HYDROLOGIC AND MICROMETEOROLOGIC DATA FROM AN UNSATURATED ZONE STUDY AT A LOW-LEVEL RADIOACTIVE-WASTE BURIAL SITE NEAR BARNWELL, SOUTH CAROLINA

by Kevin F. Dennehy and Peter B. McMahon

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ADDENDUM

to "Hydrologic and micrometeorologic data from an unsaturated zone study at a low-level radioactive-waste burial site near Barnwell, South Carolina," by Kevin F. Dennehy and Peter B. McMahon, USGS Open-File Report 85-476.

The magnetic tape (Dennehy and McMahon, 1985) referred to on pages 1, 4, 8, 9, and 10 of this report is not available as Open-file Report 85-477, but is available from:

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CONTENTS

ILLUSTRATIONS

TABLES

CONVERSION FACTORS AND ABBREVIATIONS OF UNITS

The following factors may be used to convert the inch-pound units published herein to the International System of Units (SI).

Multiply inch-pound units	By	To obtain SI units
foot (ft)	0.3048	meter (m)
foot per second (ft/s)	0.3048	meter per second (m/s)
cubic foot (ft^3)	0.02832	cubic meter (m^3)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
mile (mi)	1.609	kilometer (km)
acre	0.4047	hectare

HYDROLOGIC AND MICROMETEOROLOGIC DATA FROM AN UNSATURATED ZONE STUDY AT A LOW-LEVEL RADIOACTIVE-WASTE BURIAL SITE NEAR BARNWELL, SOUTH CAROLINA

By Kevin F. Dennehy and Peter B. McMahon

ABSTRACT

Two years of selected hydrologic and micrometeorologic data collected at a low-level radioactive-waste burial site near Barnwell, South Carolina are available on magnetic tape in card-image format. Hydrologic data include daily measurements of soil-moisture tensions, soil temperatures, and soil-moisture conductances at four monitoring site locations. Micrometeorologic data include hourly measurements for the following parameters: dry- and wet-bulb temperatures, soil temperatures, soil heat flux, wind speeds and direction, incoming and reflected short-wave solar radiation, incoming and emitted long-wave radiation, net radiation and precipitation.

INTRODUCTION

Hydrologic- and micrometeorologic-data-collection systems were designed and installed at a low-level radioactive-waste burial site about 5 miles west of Barnwell, South Carolina (fig. 1). The 320 acre site is a State-licensed burial ground for commercial low-level radioactive waste. Solid waste is buried in rectangular trenches that are excavated in unconsolidated Coastal Plain sediments.

The U.S. Geological Survey has been charged to investigate the suitability of various hydrologic environments for the shallow disposal of commercial low-level radioactive waste. The data collected during this study are from the unsaturated zone at an existing radioactive-waste burial site in a humid coastal environment. This report outlines the data which were collected during the study and presents the format in which the data are stored on a magnetic tape available to the public.

Hydrologic data were collected from two radioactive-waste burial trenches and two simulated burial trenches from January 1982 through May 1984 (fig 2). Micrometeorologic data were collected on-site near the trenches for the years 1983 and 1984 (fig 2).

Hydrologic data include daily values for soil-moisture tensions, soil-temperatures, and soil-moisture conductances from each monitored trench. Micrometeorologic data include hourly values of dry- and wet-bulb temperatures, soil temperatures, soil heat flux, wind speeds and direction, incoming and reflected short-wave solar radiation, incoming and emitted long-wave radiation, net radiation, and precipitation.

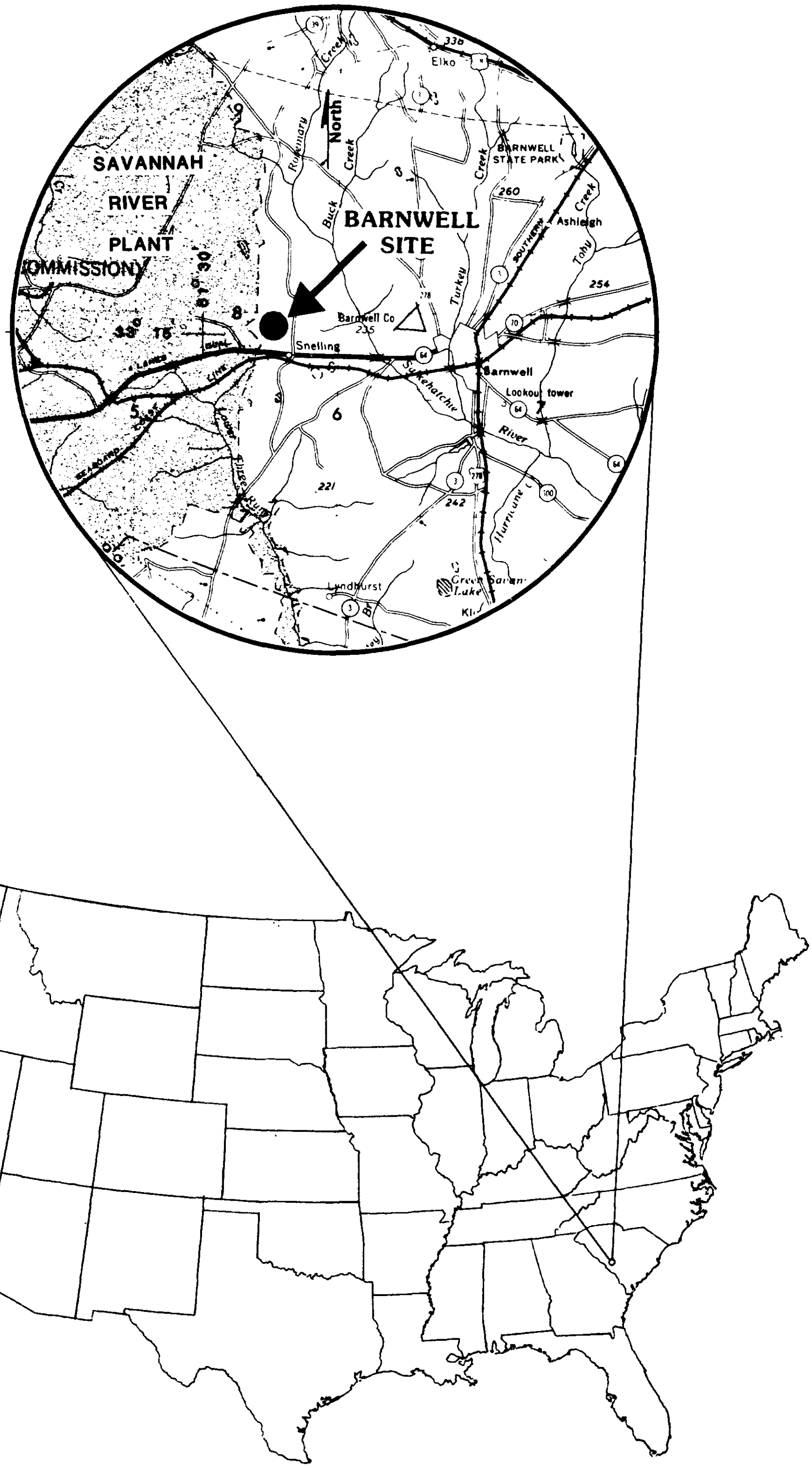

Figure 1.--Location of low-level radioactive-waste burial site near Barnwell, South Carolina.

