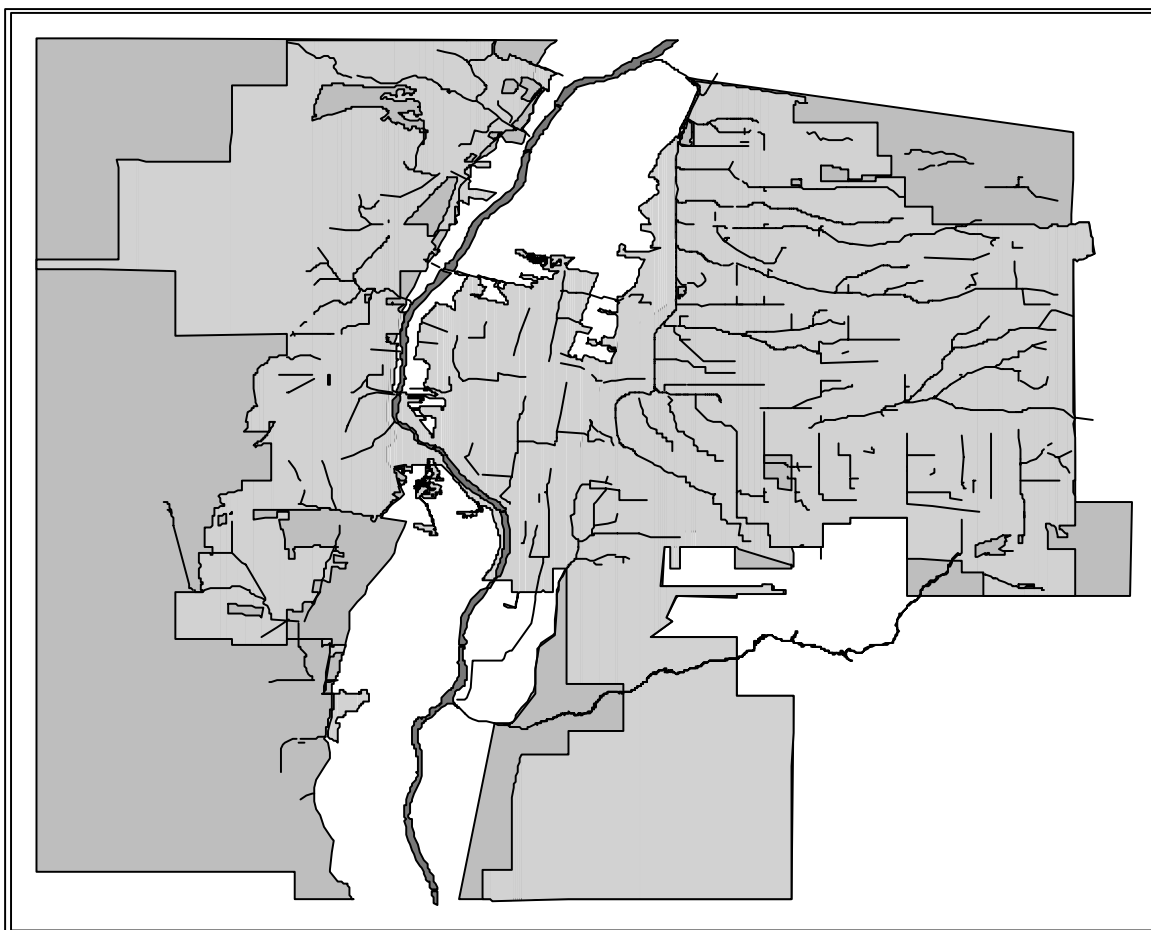


RAINFALL, RUNOFF, AND WATER-QUALITY DATA FOR THE URBAN STORM-WATER PROGRAM IN THE ALBUQUERQUE, NEW MEXICO, METROPOLITAN AREA, WATER YEAR 2003

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Open-File Report 2005-1266



Prepared in cooperation with the
ALBUQUERQUE METROPOLITAN ARROYO FLOOD CONTROL AUTHORITY
and the CITY OF ALBUQUERQUE

Rainfall, Runoff, and Water-Quality Data for the Urban Storm-Water Program in the Albuquerque, New Mexico, Metropolitan Area, Water Year 2003

By Todd Kelly, Orlando Romero, and Mike Jimenez

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**U.S. Department of the Interior
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CONVERSION FACTORS, DATUMS, AND ABBREVIATIONS

	Multiply	By	To obtain
	inch (in.)	2.54	centimeter (cm)
	foot (ft)	0.3048	meter (m)
	mile (mi)	1.609	kilometer (km)
	square mile (mi ²)	259.0	hectare (ha)
	square mile (mi ²)	2.590	square kilometer (km ²)
	cubic foot per second (ft ³ /s)	0.02832	cubic meter per second m ³ /s)

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29).

Horizontal coordinate information is referenced to the North American Datum of 1927 (NAD 27).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

RAINFALL, RUNOFF, AND WATER-QUALITY DATA FOR THE URBAN STORM-WATER PROGRAM IN THE ALBUQUERQUE, NEW MEXICO, METROPOLITAN AREA, WATER YEAR 2003

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Abstract

Urbanization has dramatically increased precipitation runoff to the system of drainage channels and natural stream channels in the Albuquerque, New Mexico, metropolitan area. Rainfall and runoff data are important for planning and designing future storm-water conveyance channels in newly developing areas. Storm-water quality also is monitored in accordance with the National Pollutant Discharge Elimination System mandated by the U.S. Environmental Protection Agency. The Albuquerque Metropolitan Arroyo Flood Control Authority, the City of Albuquerque, and the U.S. Geological Survey began a cooperative program to collect hydrologic data to help assess the quality and quantity of surface-water resources in the Albuquerque area. This report presents water-quality, streamflow, and rainfall data collected from October 1, 2002, to September 30, 2003 (water year 2003). Also provided is a station analysis for each of the 20 streamflow-gaging sites and 41 rainfall-gaging sites, which includes a description of monitoring equipment, problems associated with data collection during the year, and other information used to compute streamflow discharges or rainfall records. A hydrographic comparison shows the effects that the largest drainage channel in the metropolitan area, the North Floodway Channel, has on total flow in the Rio Grande.

INTRODUCTION

The system of drainage channels and natural stream channels in the Albuquerque, New Mexico, metropolitan area is a source of concern because of potential local flooding and water-quality problems. Rapid urbanization since 1970 has dramatically increased precipitation runoff to these channels, which in many instances return flow to the Rio Grande. As an important element of the City of Albuquerque's water resources management, accurate hydrologic data are needed for designing storm drainage and addressing storm-water-quality regulations established by the U.S. Environmental Protection Agency's National Pollutant Discharge Elimination System (NPDES). The NPDES was initiated to monitor the quality of storm-water runoff that flows into natural bodies of water from metropolitan areas. To meet regulatory requirements, long-term streamflow data can be analyzed in conjunction with water-quality sampling to compute constituent loading over time. Rainfall and runoff data for watersheds of various land uses are important for planning and designing future storm-water conveyance channels in newly developing areas of Albuquerque. In addition, accurate hydrologic data are necessary to calibrate

computer models that aid local engineers and city planners in the estimation of storm-water runoff.

With these needs in mind, the U.S. Geological Survey (USGS), in cooperation with the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) and the City of Albuquerque, began a study in 1976 to collect hydrologic data to help assess surface-water resources in the Albuquerque area and to determine long-term trends. The information gained will better help AMAFCA and the City to manage and administer water resources. The program is reviewed and revised annually to meet AMAFCA's and the City's needs. Data collected also support digital modeling programs conducted by AMAFCA. Flood-frequency analyses of selected watersheds can be completed when sufficient data are available.

Historically, daily mean discharges at selected streamflow-gaging stations are published in the USGS annual Water-Data Report, but prior to the water year 2001 summary report (Kelly and Romero, 2003), no annual data summary report had been devoted exclusively to this study. Two previous reports (Fischer and others, 1984; Metzker and others, 1993) summarized rainfall and runoff data for selected storms during 1976-83 and 1984-88. Daily rainfall totals and intensities as well as annual water-quality sampling results are not included in the annual Water-Data Report but are provided to the cooperators on request. Instantaneous maximum stages for secondary peaks and all gage-height or rainfall values recorded at 5-minute intervals are available from the USGS database.

Purpose and Scope

The purpose of this cooperative program is to obtain rainfall and surface-water (water quality and streamflow) data for an assessment of water resources (quantity and quality), for determination of long-term trends, and for water management and administration purposes. This report presents water-quality, streamflow, and rainfall data collected from October 1, 2002, to September 30, 2003 (water year 2003). The report provides a station analysis for each data-collection site, which includes a description of monitoring equipment, problems associated with data collection during the year, and other information used to compute streamflow discharges or rainfall records. A daily values table showing daily mean discharge for gaging stations or daily total rainfall recorded at rain gages accompanies each station analysis. Detailed site descriptions, drainage-basin areas, and periods of record are also included in the daily values tables.

The locations of the current network of gaging stations, rain gages, and water-quality sampling sites in the Albuquerque area are shown in figure 1. All seven stations designated as water-quality sampling sites in figure 1 also have recording streamflow gages. Information about the sites is listed in table 1.

National Pollutant Discharge Elimination System Water-Quality Monitoring

The water-quality sampling program began in fiscal year 1992 under a separate cooperative agreement between AMAFCA, the City of Albuquerque, and the USGS. Surface-water-quality samples were collected at five gaging stations and two background sites in 1992.

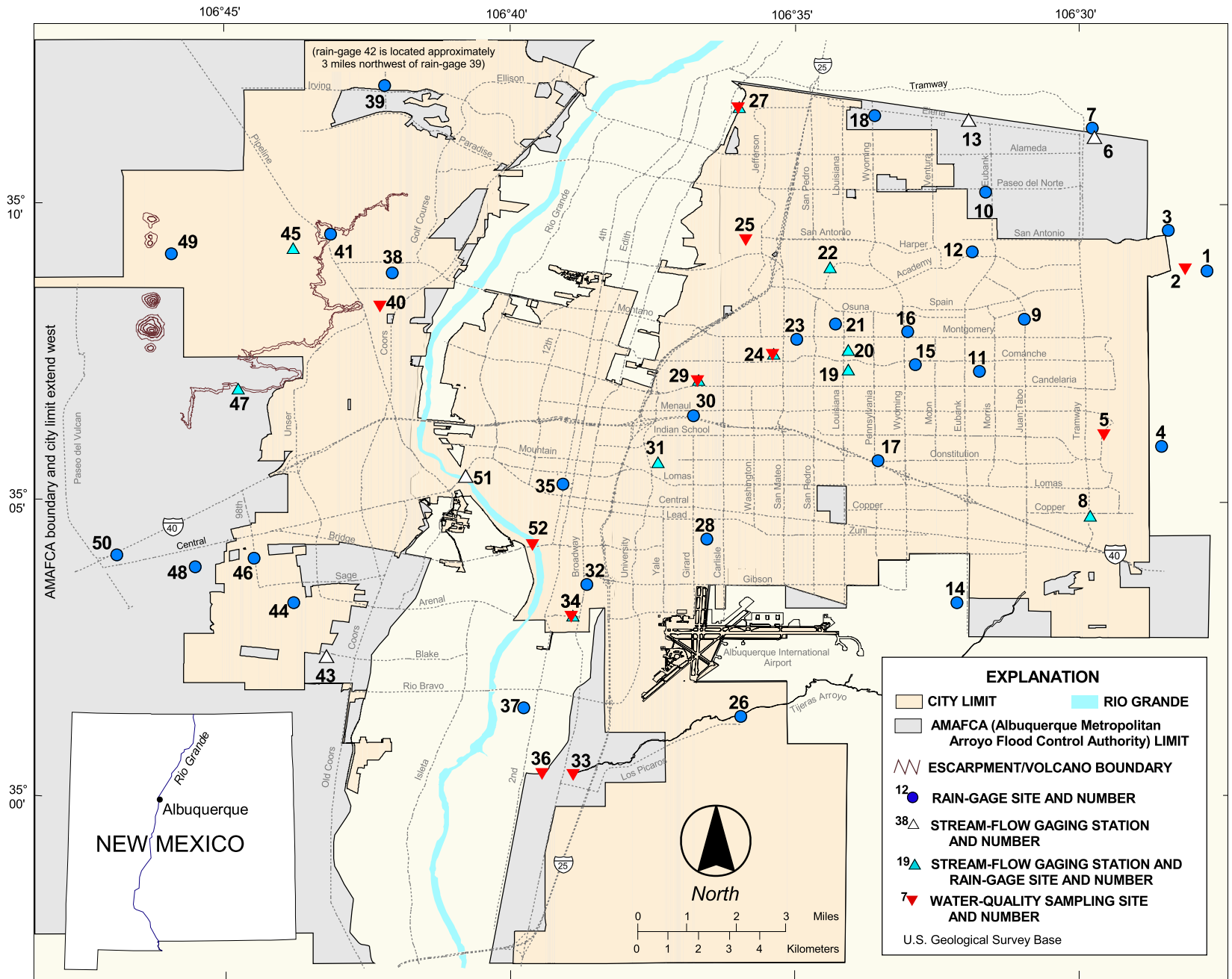


Figure 1. U.S. Geological Survey data-collection sites for 2003 Albuquerque Urban-runoff Program. Location numbers are in table 1.

Table 1. Map locations and station identification numbers

Site ID (fig. 1)	Name	U.S. Geological Survey station number	Latitude (degrees)	Longitude (degrees)	Streamflow-gaging station
1	Bear Canyon Rain Gage	350859106274330	35.1500	-106.4625	
2	Bear Canyon Arroyo nr. Albq.	08329868	35.1508	-106.4686	*
3	Elena Gallegos Picnic Area	350954106282330	35.1619	-106.4739	
4	Embudo Canyon Rain Gage	350554106283230	35.0986	-106.4758	
5	Embudo Arroyo @ Albq.	08329720	35.1022	-106.4925	*
6	La Cueva Arroyo Trib. (upper)	08329888	35.1894	-106.4956	*
7	La Cueva Arroyo Trib. near Albq.	08329890	35.1919	-106.4961	
8	Tramway Floodway Channel	08330540	35.0783	-106.4969	*
9	Fire Station #16 Rain Gage	350756106305430	35.1358	-106.5161	
10	Walker Pump Rain Gage	351023106313930	35.1731	-106.5274	
11	Borland Rain Gage	350713106314230	35.1206	-106.5292	
12	Tanoan Rain Gage	350924106315630	35.1556	-106.5314	
13	N. Camino Arroyo at Sunset Hills	08329911	35.1944	-106.5325	*
14	Kirtland AFB Rain Gage	350310106320930	35.0528	-106.5358	
15	Leonard Rain Gage	350722106325030	35.1225	-106.5481	
16	Thomas Pump Rain Gage	350755106325830	35.1322	-106.5503	
17	Love Pump Rain Gage	350540106333230	35.0944	-106.5589	
18	N. Camino Arroyo Trib. Rain Gage	08329914	35.1956	-106.56	
19	South Fork Hahn Arroyo @ Albq.	08329838	35.1211	-106.5678	*
20	North Fork Hahn Arroyo @ Albq.	08329839	35.1269	-106.5678	*
21	Grant Line Arroyo Rain Gage	08329860	35.1344	-106.5714	
22	Academy Acres Drain	08329880	35.1511	-106.5731	*
23	USGS Office Rain Gage	350748106345830	35.1300	-106.5828	
24	Hahn Arroyo @ Albq.	08329840	35.1258	-106.5897	*
25	Pino Arroyo @ Jefferson St.	08329882	35.1594	-106.5975	*
26	Tijeras Arroyo Rain Gage	08330580	35.0194	-106.5992	
27	N. Floodway Channel near Alameda	08329900	35.1981	-106.5997	*
28	Orlando Romero Rain Gage	350417106363330	35.0714	-106.6092	
29	North Floodway Channel @ Albq.	08329835	35.1181	-106.6117	*
30	AMAFCA Headqtrs. Rain Gage	350627106364630	35.1075	-106.6131	
31	Campus Wash @ Albq.	08329700	35.0939	-106.6236	*
32	Bernalillo County Bldg. Rain Gage	350340106385230	35.0581	-106.6444	
33	Tijeras Arroyo near Albq.	08330600	35.0025	-106.6481	*
34	San Jose Drain @ Woodward Road	08330200	35.0489	-106.6486	*
35	Albuquerque City Hall Rain Gage	350448106390230	35.0875	-106.6514	
36	S. Diversion Channel abv. Tijeras Arr.	08330775	35.0028	-106.6572	*
37	Wastewater Treatment Plant	350119106394630	35.0219	-106.6628	

Table 1. Map locations and station identification numbers--Concluded.

Site ID (fig. 1)	Name	U.S. Geological Survey station number	Latitude (degrees)	Longitude (degrees)	Streamflow-gaging station
38	Taylor Ranch Drain @ Albq.	08329936	35.1494	-106.7014	
39	Swinburn Dam Rain Gage	351216106421330	35.2044	-106.7036	
40	Mariposa Div. of San Antonio Arroyo	083299375	35.1400	-106.7047	*
41	Petroglyphs Park Rain Gage	350939106430930	35.1608	-106.7194	
42	TM Kelly Rain Gage	351516106431430	35.2544	-106.7206	
43	Amole del Norte Channel @ Albq.	08331118	35.0372	-106.7208	*
44	Leavitt Pump Rain Gage	350310106434930	35.0528	-106.7303	
45	Arroyo 19A @ Albq.	08329935	35.1567	-106.7306	*
46	Fire Station #14 Rain Gage	350357106443030	35.0658	-106.7419	
47	Ladera Arroyo @ Albq.	08329938	35.1156	-106.7467	*
48	Emergency Dispatch Building	350348106453230	35.0633	-106.7592	
49	La Boca Negra Rain Gage	350912106455630	35.1550	-106.7661	
50	Crown Towers Rain Gage	350400106465630	35.0667	-106.7822	
51	Rio Grande at Albuquerque	08330000	35.0835	-106.6780	*
52	Barelas Pump Station (UR400)		35.0700	-106.6600	

Since 1994, the sampling program has been included as part of the urban storm-water data-collection program. Water-quality monitoring under the NPDES is now in a phase to better define the quality of storm-water runoff in individual drainage basins. To support this program, existing gaging stations may be moved or a specified drainage basin may be supplemented with new stations to provide the data necessary for constituent-loading computations. Seven water-quality sampling sites were operational in fiscal year 2003. The water-quality data collected at 16 stations during water year 2003, including mean concentrations for 12 priority constituents and bacteria concentrations, are summarized in table 2. Flow was not recorded at the seventh site, Bear Canyon Arroyo near Albuquerque (08329868), during this time period.

Two types of samples - grab and composite - were collected during each storm. A grab sample was collected within 20 minutes after the start of flow. Discrete storm-water samples were collected at intervals ranging from 5 to 20 minutes during the first 3 hours of runoff. The discrete samples were then mixed together; the volume of each discrete sample was added dependent on the magnitude of discharge at the time of collection. The greater the discharge at the time of collection, the greater the volume of sample added to the mixture. This type of sample is referred to as a flow-weighted composite sample and represents flow during the first 3 hours of runoff (minus the grab sample). Grab and composite sample discharges are also shown in table 2.

All samples were analyzed for trace elements, phenolics, major ions, chemical oxygen demand, biochemical oxygen demand, bacteria, and cyanide by the City of Albuquerque Water Quality Laboratory; nutrients, volatile organic compounds, pesticides, and semivolatile base neutral acids were analyzed by the New Mexico State Laboratory in Albuquerque. Two additional samples are collected as replicates at two random sites each fiscal year for quality assurance/quality control purposes and shipped to the USGS National Water Quality Laboratory in Denver, Colorado.

Table 2. Albuquerque Storm-Water Sampling Program - NPDES concentrations of 12 priority water-quality constituents plus bacteria for 2003.

[NPDES, National Pollutant Discharge Elimination System; ft³/s, cubic feet per second; mg/L, milligrams per liter; µg/L, micrograms per liter; cols/100 ml, colonies per 100 milliliters; --, no data; <, less than; mpn, most probable numbers]

Sampling site and USGS number (cooperator number)	Date sampled	Grab sample discharge ¹ (ft ³ /s)	Composite sample discharge ² (ft ³ /s)	Dissolved solids (mg/L)	Suspended solids (mg/L)	Nitrogen, total Kehldahl (mg/L)	Nitrogen, total (mg/L)	Phos-phorus, dissolved (mg/L)	Phos-phorus, total (mg/L)
North Floodway nr. Alameda 08329900 (UR9900)	10-22-02	418	277	130	732	4.76	5.65	0.2	0.67
	10-07-03	42.4	1,310	105	1,040	3.17	3.72	0.206	5.45
South Diversion Channel nr. Albq. 08330775 (UR200)	08-30-03	0.81	1.3	296	7	1.46	1.56	0.048	0.111
	10-07-03	63.3	69.3	142	1,140	3.75	4.41	0.153	1.4
San Jose Drain @ Woodward Rd. @ Albq. 08330200 (UR500)	10-22-02	1	5.2	189	268	2.95	4.45	0.35	0.65
	02-20-03	2.8	11.2	200	204	2.45	3.15	0.237	0.633
	10-07-03	3.8	18.4	138	456	3.65	4.4	0.26	1.22
Mariposa Diversion of San Antonio Arroyo @ Albq. 083299375 (UR300)	10-23-02	6.9	34.9	93	312	2.25	2.89	0.17	0.58
	08-28-03	31.7	16.2	106	316	1.79	2.58	0.261	0.552
	09-10-03	0.6	1	166	12	1.62	2.1	0.2	0.3
	10-07-03	12.4	16.3	100	136	1.3	1.74	0.24	0.335
Barelas Pump Station (UR400)	10-22-02	--	--	188	1,584	5.58	7.18	0.41	2.08
	08-29-03	--	--	216	768	5.88	6.34	0.218	1.79
	09-10-03	--	--	222	168	4.3	5.19	0.35	1.18
	10-07-03	--	--	190	652	4.7	5.66	0.289	1.51
North Floodway Outfall (UR9901)	10-07-03		--	110	348	2.60	3.17	0.213	0.21

Table 2. Albuquerque Storm-Water Sampling Program - NPDES concentrations of 12 priority water-quality constituents plus bacteria for 2001 and 2002--Continued.

Sampling site and USGS number (cooperator number)	Biochem. oxygen demand (mg/L)	Chemical oxygen demand (mg/L)	Cadmium, total (µg/L)	Lead, total (µg/L)	Copper, total (µg/L)	Zinc (µg/L)	Coliform, fecal (cols/100 ml)	Streptococci, fecal (cols/100 ml)	E. coli (mpn/100 ml)
North Floodway nr. Alameda 08329900 (UR9900)	37	170	<2	54	51.1	365.5	9,100	4,400	N/A
	19	202	3.16	60.8	40	333.5	270,000	N/A	900
South Diversion Channel nr. Albq. 08330775 (UR200)	--	118	<2	<2	8.36	35.1	--	N/A	--
	14	210	4.69	77.2	57.3	495.5	19,000	N/A	900
San Jose Drain @ Woodward Rd. @ Albq. 08330200 (UR500)	45	194	<2	42.4	31.7	209	60,000	54,500	N/A
	24	86	<2	44.4	25.8	198	1,000	153	N/A
	20	226	3.69	95.2	43.7	409	19,000	N/A	
Mariposa Diversion of San Antonio Arroyo @ Albq. 083299375 (UR300)	14	58	<2	6.89	12.1	79.4	6,000	4,400	N/A
	30	204	<2	10.7	19.1	102	8,000	N/A	5,000
	12	100	<2	<2	9.07	36.4	8,000	N/A	11,100
	--	92	<2	4.31	7.74	40.7	7,600	N/A	7,600
Barelas Pump Station (UR400)	43	252	3.75	140.4	108	890	24,000	--	N/A
	34.8	365	3.47	108.4	95.4	810	--	--	N/A
	57	290	<2	35.7	37.8	298	90,000	N/A	220,000
	34	303	4.41	108.4	74	645	270,000	N/A	900
North Floodway Outfall (UR9901)	17	161	2.57	28.1	22.5	137	19,000	N/A	27,100

Table 2. Albuquerque Storm-Water Sampling Program - NPDES concentrations of 12 priority water-quality constituents plus bacteria for 2003--Continued.

Sampling site and USGS number (cooperator number)	Date sampled	Time	Grab sample discharge (ft³/s)	Coliform, fecal (cols/100 ml)	Streptococci, fecal (cols/100 ml)	E. coli (mpn/100 ml)
Pino Arroyo at Jefferson St.	08-14-2003	15:18	100	800	N/A	--
08329882 (UR2020)	08-25-2003	11:00	9.1	8,000	N/A	3,000
	10-07-2003	16:10	90.1	12,400	N/A	27,100
Embudo Arroyo at Albq. 08329720 (UR650)	10-07-2003	19:55	0.41	19,000	N/A	900
North Floodway Channel @ Albq. 08329835 (UR329835)	09-10-2003	20:30	74.2	30,000	N/A	30,000
	10-07-2003	15:05	1,120	270,000	N/A	900
Hahn Arroyo 08329840 (UR08329840)	08-25-2003	10:50	19.2	2,300	N/A	1,700
	10-07-2003	14:40	58.3	270,000	N/A	900
Tijeras Arroyo nr. Albq. 08330600 (UR330600)	10-07-2003	15:50	101	4,570	N/A	4,570
N. Domingo Baca Filter Pond (debris basin) (UR880)	09-11-2002	11:30	N/A	52,000	100,000	N/A
N. Domingo Baca Filter Pond (north outlet pipe) (UR881)	09-11-2002	11:30	N/A	50,000	87,900	N/A

Table 2. Albuquerque Storm-Water Sampling Program - NPDES concentrations of 12 priority water-quality constituents plus bacteria for 2003--Continued.

Sampling site and USGS number (cooperator number)	Date sampled	Time	Grab sample discharge (ft³/s)	Coliform, fecal (cols/100 ml)	Streptococci, fecal (cols/100 ml)	E. coli (mpn/100 ml)
N. Domingo Baca	09-11-2002	11:30	N/A	288,000	87,900	N/A
Filter Pond (west outlet pipe) (UR882)	09-13-2002	11:45	N/A	14,000	17,200	N/A
Sandia Pueblo buffalo pasture runoff (UR883)	09-10-2002		N/A	50,000	54,500	N/A
Bear Arroyo Outfall to North Diversion Channel (UR888)	09-10-2002		N/A	360,000	87,900	N/A

¹Grab sample is collected within the first 20 minutes of stormflow.

²See composite sample definition on page 5.

RAINFALL AND RUNOFF DATA COLLECTION

During water year 2003, 20 streamflow-gaging stations and 41 rain gages were operational in the Albuquerque urban-data collection program. Five gaging stations measure runoff from undeveloped drainage basins, and the remaining 15 stations monitor runoff from urbanized watersheds. The streamflow gages at Academy Acres Drain, North Fork Hahn Arroyo, and South Fork Hahn Arroyo, all in urbanized watersheds, were discontinued in July 2003. Seven gaging stations also are water-quality sampling sites. All data are recorded at 5-minute intervals and transferred from the field recorders to the USGS electronic database approximately every month. The period of record for data (unit values) digitally archived in electronic format and stored in the USGS database is listed in table 3. Data collected prior to the dates listed in table 3 are archived in paper-tape form at the USGS New Mexico Water Science Center in Albuquerque and can be converted to electronic format if needed. A similar period-of-record tabulation is available for rain gages and is listed in table 4. In the station analyses for rain-gage sites that are presented later in this report, the period of record refers only to data readily available in electronic format.

Four gaging stations were operated only from approximately October 1 to November 30, 2002, and March 1 to September 30, 2003, when the probability of rainfall is higher. These four seasonal sites are Academy Acres Drain, Ladera Arroyo, Arroyo 19A, and North Camino Arroyo at Sunset Hills. Rainfall data are collected annually using tipping-bucket rain gages. A typical rainfall collection site and tipping-bucket rain gage are shown in figure 2.

