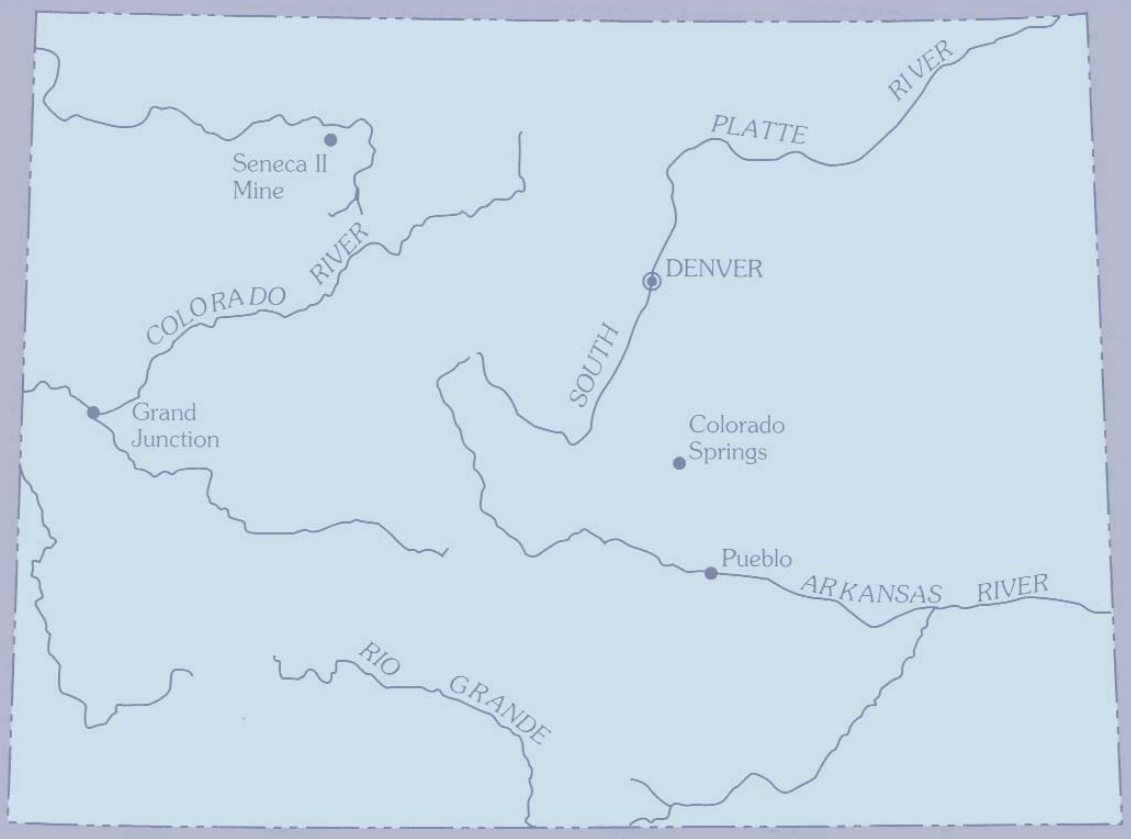
GEOMORPHIC, HYDROLOGIC AND EROSION DATA FOR SELECTED RECLAIMED HILLSLOPES, THE SENECA II MINE, ROUTT COUNTY, COLORADO, OCTOBER 1988 – JULY 1990

U.S. GEOLOGICAL SURVEY



Water-Resources Investigations Report 92-4096

Prepared in cooperation with the
COLORADO DEPARTMENT OF NATURAL RESOURCES
MINED LAND RECLAMATION DIVISION

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Denver, Colorado
1993

U.S. DEPARTMENT OF THE INTERIOR

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Multiply	By	To obtain
foot (ft)	0.3048	meter
foot per foot (ft/ft)	1.00	meter per meter
foot per 100 square feet (ft/100 ft^2)	3.281	meter per 100 square meters
inch (in.)	25.4	millimeter
square foot (ft^2)	0.09290	square meter
mile (mi)	1.609	kilometer

The following term and abbreviation also is used in this report:
millicurie (mCi)

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Sea Level Datum of 1929."

Geomorphic, Hydrologic, and Erosion Data for Selected Reclaimed Hillslopes, the Seneca II Mine, Routt County, Colorado, October 1988–July 1990

By John G. Elliott

Abstract

Geomorphic, hydrologic, and erosion data were collected from five reclaimed hillslopes in two study areas at the Seneca II mine near Hayden, Colorado. Hillslope surveys were used to determine hillslope lengths, which ranged from 670 to 1,280 feet, and hillslope gradients, which ranged from 0.17 to 0.23 foot per foot. Altitudes in the study areas ranged from 6,890 to 7,140 feet, and hillslope aspects generally were west or south. Mean total vegetation cover ranged from 74 to 91 percent. Total monthly precipitation for December 1988 through June 1990 was computed from daily measurements made with weighing-bucket precipitation gages. Several snowpack measurements were made during two winters. Volumetric soil-water content was determined at incremental depths using a neutron probe and in the upper 11.8 inches of soil using a time-domain reflectometer. Active and recent soil erosion was indicated by the presence of rills. Rill density (the sum of rill lengths per unit area) was computed at 50- to 100-foot intervals along survey transects at each hillslope study area. Differences in soil-surface altitudes between September or October 1989 and June 1990 were determined with an erosion frame and replicate soil-surface surveys at 16 erosion-study plots.

INTRODUCTION

Rill and sheet erosion of recently reclaimed hillslopes in surface-mined areas is a major cause of topsoil loss, poor revegetation success, excessive sediment production, and downstream water-quality degradation. Rill erosion occurs in small channels (generally less than 1 ft wide and 1 ft deep) where runoff is concentrated. Sheet erosion occurs over a broader, unchannelized area where runoff is dispersed. Surface-mining activities have increased the potential for soil erosion in some areas of the Rocky Mountain region. In northwestern Colorado, reclaimed areas have increased credibility because bedrock-controlled dip slopes have been mined and replaced with unconsolidated spoil slopes. Topsoil horizons have been homogenized and compacted by removal prior to mining, transportation to storage areas, and reapplication after mining. Premining native vegetation communities have been replaced by revegetated grasslands. The postmining geomorphology of these areas is partly a result of dragline and spoil-handling activities, and it may be substantially different from the premining geomorphology. Some of these changes also have increased the amount and rate of surface runoff from reclaimed hillslopes (Elliott, 1990).

Conventional soil-loss estimation techniques, such as the Universal Soil Loss Equation (Wischmeier and Smith, 1978) were developed for conditions different from those typical of large surface mines in the western United States. Many conventional soil-loss estimation techniques could be modified for use at reclaimed surface mines using empirical data collected at reclaimed surface mines.

A study was begun in 1988 to identify active hillslope-hydrologic processes on coal-spoil hillslopes and to identify relations between geomorphology, hillslope hydrology, and soil loss in reclaimed surface-mined areas. The study was a cooperative effort by the U.S. Geological Survey and the Colorado Department of Natural Resources, Mined Land Reclamation Division.

Purpose and Scope

This report presents geomorphic and hydrologic data that will be used to analyze hillslope hydrology and soil loss from a representative surface coal mine in northwestern Colorado. Data-collection methods also are presented. Data presented in this report were collected from two reclaimed hillslope areas at Peabody Coal Company's Seneca II mine near Hayden (fig. 1)

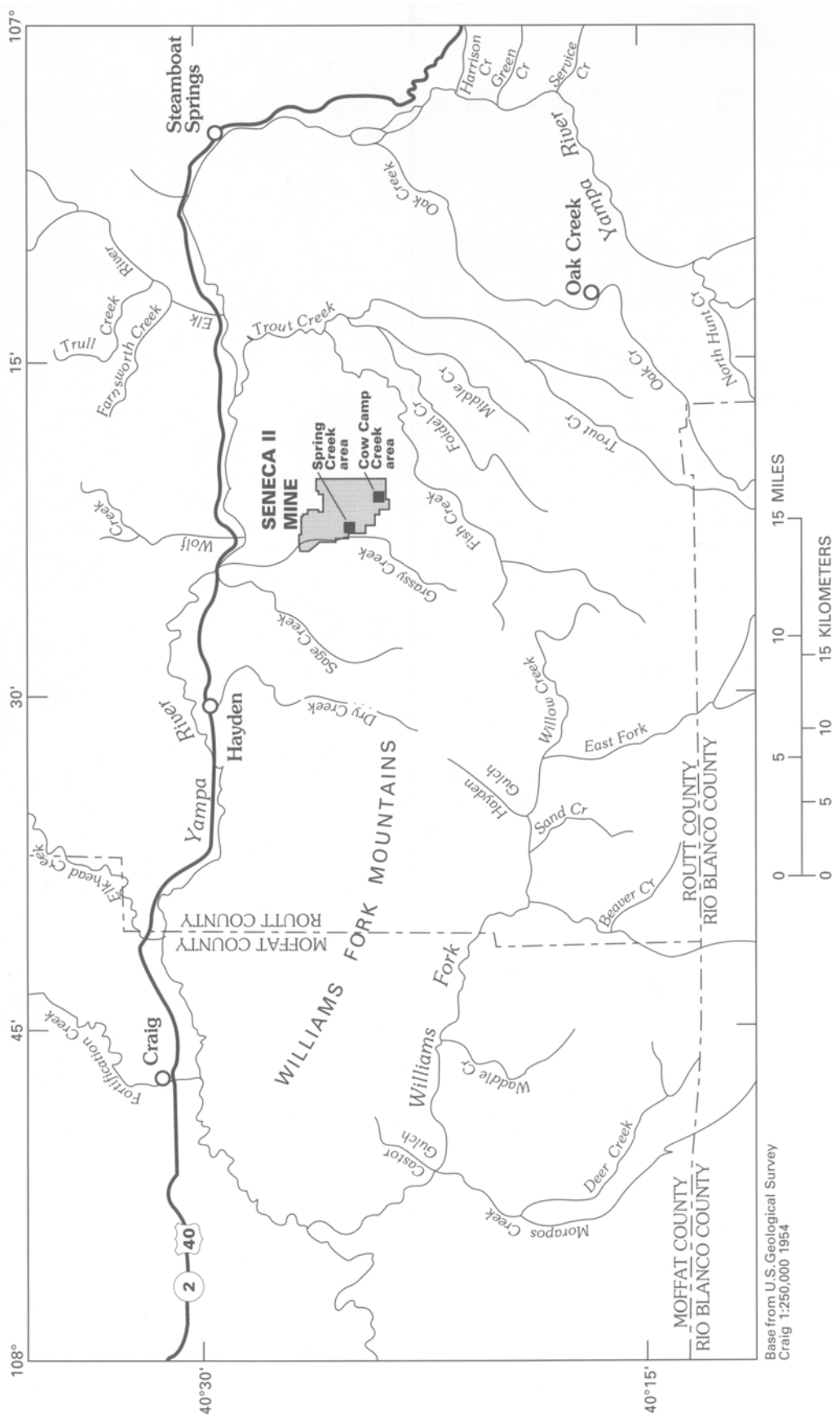

Figure 1. Location of Seneca II mine.

between October 1988 and July 1990. Climatologic and hydrologic data also were collected during a concurrent study at the Seneca II mine (Williams and others, 1993). Additional geomorphic data were collected at the Seneca II mine and at several other surface coal mines in the vicinity in an earlier study (Elliott, 1990).

Geomorphic data were collected from topographic maps and onsite surveys and are presented as hillslope profiles, hillslope lengths, hillslope gradients, rill densities, and soil-surface profiles. Vegetation data were collected with a 10-point vegetation sampling frame and are presented as percent vegetation cover. Precipitation data were collected with weighing-bucket precipitation gages and from snowpack samples. The precipitation data are presented as monthly totals; the snowpack data (depth, water content, and density) are presented as instantaneous values. Hydrologic data (volumetric soil-water content) were collected using neutron-scattering and electromagnetic techniques. Soil-water data are presented as instantaneous values by measurement depth.

Description of Study Area

The Seneca II mine is about 10 mi southeast of Hayden in Routt County. The Seneca II and other surface coal mines in the vicinity are extracting coal from folded and uplifted sedimentary rocks of the Cretaceous Williams Fork Formation. Altitudes at the Seneca II mine range from about 6,600 to 8,100 ft. The climate of the area is semiarid. Mean annual precipitation at Hayden (altitude 6,337 ft) is 16 in. (National Oceanic and Atmospheric Administration, 1982); a large percentage of annual precipitation is snow. Snowmelt is the primary source of streamflow in the area (Williams and Hammond, 1988, p. 7). Native vegetation is a mixture of grassland and mountain shrub, and the undisturbed soils are mostly loams, clay loams, and silt loams (Narten and others, 1983).

The premining topography of the Seneca II mine area was controlled by geologic structure. The mine is at the southern end of the Tow Creek anticline that plunges south-southwest (Tweto, 1976; Williams and Hammond, 1988). The postmining, or reclaimed, topography also reflects the anticlinal structure; reclaimed hillslopes have aspects that range from west, southwest, south, and southeast.

Data presented in this report were collected at two reclaimed areas. The Spring Creek area was reclaimed in 1986-87 and is in the western part of the mine (fig. 2). The Cow Camp Creek area was reclaimed in 1985 and is in the southern part of the mine (fig. 3).

Background

Recently reclaimed, surface-mined hillslopes often are areas of accelerated rill and sheet erosion. Topsoil-loss estimates from reclaimed hillslopes have been made with varying success using conventional soil-loss models developed in areas that have not undergone surface-mine reclamation. More accurate soil-loss estimates for reclaimed areas could be made with models specifically developed for the unique geomorphic, vegetational, hydrologic, and pedologic conditions at reclaimed surface mines. Several previous studies have addressed some of these conditions.

Hillslope rill erosion was studied at six surface coal mines in northwestern Colorado (Elliott, 1990). Data were collected from reclaimed surface-mined hill-slopes and from nearby unmined hillslopes with similar altitude, aspect, average gradient, and length. The reclaimed hillslopes had greater topsoil-bulk densities, lower topsoil-infiltration rates, and less woody vegetation than did the unmined hillslopes. Rill erosion was more common on the reclaimed hillslopes than on the unmined hillslopes. Rill erosion on reclaimed hill-slopes generally occurred on the mid-hillslope to lower hillslope segments and where hillslope segments had steep or convex profiles. Rill density (sum of the rill lengths per unit hillslope area) was positively correlated with the hillslope-length, hillslope-gradient product and was inversely correlated with the time since reclamation (Elliott, 1990, p. 30). However, in the previous study, topsoil loss was not quantified, nor were the hydrologic processes that caused rill and sheet erosion on reclaimed hillslopes investigated.

Surface mining and reclamation can dramatically alter local hydrologic conditions that, in turn, can affect erosion potential. Williams and Hammond (1988) noted differences between reclaimed hillslopes and unmined hillslopes in soil saturation and infiltration rates. In another study at the Seneca II mine, Clark and Williams (1990) used geochemical methods to document the relative contributions of ground water and surface water (precipitation) to a developing coal-spoil aquifer. Additional precipitation and soil-water data are presented in a report by Williams and others (1993).

Acknowledgments

The author is grateful to the Peabody Coal Company and to the staff of the Seneca II mine for their assistance and permission to conduct this study. Assistance in data collection was provided by Dave Berry, Colorado Department of Natural Resources, Mined

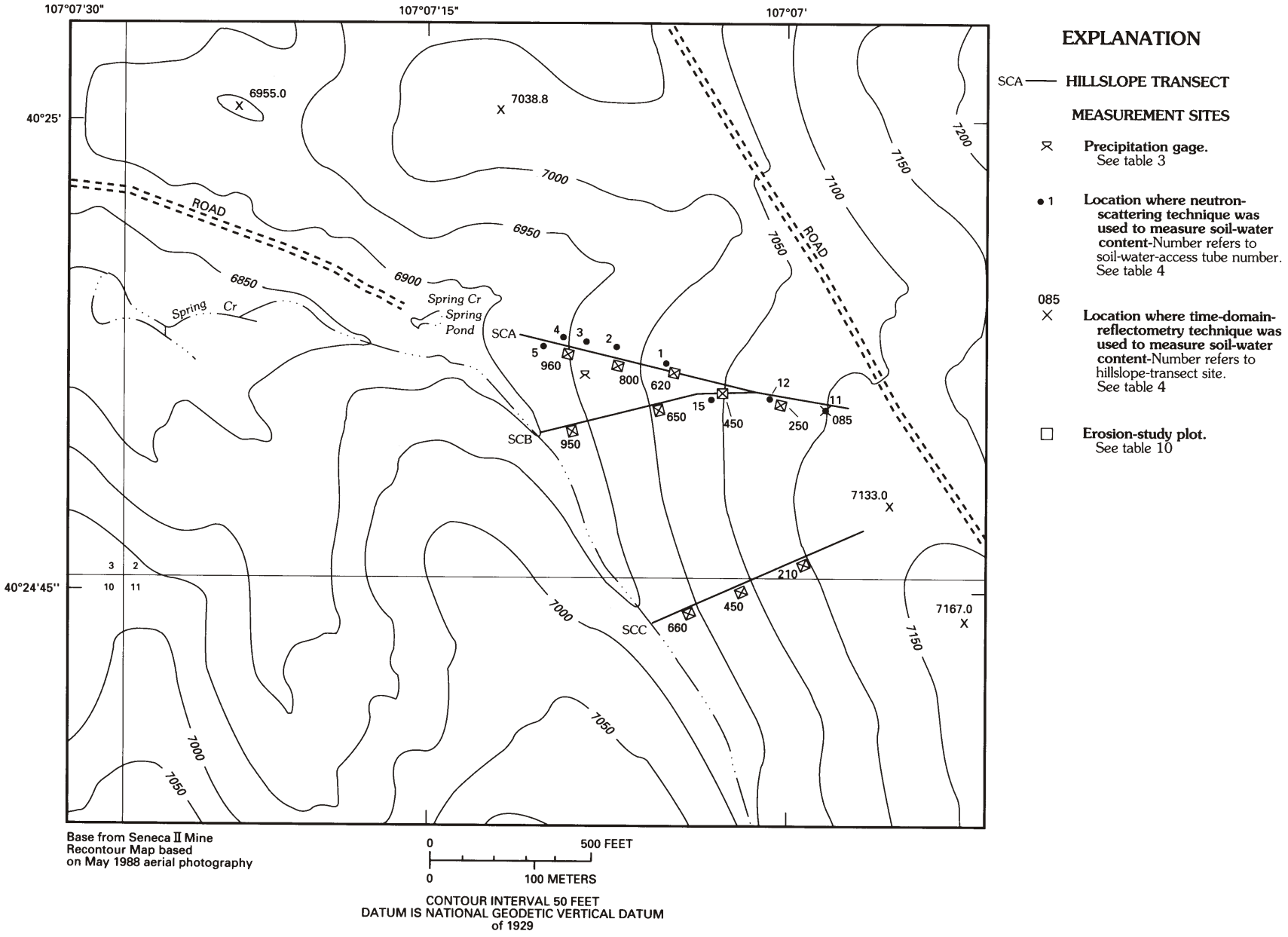

Figure 2. Data-collection sites at the Spring Creek area.

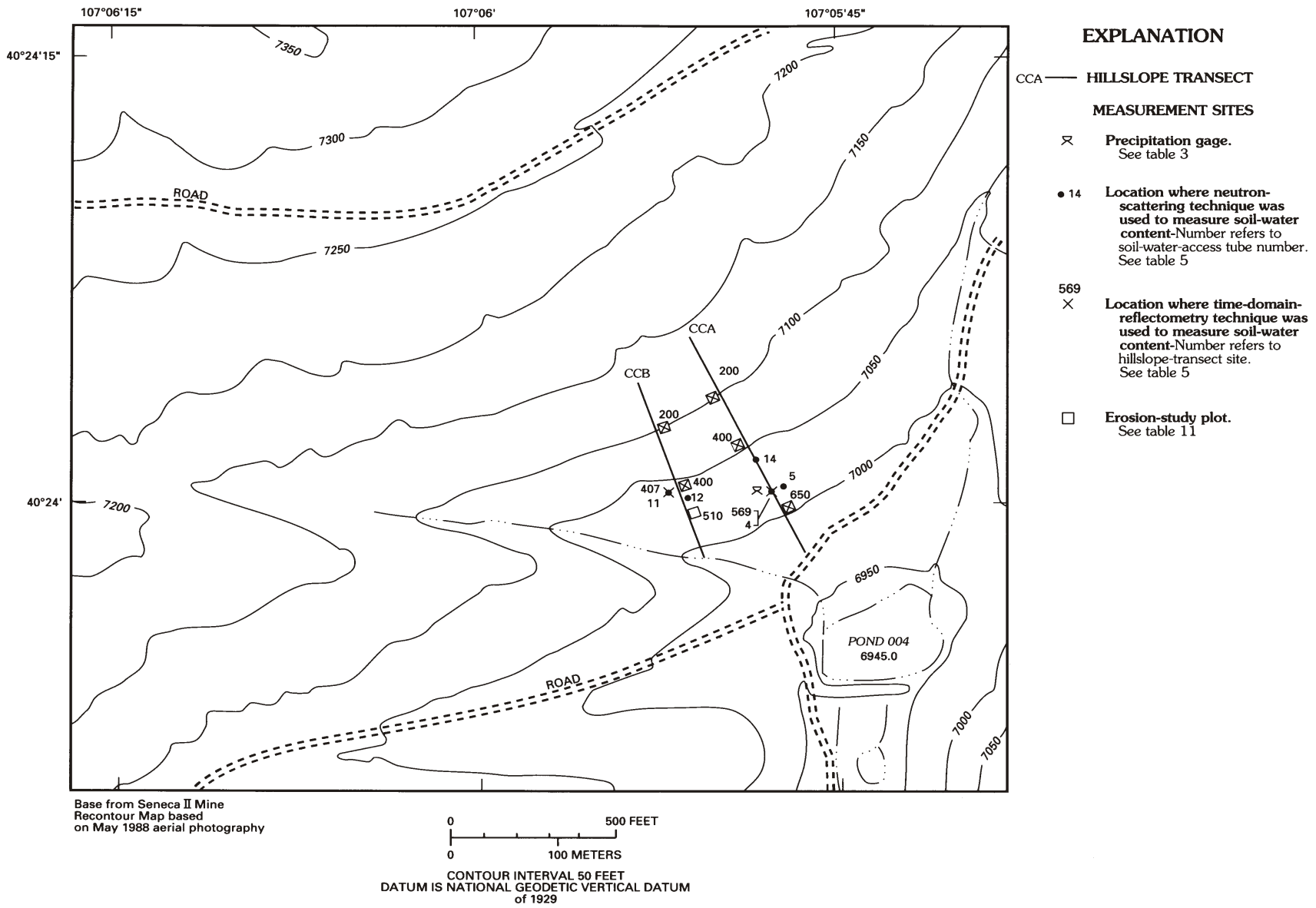

Figure 3. Data-collection sites at the Cow Camp Creek area.

Land Reclamation Division, and Marilyn K. Kastens, U.S. Bureau of Land Management.

DATA COLLECTION AND METHODOLOGY

Geomorphic, hydrologic, and erosion data were collected along three hillslope transects at the Spring Creek area (hillslope transects SCA, SCB, and SCC, fig. 2) and along two hillslope transects at the Cow Camp Creek area (hillslope transects CCA and CCB, fig. 3). Geomorphic data included aspect, hillslope length, altitude, hillslope gradient, and hillslope-profile characteristics. Hydrologic data included precipitation, snowpack depth, snowpack-water content, and soil-water content. Erosion data included rill density and soil-surface altitudes. Some additional data were collected including vegetation cover and onsite observations of soil texture and soil ice layers.

Geomorphology

Each reclaimed hillslope was surveyed from the local surface-runoff hydrologic divide to the hillslope toe with a Zeiss Ni2 self-leveling level. The surveys were made along a linear transect that generally followed the steepest line on the hillslope. Aspects of the hillslope transects were determined using a Brunton compass. Hillslope transects were plotted on Peabody Coal Company 1:4,800 scale maps with 10-ft contour intervals from which altitude ranges were determined. Hillslope length (slope distance) was determined with a tape measure. Hillslope gradient, horizontal distance, and profile characteristics were determined from the survey data. The hillslope transects were monumented with wooden survey stakes and iron rebar, and the transects served as references for additional data collection and other observations.

