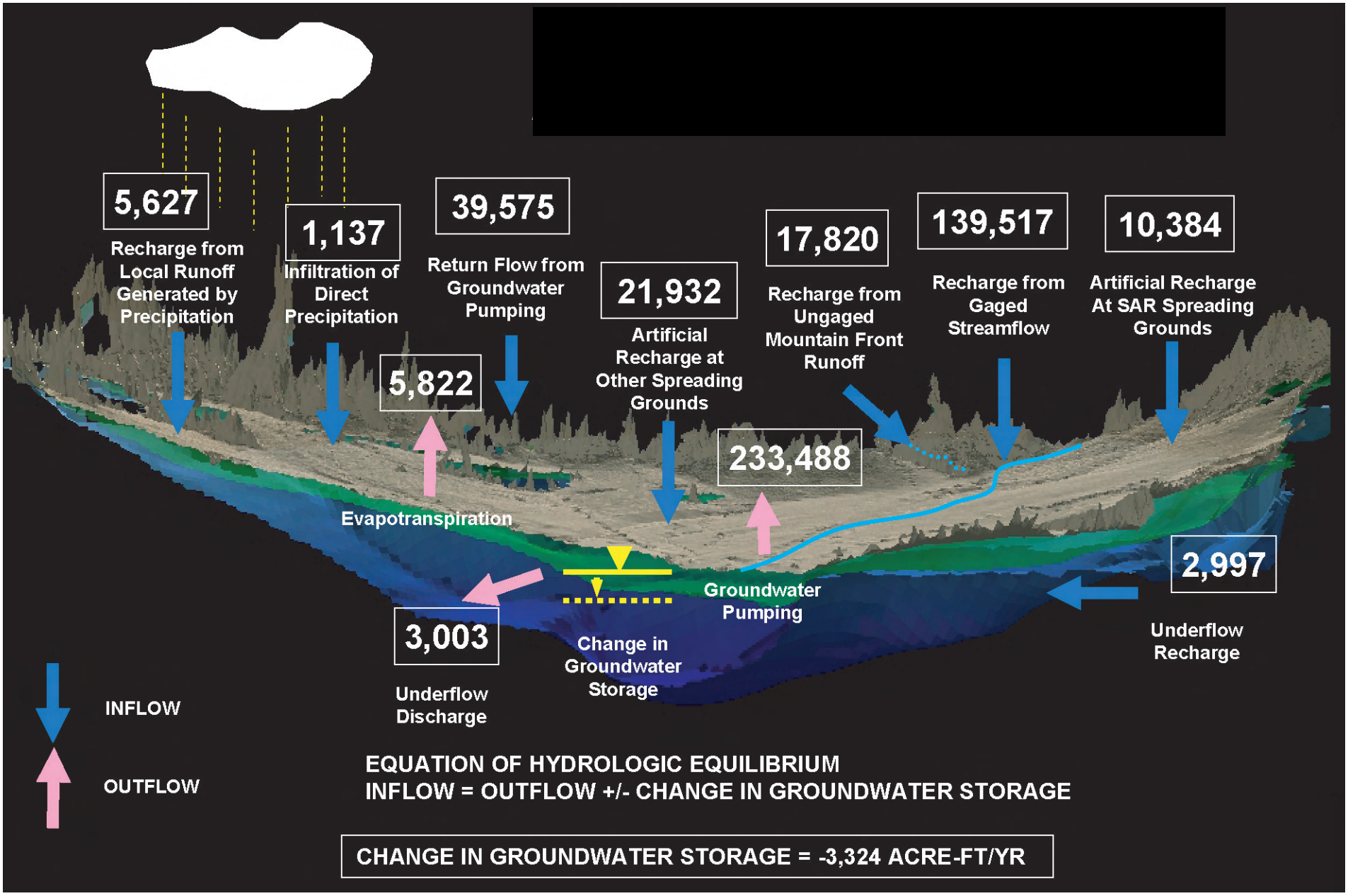


NORTH

0 5 10 Miles

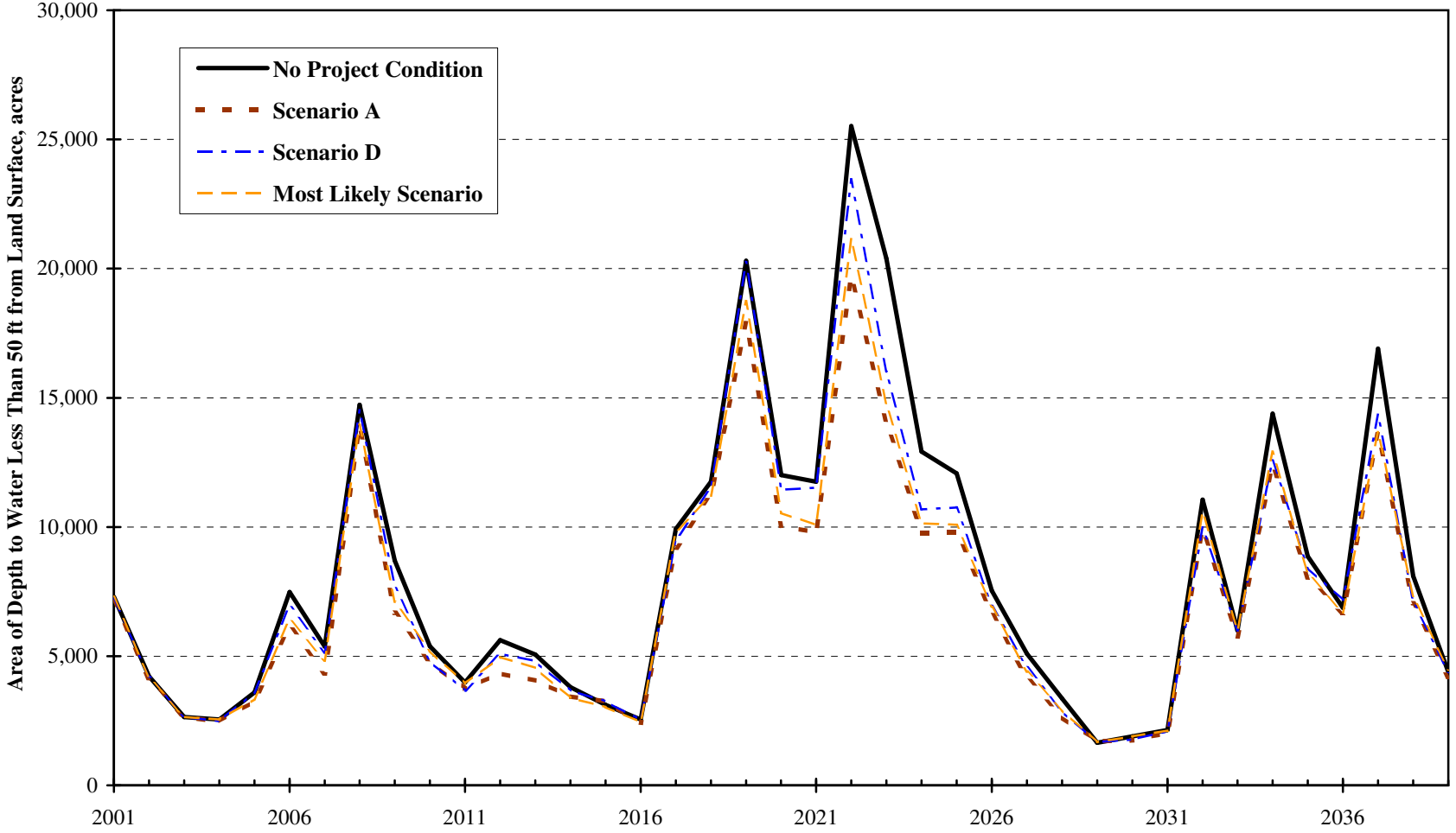
Map Projection:
State Plane 1927 (California Zone V)

Figure B 12



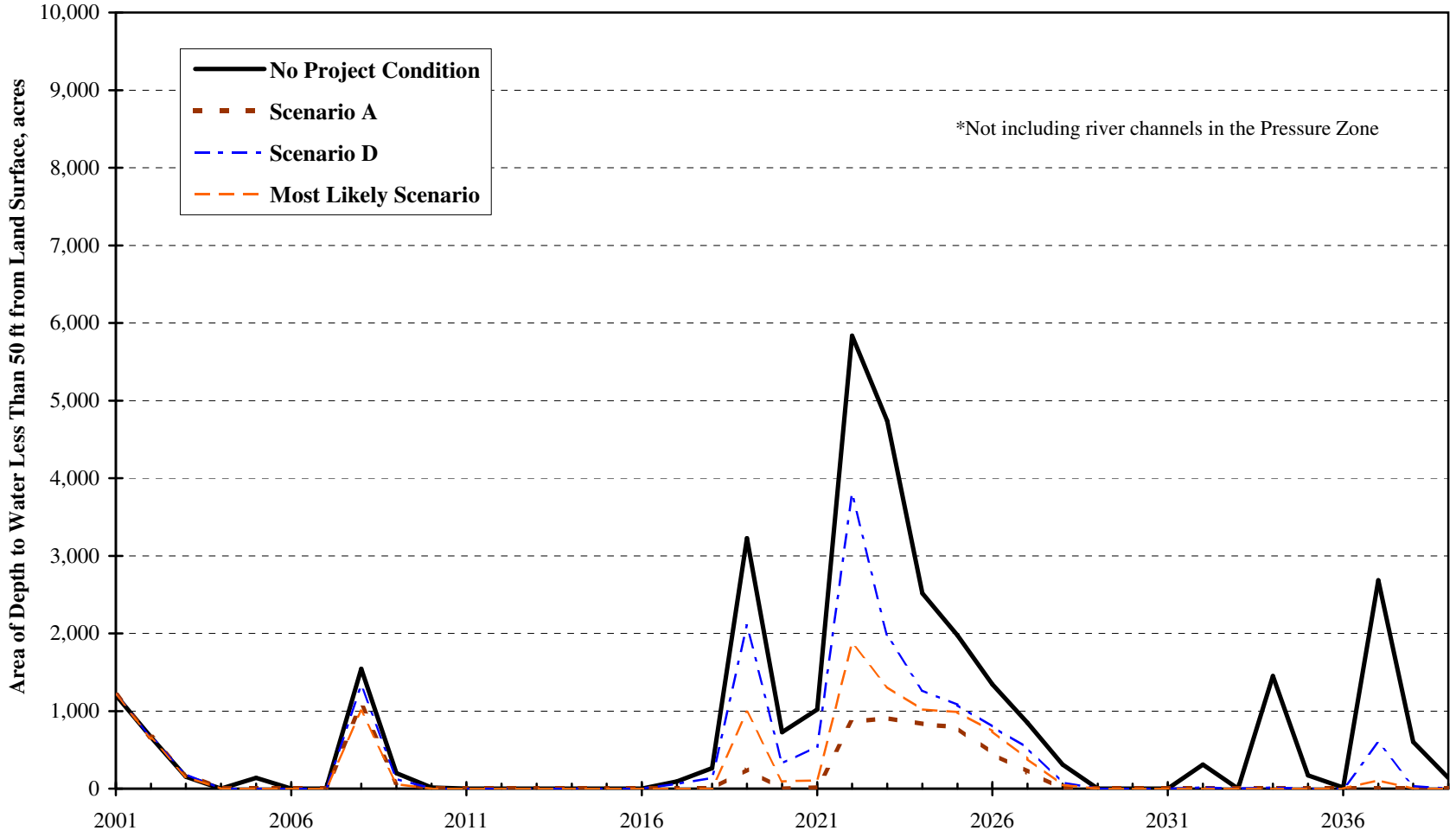
Muni/Western Ex. 6-192	Drawn: DEW Checked: Approved: Date: 16-APR-07	SANTA ANA RIVER WATER RIGHTS HEARING - TESTIMONY OF DENNIS E. WILLIAMS HYDROLOGIC BUDGET FOR THE NO PROJECT CONDITION 2001-2039 (UNITS IN ACRE-FT/YR)	GEOSCIENCE GEOSCIENCE Support Services, Incorporated P.O. Box 220, Claremont, CA 91711 Tel: (909)920-0707 Fax: (909)920-0403 www.gssiwater.com