ANNUAL DAILY MEAN FLOW HYDROGRAPH OF THE NORTH FLOODWAY CHANNEL AND THE RIO GRANDE AT ALBUQUERQUE GAGING STATIONS

The North Floodway Channel (not shown on map) drains the northeast quadrant of Albuquerque and is the largest of the concrete-lined drainage channels in the metropolitan area. Its confluence with the Rio Grande is located immediately north of the Albuquerque city limits near the small community of Alameda. North Floodway Channel discharges into the Rio Grande are measured at the North Floodway Channel near Alameda gaging station (08329900). A hydrographic comparison showing the effects of North Floodway flows on Rio Grande mean daily discharges measured at the Rio Grande at Albuquerque gaging station (08330000) is shown in figure 3. The Rio Grande gaging station is approximately 10 miles downstream from the confluence with the North Floodway Channel. The snowmelt runoff period from April through June, during which flows typically peak in any given year, was far below normal in water year 2003. Average annual flow at the Rio Grande at Albuquerque gaging station was 427 cubic feet per second and at the North Floodway Channel gaging station was 5.5 cubic feet per second, or slightly more than 1 percent of annual riverflow in water year 2003. The hydrograph shows that large stormflows from the North Floodway are usually reflected in the Rio Grande and that the effects of North Floodway flows are more pronounced when total river discharge is low. Most North Floodway peaks occur during the summer thunderstorm season (July-October) when flow in the Rio Grande is typically at its lowest level. Therefore, the larger Albuquerque urban stormflows usually are a significant percentage of the mean daily discharge of the Rio Grande. The water year 2003 instantaneous peak discharge at the North Floodway Channel

gaging station was 4,650 cubic feet per second on March 21, 2003. The daily mean discharge on that day was 266 cubic feet per second or approximately 33 percent of flow of the Rio Grande at Albuquerque gaging station. The water year 2003 maximum daily mean discharge for the North Floodway Channel was 1,260 cubic feet per second, which occurred on May 16. On that day, North Floodway flow was approximately only 0.7 percent of flow of the Rio Grande at Albuquerque.

Table 3. Period of record of digitally archived unit values for urban streamflow-gaging stations. [* , Unit values recorded only during water-quality sampling events prior to 1999]

Site ID (fig. 1)	Station name	Station number	Period of record ¹
31	Campus Wash @ Albq.	08329700	03/90 - 09/03
5	Embudo Arroyo @ Albq.	08329720	10/98 - 09/03
29	North Floodway Channel @ Albq.	08329835	03/90 - 09/03
19	South Fork Hahn Arroyo @ Albq.	08329838	06/92 - 07/03
20	North Fork Hahn Arroyo @ Albq.	08329839	06/92 - 07/03
24	Hahn Arroyo @ Albq.	08329840	06/92 - 09/03
21	Grant Line Arroyo @ Villa del Oso @ Albq.	08329860	03/84 - 07/98
2	Bear Canyon Arroyo near Albq.	08329868	10/99 - 09/03
22	Academy Acres Drain @ Albq.	08329880	10/84 - 07/03
25	Pino Arroyo @ Jefferson St. @ Albq.	08329882	05/00 - 09/03
6	La Cueva Arroyo Tributary @ Albq.	08329888	05/99 - 09/03
7	La Cueva Arroyo Trib. near Albq. (@ Tramway Rd.)	08329890	09/90 - 07/95
27	N. Floodway Channel near Alameda	08329900	10/88 - 09/03
13	North Camino Arroyo @ Sunset Hills in Albq.	08329911	08/97 - 09/03
18	North Camino Arroyo Trib. @ Albq.	08329914	10/93 - 09/97
45	Arroyo 19A @ Albq.	08329935	10/91 - 09/03
38	Taylor Ranch Drain @ Albq.	08329936	10/91 - 07/98
40	Mariposa Diversion of San Antonio Arroyo @ Albq.	083299375	*10/94 - 09/03
47	Ladera Arroyo @ Albq.	08329938	10/91 - 09/03
34	San Jose Drain @ Woodward Road @ Albq.	08330200	*09/99 - 09/03
8	Tramway Floodway Channel @ Albq	08330540	10/94 - 09/03
33	Tijeras Arroyo near Albq.	08330600	03/96 - 09/03
36	South Diversion Channel above Tijeras Arroyo	08330775	10/94 - 09/03
43	Amole del Norte Channel @ Albq.	08331118	04/00 - 09/03

¹Data collected prior to dates listed are archived in paper-tape format.

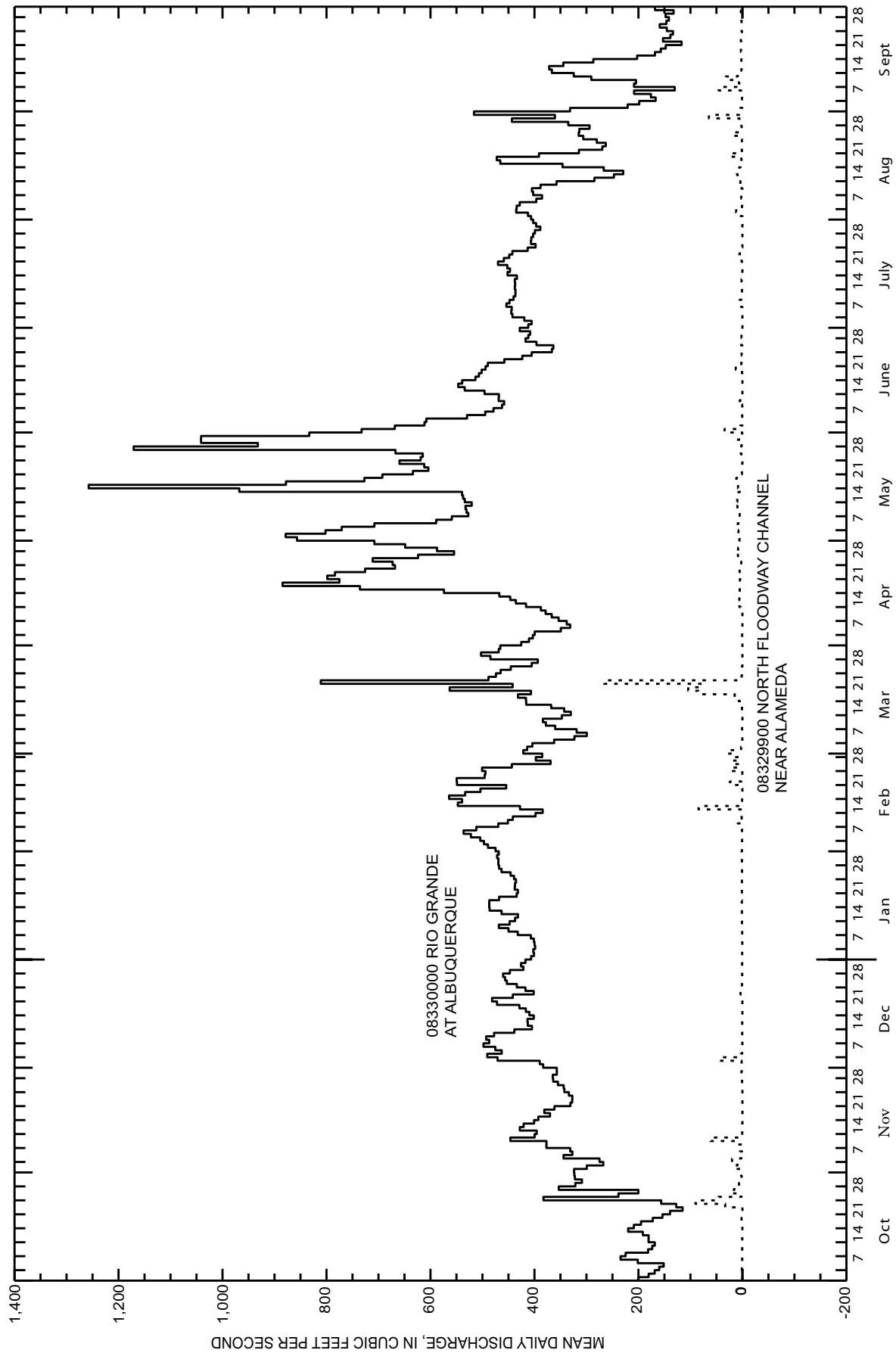
Table 4. Period of record of digitally archived unit values for urban rain-gage sites.

Site ID (fig. 1)	Station name	Station number	Period of record ¹
1	Bear Canyon in Albuquerque	350859106274330	10/84 - 09/03
3	Elena Gallegos Picnic Area @ Albq.	350954106282330	10/94 - 09/03
4	Embudo Canyon @ Albuquerque	350554106283230	06/99 - 09/03
7	La Cueva Arroyo Trib. nr. Albuquerque (@ Tramway Rd.)	08329890	07/77 - 09/03
8	Tramway Floodway Channel @ Albq.	08330540	04/01 - 09/03
9	Fire Station #16 in Albuquerque	350756106305430	10/84 - 09/03
10	Walker Pump Station	351023106313930	04/02 - 09/03
11	Borland Rain Gage in Albuquerque	350713106314230	10/84 - 09/03
12	Tanoan Rain Gage @ Albuquerque	350924106315630	04/91 - 09/03
14	Kirtland Air Force Base @ Eubank Gate, Albq.	350310106320930	06/01 - 09/03
15	Leonard Rain Gage in Albuquerque	350722106325030	04/84 - 09/03
16	Thomas Pump Station @ Albuquerque	350755106325830	10/94 - 09/03
17	Love Pump Station @ Albq.	350540106333230	09/02 - 09/03
18	North Camino Arroyo Trib. @ Albuquerque	08329914	06/79 - 09/03
19	South Fork Hahn Arroyo @ Albuquerque	08329838	10/78 - 09/03
20	North Fork Hahn Arroyo @ Albuquerque	08329839	06/79 - 07/03
21	Grant Line Arroyo @ Villa del Oso @ Albq.	08329860	06/76 - 07/03
22	Academy Acres Drain @ Albuquerque	08329880	07/76 - 09/03
23	USGS Office at Albq.	350748106345830	08/00 - 09/03
24	Hahn Arroyo @ Albuquerque	08329840	10/78 - 09/03
27	North Floodway Channel near Alameda	08329900	12/01 - 09/03
26	Tijeras Arroyo @ Montessa Park near Albq.	08330580	10/95 - 09/03
28	Orlando Romero Rain Gage in Albq.	350417106363330	03/01 - 09/03
29	North Floodway Channel @ Albuquerque	08329835	07/99 - 09/03
30	AMAFCA Headquarters near Albuquerque	350627106364630	09/97 - 09/03
31	Campus Wash @ Albuquerque	08329700	10/84 - 09/03
32	Bernalillo County Building near Albq.	350340106385230	09/97 - 09/03
34	San Jose Drain @ Woodward Road @ Albq.	08330200	12/94 - 09/03
35	Albuquerque City Hall @ Albuquerque	350448106390230	10/94 - 09/03
37	Wastewater Treatment Plant @ Albq.	350119106394630	08/00 - 09/03
38	Taylor Ranch Drain @ Albuquerque	08329936	08/78 - 09/03
39	Swinburn Dam Rain Gage @ Paradise Hills	351216106421330	08/00 - 09/03
41	Petroglyphs Park @ Albuquerque	350939106430930	02/95 - 09/03
42	TM Kelly Rain Gage @ Rio Rancho	351516106431430	10/02 - 09/03
44	Leavitt Pump Station @ Albuquerque	350310106434930	08/00 - 09/03
45	Arroyo 19A @ Albuquerque	08329935	06/77 - 09/03
46	Fire Station #14 in Albuquerque	350357106434930	10/84 - 09/03
47	Ladera Arroyo @ Albuquerque	08329938	05/87 - 09/03
48	Emergency Dispatch Bldg. @ Albq.	350348106453230	10/00 - 09/03
49	La Boca Negra near Albuquerque	350912106455630	10/90 - 09/03
50	Crown Towers @ Nine Mile Hill @ Albq.	350400106465630	08/00 - 09/03

¹Data collected prior to dates listed are archived in paper-tape format.



Figure 2. (A) La Cueva rain gage, (B) recorder next to rain gage, and (C) view inside of rain gage.



2003

Figure 3. Discharge at the North Floodway Channel near Alameda in comparison to discharge at the Rio Grande at Albuquerque stream-gaging stations.

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**RUNOFF DATA SUMMARY,
WATER YEAR 2003
(arranged by station number)**

SURFACE-WATER RUNOFF DATA FOR WATER YEAR 2003

This section presents the daily mean discharge tables for the 20 streamflow-gaging stations operating in water year 2003. Detailed location descriptions, drainage areas, periods of record, and statistical summaries are included in each table. No statistical analysis is computed for the gaging stations not operated continuously during water years 2002 and 2003. A station-specific analysis supplements each daily values table and includes a description of monitoring equipment, problems associated with data collection during the water year, and other information used to compute streamflow discharge. The annual maximum peak stage and annual maximum peak discharge for water year 2003 and for the period of record for all 20 gaging stations are listed in table 5.

Table 5. Maximum flood peak stage and discharge for water year 2003 and for the period of record.

Station number	Station name	Date station was established	Date of peak	Water year 2003		Period of record			Remarks
				Maximum stage (ft)	Maximum peak (ft ³ /s)	Date of peak	Maximum stage (ft)	Maximum peak (ft ³ /s)	
08329700	Campus Wash @ Albq.	Apr-82	3/20/03	1.97	302	7/14/90	4.5	1,230	
08329720	Embudo Arroyo @ Albq.	Oct-98	3/20/03	1.66	1.6	8/14/01	3.24	12	
08329835	N. Floodway Channel @ Albq.	May-82	3/21/03	7.5	3,240	7/9/88	12.1	8,180	
08329839	North Fork Hahn Arroyo	June-92	10/22/02	1.26	32	8/1/93	1.9	219	Discontinued 7/03
08329838	South Fork Hahn Arroyo	June-92	3/21/03	2.69	248	6/16/99	4.72	1,300	Discontinued 7/03
08329840	Hahn Arroyo @ Albq.	June-78	9/7/03	1.75	258	6/16/99	5.98	6,230	
08329868	Bear Canyon Arroyo nr. Albq.	Oct-99	--	0	0	--	0	0	No flows in 2003
08329880	Academy Acres Drain @ Albq.	June-76	10/24/02	2.41	10	8/3/78	4.09	88	Discontinued 7/03
08329882	Pino Arroyo at Jefferson St.	May-00	3/21/03	2.4	212	9/14/01	3.21	541	
08329888	La Cueva Arroyo Trib. @ Albq.	May-99	10/24/02	1.54	11	8/14/01	1.56	12	
08329900	N. Floodway Channel nr. Alameda	July-68	3/21/03	6.3	4,650	8/14/80	10.4	12,300	
08329911	N. Camino Arroyo @ Sunset Hills	Aug-97	10/23/02	1.19	9.3	7/23/01	1.38	39	
08329935	Arroyo 19A @ Albq.	June-77	--	0	0	8/2/99	2.93	234	No flows in 2003
083299375	Mariposa Div. of San Antonio Arr.	June-92	10/23/02	2.65	50	8/4/99	4.8	251	
08329938	Ladera Arroyo @ Albq.	May-81	--	0	0	8/2/99	4.12	195	No flows in 2003
08330200	San Jose Drain at Woodward Rd.	Oct-93	3/20/03	3.36	32	8/14/94	6.57	99	
08330540	Tramway Floodway Channel	July-87	9/7/03	2.12	132	7/9/88	8.62	3,250	
08330600	Tijeras Arroyo near Albq.	Oct-51	3/21/03	4.64	331	7/9/88	9.6	2,930	
08330775	South Diversion Channel	June-88	3/21/03	3.05	199	7/14/90	6.3	1,960	
08331118	Amole del Norte Channel @ Albq.	Apr-00	7/20/03	4.81	366	7/20/03	4.81	366	

08329700 CAMPUS WASH AT ALBUQUERQUE, NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger, recording stage and rainfall at 5-minute intervals, and a pressure transducer are housed in a metal 5- by 5-foot walk-in shelter on the right bank of the concrete-lined channel. The reference gage is an outside staff gage painted on both sidewalls of the channel. High-water measurements can be made from a bridge located 600 feet upstream, but flow velocities are extremely fast, so discharges computed from the theoretical rating are considered more accurate than measurements. A tipping-bucket rain gage is also located at this site. The datalogger was installed on July 22, 1996, and the pressure transducer was installed on September 12, 1996. A CSG was installed on the left bank, directly across from the gage house, on October 8, 1998. The elevation of the lower CSG cap is 1.75 feet. The pipe is mounted on the side slope of the channel at an angle of 26.5 degrees from horizontal.

Gage-Height Record.--The recorder, which is referenced to the outside staff gage, gave a complete and satisfactory record for water year 2003, except for the following time periods. Ice formed over the orifice tubing and affected gage-height readings on November 27-28 and December 20, 25, 28 and 31, 2002, and January 2, 3-6, 8, and 18 and February 4, 6-8, 10, and 11, 2003. These estimates were based on precipitation received at this site and base flows before and after each affected day. No comparison gage is located upstream from this gage, and the downstream gage at the North Floodway Channel at Albuquerque (08329835) does not correlate well because most of its flow originates from an ungaged tributary. This gage is operational the entire year.

Rating.--The control for this station is the concrete-lined channel. The bottom width of the channel is 10 feet. The slope of the sides is 26.5 degrees from horizontal. The depth of the channel at this point is about 20 feet. The point of zero flow (PZF) is 0.00 foot (1.00-foot recorded gage height because of the +1.00 foot datum added to true depths).

During water year 2003, 25 visits were made to the gaging station. The peak gage height for the water year was 1.97 feet (2.97 on recorder), correlating to a maximum discharge of 302 cubic feet per second.

Rating no. 1.0 was developed in water year 1982. It was based on a step-backwater analysis of the concrete-lined channel using the USGS software package WSPRO (Water Surface Profile Computations). Rating 1.0 did not compute any flow below a gage height of 0.15 foot, which corresponded to 3.29 cubic feet per second. This "nuisance flow" was not evaluated prior to October 1, 1996.

Beginning in water year 1997, the low end of rating 1.0 was extended and values of discharge were calculated for all gage heights above 0.00 foot. The resulting rating, 2.0, also differs slightly from rating 1.0 in that a straight line, best-fit rating line was drawn as close as possible to the theoretical computed values. In rating 1.0, the theoretical values were actually used as input points, which do not plot as a straight line on a log-log scale. For a concrete-lined, trapezoidal-shaped channel such as this, the stage versus discharge relation should plot as a straight line.

Discharge.--Discharge was computed from rating curve 2.0 directly. The channel in this reach creates extreme velocities that keep the channel bottom completely clean. For this reason, no shifting should occur in this uniformly shaped channel. The rating curve discharges are considered to be more reliable than any individual measurement.

Remarks.--Records are good, except those that were estimated because of ice or recorder malfunctions, which are rated poor. Any estimated mean daily discharges are based on precipitation records from this site and base flows typical for the time of year. In recent years, low-flow drainage has been increasing and some water is nearly always present in the channel that is not rainfall related (nuisance flows). Prior to water year 1997, all days with discharges determined to be only nuisance flow were labeled days of zero flow (gage heights less than 0.15 foot and less than 3.3 cubic feet per second on rating 1.0). Since October 1, 1996, all low-end flow has been calculated using the new rating 2.0 directly.

RIO GRANDE BASIN

08329700 CAMPUS WASH AT ALBUQUERQUE, NM

LOCATION.--Lat 35°05'38", long 106°37'25", in SE 1/4 sec.16, T.10 N., R.3 E., Bernalillo County, Hydrologic Unit 13020203, on right bank 100 ft west of southwest corner of University of New Mexico North Golf Course, 200 ft downstream from Barelás Stormwater Pumping Station outfall, 600 ft downstream from Tucker Road bridge, and 1,500 ft northeast of intersection of Lomas and University Boulevards, in Albuquerque.

DRAINAGE AREA.--3.80 mi².

PERIOD OF RECORD.--April 1982 to September 1996 (seasonal records), October 1996 to current year.

GAGE.--Water-stage and rainfall recorder and concrete-lined channel. Elevation of gage is 5,143 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good except for those estimated, which are poor. Recording rain gage at station. Prior to water year 1997, some minor streamflow may exist on days when daily mean discharges have been recorded as zero due to the sensitivity limits of the streamflow monitoring equipment. See tabulation below for monthly precipitation, in inches.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.56	0.47	0.39	0.57	0.04	0.69	0.23	0.35	3.9	0.24	0.25	0.28
2	0.57	0.43	0.46	e0.30	0.03	0.33	0.40	0.44	0.26	0.28	0.13	0.36
3	0.56	0.35	4.8	e0.40	0.09	0.27	0.45	0.44	0.16	0.20	0.42	0.55
4	0.51	1.2	0.78	0.40	e0.10	0.32	0.42	0.43	0.21	0.09	0.39	0.64
5	0.43	0.42	0.19	0.25	0.16	0.31	0.36	0.37	0.17	0.11	0.15	0.75
6	0.49	0.47	0.30	0.71	e0.10	0.34	0.32	0.32	0.19	0.10	0.23	0.30
7	0.58	0.39	0.33	1.1	e0.10	0.40	0.40	0.35	0.15	0.18	0.13	0.35
8	0.65	0.39	0.11	e1.0	e0.30	0.36	0.50	0.25	0.09	0.27	0.20	0.53
9	0.62	5.0	0.35	0.75	1.0	0.40	0.50	0.21	0.36	0.10	0.40	0.78
10	0.51	2.7	0.54	0.77	e0.10	0.30	0.48	0.18	0.25	0.25	0.30	1.3
11	0.42	0.37	0.54	0.84	e0.10	0.13	0.58	0.15	0.25	0.25	1.2	0.63
12	0.42	0.53	0.71	0.53	0.26	0.16	0.47	0.21	0.20	0.18	0.48	0.71
13	0.46	0.58	0.40	0.37	5.9	0.08	0.45	0.26	0.18	0.16	0.48	0.31
14	0.60	0.47	0.34	0.44	0.78	0.07	0.47	0.25	0.04	0.30	0.27	0.25
15	0.52	0.34	0.30	0.38	0.28	0.05	0.45	0.37	0.12	0.11	0.67	0.40
16	0.51	0.31	0.35	0.45	0.29	0.44	0.43	0.25	0.37	0.05	0.25	0.49
17	0.61	0.25	0.36	0.44	0.37	0.93	0.53	0.15	0.27	0.21	0.30	0.40
18	0.54	0.27	0.37	e0.50	0.40	9.8	0.43	0.26	0.22	0.26	2.4	0.58
19	0.46	0.28	0.76	0.67	0.32	5.2	0.57	0.41	1.5	0.20	1.1	0.59
20	0.45	0.39	e0.60	0.42	2.3	13	0.54	0.36	0.29	0.65	0.35	0.41
21	0.50	0.46	0.62	0.34	0.30	7.1	0.50	0.43	0.13	0.37	0.28	0.31
22	1.8	0.35	0.26	0.37	0.24	0.07	0.37	0.30	0.09	1.1	0.13	0.40
23	4.4	0.31	0.17	0.37	1.4	0.04	0.32	0.28	0.05	0.35	0.15	0.41
24	1.8	0.30	0.70	0.38	2.1	0.11	0.38	0.13	0.22	0.31	0.36	0.46
25	0.59	0.29	e0.30	0.38	0.41	0.23	0.41	0.21	0.14	0.10	1.8	0.37
26	1.1	0.19	0.21	0.37	1.1	0.10	0.34	0.74	0.15	0.05	0.34	0.37
27	1.1	e0.30	0.25	0.35	0.43	0.19	0.37	0.47	0.19	0.08	0.34	0.35
28	0.51	e0.40	e0.20	0.38	2.0	0.08	0.39	0.30	0.06	0.28	0.57	0.54
29	0.47	0.53	0.21	0.13	---	0.09	0.46	0.36	0.05	0.12	0.56	1.2
30	0.42	0.21	0.20	0.07	---	0.05	0.42	0.27	0.25	0.41	3.1	0.43
31	0.46	---	e0.20	0.09	---	0.08	---	0.28	---	0.26	0.50	---
TOTAL	23.62	18.95	16.30	14.52	21.00	41.72	12.94	9.78	10.51	7.62	18.23	15.45
MEAN	0.76	0.63	0.53	0.47	0.75	1.35	0.43	0.32	0.35	0.25	0.59	0.52
MAX	4.4	5.0	4.8	1.1	5.9	13	0.58	0.74	3.9	1.1	3.1	1.3
MIN	0.42	0.19	0.11	0.07	0.03	0.04	0.23	0.13	0.04	0.05	0.13	0.25
AC-FT	47	38	32	29	42	83	26	19	21	15	36	31
(+)	0.40	0.38	0.16	0.0	0.78	1.26	0.04	0.08	0.47	0.04	0.47	0.15

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1997 - 2003, BY WATER YEAR (WY)

MEAN	1.21	0.60	0.39	0.36	0.47	0.96	0.75	0.64	0.92	1.36	1.48	1.07
MAX	2.39	0.76	0.58	0.52	0.75	1.97	1.32	1.06	1.65	2.43	2.49	2.44
(WY)	(2001)	(2001)	(2002)	(2002)	(2003)	(1998)	(1997)	(1998)	(2000)	(1997)	(1999)	(1997)
MIN	0.54	0.46	0.096	0.15	0.15	0.26	0.43	0.32	0.35	0.25	0.59	0.51
(WY)	(1998)	(1999)	(1997)	(1998)	(1997)	(1997)	(2003)	(2003)	(2003)	(2003)	(2003)	(2003)

SUMMARY STATISTICS

	FOR 2002 CALENDAR YEAR		FOR 2003 WATER YEAR		WATER YEARS 1997 - 2003	
ANNUAL TOTAL	268.68		210.64			
ANNUAL MEAN	0.74		0.58		0.86	
HIGHEST ANNUAL MEAN					1.09	
LOWEST ANNUAL MEAN					0.58	
HIGHEST DAILY MEAN	17	Jun 14	13	Mar 20	39	Mar 15, 1998
LOWEST DAILY MEAN	0.01	May 12	0.03	Feb 2	0.00	Nov 28, 1996
ANNUAL SEVEN-DAY MINIMUM	0.22	Dec 25	0.08	Jan 29	0.05	Jan 6, 1997
MAXIMUM PEAK FLOW			302	Mar 20	1,230	Jul 14, 1990
MAXIMUM PEAK STAGE			1.97	Mar 20	4.50	Jul 14, 1990
ANNUAL RUNOFF (AC-FT)	533		418		620	
10 PERCENT EXCEEDS	0.86		0.78		1.1	
50 PERCENT EXCEEDS	0.52		0.37		0.48	
90 PERCENT EXCEEDS	0.28		0.11		0.15	

(+) Total precipitation accumulation, in inches.
e Estimated

08329720 EMBUDO ARROYO AT ALBUQUERQUE, NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--This station was established on October 2, 1998. An electronic datalogger and pressure transducer are housed in a metal 2.5- by 2.5- by 6-foot shelter anchored to a concrete pad on the left bank of the concrete-lined portion of the channel, approximately 90 feet upstream from the Monte Largo bridge. On September 12, 2001, an ISCO model 6700 automatic water-quality sampler was installed and housed in a separate metal shelter immediately adjacent to the gage shelter. The site is located east of Tramway Boulevard, between Indian School Road and Rover Street, on Albuquerque's far east side. The 30-foot-long orifice line is anchored immediately upstream from the 1-foot-wide, 26-inch-high concrete wall that spans the entire channel. A 12-inch-wide, U-shaped notch cut into the concrete wall acts as the low-flow control. An outside staff gage, with an attached CSG, is mounted approximately 24 inches upstream from the orifice and is the reference gage. The elevation of the CSG lower cap is 1.66 feet above the PZF. High-water measurements are computed by indirect methods. Low-water wading measurements are made in the vicinity of the gage.

Gage-Height Record.--The recorder gave a complete and satisfactory record during water year 2003. The recorder will sense water levels only above a stage of 1.04 feet because the orifice is mounted 0.05 foot above the PZF. This prevents sediment from covering the orifice during flow events. At a stage of 1.05 feet, the computed discharge is 0.04 cubic foot per second.

Rating.--The channel below the gage orifice is trapezoidal shaped and concrete lined. The bottom width is 39 feet. The channel continues straight downstream for 120 feet before gently bending toward the left bank after passing under the Monte Largo bridge. Upstream from the gage orifice, the channel consists of a wide, flat slope for approximately 50 feet, and its bottom material is coarse sand. This approach immediately upstream from the gage is a settling area for stream sediments after passing over a 10-foot-high, concrete, stair-stepped wall. A 26-inch-high concrete wall separates the concrete-lined portion of the channel downstream and the natural channel upstream. A 1-foot-wide notch cut into the concrete wall is the low-flow control. The concrete wall is 12 inches thick and flat topped, so flows breaching this wall are effectively controlled by this broad-crested weir. For rating development purposes, the 1-foot-wide notch was treated as a 1-foot-long box culvert in theoretical discharge computations. The rating breaks sharply to the right, at gage heights exceeding 3.17 feet, when flows begin to breach the entire concrete wall. Broad-crested weir flow equations were used to compute this portion of the rating. An offset of 2.5 was used for this middle section.

