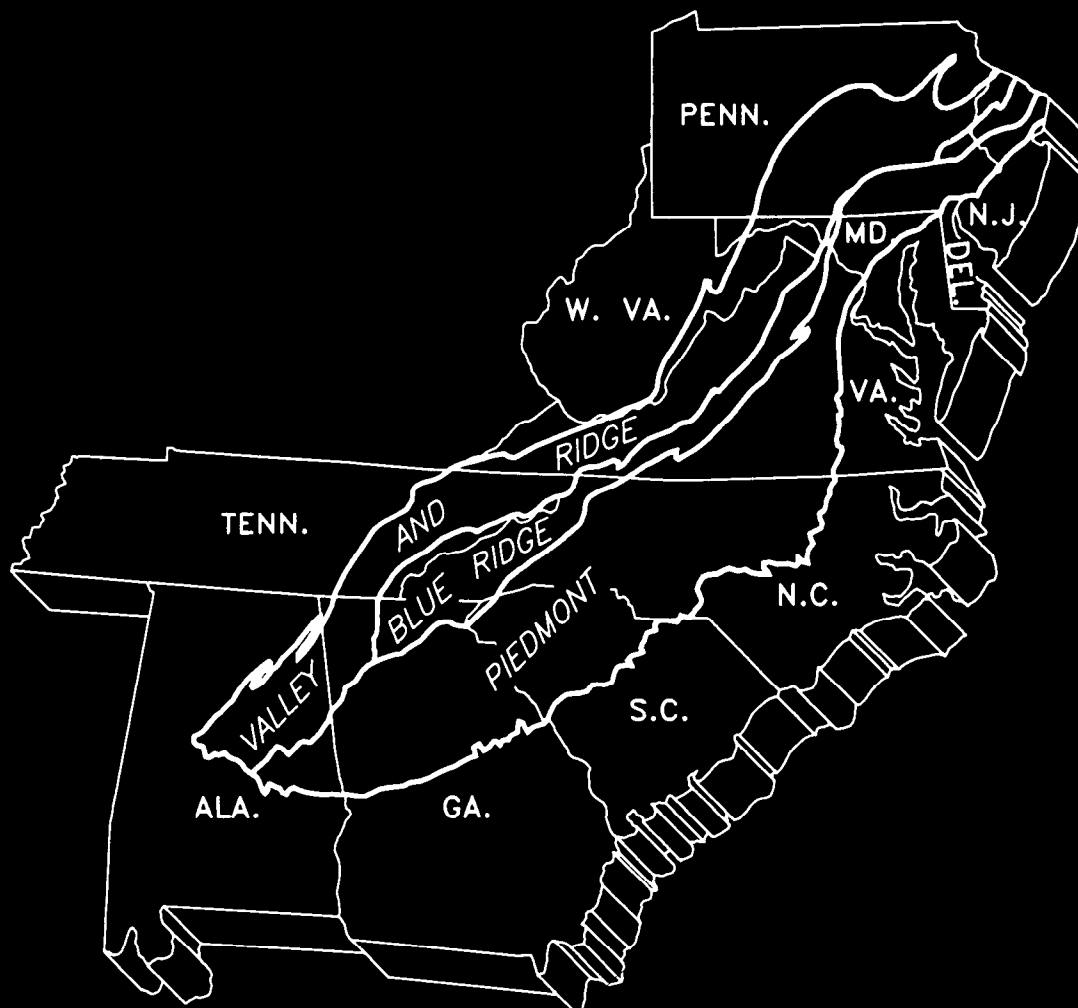


LARGE SPRINGS IN THE VALLEY AND RIDGE PROVINCE IN TENNESSEE



U.S. GEOLOGICAL SURVEY



LARGE SPRINGS IN THE VALLEY AND RIDGE PROVINCE IN TENNESSEE

By E.F. Hollyday and Mark A. Smith

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 89-4205



**Nashville, Tennessee
1990**

DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., Secretary

U.S. 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 can be purchased from:

U.S. Geological Survey
Books and Open-File Reports Section
Federal Center, Bldg. 810
Box 25425
Denver, Colorado 80225

CONTENTS

Abstract	1
Introduction	1
Data compilation and analyses	2
References cited	9

ILLUSTRATIONS

Figure 1. Map showing the Appalachian Valleys-Piedmont Regional Aquifer-System Analysis study area, physiographic provinces, and area studied in this report	3
2. Map showing the location and mean discharge of large springs in the Valley and Ridge province and adjacent parts of the Blue Ridge province in Tennessee	4

TABLE

Table 1. Discharge characteristics of large springs in the Valley and Ridge province and adjacent parts of the Blue Ridge province in Tennessee	6
---	---

CONVERSION FACTORS

For those readers who may prefer to use metric units rather than inch-pound units, conversion factors for terms used in this report are listed below:

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

LARGE SPRINGS IN THE VALLEY AND RIDGE PROVINCE IN TENNESSEE

by E.F. Hollyday and Mark A. Smith

ABSTRACT

Approximately 2,700 miscellaneous discharge measurements for 171 large springs in 28 counties of East Tennessee, predominantly within the Valley and Ridge physiographic province, were analyzed statistically and results tabulated to summarize data useful to the Appalachian Valleys-Piedmont Regional Aquifer-System Analysis study. The number of measurements at each spring ranged from 1 to 65. Information for each spring includes station number, latitude, longitude, spring name, and where data are sufficient, an estimate of the mean discharge and the discharge exceeded by 75, 50, and 25 percent of the miscellaneous measurements. Data are referenced to locations on a 1:1,000,000-scale map. The highest mean spring discharge was 32.2 cubic feet per second (14,500 gallons per minute).

