



Prepared in cooperation with the Flood Control District of Maricopa County

# **Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997-2002**

Open-File Report 2004–1230

**U.S. Department of the Interior**  
**U.S. Geological Survey**

# **Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997-2002**

By Christie M. O'Day

Prepared in cooperation with the  
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Open-File Report 2004-1230

**U.S. Department of the Interior  
U.S. Geological Survey**

**U.S. Department of the Interior**  
Gale A. Norton, Secretary

**U.S. Geological Survey**  
Charles G. Groat, Director

**U.S. Geological Survey, Reston, Virginia: 2004**

For sale by U.S. Geological Survey, Information Services  
Box 25286, Denver Federal Center  
Denver, CO 80225-0286

For more information about the USGS and its products:  
Telephone: 1-888-ASK-USGS  
World Wide Web: <http://www.usgs.gov/>

Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Although this report is in the public domain, permission must be secured from the individual copyright owners to reproduce any copyrighted materials contained within this report.

*Suggested citation:*

*O'Day, C.M., 2004, Data from channel-change monitoring at selected sites in Maricopa County, Arizona, 1997-2002: U.S. Geological Survey Open-File Report 2004-1230, 52 p.*

# Contents

Abstract . . . . .	1
Introduction . . . . .	1
Purpose and Scope . . . . .	3
Acknowledgments . . . . .	3
Methods Used to Determine Channel Changes . . . . .	3
Site Selection . . . . .	3
Cross-Section Measurements . . . . .	3
Site Descriptions . . . . .	5
09512800 Agua Fria River near Rock Springs, Arizona . . . . .	5
09512280 Cave Creek below Cottonwood Creek, near Cave Creek, Arizona . . . . .	5
09513820 Deadman Wash near New River, Arizona . . . . .	6
09517000 Hassayampa River near Arlington, Arizona . . . . .	6
09516500 Hassayampa River near Morristown, Arizona . . . . .	6
09516800 Jackrabbit Wash near Tonopah, Arizona . . . . .	7
09513800 New River at New River, Arizona . . . . .	7
09512165 Salt River at Priest Drive, near Phoenix, Arizona . . . . .	8
09517280 Tiger Wash near Aguila, Arizona . . . . .	8
09488650 Vekol Wash near Stanfield, Arizona . . . . .	8
09514200 Waterman Wash near Buckeye, Arizona . . . . .	9
Channel Change, 1997–2002 . . . . .	9
Sand Channels . . . . .	9
Bedrock, Cobble, and Gravel Channels . . . . .	10
Sand, Gravel, and Cobble Channels . . . . .	10
Selected References . . . . .	11
Cross-Section Data . . . . .	12

## Figures

Figure 1.	Map showing locations of study area and streamflow-gaging stations associated with channel-change monitoring sites, Maricopa County, Arizona . . .	2
Figure 2.	Channel-change cross sections from surveys at Agua Fria River near Rock Springs, Arizona, 1997–2000 . . . . .	12
Figure 3.	Channel-change cross sections from surveys at Cave Creek below Cottonwood Creek, near Cave Creek, Arizona, 1997–99 . . . . .	16
Figure 4.	Channel-change cross sections from surveys at Deadman Wash near New River, Arizona, 1997–2000. . . . .	18
Figure 5.	Channel-change cross sections from surveys at Hassayampa River near Arlington, Arizona, 1997–2000 . . . . .	21
Figure 6.	Channel-change cross sections from surveys at Hassayampa River near Morristown, Arizona, 1997–2001 . . . . .	31
Figure 7.	Channel-change cross sections from indirect-measurement surveys at Jackrabbit Wash near Tonopah, Arizona, 2000-2002. . . . .	34
Figure 8.	Channel-change cross sections from surveys at New River at New River, Arizona, 1997–99. . . . .	37
Figure 9.	Channel-change cross sections from surveys at Salt River at Priest Drive, near Phoenix, Arizona, 1997–99. . . . .	40
Figure 10.	Channel-change cross sections from surveys at Tiger Wash near Aguila, Arizona, 1997–2001. . . . .	43
Figure 11.	Channel-change cross sections from surveys at Vekol Wash near Stanfield, Arizona, 1998 . . . . .	46
Figure 12.	Channel-change cross sections from surveys at Waterman Wash near Buckeye, Arizona, 1997–2000 . . . . .	49

## Tables

Table 1.	Status summary for channel-change sites . . . . .	4
Table 2.	Data from surveys at Agua Fria River near Rock Springs, Arizona, 1997–2000 . . . . .	13
Table 3.	Data from surveys at Cave Creek below Cottonwood Creek, near Cave Creek, Arizona, 1997–99 . . . . .	16
Table 4.	Data from surveys at Deadman Wash near New River, Arizona, 1997–2000 . . . . .	19
Table 5.	Data from surveys at Hassayampa River near Arlington, Arizona, 1997–2000 . . . . .	23
Table 6.	Data from surveys at Hassayampa River near Morristown, Arizona, 1997–2001 . . . . .	32
Table 7.	Data from indirect-measurement surveys at Jackrabbit Wash near Tonopah, Arizona, 2000–2002 . . . . .	35
Table 8.	Data from surveys at New River at New River, Arizona, 1997–99 . . . . .	38
Table 9.	Data from surveys at Salt River at Priest Drive, near Phoenix, Arizona, 1997–99 . . . . .	41
Table 10.	Data from surveys at Tiger Wash near Aguila, Arizona, 1997–2001 . . . . .	44
Table 11.	Data from surveys at Vekol Wash near Stanfield, Arizona, 1998 . . . . .	47
Table 12.	Data from surveys at Waterman Wash near Buckeye, Arizona, 1997–2000 . . . . .	50

## Conversion Factors and Datums

### Conversion Factors

<b>Multiply</b>	<b>By</b>	<b>To obtain</b>
foot (ft)	0.3048	meter
inch (in.)	2.54	centimeter
mile (mi)	1.609	kilometer
square mile (mi <sup>2</sup> )	2.590	square kilometer
foot per second (ft/s)	0.3048	meter per second
cubic foot per second (ft <sup>3</sup> /s)	0.02832	cubic meter per second

### Datums

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; horizontal coordinate information is referenced to the North American Datum of 1927 (NAD 27).

# Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

By Christie M. O'Day

## Abstract

Stream channels in arid regions are subject to a wide range of hydrologic, hydraulic, and sedimentary conditions. These channels often are dry or have little streamflow most of the time, and the few flows that do occur can cause substantial changes to the channel and flood plain. Because floods in arid regions are often flashy, and many gaging stations are in remote areas, hydrographers must rely on indirect measurements of streamflow. Channel change is important because one major assumption necessary for indirect measurements of discharge is that the channel conditions after the flood represent the conditions during the peak discharge.

The U.S. Geological Survey, in cooperation with the Flood Control District of Maricopa County, is monitoring selected perennial and ephemeral streams within Maricopa County, Arizona, to track the amount and variability of channel change. This report contains basic data from surveys of monumented cross sections conducted from 1997 through 2002. The amount of change varied widely from channel to channel, and the largest geomorphic change occurred in conjunction with peak flows above the 10-year recurrence interval.

## Introduction

Stream channels in arid regions are subject to a wide range of hydrologic, hydraulic, and sedimentary conditions. These channels often are dry or have little or no streamflow but large magnitude flows can mobilize channel sediment and cause substantial changes to the channel and flood plain (Burkham, 1970; Graf, 1988).

Determining channel conditions in these regions during floods is difficult because of the dynamic nature of desert stream channels. Floods are often flashy, and many streamflow-gaging stations are in remote areas; therefore, hydrographers must rely on indirect measurements of discharge. One assumption necessary for indirect

measurements of discharge is that the channel conditions after the flood represent the conditions during the peak discharge (Benson and Dalrymple, 1967). The errors associated with this assumption can be significant and limit the accuracy of indirect measurements of discharge (Jarrett, 1986).

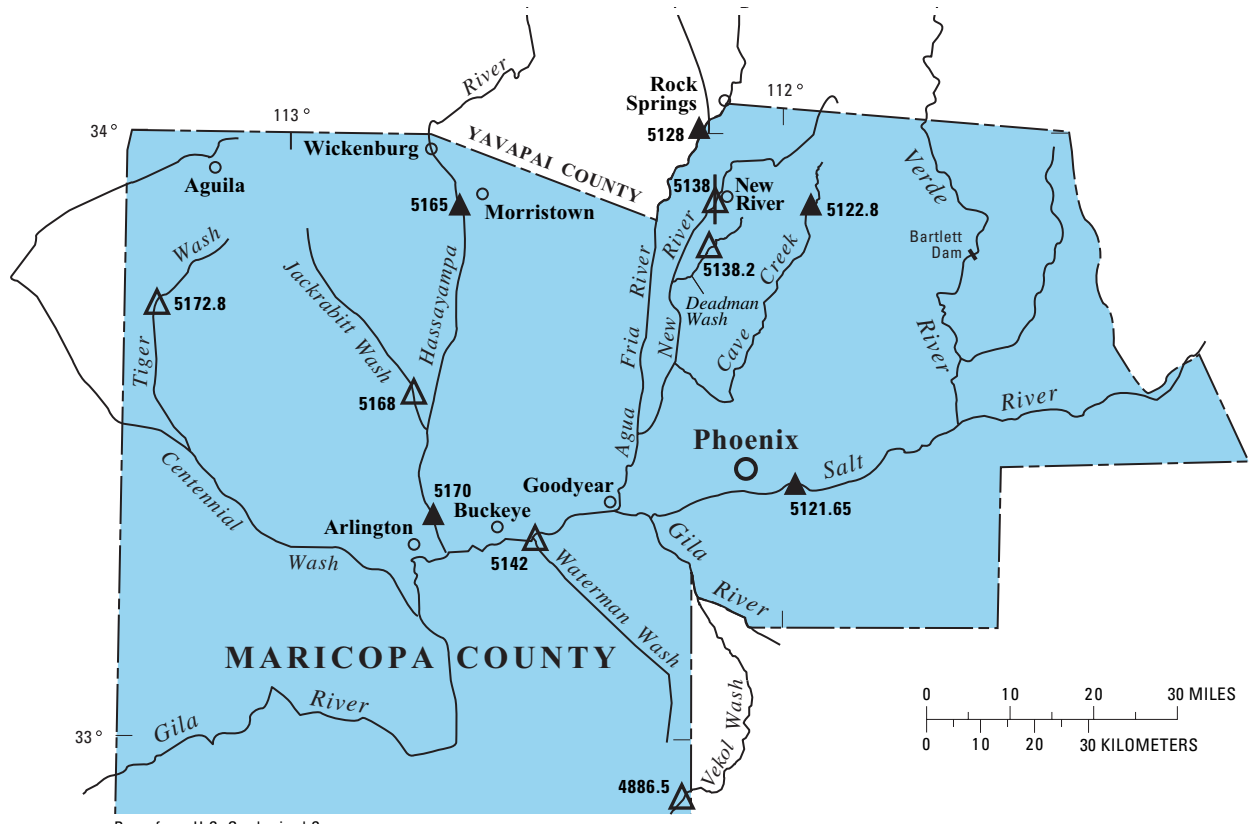
Leopold and others (1964) state that in ephemeral washes and even large rivers in the semiarid West, channel scour increases as stage increases and can occur along the width of the channel. As the flood waters recede, however, sediment fills the scoured areas. Consequently, channel change is a source of error for indirect measurements of discharge. The relation between maximum scour depth and maximum discharge is not certain, and perceptions of scour may not equate to actual scour. Channel change depends on factors such as the chronology of flooding, the location of expansions and contractions in the channel, and the mobility of bed material (Jarrett, 1986).

In 1996, the U.S. Geological Survey (USGS), in cooperation with the Flood Control District of Maricopa County (FCDMC), established a network of sites on perennial and ephemeral streams in Maricopa County for long-term monitoring of channel change. Data from the monitoring program can be used to determine geomorphic changes, identify processes that could aid in developing predictive methodology, and determine rates of channel aggradation and degradation. Channel changes documented here are measured by repeated cross-section surveys with some repeat photography (not published in this report). An examination of channel changes helps to evaluate the accuracy of peak-discharge values from (1) indirect measurements of discharge and (2) rating curves based on indirect measurements of discharge and step-backwater models that assume a fixed channel geometry.

In the pilot part of this study, Capesius and Lehman (2002) reported on channel change for 10 sites on 7 perennial and ephemeral streams using historical cross-section data and data collected during 1996–97. The data-collection network has been revised for longer term monitoring and data analysis, and now consists of 11 sites on 10 streams ([fig. 1](#)).



2 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002



Base from U.S. Geological Survey  
State base map, 1:500,000  
Arizona, 1974

EXPLANATION

- 5170 ▲ CONTINUOUS STREAMFLOW-GAGING STATION AND ABBREVIATED NUMBER — Complete station number is 09517000

STATION NUMBER	STATION NAME
09512165	Salt River at Priest Drive near Phoenix, Arizona
09512280	Cave Creek below Cottonwood Creek, near Cave Creek, Arizona
09512800	Agua Fria River near Rock Springs, Arizona
09516500	Hassayampa River near Morristown, Arizona
09517000	Hassayampa River near Arlington, Arizona
- 5172.8 ▲ CREST-STAGE GAGING STATION AND ABBREVIATED NUMBER — Complete station number is 09517280

STATION NUMBER	STATION NAME
09488650	Vekol Wash near Stanfield, Arizona
09513820	Deadman Wash near New River, Arizona
09514200	Waterman Wash near Buckeye, Arizona
09516800	Jackrabbit Wash near Tonopah, Arizona
09517280	Tiger Wash near Aguila, Arizona
- 5138 ▲ DISCONTINUED U.S. GEOLOGICAL SURVEY GAGING STATION AND ABBREVIATED NUMBER — Complete station number is 09513800

STATION NUMBER	STATION NAME
09513800	New River at New River, Arizona



Figure 1. Locations of study area and streamflow-gaging stations associated with channel-change monitoring sites, Maricopa County, Arizona.

## Purpose and Scope

This report presents data collected during repeat cross-section surveys and indirect measurements of discharge at the 11 sites from 1997 through 2002. Data were collected at sites for which long-term hydrologic records were available. Five sites are at USGS crest-stage gaging stations—Deadman Wash near New River, Jackrabbit Wash near Tonopah, Tiger Wash near Aguila, Vekol Wash near Stanfield, and Waterman Wash near Buckeye. Five sites are at continuous USGS streamflow-gaging stations—Agua Fria River near Rock Springs, Cave Creek below Cottonwood Creek, Hassayampa River near Arlington, Hassayampa River near Morristown, and Salt River at Priest Drive. The final site is at the location of a discontinued USGS gaging station—New River at New River.

## Acknowledgments

Cindy Hayek, Barbara Wilson, Arthur Rees, and Frank Johnson, USGS, all assisted with field work. Dave Gardner, FCDMC, also gave much field assistance in resurveying as well as input on the report. Steve Wiele, USGS, provided helpful suggestions and focus. Wes Heaton, USGS, gave support and advice on surveying. John Parker, USGS, provided fieldnotes, guidance, and field assistance in recovering cross-section endpoints upstream of the gaging station at Hassayampa River near Arlington.

## Methods Used to Determine Channel Changes

### Site Selection

As part of the revisions to the monitoring network, 11 sites on 10 perennial and ephemeral rivers and washes within Maricopa County, Arizona, were selected for long-term monitoring of channel change. Criteria for site selection included known changes to channel geometry or characteristics, streamflow records that exceeded 20 years, several measurements of high discharge during the same flood, mobile channels, and previously monitored cross sections. One of the 11 sites, Salt River at Priest Drive, was discontinued in 2000 after the FCDMC began grading the river channel in order to mitigate vegetation growth.

## Cross-Section Measurements

**Surveying method and frequency.**—After site selection, existing historical cross-section data were examined, including those from current-meter and indirect measurements of discharge. Monumented cross sections at Hassayampa River near Arlington (Parker, 1995) also were resurveyed. All cross sections are resurveyed after every flow that exceeds the 2-year recurrence interval as determined by Pope and others (1998) or calculated using the USGS statistical program, PEAKFQ (Kirby, 1981). Flow data and flood intervals for all selected sites are summarized in [table 1](#).

During dry cycles, such as the one in effect for the past 3 years (2000–2002) cross sections are resurveyed approximately every 3 to 5 years. All surveys were done by a two-person crew using a Ziess level or Nikon total station and standard USGS surveying techniques, with the exception of the 2000 and 2002 Jackrabbit Wash surveys that were done as indirect measurements of discharge.

**Cross sections measured for this study.**—Data from cross-section surveys during 1997–2002 are presented in [tables 2-12](#) (at back of report). There were no resurveys for most of 2002 because of drought conditions that dominated the region until September 2002. The initial survey conducted at Jackrabbit Wash in 1997 has not been included because all but three endpoints were lost in the peak-of-record flow in 2000. Survey data were plotted to illustrate cross-section changes through time in [figures 2-12](#) (at back of report). Graphical representations of cross sections in this report are oriented so that the view is downstream and the left bank appears on the left side of the graph. Two elevations were recorded for some endpoints. These represent the base (ground level) and the top of the rebar or other endpoint marker. Numbering of some of the cross sections is based on the pilot study by Capesius and Lehman (2002) and the cross-section sequence does not always start at “1.”

The given elevation used to determine the geometry of a cross section is called the relative elevation in this study. At each site, a local elevation datum is used to compare channel change in nearby cross sections. This elevation is either gage datum or zero for all sites, except for Hassayampa River near Arlington, for which the elevation from the 1992 survey (Parker, 1995) was used. This methodology focuses on the relative changes in the cross sections through time. Cross-section measurement dates are given for each site. The change in cross-sectional area was computed using the original measured cross section (usually from 1997 or 1998) as the base. A positive change in cross-sectional area represents an increase in cross-sectional area, and therefore scour, and a negative change represents a decrease in cross-sectional area, and therefore fill.

#### 4 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

**Table 1.** Status summary for channel-change sites

[Values for 2- and 10-year recurrence interval floods are from Pope and others (1998), except for stations 09512280 and 09488650, which are from Blakemore Thomas (hydrologist, U.S. Geological Survey, written commun., 2004). ft<sup>3</sup>/s, cubic feet per second; <, less than; NA, not available]

Site name and No.	Number of cross sections	Peak discharge by water year (ft <sup>3</sup> /s)					Discharge of recurrence interval flood (ft <sup>3</sup> /s)		Date of last survey
		1998	1999	2000	2001	2002	2-year	10-year	
Agua Fria River near Rock Springs, 09512800 <sup>1</sup>	4	10,400	4,830	8,230	5640	7,420	7,000	44,300	Sept. 11, 2000
Cave Creek below Cottonwood Creek, near Cave Creek, 09512280 <sup>1</sup>	4	709	924	109	815	<1	700	3,600	Aug. 8–10, 1999
Deadman Wash near New River, 09513820	6	489	467	769	714	511	348	1,590	Dec. 19, 2000
Hassayampa River near Arlington, 09517000 <sup>1</sup>	11	396	3,310	4,480	22,200	3,930	3,010	12,000	Nov. 20–21, 2000; Nov. 30, 2000
Hassayampa River near Morristown, 09516500 <sup>1</sup>	4	594	2,710	4,700	13,400	6,040	3,030	14,300	Feb. 6, 2001
Jackrabbit Wash near Tonopah, 09516800	5	9,700	706	180	27,000	6,100	847	6,860	Oct. 17, 2002
New River at New River, 09513800	3	<sup>2</sup> 5,320	<sup>2</sup> 529.	<sup>2</sup> 104	<sup>2</sup> 1,660	<sup>2</sup> 56	3,150	12,600	Mar. 11–12, 1999
Salt River at Priest Drive, near Phoenix, 09512165 <sup>1</sup>	4	7,580	584	567	( <sup>3</sup> )	( <sup>3</sup> )	NA	NA	Nov. 19, 1999; Nov. 22, 1999
Tiger Wash near Aguila, 09517280	4	683	755	2,490	3,850	5,184	961	3,160	Apr. 6, 2001
Vekol Wash near Stanfield, 09488650	5	1,100	481	294	347	602	780	4,400	Oct. 28, 1998
Waterman Wash near Buckeye, 09514200	7	325	916	no flow	3,650	72	1,250	3,420	Dec. 20–21, 2000

<sup>1</sup>Station equipped with continuous stage recorder or located near station equipped with continuous stage recorder.