Area of Depth to Water Less Than 50 ft from Land Surface of SBBA for Model Scenarios - 2001 to 2039



Muni/Western Ex. 6-193
Figure 6.2-25

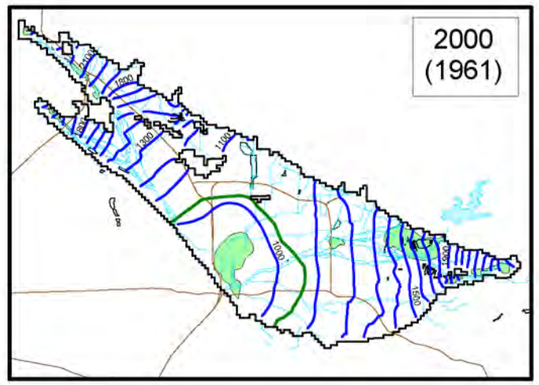
Area of Depth to Water Less Than 50 ft from Land Surface within the Pressure Zone* for Model Scenarios - 2001 to 2039

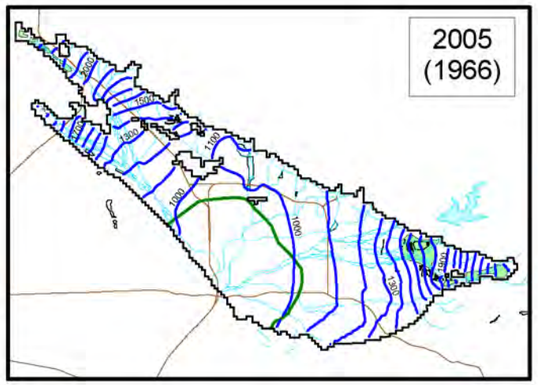


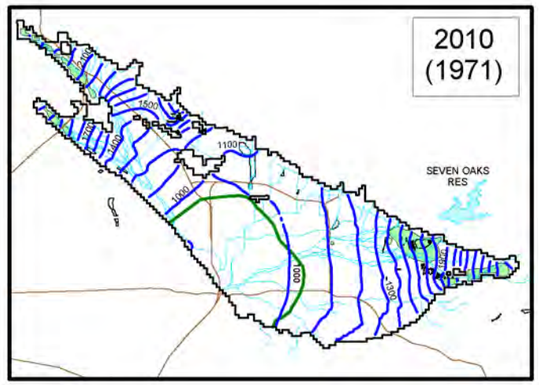
Muni/Western Ex. 6-194
Figure 6.2-26

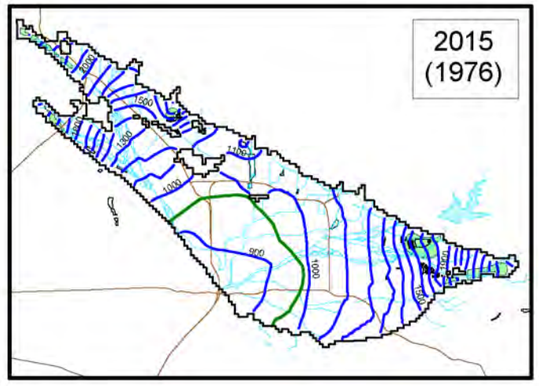
GROUNDWATER TECHNICAL APPENDIX
SAR WATER RIGHT APPLICATIONS FOR SUPPLEMENTAL WATER SUPPLY EIR

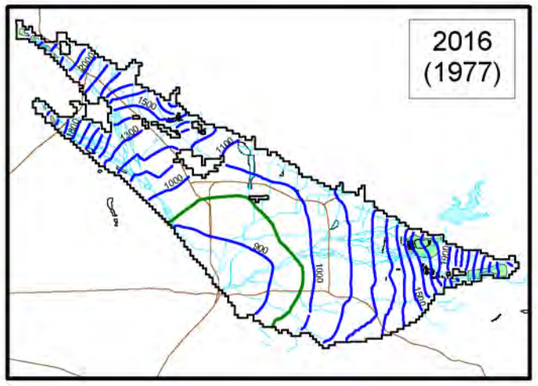
GROUNDWATER ELEVATIONS AND AREAS OF DEPTH TO WATER LESS THAN 50 FT FROM LAND SURFACE LAYER 1 SCENARIO A