When flow depths exceed 1.5 feet above the wall or gage heights over approximately 4.77 feet, the concrete wall acts as a sharp-crested weir because the turbulence caused by the upstream face of the vertical wall clears the downstream face, effectively converting flows to a sharp-crested weir type. The upper section of the rating breaks even further to the right than the middle portion. Flows downstream from the concrete control wall are supercritical but in the approach section are subcritical.

The extremely flashy nature of this stream makes it difficult to obtain discharge measurements, so the theoretical rating is the most reliable until more measurements are available. In water year 2003, 21 site inspections were made, none during a time of flow. The peak stage and discharge recorded for water year 2003 were 1.66 feet and 1.6 cubic feet per second, respectively, on March 20.

Discharge.--Discharges were calculated by applying rating 1 directly. The PZF is a gage height of 1.00 foot, but zero flow is also computed for any gage heights below 1.05 feet because the orifice is mounted 0.05 foot above the PZF. No stations are available for comparison.

RIO GRANDE BASIN

08329720 EMBUDO ARROYO AT ALBUQUERQUE, NM

LOCATION.--Lat 35°06'08", long 106°29'33", in NW ¼ NE ¼ sec.14, T.10 N., R.4 E., Bernalillo County, Hydrologic Unit 13020203, on left bank of concrete-lined channel, approximately 90 ft upstream from Monte Largo bridge over Embudo Arroyo, between Indian School Road to the south and Rover Street to the north in Albuquerque.

DRAINAGE AREA.--3.8 mi².

PERIOD OF RECORD.--October 1998 to current year.

GAGE.--Water-stage recorder, crest-stage gage, and concrete weir control. Elevation of gage is 5,925 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good. Recording rain gage located in drainage basin, approximately 1 mi upstream. Site used for gathering water-quality data for undeveloped upper drainage basin, which represents undeveloped foothill east of Albuquerque.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00	---	0.00	0.00	---	0.00	---	0.00	---	0.00	0.00	---
TOTAL	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00
MEAN	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000
MAX	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AC-FT	0.00	0.00	0.00	0.00	0.00	0.2	0.00	0.00	0.00	0.00	0.00	0.00

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1999 - 2003, BY WATER YEAR (WY)

	2001	2002	1999	2000	1999	2003	1999	1999	2000	2000	1999	2001
MEAN	0.002	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.005	0.000
MAX	0.010	0.002	0.000	0.000	0.000	0.004	0.000	0.000	0.002	0.004	0.014	0.001
(WY)	(2001)	(2001)	(1999)	(1999)	(1999)	(2003)	(1999)	(1999)	(2000)	(2000)	(1999)	(2001)
MIN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(WY)	(2000)	(1999)	(1999)	(1999)	(1999)	(1999)	(1999)	(1999)	(1999)	(2002)	(2002)	(1999)

SUMMARY STATISTICS

	FOR 2002 CALENDAR YEAR		FOR 2003 WATER YEAR		WATER YEARS 1999 - 2003	
ANNUAL TOTAL	0.00		0.11			
ANNUAL MEAN	0.000		0.000		0.001	
HIGHEST ANNUAL MEAN					0.002	2001
LOWEST ANNUAL MEAN					0.000	2002
HIGHEST DAILY MEAN	0.00	Jan 1	0.09	Mar 21	0.29	Aug 3, 1999
LOWEST DAILY MEAN	0.00	Jan 1	0.00	Oct 1	0.00	Oct 1, 1998
ANNUAL SEVEN-DAY MINIMUM	0.00	Jan 1	0.00	Oct 1	0.00	Oct 1, 1998
MAXIMUM PEAK FLOW			1.6	Mar 20	12	Aug 14, 2001
MAXIMUM PEAK STAGE			1.66	Mar 20	3.24	Aug 14, 2001
ANNUAL RUNOFF (AC-FT)	0.00		0.2		0.7	
10 PERCENT EXCEEDS	0.00		0.00		0.00	
50 PERCENT EXCEEDS	0.00		0.00		0.00	
90 PERCENT EXCEEDS	0.00		0.00		0.00	

08329835 NORTH FLOODWAY CHANNEL AT ALBUQUERQUE, NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--A pressure transducer and electronic datalogger with a speech/telephone modem were installed on July 22, 1999, and are housed in a metal 5- x 5-foot walk-in shelter on the right bank of the concrete-lined channel. A tipping-bucket rain gage was installed on the roof of the shelter on July 23, 1999, and is also recorded by the datalogger. Both water-stage and rainfall data are recorded at 5-minute intervals. An outside staff gage is painted on the inclined, channel side slopes and is the reference gage. Since July 26, 2001, this site has been a test location for a prototype radar stage sensor developed by the USGS Hydrologic Instrumentation Facility. The radar is housed in a metal shelter mounted to the hand railing of the Candelaria Boulevard bridge and transmits data by radio to the gage house and datalogger.

Gage-Height Record.--The recorder, referenced to the outside staff gage, gave a complete and satisfactory record for water year 2003, except October 1-3, 2002, when the datalogger memory malfunctioned due to a power failure. The orifice was covered with ice on November 27 and December 9-11 and 24-28, 2002, and January 2-5, 2003. All estimated mean daily discharges were based on flows before and after the affected period, flow records at the downstream Alameda gage (08329900) and upstream Campus Wash gage (08329700), and precipitation records. Instantaneous discharges remained near base flow (0.5 to 1.5 cubic feet per second) for all estimates, so mean daily discharges were not significantly affected. This station had previously been closed for winter months, but since water year 2000 has been operated all year.

Rating.--The control for the station is the concrete-lined channel. The bottom width of the channel is 30 feet. The slope of the sidewalls is approximately 27 degrees from horizontal. The depth of the channel at this location is about 30 feet and its top width is 137 feet. The channel slope at this site is much less (0.0009 foot per foot) than the downstream gage near Alameda (approximately 0.0047 foot per foot). Flows are subcritical for all stages at this location, but are supercritical at the Alameda gage at most gage heights.

During water year 2003, 49 inspections were made at the gaging station. Only extremely low flow measurements are attempted at this location because of the dangers of floating debris during most flows. The theoretical rating for this uniformly shaped, concrete-lined channel is considered more accurate than individual measurements.

Rating 1.0, effective in previous years, was replaced by a new rating, 2.0, in water year 2001. The old rating appeared to have been based on four low-flow discharge measurements. The channel was resurveyed in December 2001 and a step-backwater analysis was completed for this site using WSPRO software. The analysis assumed a Manning's n-value of 0.016 for channel bottom roughness, prorated to 0.014 over 4 feet of depth. Slight differences between the two ratings are apparent, especially at higher discharges. The old rating did not compute discharges for gage heights under 0.30 foot (11.4 cubic feet per second), whereas the new rating, 2.0, computes a discharge for all stages above the PZF (0.00-foot gage height). Because the base flow at this location is approximately 0.5 to 3.0 cubic feet per second year-round, the new rating computes a significantly larger volume of base flow passing this gage each year and returning to the Rio Grande. All previous years' records (since 1982) have been revised using the new rating.

Discharge.--Discharges were computed for water year 2003 using the new rating curve 2.0. The channel in this reach creates velocities that keep the channel bottom fairly clean, and for this reason, no shifting should occur. Discharges less than 11.4 cubic feet per second (gage heights

less than 0.30 foot) were reported as zero flow prior to water year 2001 and are generally not the result of rainfall runoff. Beginning in water year 2001, all discharges above the PZF have been computed. The maximum stage during water year 2003 was 7.50 feet, corresponding to a discharge of 3,240 cubic feet per second on March 21.

RIO GRANDE BASIN

08329835 NORTH FLOODWAY CHANNEL AT ALBUQUERQUE, NM

LOCATION.--Lat 35°07'03", long 106°36'42", in SE 1/4 sec.3, T.10 N., R.3 E., Bernalillo County, Hydrologic Unit 13020203, on right bank of concrete-lined drainage channel, 300 ft downstream (north) of bridge on Candelaria Boulevard NE, and 3,000 ft downstream from confluence of Campus Wash and Embudo Arroyo in Albuquerque.

DRAINAGE AREA.--40.0 mi².

PERIOD OF RECORD.--May 1982 to September 1999 (seasonal records), October 1999 to current year.

GAGE.--Water-stage recorder and recording tipping-bucket rain gage with 0.01-in. increments, and concrete-lined channel. Elevation of gage is 5,110 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good except for those estimated, which are poor. Prior to water year 2001, some minor streamflow may exist on days when daily mean discharges have been recorded as zero due to the sensitivity limits of the streamflow monitoring equipment. See tabulation below for monthly precipitation, in inches.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e1.0	2.4	1.2	1.1	0.34	7.4	0.58	4.5	30	0.88	0.85	3.1
2	e1.0	6.9	1.5	e1.0	0.15	1.2	0.97	4.3	1.6	0.62	3.5	0.70
3	e1.0	0.90	22	e1.0	0.03	1.0	1.0	7.6	0.62	0.41	1.5	1.7
4	2.0	7.4	2.1	e1.0	0.29	0.97	0.94	8.0	0.87	0.56	1.1	2.1
5	0.82	1.4	1.2	e1.0	0.91	1.0	0.36	4.9	0.60	0.43	0.47	2.3
6	0.67	2.3	1.5	0.91	0.68	1.0	0.26	4.8	0.59	0.74	1.4	2.7
7	0.99	1.7	1.5	1.1	0.92	1.5	0.71	4.5	0.38	3.4	2.2	35
8	1.1	1.1	1.2	1.0	2.1	1.1	1.1	4.5	0.50	2.7	0.70	0.96
9	0.96	26	e1.0	0.99	6.2	1.00	1.1	4.3	6.8	1.0	1.0	2.7
10	0.91	23	e1.0	0.96	1.1	0.88	1.3	8.1	3.2	1.3	6.3	10
11	0.69	1.00	e1.0	1.5	0.73	0.86	4.3	7.9	0.51	1.3	1.7	1.7
12	0.68	0.88	1.5	0.87	0.72	0.78	6.8	4.6	0.37	1.3	6.1	1.2
13	0.46	1.1	1.2	0.88	58	0.85	6.6	4.5	0.72	1.5	2.3	1.2
14	1.1	0.75	1.1	0.96	2.1	0.84	3.7	4.1	0.39	1.4	2.5	1.6
15	1.2	0.74	0.69	0.86	0.52	0.80	5.5	0.79	0.24	0.82	2.8	0.97
16	1.0	0.81	1.1	0.90	0.29	4.4	3.9	4.4	0.42	0.74	1.9	0.95
17	2.1	0.57	0.90	1.1	0.33	7.3	3.6	7.3	2.0	0.74	2.0	1.1
18	2.6	0.62	0.83	0.98	0.86	68	3.7	7.4	1.3	0.73	3.4	1.0
19	1.4	0.78	1.1	0.84	0.50	53	7.1	4.7	6.1	2.2	12	0.47
20	0.74	1.1	2.5	0.77	13	82	6.9	0.68	1.3	2.2	1.2	1.1
21	0.78	1.0	1.6	0.82	0.51	119	3.9	0.79	0.60	5.2	1.1	1.3
22	13	1.3	3.0	0.97	0.29	0.92	4.0	0.67	0.81	2.6	0.55	1.2
23	46	0.92	0.75	0.88	0.72	1.1	4.0	0.59	1.1	1.1	1.0	0.97
24	8.7	0.65	e1.0	0.89	15	0.73	4.0	0.60	1.2	0.69	4.1	1.0
25	0.90	0.91	e1.0	0.94	1.7	0.84	4.2	3.1	0.76	0.46	5.3	0.78
26	15	0.83	e1.0	0.81	11	0.52	7.3	2.4	2.9	0.48	1.1	0.72
27	9.9	e1.0	e1.0	0.75	2.0	1.2	7.4	1.8	1.6	0.79	0.87	1.1
28	1.8	1.2	e1.0	0.86	15	0.64	4.1	1.9	2.6	0.59	2.5	1.5
29	1.1	1.8	1.1	1.1	---	0.70	4.2	4.7	0.46	0.41	2.5	1.5
30	0.98	1.4	0.83	0.38	---	0.44	4.2	0.59	0.31	0.61	25	0.96
31	1.7	---	1.0	0.40	---	0.33	---	0.63	---	0.80	2.1	---
TOTAL	122.28	92.46	59.40	28.52	135.99	362.30	107.72	119.64	70.85	38.70	101.04	83.58
MEAN	3.94	3.08	1.92	0.92	4.86	11.7	3.59	3.86	2.36	1.25	3.26	2.79
MAX	46	26	22	1.5	58	119	7.4	8.1	30	5.2	25	35
MIN	0.46	0.57	0.69	0.38	0.03	0.33	0.26	0.59	0.24	0.41	0.47	0.47
AC-FT	243	183	118	57	270	719	214	237	141	77	200	166
(+)	0.58	0.34	0.34	0.0	0.88	1.84	0.06	0.18	0.17	0.04	0.51	0.43

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 2000 - 2003, BY WATER YEAR (WY)

	2000	2001	2002	2003	2000	2001	2002	2003	2000	2001	2002	2003
MEAN	9.34	4.91	2.63	2.57	3.57	7.62	3.70	2.78	4.45	5.75	8.73	5.12
MAX	26.2	8.68	3.25	3.88	4.86	12.5	5.27	4.07	7.95	9.51	11.7	10.0
(WY)	(2001)	(2001)	(2001)	(2001)	(2003)	(2000)	(2001)	(2001)	(2000)	(2001)	(2001)	(2002)
MIN	2.25	2.94	1.92	0.92	0.93	0.75	1.83	1.06	2.36	1.25	3.26	2.79
(WY)	(2002)	(2000)	(2003)	(2003)	(2002)	(2002)	(2000)	(2002)	(2003)	(2003)	(2003)	(2003)

SUMMARY STATISTICS

	FOR 2002 CALENDAR YEAR		FOR 2003 WATER YEAR		WATER YEARS 2000 - 2003	
ANNUAL TOTAL	1,443.16		1,322.48			
ANNUAL MEAN	3.95		3.62		5.12	
HIGHEST ANNUAL MEAN					7.61	
LOWEST ANNUAL MEAN					3.62	
HIGHEST DAILY MEAN	110	Sep 10	119	Mar 21	206	Oct 23, 2000
LOWEST DAILY MEAN	0.10	May 13	0.03	Feb 3	0.03	Feb 3, 2003
ANNUAL SEVEN-DAY MINIMUM	0.41	Jun 24	0.36	Jan 30	0.36	Jan 30, 2003
MAXIMUM PEAK FLOW			3,240	Mar 21	8,180	Jul 9, 1988
MAXIMUM PEAK STAGE			7.50	Mar 21	12.10	Jul 9, 1988
ANNUAL RUNOFF (AC-FT)	2,860		2,620		3,710	
10 PERCENT EXCEEDS	4.5		6.8		6.9	
50 PERCENT EXCEEDS	1.1		1.1		2.1	
90 PERCENT EXCEEDS	0.57		0.57		0.75	

(+) Total precipitation accumulation, in inches.
e Estimated

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger is housed in an oversized 40- by 40-inch metal shelter over a 10-foot-long, 24-inch CMC stilling well. The well is mounted to the south bank of the concrete-lined channel. Inside and outside staff gages are available for references. An electric-tape gage was also installed as a reference gage on August 14, 1998. Flow velocities are extremely fast, preventing high-water measurements from the Louisiana Boulevard bridge, about 300 feet downstream from the gage. The theoretical rating is more accurate than any single measurement. A tipping-bucket rain gage is mounted to the roof the of shelter and housed in a 12-inch steel pipe enclosure. A CSG is located 15 feet upstream from the stilling well, mounted to the concrete side slope, and inclined 32.5 degrees from horizontal. The CSG cap lip is at an equivalent gage height of 2.41 feet. High-water marks are recorded in the stilling well by a peak-stage indicator (PSI) clip.

Gage-Height Record.--The recorder, referenced to the electric tape gage, gave a complete and satisfactory record for water year 2003. On July 11, 2003, this station was shut down indefinitely. A complete water year record has been available since water year 1997; the gage was not operational during the winter months prior to that.

Rating.--The control for this station is the concrete-lined channel. Rating 2.0 was developed from a theoretical step-backwater analysis after the gage was moved to its present location in June 1992. After review of rating 2.0 in 1998, an error was discovered in the computations. A new rating, 2.1, was substituted for June 11, 1992, to July 6, 1993, when the channel bottom was elevated approximately 0.24 foot. Discharge records were revised for that period in 1999. From July 6, 1993, to September 30, 1998, a datum correction of -0.24 foot was applied to correct for the channel changes. The effective PZF was changed from 1.00 to 1.24 feet. The station levels of 1998 determined that the PZF was actually 1.22 feet. In addition to elevation of the channel bottom during the channel work of July 6, 1993, curbs were installed along the sides of the channel. However, these curbs were not incorporated into a new rating analysis. In water year 1998, a new rating, 3.0, was developed by theoretical step-backwater analysis, taking into account all the channel changes effective since July 6, 1993. Discharge records for water years 1993-97 were revised in 1999. In water year 2001, after further investigation of the theoretical rating analysis, a lower Manning's n-value of 0.016 was determined to be more accurate for the channel bottom roughness than the 0.018 used in the rating 3.0 analysis. The resulting rating, 4.0, has been effective since the channel changes on July 6, 1993, requiring another slight revision to water years 1993-2000. Rating 4.0 computes approximately 10 percent more water than rating 3.0 for equivalent gage heights in the middle flow range.

Small trickle flows, which are present nearly every day, are often not detected at this site because the channel bottom slopes slightly away from the gage. Therefore, the downstream gage at the Main Hahn Arroyo at Albuquerque (08329840) indicates a larger mean daily discharge than this gage because the Main Hahn gage detects all flows.

Discharge.--During water year 2003, 31 inspections were completed at this site. The gage height and

discharge peaked on March 21 and were 2.69 feet and 248 cubic feet per second, respectively. Discharge was computed using rating curve 4.0 directly with no shifts. Significant flow in the channel is very swift and therefore difficult to measure with conventional current meters. The channel remains free of sand, and no shifting should occur. The theoretical rating for this trapezoidal-shaped, concrete-lined channel is considered more accurate than individual measurements. Estimated mean daily discharges for ice-affected days can be based on precipitation records, base-flow patterns during the year, and downstream flow records at the Main Hahn Arroyo gage (08329840).

RIO GRANDE BASIN

08329838 SOUTH FORK HAHN ARROYO AT ALBUQUERQUE, NM

LOCATION.--Lat 35°07'16", long 106°34'04", in NE 1/4 SE 1/4 sec.1, T.10 N., R.3 E., Bernalillo County, Hydrologic Unit 13020203, on left bank 300 ft above Louisiana Boulevard, 900 ft south of Comanche Road, and 1,700 ft north of Candelaria Road, in Albuquerque.

DRAINAGE AREA.--2.03 mi².

PERIOD OF RECORD.--June 1978 to December 1983, June 1992 to September 1996 (seasonal records), October 1996 to July 2003 (discontinued).

REVISED RECORD.--WDR NM-99-1: 1992-98(M) (mean daily values).

GAGE.--Water-stage recorder and recording tipping-bucket rain gage with 0.01-in. increments, and concrete-lined channel. Elevation of gage is 5,298 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to 1983, at site 300 ft downstream on Louisiana Boulevard bridge, at different datum.

REMARKS.--Records good. Some minor streamflow may exist on days when daily mean discharges have been recorded as zero due to the sensitivity limits of the streamflow-monitoring equipment. See tabulation below for monthly precipitation, in inches.

EXTREMES FOR CURRENT YEAR.--Maximum discharge during period of seasonal operation, 248 ft³/s, Mar. 21, gage height, 2.69 ft; no flow most of the time.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.03	0.03	0.00	0.02	0.00	0.41	0.02	0.00	0.00	0.00	---	---
2	0.03	0.00	0.02	0.02	0.00	0.01	0.02	0.00	0.00	0.02	---	---
3	0.04	0.00	0.78	0.02	0.04	0.04	0.02	0.00	0.00	0.00	---	---
4	0.03	0.32	0.03	0.00	0.04	0.02	0.02	0.00	0.00	0.01	---	---
5	0.00	0.03	0.03	0.00	0.02	0.02	0.00	0.00	0.00	0.00	---	---
6	0.0	0.03	0.03	0.03	0.03	0.02	0.00	0.00	0.00	0.02	---	---
7	0.0	0.04	0.00	0.02	0.03	0.02	0.02	0.02	0.00	0.00	---	---
8	0.00	0.03	0.0	0.01	0.31	0.00	0.01	0.00	0.01	0.00	---	---
9	0.00	0.59	0.02	0.00	0.26	0.00	0.02	0.00	0.00	0.46	---	---
10	0.00	0.47	0.02	0.05	0.03	0.02	0.02	0.00	0.00	0.03	---	---
11	0.00	0.06	0.02	0.00	0.03	0.02	0.02	0.00	0.00	---	---	---
12	0.00	0.03	0.03	0.00	0.03	0.02	0.00	0.00	0.00	---	---	---
13	0.00	0.03	0.02	0.02	3.3	0.02	0.02	0.01	0.00	---	---	---
14	0.00	0.02	0.00	0.02	0.17	0.03	0.02	0.00	0.00	---	---	---
15	0.00	0.03	0.00	0.04	0.00	0.00	0.01	0.01	0.00	---	---	---
16	0.01	0.00	0.02	0.02	0.00	0.27	0.02	0.00	0.00	---	---	---
17	0.00	0.00	0.03	0.02	0.02	0.37	0.02	0.00	0.00	---	---	---
18	0.00	0.03	0.04	0.00	0.08	2.4	0.02	0.02	0.00	---	---	---
19	0.00	0.03	0.03	0.00	0.02	1.6	0.00	0.00	0.41	---	---	---
20	0.00	0.03	0.02	0.01	0.58	5.0	0.00	0.00	0.00	---	---	---
21	0.00	0.03	0.00	0.03	0.03	4.6	0.01	0.00	0.00	---	---	---
22	0.21	0.03	0.00	0.02	0.00	0.00	0.01	0.00	0.00	---	---	---
23	1.4	0.00	0.02	0.03	0.00	0.01	0.00	0.05	0.00	---	---	---
24	0.47	0.00	0.03	0.02	0.50	0.02	0.00	0.00	0.00	---	---	---
25	0.03	0.03	0.03	0.00	0.06	0.04	0.00	0.02	0.00	---	---	---
26	0.58	0.03	0.02	0.00	0.76	0.02	0.00	0.00	0.00	---	---	---
27	0.10	0.03	0.02	0.01	0.06	0.02	0.03	0.00	0.00	---	---	---
28	0.03	0.02	0.00	0.06	0.69	0.02	0.02	0.01	0.00	---	---	---
29	0.03	0.03	0.00	0.03	---	0.00	0.02	0.02	0.00	---	---	---
30	0.03	0.0	0.02	0.03	---	0.00	0.00	0.04	0.01	---	---	---
31	0.03	---	0.02	0.04	---	0.02	---	0.02	---	---	---	---
TOTAL	3.05	2.00	1.30	0.57	7.09	15.04	0.37	0.22	0.43	---	---	---
MEAN	0.098	0.067	0.042	0.018	0.25	0.49	0.012	0.007	0.014	---	---	---
MAX	1.4	0.59	0.78	0.06	3.3	5.0	0.03	0.05	0.41	---	---	---
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
AC-FT	6.0	4.0	2.6	1.1	14	30	0.7	0.4	0.9	---	---	---
(+)	0.79	0.32	0.30	0.05	0.89	2.21	0.04	0.04	0.19	0.01	0.45	0.32

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1997 - 2003, BY WATER YEAR (WY)

	0.37	0.17	0.12	0.11	0.15	0.34	0.24	0.17	0.31	0.79	0.83	0.27
MEAN	0.37	0.17	0.12	0.11	0.15	0.34	0.24	0.17	0.31	0.79	0.83	0.27
MAX	0.84	0.30	0.38	0.22	0.28	0.68	0.59	0.47	1.23	2.34	1.23	0.55
(WY)	(2001)	(1997)	(1998)	(1997)	(1998)	(1998)	(1997)	(1999)	(1999)	(1997)	(1997)	(2002)
MIN	0.076	0.066	0.023	0.018	0.027	0.053	0.012	0.007	0.014	0.14	0.50	0.064
(WY)	(2002)	(2000)	(2000)	(2003)	(2002)	(2002)	(2003)	(2003)	(2003)	(2000)	(1998)	(2000)

SUMMARY STATISTICS

FOR 2002 CALENDAR YEAR

WATER YEARS 1997 - 2003

ANNUAL TOTAL	97.02		
ANNUAL MEAN	0.27	0.34	
HIGHEST ANNUAL MEAN		0.57	1997
LOWEST ANNUAL MEAN		0.16	2000
HIGHEST DAILY MEAN	11 Jul 10	31	Jul 28, 1997
LOWEST DAILY MEAN	0.00 Feb 6	0.00	Dec 8, 1996
ANNUAL SEVEN-DAY MINIMUM	0.00 Jun 3	0.00	Jun 3, 2002
MAXIMUM PEAK FLOW		1,300	Jun 16, 1999
MAXIMUM PEAK STAGE		4.72	Jun 16, 1999
ANNUAL RUNOFF (AC-FT)	92	245	
10 PERCENT EXCEEDS	0.22	0.43	
50 PERCENT EXCEEDS	0.03	0.07	
90 PERCENT EXCEEDS	0.00	0.00	

(+) Total precipitation accumulation, in inches.

08329839 NORTH FORK HAHN ARROYO AT ALBUQUERQUE, NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger, recording stage and precipitation at 5-minute intervals, is housed in an oversized 40- by 40-inch metal shelter mounted over a 12-foot-long, 24-inch-diameter CMC stilling well. The well is mounted to the right bank of the concrete-lined channel, 200 feet upstream from the Louisiana Boulevard bridge. Gage heights are referenced to an inside staff gage, and since August 14, 1998, are also referenced to an electric-tape gage. Flow velocities are extremely fast, preventing high-water measurements from the Louisiana Boulevard bridge. A tipping-bucket rain gage is mounted to the roof of the shelter and housed in a 12-inch steel pipe enclosure. A peak stage indicator clip is attached to the float tape, which accurately records the peak gage height between site visits.

Gage-Height Record.--The recorder, referenced to the inside staff and electric-tape gage, gave a complete and satisfactory record for the entire water year. The PZF for this site is 1.00 feet. No ice-affected periods occurred in water year 2003. A complete annual record has been provided since water year 1997; prior to that, the gage was not operational during the winter months. On July 11, 2003, this gage was discontinued indefinitely.

Rating.--The control for this station is the concrete-lined channel. Rating 2.0 was developed from a theoretical step-backwater analysis after the gage was moved to its present location in June 1992. After a review of rating 2.0 in water year 1998, an error was discovered in the computations, resulting in a rerun of the step-backwater analysis and new rating, 3.0. Water year records 1992-97 were revised using rating 3.0 and published in the water year 1999 USGS Water-Data Report. In water year 2001, after further investigation of the theoretical rating analysis, a lower Manning's n-value of 0.015 was determined to be more accurate for the channel bottom roughness than the 0.018 used in the rating 3.0 analysis. The same survey points were used from ratings 2.0 and 3.0; only the Manning's n-value was changed in the theoretical computations. The resulting rating, 4.0, is retroactive to June 1992, requiring another slight revision to water years 1992-2000. Rating 4.0 computes approximately 10 percent more water than rating 3.0 for equivalent gage heights in the middle flow range.

Discharge.--During water year 2003, 16 inspections were completed at this site. The instantaneous peak gage height and discharge for water year 2003 were 1.26 feet and 32 cubic feet per second, respectively, on October 22, 2002. Discharges were computed using rating curve 4.0 directly with no shifts. The channel bottom remains clear of debris and sediment because of the supercritical flow regime. Flows are extremely fast and difficult to measure with conventional current meters. The theoretical rating for this trapezoidal-shaped, concrete-lined channel is considered more accurate than single measurements. Estimated mean daily discharges are based on precipitation data, base-flow patterns, and downstream flow records at the Main Hahn Arroyo gage (08329840).

