In cooperation with the U.S. Department of Agriculture and
Texas State Soil and Water Conservation Board

Summary Statistics and Graphical Comparisons of Historical Hydrologic and Water-Quality Data, Seco Creek Watershed, South-Central Texas

Open-File Report 98-627

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

Cover photographs:

Top Left—An area near the headwaters of the Seco Creek Basin, Seco Creek watershed, Uvalde County, Texas. Photograph by David S. Brown, 1995.

Top Right—Jon R. Gilhousen and Charles A. Hartmann, Jr., making a discharge measurement and collecting a water-quality sample, respectively, at Seco Creek Reservoir Inflow near Utopia, Texas. Photograph by Gregory M. Nalley, U.S. Geological Survey, 1992.

Bottom Left—Parkers Creek Reservoir Inflow near D'Hanis, Texas, after the flood in June 1997. Photograph by David S. Brown.

Bottom Right—Tom Fillinger, U.S. Department of Agriculture, Natural Resources Conservation Service, supervising maintenance of the Arnold rain gage near D'Hanis, Texas. Photograph by Robert Morris, 1996.

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By David S. Brown, Richard N. Slattery, and Jon R. Gilhousen

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**Austin, Texas
1998**

U.S. DEPARTMENT OF THE INTERIOR

Bruce Babbitt, Secretary

U.S. GEOLOGICAL SURVEY

Charles G. Groat, Director

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For additional information write to

**District Chief
U.S. Geological Survey
8027 Exchange Dr.
Austin, TX 78754-4733
E-mail: dc_tx@usgs.gov**

Copies of this report can be purchased from

**U.S. Geological Survey
Branch of Information Services
Box 25286
Denver, CO 80225-0286
E-mail: infoservices@usgs.gov**

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Abstract

The U.S. Geological Survey collected hydrologic (rainfall, streamflow, and reservoir content) and water-quality data in the Seco Creek watershed, south-central Texas. Most of the data from 15 sites were collected as part of a study in cooperation with the U.S. Department of Agriculture and the Texas State Soil and Water Conservation Board to evaluate the effects of agricultural best-management practices on surface- and ground-water quantity and quality in the 255-square-mile watershed. Nearly 400 best-management practices at 58 sites were implemented by landowners in the watershed during March 1990–September 1995.

Most of the data are from the early 1990s, the period during and after implementation of best-management practices. Data from five sites include water quality and are summarized in tables and graphics in the text; and data from all 15 sites are summarized on a diskette.

Maximum annual rainfall among the sites for which data are presented in the text (excluding one site) for the during-and-after-implementation period (March 1990–September 1995) was 53.27 inches in water year 1992. Maximum annual total streamflow among the sites for the period was 63,400 acre-feet, also in water year 1992. At the one site with water-quality data (under base-flow conditions) for both the before-implementation period and the during-and-after implementation period of best-management practices, percentiles (5, 25, 50, 75, 95) for specific conductance, nitrate concentration, and fecal coliform density were less for the during-and-after-implementation period than for the before-implementation period.

INTRODUCTION

The U.S. Geological Survey (USGS), in cooperation with the U.S. Department of Agriculture and the Texas State Soil and Water Conservation Board, began a study in 1990 to evaluate the effects that agricultural best-management practices (BMPs) have on surface- and ground-water quantity and quality in the Seco Creek watershed. The USGS study is part of a larger study known as the Seco Creek Water-Quality Demonstration Project, which began in spring 1990 and is currently (1998) ongoing. The Seco Creek Water-Quality Demonstration Project is intended to demonstrate and transfer technology to farmers and ranchers and thereby encourage the implementation of practices that will protect surface- and ground-water quality within and downstream of the Seco Creek watershed.

BMPs implemented in this study were designed by a number of local, State, and Federal (other than USGS) agencies to (1) reduce the impacts of nonpoint-source water pollution from agricultural chemicals, animal wastes, and sediment; (2) suppress erosion and reduce sedimentation; (3) improve ground-water and downstream surface-water quantity and quality; and (4) improve the quality and availability of vegetative cover. Nearly 400 BMPs at 58 sites were implemented by landowners in the Seco Creek watershed during March 1990–September 1995. The primary BMPs applied to land within the watershed include prescribed burning, range seeding, mechanical brush management, alternative chemical brush management, wildlife habitat management, riparian area management, and grazing management. Cropland BMPs include nutrient management, irrigation water management, and integrated crop management (Steffens and Wright, 1995, p. 18). Within the Seco Creek watershed, ranching and farming account for more than 99 percent of the land use. Land uses within the watershed, with the percentage of land that each use represents and percentage of each land-use

area to which BMPs have been applied, are presented below.

Land use	Percentage of watershed area	Percentage of land-use area to which BMPs applied
Cropland	9.3	70
Pasture	2.7	92
Rangeland	87.7	80
Urban	.3	1

The purpose of this report is to summarize the historical USGS hydrologic (rainfall, streamflow, and reservoir content) and water-quality data collected at sites in the Seco Creek watershed, south-central Texas.

Data from 15 sites in the watershed are included in this report. Data from 5 of the 15 sites comprise rainfall, streamflow, and selected water-quality properties and constituents; data from 9 of the remaining 10 sites are rainfall; and data from 1 site are reservoir content. Data from the five sites with rainfall and streamflow measurements and water-quality samples are summarized in tables and graphics in the text; and data from all 15 sites are summarized on a diskette inside the back cover of the report. (See Appendix—"readme" file for description of data on diskette.) Most of the data from the 15 sites are from the early 1990s, the during-and-after implementation period of BMPs. For the five sites for which data are presented in the text, summary statistics for monthly rainfall and monthly streamflow for the during-and-after implementation period and summary statistics for selected water-quality properties and constituents for the before-implementation period (one site) and the during-and-after-implementation period (all sites) are listed in tables. Daily rainfall for four of the five sites and daily mean streamflow for the five sites for the during-and-after implementation period, and selected water-quality properties and constituents relative to stream-stage conditions for the five sites for the during-and-after-implementation period are shown graphically.

The Seco Creek watershed is approximately 50 miles (mi) west of San Antonio (fig. 1) and comprises parts of Bandera, Medina, and Uvalde Counties. Seco Creek generally flows toward the south and has two primary tributaries within the watershed—Little Seco Creek and Parkers Creek (fig. 2). The southernmost site (site 18) in the Seco Creek watershed has a drainage area of approximately 255 square miles (mi²) (table 1 at end of report). The northern part of the Seco Creek watershed is characterized by hills of limestone

and shale. In this area, Seco Creek loses a substantial amount of flow crossing the Edwards aquifer recharge zone and becomes dry or flows intermittently immediately downstream of the recharge zone (Land and others, 1983, p. 3). Flow also is regulated by small stock ponds and an Edwards aquifer recharge dam (site 13). The middle and southern parts of the Seco Creek watershed are characterized as relatively flat with alluvial sands and gravels (MacLay and Land, 1988, p. A4).

A network of 15 data-collection sites (table 1) was established in the Seco Creek watershed (fig. 2). Data from sites 4, 6, 12, 16, and 18 were selected to provide an overview of hydrologic and water-quality conditions during the Seco Creek Water-Quality Demonstration Project. The data collected at these sites and presented in the text of this report include rainfall, streamflow, reservoir content, and water quality. Each site is equipped with a data-collection platform (DCP) that records selected data every 15 minutes. Each site also is equipped with a Geostationary Operational Environmental Satellite (GOES) transmitter that transmits the recorded data by way of satellite to a USGS computer every 4 hours and more frequently during storm events.

Rainfall data have been collected at site 4 since 1988, streamflow data have been collected at sites 4 and 16 since 1961, and water-quality data have been collected during base-flow conditions at site 4 since 1970. All other rainfall, streamflow, and stream water-quality stations were installed by the USGS during March 1991 or later. The pre-1990 data provide a basis to evaluate the quantity and quality of surface- and ground-water discharge from the headwaters of the Seco Creek watershed before implementation of BMPs, and serve as a reference for comparison of data collected during and after implementation of BMPs.

Rainfall data were collected at 14 sites using a funnel attached to a standpipe. Rainwater is funneled into the standpipe, measured by a float-and-pulley system, and subsequently recorded by data-logging equipment. Approximately 3.5 to 5 inches (in.) of rain can be measured before the standpipe siphons to empty. Rainfall during siphoning is not recorded by the data-logging equipment. Consequently, individual storms and cumulative rainfall might not have been fully measured. Starting in spring 1994, tipping-bucket rain gages were installed next to the standpipe gages at 7 of the 14 sites. The duplicate rain gages record accurate data during intense rainfall events. Rainfall data

Figure 1. Location of the Seco Creek watershed, south-central Texas.

Figure 2. Location of data-collection sites in the Seco Creek watershed, south-central Texas.

presented in this report are from the standpipe rain gages because a longer period of record is available.

Streamflow data were collected by either a mercury manometer or a pressure transducer gage using carbon dioxide (CO₂) gas. The CO₂ gas flows through a small plastic tube with the open end fixed at a low point in the stream. Changes in stream stage cause changes in back pressure on the CO₂ gas, which is measured by the gaging instrument and converted to stage values. Recorded stage is calibrated to an outside gage located at the site and verified by comparing the recorded data with the observed outside-gage data. Stage data are used in a regression equation to obtain streamflow, which is verified periodically by direct or indirect streamflow measurement.