INTRODUCTION

In 1978, the U.S. Geological Survey initiated the Regional Aquifer-System Analysis (RASA) program in response to Congressional concern over the drought of 1977. The purposes of the RASA program are to define the regional hydrology and geology and to establish a framework of background information on geology, hydrology, and water chemistry for the Nation's important aquifer systems. This information is critically needed to develop an under-

standing of regional ground-water flow systems and to support more efficient ground-water resources management (Sun, 1986).

As a part of the RASA program, the Survey began a 5-year study in 1988 of the ground-water resources of an 11-state area that includes parts of East Tennessee (fig. 1). The 5-year study, designated the Appalachian Valleys-Piedmont Regional Aquifer-System Analysis (APRASA), is investigating the quantity and quality of ground-water resources in the unglaciated part of the Valley and Ridge, Blue Ridge, and Piedmont physiographic provinces. Included in the ground-water resources of the area are the principal springs that are being or could be used for water supply. Springs are an important water source for many large cities in the region including several in East Tennessee. In addition, springs have hydrologic importance as the outlet for large, integrated ground-water-flow systems in the soluble rocks in the APRASA study area.

Studies of springs in East Tennessee were begun by the Survey in 1931 following the severe drought of 1930 (Sun and others, 1963). Later, a reconnaissance of ground water available from both wells and springs was begun in 1947 with field work completed in 1953. This work resulted in the publication of information on 960 springs in East Tennessee (DeBuchananne and Richardson, 1956). Ninety of the larger springs were selected for further study; their flows were

measured monthly for a period of 1 to 4 years (Sun and others, 1963). The period of measurement included the moderate drought from 1951 to 1954. The discharge measurements of 84 of the 90 springs were analyzed for magnitude and variability. They reported a total of 66 springs in East Tennessee with mean discharges that exceeded 1 ft³/s, four of which had mean discharges that exceeded 10 ft³/s. No spring had a mean discharge in excess of 100 ft³/s.

This report summarizes the discharge information available for springs in the APRASA area in East Tennessee that have mean discharges greater than 0.25 ft³/s. The summary is in the form of a small-scale location map (fig. 2) and a table (table 1) giving location, name, and statistical measures of the flow of each spring.

DATA COMPILATION AND ANALYSES

Data on approximately 2,700 measurements of spring discharge for 171 springs in 28 counties of East Tennessee are stored in the Geological Survey's computerized file of miscellaneous measurements in the Tennessee District. The records were analyzed using a statistical software program. The data for each spring (from 1 to 65 measurements) were

analyzed to determine the mean discharge and the discharge exceeded by 75, 50, and 25 percent of the miscellaneous measurements. Springs with mean discharge of less than 0.25 ft³/s were not tabulated (table 1). The remaining 134 springs were plotted as circles on a 1:1,000,000-scale map using geographic information system (GIS) software (fig. 2). All but seven springs are located within the Valley and Ridge physiographic province as delineated by Fenneman (1946). The area of each circle is proportional to the mean discharge of the corresponding spring. A map number was assigned to each spring and these numbers are cross referenced with station numbers in table 1. The reader may determine a more accurate location of each spring with regard to hydrographic features, cultural features, or boundaries of larger-scale topographic-quadrangle maps by overlaying figure 2 on a 1:1,000,000-scale map index (U.S. Geological Survey, 1980).

Because the number of measurements at each spring is relatively small, the maximum and minimum discharges listed in table 1 should not be construed as the full range in flow that could be expected over a long period of time. In addition, because the measurements are irregularly distributed over a number of years and hydrologic conditions, the P75, P50, and P25 values should not be construed as representative of flow duration.