Hillslopes at the Spring Creek area generally had a westerly aspect and lengths between 750 and 1,280 ft (table 1). Hillslope transects SCB and SCC were on laterally straight hillslopes (straight contour lines) and transect SCA was on a laterally convex hillslope (contour lines convex in the downhill direction) (fig. 2). Because the hillslope morphology changed from laterally straight to laterally convex, transects SCA and SCB shared a common position for the upper 300 ft but were divergent on the mid-hillslope and lower hill-slope segments. Longitudinal hillslope profiles are shown in figures 4-6.

Altitudes ranged from about 6,890 to 7,125 ft along the transects at the Spring Creek area. Mean hill-slope gradients, determined as the ratio of altitude difference to horizontal distance of the hillslope, were between 0.17 and 0.23 ft/ft. Reclamation dates (year of topsoil replacement and seeding) were 1986 for hill-slope transect SCC and 1987 for most of transects SCA and SCB. The upper 300 ft of transects SCA and SCB was reclaimed in 1986.

Hillslopes at the Cow Camp Creek area generally had a southerly aspect and the lengths of transects CCA and CCB were 800 and 670 ft (table 1). Transect CCA was on a laterally straight hillslope. Transect CCB was on a hillslope that was laterally straight throughout the upper segment; but at the middle segment, transect CCB crossed a small, diagonal-trending, hollow-like

Table 1. General characteristics of the hillslope transects

Hillslope transect	Aspect (degrees)	Hillslope length (feet)	Altitude range (feet)	Mean Hillslope Gradient (foot per foot)	Date of reclamation	Mean total-vegetation cover, 1989 (percent)
			SPRING CREEK AREA			
SCA	284	1,280	7,105-6,890	0.17	[1]1987	76
SCB	256	1,020	7,105-6,900	0.20	[1]1987	74
SCC	246	750	7,125-6,955	0.23	1986	80
			COW CAMP CREEK AREA			
CCA	154	800	7,140-6,970	0.22	[2]1985	86
CCB	161	670	7,140-6,995	0.22	1985	91

[1]Upper 300 feet of hillslope was reclaimed in 1986.

[2]Lower 50 feet of hillslope was reseeded in 1988.

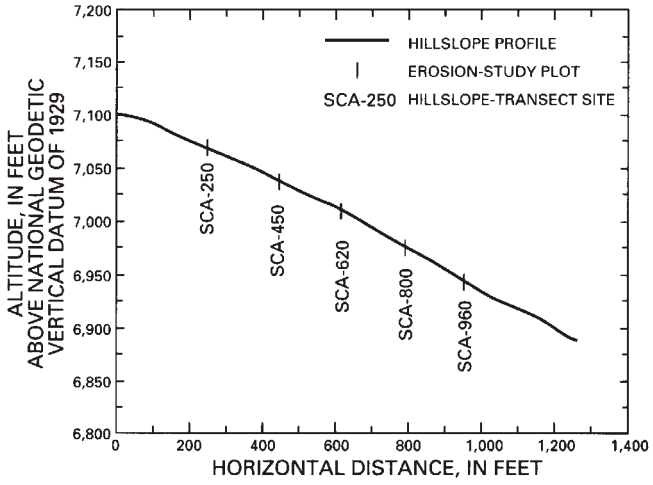

Figure 4. Longitudinal profile of hillslope transect SCA.

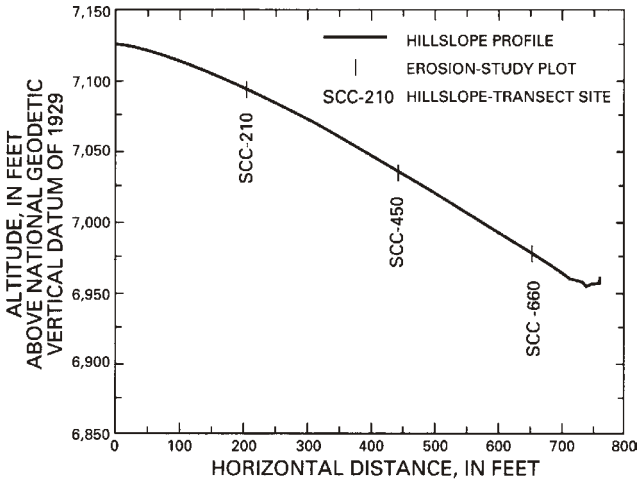

Figure 6. Longitudinal profile of hillslope transect SCC.

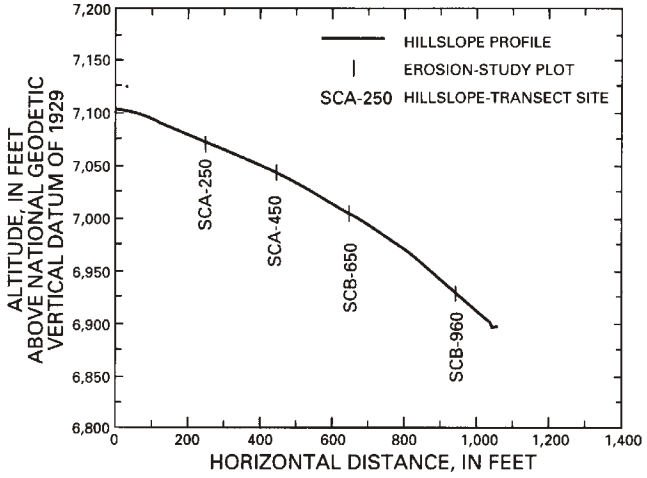

Figure 5. Longitudinal profile of hillslope transect SCB.

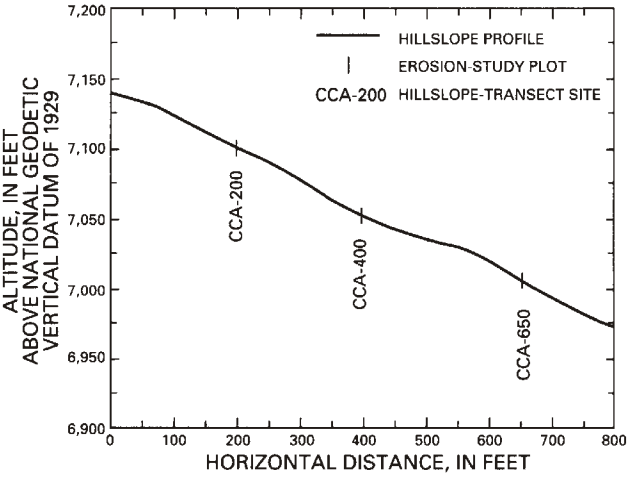

Figure 7. Longitudinal profile of hillslope transect CCA.

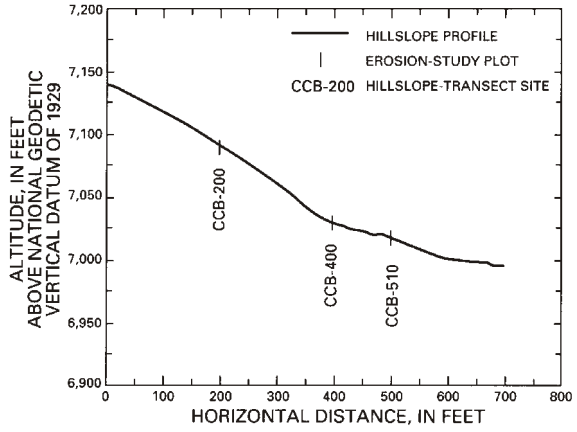

Figure 8. Longitudinal profile of hillslope transect CCB

Longitudinal hillslope profiles at the Cow Camp Creek area are shown in figures 7 and 8.

Altitudes ranged from about 6,970 to 7,140 ft along the transects at the Cow Camp Creek area, and mean hillslope gradients for both transects were 0.22 ft/ft. The reclamation date for transects CCA and CCB was 1985; however, the lower 50 ft of transect CCA was reseeded in 1988.

The surveys also were used to determine local hillslope gradients calculated for 50-ft increments of the hillslopes. Cumulative hillslope length and local hillslope gradient for transects SCA, SCB, SCC, CCA, and CCB are listed in table 2.

Vegetation

Reclaimed hillslopes were seeded with a mixture of native and introduced grass, forb, and shrub species soon after topsoil was applied to the regraded spoil material. At the Seneca II mine study areas, reseeding generally was done in late autumn. For this study, vegetation cover was determined using a 10-point vegetation sampling frame (Cook and Stubbendieck, 1986, p. 58-60). The 10-point frame was placed in three locations for each hillslope station along the transect (at the station, 10 ft uphill from the station, and 10 ft downhill from the station). A "vegetation" observation was recorded when the sampler pointer intercepted either the plant canopy, stem, or base. The local total-vegetation cover (sum of live vegetation and vegetation litter) was determined from the 30 point measurements near each station (table 2). The mean total-vegetation cover for each hillslope transect was the average of the local total-vegetation-cover measurements (table 1). The vegetation cover on reclaimed hillslopes was predominantly grasses and forbs, but no species distinctions were made onsite.

Vegetation measurements were made at the Seneca II mine in August 1989. The age of a reclaimed vegetation community was determined by the number of elapsed growing seasons since the hillslope was reclaimed. For example, hillslope SCC was reclaimed in 1986 (table 1); therefore, the vegetation community was 3 years old when it was measured in August 1989.

Precipitation

Total precipitation (rain and snow) was measured at the Spring Creek and Cow Camp Creek areas with weighing-bucket precipitation gages. The precipitation gages operated continuously and provided daily precipitation data for the duration of the study. Total monthly precipitation data for December 1988 through June 1990 are listed in table 3. The precipitation gages at the Spring Creek and Cow Camp Creek areas are at about the same altitude (figs. 2 and 3) and are about 1.6 mi apart. Monthly and site-to-site precipitation variability is shown in figures 9-11.

Snowpack

Snow courses were established along all hillslope transects for snowpack-depth, -density, and -water-content measurements. Snowpack measurements were made at 50- to 100-ft intervals along each transect and at sites where soil-water-content measurements were made using neutron-probe and time-domain reflectometry techniques. Snowpack-depth, -density, and -water-content measurements were made with standard U.S. Soil Conservation Service equipment and procedures (U.S. Soil Conservation Service, 1984). Density and water content were determined from bulk (composite) samples when the snowpack was thin or patchy. When density and water content were not measured, snowpack depth was measured with a ruler. To decrease variance from ground-surface and snow-surface irregularities, the average of three closely spaced ruler measurements was used to determine snowpack depth at each snow-course site.

Snowpack data from the Spring Creek and Cow Camp Creek areas are listed in tables 4 and 5 in the "Hydrologic Data" section at the back of this report. Snowpack depths varied seasonally, along a transect, and between the two study areas. Some snowpack

Table 2. Geomorphology, rill density, and vegetation cover of selected reclaimed hillslopes

[Rill densities are the sum of rill lengths per 100 square feet of hillslope area; --, no data]

Cumulative hillslope length (feet)	Local hillslope gradient (foot per foot)	Rill density, 1989 (feet per 100 square feet)			Local total-vegetation cover, 1989 (percent)
		Healing	Active	Total	
SPRING CREEK AREA, HILLSLOPE TRANSECT SCA					
0	--	0.00	0.00	0.00	43
50	0.05	0.00	0.00	0.00	87
100	0.12	0.52	0.52	1.04	60
150	0.16	0.00	0.00	0.00	87
200	0.15	0.00	0.00	0.00	--
250	0.15	0.00	0.00	0.00	93
300	0.14	0.00	0.00	0.00	--
350	0.15	3.01	0.00	3.01	97
400	0.14	2.04	0.00	2.04	--
450	0.20	0.91	1.09	2.00	100
500	0.18	2.04	1.25	3.29	--
550	0.16	3.33	2.87	6.20	53
600	0.16	1.72	5.47	7.19	--
650	0.15	2.48	4.54	7.02	67
700	0.22	1.01	2.36	3.37	83
750	0.22	7.82	0.00	7.82	--
800	0.18	6.32	0.00	6.32	93
850	0.19	4.47	0.56	5.03	--
900	0.19	10.90	2.00	12.90	63
950	0.20	10.27	3.61	13.88	--
1,000	0.23	7.65	4.71	12.36	70
1,050	0.19	10.88	2.06	12.94	--
1,100	0.17	6.90	0.00	6.90	73
1,150	0.16	2.52	7.90	10.42	--
1,200	0.16	6.04	3.11	9.15	73
SPRING CREEK AREA, HILLSLOPE TRANSECT SCB					
[1]0-300					
350	0.14	3.01	0.00	3.01	97
450	0.20	3.87	0.00	3.87	97
550	0.16	12.99	2.02	15.01	50
650	0.20	14.02	10.50	24.52	60
750	0.22	12.80	7.69	20.49	57
850	0.27	9.23	8.95	18.18	70
950	0.31	13.03	10.74	23.77	87

Table 2. Geomorphology, rill density, and vegetation cover of selected reclaimed hillslopes-Continued

Cumulative hillslope length (feet)	Local hillslope gradient (foot per foot)	Rill density, 1989 (feet per 100 square feet)			Local total-vegetation cover, 1989 (percent)
		Healing	Active	Total	
		SPRING CREEK AREA, HILLSLOPE TRANSECT SCC			
0	--	0.00	0.00	0.00	97
100	0.17	0.00	0.00	0.00	93
200	0.19	3.05	0.00	3.05	67
300	0.24	2.25	0.74	2.99	80
400	0.26	0.98	0.00	0.98	60
450	0.26	4.51	0.00	4.51	80
500	0.29	1.37	1.03	2.40	87
600	0.29	1.04	1.57	2.61	83
650	0.30	1.51	0.00	1.51	87
700	0.30	2.04	4.70	6.74	67
		COW CAMP CREEK AREA, HILLSLOPE TRANSECT CCA			
0	--	0.00	0.00	0.00	93
100	0.24	0.40	0.00	0.40	93
200	0.22	0.00	0.00	0.00	90
300	0.25	0.27	0.00	0.27	90
400	0.24	2.57	0.00	2.57	97
450	0.19	0.00	0.00	0.00	87
500	0.15	1.13	0.00	1.13	93
600	0.21	0.96	0.46	1.42	77
650	0.26	2.39	1.02	3.41	73
700	0.28	0.61	1.00	1.61	90
800	0.20	0.00	1.25	1.25	[2]65
		COW CAMP CREEK AREA, HILLSLOPE TRANSECT CCB			
0	--	0.00	0.00	0.00	90
100	0.22	0.00	0.00	0.00	90
200	0.28	0.84	0.83	1.67	93
300	0.34	0.92	0.00	0.92	93
400	0.32	1.28	0.00	1.28	97
450	0.13	1.27	0.00	1.27	90
500	0.17	3.14	1.11	4.25	83
600	0.20	1.84	1.01	2.85	93

[1]Upper 300 feet of hillslope transect SCB is same as upper 300 feet of hillslope transect SCA.
[2]Lower 50 feet of hillslope was reseeded in 1988.

Table 3. Total monthly precipitation at the Spring Creek and Cow Camp Creek areas

[--, no data]

Water year	Total monthly precipitation (inches)											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
SPRING CREEK AREA, PRECIPITATION GAGE 2												
1988	--	--	2.15	2.84	0.73	1.17	0.54	1.43	2.36	0.12	0.99	2.19
1989	0.07	2.01	1.18	0.90	2.40	0.93	0.27	1.14	0.50	1.56	1.02	1.25
1990	0.82	0.98	1.73	0.59	1.41	1.49	1.14	1.03	1.22	--	--	--
COW CAMP CREEK AREA, PRECIPITATION GAGE 1												
1988	--	--	2.89	3.64	1.09	2.07	1.17	2.04	1.64	0.31	1.15	2.03
1989	0.08	2.30	1.98	1.40	2.95	1.79	0.35	1.27	0.71	1.48	1.08	1.31
1990	0.96	1.79	2.57	1.25	1.83	1.81	1.35	1.28	1.15	--	--	--

variability was due to different precipitation amounts at the Spring Creek and Cow Camp Creek areas (figs. 9-11), eolian transport, and partial melting. Snowpack-depth variability at two hillslope transects is shown in figures 12 and 13.

Additional observations were made during snow-course measurements. Soil beneath the snow-pack usually was thawed and damp or wet if the snow-pack was thicker than about 6 in., even when the air temperature was below freezing. Conversely, the soil beneath a thin snowpack was frozen when the air temperature was below freezing. Diurnal melting and runoff often were observed during mid-winter.

Soil Water

Soil-water content at the study site is affected by precipitation, snowpack-water content, topsoil and spoil texture, clay mineralogy, evapotranspiration, and antecedent conditions. Volumetric soil-water content was determined at several locations on the reclaimed hillslopes using a neutron-scattering technique and an electromagnetic technique. Soil-water content was measured at 1-ft-depth increments in the topsoil and underlying coal spoil using a neutron-emitting CPN 503 Hydroprobe. Soil-water content was measured in the upper 11.8 in. Of topsoil using a Tektronix 1502-04 time domain reflectometer. McKin and others (1980) neutron-scattering, electromagnetic, and other soil-water-measurement techniques.

The neutron-scattering technique (neutron probe) for measuring soil-water content is based on the thermalization (energy loss) of neutrons by collision with hydrogen atoms (McKim and others, 1980). Fast neutrons emitted by the Hydroprobe's 50-mCi Americium-241/Beryllium source are converted to slow neutrons following collisions with hydrogen atoms in the surrounding soil. The instrument determines the amount of hydrogen present from the number of slow neutrons detected and, assuming all hydrogen is in water molecules, calculates the amount of water in the surrounding soil. Water in the liquid, solid, or vapor phases is detected by the neutron-scattering technique. Hydrocarbons (coal fragments and other organic matter) in the soil can introduce error if they are present in sufficient quantities; however, it was assumed that hydrocarbon content was negligible at the measurement sites. Williams and Hammond (1988) discuss calibration and use of the neutron probe in coal spoil.

Soil-water-content measurements using the neutron-scattering technique were made in 2-in-diameter aluminum soil-water access tubes (SWAT's) inserted into 4- to 9-ft-deep auger holes. Soil-water-content measurements were made at eight SWAT's at the Spring Creek area (fig. 2) and five SWAT's at the Cow Camp Creek area (fig. 3). SWAT's were installed on a variety of geomorphic surfaces, but some SWAT locations were partly determined by the logistics of handling the

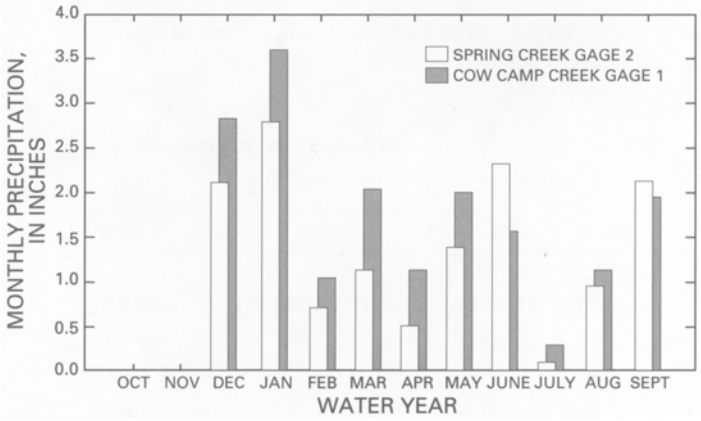

Figure 9. Monthly precipitation at the Spring Creek and Cow Camp Creek areas, water year 1988.

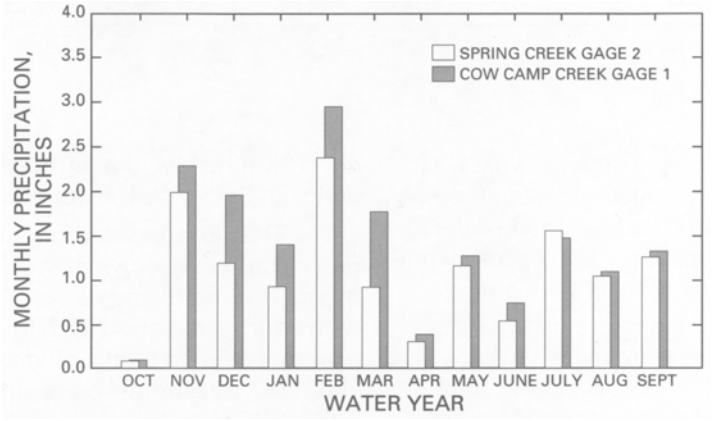

Figure 10. Monthly precipitation at the Spring Creek and Cow Camp Creek areas, water year 1989.

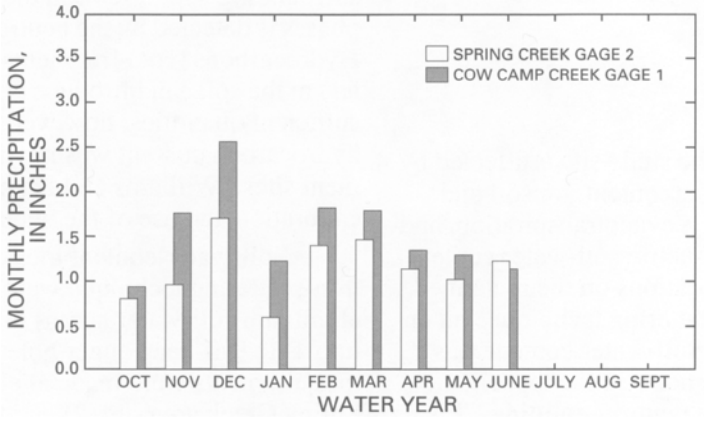

Figure 11. Monthly precipitation at the Spring Creek and Cow Camp Creek areas, water year 1990.

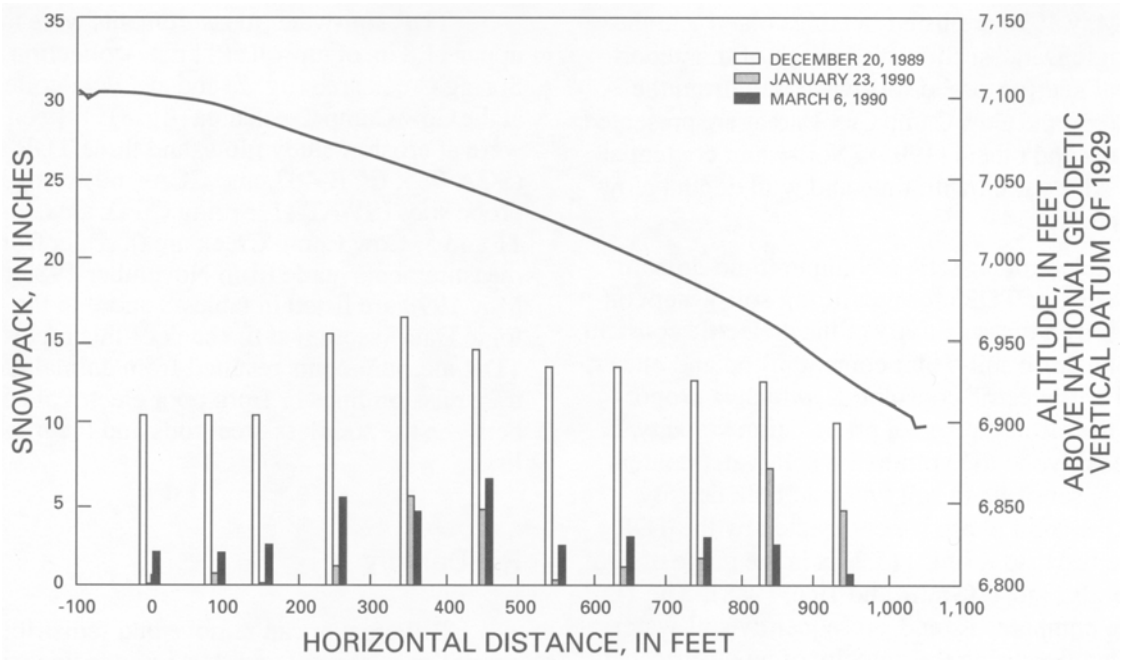

Figure 12. Snowpack depths along hillslope transect SCB, water year 1990.

