LA-14019-PR
Progress Report
Approved for public release;
distribution is unlimited.

Surface Water Data at Los Alamos National Laboratory 2002 Water Year

Los Alamos
NATIONAL LABORATORY

The four most recent reports in this unclassified series are
LA-13551-PR, LA-13706-PR, LA-13814-PR, and LA-13905-PR.

Edited by Faith Harp, Group IM-1
Photocomposition by Jeanne Bowles, Group IM-1

LA-14019-PR
Progress Report
Issued: March 2003

Surface Water Data at Los Alamos National Laboratory 2002 Water Year

D. A. Shaull
D. Ortiz
M. R. Alexander
R. P. Romero

Los Alamos
NATIONAL LABORATORY

Contents

Station Synonyms

E No.	Water Quality Database Name	Published Name
E026	Los Alamos below Ice Rink	Los Alamos Canyon below Ice Rink
E030	Los Alamos above DP Canyon	Los Alamos Canyon below Technical (TA) 2 near Los Alamos, NM
E038	DP above TA-21	DP Canyon above TA-21
E039	DP below Meadow at TA-21	DP Canyon below Meadow at TA-21
E040	DP above Los Alamos Canyon	DP Canyon at Mouth
E042	Los Alamos above SR-4	Los Alamos Canyon near Los Alamos, NM
E060	Pueblo above SR-502	Pueblo Canyon near Los Alamos, NM
E089	Guaje above Rendija	Guaje Canyon above Confluence with Rendija Canyon
E090	Rendija above Guaje	Rendija Canyon above Confluence with Guaje Canyon
E123	Sandia below Wetlands	Sandia Canyon below Sandia Wetlands
E125	Sandia above SR-4	Sandia Canyon above Highway 4 near White Rock, NM
E200	Mortandad below Effluent Canyon	Mortandad Canyon at TA-50 near Los Alamos, NM
E202	Mortandad above Sediment Traps	Mortandad Canyon at Entrance to Sediment Traps
E203	Mortandad below Sediment Traps	Mortandad Canyon below Sediment Traps
E204	Mortandad at LANL Boundary	Mortandad Canyon at Laboratory Boundary
E218	Canada del Buey near TA-46	Cañada del Buey near TA-46
E225	Canada del Buey near MDA G	Cañada del Buey above White Rock, NM
E230	Canada del Buey above SR-4	Cañada del Buey at White Rock, NM
E240	Pajarito below SR-501	Pajarito Canyon below Highway 501 near Los Alamos, NM
E241	Pajarito above Starmers	Pajarito Canyon at TA-22
E242	Starmers above Pajarito	Starmer's Gulch at TA-22
E2425	La Delfe above Pajarito	La Delfe above Pajarito
E245	Pajarito above TA-18	Pajarito Canyon above TA-18 near Los Alamos, NM
E2455	Pajarito above Threemile	Pajarito Canyon above Threemile
E246	Threemile above Pajarito	Threemile above Pajarito
E250	Pajarito above SR-4	Pajarito Canyon above Highway 4 near White Rock, NM
E252	Water above SR-501	Water Canyon above Highway 501 near Los Alamos, NM
E253	Canon de Valle above SR-501	Cañon de Valle above Highway 501 near Los Alamos, NM
E262	Canon de Valle above Water	Cañon de Valle above Confluence with Water Canyon
E2625	Water below MDA AB	Water Canyon below Area AB, TA-49
E263	Water at SR-4	Water Canyon at Highway 4 near White Rock, NM
E265	Water below SR-4	Water Canyon below Highway 4 near White Rock, NM
E267	Potrillo above SR-4	Potrillo Canyon near White Rock, NM
E275	Ancho below SR-4	Ancho Canyon near Bandelier National Monument, NM
E350	Rio de los Frijoles at Bandelier	Rio de los Frijoles at Bandelier

Glossary

Acre-foot (Ac-Ft, acre-ft) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 cubic feet, 325,851 gallons, or 1233.49 cubic meters.

Cfs-day is the volume of water represented by the flow of 1 cubic foot per second for 24 hours. It is equivalent to 86,400 cubic feet, 1.98347 acre-feet, 646,317 gallons, or 2,445 cubic meters.

Control designates a feature downstream from the gage that determines the stage-discharge relation at the gage. This feature may be a natural constriction of the channel, an artificial structure, or a uniform cross section over a long reach of the channel.

Control structure as used in this report is a structure on a stream or canal that is used to regulate the flow or stage of the stream or to prevent the intrusion of salt water.