Discrete water-quality samples were collected manually or by automatic samplers at sites 6, 12, 16, and 18 during storm events at intervals of rising, peak, and falling stages.

Quality assurance of data collected from the Seco Creek hydrologic and water-quality data network was accomplished by daily checks of the transmitted DCP data, collection of water-quality equipment blanks and duplicate samples, field verification of stage readings, and measurement of duplicate rain gages at selected stations. Data were reviewed manually and by computerized data-analysis programs.

SUMMARY STATISTICS AND GRAPHICAL COMPARISONS

Descriptions in this section pertain only to the 5 sites for which data are presented in the text, not to the entire group of 15 sites, unless otherwise noted.

Rainfall and Streamflow

Daily rainfall for sites 4, 6, 12, and 18 for October 1991 through September 1995 (water years 1992–95), which represents the during-and-after implementation period of BMPs, is shown in figure 3. Daily rainfall for site 16 is omitted because data collection at that site did not begin until June 1994. Monthly rainfall for the five sites for October 1991 (June 1994 for site 16) through September 1995 is listed in tables 2–6 (at end of report). Maximum water year total rainfall among the sites (excluding site 16) for the period was 53.27 in. at site 6 during water year 1992. Maximum monthly rainfall was 10.17 in. at site 6 during December 1991; minimum monthly rainfall was zero at sites 6 and 18 during July

1993. Maximum recorded daily rainfall was 4.55 in. at site 6 on September 20, 1995.

Daily mean streamflow for sites 4, 6, 12, 16, and 18 for October 1991 through September 1995 is shown in figure 4. Monthly streamflow for the five sites for that period is listed in tables 2–6. Maximum water year total streamflow among the sites for the period was 63,400 acre-feet (acre-ft) at site 4 during water year 1992. Maximum monthly total streamflow was 14,800 acre-ft at site 4 during December 1991; minimum monthly total streamflow was zero during numerous months at all sites except site 4, which had perennial flow.

Water Quality

Water-quality data have been collected during base-flow conditions at site 4 since March 1970 and during stormflow conditions at sites 6, 12, 16, and 18 since September 1991.

Graphs of selected water-quality properties and constituents grouped according to six stream-stage (hydrologic) conditions at the five sites for the during-and-after implementation period of BMPs are shown in figures 5–9. The six stream-stage conditions are

1 Stable, low stage	Stable stage when streamflow less than 2.10 cubic feet per second (ft ³ /s) during sampling.
2 Stable, normal stage	Stable stage when streamflow equal to or greater than 2.10 ft ³ /s and less than or equal to 17.4 ft ³ /s during sampling.
3 Stable, high stage	Stable stage when streamflow greater than 17.4 ft ³ /s during sampling.
4 Rising stage	Increasing stage associated with storm event during sampling.
5 Peak stage	Maximum stage associated with storm event during sampling.
6 Falling stage	Decreasing stage associated with storm event during sampling.

Stream-stage conditions 1, 2, and 3 are base-flow conditions and apply only to site 4. The condition-delineating flows, 2.10 and 17.4 ft³/s, are the 25th and 75th percentiles of the daily mean streamflow at site 4 for the period of record 1961–95. Stream-stage conditions 4, 5, and 6 are stormflow conditions and apply only to sites 6, 12, 16, and 18.

Summary statistics of selected water-quality properties and constituents for the five sites are listed in

Figure 3. Hydrographs showing daily rainfall at selected stations, Seco Creek watershed, south-central Texas, during-and-after implementation period of best-management practices.

Figure 4. Hydrographs showing daily mean streamflow at selected stations, Seco Creek watershed, south-central Texas, during-and-after implementation period of best-management practices.

Figure 5. Specific conductance and pH data aggregated by stream-stage condition at selected stations, Seco Creek watershed, south-central Texas, during-and-after implementation period of best-management practices.

Stream-stage condition: 1—stable, low stage; 2—stable, normal stage; 3—stable, high stage; 4—rising stage; 5—peak stage; 6—falling stage.
(1–3 pertain to site 4; 4–6 pertain to sites 6, 12, 16, and 18)

Figure 6. Dissolved oxygen and biochemical oxygen demand data aggregated by stream-stage condition at selected stations, Seco Creek watershed, south-central Texas, during-and-after implementation period of best-management practices.

Figure 7. Fecal coliform and fecal streptococcus data aggregated by stream-stage condition at selected stations, Seco Creek watershed, south-central Texas, during-and-after implementation period of best-management practices.

Stream-stage condition: 1—stable, low stage; 2—stable, normal stage; 3—stable, high stage; 4—rising stage; 5—peak stage; 6—falling stage.
(1–3 pertain to site 4; 4–6 pertain to sites 6, 12, 16, and 18)

Figure 8. Hardness and potassium data aggregated by stream-stage condition at selected stations, Seco Creek watershed, south-central Texas, during-and-after implementation period of best-management practices.

Stream-stage condition: 1–stable, low stage; 2–stable, normal stage; 3–stable, high stage; 4–rising stage; 5–peak stage; 6–falling stage.
(1–3 pertain to site 4; 4–6 pertain to sites 6, 12, 16, and 18)

Figure 9. Dissolved solids and nitrate data aggregated by stream-stage condition at selected stations, Seco Creek watershed, south-central Texas, during-and-after implementation period of best-management practices.

tables 7–11 (at end of report). For site 4, the summary statistics are grouped by sampling period—March 1970–February 1990, before-implementation period of BMPs; March 1990–September 1995, during-and-after implementation period of BMPs; and March 1970–September 1995, combined periods. For sites 6, 12, 16, and 18, the statistics summarize the during-and-after implementation period.

Minimum specific conductance was 44 microsiemens per centimeter at 25 degrees Celsius ($\mu\text{S}/\text{cm}$) at site 12 (table 9), which is on an ephemeral stream with the smallest gaged drainage area of the watershed (9.34 mi^2) (table 1). Maximum specific conductance was $1,830 \mu\text{S}/\text{cm}$ at site 18 (table 11), which is on an intermittent stream with the largest gaged drainage area of the watershed (255 mi^2). Specific conductances at ephemeral stream sites typically were smaller than at intermittent or perennial stream sites. Specific conductance percentiles at site 4 were slightly smaller for the during-and-after-implementation period than for the before-implementation period (table 7). Specific conductance at site 4 increased slightly from low stage to high stage (fig. 5). Specific conductance typically had a larger range during stormflow conditions than during base-flow conditions; site 18 had the largest range. Unlike site 4, where specific conductance during stable base-flow conditions increased with stage, sites 6, 12, 16, and 18 showed no apparent relation between specific conductance and stormflow conditions.

Minimum pH was 6.4 at site 12 (table 9), and maximum pH was 8.5 at site 4 (before-implementation period) (table 7). Minimum and maximum pH were similar for all sites, except site 12, where pH typically was lower (fig. 5). Site 4 had the smallest pH range of the five sites for the during-and-after implementation period (fig. 5). pH percentiles at site 4 were similar for all sampling periods (table 7).

Dissolved oxygen concentrations ranged from a minimum of $6.2 \text{ mg}/\text{L}$ at site 12 (table 9) to a maximum of $12.0 \text{ mg}/\text{L}$ at site 4 (before-implementation period) (table 7). Dissolved oxygen percentiles at site 4 were similar for all sampling periods (table 7). Dissolved oxygen concentrations at and between sites varied substantially except at site 16, which had the smallest range in concentration (fig. 6). Dissolved oxygen concentrations showed no apparent relation with the stream-stage conditions during sample collection.

Biochemical oxygen demand (BOD) ranged from a minimum of zero at site 4 (before-implementation period) (table 7) to a maximum of $7.2 \text{ mg}/\text{L}$ at site 12

(table 9). Base-flow samples collected at site 4 consistently had the smallest BOD concentrations; larger concentrations were associated with stormflow samples collected at sites 6, 12, 16, and 18 (fig. 6). BOD concentrations decreased between the peak and falling stages at sites 12, 16, and 18.

A relatively small number of bacteria samples were collected during storm events because of sample processing-time limitations and remoteness of sampling sites. Fecal coliform densities ranged from a minimum of 1 colony per 100 milliliters (cols./100 mL) at site 4 (during-and-after implementation period) (table 7) to a maximum of 250,000 cols./100 mL at site 18 (table 11). Base-flow samples collected at site 4 consistently had the smallest fecal coliform and fecal streptococcus densities; much larger (typically one to two orders of magnitude) densities were associated with the stormflow samples collected at sites 6, 12, 16, and 18. Fecal coliform percentiles at site 4 for the during-and-after-implementation period were about $\frac{1}{24}$ to $\frac{1}{3}$ of the percentiles for the before-implementation period (table 7). Fecal streptococcus densities at site 4 generally were smaller for the during-and-after-implementation period than for the before-implementation period.

