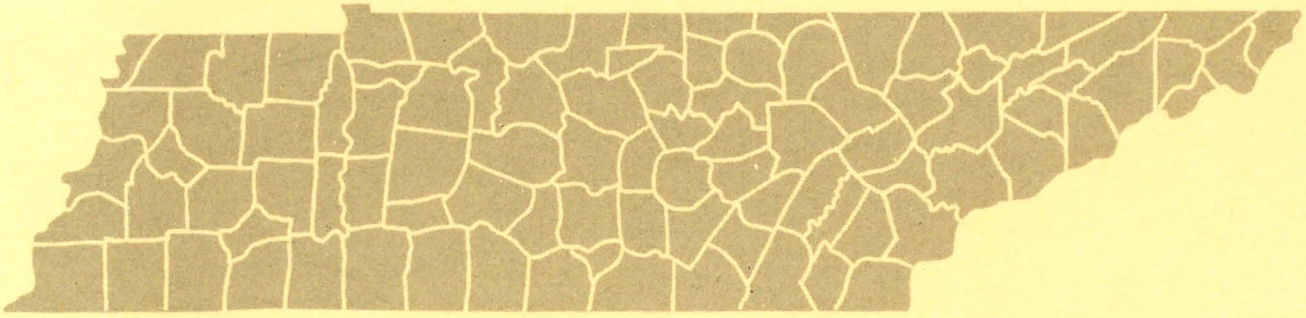
X

Open-File Report 85-682

STREAMFLOW AND SPECIFIC-CONDUCTANCE DATA FOR BEAR CREEK, AUGUST 13, 1985, THE OAK RIDGE RESERVATION, TENNESSEE



2w anal.

Prepared by
U.S. GEOLOGICAL SURVEY

in cooperation with the
U.S. DEPARTMENT OF ENERGY

STREAMFLOW AND SPECIFIC-CONDUCTANCE DATA FOR BEAR CREEK, AUGUST 13, 1985, THE OAK RIDGE RESERVATION, TENNESSEE

R. D. Evaldi

U.S. GEOLOGICAL SURVEY
Open-File Report 85-682

Prepared in cooperation with the
U.S. DEPARTMENT OF ENERGY

Knoxville, Tennessee
1986

UNITED STATES DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

District Chief
U.S. Geological Survey
A-413 Federal Building
U.S. Courthouse
Nashville, Tennessee 37203

Copies of this report can be purchased from:

Open-File Services Section
Western Distribution Branch
U.S. Geological Survey
Box 25425, Federal Center
Lakewood, Colorado 80225
(Telephone: (303) 236-7476)

CONTENTS

ILLUSTRATIONS

TABLES

FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM OF UNITS (SI)

Multiply	by	To obtain
foot (ft)	0.3048	meter (m)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
acre	0.4047	square hectometer (hm^2)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)

To convert degree Fahrenheit (°F) to degree Celsius (°C)

$$°C = \frac{5}{9}(°F-32)$$

STREAMFLOW AND SPECIFIC-CONDUCTANCE DATA FOR BEAR CREEK, AUGUST 13, 1985, THE OAK RIDGE RESERVATION, TENNESSEE

R. D. Evaldi

ABSTRACT

Discharge and specific conductance were measured August 13, 1985, during low base flow of Bear Creek in the vicinity of the Y-12 Plant on the Oak Ridge Reservation, Tennessee. Discharge of Bear Creek and its tributaries measured at specific sites ranged from 0 to 1.0 cubic foot per second. Specific conductance ranged from 225 to 7 600 microsiemens per centimeter at 25° Celsius. During the time of instantaneous discharge measurements, flow of Bear Creek at the continuous-record station at Highway 95 near Oak Ridge ranged from 0.59 to 0.63 cubic foot per second.