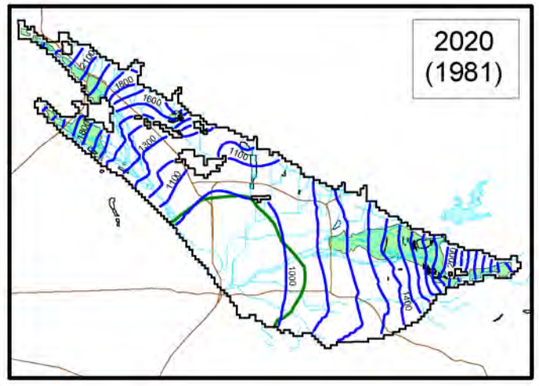


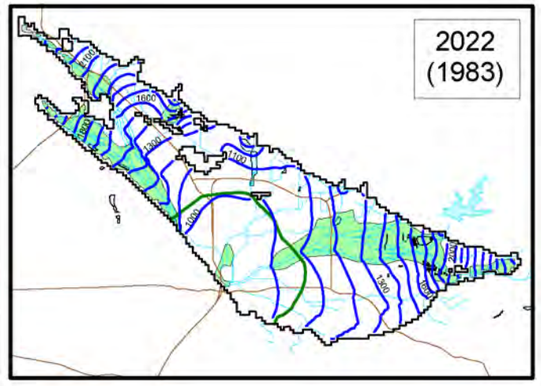


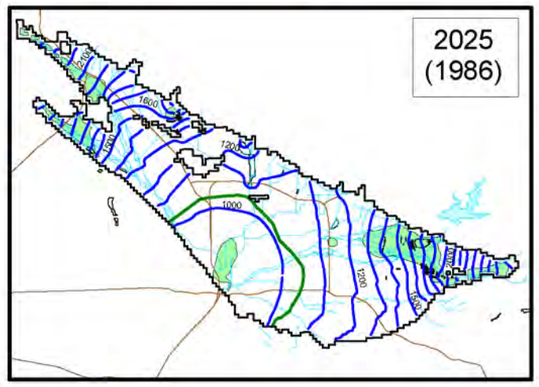


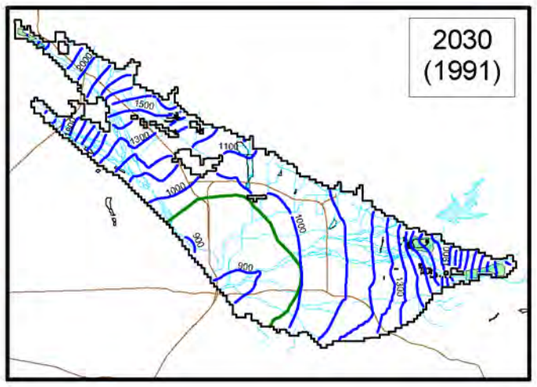


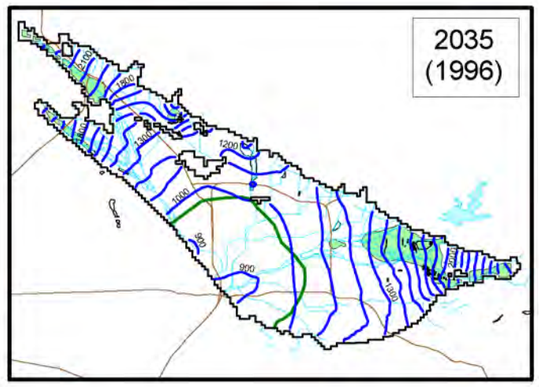


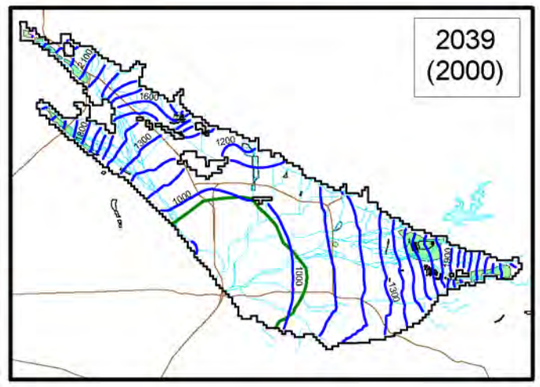












EXPLANATION

- Depth to Water Less Than 50 ft From Land Surface
- 1000 — Groundwater Contour (100 ft interval) (ft above mean sea level)
- 2000 (1961) — Model Year (Hydrological Year)
- Pressure Zone
- Model Grid of the San Bernardino Basin Area Groundwater Model
- Streams or Rivers Within Groundwater Basin Boundary
- Spreading Grounds or Basins
- Freeway

Area with Depth to Water less than 50 ft from land surface (acres)

Year	SBBA	PZ*
2001	7,116	1,204
2002	4,121	664
2003	2,640	185
2004	2,470	0
2005	3,272	0
2006	6,144	0
2007	4,338	0
2008	13,877	1,081
2009	6,668	77
2010	4,785	0
2011	3,736	0
2012	4,338	0
2013	4,044	0
2014	3,442	0
2015	3,257	0
2016	2,423	0
2017	9,200	0
2018	11,253	0
2019	17,891	247
2020	10,049	0
2021	9,787	15
2022	19,681	864
2023	14,062	911
2024	9,771	834
2025	9,787	787
2026	6,653	448
2027	4,137	216
2028	2,655	0
2029	1,698	0
2030	1,744	0
2031	2,038	0
2032	9,895	0
2033	5,758	0
2034	12,380	0
2035	8,042	0
2036	6,684	0
2037	13,615	0
2038	7,039	0
2039	4,183	0
Total	274,671	7,533

SBBA = San Bernardino Basin Area
PZ = Pressure Zone, not including river channels

NORTH

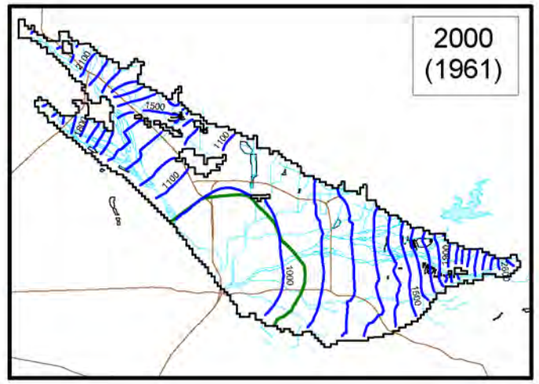
0 5 10 Miles

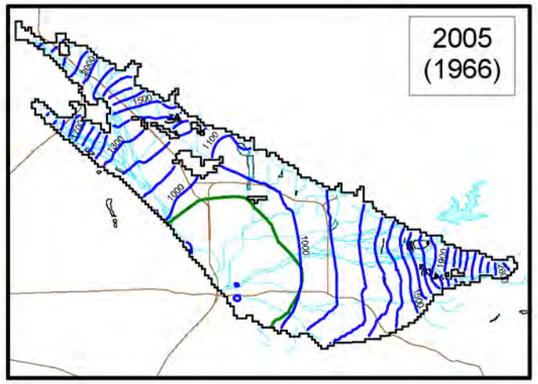
Map Projection:
State Plane 1927 (California Zone V)