RIO GRANDE BASIN

08329839 NORTH FORK HAHN ARROYO AT ALBUQUERQUE, NM

LOCATION.--Lat 35°07'37", long 106°34'04", in NE 1/4 SE 1/4 sec.1, T.10 N., R.3 E., Bernalillo County, Hydrologic Unit 13020203, on right bank 200 ft above Louisiana Boulevard, 1,150 ft north of Comanche Road, and 1,450 ft south of Montgomery Boulevard, in Albuquerque.

DRAINAGE AREA.--1.51 mi².

PERIOD OF RECORD.--May 1979 to December 1983, June 1992 to September 1996 (seasonal records), October 1996 to July 2003 (discontinued).

REVISED RECORD.--WDR NM-99-1: 1992-98(M) (mean daily values).

GAGE.--Water-stage recorder and recording tipping-bucket rain gage with 0.01-in. increments, and concrete-lined channel. Elevation of gage is 5,290 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to 1983, at site 200 ft downstream on Louisiana Boulevard bridge, at different datum.

REMARKS.--Records good. Some minor streamflow may exist on days when daily mean discharges have been recorded as zero due to the sensitivity limits of the streamflow-monitoring equipment. See tabulation below for monthly precipitation, in inches.

EXTREMES FOR CURRENT YEAR.--Maximum discharge during period of operation, 32 ft³/s, Oct. 22, gage height 1.26 ft.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---
9	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
13	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	---	---	---
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
18	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	---	---	---
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
20	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	---	---	---
21	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	---	---	---
22	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
23	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
24	0.43	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	---	---	---
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
29	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	---	---	---
30	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	---	---	---
31	0.00	---	0.00	0.00	---	0.00	---	0.00	---	---	---	---
TOTAL	0.95	0.09	0.00	0.00	0.15	1.15	0.00	0.00	0.00	---	---	---
MEAN	0.031	0.003	0.000	0.000	0.005	0.037	0.000	0.000	0.000	---	---	---
MAX	0.43	0.09	0.00	0.00	0.13	0.77	0.00	0.00	0.00	---	---	---
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---
AC-FT	1.9	0.2	0.00	0.00	0.3	2.3	0.00	0.00	0.00	---	---	---
(+)	0.71	0.33	0.28	0.01	0.90	2.04	0.04	0.02	0.12	---	---	---

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1997 - 2003, BY WATER YEAR (WY)

	2001	1998	1998	1998	1998	1997	2000	1998	1998	2000	1998	2002
MEAN	0.040	0.022	0.025	0.034	0.010	0.015	0.025	0.019	0.029	0.059	0.071	0.026
MAX	0.11	0.12	0.16	0.19	0.062	0.047	0.15	0.063	0.079	0.21	0.10	0.096
(WY)	(2001)	(1998)	(1998)	(1998)	(1998)	(1998)	(1997)	(2001)	(1997)	(1997)	(2000)	(2002)
MIN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.021	0.000
(WY)	(2000)	(1997)	(1999)	(1999)	(1999)	(1997)	(2000)	(1998)	(1998)	(2000)	(1998)	(1998)

SUMMARY STATISTICS

	FOR 2002 CALENDAR YEAR	WATER YEARS 1997 - 2003
ANNUAL TOTAL	8.88	
ANNUAL MEAN	0.024	0.033
HIGHEST ANNUAL MEAN		0.060
LOWEST ANNUAL MEAN		0.014
HIGHEST DAILY MEAN	1.1 Aug 3	2.3 Oct 4, 1996
LOWEST DAILY MEAN	0.00 Jan 1	0.00 Oct 1, 1996
ANNUAL SEVEN-DAY MINIMUM	0.00 Jan 1	0.00 Oct 6, 1996
MAXIMUM PEAK FLOW		439 Aug 14, 1980
MAXIMUM PEAK STAGE		1.94 Aug 14, 1980
ANNUAL RUNOFF (AC-FT)	18	24
10 PERCENT EXCEEDS	0.00	0.00
50 PERCENT EXCEEDS	0.00	0.00
90 PERCENT EXCEEDS	0.00	0.00

(+) Total precipitation accumulation, in inches.

08329840 HAHN ARROYO AT ALBUQUERQUE, NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger, recording stage and precipitation at 5-minute intervals, and pressure transducer were installed on September 11, 1996. An ISCO automatic pump sampler was installed in the same shelter in October 2001. All recorders are housed in a metal 4- by 4- by 6-foot walk-in building anchored to a concrete pad on the right bank of the concrete-lined channel and all are solar powered. A roof-mounted, tipping-bucket rain gage has been operational since July 20, 1992. The reference gage is a staff gage painted on the channel sidewall near the orifice line. Water-depth measurements may be obtained near the orifice sump during low flows. A CSG with a lower cap elevation of 1.10 feet was installed on the right bank on October 8, 1998. The pipe is mounted 34 degrees from horizontal.

Gage-Height Record.--The recorder, referenced to the outside staff gage or referenced to a direct measure-up from the bottom of the channel, gave a complete and satisfactory record for water year 2003 except for the following periods. Missing record, caused by a low battery voltage, occurred June 2-14, 2003. No precipitation fell during that time except 0.01 inch on June 7 and June 9. Estimated discharge values for this period of missing record apply only to base flows and were determined by averaging discharges recorded before and after. A substantial amount of water drains into the Hahn Arroyo between the two upstream gages (08329838 and 08329839) and this location, so base flows cannot be estimated by simply comparing the sum of the North and South Fork Hahn recorded discharges to the Main Hahn. In addition, the South Fork Hahn gaging station does not detect all base flows because of the channel geometry at that location. Storm flows from the two upstream gages are combined and also used as an approximation for this site. Since water year 1997, this station has been operated the entire year.

Rating.--The control for this station is the concrete-lined channel. Rating 2.0 was developed by theoretical step-backwater computations after the gage was moved to its present location on July 20, 1992. After review of rating 2.0 in water year 1998, an error was discovered in the computations, resulting in a rerun of the step-backwater analysis and new rating, 3.0. Water year records 1992-97 were revised using rating 3.0 and published in the water year 1999 USGS Water-Data Report. In water year 2001, after further investigation of the theoretical rating analysis, a lower Manning's n-value of 0.015 was determined to be more accurate for the channel bottom roughness than the 0.018 used in the rating 3.0 analysis. The same survey points were used from ratings 2.0 and 3.0; only the Manning's n-value was changed in the theoretical computations. The resulting rating, 4.0, is retroactive to June 1992, requiring another slight revision to water years 1992-2000. Rating 4.0 computes approximately 10 percent more water than rating 3.0 for equivalent gage heights in the middle flow range.

Discharge.--Discharges were computed using the new rating 4.0 directly with no shifts. The curve is considered more reliable than any measurements. Significant flow in the channel is very swift and, therefore, nearly impossible to measure with conventional current meters. During water year 2003, 30 site visits were made. The instantaneous peak stage and discharge for the water year occurred on September 7, 2003, and were 1.75 feet and 258 cubic feet per second, respectively. Mean daily discharges were estimated for days (mentioned in the "Gage-Height Record" paragraph) when the recorder malfunctioned.

Remarks.--Records are good, except those for estimated days, which are poor. The Hahn Arroyo is a drainage canal, nearly always containing small flows that are not rainfall related (nuisance flows). Prior to rating 4.0, all days with discharges determined to be only nuisance flow (gage heights less than 1.04 feet and discharge less than 2.0 cubic feet per second) were called days of zero flow. Now all flows above zero flow are computed. Nearly every day of the year shows a pulse of water usually occurring in the early morning and late evening, probably due to lawn irrigation runoff.

RIO GRANDE BASIN

08329840 HAHN ARROYO AT ALBUQUERQUE, NM

LOCATION.--Lat 35°07'33", long 106°35'23", in SE ¼ NE ¼ sec.2, T.10 N., R.3 E., Bernalillo County, Hydrologic Unit 13020203, 860 ft below San Mateo Boulevard bridge on right bank, 750 ft north of Comanche Road, and 2,050 ft south of Montgomery Boulevard in Albuquerque.

DRAINAGE AREA.--4.23 mi².

PERIOD OF RECORD.--June 1978 to September 1996 (seasonal records), October 1996 to current year.

REVISED RECORD.--WDR NM-99-1: 1992-98(M) (mean daily values).

GAGE.--Water-stage and recording tipping-bucket rain gage with 0.01-in. increments and concrete-lined channel. Elevation of gage is 5,190 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to 1992, at site on downstream side of San Mateo Boulevard bridge, at different datum.

REMARKS.--Records good except for those estimated, which are poor. Some minor streamflow may exist on days when daily mean discharges have been recorded as zero due to the sensitivity limits of the streamflow-monitoring equipment. Recording rain gage at station. Development within basin is predominantly residential, but there are some commercial areas. See tabulation below for monthly precipitation, in inches.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.94	0.37	0.26	0.69	0.46	7.4	0.52	1.6	2.6	0.79	2.8	1.5
2	0.87	0.14	0.33	0.99	0.18	0.82	0.55	1.8	e2.0	0.61	15	1.4
3	1.1	0.01	11	1.1	0.52	1.8	0.51	0.18	e2.0	0.29	2.3	1.0
4	0.57	6.3	1.8	0.70	0.50	1.2	0.53	0.51	e2.0	1.7	2.6	0.92
5	0.10	0.80	0.91	0.32	0.47	1.1	0.04	1.9	e2.0	0.17	1.8	0.88
6	0.40	0.93	0.77	0.56	0.72	1.0	0.12	2.2	e2.0	0.06	2.0	0.10
7	0.87	0.49	0.37	0.14	0.77	0.77	0.48	1.2	e2.0	1.0	3.7	6.5
8	0.77	0.60	0.39	0.27	1.2	0.19	1.1	1.0	e1.0	1.7	2.8	2.3
9	0.86	4.1	0.72	0.57	2.1	0.67	0.74	1.8	e1.0	4.9	0.66	3.9
10	0.95	5.1	1.5	1.1	0.69	0.55	0.96	0.08	e1.0	1.7	5.4	9.9
11	0.60	1.0	0.92	0.49	0.74	0.96	1.4	0.88	e1.0	0.56	4.2	2.3
12	0.28	0.65	1.1	0.45	0.93	1.1	0.53	1.4	e1.0	0.61	2.0	0.82
13	0.09	0.73	0.90	0.45	12	0.55	1.4	1.4	e1.0	0.44	0.95	0.19
14	0.74	0.72	0.28	0.57	4.3	1.4	1.6	0.75	e1.0	1.7	2.2	0.84
15	0.97	0.83	0.78	0.71	0.78	0.27	1.8	1.4	0.26	1.2	1.0	0.80
16	1.6	0.24	1.5	0.39	0.47	2.9	1.4	1.6	1.5	0.50	0.01	0.86
17	1.5	0.42	0.81	0.36	0.74	4.9	2.0	0.23	1.2	0.54	0.11	0.75
18	2.6	0.57	0.65	0.41	1.6	13	1.2	0.71	1.1	0.61	1.3	0.75
19	0.37	0.49	0.44	0.53	0.80	16	0.32	1.1	4.7	0.11	1.6	0.73
20	0.15	0.46	0.79	0.36	6.8	14	0.47	1.3	1.3	6.9	1.0	0.92
21	0.73	0.43	0.72	0.90	1.5	17	1.4	1.7	0.43	2.6	1.1	1.3
22	5.9	0.41	0.12	0.65	0.37	0.49	1.5	0.99	0.44	2.1	0.96	0.94
23	7.5	0.05	0.35	0.52	0.24	0.87	1.4	1.1	1.0	2.1	0.62	0.82
24	7.2	0.18	0.61	0.87	5.5	0.89	1.3	0.32	0.85	1.3	1.8	0.82
25	0.77	0.49	0.71	0.37	2.7	2.0	2.8	0.40	0.86	1.1	3.9	1.0
26	3.7	0.44	1.5	0.12	9.7	1.2	0.32	1.4	1.1	1.4	1.0	0.81
27	1.4	0.43	2.3	0.47	2.7	1.0	1.4	1.7	1.1	2.7	1.3	0.10
28	0.43	0.41	1.4	0.98	5.5	0.86	1.8	2.3	0.07	3.3	1.1	0.41
29	0.35	1.1	0.19	0.74	---	0.24	1.4	1.8	0.33	1.2	1.1	1.3
30	0.31	0.63	0.37	0.53	---	0.58	1.6	1.9	1.1	2.9	12	0.91
31	0.30	---	1.0	0.62	---	0.50	---	0.41	---	2.0	2.4	---
TOTAL	44.92	29.52	35.49	17.93	64.98	96.21	32.59	37.06	38.94	48.79	80.71	45.77
MEAN	1.45	0.98	1.14	0.58	2.32	3.10	1.09	1.20	1.30	1.57	2.60	1.53
MAX	7.5	6.3	11	1.1	12	17	2.8	2.3	4.7	6.9	15	9.9
MIN	0.09	0.01	0.12	0.12	0.18	0.19	0.04	0.08	0.07	0.06	0.01	0.10
AC-FT	89	59	70	36	129	191	65	74	77	97	160	91
(+)	0.96	0.34	0.40	0.0	1.11	1.98	0.01	0.07	0.25	0.03	0.64	0.36

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1997 - 2003, BY WATER YEAR (WY)

	MEAN	MAX	(WY)	MIN	(WY)	MEAN	MAX	(WY)	MIN	(WY)	MEAN	MAX	(WY)	MIN	(WY)	MEAN	MAX	(WY)	MIN	(WY)																																								
	2.17	5.26	(2001)	0.82	(1998)	1.36	2.32	(2002)	0.21	(2000)	1.32	2.59	(1998)	0.082	(2000)	1.51	3.76	(2002)	0.58	(2003)	1.57	3.52	(2001)	0.43	(1997)	2.40	4.02	(2001)	1.00	(1997)	1.81	2.39	(1999)	0.09	(2003)	1.28	2.90	(2001)	0.73	(1998)	2.38	6.94	(1999)	0.68	(1998)	2.92	4.95	(1997)	1.44	(2000)	3.41	5.37	(2001)	2.01	(1998)	1.73	3.09	(2002)	0.63	(1998)

SUMMARY STATISTICS

	FOR 2002 CALENDAR YEAR		FOR 2003 WATER YEAR		WATER YEARS 1997 - 2003	
ANNUAL TOTAL	719.01		572.61			
ANNUAL MEAN	1.97		1.57		1.99	
HIGHEST ANNUAL MEAN					3.37	
LOWEST ANNUAL MEAN					1.24	
HIGHEST DAILY MEAN	23	Apr 7	17	Mar 21	170	Jun 16, 1999
LOWEST DAILY MEAN	0.00	Aug 25	0.01	Nov 3	0.00	Dec 15, 1996
ANNUAL SEVEN-DAY MINIMUM	0.27	Oct 28	0.27	Oct 28	0.00	Nov 23, 1999
MAXIMUM PEAK FLOW			258	Sep 7	6,120	Jun 16, 1999
MAXIMUM PEAK STAGE			1.75	Sep 7	5.98	Jun 16, 1999
ANNUAL RUNOFF (AC-FT)	1,430		1,140		1,440	
10 PERCENT EXCEEDS	3.7		2.8		4.2	
50 PERCENT EXCEEDS	1.0		0.92		0.90	
90 PERCENT EXCEEDS	0.32		0.29		0.12	

(+) Total precipitation accumulation, in inches.
e Estimated

08329868 BEAR CANYON ARROYO NEAR ALBUQUERQUE, NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger, recording at 5-minute intervals, and a pressure transducer and self-contained air compressor are housed in a metal 2.5- by 2.5- by 6-foot shelter anchored to a concrete slab on the right bank of the channel. An outside staff gage is mounted on the right bank for reference. A CSG is mounted to the outside staff support and its bottom cap lip elevation is 3.90 feet referenced to the gage datum. A concrete control was constructed at the time of the gage installation on September 30, 1999. The PZF is the low point in this concrete control structure and is at an elevation of 3.47 feet. An ISCO model 3700 automatic sampler is housed in a separate metal shelter adjacent to the water-stage recorder enclosure. All instruments are powered by 12-volt batteries charged by solar panels.

Gage-Height Record.--The water-stage recorder, referenced to the PZF or outside staff, gave a complete and satisfactory record for the entire water year.

Datum Correction.--No datum or recorder corrections were required this water year. Occasionally, water is ponded around the orifice using sand embankments so the recorder can be correctly set to the depth of water over the PZF. Flows used to set the recorder to the staff gage reading are very difficult to observe.

Rating.--This natural channel is straight for approximately 50 feet upstream and 100 feet downstream from the gage. The channel bottom is composed of coarse-grained sand and pea-sized gravel that has eroded from nearby granite exposures of the Sandia Mountains foothills. A narrow, V-shaped main channel has incised approximately 6 to 8 feet into the terraced flood-plain sediments. Large boulders are exposed in portions of both banks. The width of the main channel varies from approximately 6 feet immediately upstream from the gage to nearly 20 feet immediately downstream from the control. A mountain spring discharges into the stream nearly year-round, but the flow seeps into the unconsolidated, coarse-grained sediment before reaching the gage site.

Rating 1.0 was developed by a theoretical step-backwater analysis using HEC-RAS software model.

Discharge.--During water year 2003, 16 no-flow inspections were made. No flows have occurred at this site since gage installation on September 30, 1999. The site remains dry except during substantial precipitation runoff.

Remarks.--Record is good. No flows occurred in water year 2003.

RIO GRANDE BASIN

08329868 BEAR CANYON ARROYO NEAR ALBUQUERQUE, NM

LOCATION.--Lat 35°09'02", long 106°28'07", Bernalillo County, Hydrologic Unit 13020203, in Elena Gallegos Grant, on right bank of the arroyo approximately 0.5 mi east of gated and fenced property of High Resort Development. Elena Gallegos open space land. The gage is approximately 0.25 mi south of the dirt access road, which leads to an Albuquerque public water supply reservoir tank.

DRAINAGE AREA.--5.0 mi².

PERIOD OF RECORD.--October 1999 to current year.

GAGE.--Water-stage recorder. Rain gage is located approximately $\frac{1}{2}$ mi east. Elevation of gage is 6,395 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good.

NO FLOW SINCE GAGE ESTABLISHED ON SEPTEMBER 30, 1999

08329880 ACADEMY ACRES DRAIN AT ALBUQUERQUE, NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger, recording stage at 5-minute intervals, is housed in a metal 15- by 15- by 18-inch shelter over a 12-inch-diameter CMC stilling well. The control is a 2-foot-high, 120-degree, V-notch metal weir plate 8 feet downstream from the gage. Inside and outside staff gages are available for reference. The elevation of the inside staff gage is 0.09 foot high, as determined by the levels of October 23, 1997. The PZF is 0.00 foot in reference to the gage datum, or 1.00 foot on the recorder. The 1-foot datum is added to avoid negative gage heights when the float falls below the PZF.

A datalogger and tipping-bucket rain gage are housed in a metal 15- by 15- by 18-inch shelter over a 3-inch-diameter galvanized pipe attached to the control fence rails, about 10 feet shoreward of the surface-water gage.

Gage-Height Record.--The recorder referenced to the inside staff gave a complete and satisfactory record during water year 2003. The gage was discontinued during the typically dry winter period, December 09, 2002, to February 25, 2003. The surface-water gage was discontinued indefinitely on July 1, 2003, but rain-gage recordings continue.

Rating.--The channel is concrete lined and 10 feet wide at the bottom, and both banks are inclined for at least 100 feet upstream from the gage. The 120-degree, V-notch weir plate is the control for flow depths up to 2 feet (3.00-foot gage height on the recorder). When flow depths exceed 2 feet, the V-notch is completely submerged and the entire metal plate becomes a sharp-crested weir bound by concrete sidewalls inclined at 45 degrees. Maximum flow depth is 5 feet (6.0-foot gage height on recorder). Theoretical rating 3.0 was developed in water year 2001 to replace rating 2.0 because the upper end of the old rating (depths over the V-notch weir) was based entirely on one slope-area measurement completed in 1978. The new rating, 3.0, is based on a standard 120-degree, V-notch weir computation below gage heights of 3.00 feet (2.0-foot flow depth) and sharp-crested weir flow computations above the depth of the V-notch. The stages between 3.00 and 4.00 feet represent a transition zone between these two flow regimes. The plot of stage against computed discharge does not form a straight line on a log-log plot through this transition zone, as would be expected in weir flows, but plots near the straight line that represents a best-fit through all stages above 3 feet. Previous years' peaks were revised using the new rating 3.0.

The channel tends to gradually accumulate sand during flow events, but this does not affect the rating until the bottom of the V-notch weir, or PZF, is covered. The channel is cleaned at the beginning of the season and after significant flow events. The weir control was not affected by sand accumulations this water year.

Discharge.--During water year 2003, 17 site visits were completed. The instantaneous peak stage and discharge for the water year occurred on October 24, 2002, and were 2.41 feet and 10 cubic feet per second, respectively. One flow topped the V-notch weir plate this water year. Discharges were computed directly from rating 3.0 using no shifts because the weir remained clear during all flows. The weir rating is considered more accurate than individual measurements.

RIO GRANDE BASIN

08329880 ACADEMY ACRES DRAIN AT ALBUQUERQUE, NM

LOCATION.--Lat 35°09'04", long 106°34'23", in NE ¼ SE ¼ sec.25, T.11 N., R.3 E., Bernalillo County, Hydrologic Unit 13020203, on left bank of concrete-lined channel, 250 ft north of intersection of Esther Avenue and Burlison Drive, and 0.4 mi north of Academy Road in Albuquerque.

DRAINAGE AREA.--0.124 mi².

PERIOD OF RECORD.--June 1976 to current year (seasonal records). Surface-water gage discontinued July 1, 2003. Rain gage continues.

GAGE.--Water-stage recorder and recording tipping-bucket rain gage with 0.01-in. increments; control for site is a V-notch weir. Elevation of gage is 5,305 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good. The basin is primarily urban residential. Some minor streamflow may exist on days when daily mean discharges have been recorded as zero due to the short duration of peak flows. See tabulation below for monthly precipitation, in inches. No flow most of time.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 88 ft³/s, Aug. 3, 1978, gage height, 4.09 ft, from rating curve extended above 24 ft³/s on basis of slope-area measurement of peak flow and theoretical computations for weir flow; no flow most of time.

EXTREMES FOR CURRENT YEAR.--Maximum discharge during period of seasonal operation, 10 ft³/s, Oct. 24, gage height, 2.41 ft; no flow most of time.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	---	---
2	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	---	---
3	0.00	0.00	0.03	---	---	0.00	0.00	0.00	0.00	0.00	---	---
4	0.00	0.01	0.00	---	---	0.00	0.00	0.00	0.00	0.00	---	---
5	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	---	---
6	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	---	---
7	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	---	---
8	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	---	---
9	0.00	0.05	---	---	---	0.00	0.00	0.00	0.00	0.00	---	---
10	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	---	---
11	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	---	---
12	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	---	---
13	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	---	---
14	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	---	---
15	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	---	---
16	0.00	0.00	---	---	---	0.04	0.00	0.00	0.02	---	---	---
17	0.00	0.00	---	---	---	0.01	0.00	0.00	0.00	---	---	---
18	0.00	0.00	---	---	---	0.13	0.00	0.00	0.00	---	---	---
19	0.00	0.00	---	---	---	0.09	0.00	0.00	0.06	---	---	---
20	0.00	0.00	---	---	---	0.47	0.00	0.00	0.00	---	---	---
21	0.00	0.00	---	---	---	0.15	0.00	0.00	0.00	---	---	---
22	0.08	0.00	---	---	---	0.00	0.00	0.00	0.00	---	---	---
23	0.13	0.00	---	---	---	0.00	0.00	0.00	0.00	---	---	---
24	0.16	0.00	---	---	---	0.00	0.00	0.00	0.00	---	---	---
25	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	---	---	---
26	0.00	0.00	---	---	0.03	0.00	0.00	0.00	0.00	---	---	---
27	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	---	---	---
28	0.00	0.00	---	---	0.09	0.00	0.00	0.00	0.00	---	---	---
29	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	---	---	---
30	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	---	---	---
31	0.00	---	---	---	---	0.00	---	0.00	---	---	---	---
TOTAL	0.37	0.06	---	---	---	0.89	0.00	0.00	0.08	---	---	---
MEAN	0.012	0.002	---	---	---	0.029	0.000	0.000	0.003	---	---	---
MAX	0.16	0.05	---	---	---	0.47	0.00	0.00	0.06	---	---	---
MIN	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	---	---	---
AC-FT	0.7	0.1	---	---	---	1.8	0.00	0.00	0.2	---	---	---
(+)	0.94	0.31	0.42	0.0	1.07	2.77	0.02	0.08	0.43	0.02	0.64	0.60

(+) Total precipitation accumulation, in inches.

08329882 PINO ARROYO AT JEFFERSON ST. AT ALBUQUERQUE,

NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--The station was established on May 18, 2000. An electronic datalogger and pressure transducer, recording at 5-minute intervals, is housed in a 2.5- by 2.5- by 6-foot metal shelter anchored to a concrete pad on the right bank of the concrete-lined channel. An outside staff gage is painted on the right and left sidewalls of the channel for reference. A reference point for water depth tape-ups was also established as a 9/16-inch hex-head lag bolt anchored in the channel bottom about 12 inches from the orifice. This bolt represents the PZF. A CSG is mounted to the side of the channel and is inclined 24.5 degrees from horizontal. The high point of the lower CSG cap lip is at an elevation of 2.10 feet (1.10-foot true depth with a 1.00-foot datum added to recorded gage heights to avoid negative values). On August 22, 2001, a large static tube was installed around the end of the pressure transducer line to slow down flow velocities passing over the orifice. Prior to this, the recorded gage heights during larger flows were much lower than true depths, reflecting the pressure drawdown that was occurring around the old orifice tube. In October 2001, an ISCO automatic pump sampler was installed in a 36-inch-diameter shelter 3 feet upstream from the streamflow gage and is powered by a solar-panel-charged deep-cycle marine battery.

Gage-Height Record.--The stage recorder is referenced to the tape-up PZF, which is the lag bolt anchored in the bottom of the channel, or is referenced to the outside staff gage during periods of significant flows. The recorder will normally read 1.00 foot when the water level is even with the bottom of the channel at PZF; however, the installation of the static tube on August 22, 2001, raised the orifice line 0.03 foot above the PZF. Therefore, only flows over 0.03 foot deep (1.03 feet on recorder) will be recorded. The recorder gave a complete and satisfactory record this water year, except during periods of ice effect on November 27 and December 11-12, 2002, and January 7 and 17 and February 4 and 7, 2003. These days were estimated by comparing base flows before and after the affected period and by looking at rainfall in the watershed. All estimated daily mean discharges were zero in water year 2003.

Rating.--The steeply sloping channel (0.022 foot per foot) acts as the control. A theoretical rating was developed using WSPRO software. Because flows are supercritical in this reach, a step-forward analysis was used. The trapezoidal-shaped channel is straight for at least 300 feet downstream and 1,200 feet upstream from the gage. Sidewalls are approximately 6.5 feet high and slope at 24.5 degrees from horizontal. The channel bottom is about 8 feet wide. This site will be nearly impossible to measure because of its flashy nature and extreme velocities.

During water year 2003, 33 inspections were made. Rating 2.0 was developed in water year 2001 and is the same as rating 1.0 except that all flows below recorded gage heights

of 1.04 feet (less than 0.90 cubic foot per second) are considered zero flow. This change was required because flows below 0.04 foot deep could not be detected after the static tube was installed on August 22, 2001.

No sediment or debris accumulates in the channel due to its high flow velocity, so no shifts to the rating are needed.

Discharge.--The extreme flow velocities at this site make the theoretical rating more reliable than any measurements. Wading measurements would be dangerous, even at shallow depths. Rating 2.0 was used directly for water year 2003 with no shifts applied.

Daily mean discharges were estimated for the ice-affected days as described in the "Gage-Height Record" section. No gage exists upstream for hydrographic comparisons, so only precipitation records within the drainage basin can be used for estimating discharges, and occasionally a high-water mark or CSG mark indicates the peak stage.

The maximum gage height and discharge for water year 2003 were 2.40 feet and 212 cubic feet per second, respectively, on March 21.

RIO GRANDE BASIN

08329882 PINO ARROYO AT JEFFERSON STREET AT ALBUQUERQUE, NM

LOCATION.--Lat 35°09'34", long 106°35'57". Bernalillo County, Hydrologic Unit 13020203, in the Elena Gallegos Grant, on the right bank 1,200 ft downstream from the Jefferson Street culvert over Pino Arroyo, approximately 1,200 ft north of the intersection of Jefferson Street and Osuna Road in northeast Albuquerque.