<sup>2</sup>Discharge information from 09513780, New River near Rock Springs, 10 mi upstream.

<sup>3</sup>Discontinued monitoring site in 2000.

**Indirect measurement of discharge.**—Indirect measurements of discharge frequently are made to determine peak discharge and are especially important at sites where direct measurements of discharge are difficult to obtain. Indirect methods use channel characteristics, such as resistance to flow or roughness, channel geometry or cross sections, slope, and water-surface profile as determined by high-water marks, to determine discharge (Dalrymple and Benson, 1967). This report incorporates cross sections surveyed as part of indirect measurements.

Indirect measurements of discharge can be computed using several different methods. Three USGS accepted methods are (1) slope-conveyance computation, (2) slope-area computation, and (3) step-backwater analysis. Of the three, the slope-area method is most frequently used (Dalrymple and Benson, 1967). Two slope-area measurements were done at Jackrabbit Wash near Tonopah in 2000 and 2002.

## Site Descriptions

Initially, 11 channel-change sites were selected for monitoring in 1997–98. Salt River at Priest Drive was discontinued in 2000 after Maricopa County graded the channelized river bed in order to mitigate vegetation growth. Because channel variations in this section of the Salt River would result directly or indirectly from alterations by humans, the site was no longer included in the study. The following section presents detailed descriptions of each channel-change site. Longitudinal distance between end points is provided for the sites where surveying was done with a Nikon total station.

### 09512800 Agua Fria River near Rock Springs, Arizona

**Reach location**—The channel-change monitoring reach extends from 390 ft upstream from the streamflow-gaging station, Agua Fria River near Rock Springs, to 670 ft downstream. The gaging station is at latitude 34°00'56"N., longitude 112°10'02"W., in NW¼ sec. 28, T. 8 N., R. 2 E., Yavapai County, on right bank 2.5 mi southwest of Rock Springs, 10 mi upstream from Lake Pleasant, and 45 mi north of Phoenix. Black Canyon City 7.5-minute quadrangle. There are two crest-stage gages near the staff gages at the main gaging station. Pin elevations (gage datum) are 9.377 ft and 14.876 ft from levels of June 12, 1997.

**Drainage area**—1,111 mi<sup>2</sup>.

**Channel description**—Although Agua Fria River near Rock Springs has a large drainage area, it usually has a small base flow. Channel alluvium primarily is coarse gravel but ranges in size from boulders to silt. Outcrops of bedrock restrict lateral movement of the stream channel at the gaging station. At cross-section 1, the left bank (approximately 100 ft downstream from the old cableway cross section) is a bedrock cliff, and the right bank is on the inside of a bend in the channel, which is unconsolidated alluvium. At sections 2–4, the right bank is bedrock and consolidated alluvium, and the left bank is a flood terrace.

**Most recent survey**—September 11, 2000.

**Cross-section locations**—

**Cross-section 1** is 390 ft upstream from gaging station. The left endpoint is a painted yellow dot on a rock outcrop (hard to recover) and the right endpoint is rebar in sand.

**Cross-section 2** is at gaging station. The left endpoint is rebar on downstream side of the access road, on hill, and the right endpoint is the lower crest-stage gage pin above orifice line (also can use upper crest-stage gage pin).

**Cross-section 3** is 400 ft downstream from gaging station. The left endpoint is rebar on first flood terrace, and the right endpoint is a yellow mark on rock (unrecoverable in 2000).

**Cross-section 4** is 670 ft downstream from gaging station. As with cross-section 3, the left endpoint is rebar on flood terrace, and right endpoint is yellow mark on rock (unrecoverable in 2000).

Distance between cross-section endpoints, in feet					
Cross section along left bank			Cross section along right bank		
1-2	2-3	3-4	1-2	2-3	3-4
387	398	267	501	314	310

### 09512280 Cave Creek below Cottonwood Creek, near Cave Creek, Arizona

**Reach location**—The channel-change monitoring reach extends from 150 to 750 ft upstream from the streamflow-gaging station, Cave Creek below Cottonwood Creek, near Cave Creek. The gaging station is at latitude 33°53'14"N., longitude 111°57'12"W., in SE¼SE¼SW¼, sec. 4, T. 6 N., R. 4 E., Maricopa County, on left bank 1,500 ft downstream from Cottonwood Creek and 3.7 mi north of town of Cave Creek. Datum of gaging station is 2,280 ft above NGVD of 1929, from topographic map.

**Drainage area**—82.7 mi<sup>2</sup>.

**Channel description**—The channel is cobble and gravel, and is fairly straight throughout the study reach. The channel contracts from the road crossing just downstream from cross-section 6 through cross-section 3. The gaging station orifice is on a rock outcrop composed of conglomerated boulders and cobbles about 150 ft downstream from cross-section 3. The left bank is approximately 20 ft high and is nearly vertical at the gaging station but decreases in height upstream. The right bank is 5–7 ft high, slopes gently, and is vegetated with palo verde trees, mesquite trees, Johnson grass, and large saguaros. It is subject to overflow during high flows.

**Most recent survey**—August 10, 1999.

**Cross-section locations**—Most of the right endpoints are near prominent saguaros. All endpoints are rebar. There are no cross-sections 1 and 2.

**Cross-section 3** is about 150 ft upstream from gaging station.

**Cross-section 4** is about 350 ft upstream from gaging station and 200 ft upstream from cross-section 3.

**Cross-section 5** is about 550 ft upstream from gaging station and 200 ft upstream from cross-section 4.

**Cross-section 6** is about 750 ft upstream from gaging station and 200 ft upstream from cross-section 5.

**09513820 Deadman Wash near New River, Arizona**

**Reach location**—The channel-change monitoring reach extends from 70 ft upstream from two crest-stage gages to 600 ft downstream. The crest-stage gages are at latitude 33°50'30"N., longitude 112°08'40"W., in NW¼ sec. 27, T. 6 N., R. 2 E., Maricopa County, 300 ft west of Interstate 17 bridge, 4.5 mi south of New River. Datum of gaging station is 1,719.19 ft above NGVD of 1929.

**Drainage area**—11.1 mi<sup>2</sup>.

**Channel description**—The channel is hour-glass shaped and the narrowest point is near cross-section 3 where the channel is constricted by steep, high banks, less than 50 ft across. Otherwise the channel banks are gently sloping, 4 to 6 ft high, and covered by brush and trees. The banks are subject to overflow during high flows. The channel bed is composed of cobbles and boulders with some gravel downstream from the road.

**Most recent survey**—December 19, 2000.

**Cross-section locations**—All endpoints are rebar. Cross-section 4 was not resurveyed. Cross-section 3 was added in 1998.

**Cross-section 1** is 70 ft upstream from the crest-stage gages.

**Cross-section 2** is at the crest-stage gages.

**Cross-section 3** is about 200 ft downstream from the crest-stage gages.

**Cross-section 4** is at road crossing, about 400 ft downstream from the crest-stage gages and is subject to road grading.

**Cross-section 5** is 100 ft downstream from road crossing, 500 ft downstream from the crest-stage gages.

**Cross-section 6** is 200 ft downstream from road crossing, 600 ft downstream from the crest-stage gages.

**09517000 Hassayampa River near Arlington, Arizona**

**Reach location**—The channel-change monitoring reach is about 3,000 ft upstream from the streamflow-gaging station, Hassayampa River near Arlington, and is immediately downstream from the Southern Pacific Railroad bridge. Monumented cross sections installed and surveyed by Parker (1995) are being monitored and resurveyed for the current study. The gaging station, latitude 33°20'50"N., longitude 112°43'30"W., is on upstream side of bridge on Old U.S. Highway 80, 0.2 mi east of the Hassayampa Store, 1.8 mi upstream from the mouth, and 2.8 mi northeast of Arlington. Datum of the gage is 824.75 ft above NGVD of 1929.

**Drainage area**—1,471 mi<sup>2</sup>.

**Channel description**—The river has entrenched into the alluvial valley fill. The main flow path is wide and shallow and is composed primarily of sand, silt, and local deposits of gravel. Within the main channel, there is an unvegetated low-flow channel. The areas above the low-flow channel, which constitute the flood plain, are covered with scattered tamarisk, palo verde, and other bushes and shrubs. The left bank is a man-made levee, and the right bank is the first flood terrace.

**Most recent survey**—November 20–21 and 30, 2000

**Cross-section locations**—All cross sections used were established in 1991–92 by Parker (1995). Sections start just downstream from the railroad bridge, beginning with cross-section 1, and are numbered consecutively downstream to cross-section 11. Both endpoints for cross-section 8 were unrecoverable in 2000, so cross-section 8 was dropped from survey. All left-bank endpoints are on man-made levee, and all endpoints are rebar except for cross-section 3 and 5 right-bank endpoints, which are wooden stakes.

Distance between cross-section endpoints along left bank, in feet								
1-2	2-3	3-4	4-5	5-6	6-7	7-9	9-10	10-11
27	126	233	154	220	198	555	349	177
Distance between cross-section endpoints along right bank, in feet								
1-2	2-3	3-4	4-5	5-6	6-7	7-9	9-10	10-11
186	140	280	286	181	272	820	302	132

**09516500 Hassayampa River near Morristown, Arizona**

**Reach location**—The channel-change monitoring reach extends from about 780 ft upstream from the streamflow-gaging station, Hassayampa River near Morristown, to 330 ft downstream. The gaging station is at latitude 33°53'06"N., longitude 112°39'41"W., on the left bank, 600 ft downstream from the mouth of San Domingo Wash, Maricopa County, 3 mi northwest of Morristown and 6 mi southeast of Wickenburg, Arizona. Datum of the gaging station is 1,831.16 ft above NGVD of 1929.

**Drainage area**—796 mi<sup>2</sup>.

**Channel description**—The gaging station at Hassayampa River near Morristown is attached to a bedrock cliff on the left bank. The bedrock cliffs start at the confluence of San Domingo Wash, between cross-sections 1 and 2, and continue downstream past cross-section 4. At cross-section 1, the left bank is the highway embankment. The right bank is a railroad embankment blasted into bedrock and consolidated alluvium. The flat, sand channel narrows in the downstream direction toward the gaging station.

**Most recent survey**—February 6, 2001.

**Cross-section locations—**

**Cross-section 1** is upstream from a fence crossing the channel upstream about 150 ft from where the San Domingo Wash enters the Hassayampa. Upper left endpoint is concrete pad of fence post at the top of the embankment, under a large mesquite tree. Upper right endpoint is railway caution sign, set on far side of tracks. Lower or common right endpoint is top of sunken, wooden fence post, 8×8 in.

**Cross-section 2** is 454 ft upstream from cableway (about 50 ft downstream from San Domingo Wash). Left endpoint is bolt on rock, right endpoint is rebar at top of railway embankment.

**Cross-section 3** is directly under the cableway. Left endpoint is USGS brass tablet RM-3. Right endpoint was not established, used cable anchor footing.

**Cross-section 4** is 327 ft downstream from cableway. Left endpoint is white dot on rock. Right endpoint is top of headwall of culvert.

## 09516800 Jackrabbit Wash near Tonopah, Arizona

**Reach location—**Slope-area reach extends from about 400 ft downstream from two crest-stage gages to about 1,500 ft downstream. The crest-stage gages are at latitude 33°39'32"N., longitude 112°49'40"W., in NE¼NW¼ sec. 25, T. 4 N., R. 6 W., Maricopa County, 35 ft downstream from the Wickenburg Road crossing, 5.3 mi southeast of Baine Corners, and 14 mi northeast of Tonopah. Datum of gage is 1,510 ft above NGVD of 1929 from Star Well 7.5-minute quadrangle.

**Drainage area—**137 mi<sup>2</sup>.

**Channel description—**The channel is wide, mostly sand, but also includes gravel and small cobbles. The low-flow channel shifts across this channel bottom. The channel banks are steep, entrenched into semiconsolidated alluvium, and vegetated on both sides. The banks consist of two flood terraces. Cross-section endpoints were originally set on the first terrace and most were washed away in the peak-of-record flow in October 2000.

**Most recent survey—**Indirect measurement, October 2002.

**Cross-section locations—**Original cross sections were approximately 200 ft apart, starting about 100 ft downstream from the crest-stage gages; however, all but three of the endpoints were lost in a peak-of-record flow in October 2000. New cross sections were established during indirect measurement surveys conducted in 2000 and 2002. Both surveys incorporated the remaining original endpoints.

**Cross-section 1** is about 400 ft downstream from the crest-stage gages.

**Cross-section 2** is about 700 ft downstream from the crest-stage gages.

**Cross-section 3** is about 1,000 ft downstream from the crest-stage gages.

**Cross-section 4** is about 1,250 ft downstream from the crest-stage gages.

**Cross-section 5** is about 1,500 ft downstream from the crest-stage gages.

Distance between cross-section endpoints along left bank, in feet			
1-2	2-3	3-4	4-5
310	285	210	325

Distance between cross-section endpoints along right bank, in feet			
1-2	2-3	3-4	4-5
340	420	270	130

## 09513800 New River at New River, Arizona

**Reach location—**The channel-change monitoring reach extends from about 200 ft upstream from an old cableway to 240 ft downstream. The discontinued streamflow-gaging station, New River at New River, was about 500 ft downstream from the end of the cross-section reach. There is currently no active gage at this site. The gaging station was at latitude 33°54'41"N., longitude 112°08'26"W., in NW¼NE¼, sec. 34, T. 7 N., R. 2 E., near center of downstream side of bridge on east frontage road of Interstate 17, 0.5 mi southwest of the town of New River, and 10 mi south of Rock Springs.

**Drainage area—**83.3 mi<sup>2</sup>.

**Channel description—**Channel is straight for about 300 ft upstream and 150 ft downstream from the abandoned cableway and consists mainly of sand, gravel, and boulders. The left bank is consolidated to semiconsolidated alluvium overgrown by grass and brush, and the right bank is bedrock covered with alluvium and large boulders.

**Most recent survey—**March 11–12, 1999.

**Cross-section locations—**All cross sections surveyed in 1997 were unrecoverable in 1999 and were reestablished using original survey data and photographs. There are no cross-sections 1 and 2.

**Cross-section 3** is about 200 ft upstream from old cableway, endpoints are rebar.

**Cross-section 4** is under old cableway, left bank endpoint is on A-frame.

**Cross-section 5** is about 240 ft downstream from old cableway along road crossing the river bed, endpoints are rebar.

### 09512165 Salt River at Priest Drive, near Phoenix, Arizona

**Reach location**—The channel-change monitoring reach extended from about 750 ft upstream from the streamflow-gaging station to about 1,750 ft downstream. The gaging station is at latitude 33°26'22"N., longitude 111°57'37"W., in NE¼NE¼ sec. 17, T. 1 N., R. 4 E., Maricopa County, on downstream side of the Priest Drive bridge. Elevation of gage is 1,135 ft above NGVD of 1929 from topographic map. This reach was dropped from the monitoring schedule in 2000.

**Drainage area**—13,223 mi<sup>2</sup>.

**Channel description**—The channel is approximately 1,000 ft wide and consists of bedrock and overlying bars of boulders, cobbles, and sand. It is virtually straight for 1 mi upstream and 1 mi downstream from the gaging station. Both right and left banks are man-made levees, and the whole channel was graded by the FCDMC for vegetation mitigation in 2000. Low flows are braided between exposed bedrock and cobble bars.

**Most recent survey**—November 19 and 22, 1999.

**Cross-section locations**—Endpoints are spots of paint on top of channelized banks.

**Cross-section 1** is about 750 ft upstream from the gaging station.

**Cross-section 2** is in line with gaging station, on the downstream side of the Priest Drive bridge.

**Cross-section 3** is about 620 ft downstream from the bridge.

**Cross-section 4** is about 1,130 ft downstream from cross-section 3.

### 09517280 Tiger Wash near Aguila, Arizona

**Reach location**—The channel-change monitoring reach extends from 350 ft upstream from a series of crest-stage gages to about 450 ft downstream. The crest-stage gages are at latitude 33°44'30"N., longitude 113°16'43"W., in SW¼SW¼ sec. 26, T. 5 N., R. 10 W., Maricopa County, about 0.2 mi southeast of Eagle Eye Road, 17 mi south of Aguila, and 10 mi north of the junction of Eagle Eye Road and Buckeye-Salome Road. Datum of the gages is 1,870 ft above NGVD of 1929 from Weldon Hill 7.5-minute quadrangle.

**Drainage area**—85.2 mi<sup>2</sup>.

**Channel description**—The stream channel is primarily sand and gravel and includes scattered large boulders. Vegetation is moderate, with large bushes growing in the channel near the margins. At low to medium stages, flow is confined to the flat, sandy main channel. At higher stages, the overflow channel, which is on the right side of the main channel and is heavily vegetated, becomes

effective. The left bank is confined by bedrock outcrops, and the right bank is the flood terrace.

**Most recent survey**—April 6, 2001.

**Cross-section locations**—

**Cross-section 1** is 350 ft upstream from the crest-stage gage, left endpoint is yellow paint mark on rock outcrop, right endpoint is wooden stake.

**Cross-section 2** is at the crest-stage gage, initial survey after 1997 indirect measurement.

**Cross-section 3** is 195 ft downstream from the crest-stage gage, left endpoint is wooden stake, right endpoint is rebar.

**Cross-section 4** is 446 ft downstream from the crest-stage gage. Original left endpoint was yellow "X" on rock, current left endpoint is wooden stake, right endpoint is wooden stake.

### 09488650 Vekol Wash near Stanfield, Arizona

**Reach location**—The channel-change monitoring reach extends from about 400 ft upstream from a crest-stage gage to about 400 ft downstream. The crest-stage gage is at latitude 32°50'30"N., longitude 112°15'04"W., in SW¼ SW¼ sec. 3, T. 7 S., R. 1 E., Maricopa County, on the left bank, 400 ft downstream from the Interstate 8 bridge, 29 mi west of Casa Grande, 28 mi east of Gila Bend, and 18 mi west of Stanfield. The pin elevation (gage datum) is 4.64 ft. Elevation of gage is 1,625 ft above NGVD of 1929, from topographic map. The FCDMC operates a stage pressure transducer, rain gage, and data transmitter in a shelter just downstream from the gage.