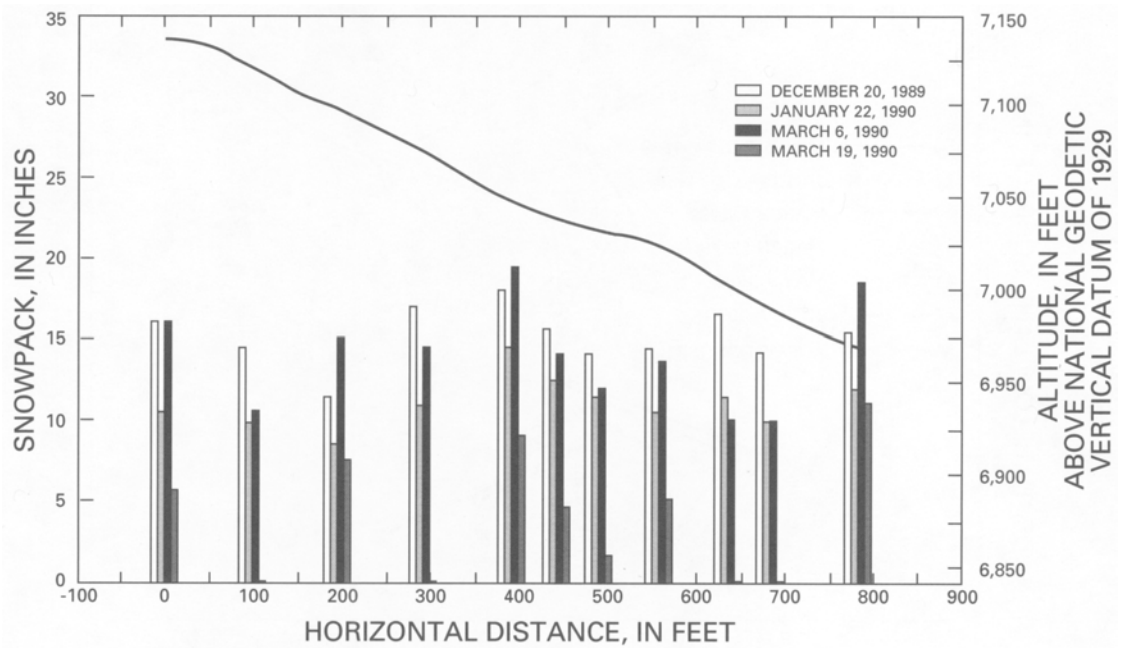

Figure 13. Snowpack depths along hillslope transect CCA, water year 1990.

trailer-mounted auger. Data from neutron-probe measurements made from November 1988 through May 1990 are listed in tables 6 and 7 in the "Hydrologic Data" section at the back of this report. Additional neutron-probe soil-water data from the Spring Creek and Cow Camp Creek areas are presented in Williams and others (1993). Soil-water content at most SWAT's varied with time and with depth below the surface (fig. 14).

The electromagnetic technique (time-domain reflectometry, or TDR) for measuring soil-water content is based on the sensitivity of the dielectric constant to the volumetric soil-water content (Topp and others, 1980). The dielectric constant, K, which is proportional to the electrical signal propagation velocity, is highly sensitive to the volumetric soil-water content but weakly sensitive to soil type and bulk density. Water in the solid phase is not detected by the TDR technique because K of ice (3.2) is in the range of K of soil minerals (3 to 4) (Smith and Tice, 1988). The TDR technique computes K, and subsequently soil-water content, by measuring the velocity of an electrical signal in a transmission line of known length. The TDR transmission lines over which K was measured were two parallel, 0.118-in-diameter stainless-steel rods inserted vertically into the topsoil. The rods were 11.8 in. long and were spaced 1.18 in. apart (W.N. Herkelrath, U.S. Geological Survey, oral commun., 1989). TDR soil-water measurements were made in the upper 11.8 in. of topsoil at 11 data-collection sites at the Spring Creek area (fig. 2) and at 7 data-collection sites at the Cow Camp Creek area (fig. 3). Fifteen TDR sites were at erosion-study plots, and three TDR sites (SCA-085, CCB-407, and CCA-569) were at neutron-probe sites (SWAT 11, Spring Creek area, and SWAT's 11 and 5, Cow Camp Creek area). Data from TDR measurements made from November 1989 through May 1990 are listed in tables 8 and 9 in the "Hydrologic Data" section at the back of this report. Missing TDR measurements resulted from animal damage to transmission lines or from poor electrical contacts between the stainless-steel rods and the transmission lines.

Rill Density

Rill erosion can remove and redistribute large quantities of topsoil and thus impede vegetation growth. Rills are small (generally less than 1 ft wide and 1 ft deep) parallel or bifurcating erosion channels. The occurrence of rills might be an indicator of the erosion history or erosion potential of a hillslope.

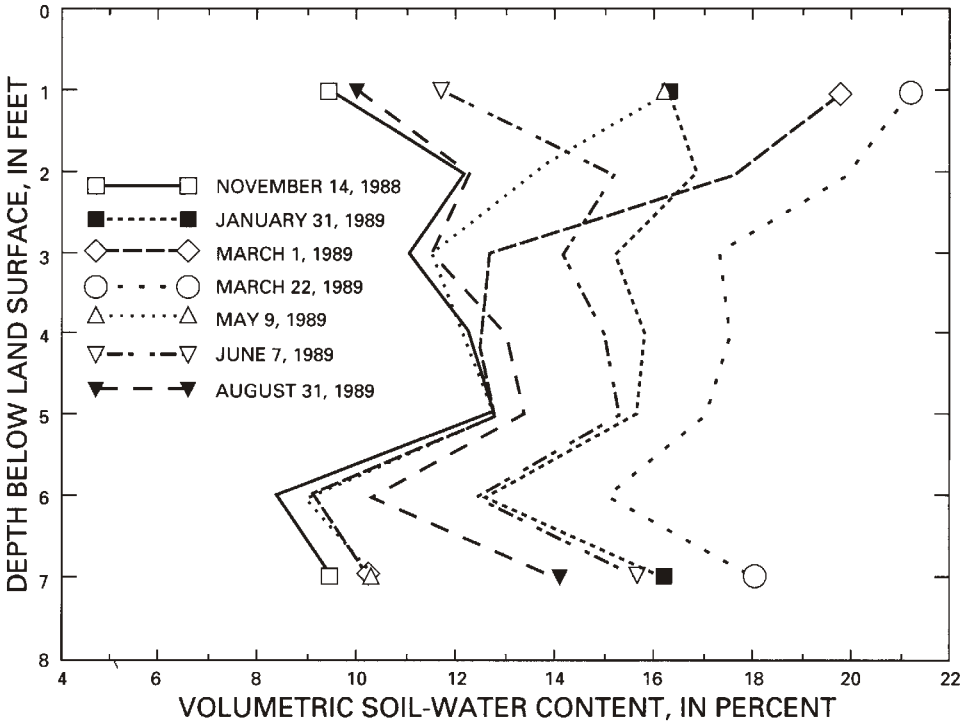

Figure 14. Variation in soil-water content with time and depth, soil-water access tube 14, hillslope transect CCA

Rills on the five reclaimed hillslopes were identified and mapped onsite in August 1989. Two types of rills were observedhealing and active. Healing rills formerly were the source of eroded topsoil; however, at the time of the study, healing rills were inactive sediment sources, and their channels were indistinct. Healing rills had subtle, smoothed channels, often were discontinuous after several feet, and usually had some vegetation growing in the rill. Active rills were the source of eroded topsoil when surface runoff was generated. Active rills had pronounced angular channels, often were continuous for several tens of feet, and usually had no vegetation growing in the rill.

Rill occurrence was quantified in 10- by 100-ft rectangular traverse areas located at 50-ft intervals along each hillslope transect. The traverse areas were oriented so that the long dimension was across (traverse to) the hillslope and the short axis was oriented down the hillslope. Individual rill lengths were measured, and the sum of all rill lengths was determined in each traverse area. The sum of all rill lengths (feet) divided by the traverse area (1,000 ft^2) determined the rill density (feet per 100 square feet) for a specific hillslope interval (table 2). Rill densities were determined for healing and active rills as well as for total rills (the sum of healing and active rill lengths).

Soil-Surface Surveys

Measurement of soil-surface altitude changes over a known time interval can provide a means to estimate soil loss where the actual eroded material cannot be collected (as in a flume). Several methods have been used to measure soil-surface altitude changes and, subsequently, to quantify soil loss. The erosion-pin method involves repeated measurements of the exposed length of an erosion pin permanently placed in the soil (Hadley and Lusby, 1967; Collins and Dunne, 1986). The principal disadvantages of the erosion-pin method are that the pin disturbs the soil when it is installed, and the pin influences the path and velocity of runoff near it.

Toy (1983, 1989) developed the linear erosion/ altitude measuring instrument (LEMI) method to avoid erosion-pin disturbance of the soil and runoff. The LEMI method involves measurements of the distance to the soil surface from a fixed point above undisturbed soil. A disadvantage of the LEMI method is that only one or two points usually are measured in a specific area.

Repeated soil-surface surveys made with a transit or level can be used to measure soil-surface altitude changes. However, transit surveys may not be accurate enough to detect small changes resulting from a single runoff event or an entire runoff season (Hadley, 1977). Inaccuracy results from surveyed points that may be spaced too far apart to define microtopographic detail or from optical limitations that are exaggerated when the distance between the instrument and rod is large. Another source of inaccuracy results from using a survey rod having a diameter wider than microtopographic landforms.

The erosion-frame method was developed to overcome some of the disadvantages of the erosion-pin, LEMI, and transit-survey methods. The erosion-frame method involves repeated soil-surface surveys in a monumented study plot with a transit and a modified survey rod. For this study, a 10- by 10-ft portable metal frame was assembled on each erosion-study plot where soil-surface altitude changes were measured. Each corner of the erosion frame was monumented and anchored with a section of rebar driven about 18 in. into the ground. Near each erosion-study plot, a fifth rebar section was driven about 30 in. into the ground and served as a vertical control for subsequent resur-veys. It was assumed that the fifth rebar section would not be affected by frost heave. The position and altitude of the fifth rebar section was referenced to fixed monuments (a powerline tower pad and a rock outcrop) on unmined land several hundred feet away. Five bolts at 2-ft intervals were placed along two opposite sides of the erosion frame. The paired bolts were anchor points for a surveyor's tape measure attached on opposite sides of the frame. A 2- by 10-in. board gangplank was placed across and above the erosion frame to prevent trampling in the erosion-study plot during surveying.

Soil-surface surveys were made along five traverses of each erosion-study plot. Soil-surface profiles were plotted from altitudes determined with a Zeiss Ni2 self-leveling level at 0.2-ft intervals along each of the five 10-ft traverses. The instrument was set up within about 30 ft of the erosion frame to minimize reading errors. A reinforced carpenter's scale with 0.01-ft graduations was used as the survey rod. The carpenter's scale had a very small cross-sectional area (0.15 by 0.6 in.), which permitted precise placement on microtopographic features. The reinforced carpenter's scale was light weight, which minimized damage to the soil surface. A total of 250 soil-surface altitudes, 50 per traverse, were determined for each soil-surface survey in the 100-ft erosion-study plot.

The initial soil-surface surveys were made at 16 erosion-study plots in September and October 1989. A second set of soil-surface surveys was made at each erosion-study plot in June 1990. Data from the soil-surface surveys are listed in tables 10 and 11 in the "Hydrologic Data" section at the back of the report. Soil-surface profiles from one erosion-study plot are shown in figure 15. The plotted profile orientation

is as if viewed looking toward the hillslope. The net soil-surface altitude change for each point (station) along an erosion-study plot traverse was the difference between the September or October 1989 altitude and the June 1990 altitude.

SUMMARY

Geomorphic, hydrologic, and erosion data were collected from five reclaimed hillslopes at the Seneca II mine near Hayden. Data presented in this report were collected during an investigation of hillslope-hydro-logic processes and soil loss at a representative reclaimed surface coal mine in northwestern Colorado. The Seneca II mine is producing coal from Cretaceous sedimentary rocks of the Williams Fork Formation. The climate of the region is semiarid, and a large amount of the 16-in. mean annual precipitation is snow.

Data were collected at two areas of the mine the Spring Creek area, reclaimed in 1986 and 1987, and the Cow Camp Creek area, reclaimed in 1985. The geomorphology of the reclaimed hillslopes was determined from surveys made onsite and from topographic maps. Cumulative hillslope lengths and local hillslope gradients were determined at 50- to 100-ft intervals along five surveyed hillslope transects. Aspect of the three Spring Creek area hillslopes was generally west and the altitude range of the hillslope transects was 6,890 to 7,125 ft. Hillslope lengths at the Spring Creek area were between 750 and 1,280 ft, and the mean hill-slope gradient was between 0.17 and 0.23 ft/ft. Aspect of *the* two Cow Camp Creek area hillslopes was generally south and the altitude range was about 6,970 to 7,140 ft. Hillslope lengths at the Cow Camp Creek area were 670 and 800 ft, and the mean hillslope gradient for both hillslopes was 0.22 ft/ft.

Vegetation cover was determined at 50- to 100-ft intervals along the hillslope transects with a 10-point vegetation sampling frame. Vegetation on

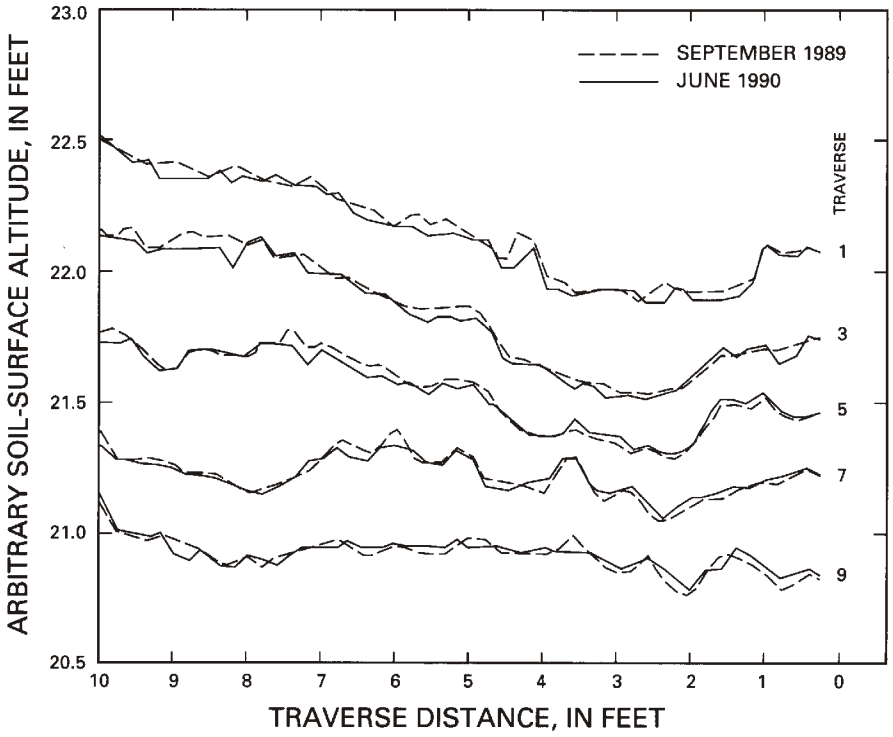

Figure 15. Soil-surface profiles from erosion-study plot SCA-620.

the reclaimed hillslopes predominantly was grasses and forbs. Mean vegetation covers (live vegetation litter) for the three Spring Creek area hillslopes ranged from 74 to 80 percent, and mean vegetation covers for the two Cow Camp Creek area hillslopes were 86 and 91 percent.

Total precipitation (rain and snow) data were collected daily at the Spring Creek and Cow Camp Creek areas with weighing-bucket precipitation gages. Total monthly precipitation, computed for December 1988 through June 1990, varied monthly, annually, and between the two study areas. Snowpack measurements were made at selected locations in water year 1989, and at 50- to 100-ft intervals along all hillslope transects in water year 1990. Snowpack depths varied seasonally, along a transect, and between the two study areas.

Volumetric soil-water contents were determined at several hillslope locations using two techniques. A neutron probe measured soil-water content at 1-ft depth intervals in 13 soil-water access tubes at the Spring Creek and Cow Camp Creek areas. Neutron-probe measurements were made approximately monthly from November 1988 through May 1990. Soil-water content in most of the soil-water access tubes varied with time and with depth below the surface. Additional soil-water measurements were made in the upper 11.8 in. of topsoil with a TDR. TDR measurements were made approximately monthly from November 1989 through May 1990 at 18 locations at the Spring Creek and Cow Camp Creek areas.

The occurrence of rills on reclaimed hillslopes may indicate active or recent soil loss. Rills along the five reclaimed hillslope transects were identified and mapped in August 1989. Rill density (the sum of all rill lengths per unit area) was computed for 10- by 100-ft traverse areas located at 50-ft intervals along each hillslope transect. Soil-surface altitude changes at selected erosion-study plots can be used to quantify soil loss by rill and sheet erosion. The erosion-frame method was developed to detect small soil-surface changes onsite. This method uses a 10- by 10-ft portable metal reference frame and involves replicate surveys of microtopographic features in several erosion-study plots. The erosion-frame method avoids some of the disadvantages of other methods used to measure erosion onsite. Soil-surface altitudes were determined at 16 erosion-study plots in September and October 1989. A second set of soil-surface surveys was made at these erosion-study plots in June 1990.

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HYDROLOGIC DATA

Table 4. Snowpack measurements, Spring Creek area

[Depth and snowpack-water content rounded to nearest 0.5 inch; -, no measurement; U, unfrozen soil; F, frozen soil; N, soil-water-content measurements also made at site--for example, Nil is representative of neutron-scattering technique and the soil-water-access tube number, and T is time-domain-reflectometry technique; B, bulk snow sample; W, wet soil (visible water in soil); M, moist soil, adheres to snow tube or rule]

Hillslope-transect site	Depth (inches)	Snowpack-water content (inches)	Density (percent)	Remarks
MEASUREMENT DATE: 01-30-89				
SCA-085	0.0	--	--	U (1 inch) over F; Nil
SCA-255	0.0	--	--	U (2 inch) over F; N12
SCA-452	4.5	2.0	39	B, F, N15
SCA-627	5.0	2.0	36	B, N1
SCA-805	3.5	1.5	36	B, N2
SCA-898	4.5	2.0	36	B, N3
SCA-970	5.5	2.0	36	B, N4
SCA-1029	8.0	3.0	36	B, N5
MEASUREMENT DATE: 03-02-89[1]				
SCA-085	0.0	--	--	F, N11
SCA-255	0.0	--	--	F, N12
SCA-452	1.5	0.5	25	B, N15
SCA-627	2.0	0.5	31	B, N1
SCA-805	4.5	1.5	31	B, U, W, N2
SCA-898	5.0	1.5	31	B, N3
SCA-970	4.0	1.0	31	B, N4
SCA-1029	4.0	1.0	31	B, N5
MEASUREMENT DATE: 12-20-89				
SCA-000	10.5	--	--	
SCA-085	10.5	--	--	F, N11, T
SCA-150	10.5	--	--	
SCA-250	15.5	--	--	T
SCA-255	16.0	--	--	U, M, N15
SCA-350	16.5	--	--	
SCA-450	14.5	--	--	T
SCA-452	15.0	--	--	U, M, N15
SCA-550	12.0	--	--	
SCA-620	11.5	--	--	T
SCA-627	13.0	--	--	U, M, Nl
SCA-700	13.5	--	--	
SCA-800	13.0	--	--	T
SCA-805	16.5	--	--	U, M, N2
SCA-898	15.5	--	--	N3
SCA-960	14.0	--	--	T
SCA-970	13.5	--	--	U, M, N4
SCA-1029	13.0	--	--	N5
SCA-1200	12.0	--	--	

Table 4. Snowpack measurements, Spring Creek area-Continued

Hillslope-transect site	Depth (inches)	Snowpack-water content (inches)	Density (percent)	Remarks
		MEASUREMENT DATE: 01-23-90		
SCA-000	0.0	--	--	F
SCA-085	0.5	--	--	F, N11, T
SCA-150	0.0	--	--	F
SCA-250	1.0	--	--	F, T
SCA-255	0.0	--	--	F at least 4 inches deep; N12
SCA-350	5.5	--	--	F
SCA-450	4.5	--	--	F, T
SCA-452	0.0	--	--	F at least 3 inches deep; N15
SCA-550	0.5	--	--	F
SCA-620	1.0	--	--	F, T
SCA-627	1.5	--	--	F at least 4 inches deep; Nl
SCA-700	2.5	--	--	F
SCA-800	2.5	--	--	F, T
SCA-805	5.5	1.0	19	B, F at least 2 inches deep; N2
SCA-898	6.0	1.0	19	B, F, N3
SCA-960	5.0	--	--	F, T
SCA-970	7.5	1.5	19	B, F (1 inch) over U, M; N4
SCA-1029	5.0	1.0	19	B, F, N5
SCA-1200	4.5	1.0	19	B, F
		MEASUREMENT DATE: 03-06-90[2]		
SCA-000	2.0	--	--	U, W
SCA-085	2.0	--	--	U, W, N11, T
SCA-150	2.5	--	--	U, W
SCA-250	5.5	--	--	T
SCA-255	3.5	--	--	U, W, N12
SCA-350	4.5	--	--	U, W
SCA-450	6.5	--	--	U, W , T
SCA-452	5.5	--	--	U, W, N15
SCA-550	4.0	--	--	U, W
SCA-620	5.0	--	--	T
SCA-627	6.5	--	--	U, W, Nl
SCA-700	3.0	--	--	U, W
SCA-800	3.0	--	--	T
SCA-805	6.0	--	--	U, W, N2
SCA-898	5.5	--	--	U, W, N3
SCA-960	2.0	--	--	T
SCA-970	4.0	--	--	U, W, N4
SCA-1029	3.5	--	--	N5
SCA-1200	1.0	--	--	

Table 4. Snowpack measurements, Spring Creek area-Continued

Hillslope-transect site	Depth (inches)	Snowpack-water content (inches)	Density (percent)	Remarks
		MEASUREMENT DATE: 12-20-89		
SCB-550	13.5	--	--	
SCB-650	13.5	--	--	U, M, T
SCB-750	12.5	--	--	
SCB-850	12.5	--	--	
SCB-950	10.0	--	--	U, M, T
		MEASUREMENT DATE: 01-23-90		
SCB-550	0.0	--	--	F
SCB-650	1.0	--	--	F, T
SCB-750	1.5	--	--	F
SCB-850	7.0	--	--	F
SCB-950	4.5	--	--	F, T
		MEASUREMENT DATE: 03-06-90[2]		
SCB-550	2.5	--	--	U, W
SCB-650	3.0	--	--	U, W, T
SCB-750	3.0	--	--	U, W
SCB-850	2.5	--	--	U, W
SCB-950	0.5	--	--	U, W, T
		MEASUREMENT DATE: 12-20-89		
SCC-000	12.5	--	--	U
SCC-100	12.5	--	--	
SCC-210	12.5	--	--	U, T
SCC-300	10.0	--	--	
SCC-400	13.5	--	--	U
SCC-450	8.5	--	--	U, T
SCC-500	11.5	--	--	U
SCC-600	10.5	--	--	U
SCC-660	14.5	--	--	U, T
SCC-700	9.5	--	--	U
		MEASUREMENT DATE: 01-23-90		
SCC-000	0.0	--	--	F
SCC-100	0.0	--	--	F
SCC-210	0.0	--	--	F, T
SCC-300	0.0	--	--	F
SCC-400	0.5	--	--	F
SCC-450	0.0	--	--	F, T
SCC-500	4.0	--	--	F

Table 4. Snowpack measurements, Spring Creek area-Continued

Hillslope-transect site	Depth (inches)	Snowpack-water content (inches)	Density (percent)	Density (percent)
		MEASUREMENT DATE: 01-23-90-Continued		
SCC-600	1.5	--	--	F
SCC-660	5.5	--	--	F, T
SCC-700	1.5	--	--	F
		MEASUREMENT DATE: 03-06-90[2]		
SCC-000	6.0	--	--	
SCC-100	3.5	--	--	
SCC-210	5.5	--	--	U, W, T
SCC-300	3.5	--	--	U, W
SCC-400	6.5	--	--	
SCC-450	1.5	--	--	U, W, T
SCC-500	3.5	--	--	
SCC-600	2.5	--	--	
SCC-660	7.0	--	--	U, W, T
SCC-700	1.5	--	--	

[1]Snowpack completely melted at all Spring Creek sites by March 16, 1989.
[2]Snowpack completely melted at all Spring Creek sites by March 19, 1990.