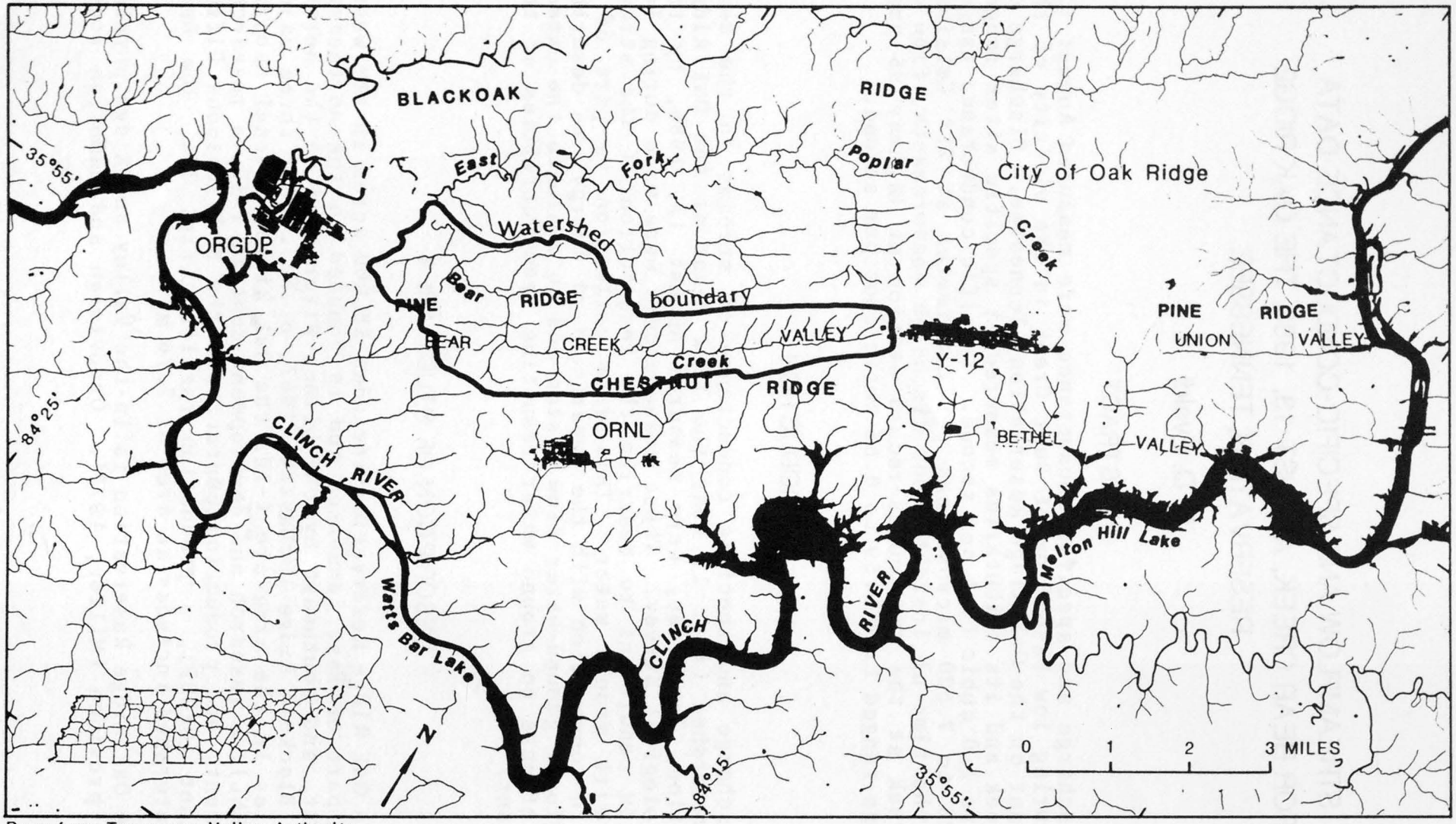
INTRODUCTION

Discharge and specific conductance of streams in the Bear Creek watershed (fig. 1) near the Y-12 Plant at the Oak Ridge Reservation, Tennessee, were measured August 13, 1985, by the U.S. Geological Survey. These measurements were made during low base flow conditions to describe the interaction of the stream system with ground water. This data collection is part of a study, in cooperation with the Department of Energy, to describe the regional ground-water flow system and to evaluate the extent of any effects on ground water resulting from activities at the Y-12 Plant.