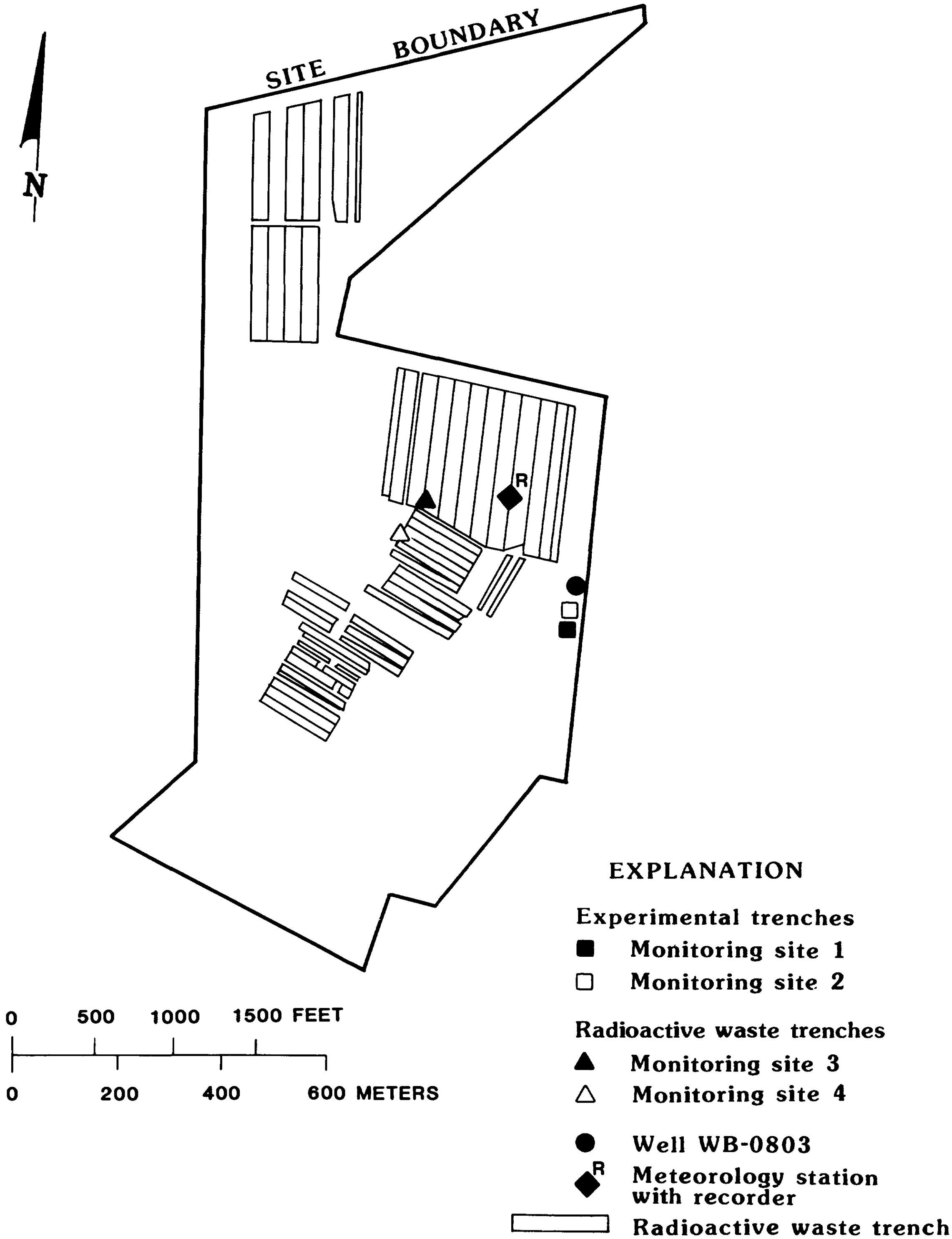

Figure 2.--Location of unsaturated zone monitoring sites and micrometeorological station at the low-level radioactive-waste burial site.

Examples of the information that is available on magnetic tape for each type of data collected are presented in computer-printout format in the section entitled, "Specifications of Hydrologic and Micrometeorologic Data Tape."

EXPLANATION OF HYDROLOGIC DATA

Collection and Computation of Data

Hydrologic data were collected from two waste burial trenches and two simulated burial trenches for the following time periods: Monitoring site 1 - January 1982 to May 1984; Monitoring site 2 - January 1982 to March 1984; Monitoring site 3 - July 1982 to May 1984; Monitoring site 4 - May 1982 to March 1984. Monitoring sites 1 and 2 were simulated burial trenches and monitoring sites 3 and 4 were radioactive-waste burial trenches. Four corrugated metal shafts, 24 to 40 feet long and 6 feet in diameter, were installed vertically in the corners of the burial trenches in order to monitor water movement in the unsaturated zone. Soil-moisture tensiometers, temperature sensors, and conductance probes were placed horizontally at different depths into undisturbed sediments and backfill material for data collection. Table 1, in the back of this report, gives the depth, orientation, and sediment type for soil-moisture tensiometers, temperature sensors, and conductance probes at each monitoring site.

Data were recorded daily with a Campbell Scientific CR5* digital recorder on cassette tape and a duplicate back-up printed record. Soil tensions were measured with a Validyne model P305D pressure transducer (0-5 psi range). Data from the soil tensiometers were recorded in millivolts; therefore, the pressure transducers were calibrated to give soil-moisture tensions in centimeters of water. Figure 3 is a diagram of a typical soil-tensiometer used for monitoring unsaturated sediments. Table 2 gives the calibrations for the transducers at each monitoring site. Copper constantan thermocouples were used to record soil temperatures. Temperatures were recorded as ^{0}C X 10; therefore, the recorded values need to be divided by ten to give temperature in degrees Celsius. Beckman conductivity cells were used to measure conductances that were recorded in micromhos per centimeter.