Cubic feet per second per square mile [$(ft^3/s)/mi^2$] is the average number of cubic feet of water flowing per second from each square mile of area drained, assuming that the runoff is distributed uniformly in time and area.

Cubic foot per second (ft^3/s) is the rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second and is equivalent to 7.48 gallons per second, 448.8 gallons per minute, or 0.02832 cubic meters per second.

Discharge is the volume of water (or more broadly, volume of fluid including suspended sediment) that passes a given point within a given period of time.

Drainage area (DA) of a stream at a specified location is that area, measured in a horizontal plane, enclosed by a topographic divide, from which direct surface runoff from precipitation normally drains by gravity into the stream above the specified point. Figures of drainage area given herein include all closed basins, or noncontributing areas, within the area unless otherwise noted.

Drainage basin is a part of the surface of the earth that is occupied by a drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

Gage height (GH) is the water-surface elevation referred to in some arbitrary gage data. Gage height is often used interchangeably with the more general term "stage," although gage height is more appropriate when used with a reading on a gage.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

GPS is an abbreviation for Global Positioning System.

Glossary (continued)

HWM is an abbreviation for high-water mark.

Instantaneous discharge is the discharge at a particular instant of time.

LANL is the acronym for Los Alamos National Laboratory.

Mean discharge (MEAN) is the arithmetic mean of individual daily mean discharges during a specific period.

National Geodetic Vertical Datum of 1929 (*NGVD*) is a geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada. It was formerly called *Sea Level Datum of 1929* or "mean sea level" in this series of reports. Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific coasts, it does not necessarily represent the local mean sea level at any particular place.

NPDES is the abbreviation for National Pollution Discharge Elimination System.

Stage. See **Gage Height**.

~~**Stage-discharge relation** is the relation between the water-surface elevation~~, termed "gage height," and the volume of water flowing in a channel per unit of time.

Stream flow is the discharge that occurs in a natural channel.

SWSC is an abbreviation for sanitary wastewater systems consolidation.

USGS is the abbreviation for United States Geological Survey.

Water year in reports dealing with surface water supply is the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 1980, is called the "1980 water year."

WDR is an abbreviation for "Water-Data Report" in the "Revised Records" paragraph to refer to annual hydrologic-data reports.

WSP is an abbreviation for "Water-Supply Paper" in references to previously published reports.

Surface Water Data at Los Alamos National Laboratory: 2002 Water Year

by
D. A. Shaull, D. Ortiz, M. R. Alexander, and R. P. Romero

ABSTRACT

The principal investigators collected and computed surface water discharge data from 34 stream-gaging stations that cover most of Los Alamos National Laboratory and one at Bandelier National Monument. Also included are discharge data from three springs—two that flow into Cañon de Valle and one that flows into Water Canyon—and peak flow data from 16 stations.

Introduction

This annual water data report from Los Alamos National Laboratory (LANL) contains flow data from 34 stream-gaging stations that cover most of the Laboratory's property. We focused data collection on the Laboratory's downstream boundary, approximated by New Mexico State Highway 4; the upstream boundary is approximated by New Mexico State Highway 501. Some of the gaging stations are within Laboratory boundaries and were originally installed to assist groups other than the Water Quality and Hydrology Group (RRES-WQH) that also conduct site-specific earth science research.

Water chemistry data from selected storm events occurring at some stations will be published in the 2002 "Los Alamos National Laboratory Environmental Surveillance Report."

Station Identification Numbers

The US Geological Survey (USGS), Water Resources Division, assigns a unique identification number to each stream-gaging station it establishes. All sites numbered since 1950 are part of the downstream order system. The downstream order system increases station numbers in the downstream direction along main streams, and, in the case of this report, their respective mouths to the Rio Grande.

This report adheres to the USGS convention of downstream order. Because of the close proximity of stations in this network, the first five digits of all station numbers are 08313. We have replaced this number string with the letter E in the station number partly to abbreviate and also to accommodate instrumentation.

Data Collection and Computation

A complete record-gaging station gathers records of stage and discharge measurements from streams or canals. In addition to gathering these stage and discharge measurements, we directly observe factors affecting the stage/discharge relation, consult weather records, and use other information that supplements base data in determining daily flow. Direct readings on a nonrecording gage or from the data logger provide integrated (5-minute) records of stage. We measure discharge with current meters, using methods adapted by the USGS as a result of experience accumulated since 1880. Standard textbooks describe these methods, as do *Water-Supply Paper 2175* and the *US Geological Survey Technique of Water Resources Investigations,* Book 3, Chapter A6.