Hardness (as CaCO_3) ranged from a minimum of $19 \text{ mg}/\text{L}$ at site 12 (table 9) to a maximum of $480 \text{ mg}/\text{L}$ at site 18 (table 11). Hardness percentiles at site 4 were similar for all sampling periods (table 7). Hardness at site 4 increased slightly from low stage to high stage; hardness at sites 12 and 16 was consistently the smallest and had the smallest range (fig. 8).

Dissolved potassium concentrations ranged from a minimum of $0.8 \text{ mg}/\text{L}$ at site 4 (table 7) to a maximum of $8.0 \text{ mg}/\text{L}$ at site 18 (table 11). Larger ranges of potassium concentrations typically were associated with stormwater samples rather than with base-flow samples (fig. 8). Potassium percentiles at site 4 were similar for all sampling periods (table 7). Potassium concentrations for all base-flow and stormwater samples showed no apparent relation with the stream-stage conditions during sample collection (fig. 8).

Dissolved solids concentrations ranged from a minimum of $32 \text{ mg}/\text{L}$ at site 12 (table 9) to a maximum of $1,190 \text{ mg}/\text{L}$ at site 18 (table 11). All dissolved solids percentiles for site 4 except 95 were smaller for the during-and-after-implementation period than for the before-implementation period (table 7). Dissolved solids concentrations at sites 4, 6, 12, and 16 showed little variability (fig. 9). However, site 4 showed a slight increase in dissolved solids concentration from

low stage to high stage. Site 18 had the largest range of dissolved solids concentrations during stormflow conditions.

Nitrate (as nitrogen) concentrations ranged from a minimum of 0.03 mg/L at site 4 (before-implementation period) (table 7) to a maximum of 4.97 mg/L at site 18 (table 11). Nitrate percentiles for site 4 were much smaller for the during-and-after-implementation period than for the before-implementation period. Nitrate concentrations did not vary substantially at and between sites, except at site 18, which had the largest range (fig. 9). Nitrate concentrations showed no apparent relation with the stream-stage conditions during sample collection.

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Table 1. Rainfall, streamflow, reservoir-content, and water-quality stations in the Seco Creek watershed, south-central Texas

Streamflow:

PER perennial
INT intermittent
EPH ephemeral

Type of data:

rf continuous rainfall, daily sum
sf continuous streamflow, daily mean
qpb periodic base-flow water quality
qps periodic stormflow water quality
rc continuous reservoir content, daily maximum

[mi², square miles; NA, not applicable]

Site no. (fig. 2)	Station no.	Station name	Latitude	Longitude	Stream-flow	Drainage area (mi ²)	Type of data	Period of record (water years)
1	2941250992554	Seco Creek rain gage no. 1	29°41'25"	99°25'54"	NA	NA	rf	1991–95
2	2937170992513	Seco Creek rain gage no. 2	29°37'17"	99°25'13"	NA	NA	rf	1991–95
3	2935500992723	Freeman rain gage near Utopia, Tex.	29°35'50"	99°27'23"	NA	NA	rf	1994–95
4	08201500	Seco Creek at Miller Ranch near Utopia, Tex.	29°34'23"	99°24'10"	PER	45.0	rf sf qpb	1988–95 1961–95 1970–95
5	2933550992019	Coffee rain gage near Utopia, Tex.	29°33'55"	99°20'19"	NA	NA	rf	1994–95
6	08202450	Seco Creek Reservoir Inflow near Utopia, Tex.	29°31'34"	99°23'42"	INT	59.4	rf sf qps	1991–95 1991–95 1991–95
9	2931150991651	Brown rain gage near D'Hanis, Tex.	29°31'15"	99°16'51"	NA	NA	rf	1995
10	2928080992030	Valdina Farms rain gage near D'Hanis, Tex.	29°28'08"	99°20'30"	NA	NA	rf	1994–95
11	2928480991442	Parkers Creek rain gage no. 1	29°28'48"	99°14'42"	NA	NA	rf	1991–95
12	08202790	Parkers Creek Reservoir Inflow near D'Hanis, Tex.	29°27'27"	99°15'16"	EPH	9.34	rf sf qps	1991–95 1991–95 1991–95
13	08202800	Parkers Creek Reservoir near D'Hanis, Tex.	29°26'42"	99°15'09"	EPH	10.0	rc	1991–95
15	2925270991837	Chaney rain gage near D'Hanis, Tex.	29°25'27"	99°18'37"	NA	NA	rf	1994–95
16	08202700	Seco Creek at Rowe Ranch near D'Hanis, Tex.	29°22'14"	99°17'15"	EPH	168	rf sf qps	1994–95 1961–95 1991–93
17	2914540991642	Arnold rain gage near D'Hanis, Tex.	29°14'54"	99°16'42"	NA	NA	rf	1994–95
18	08202900	Seco Creek near Yancey, Tex.	29°08'03"	99°12'19"	INT	255	rf sf qps	1992–95 1991–95 1991–95

Table 2. Summary statistics for monthly rainfall and streamflow at site 4, Seco Creek at Miller Ranch near Utopia, Texas (08201500), during-and-after implementation period of best-management practices

[WY, water year; e, estimated record; m, missing record]

Period	Monthly rainfall (inches)				Monthly streamflow (acre-feet)				Monthly streamflow (inches per square mile of drainage area)			
	WY 1992	WY 1993	WY 1994	WY 1995	WY 1992	WY 1993	WY 1994	WY 1995	WY 1992	WY 1993	WY 1994	WY 1995
October	1.18	1.21	0.39	2.86	1,310	169	92	169	0.55	0.07	0.04	0.07
November	2.39	4.75	.77	2.62	1,150	512 e	80	429	.48	.21	.03	.18
December	9.28	1.67	.40	3.54	14,800 e	419	69	632	6.18 e	.17	.03	.26
January	3.52	1.13	3.12	.36	5,710 e	720 e	113 e	964	2.38 e	.30 e	.05 e	.40
February	5.15	2.12	1.67	.48	7,850	783	109 e	349	3.27	.33	.05 e	.15
March	7.27	3.12	3.83	3.84	8,230	762 e	576 e	665	3.43	.32 e	.24 e	.28
April	2.91	.65	1.67	3.26	5,420	836	358 e	485	2.26	.35	.15 e	.20
May	7.17	4.92	2.87	8.83	5,960	4,210 e	707 e	527	2.48	1.76 e	.29 e	.22
June	6.45	3.42	1.91	4.71	10,100	1,100 e	281	987	4.22	.46 e	.12	.41
July	.87 m	.03	2.50	.67	2,030	450 e	136	502	.84	.19 e	.06	.21
August	.24 m	.13	1.88	1.42	668	153	104	147	.28	.06	.04	.06
September	.89	4.94	1.97	5.12	209	176	72	1,510	.09	.07	.03	.63
WY total	47.32 m	28.09	22.98	37.71	63,400 e	10,290 e	2,700 e	7,370	26.46 e	4.29 e	1.13 e	3.07
WY maximum	9.28	4.94	3.83	8.83	14,800 e	4,210 e	707 e	1,510	6.18 e	1.76 e	.29 e	.63
WY minimum	.24 m	.03	.39	.36	209	153	69	147	.09	.06	.03	.06
WY mean	3.94 m	2.34	1.92	3.14	5,286 e	858 e	225 e	614	2.21 e	.36 e	.09 e	.26
WY median	3.22	1.90	1.90	3.06	5,565 e	616 e	111 e	514	2.32	.26 e	.05	.22

Table 3. Summary statistics for monthly rainfall and streamflow at site 6, Seco Creek Reservoir Inflow near Utopia, Texas (08202450), during-and-after implementation period of best-management practices

[WY, water year; m, missing record; e, estimated record]

Period	Monthly rainfall (inches)				Monthly streamflow (acre-feet)				Monthly streamflow (inches per square mile of drainage area)			
	WY 1992	WY 1993	WY 1994	WY 1995	WY 1992	WY 1993	WY 1994	WY 1995	WY 1992	WY 1993	WY 1994	WY 1995
October	0.67 m	0.87	0.24	3.24	0	0	0	0	0	0	0	0
November	1.52 m	5.68	.77	1.90	44	80	0	0	.01	.03	0	0
December	10.17	1.58	.42	3.25	8,340	0	0	82	2.63	0	0	.03
January	4.03	.83	3.05	.26	2,980	56	0	0	.94	.02	0	0
February	5.60	2.05	1.07	.48	6,180	0	0	0	1.95	0	0	0
March	7.18	1.76	4.57	2.86	6,430	36	0	0	2.03	.01	0	0
April	2.56	.92	2.17	1.98	3,800	0	0	0	1.20	0	0	0
May	4.90	6.86	.67	5.24	2,990 e	2,290 e	9.7	65	.94 e	.72 e	0	.02
June	7.03	5.99	2.19	3.25	6,710 e	0	0	78	2.11 e	0	0	.02
July	6.16	0	.89	.74	275 e	0	0	0	.09 e	0	0	0
August	1.52	.22	2.11	2.96	0	0	0	0	0	0	0	0
September	1.93	3.66	2.96	8.72	0	0	0	1,010	0	0	0	.32
WY total	53.27 m	30.42	21.11	34.88	37,700 e	2,460 e	9.7	1,240	11.90 e	.78 e	0	0
WY maximum	10.17	6.86	4.57	8.72	8,340	2,290	9.7	1,010	2.63	.72 e	0	.32
WY minimum	.67 m	0	.24	.26	0	0	0	0	0	0	0	0
WY mean	4.44 m	2.54	1.76	2.91	3,146 e	205 e	.8	103	.99 e	.07 e	0	.03
WY median	4.47	1.67	1.59	2.91	2,985 e	0	0	0	.94 e	0	0	0