**Drainage area**—150 mi<sup>2</sup>.

**Channel description**—The channel is straight for about 1,000 ft upstream and 2,000 ft downstream from the gage and is confined to a width of about 200 ft by 10-ft high, weakly cemented alluvial banks. The channel banks are covered with dense brush and trees, whereas the sand and gravel channel bed is, for the most part, clear of vegetation.

**Most recent survey**—October 28, 1998.

**Cross-section locations**—All endpoints are rebar. There is no cross-section 1.

**Cross-section 2** is 190 ft downstream from bridge, about 212 ft upstream from the crest-stage gage.

**Cross-section 3** is at the crest-stage gage.

**Cross-section 4** is about 260 ft downstream from the crest-stage gage.

**Cross-section 5** is about 140 ft downstream from cross-section 4 and about 400 ft downstream from the crest-stage gage.

**Cross-section 6** is about 250 ft downstream from cross-section 5, not recovered in 1998.

## 09514200 Waterman Wash near Buckeye, Arizona

**Reach location**—The channel-change monitoring reach extends 400 ft upstream from a crest-stage gage to 410 ft downstream. The crest-stage gage is at latitude 33°19'49"N., longitude 112°30'33"W., in SW¼ NE¼ sec. 24, T. 1 S., R. 3 W., Maricopa County, 2.4 mi upstream from mouth and 5.2 mi southeast of Buckeye Post Office. The gage is on the left bank at edge of flat sand channel directly opposite an old gage site, which was on right bank about 500 ft streamward (west) from several old buildings (pig farm) on right bank. Cross-section 2 spans an adjacent side channel entering Waterman Wash on the right side. This part of the section is referred to as cross-section 2A.

**Drainage area**—420 mi<sup>2</sup>.

**Channel description**—Waterman Wash is a wide, flat, ephemeral sand channel that flows through Rainbow Valley. The channel at the gaging station is mainly sand with some gravel and is incised into the valley alluvium. Large bushes are present in the channel, and the banks are lined with large trees and brush.

**Most recent survey**—December 20–21, 2000.

**Cross-section locations**—All endpoints are rebar.

**Cross-section 1** is 400 ft upstream from the crest-stage gage.

**Cross-section 2** is 196 ft upstream from the crest-stage gage.

**Cross-section 2A** is 196 ft upstream from the crest-stage gage in side channel off of right bank.

**Cross-section 3** is at the crest-stage gage.

**Cross-section 4** is 205 ft downstream from the crest-stage gage.

**Cross-section 5** is 325 ft downstream from the crest-stage gage.

**Cross-section 6** is 410 ft downstream from the crest-stage gage.

## Channel Change, 1997–2002

The monitoring data for the 11 selected sites indicate that runoff and channel change are highly variable. These washes and streams are dry most of the time but are prone to flash flooding that causes significant scour and fill. Channel change is more likely to occur as discharge increases (Leopold and others, 1964); therefore, the selected sites were monitored for flows exceeding the 2-year recurrence interval ([table 1](#)). Current survey data for Jackrabbit Wash and the Hassayampa River near Arlington (Capesius and Lehman, 2002) support the idea that the most significant geomorphic change in predominately sand channels occurs in conjunction with peak flows above the 10-year recurrence interval.

The study channels fall into three categories: sand channels; bedrock, cobble, and gravel channels; and sand, gravel, and cobble channels. Sand channels typically are the most sensitive to scour and fill regimes (Leopold and others, 1964); however, they usually return to equilibrium except after very large flows. Sand channels in the study include Hassayampa River near Arlington, Hassayampa River near Morristown, Jackrabbit Wash, and Waterman Wash. Of these, only Jackrabbit Wash has experienced a peak of record, channel-changing flow. Agua Fria River, Cave Creek, Deadman Wash, New River, and Salt River are all bedrock, cobble, and gravel channels. Measured flows in these channels have all been below the 10-year recurrence interval during the study period. Sand, gravel, and cobble channels include Tiger Wash and Vekol Wash.

## Sand Channels

The Hassayampa River near Arlington below the railroad bridge has a wide, braided, sandy channel bed in which the low-flow channel shifts laterally. The base line for the cross sections is Parker's 1991–92 study (Parker, 1995), and all section resurveys show both fill and scour during the study period. High flows in October 2000 entrenched the low-flow channel near the left bank from the head of the reach though cross-section 7. Sections 9 through 11, however, had increasing amounts of fill in the downstream direction.

The flat sandy channel at Hassayampa River near Morristown is confined by vertical bedrock canyon walls in most of the study reach. San Domingo Wash enters the Hassayampa between cross-section 1 and 2. The most recent resurvey shows a sand bar building along the left margin of the main channel. The bar's relief is greatest at cross-section 2 but the bar extends through cross-section 3.

Jackrabbit Wash near Tonopah is a sand channel with some gravel and cobble that is incised into banks of cohesive to semicohesive alluvium. All but three cross-section endpoints at Jackrabbit Wash were washed out in the record peak flow in October 2000. It has not been possible to correlate cross sections used in the indirect measurement survey (conducted after flow) to the original cross sections. The road upstream from the crest-stage gages, however, was buried in sand after the flow. In addition, channel change is indicated by photos taken before and after the record flow. Comparison between the indirect-measurement surveys done in 2000 and 2002 shows well-defined scour limited to the low-flow channels in cross-section 2 ([fig. 7](#)).

Waterman Wash near Buckeye is a flat sand channel about 120 ft wide that has shallow banks of semicohesive alluvium. The peak-of-record flow, 9,400 ft<sup>3</sup>/s, occurred on August 8, 1997, but during the 5-year monitoring period there has been less than a foot of change throughout most of the reach ([fig. 12](#)).



### Bedrock, Cobble, and Gravel Channels

At Agua Fria River near Rock Springs, there has been little measurable channel change throughout the study reach over the 5-year monitoring period. Scour and fill is not large at cross-section 1, with the most change (about 1.5 ft) occurring in the low-flow channel close to the right bank (fig. 2). Cross-section 2 is in line with the gaging station and crosses the gaging-station pool. Elevation changes observed on the first flood terrace are most likely a function of the variation in the cross-section path between surveys. Measurements at cross-section 3 show apparent scour and fill but this also could be caused by the variation in the cross-section path. The right-bank endpoint at cross-section 3 was unrecoverable in January 2000 as was the right-bank endpoint at cross-section 4. Measured change at cross-section 4 is less than 0.5 ft.

The channel of Cave Creek below Cottonwood Creek is primarily cobble and gravel and is fairly straight throughout the study reach. The channel contracts starting from the road crossing just downstream from cross-section 6 all the way through cross-section 3, and all sections show apparent localized scour and fill (fig. 3). Cross-section 6 incurred fill in both the left and right low-flow channels, whereas cross-section 5 received the most scour, especially along the edges of the mid-channel gravel bar. This mid-channel gravel bar is present in all four cross sections, but by cross-section 3 the bar is thin and tapering downstream. The top of the bar also was scoured in cross-section 4, but at this section there is only one well-defined low-flow channel along the right bank. At cross-section 3, the low-flow channel cuts near the left bank and stays to the left downstream past the gaging station. Scour in cross-section 3 occurs mainly in the low-flow channel.

Deadman Wash near New River had measurable scour in the upper two cross sections: cross-section 1, which is approximately 70 ft upstream from the crest-stage gage, and cross-section 2, which is in line with the gaging station. The channel has expanded several feet to the right between cross-section 1 and cross-section 2, and at cross-section 1 there has been less than 0.5 ft of measurable fill along the left bank (fig. 4). The cross sections downstream from the gaging station (cross-section 3, established in 1998; cross-section 5; and cross-section 6) have changed less than 0.5 ft. Cross-section 4, along the downstream edge of a dirt road that crosses the wash, was measured in 1997 but was excluded in following surveys because the endpoints were unrecoverable and the surface was prone to artificial change due to road grading.

At New River at New River, all cross sections surveyed in 1997 were unrecoverable in 1999 and were reestablished at closest approximation to the original sections. Cross-section 4, along the abandoned cableway, is the closest to its original location. Cross-sections 3 and 4 exhibited little measurable change (fig. 8); the changes in section 5 could be a result of an offset from the original survey. Because there is no active stream gaging at this site, discharge values applied here are from streamflow-gaging station 09513780, New River near Rock Springs, which is about 10 mi upstream.

The channel at Salt River at Priest Drive is bedrock overlain by boulders, cobbles, and sandbars; is about 1,000 ft wide; and is essentially straight for 1 mi upstream and 1 mi downstream from the gaging station. Both right and left banks are man-made levees. Monitoring at this site was discontinued after FCDMC graded the channelized riverbed during the winter of 1999–2000 in order to mitigate vegetation growth. It was concluded that most channel changes in this section of the Salt River would result directly or indirectly from alterations by humans (fig. 9).

### Sand, Gravel, and Cobble Channels

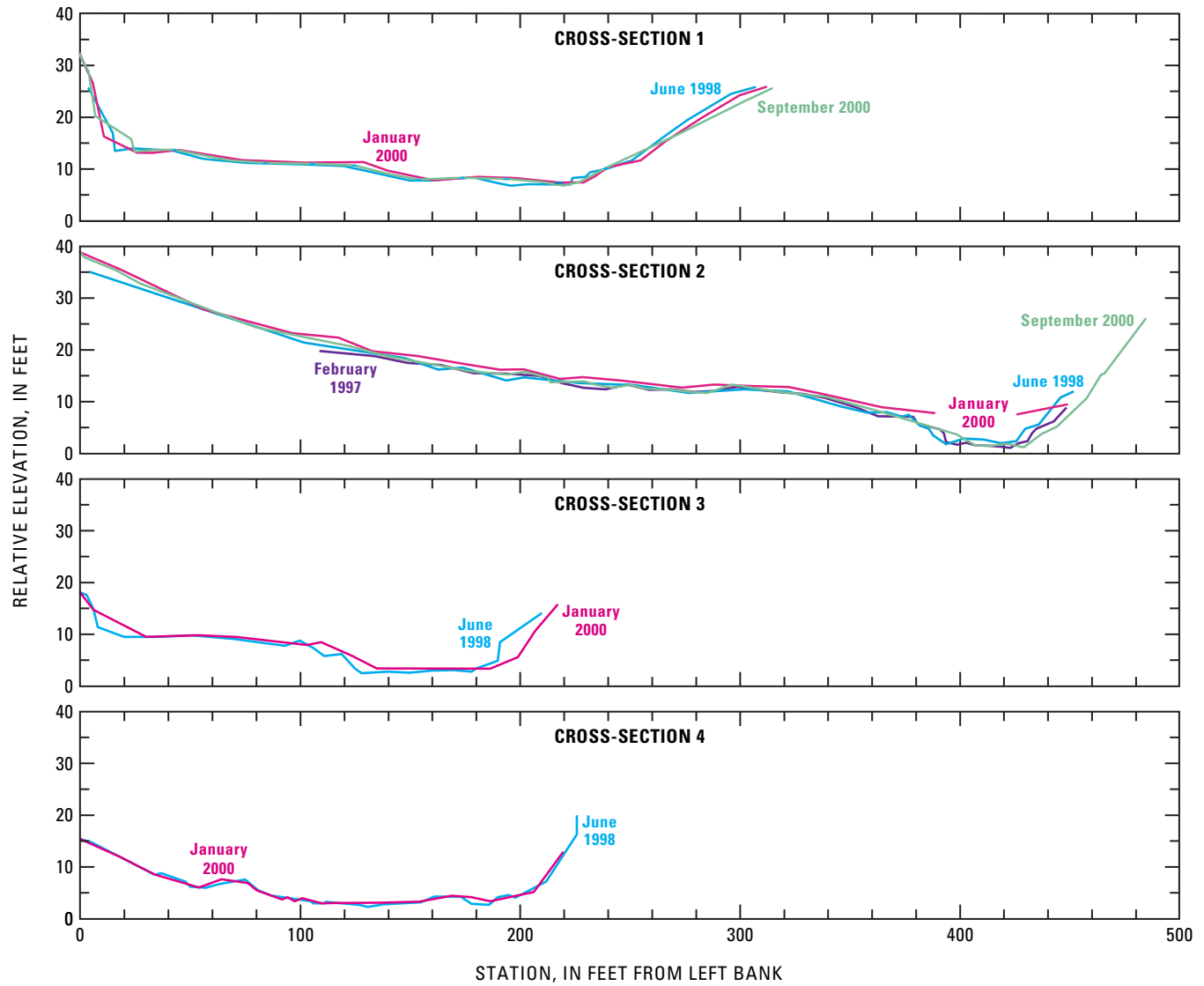
Tiger Wash near Aguila is a flat sandy channel with large boulders near the right channel margin and bedrock on the left. Fill has been the dominant change in cross-sections 1–3 (fig. 10). Cross-section 1 has shown less than 1 ft of change during the monitoring period, and larger changes on the left margin are due to changes in locations of the left endpoint. In cross-section 2, the original low-flow channel near the center of the main channel has continued to fill through time to the current mounded sandbar. Changes to cross-section 3 are similar to those at cross-section 2 but lesser in magnitude. Section 4 has had changes of less than 0.5 ft.

Vekol Wash near Stanfield is a flat sand and gravel channel confined by steep banks of semicohesive alluvium. The peak-of-record flow, 7,780 ft<sup>3</sup>/s, occurred at this site on July 25, 1996. The channel has been dry for most of the monitoring period, and there has been little measurable channel change. About 1 ft of scour has occurred in the low-flow channel (cross-section 2), and about 1 ft of fill has occurred at cross-sections 3 and 4. At cross-section 5, there also was about 1 ft of fill in the low-flow channel, but about 1 ft of scour in the rest of the section (fig. 11).

## Selected References

- Benson, M.A., and Dalrymple, Tate, 1967, General field and office procedures for indirect-discharge measurements: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap. A1, 30 p.
- Burkham, D.E., 1970, Precipitation, streamflow, and major floods at selected sites in the Gila River drainage basin above Coolidge Dam, Arizona: U.S. Geological Survey Professional Paper 655-B, 33 p.
- Capesius, J.P., and Lehman, T.W., 2002, Determination of channel change for selected streams, Maricopa County, Arizona: U.S. Geological Survey Water-Resources Investigations Report 01-4209, 63 p.
- Dalrymple, Tate, and Benson, M.A., 1967, Measurement of peak discharge by the slope-area method: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap. A2, 12 p.
- Foley, M.G., 1978, Scour and fill in steep, sand-bed ephemeral streams: Geological Society of America Bulletin, v. 89, no. 4, p. 559-570.
- Graf, W.L., 1988, Fluvial process in dryland rivers: New York, Springer-Verlag, 346 p.
- Jarrett, R.D., 1986, Evaluation of the slope-area method of computing peak discharge, *in* Subitzky, Seymour, ed., Selected Papers in the Hydrologic Sciences 1986: U.S. Geological Survey Water-Supply Paper 2310, p. 13-24.
- Kirby, W.H., 1981, Annual flood frequency analysis using U.S. Water Resources Council guidelines (program J407): U.S. Geological Survey Open-File Report 79-1336-I, WATSTORE User's Guide, v. 4, chap. I, sec. C, 56 p.
- Leopold, L.B., Wolman, M.G., and Miller, J.P., 1964, Fluvial processes in geomorphology: San Francisco, California, W.H. Freeman and Company, 522 p.
- Parker, J.T.C., 1995, Channel change and sediment transport in two desert streams in central Arizona, 1991-92: U.S. Geological Survey Water-Resources Investigations Report 95-4059, 42 p.
- Pope, G.L., Rigas, P.D., and Smith C.F., 1998, Statistical summaries of streamflow data and characteristics of drainage basins for selected streamflow-gaging stations in Arizona through water year 1996: U.S Geological Survey Water-Resources Investigations Report 98-4225, 907 p.

## Cross-Section Data



**Figure 2.** Channel-change cross sections from surveys at Agua Fria River near Rock Springs, Arizona, 1997–2000.

**Table 2.** Data from surveys at Agua Fria River near Rock Springs, Arizona, 1997–2000

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 1							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
June 1998		June 1998		January 2000		September 2000	
4	25.6	224	8.3	129	11.4	23	15.8
15	17	230	8.5	140	9.7	25	13.4
16	13.5	232	9.4	161	7.8	34	13.7
24	14	239	10	181	8.5	43	13.7
42	13.6	251	11.7	198	8.3	68	11.7
56	12	267	16.7	218	7.4	84	11.2
63	11.7	276	19.4	229	7.4	106	11.0
76	11.2	296	24.5	234	8.6	125	10.7
102	10.9	307	25.8	240	10.4	140	9.1
120	10.6	January 2000		255	11.7	154	8.0
150	7.8	0	32.4	266	15.3	174	8.3
160	7.8	1	31.2	283	20.0	194	8.1
168	8.1	6	26.6	300	24.3	210	7.6
179	8.4	11	16.3	312	25.9	220	6.8
190	7.3	26	13.2	September 2000		228	7.6
196	6.8	33	13.1	0	32.3	239	10.2
204	7.1	45	13.7	1	31.1	272	16.8
223	7	74	11.7	4	28.9	303	23.2
		102	11.3	7	20.2	315	25.6

## 14 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

**Table 2.** Data from surveys at Agua Fria River near Rock Springs, Arizona, 1997–2000—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