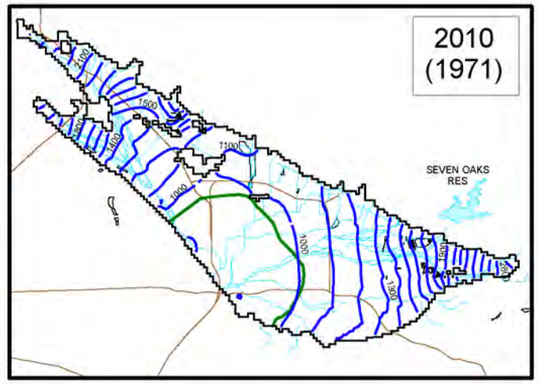
Figure B 17

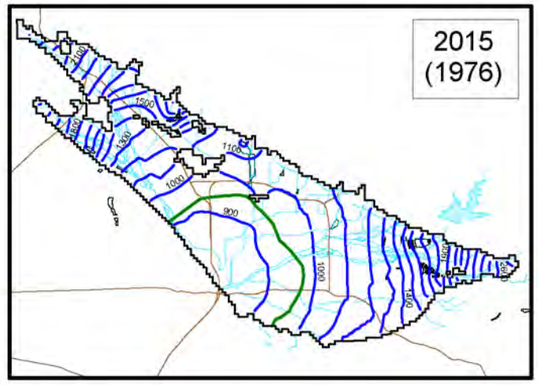
GROUNDWATER TECHNICAL APPENDIX
SAR WATER RIGHT APPLICATIONS FOR SUPPLEMENTAL WATER SUPPLY EIR

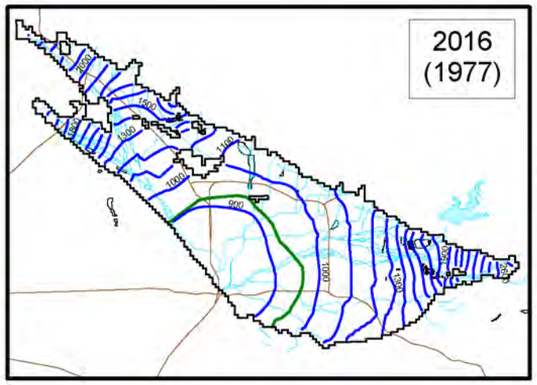
GROUNDWATER ELEVATIONS
LAYER 2
SCENARIO A