Table 4. Summary statistics for monthly rainfall and streamflow at site 12, Parkers Creek Reservoir Inflow near D’Hanis, Texas (08202790), during-and-after implementation period of best-management practices

[WY, water year; e, estimated record]

Period	Monthly rainfall (inches)				Monthly streamflow (acre-feet)				Monthly streamflow (inches per square mile of drainage area)			
	WY 1992	WY 1993	WY 1994	WY 1995	WY 1992	WY 1993	WY 1994	WY 1995	WY 1992	WY 1993	WY 1994	WY 1995
October	0.22	0.42	0.46	5.29	0	0	0	4.2	0	0	0	0.01
November	1.78	3.04	1.15	.98	0	0	0	0	0	0	0	0
December	7.83	1.73	.30	3.96	545 e	0	0	5.3	1.10 e	0	0	.01
January	3.25	.84	2.95	.18	30	0	0	0	.06	0	0	0
February	5.73	1.74	1.07	1.22	369 e	0	0	0	.74 e	0	0	0
March	3.79	1.34	4.71	2.57	156	0	96	13	.31	0	.19	.03
April	3.50	1.54	2.66	2.12	3.6	0	0	1.3	.01	0	0	0
May	4.95	2.58	3.01	5.13	7.1	0	54	4.1	.02	0	.11	.01
June	6.06	2.97	2.87	4.45	280 e	0	0	8.3	.56 e	0	0	.02
July	1.66	.03	.23	.68	0	0	0	0	0	0	0	0
August	3.19	.23	1.37	2.18	0	0	0	0	0	0	0	0
September	2.12	.80	2.30	4.39	0	0	0	9.5	0	0	0	.02
WY total	44.08	17.26	23.08	33.15	1,390 e	0	150	45.7	2.80	0	.30	.10
WY maximum	7.83	3.04	4.71	5.29	545 e	0	96	13	1.10 e	0	.19	.03
WY minimum	.22	.03	.23	.18	0	0	0	0	0	0	0	0
WY mean	3.67	1.44	1.92	2.76	116 e	0	12.5	3.8	.23 e	0	.03	.01
WY median	3.38	1.44	1.84	2.38	5	0	0	2.7	.02	0	0	.01

Table 5. Summary statistics for monthly rainfall and streamflow at site 16, Seco Creek at Rowe Ranch near D'Hanis, Texas (08202700), during-and-after implementation period of best-management practices

[WY, water year; --, not collected or computed; e, estimated record; m, missing record]

Period	Monthly rainfall (inches)				Monthly streamflow (acre-feet)				Monthly streamflow (inches per square mile of drainage area)			
	WY 1992	WY 1993	WY 1994	WY 1995	WY 1992	WY 1993	WY 1994	WY 1995	WY 1992	WY 1993	WY 1994	WY 1995
October	--	--	--	3.12	0	0	0	0	0	0	0	0
November	--	--	--	.87	0	0	0	0	0	0	0	0
December	--	--	--	2.12	7,220	0	0	0	.81	0	0	0
January	--	--	--	.19	0	0	0	0	0	0	0	0
February	--	--	--	1.40	1,910	0	0	0	.21	0	0	0
March	--	--	--	2.40	1,660	0	0	0	.19	0	0	0
April	--	--	--	1.89	0	0	0	0	0	0	0	0
May	--	--	--	3.65	141	2,490 e	0	0	.02	.28 e	0	0
June	--	--	1.00 m	3.52	1,820 e	0	0	0	.20 e	0	0	0
July	--	--	.53	.43	0	0	0	0	0	0	0	0
August	--	--	.47	.58	0	0	0	0	0	0	0	0
September	--	--	1.29	2.42	0	0	0	19	0	0	0	0
WY total	--	--	3.29 m	22.59	12,800 e	2,490 e	0	19	1.43 e	.28 e	0	0
WY maximum	--	--	--	3.65	7,220	2,490 e	0	19	.81	.28 e	0	0
WY minimum	--	--	--	.19	0	0	0	0	0	0	0	0
WY mean	--	--	--	1.88	1,063 e	208 e	0	1.6	.12 e	.02 e	0	0
WY median	--	--	--	1.89	0	0	0	0	0	0	0	0

Table 6. Summary statistics for monthly rainfall and streamflow at site 18, Seco Creek near Yancey, Texas (08202900), during-and-after implementation period of best-management practices

[WY, water year; --, not collected or computed; m, missing record; e, estimated record]

Period	Monthly rainfall (inches)				Monthly streamflow (acre-feet)				Monthly streamflow (inches per square mile of drainage area)			
	WY 1992	WY 1993	WY 1994	WY 1995	WY 1992	WY 1993	WY 1994	WY 1995	WY 1992	WY 1993	WY 1994	WY 1995
October	--	2.50	0.29	4.72	0.08	12	0	103	0	0	0	0.01
November	--	.74	.42	1.01	.5	89	0	0	0	.01	0	0
December	1.67 m	.42	.11	1.30	10,400	151	0	0	.77	.01	0	0
January	2.58	.77	.83	.13	383	163	5.1 e	0	.03	.01	0	0
February	3.99	1.52	.23	1.79	2,860 e	148	.2	0	.21 e	.01	0	0
March	1.58	1.76	1.08	3.13	4,380	166	9.5	46	.32	.01	0	0
April	1.17	2.43	1.31	.29	795	59	0	25 e	.06	0	0	0 e
May	3.69	2.60	1.34	5.13	1,320 e	3,040	44	77 e	.10 e	.23	0	.01 e
June	2.89	4.34	2.62	2.92	4,770	84	0	2.8 e	.35	.01	0	0 e
July	.14 m	0	1.11	.89	156	8.5	0	.1	.01	0	0	0
August	.01	.02	1.43	.14	46	0	0	0	0	0	0	0
September	1.43	.13	1.07	1.93	30	0	0	0	0	0	0	0
WY total	19.15 m	17.23	11.84	23.38	25,100 e	3,920	58.8 e	254 e	1.85 e	.29	0	.02 e
WY maximum	3.99 m	4.34	2.62	5.13	10,400	3,040	44	103	.77	.23	0	.01 e
WY minimum	.01 m	0	.11	.13	0	0	0	0	0	0	0	0
WY mean	1.92 m	1.44	.99	1.95	2,100 e	327	4.9 e	21 e	.15 e	.02	0	0 e
WY median	1.63 m	1.15	1.08	1.55	589	86	0	0	.05	.01	0	0

Table 7. Summary statistics for selected physical properties and water-quality constituents at site 4, Seco Creek at Miller Ranch near Utopia, Texas (08201500), before-implementation and during-and-after implementation periods of best-management practices

Sampling period: 1, March 1970–February 1990, before-implementation period of best-management practices
2, March 1990–September 1995, during-and-after implementation period of best-management practices
3, March 1970–September 1995, combined periods

[Data collected during base-flow conditions. ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; BOD, biochemical oxygen demand; cols./100 mL, colonies per 100 milliliters; CaCO₃, calcium carbonate; N, nitrogen; <, less than; --, not computed; µg/L, micrograms per liter]

Selected property or constituent	Sampling period	No. of samples	Maxi- mum	Mini- mum	Mean	Percentiles ¹				
						95	75	Median	25	5
Discharge, instantaneous (ft ³ /s)	1	68	107	0.29	16	66	21	7.4	2.6	0.50
	2	13	103	1.3	16	103	14	7.0	2.4	1.3
	3	81	107	.29	16	69	20	7.4	2.6	.54
Specific conductance (µS/cm)	1	67	516	356	425	490	450	428	395	368
	2	13	466	354	401	466	440	392	363	354
	3	80	516	354	421	482	448	423	391	360
pH (standard units)	1	67	8.5	7.4	8.1	8.5	8.2	8.0	7.9	7.6
	2	13	8.4	8.0	8.1	8.4	8.2	8.1	8.0	8.0
	3	80	8.5	7.4	8.1	8.4	8.2	8.1	8.0	7.7
Dissolved oxygen (mg/L)	1	65	12.0	7.4	9.5	11.3	10.2	9.6	8.4	7.5
	2	13	11.2	7.7	9.2	11.2	9.8	8.9	8.5	7.7
	3	78	12.0	7.4	9.4	11.2	10.2	9.4	8.4	7.7
BOD, 5-day (mg/L)	1	64	1.6	0	.5	1.5	.7	.4	.2	0
	2	11	1.7	.4	1.0	1.7	1.4	.8	.7	.4
	3	75	1.7	0	.6	1.5	.8	.5	.3	.1
Coliforms, fecal (cols./100 mL)	1	45	1,800	2	180	940	200	41	16	3
	2	10	39	1	14	39	30	7	2	1
	3	55	1,800	1	150	900	150	32	8	2
Streptococci, fecal (cols./100 mL)	1	46	580	1	87	490	88	44	18	5
	2	11	160	6	51	160	68	34	14	6
	3	57	580	1	80	350	84	34	16	6
Hardness, total as CaCO ₃ (mg/L)	1	66	250	160	210	250	220	210	190	170
	2	13	260	150	200	260	220	190	180	150
	3	79	260	150	200	250	220	200	190	170
Calcium, dissolved (mg/L)	1	66	82	47	63	80	70	62	57	49
	2	13	89	46	62	89	71	59	54	46
	3	79	89	46	63	81	70	62	56	47
Magnesium, dissolved (mg/L)	1	66	14	10	12	13	12	12	11	11
	2	13	12	8.7	10	12	10	10	9.4	8.7
	3	79	14	8.7	11	13	12	11	11	9.6
Sodium, dissolved (mg/L)	1	65	11	5.6	7.6	9.4	8.0	7.4	7.0	6.0
	2	13	8.5	6.3	7.1	8.5	7.7	6.9	6.4	6.3
	3	78	11	5.6	7.5	9.4	7.9	7.4	6.9	6.0

Footnote at end of table.