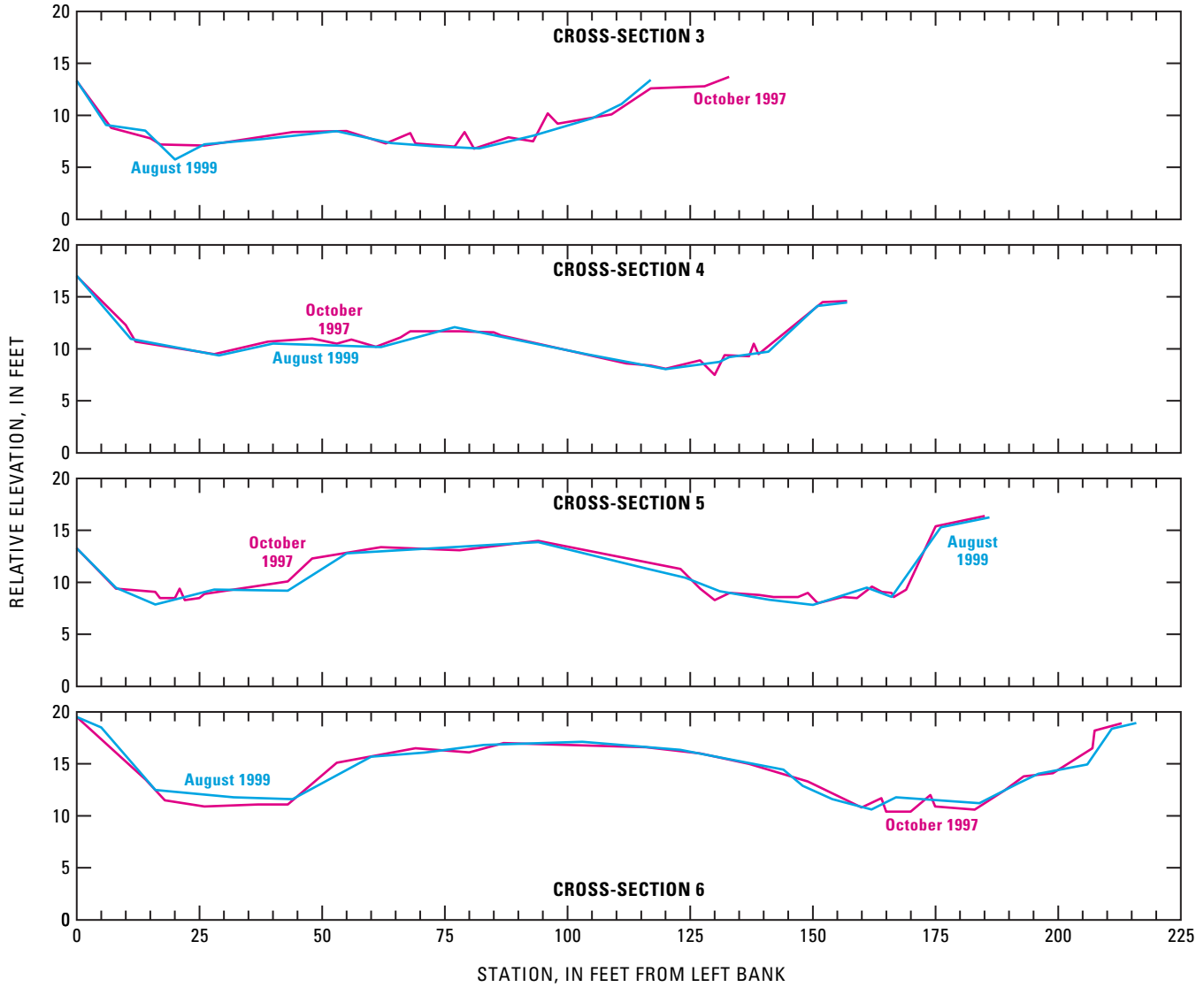
Cross-section 2							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
February 1997		February 1997		June 1998		September 2000	
109	19.8	423	1.1	430	4.8	123	20.7
134	18.8	427	2.0	436	5.6	140	18.7
149	17.5	431	2.4	446	10.8	161	17.1
164	17.1	433	3.9	452	12.0	177	15.9
179	15.5	435	4.8	January 2000		194	15.2
194	15.4	443	6.2	0	38.8	202	15.8
209	15.0	449	9.0	19	35.5	213	14.7
219	13.6	June 1998		57	27.8	214	13.8
229	12.7	4	35.1	97	23.2	229	13.9
239	12.4	102	21.4	118	22.4	234	13.3
249	13.3	148	18.4	133	19.7	242	12.7
259	12.3	163	16.2	153	18.8	250	13.3
269	12.4	174	16.6	176	17.2	257	12.5
279	11.9	194	14.1	191	16.2	269	12.3
289	12.1	202	14.7	202	16.3	278	11.9
299	12.9	227	13.6	218	14.4	285	11.7
309	12.3	252	13.2	229	14.8	297	13.3
319	11.8	277	11.7	246	14.1	307	12.6
329	11.5	302	12.4	274	12.7	316	12.0
339	10.7	322	12.0	289	13.3	339	10.9
353	8.9	346	9.1	306	13.0	363	8.2
363	7.2	358	7.9	322	12.8	399	3.7
379	7.1	367	8.0	337	11.5	407	1.6
381	5.8	374	7.1	365	8.9	413	1.5
389	4.9	377	7.5	389	7.8	422	1.9
391	4.7	382	5.4	channel under water		429	1.2
393	3.9	386	4.8	426	7.6	437	3.8
394	2.2	388	3.5	449	9.4	444	5.2
399	1.7	394	1.8	September 2000		458	10.7
403	2.1	402	2.9	0	38.9	464	15.2
407	1.6	411	2.7	2	37.9	466	15.5
413	1.5	419	2.0	17	35.3	485	26.0
419	1.3	426	2.4	27	32.8		
		428	3.6	80	24.4		

**Table 2.** Data from surveys at Agua Fria River near Rock Springs, Arizona, 1997–2000—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 3							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
June 1998		June 1998		June 1998		January 2000	
332	18.1	432	8.8	510	2.8	403	9.5
335	17.6	438	7.4	512	3.4	435	7.9
338	14.9	443	5.8	522	4.9	442	8.5
340	11.4	451	6.2	523	8.5	455	5.9
352	9.5	457	3.4	542	14.1	467	3.4
367	9.5	460	2.5	January 2000		519	3.4
383	9.8	472	2.8	332	18.1	531	5.6
402	9.1	482	2.6	338	14.8	539	10.6
425	7.8	492	3	362	9.5	549	15.7
		502	3.1	386	9.8		
Cross-section 4							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
June 1998		June 1998		June 1998		January 2000	
397	15.4	508	3	595	4.1	491	4.2
402	14.8	509	3.3	609	7.2	495	3.4
431	8.5	511	3.2	623	16.3	498	4.0
434	8.8	524	2.7	623	20	507	3.0
445	7.2	528	2.3	January 2000		512	3.0
447	6.2	535	2.8	397	15.4	534	3.1
454	6	552	3.2	415	12.0	551	3.3
460	6.7	558	4.3	431	8.6	566	4.5
472	7.6	570	4.3	451	6.1	575	4.2
478	5.5	575	2.9	461	7.6	584	3.4
484	4.5	583	2.7	473	6.9	603	5.2
502	3.4	587	4.2	477	5.5	616	12.8
503	3	592	4.6	489	3.7		

**16 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002**



**Figure 3.** Channel-change cross sections from surveys at Cave Creek below Cottonwood Creek, near Cave Creek, Arizona, 1997–99.

**Table 3.** Data from surveys at Cave Creek below Cottonwood Creek, near Cave Creek, Arizona, 1997–99

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 3							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
October 1997		October 1997		October 1997		August 1999	
0	13.3	69	7.3	117	12.6	38	7.7
7	8.8	77	7	128	12.8	53	8.5
15	7.8	79	8.4	133	13.7	64	7.3
17	7.2	81	6.8	August 1999		73	7.0
26	7.1	88	7.9	0	13.3	82	6.8
44	8.4	93	7.5	6	9.1	93	8.0
55	8.5	96	10.2	14	8.5	105	9.7
63	7.3	98	9.2	20	5.8	111	11.1
68	8.3	109	10.1	26	7.2	117	13.4

**Table 3.** Data from surveys at Cave Creek below Cottonwood Creek, near Cave Creek, Arizona, 1997–99—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 4							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
October 1997		October 1997		October 1997		August 1999	
0	17.0	68	11.7	137	9.3	62	10.2
10	12.3	78	11.7	138	10.5	77	12.1
12	10.7	85	11.6	139	9.5	104	9.5
28	9.5	86.5	11.3	152	14.5	120	8.1
39	10.7	112	8.6	157	14.6	131	8.8
48	11.0	117	8.4	August 1999		133	9.2
53	10.5	120	8.1	0	17.0	141	9.7
56	10.9	127	8.9	11	11.0	151	14.1
61	10.2	130	7.5	29	9.4	157	14.5
66	11.1	132	9.4	40	10.5		

Cross-section 5							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
October 1997		October 1997		October 1997		August 1999	
0	13.3	94	14.0	162	9.6	55	12.8
8	9.4	123	11.3	164	9.1	94	13.9
16	9.1	127	9.4	166	9	116	11.4
17	8.5	130	8.3	166.5	8.6	124	10.5
20	8.5	133	9.0	169	9.3	131	9.2
21	9.4	139	8.8	175	15.4	141	8.3
22	8.3	142	8.6	185	16.4	150	7.8
25	8.5	145	8.6	August 1999		161	9.5
26	8.9	147	8.6	0	13.3	166	8.6
43	10.1	149	9.0	8	9.5	176	15.3
48	12.3	151	8.0	16	7.9	186	16.3
62	13.4	156	8.6	28	9.3		
78	13.1	159	8.5	43	9.2		

Cross-section 6							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
October 1997		October 1997		October 1997		August 1999	
0	19.5	137	15	207.5	18.2	144	14.4
14	13.5	149	13.3	213	18.9	148	12.9
18	11.5	160	10.8	August 1999		154	11.6
26	10.9	164	11.7	0	19.5	162	10.6
37	11.1	165	10.4	5	18.5	167	11.8
43	11.1	170	10.4	16	12.5	184	11.2
53	15.1	174	12	32	11.8	192	13.1
69	16.5	175	10.9	44	11.6	196	14.0
80	16.1	183	10.6	60	15.7	206	14.9
87	17	189	12.4	71	16.1	211	18.4
116	16.6	193	13.8	83	16.8	216	18.9
127	16	199	14.1	103	17.1		
		207	16.5	123	16.4		



18 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

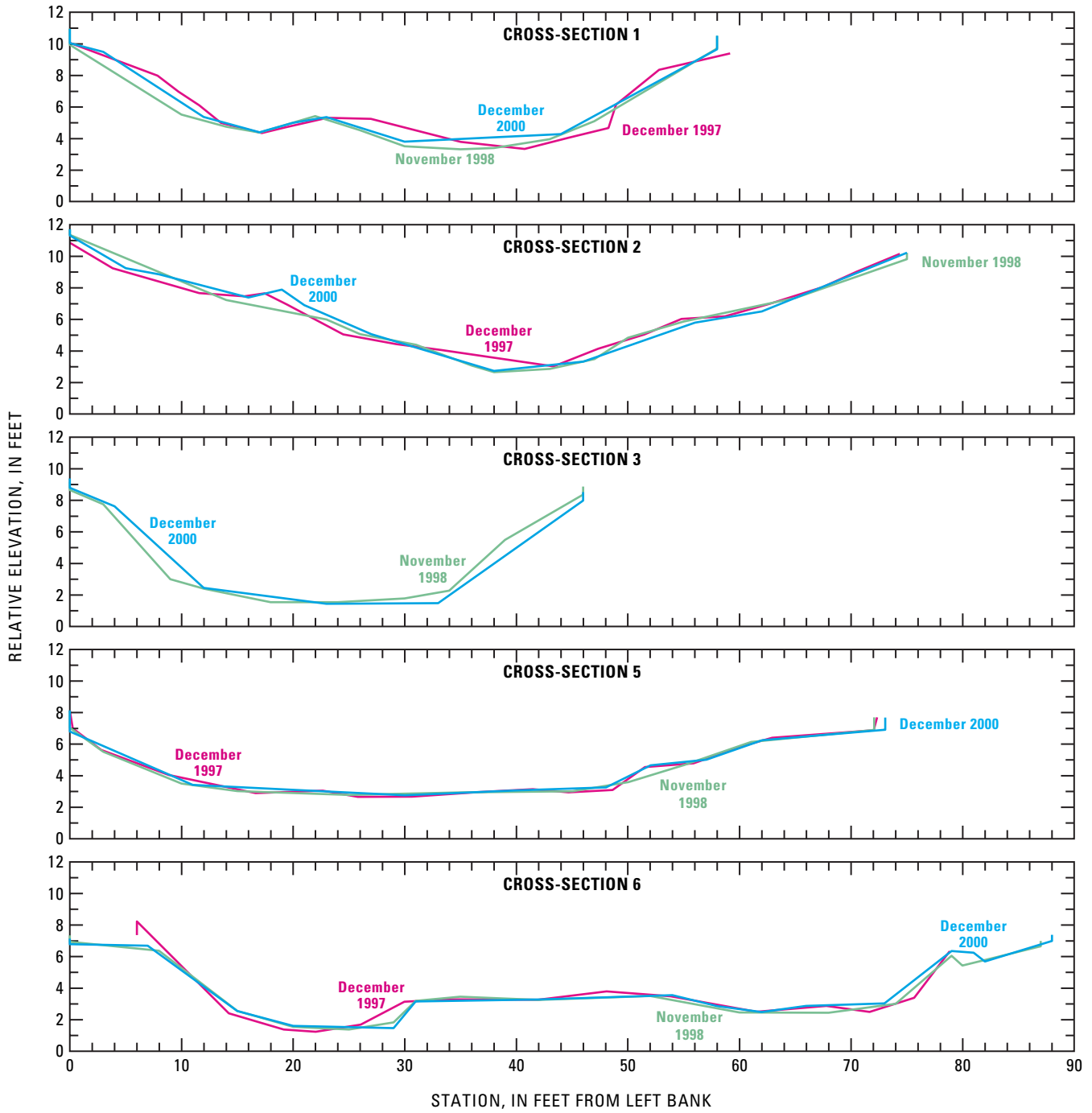


Figure 4. Channel-change cross sections from surveys at Deadman Wash near New River, Arizona, 1997–2000.

**Table 4.** Data from surveys at Deadman Wash near New River, Arizona, 1997–2000

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Cross-section 3 established in 1998]

<b>Cross-section 1</b>							
<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>
December 1997		December 1997		November 1998		December 2000	
0	10.1	41	3.3	17	4.4	0	10.9
8	8.0	45	4.0	22	5.4	0	10.0
10	7.0	48	4.7	26	4.5	3	9.5
12	6.1	49	6.1	30	3.5	12	5.4
14	5.0	53	8.3	35	3.3	17	4.4
17	4.3	59	9.4	38	3.4	20	5.0
19	4.7	November 1998		43	4.0	23	5.3
23	5.3	0	11.0	47	5.1	30	3.8
27	5.2	0	9.9	58	9.7	44	4.3
31	4.5	10	5.5	58	10.5	58	9.6
35	3.8	14	4.7			58	10.5
<b>Cross-section 2</b>							
<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>
December 1997		December 1997		November 1998		December 2000	
0	10.8	55	6.0	36	3.1	5	9.2
4	9.2	59	6.2	38	2.7	8	8.9
12	7.7	63	7.0	39	2.7	16	7.4
16	7.5	67	8.0	43	2.9	19	7.9
17	7.6	70	9.0	47	3.5	21	6.9
19	6.9	74	10.1	50	4.8	27	5.1
24	5.0	November 1998		55	5.9	38	2.7
29	4.4	0	11.7	65	7.4	46	3.3
33	4.1	0	11.4	75	9.8	56	5.8
43	3.0	14	7.2	75	10.2	62	6.5
47	4.1	23	6.0	December 2000		75	10.2
51	5.0	26	5.1	0	11.7		
		31	4.4	0	11.3		
<b>Cross-section 3</b>							
<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>
November 1998		November 1998		December 2000		December 2000	
0	9.2	24	1.5	0	9.4	46	8.0
0	8.7	30	1.8	0	8.8	46	8.5
3	7.8	34	2.3	4	7.6		
9	3.0	39	5.5	12	2.5		
12	2.4	46	8.4	23	1.4		
18	1.5	46	8.9	33	1.5		

## 20 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

**Table 4.** Data from surveys at Deadman Wash near New River, Arizona, 1997–2000—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Cross-section 3 established in 1998]

Cross-section 5							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
December 1997		December 1997		November 1998		December 2000	
0	8.1	49	3.1	10	3.5	0	8.1
0	7.0	51	4.5	15	3.0	0	6.8
3	5.6	56	4.8	25	2.8	11	3.4
9	4.0	60	5.9	35	2.9	20	3.1
17	2.9	63	6.4	45	3.0	30	2.8
23	3.0	72	6.9	50	3.6	40	3.1
26	2.7	72	7.7	55	4.7	48	3.3
31	2.7	November 1998		61	6.1	52	4.7
37	3.0	0	8.1	72	6.9	57	5.0
41	3.1	0	7.0	72	7.7	62	6.3
45	2.9	3	5.5			73	6.9
						73	7.7
Cross-section 6							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
December 1997		December 1997		November 1998		December 2000	
6	8.2	72	2.5	52	3.5	29	1.5
6	7.4	76	3.4	60	2.5	31	3.2
14	2.4	79	6.3	68	2.4	42	3.3
19	1.4	November 1998		74	3.0	54	3.6
22	1.2	0	7.4	79	6.1	58	2.9
26	1.7	0	6.9	80	5.4	62	2.5
30	3.1	8	6.4	87	6.7	66	2.9
34	3.3	15	2.6	87	7.0	73	3.0
42	3.3	20	1.6	December 2000		79	6.4
48	3.8	25	1.4	0	7.1	81	6.3
54	3.5	29	1.8	0	6.8	82	5.7
62	2.5	31	3.2	7	6.7	88	7.0
68	2.9	35	3.5	15	2.5	88	7.4
		42	3.3	20	1.6		

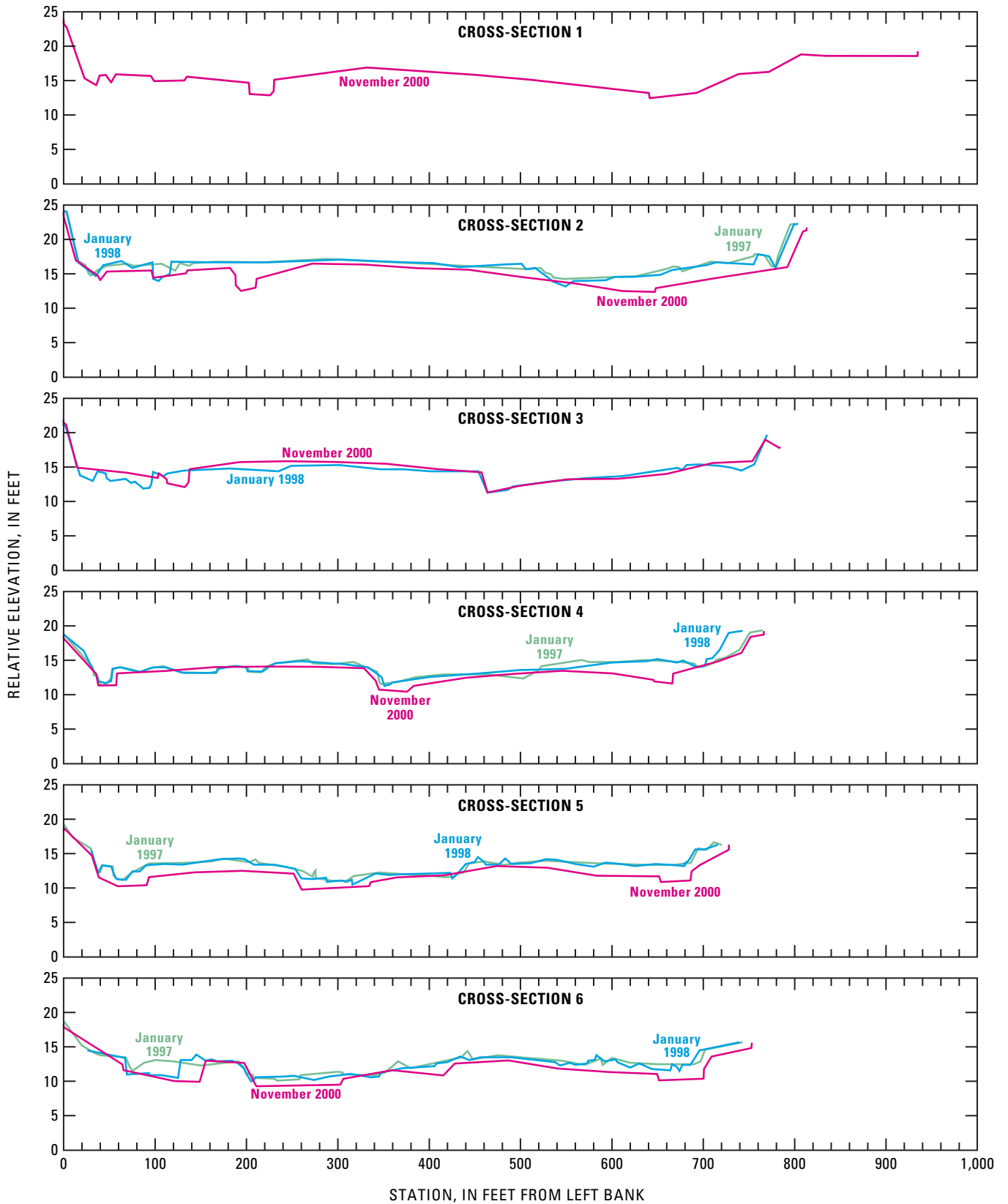


Figure 5. Channel-change cross sections from surveys at Hassayampa River near Arlington, Arizona, 1997–2000.