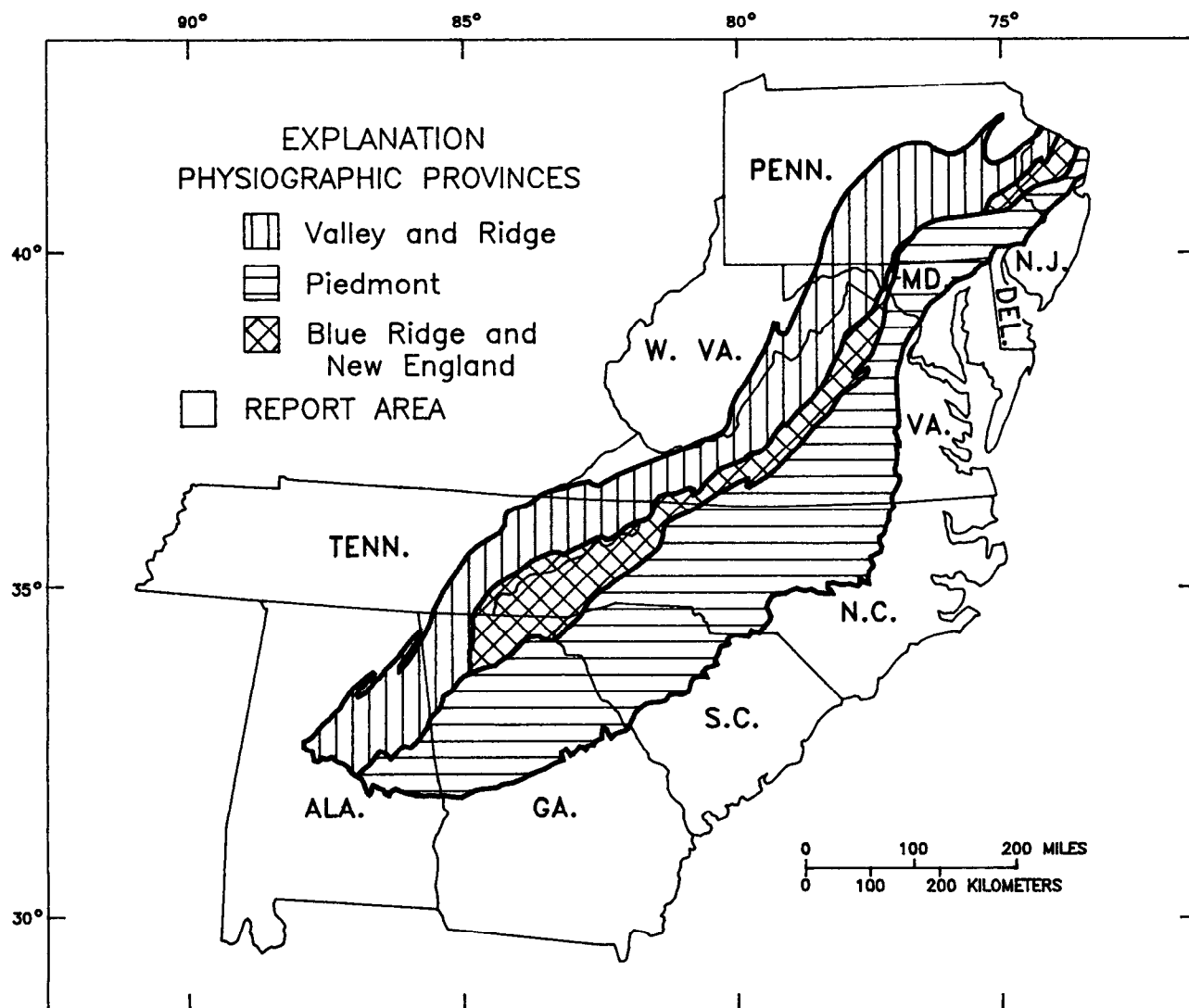


Figure 1.—The Appalachian Valleys-Piedmont Regional Aquifer-System Analysis study area, physiographic provinces, and area studied in this report.