Table 5. Snowpack measurements, Cow Camp Creek area

[Depth and snowpack-water content rounded to nearest 0.5 inch; --, no measurement; U, unfrozen soil; M, moist soil, adheres to snow tube or ruler; N, soil-water-content measurements also made at site—for example, N14 is representative of neutron-probe technique and the soil-water-access tube number, and T is time-domain-reflectometry technique; W, wet soil (visible water in soil); F, frozen soil]

Hillslope-transect site	Depth (inches)	Snowpack-water content (inches)	Density (percent)	Remarks
		MEASUREMENT DATE: 01-31-89		
CCA-425	13.5	4.0	30	U, M
CCA-451	16.5	4.0	24	U, M, N14
CCA-569	13.0	3.5	27	U, M, N4
CCA-567	11.0	2.5	23	U, M, N5
		MEASUREMENT DATE: 03-02-89		
CCA-425	19.5	6.0	31	U, W
CCA-451	21.5	7.0	33	U, W, N14
CCA-569	17.0	5.0	29	U, W, N4
CCA-567	12.0	4.5	38	U, W, N5
		MEASUREMENT DATE: 03-22-89[1]		
CCA-425	0.0	-	--	U, W
CCA-451	0.0	--	--	U, W, N14
CCA-569	0.0	--	--	U, W, N4
CCA-567	0.0	--	--	U, W, N5
		MEASUREMENT DATE: 12-20-89		
CCA-000	16.0	--	--	U, M
CCA-100	14.5	--	--	U, M
CCA-200	11.5	--	--	U, M, T
CCA-300	17.0	--	--	U, M
CCA-400	18.0	--	--	U, M, T
CCA-425	16.5	--	--	U, M
CCA-451	15.5	--	--	U, M, N14
CCA-500	14.0	--	--	U, M
CCA-569	14.5	--	--	U, M, N14, T
CCA-567	14.5	--	--	U, M, N5
CCA-602	10.0	--	--	U, W
CCA-650	16.5	--	--	U, M, T
CCA-700	14.0	--	--	U, M
CCA-800	15.5	--	--	U, M
		MEASUREMENT DATE: 12-21-89		
CCA-000	15.0	3.0	20	U, M
CCA-100	13.0	4.0	31	U, M
CCA-200	12.0	1.5	12	U, M, T
CCA-300	17.0	3.5	21	U, M
CCA-400	16.5	3.5	21	U, M, T

Table 5. Snowpack measurements, Cow Camp Creek area-Continued

Hillslope-transect site	Depth (inches)	Snowpack-water content (inches)	Density (percent)	Remarks
		MEASUREMENT DATE: 12-21-89-Continued		
CCA-425	--	--	--	
CCA-451	14.0	2.5	18	U, M, N14
CCA-500	12.5	2.5	20	U, M
CCA-569	13.5	2.5	18	U, M, N4, T
CCA-567	14.0	3.0	21	U, M, N5
CCA-602	9.5	1.5	16	U, M
CCA-650	14.0	2.0	14	U, M, T
CCA-700	12.5	1.5	12	U, M
CCA-800	14.5	2.5	17	U, M
		MEASUREMENT DATE: 01-22-90		
CCA-000	10.5	--	--	
CCA-100	9.5	--	--	
CCA-200	8.5	--	--	T
CCA-300	11.0	--	--	
CCA-400	14.5	--	--	T
CCA-451	12.5	--	--	F, N14
CCA-500	11.5	--	--	
CCA-569	10.5	--	--	U, M, N4, T
CCA-567	11.0	--	--	U, M, N5
CCA-602	8.0	--	--	
CCA-650	11.5	--	--	T
CCA-700	10.0	--	--	
CCA-800	12.0	--	--	
		MEASUREMENT DATE: 01-23-90		
CCA-200	9.0	2.0	22	T
CCA-400	14.5	3.5	24	U, T
CCA-451	11.5	3.0	26	F, N14
CCA-569	10.0	3.0	30	U, N4, T
CCA-567	9.0	2.0	22	U, N5
CCA-650	9.5	3.0	32	T
		MEASUREMENT DATE: 03-06-90		
CCA-000	16.0	--	--	
CCA-100	10.5	--	--	U
CCA-200	15.0	4.0	27	U, T
CCA-300	14.5	--	--	U
CCA-400	19.5	5.5	28	U, M, T
CCA-451	14.0	3.0	21	U, M, N14

Table 5. Snowpack measurements, Cow Camp Creek area-Continued

Hillslope-transect site	Depth (inches)	Snowpack-water content (inches)	Density (percent)	Remarks
		MEASUREMENT DATE: 03-06-90-Continued		
CCA-500	12.0	--	--	U, M
CCA-569	13.5	3.0	22	U, M, N4, T
CCA-567	6.5	--	--	U, M, N5
CCA-602	16.5		--	U
CCA-650	10.0	2.5	25	U, T
CCA-700	10.0	--	--	U
CCA-800	18.5	--	--	U
		MEASUREMENT DATE: 03-19-90[2]		
CCA-000	5.5	--	--	U, W
CCA-100	0.0	--	--	U, M
CCA-200	7.5	--	--	U, W, T
CCA-300	0.0	--	--	U, W
CCA-400	9.0	--	--	U, W, T
CCA-451	4.5	--	--	U, W, N14
CCA-500	1.5	--	--	U, W
CCA-569	5.0	--	--	U, W, N4, T
CCA-567	0.0	--	--	U, W, N5
CCA-602	8.5	--	--	U, W
CCA-650	0.0	--	--	T
CCA-700	0.0	--	--	U, W
CCA-800	11.0	--	--	U, W
		MEASUREMENT DATE: 01-31-89		
CCB-407	18.5	5.0	27	U, M, N11
CCB-429	14.5	3.5	24	U, M, N12
		MEASUREMENT DATE: 03-02-89		
CCB-407	26.0	8.0	31	U, W, N11
CCB-429	15.0	5.0	33	U, W, N12
		MEASUREMENT DATE: 03-22-89[1]		
CCB-407	14.5	--	--	U,W, N11
CCB-429	4.5	--	--	U, W, standing water; N12
		MEASUREMENT DATE: 12-21-89		
CCB-000	5.0	--	--	F
CCB-100	14.5	--	--	U, M
CCB-200	13.5	--	--	U, M, T
CCB-300	13.5	--	--	U
CCB-350	10.0	--	--	U

Table 5. Snowpack measurements, Cow Camp Creek area-Continued

Hillslope-transect site	Depth (inches)	Snowpack-water content (inches)	Density (percent)	Remarks
		MEASUREMENT DATE: 12-21-89-Continued		
CCB-400	14.0	1.0	7	U, M, T
CCB-401	11.5	1.0	9	100 feet east of CCB-400; U
CCB-402	20.0	3.0	15	100 feet west of CCB-400; U
CCB-407	15.5	2.0	13	U, M, N11, T
CCB-429	17.0	--	--	U, M, N12
CCB-450	15.0	--	--	U
CCB-510	15.5	--	--	U
CCB-600	16.5	--	--	U
		MEASUREMENT DATE: 01-22-90		
CCB-000	4.0	--	--	F
CCB-100	12.5	--	--	
CCB-200	9.0	--	--	T
CCB-300	6.5	--	--	
CCB-350	7.5	--	--	
CCB-400	9.5	--	--	T
CCB-401	7.5	--	--	
CCB-402	16.5	--	--	
CCB-407	11.5	--	--	N11, T
CCB-429	14.0	--	--	N12
CCB-450	14.5	--	--	
CCB-510	12.5	--	--	
CCB-600	15.0	--	--	
		MEASUREMENT DATE: 01-23-90		
CCB-200	8.0	2.5	31	T
CCB-400	10.0	2.0	20	U, T
CCB-401	10.0	2.5	25	
CCB-402	15.5	3.0	19	U, M
CCB-407	12.0	3.0	25	N11., T
CCB-429	13.0	3.0	23	U, W, N12
		MEASUREMENT DATE: 03-06-90		
CCB-000	0.0	--	--	U, M
CCB-100	16.0	--	--	U
CCB-200	10.5	--	--	U, T
CCB-300	7.0	--	--	U
CCB-350	5.5	--	--	U
CCB-400	12.5	3.5	28	U, T
CCB-401	7.0	--	--	U

Table 5. Snowpack measurements, Cow Camp Creek area-Continued

Hillslope-transect site	Depth (inches)	Snowpack-water content (inches)	Density (percent)	Remarks
MEASUREMENT DATE: 03-06-90-Continued				
CCB-402	20.0	4.5	22	U
CCB-407	23.5	6.5	28	U, M, N11, T
CCB-429	15.5	--	--	U, M, N12
CCB-450	11.0	--	--	U
CCB-510	11.0	--	--	U
CCB-600	18.5	--	--	U
MEASUREMENT DATE: 03-19-90[2]				
CCB-000	0.0	--	--	U, W
CCB-100	0.0	--	--	U, W
CCB-200	0.0	--	--	U, W, T
CCB-300	0.0	--	--	U, M
CCB-350	0.0	--	--	U, M
CCB-400	0.0	--	--	U, M, T
CCB-401	0.0	--	--	U, M
CCB-402	14.5	--	--	U, W
CCB-407	6.5	--	--	U, W, N11, T
CCB-429	11.0	--	--	U, W, N12
CCB-450	1.0	--	--	U, W
CCB-510	0.0	--	--	U, W
CCB-600	11.5	--	--	U, W

[1]Snowpack completely melted at all Cow Camp Creek sites by April 5, 1989.
[2]Snowpack completely melted at all Cow Camp Creek sites between March 19, 1990, and April 23, 1990.

Table 6. Soil-water-content measurements using neutron-scattering technique, Spring Creek area

[Soil-water content in percent by volume; Nil, neutron-scattering technique and number (for example, 11) is soil-water-access tube number; --, no measurement]

Measurement date	Measurement Depth (feet)								
	1	2	3	4	5	6	7	8	9
				HILLSLOPE-TRANSECT SITE SCA-085 (N11)					
11-16-88	9.3	10.8	11.8	12.1	12.5	12.2	12.2	12.8	--
12-12-88	10.1	11.2	12.2	12.4	13.0	12.0	12.5	13.0	--
01-30-89	10.6	11.8	12.2	12.6	12.8	12.4	12.6	12.9	--
03-01-89	10.8	11.5	12.2	12.5	12.4	12.0	12.3	12.7	--
03-21-89	11.3	11.9	12.1	12.6	12.7	12.0	12.3	13.0	--
04-04-89	11.2	12.0	12.2	12.4	12.5	12.0	12.1	12.6	--
05-09-89	10.3	12.3	12.5	12.8	12.9	12.1	12.5	12.9	--
06-07-89	8.6	11.8	12.3	12.8	12.8	12.0	12.4	13.0	--
07-19-89	7.2	10.8	11.3	12.4	12.6	11.8	12.2	12.6	--
08-31-89	7.0	10.6	10.7	11.7	12.5	11.3	12.2	13.0	--
10-03-89	7.2	10.5	10.9	11.5	11.5	10.9	11.9	12.9	--
11-14-89	7.5	10.7	10.9	11.9	11.7	11.1	12.0	12.7	--
12-20-89	7.3	10.5	10.7	11.6	11.7	10.8	11.6	12.2	--
01-23-90	7.6	10.6	10.9	11.7	12.1	11.0	11.9	12.2	--
03-05-90	7.8	10.7	11.1	11.7	11.8	11.2	11.8	12.4	--
05-22-90	9.6	11.4	11.2	12.0	12.0	11.0	11.8	12.3	--
				HILLSLOPE-TRANSECT SITE SCA-2S5 (N12)					
11-16-88	12.3	11.6	8.5	7.8	5.2	3.8	3.4	6.3	--
12-12-88	15.4	12.1	9.1	8.1	5.4	3.7	3.8	7.0	--
01-30-89	18.7	16.8	16.7	8.8	5.7	3.7	3.6	7.8	--
03-01-89	19.6	18.9	21.5	10.7	6.2	3.9	3.8	12.9	--
03-21-89	18.7	17.4	21.2	10.4	6.0	3.9	4.0	12.8	--
04-04-89	18.1	17.1	20.1	10.4	5.8	3.8	3.8	12.5	--
05-09-89	15.1	16.7	19.3	10.2	6.0	3.9	3.9	12.6	--
06-07-89	11.8	14.2	16.1	9.6	5.7	3.9	3.9	11.9	--
07-19-89	9.8	10.9	8.9	8.2	5.3	3.9	3.8	11.6	--
08-31-89	10.1	10.6	8.6	6.9	4.6	3.6	3.7	10.2	--
10-03-89	10.3	10.3	8.6	6.6	4.6	3.7	3.8	9.3	--
11-14-89	10.5	10.5	8.8	6.8	4.6	3.5	3.5	8.8	--
12-20-89	11.3	10.7	8.9	7.2	4.6	3.6	3.8	9.0	--
01-23-90	15.3	13.7	10.4	7.0	4.7	3.6	3.7	9.0	--
03-05-90	18.3	16.9	10.4	7.4	4.8	3.5	3.6	9.2	--
05-22-90	15.1	14.4	13.7	8.2	4.9	3.7	3.7	9.3	--
				HILLSLOPE-TRANSECT SITE SC-452 (N15)					
11-16-88	18.9	15.0	13.7	14.7	13.6	14.0	--	--	--
12-12-88	19.2	15.2	14.1	14.7	14.0	14.2	--	--	--
01-30-89	20.5	18.8	18.0	16.3	14.4	14.6	--	--	--

Table 6. Soil-water-content measurements using neutron-scattering technique, Spring Creek area--Continued

Measurement date	Measurement depth (feet)								
	1	2	3	4	5	6	7	8	9
				HILLSLOPE-TRANSECT SITE SCA-452 (N15)-Continued					
03-01-89	20.9	22.3	19.4	18.6	17.8	16.4	--	--	--
03-21-89	20.3	18.9	18.6	18.0	17.5	17.6	--	--	--
04-04-89	19.4	18.6	18.0	17.3	16.7	17.3	--	--	--
05-09-89	19.4	19.1	18.1	17.6	17.4	17.2	--	--	--
06-07-89	16.8	18.1	17.7	17.5	16.5	17.0	--	--	--
07-19-89	13.9	14.0	13.9	15.4	16.2	16.6	--	--	--
08-31-89	13.2	12.6	12.1	13.5	14.1	15.8	--	--	--
10-03-89	12.6	12.5	12.0	13.7	14.0	15.0	--	--	--
11-14-89	12.5	12.3	12.6	14.4	14.1	15.2	--	--	--
12-20-89	12.8	12.5	13.0	14.2	14.0	14.9	--	--	--
01-23-90	17.7	13.2	13.1	14.3	14.1	15.0	--	--	--
03-05-90	19.4	19.7	18.9	18.6	18.0	18.0	--	--	--
05-22-90	18.5	18.9	17.8	17.4	16.9	16.8	--	--	--
				HILLSLOPE-TRANSECT SITE SCA-627 (N1)					
11-16-88	19.5	19.5	20.0	18.8	18.0	14.8	--	--	--
12-12-88	20.0	20.3	19.7	18.5	17.5	14.7	--	--	--
01-30-89	20.4	20.4	20.1	18.8	18.0	15.0	--	--	--
03-01-89	20.4	20.1	20.4	18.7	18.0	15.4	--	--	--
03-21-89	20.5	20.4	20.4	18.6	17.7	14.6	--	--	--
04-04-89	20.0	19.7	20.0	18.5	17.4	14.4	--	--	--
05-09-89	19.5	20.6	20.6	18.6	17.7	14.8	--	--	--
06-07-89	17.5	20.0	20.3	18.5	17.5	14.4	--	--	--
07-19-89	15.7	17.2	19.3	17.3	17.5	14.5	--	--	--
08-31-89	14.9	16.4	19.2	17.6	17.2	14.6	--	--	--
10-03-89	15.5	17.4	19.8	17.7	17.4	14.4	--	--	--
11-14-89	15.0	17.1	19.6	17.5	17.5	14.7	--	--	--
12-20-89	17.0	17.0	18.9	17.0	17.1	14.4	--	--	--
01-23-90	19.0	19.6	19.9	17.5	17.5	14.3	--	--	--
03-05-90	19.9	20.4	20.7	18.3	17.8	15.1	--	--	--
05-22-90	19.6	20.6	20.7	18.5	18.0	15.0	--	--	--
				HILLSLOPE-TRANSECT SITE SCA-805 (N2)					
11-16-88	13.6	12.7	16.2	17.3	14.3	17.8	12.1	10.1	--
12-12-88	17.2	13.0	16.3	17.1	14.5	17.6	12.4	10.2	--
01-30-89	20.0	18.3	16.7	17.1	14.2	17.9	13.1	10.7	--
03-01-89	20.4	20.5	19.5	17.5	14.3	17.9	12.7	10.6	--
03-21-89	20.3	20.6	20.7	19.1	18.2	20.0	14.0	11.7	--
04-04-89	20.2	20.1	20.1	19.0	18.0	19.7	13.8	11.6	--
05-09-89	19.8	20.0	20.2	19.1	18.1	19.7	13.8	11.6	--
06-07-89	15.1	16.4	19.9	18.7	17.8	19.5	13.7	11.4	--

Table 6. Soil-water-content measurements using neutron-scattering technique, Spring Creek area-Continued

Measurement date	Measurement depth (feet)								
	1	2	3	4	5	6	7	8	9
HILLSLOPE-TRANSECT SITE SCA-805 (N2)-Continued									
07-19-89	12.7	12.6	15.1	17.8	16.9	19.2	13.5	11.0	--
08-31-89	12.7	12.2	13.8	16.4	14.8	19.0	13.5	11.1	--
10-03-89	12.5	12.2	13.8	16.0	15.0	18.9	13.2	10.8	--
11-14-89	12.4	12.2	14.0	16.1	15.0	19.1	13.2	10.7	--
12-20-89	12.4	12.2	13.9	15.4	14.5	18.3	12.9	10.2	--
01-23-90	15.9	12.4	13.7	15.4	14.9	18.1	12.9	10.7	--
03-05-90	19.9	20.2	18.0	16.2	14.8	18.4	13.2	10.7	--
05-22-90	18.9	19.0	19.1	17.5	15.5	18.8	13.1	10.5	--
HILLSLOPE-TRANSECT SITE SCA-898 (N3)									
11-16-88	19.4	15.0	9.9	11.0	17.3	16.2	18.0	18.6	--
12-12-88	19.6	15.4	9.8	10.9	17.5	16.6	18.1	18.4	--
01-30-89	20.6	17.6	11.2	11.8	17.6	16.7	18.2	18.8	--
03-01-89	20.5	18.0	12.9	12.3	17.8	16.8	19.1	19.7	--
03-21-89	21.0	18.0	13.7	13.5	17.9	17.1	19.2	19.1	--
04-04-89	20.4	17.8	13.2	12.8	17.6	16.8	18.6	19.0	--
05-09-89	19.0	17.7	13.5	13.5	18.1	17.2	18.9	19.5	--
06-07-89	14.7	17.2	13.5	13.5	18.1	17.2	19.0	19.5	--
07-19-89	13.5	14.5	12.6	13.3	17.9	16.8	19.1	19.2	--
08-31-89	13.3	13.9	12.0	12.9	18.1	16.6	19.2	19.1	--
10-03-89	13.7	13.5	11.2	12.8	17.6	16.6	19.0	19.2	--
11-14-89	14.1	13.3	10.6	12.8	17.6	16.6	19.1	19.2	--
HILLSLOPE-TRANSECT SITE SCA-970 (N4)									
11-16-88	14.8	14.6	17.0	19.2	16.0	16.0	17.0	20.6	15.5
12-12-88	17.8	14.9	17.6	19.2	16.1	16.5	17.2	20.4	15.5
01-30-89	20.3	17.5	18.9	19.2	16.4	16.8	17.3	20.7	15.9
03-01-89	21.0	18.2	19.5	20.1	18.3	16.3	17.2	20.7	15.6
03-21-89	20.5	18.1	19.3	20.1	19.0	17.7	17.2	20.5	15.8
04-04-89	20.4	17.6	19.1	19.8	18.5	17.6	16.8	20.4	15.5
05-09-89	19.6	17.6	19.2	20.1	18.7	18.0	17.2	21.2	15.9
06-07-89	14.8	16.6	19.1	20.4	18.2	18.2	17.4	21.1	15.9
07-19-89	13.1	15.1	17.9	19.9	18.1	18.0	17.2	21.0	15.7
08-31-89	13.5	14.9	17.3	19.3	18.2	18.4	17.4	21.3	15.7
10-03-89	13.4	15.3	16.6	19.3	17.6	18.1	16.9	21.0	16.1
11-14-89	13.5	14.7	16.7	19.0	17.5	18.2	17.2	21.1	16.2
12-20-89	13.6	14.9	16.6	18.9	17.1	17.6	17.0	21.1	16.0
01-23-90	18.8	15.8	16.7	18.5	17.1	17.7	17.2	20.9	16.1
03-05-90	21.3	19.2	19.2	19.6	18.6	18.7	17.1	21.3	16.0
05-22-90	18.6	17.9	19.2	20.0	19.1	18.9	18.0	21.3	16.5

Table 6. Soil-water-content measurements using neutron-scattering technique, Spring Creek area-Continued

Measurement date	Measurement depth								
	1	2	3	4	5	6	7	8	9
	HILLSLOPE-TRANSECT SITE SCA-1029 (N5)								
11-16-88	18.9	19.6	14.1	14.2	--	--	--	--	--
12-12-88	20.0	19.8	13.9	14.4	--	--	--	--	--
01-30-89	20.9	20.1	15.4	15.3	--	--	--	--	--
03-01-89	21.3	21.5	15.8	16.2	--	--	-	--	--
03-21-89	21.0	20.5	15.5	15.7	--	--	--	--	--
04-04-89	20.4	20.0	15.3	15.0	--	--	--	--	--
05-09-89	20.2	20.4	15.6	15.4	--	--	--	--	-
06-07-89	17.1	19.7	15.2	15.5	--	--	--	--	--
07-19-89	14.9	16.9	14.3	15.1	--	--	--	--	--
08-31-89	15.4	16.5	13.6	15.0	--	--	--	--	--
10-03-89	15.4	16.1	13.2	14.8	--	--	--	--	--
11-14-89	15.8	16.6	13.3	14.8	--	--	--	--	--

Table 7. Soil-water-content measurements using neutron-scattering technique, Cow Camp Creek area

[Soil-water content in percent by volume; N14, neutron-scattering technique and number (for example, 14) is soil-water-access tube number; --, no measurement]