DRAINAGE AREA.--8.3 mi² (but is controlled by detention pond upstream).

PERIOD OF RECORD.--May 18, 2000, to current year.

GAGE.--Water-stage recorder, crest-stage gage, and concrete-lined channel. Elevation of gage is 5,119 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Water-stage records good except for those estimated, which are fair. Since installation of the large static tube around the orifice on Aug. 22, 2001, only flows over about 0.03 ft deep (1.03 ft on recorder) will cover the orifice sufficiently to record true water depths. This channel often shows trickle flows not related to rainfall.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.18
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.8	0.24
3	0.00	0.00	1.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.4	0.11
4	0.00	0.48	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.14
5	0.00	0.00	0.01	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.13	0.17
6	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.08	0.18
7	0.00	0.00	0.00	e0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.40
8	0.00	0.00	0.00	0.10	0.20	0.00	0.00	0.00	0.00	0.00	0.68	0.05
9	0.00	0.51	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.48	0.95
10	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	2.3
11	0.00	0.00	e0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.18	0.45
12	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
13	0.00	0.00	0.00	0.00	1.7	0.00	0.00	0.00	0.02	0.00	0.05	0.05
14	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.03	1.7	0.32
15	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.58
16	0.00	0.00	0.01	0.04	0.00	0.49	0.00	0.00	0.49	0.00	0.00	0.29
17	0.04	0.00	0.00	e0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.26
18	0.17	0.00	0.01	0.00	0.00	1.8	0.00	0.00	0.00	0.00	0.07	0.11
19	0.00	0.00	0.00	0.00	0.00	2.2	0.00	0.00	0.90	0.00	0.04	0.20
20	0.00	0.00	0.00	0.00	0.69	7.0	0.00	0.00	0.00	0.00	0.00	0.22
21	0.00	0.00	0.00	0.02	0.00	5.2	0.00	0.01	0.00	0.00	0.00	0.10
22	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
23	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.07
24	3.6	0.00	0.00	0.00	0.59	0.00	0.00	0.02	0.00	0.01	0.25	0.01
25	0.00	0.00	0.00	0.00	0.08	0.09	0.00	0.03	0.00	0.00	0.64	0.12
26	0.00	0.00	0.06	0.00	0.61	0.00	0.00	0.18	0.00	0.00	0.01	0.35
27	0.14	e0.00	0.13	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.27
28	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.02	0.00	0.00	0.10	0.18
29	0.00	0.00	0.00	0.00	---	0.00	0.00	0.02	0.00	0.00	0.07	0.30
30	0.00	0.00	0.05	0.00	---	0.00	0.00	0.02	0.00	0.00	4.7	0.36
31	0.00	---	0.08	0.00	---	0.00	---	0.00	---	0.00	0.48	---
TOTAL	5.95	1.23	2.25	0.21	5.08	17.25	0.02	0.32	1.41	0.04	14.43	9.09
MEAN	0.19	0.041	0.073	0.007	0.18	0.56	0.001	0.010	0.047	0.001	0.47	0.30
MAX	3.6	0.51	1.9	0.10	1.7	7.0	0.02	0.18	0.90	0.03	4.7	2.3
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
AC-FT	12	2.4	4.5	0.4	10	34	0.04	0.6	2.8	0.08	29	18

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 2000 - 2003, BY WATER YEAR (WY)

	2000	2001	2002	2003	2000	2001	2002	2003	2000	2001	2002	2003
MEAN	0.64	0.35	0.21	0.30	0.30	0.40	0.27	0.30	0.50	0.50	1.09	0.58
MAX	1.72	0.94	0.48	0.80	0.70	0.65	0.73	0.89	1.18	1.09	1.99	0.93
(WY)	(2001)	(2001)	(2001)	(2001)	(2001)	(2001)	(2001)	(2001)	(2001)	(2001)	(2001)	(2000)
MIN	0.000	0.041	0.064	0.007	0.000	0.000	0.001	0.002	0.047	0.001	0.37	0.30
(WY)	(2002)	(2003)	(2002)	(2003)	(2002)	(2002)	(2003)	(2002)	(2003)	(2003)	(2002)	(2003)

SUMMARY STATISTICS

	FOR 2002 CALENDAR YEAR		FOR 2003 WATER YEAR		WATER YEARS 2000 - 2003	
ANNUAL TOTAL	52.97		57.28			
ANNUAL MEAN	0.15		0.16		0.42	
HIGHEST ANNUAL MEAN					0.97	
LOWEST ANNUAL MEAN					0.13	
HIGHEST DAILY MEAN	13	Sep 10	7.0	Mar 20	16	Aug 14, 2001
LOWEST DAILY MEAN	0.00	Jan 1	0.00	Oct 1	0.00	Aug 23, 2001
ANNUAL SEVEN-DAY MINIMUM	0.00	Jan 1	0.00	Oct 1	0.00	Aug 31, 2001
MAXIMUM PEAK FLOW			212	Mar 21	541	Sep 14, 2001
MAXIMUM PEAK STAGE			2.40	Mar 21	3.21	Sep 14, 2001
ANNUAL RUNOFF (AC-FT)	105		114		303	
10 PERCENT EXCEEDS	0.16		0.35		1.0	
50 PERCENT EXCEEDS	0.00		0.00		0.00	
90 PERCENT EXCEEDS	0.00		0.00		0.00	

e Estimated

**08329888 LA CUEVA ARROYO TRIBUTARY (UPPER) AT ALBUQUERQUE,
NEW MEXICO**

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger, recording at 5-minute intervals, and pressure transducer are housed in a 2.5- by 2.5- by 5.5-foot metal shelter anchored to a concrete slab on the left bank of the channel, approximately 100 feet upstream from a concrete box culvert under Tramway Boulevard. An outside staff gage is mounted on the right and left banks for reference. High-water discharge measurements are computed by indirect methods. A CSG was installed on May 6, 1999, and its bottom cap lip elevation is 0.36 foot above the PZF. It is mounted to the left-bank staff gage.

Gage-Height Record.--The water-stage recorder, referenced to the PZF or outside staff, gave a complete and satisfactory record for the entire water year except for missing records April 29-May 26, 2003, due to a recorder malfunction. Because this channel will not flow without significant precipitation, all days of missing record or no precipitation can be accurately interpreted as zero-flow days. The entire missing period had no rainfall except May 26, so only that day was estimated. A 1.00-foot datum is added to the recorded gage heights to avoid negative values during dry periods.

Rating.--The trapezoidal-shaped channel is straight for about 100 feet above and 100 feet below the gage before it drops sharply into a concrete box culvert that passes under Tramway Boulevard. This channel has a natural, coarse-grained sand bottom and concrete sidewalls. The concrete sidewalls extend from approximately 6 feet upstream from the gage to the box culvert downstream. Upstream from the concrete-lined channel, the side slopes are covered with cobble and boulder rip-rap. The channel bottom is about 12 feet wide at the gage, slightly narrower upstream, and has sidewalls about 4 feet high with 30-degree slopes. A concrete control structure was installed immediately downstream from the gage on May 6, 1999. The concrete slab is inclined from the right channel sidewall toward the left bank, where the gage is located. The PZF of the gage is located at the juncture of the concrete control with the left sidewall. Prior to the installation of this control, only high flows could reach the pressure transducer orifice because the channel bottom had severely scoured. The orifice was mounted approximately 0.08 foot above the PZF so sediment will not interfere with gage-height recordings; therefore, only flow depths greater than 0.08 foot are recorded. Most flows are of a supercritical regime because of the steep channel slope.

Rating 1.0, used since the concrete control installation on May 6, 1999, was developed by step-forward analysis using WSPRO software. Water-surface elevations for flows less than 30 cubic feet per second could not be successfully computed because the energy equation for supercritical flow would not balance at the gage cross section. These smaller flows are probably experiencing subcritical regimes. Additional measurements are needed to better define the rating, especially at the lower end. Two very low flow measurements (1 and 2) were made in water year 1999, but no measurements have been made since. Flow events are extremely flashy, normally lasting less than an hour, so discharge measurements are difficult to obtain. The two measurements plot at 0.0 and -46 percent from rating 1.0, respectively. Because both were made during extremely low flow, they are rated "poor" and serve only as a good estimate of discharge. High-water discharge measurements are computed by indirect methods.

The PZF is 1.00 foot on rating 1.0. A "dog leg" breaks to the left at a gage height of 1.70 feet on the rating curve. This point represents the level at which the concrete control is completely submerged and flows begin to be constricted by both concrete sidewalls.

Discharge--During water year 2003, 24 no-flow inspections were completed. Rating 1.0 was used directly, without any shifts, for the water year. The mean daily discharge for May 26, 2003, was estimated as zero. Although 0.15 inch of precipitation fell on that day at the La Cueva rain gage, other days with equal precipitation did not generate flow at the stream gage; therefore, flow on May 26 was estimated as zero also. The maximum instantaneous stage and discharge recorded during the water year are 1.54 feet and 11 cubic feet per second, respectively. This site will remain dry except during significant precipitation.

RIO GRANDE BASIN

08329888 LA CUEVA ARROYO TRIBUTARY AT ALBUQUERQUE, NM

LOCATION.--Lat 35°11'22", long 106°29'43", Bernalillo County, Hydrologic Unit 13020203, in Elena Gallegos Grant, on the left bank of concrete-lined arroyo, approximately 100 ft upstream from a box culvert passing under Tramway Boulevard, in the extreme northeast corner of Albuquerque city limits. This site is located approximately 0.2 mi south of the old gage site La Cueva Arroyo Tributary at Tramway Boulevard (08329890).

DRAINAGE AREA.--0.5103 mi².

PERIOD OF RECORD.--May 1999 to current year.

GAGE.--Water-stage recorder. A tipping-bucket rain gage recording in 0.01-inch increments is located approximately 0.25 mi north of gage. Elevation of gage is 6,080 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00	---	0.00	0.00	---	0.00	---	0.00	---	0.00	0.00	---
TOTAL	0.05	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01
MEAN	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MAX	0.03	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AC-FT	0.1	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.02

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 2000 - 2003, BY WATER YEAR (WY)

	2000	2001	2002	2003	2000	2001	2002	2003	2000	2001	2002	2003
MEAN	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.004	0.001
MAX	0.004	0.001	0.000	0.000	0.000	0.001	0.001	0.000	0.002	0.004	0.012	0.003
(WY)	(2001)	(2001)	(2000)	(2000)	(2003)	(2000)	(2002)	(2001)	(2001)	(2001)	(2001)	(2002)
MIN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(WY)	(2002)	(2000)	(2000)	(2000)	(2000)	(2001)	(2000)	(2000)	(2000)	(2003)	(2003)	(2000)

SUMMARY STATISTICS

	FOR 2002 CALENDAR YEAR		FOR 2003 WATER YEAR		WATER YEARS 2000 - 2003	
ANNUAL TOTAL	0.35		0.08			
ANNUAL MEAN	0.001		0.000		0.001	
HIGHEST ANNUAL MEAN					0.002	
LOWEST ANNUAL MEAN					0.000	
HIGHEST DAILY MEAN	0.07	Sep 10	0.03	Oct 24	0.14	Aug 14, 2001
LOWEST DAILY MEAN	0.00	Jan 1	0.00	Oct 1	0.00	Oct 1, 1999
ANNUAL SEVEN-DAY MINIMUM	0.00	Jan 1	0.00	Oct 1	0.00	Oct 1, 1999
MAXIMUM PEAK FLOW			11	Oct 24	12	Aug 14, 2001
MAXIMUM PEAK STAGE			1.54	Oct 24	1.56	Aug 14, 2001
ANNUAL RUNOFF (AC-FT)	0.7		0.2		0.7	
10 PERCENT EXCEEDS	0.00		0.00		0.00	
50 PERCENT EXCEEDS	0.00		0.00		0.00	
90 PERCENT EXCEEDS	0.00		0.00		0.00	

e Estimated

08329900 NORTH FLOODWAY CHANNEL NEAR ALAMEDA, NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--This station was established in July 1968. Since August 1998, an electronic datalogger with satellite transmitter and pressure transducer have been housed in a concrete 6- by 6-foot block shelter. A painted staff gage on the channel sidewall is the reference gage, which indicates the true vertical depth in the channel. A tipping-bucket rain gage, recording in 0.01-inch increments, was installed on the roof of the shelter on December 8, 2001. Both water-stage and rainfall data are recorded at 5-minute intervals. An ISCO automatic pump sampler is also housed in the shelter for water-quality sampling.

Gage-Height Record.--The recorder, referenced to the outside staff gage, gave a complete and satisfactory record for water year 2003 except for the following periods. Ice affected gage heights on November 26 and December 13-15, 20, and 25-29, 2002, and on January 1-5 and 7-14, 2003. All days were considered base flow because no precipitation fell during these periods. Sand and debris are commonly transported by the North Floodway Channel and it often catches on the pressure transducer orifice pipe or, because the orifice is mounted in a depression below the channel bottom elevation, accumulates in the orifice sump during flows. Erroneous gage-height recordings result in either case and can cause recordings to drift higher or lower than true flow depths. The following periods experienced such "silting" problems, so their daily mean discharges were estimated: November 5-6, 2002, and February 10, April 3-4, May 20-21, June 23, August 26, and September 11-12, 2003. No precipitation fell during these estimated days so only base flows were expected (0.5 to 2.0 cubic feet per second). Very commonly the "silting" occurs during the receding limb of a hydrograph so a gage-height trace can be estimated by graphical methods. Estimated mean daily discharges are based on hydrographic comparison with a flow gage approximately 5 miles upstream at the Candelaria bridge (North Floodway Channel at Albuquerque, 08329835), precipitation records, and base flows before and after the estimated time periods. Occasionally, gage-height recordings are slightly affected by debris accumulations after a flow event, but not to the extent of the "estimated" days. In this situation, graphing recorded gage heights clearly shows erroneous readings and the trace of actual flow depths is estimated with little loss in accuracy. The following dates had such minor gage-height corrections, but were not labeled as "estimated" discharges: October 23, 28 and November 10, 2002, and February 9 and 13-14, March 3, May 30, June 2, August 2-4 and 30, and September 8, 2003.

Rating.--The control for this station is the concrete-lined channel. The bottom width of the channel is 25 feet. The side slopes are approximately 35 degrees from horizontal. The depth of the channel at this point is about 23 feet, and the top width is approximately 117 feet.

During water year 2003, four low-flow measurements (numbers 46-49) and 106 site visits and observations were made at this gaging station, ranging from storm flows to base flows.

Rating 1.0, used during water years 1968-99, was replotted in water year 2000, using only two points. The rating curve of a trapezoidal-shaped, concrete-lined channel with uniform sidewalls, such as the North Floodway, should plot as a straight line. The new plot was labeled rating 2.0. The old rating, 1.0, had been plotted with many input points, resulting in an irregular line plot. The two ratings varied by less than 2 percent, except below 25 cubic feet per second, at which they vary by about 5 percent.

In water year 2001, the channel was resurveyed and the step-backwater analysis was recomputed using the software package HECRAS. Low-flow measurements prior to water year 2001 and four measurements (42-45) completed in December 2001 were also plotted on the new step-backwater rating. A new rating, 3.0, was developed and is significantly different from the previous ratings. The new rating 3.0 computes discharges over 100 percent less than the old rating at low flows and about 35 percent less discharge is computed at a 2.00-foot stage (560 cubic feet per second). Rating 3.0 discharge equals the old rating discharge at a stage of approximately 8.0 feet (7,400 cubic feet per second). Also, rating 3.0 closely parallels the original design rating developed by the U.S. Army Corps of Engineers for planning purposes. The new rating computes discharges for all gage heights more than 0.01 foot deep (0.7 cubic foot per second), whereas the old rating did not compute flows less than 14.5 cubic feet per second (less than 0.14-foot stages). Three of the four new measurements completed in December 2001 plotted less than 10 percent different from the new rating. The poorly rated, very low flow measurement 44 plotted at -63 percent from the rated discharge. All four measurements completed in water year 2003 plot -8 to -20 percent from rating 3.0. The inherent errors in measuring very shallow water lead to the slight misfit from the new rating line. No shifting occurs in this concrete-lined channel because high flow velocities keep the channel bottom clear of sediment. Supercritical flow regimes occur here at all stages over 1.00 foot. Prior water year records have been revised using the new rating 3.0.

Discharge.--Discharge was computed using rating 3.0 directly. The rating curve discharge is considered to be better than any individual measurements. Wading at this site would be very dangerous at anything over 0.2-foot depths because of extreme velocities and floating debris during storms. Bridge measurements are also not possible. Base-flow measurements are completed about 1,000 feet downstream at the old low-flow gaging station (08329916), where flow is constricted. The low-flow gage was used to record discharges less than 15 cubic feet per second; these discharges were combined with this station's storm flows to complete the daily values table published in the USGS Water-Data Reports for water years 1997-99.

The maximum gage height and discharge for the water year were 6.30 feet and 4,650 cubic feet per second, respectively, on March 21, 2003.

RIO GRANDE BASIN

08329900 NORTH FLOODWAY CHANNEL NEAR ALAMEDA, NM

LOCATION.--Lat 35°11'53", long 106°35'59", Bernalillo County, Hydrologic Unit 13020203, in Elena Gallegos Grant, on left bank 0.5 mi upstream from Edith Boulevard, 1.1 mi upstream from mouth, and 1.2 mi northeast of Alameda.

DRAINAGE AREA.--87.9 mi².

PERIOD OF RECORD.--July 1968 to September 1989 (seasonal records), October 1989 to current year.

GAGE.--Water-stage recorder with satellite telemetry, recording rain gage, and concrete-lined channel. Elevation of gage is 5,015 ft above National Geodetic Vertical Datum of 1929, from U.S. Army Corps of Engineers plan and profile map. Recording tipping-bucket rain gage, recording in 0.01-in. increments since Dec. 8, 2001.

REMARKS.--Water-discharge records good except for those estimated, which are poor. For water years 1997-99, low-flow values of 15 ft³/s or less were obtained from gaging station (08329914), 1,000 ft downstream. Prior to water year 1997, any discharges below 15 ft³/s were reported as "zero flow" in the mean daily values tables. Floodway channel intercepts flow of numerous arroyos in northeast Albuquerque and discharges into the Rio Grande at a point 1.6 mi north of Alameda. See tabulation below for monthly precipitation, in inches.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.15	4.4	1.1	e0.50	0.93	28	0.00	5.6	34	0.00	0.05	4.2
2	0.42	15	1.5	e0.50	0.81	2.6	0.59	4.6	4.2	0.42	11	0.31
3	0.10	9.6	44	e0.50	0.71	0.86	e0.50	7.7	0.12	0.07	12	0.48
4	1.1	20	3.2	e0.40	0.60	0.37	e0.50	11	0.01	0.09	0.93	0.76
5	0.35	e2.0	0.59	e0.30	0.51	0.13	0.27	9.0	0.37	0.14	0.08	1.1
6	0.24	e5.0	0.12	0.23	0.97	0.22	0.00	5.7	0.54	0.17	0.53	0.44
7	0.47	0.95	0.15	e0.30	0.57	0.39	0.00	5.2	0.49	2.7	2.3	46
8	0.38	0.10	0.09	e0.40	1.4	0.60	0.03	5.3	0.37	5.6	1.3	3.6
9	0.40	12	0.77	e0.70	8.9	0.02	0.00	7.0	7.6	2.3	0.12	6.8
10	0.30	62	0.39	e0.80	e1.5	0.02	0.00	9.7	4.1	1.7	6.5	32
11	0.58	0.06	0.45	e0.90	1.7	0.07	2.8	14	0.00	0.82	4.0	e9.0
12	0.17	0.45	0.44	e1.0	1.1	0.61	5.8	10	0.00	1.0	4.0	e2.0
13	0.34	0.50	e0.40	e1.0	84	0.81	8.4	8.5	0.00	1.2	9.3	1.5
14	0.10	0.31	e0.30	e1.0	5.9	0.86	5.9	7.6	0.00	1.6	11	2.3
15	0.14	0.04	e0.10	1.2	0.65	0.62	6.8	2.3	0.00	0.80	6.2	2.0
16	0.14	0.05	0.03	1.0	0.02	6.9	5.3	8.4	0.73	0.04	3.6	1.6
17	0.60	0.12	0.03	1.1	0.00	15	5.1	9.7	0.06	0.10	1.4	1.7
18	1.7	0.01	0.17	1.4	0.00	85	4.8	12	0.86	0.01	2.1	2.9
19	0.07	0.01	0.12	1.2	0.51	104	4.9	8.2	13	1.0	23	2.2
20	0.00	0.12	e0.20	1.1	24	78	4.1	e1.0	2.2	1.6	1.1	2.3
21	0.00	0.02	0.89	1.3	2.2	266	3.1	e0.80	1.3	6.2	1.5	3.0
22	33	0.08	3.7	1.1	0.15	2.8	5.5	0.45	0.50	4.9	0.85	1.7
23	90	0.02	1.3	1.0	0.19	1.2	3.0	0.03	1.5	e2.7	1.0	0.95
24	46	0.02	0.98	1.0	22	0.60	2.2	0.14	1.1	0.09	1.2	1.8
25	1.9	0.63	e0.50	0.87	5.2	0.65	4.0	1.9	0.15	0.05	18	1.6
26	22	e0.60	e0.50	0.72	19	0.01	8.5	3.5	2.5	0.00	e2.0	1.7
27	16	0.57	e0.50	0.76	5.9	0.09	12	4.4	0.87	0.00	1.6	2.0
28	6.5	0.73	e0.50	0.75	19	0.13	8.4	1.5	1.8	0.63	2.6	2.2
29	2.0	1.9	e0.50	1.0	---	0.00	6.8	8.5	0.00	0.30	5.7	2.9
30	1.4	1.1	0.50	1.5	---	0.00	6.0	1.1	0.00	0.00	64	2.3
31	2.3	---	0.51	1.6	---	0.00	---	0.34	---	0.14	3.9	---
TOTAL	228.85	138.39	64.53	27.13	208.42	596.56	115.29	175.16	78.37	36.37	202.86	143.34
MEAN	7.38	4.61	2.08	0.88	7.44	19.2	3.84	5.65	2.61	1.17	6.54	4.78
MAX	90	62	44	1.6	84	266	12	14	34	6.2	64	46
MIN	0.00	0.01	0.03	0.23	0.00	0.00	0.00	0.03	0.00	0.00	0.05	0.31
AC-FT	454	274	128	54	413	1,180	229	347	155	72	402	284
(+)	1.31	0.21	0.28	0.0	0.69	1.68	0.0	0.01	0.05	0.30	0.68	0.32

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1990 - 2003, BY WATER YEAR (WY)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
MEAN	11.1	6.62	2.68	3.34	3.68	8.64	7.82	7.59	8.63	22.0	28.7	14.8		
MAX	38.3	16.9	8.32	14.2	16.3	21.3	42.9	30.5	25.0	67.9	45.7	34.5		
(WY)	(2001)	(1995)	(1994)	(1995)	(1993)	(2000)	(1997)	(1994)	(1996)	(1997)	(1994)	(1991)		
MIN	2.16	0.000	0.000	0.000	0.000	0.55	0.78	0.92	1.42	1.17	6.54	2.15		
(WY)	(1996)	(1990)	(1990)	(1990)	(1991)	(1991)	(2000)	(1998)	(1998)	(2003)	(2003)	(2000)		

SUMMARY STATISTICS

	FOR 2002 CALENDAR YEAR		FOR 2003 WATER YEAR		WATER YEARS 1990 - 2003	
ANNUAL TOTAL	2,333.06		2,015.27			
ANNUAL MEAN	6.39		5.52		10.5	
HIGHEST ANNUAL MEAN					20.2	
LOWEST ANNUAL MEAN					5.52	
HIGHEST DAILY MEAN	251	Sep 10	266	Mar 21	961	Jul 14, 1990
LOWEST DAILY MEAN	0.00	Apr 22	0.00	Oct 20	0.00	Oct 1, 1989
ANNUAL SEVEN-DAY MINIMUM	0.04	Nov 18	0.03	Mar 26	0.00	Oct 5, 1989
MAXIMUM PEAK FLOW			4,650		12,300	
MAXIMUM PEAK STAGE			6.30		10.40	
ANNUAL RUNOFF (AC-FT)	4,630		4,000		7,630	
10 PERCENT EXCEEDS	9.6		9.8		15	
50 PERCENT EXCEEDS	1.1		1.0		1.8	
90 PERCENT EXCEEDS	0.17		0.03		0.05	

(+) Total precipitation accumulation, in inches.
e Estimated

**08329911 NORTH CAMINO ARROYO AT SUNSET HILLS IN ALBUQUERQUE,
NEW MEXICO**

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger and pressure transducer, recording at 5-minute intervals, are housed in a metal 2.5- by 2.5- by 5.5-foot shelter anchored to a concrete slab on the right bank of the concrete-lined channel. An outside staff gage is painted on the right sidewall of the channel for reference. High-water measurements are determined by indirect methods. A CSG was installed on October 23, 1998, and is 0.42 foot above the bottom of the channel and mounted 32 degrees from horizontal.

Gage-Height Record.--The water-stage recorder is referenced to the channel bottom or to the outside staff during flows. When the orifice sump is filled with water to the level of the channel bottom, or PZF, the recorded gage height is 1.00 foot. The datalogger gave a complete and satisfactory record for water year 2003. The station was not operated for the winter period December 09, 2002, to March 05, 2003.

Rating.--The trapezoidal-shaped channel is straight for approximately 0.50 mile upstream from the gage and bends sharply to the right approximately 20 feet below the gage. Because flow regimes are supercritical in this steep channel, the downstream channel geometry is not necessary to compute the theoretical rating. The channel bottom is approximately 21 feet wide at the gage and has sidewalls about 7 feet high. The channel bottom is sloped toward the right bank (orifice side) at the gage.

Rating 1.0 was developed by a step-forward theoretical analysis during water year 1997. Because of extremely high flow velocities, discharge measurements at this site are nearly impossible with the current technology. Flows are very flashy, lasting less than an hour, so mean daily discharges are very small relative to the instantaneous peak discharges.

Discharge.--Rating 1.0 was used directly, without any shifts, for water year 2003. This site will remain dry unless significant precipitation falls in the watershed. During water year 2003, 15 no-flow inspections were made at this site. The maximum instantaneous gage height and discharge for the water year were 1.19 feet and 9.3 cubic feet per second, respectively, on October 23, 2002.

RIO GRANDE BASIN

08329911 NORTH CAMINO ARROYO AT SUNSET HILLS IN ALBUQUERQUE, NM

LOCATION.--Lat 35°11'40", long 106°31'57", Bernalillo County, Hydrologic Unit 13020203, in Elena Gallegos Grant, on right bank of concrete-lined arroyo, 10 ft above Holbrook Avenue bridge over North Camino Arroyo. This is located approximately 100 ft north of intersection of Holbrook Avenue and Elena Drive and 1.3 mi north of Paseo del Norte, on the northern edge of Albuquerque.

DRAINAGE AREA.--2.06 mi².

PERIOD OF RECORD.--August 1997 to current year (seasonal records).

GAGE.--Water-stage recorder. Elevation of gage is 5,645 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 39 ft³/s, at 1955 hours, July 23, 2001, gage height, 1.38 ft, from step-forward analysis of concrete-lined stream channel; no flow most of time.