Table 7. Summary statistics for selected physical properties and water-quality constituents at site 4, Seco Creek at Miller Ranch near Utopia, Texas (08201500), before-implementation and during-and-after implementation periods of best-management practices—Continued

Selected property or constituent	Sampling period	No. of samples	Maximum	Minimum	Mean	Percentiles ¹				
						95	75	Median	25	5
Potassium, dissolved (mg/L)	1	65	1.7	.8	1.1	1.6	1.2	1.0	1.0	.8
	2	13	1.3	.8	1.0	1.3	1.1	.9	.9	.8
	3	78	1.7	.8	1.1	1.6	1.2	1.0	.9	.8
Sulfate, dissolved (mg/L)	1	66	79	25	46	72	55	44	36	29
	2	13	51	27	39	51	48	38	32	27
	3	79	79	25	45	66	52	44	36	29
Chloride, dissolved (mg/L)	1	66	18	8.3	13	17	15	13	11	8.6
	2	13	17	9.6	12	17	14	11	10	9.6
	3	79	18	8.3	13	17	14	13	11	8.9
Dissolved solids, sum of constituents (mg/L)	1	65	286	208	247	283	264	245	230	216
	2	13	295	197	236	295	258	227	218	197
	3	78	295	197	245	284	261	245	226	212
Nitrate, total as N (mg/L)	1	59	1.59	.03	.59	1.50	.80	.53	.30	.10
	2	13	.62	.07	.25	.62	.34	.19	.10	.07
	3	72	1.59	.03	.53	1.37	.74	.47	.20	.09
Phosphorus, total (mg/L)	1	65	.17	<.01	--	.03	.01	<.01	<.01	<.01
	2	8	<.01	<.01	<.01	--	--	--	--	--
	3	73	.17	<.01	--	.03	.01	<.01	<.01	<.01
Strontium, dissolved (µg/L)	1	9	480	290	410	--	--	--	--	--
	2	10	480	300	380	480	420	360	330	300
	3	19	480	290	390	480	440	400	330	290

¹ The nth percentile is the value exceeded by no more than n percent of the data.

Table 8. Summary statistics for selected physical properties and water-quality constituents at site 6, Seco Creek Reservoir Inflow near Utopia, Texas (08202450), during-and-after implementation period of best-management practices

[Data collected during stormflow conditions. ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; BOD, biochemical oxygen demand; cols./100 mL, colonies per 100 milliliters; --, not computed; CaCO₃, calcium carbonate; N, nitrogen; <, less than; µg/L, micrograms per liter]

Selected property or constituent	No. of samples	Maximum	Minimum	Mean	Percentiles ¹				
					95	75	Median	25	5
Discharge, instantaneous (ft ³ /s)	26	935	6.8	126	762	150	76	24	7.7
Specific conductance (µS/cm)	21	420	95	288	418	370	299	204	100
pH (standard units)	13	8.4	7.3	7.9	8.4	8.2	8.1	7.5	7.3
Dissolved oxygen (mg/L)	12	11.5	6.5	8.6	11.5	9.5	8.3	7.6	6.5
BOD, 5-day (mg/L)	11	4.2	.6	2.1	4.2	2.9	2.3	1.3	.6
Coliforms, fecal (cols./100 mL)	6	18,000	780	6,500	--	--	--	--	--

Footnote at end of table.

Table 8. Summary statistics for selected physical properties and water-quality constituents at site 6, Seco Creek Reservoir Inflow near Utopia, Texas (08202450), during-and-after implementation period of best-management practices—Continued

Selected property or constituent	No. of samples	Maximum	Minimum	Mean	Percentiles ¹				
					95	75	Median	25	5
Streptococci, fecal (cols./100 mL)	6	10,000	780	5,200	--	--	--	--	--
Hardness, total as CaCO ₃ (mg/L)	19	240	45	160	240	190	170	120	45
Calcium, dissolved (mg/L)	19	86	16	52	86	63	54	39	16
Magnesium, dissolved (mg/L)	19	9.7	1.1	6.3	9.7	8.4	6.6	4.9	1.1
Sodium, dissolved (mg/L)	19	7.4	1.4	4.0	7.4	4.9	3.5	2.8	1.4
Potassium, dissolved (mg/L)	19	2.7	.9	1.5	2.7	1.7	1.6	1.2	.9
Sulfate, dissolved (mg/L)	19	43	2.2	23	43	32	21	12	2.2
Chloride, dissolved (mg/L)	19	16	1.7	6.7	16	8.1	6.2	4.1	1.7
Dissolved solids, sum of constituents (mg/L)	18	249	60	178	249	220	189	137	60
Nitrate, total as N (mg/L)	19	.50	.05	.27	.50	.36	.25	.21	.05
Phosphorus, total (mg/L)	8	.08	<.01	--	--	--	--	--	--
Strontium, dissolved (µg/L)	19	360	35	240	360	310	250	170	35

¹ The nth percentile is the value exceeded by no more than n percent of the data.

Table 9. Summary statistics for selected physical properties and water-quality constituents at site 12, Parkers Creek Reservoir Inflow near D'Hanis, Texas (08202790), during-and-after implementation period of best-management practices

[Data collected during stormflow conditions. ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; --, not computed; mg/L, milligrams per liter; BOD, biochemical oxygen demand; cols./100 mL, colonies per 100 milliliters; CaCO₃, calcium carbonate; N, nitrogen; µg/L, micrograms per liter]

Selected property or constituent	No. of samples	Maximum	Minimum	Mean	Percentiles ¹				
					95	75	Median	25	5
Discharge, instantaneous (ft ³ /s)	25	143	0.97	17	124	16	8.4	2.2	0.97
Specific conductance (µS/cm)	18	201	44	98	201	121	94	71	44
pH (standard units)	9	8.0	6.4	7.3	--	--	--	--	--
Dissolved oxygen (mg/L)	7	9.3	6.2	7.6	--	--	--	--	--
BOD, 5-day (mg/L)	15	7.2	1.7	4.8	7.2	5.8	4.8	4.2	1.7
Coliforms, fecal (cols./100 mL)	7	17,000	3,400	9,400	--	--	--	--	--
Streptococci, fecal (cols./100 mL)	7	26,000	2,000	14,000	--	--	--	--	--
Hardness, total as CaCO ₃ (mg/L)	18	67	19	43	67	54	44	32	19
Calcium, dissolved (mg/L)	18	25	6.8	16	25	20	16	12	6.8
Magnesium, dissolved (mg/L)	18	1.3	.43	.85	1.3	1.1	.81	.64	.43
Sodium, dissolved (mg/L)	18	1.4	.5	.8	1.4	1.0	.8	.5	.5
Potassium, dissolved (mg/L)	18	4.8	2.2	3.3	4.8	3.9	3.4	2.7	2.2

Footnote at end of table.

Table 9. Summary statistics for selected physical properties and water-quality constituents at site 12, Parkers Creek Reservoir Inflow near D’Hanis, Texas (08202790), during-and-after implementation period of best-management practices—Continued

Selected property or constituent	No. of samples	Maximum	Minimum	Mean	Percentiles ¹				
					95	75	Median	25	5
Sulfate, dissolved (mg/L)	18	2.6	1.1	1.7	2.6	2.1	1.7	1.3	1.1
Chloride, dissolved (mg/L)	18	4.5	.7	1.7	4.5	2.2	1.4	.9	.7
Dissolved solids, sum of constituents (mg/L)	18	93	32	63	93	79	62	51	32
Nitrate, total as N (mg/L)	17	.27	.08	.15	.27	.22	.11	.10	.08
Phosphorus, total (mg/L)	7	.14	.06	.09	--	--	--	--	--
Strontium, dissolved (µg/L)	18	20	4.0	11	20	14	11	8.2	4.0

¹ The nth percentile is the value exceeded by no more than n percent of the data.