Measurement date	Measurement depth (feet)							
	1	2	3	4	5	6	7	8
HILLSLOPE-TRANSECT SITE CCA-451 (N14)								
11-14-88	9.5	12.3	11.1	12.3	12.8	8.4	9.5	--
12-13-88	16.1	13.1	11.8	12.6	13.5	9.0	10.4	--
01-31-89	16.4	13.5	11.6	12.2	12.9	9.0	10.3	--
03-01-89	19.8	17.7	12.7	12.5	12.8	9.2	10.3	--
03-22-89	21.3	20.0	17.4	17.6	17.1	15.2	18.1	--
04-05-89	20.6	19.3	16.3	17.1	16.9	14.1	17.3	--
05-09-89	16.4	16.9	15.3	15.9	15.7	12.6	16.2	--
06-07-89	11.8	15.4	14.2	15.1	15.4	12.3	15.8	--
07-19-89	10.2	12.7	12.6	14.0	14.7	11.6	15.5	--
08-31-89	10.1	12.4	11.6	13.0	13.4	10.3	14.1	--
10-03-89	10.2	12.4	11.7	12.8	13.3	10.1	12.6	--
11-14-89	10.5	12.7	11.7	12.9	13.0	9.9	12.3	--
12-21-89	10.8	12.3	11.4	12.5	13.0	9.8	11.7	--
01-22-90	11.9	12.9	11.7	12.6	13.2	9.8	11.8	--
03-05-90	18.5	18.3	15.4	12.6	13.0	9.8	11.6	--
05-21-90	15.8	16.6	15.7	15.7	15.5	12.6	16.0	--
HILLSLOPE-TRANSECT SITE CCA-569 (N4)								
11-14-88	12.2	15.7	15.7	17.2	17.5	17.1	13.9	14.8
12-13-88	15.3	16.4	15.9	17.2	18.1	17.6	14.0	14.9
01-31-89	16.2	16.2	15.6	16.6	17.1	16.6	13.5	14.2
03-01-89	16.6	17.0	16.3	16.4	16.8	16.6	13.4	13.9
03-22-89	17.4	17.7	17.6	18.2	18.1	17.2	14.5	--
04-05-89	17.3	17.4	17.6	18.1	18.3	17.1	14.0	16.2
05-09-89	15.8	17.3	17.6	18.0	17.8	17.3	14.0	15.4
06-07-89	13.4	17.1	17.5	18.2	17.7	17.2	13.8	15.4
07-19-89	12.3	16.2	16.8	17.4	17.6	17.0	13.9	--
08-31-89	12.5	16.0	16.0	16.8	17.3	17.1	13.9	14.9
10-03-89	12.7	15.9	16.0	16.8	16.9	17.1	13.3	--
11-14-89	13.1	15.7	15.7	16.7	16.9	16.8	13.6	--
12-21-89	12.8	15.3	15.5	16.6	16.6	16.6	13.0	--
01-22-90	14.2	15.5	15.7	16.3	16.6	16.8	13.3	--
03-05-90	16.9	16.8	17.0	17.0	17.2	17.0	13.5	--
05-21-90	16.3	17.6	17.9	17.8	17.5	17.3	13.8	--
HILLSLOPE-TRANSECT SITE CCA-567								
11-14-88	15.6	16.5	14.5	17.4	15.9	17.1	11.9	13.9
12-13-88	16.6	16.5	14.0	17.3	15.9	17.0	11.6	13.7
01-31-89	16.3	15.9	14.0	16.4	15.0	16.2	11.0	13.0

Table 7. Soil-water-content measurements using neutron-scattering technique, Cow Camp Creek area-Continued

Measurement date	Measurement depth (feet)							
	1	2	3	4	5	6	7	8
HILLSLOPE-TRANSECT SITE CCA-567-Continued								
03-01-89	16.2	15.8	13.8	16.4	14.7	16.2	10.9	12.7
03-22-89	18.6	17.8	16.6	18.1	16.5	17.7	12.0	14.6
04-05-89	18.3	17.8	16.4	18.0	16.7	17.3	11.9	14.4
05-09-89	16.0	17.4	16.0	18.0	16.0	17.7	11.7	14.0
06-07-89	12.9	16.2	15.5	17.8	16.2	17.2	11.4	13.8
07-19-89	13.1	15.0	14.0	17.6	15.6	16.8	11.1	13.4
08-31-89	12.4	14.7	13.1	16.8	14.9	16.8	11.4	13.4
10-03-89	12.9	14.0	12.5	16.5	14.6	16.6	11.1	13.4
11-14-89	13.1	14.1	12.5	16.4	13.8	16.6	11.0	13.4
12-21-89	13.2	13.8	12.3	15.8	13.6	15.8	10.9	13.0
01-22-90	15.0	13.9	12.4	16.2	13.7	15.8	11.2	13.0
03-05-90	17.4	15.2	12.4	16.3	13.8	16.0	11.2	13.2
05-21-90	17.0	17.8	16.0	17.9	16.0	17.5	11.5	13.8
HILLSLOPE-TRANSECT SITE CCB-407 (N11)								
11-14-88	18.7	14.2	15.4	17.4	15.6	--	--	--
12-13-88	18.9	15.4	15.6	17.6	16.2	--	--	--
01-31-89	19.6	17.6	14.8	16.8	15.5	--	--	--
03-01-89	20.3	20.6	17.2	17.4	15.6	--	--	--
03-22-89	22.7	22.4	18.0	18.7	18.5	--	--	--
04-05-89	21.9	21.8	17.9	18.6	17.9	--	--	--
05-09-89	19.3	20.2	16.9	17.6	15.8	--	--	--
06-07-89	16.9	17.8	16.6	17.1	15.3	--	--	--
07-19-89	11.5	13.0	14.9	17.2	15.4	--	--	--
08-31-89	11.1	12.2	14.6	16.6	15.0	--	--	--
10-03-89	11.2	12.5	14.4	16.5	14.9	--	--	--
11-14-89	11.3	12.9	14.6	16.8	15.2	--	-	--
12-21-89	11.2	12.8	14.5	16.6	14.8	--	--	--
01-22-90	14.7	13.0	14.8	16.8	15.0	--	--	-
03-05-90	19.0	20.2	16.3	16.8	15.1	--	--	--
05-21-90	18.8	20.0	16.8	17.5	15.6	--	--	--
HILLSLOPE-TRANSECT SITE CCB-429 (N11)								
11-14-88	13.5	15.8	14.8	16.6	--	--	--	--
12-13-88	20.6	17.9	15.8	17.3	--	--	--	--
01-31-89	20.4	17.2	15.8	17.6	--	--	--	--
03-01-89	20.7	17.3	17.6	18.7	--	--	--	--
03-22-89	21.4	18.4	17.4	19.0	--	--	--	--
04-05-89	20.9	18.2	17.5	19.1	--	--	--	--
05-09-89	19.7	17.6	17.2	19.1	--	--	--	--
06-07-89	15.8	17.2	16.1	19.1	--	--	--	--

Table 7. Soil-water-content measurements using neutron-scattering technique, Cow Camp Creek area-Continued

Measurment date	Measurement Depth (feet)							
	1	2	3	4	5	6	7	8
HILLSLOPE-TRANSECT SITE CCB-429 (N11)-Continued								
07-19-89	12.3	16.3	15.7	18.0	--	--	--	--
08-31-89	12.3	15.9	15.1	17.6	--	--	--	--
10-03-89	12.7	15.1	14.8	16.8	--	--	--	--
11-14-89	13.4	15.1	14.3	16.7	--	--	--	--
12-21-89	14.3	14.9	13.6	16.3	--	--	--	--
01-22-90	17.8	16.2	13.7	16.4	--	--	--	--
03-05-90	18.8	17.8	16.8	17.5	--	--	--	--
05-21-90	18.4	17.8	17.3	19.4	--	--	--	--

Table 8. Soil-water-content measurements using time-domain-reflectometry technique, Spring Creek area

[Soil-water content in percent by volume; --, no measurement]

Measurement date	Hillslope-transect site					
	SCA-085	SCA-250	SCA-450	SCA-620	SCA-600	SCA-960
11-22-89	10.4	9.9	16.2	22.6	11.1	18.0
12-19-89	11.8	18.8	23.2	35.6	22.2	25.3
01-23-90	7.4	--	29.4	20.0	23.5	25.4
03-06-90	21.0	--	35.7	34.5	29.8	32.4
03-19-90	6.4	--	13.1	11.8	9.6	10.1
04-23-90	--	--	--	--	--	--
05-22-90	1.6	4.4	8.4	11.6	7.4	7.2

Measurment date	Hillslope-transect site				
	SCC-650	SCB-950	SCC-210	SCC-450	SCC-660
11-22-89	12.2	12.8	14.1	8.5	8.9
12-19-89	14.8	19.5	26.6	18.0	20.8
01-23-90	15.3	26.6	23.0	21.0	18.6
03-06-90	23.3	33.0	33.0	31.8	33.0
03-19-90	6.4	10.2	12.1	--	8.5
04-23-90	3.9	--	5.8	--	1.9
05-22-90	3.5	7.2	4.2	3.4	2.3

Table 9. Soil-water-content measurements using time-domain-reflectometry technique, Cow Camp Creek area

[Soil-water content in percent by volume; --, no measurement]

Measurement date	Hillslope-transect site						
	CCA-200	CCA-400	CCA-569	CCA-650	CCB-200	CCB-400	CCB-407
11-22-89	11.2	8.5	12.0	8.3	16.8	7.4	13.6
12-20-89	24.6	16.7	18.3	21.8	24.6	21.9	--
01-22-90	27.4	22.6	27.0	25.0	30.1	23.9	--
03-06-90	32.4	30.5	33.8	31.1	35.4	35.1	--
03-19-90	16.5	13.4	17.1	--	--	15.7	--
04-23-90	6.5	6.1	8.0	--	--	7.8	--
05-21-90	9.5	6.0	7.6	3.9	8.3	6.5	7.0

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area

[Altitudes in feet, relative to local reference mark with arbitrary altitude of 20.00 feet; --, no data]

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCA-250)										
0.2	22.32	22.33	22.05	22.07	21.76	21.76	21.36	21.36	21.13	21.10
0.4	22.36	22.35	22.02	22.02	21.70	21.71	21.40	21.40	21.16	21.15
0.6	22.39	22.32	21.99	21.97	21.69	21.71	21.38	21.40	21.13	21.14
0.8	22.34	22.33	21.99	21.98	21.67	21.67	21.39	21.39	21.09	21.10
1.0	22.32	22.27	22.04	22.03	21.65	21.66	21.42	21.41	21.07	21.08
1.2	22.30	22.26	22.03	22.02	21.63	21.63	21.42	21.42	21.05	21.05
1.4	22.24	22.22	22.05	22.02	21.65	21.62	21.42	21.41	21.02	21.03
1.6	22.24	22.22	22.07	22.05	21.65	21.66	21.47	21.46	21.02	21.05
1.8	22.28	22.27	22.00	22.00	21.65	21.65	21.45	21.45	20.98	20.98
2.0	22.29	22.26	22.01	22.05	21.69	21.66	21.49	21.47	21.01	21.00
2.2	22.26	22.24	21.96	21.99	21.66	21.65	21.46	21.43	21.01	21.01
2.4	22.24	22.23	21.98	21.98	21.64	21.63	21.47	21.45	21.03	21.04
2.6	22.30	22.29	21.96	21.98	21.64	21.64	21.49	21.46	21.04	21.06
2.8	22.33	22.33	21.95	21.96	21.68	21.67	21.53	21.46	21.01	21.03
3.0	22.36	22.33	21.95	21.96	21.69	21.68	21.48	21.49	20.99	21.00
3.2	22.36	22.37	21.93	21.95	21.69	21.69	21.48	21.44	21.05	21.06
3.4	22.26	22.27	21.94	21.94	21.70	21.71	21.47	21.53	21.02	21.03
3.6	22.26	22.26	21.96	21.96	21.68	21.71	21.49	21.45	21.03	21.02
3.8	22.25	22.25	21.97	21.97	21.65	21.70	21.52	21.50	21.05	21.07
4.0	22.23	22.23	21.97	22.00	21.62	21.63	21.45	21.46	21.06	21.05
4.2	22.22	22.23	21.99	22.02	21.72	21.70	21.45	21.45	21.05	21.07
4.4	22.22	22.22	21.98	22.00	21.68	21.69	21.42	21.42	21.03	21.05
4.6	22.26	22.26	22.01	22.01	21.69	21.70	21.42	21.37	21.05	21.06
4.8	22.26	22.26	22.00	21.99	21.70	21.71	21.44	21.44	21.07	21.07
5.0	22.28	22.28	22.01	22.00	21.69	21.71	21.45	21.42	21.06	21.07
5.2	22.33	22.32	22.01	22.02	21.70	21.72	21.45	21.44	21.09	21.07
5.4	22.30	22.29	22.04	22.03	21.76	21.72	21.43	21.45	21.06	21.09
5.6	22.27	22.27	22.02	22.00	21.74	21.74	21.47	21.47	21.09	21.09
5.8	22.26	22.26	21.98	21.98	21.72	21.74	21.44	21.44	21.03	21.03
6.0	22.23	22.23	22.01	22.02	21.76	21.74	21.47	21.48	21.03	21.03
6.2	22.21	22.22	22.01	22.01	21.69	21.73	21.51	21.52	21.04	21.06
6.4	22.26	22.25	22.03	22.03	21.73	21.74	21.54	21.53	21.06	21.05
6.6	22.28	22.28	22.06	22.05	21.70	21.70	21.55	21.53	21.05	21.06
6.8	22.29	22.29	22.05	22.03	21.71	21.71	21.52	21.50	21.05	21.06
7.0	22.30	22.29	22.09	22.07	21.74	21.71	21.49	21.49	21.11	21.13
7.2	22.23	22.22	22.04	22.05	21.71	21.73	21.43	21.39	21.18	21.14
7.4	22.29	22.29	22.02	22.02	21.71	21.72	21.39	21.38	21.16	21.15

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCA-250)-Continued										
7.6	22.30	22.30	22.04	22.05	21.70	21.68	21.45	21.42	21.19	21.18
7.8	22.31	22.30	21.99	22.01	21.71	21.71	21.45	21.45	21.14	21.17
8.0	22.32	22.31	21.96	21.97	21.69	21.67	21.45	21.43	21.19	21.19
8.2	22.31	22.29	21.97	21.98	21.66	21.66	21.47	21.44	21.20	21.19
8.4	22.37	22.32	21.95	21.96	21.64	21.67	21.50	21.51	21.19	21.22
8.6	22.25	22.25	21.94	21.93	21.59	21.60	21.52	21.51	21.24	21.22
8.8	22.23	22.22	21.93	21.93	21.60	21.56	21.53	21.47	21.25	21.25
9.0	22.20	22.17	21.91	21.89	21.52	21.53	21.48	21.52	21.22	21.26
9.2	22.14	22.13	21.86	21.86	21.54	21.55	21.54	21.53	21.24	21.24
9.4	22.15	22.13	21.83	21.86	21.55	21.57	21.55	21.52	21.25	21.25
9.6	22.14	22.14	21.85	21.85	21.55	21.56	21.53	21.56	21.26	21.24
9.8	22.16	22.17	21.85	21.85	21.55	21.55	21.59	21.59	21.27	21.27
10.0	22.19	22.19	21.80	21.77	21.55	21.55	21.54	21.52	21.30	21.27
EROSION-STUDY PLOT (SITE SCA-450)										
0.2	23.39	23.43	22.96	23.01	22.45	22.45	22.02	22.05	21.79	21.81
0.4	23.40	23.45	22.96	22.99	22.43	22.43	22.01	22.02	21.79	21.86
0.6	23.46	23.50	22.94	22.99	22.45	22.46	22.06	22.07	21.81	21.86
0.8	23.46	23.51	22.90	22.92	22.51	22.51	22.14	22.16	21.86	21.88
1.0	23.51	23.57	22.97	23.01	22.50	22.51	22.16	22.16	21.84	21.89
1.2	23.68	23.71	23.01	23.04	22.53	22.56	22.24	22.20	21.83	21.88
1.4	23.50	23.42	22.98	23.05	22.57	22.60	22.20	22.22	21.88	21.88
1.6	23.47	23.49	23.00	23.00	22.59	22.51	22.22	22.22	21.88	21.91
1.8	23.48	23.51	22.93	23.02	22.65	22.64	22.27	22.30	21.90	21.91
2.0	23.43	23.47	23.01	23.11	22.64	22.65	22.23	22.30	21.88	21.91
2.2	23.44	23.48	23.08	23.11	22.62	22.63	22.26	22.28	21.88	21.93
2.4	23.52	23.56	22.95	23.08	22.62	22.66	22.23	22.26	21.89	21.94
2.6	23.42	23.46	22.95	23.03	22.62	22.64	22.23	22.24	21.87	21.91
2.8	23.43	23.47	23.00	23.07	22.62	22.68	22.26	22.26	21.87	21.91
3.0	23.45	23.48	23.03	23.12	22.60	22.57	22.24	22.27	21.86	21.90
3.2	23.44	23.49	23.08	23.13	22.61	22.62	22.25	22.24	21.80	21.84
3.4	23.42	23.45	23.07	23.14	22.64	22.65	22.27	22.33	21.72	21.77
3.6	23.42	23.46	23.08	23.17	22.66	22.71	22.29	22.39	21.69	21.72
3.8	23.54	23.53	23.08	23.15	22.63	22.68	22.34	22.37	21.73	21.76
4.0	23.53	23.58	23.07	23.14	22.58	22.61	22.34	22.33	21.67	21.71
4.2	23.56	23.61	22.98	23.16	22.62	22.60	22.29	22.29	21.65	21.69
4.4	23.57	23.64	23.06	23.17	22.64	22.62	22.21	22.45	21.66	21.70
4.6	23.54	23.61	23.08	23.19	22.66	22.68	22.35	22.23	21.67	21.71
4.8	23.51	23.58	23.12	23.21	22.82	22.76	22.20	22.23	21.72	21.74
5.0	23.53	23.59	23.11	23.22	22.66	22.57	22.26	22.27	21.73	21.77

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCA-450)-Continued										
5.2	23.52	23.58	23.28	23.39	22.63	22.60	22.23	22.26	21.78	21.80
5.4	23.62	23.67	23.47	23.53	22.62	22.66	22.25	22.31	21.76	21.79
5.6	23.55	23.71	23.53	23.49	22.63	22.66	22.26	22.30	21.79	21.82
5.8	23.50	23.68	23.44	23.40	22.63	22.66	22.19	22.29	21.79	21.81
6.0	23.52	23.59	23.33	23.18	22.63	22.66	22.21	22.27	21.77	21.81
6.2	23.55	23.61	23.11	23.17	22.64	22.67	22.21	22.30	21.77	21.78
6.4	23.61	23.64	23.10	23.16	22.63	22.65	22.23	22.26	21.78	21.79
6.6	23.56	23.59	23.10	23.12	22.63	22.65	22.23	22.28	21.78	21.80
6.8	23.47	23.53	23.11	23.14	22.64	22.66	22.19	22.24	21.78	21.80
7.0	23.47	23.52	23.11	23.17	22.67	22.67	22.16	22.23	21.82	21.83
7.2	23.50	23.52	23.14	23.20	22.67	22.69	22.23	22.27	21.88	21.86
7.4	23.49	23.53	23.11	23.21	22.73	22.67	22.30	22.31	21.84	21.85
7.6	23.48	23.54	23.08	23.13	22.72	22.69	22.30	22.33	21.83	21.85
7.8	23.52	23.55	23.09	23.17	22.69	22.71	22.30	22.34	21.90	21.88
8.0	23.51	23.55	23.12	23.18	22.69	22.73	22.29	22.35	21.87	21.88
8.2	23.51	23.57	23.16	23.14	22.69	22.73	22.30	22.37	21.88	21.89
8.4	23.54	23.57	23.14	23.16	22.64	22.69	22.53	22.58	--	21.89
8.6	23.52	23.55	23.15	23.18	22.63	22.65	22.46	22.49	21.92	21.98
8.8	23.52	23.57	23.13	23.15	22.65	22.66	22.30	22.33	21.83	21.89
9.0	23.54	23.56	23.10	23.16	22.69	22.72	22.30	22.34	21.87	21.89
9.2	23.51	23.54	23.10	23.13	22.71	22.74	22.32	22.36	21.89	21.89
9.4	23.58	23.54	23.08	23.09	22.68	22.69	22.33	22.38	21.90	21.92
9.6	23.57	23.61	23.06	23.10	22.63	22.65	22.32	22.36	21.85	21.90
9.8	23.50	23.48	23.09	23.12	22.60	22.62	22.30	22.34	21.84	21.88
10.0	23.50	23.51	23.04	23.07	22.59	22.57	22.30	22.30	21.85	21.88
EROSION-STUDY PLOT (SITE SCA-620)										
0.2	22.10	22.11	21.77	21.76	21.47	21.48	21.22	21.23	20.81	20.84
0.4	22.12	22.13	21.76	21.78	21.46	21.47	21.25	21.26	20.85	20.88
0.6	22.11	22.09	21.74	21.69	21.45	21.47	21.23	21.24	20.81	20.85
0.8	22.10	22.10	21.72	21.67	21.47	21.48	21.20	21.23	20.80	20.83
1.0	22.13	22.13	21.72	21.74	21.53	21.56	21.21	21.20	20.85	20.87
1.2	22.00	21.99	21.71	21.73	21.49	21.51	21.18	21.18	20.89	20.93
1.4	21.98	21.93	21.69	21.70	21.51	21.54	21.17	21.19	20.91	20.96
1.6	21.95	21.92	21.70	21.73	21.50	21.53	21.14	21.17	20.92	20.86
1.8	21.95	21.92	21.64	21.66	21.42	21.46	21.14	21.15	20.86	20.87
2.0	21.95	21.92	21.59	21.60	21.35	21.35	21.11	21.14	20.77	20.80
2.2	21.96	21.98	21.57	21.57	21.30	21.32	21.08	21.11	20.78	20.83
2.4	21.98	21.90	21.57	21.54	21.30	21.32	21.05	21.06	20.83	20.88
2.6	21.95	21.90	21.54	21.52	21.34	21.35	21.08	21.11	20.92	20.91

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCA-620)-Continued										
2.8	21.92	21.96	21.55	21.54	21.32	21.33	21.16	21.19	20.86	20.89
3.0	21.96	21.96	21.55	21.53	21.36	21.39	21.17	21.18	20.85	20.88
3.2	21.96	21.96	21.59	21.54	21.37	21.39	21.12	21.17	20.88	20.91
3.4	21.95	21.94	21.59	21.59	21.39	21.40	21.20	21.20	20.94	20.94
3.6	21.95	21.93	21.60	21.57	21.41	21.45	21.30	21.29	21.00	20.94
3.8	21.99	21.95	21.63	21.60	21.39	21.39	21.28	21.28	20.95	20.94
4.0	22.00	21.96	21.63	21.65	21.38	21.38	21.16	21.21	20.93	20.95
4.2	22.15	22.12	21.67	21.67	21.39	21.39	21.18	21.21	20.93	20.94
4.4	22.17	22.05	21.69	21.67	21.42	21.43	21.20	21.18	20.93	20.94
4.6	22.07	22.03	21.72	21.69	21.47	21.48	21.20	21.18	20.93	20.95
4.8	22.13	22.15	21.83	21.81	21.56	21.52	21.22	21.20	20.98	20.96
5.0	22.15	22.15	21.89	21.84	21.60	21.59	21.30	21.30	21.00	20.96
5.2	22.19	22.16	21.89	21.84	21.60	21.57	21.33	21.33	20.97	20.99
5.4	22.23	22.18	21.88	21.85	21.60	21.59	21.28	21.27	20.92	20.96
5.6	22.21	22.16	21.87	21.83	21.58	21.55	21.27	21.28	20.92	20.95
5.8	22.25	22.20	21.88	21.85	21.58	21.60	21.30	21.33	20.94	20.95
6.0	22.20	22.19	21.92	21.90	21.61	21.59	21.41	21.35	20.96	20.97
6.2	22.23	22.21	21.94	21.95	21.65	21.62	21.34	21.34	20.94	20.95
6.4	22.26	22.22	21.96	21.93	21.66	21.62	21.31	21.28	20.92	20.95
6.6	22.27	22.25	22.00	21.98	21.68	21.66	21.35	21.30	20.96	20.98
6.8	22.30	22.33	22.00	22.02	21.72	21.69	21.36	21.33	20.99	20.95
7.0	22.33	22.33	22.04	22.02	21.74	21.72	21.29	21.29	20.97	20.96
7.2	22.38	22.36	22.08	22.02	21.72	21.67	21.24	21.28	20.95	20.96
7.4	22.35	22.36	22.09	22.10	21.80	21.73	21.22	21.21	20.93	20.93
7.6	22.37	22.40	22.08	22.09	21.74	21.74	21.19	21.18	20.91	20.88
7.8	22.38	22.37	22.14	22.16	21.74	21.74	21.18	21.16	20.87	20.91
8.0	22.41	22.39	22.13	22.13	21.68	21.71	21.16	21.17	20.91	20.92
8.2	22.42	22.36	22.15	22.03	21.70	21.69	21.19	21.20	20.88	20.87
8.4	22.41	22.41	22.15	22.11	21.69	21.71	21.22	21.22	20.89	20.88
8.6	22.39	22.38	22.15	22.11	21.73	21.72	21.23	21.23	20.93	20.94
8.8	22.42	22.38	22.18	22.11	21.71	21.72	21.23	21.23	20.95	20.90
9.0	22.44	22.38	22.14	22.10	21,64	21.64	21.26	21.25	20.98	20.92
9.2	22.43	22.38	22.11	22.10	21.66	21.64	21.28	21.27	21.00	21.01
9.4	22.44	22.46	22.11	22.09	21.71	21.69	21.28	21.27	20.97	20.99
9.6	22.46	22.44	22.19	22.14	21.76	21.76	21.28	21.29	20.99	21.01
9.8	22.49	22.49	22.15	22.15	21.79	21.74	21.30	21.29	21.02	21.03
10.0	22.51	22.53	22.18	22.16	21.78	21.74	21.40	21.35	21.13	21.16