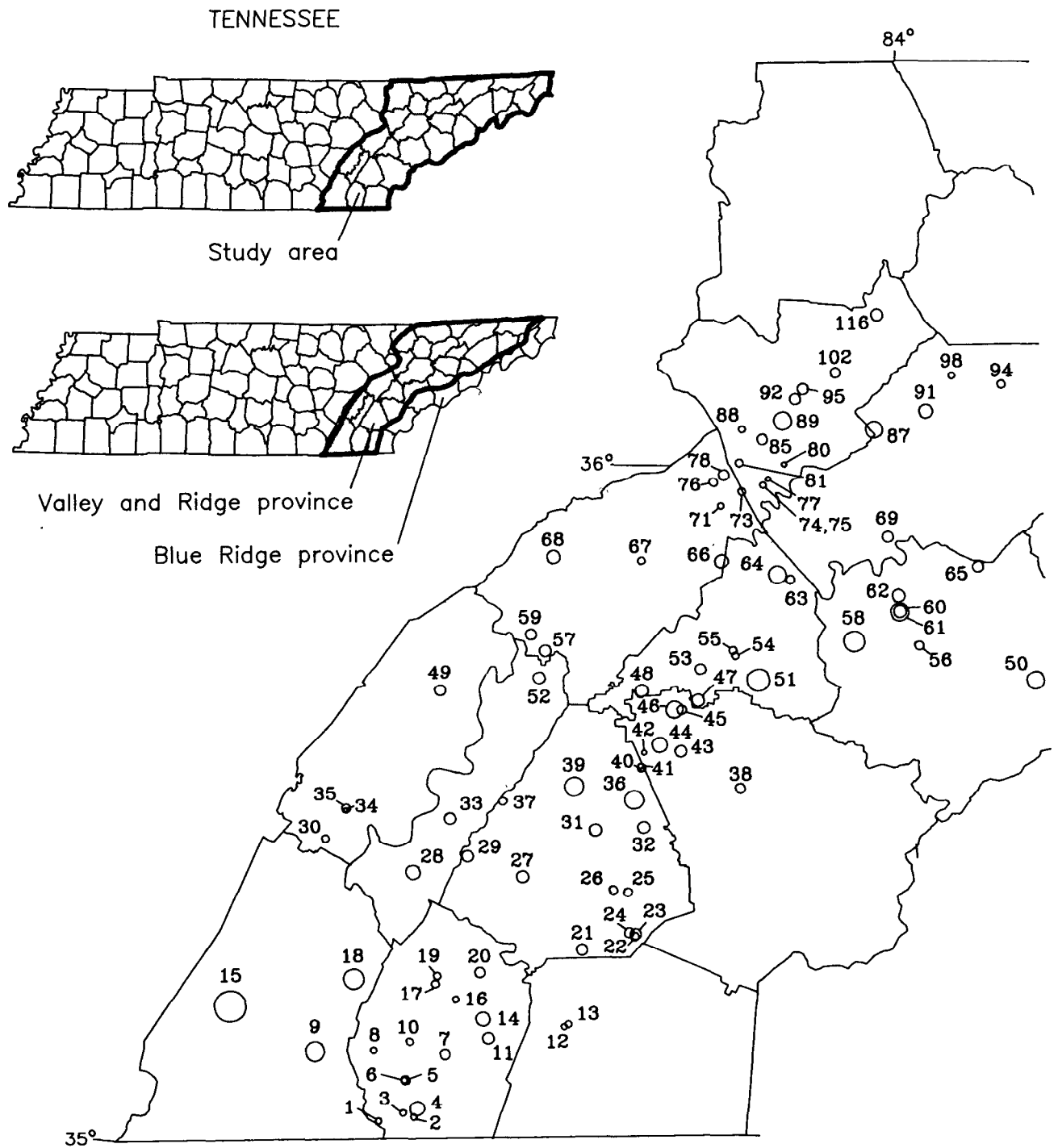
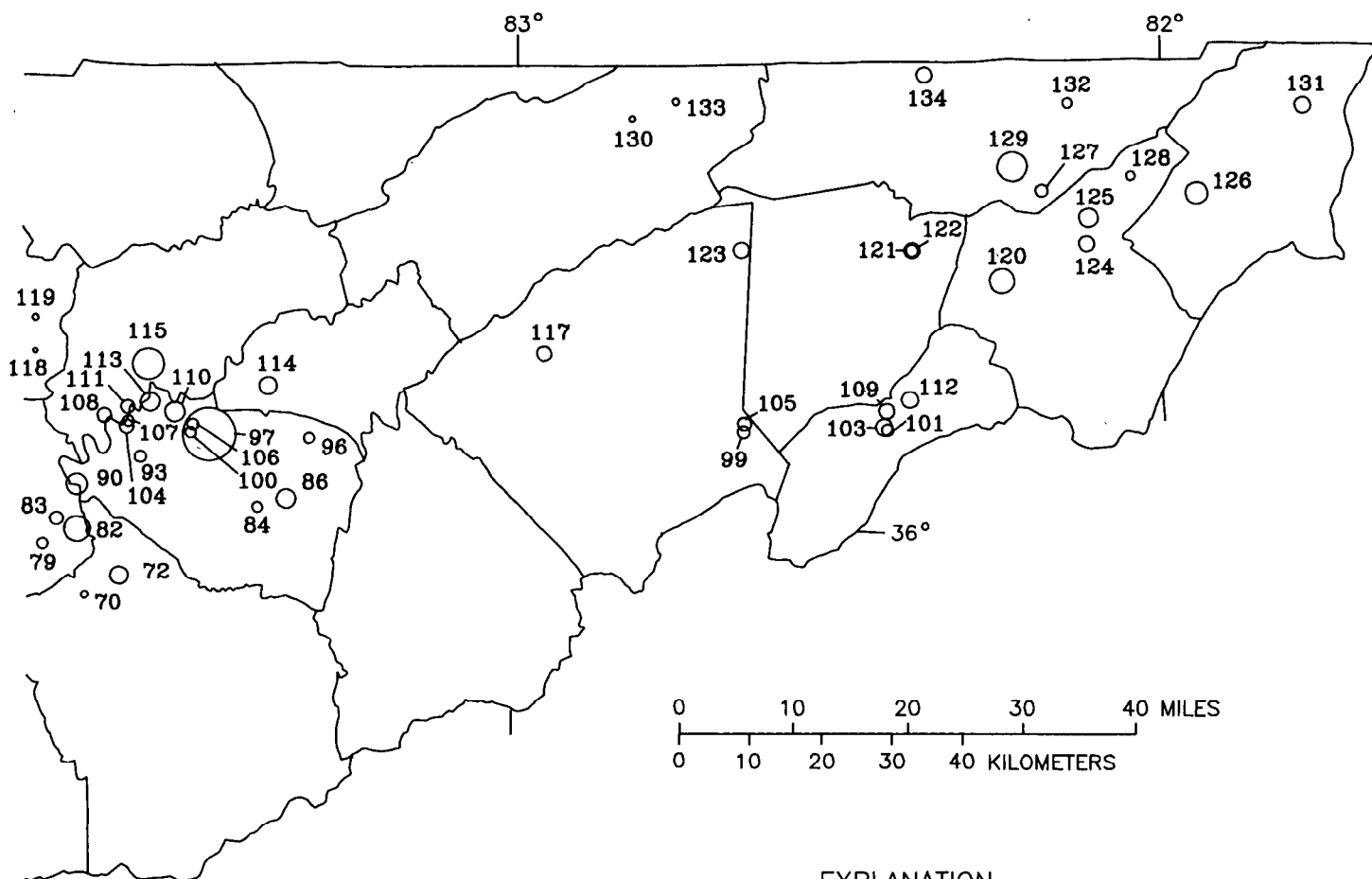


Figure 2.--Location and mean discharge
province and adjacent parts of the



EXPLANATION

○ 72 SPRING AND MAP NUMBER--See table 1

MEAN DISCHARGE, IN CUBIC FEET
PER SECOND

SCALE OF
DIAMETERS

of large springs in the Valley and Ridge
Blue Ridge province in Tennessee.