Table 10. Summary statistics for selected physical properties and water-quality constituents at site 16, Seco Creek at Rowe Ranch near D’Hanis, Texas (08202700), during-and-after implementation period of best-management practices

[Data collected during stormflow conditions. ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; --, not computed; mg/L, milligrams per liter; BOD, biochemical oxygen demand; cols./100 mL, colonies per 100 milliliters; >, greater than; CaCO₃, calcium carbonate; N, nitrogen; µg/L, micrograms per liter]

Selected property or constituent	No. of samples	Maximum	Minimum	Mean	Percentiles ¹				
					95	75	Median	25	5
Discharge, instantaneous (ft ³ /s)	13	2,900	37	618	2,900	846	341	146	37
Specific conductance (µS/cm)	12	233	102	157	233	200	144	120	102
pH (standard units)	9	8.2	7.4	7.8	--	--	--	--	--
Dissolved oxygen (mg/L)	9	9.6	8.2	8.8	--	--	--	--	--
BOD, 5-day (mg/L)	10	5.8	.2	3.5	5.8	4.6	3.7	2.8	.2
Coliforms, fecal (cols./100 mL)	3	>160,000	4,400	--	--	--	--	--	--
Streptococci, fecal (cols./100 mL)	3	30,000	4,100	--	--	--	--	--	--
Hardness, total as CaCO ₃ (mg/L)	11	99	46	75	99	93	73	59	46
Calcium, dissolved (mg/L)	11	35	17	27	35	33	27	22	17
Magnesium, dissolved (mg/L)	11	3.2	.8	1.9	3.2	2.6	1.6	1.1	.8
Sodium, dissolved (mg/L)	11	4.3	1.1	2.2	4.3	3.1	1.7	1.3	1.1
Potassium, dissolved (mg/L)	11	4.1	2.0	3.0	4.1	3.7	2.8	2.2	2.0
Sulfate, dissolved (mg/L)	11	12	1.7	5.8	12	9.4	4.4	2.6	1.7
Chloride, dissolved (mg/L)	11	7.3	1.5	3.6	7.3	5.2	3.0	2.2	1.5
Dissolved solids, sum of constituents (mg/L)	11	124	60	95	124	117	90	77	60
Nitrate, total as N (mg/L)	11	.57	.06	.26	.57	.37	.20	.15	.06
Phosphorus, total (mg/L)	11	.17	.02	.11	.17	.16	.13	.06	.02
Strontium, dissolved (µg/L)	11	110	21	60	110	95	49	27	21

¹ The nth percentile is the value exceeded by no more than n percent of the data.

Table 11. Summary statistics for selected physical properties and water-quality constituents at site 18, Seco Creek near Yancey, Texas (08202900), during-and-after implementation period of best-management practices

[Data collected during stormflow conditions. ft³/s, cubic feet per second; <, less than; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; BOD, biochemical oxygen demand; --, not computed; cols./100 mL, colonies per 100 milliliters; CaCO₃, calcium carbonate; N, nitrogen; µg/L, micrograms per liter]

Selected property or constituent	No. of sam- ples	Maxi- mum	Mini- mum	Mean	Percentiles ¹				
					95	75	Median	25	5
Discharge, instantaneous (ft ³ /s)	17	1,920	<0.01	202	566	62	44	1.22	<0.01
Specific conductance (µS/cm)	17	1,830	106	760	1,830	1,400	418	303	106
pH (standard units)	15	8.3	7.0	7.8	8.3	8.0	7.8	7.6	7.0
Dissolved oxygen (mg/L)	12	9.3	7.1	8.2	9.3	8.7	8.0	7.8	7.1
BOD, 5-day (mg/L)	8	4.6	1.6	3.11	--	--	--	--	--
Coliforms, fecal (cols./100 mL)	6	250,000	570	56,000	--	--	--	--	--
Streptococci, fecal (cols./100 mL)	6	37,000	510	14,000	--	--	--	--	--
Hardness, total as CaCO ₃ (mg/L)	17	480	47	211	480	320	140	96	47
Calcium, dissolved (mg/L)	17	140	16	62	140	92	46	32	16
Magnesium, dissolved (mg/L)	17	38	1.8	13	38	25	6.2	4.1	1.8
Sodium, dissolved (mg/L)	17	220	2.3	72	220	160	28	14	2.3
Potassium, dissolved (mg/L)	17	8.0	2.8	5.2	8.0	6.6	5.0	3.9	2.8
Sulfate, dissolved (mg/L)	17	480	7.5	150	480	310	57	28	7.5
Chloride, dissolved (mg/L)	17	230	2.8	75	230	120	36	16	2.8
Dissolved solids, sum of constituents (mg/L)	17	1,190	77	456	1,190	863	248	174	77
Nitrate, total as N (mg/L)	16	4.97	.11	1.22	4.97	1.42	.68	.49	.11
Phosphorus, total (mg/L)	6	.42	.06	.18	--	--	--	--	--
Strontium, dissolved (µg/L)	17	1,100	60	410	1,100	740	210	140	60

¹ The nth percentile is the value exceeded by no more than n percent of the data.

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APPENDIX—“Readme” File

3. rfxxxxx.rdb (14), rfxxxxx.tbl (14)-- Continuous rainfall, daily sum.
4. qpbxxxx.rdb (1), qpbxxxx.tbl (1) -- Periodic base-flow water quality.
5. qpsxxxx.rdb (4), qpsxxxx.tbl (4) -- Periodic stormflow water quality.

CONTENTS OF THE REMAINDER OF THIS README FILE:

1. LIST OF USGS SITES AND DATA TYPE AVAILABLE
2. FORMATS AND CONTENTS FOR CONTINUOUS STREAMFLOW, DAILY MEAN FILES
 - Tab-delimited files (sfxxxxx.rdb)
 - Table files (sfxxxxx.tbl)
 - Daily Mean Values
 - Statistics of Monthly Mean Data
 - Summary Statistics
 - Explanation of Terms
3. FORMATS FOR CONTINUOUS RESERVOIR STORAGE, DAILY MAXIMUM FILES
 - Tab-delimited file (rcxxxxx.rdb)
 - Table file (rcxxxxx.tbl)
4. FORMATS FOR CONTINUOUS RAINFALL, DAILY SUM FILES
 - Tab-delimited files (rfxxxxx.rdb)
 - Table files (rfxxxxx.tbl)
5. FORMATS FOR WATER-QUALITY DATA FILES
 - Tab-delimited files (qpbxxxx.rdb and qpsxxxx.rdb)
 - Table files (qpbxxxx.tbl and qpsxxxx.tbl)
 - Explanation of Hydrologic Condition Codes, Remark Codes, Units of Measure, and STORET codes

1. LIST OF USGS SITES AND DATA TYPE AVAILABLE

The table below is a list of sites, the type of data for each site, and the period of record of data for each site. The numbers in the first column correspond to site numbers on figure 2 in the report. The last five digits of the station number correspond to the five digits of the file name. The period of record is in water years.

[rf, rainfall; sf, streamflow; qpb, periodic base-flow water quality; qps, periodic stormflow water quality; rc, reservoir content]

Site no.	Station no.	Station no.	Data type	Period of record
1	2941250992554	Seco Creek rain gage no. 1	rf	1991-95
2	2937170992513	Seco Creek rain gage no. 2	rf	1991-95
3	2935500992723	Freeman rain gage near Utopia, Tex.	rf	1994-95

4	08201500	Seco Creek at Miller Ranch near Utopia, Tex.	rf sf qpb	1988-95 1961-95 1970-95
5	2933550992019	Coffee rain gage near Utopia, Tex.	rf	1994-95
6	08202450	Seco Creek Reservoir Inflow near Utopia, Tex.	rf sf qps	1991-95 1991-95 1991-95
9	2931150991651	Brown rain gage near D'Hanis, Tex.	rf	1995
10	2928080992030	Valdina Farms rain gage near D'Hanis, Tex.	rf	1994-95
11	2928480991442	Parkers Creek rain gage no. 1	rf	1991-95
12	08202790	Parkers Creek Reservoir Inflow near D'Hanis, Tex.	rf sf qps	1991-95 1991-95 1991-95
13	08202800	Parkers Creek Reservoir near D'Hanis, Tex.	rc	1991-95
15	2925270991837	Chaney rain gage near D'Hanis, Tex.	rf	1994-95
16	08202700	Seco Creek at Rowe Ranch near D'Hanis, Tex.	rf sf qps	1994-95 1961-95 1991-93
17	2914540991642	Arnold rain gage near D'Hanis, Tex.	rf	1994-95
18	08202900	Seco Creek near Yancey, Tex.	rf sf qps	1992-95 1991-95 1991-95

2. FORMATS AND CONTENTS FOR CONTINUOUS STREAMFLOW, DAILY MEAN FILES

sfxxxxx.rdb files -- The first three tab-delimited columns are the date with the year, month, and day separated by tabs. Dates are in ascending order for the period of available record. The fourth column is the daily-mean discharge for that date in cubic feet per second. Missing record is indicated by a negative value.

sfxxxxx.tbl files -- The 132-column table file has three parts: (1) Daily mean values; (2) Statistics of monthly mean data; and (3) Summary statistics. Each part is described below:

Daily Mean Values

The daily mean values table for streamflow-gaging stations lists mean discharge for each day in cubic feet per second. Estimated daily mean values are indicated by "e" preceding the value. Missing record is indicated by ---. In the monthly summary below the daily mean table, the TOTAL line lists the sum of the daily values. The MEAN line lists the average flow in cubic feet per second during the month. MAX, MIN, and MED list the maximum, minimum, and median daily discharges, respectively, for the month. Discharge for the month also may be expressed in acre-feet (on the drainage area upstream of the gaging station) (AC-FT), or in cubic feet per second per square mile (of drainage area upstream of the gaging station) (CFSM), or in inches (on the drainage area upstream of the gaging station) (IN.).