Accuracy of Data

The accuracy of the various hydrologic parameters measured must be examined individually. For the tensiometer data it was essential to maintain a constant power supply to the monitoring equipment. A 12-volt lead-acid gel-type battery supplied the necessary power. Battery voltages were checked at regularly scheduled intervals. However, occasional site inaccessability delayed battery checks so that some data were lost during

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*Use of brand names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

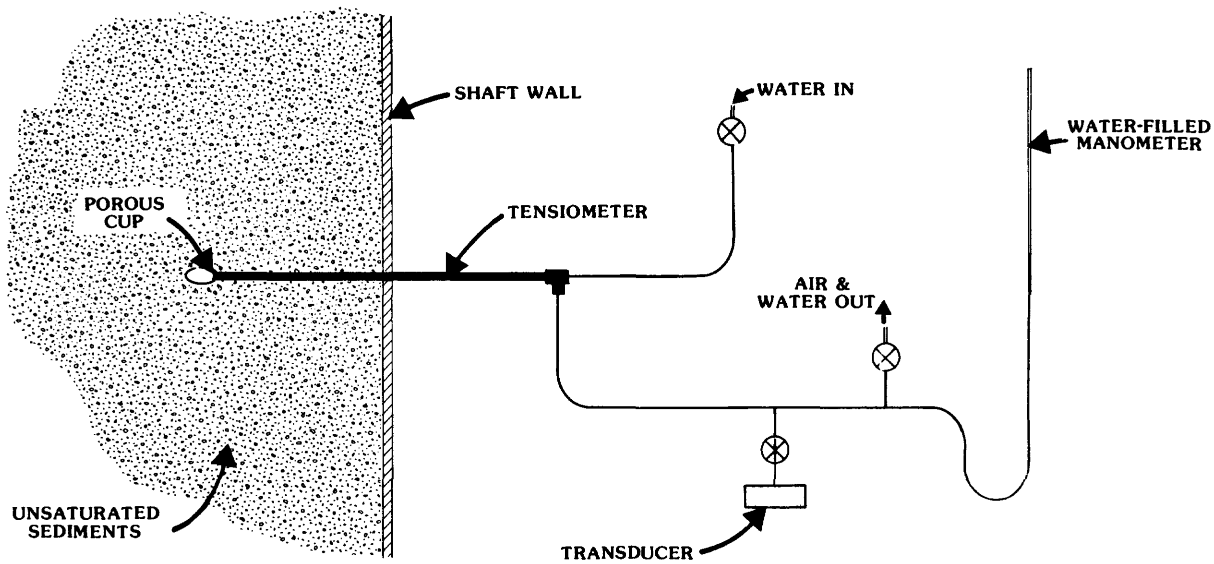

Figure 3.--Typical tensiometer apparatus used for monitoring soil-moisture tensions in unsaturated sediments.

these periods. Additionally, accuracy of soil-moisture tensiometers depends on the accuracy of the pressure transducer calibrations and adequate contact of the tensiometer's porous cup with the soil. Transducer calibrations were checked over the monitoring period. Measurements were taken of specific manometer readings and checked against the associated voltage readings. From this, a drift in the transducer calibration could be detected. If a drift was apparent the transducer was replaced. Accuracy of the transducers used was within ± 0.5 percent, full scale, that includes linearity, hysteresis, and repeatability. Each tensiometer was also "watered" in an attempt to evacuate any trapped air within the apparatus (fig. 3). This is of particular importance in those tensiometers which tilted upwards due to subsidence of backfill and waste materials.

Electrical power for the temperature sensors and conductance probes was provided by a separate power supply consisting of eight alkaline D cells. Thermocouples were calibrated at various temperatures prior to installation. Conductivity probes had an accuracy of within 1 percent for corrected readings. Because conductance measurements were taken in a variably saturated system, soil-moisture conductance values presented in Dennehy and McMahon (1985), and referred to in this report, reflect changes in soil-moisture content as well as the presence of the sodium chloride tracer. Soil-moisture conductance as defined above will be referred to as conductance in the remainder of this report.

EXPLANATION OF MICROMETEOROLOGIC DATA

Collection of Data

Micrometeorologic data were collected hourly at a location near the burial trenches during 1983 and 1984. Data were recorded with a Campbell Scientific CR21 digital recorder. Both incoming and reflected short-wave solar radiation were measured with Eppley Precision Spectral Pyranometers, (PSP). Incoming and emitted long-wave radiations were recorded with Eppley Precision Infrared Radiometers (Pyrgeometer, PIR). Net radiation was measured with a No. 621-1 Fritschen Net Radiometer with heavy-duty domes. Radiation values were recorded in units of langleys per hour and the radiation sensors were positioned 3.28 feet above ground surface.

Dry- and wet-bulb temperatures were measured with two nonventilated thermilinear thermistor psychrometers placed 1.64 and 3.28 feet above ground surface. The thermistors have a temperature range of -5 to +45°C.

The psychrometer has a tetraskelion radiation shield and a large coolie hat developed by F.R. Bellaire and L.J. Anderson (1951). The tetraskelin shield is constructed with an upper and lower section to accommodate both the dry-bulb (upper) and wet-bulb (lower) temperature sensors. This design prevents wet-bulb cooling from affecting the dry-bulb sensor, regardless of wind direction.

A plastic reservoir, which houses the temperature sensors and holds the distilled water supply for the wet-bulb temperature wick, is attached directly to the bottom of the tetraskelin shield.

Soil temperatures, recorded in degrees Celsius, were measured at depths of 0.33 and 3.28 feet using thermilinear thermistors. Soil heat flux, recorded in langleys per hour, was measured at a depth of 0.10 feet using a Thornthwaite model 610 soil-heat flux plate.

Wind speed was measured at 1.64 and 3.28 feet above the ground surface with Met-1 and Gill cup type anemometers that use a magnetic reed switch and a D.C. generator respectively, to output signals directly proportional to the wind speed. The wind direction was measured at 3.28 feet above the ground surface with a Met-1 vane which uses a potentiometer to oroduce an output in degrees proportional to the wind direction.

Precipitation data were measured, in inches, with a Fischer and Porter Series 33B1558 (weighing bucket) precipitation gage-recorder. Manufacturer specifications claim a recording accuracy of ± 0.1 inches and a range of 0 to 19.5 inches of precipitation. Table 3 gives daily precipitation values from June 1981 through December 1984.

Accuracy of Data

The accuracy of the data depended largely upon proper maintenance of the equipment. The Eppley equipment required annual calibrations as well as routine verification of their calibrations, changing the silica gel dessicant to prevent moisture accumulation in the instrument, cleaning of outside domes, and checking the 1.5 volt battery in the PIR. The Fritschen net radiometer was used to obtain a second value of net radiation to compare with the values obtained from the Eppleys. Periodically another calibrated Fritschen was run side-by-side to check the on-site instrument's calibration. If the two instrument readings were not within 5 percent of each other, the on-site instrument was removed, checked, and repaired if necessary. The Fritschen was subject to occasional moisture buildup on the inside surface of its plastic domes. Condensation was reduced by allowing the radiometer to breathe through a dessicant-filled tube. Additional dome maintenance included periodically washing its outer surface with distilled water to remove dirt and dust that could affect readings.