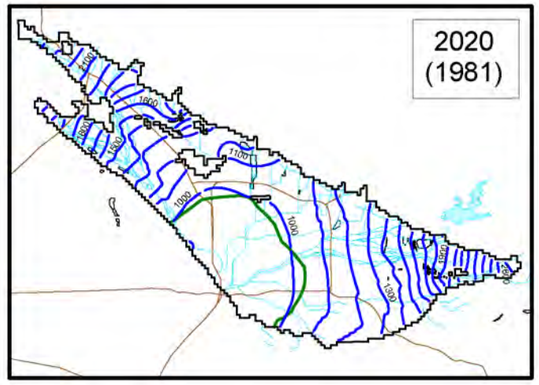


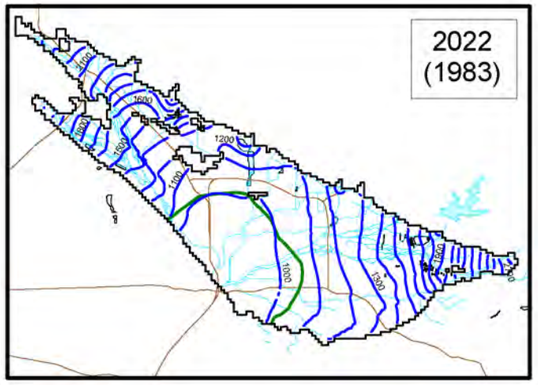


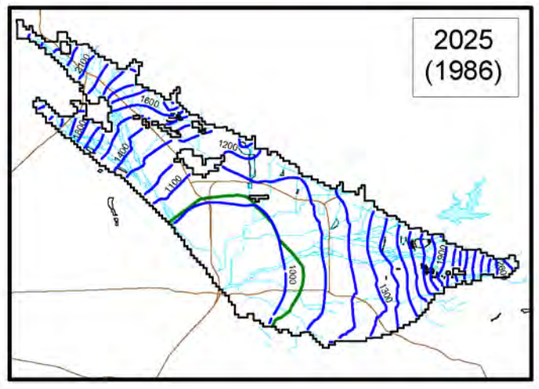


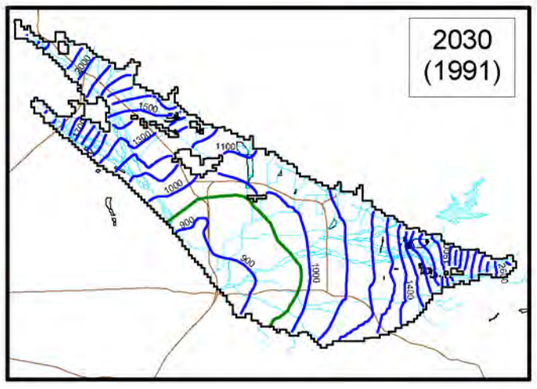


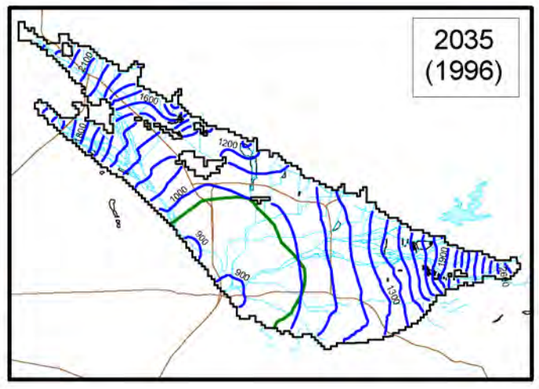


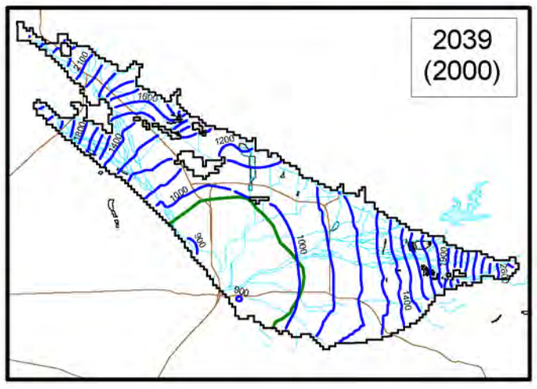












EXPLANATION

1000 — Groundwater Contour (100 ft interval) (ft above mean sea level)

2000 (1961) — Model Year (Hydrological Year)

Pressure Zone

Model Grid of the San Bernardino Basin Area Groundwater Model

Streams or Rivers Within Groundwater Basin Boundary

Spreading Grounds or Basins

Freeway

NORTH

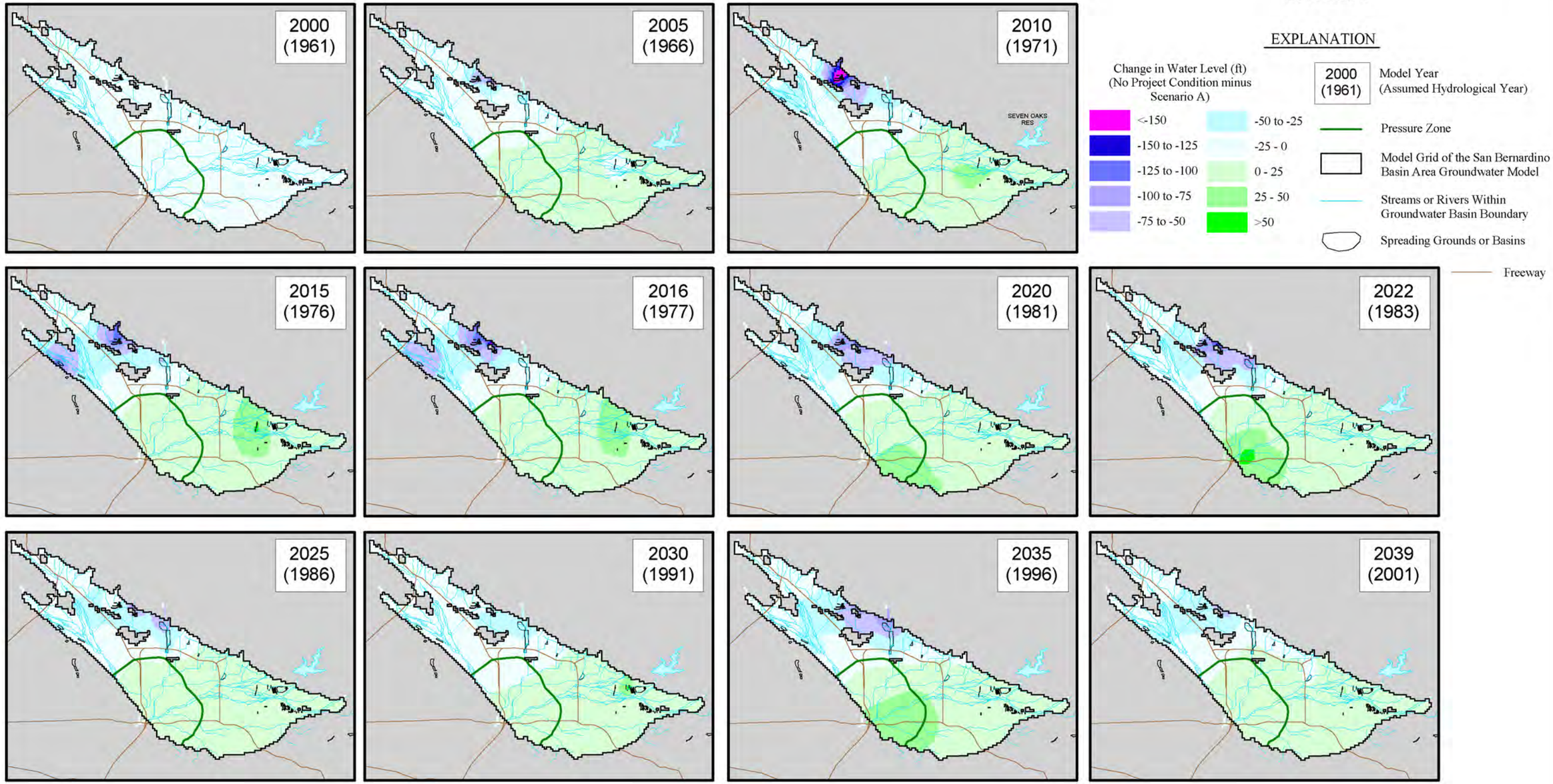
0 5 10 Miles

Map Projection:
State Plane 1927 (California Zone V)