22 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

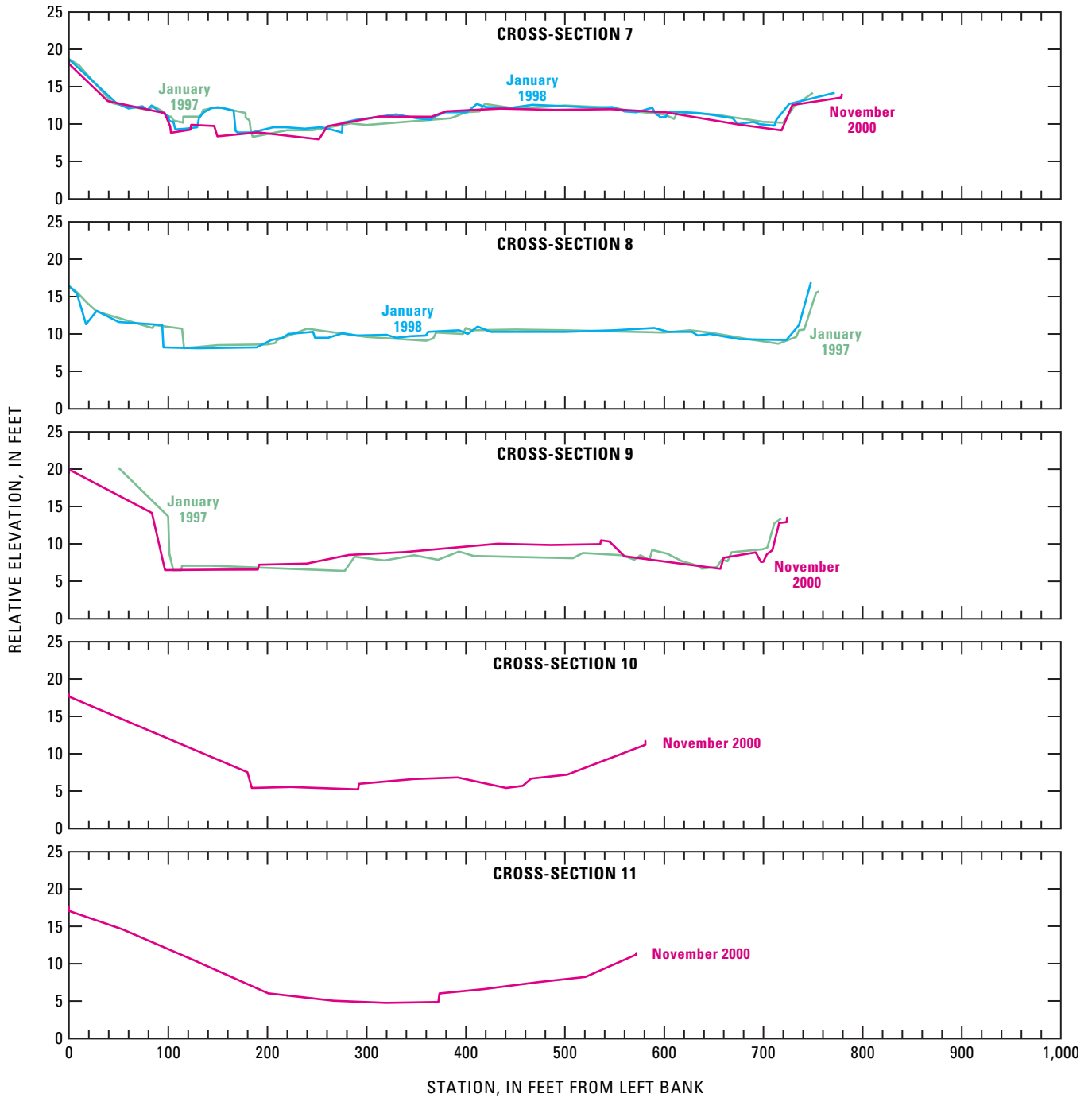


Figure 5.—Continued.

**Table 5.** Data from surveys at Hassayampa River near Arlington, Arizona, 1997–2000

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Endpoints for cross-section 8 unrecoverable in 2000]

Cross-section 1							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
November 2000		November 2000		November 2000		November 2000	
0	23.8	52	14.7	226	12.9	693	13.2
0	23.3	57	15.9	230	13.5	739	16.0
3	22.7	95	15.7	230	15.1	772	16.3
23	15.3	99	14.9	332	16.9	807	18.8
36	14.3	132	15.0	450	15.8	834	18.6
39	15.7	135	15.6	511	15.1	935	18.6
46	15.8	203	14.7	641	13.2	935	19.2
		204	13.0	641	12.5		
Cross-section 2							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
January 1997		January 1997		January 1998		November 2000	
0	24.2	661	15.8	223	16.7	13	17.0
3	24.1	667	16.1	303	17.1	37	14.8
16	16.9	674	16.0	373	16.7	40	14.1
24	16.3	677	15.4	405	16.6	47	15.4
27	15.1	708	16.8	433	16.0	96	15.5
29	14.8	727	16.6	483	16.4	98	14.5
31	14.9	755	17.6	501	16.5	134	15.1
37	15.6	756	17.9	506	15.7	135	15.5
47	16.2	767	17.7	516	15.9	182	15.9
69	16.5	775	16.1	536	13.9	187.8	14.8
77	16.2	779	16.2	549	13.2	188.2	13.4
107	16.5	782	17.7	558	14.0	194	12.6
122	15.5	795	22.2	593	14.1	210	13.0
127	16.6	800.5	22.3	603	14.6	211	14.3
137	16.2	January 1998		623	14.6	272	16.5
142	16.6	0	24.2	653	14.9	329	16.4
167	16.8	3	24.0	666	15.6	387	15.9
217	16.7	16	16.7	703	16.3	443	15.6
287	17.2	35	14.7	714	16.7	500	14.6
347	16.8	43	16.3	755	16.4	562	13.6
397	16.5	63	16.9	760	17.9	611	12.5
437	16.2	75	15.9	772	17.6	647	12.4
507	15.7	97	16.7	779	15.9	648	13.0
522	15.9	98	14.3	786	18.1	714	14.4
527	15.2	104	14.0	799	22.2	792	16.0
533	15.0	107	14.5	804	22.3	809	21.2
536	14.5	116	15.0	November 2000		813	21.4
547	14.3	118	16.8	0	24.0	813	21.7
627	14.7	163	16.7	0	23.3		

## 24 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

**Table 5.** Data from surveys at Hassayampa River near Arlington, Arizona, 1997–2000—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Endpoints for cross-section 8 unrecoverable in 2000]

Cross-section 3							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
January 1998		January 1998		January 1998		November 2000	
0	21.5	182	14.8	696	15.4	138	14.7
0	21.1	222	14.5	718	15.2	193	15.7
2	21.0	235	14.4	732	14.9	245	15.9
18	13.8	249	15.2	742	14.5	297	15.8
32	13.0	302	15.3	756	15.4	353	15.5
37	14.4	347	14.7	770	19.7	408	14.7
46	14.1	372	14.7	November 2000		457	14.3
47	13.4	402	14.4	0	21.8	464	11.3
51	13.0	454	14.4	0	21.5	499	12.3
68	13.3	464	11.3	3	21.2	552	13.2
74	12.7	486	11.7	15	14.9	607	13.3
78	12.9	492	12.2	70	14.2	660	14.0
87	11.9	532	12.9	103	13.4	711	15.6
94	12.0	572	13.4	104	14.1	754	15.9
96	12.5	612	13.7	113	13.3	768	19.0
98	14.3	672	14.9	114	12.6	784	17.8
109	13.7	677	14.6	133	12.1	784	17.9
114	14.1	682	15.3	137	12.8		
132	14.5						

**Table 5.** Data from surveys at Hassayampa River near Arlington, Arizona, 1997–2000—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Endpoints for cross-section 8 unrecoverable in 2000]

Cross-section 4							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
January 1997		January 1997		January 1998		January 1998	
0	18.9	503	12.4	167	13.3	718	16.5
32	14.0	520	13.6	170	13.8	728	19.0
33	12.9	523	14.2	188	14.2	743	19.3
37	12.7	567	15.1	200	14.0	November 2000	
39	11.7	575	14.8	201	13.5	0	18.5
42	11.4	605	14.8	210	13.4	0	18.2
47	11.7	638	15.1	218	13.4	36	13.0
52	12.5	675	14.8	224	14.0	38	11.4
53	13.8	690	14.6	232	14.6	58	11.4
62	14.1	693	14.2	260	14.9	58	13.1
84	13.4	697	14.1	270	14.8	112	13.5
95	13.9	704	14.3	300	14.5	166	14.0
109	14.2	712	14.7	304	14.5	222	14.1
128	13.3	714	15.1	333	14.0	279	14.1
167	13.2	725	15.5	348	12.6	329	13.9
168	13.9	740	16.6	351	11.3	342	12.1
185	14.2	751	19.1	357	11.5	345	10.8
202	14.0	765	19.4	360	11.8	376	10.5
202	13.4	January 1998		370	12.0	383	11.3
216	13.3	0	18.8	400	12.6	440	12.5
221	14.1	22	16.4	454	13.1	490	13.0
231	14.6	33	13.4	500	13.6	545	13.5
267	15.2	36	13.0	530	13.7	601	13.1
273	14.6	38	12.0	550	13.8	646	12.2
295	14.5	46	11.7	600	14.7	647	12.0
317	14.8	52	12.0	639	14.9	667	11.6
343	13.4	54	13.8	650	15.2	667	13.1
346	11.8	62	14.0	671	14.7	717	14.9
348	11.6	83	13.3	678	15.0	742	16.1
365	11.9	98	14.0	693	14.0	752	18.4
385	12.6	111	14.0	702	14.2	766	18.7
415	13.0	131	13.2	704	15.2	766	19.2
465	13.0	160	13.2	710	15.3		



## 26 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

**Table 5.** Data from surveys at Hassayampa River near Arlington, Arizona, 1997–2000—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Endpoints for cross-section 8 unrecoverable in 2000]

Cross-section 5							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
January 1997		January 1997		January 1998		January 1998	
0	19.3	443.5	13.6	260	11.4	679	13.2
9.5	17.4	459.5	13.9	272	11.3	681	13.6
29.5	15.8	482.5	13.4	287	11.5	680	13.6
36.5	12.4	495.5	13.7	288	10.9	684	14.0
39.5	12.3	527.5	14.0	304	11.1	691	15.6
42.5	13.3	587.5	13.6	309	10.9	701	15.6
53.5	13.2	641.5	13.4	315	11.2	716	16.3
54.5	11.9	667.5	13.4	316	10.5	November 2000	
57.5	11.4	686.5	13.7	341	12.1	0	18.3
64.5	11.2	694.5	15.8	356	11.9	0	18.7
74.5	12.3	703.5	15.6	370	12.0	31	14.7
93.5	13.6	711.5	16.7	400	12.1	39	11.5
133.5	13.7	720.5	16.3	423	12.2	59	10.3
161.5	13.9	January 1998		425	11.4	91	10.4
175.5	14.3	30	15.5	428	11.7	93	11.6
203.5	13.8	37	12.4	431	12.1	143	12.3
209.5	14.2	38	12.3	440	13.5	196	12.5
213.5	13.7	42	13.3	450	13.8	251	12.1
243.5	13.1	52	13.1	453	14.5	261	9.8
261.5	12.5	56	11.7	460	13.8	334	10.3
272.5	11.7	58	11.3	462	13.4	336	10.8
273.5	12.3	68	11.2	476	13.4	365	11.6
275.5	12.6	75	12.4	483	14.3	416	11.8
275.5	11.5	83	12.4	490	13.5	474	13.2
293.5	11.1	90	13.3	511	13.6	529	12.9
309.5	11.1	110	13.5	528	14.2	583	11.8
317.5	11.8	130	13.4	540	14.1	652	11.7
345.5	12.3	150	13.8	560	13.5	654	10.9
377.5	12.0	172	14.2	580	13.1	686	11.1
403.5	11.8	191	14.3	593	13.7	687	12.4
417.5	11.6	198	14.2	610	13.5	696	13.3
427.5	11.7	208	13.4	625	13.2	728	15.6
429.5	12.1	230	13.4	648	13.5	728	16.2
437.5	12.3	253	12.8	670	13.3		

**Table 5.** Data from surveys at Hassayampa River near Arlington, Arizona, 1997–2000—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Endpoints for cross-section 8 unrecoverable in 2000]

Cross-section 6							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
January 1997		January 1997		January 1998		January 1998	
0	18.8	500	13.5	240	10.7	671	12.1
20	15.2	545	13.0	252	10.8	674	11.5
34	14.1	570	12.4	274	10.2	677	12.4
40	13.8	588	13.3	290	10.7	686	12.4
68	13.5	590	12.4	314	11.1	696	14.5
71.5	12.3	600	13.4	336	10.6	740	15.7
75	11.5	620	12.7	345	10.7	November 2000	
88	12.7	650	12.5	347	11.3	0	18.2
100	13.1	690	12.5	360	11.6	0	17.9
120	12.9	697	12.9	370	11.9	64	12.5
150	12.3	702	14.6	406	12.2	66	11.6
191	12.9	743	15.7	408	12.6	121	10.0
197	12.0	January 1998		420	12.8	149	9.9
200	11.2	26	14.5	434	13.6	156	13.0
207	10.9	67	13.4	444	13.1	198	12.7
208	10.5	69	11.0	456	13.5	211	9.3
230	10.4	93	11.2	490	13.5	303	9.5
234	10.1	94	10.9	538	12.8	306	10.4
258	10.3	107	10.9	543	12.3	360	11.6
259	10.9	125	10.5	554	12.7	416	10.9
300	11.4	128	13.1	560	12.4	428	12.6
305	11.3	140	13.1	573	12.6	487	13.0
306	11.0	145	13.9	574	13.0	541	11.9
340	10.9	155	13.0	581	13.1	597	11.4
352	11.3	162	13.2	583	13.8	650	11.1
366	12.9	168	12.9	592	12.9	652	10.1
380	11.9	184	13.0	604	13.2	700	10.4
400	12.5	190	12.7	606	12.8	701	11.8
435	13.5	197	11.9	620	12.0	709	13.6
442	14.4	200	11.1	630	12.6	753	14.8
448	13.2	205	10.0	644	11.8	753	15.5
475	13.8	208	10.2	664	11.6		
		210	10.6	666	12.5		

## 28 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

**Table 5.** Data from surveys at Hassayampa River near Arlington, Arizona, 1997–2000—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Endpoints for cross-section 8 unrecoverable in 2000]

Cross-section 7							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
January 1997		January 1997		January 1998		January 1998	
0	18.7	610	10.7	218	9.6	690	10.3
10	17.9	613	11.6	238	9.4	696	10.0
44	12.8	650	11.3	253	9.6	711	9.8
80	11.9	700	10.3	261	9.4	713	10.6
85	12.4	720	10.2	275	8.9	726	12.7
96	11.6	730	12.2	276	10.2	772	14.2
98	11.0	734	12.7	290	10.6	November 2000	
103	11.0	750	14.2	330	11.3	0	18.7
105	10.5	January 1998		350	10.8	0	18.1
115	10.2	0	18.7	364	10.6	39	13.1
115	11.0	48	12.8	370	11.1	96	11.5
133	11.0	60	12.1	379	11.6	102	9.7
135	11.9	74	12.4	401	11.6	103	8.8
150	12.3	79	11.9	411	12.7	122	9.3
178	11.5	83	12.5	420	12.3	123	9.9
178	10.9	90	11.8	446	12.2	146	9.8
182	10.5	97	11.3	467	12.6	150	8.4
183	9.2	100	11.1	500	12.4	191	8.9
185	8.3	101	10.4	530	12.2	252	8.0
220	9.2	105	10.3	548	12.3	261	9.7
245	9.2	107	9.3	560	11.7	313	11.0
284	10.1	118	9.4	572	11.6	365	11.0
300	9.9	129	9.6	588	12.2	381	11.7
385	10.8	131	10.9	592	11.3	435	12.1
400	11.6	136	11.6	595	11.1	490	11.9
414	11.7	144	12.2	596	10.9	546	12.0
419	12.7	154	12.2	602	11.0	602	11.6
450	12.1	166	11.8	605	11.7	674	10.0
500	12.5	168	9.1	634	11.5	718	9.2
550	12.2	170	8.9	645	11.3	729	12.6
563	11.8	184	8.9	669	10.8	779	13.6
600	11.3	206	9.6	674	10.0	779	14.1

**Table 5.** Data from surveys at Hassayampa River near Arlington, Arizona, 1997–2000—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Endpoints for cross-section 8 unrecoverable in 2000]

Cross-section 8							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
January 1997		January 1997		January 1998		January 1998	
0	16.4	400	10.8	28	13.1	362	10.3
8	15.6	406	10.5	50	11.6	393	10.5
18	14.2	450	10.6	94	11.2	402	10.0
28	13.0	500	10.5	95	8.2	412	11.0
84	10.8	600	10.2	130	8.1	425	10.3
86	11.2	626	10.5	189	8.2	440	10.3
114	10.7	646	10.2	204	9.2	445	10.3
116	8.1	685	9.3	215	9.5	500	10.3
150	8.5	715	8.7	221	10.0	550	10.5
200	8.6	733	9.6	246	10.3	590	10.8
208	8.8	736	10.5	248	9.5	604	10.3
210	9.2	741	10.6	261	9.5	628	10.3
240	10.7	753	15.5	276	10.1	634	9.8
300	9.6	756	15.7	290	9.8	646	10.0
360	9.1	January 1998		320	9.9	676	9.3
367	9.4	0	16.4	330	9.5	723	9.2
370	10.2	8	15.4	344	9.7	736	11.2
397	10.0	17	11.3	360	9.8	748	16.9
Cross-section 9							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
January 1997		January 1997		November 2000		November 2000	
50	20.2	570	7.9	0	19.5	660	8.2
100	13.7	576	8.5	0	20.0	672	8.4
101	8.7	585	7.9	84	14.2	693	8.9
105	6.5	588	9.2	97	6.5	698	7.6
113	6.5	603	8.7	150	6.6	700	7.6
114	7.1	618	7.7	190	6.6	704	8.6
143	7.1	634	7.1	191	7.2	709	9.2
278	6.4	638	6.7	240	7.4	716	12.8
288	8.3	653	6.9	282	8.5	724	12.9
318	7.8	658	7.9	338	8.9	724	13.5
348	8.5	664	7.7	432	10.0		
372	7.9	668	8.9	486	9.9		
393	9.0	699	9.3	536	10.0		
408	8.4	704	9.5	536	10.5		
508	8.1	711	12.8	545	10.3		
518	8.8	718	13.4	560	8.4		
558	8.5			657	6.7		