Table 1.--*Discharge characteristics of large springs in the Valley and Ridge province and adjacent parts of the Blue Ridge province in Tennessee*

[Latitude and longitude in degrees, minutes, and seconds. Spring discharge is in cubic feet per second. P75, P50, P25, is discharge that is equalled or exceeded by 75, 50, and 25 percent of the discharge measurements, respectively. Min is the minimum discharge measurement of record. Max is the maximum discharge measurement of record. Mean is the arithmetic mean, unless there is only one measurement. In this case, the one measurement is listed as the mean. --, insufficient data to determine a value]

Map No.	Station number	Latitude	Longitude	Station name	Discharge						No. of measurements
					Min	P75	P50	P25	Max	Mean	
1	03566180	350136	845814	TAYLOR SPRING NEAR APISON	0.14	0.34	0.40	0.55	0.64	0.43	18
2	02384930	350157	845424	FLINT SPRING AT FLINT SPRINGS	.29	.37	.45	.52	.55	.45	17
3	02384950	350218	845538	HIGGINS SPRINGS NEAR CLEVELAND	.08	.41	.61	.82	1.28	.62	18
4	02384920	350243	845407	SEATON SPRINGS NEAR CLEVELAND	1.87	2.70	2.98	3.42	3.97	3.02	31
5	03566205	350511	845517	MOORE AND EADS SPRINGS AT BLUE SPRINGS	.41	.83	1.05	1.45	2.01	1.13	18
6	03566210	350515	845535	TRIPLETT SPRING NEAR MCDONALD	.07	.22	.37	.55	.88	.39	19
7	02384905	350726	845105	WILDWOOD SPRING NEAR CLEVELAND	.86	1.10	1.28	1.59	1.98	1.34	34
8	03566190	350750	845840	ROARK SPRING NEAR MCDONALD	.28	.43	.47	.52	.66	.47	19
9	03566446	350751	850457	CARSON SPRING NEAR OOLTEWAH	5.39	--	--	--	6.40	6.03	3
10	03566220	350834	845448	HALL SPRING NEAR CLEVELAND	.49	.62	.67	.85	1.19	.73	18
11	03565290	350848	844627	CARPENTER SPRING NEAR CLEVELAND	.83	1.52	1.83	2.42	3.63	1.95	30
12	03564905	350943	843802	SHELTON SPRING NEAR BENTON	.10	.26	.73	.89	1.26	.61	25
13	03564901	350955	843741	MAYNO-PRESTWOOD SPRINGS NEAR BENTON	.16	.24	.35	.57	1.36	.49	25
14	03565400	351026	844659	RICHEY SPRING NEAR CLEVELAND	.94	1.90	2.15	2.47	4.58	2.23	21
15	03566540	351148	851354	CAVE SPRING NEAR HIXSON	.08	3.51	16.2	32.6	43.7	17.5	28
16	03566098	351216	844955	HARDWICK SPRING NEAR CLEVELAND	.38	.52	.60	.74	1.09	.63	31
17	03566252	351342	845203	PULLAM SPRING NEAR CLEVELAND	.42	.65	.74	.85	1.04	.75	18
18	03566449	351416	850041	ANDERSON SPRING NEAR GEORGETOWN	1.02	3.38	4.23	10.5	15.6	6.47	52
19	03566255	351424	845148	MCKENZIE SPRING NEAR CLEVELAND	.48	.71	.82	.98	1.16	.84	18
20	03566110	351442	844715	BELLE FOUNTAIN SPRINGS AT BELLE FOUNTAIN	.42	1.09	1.48	2.14	2.86	1.56	30
21	03565252	351641	843611	DODD SPRING AT DENTVILLE	1.56	2.13	2.47	2.95	3.31	2.53	15
22	035571453	351745	843033	MCSPADDEN SPRING NEAR ETOWAH	.25	--	--	--	1.22	.64	6
23	03557140	351754	843027	TUGGLE SPRINGS NEAR ETOWAH	.47	--	--	--	4.79	1.97	6
24	035571455	351804	843103	FOWLER SPRING NEAR ETOWAH	.82	--	--	--	2.98	1.55	3
25	03557180	352147	843108	CROCKETT SPRING NEAR ETOWAH	.21	.65	1.15	1.42	2.20	1.12	14
26	03566220	352201	843237	CHESTNUT SPRING NEAR ETOWAH	.50	.66	.92	1.38	1.58	1.01	13
27	03566130	352319	844227	BELL SPRING AT RICEVILLE	1.37	2.18	2.55	3.11	4.46	2.65	34
28	03566265	352350	845414	BIG SPRING AT BIG SPRING	.69	1.78	2.86	4.63	10.3	3.43	30
29	03566258	352512	844817	SHORT CREEK SPRING NEAR GOODFIELD	1.35	1.51	1.70	2.23	2.79	1.85	14
30	03566288	352657	850333	HENSON-ROGERS SPRING AT GRAYSVILLE	.21	--	--	--	1.71	.61	7
31	035654363	352724	843429	INGLESIDE SPRING AT ATHENS	.15	--	--	--	4.11	2.47	5
32	03565140	352733	842916	HICKS-BROWN SPRING NEAR ENGLEWOOD	1.02	1.49	2.06	3.23	4.50	2.27	31
33	03544218	352839	845007	MARLER SPRING NEAR GOODFIELD	.29	.89	1.45	2.63	5.21	1.88	14
34	03544606	352932	850119	DAYTON SPRING NO. 2 AT DAYTON	.13	.20	.29	.33	.36	.27	13
35	03544605	352935	850118	DAYTON SPRING NO. 1 AT DAYTON	.51	.82	1.23	1.41	1.88	1.16	14
36	03565425	353004	843018	MALONE SPRING NEAR NIOTA	1.48	3.71	4.82	7.11	9.77	5.39	29
37	035662565	353005	844428	MITCHELLS SPRINGS NEAR DECATUR	--	--	--	--	--	.87	1
38	03518790	353056	841850	ROSS JEWEL SPRING NEAR MADISONVILLE	--	--	--	--	--	.82	1
39	03566119	353116	843644	ARNWINE SPRING NEAR ATHENS	1.21	3.08	4.33	6.33	7.89	4.56	19
40	03520022	353247	842914	BELL SPRING NEAR SWEETWATER	.17	--	--	--	.83	--	2
41	03520031	353258	842926	DUGAN SPRING NEAR SWEETWATER	.33	--	--	--	1.50	--	2
42	035200383	353416	842901	UNNAMED SPRING AT WOOD	.06	--	--	--	.55	--	2
43	03519710	353417	842504	HOWARD SPRING NEAR SWEETWATER	.29	--	--	--	3.12	1.57	3
44	03520040	353458	842721	KILPATRICK SPRING NEAR SWEETWATER	.78	2.00	2.92	4.93	9.63	3.58	30
45	035200525	353759	842455	UNNAMED SPRING NEAR OLD SWEETWATER	--	--	--	--	--	1.33	1
46	035200529	353759	842540	FURROW SPRING NEAR SWEETWATER	--	--	--	--	--	4.63	1
47	03520060	353848	842313	REED SPRING NEAR PHILADELPHIA	.37	1.69	2.36	3.10	4.23	2.46	40
48	03520165	353945	842911	WILSON SPRING NEAR SWEETWATER	--	--	--	--	--	1.82	1
49	03542512	354002	845103	BLUE SPRING AT RHEA SPRINGS	.90	--	--	--	2.54	1.72	3
50	03497319	354004	834647	DUNN SPRING NEAR TOWNSEND	1.60	--	--	--	7.85	4.20	3