Figure B 18

GROUNDWATER TECHNICAL APPENDIX
SAR WATER RIGHT APPLICATIONS FOR SUPPLEMENTAL WATER SUPPLY EIR

DIFFERENCES IN GROUNDWATER LEVEL BETWEEN NO PROJECT CONDITION AND SCENARIO A LAYER 1

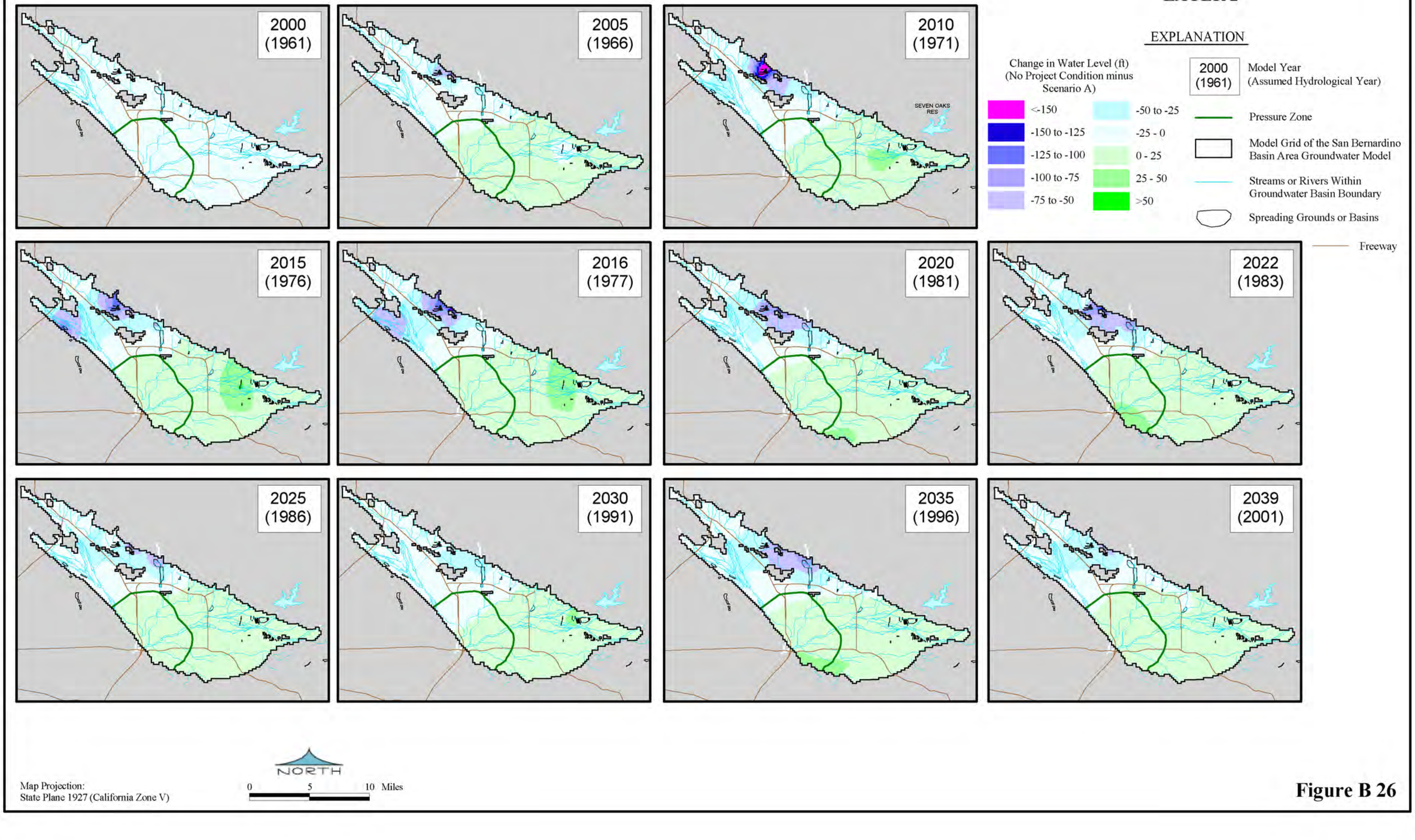


Map Projection:
State Plane 1927 (California Zone V)

Figure B 25

GROUNDWATER TECHNICAL APPENDIX
SAR WATER RIGHT APPLICATIONS FOR SUPPLEMENTAL WATER SUPPLY EIR

DIFFERENCES IN GROUNDWATER LEVEL BETWEEN NO PROJECT CONDITION AND SCENARIO A LAYER 2



Map Projection:
State Plane 1927 (California Zone V)