The wet- and dry-bulb thermilinear thermistor psychrometers suffered from dust buildup on the wicks causing their capillary action to cease. This problem did not affect dry-bulb values and could be alleviated by washing the wicks weekly. Weekly visits were also necessary to fill the wet-bulb reservoirs. Freezing of wet-bulb reservoirs would also cause capillary action to cease. To check accuracy of the thermistor psychrometer, comparative tests were conducted using an alternating current ventilated laboratory Assman psychrometer, accurate to 0.1^{o}C. If the depression observed on the thermistor unit did not agree within 0.5^{o}C of the Assman value that unit was replaced with a standby psychrometer while the thermistor psychrometer was repaired.

The soil temperature thermistors and soil heat flux plate worked adequately during their period of operation.

At 3.28-feet, the wind speed and wind direction devices also functioned adequately during the period of operation. The 1.64-feet wind speed device however, worked sporadically. The anemometers were returned to the manufacturer for recalibration on an annual basis and when anomalies appeared.

The weighing bucket rain gage worked adequately during its period of operation. The recorded values were checked at randomly chosen times with calibrated weights to verify the accuracy of the measurements.

SPECIFICATIONS OF HYDROLOGIC AND MICROMETEOROLOGIC DATA TAPE

The magnetic data tape (Dennehy and McMahon, 1985) is available from the Open-File Services Section of the United States Geological Survey in Denver, Colorado. The magnetic tape containing the hydrologic and micrometeorologic data has a structured format that facilitates transfer of data to other computer systems. The tape specifications necessary for data transfers to other computer systems are listed in table 4. Given these specifications, most computer systems should be able to read data directly from this formatted tape.

The data are arranged in 17 separate data files. A listing of these files and their record lengths is provided in table 5. The first 12 files are labeled with the following naming convention; TRENCHX.DATA.8Y. Under this system X refers to the monitoring site from which data were collected and 8Y refers to the calendar year during which data were collected. Within each of the first 12 data files are the soil-moisture tensiometer, temperature sensor, and conductance data collected at the specified monitoring site. For example, TRENCH1.DATA.84 contains the tensiometer, temperature, and conductance data collected at monitoring site 1 during 1984.

The next four data files are labeled with the following naming convention; BX.DATA.8Y. These files contain data collected at the micrometeorologic station during 1983 and 1984. Under this system BX refers to either the B1 digital recorder or the B2 digital recorder, and 8Y refers to the year during which the data were recorded. Data recorded on the B1 digital recorder included dry- and wet-bulb temperatures, soil temperatures, soil heat flux, and wind speed at 1.64 feet. Data recorded on the B2 digital recorder included both components of short-wave and long-wave radiation, net radiation, wind speed at 3.28 feet, and wind direction at 3.28 feet.

The final data file, "RAINFALL.RECORD," contains the precipitation data for June 1981 through December 1984. These data are also found in table 3.

CARD-IMAGE FORMATS

Hydrologic Data

Hydrologic data were recorded on a Campbell Scientific CR5 digital recorder. A single day of data consists of up to 62 channels of information, 10 channels per card-image. A single day of data, therefore, contains up to seven card images. Each channel has a two-digit channel identification field, one sign digit field, and three digits of data. Channel 00 contains the Julian date, channel 01 contains the hour, and channel 02 contains the minute. The first space of the three-digit data field on channels 00, 01, and 02 contains the letter T. Only the last two digits on the first three channels contain identifying information. For example, Julian date 125, hour 10 and minute 15 appear as 00+T25 01+T10 02+T15. Data for the soil-moisture tensiometers, temperature sensors, and conductance probes are on the remaining channels. To clarify this description, one day of hydrologic data output as it appears formatted by the CR5 micrologger is presented in table 6. Table 7 gives the channel location for each probe. The channel locations for the probes were switched at times during the period of record; however, the changes are noted in table 7.

Micrometeorologic Data

Micrometeorologic data were recorded on a Campbell Scientific CR21 digital recorder. A single hour of data consists of up to 11 channels of information, seven channels per card image. A single hour of data, therefore, contains two card images. Each channel has a two-digit channel identification field, a blank space, and five digits of data. Channel 01 contains the output table number indicating hourly output, channel 02 contains the station identification number and Julian date, and channel 03 contains the hour and minute. Micrometeorologic data are on the remaining channels. An example of the formatted micrometeorologic data as it appears on the magnetic tape for 1 hour of data collection at stations B-1 and B-2 is presented in table 6. Table 8 gives the channel location for each parameter along with its measurement unit and the associated height or depth of the sensor.

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Tables 1 through 8

Table 1.--Depth, orientation, and sediment type for soil-moisture tensiometers, temperature sensors, and conductance probes

Monitoring site number 1
Elevation of ground surface above sea level = 257.60 feet

Probe	Number	Elevation of probe above sea level (feet)	Orientation of probe from north (degrees)	Sediment type
Tensiometer	1	255.56	97	Fine-grained clayey sand cap
	2	255.71	158	Fine-grained clayey sand cap
	3	254.56	110	Fine-grained clayey sand cap
	4	253.16	123	Fine-grained clayey sand cap
	5	247.35	132	Fine-grained clayey sand
	6	247.86	273	Fine-grained sand
	7	244.00	150	Sandy clay
	8	not installed		--
	9	238.46	105	Sandy clay
	10	238.46	201	Fine-grained sand
Temperature and Conductance	1	255.73	36	Fine-grained clayey sand cap
	2	255.95	210	Fine-grained clayey sand cap
	3	256.01	301	Fine-grained clayey sand cap
	4	253.63	85	Fine-grained clayey sand cap
	5	253.99	212	Fine-grained clayey sand cap
	6	254.07	298	Fine-grained clayey sand cap
	7	251.24	130	Fine-grained clayey sand
	8	251.51	211	Fine-grained sand
	9	251.94	355	Fine-grained clayey sand
	10	248.75	136	Fine-grained clayey sand
	11	249.16	261	Fine-grained sand
	12	249.01	10	Fine-grained clayey sand
	13	245.82	126	Fine-grained clayey sand
	14	246.36	261	Fine-grained sand
	15	246.05	18	Fine-grained clayey sand
	16	243.86	112	Fine-grained clayey sand
	17	244.56	260	Fine-grained sand
	18	240.10	65	Fine-grained clayey sand
	19	240.49	147	Fine-grained sand
	20	236.86	154	Fine-grained sand
	21	236.61	355	Fine-grained clayey sand

Table 1.--Depth, orientation, and sediment type for soil-moisture tensiometers, temperature sensors, and conductance probes (Continued)

Monitoring site number 1 (Continued)
Elevation of ground surface above sea level = 257.60 feet

Probe	Number	Elevation of probe above sea level (feet)	Orientation of probe from north (degrees)	Sediment type
Conductance	22	232.11	probes in	Fine-grained clayey sand
	23	233.11	side of	Fine-grained clayey sand
	24	234.11	trench	Fine-grained clayey sand
	25	232.11		Fine-grained clayey sand
	26	233.11	probes in	Fine-grained clayey sand
	27	234.11	bottom of	Fine-grained clayey sand
	28	235.61	trench	Fine-grained clayey sand
	29	235.11	disconnected	Fine-grained clayey sand

Table 1.--Depth, orientation, and sediment type for soil-moisture tensiometers, temperature sensors, and conductance probes (Continued).