DESCRIPTION OF STUDY AREA

The Oak Ridge Reservation includes 58,000 acres in the west-central part of East Tennessee and is bounded on the northeast, southeast, and southwest by the Clinch River, and on the northwest by Blackoak Ridge (McMaster, 1967, p. N2). The three major facilities in the area are X-10, the Oak Ridge National Laboratory (ORNL), a research and development center; Y-12, a research, development, and production center; and the K-25 Gaseous Diffusion Plant (ORGDP), a production facility (fig. 1). The Bear Creek watershed includes an area of 7.76 mi^2.

The Oak Ridge Reservation is in the Valley and Ridge physiographic province (Miller, 1974). Ordovician and Cambrian rocks



Base from Tennessee Valley Authority
1:24,000 map S-16A, revised in part June 1974

Figure 1.--Study area.

that underlie the Valley and Ridge are predominantly carbonate rocks, siltstone, shale, and some sandstone. Northeast-trending ridges, generally at altitudes of 1,000 to 1,200 feet, are formed by rocks that are resistant to weathering such as the sandstone and shale of the Rome Formation or by chert-rich residuum of the Knox Group. The valleys, generally flat and at altitudes of 750 to 850 feet, are underlain by less resistant rocks such as the shale in the Conasauga Group or the limestone and shale in the Chickamauga Group.

STREAMFLOW

Streamflow, measured during a period of base flow at 87 sites along Bear Creek and its tributaries, ranged from 0 to 1.0 ft^3/s (fig. 2 and table 1). Flow in the stream system was assumed to be largely from ground-water discharge rather than from surface runoff. Flow decreased in a downstream direction in several channel reaches; some reaches were dry. Discharge is reported to the nearest hundredth for flows of less than 1 ft^3/s, and to tenths above 1.0 ft^3/s. Measurements were made with current meters, and the measurement error was estimated to be within 10 percent.

The discharge of Bear Creek is measured at a continuous-record station at Highway 95 (site 76, fig. 2) by the U.S. Geological Survey. A discharge graph of Bear Creek for August 7-14, 1985 (fig. 3), shows the antecedent streamflow recession and indicates stable streamflow conditions for measurements on August 13. During the time measurements were made on August 13, streamflow at Highway 95 ranged from 0.59 to 0.63 ft^3/s.

SPECIFIC CONDUCTANCE

Specific conductance, measured at 107 sites along Bear Creek and its tributaries ranged from 225 to 7 600 microsiemens per centimeter at 25° Celsius (fig. 2 and table 1). Specific conductance was measured to help detect locations of ground-water discharge to Bear Creek and to distinguish between re-emergence of channel flow and natural springflow.