Figure B 26

Figure B 29a. Hydrograph for IW-01

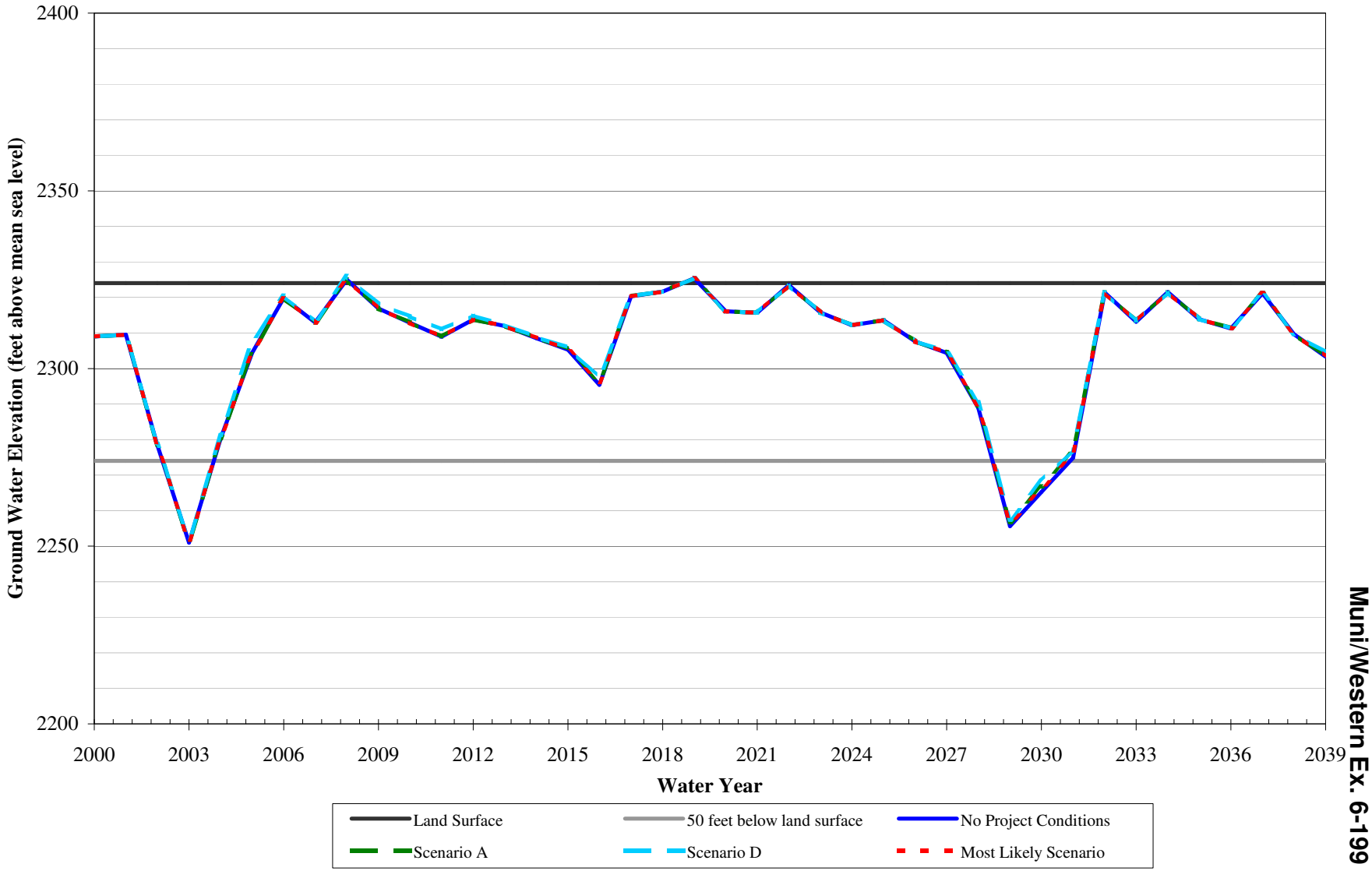


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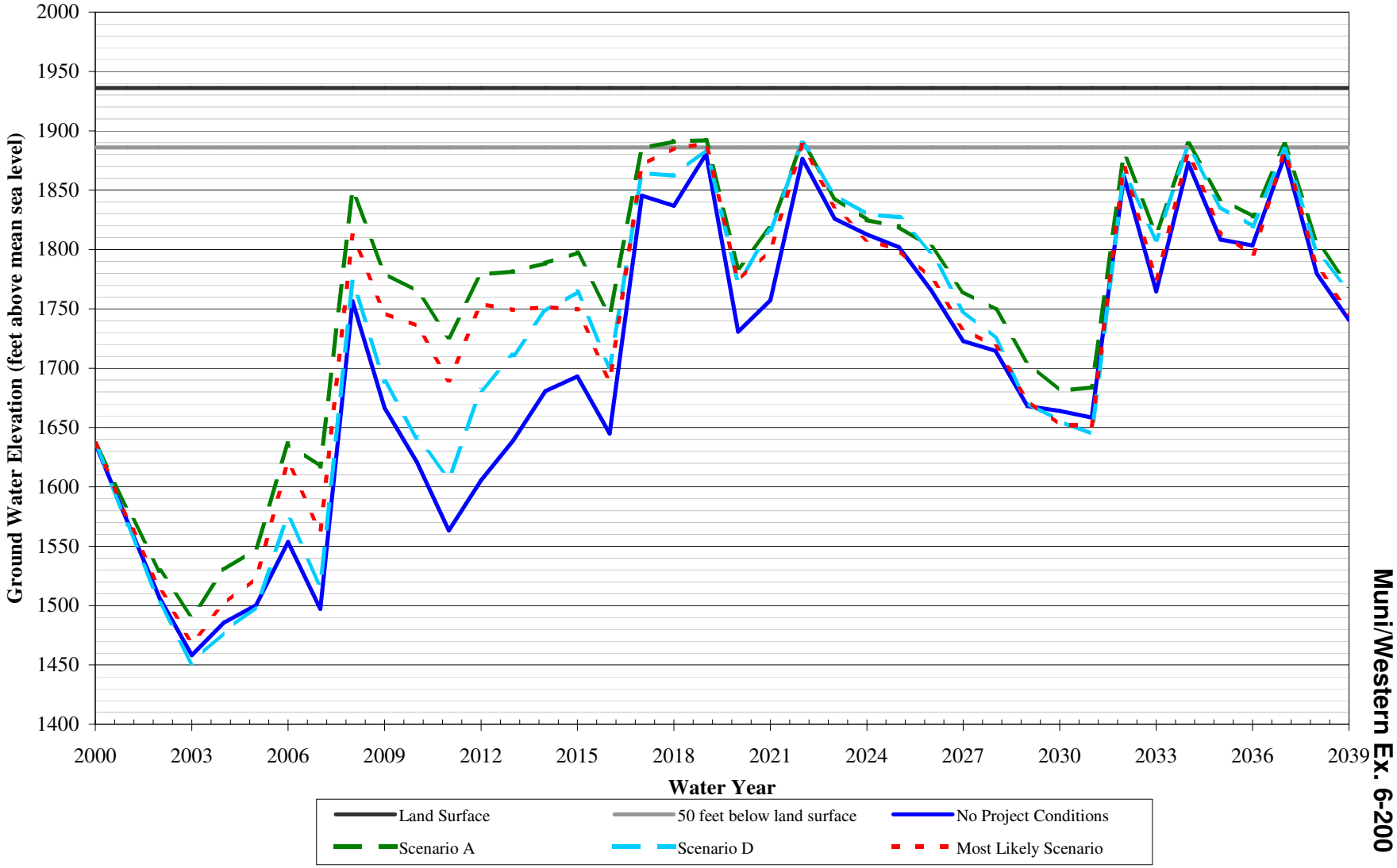
Figure B 29b. Hydrograph for IW-02



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