Table 1.--Discharge characteristics of large springs in the Valley and Ridge province and adjacent parts of the Blue Ridge province in Tennessee--Continued

Map No.	Station number	Latitude	Longitude	Station name	Discharge						No. of measurements
					Min	P75	P50	P25	Max	Mean	
51	03519730	354029	841640	SIMPSON SPRING NEAR LOUDON	3.12	5.74	6.99	8.68	13.6	7.17	30
52	03543180	354102	844017	KEYLONS SPRING NEAR TEN MILE	.21	--	--	--	5.30	2.03	3
53	03520075	354135	842253	CALLAWAY SPRING NEAR PHILADELPHIA	--	--	--	--	--	1.64	1
54	03519975	354245	841902	LAMBERT SPRING NEAR LOUDON	.65	--	--	--	.79	.70	3
55	03519980	354307	841921	MCKELVEY SPRING NEAR LOUDON	.88	--	--	--	1.45	1.09	3
56	03498993	354318	835906	PEARSON SPRING AT MARYVILLE	1.10	--	--	--	1.69	--	2
57	03541465	354318	843957	BLUE SPRING NEAR EUCHEE	.56	--	--	--	4.53	1.91	4
58	03499400	354343	840609	BIG SPRING NEAR FRIENDSVILLE	1.58	3.14	4.54	9.18	21.5	6.42	27
59	03541463	354452	844108	GORDONS SPRING NEAR EUCHEE	.33	--	--	--	3.56	1.65	3
60	03499050	354621	840109	KIDD SPRING NEAR MARYVILLE	1.00	1.55	1.87	2.14	2.97	1.89	41
61	03499150	354621	840109	LOVINGWOOD SPRING NEAR ALCOA	2.29	3.60	4.74	5.94	7.83	4.82	37
62	03499165	354749	840116	PROFFITT SPRING NEAR MARYVILLE	2.22	--	--	--	2.24	--	2
63	03499590	354929	841256	TOM CARSON SPRING AT MARTEL	.41	.59	1.03	1.40	1.90	1.07	15
64	03499580	354956	841423	MCNEELY SPRING NEAR MARTEL	.89	1.98	2.94	5.73	8.45	3.74	31
65	03498800	355017	835242	CHAMBERS SPRING NEAR ROCKFORD	1.33	1.44	1.49	1.63	1.87	1.52	27
66	03538080	355117	842025	BLUE SPRING NEAR ORAL	.74	1.20	1.93	4.47	8.58	2.92	26
67	03520218	355124	842901	ROSE BAILEYS SPRING NEAR KINGSTON	.14	--	--	--	1.56	--	2
68	03541440	355151	843830	FACTORY SPRING NEAR ROCKWOOD	.48	1.19	1.81	2.60	4.90	2.11	24
69	03499140	355306	840219	MAXWELL SPRING NEAR ROCKY HILL	.55	1.14	1.63	1.97	2.57	1.58	15
70	03470200	355521	833959	ROCKY SPRING AT BOYDS CREEK	.16	.18	.25	.55	.99	.41	13
71	03538269	355613	842023	BEAR CREEK SPRING NO. 2 NEAR OAK RIDGE.	.09	.15	.31	.66	1.16	.40	31
72	03470100	355640	833655	BAILEY SPRING NEAR KODAK	.87	1.56	2.24	4.71	7.74	3.03	26
73	03538261	355726	841803	BEAR CREEK SPRING NO. 1 NEAR OAK RIDGE	.10	.26	.51	.96	1.62	.62	31
74	03535643	355756	841541	UNNAMED SPRING TO WALKER BRANCH TRIB OAK RIDGE.	--	--	--	--	--	.37	1
75	03535639	355802	841543	UNNAMED SPRING BELOW MT VERNON CEMETERY	.47	--	--	--	.47	--	2
76	03538249	355818	842107	EAST FORK POPLAR CREEK SPRING NO.3 NEAR OAK RIDGE.	.08	--	--	--	1.78	--	2
77	03535590	355833	841508	UNNAMED SPRING BELOW TAILINGS POND NEAR OAK RIDGE.	--	--	--	--	--	.27	1
78	03538245	355857	841957	CRYSTAL SPRING NEAR OAK RIDGE	.32	1.19	1.43	1.96	3.20	1.61	30
79	03470400	355904	834355	HUFFAKER SPRING NEAR THORNGROVE	.12	.23	.51	1.28	3.81	.98	14
80	03535087	355944	841322	UNNAMED SPRING NO. 2 TO SCARBORO CREEK, OAK RIDGE.	--	--	--	--	--	.32	1
81	035382425	355958	841814	EAST FORK POPLAR CREEK SPRING NO.2, OAK RIDGE.	.08	--	--	--	1.97	--	2
82	03470300	360016	834042	BOILING SPRING NEAR THORNGROVE	1.97	4.12	6.62	12.8	21.2	8.75	30
83	03494960	360105	834241	CARTER MILL SPRING NEAR TRENTVILLE	1.32	1.81	2.25	3.58	7.09	2.90	41
84	034681955	360153	832359	RILEY SPRING NEAR DANDRIDGE	.46	--	--	--	1.45	.81	7
85	03538193	360156	841545	KEY SPRING AT OAK RIDGE	--	--	--	--	--	1.34	1
86	03468168	360229	832118	SWANN SPRING NEAR DANDRIDGE	1.14	--	--	--	5.14	--	2
87	03535040	360241	840335	FOWLER SPRING NEAR POWELL	1.35	2.13	2.96	7.30	10.8	4.38	27
88	03538155	360255	841758	BLUE SPRING NEAR OLIVER SPRINGS	.06	.19	.42	.87	3.18	.62	40
89	03538190	360334	841331	BACON SPRING AT DOSSETT	.94	1.59	3.00	5.51	12.9	4.10	42
90	03494890	360341	834041	BAKER SPRING AT STRAWBERRY PLAINS	1.17	2.48	6.26	9.20	11.4	5.91	25

Table 1.--*Discharge characteristics of large springs in the Valley and Ridge province and adjacent parts of the Blue Ridge province in Tennessee--Continued*