We use stage/discharge relation curves to prepare rating tables that give the discharge for any stage measured at a stream-gaging station. When it is necessary to define discharge extremes outside the range of current meter measurements, we extend the curves using

- logarithmic plotting;
- velocity area studies;
- results of indirect measurements of peak discharge, such as slope area or contracted opening measurements and computations of flow over dams or weirs; or
- step backwater techniques.

Daily mean discharges are computed by applying daily mean gage height (stage) to the stage-discharge curves or tables. If the stage/discharge relation is subject to change because of frequent or continual change in the physical features that form the control, the daily mean discharge is computed by the shifting-control method. In the shifting-control method, correction factors based on individual discharge measurements and notes by personnel taking the measurements are applied to the gage heights before discharges are determined from the curves or tables.

The shifting-control method is also used if the stage/discharge relation for a station is temporarily changed by the presence of aquatic growth or debris on the control. At some northern stream-gaging stations, the stage/discharge relation is affected by ice in the winter, and it becomes impossible to compute discharge in the usual manner. Discharge for the period of ice effect is computed on the basis of gage height record and occasional winter discharge measurements. Consideration is given to the available information about temperature and precipitation, notes of observations, and comparable discharge records for other stations in the same or nearby basins for comparable periods of time.

For some gaging stations, periods occur when no gage height record is obtained, or the recorded gage height is so faulty that it cannot be used to compute daily discharge or contents. This happens when the recorder stops or otherwise fails to operate properly, intakes are plugged, the float is frozen in the well, etc. For such periods, the daily discharges are estimated on the basis of recorded range-in-stage, prior and subsequent records, discharge measurements, weather records, and record comparisons made against other stations in the same or nearby basins. Likewise, daily contents may be estimated from operator logs, prior and subsequent records, inflow-outflow studies, and other information.

Accuracy of Records

Two factors determine the accuracy of streamflow records:

- stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements; and
- accuracy of measurements or stage, accuracy of discharge measurements, and interpretations of records.

Accuracy attributed to records is noted under "Remarks."

- Excellent—95% of daily discharges are within 5% of true value;
- Good—95% of daily discharges are within 10% of true value;
- Fair—95% of daily discharges are within 15% of true value; and
- Poor—records do not meet the criteria mentioned.

Differences in accuracy may be attributed to different parts of a given record.

The number of significant figures used to report daily mean discharges is based solely on the magnitude of the discharge value:

If—the value (ft^3/s) is	**Then**—it is reported as
less than 1 ft^3/s	nearest hundredth
1–10 ft^3/s	nearest tenth
10–1,000 ft^3/s	whole number
above 1,000 ft^3/s	three significant figures

Data Presentation

The records published in this report are for each gaging station and comprise two parts:

- station manuscript description with photo and
- data table for the water year (October 1, 2001, to September 30, 2002).

The station manuscript provides data under various headings: station location, period of record, average discharge, historical extremes, record accuracy, and other points pertinent to station operation and regulation. Each continuous record of discharge includes the following categories of descriptions.

Location. The most accurate and available maps provide location information. The location of the gage with respect to the vicinity's cultural and physical features is given, as well as a name that refers to place. For a few stations, the US Army Corps of Engineers or the Water Resources Council (*River Mileage Measurement*, Bulletin 14, rev. October 1968) provided river mileage. We define left and right banks from the perspective of facing downstream.

Drainage Area. The most accurate and available maps provide drainage area measurements. The accuracy of drainage area measurements varies, depending on the type of map available for this purpose.

Revised Records. Because of new information, published records occasionally are found to be incorrect, and revisions are printed in later reports. Listed under this heading are all the reports in which revisions have been published for the station and the water years to which the revisions apply. If a revision did not include daily, monthly, or annual figures of discharge, that fact is noted after the year as follows: (M) means that only instantaneous maximum discharge was revised; (m) means that only the instantaneous minimum was revised; and (P) means that only the peak discharge was revised. If the drainage area has been revised, the report in which the most recently revised figure was first published is given.

Period of Record. The period of record is the time during which published records exist for a station or its equivalent station. An equivalent station is one that was in operation at a time that the present station was not and was located so that records from it can reasonably be considered equivalent to records from the present station.

Gage. This section describes the type of gage in current use. The datum of the current gage referred to in the *National Geodetic Vertical Datum of 1929* (see Glossary) and a condensed history of the types, locations, and data of previous gages are given under this heading.

Remarks. The text presents information relative to the accuracy of the records, special methods of computation, conditions that affect natural flow at the station, and other pertinent information.