### 30 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

**Table 5.** Data from surveys at Hassayampa River near Arlington, Arizona, 1997–2000—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Endpoints for cross-section 8 unrecoverable in 2000]

Cross-section 10							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
November 2000		November 2000		November 2000		November 2000	
0	18.0	224	5.6	392	6.9	502	7.2
0	17.7	292	5.3	441	5.5	581	11.2
180	7.5	292	6.0	458	5.7	581	11.7
184	5.4	348	6.6	466	6.7		

Cross-section 11							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
November 2000		November 2000		November 2000		November 2000	
0	17.6	201	6.1	373	6.1	572	11.3
0	17.1	267	5.1	419	6.6	572	11.5
54	14.6	319	4.8	474	7.6		
124	10.6	372	4.9	521	8.3		

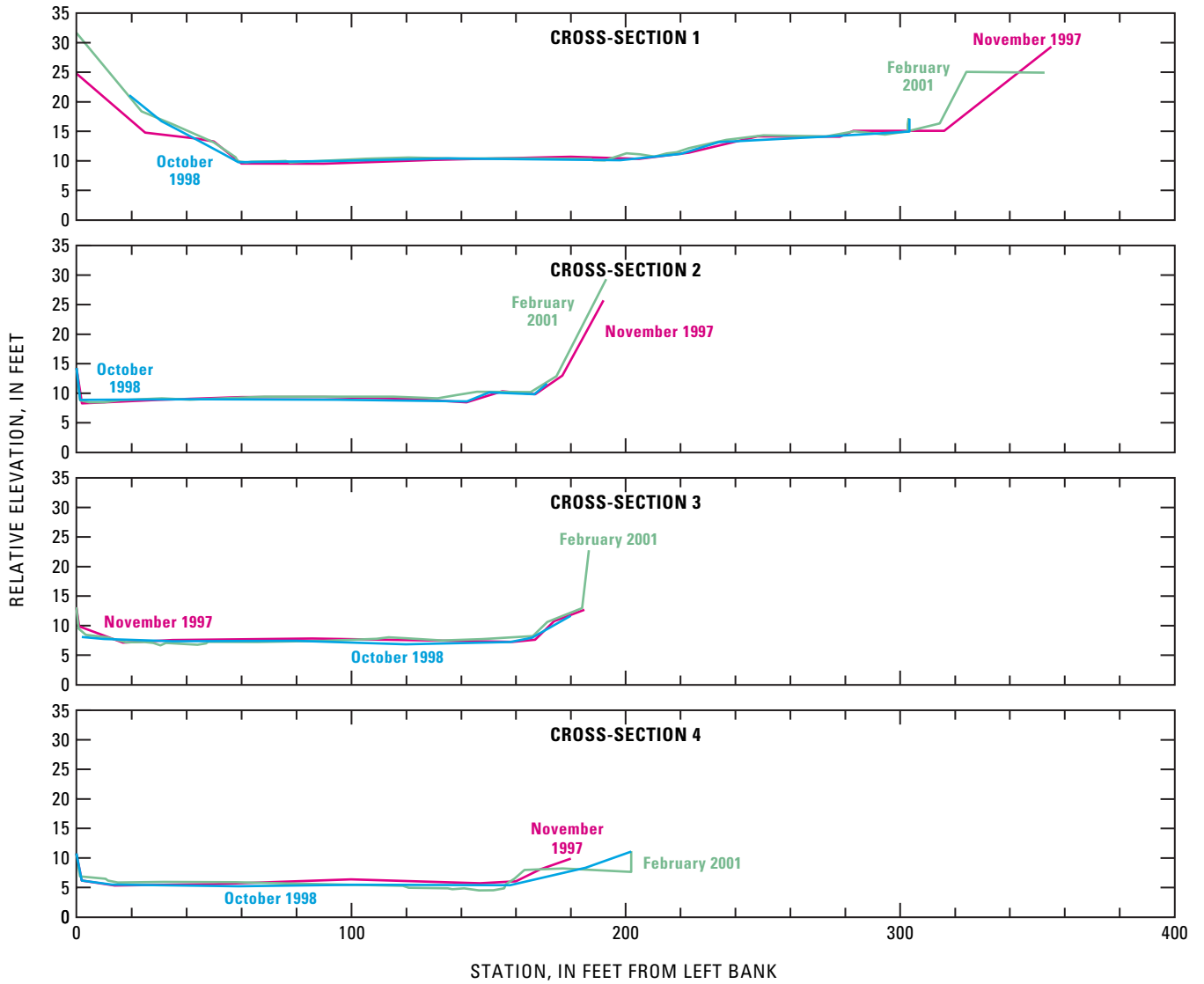


Figure 6. Channel-change cross sections from surveys at Hassayampa River near Morristown, Arizona, 1997–2001.

### 32 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

**Table 6.** Data from surveys at Hassayampa River near Morristown, Arizona, 1997–2001

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

<b>Cross-section 1</b>							
<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>
November 1997		October 1998		February 2001		February 2001	
0	24.8	19	18.9	50	13.1	205	11.1
25	14.8	31	14.6	58	10.7	211	10.8
44	13.8	43	11.7	59	10.0	215	11.3
50	13.3	54	8.9	62	9.8	219	11.5
60	9.6	59	7.6	64	9.9	223	12.2
90	9.6	95	7.8	73	10.0	237	13.6
130	10.2	135	8.2	76	10.0	250	14.3
180	10.7	198	7.9	78	9.8	273	14.2
205	10.4	220	9.0	88	10.0	283	15.0
223	11.4	234	11.0	106	10.4	294	14.5
248	14.2	273	11.9	121	10.6	303	15.0
278	14.1	303	15.0	139	10.4	303	17.1
283	15.1	303	17.2	157	10.5	314	16.4
316	15.1	February 2001		187	10.4	324	25.1
355	29.3	0	31.7	188	10.1	353	24.9
		24	18.4	192	10.1		
		35	16.2	200	11.3		
<b>Cross-section 2</b>							
<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>
November 1997		October 1998		February 2001		February 2001	
0	14.3	0	14.3	0	14.3	138	9.7
2	8.3	1	8.9	1	8.8	146	10.3
30	8.9	44	9.0	5	8.5	165	10.2
60	9.4	95	8.9	10	8.5	175	12.9
90	9.4	142	8.6	16	8.9	193	29.3
120	9.1	150	10.2	31	9.2		
142	8.5	167	9.9	41	8.9		
155	10.4	171	11.7	68	9.5		
167	9.9			94	9.5		
177	13.0			115	9.5		
192	25.8			132	9.2		

**Table 6.** Data from surveys at Hassayampa River near Morristown, Arizona, 1997–2001—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 3							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
November 1997		October 1998		February 2001		February 2001	
0	13.1	2	8.1	3	8.5	90	7.5
1	9.9	10	7.8	11	8.1	109	7.8
14	7.7	35	7.4	18	7.2	114	8.0
17	7.2	80	7.5	25	7.3	120	7.9
35	7.6	120	6.9	28	7.1	133	7.5
86	7.8	158	7.2	31	6.7	148	7.7
122	7.5	166	8.0	33	7.1	166	8.3
159	7.3	180	11.7	44	6.8	171	10.6
167	7.6	February 2001		47	7.0	184	13.0
174	10.8	0	13.1	48	7.3	187	22.8
185	12.7	1	9.5	66	7.2		
Cross-section 4							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
November 1997		October 1998		February 2001		February 2001	
0	10.8	0	10.8	0	10.8	137	4.7
2	6.2	2	6.2	1	6.9	141	4.9
14	5.4	13	5.5	11	6.5	147	4.6
50	5.6	59	5.3	11	6.2	152	4.6
100	6.4	102	5.5	15	5.9	156	4.9
147	5.8	158	5.4	32	6.0	157	5.6
160	6.1	186	8.4	58	5.9	160	6.5
169	8.1	202	11.1	84	5.7	163	8.0
180	9.9			119	5.3	177	8.3
				121	5.0	202	7.7
				135	4.9	202	11.2



34 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

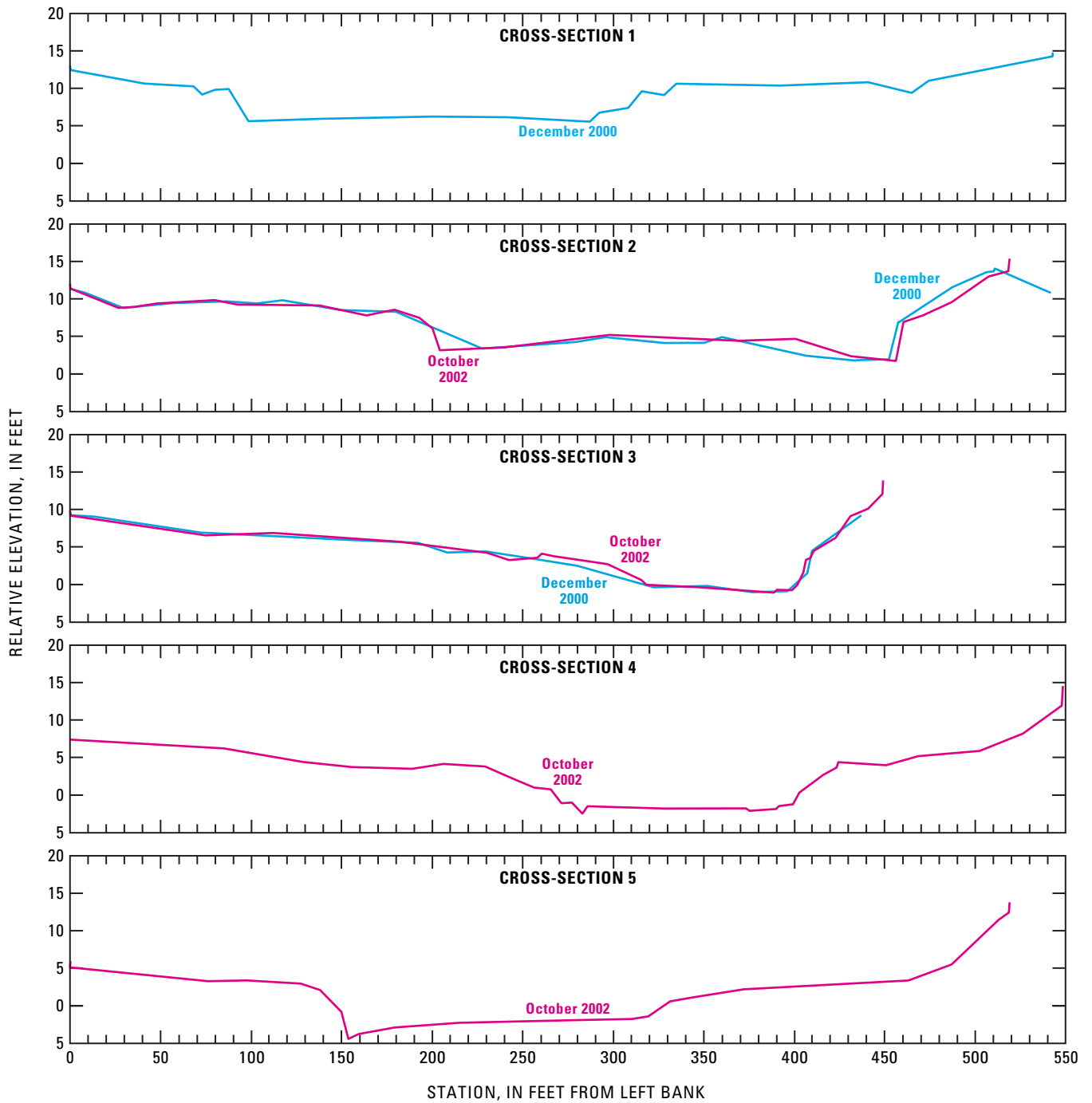


Figure 7. Channel-change cross sections from indirect-measurement surveys at Jackrabbit Wash near Tonopah, Arizona, 2000-2002.

**Table 7.** Data from indirect-measurement surveys at Jackrabbit Wash near Tonopah, Arizona, 2000–2002

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Cross-section 1 had no match in 2002, and cross-sections 4 and 5 had no match in 2000]

<b>Cross-section 1</b>							
<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>
December 2000		December 2000		December 2000		December 2000	
0	13.0	88	9.9	292	6.8	441	10.8
0	12.5	99	5.6	308	7.4	465	9.4
41	10.7	139	6.0	316	9.6	474	11.0
68	10.3	200	6.3	328	9.1	543	14.3
73	9.2	242	6.2	335	10.6	543	14.8
80	9.8	287	5.6	392	10.4		
<b>Cross-section 2</b>							
<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>
December 2000		December 2000		October 2002		October 2002	
0	11.5	350	4.2	0	12.0	298	5.2
0	11.3	360	4.9	0	11.4	369	4.4
8	10.9	377	4.0	27	8.8	401	4.7
29	8.8	407	2.4	35	8.9	432	2.4
57	9.5	434	1.8	48	9.4	456	1.8
87	9.7	435	1.9	80	9.9	460	6.9
103	9.4	452	2.0	92	9.3	471	7.8
117	9.8	458	6.9	138	9.1	487	9.6
150	8.5	458	6.9	164	7.8	507	13.0
180	8.3	487	11.6	179	8.6	518	13.7
228	3.4	506	13.6	193	7.5	519	15.4
279	4.3	510	13.7	200	6.1		
296	4.9	511	14.1	204	3.2		
328	4.1	542	10.8	240	3.6		

### 36 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

**Table 7.** Data from indirect-measurement surveys at Jackrabbit Wash near Tonopah, Arizona, 2000–2002—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Cross-section 1 had no match in 2002, and cross-sections 4 and 5 had no match in 2000]

Cross-section 3							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
December 2000		December 2000		October 2002		October 2002	
0	9.6	323	-0.4	182	5.7	399	-0.7
1	9.2	352	-0.2	230	4.2	402	-0.1
13	9.1	377	-1.0	243	3.3	405	1.6
38	8.2	396	-0.9	258	3.6	407	3.3
72	6.9	407	1.5	261	4.1	409	3.6
115	6.4	410	4.5	267	3.8	411	4.5
153	6.0	437	9.2	297	2.7	423	6.2
192	5.6	October 2002		316	0.6	431	9.1
208	4.3	0	9.8	318	0.0	441	10.1
230	4.4	0	9.2	346	-0.3	449	12.1
258	3.4	75	6.6	389	-1.1	449	13.9
280	2.5	112	6.9	391	-0.7		

Cross-section 4							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
October 2002		October 2002		October 2002		October 2002	
0	7.4	244	2.2	373	-1.8	424	4.4
85	6.2	256	1.0	375	-2.1	451	4.0
129	4.4	266	0.8	390	-1.8	468	5.2
156	3.7	271	-1.1	392	-1.5	502	5.9
189	3.5	277	-1.0	399	-1.2	526	8.2
206	4.2	283	-2.5	403	0.3	548	11.9
229	3.8	286	-1.5	416	2.7	548	14.5
		328	-1.8	423	3.7		

Cross-section 5							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
October 2002		October 2002		October 2002		October 2002	
0	6.0	150	-0.8	311	-1.7	487	5.5
0	5.1	154	-4.4	320	-1.4	513	11.5
76	3.3	159	-3.8	332	0.6	519	12.4
98	3.4	179	-2.9	344	1.1	519	13.8
127	3.0	215	-2.3	372	2.2		
138	2.1	280	-1.9	463	3.4		

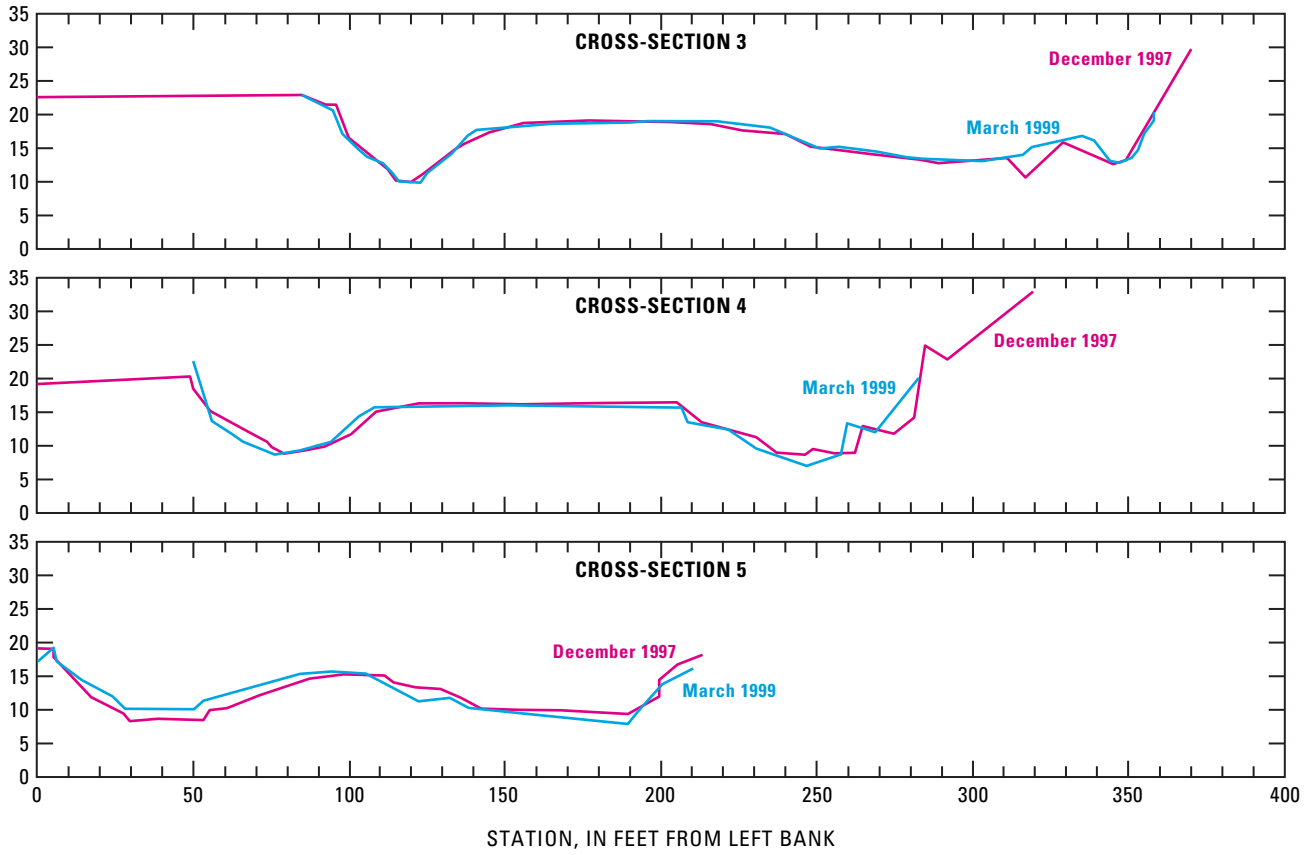


Figure 8. Channel-change cross sections from surveys at New River at New River, Arizona, 1997–99.