Map No.	Station number	Latitude	Longitude	Station name	Discharge						No. of measurements
					Min	P75	P50	P25	Max	Mean	
91	03535185	360413	835751	BIG BLUE SPRING NEAR FOUNTAIN CITY	.92	1.25	1.63	3.54	10.6	2.93	29
92	03538175	360531	841204	SHEFTERLY SPRING NEAR CLINTON	.25	.56	1.24	2.91	6.32	1.76	26
93	03494700	360544	833451	JONES SPRING AT NEW MARKET	.43	.89	1.57	2.70	4.03	1.82	24
94	03495100	360625	834936	CARDWELL SPRING NEAR MALONEYVILLE	.28	.52	.90	1.51	2.23	1.00	26
95	03538170	360625	841111	BURRESS SPRING NEAR CLINTON	.24	.76	1.55	3.23	6.50	1.99	14
96	03467990	360713	831911	BLUE HOLE SPRING NEAR WHITE PINE	0.44	0.69	1.07	2.11	2.38	1.32	24
97	03492500	360717	832822	MOSSY SPRING NEAR JEFFERSON CITY	6.00	10.8	17.1	53.7	90.1	32.2	36
98	03535182	360719	835457	HOBBS SPRING NEAR HALLS CROSSROADS	.30	.42	.52	.89	0.99	.61	13
99	03466240	360730	823844	SKYLES SPRING AT PLEASANT HILL	.33	.81	1.26	1.94	2.71	1.36	17
100	03493100	360737	833008	PECKS MILL SPRING AT JEFFERSON CITY	.27	.60	1.08	2.19	3.49	1.39	27
101	03464895	360739	822519	LOVE SPRING AT ERWIN	1.27	--	--	--	2.86	1.98	5
102	03534097	360745	840740	MARTIN SPRING NEAR CLINTON	.65	--	--	--	3.63	1.66	3
103	03464900	360750	822534	STATE FISH HATCHERY SPRING AT ERWIN	2.02	2.96	3.34	4.07	5.99	3.54	27
104	03494610	360800	833602	BUCK HOLLOW SPRING NEAR NEW MARKET	1.02	1.25	1.40	2.41	2.71	1.73	13
105	03466242	360811	823836	SEATON SPRING AT PLEASANT HILL	.32	.90	2.08	2.60	4.52	1.93	29
106	03493105	360812	832953	BYRDS SPRING AT JEFFERSON	.94	--	--	--	1.90	1.35	3
107	03494600	360827	833554	MILLICAN SPRING NEAR NEW MARKET	.36	.58	.86	2.27	2.71	1.36	13
108	03494650	360851	833810	HEATHERLY SPRING AT PERRIN SCHOOL	.57	.66	1.17	2.02	3.99	1.44	36
109	03465225	360909	822524	BIRCHFIELD SPRING NEAR ERWIN	2.01	2.37	2.96	3.60	4.84	3.09	29
110	03494500	360909	833135	MILL SPRING NEAR JEFFERSON CITY	1.71	2.28	3.44	7.20	11.8	4.88	65
111	03494549	360939	833600	INDIAN CAVE SPRING AT INDIAN CAVE	.52	.88	2.09	3.85	6.85	2.40	36
112	03465200	360957	822311	U.S. FISHERIES SPRING NEAR ERWIN	1.99	2.29	2.45	2.79	3.18	2.52	40
113	03494540	360958	833349	BLUE SPRING NEAR NEW MARKET	1.51	2.08	2.89	5.26	11.7	3.98	39
114	03492200	361114	832254	PANTHER SPRING AT ALPHA	.81	1.54	2.23	4.30	10.9	3.47	34
115	03494525	361251	833403	BUFFALO SPRING AT BUFFALO SPRINGS	3.76	5.51	9.09	14.9	26.2	10.8	47
116	03533097	361259	840257	CLEAR CREEK SPRING NEAR NORRIS	--	--	--	--	--	2.22	1
117	03466900	361342	825717	TIPTON SPRING NEAR MOSHEIM	.61	1.23	1.78	2.95	5.54	2.14	45
118	03534930	361354	834436	DYER SPRING NEAR LUTTRELL	.22	--	--	--	.35	.27	3
119	03534920	361628	834436	LAY SPRING NEAR MAYNARDVILLE	.32	--	--	--	.49	.39	3
120	03486100	361900	821432	BIG SPRING NEAR ELIZABETHTON	1.94	3.86	5.90	9.64	19.3	7.10	43
121	034866604	362123	822253	CUMMINGS SPRING AT NORTH JOHNSON CITY	1.60	--	--	--	3.67	2.51	3
122	034866605	362124	822250	THOMAS SPRING AT NORTH JOHNSON CITY	.76	--	--	--	2.25	1.47	3
123	03466800	362133	823849	CRAWFORD SPRING AT CEDAR LANE	1.23	1.49	2.53	4.41	4.81	2.90	14
124	03484150	362148	820638	BLUE SPRING NEAR ELIZABETHTON	.49	.69	1.25	3.93	8.96	2.51	24
125	03484190	362347	820622	ELLIOT SPRING NEAR ELIZABETHTON	.97	1.44	2.31	5.60	10.4	3.61	24
126	03482175	362538	815609	BARTLOWE SPRING NEAR DOE STATION	--	--	--	--	--	5.18	1
127	03476850	362557	821041	UNDERWOOD SPRING NEAR KEENBURG	--	--	--	--	--	1.40	1
128	03484175	362700	820225	ELIZABETHTON SPRING NEAR ELIZABETHTON	--	--	--	--	--	.70	1
129	03476900	362746	821333	MORRELL SPRING NEAR BLUFF CITY	1.62	3.61	5.79	10.5	4.30	9.90	15
130	03490361	363144	824851	HENDERSON SPRING ABOVE AMIS CHAPEL	.37	--	--	--	.53	.45	4
131	03472370	363210	814615	SILVER LAKE SPRING NEAR MOUNTAIN CITY	1.57	--	--	--	2.34	1.99	4
132	03476510	363235	820813	BUMGARDNER SPRING NEAR BRISTOL	.26	.40	.84	1.25	1.51	.83	13
133	034903513	363256	824452	TIPTON SPRING NEAR CHURCH HILL	--	--	--	--	--	.41	1
134	03487540	363456	822140	WOLFORD SPRING NEAR BLOUNTVILLE	.82	1.04	1.40	2.47	10.9	2.18	24

REFERENCES CITED

- DeBuchananne, G.D., and Richardson, R.M., 1956, Ground-water resources of East Tennessee: Tennessee Division of Geology Bulletin 58, pt. 1, 393 p.
- Fenneman, N.M., 1946, Physical divisions of the United States: U.S. Geological Survey Miscellaneous Maps and Charts of the United States, scale 1:7,000,000, 1 sheet.
- Sun, P.-C.P., Criner, J.H., and Poole, J.L., 1963, Large springs of East Tennessee: U.S. Geological Survey Water-Supply Paper 1755, 52 p.
- Sun, R.J., editor, 1986, Regional aquifer-system analysis program of the U.S. Geological Survey summary of projects, 1978-84: U.S. Geological Survey Circular 1002, 264 p.
- U.S. Geological Survey, 1980, Index to topographic maps of Tennessee: Reston, Va., U.S. Geological Survey, map scale 1:1,000,000, 1 sheet.