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCA-800)										
0.2	22.20	22.24	21.79	21.81	21.47	21.49	21.07	21.11	20.71	20.70
0.4	22.11	22.20	21.80	21.83	21.41	21.44	21.11	21.14	20.70	20.72
0.6	22.17	22.21	21.86	21.83	21.45	21.48	21.09	21.13	20.72	20.73
0.8	22.24	22.24	21.89	21.90	21.45	21.49	21.06	21.09	20.65	20.69
1.0	22.24	22.23	21.91	21.90	21.46	21.50	21.05	21.11	20.63	20.69
1.2	22.25	22.26	21.85	21.78	21.38	21.46	21.02	21.02	20.63	20.64
1.4	22.25	22.27	21.72	21.76	21.28	21.34	21.03	21.03	20.62	20.61
1.6	22.22	22.22	21.70	21.73	21.30	21.36	21.03	21.03	20.58	20.61
1.8	22.13	22.16	21.68	21.67	21.36	21.39	20.98	21.03	20.55	20.59
2.0	22.06	22.11	21.75	21.69	21.37	21.40	20.98	21.05	20.50	20.50
2.2	22.10	22.13	21.70	21.70	21.40	21.44	21.00	21.00	20.47	20.49
2.4	22.17	22.17	21.71	21.74	21.40	21.38	20.98	20.98	20.47	20.48
2.6	22.22	22.19	21.76	21.76	21.40	21.45	20.90	20.97	20.47	20.48
2.8	22.25	22.24	21.79	21.81	21.47	21.45	20.84	20.89	20.48	20.48
3.0	22.27	22.31	21.83	21.84	21.40	21.36	20.82	20.86	20.44	20.48
3.2	22.26	22.30	21.86	21.82	21.37	21.34	20.83	20.84	20.40	20.38
3.4	22.25	22.25	21.85	21.80	21.30	21.31	20.82	20.79	20.44	20.40
3.6	22.21	22.23	21.84	21.80	21.24	21.23	20.79	20.92	20.43	20.55
3.8	22.18	22.20	21.80	21.81	21.20	21.25	20.96	20.94	20.67	20.69
4.0	22.14	22.18	21.75	21.82	21.25	21.29	21.03	21.03	20.72	20.71
4.2	22.10	22.03	21.68	21.73	21.24	21.27	21.10	21.07	20.79	20.79
4.4	22.02	22.09	21.54	21.62	21.28	21.36	21.12	21.14	20.83	20.81
4.6	21.97	22.12	21.57	21.63	21.41	21.45	21.16	21.13	20.83	20.82
4.8	22.00	22.02	21.66	21.66	21.52	21.53	21.22	21.21	20.82	20.87
5.0	21.96	21.96	21.70	21.69	21.54	21.58	21.27	21.30	20.79	20.88
5.2	21.95	22.01	21.77	21.82	21.63	21.58	21.33	21.36	20.82	20.81
5.4	22.05	22.10	21.82	21.87	21.61	21.53	21.23	21.25	20.81	20.83
5.6	22.11	22.12	21.86	21.90	21.63	21.56	21.24	21.27	20.80	20.77
5.8	22.19	22.19	21.87	21.93	21.61	21.65	21.23	21.24	20.74	20.79
6.0	22.23	22.24	21.93	21.94	21.63	21.62	21.21	21.25	20.77	20.81
6.2	22.26	22.28	21.95	21.98	21.60	21.61	21.20	21.23	20.81	20.82
6.4	22.27	22.29	21.88	21.99	21.55	21.61	21.22	21.24	20.87	20.82
6.6	22.25	22.31	21.92	21.96	21.56	21.62	21.25	21.22	20.82	20.82
6.8	22.23	22.29	21.92	21.96	21.54	21.58	21.25	21.21	20.73	20.74
7.0	22.22	22.26	21.89	21.91	21.50	21.56	21.20	21.18	20.59	20.65
7.2	22.27	22.29	21.95	21.92	21.50	21.53	21.15	21.14	20.54	20.60
7.4	22.27	22.33	21.97	21.94	21.45	21.42	21.08	21.07	20.60	20.65
7.6	22.28	22.32	21.94	21.88	21.43	21.41	21.01	21,02	20.73	20.68
7.8	22.30	22.34	21.92	21.92	21.40	21.40	21.01	21.06	20.77	20.80
8.0	22.28	22.33	21.86	21.84	21.42	21.48	21.08	21.12	20.90	20.88

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCA-800)-Continued										
8.2	22.28	22.29	21.74	21.75	21.46	21.52	21.20	21.26	20.91	20.99
8.4	22.04	22.12	21.79	21.80	21.51	21.66	21.38	21.39	20.89	20.93
8.6	22.05	22.05	21.83	21.88	21.63	21.69	21.56	21.61	20.97	20.91
8.8	22.08	22.10	21.89	21.94	21.70	21.75	21.42	21.42	20.90	20.91
9.0	22.18	22.20	21.96	22.01	21.77	21.81	21.35	21.38	20.77	20.86
9.2	22.23	22.29	22.12	22.01	21.78	21.81	21.30	21.38	20.72	20.74
9.4	22.35	22.35	22.14	22.05	21.72	21.75	21.26	21.30	20.72	20.73
9.6	22.36	22.43	22.15	22.19	21.70	21.74	21.17	21.17	20.76	20.78
9.8	22.51	22.51	22.09	22.11	21.69	21.73	21.26	21.29	20.84	20.87
10.0	22.58	22.56	22.10	22.18	21.58	21.60	21.33	21.33	20.85	20.90
EROSION-STUDY PLOT (SITE SCA-960)										
0.2	22.62	22.66	22.31	22.35	21.86	21.88	21.48	21.51	21.01	21.03
0.4	22.61	22.65	22.26	22.33	21.86	21.90	21.46	21.49	21.00	21.03
0.6	22.57	22.61	22.19	22.22	21.84	21.86	21.42	21.46	21.04	21.11
0.8	22.54	22.54	22.17	22.20	21.77	21.82	21.39	21.40	21.05	21.09
1.0	22.47	22.53	22.11	22.16	21.70	21.77	21.38	21.40	21.07	21.09
1.2	22.49	22.52	22.06	22.12	21.66	21.71	21.34	21.35	21.05	21.00
1.4	22.55	22.56	22.08	22.18	21.61	--	21.29	21.34	21.01	20.95
1.6	22.61	22.63	22.17	22.21	21.58	21.64	21.28	21.34	20.96	21.02
1.8	22.66	22.68	22.19	22.24	21.52	21.59	21.27	21.30	20.93	21.02
2.0	22.67	22.69	22.17	22.27	21.49	21.53	21.29	21.32	20.97	21.05
2.2	22.70	22.66	22.17	22.25	21.47	21.52	21.30	21.32	21.03	21.09
2.4	22.69	22.70	22.18	22.27	21.53	21.54	21.29	21.34	21.00	21.02
2.6	22.73	22.72	22.16	22.25	21.55	21.59	21.25	21.32	20.92	20.99
2.8	22.82	22.80	22.17	22.24	21.62	21.62	21.20	21.27	20.93	20.96
3.0	22.84	22.86	22.20	22.25	21.63	21.65	21.15	21.19	20.88	20.94
3.2	22.84	22.85	22.20	22.25	21.59	21.63	21.13	21.17	20.87	20.95
3.4	22.81	22.86	22.18	22.25	21.62	21.66	21.09	21.18	20.91	20.93
3.6	22.75	22.74	22.19	22.25	21.64	21.69	21.08	21.13	20.84	20.93
3.8	22.76	22.78	22.20	22.24	21.67	21.70	21.08	21.13	20.77	20.86
4.0	22.77	22.77	22.20	22.20	21.67	21.72	21.11	21.16	20.71	20.78
4.2	22.83	22.73	22.22	22.23	21.64	21.72	21.18	21.22	20.71	20.85
4.4	22.79	22.78	22.22	22.28	21.65	21.72	21.28	21.30	20.77	20.85
4.6	22.80	22.80	22.22	22.29	21.75	21.80	21.25	21.29	20.90	20.91
4.8	22.76	22.81	22.20	22.29	21.77	21.82	21.23	21.26	20.93	20.98
5.0	22.78	22.75	22.19	22.28	21.80	21.84	21.31	21.37	20.93	21.03
5.2	22.74	22.74	22.20	22.22	21.82	21.85	21.39	21.42	20.95	20.99
5.4	22.71	22.76	22.19	22.22	21.86	21.85	21.36	21.43	20.96	20.99
5.6	22.64	22.70	22.20	22.25	21.91	21.89	21.43	21.50	20.99	21.03

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCA-960)-Continued										
5.8	22.66	22.70	22.24	22.30	21.89	21.94	21.39	21.48	21.03	21.10
6.0	22.64	22.69	22.25	22.30	21.95	21.98	21.43	21.42	21.13	21.12
6.2	22.64	22.68	22.21	22.26	21.94	21.96	21.42	21.49	21.12	21.17
6.4	22.68	22.68	22.22	22.23	21.96	21.97	21.45	21.53	21.12	21.17
6.6	22.67	22.70	22.19	22.25	21.94	21.98	21.50	21.53	21.07	21.17
6.8	22.68	22.67	22.28	22.33	21.95	21.95	21.47	21.55	21.05	21.17
7.0	22.70	22.66	22.30	22.40	21.95	21.91	21.40	21.43	21.09	21.17
7.2	22.65	22.66	22.34	22.39	21.96	21.92	21.36	21.41	21.01	21.10
7.4	22.79	22.82	22.33	22.40	21.92	21.93	21.37	21.40	21.06	21.13
7.6	22.81	22.84	22.40	22.48	21.84	21.89	21.37	21.38	21.05	21.12
7.8	22.76	22.80	22.41	22.49	21.81	21.83	21.52	21.56	21.07	21.14
8.0	22.79	22.74	22.47	22.51	21.82	21.85	21.47	21.49	20.95	21.04
8.2	22.82	22.78	22.42	22.47	21.88	21.93	21.48	21.46	20.96	21.00
8.4	22.82	22.76	22.32	22.33	21.99	22.03	21.47	21.50	20.95	21.13
8.6	22.92	22.87	22.31	22.30	22.11	22.11	21.44	21.47	21.15	21.15
8.8	22.81	22.77	22.34	22.36	22.14	22.17	21.53	21.55	21.19	21.24
9.0	22.80	22.83	22.40	22.38	22.13	22.15	21.59	21.62	21.19	21.23
9.2	22.77	22.81	22.44	22.44	22.08	22.12	21.66	21.68	21.24	21.29
9.4	22.85	22.87	22.47	22.43	22.14	22.15	21.71	21.69	21.26	21.32
9.6	22.96	22.86	22.49	22.44	22.20	22.23	21.74	21.72	21.28	21.33
9.8	23.04	22.92	22.52	22.49	22.26	22.31	21.78	21.75	21.30	21.30
10.0	22.97	22.99	22.50	22.55	22.28	22.31	21.82	21.78	21.31	21.29

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCB-650)										
0.2	22.13	22.14	21.81	21.80	21.44	21.44	21.24	21.26	21.00	21.02
0.4	22.18	22.19	21.78	21.79	21.51	21.54	21.25	21.23	21.03	21.04
0.6	22.24	22.28	21.73	21.76	21.65	21.67	21.25	21.26	21.06	21.04
0.8	22.27	22.30	21.79	21.81	21.71	21.75	21.24	21.25	21.02	21.05
1.0	22.26	22.31	21.82	21.83	21.70	21.75	21.15	21.21	20.93	21.02
1.2	22.26	22.35	21.84	21.80	21.68	21.71	21.17	21.19	20.88	20.90
1.4	22.26	22.13	21.86	21.81	21.66	21.68	21.15	21.15	20.86	20.88
1.6	22.29	22.19	21.85	21.88	21.62	21.61	21.17	21.20	20.90	20.91
1.8	22.27	22.31	21.81	21.81	21.59	21.58	21.24	21.29	20.85	20.87
2.0	22.24	22.26	21.75	21.78	21.55	21.59	21.32	21.37	20.77	20.81
2.2	22.23	22.28	21.76	21.77	21.57	21.59	21.32	21.35	20.71	20.72

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCB-650)-Continued										
2.4	22.23	22.23	21.75	21.77	21.57	21.60	21.29	21.33	20.74	20.73
2.6	22.20	22.19	21.65	21.67	21.55	21.58	21.33	21.36	20.79	20.79
2.8	22.18	22.19	21.73	21.70	21.55	21.59	21.37	21.40	20.83	20.82
3.0	22.11	22.15	21.77	21.76	21.51	21.54	21.44	21.43	20.87	20.84
3.2	22.05	22.09	21.81	21.84	21.47	21.48	21.43	21.42	20.84	20.88
3.4	22.27	22.26	21.85	21.88	21.39	21.43	21.42	21.43	20.85	20.87
3.6	22.24	22.28	21.88	21.92	21.35	21.38	21.38	21.40	20.82	20.83
3.8	22.26	22.28	21.84	21.88	21.35	21.36	21.22	21.26	20.70	20.78
4.0	22.19	22.22	21.81	21.86	21.39	21.37	21.10	21.19	20.67	20.70
4.2	22.24	22.23	21.79	21.84	21.39	21.38	21.07	21.10	20.55	20.56
4.4	22.27	22.25	21.82	21.78	21.34	21.32	20.95	20.98	20.55	20.54
4.6	22.19	22.20	21.95	21.92	21.39	21.34	21.03	21.04	20.55	20.54
4.8	22.20	22.27	21.95	22.00	21.59	21.54	21.02	21.05	20.53	20.53
5.0	22.33	22.31	21.99	22.02	21.62	21.57	21.10	21.12	20.55	20.52
5.2	22.37	22.40	21.98	22.03	21.68	21.67	21.18	21.20	20.63	20.66
5.4	22.41	22.37	21.99	22.00	21.72	21.71	21.25	21.29	20.74	20.58
5.6	22.36	22.38	21.98	21.99	21.70	21.70	21.25	21.29	20.73	20.63
5.8	22.33	22.37	21.95	21.95	21.69	21.71	21.24	21.14	20.73	20.74
6.0	22.30	22.33	21.90	21.87	21.65	21.65	21.22	21.09	20.83	20.77
6.2	22.29	22.29	21.87	21.81	21.60	21.59	21.26	21.20	20.77	20.74
6.4	22.30	22.31	21.85	21.79	21.58	21.56	21.19	21.21	20.80	20.74
6.6	22.33	22.30	21.87	21.87	21.52	21.52	21.20	21.21	20.83	20.80
6.8	22.36	22.36	21.91	21.90	21.48	21.48	21.21	21.23	20.86	20.83
7.0	22.32	22.21	21.93	21.91	21.45	21.43	21.22	21.19	20.86	20.84
7.2	22.33	22.24	21.92	21.94	21.43	21.40	21.22	21.15	20.84	20.84
7.4	22.34	22.30	21.89	21.88	21.43	21.40	21.07	21.06	20.80	20.81
7.6	22.33	22.31	21.84	21.85	21.42	21.41	21.07	21.06	20.78	20.80
7.8	22.39	22.33	21.88	21.86	21.48	21.45	21.11	21.12	20.78	20.77
8.0	22.36	22.30	21.89	21.86	21.50	21.48	21.17	21.20	20.71	20.65
8.2	22.56	22.53	21.91	21.96	21.55	21.54	21.22	21.30	20.70	20.71
8.4	22.64	22.63	21.93	21.94	21.60	21.60	21.30	21.26	20.90	20.89
8.6	22.56	22.49	22.01	21.99	21.69	21.65	21.35	21.26	20.95	20.95
8.8	22.46	22.62	22.06	22.07	21.73	21.70	21.35	21.35	20.91	20.92
9.0	22.40	22.39	22.05	22.04	21.69	21.63	21.36	21.38	20.90	20.95
9.2	22.45	22.40	22.04	22.03	21.65	21.62	21.35	21.29	20.90	20.94
9.4	22.35	22.32	22.03	22.02	21.66	21.62	21.28	21.28	20.80	20.83
9.6	22.29	22.30	22.01	21.99	21.62	21.62	21.23	21.23	20.79	20.80
9.8	22.30	22.34	22.02	21.99	21.64	21.67	21.16	21.18	20.75	20.72
10.0	22.35	22.33	22.02	22.03	21.57	21.57	21.18	21.18	20.70	20.68

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
					EROSION-STUDY PLOT (SITE SCB-950)					
0.2	24.13	24.03	23.47	23.38	22.94	22.85	22.46	22.36	21.74	21.65
0.4	24.12	24.03	23.46	23.43	22.92	22.81	22.41	22.30	21.71	21.63
0.6	24.10	24.05	23.42	23.36	22.91	22.86	22.32	22.26	21.70	21.65
0.8	24.12	24.07	23.44	23.39	22.86	22.84	22.28	22.25	21.74	21.58
1.0	24.08	24.02	23.35	23.33	22.83	22.82	22.29	22.23	21.69	21.64
1.2	24.05	23.98	23.32	23.32	22.80	22.76	22.25	22.21	21.62	21.58
1.4	23.97	23.93	23.28	23.23	22.81	22.75	22.30	22.27	21.52	21.51
1.6	24.02	23.92	23.28	23.21	22.80	22.73	22.29	22.27	21.51	21.45
1.8	23.97	23.88	23.31	23.26	22.81	22.70	22.26	22.17	21.54	21.49
2.0	23.92	23.86	23.30	23.26	22.75	22.70	22.24	22.17	21.50	21.48
2.2	23.89	23.84	23.31	23.25	22.71	22.68	22.19	22.09	21.46	21.39
2.4	23.89	23.84	23.27	23.17	22.64	22.65	22.13	22.02	21.48	21.42
2.6	23.82	23.77	23.23	23.15	22.61	22.60	22.05	21.98	21.46	21.41
2.8	23.84	23.81	23.19	23.20	22.65	22.60	21.95	21.93	21.43	21.35
3.0	23.88	23.86	23.14	23.13	22.67	22.64	21.90	21.85	21.40	21.32
3.2	23.85	23.87	23.13	23.12	22.69	22.60	21.88	21.86	21.37	21.31
3.4	23.86	23.79	23.07	22.99	22.61	22.58	21.85	21.84	21.27	21.30
3.6	23.86	23.80	23.08	23.01	22.56	22.51	21.85	21.83	21.32	21.32
3.8	23.74	23.69	23.10	23.03	22.50	22.47	21.80	21.76	21.33	21.28
4.0	23.72	23.67	23.05	23.04	22.45	22.42	21.83	21.83	21.31	21.30
4.2	23.68	23.62	22.99	22.97	22.34	22.32	21.95	21.92	21.27	21.27
4.4	23.81	23.74	22.90	22.90	22.35	22.32	21.97	21.93	21.25	21.17
4.6	23.67	23.55	22.88	22.87	22.27	22.26	21.95	21.92	21.21	21.14
4.8	23.65	23.53	22.88	22.87	22.28	22.27	21.77	21.71	21.26	21.17
5.0	23.52	23.52	22.88	22.85	22.28	22.27	21.75	21.69	21.21	21.18
5.2	23.52	23.45	22.90	22.87	22.28	22.25	21.69	21.68	21.27	21.23
5.4	23.52	23.46	22.88	22.85	22.22	22.21	21.68	21.65	21.30	21.25
5.6	23.53	23.48	22.83	22.79	22.22	22.18	21.67	21.60	21.28	21.26
5.8	23.51	23.48	22.87	22.82	22.20	22.20	21.65	21.64	21.29	21.27
6.0	23.55	23.47	22.88	22.84	22.23	22.24	21.62	21.59	21.30	21.26
6.2	23.53	23.49	22.90	22.87	22.26	22.26	21.62	21.60	21.32	21.29
6.4	23.57	23.54	22.87	22.85	22.24	22.23	21.60	21.58	21.16	21.17
6.6	23.61	23.56	22.86	22.80	22.26	22.24	21.64	21.64	21.04	21.00
6.8	23.61	23.51	22.83	22.80	22.25	22.26	21.65	21.59	20.99	20.98
7.0	23.38	23.39	22.82	22.78	22.24	22.24	21.61	21.57	20.97	21.01
7.2	23.39	23.33	22.81	22.79	22.15	22.12	21.51	21.47	21.01	20.98
7.4	23.33	23.28	22.78	22.75	22.12	22.11	21.39	21.40	20.98	20.97
7.6	23.26	23.22	22.73	22.72	22.07	22.03	21.31	21.34	20.91	20.89
7.8	23.23	23.20	22.69	22.63	21.97	22.01	21.28	21.24	20.85	20.86
8.0	23.21	23.19	22.63	22.62	22.02	21.98	21.30	21.23	20.77	20.74

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCB-950)-Continued										
8.2	23.26	23.23	22.62	22.58	22.15	22.07	21.39	21.36	20.90	20.88
8.4	23.22	23.20	22.57	22.54	22.16	22.12	21.47	21.46	20.92	20.90
8.6	23.14	23.13	22.59	22.57	22.11	22.07	21.84	21.71	21.00	21.00
8.8	23.07	23.07	22.63	22.59	22.14	22.10	21.81	21.77	20.98	21.02
9.0	23.03	23.00	22.63	22.61	22.19	22.12	21.73	21.70	20.98	20.99
9.2	23.07	23.09	22.68	22.64	22.38	22.35	21.77	21.72	21.00	20.93
9.4	23.16	23.13	22.72	22.72	22.42	22.39	21.80	21.74	20.92	20.92
9.6	23.24	23.21	22.74	22.70	22.40	22.34	21.75	21.75	20.95	21.02
9.8	23.31	23.29	22.75	22.72	22.13	22.15	21.70	21.64	21.00	21.05
10.0	23.38	23.30	22.77	22.74	22.12	22.13	21.63	21.59	21.07	20.97

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCC-210)										
0.2	18.63	18.64	18.25	18.25	17.84	17.84	17.48	17.48	17.09	17.09
0.4	18.65	18.62	18.26	18.22	17.87	17.87	17.51	17.52	17.08	17.02
0.6	18.67	18.66	18.26	18.26	17.82	17.83	17.47	17.46	17.08	17.01
0.8	18.67	18.63	18.20	18.23	17.81	17.83	17.45	17.43	16.94	17.00
1.0	18.61	18.63	18.23	18.20	17.78	17.81	17.39	17.34	16.94	16.96
1.2	18.59	18.60	18.28	18.24	17.80	17.81	17.40	17.40	16.99	17.04
1.4	18.59	18.58	18.30	18.28	17.81	17.81	17.39	17.40	16.94	16.97
1.6	18.59	18.60	18.31	18.33	17.83	17.77	17.37	17.37	16.94	16.95
1.8	18.64	18.65	18.34	18.37	17.81	17.78	17.36	17.35	16.94	16.99
2.0	18.71	18.71	18.16	18.21	17.84	17.81	17.40	17.35	16.95	16.98
2.2	18.72	18.68	18.14	18.20	17.72	17.79	17.39	17.37	16.99	17.00
2.4	18.76	18.75	18.25	18.24	17.71	17.76	17.38	17.39	17.01	16.98
2.6	18.79	18.73	18.34	18.33	17.79	17.76	17.38	17.37	17.01	17.01
2.8	18.67	18.70	18.38	18.39	17.81	17.82	17.39	17.42	17.05	17.02
3.0	18.71	18.76	18.45	18.38	17.85	17.84	17.41	17.41	17.04	16.98
3.2	18.82	18.74	18.47	18.38	17.84	17.85	17.32	17.32	17.05	16.99
3.4	18.82	18.75	18.46	18.46	17.84	17.85	17.36	17.38	17.04	17.05
3.6	18.81	18.80	18.57	18.59	17.93	17.89	17.40	17.41	17.05	17.06
3.8	18.83	18.82	18.50	18.53	17.92	17.89	17.41	17.40	17.02	17.03
4.0	18.89	18.86	18.50	18.54	17.95	17.89	17.38	17.41	16.90	16.91
4.2	18.90	18.92	18.50	18.52	17.95	17.84	17.36	17.36	16.88	16.89
4.4	18.94	18.92	18.50	18.52	17.95	17.88	17.33	17.35	16.98	16.93
4.6	18.93	18.86	18.50	18.54	17.95	17.97	17.33	17.38	16.93	16.89