Monitoring site number 2
Elevation of ground surface above sea level = 258.04 feet

Probe	Number	Elevation of probe above sea level (feet)	Orientation of probe from north (degrees)	Sediment type
Tensiometer	1	256.10	96	Fine-grained sand
	2	255.85	26	Fine-grained clayey sand cap
	3	254.55	84	Fine-grained clayey sand cap
	4	253.55	84	Fine-grained sand
	5	251.65	95	Fine-grained sand
	6	247.75	96	Sandy clay
	7	247.55	35	Fine-grained sand
	8	245.65	95	Sandy clay
	9	239.87	84	Fine-grained clayey sand
	10	238.45	279	Fine-grained sand
Temperature and Conductance	1	255.95	66	Fine-grained clayey sand cap
	2	254.00	66	Fine-grained clayey sand cap
	3	251.55	66	Fine-grained sand
	4	255.90	291	Fine-grained clayey sand cap
	5	253.95	291	Fine-grained clayey sand cap
	6	251.52	291	Fine-grained sand
	7	256.18	181	Fine-grained clayey sand cap
	8	254.22	181	Fine-grained clayey sand cap
	9	251.78	181	Fine-grained clayey sand
	10	248.65	74	Fine-grained clayey sand
	11	246.65	74	Fine-grained clayey sand
	12	243.80	74	Fine-grained clayey sand
	13	248.60	284	Fine-grained sand
	14	246.75	284	Fine-grained sand
	15	243.95	284	Fine-grained sand
	16	248.80	186	Fine-grained clayey sand
	17	243.95	186	Fine-grained clayey sand
	18	239.92	69	Fine-grained clayey sand
	19	236.80	69	Fine-grained clayey sand
	20	238.62	180	Fine-grained clayey sand
	21	235.85	269	Fine-grained sand

Table 1.--Depth, orientation, and sediment type for soil-moisture tensiometers, temperature sensors, and conductance probes (Continued)

Monitoring site number 2 (Continued)
Elevation of ground surface above sea level = 258.04 feet

Probe	Number	Elevation of probe above sea level (feet)	Orientation of probe from north (degrees)	Sediment type
Conductance	22	231.67		Fine-grained clayey sand
	23	232.67	Probes at	Fine-grained clayey sand
	24	233.67	side of	Fine-grained clayey sand
	25	234.17	trench	Fine-grained clayey sand
	26	231.67		Fine-grained clayey sand
	27	232.67	Probes in	Fine-grained clayey sand
	28	233.67	bottom of	Fine-grained clayey sand
	29	234.17	trench	Fine-grained clayey sand

Table 1.--Depth, orientation, and sediment type for soil-moisture tensiometers, temperature sensors, and conductance probes (Continued)

Monitoring site number 3
Elevation of ground surface above sea level = 259.67 feet

Probe	Number	Elevation of probe above sea level (feet)	Orientation of probe from north (degrees)	Sediment type
Tensiometer	1	252.40	225	Fine-grained clayey sand
	2	250.89	15	Fine-grained sand
	3	250.38	210	Fine-grained clayey sand
	4	247.82	240	Fine-grained clayey sand
	5	244.27	195	Fine-grained clayey sand
	6	240.96	45	Fine-grained sand
	7	240.45	225	Fine-grained clayey sand
	8	233.79	270	Fine-grained clayey sand
Temperature and Conductance	1	256.31	50	Fine-grained clayey sand cap
	2	256.96	210	Fine-grained clayey sand cap
	3	255.50	330	Fine-grained clayey sand cap
	4	255.60	50	Fine-grained clayey sand cap
	5	254.42	210	Fine-grained clayey sand
	6	254.02	330	Fine-grained clayey sand cap
	7	253.84	50	Fine-grained sand
	8	252.72	30	Fine-grained sand
	9	252.55	190	Fine-grained clayey sand
	10	252.05	315	Fine-grained sand
	11	250.37	30	Fine-grained sand
	12	250.50	210	Fine-grained clayey sand
	13	250.09	315	Fine-grained sand
	14	245.65	105	Fine-grained sand
	15	245.69	210	Fine-grained clayey sand
	16	245.17	0	Fine-grained sand
	17	240.64	60	Fine-grained sand
	18	240.34	0	Fine-grained sand
	19	236.77	270	Fine-grained clayey sand
	20	236.74	0	Fine-grained sand
	21	233.23	0	Fine-grained sand
Temperature	22	247.50	-	Air temperature in shaft
	23	235.25	-	Air temperature in shaft

Table 1.--Depth, orientation, and sediment type for soil-moisture tensiometers, temperature sensors, and conductance probes (Continued)

Monitoring site number 4
Elevation of ground surface above sea level = 257.11 feet

Probe	Number	Elevation of probe above sea level (feet)	Orientation of probe from north (degrees)	Sediment type
Tensiometer	1	251.92	0	Fine-grained clayey sand cap
	2	250.71	330	Fine-grained clayey sand
	3	250.30	180	Fine-grained sand
	4	248.08	270	Fine-grained clayey sand
	5	244.30	330	Fine-grained clayey sand
	6	239.79	330	Fine-grained clayey sand
	7	228.66	345	Fine-grained clayey sand
Temperature and Conductance	1	251.70	285	Fine-grained clayey sand cap
	2	252.26	30	Fine-grained clayey sand cap
	3	251.79	155	Fine-grained clayey sand cap
	4	250.69	285	Fine-grained clayey sand
	5	251.26	30	Fine-grained sand
	6	250.78	155	Fine-grained sand
	7	248.73	285	Fine-grained clayey sand
	8	249.28	30	Fine-grained sand
	9	248.84	155	Fine-grained sand
	10	245.30	285	Fine-grained clayey sand
	11	245.80	15	Fine-grained sand
	12	245.43	165	Fine-grained sand
	13	241.42	285	Fine-grained clayey sand
	14	241.94	15	Fine-grained sand
	15	241.54	165	Fine-grained sand
	16	237.97	300	Fine-grained clayey sand
	17	238.51	30	Fine-grained sand
	18	234.50	300	Fine-grained clayey sand
	19	234.52	30	Fine-grained sand
	20	231.55	315	Fine-grained clayey sand
	21	232.16	45	Fine-grained sand
	22	227.72	315	Fine-grained clayey sand
	23	228.34	45	Fine-grained sand