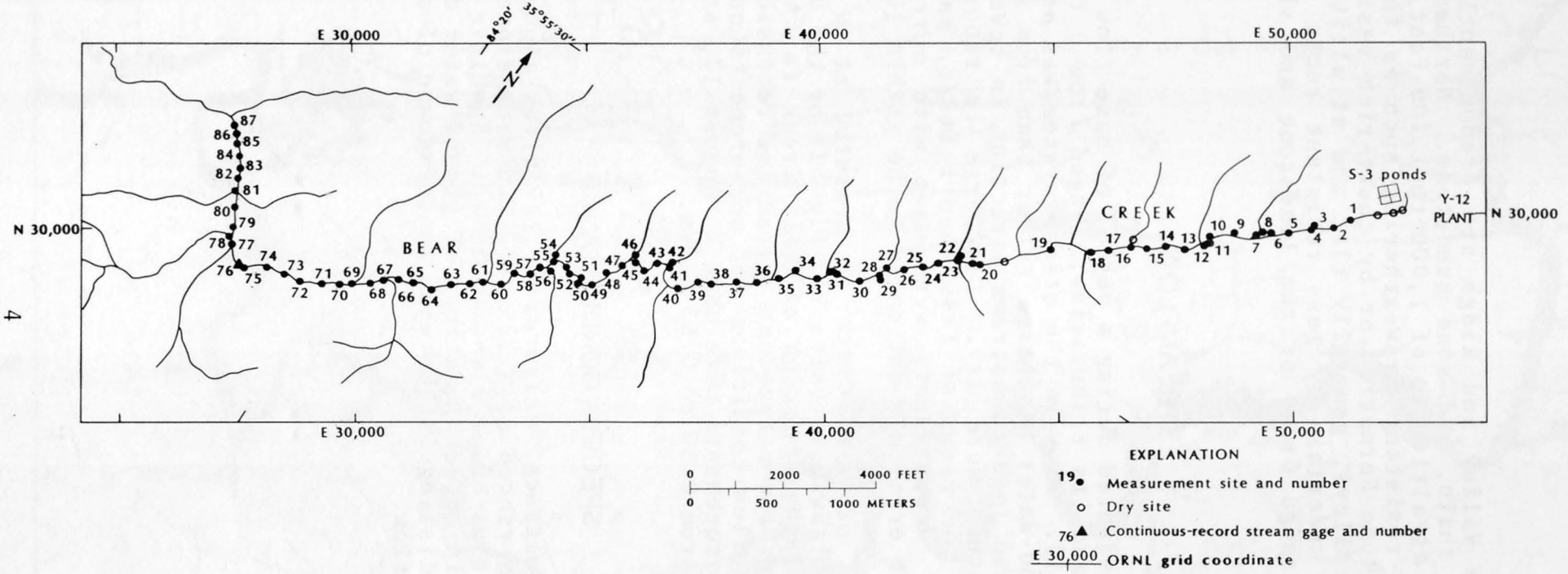


Figure 2.--Measurement sites in the Bear Creek watershed, August 13, 1985.

Table 1.--Discharge and specific-conductance measurements of the Bear Creek watershed, August 13, 1985

[Five dry sites (0 ft^3/s) shown on figure 2 are not included. Site numbers are referenced to figure 2. All sites are on Bear Creek unless otherwise noted. µS/cm at 25°C, microsiemen per centimeter at 25° Celsius]

Site No.	Remarks	Discharge (ft^3/s)	Specific conductance (µS/cm at 25°C)
1		<0.01	7 600
2	Left bank seep	.02	4 500
3		.02	5 900
4		.05	5 800
5		.02	4 700
6		.03	4 300
7		.03	4 250
8	Right tributary	<.01	1 500
	Bear Creek below site 8		4 100
9		.02	3 500
10		.04	3 200
11	Left bank spring	.02	365
	Bear Creek below site 11		2 100
	Bear Creek above site 12		2 250
12	Left bank spring	<.01	370
	Bear Creek below site 12		2 200
13		.06	1 750
14		.06	1 630
15		.03	1 580
16		.01	1 350
17		.02	1 740
18		.02	1 820
19	Left tributary	.01	1 270
20	Left tributary	.07	1 160
21		.06	1 200
	Bear Creek above site 22		1 200
22	Right tributary	.02	950
	Bear Creek below site 22		1 150
23		.05	1 150
24		.08	1 100
25		.13	1 100
26		.05	1 100
	Bear Creek above site 27		1 100
27	Right tributary	.01	450
	Bear Creek below site 27		900
28		.04	900
29	Left bank spring	.16	950
	Bear Creek below site 29		950
30		.16	950
31		.18	950
	Bear Creek above site 32		925
32	Right tributary	<.01	350

Table 1.--Discharge and specific-conductance measurements of the Bear Creek watershed, August 13, 1985--Continued

Site No.	Remarks	Discharge (ft^3/s)	Specific conductance ($\mu S/cm$ at 25°C)
	Bear Creek below site 32		925
33		0.24	925
34		.22	900
35		.28	900
36		.24	900
37		.22	850
38		.24	900
39		.20	890
40		.28	880
41		.26	850
	Bear Creek above site 42		850
42	Right tributary	.01	225
	Bear Creek below site 42		845
43		.28	840
44		.32	825
45		.28	825
	Bear Creek above site 46		825
46	Right tributary	.02	225
	Bear Creek below site 46		800
47		.27	800
48		.28	800
49		.28	800
	Bear Creek above site 50		800
50	Left tributary	.04	420
	Bear Creek below site 50		775
51		.28	775
52		.23	760
53		.29	775
	Bear Creek above site 54		775
54	Right tributary	.01	260
55		.27	740
	Bear Creek above site 56		750
56	Left tributary	.09	262
57		.23	700
58		.28	675
59		.36	675
60		.31	660
61		.38	650
62		.38	615
63		.35	600
64		.33	600
65		.38	595
66		.29	600