EXTREMES FOR CURRENT YEAR.--Maximum discharge during period of seasonal operation, 9.3 ft³/s, Oct. 23, gage height, 1.19 ft; no flow most of time.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	---	---	---	0.00	0.00	0.02	0.00	0.00	0.00
2	0.00	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.01	0.00
3	0.00	0.00	0.19	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.04	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.04	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.06
10	0.00	0.02	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.13
11	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.04	0.00
15	0.00	0.00	---	---	---	0.00	0.01	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	---	---	---	0.07	0.00	0.00	0.00	0.00	0.00	0.00
17	0.01	0.00	---	---	---	0.02	0.00	0.00	0.00	0.00	0.00	0.00
18	0.01	0.00	---	---	---	0.16	0.00	0.00	0.00	0.00	0.01	0.00
19	0.00	0.00	---	---	---	0.26	0.00	0.00	0.03	0.00	0.00	0.00
20	0.00	0.00	---	---	---	0.32	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	---	---	---	0.46	0.00	0.00	0.00	0.00	0.00	0.00
22	0.02	0.00	---	---	---	0.00	0.00	0.00	0.00	0.01	0.00	0.00
23	0.29	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.11	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	---	---	---	0.03	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.01	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.04	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.01	0.00
29	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.02	0.00
31	0.00	---	---	---	---	0.00	---	0.00	---	0.00	0.00	---
TOTAL	0.49	0.10	---	---	---	---	0.01	0.00	0.05	0.01	0.09	0.19
MEAN	0.016	0.003	---	---	---	---	0.000	0.000	0.002	0.000	0.003	0.006
MAX	0.29	0.04	---	---	---	---	0.01	0.00	0.03	0.01	0.04	0.13
MIN	0.00	0.00	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
AC-FT	1.0	0.2	---	---	---	---	0.02	0.00	0.1	0.02	0.2	0.4

08329935 ARROYO 19A AT ALBUQUERQUE, NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger, recording at 5-minute intervals, is housed in a metal 15- by 15- by 18-inch shelter over a 12-inch-diameter CMC stilling well attached to a 1-foot Parshall flume. An outside staff gage is mounted to the flume for reference. The intake pipe to the well is 0.03 foot above the floor of the flume. Because the PZF is 1.00 foot, only flows above 1.03 feet (0.035 cubic foot per second) are recorded. A tipping-bucket rain gage is housed in a metal 15- by 15- by 18-inch shelter over a 3-inch-diameter galvanized pipe located approximately 40 feet south of the flume.

Gage-Height Record.--The water-stage recorder supplied a complete and satisfactory record for water year 2003. The station was not operated during the winter period December 10, 2002, to March 4, 2003.

Rating.--The control for the site is a 1-foot-wide Parshall flume, which is 1.2 feet tall and has a capacity of 5.28 cubic feet per second. In water year 1999, flows exceeded the capacity of the Parshall flume for the first time since the 1986 installation. The flume was submerged on two occasions: August 2 and August 5, 1999. Results of each slope-area indirect measurement are:

August 2, 1999, flood: gage height = 2.93 feet, $Q = 235$ cubic feet per second

August 5, 1999, flood: gage height = 2.63 feet, $Q = 100$ cubic feet per second

Rating 1.0, used prior to water year 1999, did not extend beyond the flow capacity of the flume (5.28 cubic feet per second). Rating 2.0 was developed in 1999 and computes discharges up to 270 cubic feet per second. A break point in the rating occurs at the gage height where the flume is filled to capacity (2.2 feet), and multiple offsets are used to plot the lower and upper portions of the stage-discharge relation.

No shifts to rating 2.0 were needed for water year 2003. The flume remains clear of debris or sediment. More high-water flows are needed to confirm the portion of rating 2.0 greater than the flume capacity.

During water year 2003, 14 no-flow visits were made at this site.

Discharge.--Discharges are computed from rating 2.0 directly. No flows occurred in water year 2003. Flows at this site are rare and require a significant amount of rainfall in the upper watershed.

RIO GRANDE BASIN

08329935 ARROYO 19A AT ALBUQUERQUE, NM

LOCATION.--Lat 35°09'24", long 106°43'50", in NE 1/4 NE 1/4 sec.28, T.11 N., R.2 E., Bernalillo County, Hydrologic Unit 13020203, on right bank 900 ft upstream from culvert under 81st Street, 1,200 ft south of city water tank, and 0.6 mi south of intersection of 81st Street and Atrisco Drive at Albuquerque.

DRAINAGE AREA.--1.50 mi².

PERIOD OF RECORD.--June 1977 to current year (seasonal records).

GAGE.--Water-stage recorder and recording tipping-bucket rain gage with 0.01-in. increments. The control at the site is a Parshall flume. Elevation of gage is 5,341 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to June 19, 1986, at site 450 ft downstream at different datum.

REMARKS.--Records good. Recording rain gage at station. The basin drains undeveloped semidesert terrain above the escarpment west of Albuquerque. See tabulation below for monthly precipitation, in inches. No flow most of time.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 234 ft³/s, Aug. 2, 1999, gage height, 2.93 ft, on basis of two slope-area measurements of peak flow needed to extend rating beyond flume capacity. No flow most of time.

EXTREMES FOR CURRENT YEAR.--No flow this year.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00	---	---	---	---	0.00	---	0.00	---	0.00	0.00	---
TOTAL	0.00	0.00	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
MEAN	0.000	0.000	---	---	---	---	0.000	0.000	0.000	0.000	0.000	0.000
MAX	0.00	0.00	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
MIN	0.00	0.00	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
AC-FT	0.00	0.00	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
(+)	1.07	0.35	0.51	0.0	0.51	1.26	0.04	0.07	0.20	0.16	0.55	0.30

(+) Total precipitation accumulation, in inches.

083299375 MARIPOSA DIVERSION OF SAN ANTONIO ARROYO AT ALBUQUERQUE,
NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--This station was established during the summer of 1993 exclusively for water-quality sampling. As desired by the cooperators, AMAFCA and City of Albuquerque Hydrology Department, only gage heights during sampling were recorded. No data for this site were published in the USGS Water-Data Report prior to water year 2001. Complete water year discharge records were not calculated until water year 2000. On October 26, 1999, an electronic datalogger and pressure transducer became the primary water-stage recorder. The instruments are housed in a metal 2.5- by 2.5- by 6-foot shelter anchored to a concrete pad on the left bank, approximately 15 feet upstream from a 15-foot-diameter corrugated metal culvert. The culvert acts as the gage control. An outside staff with attached CSG is mounted approximately 10 feet upstream from the culvert. The pressure transducer orifice is mounted to the concrete pad immediately upstream from the culvert. The PZF is a chiseled square on the concrete pad of the culvert entrance. Its given elevation is 1.00 foot.

Gage-Height Record.--The recorder referenced to the outside staff gave a complete and satisfactory record during the entire water year. The sensor orifice is mounted in a depression upstream from the culvert lip, so all flow depths above the PZF are recorded. No flows occur without significant precipitation in the watershed.

Rating.--The concrete lip at the culvert entrance acts as the low-flow control and PZF. Low flows are measured with a standard current-velocity meter, and higher flows are calculated indirectly using culvert-flow computational methods. Rating 3.0 was in effect prior to water year 2001 and has a PZF of 0.00 foot. To avoid negative gage-height readings during times of no flow, the recorders are set with a built-in 1.00-foot datum, or an effective PZF of 1.00 foot. Rating 4.0, which incorporates this 1.00-foot datum, was developed and started in water year 2001. The new rating is the same as rating 3.0 in all other aspects.

Discharge.--Rating 4.0 was applied directly without shifts this water year. Rating shifts may be required if debris accumulates in the barrel or entrance of the culvert. Estimated discharges are based exclusively on precipitation records for the watershed because no upstream or downstream gages are available for comparison. The peak stage and discharge for this water year occurred on October 23, 2002, and were 2.65 feet and 50 cubic feet per second, respectively. Twenty no-flow inspections were made and three water-quality samples were collected at this site in water year 2003.

RIO GRANDE BASIN

083299375 MARIPOSA DIVERSION OF SAN ANTONIO ARROYO AT ALBUQUERQUE

LOCATION.--Lat 35°08'24", long 106°42'17", in SE ¼ NE ¼ sec.35, T.11 N., R.2 E., Bernalillo County, Hydrologic Unit 13020203, 1,500 ft upstream from the San Antonio underpass at Coors Boulevard on Albuquerque's west side, 1.1 mi north of Interstate 25 and Coors Boulevard intersection.

DRAINAGE AREA.--30.5 mi².

PERIOD OF RECORD.--Summer 1993 to October 1999, recorded flow events only during water-quality sampling. October 1999 to current year, continuous record.

GAGE.--Water-stage recorder and crest-stage gage referenced to outside staff gage. Elevation of gage is 5,100 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good. No flows occur unless significant precipitation falls in the watershed.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16
11	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.08	0.00	1.1	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	2.2	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	4.3	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00
23	5.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	3.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.3	0.00
29	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	0.55	0.00
30	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00	---	0.00	0.00	---	0.00	---	0.00	---	0.00	0.00	---
TOTAL	9.52	1.09	0.88	0.08	0.05	8.65	0.00	0.00	0.00	0.00	3.85	0.34
MEAN	0.31	0.036	0.028	0.003	0.002	0.28	0.000	0.000	0.000	0.000	0.12	0.011
MAX	5.7	1.0	0.69	0.08	0.05	4.3	0.00	0.00	0.00	0.00	3.3	0.18
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AC-FT	19	2.2	1.7	0.2	0.1	17	0.00	0.00	0.00	0.00	7.6	0.7

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 2000 - 2003, BY WATER YEAR (WY)

	2000	2001	2002	2003
MEAN	0.22	0.071	0.010	0.007
MAX	0.55	0.25	0.028	0.027
(WY)	(2001)	(2001)	(2003)	(2001)
MIN	0.000	0.000	0.000	0.000
(WY)	(2002)	(2000)	(2002)	(2000)

SUMMARY STATISTICS

FOR 2002 CALENDAR YEAR

FOR 2003 WATER YEAR

WATER YEARS 2000 - 2003

ANNUAL TOTAL	35.27	24.46		
ANNUAL MEAN	0.097	0.067		0.074
HIGHEST ANNUAL MEAN				0.092
LOWEST ANNUAL MEAN				0.065
HIGHEST DAILY MEAN	8.8	Aug 3	5.7	Oct 23
LOWEST DAILY MEAN	0.00	Jan 1	0.00	Oct 1
ANNUAL SEVEN-DAY MINIMUM	0.00	Jan 1	0.00	Oct 1
MAXIMUM PEAK FLOW			50	Oct 23
MAXIMUM PEAK STAGE			2.65	Oct 23
ANNUAL RUNOFF (AC-FT)	70	49		54
10 PERCENT EXCEEDS	0.00	0.00		0.00
50 PERCENT EXCEEDS	0.00	0.00		0.00
90 PERCENT EXCEEDS	0.00	0.00		0.00

08329938 LADERA ARROYO AT ALBUQUERQUE, NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger, recording at 5-minute intervals, is housed in a metal shelter over an 18-inch-diameter corrugated metal stilling well. Inside and outside staff gages are available as references. An electric-tape gage was installed as an additional inside reference gage on September 12, 2000. A peak stage indicator clip was attached to the float tape on April 23, 1998. A tipping-bucket rain gage is housed in a metal 15- by 15- by 18-inch shelter attached to a 3-inch-diameter galvanized pipe and is located approximately 75 feet south of the water-stage recorder.

Gage-Height Record.--The water-stage recorder referenced to the inside staff and electric-tape gage gave a complete and satisfactory record for the entire water year. This station was not operated during the winter period from December 10, 2002, to March 4, 2003.

Rating.--The channel is straight for approximately 40 feet upstream and 300 feet downstream from the gage. The channel bottom is plane-bedded, loose sand and is approximately 15-20 feet wide with no vegetation. Light to moderate vegetation grows on both banks, mostly small weeds and shrubs. An occasional desert willow shrub grows on the right overbank area. Both banks are generally less than 2 feet high and contain most flows.

Rating 5.0 was developed in water year 1999 and was based on the four measurements completed during that year. Measurements 5 and 6 along with the approximate PZF for most of that water year (2.20 feet) defined the lower end of the new rating, and the two slope-area indirect measurements (4 and 7) defined the upper end. The rating breaks to the right at about the 3.3- to 3.4-foot gage-height range because this represents the level when flows start to top the channel banks and spill over to a flatter, wider flood plain.

The channel bottom (PZF) was at approximately 2.00 feet on the outside staff at the close of water year 2001 and because the PZF for rating 5.0 is 2.20 feet, a +0.20-foot shift to the rating is required. No flows occurred in water years 2002-03, so the same +0.20-foot shift effective at the close of water year 2001 was carried through water years 2002 and 2003. This shift diagram was derived from three points of reference; the low end point is below the PZF; the midpoint (3.4 feet) represents the break in the rating where flows begin to overtop the small banks and spill out onto a broader flood plain; and the upper input point represents the top of the rating, which was defined by the water year 1999 flood event. The shift value is held constant through the midpoint break of 3.4 feet because a change in bed elevation affects all flows within the confines of the small banks. The shift value returns to zero by the top of the rating, at a gage height of 4.1 feet.

Discharge.--During water year 2003, 13 no-flow site visits were made. No flows occurred this water year. Because of its flashy nature, with flows lasting less than an hour, actually observing any flow is difficult. Usually, only points of zero flow (channel bottom elevations) are available to define shifts. This channel does not flow until significant thunderstorms occur in the watershed.

RIO GRANDE BASIN

08329938 LADERA ARROYO AT ALBUQUERQUE, NM

LOCATION.--Lat 35°06'56", long 106°44'48", in Town of Atrisco Land Grant, Bernalillo County, Hydrologic Unit 13020203, on left bank, 0.25 mi northwest of City of Albuquerque water storage tank, on dirt road extension of 98th Street, and 2.3 mi west of North Coors Boulevard in Albuquerque.

DRAINAGE AREA.--0.34 mi².

PERIOD OF RECORD.--May 1981 to current year (seasonal records).

GAGE.--Water-stage recorder and recording tipping-bucket rain gage with 0.01-in. increments. Elevation of gage is 5,312 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to June 5, 1986, at site 0.2 mi downstream at different datum.

REMARKS.--Records fair. Recording rain gage at station. The basin is undeveloped semidesert terrain, part of which is above the escarpment west of Albuquerque.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 195 ft³/s, Aug. 2, 1999, gage height, 4.12 ft, from slope-area indirect measurement; no flow most of time.

EXTREMES FOR CURRENT YEAR.--No flow this water year.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00	---	---	---	---	0.00	---	0.00	---	0.00	0.00	---
TOTAL	0.00	0.00	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
MEAN	0.000	0.000	---	---	---	---	0.000	0.000	0.000	0.000	0.000	0.000
MAX	0.00	0.00	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
MIN	0.00	0.00	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
AC-FT	0.00	0.00	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00

**08330200 SAN JOSE DRAIN AT WOODWARD ROAD AT ALBUQUERQUE,
NEW MEXICO**

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger and pressure transducer, recording at 5-minute intervals, have been used to collect gage-height and rainfall data since September 23, 1999. Prior to this date, gage heights were recorded only during water-quality sampling. An ISCO model 3700 automatic pump sampler is also located in the gage house. Electricity is provided to the shelter. The instruments are housed in a 4- by 4- by 8-foot brick walk-in building located approximately one-quarter mile west of the intersection of Woodward Road and South Broadway Boulevard in Albuquerque. The shelter is immediately adjacent to the north shoulder of Woodward Road and directly over a 10-foot-diameter metal culvert. The channel is concrete lined upstream from the culvert. Downstream, the natural channel is normally choked with weed growth. City maintenance crews clear the channel at least once each year. The reference gage is an outside staff painted on the concrete channel side slope near the recorder orifice pipe. The staff is referenced to a tape-up point (RM1), which is a hex-head bolt anchored in the channel bottom approximately 1 foot streamward of the staff gage. Low- to medium-stage discharge measurements can be made by wading near the gage or downstream from the culvert.

Gage-Height Record.--The recorder gave a complete and satisfactory record for the water year except when ice covered the orifice, leading to erroneous data on January 4 and June 5-23, 2003, when the orifice line was torn from its anchors by maintenance personnel during a channel clean-out operation, and August 28-29 when the datalogger malfunctioned. The daily mean discharge was estimated as zero for January 4, but estimated as 0.80 cubic foot per second for August 28-29 due to small base flows before and after these 2 days. Estimated daily mean discharges for June 5-23 vary from zero to 0.2 cubic foot per second based on flows before and after this precipitation-free period.

Datum correction.--Only one recorder correction was applied this water year. The damaged orifice line was reattached to the concrete sidewall of the channel on June 23, 2003; however, the water level was not high enough to cover the orifice, preventing an accurate gage-height calibration. The site visit on July 17 provided an opportunity to correctly set the instrument, and a +0.06-foot correction was required for June 23-July 17.

Rating.--Rating 3.0 was developed for water year 2000 because rating 2.0 used theoretical discharge computations as input points for the rating curve, giving it an irregular shape. The new rating is basically the same as rating 2.0, with the exception of a smooth, best-fit line through these input points. Because of a very flat channel slope (approximately 0.0003 foot per foot), sediment and debris commonly accumulate in the culvert and channel, resulting in large negative shifts to the stage against discharge rating. Occasionally, large sediment deposits in the culvert throat cause ponding at the gage orifice, but no flows exist downstream. The control is the 10-foot-diameter culvert pipe for most flows, but the mud layer in the culvert or vegetative cover in the natural lined

part of the channel downstream may act as the control during extremely low flows and times of sediment accumulation in the culvert. The orifice is mounted 0.54 foot above the bottom of the channel to prevent sediment accumulations from covering the sensor and affecting the gage-height record. Because of this, discharge computations show a constant -0.54-foot shift, or correction to the rating, below recorded gage heights of 0.55 foot. This technique eliminates computing a discharge when water levels are below the orifice. Prior to the June 23, 2003, repair, the orifice was mounted at an elevation of 0.50 foot, requiring a constant -0.50-foot shift to the rating.

Discharge.--Two measurements (6-7) were completed on March 21, 2003, and indicate a positive difference to rating 3.0 of 15 percent and 2.3 percent, respectively. Because the measuring cross section was congested with weeds, the rated discharge is considered more accurate than the two computed discharges. Both measurements were completed within an hour; the 13-percent variability illustrates the difficulty in duplicating discharge computations under these conditions. This pair of measurements indicates that the -0.28-foot shift, carried over from water year 2002, was no longer in effect by March 21, 2003. The negative shift was prorated to zero during the first significant flow of water year 2003, on November 9, 2002. This large flow presumably washed out enough debris and weed growth downstream from the concrete-lined portion of the channel to eliminate backwater effects. The zero shift was applied through the remainder of water year 2003 because channel conditions remained unchanged. No other measurements were completed in this water year to better define the stage-discharge relation. Occasionally, negative shift values can be determined by hydrographic interpretations. Peak flows generally display a slower recession pattern after reaching the water level of a channel obstruction. The shift values coincide with the approximate maximum gage height resulting from daily trickle flows ponding in the area behind the mud "dam" in the channel, then slowly seeping into the sediment layers, resulting in a diurnal-type hydrograph. In reality, these tiny trickle flows would not register on the datalogger in a clean channel. Field inspections are also valuable in determining ponded water depths upstream from the sediment bars, even though no flows are detected downstream. During water year 2003, no sediment dams existed in the culvert pipe under Woodward Road, so no shift corrections to rating 3.0 were required. The peak gage height and discharge for water year 2003 occurred on March 20 and were 3.36 feet and 32 cubic feet per second, respectively.

RIO GRANDE BASIN

08330200 SAN JOSE DRAIN AT WOODWARD ROAD AT ALBUQUERQUE, NM

LOCATION.--Lat 35°02'56", long 106°38'55", in NE 1/4 of SW 1/4 sec.32, T.10 E., R.3 E., Bernalillo County, Hydrologic Unit 13020203, approximately 1/4 mi west of the intersection of Woodward Road and South Broadway on Albuquerque's south side. The gage is located on the right bank of San Jose Drain and the shoulder of Woodward Road where a corrugated metal culvert passes under Woodward.

DRAINAGE AREA.--1.95 mi².

PERIOD OF RECORD.--October 1993 to September 23, 1999, only data during water-quality sampling events were recorded and never published in the USGS annual data report. September 23, 1999 to present, full year's data are recorded, along with rainfall.

GAGE.--Water-stage recorder, and since July 1998, a tipping-bucket rain gage on the roof of the gage house is operational. The channel is concrete-lined above Woodward Road and natural below. Elevation of gage is 4,946 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records fair because stage-discharge relation affected by heavy weed growth downstream. Estimated days poor.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.30	0.00	0.79	0.00	0.00	2.5	1.7	2.1	0.26
2	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	1.9	2.1	2.0	0.07
3	0.00	0.00	5.6	0.03	0.00	0.00	0.00	0.00	0.09	2.3	2.4	0.09
4	0.00	0.41	0.15	e0.10	0.00	0.00	0.00	0.00	0.08	2.7	1.5	0.21
5	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	e0.00	2.7	0.32	0.12
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	e0.00	2.1	0.77	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	e0.00	2.5	1.0	0.23
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	e0.00	2.6	1.8	0.05
9	0.02	0.63	0.00	0.32	1.3	0.00	0.00	0.00	e0.00	2.7	1.5	0.04
10	0.00	5.5	0.00	0.31	0.31	0.00	0.00	0.00	e0.00	2.8	1.7	0.49
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	e0.00	2.8	2.0	0.02
12	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	e0.00	2.5	2.0	0.00
13	0.00	0.00	0.00	0.00	6.3	0.00	0.00	0.00	e0.00	2.6	2.1	0.00
14	0.00	0.00	0.00	0.00	1.9	0.00	0.00	0.00	e0.00	2.7	2.0	0.06
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	e0.00	2.4	1.7	0.00
16	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	e0.00	2.2	1.1	0.00
17	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00	e0.00	2.0	1.0	0.00
18	0.00	0.00	0.00	0.00	0.00	2.7	0.00	0.00	e0.10	2.1	1.2	0.12
19	0.00	0.00	0.00	0.00	0.00	7.1	0.15	0.00	e0.10	2.2	1.5	0.00
20	0.00	0.00	0.00	0.00	3.3	3.0	0.11	0.69	e0.00	2.4	0.98	0.00
21	0.00	0.00	0.00	0.00	0.17	7.9	0.00	0.00	e0.00	1.6	0.69	0.13
22	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	e0.10	1.8	0.93	0.55
23	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	e0.20	2.1	0.88	0.02
24	0.66	0.00	0.00	0.00	1.2	0.00	0.00	0.00	0.41	1.8	0.59	0.00
25	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.09	0.48	1.5	1.5	0.60
26	0.00	0.00	0.00	0.00	0.65	0.00	0.97	0.27	0.39	1.7	0.21	0.05
27	0.08	0.00	0.00	0.00	0.00	0.00	1.7	1.3	0.31	1.6	0.92	0.00
28	0.00	0.00	0.14	0.00	0.92	0.00	0.00	0.00	0.54	2.0	e0.80	0.20
29	0.00	0.00	0.18	0.00	---	0.00	0.05	0.00	0.00	2.1	e0.80	0.05
30	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	1.1	2.2	1.6	0.00
31	0.00	---	0.00	0.00	---	0.00	---	0.00	---	2.1	0.08	---
MEAN	0.07	0.22	0.20	0.04	0.62	0.73	0.10	0.08	0.28	2.21	1.28	0.11
MAX	1.1	5.5	5.6	0.32	6.3	7.9	1.7	1.3	2.5	2.8	2.4	0.60
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.5	0.08	0.00
AC-FT	4.4	13	12	2.8	34	45	5.9	4.9	16	136	79	6.7

e Estimated

**08330540 TRAMWAY FLOODWAY CHANNEL AT ALBUQUERQUE,
NEW MEXICO**

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger and pressure transducer, recording at 5-minute intervals, are housed in a metal 5- by 5-foot walk-in shelter on the right bank of the concrete-lined channel. An outside staff gage is painted on the channel side slope and is the reference gage. A CSG, inclined 35 degrees from horizontal, was mounted to the right bank on October 22, 1998. Rainfall data from a tipping-bucket rain gage mounted to the gage-house roof have been recorded by the datalogger since May 1, 2001. Prior to March 19, 1998, the pressure transducer orifice was mounted 0.12 foot above the channel bottom. On March 19, the orifice was lowered into a sump, which is below the channel bottom so all gage heights above the PZF are recorded. The recorded gage height is 1.00 foot when the water level in the sump is equal to the channel bottom elevation, or PZF.

Gage-Height Record.--The water-stage recorder, referenced to the outside staff gage, provided a complete and satisfactory record for the entire water year except for periods of ice-affected gage heights on December 9, 11, 28, and 31, 2002, and February 10, 2003. Estimations of mean daily discharges were determined by base-flow values available before and after the estimated period and by precipitation records. No other gage is located on this channel that could provide a hydrographic comparison for estimating missing record at the Tramway Floodway station. Prior to water year 2002, the gage was not operational during the winter period from approximately November 15 to March 15.

Rating.--The control for the gage is the concrete-lined channel. The depth of the channel at the gage is approximately 10 feet, and the bottom width is 10 feet. The sidewalls are inclined 35 degrees from horizontal. Rating 2.0 was effective from October 1, 1996, until March 19, 1998, when the orifice was lowered. Rating 2.0 is essentially identical to rating 1.0; the old rating, however, computed discharges for gage heights below the level of the orifice (0.12 foot). Because recording gage heights less than the orifice elevation is impossible, all discharges below the 0.12-foot gage height (less than 3.4 cubic feet per second) were computed as zero for rating 2.0.

Rating 3.0 was developed for the period after March 19, 1998, when all gage heights greater than the PZF are recorded. Rating 3.0 is identical to rating 1.0, except the PZF for rating 3.0 is 1.00 foot instead of 0.00 foot. All three ratings were developed by step-forward theoretical analysis because flow regimes here are supercritical.

Discharge.--Estimations of missing record are based on only rainfall data and historic base flows. No upstream or downstream gage is available for hydrographic comparison. Small daily flows, probably from sprinkler system runoff, usually occur in the evening and early morning hours.

During water year 2003, 16 site inspections were made. Small trickle flows were

occasionally observed and the recorder was tracking them to correct water levels. The instantaneous peak stage and discharge for water year 2003 were 2.12 feet and 132 cubic feet per second, respectively, on September 7.

Discharges were computed using rating curve 3.0 directly with no shifts. Flows probably cause enough turbulence in the orifice sump to wash out any debris that might affect gage heights. The channel slope in this reach creates extremely high velocities that make streamflow measurements nearly impossible. Because of the stability of the channel, the theoretical rating curve is considered better than individual measurements.

RIO GRANDE BASIN

08330540 TRAMWAY FLOODWAY CHANNEL AT ALBUQUERQUE, NM

LOCATION.--Lat 35°04'42", long 106°29'49", Bernalillo County, Hydrologic Unit 13020203, on right bank 300 ft downstream from Copper Boulevard Bridge, near corner of Tramway and Copper Boulevards NE in Albuquerque.

DRAINAGE AREA.--1.60 mi².

PERIOD OF RECORD.--July 1987 to November 2000 (seasonal records), March 2001 to current year.