Table 2.--Tensiometer calibrations

Monitoring site number	Tensiometer	Calibration (millivolts to centimeters of freshwater)
1	1	y = -0.6815x + 191.63
	2	y = -0.6969x + 108.82
	3	y = -0.6958x + 132.87
	4	y = -0.6670x + 168.83
	5	y = -0.7237x + 167.24
	6	y = -0.8031x + 284.76
	7	y = -0.6878x + 134.24
	8	not installed
	9	y = -0.6977x + 103.99
	10	y = -0.7768x + 66.19
2	1	y = -0.7482x + 187.98
	2	y = -0.6965x + 129.95
	3	y = -0.6863x + 218.09
	4	y = -0.7378x + 118.92
	5	y = -0.6850x + 147.28
	6	y = -0.6917x + 183.36
	7	y = -0.7044x + 122.67
	8	y = -0.7254x + 181.60
	9	-- -- --
	10	-- -- --
3	1	y = -0.8576x + 195.64
	2	y = -0.6790x + 163.06
	3	y = -0.6627x + 79.86
	4	y = -1.0000x + 169.61
	5	y = -0.6901x + 156.24
	6	y = -0.6592x + 108.03
	7	y = -0.6777x + 137.97
	8	y = -0.9952x + 104.20
4	1	y = -0.6916x + 150.83
	2	y = -0.7133x + 154.54
	3	-- -- --
	4	y = -1.3498x + 153.80
	5	y = -0.7052x + 218.30
	6	y = -0.7334x + 163.84
	7	y = -0.8772x + 215.50

Table 3.--Precipitation data, in inches, collected at the low-level radioactive-waste burial site from June 1981 through December 1984

Day	Jan.	Feb.	Mar.	Apr.	May	1981 June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1						0.4	0.1	2.6	---	---	---	1.0
2						0.1	0.3	0.6	---	---	---	0.1
3						0.3	---	---	---	---	---	---
4						1.6	---	---	---	---	---	---
5						---	1.3	---	---	---	---	---
6						---	---	---	---	---	---	0.1
7						2.6	0.3	---	---	---	---	---
8						---	---	---	0.1	---	---	---
9						---	---	---	---	0.1	---	---
10						---	---	0.1	---	0.9	---	---
11						0.3	---	0.1	---	---	---	---
12						0.2	0.3	0.4	---	---	---	---
13						---	---	---	---	---	---	---
14						---	---	---	---	---	---	0.8
15						---	---	---	---	---	---	1.3
16						---	0.4	0.4	0.1	---	0.3	---
17						---	---	0.2	---	---	---	---
18						---	---	---	---	---	---	0.6
19						---	---	0.3	---	---	---	---
20						---	---	---	---	---	0.2	---
21						---	---	---	---	---	---	---
22						---	---	---	---	---	---	---
23						---	---	0.2	---	---	---	---
24						---	---	---	---	0.3	0.3	0.3
25						---	0.3	---	---	0.8	---	0.8
26						---	---	---	---	0.1	---	---
27						---	---	---	---	0.4	---	0.1
28						---	---	---	---	---	---	1.0
29						---	---	---	---	---	---	0.3
30						---	---	0.2	---	---	0.4	---
31						---	---	---	---	---	---	2.6
Total						5.5	3.0	5.1	0.2	2.6	1.2	9.0

Table 3.--Precipitation data, in inches, collected at the low-level radioactive-waste burial site from June 1981 through December 1984 (Continued)

Day						1982						
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	---	---	---	---	---	---	---	---	---	---	---	---
2	---	0.2	---	---	---	---	---	---	---	---	---	0.3
3	0.7	0.8	---	0.1	---	0.2	---	---	---	---	---	---
4	0.7	---	---	---	---	---	0.4	---	---	---	1.2	---
5	---	---	---	0.6	---	---	0.1	2.2	---	---	---	0.4
6	---	---	---	---	---	---	---	0.2	---	---	---	---
7	---	---	0.5	---	---	---	0.1	0.2	---	---	---	---
8	---	---	---	0.6	---	---	---	0.1	---	---	---	---
9	---	0.1	---	---	---	---	0.9	0.1	---	0.3	---	---
10	---	---	---	---	---	---	---	---	0.4	0.1	---	---
11	---	---	---	---	---	---	---	---	---	0.2	---	1.0
12	---	0.7	---	0.1	---	0.7	---	0.2	---	---	---	1.0
13	0.1	---	---	---	---	0.8	1.2	---	---	0.9	0.2	---
14	1.0	---	---	---	---	---	0.2	---	---	0.3	---	---
15	---	---	---	---	---	---	0.3	---	---	---	---	0.3
16	---	0.3	---	---	---	0.4	0.4	---	---	---	---	0.6
17	---	0.3	0.3	0.9	0.6	0.3	---	---	---	---	---	---
18	---	---	---	---	---	---	---	0.9	1.6	---	---	---
19	0.2	---	---	---	0.3	---	1.9	---	0.3	---	---	0.1
20	0.1	---	---	0.6	---	---	0.5	---	---	---	---	---
21	---	---	---	---	---	---	---	---	0.4	---	---	---
22	---	---	---	---	---	0.3	---	---	---	---	---	---
23	0.5	---	---	---	---	---	1.1	---	---	---	---	---
24	---	---	0.1	---	0.8	---	0.1	---	---	---	---	---
25	---	---	---	1.4	---	---	---	---	---	---	---	---
26	---	0.1	---	2.3	---	0.1	---	---	0.1	---	---	---
27	---	0.5	---	0.2	2.3	0.1	0.1	---	---	---	---	---
28	---	---	---	---	---	0.3	---	---	---	---	---	---
29	---	---	---	---	---	---	0.1	---	---	---	---	1.4
30	---	---	---	---	0.2	---	---	---	---	---	---	0.7
31	0.3	---	---	---	---	---	---	---	---	---	---	0.1
Total	3.6	3.0	0.9	6.8	4.2	3.2	7.4	3.9	2.8	1.8	1.4	5.9

Table 3.--Precipitation data, in inches, collected at the low-level radioactive-waste burial site from June 1981 through December 1984 (Continued)