Statistics of Monthly Mean Data

A tabular summary of the mean (MEAN), maximum (MAX), and minimum (MIN) monthly mean discharges for each month for a designated period of water years is listed with the water years of the first occurrence of the maximum and minimum monthly mean discharges immediately below.

Summary Statistics

The SUMMARY STATISTICS table is a statistical summary of annual, daily, and instantaneous discharges for the previous calendar year, designated water year, and period of record through the designated water year.

Annual period-of-record statistics are computed from data for complete-record water years, except ANNUAL SEVEN-DAY MINIMUM, which includes data for partial-record water years (if any). The other period-of-record statistics also include data for partial-record water years (if any).

The date or water year, as appropriate, of the first occurrence of each statistic of an extreme value of discharge is provided adjacent to the statistic. Runoff data also are listed unless the drainage basin has extensive regulation or diversion of flow.

Explanation of Terms

ANNUAL TOTAL

The sum of the daily mean discharges for the year.

ANNUAL MEAN

The arithmetic mean of individual daily mean discharges for the year noted or for the designated period.

HIGHEST ANNUAL MEAN

The maximum annual mean discharge for the designated period.

LOWEST ANNUAL MEAN

The minimum annual mean discharge for the designated period.

HIGHEST DAILY MEAN

The maximum daily mean discharge for the year or for the designated period.

LOWEST DAILY MEAN

The minimum daily mean discharge for the year or for the designated period.

ANNUAL SEVEN-DAY MINIMUM

The lowest mean discharge for 7 consecutive days for a calendar year or a water year. Most low-flow frequency analyses of annual 7-day minimum flows use a climatic year (April 1-March 31). The date shown in the summary statistics table is the initial date of the 7-day period.

INSTANTANEOUS PEAK FLOW

The maximum instantaneous discharge for the water year or for the designated period.

INSTANTANEOUS PEAK STAGE

The maximum instantaneous stage for the water year or for the designated period.

ANNUAL RUNOFF (AC-FT), (CFSM), (INCHES)

Indicates the total quantity of runoff for the drainage area upstream of the gage for the year.

10 PERCENT EXCEEDS

The discharge that has been exceeded 10 percent of the time for the designated period.

50 PERCENT EXCEEDS

The discharge that has been exceeded 50 percent of the time for the designated period.

90 PERCENT EXCEEDS

The discharge that has been exceeded 90 percent of the time for the designated period.

WATER YEAR (WY)

The 12-month period October 1 through September 30. The water year is designated by the calendar year in which it ends. Thus, the year ending September 30, 1995, is water year 1995.

3. FORMATS FOR CONTINUOUS RESERVOIR STORAGE, DAILY MAXIMUM FILES

rcxxxxx.rdb file -- The first three tab-delimited columns are the date with the year, month, and day separated by tabs. Dates are in ascending order for the period of available record. The fourth column is the daily maximum for that date, in acre-feet. Missing record is indicated by a negative value.

rcxxxxx.tbl file -- The 132-column table file comprises daily maximum values, in acre-feet for the given water year, followed by monthly totals and maximums, and calendar year and water year totals and monthly maximums.

Estimated daily maximum values are indicated by "e" preceding the value.
Missing record is indicated by ---.

4. FORMATS FOR CONTINUOUS RAINFALL, DAILY SUM FILES

rfxxxxx.rdb files -- The first three tab-delimited columns are the date with the year, month, and day separated by tabs. Dates are in ascending order for the period of available record. The fourth column is the daily total for that date, in inches. Missing record is indicated by a negative value.

rfxxxxx.tbl files -- The 132-column table file comprises daily sum values, in inches for the given water year, followed by monthly totals and water year totals. Estimated daily sum values are indicated by "e" preceding the value. Missing record is indicated by ---.

5. FORMATS FOR WATER-QUALITY DATA FILES

qpbxxxxx.rdb and qpsxxxxx.rdb files -- These tab-delimited files contain the following data columns: (Each row is a single sample set.)

STAID - Station identification number

DATES - Date sample was collected (format YYYYMMDD)

TIMES - Time (24-hour) sample was collected (format HHMM)

HSTAT - Hydrologic condition code (see list at end of section)

STORET CODE (U.S. Environmental Protection Agency 5-digit identifier for property or constituent) - Each code heads a column for 1 of 165 properties or constituents. STORET codes with descriptions are listed at the end of this section. Values of properties or constituents might be accompanied by a remark code (see list at end of section).

The station identification number, time, and STORET code are shown without leading zeros.

qpbxxxxx.tbl and qpsxxxxx.tbl files -- 132-column tables. The table header lists the station number, station name, and period of record available in the file. The tables list the date and time of samples, hydrologic condition and discharge when samples were obtained, and as many as 165 water-quality properties or constituents and STORET codes. Values of properties and constituents might be accompanied by a remark code.

Explanation of Hydrologic Condition Codes, Remark Codes, Units of Measure, and STORET Codes

Hydrologic condition codes:

4 - Stable, low stage	8 - Rising stage
9 - Stable, normal stage	7 - Peak stage
6 - Stable, high stage	5 - Falling stage

Remark codes:

> - Actual value known to be greater than value shown
< - Actual value known to be less than value shown
K - Results based on colony count outside the acceptance range
 (non-ideal colony count)
ND or U.00 - Constituent analyzed for but not detected
-- - No data (.tbl files); shown as blank in .rdb files

Units of measure:

US/CM - microsiemens per centimeter at 25 degrees Celsius
DEG C - degrees Celsius
NTU - nephelometric turbidity units
MG/L - milligrams per liter
UM - micrometers
COLS./100 ML - colonies per 100 milliliters
Dissolved - Pertains to the constituents in a representative water sample that pass through a 0.45-micrometer membrane filter or a 0.7-micrometer glass-fiber filter for organic analysis.
Total - Pertains to the constituents in a representative suspended sediment sample. This term is used only when the analytical procedure ensures measurement of at least 95 percent of the constituent in the sample.
T/DAY - tons per day
% - percent
MM - millimeters
UG/L - micrograms per liter
Whole water, recoverable (WHLREC) - Pertains to the constituent in solution after a representative suspended sediment sample is digested (usually using a dilute acid solution). Complete dissolution of the particulate matter often is not achieved by the digestion treatment, and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the dissolved and suspended phases of the sample.

STORET codes:

STORET Description
code

00061 DISCHARGE, INST., CUBIC FEET PER SECOND
00095 SPECIFIC CONDUCTANCE (US/CM)
00400 PH, WATER WHOLE FIELD (STANDARD UNITS)
00403 PH, WATER WHOLE LAB (STANDARD UNITS)
00010 TEMPERATURE, WATER (DEG C)
00080 COLOR (PLATINUM-COBALT UNITS)
00076 TURBIDITY (NTU)
00300 OXYGEN, DISSOLVED (MG/L)
00301 OXYGEN, DISSOLVED (PERCENT SATURATION)
00310 OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)
31625 COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)
31673 STREPTOCOCCI, FECAL, KF AGAR (COLS./100 ML)
00900 HARDNESS, TOTAL (MG/L AS CaCO3)