Table 1.--Discharge and specific-conductance measurements of the Bear Creek watershed, August 13, 1985--Continued

Site No.	Remarks	Discharge (ft^3/s)	Specific conductance ($\mu S/cm$ at 25°C)
67		0.36	600
68		.33	600
69		.25	620
70		.30	620
71		.19	620
72		.18	610
73		.21	615
74		.26	600
75	Left bank spring	.12	330
76	Continuous-record stream gage, Bear Creek at Highway 95	.61	515
77		.53	495
78	Left tributary	.10	500
	Bear Creek below site 78		485
79		.63	495
80		1.0	482
81		.72	485
82		.75	480
83		.48	480
84		.69	475
85		.69	482
86		.57	460
87		.71	460

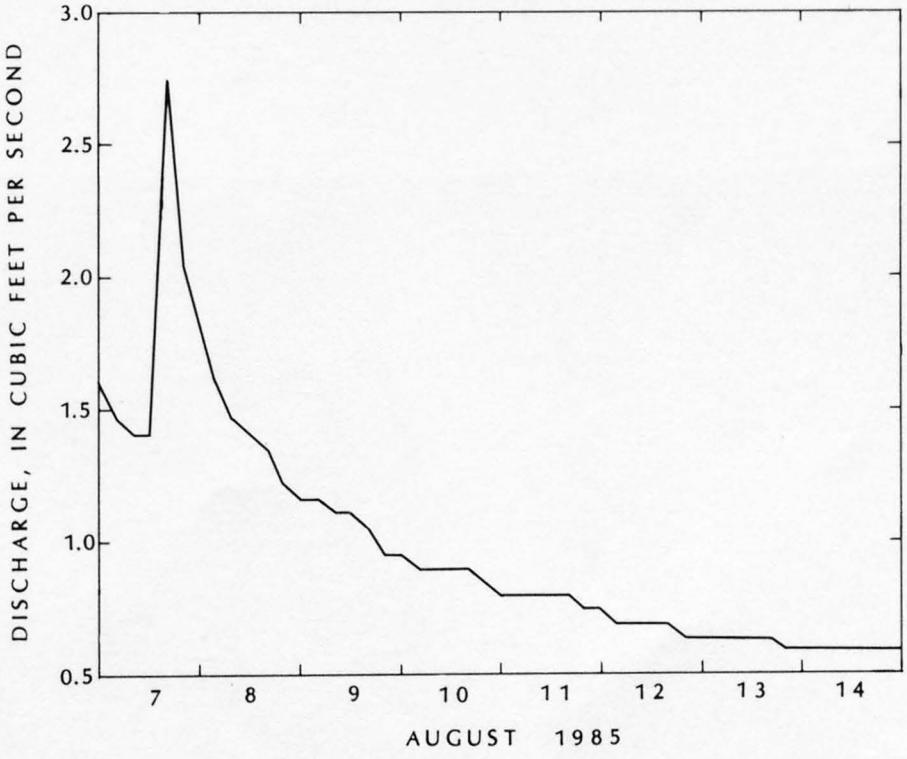


Figure 3.--Discharge of Bear Creek at Highway 95 near Oak Ridge, Tennessee, August 7-14, 1985.

REFERENCES

Hem, J. C., 1970, Study and interpretation of the chemical characteristics of natural water (2d ed.): U.S. Geological Survey Water-Supply Paper 1473, 363 p.

McMaster, W. M., 1967, Hydrologic data for the Oak Ridge area, Tennessee: U.S. Geological Survey Water-Supply Paper 1839-N, 60 p.

Miller, R. A., 1974, The geologic history of Tennessee: Tennessee Division of Geology Bulletin 74, 63 p.

STREAMFLOW AND SPECIFIC-CONDUCTANCE DATA FOR BEAR CREEK, AUGUST 13, 1985, THE OAK RIDGE RESERVATION, TENNESSEE

OFR 85-682