	1983											
Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.1	---	1.3	---	---	---	---	---	1.3	---	---	---
2	0.3	1.3	---	---	---	---	---	0.2	---	---	---	0.1
3	---	---	---	---	0.6	---	---	1.0	0.2	---	---	---
4	---	0.2	---	---	---	---	0.4	0.4	---	---	0.5	0.3
5	---	---	---	---	---	0.1	---	---	---	---	---	---
6	---	---	1.4	0.6	---	0.9	0.6	---	---	---	---	1.2
7	---	---	0.1	0.4	---	1.2	---	---	---	---	0.1	---
8	---	---	---	0.7	---	---	---	---	---	0.7	---	---
9	0.3	---	---	0.7	0.1	---	---	---	2.2	---	---	---
10	---	0.2	---	0.1	---	---	---	---	0.1	---	---	---
11	---	0.1	---	---	---	---	---	---	---	---	---	---
12	---	---	---	---	---	---	---	0.1	---	---	---	0.8
13	---	1.7	---	---	---	---	---	---	1.4	---	---	---
14	---	1.0	---	---	---	---	---	---	0.7	---	0.5	---
15	---	---	---	0.4	---	---	---	---	---	---	0.6	0.2
16	---	---	0.2	0.2	---	---	---	---	---	---	0.1	---
17	---	0.1	1.7	---	---	---	0.3	---	---	---	---	---
18	---	---	0.1	---	---	---	---	---	---	---	---	---
19	---	---	---	0.3	---	---	---	---	---	---	1.4	---
20	---	---	---	---	---	---	---	---	---	---	---	---
21	1.3	---	0.2	---	---	---	---	---	0.6	---	---	---
22	0.1	0.6	---	---	---	1.4	0.5	---	---	---	---	0.5
23	0.1	0.6	---	1.7	0.1	0.1	0.1	---	---	1.1	0.7	0.1
24	---	---	0.4	---	---	---	0.2	---	---	---	0.7	---
25	---	0.2	0.1	---	---	---	0.6	---	---	---	---	---
26	---	---	---	---	0.8	---	---	0.1	---	---	---	---
27	0.9	---	0.7	---	---	---	---	---	---	---	0.2	---
28	0.3	0.2	---	---	---	---	---	0.1	---	---	0.1	---
29	---	---	---	---	---	---	---	---	---	---	---	0.6
30	0.2	---	---	---	---	0.1	---	0.1	---	---	---	0.5
31	---	---	0.5	---	---	---	---	---	---	---	---	---
Total	4.1	6.2	6.7	5.1	1.6	3.8	2.7	2.0	6.5	1.8	4.9	4.3

Table 3.--Precipitation data, in inches, collected at the low-level radioactive-waste burial site from June 1981 through December 1984 (Continued)

Day	Jan.	Feb.	Mar.	Apr.	May	1984 June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	---	---	---	---	0.6	---	---	---	---	0.1	---	0.1
2	---	---	---	---	---	---	---	0.9	---	---	---	0.3
3	---	---	---	0.3	1.4	---	---	---	---	---	0.1	---
4	---	---	---	0.4	0.1	---	---	---	---	---	0.1	---
5	---	---	---	---	---	---	---	---	---	---	---	0.6
6	---	---	0.8	---	0.2	---	---	---	---	---	---	0.1
7	---	---	---	---	2.7	---	---	---	---	---	---	---
8	---	---	---	---	0.2	---	---	---	---	---	---	---
9	---	---	---	0.4	---	---	---	---	---	---	---	---
10	0.6	---	---	0.1	---	---	---	0.4	---	---	---	---
11	0.1	---	---	---	---	---	---	0.5	---	---	---	---
12	---	---	---	---	---	---	---	---	---	---	---	---
13	---	1.4	0.4	---	---	---	---	0.1	---	---	---	---
14	---	0.2	---	0.8	---	---	---	---	---	---	---	---
15	0.1	---	---	---	---	---	---	---	---	---	---	---
16	0.1	---	---	---	---	---	---	0.4	---	---	---	---
17	0.1	---	---	---	---	---	0.4	0.1	---	0.2	---	---
18	0.5	---	---	---	---	---	0.1	---	---	---	---	---
19	0.5	---	---	---	---	---	0.3	2.3	---	---	---	---
20	---	---	1.0	1.0	---	---	---	0.1	---	---	---	---
21	---	---	0.1	---	---	1.5	---	---	---	---	---	---
22	---	0.6	---	0.3	---	0.7	---	---	---	---	---	---
23	---	0.3	---	0.7	1.1	---	---	0.1	---	---	---	---
24	0.8	---	---	---	---	---	---	---	---	---	---	---
25	0.2	---	2.4	---	---	---	---	---	---	---	---	---
26	---	---	---	---	---	---	0.8	---	---	---	---	---
27	1.0	2.4	---	---	0.4	1.5	0.4	0.1	---	---	---	---
28	---	---	0.5	1.4	1.4	---	0.7	---	0.1	0.6	0.4	---
29	---	---	0.4	1.0	1.4	0.3	0.4	---	0.5	0.1	---	---
30	---	---	---	---	---	0.1	0.4	---	0.5	---	---	---
31	---	---	---	---	---	---	---	---	---	---	---	---
Total	4.0	4.9	5.6	6.4	9.5	4.1	3.5	5.0	1.1	1.0	0.6	1.1

Table 4.--Magnetic data tape specifications

9-track	ASCII
1600 BPI	80 byte records
Block size equal 80 bytes	90,886 records (card images)
Unlabelled	

Table 5.--File index of data records on tape

File name	Logical record length (number of 80 column card images per file)
TRENCH1.DATA.82	2,471
TRENCH1.DATA.83	2,387
TRENCH1.DATA.84	868
TRENCH2.DATA.82	2,192
TRENCH2.DATA.83	2,464
TRENCH2.DATA.84	497
TRENCH3.DATA.82	2,189
TRENCH3.DATA.83	2,010
TRENCH3.DATA.84	744
TRENCH4.DATA.82	1,866
TRENCH4.DATA.83	2,323
TRENCH4.DATA.84	519
B1.DATA.83	17,520
B2.DATA.83	17,520
B1.DATA.84	17,568
B2.DATA.84	17,568
RAINFALL.RECORD	180

Table 6.--Examples of hydrologic and micrometeorologic data formats

Hydrologic Data

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....

 00+T02 01+T14 02+T54 03+148 04+181 05+066 06+104 07+150 08+298 09+152
 10+051 11-046 12+073 13+071 14+066 15+098 16+099 17+099 18+141 19+130
 20+131 21+147 22+151 23+150 24+159 25+173 26+162 27+163 28+177 29+182
 30+174 31+184 32+177 33-001 34+036 35+045 36-002 37+067 38+145 39+035
 40+001 41+112 42+024 43-000 44+003 45+012 45+276 47+006 48+000 49-001
 50+004 51+021 52+008 53+008 54+039 55+043 56+126 57+022 58+029 59+073
 60+037 61-001
```

Micrometeorologic Data, Station B-1

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....

 01 0001.  02 1306.  03 0100.  04 19.43  05 18.53  06 19.51  07 18.34
 08 21.88  09 17.18  10 -.568  11 4.175
```

Micrometeorologic Data, Station B-2

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....