Average Discharge. The average discharge is the average of the annual mean discharge published after five years of record. Once it is published, it continues as a moving average.

Extremes for Period of Record. Extremes may include maximum and minimum stages and maximum and minimum discharges or content. Unless otherwise qualified, the maximum discharge or content is the instantaneous maximum corresponding to the highest stage that occurred. The highest stage may have been obtained from a graphic or digital recorder, a crest stage gage, or by direct observation of a nonrecording gage. If the maximum stage did not occur on the same day as the maximum discharge or content, it is given separately. Similarly, the minimum is the instantaneous minimum discharge, unless otherwise qualified, and was determined and is reported in the same manner as the maximum.

Extremes Outside Period of Record. This section contains information concerning major floods or unusually low flows that occurred outside the stated period of record. The information may have been obtained from other agencies, old data files, newspapers, or local citizens.

Extremes for Current Year. Extremes given here are similar to those for the period of record. The time for occurrence of peaks is expressed in 24-hour local standard time. For example, 12:30 A.M. is 0030 and 1:30 P.M. is 1330. The minimum for the current water year appears in this section.

Data Table of Daily Mean Values. The daily table of discharge records for stream gaging stations gives the mean discharge for each day of the water year. In the monthly summary for the table, the line headed "Total" gives the sum of the daily figures for each month; the line headed "Mean" gives the average flow in cubic feet per second for the month; and the lines headed "Max" and "Min" give the maximum and minimum daily mean discharges for each month and in acre feet, respectively, in the line headed "Ac-Ft."

Acknowledgments

This work was funded through emergency funds provided to DOE and LANL to remediate damage and address demonstrated vulnerabilities associated with the Cerro Grande Fire. This work has been conducted by LANL using two initiatives: The Emergency Rehabilitation Team, to address emergency and urgent actions to recover from the fire, and the Cerro Grand Rehabilitation Project (CGRP), to address near- and long-term activities required for LANL to fully recover from the fire. This work was conducted as part of the erosion control task of the CGRP.

The authors thank the following individuals for their contribution to this report: K. Buckley, B. Cata, E. Gray, G. Helland, E. Riebsomer, and L. Martinez of RRES-WQH and Stephen Mee and Victoria George of FWO-CGRP. Thanks also go to Bruce Gallaher and Ken Mullen for peer review.

References

Water-Supply Paper 2175 and the *US Geological Survey Technique of Water Resources Investigations*, Book 3, Chapter A6.

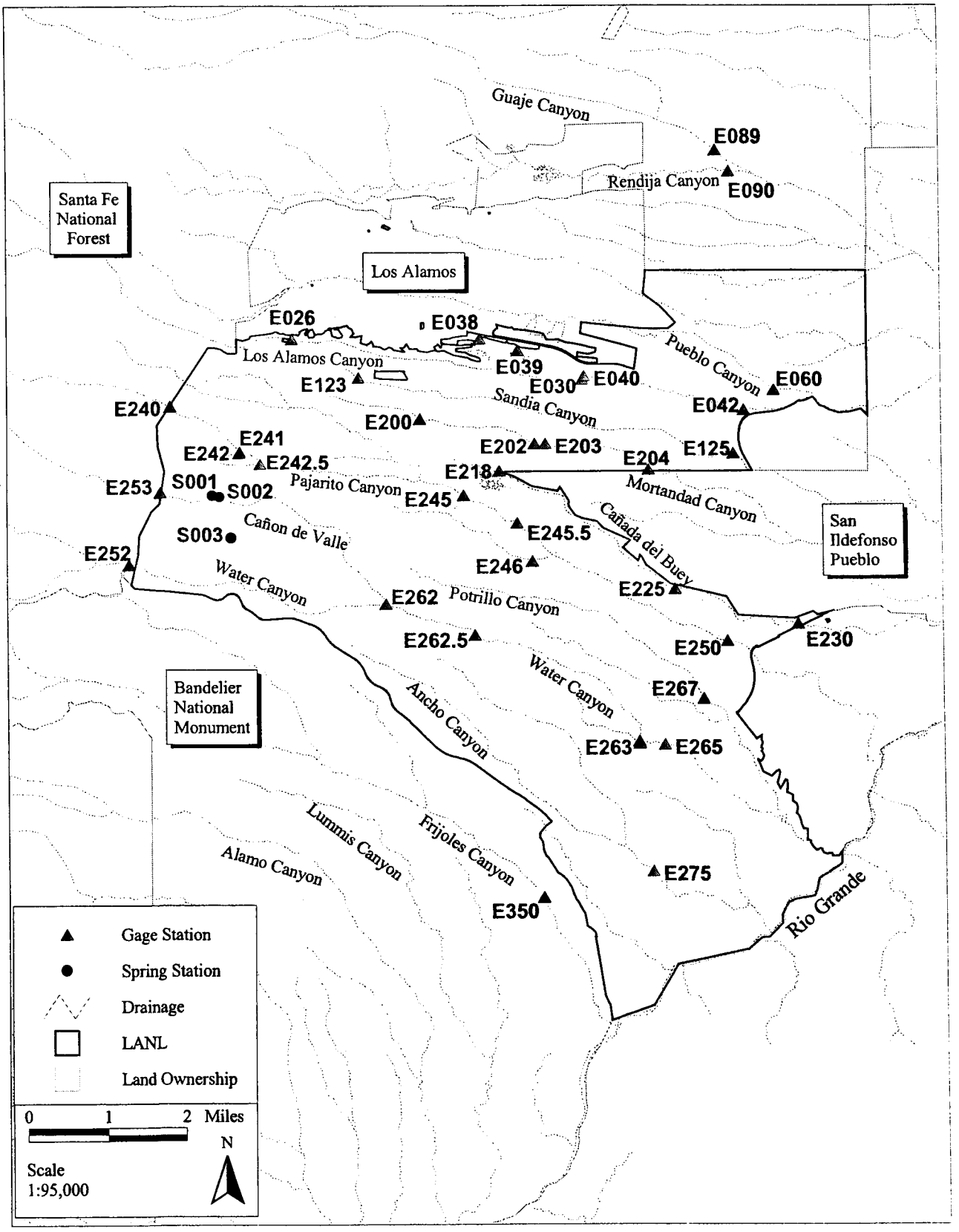
US Army Corps of Engineers, *River Mileage Measurement*, Bulletin 14, rev. October 1968.