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCC-210)-Continued										
4.8	18.91	18.88	18.56	18.54	18.02	18.06	17.33	17.34	16.90	16.90
5.0	18.96	18.98	18.49	18.50	17.99	17.91	17.37	17.36	16.88	16.92
5.2	18.95	18.87	18.50	18.51	17.98	17.98	17.32	17.35	16.86	16.93
5.4	18.98	18.92	18.46	18.51	17.93	17.99	17.34	17.35	17.02	16.92
5.6	19.02	18.98	18.50	18.42	17.89	17.92	17.37	17.33	16.92	16.95
5.8	19.03	19.02	18.53	18.47	17.89	17.90	17.35	17.34	16.92	16.93
6.0	18.96	18.95	18.55	18.55	17.92	17.88	17.34	17.36	16.85	16.87
6.2	18.95	18.97	18.55	18.55	17.88	17.85	17.37	17.36	16.86	16.85
6.4	18.92	18.92	18.51	18.49	17.85	17.85	17.36	17.38	16.85	16.86
6.6	18.93	18.92	18.50	18.44	17.93	17.91	17.38	17.38	16.93	16.77
6.8	18.94	18.92	18.55	18.45	18.02	18.00	17.42	17.42	16.84	16.83
7.0	18.92	18.91	18.47	18.39	17.97	17.98	17.46	17.46	16.86	16.87
7.2	18.87	18.89	18.50	18.48	17.94	17.96	17.40	17.41	16.88	16.90
7.4	18.88	18.87	18.52	18.49	17.96	17.96	17.42	17.43	16.93	16.94
7.6	18.89	18.88	18.50	18.44	18.04	17.94	17.45	17.46	16.91	16.95
7.8	18.84	18.85	18.43	18.40	18.04	17.99	17.50	17.50	16.83	16.84
8.0	18.84	18.84	18.48	18.45	17.94	17.96	17.46	17.48	16.87	16.85
8.2	18.85	18.84	18.46	18.48	17.93	17.89	17.50	17.49	16.89	16.89
8.4	18.87	18.85	18.38	18.40	17.99	17.94	17.49	17.50	16.83	16.87
8.6	18.84	18.86	18.39	18.40	18.02	18.00	17.45	17.47	16.85	16.86
8.8	18.81	18.82	18.37	18.38	17.96	17.97	17.60	17.45	16.86	16.89
9.0	18.84	18.80	18.24	18.32	17.95	17.93	17.61	17.59	16.95	16.94
9.2	18.89	18.81	18.32	18.34	17.89	17.85	17.60	17.56	17.00	16.90
9.4	18.85	18.81	18.40	18.40	17.86	17.86	17.62	17.55	16.99	16.91
9.6	18.71	18.74	18.38	18.39	17.85	17.83	17.60	17.62	17.03	17.00
9.8	18.68	18.71	18.35	18.39	17.80	17.80	17.59	17.57	17.02	17.00
10.0	18.69	18.71	18.36	18.38	17.72	17.73	17.57	17.56	16.98	16.90
EROSION-STUDY PLOT (SITE SCCM50)										
0.2	22.86	22.83	22.24	22.19	21.92	21.92	21.25	21.28	20.69	20.71
0.4	22.92	22.82	22.28	22.20	21.93	21.94	21.22	21.24	20.66	20.68
0.6	22.95	22.77	22.21	22.24	21.91	21.80	21.20	21.21	20.65	20.64
0.8	22.87	22.86	22.25	22.22	21.82	21.80	21.26	21.27	20.69	20.68
1.0	22.83	22.88	22.27	22.27	21.77	21.79	21.17	21.22	20.65	20.67
1.2	22.90	22.80	22.31	22.28	21.78	21.77	21.17	21.16	20.65	20.69
1.4	22.94	22.76	22.30	22.31	21.74	21.74	21.19	21.18	20.60	20.63
1.6	22.66	22.76	22.19	22.16	21.73	21.76	21.16	21.10	20.51	20.53
1.8	22.63	22.65	22.15	22.14	21.76	21.75	21.08	21.08	20.49	20.52
2.0	22.62	22.65	22.15	22.13	21.72	21.63	21.11	21,05	20.47	20.49
2.2	22.61	22.66	22.06	22.08	21.65	21.61	20.96	21,01	20.45	20.49

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE SCCM50)-Continued										
2.4	22.69	22.67	22.03	22.05	21.58	21.60	20.95	20.94	20.35	20.40
2.6	22.68	22.70	22.08	22.08	21.56	21.57	20.98	20.98	20.40	20.38
2.8	22.59	22.58	22.06	22.09	21.54	21.54	20.88	20.93	20.40	20.40
3.0	22.62	22.62	22.00	22.00	21.48	21.47	20.90	20.76	20.25	20.32
3.2	22.70	22.69	21.97	21.95	21.49	21.50	20.85	20.81	20.23	20.24
3.4	22.70	22.70	21.95	21.94	21.48	21.47	20.78	20.84	20.28	20.25
3.6	22.61	22.64	21.99	21.96	21.45	21.44	20.79	20.81	20.25	20.25
3.8	22.56	22.58	22.07	21.93	21.51	21.50	20.82	20.81	20.24	20.26
4.0	22.63	22.64	22.17	22.06	21.49	21.52	20.82	20.84	20.21	20.22
4.2	22.72	22.74	22.11	22.19	21.45	21.48	20.81	20.84	20.22	20.29
4.4	22.69	22.75	22.13	22.14	21.47	21.54	20.84	20.84	20.20	20.26
4.6	22.73	22.75	22.17	22.14	21.53	21.54	20.93	20.93	20.27	20.23
4.8	22.75	22.77	22.16	22.13	21.67	21.60	20.97	21.00	20.31	20.32
5.0	22.72	22.76	22.05	22.10	21.61	21.63	20.95	20.99	20.35	20.32
5.2	22.72	22.74	22.09	22.08	21.61	21.64	20.95	20.95	20.34	20.42
5.4	22.74	22.74	22.13	22.12	21.63	21.63	20.99	20.99	20.38	20.43
5.6	22.77	22.76	22.20	22.18	21.67	21.62	21.05	20.99	20.53	20.46
5.8	22.80	22.77	22.21	22.17	21.70	21.71	21.03	21.00	20.46	20.43
6.0	22.81	22.81	22.21	22.23	21.69	21.71	21.01	21.02	20.45	20.48
6.2	22.81	22.78	22.17	22.28	21.71	21.78	21.03	21.02	20.53	20.54
6.4	22.85	22.83	22.21	22.23	21.75	21.74	21.16	21.03	20.64	20.55
6.6	22.87	22.84	22.27	22.29	21.75	21.75	21.15	21.08	20.51	20.49
6.8	22.85	22.86	22.29	22.28	21.90	21.92	21.11	21.10	20.53	20.58
7.0	22.87	22.87	22.30	22.30	21.67	21.73	21.15	21.10	20.58	20.61
7.2	22.81	22.82	22.33	22.32	21.68	21.69	21.15	21.16	20.55	20.59
7.4	22.80	22.80	22.34	22.34	21.72	21.73	21.16	21.18	20.57	20.56
7.6	22.72	22.73	22.32	22.34	21.75	21.73	21.17	21.19	20.55	20.54
7.8	22.77	22.79	22.29	22.30	21.79	21.78	21.16	21.19	20.64	20.63
8.0	22.79	22.82	22.34	22.31	21.78	21.80	21.13	21.18	20.65	20.63
8.2	22.86	22.93	22.33	22.30	21.75	21.66	21.14	21.20	20.64	20.58
8.4	22.94	22.96	22.35	22.31	21.73	21.68	21.14	21.14	20.48	20.53
8.6	22.96	22.96	22.37	22.37	21.74	21.74	21.15	21.17	20.47	20.52
8.8	22.96	22.94	22.30	22.33	21.76	21.76	21.16	21.14	20.53	20.55
9.0	22.92	22.91	22.29	22.29	21.71	21.73	21.16	21.15	20.62	20.62
9.2	22.90	22.90	22.29	22.30	21.74	21.73	21.14	21.16	20.68	20.64
9.4	22.88	22.91	22.27	22.33	21.76	21.79	21.21	21.18	20.66	20.61
9.6	22.90	22.90	22.23	22.26	21.72	21.66	21.18	21.19	20.69	20.60
9.8	22.93	22.91	22.13	22.20	21.68	21.73	21.16	21.18	20.62	20.58
10.0	22.91	22.97	22.25	22.25	21.70	21.72	21.14	21.16	20.55	20.55

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Oct 1989	June 1990	Oct 1989	June 1990	Oct. 1989	June 1990	Oct. 1989	June 1990	Oct. 1989	June 1990
					EROSION-STUDY PLOT (SITE SCC-660)					
0.2	19.33	19.31	18.72	18.73	18.15	18.14	17.74	17.69	17.00	17.05
0.4	19.28	19.25	18.69	18.73	18.12	18.10	17.75	17.69	17.02	17.03
0.6	19.29	19.31	18.70	18.71	18.12	18.18	17.75	17.71	17.03	17.08
0.8	19.32	19.32	18.67	18.70	18.23	18.22	17.61	17.66	17.07	17.13
1.0	19.27	19.23	18.66	18.67	18.26	18.29	17.57	17.61	17.05	17.10
1.2	19.19	19.20	18.70	18.70	18.28	18.31	17.61	17,68	17.09	17.12
1.4	19.21	19.19	18.69	18.69	18.24	18.28	17.60	17.72	17.11	17.11
1.6	19.24	19.26	18.72	18.72	18.19	18.23	17.56	17.59	17.08	17.14
1.8	19.21	19.18	18.65	18.67	18.22	18.25	17.67	17.69	17.09	17.12
2.0	19.18	19.23	18.67	18.63	18.28	18.11	17.64	17.63	17.00	17.04
2.2	19.17	19.21	18.65	18.66	18.15	18.12	17.56	17.60	17.03	17.09
2.4	19.15	19.17	18.63	18.64	18.08	18.12	17.59	17.63	17.03	17.07
2.6	19.09	19.10	18.65	18.67	18.23	18.26	17.64	17.67	16.95	16.98
2.8	18.98	19.02	18.66	18.67	18.15	18.12	17.57	17.62	16.89	16.91
3.0	18.98	19.02	18.59	18.64	18.12	18.11	17.59	17.58	16.83	16.87
3.2	19.01	19.00	18.53	18.58	18.15	18.19	17.59	17.66	16.82	16.87
3.4	18.95	18.97	18.56	18.56	18.02	18.05	17.58	17.61	16.81	16.84
3.6	18.98	18.96	18.48	18.52	18.06	18.02	17.45	17.47	16.92	16.94
3.8	18.90	18.90	18.41	18.48	18.05	18.05	17.41	17.45	16.85	16.87
4.0	18.90	18.86	18.39	18.42	18.09	18.10	17.44	17.49	16.74	16.79
4.2	18.94	18.92	18.41	18.44	18.08	18.02	17.36	17.39	16.70	16.75
4.4	18.89	18.92	18.39	18.41	18.03	18.05	17.31	17.31	16.65	16.69
4.6	18.76	18.78	18.35	18.38	17.97	18.00	17.29	17.30	16.71	16.75
4.8	18.76	18.77	18.29	18.31	17.92	17.96	17.29	17.25	16.72	16.78
5.0	18.79	18.81	18.23	18.26	17.95	17.97	17.36	17.35	16.75	16.80
5.2	18.78	18.80	18.26	18.27	17.95	17.98	17.30	17.36	16.75	16.81
5.4	18.91	18.77	18.27	18.27	17.96	18.02	17.29	17.32	16.72	16.74
5.6	18.82	18.79	18.26	18.25	17.97	17.96	17.24	17.28	16.68	16.75
5.8	18.76	18.75	18.17	18.20	17.92	17.91	17.26	17.32	16.68	16.76
6.0	18.73	18.65	18.15	18.13	17.90	17.92	17.28	17.33	16.71	16.83
6.2	18.68	18.63	18.11	18.12	17.88	17.82	17.25	17.30	16.69	16.71
6.4	18.67	18.68	18.06	18.08	17.80	17.82	17.16	17.20	16.63	16.68
6.6	18.71	18.68	18.06	18.08	17.80	17.81	17.10	17.14	16.72	16.71
6.8	18.70	18.70	18.10	18.12	17.77	17.81	17.01	17.09	16.63	16.68
7.0	18.67	18.68	18.09	18.12	17.78	17.81	17.10	17.18	16.66	16.71
7.2	18.74	18.73	18.13	18.15	17.85	17.90	17.31	17.28	16.70	16.73
7.4	18.76	18.75	18.15	18.20	17.85	17.87	17.32	17.17	16.70	16.71
7.6	18.76	18.74	18.14	18.18	17.83	17.85	17.28	17.30	16.57	16.62
7.8	18.74	18.71	18.10	18.16	17.83	17.85	17.20	17.28	16.60	16.70
8.0	18.75	18.71	18.10	18.14	17.78	17.83	17.19	17.32	16.61	16.54

Table 10. Soil-surface surveys from erosion-study plots, Spring Creek area-Continued

Traverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Oct. 1989	June 1990	Oct. 1989	June 1990	Oct. 1989	June 1990	Oct. 1989	June 1990	Oct. 1989	June 1990
EROSION-STUDY PLOT (SITE SCC-660)-Continued										
8.2	18.72	18.72	18.13	18.15	17.83	17.85	17.33	17.39	16.49	16.66
8.4	18.77	18.76	18.15	18.17	17.93	17.95	17.38	17.42	16.63	16.61
8.6	18.75	18.75	18.16	18.20	17.95	17.98	17.39	17.45	16.61	16.67
8.8	18.84	18.89	18.18	18.22	17.97	17.99	17.36	17.42	16.60	16.67
9.0	18.94	18.95	18.23	18.26	17.96	17.86	17.31	17.42	16.61	16.61
9.2	18.96	18.79	18.24	18.27	17.97	17.94	17.33	17.36	16.67	16.60
9.4	18.96	18.89	18.29	18.30	18.03	18.04	17.37	17.41	16.60	16.66
9.6	19.05	19.10	18.30	18.33	18.00	18.04	17.38	17.46	16.69	16.73
9.8	19.07	19.06	18.33	18.38	18.01	18.04	17.43	17.44	16.74	16.76
10.0	19.10	19.12	18.40	18.44	18.04	18.08	17.42	17.45	16.66	16.72

Table 11. Soil-surface surveys from erosion-study plots, Cow Camp Creek area

[Altitudes in feet, relative to local reference mark with arbitrary altitude of 20.00 feet]

Transverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
					EROSION-STUDY PLOT (SITE CCA-200)					
0.2	21.60	21.61	21.28	21.28	20.72	20.71	20.28	20.28	19.97	19.97
0.4	21.65	21.67	21.27	21.29	20.72	20.73	20.26	20.28	19.97	19.97
0.6	21.66	21.66	21.25	21.28	20.74	20.75	20.28	20.29	19.99	20.00
0.8	21.64	21.63	21.29	21.31	20.73	20.73	20.31	20.33	20.00	20.01
1.0	21.64	21.64	21.28	21.30	20.75	20.77	20.36	20.38	20.04	20.03
1.2	21.62	21.62	21.29	21.31	20.77	20.79	20.33	20.32	20.01	20.01
1.4	21.65	21.64	21.26	21.28	20.84	20.84	20.34	20.33	20.03	20.06
1.6	21.67	21.67	21.27	21.28	20.82	20.83	20.35	20.35	20.00	20.00
1.8	21.69	21.69	21.27	21.28	20.85	20.82	20.39	20.37	19.98	20.00
2.0	21.67	21.67	21.31	21.31	20.83	20.84	20.38	20.39	20.00	20.03
2.2	21.62	21.63	21.26	21.27	20.85	20.86	20.40	20.42	20.03	20.05
2.4	21.65	21.65	21.26	21.25	20.89	20.90	20.45	20.44	19.96	20.03
2.6	21.64	21.65	21.31	21.32	20.90	20.91	20.48	20.45	20.05	20.05
2.8	21.63	21.64	21.35	21.35	20.92	20.94	20.48	20.48	19.96	19.98
3.0	21.64	21.64	21.28	21.27	20.92	20.93	20.47	20.49	19.97	20.01
3.2	21.62	21.62	21.28	21.29	20.93	20.94	20.46	20.48	20.01	20.03
3.4	21.60	21.60	21.37	21.38	20.94	20.95	20.49	20.51	20.01	20.04
3.6	21.58	21.59	21.31	21.32	20.98	20.98	20.52	20.53	20.05	20.07
3.8	21.61	21.61	21.33	21.33	20.96	20.97	20.52	20.52	20.05	20.09
4.0	21.59	21.60	21.35	21.35	21.02	21.03	20.55	20.53	20.07	20.12
4.2	21.62	21.61	21.35	21.35	21.03	21.02	20.56	20.56	20.10	20.12
4.4	21.60	21.61	21.36	21.37	20.96	20.98	20.54	20.55	20.11	20.12
4.6	21.62	21.62	21.34	21.35	21.00	21.00	20.54	20.52	20.11	20.13
4.8	21.62	21.61	21.36	21.36	21.10	21.10	20.53	20.53	20.12	20.13
5.0	21.60	21.61	21.33	21.34	21.10	21.10	20.53	20.53	20.08	20.11
5.2	21.62	21.62	21.34	21.35	21.06	21.05	20.54	20.52	20.10	20.11
5.4	21.61	21.61	21.35	21.35	21.06	21.06	20.52	20.51	20.11	20.14
5.6	21.59	21.60	21.35	21.36	21.07	21.05	20.53	20.56	20.15	20.15
5.8	21.64	21.65	21.37	21.38	21.08	21.08	20.51	20.53	20.13	20.15
6.0	21.65	21.64	21.37	21.39	21.06	21.06	20.47	20.52	20.11	20.16
6.2	21.62	21.62	21.41	21.41	21.09	21.09	20.49	20.50	20.10	20.13
6.4	21.64	21.65	21.35	21.37	21.05	21.04	20.52	20.52	20.11	20.11
6.6	21.63	21.63	21.31	21.32	21.02	20.98	20.53	20.54	20.12	20.13

Table 11. Soil-surface surveys from erosion-study plots, Cow Camp Creek area-Continued

Transverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE CCA-200)-Continued										
6.8	21.65	21.65	21.34	21.34	20.99	20.99	20.51	20.50	20.10	20.12
7.0	21.72	21.71	21.33	21.34	20.98	20.97	20.53	20.53	20.12	20.13
7.2	21.67	21.66	21.31	21.31	21.00	21.00	20.54	20.55	20.11	20.12
7.4	21.65	21.66	21.32	21.31	20.97	20.97	20.55	20.54	20.12	20.13
7.6	21.67	21.67	21.31	21.31	20.97	20.96	20.55	20.55	20.13	20.14
7.8	21.65	21.65	21.29	21.29	20.98	20.98	20.53	20.53	20.09	20.13
8.0	21.67	21.68	21.29	21.30	21.01	21.01	20.56	20.57	20.10	20.11
8.2	21.68	21.68	21.34	21.33	20.98	20.97	20.58	20.58	20.10	20.11
8.4	21.67	21.66	21.35	21.33	21.00	20.99	20.58	20.61	20.07	20.06
8.6	21.68	21.68	21.36	21.36	21.01	21.01	20.60	20.60	20.08	20.10
8.8	21.65	21.66	21.38	21.38	20.99	21.00	20.58	20.59	20.11	20.11
9.0	21.69	21.68	21.38	21.38	21.02	21.02	20.56	20.55	20.07	20.08
9.2	21.69	21.68	21.37	21.38	21.06	21.05	20.54	20.54	20.10	20.09
9.4	21.66	21.71	21.40	21.39	21.04	21.03	20.60	20.60	20.07	20.09
9.6	21.71	21.71	21.39	21.40	21.04	21.05	20.60	20.60	20.05	20.06
9.8	21.74	21.73	21.44	21.43	21.04	21.02	20.58	20.59	20.04	20.04
10.0	21.74	21.73	21.44	21.43	21.01	20.99	20.60	20.59	20.06	20.07
EROSION-STUDY PLOT (CCA-400)										
0.2	22.56	22.58	22.08	22.09	21.73	21.74	21.32	21.33	20.92	20.94
0.4	22.60	22.61	22.09	22.09	21.71	21.71	21.33	21.32	20.91	20.90
0.6	22.67	22.70	22.10	22.13	21.70	21.71	21.35	21.36	20.89	20.91
0.8	22.69	22.70	22.08	22.10	21.70	21.71	21.34	21.36	20.87	20.92
1.0	22.68	22.68	22.12	22.14	21.75	21.77	21.38	21.39	20.84	20.87
1.2	22.71	22.72	22.11	22.12	21.82	21.83	21.37	21.35	20.85	20.86
1.4	22.73	22.74	22.10	22.11	21.85	21.85	21.32	21.35	20.87	20.88
1.6	22.77	22.77	22.11	22.11	21.93	21.93	21.37	21.33	20.87	20.89
1.8	22.80	22.82	22.13	22.14	21.88	21.89	21.33	21.35	20.86	20.89
2.0	22.81	22.82	22.13	22.14	21.91	21.92	21.33	21.33	20.92	20.95
2.2	22.83	22.85	22.17	22.17	21.92	21.91	21.38	21.36	20.94	20.96
2.4	22.82	22.85	22.24	22.24	21.86	21.87	21.36	21.39	20.99	21.01
2.6	22.88	22.91	22.29	22.29	21.95	21.96	21.39	21.39	21.00	21.02
2.8	22.80	22.80	22.38	22.37	21.95	21.93	21.42	21.40	21.02	21.03
3.0	22.82	22.82	22.34	22.31	21.93	21.94	21.42	21.42	21.05	21.06
3.2	22.79	22.80	22.31	22.31	21.90	21.96	21.43	21.45	21.04	21.02

Table 11. Soil-surface surveys from erosion-study plots, Cow Camp Creek area-Continued

Transverse Station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
					EROSION-STUDY PLOT (CCA-400)-Continued					
3.4	22.75	22.75	22.31	22.30	21.97	21.98	21.43	21.43	21.12	21.08
3.6	22.86	22.87	22.32	22.31	21.91	21.92	21.44	21.45	21.16	21.12
3.8	22.86	22.86	22.40	22.32	21.92	21.92	21.45	21.44	21.15	21.16
4.0	22.83	22.83	22.34	22.34	21.90	21.89	21.40	21.40	21.14	21.15
4.2	22.88	22.88	22.35	22.35	21.90	21.92	21.43	21.44	21.12	21.14
4.4	22.90	22.90	22.31	22.33	21.87	21.89	•21.47	21.48	21.17	21.21
4.6	22.91	22.93	22.34	22.30	21.88	21.89	21.39	21.41	21.13	21.14
4.8	22.93	22.95	22.33	22.31	21.92	21.93	21.37	21.38	21.07	21.07
5.0	22.95	22.97	22.35	22.37	21.93	21.94	21.38	21.38	21.01	21.03
5.2	22.96	22.98	22.39	22.40	21.93	21.95	21.41	21.41	21.02	21.02
5.4	22.95	22.97	22.45	22.46	21.95	21.96	21.41	21.41	21.00	21.01
5.6	22.95	22.96	22.51	22.48	21.99	22.01	21.42	21.42	21.00	21.01
5.8	22.93	22.96	22.45	22.45	22.07	22.08	21.44	21.43	21.00	21.01
6.0	22.97	22.98	22.44	22.42	22.05	22.07	21.42	21.42	20.97	20.97
6.2	22.97	22.99	22.47	22.43	22.07	22.07	21.43	21.45	20.98	20.99
6.4	22.96	22.97	22.47	22.47	22.08	22.08	21.49	21.49	20.99	20.98
6.6	22.99	23.00	22.49	22.47	22.09	22.10	21.50	21.52	20.98	20.98
6.8	23.02	23.03	22.49	22.46	22.14	22.15	22.54	21.54	21.03	21.02
7.0	23.09	23.10	22.51	22.50	22.13	22.16	21.55	21.56	21.06	21.05
7.2	23.08	23.10	22.54	22.54	22.14	22.15	21.58	21.56	21.10	21.11
7.4	23.06	23.07	22.55	22.52	22.15	22.15	21.64	21.64	21.10	21.09
7.6	23.03	23.08	22.54	22.56	22.14	22.16	21.59	21.58	21.07	21.08
7.8	23.08	23.10	22.61	22.60	22.19	22.20	21.60	21.61	21.09	21.12
8.0	23.06	23.09	22.68	22.68	22.24	22.24	21.60	21.61	21.17	21.14
8.2	23.10	23.12	22.64	22.65	22.24	22.25	21.63	21.64	21.14	21.15
8.4	23.08	23.09	22.62	22.63	22.21	22.25	21.67	21.66	21.16	21.17
8.6	23.09	23.09	22.66	22.69	22.19	22.20	21.70	21.69	21.15	21.15
8.8	23.13	23.14	22.72	22.71	22.20	22.21	21.67	21.67	21.14	21.15
9.0	23.12	23.13	22.72	22.71	22.23	22.23	21.66	21.67	21.13	21.13
9.2	23.10	23.13	22.73	22.73	22.24	22.24	21.63	21.64	21.13	21.14
9.4	23.20	23.18	22.69	22.68	22.22	22.20	21.63	21.61	21.15	21.16
9.6	23.13	23.12	22.71	22.71	22.19	22.19	21.66	21.65	21.14	21.15
9.8	23.14	23.14	22.69	22.70	22.27	22.25	21.69	21.69	21.14	21.14
10.0	23.12	23.15	22.74	22.74	22.26	22.26	21.70	21.71	21.13	21.12