### 38 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

**Table 8.** Data from surveys at New River at New River, Arizona, 1997–99

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 3							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
December 1997		December 1997		March 1999		March 1999	
0	22.6	226	17.6	103	14.9	257	15.2
85	22.9	240	17.1	106	13.7	269	14.5
92.5	21.5	248	15.2	111	12.7	279	13.6
96	21.5	268	14.1	114	11.3	284	13.4
100	16.5	283	13.3	116	10.1	303	13.1
112.5	11.8	289	12.8	123	9.9	316	14.0
115	10.2	311	13.5	125	11.3	319	15.2
120	9.9	317	10.6	133	14.2	335	16.8
124	11.2	329	15.9	138	16.8	339	16.2
134	14.8	345	12.6	141	17.7	344	13.1
137	15.6	349	13.2	165	18.6	347	12.8
145	17.3	370	29.7	190	18.8	351	13.6
156	18.8	March 1999		196	19.0	353	14.7
177	19.1	85	22.9	218	19.0	355	17.2
203	18.9	95	20.6	235	18.1	358	19.1
216	18.6	98	17.1	251	15.0	358	20.4

Cross-section 4							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
December 1997		December 1997		December 1997		March 1999	
0	19.2	136	16.4	274	11.8	103	14.4
49	20.3	155	16.2	280.5	14.2	108	15.7
50	18.5	179	16.4	284	24.9	151	16.0
55.5	15.2	204.5	16.5	291	22.9	206	15.7
67.5	12.1	212.5	13.5	318.5	33.0	208	13.5
73.5	10.6	230	11.3	March 1999		221	12.4
75	9.8	236.5	9.0	50	22.6	230	9.6
79	8.8	245.5	8.7	56	13.7	246	7.0
86	9.4	248	9.5	62	11.9	257	8.7
92	9.9	255	8.9	66	10.6	259	13.4
100.5	11.7	261.5	9.0	76	8.7	268	12.0
108.5	15.1	264	13.0	84	9.3	282	20.1
122	16.3	269	12.4	94	10.6		

**Table 8.** Data from surveys at New River at New River, Arizona, 1997–99—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 5							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
December 1997		December 1997		March 1999		March 1999	
0	19.1	111	15.1	0	17.2	132	11.8
5	19.1	114	14.1	5	19.2	138	10.3
5	17.8	121	13.3	6	17.2	159	9.3
17	11.9	129	13.1	14	14.4	189	7.9
27.5	9.4	135.5	11.8	24	12.0	192	9.6
29.5	8.3	142	10.2	28	10.1	200	13.8
38.5	8.6	154	10.0	50	10.1	210	16.1
53	8.5	167.5	9.9	53	11.3		
55	9.9	189	9.3	65	12.9		
60.5	10.2	199	12.0	84	15.3		
71	12.1	199	14.4	94	15.7		
87	14.6	205	16.7	105	15.4		
98	15.3	213	18.2	122	11.2		

40 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

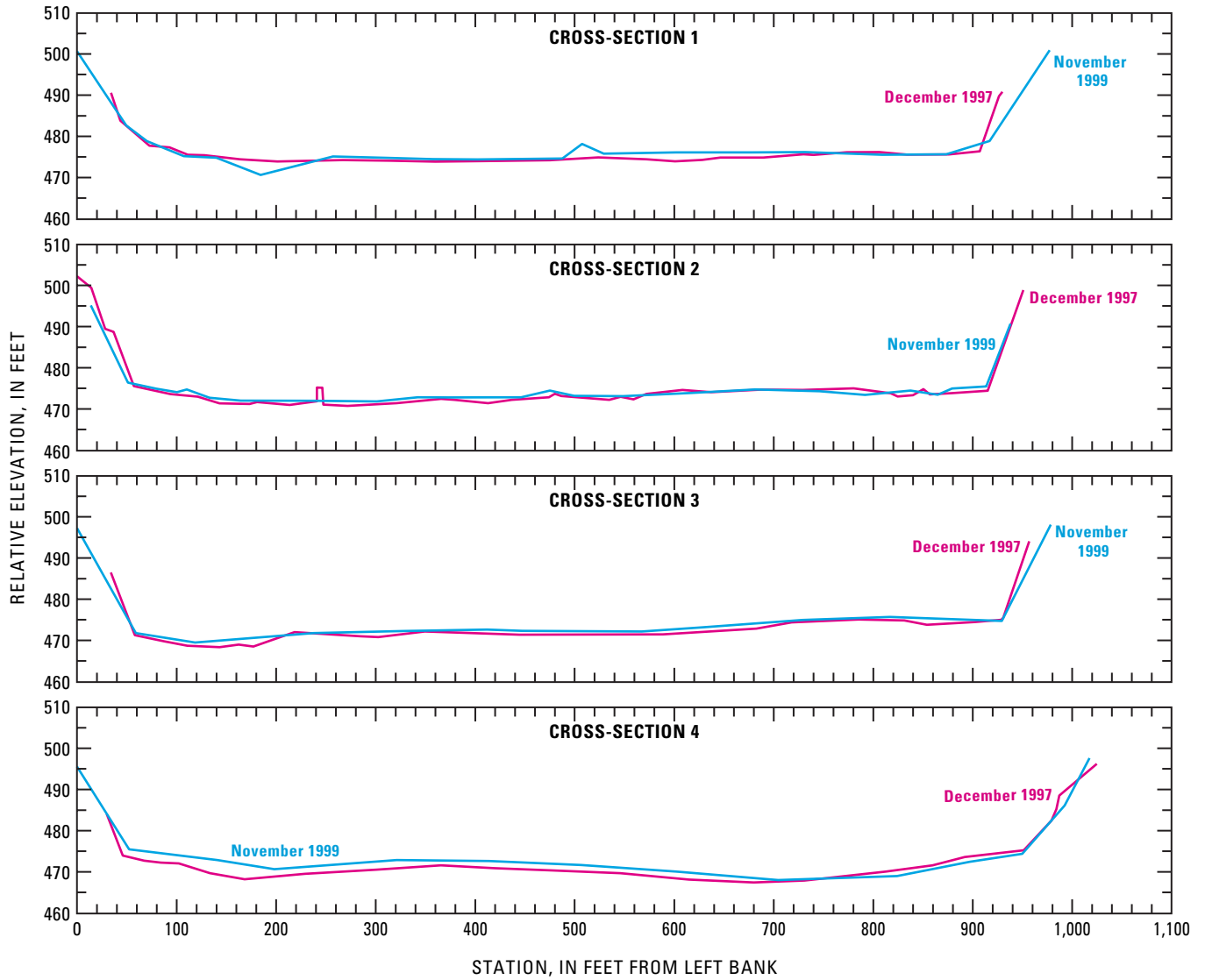


Figure 9. Channel-change cross sections from surveys at Salt River at Priest Drive, near Phoenix, Arizona, 1997–99.

**Table 9.** Data from surveys at Salt River at Priest Drive, near Phoenix, Arizona, 1997–99

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 1							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
December 1997		December 1997		December 1997		November 1999	
34	490.7	475	474.3	907	476.5	403	474.5
44	483.9	524	475.0	926	489.8	488	474.7
73	477.9	572	474.5	930	490.9	507	478.3
93	477.4	601	474.0	November 1999		529	475.9
111	475.6	628	474.4	0	500.7	602	476.2
128	475.5	647	475.0	50	482.7	678	476.2
164	474.5	689	474.9	70	478.9	731	476.3
201	474.0	730	475.8	107	475.3	809	475.6
267	474.4	740	475.6	140	474.9	874	475.8
315	474.2	774	476.2	184	470.8	917	479.0
360	474.0	806	476.3	257	475.2	977	501.0
414	474.1	834	475.7	313	474.9		
		876	475.7	358	474.6		
Cross-section 2							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
December 1997		December 1997		December 1997		November 1999	
0	502.3	321	471.5	818	473.9	301	471.9
14	499.5	366	472.6	825	473.2	343	473.0
28	489.6	379	472.3	840	473.5	374	472.9
37	488.8	413	471.5	850	474.9	446	472.9
57	475.7	437	472.3	857	473.6	475	474.6
94	473.7	474	473.0	880	474.0	500	473.3
121	473.1	480	473.8	915	474.6	527	473.3
143	471.5	487	473.3	951	498.9	549	473.2
173	471.3	535	472.4	November 1999		617	474.0
181	471.8	546	473.1	14	495.2	682	474.9
214	471.1	559	472.4	51	476.5	746	474.4
241	472.0	572	473.8	80	475.1	792	473.6
241	475.3	608	474.7	101	474.2	838	474.6
244	475.3	637	474.2	110	474.8	865	473.6
247	475.3	687	474.8	133	472.8	879	475.1
248	471.2	729	474.7	165	472.2	914	475.6
272	470.9	780	475.1	238	472.1	938	490.8



## 42 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

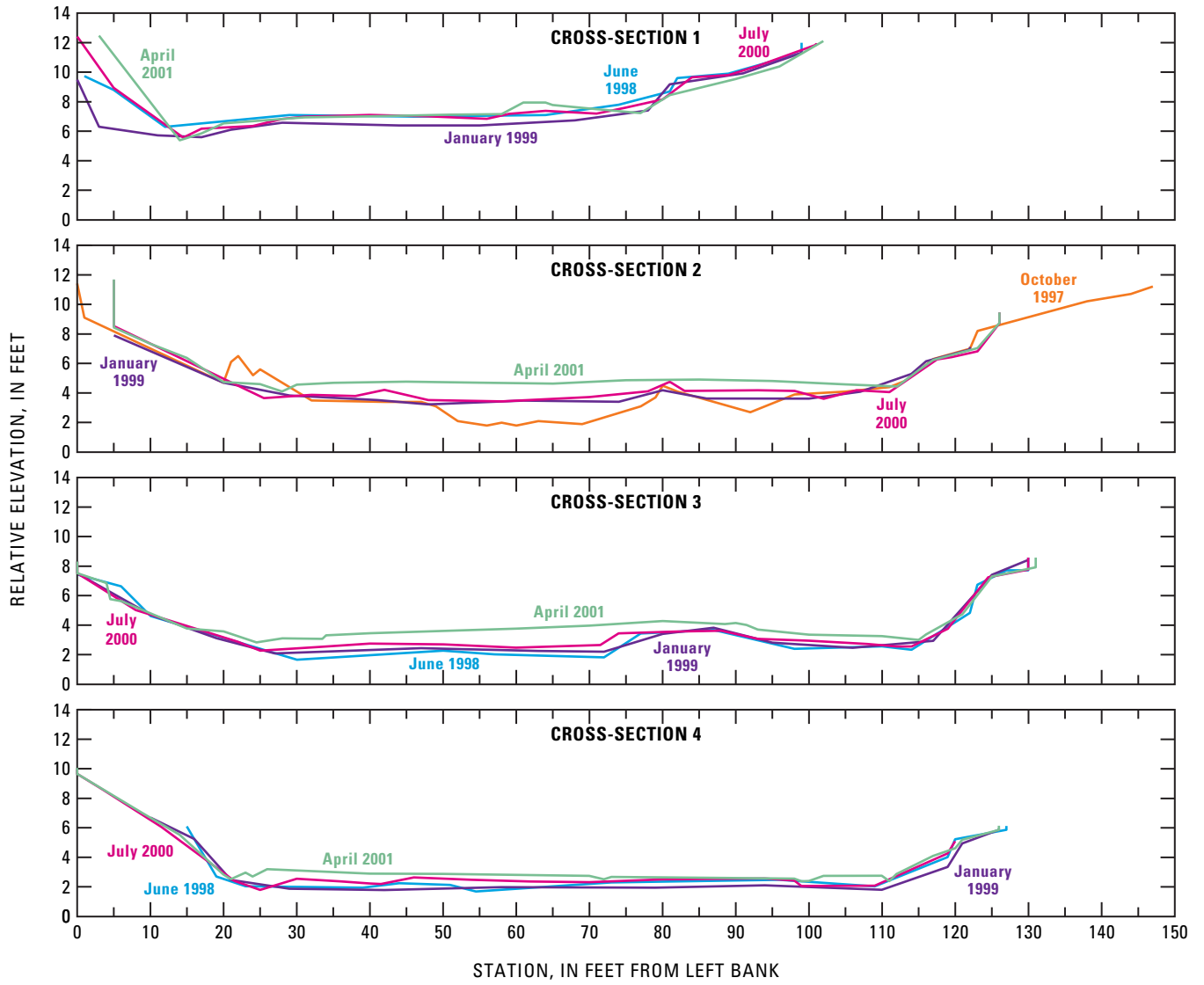
**Table 9.** Data from surveys at Salt River at Priest Drive near Phoenix, Arizona, 1997–99—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 3							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
December 1997		December 1997		December 1997		November 1999	
34	486.6	303	470.9	902	474.5	328	472.4
58	471.4	349	472.3	929	475.1	412	472.7
87	469.9	444	471.5	931	475.6	447	472.4
111	468.8	589	471.6	957	494.1	568	472.3
143	468.5	683	473.0	November 1999		629	473.3
162	469.1	718	474.5	0	497.3	729	475.0
177	468.6	786	475.2	59	471.9	817	475.8
218	472.1	831	474.9	119	469.6	929	474.8
285	471.1	854	473.9	238	471.9	978	498.1

Cross-section 4							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
December 1997		December 1997		December 1997		November 1999	
30	484.0	420	471.0	979	482.5	414	472.7
46	474.0	478	470.4	984	485.2	507	471.7
68	472.8	546	469.8	987	488.5	602	470.1
84	472.3	615	468.2	1,025	496.2	704	468.1
102	472.1	680	467.5	November 1999		824	469.1
134	469.8	731	468.0	0	495.5	897	472.5
169	468.3	813	470.1	52	475.5	950	474.4
229	469.6	860	471.6	141	472.9	992	486.1
301	470.6	892	473.6	198	470.7	1,017	497.6
366	471.7	951	475.3	321	472.9		



**Figure 10.** Channel-change cross sections from surveys at Tiger Wash near Aguila, Arizona, 1997–2001.

#### 44 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

**Table 10.** Data from surveys at Tiger Wash near Aguila, Arizona, 1997–2001

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 1							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
June 1998		January 1999		July 2000		April 2001	
1	9.7	28	6.6	48	7.0	42	7.0
5	8.8	44	6.4	56	6.9	51	7.1
12	6.3	55	6.4	59	7.2	58	7.2
29	7.1	68	6.7	64	7.4	61	8.0
46	7.0	78	7.4	71	7.2	64	8.0
64	7.1	81	9.2	75	7.6	65	7.8
74	7.8	91	9.9	80	8.2	71	7.5
81	8.7	99	11.3	84	9.7	77	7.2
82	9.6	99	11.4	89	9.8	81	8.5
89	9.9	July 2000		93	10.4	90	9.5
99	11.3	0	12.4	101	11.9	96	10.4
99	12.0	5	8.9	101	12.0	102	12.1
January 1999		15	5.6	April 2001			
0	9.5	17	6.2	3	12.5		
3	6.3	24	6.4	14	5.4		
11	5.7	28	6.8	17	5.9		
17	5.6	31	7.0	20	6.5		
21	6.1	40	7.1	31	6.9		

Cross-section 2							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
June 1998		June 1998		July 2000		April 2001	
0	11.4	111	4.4	5	11.7	5	11.7
1	9.1	113	4.8	5	8.5	5	8.4
20	4.7	115	5.5	26	3.7	10	7.3
21	6.1	117	6.3	32	3.9	15	6.4
22	6.5	122	7.0	38	3.8	20	4.7
24	5.2	123	8.2	42	4.2	25	4.6
25	5.6	138	10.2	48	3.5	27	4.3
32	3.5	144	10.7	58	3.4	28	4.1
42	3.4	147	11.2	70	3.7	30	4.6
47	3.4	January 1999		78	4.1	35	4.7
49	3.1	5	7.9	81	4.8	45	4.8
52	2.1	20	4.7	83	4.1	55	4.7
56	1.8	29	3.8	93	4.2	65	4.6
58	2.0	41	3.5	98	4.1	75	4.9
60	1.8	48	3.2	102	3.6	85	4.9
63	2.1	61	3.5	107	4.2	95	4.8
69	1.9	74	3.4	111	4.1	105	4.6
77	3.1	80	4.2	118	6.3	112	4.4
79	3.7	86	3.6	120	6.4	115	5.6
80	4.5	100	3.6	123	6.8	117	6.2
82	4.1	107	4.1	126	8.7	123	7.0
92	2.7	114	5.3	126	9.5	126	8.7
98	3.9	116	6.2			126	9.5
105	4.1	122	6.9				
		122	7.1				

**Table 10.** Data from surveys at Tiger Wash near Aguila, Arizona, 1997–2001—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 3							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
June 1998		January 1999		July 2000		April 2001	
0	7.4	27	2.1	72	2.7	25	2.8
6	6.6	47	2.5	74	3.5	28	3.1
10	4.6	63	2.3	82	3.6	34	3.1
30	1.7	72	2.2	88	3.6	34	3.3
50	2.3	80	3.4	93	3.1	40	3.5
57	2.0	87	3.8	100	3.0	60	3.8
72	1.8	95	2.8	108	2.7	70	4.0
77	3.4	106	2.5	112	2.6	80	4.3
87	3.7	117	2.9	114	2.6	89	4.1
98	2.4	125	7.4	119	3.8	90	4.1
110	2.6	130	8.4	125	7.2	92	4.0
114	2.3	July 2000		130	7.8	93	3.7
122	4.8	0	8.3	130	8.6	100	3.4
123	6.7	0	7.5	April 2001		110	3.3
127	7.7	8	5.0	0	8.3	115	3.0
130	7.7	22	2.9	0	7.5	116	3.4
130	8.6	25	2.3	4	6.9	121	4.7
January 1999		33	2.5	5	5.8	125	7.3
0	7.5	40	2.8	6	5.6	131	7.9
10	4.7	50	2.7	15	3.8	131	8.6
19	3.1	60	2.5	20	3.6		