National Geodetic Vertical Datum of 1929.

Previous Los Alamos National Laboratory reports in this series—"Surface Water Data at Los Alamos National Laboratory" for water years 1995–2000
1995: LA-13177-PR (August 1996)
1996: LA-13234-PR (November 1996)
1997: LA-13403-PR (January 1996)
1998: LA-13551-PR (February 1999)
1999: LA-13706-PR (April 2000)
2000: LA-13814-PR (July 2001)
2001: LA-13905-PR (April 2002)

Gaging Stations

Gaging Stations at Los Alamos National Laboratory



Summary of Discharges from Stream-Monitoring Stations at Los Alamos National Laboratory

Water Year 2002
October 1, 2001 to September 30, 2002

Canyon Sites	Days with Flow	Volume in Ac-Ft	Instantaneous Max in ft^3/s
E026 Los Alamos Canyon below Skating Rink**	47	9.6	43
E030 Middle Los Alamos	10	8.8	125
E038 Head of DP Canyon	40	30	212
E039 DP Canyon below Meadow	17	24	105
E040 DP Canyon at Mouth	6	6.2	90
E042 Lower Los Alamos*	5	19	160
E060 Pueblo*	357	653	582
E089 Guaje Canyon above Rendija Canyon**	11	41	263
E090 Rendija Canyon at Mouth**	5	23	486
E123 Sandia Canyon below Wetland	365	358	76
E125 Sandia*	1	2.1	18
E200 Middle Mortandad	193	17	14
E202 Mortandad, above Sediment Traps	0	0	0
E203 Mortandad, below Sediment Traps	0	0	0
E204 Lower Mortandad*	0	0	0
E218 Cañada del Buey at TA-46	17	3.1	5.8
E225 Upper Cañada del Buey	0	0	0
E230 Lower Cañada del Buey*	5	8.3	168
E240 Upper Pajarito**	6	49	173
E241 Pajarito at TA-22**	239	180	207
E242 Starmer's Gulch at TA-22	365	14	7.8
E245 Middle Pajarito	16	32	140
E246 Threemile at TA-18	0	0	0
E250 Lower Pajarito*	6	5.4	26
E252 Upper Water**	312	18	114
E253 Upper Cañon de Valle**	4	1	12
E262 Cañon de Valle at Mouth	7	2.7	32
E2625 Water Canyon, Area AB**	4	5.1	53
E263 Water Canyon at State Rd. 4	3	20	149
E265 Lower Water*	6	21	105
E267 Potrillo*	2	0.6	15
E275 Ancho*	0	0	0
E350 Frijoles at Bandelier	365	439	19

*Stations at downstream Laboratory boundary.
**Based on Partial year of record.