00904 HARDNESS, NONCARB DISSOLV FLD. AS CaCO_3 (MG/L)
00915 CALCIUM, DISSOLVED (MG/L AS CA)
00925 MAGNESIUM, DISSOLVED (MG/L AS MG)
00930 SODIUM, DISSOLVED (MG/L AS NA)
00931 SODIUM ADSORPTION RATIO
00932 SODIUM, PERCENT
00935 POTASSIUM, DISSOLVED (MG/L AS K)
39036 ALKALINITY, WAT DIS FIX END FIELD CaCO_3 (MG/L)
00945 SULFATE, DISSOLVED (MG/L AS SO_4)
00940 CHLORIDE, DISSOLVED (MG/L AS CL)
00950 FLUORIDE, DISSOLVED (MG/L AS F)
00955 SILICA, DISSOLVED (MG/L AS SiO_2)
70301 SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)
00530 RESIDUE, TOTAL AT 105 DEG C, SUSPENDED (MG/L)
00535 RESIDUE, VOLATILE, SUSPENDED (MG/L)
00540 RESIDUE, FIXED NONFILTERABLE (MG/L)
00620 NITROGEN, NITRATE TOTAL (MG/L AS N)
00618 NITROGEN, NITRATE DISSOLVED (MG/L AS N)
00615 NITROGEN, NITRITE TOTAL (MG/L AS N)
00613 NITROGEN, NITRITE DISSOLVED (MG/L AS N)
00630 NITROGEN, $\text{NO}_2 + \text{NO}_3$ TOTAL (MG/L AS N)
00631 NITROGEN, $\text{NO}_2 + \text{NO}_3$ DISSOLVED (MG/L AS N)
00610 NITROGEN, AMMONIA TOTAL (MG/L AS N)
00608 NITROGEN, AMMONIA DISSOLVED (MG/L AS N)
00605 NITROGEN, ORGANIC TOTAL (MG/L AS N)
00607 NITROGEN, ORGANIC DISSOLVED (MG/L AS N)
00623 NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N)
00625 NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)
00665 PHOSPHORUS, TOTAL (MG/L AS P)
00666 PHOSPHORUS, DISSOLVED (MG/L AS P)
00671 PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)
70507 PHOSPHORUS ORTHO, TOTAL (MG/L AS P)
00680 CARBON, ORGANIC TOTAL (MG/L AS C)
80154 SEDIMENT, SUSPENDED (MG/L)
80155 SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)
70331 SED., SUSP., SIEVE DIAM., % FINER THAN .062 MM
01106 ALUMINUM, DISSOLVED (UG/L AS AL)
01000 ARSENIC, DISSOLVED (UG/L AS AS)
01005 BARIUM, DISSOLVED (UG/L AS BA)
01010 BERYLLIUM, DISSOLVED (UG/L AS BE)
01020 BORON, DISSOLVED (UG/L AS B)
01025 CADMIUM, DISSOLVED (UG/L AS CD)
01030 CHROMIUM, DISSOLVED (UG/L AS CR)
01035 COBALT, DISSOLVED (UG/L AS CO)
01040 COPPER, DISSOLVED (UG/L AS CU)
01046 IRON, DISSOLVED (UG/L AS FE)
01049 LEAD, DISSOLVED (UG/L AS PB)
01130 LITHIUM, DISSOLVED (UG/L AS LI)
01056 MANGANESE, DISSOLVED (UG/L AS MN)
71890 MERCURY, DISSOLVED (UG/L AS HG)
01060 MOLYBDENUM, DISSOLVED (UG/L AS MO)
01065 NICKEL, DISSOLVED (UG/L AS NI)
01145 SELENIUM, DISSOLVED (UG/L AS SE)
01075 SILVER, DISSOLVED (UG/L AS AG)

01080 STRONTIUM, DISSOLVED (UG/L AS SR)
 01085 VANADIUM, DISSOLVED (UG/L AS V)
 01090 ZINC, DISSOLVED (UG/L AS ZN)
 30234 BROMACIL, WATER WHLREC (UG/L)
 30235 BUTACHLOR, WATER WHLREC (UG/L)
 30236 BUTYLATE, WATER WHLREC (UG/L)
 30245 CARBOXIN, WATER WHOLE RECOVERABLE (UG/L)
 30254 CYCLOATE, WATER WHOLE RECOVERABLE (UG/L)
 30255 DIPHENAMID, WATER WHOLE RECOVERABLE (UG/L)
 30264 HEXAZINONE, WATER WHOLE RECOVERABLE (UG/L)
 30295 PROPACHLOR, WATER WHOLE RECOV. (UG/L)
 30311 TERBACIL, WATER WHOLE RECOV. (UG/L)
 30324 VERNOLATE, WATER WHOLE RECOV. (UG/L)
 34030 BENZENE, TOTAL (UG/L)
 32104 BROMOFORM, TOTAL (UG/L)
 32102 CARBON TETRACHLORIDE, TOTAL (UG/L)
 34301 CHLOROBENZENE, TOTAL (UG/L)
 32105 CHLORODIBROMOMETHANE, TOTAL (UG/L)
 34311 CHLOROETHANE, TOTAL (UG/L)
 32106 CHLOROFORM, TOTAL (UG/L)
 34418 METHYLCHLORIDE, TOTAL (UG/L)
 34704 CIS-1,3-DICHLOROPROPENE, TOTAL (UG/L)
 32101 DICHLOROBROMOMETHANE, TOTAL (UG/L)
 34668 DICHLORODIFLUOROMETHANE, TOTAL (UG/L)
 34371 ETHYLBENZENE, TOTAL (UG/L)
 34413 METHYL BROMIDE, TOTAL (UG/L)
 34423 METHYLENE CHLORIDE, TOTAL (UG/L)
 77128 STYRENE, TOTAL (UG/L)
 34475 TETRACHLOROETHYLENE, TOTAL (UG/L)
 34010 TOLUENE, TOTAL (UG/L)
 34699 TRANS-1,3-DICHLOROPROPENE, TOTAL (UG/L)
 39030 TRIFLURALIN, TOTAL RECOVER (UG/L)
 39180 TRICHLOROETHYLENE, TOTAL (UG/L)
 34488 TRICHLOROFLUOROMETHANE, TOTAL (UG/L)
 39175 VINYL CHLORIDE, TOTAL (UG/L)
 34501 1,1-DICHLOROETHYLENE, TOTAL (UG/L)
 34496 1,1-DICHLOROETHANE, TOTAL (UG/L)
 34506 1,1,1-TRICHLOROETHANE, TOTAL (UG/L)
 34511 1,1,2-TRICHLOROETHANE, TOTAL (UG/L)
 34516 ETHANE, 1,1,2,2-TETRACHLORO, WAT UNF REC (UG/L)
 34536 1,2-DICHLOROBENZENE, WATER UNFLTRD REC (UG/L)
 32103 1,2-DICHLOROETHANE, TOTAL (UG/L)
 34541 1,2-DICHLOROPROPANE, TOTAL (UG/L)
 34566 BENZENE, 1,3-DICHLORO, WATER UNFLTRD REC (UG/L)
 34561 1,3-DICHLOROPROPENE, TOTAL (UG/L)
 34571 BENZENE, 1,4-DICHLORO, WATER UNFLTRD REC (UG/L)
 34546 1,2-TRANSDICHLOROETHENE, TOTAL (UG/L)
 34576 2-CHLOROETHYL VINYL ETHER, TOTAL (UG/L)
 81551 XYLENE, WATER UNFLTRD REC (UG/L)
 39516 PCB, TOTAL (UG/L)
 39250 PCNS, UNFILT RECOVER (UG/L)
 39330 ALDRIN, TOTAL (UG/L)
 82184 AMETRYNE, TOTAL (UG/L)
 39630 ATRAZINE, WATER UNFLTRD REC (UG/L)

39350 CHLORDANE, TECHNICAL TOTAL (UG/L)
81757 CYANAZINE, TOTAL (UG/L)
39360 P,P'-DDD, UNFILT RECOVER (UG/L)
39365 P,P'-DDE, TOTAL (UG/L)
39370 P,P'-DDT, UNFILT RECOVER (UG/L)
39570 DIAZINON, TOTAL (UG/L)
39380 DIELDRIN, TOTAL (UG/L)
39011 DISULFOTON, UNFILT RECOVER (UG/L)
39388 ENDOSULFAN I, TOTAL (UG/L)
39390 ENDRIN, WATER UNFLTRD REC (UG/L)
39398 ETHION, TOTAL (UG/L)
39410 HEPTACHLOR, TOTAL (UG/L)
39420 HEPTACHLOREPOXIDE, TOTAL (UG/L)
39340 LINDANE, TOTAL (UG/L)
39530 MALATHION, TOTAL (UG/L)
39051 METHOMYL, TOTAL (UG/L)
39480 METHOXYCHLOR, TOTAL (UG/L)
39600 METHYLPARATHION, TOTAL (UG/L)
39720 PICLORAM, UNFILT RECOVER (UG/L)
39790 METHYLTRITHION, TOTAL (UG/L)
39755 MIREX, TOTAL (UG/L)
39540 PARATHION, TOTAL (UG/L)
39034 PERTHANE, TOTAL (UG/L)
49231 ANILINE, 3,5-DINITRO, WAT, FLT GF 0.7U REC (UG/L)
39023 PHORATE, TOTAL (UG/L)
39056 PROMETONE, TOTAL (UG/L)
39057 PROMETRYNE, TOTAL (UG/L)
39024 PROPAZINE, TOTAL (UG/L)
39052 PROPHAM, TOTAL (UG/L)
39750 CARBARYL, UNFILT RECOVER (UG/L)
39760 SILVEX, TOTAL (UG/L)
39055 SIMAZINE, TOTAL (UG/L)
39054 SIMETRYNE, TOTAL (UG/L)
39400 TOXAPHENE, TOTAL (UG/L)
39786 TOTAL TRITHION (UG/L)
39730 2,4-D, TOTAL (UG/L)
82183 2,4-DP, TOTAL (UG/L)
39740 2,4,5-T, TOTAL (UG/L)
75980 DE-ISOPROPYLATRAZIN, WATER, WHOLE, TOTAL (UG/L)
75981 DEETHYL ATRAZINE, WATER, WHOLE, TOTAL (UG/L)
77825 ALACHLOR, TOTAL RECOVER (UG/L)
77651 1,2-DIBROMOETHANE, WATER WHOLE TOTAL (UG/L)
82052 DICAMBA, TOTAL (UG/L)
82611 METRIBUZIN, WATER WHOLE TOT. REC (UG/L)
82612 METOLACHLOR, WATER WHOLE TOT. REC (UG/L)