GAGE.--Water-stage recorder, crest-stage gage, and concrete-lined channel. Recording rain gage at this site since May 2001. Elevation of gage is 5,740 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good except for those estimated, which are poor. Prior to water year 1998, some minor streamflow may have existed on days when daily mean discharges have been recorded as zero due to the sensitivity limits of the streamflow-monitoring equipment. Since 1998, all flows above zero are recorded. See tabulation below for monthly precipitation, in inches.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.08	0.00	0.00	0.00	0.00	0.44	0.00	0.07	0.78	0.13	0.16	0.13
2	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.10	1.1	0.15
3	0.03	0.00	1.3	0.00	0.01	0.00	0.00	0.00	0.08	0.17	0.21	0.14
4	0.02	0.26	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.13	0.17	0.15
5	0.20	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.09	0.12	0.16	0.15
6	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.02	0.09	0.13	0.48
7	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.06	0.27	0.08	1.8
8	0.21	0.00	0.01	0.00	0.51	0.00	0.00	0.06	0.07	0.41	0.08	0.18
9	0.12	1.1	e0.00	0.00	1.3	0.00	0.00	0.07	1.2	0.33	0.13	0.36
10	0.05	0.63	0.07	0.00	e0.00	0.00	0.00	0.00	0.13	0.22	0.71	1.1
11	0.01	0.06	e0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.25	0.17	0.11
12	0.04	0.02	0.00	0.00	0.00	0.00	0.02	0.06	0.07	0.22	0.22	0.04
13	0.03	0.00	0.00	0.00	2.3	0.00	0.00	0.06	0.05	0.26	0.19	0.03
14	0.01	0.00	0.00	0.00	0.37	0.00	0.00	0.09	0.06	0.32	0.36	0.02
15	0.03	0.00	0.00	0.01	0.03	0.01	0.05	0.08	0.04	0.22	0.16	0.03
16	0.03	0.00	0.00	0.00	0.00	0.30	0.00	0.06	0.08	0.20	0.63	0.05
17	0.02	0.00	0.00	0.00	0.01	0.40	0.00	0.00	0.31	0.18	0.39	0.06
18	0.05	0.00	0.00	0.00	0.18	1.7	0.00	0.00	0.11	0.29	0.29	0.04
19	0.04	0.00	0.00	0.00	0.00	2.0	0.12	0.00	0.22	0.05	0.20	0.04
20	0.00	0.00	0.00	0.00	0.40	2.3	0.00	0.00	0.08	0.21	0.20	0.07
21	0.00	0.00	0.00	0.00	0.00	2.3	0.00	0.00	0.07	1.1	0.21	0.03
22	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.03	0.24	0.18	0.02
23	0.96	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.06	0.13	0.05	0.01
24	0.60	0.00	0.00	0.00	0.58	0.00	0.00	0.02	0.10	0.12	0.10	0.03
25	0.01	0.00	0.00	0.00	0.05	0.02	0.01	0.46	0.07	0.09	0.27	0.04
26	0.61	0.00	0.00	0.00	1.9	0.00	0.00	0.11	0.09	0.11	0.12	0.04
27	0.83	0.00	0.01	0.00	0.16	0.00	0.01	0.11	0.14	0.05	0.40	0.00
28	0.05	0.00	e0.00	0.00	1.0	0.00	0.00	0.07	0.11	0.07	0.43	0.00
29	0.00	0.00	0.00	0.03	---	0.00	0.01	0.08	0.05	0.07	0.15	0.02
30	0.00	0.00	0.02	0.00	---	0.00	0.05	0.03	0.09	0.10	0.91	0.02
31	0.00	---	e0.00	0.00	---	0.00	---	0.23	---	0.13	0.07	---
TOTAL	4.27	2.07	1.41	0.04	8.82	9.47	0.29	1.86	4.53	6.38	8.63	5.34
MEAN	0.14	0.069	0.045	0.001	0.32	0.31	0.010	0.060	0.15	0.21	0.28	0.18
MAX	0.96	1.1	1.3	0.03	2.3	2.3	0.12	0.46	1.2	1.1	1.1	1.8
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.00
AC-FT	8.5	4.1	2.8	0.08	17	19	0.6	3.7	9.0	13	17	11
(+)	0.64	0.43	0.24	0.0	1.26	1.77	0.04	0.09	0.59	0.26	0.58	0.46

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1990 - 2003, BY WATER YEAR (WY)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
MEAN	0.24	0.088	0.097	0.15	0.20	0.32	0.11	0.12	0.12	0.35	0.49	0.23		
MAX	1.03	0.38	0.17	0.29	0.31	1.17	0.38	0.38	0.41	0.95	1.44	0.93		
(WY)	(1990)	(2002)	(2002)	(2002)	(2003)	(1990)	(2002)	(1998)	(2001)	(1998)	(2001)	(1991)		
MIN	0.000	0.000	0.000	0.001	0.093	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
(WY)	(1991)	(1990)	(1990)	(2003)	(2002)	(1991)	(1991)	(1995)	(1990)	(1994)	(1994)	(1990)		

SUMMARY STATISTICS

	FOR 2002 CALENDAR YEAR		FOR 2003 WATER YEAR		WATER YEARS 1990 - 2003	
ANNUAL TOTAL	72.74		53.11			
ANNUAL MEAN	0.20		0.15		0.23	
HIGHEST ANNUAL MEAN					0.59	
LOWEST ANNUAL MEAN					0.000	
HIGHEST DAILY MEAN	5.4	Apr 7	2.3	Feb 13	32	Oct 4, 1989
LOWEST DAILY MEAN	0.00	Jan 3	0.00	Oct 20	0.00	Oct 1, 1989
ANNUAL SEVEN-DAY MINIMUM	0.00	Feb 6	0.00	Nov 13	0.00	Oct 5, 1989
MAXIMUM PEAK FLOW			132	Sep 7	3,190	Jul 9, 1988
MAXIMUM PEAK STAGE			2.12	Sep 7	8.62	Jul 9, 1988
ANNUAL RUNOFF (AC-FT)	144		105		166	
10 PERCENT EXCEEDS	0.49		0.36		0.46	
50 PERCENT EXCEEDS	0.07		0.02		0.00	
90 PERCENT EXCEEDS	0.00		0.00		0.00	

(+) Total precipitation accumulation, in inches.
e Estimated

08330600 TIJERAS ARROYO NEAR ALBUQUERQUE, NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger, recording at 5-minute intervals, is housed in a metal 34-by 34-inch shelter over a 24-inch-diameter, 10-foot-long, corrugated metal stilling well. The stilling well is recessed into the left streambank and is accessed by a 4- by 8-foot expanded metal walkway. The walkway also serves as a support for the well and is anchored into the bank with steel angle-iron braces. Outside and inside staff gages are available as references to the gage datum. An electric-tape gage was installed as an additional reference gage on July 9, 1998. A peak stage indicator clip was attached to the float tape on March 17, 1998.

Gage-Height Record.--The water-stage recorder, which is referenced to the inside staff and electric-tape gages, gave a complete and satisfactory record for water year 2003, except March 21, 2003, when silt was deposited in the well. This sediment commonly accumulates during the recession of a hydrograph and may suspend the recorder float above the channel bottom elevation. The final hours of the March 21 flow hydrograph were estimated by graphical methods with little loss in accuracy, and the estimated gage heights were re-entered into the database to compute a mean daily discharge. No flows occur at this site without substantial rainfall or snowmelt runoff in the upper drainage basin. This station recorded gage heights continuously during the entire water year. Prior to water year 1999, it was not operated during the winter months.

Rating.--The channel is straight for at least 1,000 feet upstream and downstream from the gage. Steep-cut banks on both sides of the channel are approximately 4 feet high and partially covered with vegetation. The channel bottom is approximately 30 feet wide and is composed of very loose sand that is prone to extreme shifting. The channel bottom elevation, or PZF, may change many times throughout the year and is critical in the determination of shift values because most flows cannot be measured. A hydrograph generally indicates the PZF because ponded water remains in the stilling well long after flows cease. Field recordings of channel bottom elevations also confirm that the channel alternates between aggrading and scouring conditions.

Measuring conditions at this site are poor. Generally, low flows are shallow and characterized by high velocities and uneven measuring sections. Peak flows are flashy and change so quickly that mean gage heights for measurements are difficult to determine. High-water measurements are made by indirect methods. Even poorly rated measurements are often used to define a shift because measurements are so difficult to obtain at this site.

Rating 4.0 was developed in water year 1997 and began on October 1, 1996. The upper end of the rating is based on a theoretical step-backwater analysis and is verified by a slope-area indirect measurement (22) on July 9, 1996. Rating 4.0 was used through water year 2000. Measurements 56 and 57, completed in water year 2001, plot left (negative) of

rating curve 4.0, as do all measurements from water year 2000, so a new rating, 5.0, was developed in water year 2001. Because of the extremely variable sand channel, most flows scour or aggrade the bed slightly, making development of a standard rating curve difficult.

No shifts were being applied to rating 5.0 at the end of water year 2002. This zero shift correction was based on channel bottom elevations measured during field inspections that matched the rated PZF gage height of 2.75 feet. Beginning with the recession of the November 10 hydrograph, a -0.10-foot shift was applied because channel aggradation raised the PZF to approximately 2.85 feet. Field inspections after the large flow on March 21 indicated that the channel had aggraded further and the PZF was at a gage height of approximately 2.90 feet, which required a shift of -0.15 foot to rating 5.0. The -0.10-foot shift was prorated to -0.15 foot during the falling limb of the hydrograph on March 21. Generally, aggradations occur as the discharge decreases and sediment drops out of suspension. Channel bottom elevations remained fairly stable until after the storm event on August 10 when the PZF was scoured to a gage height of approximately 2.85 feet, indicating a -0.10-foot shift again. This shift change was prorated from -0.15 foot to -0.10 foot during the rising limb of the hydrograph on August 10. The channel bottom scoured further, to a gage height of approximately 2.80 feet, during the large peak on August 30, 2003. A -0.05-foot shift correction was prorated from -0.10 foot during the rising limb of the hydrograph. This -0.05-foot shift was continued through the end of the water year.

Discharge.--During water year 2003, 41 no-flow site visits were completed. No discharge measurements were completed this water year. The instantaneous peak stage and discharge for the water year were 4.64 feet and 331 cubic feet per second, respectively, on March 21, 2003.

Remarks.--Records good except when the stilling well silted on March 21, resulting in estimated gage heights during the falling side of the hydrograph. This day is considered "estimated fair record."

RIO GRANDE BASIN

08330600 TIJERAS ARROYO NEAR ALBUQUERQUE, NM

LOCATION.--Lat 35°00'10", long 106°38'53", in SW ¼ SW ¼ sec.17, T.9 N., R.3 E., Bernalillo County, Hydrologic Unit 13020203, on left bank 800 ft upstream from bridge on Broadway Boulevard SE, 0.2 mi downstream from bridge on Interstate Highway 25, and 3.0 mi south of Albuquerque.

DRAINAGE AREA.--128 mi².

PERIOD OF RECORD.--October 1951 to September 1968 (annual maximum only), August 1974 to September 1998 (seasonal records), October 1998 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 4,999 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Mar. 10, 1988, at site 1,700 ft downstream at different datum.

REMARKS.--Records good except those for Mar. 21, which are fair.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.6
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
9	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	6.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.7	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	1.4	0.00	0.00	8.4	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	10	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.37	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	e26	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	2.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	6.6	0.00
31	0.00	---	0.00	0.00	---	0.00	---	0.00	---	0.00	1.9	---
TOTAL	2.95	6.39	0.00	0.00	6.10	37.54	0.00	0.00	15.10	0.37	8.68	4.67
MEAN	0.095	0.21	0.000	0.000	0.22	1.21	0.000	0.000	0.50	0.012	0.28	0.16
MAX	2.4	6.0	0.00	0.00	4.1	26	0.00	0.00	8.4	0.37	6.6	4.6
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AC-FT	5.9	13	0.00	0.00	12	74	0.00	0.00	30	0.7	17	9.3

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1999 - 2003, BY WATER YEAR (WY)

	1999	2000	2001	2002	2003
MEAN	0.52	0.087	0.000	0.000	0.043
MAX	2.20	0.21	0.000	0.000	0.22
(WY)	(2001)	(2003)	(1999)	(1999)	(2003)
MIN	0.000	0.000	0.000	0.000	0.000
(WY)	(2000)	(1999)	(1999)	(1999)	(2001)

SUMMARY STATISTICS

	FOR 2002 CALENDAR YEAR	FOR 2003 WATER YEAR	WATER YEARS 1999 - 2003
ANNUAL TOTAL	88.78	81.80	
ANNUAL MEAN	0.24	0.22	0.24
HIGHEST ANNUAL MEAN			0.43
LOWEST ANNUAL MEAN			0.063
HIGHEST DAILY MEAN	17	26	47
LOWEST DAILY MEAN	0.00	0.00	0.00
ANNUAL SEVEN-DAY MINIMUM	0.00	0.00	0.00
MAXIMUM PEAK FLOW		331	a2,930
MAXIMUM PEAK STAGE		4.64	b9.60
ANNUAL RUNOFF (AC-FT)	176	162	173
10 PERCENT EXCEEDS	0.00	0.00	0.00
50 PERCENT EXCEEDS	0.00	0.00	0.00
90 PERCENT EXCEEDS	0.00	0.00	0.00

a From rating curve extended above 10 ft³/s, on basis of step-backwater analysis, and slope-area measurement.

b From floodmarks.

c Estimated

**08330775 SOUTH DIVERSION CHANNEL ABOVE TIJERAS ARROYO NEAR
ALBUQUERQUE, NEW MEXICO**

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger and pressure transducer, recording at 5-minute intervals, are housed in a concrete block, walk-in shelter on the left bank where the earthen channel upstream becomes entirely concrete lined. The gage is approximately 0.3 mile downstream from the Murray Road bridge, which is 0.2 mile west of South Broadway Boulevard. An outside staff gage is the reference gage. On April 30, 1999, the lower staff gage was moved to the right bank and a CSG was mounted to the staff support. The lower CSG cap lip elevation is 1.69 feet. A satellite transmitter was installed on May 1, 2003, and updates the USGS web site every 4 hours.

Gage-Height Record.--The recorder gave a complete and satisfactory record for water year 2003. Prior to May 3, 1999, only gage heights above 0.11 foot were recorded because the orifice line was mounted on top of the concrete channel bottom. On May 3, 1999, the orifice was mounted on the upstream face of the concrete channel apron and below the PZF. A 1.00-foot datum was added to recorded gage heights to prevent negative readings during dry periods.

Rating.--The control for this station is the upstream lip of the concrete-lined trapezoidal channel. The concrete-lined portion of the channel starts at the orifice mount. Upstream from the gage, the channel is an earthen bottom, trapezoidal shape. The bottom width of the channel is 16 feet. The slope of the sides is approximately 35 degrees. The depth of the channel is approximately 18 feet. New ratings 5.0 and 5.1 were developed in water year 2002. They are basically the same as rating 4.0 except the multiple input points used in rating 4.0, which caused an irregular-shaped line, were eliminated in ratings 5.0 and 5.1. The new ratings more closely approximated actual discharge measurements. Rating 5.1 is the same as 5.0 except that a 1.00-foot datum is added to all gage heights to prevent negative readings during dry periods. No shift corrections were applied to rating 5.1 this water year because of the stable nature of the channel at the gage and control.

Discharge.--Discharges were computed using rating 5.1 directly, with no shifts, for the entire water year. The channel bottom normally remains clear; therefore, shifts are rarely required at this site.

During water year 2003, 38 site inspections were completed. The maximum instantaneous stage and discharge during this water year were 3.05 feet and 199 cubic feet per second, respectively, on March 21, 2003.

RIO GRANDE BASIN

08330775 SOUTH DIVERSION CHANNEL ABOVE TIJERAS ARROYO NEAR ALBUQUERQUE, NM

LOCATION.--Lat 35°00'10", long 106°39'26", Bernalillo County, Hydrologic Unit 13020203, on right bank 600 ft upstream from confluence with Tijeras Arroyo, and 2.5 mi south of Albuquerque.

DRAINAGE AREA.--11.0 mi².

PERIOD OF RECORD.--June 1988 to current year.

GAGE.--Water-stage recorder, crest-stage gage, and concrete control. Elevation of gage is 4,930 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.00	0.00	1.6	0.00	0.00	3.8	0.00	0.00	0.38
2	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.84	0.00	0.00	0.16
3	0.00	0.00	3.2	0.00	0.00	0.10	0.00	0.00	0.01	0.00	0.00	0.00
4	0.00	0.00	1.1	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.03	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00
6	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
8	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.1
9	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.14
10	0.00	4.4	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.26
12	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.38
13	0.00	0.00	0.00	0.00	6.7	0.00	0.00	0.00	0.00	0.00	0.00	0.14
14	0.00	0.00	0.00	0.00	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.15
15	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.38
16	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.26
17	0.00	0.00	0.00	0.00	0.19	1.0	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.01	3.4	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	15	0.00	0.00	0.10	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	2.7	2.3	0.00	0.00	0.04	0.64	0.08	0.00
21	0.00	0.00	0.00	0.00	0.47	24	0.00	0.00	0.00	1.4	0.00	0.00
22	0.00	0.00	0.00	0.00	0.03	0.49	0.00	0.00	0.00	0.11	0.00	0.28
23	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.45	0.66	0.00	0.17
24	0.00	0.00	0.00	0.00	0.32	0.06	0.00	0.00	0.06	0.13	0.00	0.00
25	0.24	0.00	0.00	0.00	1.5	0.00	0.00	0.00	0.00	0.00	0.10	0.00
26	0.02	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.74	0.00
27	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.12	0.00
28	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	0.00	0.11
30	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	0.53	0.21
31	0.00	---	0.00	0.00	---	0.00	---	0.00	---	0.00	1.4	---
TOTAL	0.26	5.40	4.51	0.00	14.97	48.24	0.00	0.00	5.30	2.94	3.42	4.13
MEAN	0.008	0.18	0.15	0.000	0.53	1.56	0.000	0.000	0.18	0.095	0.11	0.14
MAX	0.24	4.4	3.2	0.00	6.7	24	0.00	0.00	3.8	1.4	1.4	1.1
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AC-FT	0.5	11	8.9	0.00	30	96	0.00	0.00	11	5.8	6.8	8.2

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1994 - 2003, BY WATER YEAR (WY)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003		
MEAN	0.89	0.74	0.070	0.060	0.12	0.35	0.12	0.23	0.46	0.70	1.41	0.82
MAX	2.88	4.50	0.39	0.18	0.53	1.56	0.57	1.83	3.14	2.09	4.65	2.79
(WY)	(1995)	(1995)	(1995)	(1995)	(2003)	(2003)	(1997)	(1994)	(1996)	(1997)	(1994)	(1997)
MIN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.044	0.11	0.000
(WY)	(2002)	(1996)	(1994)	(1994)	(1996)	(1996)	(1994)	(1995)	(1995)	(2002)	(2003)	(1998)

SUMMARY STATISTICS

	FOR 2002 CALENDAR YEAR		FOR 2003 WATER YEAR		WATER YEARS 1994 - 2003	
ANNUAL TOTAL	58.18		89.17			
ANNUAL MEAN	0.16		0.24		0.50	
HIGHEST ANNUAL MEAN					0.94	
LOWEST ANNUAL MEAN					0.15	
HIGHEST DAILY MEAN	13	Sep 11	24	Mar 21	133	Aug 15, 1994
LOWEST DAILY MEAN	0.00	Jan 2	0.00	Oct 1	0.00	Oct 1, 1993
ANNUAL SEVEN-DAY MINIMUM	0.00	Jan 2	0.00	Oct 1	0.00	Oct 9, 1993
MAXIMUM PEAK FLOW			199	Mar 21	a1,960	Jul 14, 1990
MAXIMUM PEAK STAGE			3.05	Mar 21	b6.30	Jul 14, 1990
ANNUAL RUNOFF (AC-FT)	115		177		362	
10 PERCENT EXCEEDS	0.03		0.25		0.15	
50 PERCENT EXCEEDS	0.00		0.00		0.00	
90 PERCENT EXCEEDS	0.00		0.00		0.00	

a From rating curve extended above 30 ft³/s, on basis of step-backwater analysis.

b From floodmarks.

08331118 AMOLE DEL NORTE CHANNEL AT ALBUQUERQUE, NEW MEXICO

STATION ANALYSIS

WATER YEAR 2003

Equipment.--An electronic datalogger and pressure transducer, recording at 5-minute intervals, are housed in a metal, 2.5- by 2.5- by 6-foot shelter on the right bank of the concrete-lined channel, approximately 100 feet south of the Blake Road bridge. The site is approximately 0.5 mile west of Coors Boulevard on Albuquerque's southwest side. The 30-foot orifice line is housed in a 3/4-inch-diameter galvanized pipe anchored to the sidewall of the channel. A concrete, broad-crested weir 980 feet downstream from the gage is the control. The top of the control wall is 1.0 foot higher than the elevation of the channel bottom at the gage because the channel slope is a very flat 0.0007 foot per foot. Because of this gentle slope, sediment accumulates in the channel bottom at the gage. An outside staff gage is painted on the channel side slope for reference. The PZF is referenced to a hex-head lag bolt anchored in the channel bottom outlined by a chiseled square. The PZF elevation is 1.00 foot. A CSG is mounted to the right channel sidewall and is inclined 26.5 degrees from horizontal. The elevation of the CSG cap is 2.14 feet referenced to the PZF. Low-water wading measurements are made in the vicinity of the gage.

Gage-Height Record.--The water-stage recorder, referenced to the PZF bolt in the bottom of the channel or the outside staff gage, gave a complete and satisfactory record during water year 2003, except for periods when sediment covered the orifice on July 22-29, August 26-27, and September 12-15. All these affected days were periods of zero flow because no precipitation fell, and substantial rainfall is necessary to produce runoff at this site. Because no other gage exists on this particular channel, no hydrographic comparisons are possible.

The recorder senses only water levels greater than 0.30 foot deep (1.30-foot recorded gage height) because the orifice pipe is mounted 0.30 foot above the channel bottom to prevent siltation problems. At a gage height of 1.31 feet, the computed discharge is 0.17 cubic foot per second.

Rating.--The channel is concrete lined and of a trapezoidal shape at the gage, but the gage pool is controlled by a 40-foot-wide, broad-crested concrete weir 980 feet downstream. A one-foot-wide notch is cut into the weir wall and is the low-flow control. The channel is straight for at least 1,000 feet upstream and 980 feet downstream from the gage. A theoretical rating was developed using a step-backwater analysis and WSPRO software. This site was measured for the first time in water year 2001, which better defined the low end of the rating. Measurements are difficult to obtain because of the flashy nature of this channel. All four measurements in water year 2001 plotted significantly left of theoretical rating 1.0, so a new rating, 2.0, was developed in water year 2001. The new rating breaks to the right at a gage height of approximately 2.12 feet, or the level at which broad-crested weir flow begins. The new rating curve gradually blends into the old theoretical rating by a stage of 9.38 feet.

One measurement, number 5, was completed in water year 2002. It plotted within 1.4 percent of rating 2.0. Because the channel is concrete lined and the control weir was clear at the time of this measurement, no shift was needed. The small measurement variation from the rating curve is due to inherent errors in the measuring process. The weir control is subject to debris accumulations, which affect the low-flow rating if the 1-foot notch in the control wall is obstructed.

Various shifts were applied this water year because the low-flow notch of the weir was often obstructed with debris. Measurements 6-8, completed on October 22, 2002, represent the condition of a partially blocked low-flow control that affects gage-height readings at the gage. The three measurements define a single average shift correction curve to rating 2.0 with a base shift value of -0.10 foot. This effective shift value is assumed to remain at approximately -0.10 foot whenever the low-flow weir notch is partially obstructed. Measurements 9 and 10 were completed on February 13, 2003, when the low-flow notch was completely blocked by debris. Both measurements define an average shift of -0.30 feet to rating 2.0 and are the basis of the assumption that a -0.30-foot shift is applied when this similar condition occurred throughout the water year.

Discharge.--Rating 2.0 was applied directly without shifts at the end of water year 2002 and into the beginning of water year 2003 because the control weir was clear of debris. No flows occurred until October 22, 2002, when measurements 6-8 were completed and field inspections noted partial blockage of the low-flow weir notch. These three measurements defined the -0.10-foot shift applied only during the flow event. Because of the very flat slope and low flow velocities, the measurements still showed the effects of the partially obstructed weir even though the debris was cleared just prior to the measurement times. Field inspections between October 22, 2002, and February 13, 2003, confirmed that the weir remained clear, so no shifts were necessary. The flow on February 13 washed in large amounts of debris and completely plugged the low-flow notch of the control by the time measurements 9 and 10 were completed on that same day. These two measurements defined the -0.30-foot shift applied to rating 2.0, which continued until field inspections noted that the tumbleweed accumulation had been partially burned out by March 6, 2003. The shift was reduced to -0.10 foot based on the same type of flow obstructions observed during the October 22 measurements. The flow of March 18 washed in large amounts of debris that again completely plugged the low-flow weir. The same -0.30-foot shift that was defined by the February 13 measurements was applied on March 18 because similar flow restrictions existed. The channel conditions did not change until maintenance personnel cleared the debris on August 12, so the -0.30-foot shift remained until this time. Site inspections were made after the flow events of August 25 and August 29. Only after the flow on August 29 was debris identified as a significant obstruction in the weir. A -0.10-foot shift was applied from the rise on August 29 until the debris was cleared on September 3. Again, because no flow measurements were completed during this time period, the -0.10-foot shift value was based on measurements 6-8, which were made during similar control conditions. The control weir remained clear until the end of the water year so no other shifts were applied.

During water year 2003, 29 site inspections and five measurement were completed. The instantaneous peak stage and discharge for water year 2003 were 4.81 feet and 366 cubic feet per second, respectively, on July 20, 2003. This was a new maximum peak for the period of record.

Remarks.--No flows will occur until significant precipitation falls in the watershed. No other gages exist in this watershed for comparison, so precipitation records are the only source available to estimate discharges at this site.

RIO GRANDE BASIN

08331118 AMOLE DEL NORTE CHANNEL AT ALBUQUERQUE, NM

LOCATION.--Lat 35°02'14", long 106°43'15", Bernalillo County, Hydrologic Unit 13020203, in Atrisco Grant, on right bank of concrete-lined channel 100 ft south of Blake Road and 2,500 ft west of intersection of Blake Road and Coors Boulevard in southwest Albuquerque.

DRAINAGE AREA.--6.302 mi².

PERIOD OF RECORD.--April 2000 to current year.

GAGE.--Water-stage recorder and crest-stage gage. Elevation of gage is 4,997 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good except for those estimated, which are poor.

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
4	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
8	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	1.9	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.22
10	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	e0.00
13	0.00	0.00	0.00	0.00	0.95	0.00	0.00	0.00	0.00	0.00	0.00	e0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	e0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	e0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.01	0.00	0.00	2.3	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.25	2.5	0.00	0.00	0.00	18	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	1.9	0.00	0.00	0.00	2.0	0.00	0.00
22	2.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.3	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	0.26	0.00
30	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	1.9	0.00
31	0.00	---	0.00	0.00	---	0.00	---	0.00	---	0.00	0.00	---
TOTAL	3.48	2.80	0.62	0.00	1.32	7.15	0.00	0.00	0.00	20.00	3.46	1.31
MEAN	0.11	0.09	0.02	0.00	0.05	0.23	0.00	0.00	0.00	0.65	0.11	0.04
MAX	2.9	1.9	0.61	0.00	0.95	2.5	0.00	0.00	0.00	18	1.9	0.26
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AC-FT	6.9	5.6	1.2	0.00	2.6	14	0.00	0.00	0.00	40	6.9	2.6

e Estimated

RAINFALL DATA SUMMARY,
WATER YEAR 2003
(arranged alphabetically)

PRECIPITATION FOR WATER YEAR 2003

The following section presents daily precipitation totals for the 41 rain gages in the Urban Runoff Program. A station analysis, which lists detailed location descriptions, equipment, and periods of record, is also included for each rain-gage location. In addition, the station analysis describes data problems and how data estimates were made.

Precipitation Totals

During water year 2003, 39 rain gages were operated over the entire year; the North Fork Hahn Arroyo (site ID 20 in table 1) and Grant Line Arroyo (site ID 21) rain gages were discontinued in July 2003. Averaged over the 39 rain gages that were operated continuously in the metropolitan area, approximately 6.6 inches of rain fell over Albuquerque during water year 2003. However, the variation in both spatial and temporal distribution of rainfall in the Albuquerque area is large. For example, the rain gage at North Camino Arroyo Tributary (site ID 18) in the far northeast heights measured more than 14 inches of rain, whereas the rain gage at Albuquerque City Hall (site ID 35), located approximately 9 miles southwest of the rain gage at North Camino Arroyo, measured less than 4 inches of rain during water year 2003.

The variation in spatial distribution of annual precipitation over the USGS rain-gage network is illustrated in figure 4, which shows water year 2003 precipitation totals for 39 of the USGS rain gages. The rain gages at North Fork Hahn Arroyo and Grant Line Arroyo are not included in the figure because they did not have a complete data record for water year 2003. Additionally, annual precipitation totals for the Embudo Canyon (site ID 4), Hahn Arroyo (site ID 24), AMAFCA Headquarters (site ID 30), North Floodway Channel at Albuquerque (site ID 29), Bernalillo County Building (site ID 32), San Jose Drain (site ID 34), and Swinburn Dam (site ID 39) rain gages include days with estimated daily totals; details are given in the station analysis.

In general, a disproportionate amount of total annual precipitation in Albuquerque falls in July through September due to the onset of the southwestern monsoon, during which moisture-laden air is drawn into Mexico and the southwestern United States from the Gulf of California and the Gulf of Mexico (Adams and Comrie, 1997). During water year 2003, however, the precipitation totals for July through September at most rain gages were actually less than other months; the average monthly precipitation for July through September was 0.48 inch, while the average monthly precipitation for October through June was 0.57 inch. For comparison, in water year 2002 these same average monthly totals were 1.38 and 0.29 inches, respectively. The combined precipitation for July through September for water year 2003 is also shown in figure 4.

The station locations shown in figure 4 are listed, from left to right, in order of increasing longitude. Although not readily apparent in figure 4, there is a slight increasing total precipitation trend in an eastward direction, or toward the Sandia Mountains. This precipitation trend, although modest, is not surprising because increasing elevation forces an increase in convection and consequently creates more uplift of water vapor to the condensation level.

Comparison to Historical Data

Because of the large variation in precipitation distribution across the metropolitan area, using an annual average of the entire rain-gage network to determine if water year 2003 was a "wet" or "dry" year is difficult. Instead, it is more meaningful to compare annual precipitation data, sampled both spatially and temporally, with historical precipitation data sampled over the same spatial and temporal scales. Figures 5-8 show total monthly precipitation, for both water year 2003 and for each water year in the historical USGS precipitation record, at seven rain gages in the USGS network. Data point symbols in these figures are centered over their corresponding values. Also, because some selected stations have a data record that exceeds 15 years, whereas others have as few as 6 years of historical data, the number of historical data points for each gage varies accordingly.