Cross-section 4							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
June 1998		January 1999		July 2000		April 2001	
15	6.1	42	1.8	42	2.2	24	2.7
19	2.7	58	2.0	46	2.6	26	3.2
23	2.1	79	2.0	54	2.5	40	2.9
39	2.0	94	2.1	62	2.4	50	2.9
44	2.3	110	1.8	70	2.3	70	2.8
51	2.1	119	3.4	80	2.5	72	2.5
55	1.7	121	5.0	94	2.6	73	2.7
73	2.3	126	5.9	98	2.4	89	2.6
96	2.5	126	6.0	99	2.1	98	2.6
109	2.0	July 2000		109	2.1	99	2.4
119	4.0	0	10.0	119	4.3	100	2.4
120	5.2	0	9.7	120	5.1	102	2.8
127	5.9	4	8.6	April 2001		110	2.8
127	6.1	12	6.1	0	10.1	111	2.4
January 1999		22	2.4	0	9.7	112	2.9
10	6.7	25	1.8	9	7.0	117	4.1
16	5.3	30	2.6	14	5.5	120	4.6
21	2.5	36	2.4	20	2.8	121	5.2
29	1.9	40	2.2	21	2.5	126	5.9
				23	3.0	126	6.2

46 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

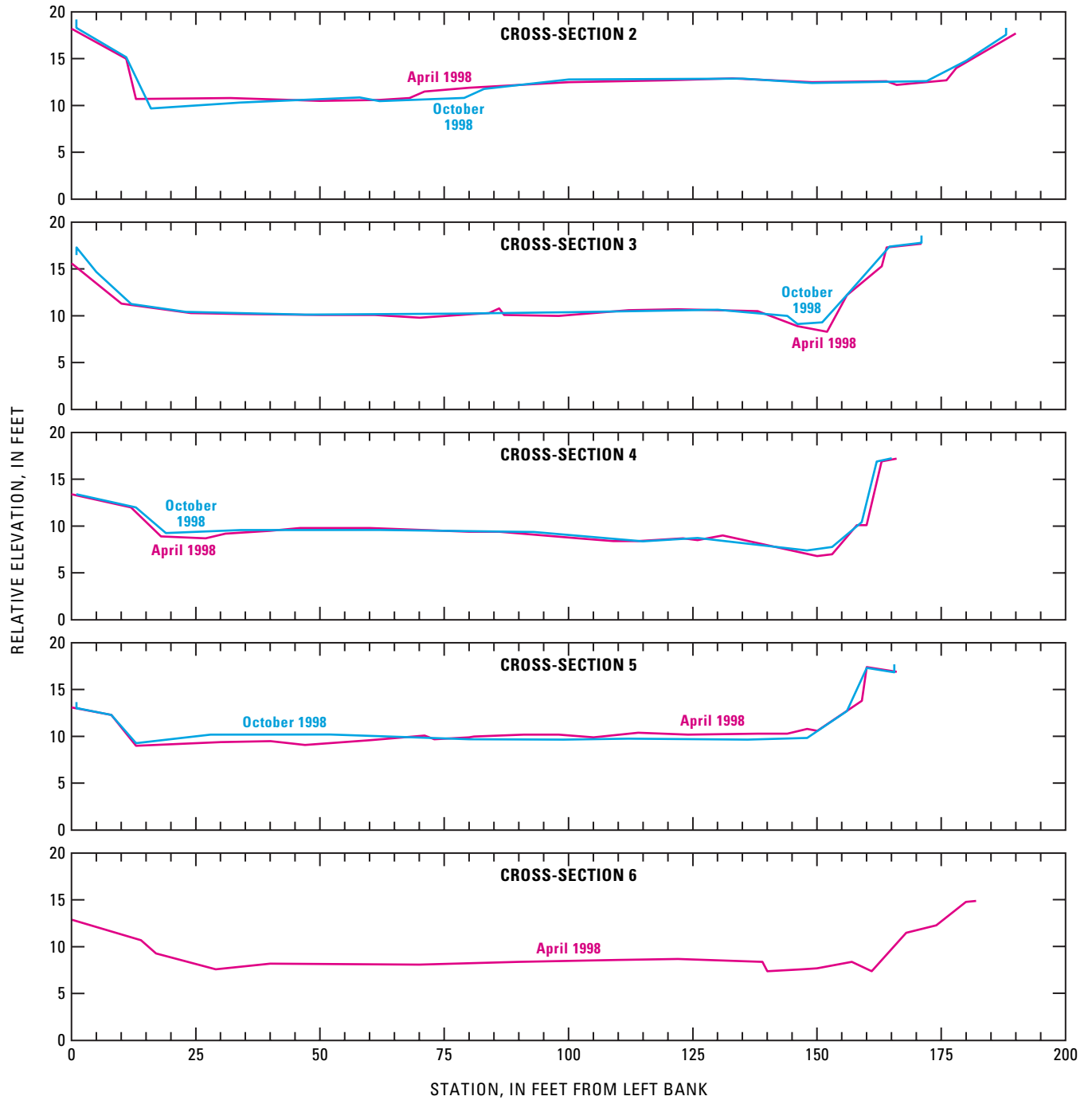


Figure 11. Channel-change cross sections from surveys at Vekol Wash near Stanfield, Arizona, 1998.

**Table 11.** Data from surveys at Vekol Wash near Stanfield, Arizona, 1998

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Endpoints for cross-section 6 unrecoverable in October 1998]

Cross-section 2							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
April 1998		April 1998		October 1998		October 1998	
0	18.2	100	12.5	1	19.2	100	12.8
11	15.0	120	12.7	1	18.3	135	12.9
13	10.7	133	12.9	11	15.2	149	12.4
32	10.8	149	12.5	16	9.7	172	12.6
50	10.5	164	12.6	34	10.3	180	14.8
62	10.6	166	12.2	58	10.9	188	17.6
68	10.8	176	12.7	62	10.5	188	18.3
71	11.5	178	14.0	79	10.8		
80	11.9	190	17.7	83	11.8		

Cross-section 3							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
April 1998		April 1998		October 1998		October 1998	
0	15.6	87	10.1	1	16.5	151	9.3
10	11.3	98	10.0	1	17.3	156	12.2
24	10.3	112	10.6	5	14.7	165	17.4
34	10.2	122	10.7	12	11.3	171	17.8
50	10.1	138	10.5	23	10.4	171	18.6
61	10.1	146	8.9	47	10.1		
70	9.8	152	8.3	77	10.2		
81	10.2	156	12.2	100	10.4		
84	10.3	163	15.3	130	10.7		
86	10.8	164	17.3	144	10.0		
		171	17.7	146	9.1		

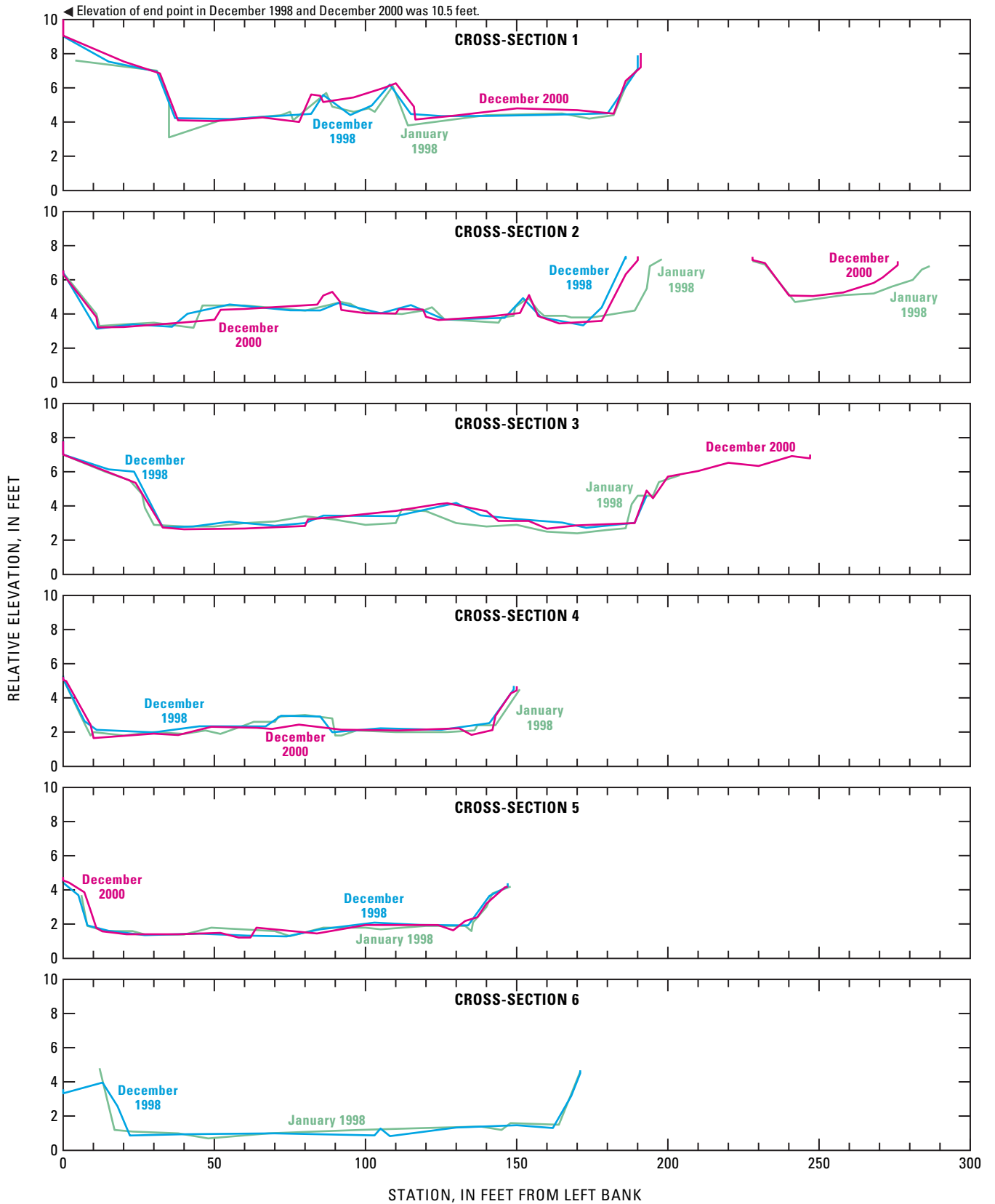
Cross-section 4							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
April 1998		April 1998		April 1998		October 1998	
0	13.4	86	9.4	158	10.1	62	9.6
12	12.0	102	8.7	160	10.1	93	9.4
18	8.9	109	8.4	163	16.9	115	8.4
27	8.7	114	8.4	166	17.2	126	8.7
31	9.2	123	8.7			148	7.4
40	9.5	126	8.5	October 1998		153	7.8
46	9.8	131	9.0	1	13.4	159	10.4
60	9.8	150	6.8	13	12.0	162	16.9
80	9.4	153	7.0	19	9.3	165	17.2
				34	9.6		

**48 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002**

**Table 11.** Data from surveys at Vekol Wash near Stanfield, Arizona, 1998—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank. Endpoints for cross-section 6 unrecoverable in October 1998]

<b>Cross-section 5</b>							
<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>
April 1998		April 1998		April 1998		October 1998	
0	13.1	80	9.9	150	10.6	52	10.2
8	12.3	81	10.0	159	13.8	80	9.7
13	9.0	91	10.2	160	17.4	99	9.7
30	9.4	98	10.2	166	16.9	112	9.8
40	9.5	105	9.9	October 1998		136	9.7
47	9.1	114	10.4	1	13.7	148	9.8
60	9.6	124	10.2	1	13.0	156	12.7
71	10.1	138	10.3	8	12.3	160	17.3
73	9.7	144	10.3	13	9.3	166	16.9
		148	10.8	28	10.2	166	17.7
<b>Cross-section 6</b>							
<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>
April 1998		April 1998		April 1998		April 1998	
0	12.7	40	8.2	139	8.4	161	7.4
14	10.7	70	8.1	140	7.4	168	11.5
17	9.3	90	8.4	147	7.6	174	12.3
29	7.6	110	8.6	150	7.7	180	14.8
		122	8.7	157	8.4	182	14.9



**Figure 12.** Channel-change cross sections from surveys at Waterman Wash near Buckeye, Arizona, 1997–2000.



## 50 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002

**Table 12.** Data from surveys at Waterman Wash near Buckeye, Arizona, 1997–2000

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 1							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
January 1998		January 1998		December 1998		December 2000	
4	7.6	165	4.5	115	4.5	85	5.5
31	7.0	174	4.2	125	4.4	86	5.2
35	5.4	182	4.4	140	4.4	96	5.4
35	3.1	187	6.5	160	4.4	106	6.0
52	4.1	190	7.1	180	4.5	110	6.3
72	4.4	December 1998		190	7.1	116	4.9
75	4.6	0	10.5	190	7.9	117	4.2
76	4.1	0	9.0	December 2000		130	4.4
87	5.7	15	7.5	0	10.5	150	4.8
89	4.9	31	7.0	0	9.1	170	4.7
96	4.6	37	4.2	20	7.5	182	4.5
101	4.8	55	4.2	32	6.8	186	6.4
103	4.6	82	4.5	38	4.1	191	7.2
109	6.1	86	5.6	50	4.1	191	8.0
114	3.8	95	4.4	66	4.3		
140	4.4	102	5.0	78	4.0		
		108	6.2	82	5.6		
Cross-section 2							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
January 1998		January 1998		December 1998		December 2000	
0	6.4	154	4.9	105	4.1	84	4.6
11	4.0	157	4.2	115	4.5	86	5.1
12	3.3	159	3.9	126	3.7	89	5.3
20	3.4	166	3.9	146	3.8	92	4.7
30	3.5	168	3.8	152	4.9	92	4.2
43	3.2	175	3.8	158	3.8	100	4.1
46	4.5	189	4.2	172	3.3	110	4.0
60	4.5	193	5.5	178	4.4	111	4.3
80	4.2	194	6.8	186	7.2	119	4.3
92	4.7	198	7.2	186	7.4	120	3.8
95	4.6	December 1998		December 2000		124	3.7
100	4.1	0	6.6	0	6.6	140	3.8
112	4.0	0	6.4	0	6.3	151	4.1
119	4.2	11	3.1	11	3.8	154	5.1
122	4.4	23	3.4	12	3.2	157	3.9
126	3.7	36	3.3	20	3.2	164	3.5
144	3.5	41	4.0	30	3.4	178	3.6
145	3.8	55	4.6	40	3.5	186	6.3
149	3.9	75	4.2	50	3.7	190	7.1
150	4.4	85	4.2	52	4.3	190	7.4
153	4.8	91	4.6	60	4.3		

**Table 12.** Data from surveys at Waterman Wash near Buckeye, Arizona, 1997–2000—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

Cross-section 2A							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
January 1998		January 1998		December 2000		December 2000	
228	7.1	268	5.2	228	7.3	258	5.3
232	6.9	274	5.6	228	7.2	268	5.8
242	4.7	281	6.0	232	7.0	271	6.1
258	5.1	284	6.6	240	5.1	276	6.9
		287	6.8	248	5.1	276	7.1
Cross-section 3							
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
January 1998		January 1998		December 1998		December 2000	
0	7.0	150	2.9	80	3.0	90	3.4
14	6.0	160	2.5	86	3.4	110	3.7
22	5.5	170	2.4	110	3.4	124	4.1
26	4.7	180	2.6	130	4.2	127	4.2
27	3.9	186	2.7	138	3.5	140	3.7
30	2.9	188	4.1	150	3.2	144	3.1
40	2.8	190	4.6	165	3.0	154	3.1
50	2.8	195	4.6	173	2.7	160	2.7
60	3.0	197	5.4	189	3.0	170	2.9
70	3.1	204	5.8	193	4.6	189	3.0
80	3.4	December 1998		December 2000		193	4.9
90	3.2	0	7.8	0	7.8	195	4.5
100	2.9	0	7.0	0	7.0	200	5.7
110	3.0	15	6.1	24	5.4	210	6.0
112	3.8	24	6.0	33	2.7	220	6.5
120	3.7	33	2.8	40	2.6	230	6.3
130	3.0	43	2.8	60	2.7	241	6.9
140	2.8	55	3.1	80	2.8	247	6.8
		70	2.8	81	3.2	247	7.0

**52 Data from Channel-Change Monitoring at Selected Sites in Maricopa County, Arizona, 1997–2002**

**Table 12.** Data from surveys at Waterman Wash near Buckeye, Arizona, 1997–2000—*Continued*

[Values in feet above local datum (see explanation in text). Station locations are distances from left bank]

<b>Cross-section 4</b>							
<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>
January 1998		January 1998		December 1998		December 2000	
0	5.1	90	1.8	67	2.3	38	1.8
6	2.9	92	1.8	72	3.0	49	2.3
9	1.8	97	2.1	85	2.9	64	2.3
10	2.0	110	2.0	89	2.0	69	2.2
20	1.8	127	2.0	105	2.2	78	2.4
30	2.0	136	2.1	125	2.1	92	2.1
40	1.9	137	2.4	141	2.5	111	2.1
47	2.1	143	2.4	149	4.5	131	2.2
52	1.9	151	4.5	149	4.7	135	1.8
60	2.4	December 1998		December 2000		142	2.1
63	2.6	0	5.3	0	5.2	143	2.9
70	2.6	0	5.1	0	5.0	148	4.3
71	2.9	7	2.6	1	5.0	150	4.4
80	3.0	11	2.1	9	2.4	150	4.7
89	2.8	30	2.0	10	1.7		
		45	2.3	30	1.9		

<b>Cross-section 5</b>							
<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>
January 1998		January 1998		December 1998		December 2000	
6	3.7	135	1.6	85	1.7	21	1.4
8	1.9	136	2.1	103	2.1	38	1.4
14	1.6	140	3.0	118	2.0	52	1.5
23	1.6	142	3.8	134	1.9	58	1.2
27	1.4	148	4.2	141	3.7	62	1.2
40	1.4	December 1998		147	4.2	64	1.8
49	1.8	0	4.6	147	4.4	84	1.5
70	1.6	0	4.4	December 2000		100	2.0
75	1.3	5	3.7	0	4.8	124	2.0
86	1.8	8	1.9	0	4.6	129	1.6
100	1.8	15	1.6	2	4.4	133	2.2
105	1.7	27	1.4	7	3.9	137	2.4
120	1.9	45	1.5	9	2.9	140	3.2
130	1.9	61	1.3	11	1.8	146	4.2
133	1.9	74	1.3	13	1.6	147	4.2

<b>Cross-section 6</b>							
<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>	<b>Station</b>	<b>Elevation</b>
January 1998		January 1998		December 2000		December 2000	
12	4.8	118	1.3	0	3.3	108	0.8
17	1.2	138	1.4	13	4.0	130	1.3
23	1.1	145	1.2	18	2.6	150	1.5
38	1.0	148	1.6	22	0.9	162	1.3
48	0.7	164	1.5	40	1.0	168	3.2
68	1.0	171	4.6	70	1.0	171	4.5
83	1.1	December 2000		103	0.9	171	4.7
98	1.2	0	3.6	105	1.3		

Manuscript approved for publication, May 19, 2004

Prepared by U.S. Geological Survey Publishing staff

Arizona District, Tucson, Arizona:

Sid Alwin

Steve Longworth

Washington Water Science Center, Tacoma, Washington:

Linda Rogers

For more information concerning the research in this report, contact the

District Chief, Water Resources Discipline

U.S. Geological Survey, 520 N. Park Avenue, Suite 221

Tucson, Arizona 85719-5035

<http://az.water.usgs.gov>



1879-2004