 00 0001.  02 2306.  03 0015.  04 -.017  05 0.022  06 36.34  07 35.33
 08 -.340  09 4.401  10 63.61
```

Table 7.--Channel location for each soil-moisture tensiometer, temperature sensor, and conductance probe for the period of record

Monitoring site 1

01/05/82 through 05/03/84					
Tensiometer	Channel	Temperature	Channel	Conductance	Channel
	00	1	12	1	33
	01	2	13	2	34
	02	3	14	3	35
1	03	4	15	4	36
2	04	5	16	5	37
3	05	6	17	6	38
4	06	7	18	7	39
5	07	8	19	8	40
6	08	9	20	9	41
7	09	10	21	10	42
8	not installed	11	22	11	43
9	10	12	23	12	44
10	11	13	24	13	45
		14	25	14	46
		15	26	15	47
		16	27	16	48
		17	28	17	49
		18	29	18	50
		19	30	19	51
		20	31	20	52
		21	32	21	53
				22	54
				23	55
				24	56
				25	57
				26	58
				27	59
				28	60
				29	61

Table 7.--Channel location for each soil-moisture tensiometer, temperature sensor, and conductance probe for the period of record (Continued)

Monitoring site 2

01/05/82 through 03/14/84					
Tensiometer	Channel	Temperature	Channel	Conductance	Channel
	00	1	13	1	34
	01	2	14	2	35
	02	3	15	3	36
1	03	4	16	4	37
2	04	5	17	5	38
3	05	6	18	6	39
4	06	7	19	7	40
5	07	8	20	8	41
6	08	9	21	9	42
7	09	10	22	10	43
8	10	11	23	11	44
9	11	12	24	12	45
10	12	13	25	13	46
		14	26	14	47
		15	27	15	48
		16	28	16	49
		17	29	17	50
		18	30	18	51
		19	31	19	52
		20	32	20	53
		21	33	21	54
				22	55
				23	56
				24	57
				25	58
				26	59
				27	60
				28	61
				29	62

Table 7.--Channel location for each soil-moisture tensiometer, temperature sensor, and conductance probe for the period of record (Continued)

Monitoring site 3

07/22/82 through 05/10/83					
Tensiometer	Channel	Temperature	Channel	Conductance	Channel
	00	1	11	1	35
	01	2	12	2	36
	02	3	13	3	37
1	03	4	14	4	38
2	04	5	15	5	39
3	05	6	16	6	40
4	06	7	17	7	41
5	07	8	18	8	42
6	08	9	19	9	43
7	09	10	20	10	44
-	10	11	21	11	45
		12	22	12	46
		13	23	13	47
		14	24	14	48
		15	25	15	49
		16	26	16	50
		17	27	17	51
		18	28	18	52
		19	29	19	53
		20	30	20	54
		21	31	21	55
		22	32		
		23	33		
		-	34		

Table 7.--Channel location for each soil-moisture tensiometer, temperature sensor, and conductance probe for the period of record (Continued)

Monitoring site 3 (Continued)

05/11/83 through 05/03/84					
Tensiometer	Channel	Temperature	Channel	Conductance	Channel
	00	1	12	1	35
	01	2	13	2	36
	02	3	14	3	37
1	03	4	15	4	38
2	04	5	16	5	39
3	05	6	17	6	40
4	06	7	18	7	41
5	07	8	19	8	42
6	08	9	20	9	43
7	09	10	21	10	44
-	10	11	22	11	45
8	11	12	23	12	46
		13	24	13	47
		14	25	14	48
		15	26	15	49
		16	27	16	50
		17	28	17	51
		18	29	18	52
		19	30	19	53
		20	31	20	54
		21	32	21	55
		22	33		
		23	34		

Table 7.--Channel location for each soil-moisture tensiometer, temperature sensor, and conductance probe for the period of record (Continued)

Monitoring site 4

02/24/82 through 05/11/83					
Tensiometer	Channel	Temperature	Channel	Conductance	Channel
	00	1	10	1	36
	01	2	11	2	37
	02	3	12	3	38
1	03	4	13	4	39
2	04	5	14	5	40
3	05	6	15	6	41
4	06	7	16	7	42
5	07	8	17	8	43
6	08	9	18	9	44
7	09	10	19	10	45
		11	20	11	46
		12	21	12	47
		13	22	13	48
		14	23	14	49
		15	24	15	50
		16	25	16	51
		17	26	17	52
		18	27	18	53
		19	28	19	54
		20	29	20	55
		21	30	21	56
		22	31	22	57
		23	32	23	58
		-	33		
		-	34		
		-	35		

Table 7.--Channel location for each soil-moisture tensiometer, temperature sensor, and conductance probe for the period of record (Continued)

Monitoring site 4 (Continued)

05/12/83 through 03/14/84					
Tensiometer	Channel	Temperature	Channel	Conductance	Channel
	00	1	13	1	38
	01	2	14	2	39
	02	3	15	3	40
1	03	4	16	4	41
-	04	5	17	5	42
2	05	6	18	6	43
3	06	7	19	7	44
-	07	8	20	8	45
4	08	9	21	9	46
-	09	10	22	10	47
5	10	11	23	11	48
6	11	12	24	12	49
7	12	13	25	13	50
		14	26	14	51
		15	27	15	52
		16	28	16	53
		17	29	17	54
		18	30	18	55
		19	31	19	56
		20	32	20	57
		21	33	21	58
		22	34	22	59
		23	35	23	60
		-	36		
		-	37		

Table 8.--Channel location for micrometeorologic parameters for the period of record

Station	Parameter	Channel location 1983 and 1984
B-1	Dry bulb temperature (°C), 1.64 feet	04
	Wet bulb temperature (°C), 1.64 feet	05
	Dry bulb temperature (°C), 3.28 feet	06
	Wet bulb temperature (°C), 3.28 feet	07
	Soil temperature (°C), 0.328 foot	08
	Soil temperature (°C), 3.28 feet	09
	Soil heat flux (langleys per hour), 0.10 foot	10
	Wind speed (miles per hour), 1.64 feet	11
B-2	Incoming solar radiation (short-wave), (langleys per hour), 3.28 feet	04
	Reflected solar radiation (short-wave), (langleys per hour), 3.28 feet	05
	Incoming long-wave radiation (langleys per hour), 3.28 feet	06
	Emitted long-wave radiation (langleys per hour), 3.28 feet	07
	Net radiation (langleys per hour), 3.28 feet	08
	Wind speed (miles per hour), 3.28 feet	09
	Wind direction (degrees), 3.28 feet	10