These rain gages were selected to give a geographic representation of the 41 rain gages in the metropolitan area: Bear Canyon Arroyo (site ID 1) in the Sandia Mountains foothills, Leonard (site ID 15) in east-central Albuquerque, North Camino Arroyo Tributary (site ID 18) in the far northeast heights, Tijeras Arroyo (site ID 26) on the southern edge of Albuquerque, City Hall (site ID 35) in central Albuquerque, Taylor Ranch Drain (site ID 38) in the northwest, and Fire Station 14 (site ID 46) in southwestern Albuquerque.

Generally, monthly totals for water year 2003 at these seven selected rain gages were below corresponding historical averages. February 2003 and March 2003, however, were notable exceptions, during which all seven selected rain gages recorded above-average precipitation totals that were close to period-of-record monthly maximums. February was a period-of-record monthly maximum for the North Camino Arroyo and Taylor Ranch rain gages, whereas March was a period-of-record monthly maximum for North Camino Arroyo.

Lastly, figure 9 compares total annual precipitation for water year 2003 to average historical total annual precipitation at each of the selected seven rain gages. With the exception of Fire Station #14, the rain gages averaged about 40 percent less than normal precipitation for water year 2003. Although Fire Station #14 recorded about 60 percent above average precipitation for the water year, numerous days in April and May may have recorded erroneous data; details are given in the station analysis.

These last numbers hint at the importance of monsoonal moisture in Albuquerque. Although February and March were exceptionally wet, these 2 months did not compensate for an exceptionally dry July through August. Based on totals for these monsoonal months, the water year 2003 monsoon was almost "shut down" in Albuquerque, and July was actually a period-of-record monthly minimum at all selected gages except for the Tijeras Arroyo and Fire Station #14 rain gages. August was also a period-of-record monthly minimum at the Albuquerque City Hall rain gage.

REFERENCES CITED

Adams, D.K., and Comrie, A.C., 1997: The North American monsoon: *Bulletin of the American Meteorological Society*, v. 78, p. 2197-2213.

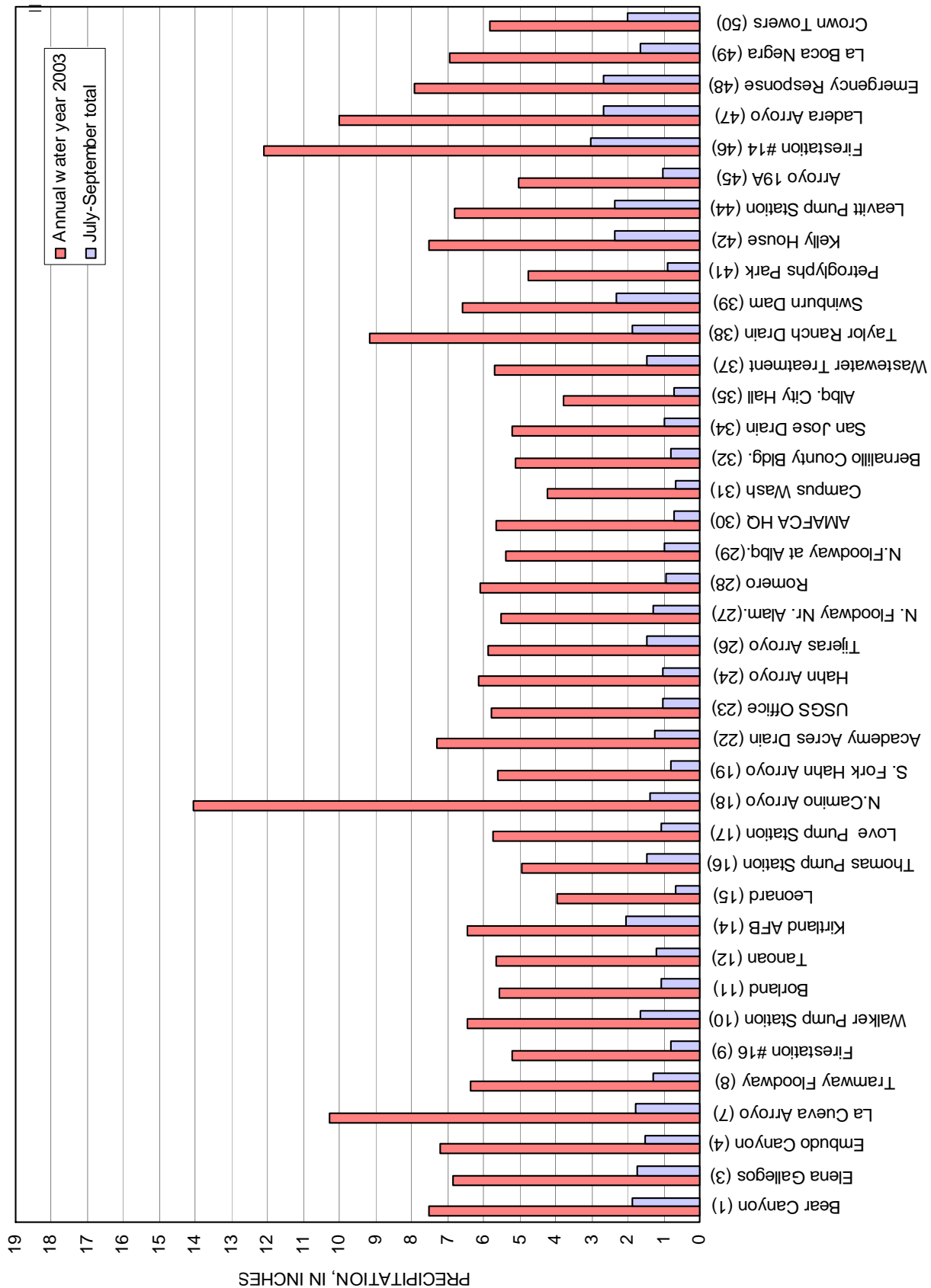


Figure 4. Precipitation totals for water year 2003 in comparison to totals for July through September 2003 at 39 U.S. Geological Survey rain gages. The gages are listed by name and site ID number from table 1.

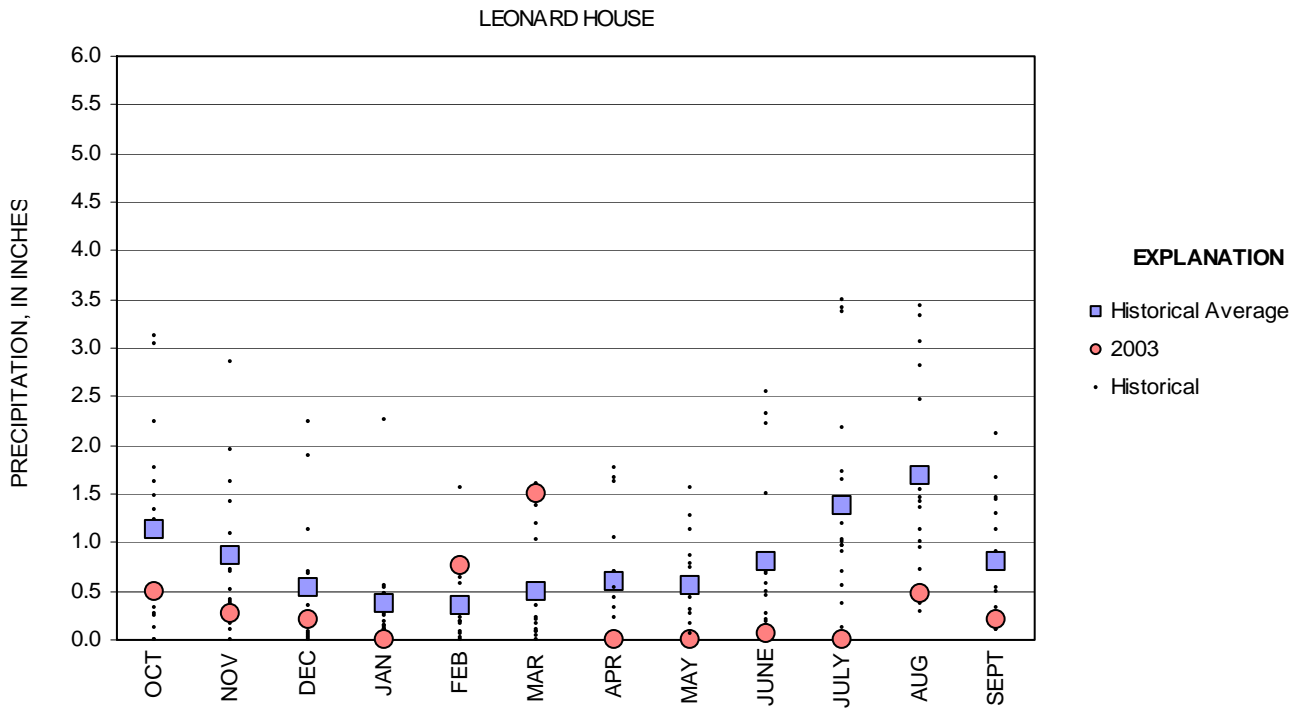
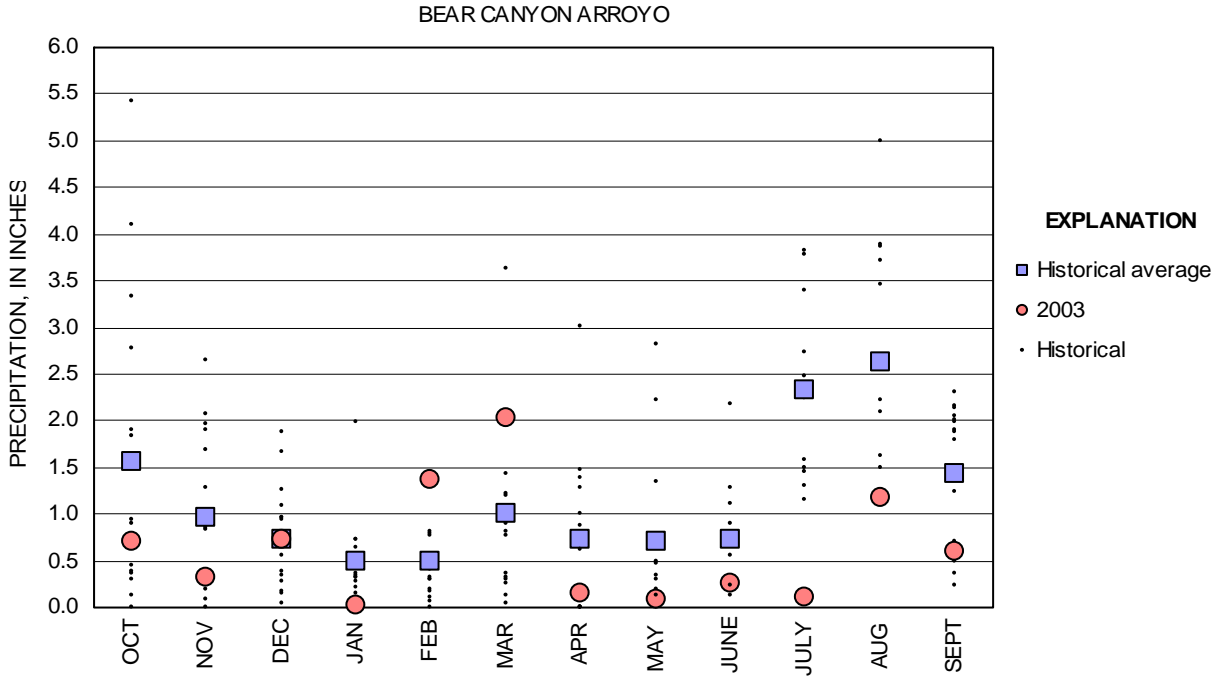


Figure 5. Monthly precipitation at selected U.S. Geological Survey rain-gage sites. Location of gages in figure 1.

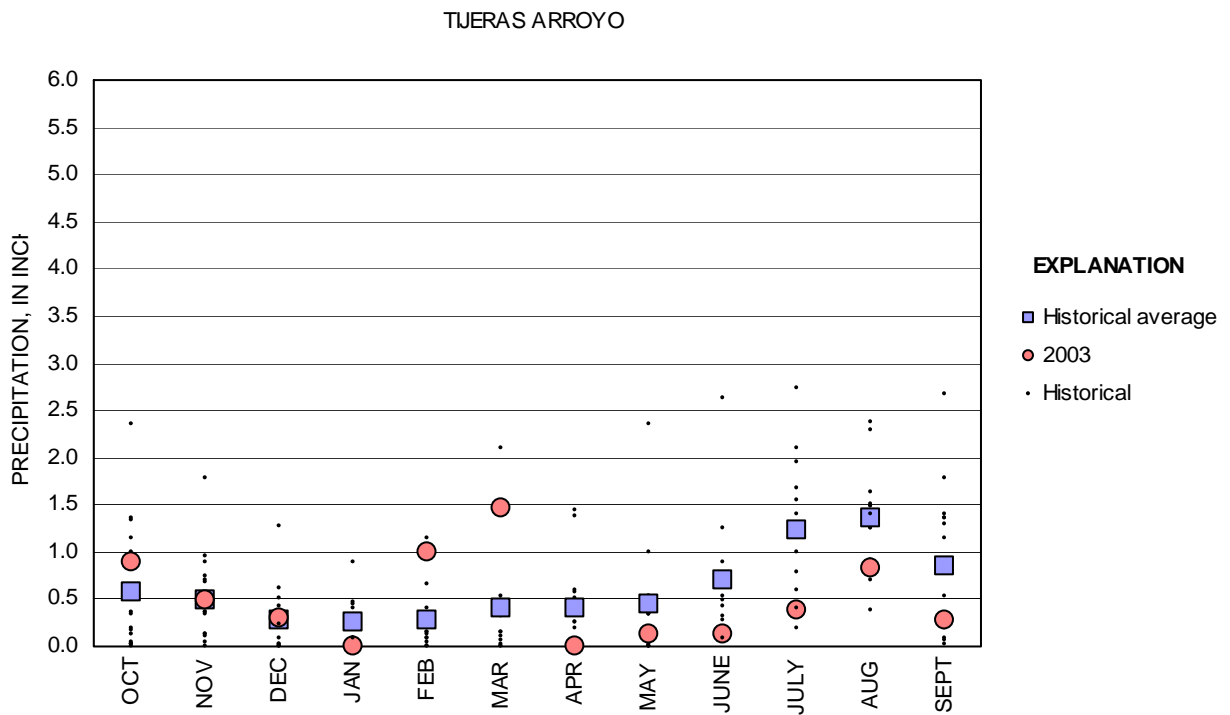
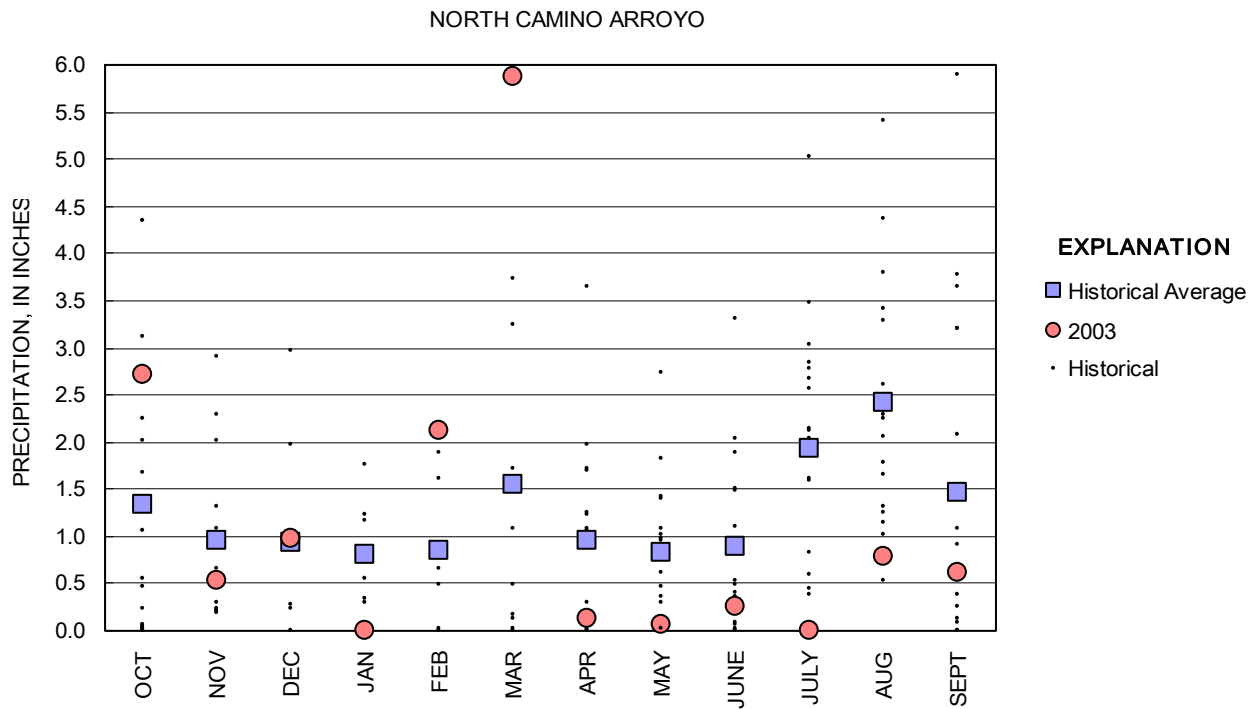


Figure 6. Monthly precipitation at selected U.S. Geological Survey rain-gage sites. Location of gages in figure 1.

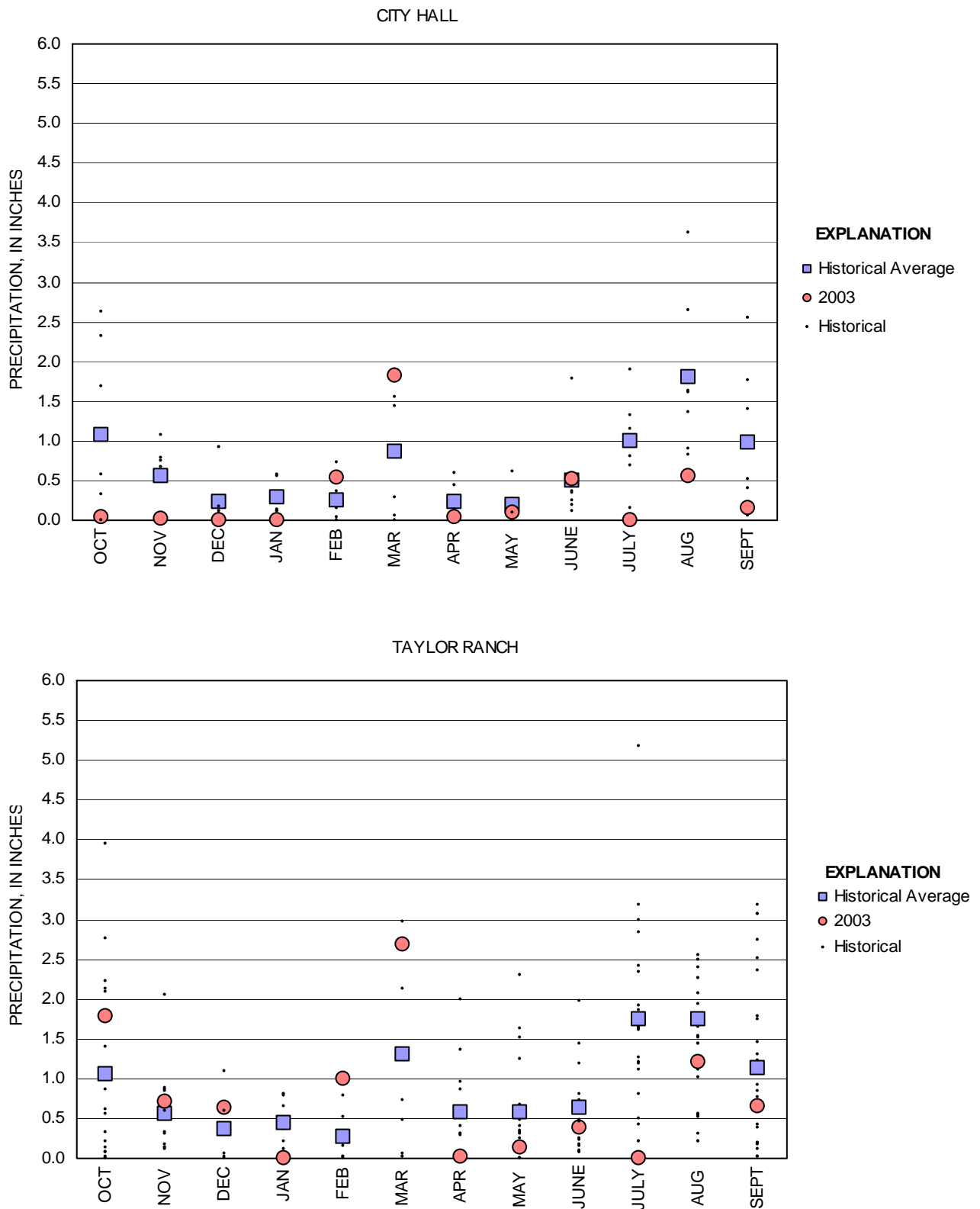


Figure 7. Monthly precipitation at selected U.S. Geological Survey rain-gage sites. Location of gages in figure 1. Although the Taylor Ranch Drain gage recorded more than 8" of rain in August 1999, the point is not plotted to maintain vertical-scale consistency across figures 5-8.

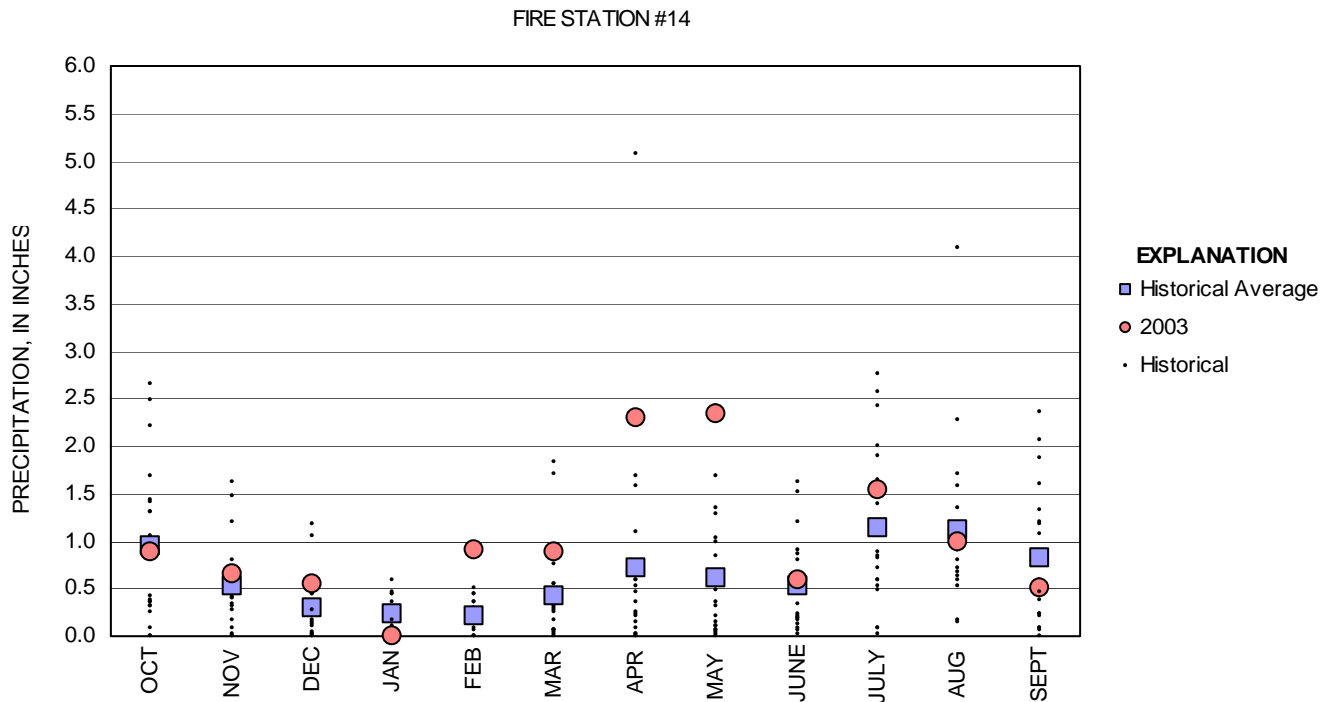


Figure 8. Monthly precipitation at the Fire Station #14 rain-gage site. Location of gage in figure 1.

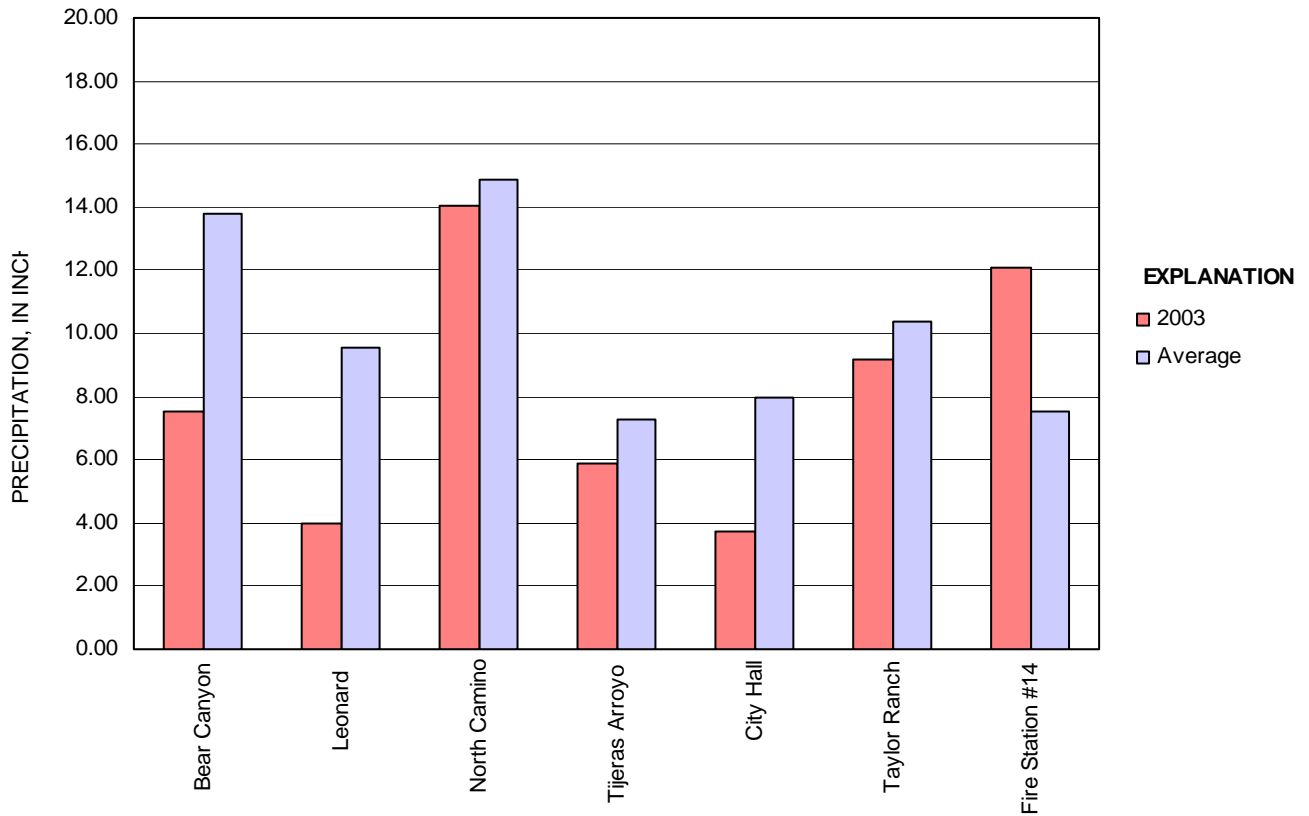


Figure 9. Comparison of total annual precipitation for water year 2002 to average historical total annual precipitation at selected U.S. Geological Survey rain-gage sites. Location of gages in figure 1.