Table 11. Soil-surface surveys from erosion-study plots, Cow Camp Creek area-Continued

Transverse Station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
					EROSION-STUDY PLOT (SITE CCA-650)					
0.2	22.43	22.38	21.77	21.78	21.12	21.07	20.42	20.41	19.84	19.83
0.4	22.26	22.28	21.73	21.75	21.14	21.08	20.40	20.40	19.82	19.82
0.6	22.31	22.31	21.71	21.74	21.13	21.14	20.52	20.51	19.84	19.84
0.8	22.30	22.30	21.73	21.79	21.15	21.15	20.46	20.46	19.88	19.88
1.0	22.30	22.25	21.77	21.75	21.18	21.22	20.44	20.47	19.88	19.89
1.2	22.37	22.30	21.80	21.78	21.15	21.15	20.49	20.50	19.90	19.90
1.4	22.29	22.33	21.80	21.80	21.09	21.11	20.50	20.52	19.97	19.98
1.6	22.33	22.33	21.76	21.80	21.08	21.11	20.47	20.48	19.90	19.91
1.8	22.38	22.37	21.78	21.79	21.13	21.13	20.46	20.48	19.91	19.92
2.0	22.34	22.33	21.73	21.74	21.12	21.13	20.51	20.51	19.91	19.93
2.2	22.31	22.32	21.72	21.72	21.08	21.09	20.55	20.56	19.96	20.00
2.4	22.24	22.25	21.68	21.66	21.06	21.02	20.49	20.49	19.96	19.98
2.6	22.23	22.23	21.68	21.69	21.04	21.04	20.53	20.54	19.94	19.96
2.8	22.28	22.26	21.67	21.67	21.05	21.06	20.57	20.56	19.95	19.98
3.0	22.30	22.29	21.74	21.69	21.04	21.02	20.55	20.57	20.02	19.99
3.2	22.29	22.28	21.72	21.74	21.07	21.00	20.57	20.57	20.02	20.01
3.4	22.28	22.30	21.67	21.70	21.06	21.05	20.62	20.64	20.03	20.06
3.6	22.22	22.23	21.67	21.69	21.06	21.06	20.62	20.57	20.00	20.02
3.8	22.24	22.21	21.60	21.62	21.05	21.11	20.54	20.54	19.97	20.00
4.0	22.31	22.36	21.57	21.59	21.07	21.05	20.52	20.50	19.96	19.97
4.2	22.32	22.35	21.57	21.57	20.99	21.00	20.44	20.45	19.97	19.96
4.4	22.20	22.21	21.55	21.55	20.93	20.94	20.42	20.42	19.91	19.93
4.6	22.15	22.16	21.53	21.50	20.91	20.93	20.41	20.40	19.85	19.87
4.8	22.08	22.10	21.57	21.62	20.88	20.91	20.35	20.36	19.81	19.81
5.0	22.01	22.04	21.49	21.47	20.83	20.86	20.32	20.32	19.77	19.78
5.2	22.07	22.07	21.47	21.45	20.82	20.84	20.31	20.34	19.76	19.77
5.4	22.09	22.10	21.43	21.44	20.89	20.91	20.35	20.36	19.74	19.76
5.6	22.10	22.09	21.41	21.42	20.90	21.01	20.38	20.38	19.73	19.74
5.8	22.07	21.98	21.57	21.57	20.98	20.99	20.41	20.45	19.74	19.74
6.0	21.87	21.87	21.53	21.52	21.01	21.01	20.43	20.44	19.72	19.71
6.2	21.88	21.86	21.42	21.41	21.06	20.73	20.27	20.30	19.52	19.51
6.4	21.87	21.82	21.40	21.36	20.73	20.70	20.25	20.21	19.53	19.44
6.6	21.84	21.80	21.46	21.41	20.75	20.74	20.19	20.14	19.54	19.56
6.8	21.84	21.82	21.54	21.55	20.88	20.89	20.19	20.14	19.76	19.77

Table 11. Soil-surface surveys from erosion-study plots, Cow Camp Creek area-Continued

Transverse Station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE CCA-650)-Continued										
7.0	21.91	21.89	21.50	21.50	20.92	20.95	20.36	20.39	19.79	19.80
7.2	22.00	22.06	21.55	21.46	20.98	21.02	20.37	20.39	19.78	19.79
7.4	22.11	22.06	21.66	21.67	20.99	21.02	20.40	20.42	19.78	19.80
7.6	22.12	22.22	21.59	21.59	20.98	21.01	20.40	20.43	19.78	19.80
7.8	22.22	22.22	21.58	21.60	20.99	21.00	20.37	20.38	19.77	19.79
8.0	22.16	22.18	21.62	21.61	21.01	21.03	20.41	20.43	19.75	19.75
8.2	22.14	22.15	21.52	21.54	21.04	21.02	20.35	20.34	19.73	19.73
8.4	22.24	22.25	21.53	21.54	20.95	20.97	20.31	20.33	19.66	19.71
8.6	22.15	22.14	21.55	21.55	20.92	20.92	20.35	20.38	19.71	19.77
8.8	22.12	22.14	21.49	21.51	20.95	20.97	20.38	20.39	19.77	19.78
9.0	22.18	22.19	21.52	21.52	20.96	20.95	20.41	20.43	19.79	19.80
9.2	22.33	22.35	21.66	21.66	20.91	20.94	20.48	20.49	19.77	19.77
9.4	22.36	22.37	21.63	21.64	20.89	20.90	20.34	20.36	19.75	19.80
9.6	22.37	22.37	21.64	21.65	20.92	20.95	20.32	20.31	19.79	19.81
9.8	22.34	22.36	21.63	21.69	20.94	20.96	20.32	20.35	19.71	19.73
10.0	22.36	22.35	21.67	21.69	21.02	21.04	20.41	20.37	19.73	19.74
EROSION-STUDY PLOT (SITE CCB-200)										
0.2	22.41	22.42	21.87	21.87	21.18	21.18	20.66	20.63	20.04	20.03
0.4	22.43	22.41	21.90	21.90	21.16	21.15	20.69	20.70	20.03	20.03
0.6	22.39	22.40	21.88	21.90	21.19	21.18	20.73	20.72	20.01	20.02
0.8	22.43	22.42	21.90	21.90	21.21	21.21	20.75	20.74	20.03	20.03
1.0	22.41	22.39	21.92	21.90	21.28	21.28	20.72	20.69	20.03	20.03
1.2	22.41	22.41	21.87	21.90	21.27	21.29	20.67	20.65	20.05	20.08
1.4	22.41	22.43	21.93	21.93	21.32	21.34	20.70	20.66	20.11	20.13
1.6	22.42	22.42	21.93	21.92	21.34	21.36	20.71	20.70	20.09	20.10
1.8	22.40	22.38	21.89	21.88	21.37	21.38	20.73	20.71	20.11	20.13
2.0	22.40	22.41	21.90	21.89	21.33	21.37	20.69	20.68	20.14	20.13
2.2	22.41	22.39	21.88	21.88	21.34	21.35	20.71	20.72	20.18	20.15
2.4	22.42	22.39	21.88	21.88	21.36	21.37	20.76	20.73	20.19	20.19
2.6	22.40	22.39	21.91	21.90	21.38	21.42	20.78	20.76	20.16	20.13
2.8	22.39	22.41	21.98	21.97	21.41	21.40	20.78	20.76	20.15	20.15
3.0	22.47	22.45	21.93	21.91	21.39	21.41	20.78	20.77	20.18	10.17
3.2	22.43	22.45	21.96	21.98	21.39	21.40	20.84	20.80	20.20	20.19
3.4	22.44	22.44	21.90	21.88	21.39	21.41	20.84	20.83	20.18	20.20

Table 11. Soil-surface surveys from erosion-study plots, Cow Camp Creek area-Continued

Transverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
	EROSION-STUDY PLOT (SITE CCB-200)-Continued									
3.6	22.44	22.43	21.90	21.90	21.42	21.44	20.85	20.85	20.18	20.19
3.8	22.41	22.40	21.90	21.89	21.40	21.44	20.87	20.86	20.18	20.18
4.0	22.39	22.39	21.91	21.91	21.42	21.43	20.87	20.85	20.22 '	20.17
4.2	22.41	22.41	21.91	21.91	21.43	21.44	20.89	20.88	20.23	20.22
4.4	22.41	22.42	21.88	21.88	21.44	21.49	20.88	20.86	20.22	20.23
4.6	22.37	22.37	21.85	21.85	21.45	21.49	20.87	20.87	20.22	20.22
4.8	22.39	22.36	21.83	21.82	21.39	21.42	20.91	20.91	20.23	20.23
5.0	22.37	22.35	21.83	21.81	21.39	21.41	20.80	20.79	20.22	20.33
5.2	22.37	22.36	21.84	21.83	21.39	21.42	20.88	20.88	20.27	20.37
5.4	22.37	22.37	21.82	21.83	21.43	21.45	20.94	20.92	20.23	20.33
5.6	22.39	22.38	21.82	21.84	21.42	21.45	20.92	20.92	20.24	20.31
5.8	22.36	22.35	21.77	21.77	21.40	21.41	20.90	20.89	20.22	20.31
6.0	22.38	22.37	21.79	21.79	21.37	21.40	20.89	20.88	20.20	20.31
6.2	22.37	22.37	21.80	21.80	21.39	21.40	20.90	20.88	20.28	20.35
6.4	22.33	22.35	21.81	21.81	21.37	21.38	20.88	20.86	20.31	20.31
6.6	22.36	22.36	21.79	21.79	21.37	21.36	20.86	20.85	20.29	20.33
6.8	22.39	22.40	21.80	21.83	21.35	21.36	20.84	20.83	20.23	20.24
7.0	22.36	22.41	21.77	21.76	21.32	21.32	20.77	20.77	20.18	20.18
7.2	22.41	22.41	21.71	21.71	21.32	21.33	20.83	20.83	20.16	20.17
7.4	22.38	22.39	21.71	21.71	21.32	21.33	20.87	20.89	20.21	20.22
7.6	22.38	22.40	21.74	21.75	21.32	21.32	20.83	20.85	20.19	20.21
7.8	22.36	22.32	21.75	21.75	21.32	21.32	20.87	20.87	20.23	20.24
8.0	22.36	22.36	21.77	21.73	21.32	21.36	20.79	20.78	20.24	20.24
8.2	22.42	22.41	21.77	21.76	21.29	21.30	20.77	20.75	20.27	20.23
8.4	22.41	22.43	21.74	21.73	21.28	21.28	20.72	20.70	20.25	20.23
8.6	22.40	22.42	21.74	21.74	21.27	21.28	20.74	20.75	20.28	20.26
8.8	22.39	22.44	21.76	21.77	21.30	21.31	20.86	20.84	20.24	20.25
9.0	22.40	22.41	21.74	21.73	21.30	21.28	20.85	20.85	20.18	20.18
9.2	22.40	22.41	21.74	21.71	21.32	21.29	20.86	20.84	20.17	20.21
9.4	22.41	22.44	21.77	21.76	21.29	21.29	20.87	20.85	20.25	20.26
9.6	22.43	22.43	21.74	21.74	21.28	21.28	20.90	20.89	20.26	20.28
9.8	22.43	22.43	21.75	21.75	21.29	21.29	20.82	20.86	20.25	20.29
10.0	22.41	22.41	21.77	21.81	21.31	21.29	20.90	20.89	20.27	20.26

Table 11. Soil-surface surveys from erosion-study plots, Cow Camp Creek area-Continued

Transverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
					EROSION-STUDY PLOT (SITE CCB-400)					
0.2	23.11	23.11	22.45	22.42	22.14	22.12	21.24	21.26	20.85	20.85
0.4	23.10	23.09	22.44	22.44	22.11	22.11	21.26	21.23	20.84	20.82
0.6	23.09	23.10	22.39	22.38	22.08	22.08	21.20	21.19	20.79	20.77
0.8	23.08	23.08	22.40	22.40	22.03	22.08	21.19	21.20	20.78	20.77
1.0	23.08	23.08	22.42	22.39	22.03	22.04	21.17	21.17	20.76	20.76
1.2	23.05	23.03	22.38	22.42	21.95	22.01	21.14	21.14	20.73	20.72
1.4	23.03	23.03	22.41	22.45	21.93	21.93	21.15	21.13	20.68	20.68
1.6	23.07	23.07	22.36	22.33	21.91	21.93	21.09	21.09	20.65	20.65
1.8	23.04	23.04	22.35	22.37	21.91	21.89	21.10	21.09	20.65	20.65
2.0	23.05	23.01	22.36	22.33	21.88	21.82	21.11	21.05	20.67	20.68
2.2	23.03	23.01	22.34	22.35	21.81	21.79	21.04	21.03	20.64	20.65
2.4	23.01	23.01	22.35	22.36	21.75	21.71	21.01	20.99	20.65	20.64
2.6	23.02	23.02	22.35	22.31	21.65	21.62	20.97	20.97	20.58	20.59
2.8	23.02	23.02	22.32	22.31	21.63	21.63	20.95	20.94	20.61	20.61
3.0	23.02	23.01	22.34	22.33	21.63	21.65	20.98	20.97	20.59	20.59
3.2	23.02	22.99	22.32	22.30	21.70	21.75	20.99	21.02	20.61	20.60
3.4	23.00	22.99	22.32	22.31	21.78	21.81	21.00	20.98	20.62	20.72
3.6	23.00	23.00	22.39	22.39	21.70	21.75	20.98	20.98	20.57	20.58
3.8	22.99	23.00	22.35	22.37	21.66	21.66	21.02	20.97	20.55	20.55
4.0	23.00	23.01	22.40	22.39	21.60	21.60	21.04	21.05	20.56	20.57
4.2	23.04	23.03	22.38	22.37	21.61	21.62	21.00	21.00	20.64	20.64
4.4	23.05	23.02	22.33	22.35	21.65	21.70	20.96	20.95	20.63	20.63
4.6	23.05	23.03	22.35	22.35	21.69	21.67	20.93	20.93	20.60	20.66
4.8	23.05	23.05	22.33	22.33	21.65	21.66	20.94	20.93	20.66	20.68
5.0	23.07	23.05	22.34	22.34	21.62	21.64	20.97	20.96	20.62	20.64
5.2	23.06	23.03	22.32	22.31	21.64	21.64	20.98	20.96	20.68	20.67
5.4	23.05	23.08	22.28	22.28	21.64	21.63	20.99	20.98	20.67	20.68
5.6	23.10	23.12	22.27	22.26	21.68	21.68	21.05	21.04	20.66	20.68
5.8	23.09	23.10	22.24	22.24	21.68	21.71	21.05	21.05	20.67	20.72
6.0	23.13	23.12	22.27	22.27	21.80	21.83	21.07	21.08	20.73	20.78
6.2	23.18	23.16	22.27	22.28	21.81	21.82	21.07	21.06	20.76	20.80
6.4	23.16	23.23	22.27	22.27	21.84	21.86	21.05	21.04	20.81	20.82
6.6	23.23	23.22	22.31	22.33	21.86	21.87	21.07	21.08	20.78	20.79
6.8	23.22	23.22	22.27	22.27	21.92	21.92	21.11	21.10	20.81	20.81

Table 11. Soil-surface surveys from erosion-study plots, Cow Camp Creek area-Continued

Transverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE CCB-400)-Continued										
7.0	23.23	23.22	22.29	22.29	21.89	21.90	21.09	21.08	20.84	20.84
7.2	23.29	23.20	22.33	22.31	21.92	21.93	21.07	21.07	20.86	20.89
7.4	23.37	23.36	22.29	22.29	21.94	21.94	21.08	21.09	20.88	20.86
7.6	23.18	23.20	22.27	22.27	21.89	21.93	21.10	21.08	20.89	20.87
7.8	23.14	23.15	22.29	22.28	22.03	22.03	21.09	21.10	20.84	20.87
8.0	23.13	23.14	22.28	22.29	21.98	21.98	21.11	21.11	20.86	20.90
8.2	23.17	23.17	22.34	22.33	21.91	21.93	21.11	21.12	20.85	20.86
8.4	23.19	23.14	22.31	22.29	21.92	21.93	21.11	21.11	20.81	20.78
8.6	23.15	23.13	22.30	22.30	21.97	21.97	21.09	21.09	20.79	20.81
8.8	23.11	23.11	22.28	22.29	21.93	21.94	21.13	21.14	20.82	20.80
9.0	23.08	23.08	22.30	22.31	21.93	21.94	21.19	21.18	20.84	20.85
9.2	23.04	23.02	22.32	22.32	21.91	21.92	21.16	21.16	20.89	20.88
9.4	22.96	22.97	22.33	22.32	21.96	21.92	21.19	21.22	20.89	20.88
9.6	22.87	22.88	22.27	22.27	21.89	21.89	21.21	21.19	20.88	20.86
9.8	22.92	22.93	22.24	22.22	21.89	21.90	21.17	21.15	20.84	20.84
10.0	23.00	23.01	22.25	22.27	21.88	21.90	21.16	21.16	20.85	20.84

Transverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
EROSION-STUDY PLOT (SITE CCB-510)										
0.2	19.16	19.17	18.81	18.81	18.66	18.69	18.36	18.36	18.17	18.18
0.4	19.14	19.13	18.80	18.81	18.65	18.66	18.32	18.33	18.23	18.22
0.6	19.12	19.12	18.78	18.81	18.67	18.67	18.37	18.38	18.14	18.15
0.8	19.07	19.07	18.81	18.82	18.64	18.66	18.39	18.40	18.12	18.13
1.0	18.99	19.01	18.84	18.86	18.61	18.62	18.35	18.36	18.14	18.14
1.2	18.97	18.99	18.82	18.83	18.64	18.65	18.32	18.34	18.11	18.12
1.4	18.92	18.95	18.80	18.82	18.67	18.66	18.30	18.32	18.07	18.10
1.6	18.90	18.89	18.79	18.81	18.55	18.51	18.28	18.29	18.08	18.08
1.8	18.88	18.88	18.77	18.79	18.53	18.55	18.30	18.30	18.08	18.08
2.0	18.87	18.93	18.78	18.81	18.50	18.52	18.26	18.26	18.02	18.02
2.2	18.87	18.94	18.69	18.70	18.45	18.45	18.23	18.24	17.90	17.90
2.4	18.85	18.87	18.64	18.66	18.41	18.44	18.22	18.22	17.86	17.87
2.6	18.87	18.88	18.63	18.65	18.39	18.41	18.16	18.17	17.85	17.87
2.8	18.86	18.84	18.59	18.57	18.35	18.37	18.08	18.08	17.82	17.82

Table 11. Soil-surface surveys from erosion-study plots, Cow Camp Creek area-Continued

Transverse station (feet)	Traverse 1 altitudes		Traverse 3 altitudes		Traverse 5 altitudes		Traverse 7 altitudes		Traverse 9 altitudes	
	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990	Sept. 1989	June 1990
					EROSION-STUDY PLOT (SITE CCB-510)-Continued					
2.8	18.86	18.84	18.59	18.57	18.35	18.37	18.08	18.08	17.82	17.82
3.0	18.84	18.85	18.55	18.56	18.23	18.23	17.95	17.86	17.79	17.79
3.2	18.81	18.81	18.56	18.57	18.20	18.20	17.92	17.84	17.77	17.77
3.4	18.78	18.78	18.59	18.59	18.16	18.18	17.89	17.87	17.69	17.70
3.6	18.72	18.72	18.57	18.57	18.15	18.15	17.77	17.77	17.63	17.64
3.8	18.68	18.69	18.56	18.57	18.07	18.08	17.55	17.54	17.64	17.64
4.0	18.66	18.66	18.44	18.42	17.93	17.81	17.49	17.50	17.63	17.63
4.2	18.64	18.65	18.33	18.34	17.67	17.69	17.41	17.46	17.61	17.61
4.4	18.64	18.61	18.26	18.25	17.63	17.65	17.39	17.47	17.28	17.23
4.6	18.59	18.57	18.11	18.10	17.68	17.69	17.44	17.46	17.14	17.13
4.8	18.52	18.48	17.99	18.00	17.71	17.74	17.65	17.68	17.15	17.08
5.0	18.31	18.37	17.94	17.97	17.80	17.81	17.84	17.85	17.14	17.16
5.2	18.29	18.30	17.92	17.94	17.87	17.91	17.92	17.92	17.16	17.17
5.4	18.25	18.27	17.99	18.00	18.06	18.10	17.91	17.93	17.23	17.28
5.6	18.24	18.25	17.99	18.00	18.16	18.17	17.88	17.87	17.32	17.36
5.8	18.23	18.27	18.16	18.17	18.19	18.19	17.87	17.88	17.39	17.41
6.0	18.33	18.34	18.33	18.34	18.22	18.22	17.92	17.93	17.43	17.44
6.2	18.31	18.30	18.37	18.38	18.21	18.22	17.93	17.93	17.44	17.44
6.4	18.30	18.32	18.39	18.40	18.21	18.25	17.93	17.94	17.47	17.47
6.6	18.44	18.45	18.43	18.44	18.22	18.21	17.97	17.97	17.52	17.50
6.8	18.50	18.56	18.46	18.50	18.16	18.19	17.96	17.97	17.50	17.51
7.0	18.64	18.63	18.42	18.43	18.16	18.17	17.99	18.01	17.52	17.53
7.2	18.66	18.66	18.41	18.39	18.15	18.16	17.99	18.00	17.56	17.57
7.4	18.68	18.68	18.40	18.39	18.14	18.15	17.89	17.91	17.60	17.60
7.6	18.70	18.71	18.37	18.35	18.13	18.14	17.87	17.91	17.59	17.61
7.8	18.72	18.73	18.34	18.36	18.16	18.19	17.94	17.95	17.59	17.60
8.0	18.67	18.70	18.28	18.30	18.17	18.18	18.00	18.01	17.55	17.60
8.2	18.70	18.69	18.28	18.31	18.19	18.20	18.02	18.03	17.58	17.60
8.4	18.73	18.69	18.28	18.38	18.20	18.21	18.06	18.07	17.56	17.57
8.6	18.69	18.70	18.47	18.49	18.29	18.33	18.07	18.10	17.56	17.57
8.8	18.73	18.74	18.43	18.41	18.33	18.33	18.10	18.12	17.55	17.57
9.0	18.73	18.74	18.40	18.42	18.31	18.32	18.05	18.09	17.53	17.54
9.2	18.73	18.74	18.42	18.43	18.35	18.37	18.09	18.09	17.57	17.57
9.4	18.76	18.77	18.46	18.45	18.37	18.38	18.08	18.06	17.53	17.54
9.6	18.81	18.82	18.50	18.50	18.42	18.42	18.05	18.06	17.51	17.52
9.8	18.71	18.73	18.49	18.50	18.40	18.41	18.05	18.06	17.51	17.52
10.0	18.70	18.73	18.47	18.52	18.44	18.45	18.03	18.03	17.52	17.52